Appendix 16-1- Derryadd Wind Farm Aviation Review Statement

Report

Derryadd Wind Farm

Aviation Review Statement

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Executive Summary

Ai Bridges Ltd have been commissioned to review the possible impacts of the proposed wind farm on aviation systems in the vicinity of the proposed wind farm development at Derryadd. As part of the review, the following subjects were considered:

- Annex 14 - Obstacle Limitation Surfaces (OLS)
- Annex 15 – Aerodrome Surfaces
- Building Restricted Areas (BRA)
- Minimum Sector Altitudes (MSA)
- Instrument Flight Procedures
- Permitted Wind Farms in vicinity of Proposed Wind Farm
- Communications, Navigation and Radar Surveillance Systems Safeguarding
- Flight Inspection and Calibration
- Aeronautical Obstacle Warning Light Scheme
- Department of Defense Aeronautical Safeguarding
- Garda Air Support Unit (GASU) and Emergency Aeromedical Service (EAS)

Annex 14 - Obstacles Limitation Surfaces (OLS)

A review shows that the proposed wind farm would be located outside the Obstacle Limitation Surfaces for the runways at Ireland West Airport and Abbeyshrule Aerodrome, as defined in ICAO (International Civil Aviation Organization) Annex 14.

As the proposed wind farm is situated outside the Outer Horizontal Surfaces and there is no penetration of the take-off or approach surfaces, it is unlikely that there will be any impacts to the OLS surfaces for the aerodromes.

Annex 15 - Aerodrome Surfaces

Following a review of “Terrain and Obstacle Requirements” as defined in ICAO Annex 15, turbines at the proposed development would need to be registered if they are more than 100 meters above terrain. The distance from the centre point (ARP – Airport Reference Point) of Ireland West Airport to the boundary of Area 1 of the Annex 15 Aerodrome Surface is 45 km. This area encloses the TMA area i.e. Total Maneuvering Area and this is used for circling and maneuvering by aircraft. Should the proposed windfarm be permitted, the turbines would be outside 45 km of Ireland West Airport’s ARP and would not cause an impact on the Annex 15 Aerodrome Surface. However, the proposed turbines would be required to be included in the IAA Electronic Air Navigation Obstacle Dataset.

Building Restricted Areas (BRA)

A Building Restricted Area is the airspace surrounding an aviation facility that needs to be clear from physical intrusions. The purpose of the safeguarded areas is to identify developments with the potential for causing unacceptable interference to navigation facilities. A review shows that the proposed wind farm is over 50 km from the BRA surfaces at Ireland West Airport. At this distance there will be no impacts to the BRAs due to the proposed wind turbines at the proposed wind farm.

Minimum Sector Altitudes (MSA)

The Minimum Sector Altitudes (MSA) is the lowest altitude which may be used that will provide a minimum obstacle clearance of 1000 ft above all obstacles within a sector of 25 nautical miles (46 km) from the VOR/DME at Ireland West Airport. As the proposed wind farm is located outside the MSA Sectors for Ireland West Airport, there should be no impact on the published MSA altitudes.

Instrument Flight Procedures

There are 16 published Instrument Flight Procedures for flights to/from Ireland West Airport. Due to the distance of the proposed wind farm from the airport, and as there are existing obstacles nearer to the airport than the proposed development, there should be no impacts to these flight procedures.

Communications, Navigation and Surveillance System Safeguarding

As the proposed wind farm is approximately 61 km from the Localizer and transmitting antennas at Ireland West Airport, it is very unlikely that wind turbines at the proposed development will have any impact on these ATS communications and radio navigational aids.

For Radar Surveillance Systems, EUROCONTROL Guidelines require a 16km safe distance from the surveillance radar system (SSR), for a "*Zone 4 - No Assessment*" condition. It has been highlighted in the analysis that turbines located at the proposed farm would be located at a minimum distance over 100 km from the radar stations at Dooncarton, Shannon, Woodcock Hill and Dublin Airport and in Assessment Zone 4 of the EUROCONTROL Guidelines. As turbines at the proposed development would be located in Assessment Zone 4, a detailed impact assessment on Radar Surveillance Systems will not be required by the IAA.

Flight Inspection and Calibration

Flight checks are conducted annually to ensure that flight procedures and associated navigational aids are safe and accurate. These flight checks are carried out by an IAA approved Flight Inspection Service Provider. The checks are carried out during annual inspections consisting of radial and orbital test flights around Ireland West Airport for calibration of instrument landing systems. It is unlikely that the Flight Inspection Procedures will be impacted as the proposed wind farm is sufficiently far from the airport runways and the flight inspection procedures should already account for the existing obstacles (e.g. terrain and existing wind farms).

Aeronautical Obstacle Warning Light Scheme

In the event of a grant of planning consent the IAA and DoD are likely to request lighting of the proposed wind turbines in the interest of aviation safe-guarding as the proposed development would be considered as an en-route obstacle.

Department of Defense Aeronautical Safeguarding

The Irish Air Corps position on wind farms / tall structures are outlined in the paper which was published in 2014: “Air Corps Wind Farm/ Tall Structures Position Paper”. In the position paper the Irish Air Corps (IAC) outlines restricted areas where they would object to the installation of wind turbines /tall structures. The areas defined by the Air Corps have been mapped and analysis shows that proposed wind farm site is located outside the restricted areas. As the proposed wind farm is not located in a restricted area it should have no impacts on the Irish Air Corps activities. However, the DoD have specific observations regarding an Aeronautical Obstacle Warning Light Scheme for the IAC. A review of the specified IAC Aeronautical Obstacle Warning Light Scheme is subject to a further detailed assessment.

Garda Air Support Unit (GASU) and Emergency Aeromedical Service (EAS)

The standard concerns that are being raised in recent consultations with the Irish Air Corps also highlight the potential for obstacles that could impact the operations of the Garda Air Support Unit (GASU) and the Emergency Aeromedical Service (EAS). An assessment of GASU and EAS operations indicates that they are unlikely to be impacted by the proposed wind farm development.

Sections

Appendices

Abbreviations

AGL	Above Ground Level
AMSL	Above Mean Sea Level
ARP	Airport Reference Point
BRA	Building Restricted Area
DME	Distance Measuring Equipment
DoD	Department of Defence
EAS	Emergency Aeromedical Service
GASU	Garda Air Support Unit
GP	Glide Path
HLS	Helicopter Landing Site
IAA	Irish Aviation Authority
IAC	Irish Air Corps
ICAO	International Civil Aviation Organization
IFP	Instrument Flight Procedure
ILS	Instrument Landing System
OLS	Obstacle Limitation Surface
PSR	Primary Surveillance Radar
RWY	Runway
SID	Standard Instrument Departure Route
STAR	Standard Arrival Route
SSR	Secondary Surveillance Radar
NATS	National Air Traffic Services (UK)
NM	Nautical Miles
VOR	VHF Omni-directional Range Station

1. Introduction

This section provides a brief summary of the proposed wind farm development at Derryadd and of the nearest significant aviation installations at Ireland West Airport and Abbeyshrule Aerodrome.

1.1 Wind Farm Site Information

The proposed wind farm development is located in County Longford approximately 61 km southeast of Ireland West Airport. Figure 1 shows the proposed wind farm site with respect to Ireland West Airport and the privately owned Abbeyshrule Aerodrome.

Figure 1. Location of proposed wind farm at Derryadd

1.2 Ireland West Airport

Table 2 below shows the co-ordinates of Ireland West Airport and the distance from the Airport reference Point (ARP) to the proposed wind farm site. Ireland West Airport operates in Class C controlled airspace with Instrument Flight Rules (IFR) and Visual Flight Rules (VFR) Flight rules.

Location	Installation	Description	Airport Ref. Point ARP	ARP Distance to Proposed Wind Farm
Ireland West Airport, Charlestown, Co Mayo	International Airport	Single Asphalt Runway Airspace: Class C	53 54 37 N 08 49 06 W (Mid-point of Runway 08/26).	61.2 km

Table 1. Ireland West Airport Details

The aeronautical navigation aids at the aerodrome include DVOR/DME, NDB, ILS LOC and ILS GP.

Figure 2. Ireland West International Airport

1.3 Abbeyshrule Aerodrome

Table 2 below shows the co-ordinates of Abbeyshrule Aerodrome and the distance from the Airport Reference Point (ARP) to the proposed wind farm site. Abbeyshrule Aerodrome operates in Class G un-controlled airspace with Visual Flight Rules (VFR) Flight rules.

Location	Installation	Description	Airport Ref. Point ARP	ARP Distance to Proposed Wind Farm
Abbeyshrule Aerodrome, Abbeyshrule, Co Longford	Private Aerodrome	Single Runway (Code 1) Airspace: Class G	53 35 29 N 07 38 34 W (Mid-point of Runway).	14.0 km

Table 2. A**bbeyshrule Aerodrome Details**

Figure 3. Aerial View of Abbeyshrule Aerodrome

2. Aviation Review

In this section a review of the following a review of the following Aviation topics is provided.

- Annex 14 - Obstacle Limitation Surfaces (OLS)
- Annex 15 – Aerodrome Surfaces
- Building Restricted Areas (BRA)
- Minimum Sector Altitudes (MSA)
- Instrument Flight Procedures
- Permitted Wind Farms in vicinity of Proposed Wind Farm
- Communications, Navigation and Radar Surveillance Systems Safeguarding
- Flight Inspection and Calibration
- Aeronautical Obstacle Warning Light Scheme
- Department of Defense Aeronautical Safeguarding
- Garda Air Support Unit (GASU) and Emergency Aeromedical Service (EAS)

2.1 Annex 14 Obstacle Limitation Surfaces (OLS)

A review of the Annex 14 Obstacles Limitation Surfaces (OLS) was first was carried out by first plotting the proposed wind farm location and the airport obstacle surfaces. The obstacle limitation surfaces for Ireland West Airport are plotted based on the following:

- Annex 14 to the Convention on International Civil Aviation Aerodromes Volume I - Aerodrome Design and Operations Seventh Edition July 2016"
- Certification Specifications and Guidance Material for Aerodromes Design CS-ADR-DSN Issue 4, 8th of December 2017

Figure 4 below shows the OLS surfaces for Ireland West Airport and Abbeyshrule Aerodrome relative to the proposed wind farm.

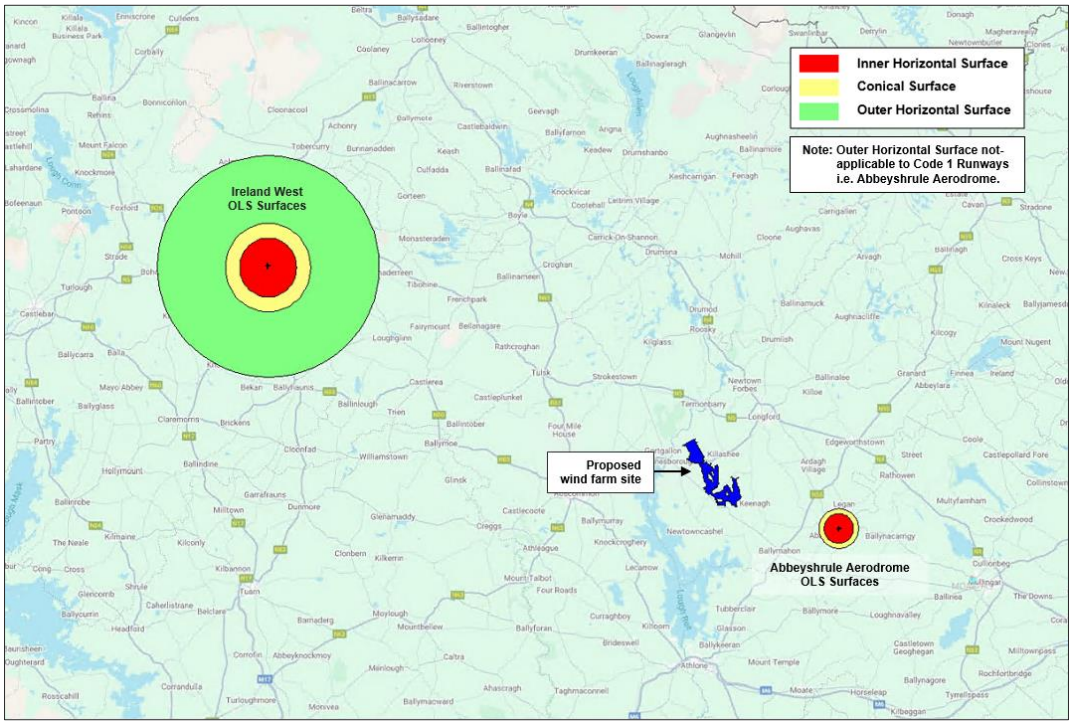


Figure 4. Derryadd Wind Farm in relation to Aerodrome OLS Surfaces.

Aerodrome	Runway Code	Outer Horizontal Surface Applicable	Clearance Distance to Aerodrome OLS Surface
Ireland West Airport	Runway Code 4	Y	46.2 km
Abbeyshrule Aerodrome	Runway Code 1	N	11.3 km

Table 3. Clearance Distances to Aerodrome OLS Surfaces

For Code 1 non-instrument runways, such as the runway at Abbeyshrule an Outer Horizontal Surface is not applicable. The Obstacle Free Zone for a Code 1 non-instrument runway extends 2.7 km from the aerodrome's ARP (Inner Horizontal Surface (2 km) + Conical Surface (0.7 km)). It should also be noted that the OLS constraints outlined above are IAA safeguarding limits to ensure safe aviation activities; however, from consultations with pilots who fly to/from small

aerodromes, pilots use an area of approximately 1 mile (1.6 km) around the runway to ascend and descend.

This 1 mile area is not limited to the take-off and approach surfaces, as pilots sometimes conduct a low-level flyover across the aerodrome to carry out a visual inspection of the wind-sock to assess wind conditions prior to landing. This flyover can occur from any direction relative to the runway (i.e. not just on the take-off and ascend surfaces). The proposed wind farm site is more than 1 mile from the each of the aerodrome runways.

The analysis of the OLS plots indicate that turbines at the proposed wind farm would not penetrate the OLS surfaces of Ireland West Airport or Abbeyshrule Aerodrome.

Aviation Impact Review	Mitigation Measure Action	Residual Impact
Annex 14 Obstacle Limitation Surfaces	No action.	None

Table 4. Aviation Impact Review - Annex 14 Obstacle Limitation Surfaces

2.2 Building Restricted Areas (BRA)

A Building Restricted Area is the airspace surrounding an aviation facility that needs to be clear from physical intrusions. The purpose of the safeguarded areas is to identify developments with the potential for causing unacceptable interference to navigation facilities.

The navigation facilities to be considered at Ireland Airport include the ILS Localisers, Glidepaths and DMEs that provide guidance for aircraft landings. The minimum safeguarded areas for these facilities are defined by the International Civil Aviation Organisation (ICAO) in the document ICAO EUR DOC 015, Section 7. The BRA parameters as specified by the ICAO are provided in Appendix B of this report.

Figure 5 below illustrates that the proposed wind farm at Derryadd is over 50 km from the nearest BRA at Ireland West Airport. At this distance, turbines at the proposed wind farm will have no impact on the navigation facilities associated with the Building Restricted Areas for Ireland West Airport.

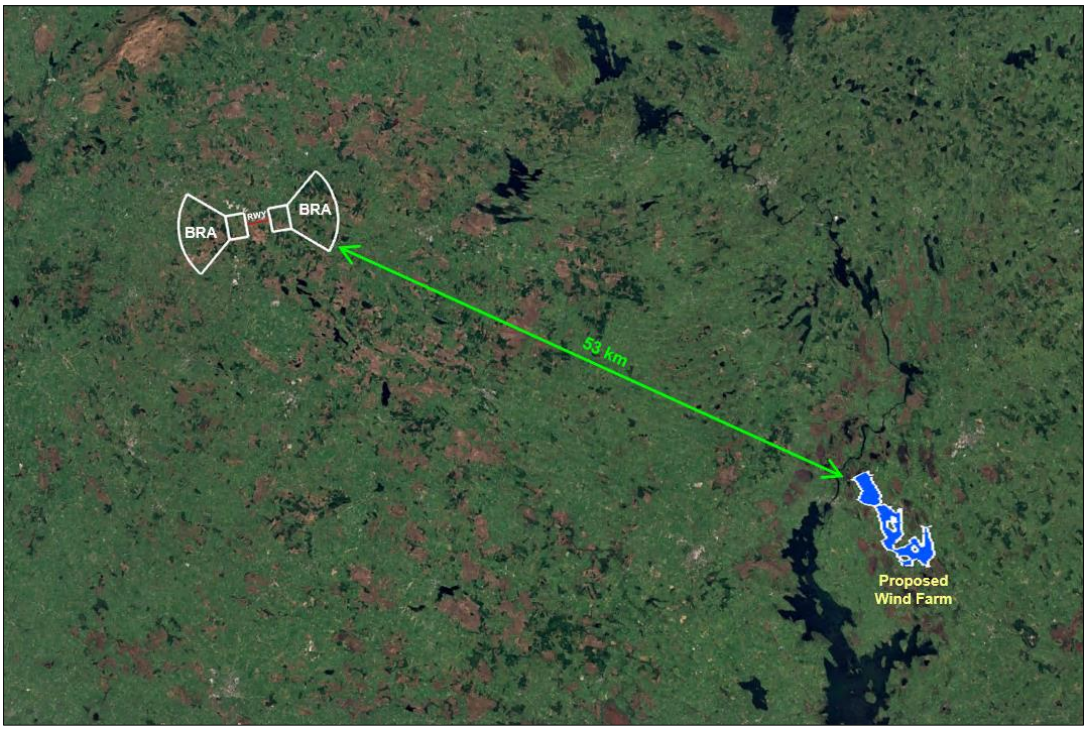


Figure 5. Proposed Wind Farm relative to Ireland West Airport BRAs (RWY 08 and RWY 26)

Aviation Impact Review	Mitigation Measure Action	Residual Impact
Building Restricted Areas	No action.	None

Table 5. Aviation Impact Review - Building Restricted Areas

2.3 Annex 15 Aerodrome Surfaces

Turbines at the proposed wind farm may potentially penetrate the ICAO Annex 15 Aerodrome Surface as shown in Figure 4. The “Terrain and Obstacle Requirements Area” is defined in ICAO Annex 15 as an area of up to 45 km from the Aerodrome ARP. (An illustration of ICAO Annex 15 Area 1 and Area 2 Surface is provided in Appendix A).

As the nearest turbine at the proposed wind farm would be more than 60 km from the ARP at Ireland West Airport, there will be no penetration of the Annex 15 surface for the Aerodrome. All obstacles, if they are more than 100 meters above terrain for a distance of up to 45 km from the ARP, need to be registered in the IAA Air Navigation Obstacle Data Set. This area is known as the TMA area i.e. Terminal Maneuvering Area and is used for en-route circling and maneuvering and is shown in Figure 6.

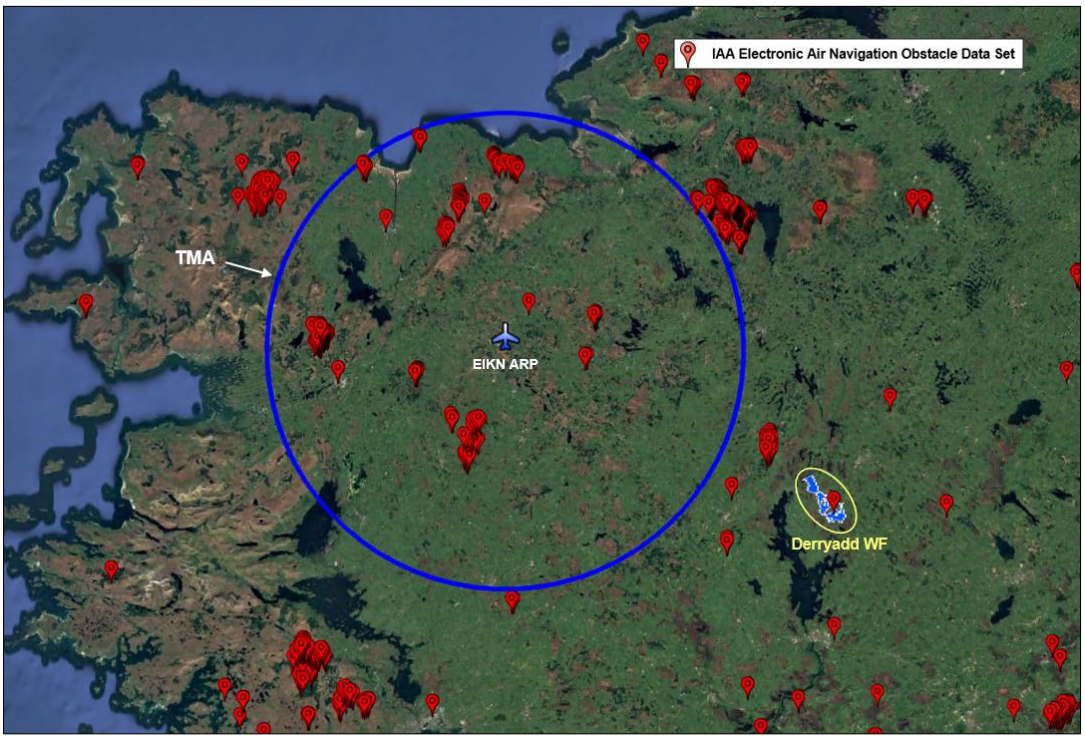


Figure 6. Annex 15 Aerodrome Surface and IAA Electronic Air Navigation Obstacle Data Set

It should also be noted that there are other existing tall structures (obstacles) nearer to the airport, e.g. the turbines at the operational wind farm at Sliabh Bawn.

These existing obstacles would shield any potential impacts from the proposed wind farm at Derryadd. The IAA Electronic Air Navigation Obstacle Data Set of permitted obstacles are shown relative to the proposed wind farm in Figure 7.

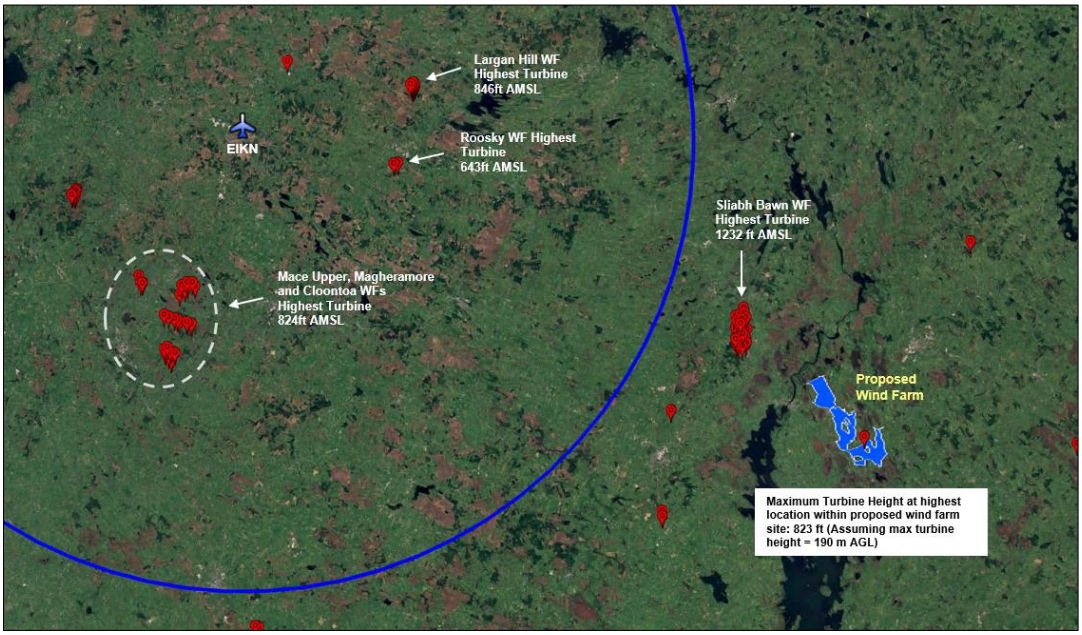


Figure 7. Permitted Obstacles in vicinity of Derryadd Wind Farm

Although there are other obstacles closer to the airport than the proposed wind farm, all new obstacles must be considered and assessed to see if they cause a "hazard to air navigation" and all Terrain Obstacle Data (including man-made obstacles) have to be considered by the relevant Aviation Authorities.

Aviation Impact Review	Mitigation Measure Action	Residual Impact
Annex 15 Aerodrome Surfaces	The proposed wind turbines would be required to be included in the IAA Obstacle Data Set.	None

Table 6. Aviation Impact Review - Annex 15 Aerodrome Surfaces

2.4 Minimum Sector Altitudes

A review of the Minimum Sector Altitudes (MSA) shows that the proposed wind farm is not within 25 nautical miles from the VOR/DME at Ireland West Airport. The MSA provides a minimum obstacle clearance of 1000 ft above the highest obstacle within specified sectors.

The proposed wind farm site is located more than 25 NM from the VOR/DME as shown in Figure 8. Therefore, the MSAs will not be affected and there will be no impact on the published MSA altitude figures.

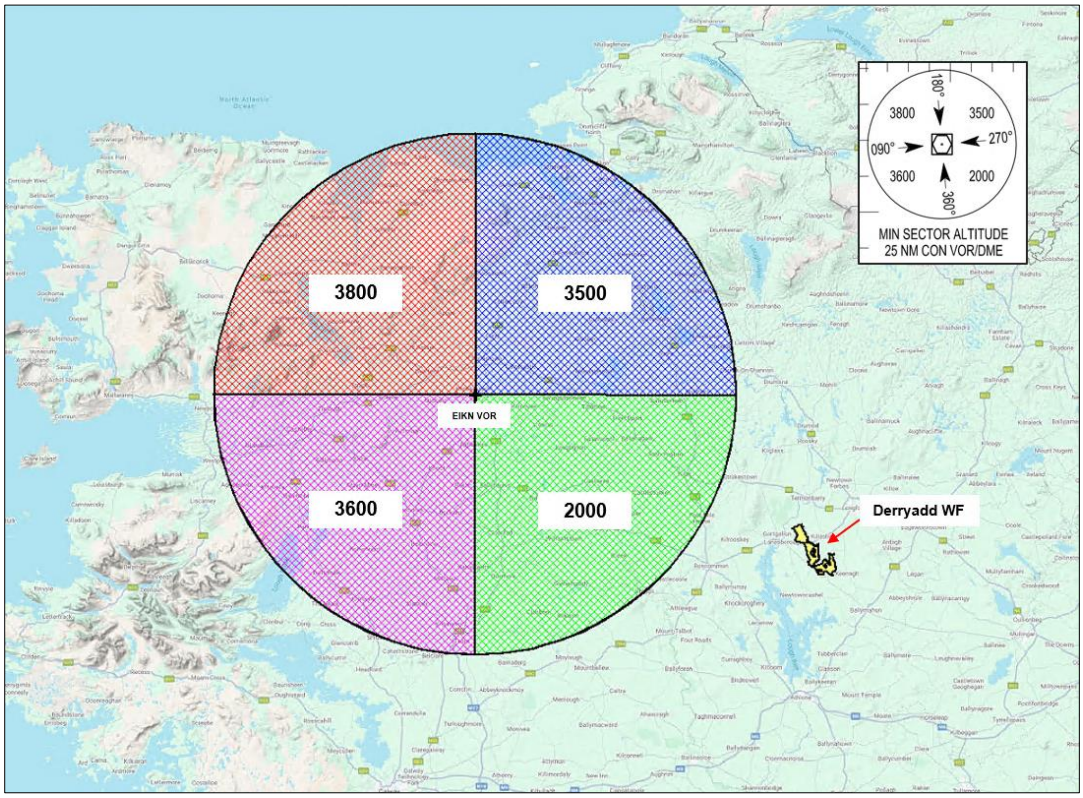


Figure 8. Ireland West Airport (EIKN) Minimum Sector Altitudes

Aviation Impact Review	Mitigation Measure Action	Residual Impact
Minimum Sector Altitudes	No action	None

Table 7. Aviation Impact Review - Minimum Sector Altitudes

2.5 Instrument Flight Procedures

There are 16 published Instrument and Visual Flight Procedures for arrivals to and departures from Ireland West Airport.

Aerodrome	Aerodrome Procedure	Chart ID	Likely WF Impacts
Ireland West	Precision Approach Terrain Chart RWY 26– ICAO	EIKN AD 2.24-3	None.
Ireland West	RNAV Standard Departure Chart Instrument (SID) RWY 26 - ICAO	EIKN AD 2.24-4.1	None.
Ireland West	RNAV Standard Departure Instrument (SID) Chart RWY 08 - ICAO	EIKN AD 2.24-5.1	None.
Ireland West	RNAV Standard Arrival Chart Instrument (STAR) RWY 26 - ICAO	EIKN AD 2.24-6.1	None.
Ireland West	RNAV Standard Arrival Chart Instrument (STAR) RWY 08- ICAO	EIKN AD 2.24-7.1	None.
Ireland West	Instrument Approach Chart RNP RWY 26 (ACFT CAT A, B, C, D) - ICAO	EIKN AD 2.24-8	None.
Ireland West	Instrument Approach Chart ILS A CAT 1and CAT 11 or LOC RWY 26 (ACFT CAT A, B, C, D) – ICAO	EIKN AD 2.24-9.1	None.
Ireland West	Instrument Approach Chart ILS B CAT 1 and 11 RWY 26 (ACFT CAT A, B, C, D) – ICAO	EIKN AD 2.24-10.1	None.
Ireland West	Instrument Approach Chart VOR RWY 26 (ACFT CAT A, B, C, D) - ICAO	EIKN AD 2.24-11.1	None.
Ireland West	Instrument Approach Chart NDB RWY 26 (ACFT CAT A, B, C, D) - ICAO	EIKN AD 2.24-12.1	None.
Ireland West	Instrument Approach Chart NDB RWY 26 (ACFT CAT A, B, C, D) - ICAO	EIKN AD 2.24-13.1	None.
Ireland West	Instrument Approach Chart RNP RWY 08 (ACFT CAT A, B, C, D) - ICAO	EIKN AD 2.24-14	None.
Ireland West	Instrument Approach Chart VOR RWY 08 (ACFT CAT A, B, C, D) - ICAO	EIKN AD 2.24-15.1	None.
Ireland West	Instrument Approach Chart NDB RWY 08 (ACFT CAT A, B, C, D) - ICAO	EIKN AD 2.24-16.1	None.
Ireland West	Instrument Approach Chart NDB RWY 08 (ACFT CAT A, B, C, D) - ICAO	EIKN AD 2.24-17.1	None.
Ireland West	Visual Approach Chart – ICAO	EIKN AD 2.24-19	None.

Table 8. Instrument and Visual Flight Procedures – Ireland West Airport

Due to the distance of the proposed wind farm from the Airport (and as there are existing obstacles (e.g. telecom masts and existing wind farms)) it is unlikely that there will be any impacts on the Instrument Flight Procedures for flights to/from Ireland West Airport.

Aviation Impact Review	Mitigation Measure Action	Residual Impact
Instrument Flight Procedures	No action	None.

Table 9. Aviation Impact Review - Instrument Flight Procedures

2.6 Permitted Wind Farms in vicinity of Proposed Wind Farm

The Planning References for the permitted wind farms in the vicinity of the proposed wind farm are shown below in Table 10. None of these wind farms required a Full Assessment of Instrument Flight Procedures.

Wind Farm	Planning Reference	Description
Sliabh Bawn	https://www.eplanning.ie/roscommoncc/	Operational Wind Farm
Cloontoa	https://www.eplanning.ie/mayocc/	Operational Wind Farm
Magheramore	https://www.eplanning.ie/mayocc/	Operational Wind Farm
Mace Upper	https://www.eplanning.ie/mayocc/	Operational Wind Farm
Largan Hill	https://www.eplanning.ie/roscommoncc/	Operational Wind Farm
Roosky	https://www.eplanning.ie/roscommoncc/	Operational Wind Farm

Table 10. Permitted Wind Farms in vicinity of proposed Wind Farm

2.7 Communication Navigation and Surveillance Systems

In this section the possible impact of the proposed wind farm on the Communication, Navigation and Radar Surveillance Systems for the aerodrome at Ireland West Airport is assessed.

2.7.1 Communications and Navigation Systems

The AIP document EIKN AD 2-18/19 provides the information for communication and navigation facilities for Ireland West Airport. The table below shows the channel frequencies for the ATS communications Facilities and the Radio Navigation and Landing Aids for the airport.

Aerodrome	ATS communications Facilities Channel Frequency	Radio Navigation and Landing Aids Channel Frequency	Approximate Distance to Localizer and Transmitting antennas	Impacts of wind fam
Ireland West	118MHz –131MHz	110KHz – 330MHz	60 km	No impacts

Table 11. Impacts on Communications and Navigation Systems

As the proposed wind farm is approximately 60 km from the Localizers and transmitting antennas, it is very unlikely that turbines at the proposed wind farm will have any impact on these ATS communications and radio navigational aids. Typically, interference to VHF communications systems will only occur when obstacles are in close proximity to the VHF transmitter e.g. less than 500m.

2.7.2 Radar Surveillance Systems

The tables below show the Irish Aviation Authority Assessment Zone arrangement for the two types of aviation radar surveillance systems; Primary Surveillance Radar (PSR) and Secondary Surveillance Radar (SSR).

Zone	Description	Assessment Requirements
Zone 1	0 - 500m	Safeguarding
Zone 2	500m - 15km and in radar line of sight	Detailed Assessment
Zone 3	Further than 15km and in radar line of sight	Simple Assessment
Zone 4	Not in radar line of sight	No Assessment

Table 12. PSR Zone Arrangements

Zone	Description	Assessment Requirements
Zone 1	0 - 500m	Safeguarding
Zone 2	500m - 16km but within maximum instrumented range and in radar line of sight	Detailed Assessment
Zone 4	Further than 16km or not in radar line of sight	No Assessment

Table 13. SSR Zone Arrangements

The EUROCONTROL Guidelines require a 16km safe distance for a “Zone 4 - No Assessment” condition and detailed assessments are required for any proposed wind within 16 km of a secondary surveillance radar.

It should be noted that in the UK, NATS (Air Traffic Control) safeguards SSR to a distance of 10 km. The guidelines used by NATS (*CAP 764: Chapter 2: Impact of wind turbines on aviation*) state that:

> *"Wind turbine effects on SSR are traditionally less than those on PSRs but 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 typically only a consideration when the turbines are located very close to the SSR i.e. less than 10 km."*

2.7.2.1 Irish Aviation Authority (IAA) Radar Surveillance Sensors

To determine which Assessment Zones are applicable to the proposed wind farm a desktop assessment was carried out. The nearest radar surveillance sites to the proposed wind farm development are at Dooncarton, Shannon, Woodcock Hill and Dublin Airport.

Figure 9. Radar Surveillance Sites relative to Derryadd Wind Farm.

2.7.2.1.1 Dooncarton Radar Assessment

The radar surveillance site at Dooncarton consists of a SSR system located in the six-story circular reinforced concrete communications tower shown in Figure 10. The SSR antennas are housed in the dome-shaped structure at the top of the tower.

Figure 10. Dooncarton Radar Station

Table 14 below shows the (EuroControl & NATS) assessment zone applicable to the nearest point where a turbine could potentially be located. The applicable assessment zone has been based on distance from the Radar Station and whether a radar line-of-sight condition exists.

Wind Farm ID	Distance to PSR/SSR Radar Station	Radar LOS Assessment (EuroControl Guidelines)	Radar LOS Assessment (NATS Guidelines – UK)
Derryadd	138 km	Detailed Assessment Not Required	Detailed Assessment Not Required

Table 14. EuroControl / UK Safeguarding Guidelines – Dooncarton Radar Station

As the table above show, the proposed wind farm is within Assessment Zone 4 as specified by the EUROCONTROL guidelines, which would indicate that a detailed technical assessment would not be required for the impact on the SSR radar station at Dooncarton.

2.7.2.1.2 Shannon Airport Radar Assessment

The radar surveillance site at Shannon Airport consists of a PSR and a SSR. The PSR and the SSR antennas are co-located on the same structure at Shannon Airport (Figure 11).

Figure 11. Shannon Airport Radar Station

Table 15 below shows the (EuroControl & NATS) assessment zone applicable to the nearest point where a turbine could potentially be located. The applicable assessment zone has been based on distance from the Radar Station and whether a radar line-of-sight condition exists.

Wind Farm ID	Distance to PSR/SSR Radar Station	Radar LOS Assessment (EuroControl Guidelines)	Radar LOS Assessment (NATS Guidelines – UK)
Derryadd	124 km	Detailed Assessment Not Required	Detailed Assessment Not Required

Table 15. EuroControl / UK Safeguarding Guidelines – Shannon Airport Radar Station

As the table above show, the proposed wind farm is within Assessment Zone 4 as specified by the EUROCONTROL guidelines, which would indicate that a detailed technical assessment would not be required for the impact on the PSR/SSR radar station at Shannon Airport.

2.7.2.1.3 Woodcock Hill Radar Assessment

The radar surveillance site at Woodcock Hill consists of a SSR system housed in the dome-shaped structure shown in Figure 12.

Figure 12. Woodcock Hill Radar Station

Table 16 below shows the (EuroControl & NATS) assessment zone applicable to the nearest point where a turbine could potentially be located. The applicable assessment zone has been based on distance from the Radar Station and whether a radar line-of-sight condition exists.

Wind Farm ID	Distance to PSR/SSR Radar Station	Radar LOS Assessment (EuroControl Guidelines)	Radar LOS Assessment (NATS Guidelines – UK)
Derryadd	114 km	Detailed Assessment Not Required	Detailed Assessment Not Required

Table 16. EuroControl / UK Safeguarding Guidelines – Woodcock Hill Radar Station

As the table above show, the proposed wind farm is within Assessment Zone 4 as specified by the EUROCONTROL guidelines, which would indicate that a detailed technical assessment would not be required for the impact on the SSR radar station at Woodcock Hill.

2.7.2.1.4 Dublin Airport Radar Assessment

The radar surveillance site at Dublin Airport consists of two PSR/SSR (MSSR) radar stations as shown below in Figure 13 and Figure 14.

Figure 13. Dublin Airport MSSR Radar Station #1

Figure 14. Dublin Airport MSSR Radar Station #2

Table 17 below shows the (EuroControl & NATS) assessment zone applicable to the nearest point where a turbine could potentially be located. The applicable assessment zone has been based on distance from the Radar Station and whether a radar line-of-sight condition exists.

Wind Farm ID	Distance to PSR/SSR Radar Station	Radar LOS Assessment (EuroControl Guidelines)	Radar LOS Assessment (NATS Guidelines – UK)
Derryadd	107 km	Detailed Assessment Not Required	Detailed Assessment Not Required

Table 17. EuroControl / UK Safeguarding Guidelines – Dublin Airport Radar (Station #1 and #2)

As the table above show, the proposed wind farm is within Assessment Zone 4 as specified by the EUROCONTROL guidelines, which would indicate that a detailed technical assessment would not be required for the impact on the PSR/SSR radar stations at Dublin Airport.

2.8 Flight Inspection and Calibration

Flight checks are conducted annually to ensure that flight procedures and associated navigational aids are safe and accurate. These flight checks are carried out by an IAA approved Flight Inspection Service Provider. The checks are carried out during annual inspections consisting of radial and orbital test flights around Ireland West Airport for calibration of instrument landing systems.

It is unlikely that the Flight Inspection Procedures will be impacted as the proposed wind farm is sufficiently far from the airport runways and the flight inspection procedures should already account for the existing obstacles (e.g. terrain and existing wind farms).

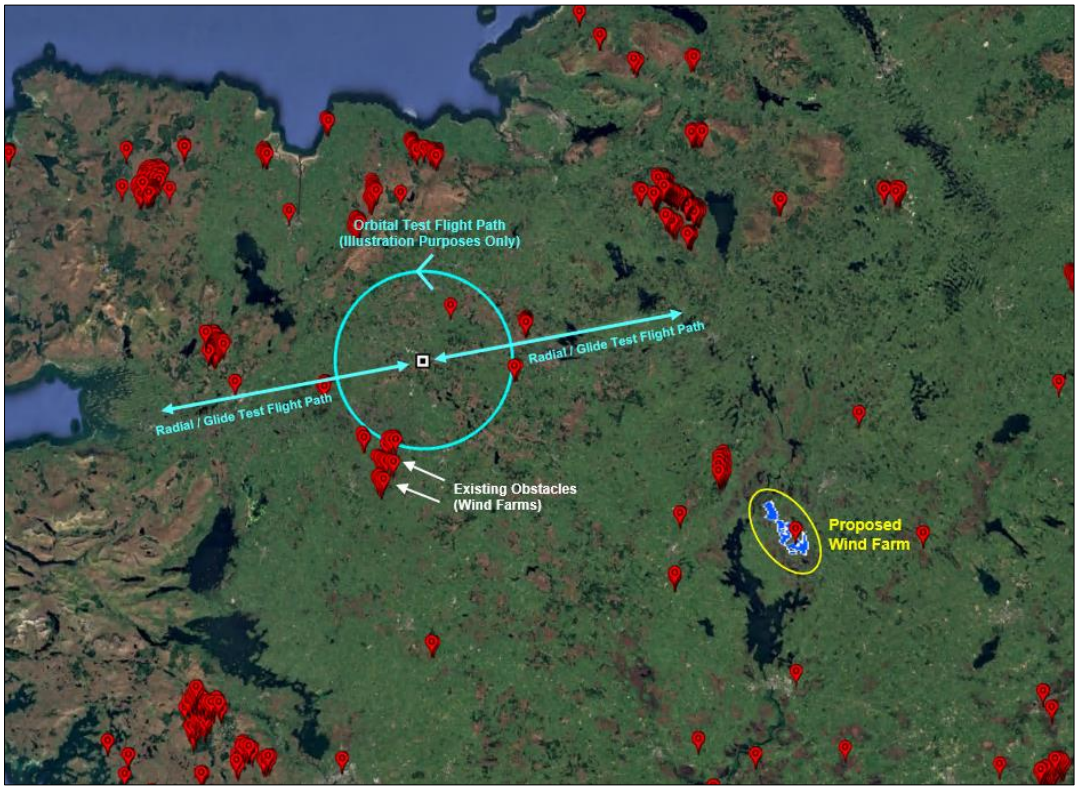


Figure 15. Flight Inspection and Calibration Test Procedures should account for existing obstacles (e.g. terrain and existing wind farms)

Aviation Impact Review	Mitigation Measure Action	Residual Impact
Flight Inspection and Calibration	No action	None.

Table 18. Aviation Impact Review - Flight Inspection and Calibration

2.9 IAA - Aeronautical Obstacle Warning Light Scheme

In the event of a grant of planning consent the IAA-ANSP would require the lighting of the proposed wind turbines in the interest of aviation safe-guarding as the proposed development may be considered as an en-route obstacle. The developers of the proposed turbines would intend to implement an aeronautical obstacle warning light.

It is recommended that lighting requirements should be in accordance with Chapter Q – Visual Aids for denoting Obstacles; CS ADR.DSN.Q.851 and GM.ADR.DSN.Q.851 (Pages 729/730) of the EASA Easy Access Rules for Aerodromes (Reg (EU) No. 139/2014) where it states that

> *"Applicability: When considered as an obstacle a wind turbine should be marked and/or lighted."*

Aviation Impact Review	Mitigation Measure Action	Residual Impact
Aeronautical Obstacle Warning Light Scheme	It is likely that the IAA would request that the wind farm, if permitted, would be fitted with Aeronautical Obstacle Warning Lights in accordance with civil aviation industry standards. Subject to further consultation with the IAA.	None

Table 19. Aviation Impact Review - Aeronautical Obstacle Warning Light Scheme

2.10 Department of Defence Aeronautical Safeguarding

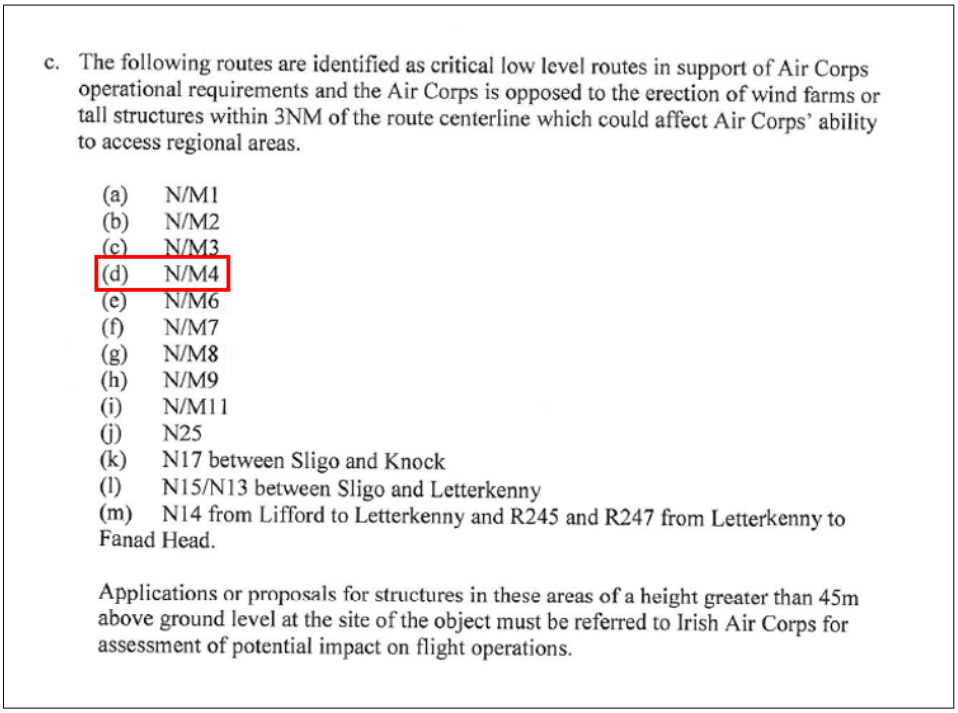
The standard concerns that are being raised by the Department of Defence, relate to the potential impact of wind turbines on the aviation activities of the Irish Air Corps (IAC). The Department of Defence highlights IAC Restricted Areas (for wind farms/ tall structures). They also request a specific Aeronautical Obstacle Warning Light Scheme for turbines that are permitted.

An assessment of the IAC Restricted Areas is provided in Sections 2.9.1 and a review of the IAC Aeronautical Obstacle Warning Light Scheme is provided in Sections 2.9.2.

2.10.1 Department of Defence – IAC Restricted Areas

The Irish Air Corps (IAC) Position Paper "*Air Corps Wind Farm/ Tall Structures Position Paper*" published on 08th August 2014, states that the Air Corps are likely to oppose any wind farm / tall structure in the following restricted areas:

- Lands underlying military airspace for flying activity. (Areas contained in Danger Areas EI-D1, EI-D5, EI-D6, EI-D13, EI-D14, Restricted Areas EI-R15, EI-R16 within 20 NM of Baldonnel, MOAs 3 and 4 within 20 NM of Baldonnel.
- Low Flying Training Areas within MOA 4 in the areas of; Blessignton, Edenderry/Allenwood/Rathangan, Kilmeague/Newbridge.
- Low Flying Training Area West – LFTA WEST.
- A distance of 5 NM or less from military installations.
- Critical low level flying routes in support of Air Corps operation requirements as described in Figure 16 below.



c. The following routes are identified as critical low level routes in support of Air Corps operational requirements and the Air Corps is opposed to the erection of wind farms or tall structures within 3NM of the route centerline which could affect Air Corps' ability to access regional areas.

(a) N/M1
(b) N/M2
(c) N/M3
(d) N/M4
(e) N/M6
(f) N/M7
(g) N/M8
(h) N/M9
(i) N/M11
(j) N25
(k) N17 between Sligo and Knock
(l) N15/N13 between Sligo and Letterkenny
(m) N14 from Lifford to Letterkenny and R245 and R247 from Letterkenny to Fanad Head.

Applications or proposals for structures in these areas of a height greater than 45m above ground level at the site of the object must be referred to Irish Air Corps for assessment of potential impact on flight operations.

Figure 16. Irish Air Corps – Critical Low Level Routes

The nearest military installation to Derryadd is Custume Barracks in Athlone. The proposed development is more than 12 km outside the 5 NM restricted area around the military barracks in Athlone, as illustrated in Figure 17.

The proposed development is not located in a low flying training area and is over 60 km from the restricted area around Baldonnel Aerodrome.

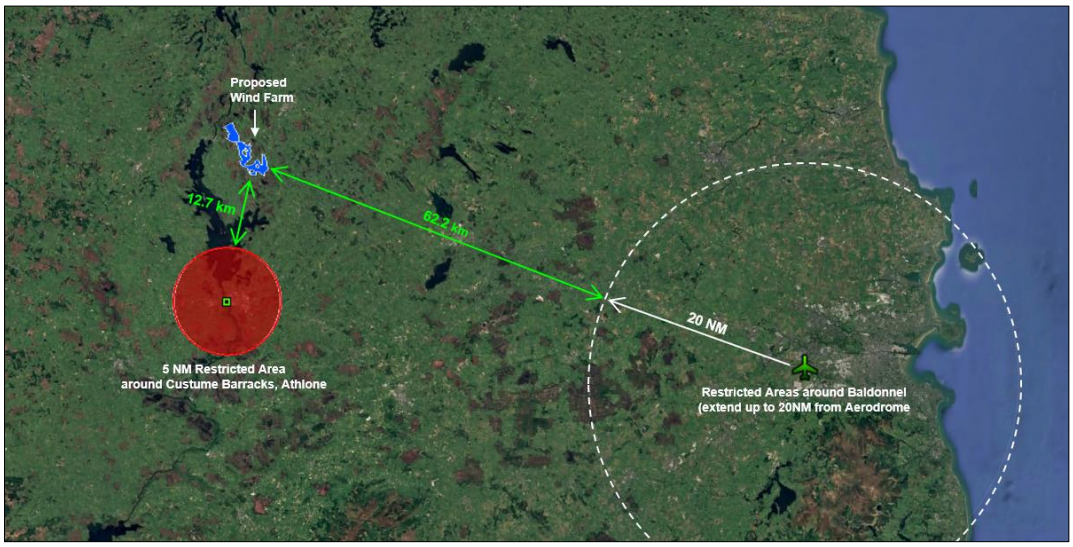


Figure 17. IAC Restricted Areas – Custume Barracks and Baldonnel Aerodrome

The nearest of the IAC restricted areas to the proposed wind farm is the low level flight route around the N4 national primary road. As Figure 18 below shows the proposed development is located outside the restricted areas, and should have no impacts on the Irish Air Corps activities.

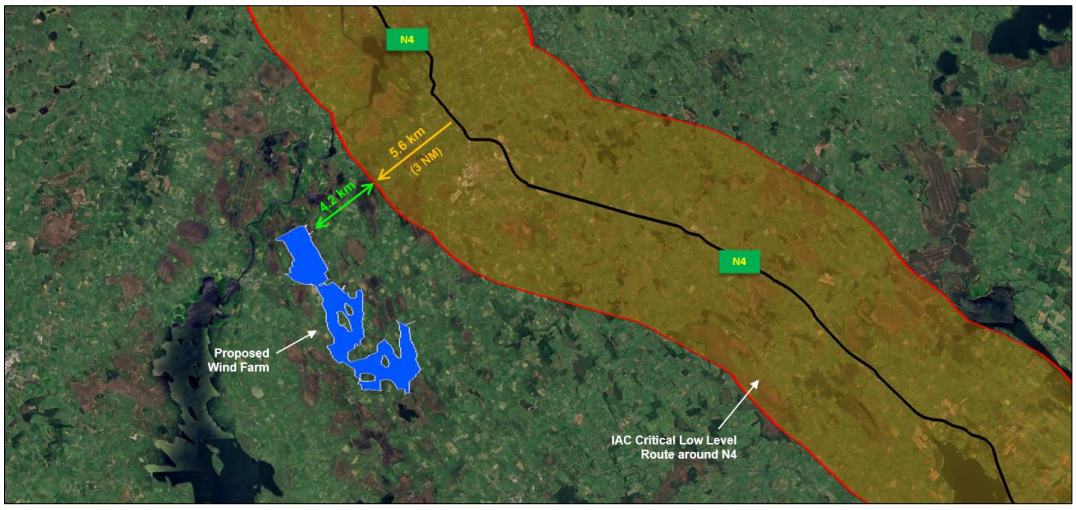


Figure 18. IAC Restricted Areas - Critical Low Level Route (N4)

Aviation Impact Review	Mitigation Measure Action	Residual Impact
Department of Defence – IAC Restricted Areas	No action	None.

Table 20. Aviation Impact Review - Irish Air Corps / Department of Defence Safeguarding

2.10.2 Department of Defence – IAC Aeronautical Obstacle Warning Light Scheme

During recent correspondences with the Department of Defensse regarding the IAC Aeronautical Obstacle Warning Light Scheme requirements for new wind farms, the following observations were made…

> *"I wish to advise at the outset that any determination in relation to a planning consent is solely a matter for the planning authorities and/or ABP, as appropriate. Therefore, the following observations are made on a non-prejudicial basis, and are not intended to be used to rely on for a prospective planning application, nor are these observations to be relied on in the event of any commercial transaction pertaining to such lands and they are not to be relied on in the event of any contract exchange pertaining to same.*
>
> *As a matter of practice, the Department of Defence does not provide observations or advice in the scoping process, except where the relevant parties have been directed by a planning authority to seek the Department's views.*
>
> *Having consulted with the Military authorities, the Department of Defence wishes to make the following observations:*
>
> - *The Minister for Defence is responsible for the regulation of military aviation, whereas the Irish Aviation Authority (IAA) is responsible for the safety regulation of civil aviation including aerodromes. The IAA does not have remit for military aviation or installations. Safeguarding of military flight operations and installations is intended to protect both current and future aircraft operations and also to take account of the security requirements associated with some of those operations.*
> - *All turbines should be illuminated by Type C, Medium intensity, Fixed Red obstacle lighting with a minimum output of 2,000 candela to be visible in all directions of azimuth and to be operational H24/7 days a week.*
> - *Obstacle lighting should be incandescent or, if LED or other types are used, of a type visible to Night Vision equipment. Obstacle lighting used must emit light at the near Infra-Red (IR) range of the electromagnetic spectrum, specifically at or near 850 nanometres (nm) of wavelength. Light intensity to be of similar value to that emitted in the visible spectrum of light*
> - *Any Irish Air Corps (IAC) requirements for are separate to Irish Aviation Authority (IAA) requirements.*
>
> *Nothing in the above observations shall be taken as a binding response by the Minister for Defence in the event that a planning application is made. The Minister reserves the right to comment on an actual planning application as and when it is submitted in accordance with the provisions of the planning regulatory code."*

A detailed assessment of the IAC Aeronautical Obstacle Warning Light Scheme is beyond the scope of this report. However, the appropriate lighting scheme for Derryadd would depend on; the existing obstacle environment, airspace class (i.e. Class G for Derryadd) and existing Irish/ EU lighting standards and regulations.

The IAC requirement for all turbines to be illuminated should also be reviewed to determine if cardinal or perimeter lighting could be implemented instead.

A further detailed technical assessment will be required to determine the appropriate aeronautical lighting scheme. This is outside of the scope of this Aviation Review Statement.

It would then be recommended that this technical assessment report with suitable lighting proposals would be submitted to the Department of Defence /IAC for their review.

Aviation Impact Review	Mitigation Measure Action	Residual Impact
Department of Defence - IAC Aeronautical Obstacle Warning Light Scheme	Subject to detailed technical assessment and further consultations with the IAC.	Subject to detailed technical assessment and further consultations with the IAC.

Table 21. Aviation Impact Review - IAC Aeronautical Obstacle Warning Light Scheme

2.11 Garda Air Support Unit (GASU) and Emergency Aeromedical Service (EAS)

The standard concerns that are being raised in recent consultations with the Air Corps also highlight the potential for obstacles that could impact the operations of the Garda Air Support Unit (GASU) and the Emergency Aeromedical Service (EAS). The excerpt below is taken from a response received from the IAC in relation to a third-party wind farm project:

> "*Having consulted with the subject matter experts in the Irish Air Corps, the Department of Defence wishes to make the following observations:*
>
> - *The Department of Defence cannot support, based on military advises, the erection of wind farms or other tall structures within 3 NM of roads identified as critical low level routes in support of operational requirements. The erection of obstacles within low-level helicopter routes could affect the Irish Air Corps ability to access regional areas and to fulfil its role.*
> - *If this proposed development was to go to the planning stage, the Department of Defence would be obligated to raise the following concerns and advise the planning authorities that the proposed windfarm*
>
> *a) lies wholly within 3 nautical miles of the [Motorway/National Road] which is identified as a critical low level route used by state aircraft on operational taskings. A windfarm or any other tall structures within a low-level route will be an obstacle to state aircraft not operating within the civil rules of the air;*
>
> *b) The [Motorway/National Road] low level route requires protection from obstacles for low level state aircraft on operational tasking's such as:*
>
> *(i) The Garda Air Support Unit (GASU)*
> *(ii) The Emergency Aeromedical Service (EAS)"*

A review of the possible impacts of the proposed wind farm on the Garda Air Support Unit and the Emergency Aeromedical Service operations is provided in Sections 2.11.1 and 2.11.2 that follow. The review indicates that they are unlikely to be impacted by the proposed wind farm development.

Aviation Impact Review	Mitigation Measure Action	Residual Impact
GASU and EAS	The proposed wind turbines would be required to be included in the IAA Obstacle Data Set.	None.

Table 22. Aviation Impact Review – GASU and EAS

2.11.1 The Garda Air Support Unit (GASU)

The Garda Air Support Unit is based at Casement Aerodrome, Baldonnel and is typically deployed to incidents in the following cases:

- Immediate threat to life
- Incidents of a criminal, terrorist or other nationally important nature
- Immediate threat of serious public disorder
- Tasks leading to the prevention or detection of crime
- Evidence gathering
- Intelligence gathering
- Photographic tasks
- Traffic Management/Monitoring

The unit consists of one fixed-wing aircraft (a Pilatus Britten-Norman BN 2T-4S Defender 4000) and two helicopters (Eurocopter EC 135 T2).

Figure 19. GASU - Pilatus Britten-Norman BN 2T-4S Defender 4000

Figure 20. GASU - Eurocopter EC135 T2

The proposed wind farm is located in an area that is sparsely populated and on boggy / agricultural terrain. For these reasons, it is highly unlikely that the proposed wind farm development would have any significant impacts on GASU operations.

In the unlikely event of GASU operations in the general area, it should be noted that all modern aircraft are equipped with a range of Global Navigation Satellite Systems (GNSS), e.g. GPS, GLNASS, Galileo, etc. These GNSS systems provide pilots with accurate navigation information including data to avoid obstacles during VFR operations. Should the proposed wind farms be permitted the associated turbine locations would be submitted to the IAA and aviation charts and GNSS databases would be updated accordingly.

GASU Aircraft	Impact of proposed wind farms - Opinion
Fixed-wing Airplane (Pilatus Britten-Norman BN 2T-4S Defender 4000)	Low – Fixed-wing aircraft are unlikely to be deployed in low level activity in the subject areas. In addition, the aircraft would be equipped with modern communications systems and navigational equipment. Should the wind farm be permitted, the turbines would be fitted with aeronautical lighting and would be clearly marked in aviation charts.
Helicopter (Eurocopter EC135 T2)	Low – Helicopter landings in the subject area would not occur as the proposed wind farm located in boggy / agricultural terrain. In addition, the aircraft would be equipped with modern communications systems and navigational equipment. Should the wind farm be permitted, the turbines would be fitted with aeronautical lighting and would be clearly marked in aviation charts.

Table 23. Impact of proposed wind farm on GASU Operations

2.11.2 The Emergency Aeromedical Service (EAS)

The air ambulance service in Ireland is known as the Emergency Aeromedical Service (EAS). The EAS crew (which include National Ambulance Service (NAS) paramedics) deal with time-critical emergency callouts to major emergencies such as road collisions and urgent medical events. The EAS currently operate two air ambulance helicopters operating from two bases:

- Custume Barracks, Athlone, Co Westmeath.
- Rathcoole Aerodrome, Rathcoole, Mallow, Co Cork.

The two helicopter borne emergency air ambulances consist of an Air Corps operated aircraft based at Custume Barracks in Athlone, and an aircraft located at Rathcoole Aerodrome in North County Cork. The nearest EAS base to the proposed development at Derryadd is the base in Athlone. The flight times from the EAS base at Athlone are shown in Figure 21.

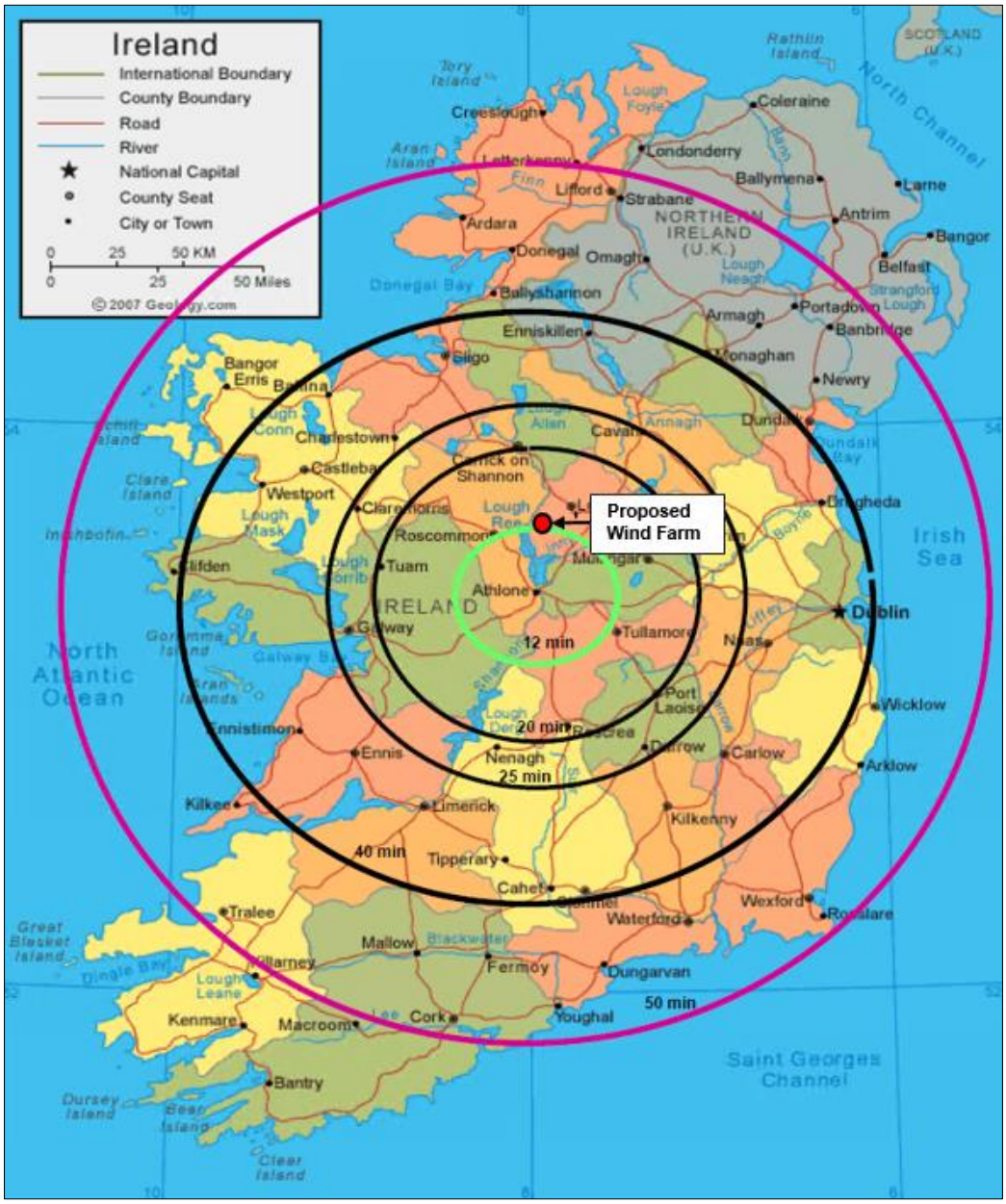


Figure 21. EAS – Flying Times from Athlone

Helicopter landings are highly unlikely to occur in the subject area due to the boggy /agricultural terrain of the proposed site.

Also, should the proposed wind farms be permitted the associated turbine locations would be submitted to the IAA and aviation charts and GNSS databases would be updated accordingly. EAS helicopters would also be fitted with GNSS systems which would clearly identify any potential objects in the operational area (e.g. wind turbines).

In addition, the footprint of the proposed wind farm development is small and any flight diversions for EAS operations would have negligible time impacts. For these reasons, turbines at the proposed wind farm should have no impact on EAS flights from Athlone.

EAS Aircraft	Impact of proposed wind farms – Opinion
Helicopter (Eurocopter EC135)	Low – Helicopter landings at the subject area are highly unlikely to occur as the proposed wind farm site is located on boggy / agricultural terrain. In addition, the aircraft would be equipped with modern communications systems and navigational equipment. Should the wind farm be permitted, the turbines would be fitted with aeronautical lighting and would be clearly marked in aviation charts.

Table 24. Impact of proposed wind farm on EAS Operations

3. Summary

A summary of the aviation review for the proposed wind farm at Derryadd is provided in Table 25 below.

Item	Impact	Summary
Annex 14 - Obstacle Limitation Surfaces (OLS)	None	The proposed turbines are located outside the OLS Surfaces for Ireland West Airport and Abbeyshrule Aerodrome.
Annex 15 - Aerodrome Surfaces	None	Turbines at the proposed wind farm would not penetrate the ICAO Annex 15 Aerodrome Surface for Ireland West Airport. All obstacles, if more than 100 meters above terrain for a distance of 45km from center point of Ireland West Airport, need to be registered in the IAA Air Navigation Obstacle Data Set. The IAA may request that the turbines be included in the IAA Aeronautical Electronic Obstacle Data Sets. It should be noted that there are other existing tall structures nearer to Ireland West Airport (e.g. Sliabh Bawn wind farm) which are already listed in the IAA Aeronautical Electronic Obstacle Data Sets.
Building Restricted Areas	None	A review shows that Derryadd is more than 50 km from the BRA for Ireland West Airport. At this distance there would be no impacts due to the proposed wind farm.
Minimum Sector Altitudes (MSA)	None	A review of the Minimum Sector Altitudes (MSA) shows that the proposed wind farm is outside 25 nautical miles from the VOR/DME at Ireland West Airport. Therefore the MSA of the relevant sector will not be affected and there will be no impact on the published MSA altitude figures.
Instrument Flight Procedures	None	A review shows that the instrument flight procedures for Ireland West RWY 08 and RWY 26 standard instrument departures are unlikely to be impacted for precision aircraft.
Communication and Navigation Systems	None	As the proposed wind farm is approximately 61 km from the Localizer and transmitting antenna at Ireland West Airport, it is very unlikely that the proposed development will have any impact on these ATS communications and radio navigational aids.
Radar Surveillance Systems Safeguarding	None	The proposed wind turbines would be located in Assessment Zone 4 (EuroControl guidelines) for SSR and PSR instruments and a detailed Impact Assessment will not be required
Flight Inspection and Calibration	None	The annual Flight Inspection Procedures will not be impacted by the proposed wind farm as the proposed site is sufficiently far from the ARP at Ireland West Airport that there would be no impacts. In addition, the Flight Inspection Procedures should already account for existing obstacles.
Aeronautical Obstacle Warning Light Scheme	None	It is possible that the IAA and DoD may request that the wind farm, if permitted, would be fitted with Aeronautical Obstacle Warning Lights in accordance to industry standards. Subject to further consultation with the IAA and the DoD.
DoD Aeronautical Safeguarding	Subject to detailed technical assessment.	As the proposed development is located outside IAC / DoD Restricted Areas (i.e. Military Installations, Training Areas, Baldonnel restricted airspace, Low Level Flight Routes), there should be no impact to IAC / DoD activities. However, DoD correspondences have made specific observations regarding an Aeronautical Obstacle Warning Light Scheme for the IAC. A review of the specified IAC Aeronautical Obstacle Warning Light Scheme is subject to a further detailed assessment.
Garda Air Support Unit and Emergency Aeromedical Service	None	An assessment of GASU and EAS operations indicate that they are unlikely to be impacted by the proposed wind farm development.

Table 25. Derryadd Wind Farm – Aviation Review Summary

APPENDIX A - ICAO Annex 15 Area 1 and Area 2 Surfaces.

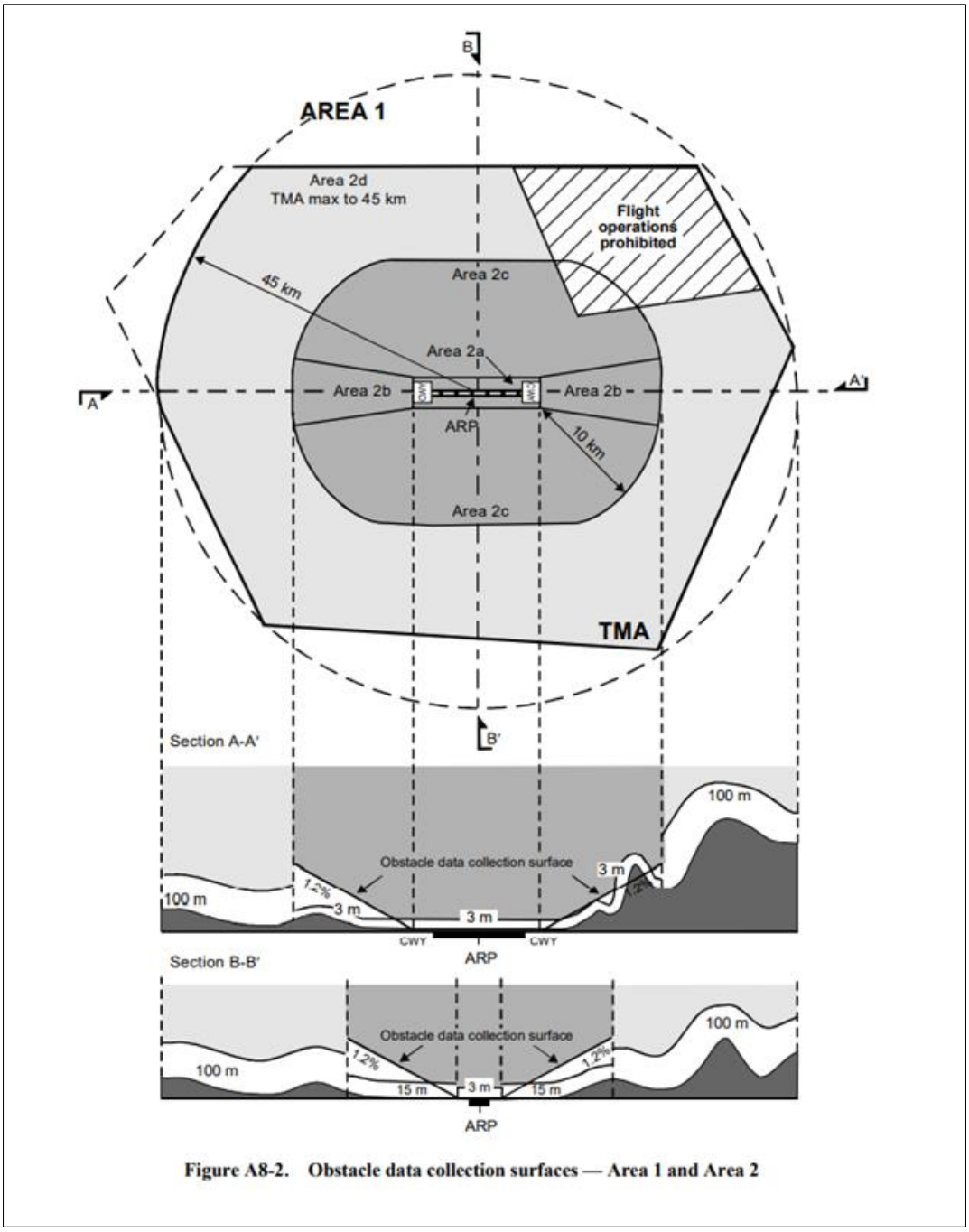


Figure A8-2. Obstacle data collection surfaces — Area 1 and Area 2

ICAO Annex 15 Area 1 and Area 2 Surfaces.

APPENDIX B – Air Corps Wind Farm / Tall Structures Position Paper, August 2014

Óglaigh na hÉireann
DEFENCE FORCES IRELAND

Ceanncheatru an Aer Chor
Air Corps Headquarters

08 August 14

GOC AC

Air Corps Wind Farm/Tall Structures Position Paper

Sir,

1. The attached is the draft Air Corps Position Paper agreed and developed in concert with the flying units under the auspices of CAS Ops.
2. It is recommended that it be forwarded to the Directorate of Operations for transmission to the Department of Defence.
3. The AC position contained within this paper should be notified to planning authorities including An Bord Pleanala. It should also be forwarded to the Department of the Environment, Heritage and Local Government to inform its policies and guidance in respect of wind farms.

Raymond Martin, Lt Col
CATSO

CATSO, Ceanncheatru an Aer Chor, Aerodrom Mhic Easmuinn, BAC 22.
CATSO Air Corps Headquarters, Casement Aerodrome, Baldonnel, Dublin 22
Ph +353 (0)1 403 7513 *Fax: +353 (0)1 403 7850*

Óglaigh na hÉireann
DEFENCE FORCES IRELAND

Ceanncheatru an Aer Chor
Air Corps Headquarters

Air Corps Wind farm/Tall Structures Position Paper.

1. **Objective:**
This position paper is intended to ensure that
   a. Air Corps operations and training may be accomplished in a safe and economical manner;
   b. Baldonnel remains a viable aerodrome for IFR and VFR traffic;
   c. The ability to train military flying skills is protected;
   d. Vital navigation routes to and from the regions to Baldonnel and the Dublin area are protected to safeguard the ability of the Air Corps to fulfill its role.

2. **Statement of position.**

   a. The Air Corps is opposed the erection of wind farms or other obstacles which will affect its ability to train and operate in a safe and economic manner.

   b. The Air Corps is opposed to any wind farms or tall structures in the following areas:

   (1) Lands underlying military airspace used for flying activity

   (a) The area contained in Danger Area EI-D1.
   (b) The area contained in Danger Area EI-D5.
   (c) The area contained within Danger Area EI-D6.
   (d) The area contained within Danger Area EI-D13.
   (e) The area contained within Danger Area EI-D14.
   (f) The area contained within Restricted Area EI-R15.
   (g) The area contained within Restricted Area EI-R16 within 20NM of Baldonnel.
   (h) The area contained within Military Operating Areas, MOAs 3 and 4 within 20NM of Baldonnel.

   (2) Areas wherein military flying occurs at low level as identified in the annexes listed below.
   (a) Annex A: Low flying training areas within MOA 4 in the areas of
      a. Blessington
      b. Edenderry/Allenwood/Rathangan
      c. Kilmeague/Newbridge

   (b) Annex B: low flying training area West (LFTA WEST).

(3) A distance of 5NM or less from military installations.

c. The following routes are identified as critical low level routes in support of Air Corps operational requirements and the Air Corps is opposed to the erection of wind farms or tall structures within 3NM of the route centerline which could affect Air Corps' ability to access regional areas.

(a) N/M1
(b) N/M2
(c) N/M3
(d) N/M4
(e) N/M6
(f) N/M7
(g) N/M8
(h) N/M9
(i) N/M11
(j) N25
(k) N17 between Sligo and Knock
(l) N15/N13 between Sligo and Letterkenny
(m) N14 from Lifford to Letterkenny and R245 and R247 from Letterkenny to Fanad Head.

Applications or proposals for structures in these areas of a height greater than 45m above ground level at the site of the object must be referred to Irish Air Corps for assessment of potential impact on flight operations.

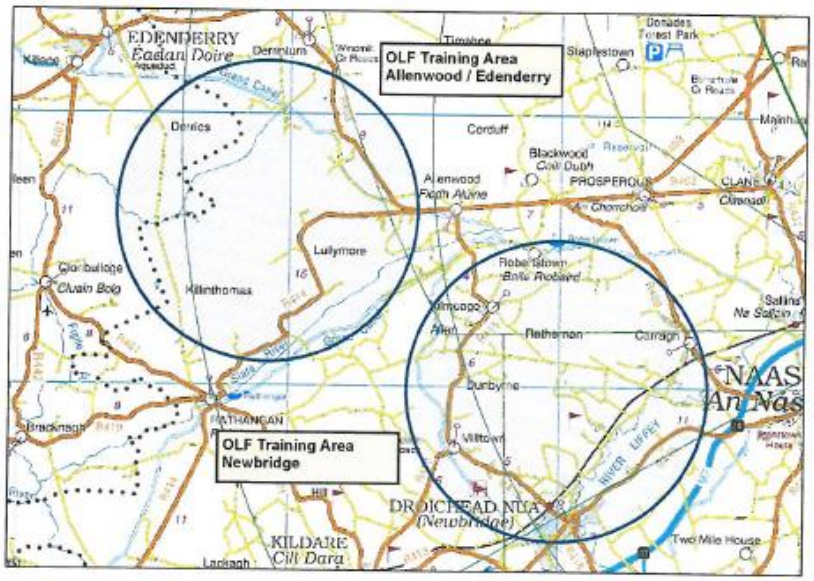
d. In MOA 4 outside of the areas identified in b.(1) (2) and (3), and in MOA 5, applications or proposals for objects of a height greater than 45m above ground level at the site of the object must be referred to the Irish Air Corps for assessment of potential impact on flight operations.

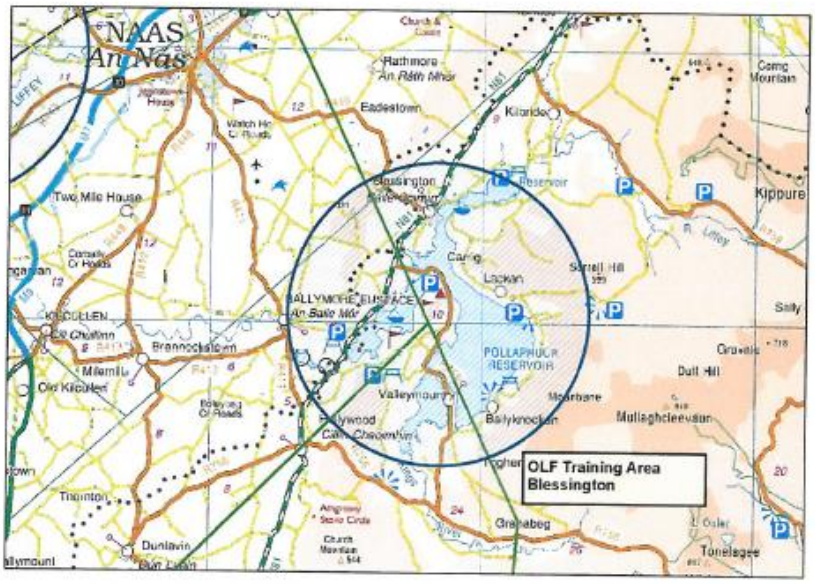
e. In all locations where wind farms or masts are permitted it should be a condition that they meet the following lighting requirements

(1) Single turbines or structures, or turbines delineating corners of a wind farm, should be illuminated by high intensity strobe lights (Red).
(2) Obstruction lighting elsewhere in a wind farm will be of a pattern that will allow the hazard be identified and avoided by aircraft in flight.
(3) Obstruction lights used should be incandescent or of a type visible to Night Vision Equipment. Obstruction lighting fitted to obstacles must emit light at the near Infra-Red (IR) range of the electromagnetic spectrum, specifically at or near 850nanometres (nm) of wavelength. Light intensity to be of similar value to that emitted in the visible spectrum of light.

Annex A

Low Flying Areas - MOA 4





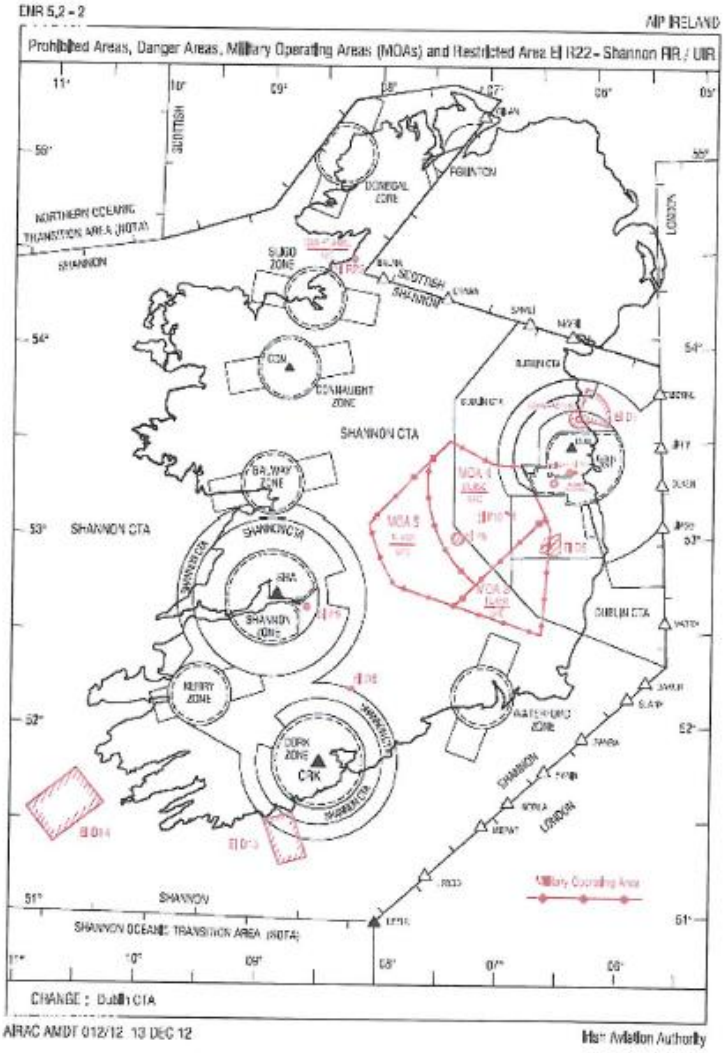
Annex B

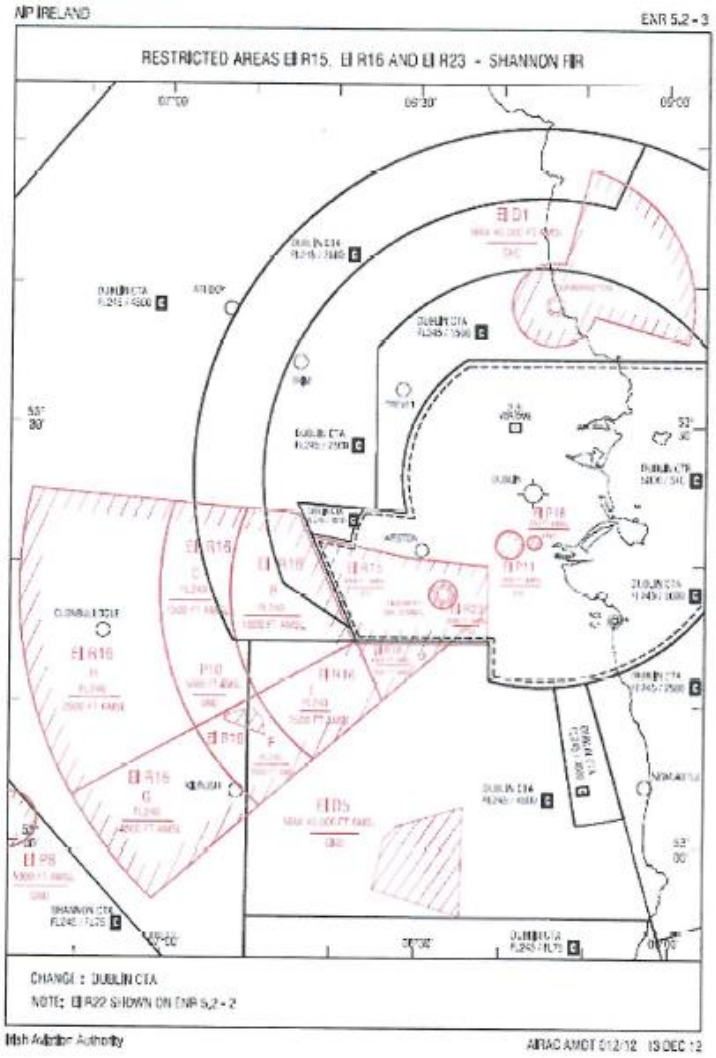
Low Flying Area – LFTA WEST

1. Area contained within the following grid L6972; L6945; M0745; M0772
2. Routes are primarily within valley areas.
3. Applications for wind farms/masts should be referred to Air Corps Operations for assessment against low flying routes.

Annex C

Designated Airspace
Restricted Areas, Danger Areas and Military Operating Areas





Annex D

Low Level Routes