Partners in UK offshore wind

MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

Environmental Statement

Volume 4, Annex 11.1: Aviation and radar technical report

Planning Inspectorate Reference Number: EN010136

Document Number: MRCNS-J3303-RPS-10095

Document Reference: F4.11.1

APFP Regulations: 5(2)(a)

April 2024

F01

www.morganandmona.com/morgan

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
F01	Application	Osprey	Morgan Offshore Wind Ltd.	Morgan Offshore Wind Ltd.	April 2024

Prepared by:

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Prepared for:

Morgan Offshore Wind Ltd.

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Glossary

Term	Meaning
Controlled airspace	Airspace in which Air Traffic Control exercises authority. In the UK, Class A, C, D and E airspace is controlled.
Flight Level	A standard nominal altitude of an aircraft, in hundreds of feet, based upon a standardized air pressure at sea-level.
Instrument Flight Rules	The rules governing procedures for flights conducted with the crew making reference to aircraft cockpit instruments for situation awareness and navigation.
Instrument Meteorological Conditions	Weather conditions which would preclude flight by the Visual Flight Rules (i.e. conditions where the aircraft is in or close to cloud or flying in visibility less than a specified minimum).
Minimum Safe Altitude	Under aviation flight rules, the altitude below which it is unsafe to fly in Instrument Meteorological Conditions owing to presence of terrain or obstacles within a specified area.
Uncontrolled airspace	Airspace in which Air Traffic Control does not exercise any executive authority but may provide basic information services to aircraft in radio contact. In the UK, Class G airspace is uncontrolled.
Visual Flight Rules	The rules governing flight conducted visually (i.e. with the crew maintaining separation from obstacles, terrain and other aircraft visually).
Visual Meteorological Conditions	A flight category which allows flight to be conducted under Visual Flight Rules defined by in flight visibility and clearance from cloud.

Acronyms

Acronym	Description
AIP	Aeronautical Information Publication
ANO	The Air Navigation Order (ANO) 2022 and Regulations
ANSP	Air Navigation Service Provider
ARA	Airborne Radar Approach
ARP	Aerodrome Reference Point
ATC	Air Traffic Control
ATCSMAC	Air Traffic Control Surveillance Minimum Altitude Chart
ATS	Air Traffic Service
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CAS	Controlled Airspace
CAT	Commercial Air Transport
CTA	Control Area
CTR	Control Zone
DME	Distance Measuring Equipment
EASA	European Union Aviation Safety Agency

Acronym	Description
EIA	Environmental Impact Assessment
FAF	Final Approach Fix
FL	Flight Level
GDF	Great Dun Fell
GPS	Global Positioning System
HAR	Helicopter Access Report
HMRI	Helicopter Main Route Indicator
HTZ	Helicopter Traffic Zone
IAF	Initial Approach Fix
IAIP	Integrated Aeronautical Information Package
IFP	Instrument Flight Procedure
IFR	Instrument Flight Rules
IMC	Instrument Meteorological Conditions
IoM	Isle of Man
ISAR	Integrated Search and Rescue
LAT	Lowest Astronomical Tide
LFA	Low Flying Area
LoS	Line of Sight
MAP	Missed Approach Point
MCA	Maritime Coastguard Agency
MDH	Minimum Descent Height
MDS	Maximum Design Scenario
MGN	Maritime Guidance Note
MOD	Ministry of Defence
MSA	Minimum Safety Altitude
NDB	Non-Directional Radio Beacons
NOGEPA	Nederlands Olie en Gas Exploratie en Productie Associatie
NPI	Non-Production Installation
NUI	Normally Unmanned Installation
OCA	Obstacle Clearance Altitude
OLS	Obstacle Limitation Surfaces
OPERA	Operational Programme for the Exchange of Weather Radar
OREI	Offshore Renewable Energy Installations
PEIR	Preliminary Environmental Information Report
PEXA	Practice and Exercise Area
PSR	Primary Surveillance Radar

Acronym	Description
RAF	Royal Air Force
RCS	Radar Cross Section
RDP	Radar Data Processor
SAR	Search and Rescue
SMAC	Surveillance Minimum Altitude Chart
SPA.HOFO	Specific Approval for Helicopter Offshore Operations
SSR	Secondary Surveillance Radar
TEMPSC	Totally Enclosed Motor Propelled Survival Craft
UKLFS	UK Low Flying System
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions

Units

Unit	Description
%	Percentage
°	Degrees
ft	Feet
°C	Degrees Celsius
km	Kilometres
kt	knot
m	Metres
nm	Nautical mile
rpm	Rotations per minute

1 Aviation and radar technical report

1.1 Introduction

1.1.1.1 This technical report provides a detailed description of aviation and radar activity within the vicinity of the proposed Morgan Offshore Wind Project: Generation Assets (hereafter referred to as the Morgan Generation Assets) and the wider Irish Sea region. This information is used to inform Volume 2, Chapter 11: Aviation and radar of the Environmental Statement, as part of the consenting process for the Morgan Generation Assets.

1.1.1.2 Appendix A, Helicopter Access Report (HAR) (Anatec, 2023), of this technical report contains details on weather and airspace access to current Irish Sea (Morecambe Bay) oil and gas installations (platforms) near the Morgan Generation Assets.

1.1.1.3 Appendix B, Instrument Flight Procedures (IFP) assessment by a Civil Aviation Authority (CAA) Approved Procedure Design Organisation (APDO), Osprey Consulting Services, (Osprey, 2024), to this technical report details published flight procedures of Irish Sea littoral aerodromes.

1.1.1.4 This technical report has been produced by Osprey Consulting Services Ltd (Osprey) on behalf of RPS, which has been appointed as the lead Environmental Impact Assessment (EIA) consultant for the Morgan Generation Assets by bp/EnBW (hereafter referred to as the Applicant) and considers wind turbines once they are fully installed with regard to aviation and radar.

1.2 Study area

1.2.1 Introduction

1.2.1.1 To identify and characterise aviation and radar receptors, a broad study area has been defined. The Morgan aviation and radar study area is presented in Figure 1.1.

1.2.1.2 The Morgan aviation and radar study area covers the aviation radar systems that potentially detect the maximum (highest) wind turbine blade tip (364 m above Lowest Astronomical Tide (LAT)) height. It includes the airspace within the following points as provided in Figure 1.2 below:

- The NATS Clee Hill Primary Surveillance Radar (PSR) to the southeast of the Morgan Array Area
- The NATS Great Dun Fell PSR to the northeast of the Morgan Array Area
- The NATS Lowther Hill PSR to the north northeast of the Morgan Array Area
- The Manchester Airport PSR to the southeast of the Morgan Array Area
- The Ministry of Defence (MOD) Royal Air Force (RAF) Valley PSR location to the south southwest of the Morgan Array Area
- A point 30 km west of the location of the Ronaldsway (Isle of Man (IoM)) Airport PSR, on the Isle of Man (IoM)
- The MOD (QinetiQ) West Freugh PSR to the northwest of the Morgan Array Area.

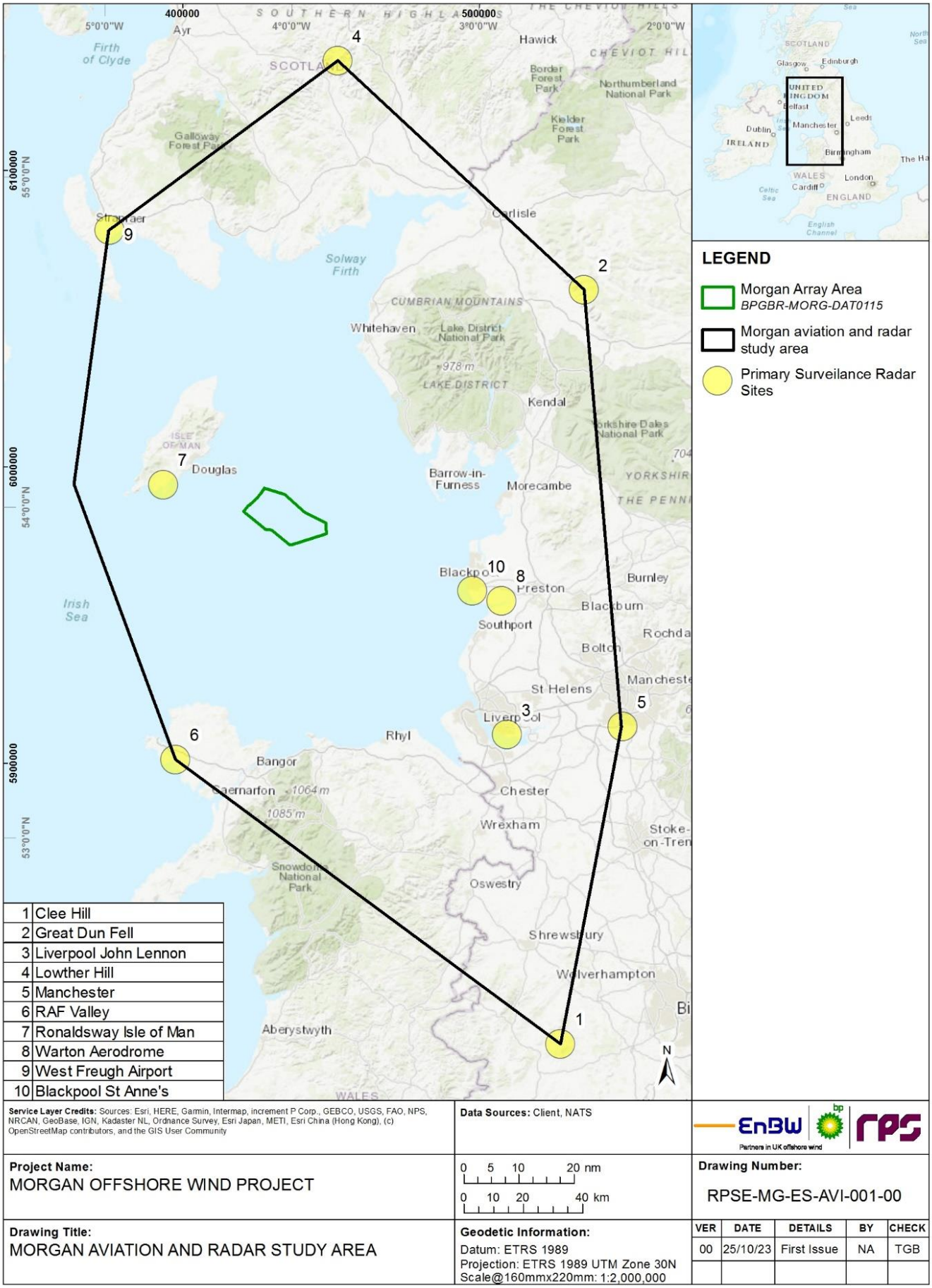


Figure 1.1: The Morgan aviation and radar study area.

1.2.2 Aerodromes

1.2.2.1 Following stakeholder consultation and responses to the Preliminary Environmental Information Report (PEIR) and conclusions of Appendix B, IFP Assessment. A refined list of potential impacts to aviation stakeholder operations was determined. The aerodromes listed below are predicted to be affected by the development of the Morgan Generation Assets, highlighted within Figure 1.2. Approximate measurements have been taken from the closest boundary of the Morgan Array Area to the relevant Aerodrome Reference Point (ARP):

1. Ronaldsway IoM Airport is located on a bearing of approximately 287°/28.1 km. The aerodrome is the main civilian airport on the IoM; owned by the Manx Government and operated by the Department of Infrastructure. It is in the south of the IoM at Ronaldsway near Castletown, 6 nautical miles (nm) southwest of Douglas, the island's capital. The airport operates an aviation radar system and has scheduled services to the United Kingdom and the Republic of Ireland and in 2023, 636,000 passengers passed through the airport. Aircraft approaching from, and departing to, the east will transit above and close to the Morgan Array Area along the airways structure depicted in Figure 1.3
2. RAF Valley is a military operated aerodrome located on a bearing of approximately 206°/82.4 km. The airfield is the home of Number 4 Flying Training School, which provides basic and advanced fast jet training utilising Hawk and Texan aircraft. The airbase operates an aviation radar in support of the provision of Air Traffic Control (ATC) services. 202 Squadron based at the airfield provides maritime and mountain training for aircrews on the Jupiter helicopter
3. British Aerospace Systems (BAES) Walney Aerodrome is located on a bearing of approximately 063°/38.1 km. The aerodrome is owned by BAES, who operate private communication flights to locations across the UK and expanded the airport with new infrastructure and terminal buildings in 2018. The aerodrome operates ATC services without the use of aviation radar. The Lakes Gliding Club also operates out of the aerodrome. Aviation radar is not used at the aerodrome.

1.2.3 Airspace designation at the Morgan Array Area

1.2.3.1 The Morgan Array Area is located within Class G uncontrolled airspace which extends from the surface up to Flight Level (FL) 195 (approximately 19,500 ft), as shown in Figure 1.3. A triangular portion in the northwest of the Morgan Array Area, geographically overlaps a part of the airspace block known as the IoM Airport Control Area (CTA). Appendix B, IFP assessment, (Osprey, 2024) has considered all published IoM Airport IFPs available at the time of analysis. Impact is defined in the IFP Report, and it is therefore judged that geographical intersection of the IoM airspace by the Morgan Array Area will not create a material impact to IoM Airport IFPs. The CTA is Class D controlled airspace established from an altitude of 2,500 ft to FL 105 (approximately 10,500 ft). Additionally, the northwest Morgan Array Area crosses into a small area of the IoM Control Zone (CTR), which extends from the surface to FL 105. Within Class G airspace, any aircraft, civil or military, can enter and transit the airspace without ATC clearance and subject only to a small set of mandatory rules, as stipulated in the UK Integrated Aeronautical Information Package (IAIP) (CAA, 2024) En-Route Section 1.4-2 Air Traffic Service (ATS) Airspace Description. Aircraft operating in this area may be in receipt of an ATS; however, within this classification of airspace, pilots are ultimately responsible for their own terrain and obstacle clearance. This is achieved

through prudent planning (using published aviation charts, the UK IAIP and local aerodrome instructions) and diligent 'lookout' throughout the flight.

1.2.3.2 Aircraft operating in the Class D of the IoM CTA and CTR are predominately controlled by air traffic controllers located at the Airport. Within Class D airspace all flights are subject to ATC service, pilots must maintain two-way radio communication with ATC with standard separation maintained between aircraft dependent on whether they are flying under Instrument Flight Rules (IFR) or Visual Flight Rules (VFR).

1.2.3.3 The Millom Helicopter Traffic Zone (HTZ) is established around the Millom Field as a means of notification of helicopter activity engaged in platform approaches, departures and extensive uncontrolled inter-platform transit flying. HTZs consist of the airspace from sea level to 2,000 ft contained within specific lateral dimensions that are notified via aeronautical charts and documents and adopt the airspace classification they sit in (in this case Class G uncontrolled airspace). Helicopters operating with the HTZ may be impacted by the proximity of the Morgan Array Area. Appendix A Helicopter Access Report provides the conclusions of assessment.

1.2.3.4 Military low flying is a demanding but essential skill for military aircrew, gained through progressive training and continuous practice within the UK Low Flying System (UKLFS). The ability to operate effectively at low level by day and night is vital to fast jet, transport aircraft and helicopters as they support forces on the ground. Military aircraft are deemed to be low flying when operating below 2,000 ft above the surface.

1.2.3.5 The Irish Sea Class G airspace within which the Morgan Array Area sits, is in the MOD Low Flying Area (LFA) 17 (part of the UKLFS), between Cumbria (Lake District) and North Wales.

1.2.3.6 Helicopter Main Route Indicators (HMRIs) support the transport of personnel and equipment to offshore oil and gas installations. HMRIs are routes typically and routinely flown by helicopters operating to and from offshore destinations and are promulgated for the purpose of signposting concentrations of helicopter traffic to other airspace users. HMRI promulgation does not predicate the flow of helicopter traffic. Whilst HMRIs have no airspace status and assume the background airspace classification within which they lie (in the case of the Irish Sea, Class G), they are used by the Air Navigation Service Provider (ANSP) and helicopter operators for flight planning and management purposes. CAA Civil Aviation Publication (CAP) 764 Policy and Guidelines on Wind Turbines (CAA, 2016) states that HMRIs have no defined lateral dimensions (only route centrelines are charted on navigation charts) and that 2 nautical miles (nm) either side of the route centreline should be kept obstacle free; no HMRIs cross the Morgan Array Area. There are no HMRIs located within the vicinity of the Morgan Array Area; consequently, further consideration of these have been scoped out. The HMRI system in the east Irish Sea is shown in Figure 1.2.

1.2.3.7 In order to maintain a safe operating environment, the CAA recommend, in CAP 764 (CAA, 2016) a consultation zone of 9 nm radius around offshore installations serviced by helicopters. This consultation zone is not considered a prohibition on development, but a trigger for consultation between offshore helicopter operators, the operators of existing installations and developers of proposed offshore wind farms, to determine a solution that maintains safe offshore helicopter operations. Appendix A, HAR (Anatec, 2023) of this technical report contains details on weather and airspace access to current Irish Sea (Morecambe Bay) hydrocarbon installations (platforms) near the Morgan Generation Assets.

1.2.3.8 The Morgan Array Area extends into the 9 nm consultation zones established around seven platforms (Figure 1.2):

- Millom West located 1.6 nm from the Morgan Array Area
- North Morecambe DPPA located 4.1 nm from the Morgan Array Area
- North Morecambe located 4.1 nm from the Morgan Array Area
- South Morecambe DP8 (N) located 6.6 nm from the Morgan Array Area
- South Morecambe DP8 (S) located 6.6 nm from the Morgan Array Area
- South Morecambe DP6 (N) located 7.6 nm from the Morgan Array Area
- South Morecambe DP6 (S) located 7.6 nm from the Morgan Array Area.

1.2.3.9 The 9 nm consultation zones are a trigger for consultation with the operators of any subsea infrastructure and wells where mobile drilling rigs or vessels may require helicopter access. This consultation is described in Section 11.3 of Volume 2, Chapter 11: Aviation and radar of the Environmental Statement. Appendix A, HAR (Anatec, 2023) of this technical report, assesses the potential impact to helicopter operations to those hydrocarbon platforms located within proximity to the Morgan Array Area.

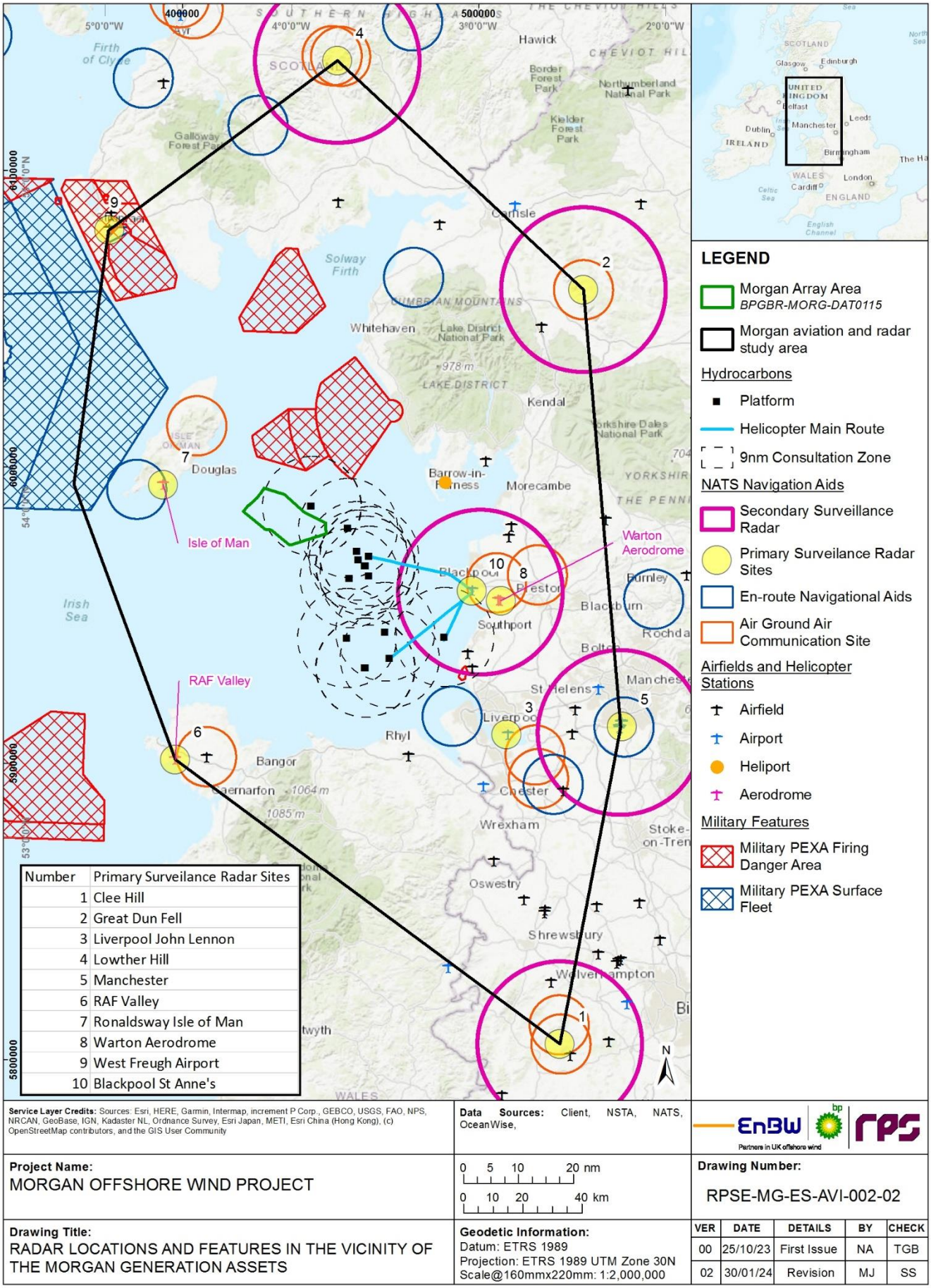


Figure 1.2: Radar locations and features in the vicinity of the Morgan Generation Assets.

1.2.4 Instrument Flight Procedures (IFP)

1.2.4.1 IFP design covers the planning of routes used by pilots and air traffic control from take-off to landing and is a complex and highly regulated process. All IFP design must be undertaken by an approved procedure designer that is authorised by the relevant State. In the UK, all IFP design must be undertaken in accordance with CAA requirements. Wind turbines placed in proximity to IFP may adversely affect IFP safeguarded areas which may result in individual IFP being no longer fit for purpose without mitigation being applied. Appendix B, IFP Assessment (Osprey, 2024), assesses those Irish Sea littoral aerodromes' flight procedures which are within 50 nm of the Morgan Array Area together with analysis conclusions.

1.3 Methodology

1.3.1 Introduction

The baseline was defined through the PEIR stage and desktop study. Through the desktop study the identification of all aviation and radar stakeholders potentially affected by the Morgan Array Area has been established in accordance with regulatory guidelines on safeguarding distances as provided within from CAP 764.

1.3.2 Desktop study

1.3.2.1 The types of radar operating over the Morgan Array Area have been considered, together with civil aviation agencies including NATS (En Route) plc (hereafter referred to as NATS) which is the en-route ANSP in the UK for en-route traffic, offshore airborne Search and Rescue (SAR) and military operations of relevance to confirm the baseline.

1.3.2.2 The radar technical effects, radar Line of Sight (LoS), analysis between the maximum blade tip height and potentially affected civil and military aviation radar systems have been completed to establish the theoretical detectability of the wind turbines to those regional radar systems which have the potential to be affected by their operation. In addition, stakeholder response to consultation has indicated that the NATS Lowther Hill and St Anne's PSR systems will be affected together with the IoM Airport PSR system through the detection of operational wind turbines at the maximum blade tip height of 364 m above LAT.

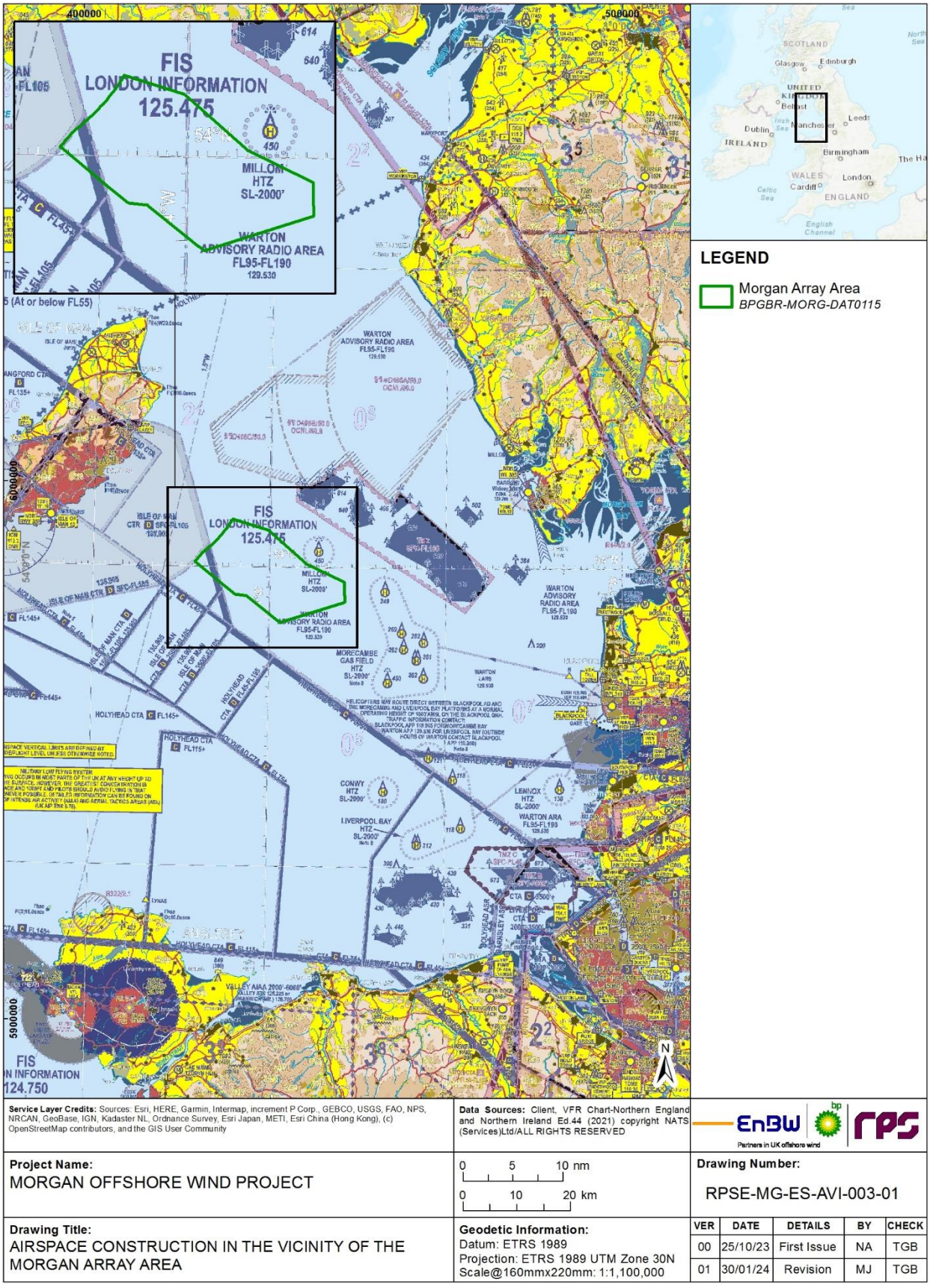
1.3.2.3 No site-specific surveys were undertaken during this desk-based study. No consultation was undertaken during this desk-based study, but subsequent consultation is described in Section 11.3 of Volume 2, Chapter 11: Aviation and radar of the Environmental Statement.

1.3.2.4 Information on aviation and radar activities within the Morgan aviation and radar study area was collected through a detailed desktop review of existing datasets. These are summarised in Table 1.1 below.

Table 1.1: Summary of key desktop sources.

Title	Source	Year	Author
UK IAIP	CAA/NATS	January 2024	CAA/NATS
UK Military Aeronautical Information Publication (AIP)	MOD	January 2024	MOD
MOD Lighting Review	MOD	January 2020	MOD

Title	Source	Year	Author
CAP 168 Licensing of Aerodromes	CAA	January 2022	CAA
CAP 393 The Air Navigation Order 2022	CAA	February 2021	CAA
CAP 437 Standards for Offshore Helicopter Landing Areas	CAA	February 2023	CAA
CAP 670 Air Traffic Services Safety Requirements	CAA	June 2019	CAA
CAP 738 Safeguarding of Aerodromes	CAA	October 2020	CAA
CAP 764 Policy and Guidelines on Wind Turbines	CAA	February 2016	CAA
CAP 777 ATC Surveillance Minimum Altitude Charts in UK Airspace Policy and Design Criteria	CAA	Edition 5, September 2018	CAA
European Union Aviation Safety Agency (EASA) Document 923 Safety Instruction Bulletin	EASA	2012	EASA
Marine Guidance Note (MGN) 654 Marine Guidance Note Safety of Navigation: Offshore Renewable Energy Installations (OREIs), Guidance on UK Navigational Practice, Safety and Emergency Response.	Maritime and Coastguard Agency (MCA)	April 2021	MCA
UK VFR Charts	CAA/NATS	April 2023	CAA/NATS
Statement of the Operational Programme for the Exchange of Weather Radar (OPERA) group on the cohabitation between weather radars and wind turbines	OPERA	November 2009	OPERA
Meteorological data from 19 December 2017 to 19 December 2022 - from the Morecambe Bay Millom West Platform, owner/operator Harbour Energy	Harbour Energy	November 2023	Harbour Energy
Vantage flight data for Noble Innovator jack-up performing decommissioning work at the Kate Field in the Central North Sea.	bp	November 2023	Vantage



Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community	**Data Sources:** Client, VFR Chart-Northern England and Northern Ireland Ed.44 (2021) copyright NATS (Services)Ltd/ALL RIGHTS RESERVED	EnBW bp RPS Partners in UK offshore wind
Project Name: MORGAN OFFSHORE WIND PROJECT	0 5 10 nm 0 10 20 km	**Drawing Number:** RPSE-MG-ES-AVI-003-01
Drawing Title: AIRSPACE CONSTRUCTION IN THE VICINITY OF THE MORGAN ARRAY AREA	**Geodetic Information:** Datum: ETRS 1989 Projection: ETRS 1989 UTM Zone 30N Scale@160mmx220mm: 1:1,100,000	

VER	DATE	DETAILS	BY	CHECK
00	25/10/23	First Issue	NA	TGB
01	30/01/24	Revision	MJ	TGB

Figure 1.3: Airspace construction in the vicinity of the Morgan Array Area.[1]

[1] *Data included in this product reproduced under licence from NATS (Services) Ltd © Copyright 2022 NATS (Services) Ltd. All rights reserved.*

1.3.3 Helicopter access to hydrocarbon platforms

1.3.3.1 The Morgan Array Area extends into the CAA recommended 9 nm consultation zones established around three offshore facilities (Figure 1.2): Millom West, Millom PLEM Wellhead and Q1-3 Wellheads. Appendix A, HAR (Anatec, 2023) of this technical report, assesses the potential impact to helicopter operations to those hydrocarbon platforms located within proximity to the Morgan Array Area.

1.3.4 NATS PSR

1.3.4.1 The following NATS PSRs provide en-route radar coverage over the Irish Sea airspace, and are predicted to be affected by the detection of operational 364 m above LAT blade tip height wind turbines placed within the Morgan Array Area:

- Lowther Hill
- St Anne's.

1.3.5 Aerodrome PSR

1.3.5.1 An additional aerodrome PSR (Figure 1.2) located at the following airfield is also predicted to be affected by the detection of the operational 364 m above LAT blade tip height wind turbines placed within the Morgan Array Area:

- Ronaldsway (IoM).

1.3.5.2 Based on stakeholder responses to PEIR, responding stakeholders indicated that no impact is predicted to occur on the following aerodrome PSR systems, which have been discounted from further analysis:

- RAF Valley PSR
- British Aerospace Systems (BAES) Warton PSR
- West Freugh PSR
- Liverpool Airport PSR.

1.3.6 Secondary Surveillance Radar

1.3.6.1 CAP 764 states that wind turbine effects on Secondary Surveillance Radar (SSR) are less than those on PSRs but can be caused due to the physical blanking and diffracting effects of the wind turbines, depending on the size of the wind turbines in the Morgan Array Area. These effects are typically only a consideration when the wind turbines are located very close to the SSR (less than 10 km). There are no SSR systems within 10 km of the Morgan Array Area.

1.3.7 Meteorological Office radar

1.3.7.1 The Meteorological (Met) Office radar infrastructure is safeguarded by the Met Office. The Met Office works to wind turbine safeguarding guidelines that stipulate a 20 km separation between any development and a weather radar system.

1.3.7.2 The closest Met Office radar system is located at Hameldon Hill (Met Office, 2020), approximately 4.6 km southwest of Burnley, Lancashire, over 100 km from the Morgan Array Area and is discounted from further analysis.

1.3.8 Radar Line of Sight (LoS) modelling

1.3.8.1 The ATDI ICS LT (Version 22.4.7 x64) tool was utilised to model the terrain elevation profile between the identified PSR systems and the Morgan Array Area. Otherwise known as a point-to-point radar LoS analysis, the result is a graphical representation of the intervening terrain and the direct signal LoS, taking into account earth curvature and radar signal properties.

1.3.8.2 It should be noted that this is a limited and theoretical desk-based study; in reality there are unpredictable levels of signal diffraction and attenuation within a given radar environment that can influence the probability of a wind turbine being detected. The analysis is designed to give an indication of the likelihood of the wind turbine being detected such that the operational significance of the Morgan Array Area relative to the radar systems can be assessed. The aim of the LoS analysis is to determine which radar systems have the potential to detect operational wind turbines at the maximum blade tip height placed within a projected array area; the layout of wind turbines does not have a material effect on establishing theoretical radar LoS. Therefore, to enable the analysis, points of reference in the form of a regular grid pattern were established across the Morgan Array Area with wind turbines on all array vertices at the maximum tip height of 364 m above LAT, which is considered to be the Maximum Design Scenario (MDS) for aviation. The model does not use precise planned/proposed wind turbine positions, but representative locations within the Morgan Array Area, on a 4 km grid pattern of 27 wind turbines, ensuring an even distribution (as Figure 1.4). The result for a particular location provides an indication of detectability of a wind turbine, based on a maximum upper blade tip height, within a 2 km radius of that location; providing a result that covers the whole of the Morgan Array Area.

1.3.8.3 The qualitative definitions utilised in the LoS assessment are defined in Table 1.2.

Table 1.2: LoS qualitative definitions.

Result	Definition
Yes	The wind turbine is highly likely to be detected by the radar; direct LoS exists between the radar and the wind turbine.
Likely	The wind turbine is likely to be detected by the radar at least intermittently.
Unlikely	The wind turbine is unlikely to be detected by the radar but cannot rule out occasional detection.
No	The wind turbine is unlikely to be detected by the radar as significant intervening terrain exists.

1.3.8.4 A radar LoS analysis across the Morgan Array Area has been completed in order to establish theoretical radar detectability of the wind turbines, placed within the Morgan Array Area to selected PSR systems located in the UK based on a maximum upper blade tip height of 364 m LAT. This is a representative modelling ‘datum’ height and the error tolerance of the analysis model covers the wind turbine blade tip height of 364 m above LAT. Radar operates by alternately transmitting a stream of high-power radio frequency pulses and ‘listening’ to echoes received back from targets within its radar LoS. Generally, air surveillance (aviation) radars employ a rotating antenna that provides 360° coverage in azimuth; the typical scan rate is 15 rotations per minute (rpm) thus illuminating a given target every four seconds.

1.3.8.5 PSR can distinguish between moving and static targets; for targets that are moving towards or away from the radar, the frequency of the reflected signal from a moving target changes between each pulse (transmit and receive) which is known as the Doppler shift. This can be most practically explained by considering the change in frequency of the engine sound heard by a pedestrian when a car passes by on the road – the sound as the car approaches is higher than the sound heard by the pedestrian as it travels away. The Doppler shift has the effect of making the sound waves appear to bunch up in front of the vehicle (giving a higher frequency) and spread out behind it (lower frequency). The true frequency of the engine is only heard when the car is immediately next to the pedestrian. The aviation radar receiver is 'listening' to the radio waves reflected from the moving object and working out whether the returned signal is of a higher or lower frequency (moving object) or if the returned frequency is the same as the transmitted signal (a stationary object).

1.3.8.6 Wind turbines are a significant cause of PSR false plots or clutter, as the rotating blades can trigger the Doppler threshold (minimum shift in signal frequency) of the Radar Data Processor (RDP) and therefore may be interpreted as aircraft movements (CAP 764). Significant effects have been observed on radar sensitivity caused by the substantial Radar Cross Section (RCS) of the wind turbine structural components (blades, tower and nacelle) which can exceed that of a large aircraft; the effect 'blinds' the radar (or the operator) to wanted targets in the immediate vicinity of the wind turbine. False plots and reduced radar sensitivity may reduce the effectiveness of the radar system itself to an unacceptable level and compromise the provision of a safe radar service to participating aircraft.

1.3.9 Radar LoS Results

1.3.9.1 Due to the location of the Morgan Array Area possible effects are likely to the operations associated with the following PSRs due to detectability of the wind turbines:

- Lowther Hill: 146 km from the Morgan Array Area, but due to the vertical extent of the wind turbines, 90% of the Morgan Array Area is theoretically highly likely to be in radar LoS to this NATS PSR (Figure 1.4)
- St Anne's: 53 km from the Morgan Array Area, the wind turbines are theoretically highly likely to be in radar LoS to this NATS PSR (Figure 1.5))
- Ronaldsway (IoM): 29 km from the Morgan Array Area, the wind turbines are theoretically highly likely to be in radar LoS to this aerodrome PSR (Figure 1.6).

1.3.9.2 Radar detection of operational wind turbines may not, in itself be sufficient reason to lead to objection by the stakeholder. Other factors such as the operational significance of the airspace to the operator, aircraft traffic patterns and types of radar service provided to air traffic using the airspace will determine the nature and severity of the operational impact on the receptor. Radar clutter created by the Morgan Array Area from detectable wind turbines could cause air traffic controllers to lose aircraft track identity and hence they may be unable to maintain the appropriate separation standard on fixed airspace procedures or other aircraft manoeuvring under their control. Radar LoS analysis results for those aviation radar systems that have provided theoretical radar detectability of the Morgan Array Area are provided in Figure 1.4 to Figure 1.6 below.

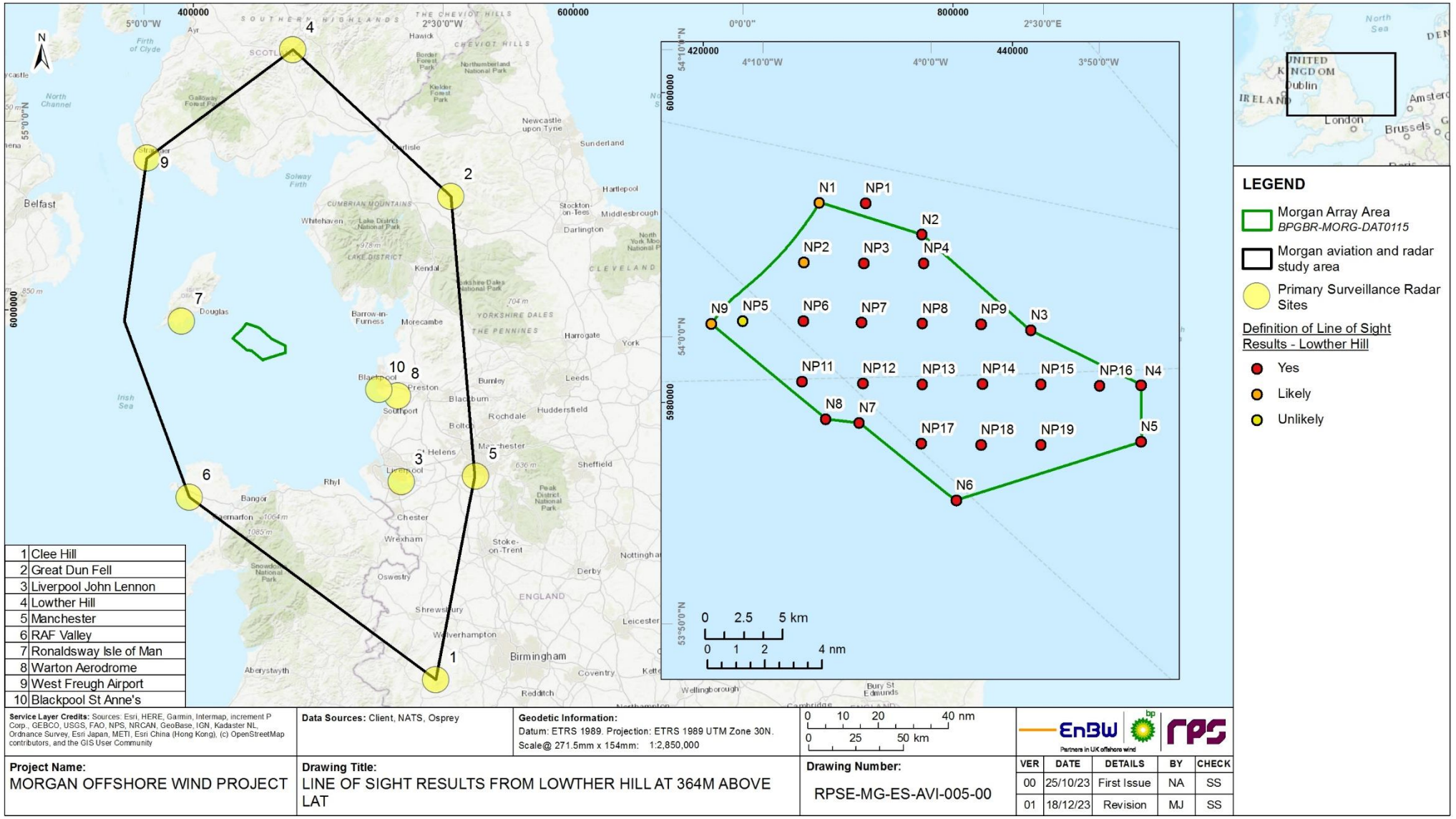


Figure 1.4: NATS Lowther Hill Radar LoS of the Morgan Array Area (not to scale) (turbine layout is indicative).

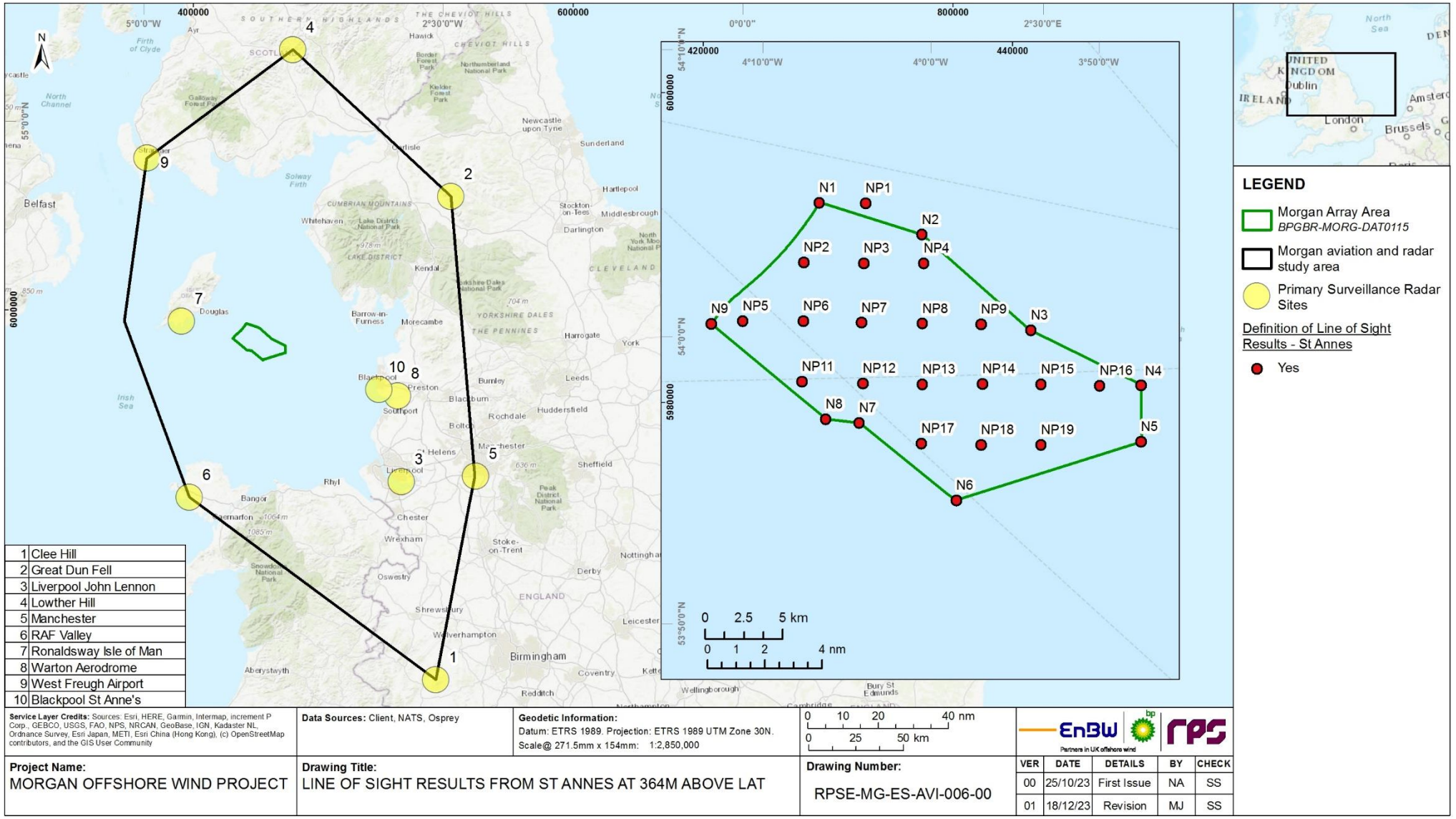


Figure 1.5: NATS St Anne's Radar LoS of the Morgan Array Area (not to scale) (turbine layout is indicative).

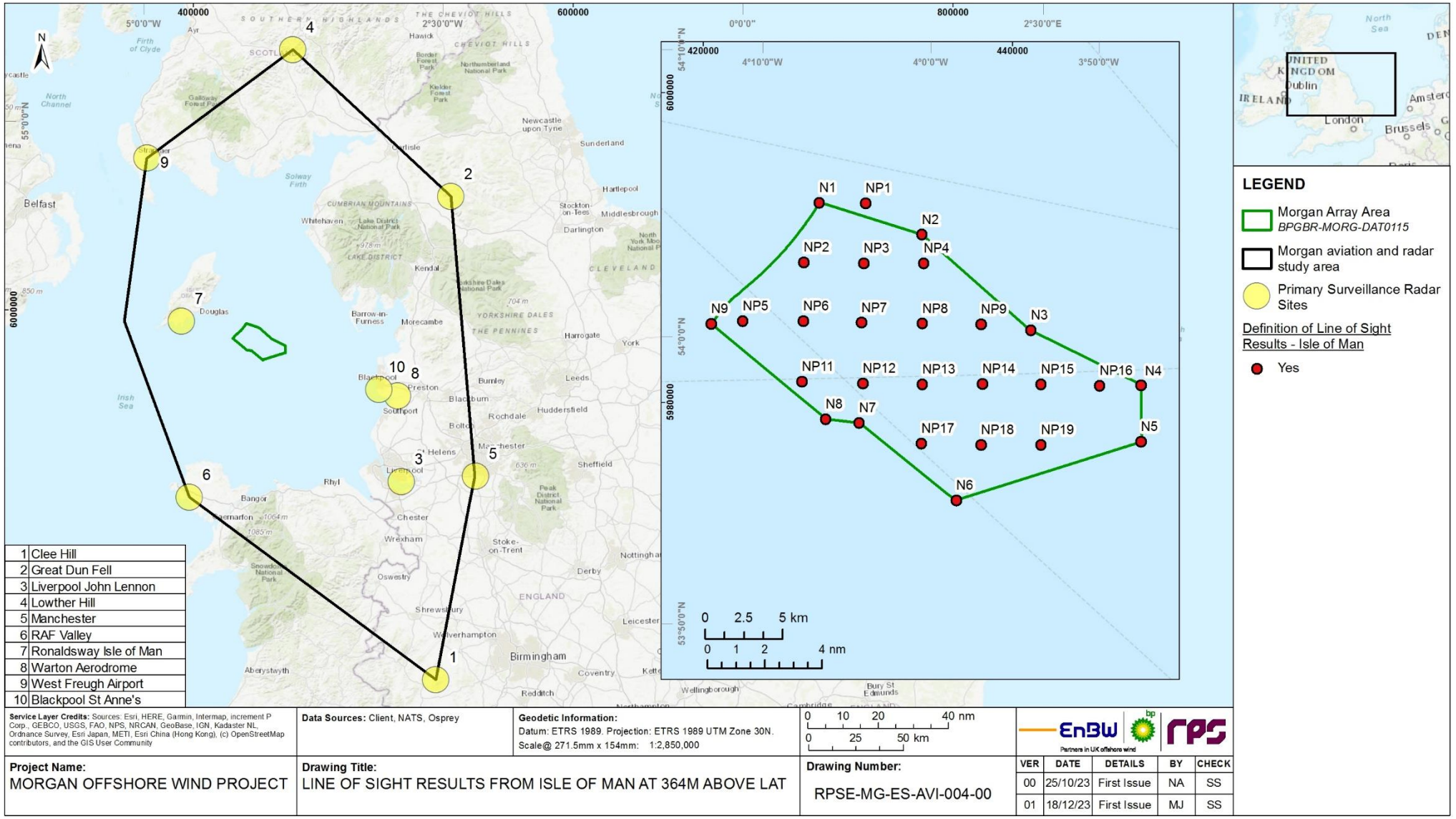


Figure 1.6: Ronaldsway (IoM) Airport Radar LoS of the Morgan Array Area (not to scale) (turbine layout is indicative).

1.4 Instrument Flight Procedures (IFP), Air Traffic Control Surveillance Minimum Altitude Chart (ATCSMAC)/Minimum Sector Altitude (MSA)

1.4.1.1 Appendix B, IFP Assessment (Osprey, 2024), assesses those Irish Sea littoral aerodromes' flight procedures which are within 50 nm of the Morgan Array Area together with analysis conclusions.

1.4.1.2 Licenced Airports ensure safe operations in the vicinity of the airport by minimising, as far as practicable, any penetration of the Obstacle Limitation Surfaces (OLS). Whilst the OLS offers vital protection to aircraft against new and existing developments, they do not ensure that IFPs remain unaffected by such developments. It is vital that airports are made aware of any new development that may require an increase to the published Obstacle Clearance Altitude (OCA) associated with IFPs, as well as the IFPs themselves.

1.4.1.3 Appendix B, IFP Assessment (Osprey, 2024), also assesses the minimum altitude available to ATC, at the Irish Sea littoral aerodromes, for vectoring arriving flights within the Air Traffic Control Surveillance Minimum Altitude Chart (ATCSMAC) or the Minimum Sector Altitude (MSA) for aerodromes without PSR or SSR. This minimum altitude is 300 m (984 ft) above the highest obstacle within the ATCSMAC or ATCSMAC sector (MSA).

1.4.1.4 Appendix B, IFP Assessment provides the following potential impacts to IFP, ATCSMAC and MSA at the affected aerodromes:

- Ronaldsway (IoM) Airport
- Potential impact on ATCSMAC
- Potential impact on IFP
- RAF Valley
- Potential impact on ATCSMAC
- Walney Aerodrome
- Potential impact on MSA.

1.5 Summary

1.5.1.1 Based on the modelling results, stakeholder consultation responses and the conclusions of the assessments completed in Appendix A and Appendix B, this report concludes:

1.5.1.2 Radar clutter created by the Morgan Array Area from operational detectable wind turbines could cause air traffic controllers to potentially lose aircraft track identity and hence they may be unable to maintain the appropriate separation standard on fixed airspace procedures or other aircraft manoeuvring under their control when providing a relevant ATS from the following PSR systems:

- NATS Lowther Hill PSR
- NATS St Anne's PSR
- Ronaldsway (IoM) Airport PSR.

1.5.1.3 Large wind turbine developments, dependent on location and proximity to published airport IFP and airspace safeguarded areas may impact the safe operation of these published procedures. The assessment indicated that potential impact on IFP, MSA and ATCSMAC from the Morgan Generation assets:

- Ronaldsway (IoM) Airport

  Potential impact on ATCSMAC 1,600 ft Surveillance Minimum Altitude Area (SMAA). Minimum Obstacle Clearance Area (MOCA) will need increasing from 1,600 ft to 2,200 ft

  Potential impact on IFP NDB(L)/DME RWY26 for DME I-RY Inoperative (CAT C, D). Base turn MOCA needs increasing from 2,000 ft to 2,200 ft

- RAF Valley

  Potential impact on ATCSMAC 1,500 ft QNH[2] 1,400 ft QFE[3] SMAA. MOCA needs increasing to 2.300 ft QNH 2,200 ft QFE

- Walney Aerodrome

  Potential impact on MSA 25 nm Non-Directional Beacon (NDB) (L) WL SW Sector. MOCA needs increasing from 1,800 ft to 2,200 ft.

1.5.1.4 The creation of offshore obstructions may affect military low flying operations within LFA 17 airspace which forms part of the UKLFS. A range of adopted measures, in the form of appropriate notification to aviation stakeholders, regularity of layout and lighting and marking to minimise effects to low flying operations would apply to the development of the Morgan Generation Assets. These will comply with current guidelines where appropriate and be agreed with the appropriate stakeholders.

1.5.1.5 The Morgan Array Area is located within the 9 nm consultation zone of offshore hydrocarbon helicopter platforms, operations to which in poor weather conditions may be impacted by the creation of offshore obstructions. The assessment indicated that there would be no significant impact on the following installations from the Morgan Generation Assets:

- Dalton R1 well
- Dalton R2 well
- North Morecambe DPPA platform Normally Unmanned Installation (NUI)
- Whitehaven Wellhead
- Rhyl Wellheads
- South Morecambe DP8 platform (NUI)
- South Morecambe DP6 platform (NUI)
- South Morecambe DP4 (considered a wellhead as topside removed).

1.5.1.6 For the following installations the Morgan Generation Assets could restrict or prevent access under IMC or night VMC:

[2] QNH is an aircraft altimeter pressure setting which is derived by reducing the measured pressure at ground level to mean sea level using the specifications of the ICAO standard atmosphere. QNH provides the altitude of an aircraft measured above sea level.

[3] QFE is an aircraft altimeter pressure setting which provides the height of the aircraft above ground

- Millom West platform (Daylight Only NUI) - Millom West Platform is located 1.6 nm from the Morgan Array Area. This distance to the Morgan Array Area will prevent IMC approaches, resulting in a 4.3% average annual loss of access. Day VMC approaches will provide access for an average of 94.4% of daylight conditions
- Millom PLEM wellhead - With the Morgan Array Area situated 2 nm away, Day VMC access would be possible. This would provide average access of 94.4% of daylight conditions, but no night access under the new CAA regulations. This is a logistics issue as emergency helicopter flights by the Coastguard would still be possible to a drilling rig or vessel working over the wellhead
- Q1-3 Wellheads - With the Morgan Array Area situated 2 nm away Day VMC would be possible. This would provide average access of 94.4% of daylight conditions but no night access. This is a logistics issue as emergency helicopter flights by the Coastguard would still be possible to a drilling rig or vessel working over the wellhead.

1.5.1.7 Appendix A, HAR (Anatec, 2023) provides the study supporting these conclusions. An effect on Walney Aerodrome MSA and the Ronaldsway IoM airport IFPs is predicted.

1.5.1.8 IFP (including ATCSMAC and MSA) analysis conclusions are contained within Appendix B, IFP Assessment (Osprey, 2024). This analysis concludes that the Morgan Array Area will not affect the OLS or IFP at the following airports:

- Manchester
- Liverpool
- Warton
- Blackpool.

1.5.1.9 This analysis also concludes that the Morgan Array Area has the potential to affect the ATCSMAC/MSA of the following airports:

- Ronaldsway (IoM) Airport
- RAF Valley
- Walney Aerodrome.

1.5.1.10 This analysis also concludes that the Morgan Array Area has the potential to affect the IFPs of the following airports:

- IoM.

1.5.1.11 Volume 2, Chapter 11: Aviation and radar of the Environmental Statement provides assessment of the conclusions of this document.

1.6 References

Anatec Limited (Anatec) (2023) Mona and Morgan Offshore Wind Farm Helicopter Access Report (HAR). Appendix A.

Civil Aviation Authority (CAA) (2024) Civil Aviation Publication (CAP) 032, UK Integrated Aeronautical Information Package (IAIP).

CAA (2016) CAP 764, Policy and Guidelines on Wind Turbines.

CAA (2022) CAP 168, Licensing of Aerodromes.

CAA (2023) CAP 437, Standards for Offshore Helicopter Landing Areas.

CAA (2022b) CAP 393, The Air Navigation Order (ANO).

CAA (2020) CAP 670, Air Traffic Services Safety Requirements.

CAA (2020) CAP 738, Safeguarding of Aerodromes.

CAA (2018) CAP 777, ATC Surveillance Minimum Altitude Charts in UK Airspace Policy and Design Criteria.

European Union Aviation Safety Agency (EASA) (2012) Document 923 Safety Instruction Bulletin.

Maritime and Coastguard Agency (MCA) (2021) Marine Guidance Note (MGN) 654.

Ministry of Defence (MOD) (2020) Lighting Review.

Operational Programme for the Exchange of Weather Radar Information (OPERA) (2009). Statement on the cohabitation between weather radars and wind turbines.

Osprey Consulting Services (Osprey, 2024) Morgan and Mona Windfarms - Instrument Flight Procedure (IFP) Impact Assessment. Appendix B.

UK Mil (2024) Aeronautical Information Publication (AIP).

Appendix A Helicopter Access Report (HAR)

A.1. Executive summary

A.1.1 Regulations

A.1.1.1.1 Commercial Air Transport (CAT) Regulations have been applied to identify the current helicopter access available without any nearby wind farms. The access was then updated to take account of the Morgan Generation Assets. Finally, in line with planning guidance, the cumulative effect of the Mona Offshore Wind Project and Morecambe Offshore Windfarm was included to assess the impact on helicopter access. The report applies a worse case assumption that wind turbines are built up to the proposed boundaries.

A.1.2 Meteorological data

A.1.2.1.1 The meteorological data analysed was provided by Harbour Energy. The data provided was from the Morecambe Bay Millom West Platform, owner/operator Harbour Energy, sampled at 10-minute intervals between 19 December 2017 and 19 December 2022. There were a total of 262,007 observations.

A.1.2.1.2 A series of filters were applied to the meteorological data to identify Day and Night Visual Meteorological Conditions (VMC) and Instrument Meteorological Conditions (IMC), also when flying could not take place. The output is shown in tables A.2 and A.3 for each year. In addition, the wind directions for IMC were analysed and plotted.

A.1.2.1.3 The CAA is consulting on limiting take-offs and landings to installations within 3 nm of a wind farm to Day VMC only. Linked to this are slightly higher cloud base and visibility limits. Although the regulations have not yet been updated, the proposed limits have been applied to this analysis as a worse case assumption.

A.1.3 Analysis and results

A.1.3.1.1 The impact of the Morgan Generation Assets on helicopter access to 11 platforms/infrastructure, floating facilities and wellheads, that are within 9 nm of the Morgan Array Area, as required by CAP 764, was assessed. The assessment indicated that there would be no significant impact on the following installations from the Morgan Generation Assets:

- Dalton R1 well
- Dalton R2 well
- North Morecambe DPPA platform Normally Unmanned Installation (NUI)
- Whitehaven Wellhead
- Rhyl Wellheads
- South Morecambe DP8 platform (NUI)
- South Morecambe DP6 platform (NUI)
- South Morecambe DP4 (considered a wellhead as topside removed).

A.1.3.1.2 For the following installations the Morgan Generation Assets could restrict or prevent access under IMC or night VMC:

- Millom West platform (Daylight Only NUI) - Millom West Platform is located 1.6 nm from the Morgan Array Area. This distance to the Morgan Array Area will prevent IMC approaches, resulting in a 4.3% average annual loss of access. Day VMC approaches will provide access for an average of 94.4% of daylight conditions
- Millom PLEM wellhead - With the Morgan Array Area situated 2 nm away, Day VMC access would be possible. This would provide average access of 94.4% of daylight conditions, but no night access under the new CAA regulations. This is a logistics issue as emergency helicopter flights by the Coastguard would still be possible to a drilling rig or vessel working over the wellhead
- Q1-3 Wellheads - With the Morgan Array Area situated 2 nm away Day VMC would be possible. This would provide average access of 94.4% of daylight conditions but no night access. This is a logistics issue as emergency helicopter flights by the Coastguard would still be possible to a drilling rig or vessel working over the wellhead.

A.1.3.1.3 In the cumulative scenario where the Mona Offshore Wind Project and Morecambe Offshore Windfarm are also built, it is assessed that the Mona Offshore Wind Project will have no cumulative impact and the Morecambe Offshore Windfarm will have a minimal cumulative impact on localised access.

A.1.4 Safety considerations

A.1.4.1.1 The SAR helicopters operated on behalf of the MCA are not constrained by Commercial Air Transport (CAT) meteorological limits, or operational limits. The Morgan Generation Assets will have a layout which will need to be compliant with MGN 654, and so SAR access to installations adjacent to the Morgan Generation Assets will still be available. Any reduction in CAT helicopter access will result in a logistical impact on the installation operator, rather than a safety impact as SAR helicopters will be tasked for major incidents, accidents and urgent medical evacuations, rather than CAT helicopters.

A.2. Introduction

A.2.1 Overview

A.2.1.1.1 Anatec were commissioned by the Applicant to undertake a HAR for the purpose of informing the aviation and radar assessment of the proposed Morgan Generation Assets. This Appendix was produced as part of the Applicant's obligations under CAP 764 (CAA, 2016), where the operator of any offshore helicopter destination within 9 nm of a wind farm must be consulted at the planning stage of a wind farm.

A.2.1.1.2 The methodology used to assess the operational impact has been accepted by helicopter operators and hydrocarbon operators on a number of previous offshore wind farm projects. Meteorological data was supplied by Harbour Energy, owner/operator of the Millom West Platform, covering the period from December 2017 to December 2022. The data was sampled every 10 minutes, resulting in 262,007 observations.

A.2.2 Commercial Air Transport regulations

A.2.2.1.1 CAT flights, such as crew change flights to hydrocarbon platforms, are regulated under the following requirements.

A.2.2.1 Offshore approvals

A.2.2.1.1 Offshore operations are regulated under Specific Approval for Helicopter Offshore Operations (SPA.HOFO) (CAA, 2018):

A.2.2.1.2 'Offshore operation' means a helicopter operation that has a substantial proportion of any flight conducted over open sea areas to or from an offshore location. An offshore operation includes, but is not limited to, a helicopter flight for the purpose of:

- Support of offshore oil, gas and mineral exploration, production, storage and transport
- Support of offshore wind turbines and other renewable-energy sources
- Support of ships including sea pilot transfer.

A.2.2.2 Meteorological limits

A.2.2.2.1 The limitations presented within this section, based on CAT Regulations, have been applied to the meteorological data to identify when wind farms will affect helicopter access to the infrastructure. The CAA has consulted on increasing the Day Visual Meteorological Conditions (VMC) limits from the current cloud base of 600 ft to 700 ft, with an increase in visibility from the current 4,000 m to 5,000 m. Additionally, only Day VMC approaches and departures from a helideck would be permitted within 3 nm of a wind farm. Although still a draft proposal, these increased limits have been applied to this assessment.

A.2.2.2.2 An en-route descent, where a helicopter may descend from IMC into VMC, and so make a visual approach to the platform, is permitted when:

- Day – cloud base ≥700 ft and visibility ≥5,000 m
- Night – cloud base ≥1,200 ft and visibility ≥5,000 m.

A.2.2.3 Instrument Meteorological Conditions (IMC)

A.2.2.3.1 IMC conditions are assumed to exist when the weather limits are below those for flight under VMC. When the conditions are below those for an en-route descent, an Airborne Radar Approach (ARA) is mandatory.

A.2.2.4 Airborne Radar Approach

A.2.2.4.1 An ARA is flown to a platform when the weather conditions are below the VMC limits. The minima for an ARA are:

- A descent to a Minimum Descent Height (MDH) of 200 ft by day or 300 ft by night (or deck height plus 50 ft if higher)
- A Missed Approach Point (MAP) no closer than 1,390 m (0.75 nm) from the installation; this distance is based on the limitations of the Radio Detection and Ranging (Radar) in mapping mode and how it is displayed to the crew.

A.2.2.4.2 As the helicopter has to be below cloud and in sight of the installation before proceeding visually beyond the MAP, in practical terms this results in the following minimum weather conditions:

- Day – cloud base ≥200 ft and visibility ≥1,390 m
- Night – cloud base ≥300 ft and visibility ≥1,390 m.

A.2.3 Helicopter approach profiles

A.2.3.1 Profiles

A.2.3.1.1 The distance required for a safe helicopter approach to an installation depends on the profile flown, which in turn depends on the meteorological conditions. There are three basic profiles: firstly, the most commonly flown is the day visual approach; in degraded visual conditions, such as night, a stabilised approach is flown; finally, in conditions of low visibility or low cloud the ARA is flown.

A.2.3.2 Day visual approach

A.2.3.2.1 A day visual approach can be conducted when the cloud base is greater than 700 ft and the visibility is greater than 5,000 m (2.70 nm). This type of approach is routinely flown by day inside and adjacent to wind farms. For example, routine flights are flown by day to a platform inside the Hornsea Two Wind Farm where the closest wind turbine blades are 910 m (0.49 nm) away; another example is the Blythe Platform which has wind turbines in an arc 1,200 m (0.65 nm) from the helideck. Even in good visibility, it is industry best practice to ensure the approach is stabilised by 0.5 nm from the helideck. Positioning to the 0.5 nm point requires a minimum approach arc of 1 nm free from obstacles. So, although wind turbines may be closer than 1 nm to the helideck, providing the approach arc was obstacle free, an approach can be made.

A.2.3.3 Stabilised approaches

A.2.3.3.1 In VMC but where degraded visual conditions exist such as at night, the helicopter industry best practice is to fly a stabilised approach (HeliOffshore, 2020). Part of the stabilisation criteria is the requirement to maintain a constant heading into wind for 1 nm of the final approach. To enable this, the distance between the wind turbines and

the helideck must allow enough space to position to the 1 nm final point. So, typically 2 nm is required in total. If sufficient distance is not available, then access to the installation would not be possible at night when the wind direction requires an approach in a direction from the wind farm towards the helideck.

A.2.3.4 Airborne Radar Approach profile

A.2.3.4.1 The ARA profile is shown in Figure A. 1 and Figure A. 2. The helicopter's radar is used as the primary means of navigation and obstacle avoidance, supported by Global Positioning System (GPS).

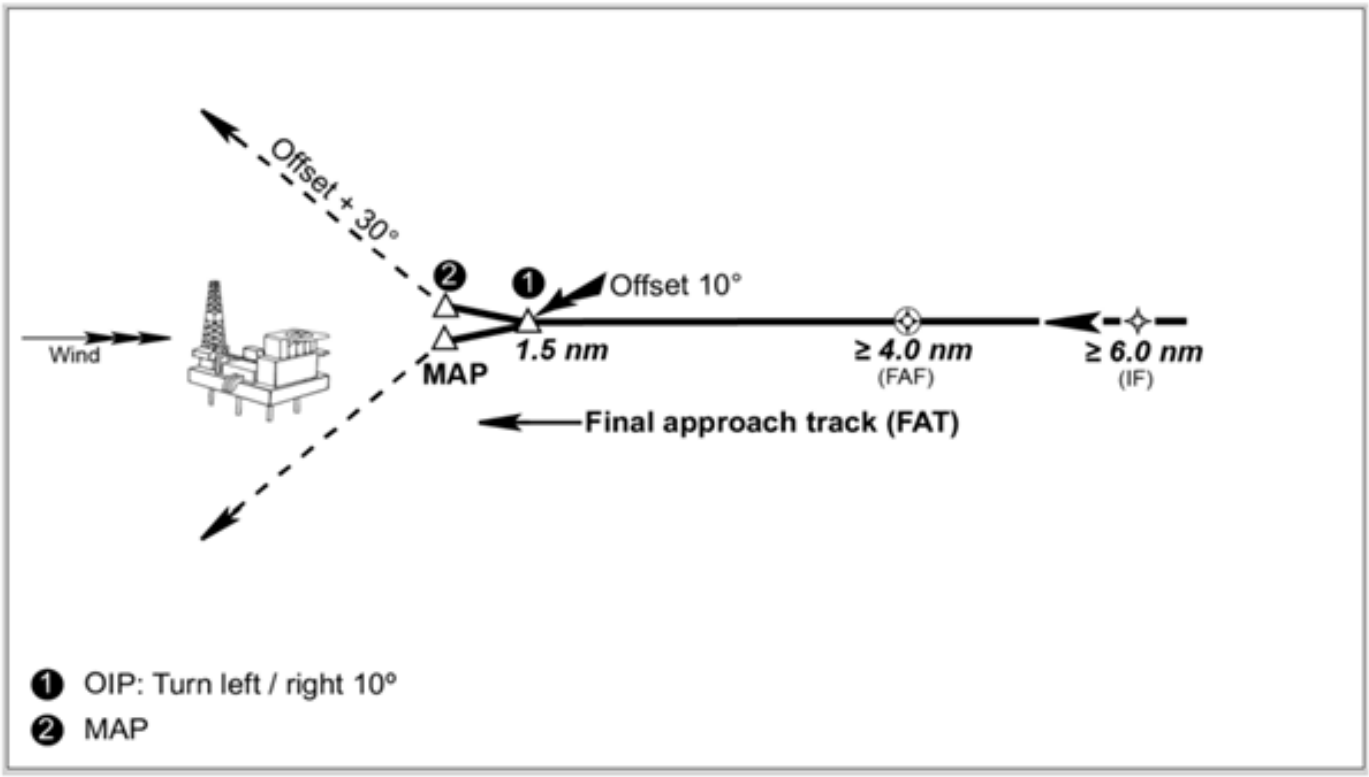


Figure A. 1: ARA Horizontal Profile.

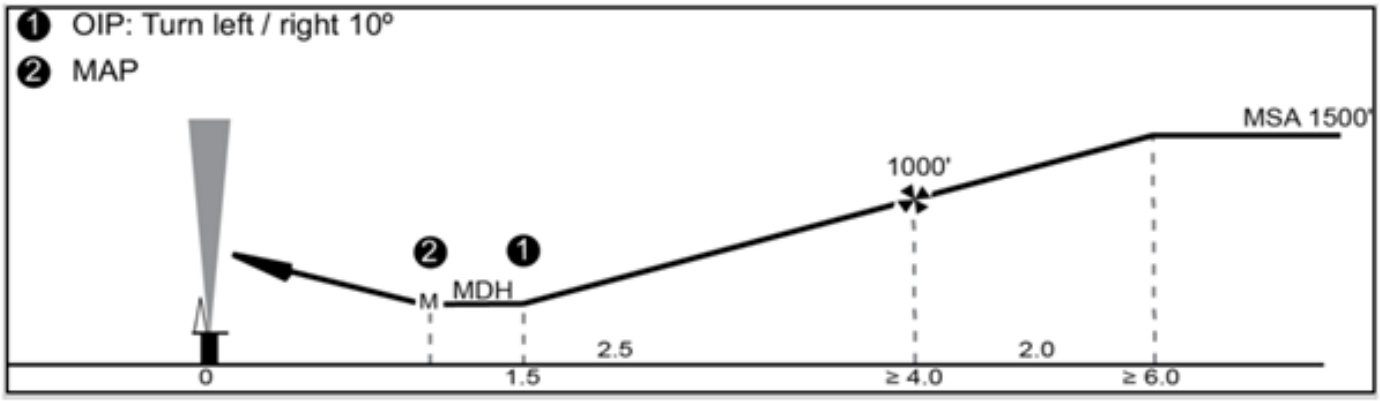


Figure A. 2: ARA Vertical Profile.

A.2.3.4.2 For the purposes of this assessment, it is assumed a 9 nm approach sector clear of obstructions is required for an ARA. This distance will allow a helicopter to conduct a direct approach, descending from the Minimum Safe Altitude overhead the wind turbines to achieve the Initial Approach Fix (IAF, shown as IF in Figure A.1) at 1,500 ft, or to conduct an arc approach maintaining a 1 nm lateral separation distance from any obstacles, as required by the regulations. An arc approach is where an aircraft flies at a set radius around the landing point, until the final into wind approach is commenced.

A.2.3.5 No-fly conditions

A.2.3.5.1 Any of the following conditions would result in flights being cancelled, or being unable to land at an offshore installation:

- Sea state (significant wave height) ≥6 m
- Wind speed ≥60 kt; this is a general limit, but it should be noted that some NUIs have values as low as 30 kt due to reduced deck friction
- Unable to land from an ARA – cloud base <200 ft by day or <300 ft at night or visibility <1,390 m. These can be conditions reported by the installation, or those experienced by the pilots in flight
- Forecast Triggered Lightning (Wilkinson *et al.,* 2012)
- For a helicopter lacking an approval for flight in icing conditions, icing conditions occurring at 1,500 ft when a VMC transit is not permitted is assessed.

A.2.3.5.2 The likelihood of no-fly conditions calculated from the meteorological data are presented in Table A. 3.

A.2.3.5.3 Icing conditions are defined as an air temperature below 0 degrees Celsius (°C), with an inflight visibility less than 1,000 m and visible moisture present. In practical terms this means that there is the potential for icing in cloud when the temperature is below 0°C. When a VMC transit is not permitted due to low cloud or poor visibility the conditions are IMC. In IMC over the sea, the aircraft has to avoid all obstacles by 1,000 ft vertically. A default value for obstacles over water is 500 ft, and so the minimum transit height is 1,500 ft above sea level. Using a lapse rate of 2°C per thousand feet, a surface temperature of 3 °C or less indicates that any cloud at 1,500 ft or higher meets the definition of icing conditions.

A.2.3.5.4 The meteorological data used in this report did not include Triggered Lightning. When the annual percentage of no-fly conditions was calculated, expert opinion indicates that the figures will slightly underestimate the true value of no-fly conditions, as forecasts of Triggered Lightning will also prevent flying. High winds have not been included in the no-fly criteria as different operational limitations apply to various helidecks, ranging from 25 kt to the standard 60 kt. Reduced limitations are often temporary in nature, for example excessive guano causing the helideck to fail a friction test, resulting in a 30 kt limitation. Furthermore, regulatory changes introduced under CAA Safety Directive SD-2022-001 (CAA, 2022) are likely to affect the frequency of access in future years as improved firefighting, helideck lighting and wind and motion limits will constrain access to any helideck which has not been upgraded. As it is not possible to predict which helidecks will be upgraded, current limitations for individual installations are identified in section A.6 but the generic limitations shown in Table A. 2 and Table A. 3 are applied.

A.3. Methodology

A.3.1 Introduction

A.3.1.1.1 This assessment has applied the CAT weather limits, as a series of filters, to the meteorological data provided in order to understand the potential operational impact on the gas infrastructure within 9 nm of the wind farms.

A.3.1.1.2 Any planned obstructions within a radius of 9 nm have been taken into account in this assessment, as required by CAP 764.

A.3.1.1.3 The assessment is focused on identifying any reduced access when operating under CAT Regulations, but access under SAR Regulations has also considered.

A.3.2 Assumptions

A.3.2.1.1 The following assumptions were used:

- As the exact locations of the wind turbines is not yet known, it is assumed that the boundary of the wind farm forms a solid wall of wind turbines and they are greater than 1,000 ft high (364 m (1,194.23 ft) is maximum design scenario)
- For an ARA, an approach arc clear of obstacles out to 9 nm is required. This will allow a circling approach to a Final Approach Fix (FAF) at 6 nm
- An approach up to 30° out of wind may be made providing the resulting angle of drift is no more than 10°.

A.3.3 Infrastructure assessed

A.3.3.1.1 The infrastructure assessed is shown in Table A. 1. Only installations within 9 nm of the wind farm perimeter were assessed in line with CAP 764 guidance. The Helideck Certification Agency (HCA) website (helidecks.org) was consulted for information on the operating period and approvals of helidecks.

Table A. 1: Details of assessed infrastructure.

Installation Name	Type	Operator	Status	Distance from Morgan Array Area (nm)
Millom West	NUI Day Only	Chrysaor Resources (Irish Sea) Limited (Harbour Energy)	Active – Decomissioning scheduled 2024 to 2030	1.6
Millom PLEM	Wellhead	Chrysaor Resources (Irish Sea) Limited (Harbour Energy)	Active – Decomissioning scheduled 2027 to 2032	2.0
Q1-3 Wellheads	Wellhead	Chrysaor Resources (Irish Sea) Limited (Harbour Energy)	Active – Decomissioning scheduled 2027 to 2032	2.0

Installation Name	Type	Operator	Status	Distance from Morgan Array Area (nm)
Dalton Well R1	Wellhead	Chrysaor Resources (Irish Sea) Limited (Harbour Energy)	Active – Decomissioning scheduled 2027 to 2032	3.3
Dalton Well R2	Wellhead	Chrysaor Resources (Irish Sea) Limited (Harbour Energy)	Active – Decomissioning scheduled 2027 to 2032	3.6
North Morecambe DPPA	NUI Day and Night	Spirit Energy	Active	4.1
Whitehaven Wellhead 113/27B-K	Wellhead	Spirit Energy	Active	5.8
South Morecambe DP8	NUI Day and Night	Spirit Energy	Active	6.6
Rhyl Wellheads	Wellhead	Spirit Energy	Active	7.1
South Morecambe DP6	NUI Day and Night	Spirit Energy	Active	7.6
South Morecambe DP4	NUI No HCA Certificate	Spirit Energy	Topside Removed June 2021	9.0

A.3.4 Meteorological data provided

A.3.4.1.1 The meteorological data analysed was provided by Harbour Energy. The data was from the Millom West Platform, owner/operator Harbour Energy, sampled at 10-minute intervals between 19 December 2017 and 19 December 2022. There were a total of 262,007 observations.

A.3.4.1.2 The following parameters were used:

- Timestamp – year/month/day/hour/minute/second
- Visibility – recorded in metres
- Cloud base – recorded in feet
- Wind direction – degrees
- Wind speed – knots
- Air temperature – °C
- Dew Point - °C
- Significant Wave Height (Hs) – m.

A.3.5 Meteorological analysis

A.3.5.1.1 The meteorological limits, defined in the Regulations were applied as a series of filters (based on the parameters above) to the data. The filters identified when the conditions were:

- Day VMC
- Night VMC
- Day IMC
- Night IMC
- No-fly, when the conditions were below offshore limits and so an ARA could not be flown or icing precluded flying.

A.3.5.1.2 The data is then summarised in a series of tables and graphs to identify if and when CAT flights might have reduced access to the different offshore facilities. The data for 2017 is shown in Table A. 2 and Table A. 3 but it only consisted of 12 days in December 2017, so the results should not be given equivalence with the large datasets for the following years.

A.4. Operational restrictions

A.4.1 Introduction

A.4.1.1.1 This section uses the methodology described in section A.3 and applies it to the operational helicopter environment. Following this, section A.5 onwards identifies any restrictions on helicopter access specific to the facilities shown in Table A. 1.

A.4.2 Approach limitations

A.4.2.1.1 Applying the meteorological limits described in section A.2 to the meteorological data provides the percentage of occasions when each approach type is permitted or required.

A.4.2.1.2 Table A. 2 shows the percentage of day and night VMC and IMC access (i.e. when an en-route descent into visual conditions can be made, and a visual approach and take-off to/from a platform is available). This takes no account of any obstructions within 9 nm.

Table A. 2: Day and Night VMC and IMC Access.

Year	Day VMC (%)	Day IMC (%)	Night VMC (%)	Night IMC (%)
2017	70.7	29.3	67.7	32.3
2018	92.9	7.1	88.5	11.5
2019	95.3	4.7	89.8	10.2
2020	93.7	6.3	87.0	13.0
2021	93.9	6.1	85.2	14.8
2022	96.2	3.8	92.0	8.0
Mean[Note]	**94.4**	**5.6**	**88.5**	**11.5**

Note: as the 2017 data only consisted of 12 days of data, it has been excluded when calculating the mean.

A.4.2.1.3 Table A. 2 does not consider when the conditions did not permit flying (i.e. the conditions identified in section A.2.3.5). An average of 1.3% of daylight conditions did not permit flying, so leaving 4.3% (5.6% to 1.3%) usable for IMC. For night conditions, 3.3% were unusable, leaving 8.2% (11.5% to 3.3%) usable. When considering the loss of access, the usable IMC figures should be applied and not all IMC periods. This information is presented in Table A. 3. The no flying conditions identified are conservative, as no account was taken of high winds or Triggered Lightning, which would further reduce the number of flyable hours.

Table A. 3: Usable IMC access.

Year	Usable IMC Day (%)	Day IMC (%)	Day No Fly (%)	Usable IMC Night (%)	Night IMC (%)	Night No Fly (%)
2017	**11.9**	29.3	17.4	**17.3**	32.3	15.0
2018	**5.2**	7.1	1.9	**6.2**	11.5	5.3
2019	**3.6**	4.7	1.1	**8.1**	10.2	2.1
2020	**5.2**	6.3	1.1	**11.0**	13.0	2.0
2021	**4.7**	6.1	1.4	**10.0**	14.8	4.8
2022	**3.0**	3.8	0.8	**5.5**	8.0	2.5
Mean[Note]	**4.3**	**5.6**	**1.3**	**8.2**	**11.5**	**3.3**

A.4.3 Wind data

A.4.3.1.1 Figure A. 3 shows the day IMC hours from 2017-2022, and the wind directions which generated IMC.

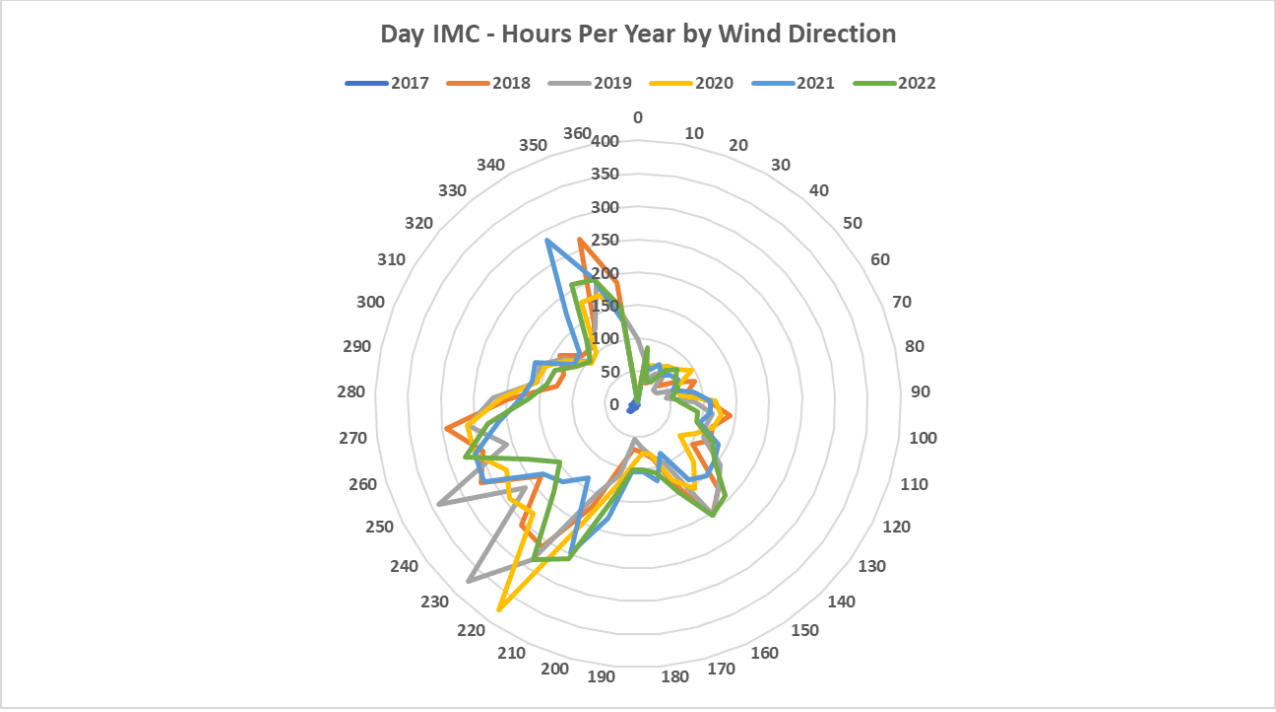


Figure A. 3: DAY IMC Condition Wind Direction Hours Per Year.

A.4.3.1.2 Figure A. 3 shows that the predominant wind direction for Day IMC is from the southwest. Figure A. 4 shows the night IMC hours from 2017-2022, and the wind directions which generated IMC. Night IMC wind directions are predominantly from the southwest.

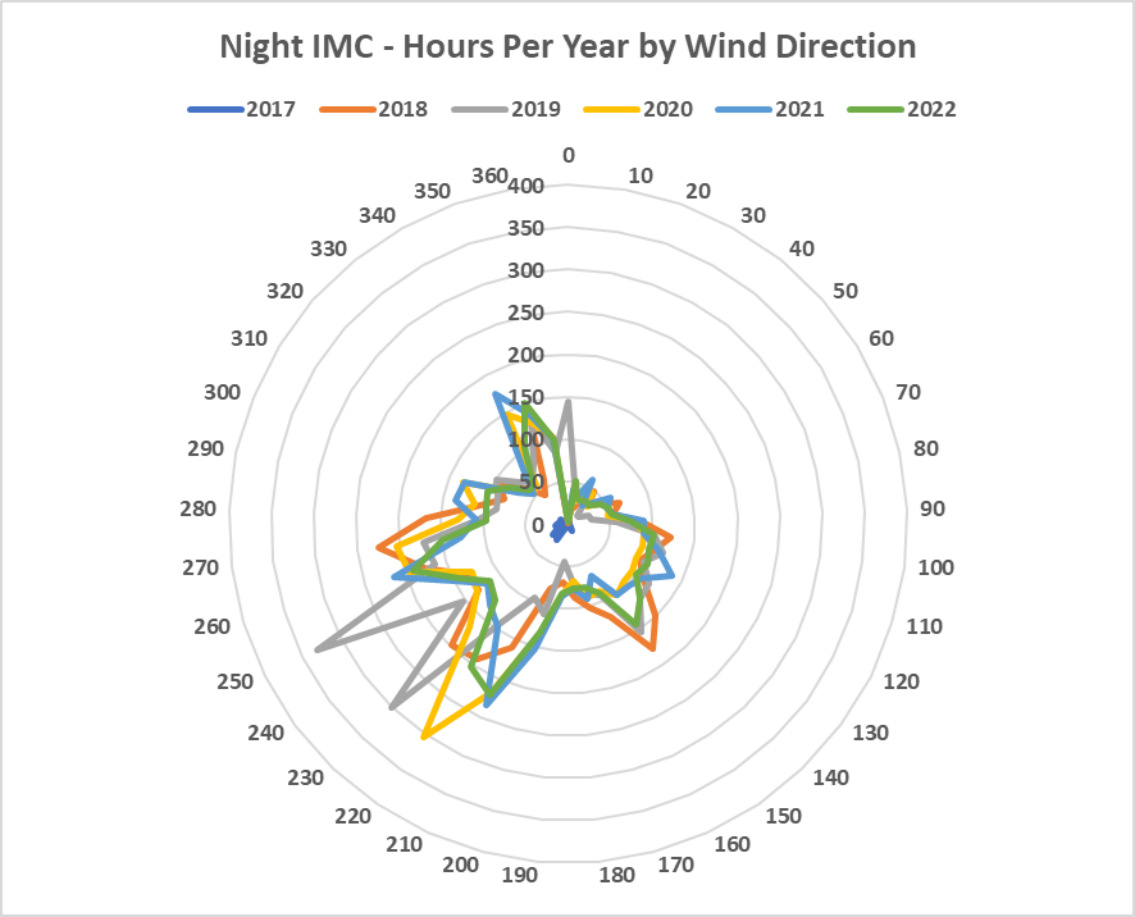


Figure A. 4: Night IMC Hours – 2017 to 2022.

A.5. Emergency conditions

A.5.1.1.1 The methodology used so far in this report addresses helicopter access under CAT Regulations. Emergency down manning of any installation, critical Medivacs and SAR are not constrained by CAT Regulations as these flights are generally flown by the Coastguard SAR aircraft operating under CAP 999 (CAA, 2014). The Coastguard helicopters are operated as State Aircraft under National Regulations and are not constrained by the higher weather limits in CAT Regulations. Also, commercial SAR can be flown with some alleviations from CAT Regulations. Such SAR arrangements have existed in the United Kingdom, Norway and the Netherlands for decades and include SAR coverage provided by the Integrated Search and Rescue (ISAR) Consortium in Aberdeen (formerly Jigsaw Aviation), SAR helicopters based in the Ekofisk Field, and SAR helicopters under contract to Nederlands Olie en Gas Exploratie en Productie Associatie (NOGEPA), the Dutch equivalent of Oil & Gas UK.

A.5.1.1.2 CAP 999 defines the SAR operating minima as:

'Operating minima for the dispatch and continuation of a SAR operational flight are at the discretion of the aircraft commander. However, he is to consider the urgency of the task, crew and aircraft capability and the requirement to recover the aircraft safely.'

A.5.1.1.3 Due to the SAR autopilot modes and enhanced sensors fitted to the Coastguard SAR helicopters, a shorter distance is required to enter the field and manoeuvre to land on platforms, even in poor weather. The Morgan Generation Assets will be designed in accordance with MGN 654 (MCA, 2021), which permits helicopter SAR operations within a wind turbine array, and so SAR access will also be available to platforms adjacent to the Morgan Generation Assets.

A.5.1.1.4 Furthermore, in the event of an emergency on the platform resulting in an explosion, fire or release of hydrocarbons, helicopters will be unable to land and so other means of escape, such as Totally Enclosed Motor Propelled Survival Craft (TEMPSC) and/or Seascape systems will be required. Although helicopters are usually the preferred means of down manning an installation, they cannot be the primary means of down manning in all cases.

A.5.1.1.5 Icing conditions will not affect the Coastguard SAR helicopters are they are certified and equipped for flight in icing conditions.

A.5.1.1.6 In summary, although a reduction in helicopter access under CAT Regulations will impose a logistic restriction on an offshore installation, it will not result in a reduced level of safety, as SAR helicopters will still be able to access an installation.

A.6. Infrastructure specific access

A.6.1 Introduction

A.6.1.1.1 This section identifies how helicopter operations would be constrained by current and future offshore wind farms. It is done in two parts: firstly, identifying current access and then taking account of any restrictions due to the Morgan Generation Assets. Section A.7 identifies any cumulative impact from the Mona Offshore Wind Project and Morecambe Offshore Windfarm currently in the planning phase.

A.6.1.1.2 Platforms within 9 nm of the Morgan Generation Assets were considered, as presented in Figure A. 5.

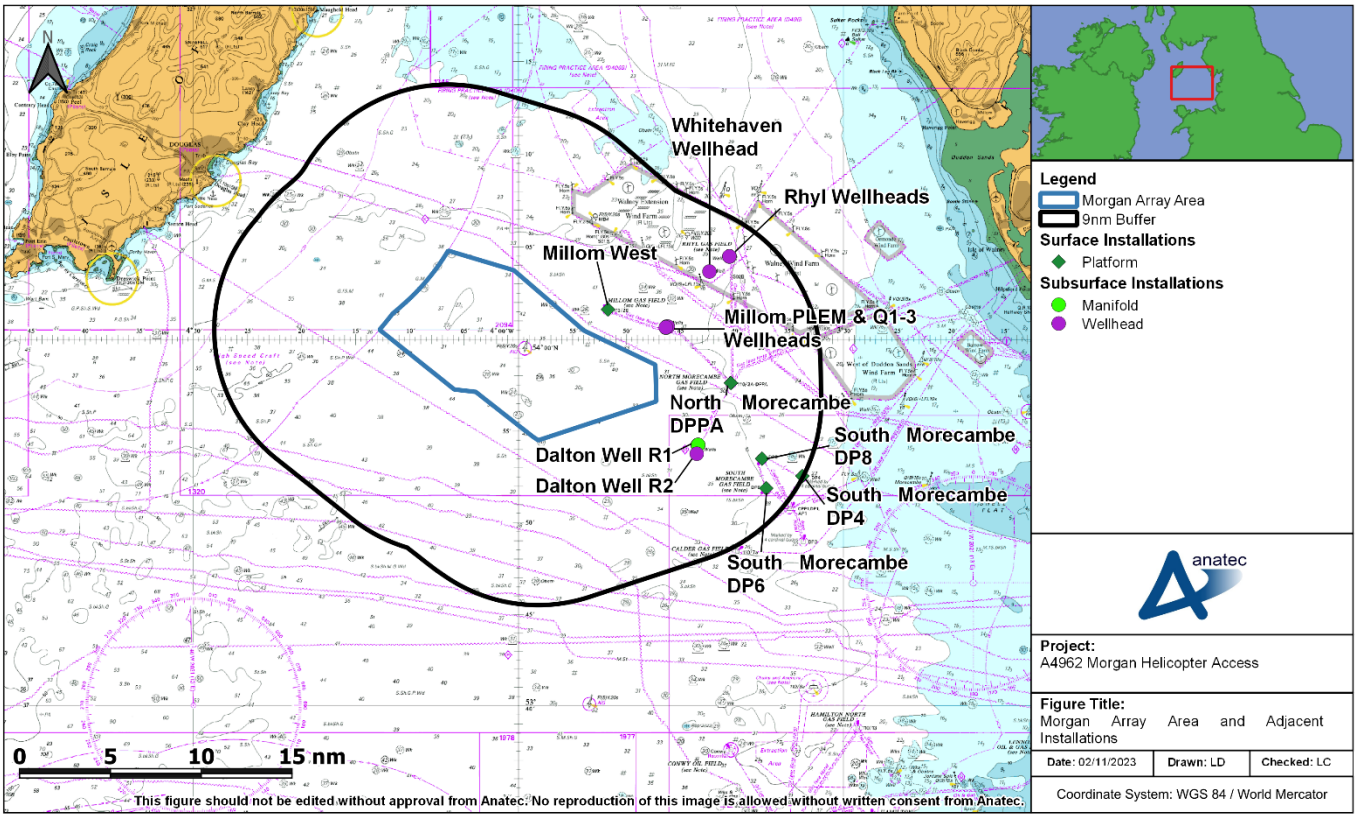
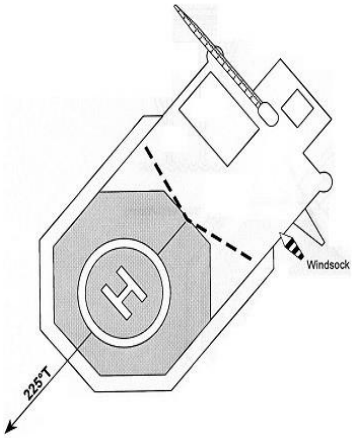


Figure A. 5: Morgan Array Area and adjacent installations.

A.6.1.1.3 The HCA website was used to obtain current information on the certification standards of each helideck that is presented in the following sections.

A.6.2 Millom West platform

HELIDECK Elev. **98 ft**	VAR **2 W**	POSITION **N54 01.6 W003 51.7**	**EGMX Millom West**		
HEIGHT OF INSTALLATION: **125** HIGHEST OBSTACLE WITHIN 5NM: **Check**			VHF **122.380**	NDB	Issue Date **29 Jun 2022**
FUELLING INSTALLATION: **No** STARTING EQUIPMENT: **No**			Operating Company **Harbour Energy**		Issued By **Helideck Certification Agency**
HELIDECK D value: **16.1m** P/R/H Category: **F** Max Weight: **5.3t** Circle & H Lights: **Not fitted**					



Wind (T°)	Kts	Limitation /Comment
	+25 +30	• NUI • Daylight operations only - circle and 'H' lights not fitted • No helicopter operations - perimeter net frames corroded • No helicopter operations due to poor friction surface • Table 1(T) if overflight of 5:1 items is unavoidable • East staircase access closed due to corrosion • No net fitted.

Figure A. 6: Details of Millom West platform.

A.6.2.1.1 The Millom West platform is a NUI approved for day only operations. In addition, it currently has a wind speed limit of 25 kt due to a corroded perimeter net. No account has been taken of this 25 kt wind limit, as the perimeter net could be repaired in the future. Millom West is located 1.6 nm to the northeast side of the Morgan Array Area.

A.6.2.1 Current access

A.6.2.1.1 At present there is the option of using an ARA to approach and land on the Millom West platform under daylight conditions only. For the period 2018 to 2022, access was available for 98.7% of daylight condition (Day VMC 94.4% (Table A. 2) plus 4.3% average usable IMC (Table A. 3).

A.6.2.2 Future access

A.6.2.2.1 The distance to the Morgan Array Area is insufficient for an IMC approach. Consultation with stakeholders, including helicopter operators, indicates that a distance of 1.5 nm is sufficient for a Day VMC approach and take-off. The access would be an average of 94.4% of daylight conditions (i.e. an average annual loss of 4.3%). Operations to NUIs are not usually conducted when the forecast shows marginal conditions as NUIs tend to have limited domestic facilities for a prolonged stay.

A.6.2.2.2 Consultation with Harbour Energy has confirmed that the Millom West platform is planned to be decommissioned and vessel and helicopter access will be required from 2024 to approximately 2030. During decommissioning a Non-Production Installation (NPI), such as a jack-up platform may be positioned over Millom West. Usually, NPIs have a helideck approved for night operations. Due to proximity of the Morgan Array Area, night operations would not be possible as there would be insufficient distance to manoeuvre. Blackpool Airport has standard opening times of 07:00 to 21:00. The flight time from Blackpool Airport to Millom West is approximately 15 minutes. So, any potential CAT night operations would be lost between 07:15 and daylight, and between dusk and 20:45. There would be no additional impact on daylight operations to those already shown. Vantage POB flight data for a typical NPI decommissioning project was reviewed. Noble Innovator jack-up performing decommissioning work at the Kate Field in the Central North Sea was utilised for this assessment. The flight data covered the five-month decommissioning campaign. The Vantage data confirmed the assumption that flights typically take place during daylight hours, with approximately one flight every two days. If these flights had occurred at the same time during the winter months, five flights out of 63 (8%) would have arrived at the rig at night, so would have to be rescheduled. Whilst the number of flights would be expected to be greater for an Irish Sea decommissioning operation due to the smaller helicopters being used, however, based on experience; the vast majority would still be expected to take place during daylight hours. It is recommended that this assessment is repeated using Vantage data from recent projects in the Morecambe Bay area. The graphs below (Figures A.7, A.8 and A.9) summarise the data.

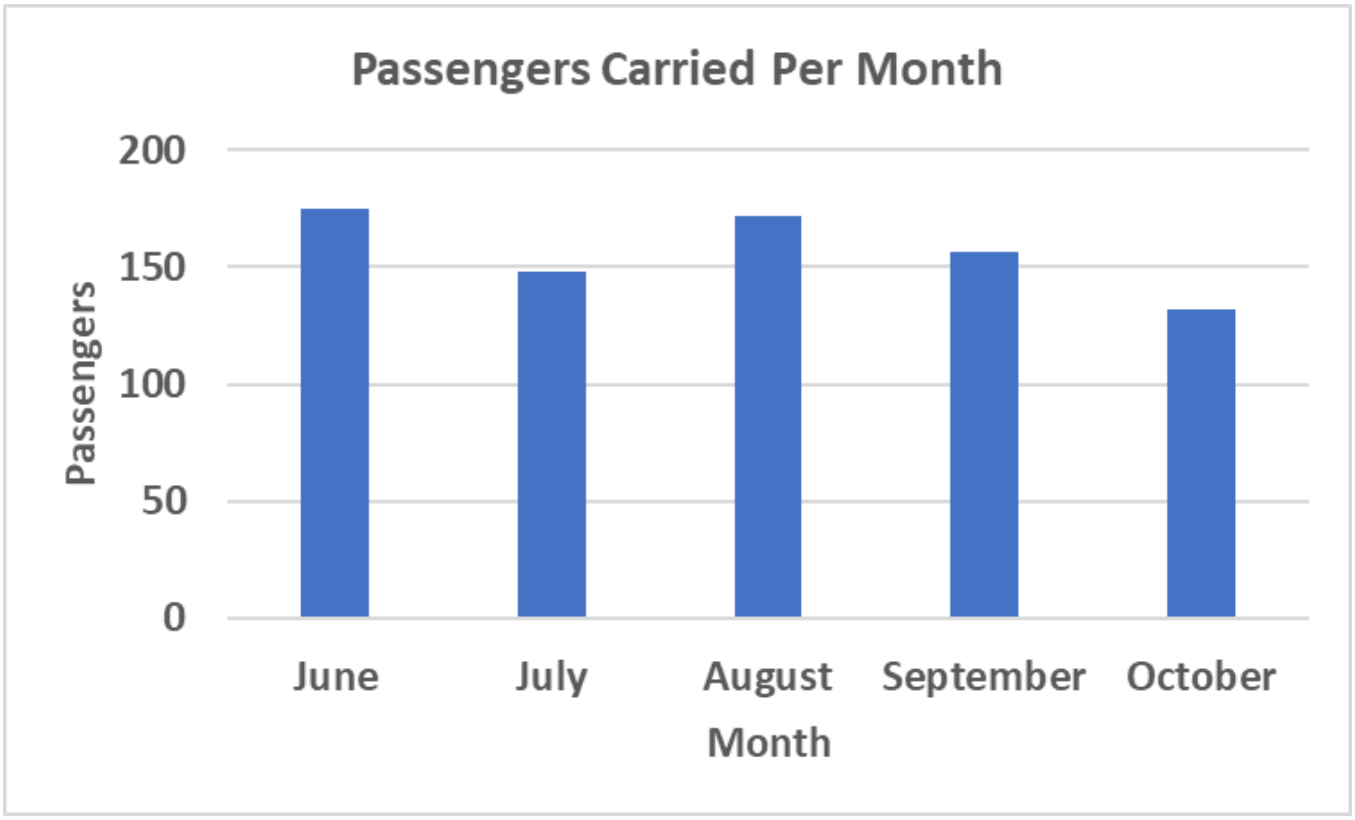


Figure A. 7: Passengers carried per month to the Noble Innovator.

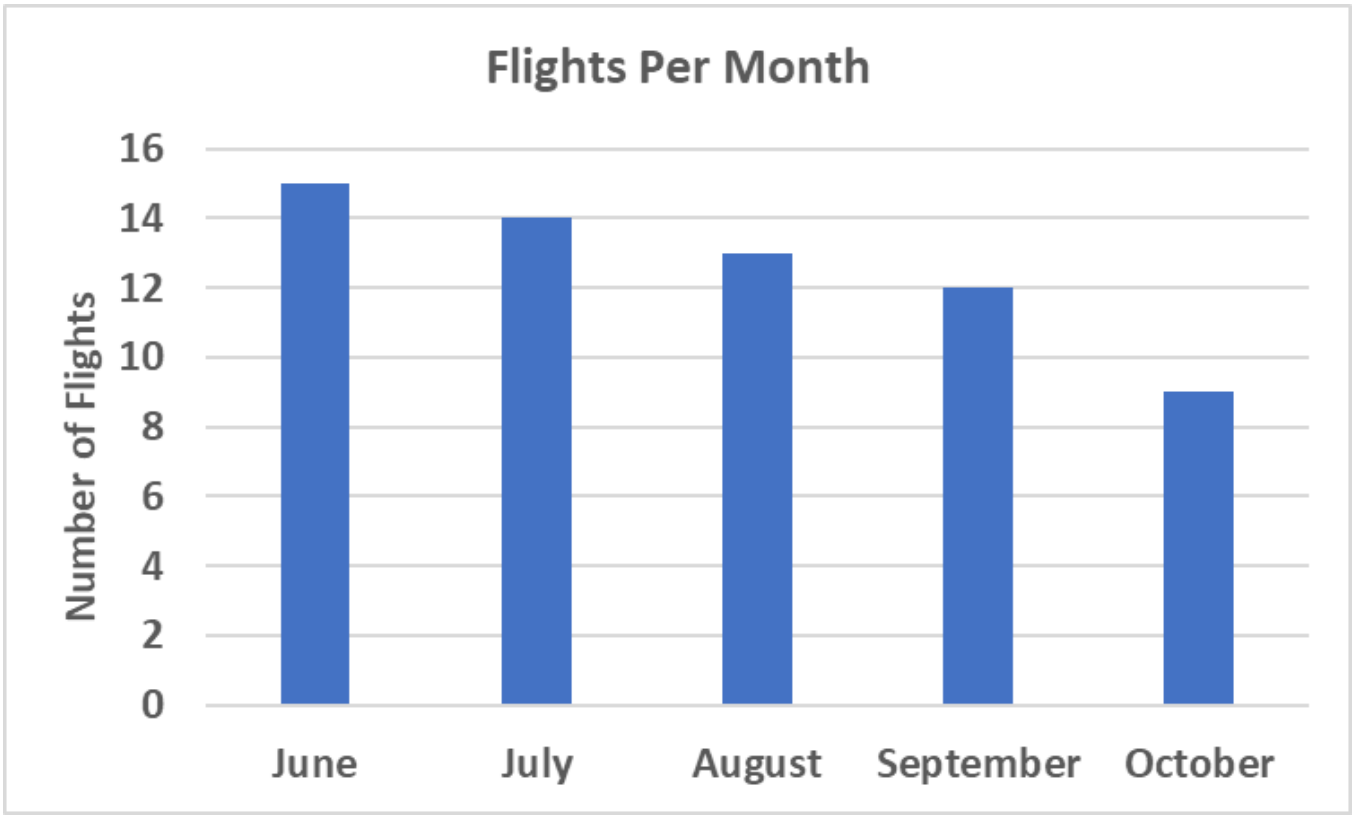


Figure A. 8: Flights per month to the Noble Innovator.

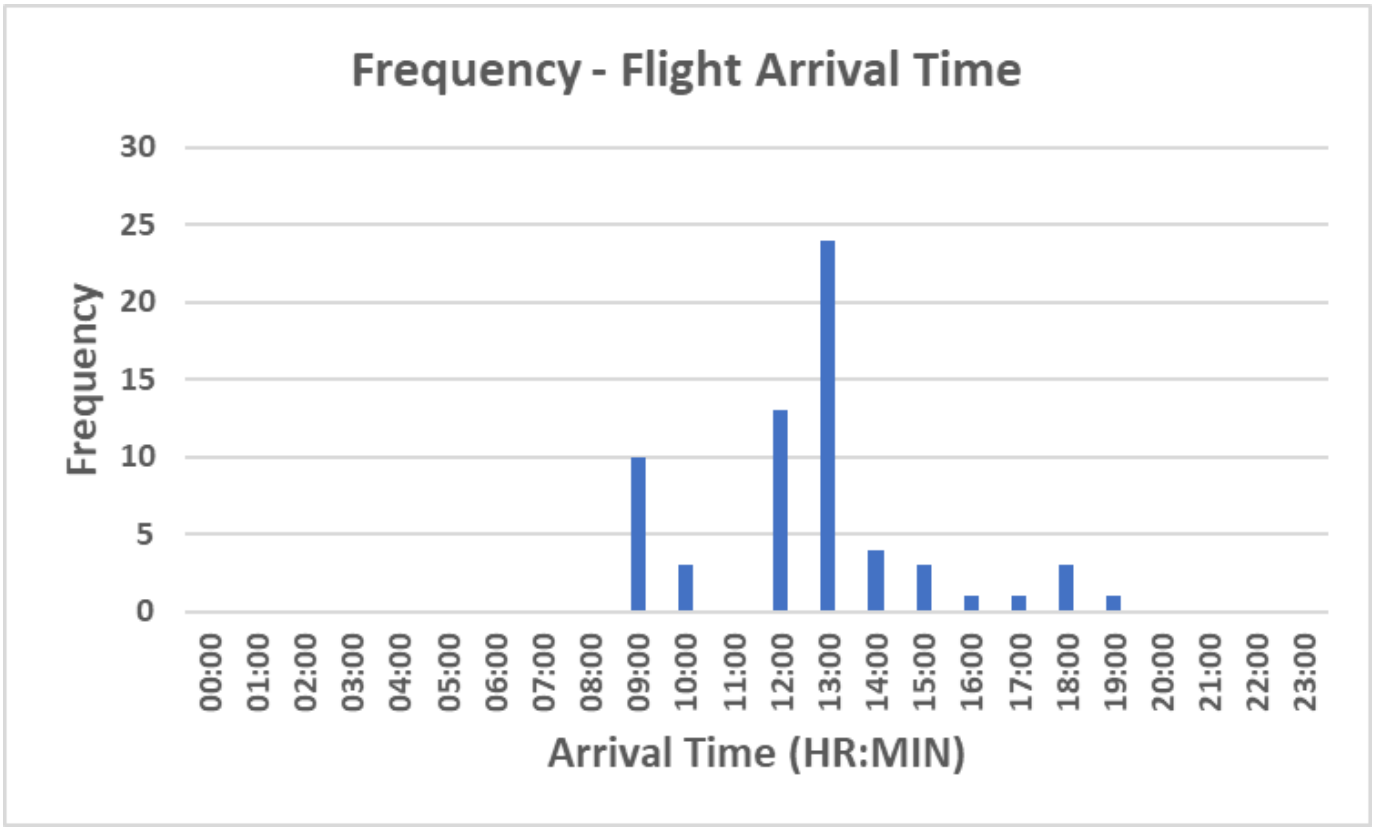


Figure A. 9: Arrival time at the Noble Innovator.

A.6.3 Summary

A.6.3.1.1 The Millom West Platform is located 1.6 nm from the Morgan Array Area. This will prevent IMC approaches, resulting in a 4.3% average annual loss of access. A distance of 1.5 nm is a sufficient distance for a day VMC approach, so the access will be an average of 94.4% of daylight conditions.

A.6.4 Millom PLEM wellhead

A.6.4.1 Current access

A.6.4.1.1 The Millom PLEM wellhead is located 2 nm to the east of the Morgan Array Area. When a drilling rig or diving support vessel is required to work on the wellhead, helicopter access might be required. Most drilling rigs and diving support vessels have helidecks approved for both day and night operations. For the period 2018 to 2021, access is available for 98.7% of daylight condition (Day VMC 94.4% (Table A. 2) plus 4.3% average usable IMC (Table A. 3).

A.6.4.2 Future access

A.6.4.2.1 A worse case assumption is that the new draft CAA regulations will only permit Day VMC operations within 3 nm of a wind farm (see section A.2.2.2). Consultation with stakeholders, including helicopter operators, indicates that a distance of 2 nm is sufficient for a Day VMC approach and take-off. This would provide an average daytime access of 94.4% (see Table A. 2), but no CAT night operations. As explained in section A.5, this is a logistics issue as emergency helicopter flights by the

Coastguard would still be possible to a drilling rig or vessel working over the wellhead. Consultation with Harbour Energy has confirmed that Millom PLEM wellhead is planned to be decommissioned and vessel and helicopter access will be required from 2027 to approximately 2032.

A.6.4.3 Summary

A.6.4.3.1 The average daytime access will be 94.4%. Due to the wellhead being located within 3 nm of the Morgan Array Area, it is likely that night operations will be prohibited.

A.6.5 Q1-3 wellheads

A.6.5.1.1 These wellheads are close to the Millom PLEM Wellhead and so the same comments apply.

A.6.5.1 Current access

A.6.5.1.1 The Q1-3 Wellheads are located 2 nm to the east of the Morgan Array Area. When a drilling rig or diving support vessel is required to work on the wellheads helicopter access might be required. Most drilling rigs and diving support vessels have helidecks approved for both day and night operations. For the period 2018 to 2022, access was available for 98.7% of daylight condition (Day VMC 94.4% (Table A. 2)) plus 4.3% average usable IMC (Table A. 3).

A.6.5.2 Future access

A.6.5.2.1 A worse case assumption is that the new draft CAA regulations will only permit Day VMC operations within 3 nm of a wind farm (see section A.2.2.2). Consultation with stakeholders, including helicopter operators, indicates that a distance of 2 nm is sufficient for a Day VMC approach and take-off. This would provide an average daytime access of 94.4% (see Table A. 2), but no Day IMC or CAT night operations. With the Morgan Array Area situated 2 nm away from the Q1-3 Wellheads, therefore, an average daytime loss of access of 4.3% would occur. Consultation with Harbour Energy has confirmed that the Millom Q1-3 wellheads are planned to be decommissioned and vessel and helicopter access will be required from 2027 to approximately 2032.

A.6.5.3 Summary

A.6.5.3.1 Day VMC operations would be possible. The average Day VMC access will be 94.4%. Due to the wellhead being located within 2 nm of the Morgan Array Area, it is likely that night operations will be prohibited.

A.6.6 Dalton well R1 and R2

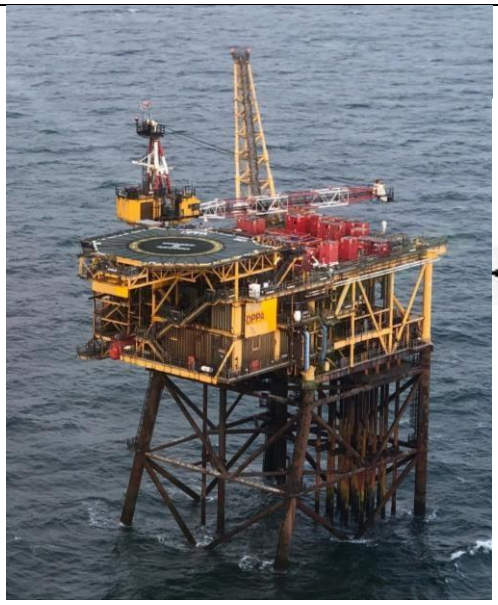
A.6.6.1.1 The R1 wellhead is located 3.3 nm from the Morgan Generation Assets. The R2 is located 3.6 nm from the Morgan Generation Assets. A drilling rig or diving support vessel may require to work over these wellheads.

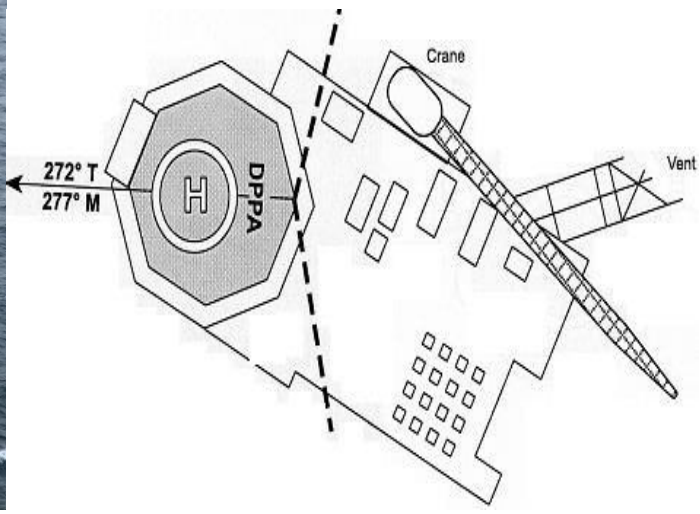
A.6.6.1.2 The predominant wind direction for IMC conditions is from the southwest, see Figure A. 3. In consultation with helicopter operators, it was agreed that ARAs up to 30º out of wind can be conducted, providing the drift angle remains 10º or less. Taking this into account, along with the location of these wellheads, and the spacing to the Morgan Array Area, it is assessed that both IMC and night approaches will be permitted.

Therefore, there will no significant loss of access by day or night, except under exceptional wind and weather conditions.

A.6.7 North Morecambe DPPA

HELIDECK Elev **153 ft**	VAR **2** **W**	POSITION **N53 57.57** **W003 40.35**	EGMS **DPPA**		
HEIGHT OF INSTALLATION: **210ft** HIGHEST OBSTACLE WITHIN 5NM: **Check**			VHF **122.380**	NDB	Issue Date **23** **August 2022**
FUELLING INSTALLATION: **No** STARTING EQUIPMENT: **No**			Operating Company **Spirit Energy**		Issued By **Helideck Certification Agency**
HELIDECK D value: **18.7m** P/R/H Category: **F** Max Weight: **8.6t** Circle & H Lights: **Yes**					





Wind (T°)	Kts	Limitation /Comment
		• NUI • Table 1(T) if overflight of 5:1 items unavoidable • Call sign DPP-Alpha • H2 RFFS Large Compliant (Automated).

Figure A. 10: Details of North Morecambe DPPA.

A.6.7.1.1 The North Morecambe DPPA is a NUI approved for day and night operations. It is located 4.1 nm from the Morgan Array Area.

A.6.7.2 Current access

A.6.7.2.1 Currently there are no restrictions on access. Current access is 98.7% of daylight condition (Day VMC 94.4% (Table A. 2) plus 4.3% usable IMC (Table A. 3)) and 96.7% of night conditions (Night VMC 88.5% (Table A. 2) and Usable Night IMC 8.2% (Table A. 3)).

A.6.7.3 Future access

A.6.7.3.1 In consultation with helicopter operators, it was agreed that ARAs up to 30º out of wind can be conducted, providing the drift angle remains 10º or less. Due to the location of the platform, and IMC conditions prevailing with a southwesterly wind, sufficient distance is available for an ARA. Even with a westerly wind, taking account of the 1 nm IMC safety buffer, and reduced performance following an engine failure, 4.1 nm is a sufficient distance for a take-off into IMC or go-around.

A.6.7.4 Summary

A.6.7.4.1 The Morgan Generation Assets will not affect access to the North Morecambe DPPA installation.

A.6.8 Whitehaven wellhead

A.6.8.1.1 The Whitehaven Wellhead is at the pre-commissioning stage of development. It is located 5.8 nm from the Morgan Array Area. A drilling rig or diving support vessel may be required to work over the wellhead.

A.6.8.1.2 The predominant wind direction for IMC conditions is from the southwest, see Figure A. 3. The location of this wellhead allows a clear 9 nm ARA approach in IMC. As the Morgan Array Area is situated 5.8 nm southwest of the wellhead, there will be sufficient space for a one engine inoperative continued take-off, or go-around, meeting the IMC obstacle criteria. Therefore, there will be no loss of access by day or night.

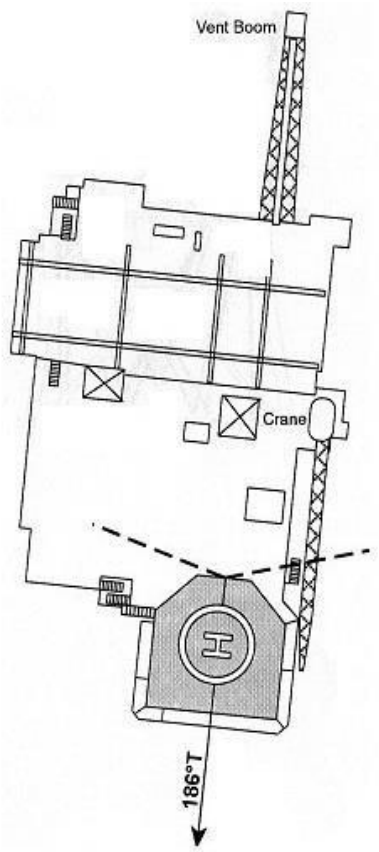
A.6.9 Rhyl wellheads

A.6.9.1.1 The Rhyl wellheads are located 7.1 nm to the northeast of the Morgan Array Area. A drilling rig or diving support vessel may require to work over the wellhead.

A.6.9.1.2 The predominant wind direction for IMC conditions is from the southwest, see Figure A. 3. The location of the wellheads allows a clear 9 nm ARA approach in IMC. The Morgan Array Area is situated 7.1 nm southwest of the wellhead, so allowing for a 1 nm IMC safety buffer and reduced helicopter performance following an engine failure. Therefore, there will be no loss of access by day or night.

A.6.10 South West Morecambe DP8

HELIDECK Elev **110 ft**	VAR **2** **W**	POSITION **N53 53.50** **W003 37.50**	EGMR **DP-8**		
HEIGHT OF INSTALLATION: **183ft** HIGHEST OBSTACLE WITHIN 5NM: **Check**			VHF **122.380**	NDB	Issue Date **25/7/2022**
FUELLING INSTALLATION: **No** STARTING EQUIPMENT: **No**			Operating Company **Spirit Energy**		Issued By **Helideck Certification Agency**
HELIDECK D value: **17.46** P/R/H Category: F Max Weight: **6.8** Circle & H Lights: Yes					



ind (T°)	Kts	Limitation /Comment
		• NUI • Table 1(T) if overflight of 5:1 items unavoidable • Wireline gantry operations may infringe 210 sector - Local restrictions apply • Automatic self-oscillating monitors - H2- Large compliant.

Figure A. 11: Details of the DP8 platform.

A.6.10.1.1 The DP8 platform is a NUI approved for day and night operations. It is located 6.6 nm southeast of the Morgan Array Area.

A.6.10.2 Current access

A.6.10.2.1 Currently there are no restrictions on access. Current access is 98.7% of daylight conditions (Day VMC 94.4% (Table A. 2) plus 4.3% average usable IMC (Table A. 3)) and 96.7% of night conditions (Night VMC 88.5% (Table A. 2) and Usable Night IMC 8.2% (Table A. 3)).

A.6.10.3 Future access

A.6.10.3.1 Due to its location, an unobstructed approach is available for an ARA, go-around and take-off into IMC conditions.

A.6.10.4 Summary

A.6.10.4.1 Due to its location, and the fact that IMC conditions predominately exist with a southwesterly wind, the Morgan Generation Assets will not affect access to the DP8 platform.

A.6.11 South Morecambe DP6

HELIDECK Elev **117 ft**	VAR **2** **W**	POSITION **N53 51.9 W003 37.1**	EGMQ **DP-6**		
HEIGHT OF INSTALLATION: **262ft** HIGHEST OBSTACLE WITHIN 5NM: **Check**			VHF **122.380**	NDB	Issue Date **6/5/22**
FUELLING INSTALLATION: **No** STARTING EQUIPMENT: **No**			Operating Company **Spirit Energy**		Issued By **Helideck Certification Agency**
HELIDECK D value: **17.46** P/R/H Category: **F** Max Weight: **7.0** Circle & H Lights**:** **Yes**					

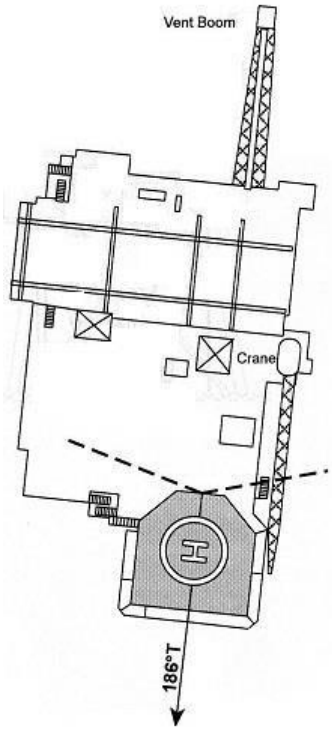


Figure A. 12: Details of the DP6 platform.

A.6.11.1.1 The DP6 platform is a NUI approved for day and night operations. It is located 7.6 nm southeast of the Morgan Array Area.

A.6.11.1 Current access

A.6.11.1.1 Currently there are no restrictions on access. Current access is 98.7% of daylight conditions (Day VMC 94.4% (Table A. 2) plus 4.3% average usable IMC (Table A. 3)) and 96.7% of night conditions (Night VMC 88.5% (Table A. 2) and Usable Night IMC 8.2% (Table A. 3)).

A.6.11.2 Future access

A.6.11.2.1 Due to its location, an unobstructed approach is available for an ARA, go-around and take-off into IMC. There will be no reduction in access to the DP6 platform.

A.6.11.3 Summary

A.6.11.3.1 Due to its location, the Morgan Generation Assets will not affect access to the DP6 Platform.

A.6.12 South Morecambe DP4 platform

A.6.12.1.1 The South Morecambe topside was removed in 2021 and so it will be considered as being equivalent to a wellhead.

A.6.12.1.2 The DP4 structure is located 9 nm to the southeast of the Morgan Array Area. A drilling rig or diving support vessel may be required to work over the wellhead, potentially just infringing the 9 nm consultation radius imposed by CAP 764. However, due to the Morgan Array Area boundary being close to 9 nm away, no impact on flights will result.

A.7. Cumulative assessment

A.7.1.1 Assessment

A.7.1.1.1 In addition to the Morgan Generation Assets, there are proposals to develop the Mona Offshore Wind Project and Morecambe Offshore Windfarm. This section identifies the cumulative effect of the three wind farms. Figure A. 11 shows the Mona Offshore Wind Project and Morecambe Offshore Windfarm in relation to the Morgan Generation Assets.

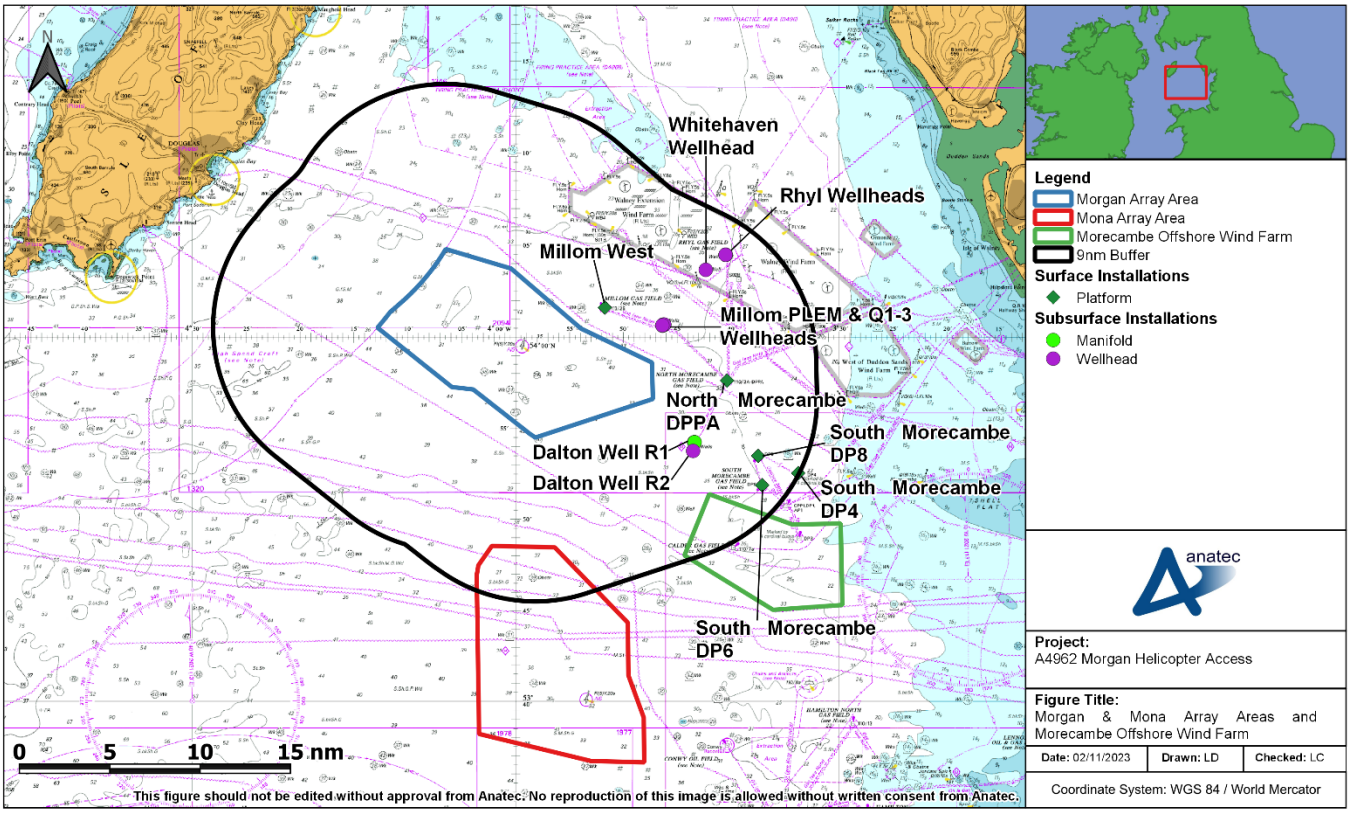


Figure A. 13: The Morgan & Mona Array Areas and Morecambe Offshore Windfarm.

A.7.1.1.2 The cumulative assessment considers whether installations already affected by the Morgan Generation Assets will have additional impacts imposed by the Mona Offshore Wind Project or Morecambe Offshore Windfarm.

A.7.1.1.3 Figure A. 3 and Figure A. 4 show that IMC conditions are most prevalent with a south-westerly wind direction. In consultation with helicopter operators, it was agreed that ARAs up to 30º out of wind can be conducted, providing the drift angle remains 10º or less. Taking these two factors into account, it is assessed that the Mona Offshore Wind Project will have no cumulative impact and the Morecambe Offshore Windfarm will have no significant cumulative impact on access. The only potential impact from the Morecambe Offshore Windfarm will be on the Dalton Wellheads in exceptional wind and weather conditions, combined with a NPI operating over the location.

A.7.1.2 Helicopter Icing Considerations

A.7.1.2.1 If the Mona Offshore Wind Project and/or Morecambe Offshore Windfarm is built, it is highly unlikely that it will increase the transit time to any of the installations due to icing, or other factors.

A.7.2 References

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Appendix B Instrument Flight Procedure (IFP) Assessment

Morgan and Mona Offshore Wind Projects – Impact Assessment

Impact Assessment for Obstacle Limitation Surfaces (OLS) and Instrument Flight Procedures (IFPs)

Date: 30/01/2024
Author: Daniel Figueras Gomez / Liam Clarke
Revision: V1.3
Osprey Ref: 71578-019

Harston Mill, Royston Road, Harston, Cambridge, CB22 7GG
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Registered in England and Wales under No: 06034579

Document Details

Reference	Description
Document Title	Morgan and Mona Offshore Wind Projects – Impact Assessment
	Impact Assessment for Obstacle Limitation Surfaces (OLS) and Instrument Flight Procedures (IFPs)
Document Ref	71578-019
Issue	V1.3
Date	30/01/2024
Client Name	RPS Energy
Classification	Commercial in Confidence

Issue	Amendment	Date
V1	Initial Release	22/09/2023
V1.1	Wording Clarification	31/10/2023
V1.2	Wording Clarification	14/11/2023
V1.3	Wording Clarification and List of Acronyms added	30/01/2024

Approval Level	Authority	Name
APD	Osprey CSL	Daniel Figueras Gomez under the supervision of Liam Clarke
IAPD	Osprey CSL	Sam Shuttlewood
Design Authority	Osprey CSL	Mark Wakeman

List of Abbreviations and Acronyms

AIP	Aeronautical Information Publication
AIRAC	Aeronautical Information Regulation and Control
AMSL	Above Mean Sea Level
APD	Approved Procedure Designer
APDO	Approved Procedure Design Organisation
ARP	Aerodrome Reference Point
ASDA	Acceleration-Stop Distance Available
ATCSMAC	Air Traffic Control Surveillance Minimum Altitude Chart
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CAT	Category
DER	Departure End of Runway
DME	Distance Measurement Equipment
FAF	Final Approach Fix
FL	Flight Level
IAF	Initial Approach Fix
IAPD	Independent Approved Procedure Designer
ICAO	International Civil Aviation Organisation
IF	Intermediate Fix
IFP	Instrument Flight Procedure
ILS	Instrument Landing System
LAT	Lowest Astronomical Tide
LDA	Landing Distance Available
LHA	Lowest Holding Altitude
LOC	Localiser
MAPt	Missed Approach Point
MID	Military Instrument Departure
MOC	Minimum Obstacle Clearance
MOCA	Minimum Obstacle Clearance Altitude
MSA	Minimum Sector Altitude

NDB(L)	Non-Directional Beacon (Locator)
OAS	Obstacle Assessment Surfaces
OCA	Obstacle Clearance Altitude
OCH	Obstacle Clearance Height
OLS	Obstacle Limitation Surfaces
OSWF	Off-Shore Wind Farm
PAR	Precision Approach Radar
RAF	Royal Air Force
RNP	Required Navigation Performance
RWY	Runway
SID	Standard Instrument Departure
SMAA	Surveillance Minimum Altitude Area
SRA	Surveillance Radar Approach
STAR	Standard Terminal Arrival
TAA	Terminal Arrival Altitude
TAC	TACAN
THR	Runway Threshold
TIA	Turn Initiation Area
TODA	Take-Off Distance Available
TORA	Take-Off Run Available
VM(C)	Visual Manoeuvring (Circling)
VOR	Very-High Frequency Omnidirectional Range
VSS	Visual Segment Surface

Executive Summary

Osprey CSL has been commissioned by RPS Energy to assess the potential impact of Mona Offshore Wind Project and Morgan Offshore Wind Project Generation Assets (hereafter referred to as the Morgan Generation Assets) in the vicinity of Manchester, Liverpool John Lennon, Isle of Man Ronaldsway, Warton, Blackpool, Walney and RAF Valley Airports, with turbine tip heights of 364m Above Mean Sea Level (AMSL)*.

This report includes an assessment of the potential impact the Windfarms may have in relation to the Obstacle Limitation Surfaces (OLS) and the Instrument Flight Procedures (IFPs) serving each of the airports.

*This has been used for Lowest Astronomical Tide (LAT) as per Section 1.3.

OLS

None of the Windfarms affects the OLS of the airports analysed in this report.

IFPs

For a summary of the Potential Impact to IFPs see below table:

NOTE: A full IFP review will need to be conducted by the Approved Procedure Design Organisation (APDO) for each Airport at the relevant stage in the planning process. Any actions suggested in this report will need to be agreed and developed with the individual Airport Safeguarding Teams through their appointed APDO. Any mitigation or redesign must be actioned by the Procedure Sponsor (Airport). This Impact Assessment highlights those procedures that may be impacted but is not a formal IFP Safeguarding Review as defined by UK CAA CAP 738 or an APDO Review as defined by CAP785. Such formal reviews will be required through separate commercial agreement between the developer and the individual Airports.

Airport	Mona Offshore Wind Project	Morgan Generation Assets
Manchester	No Impact on OLS. No Impact on IFPs.	No Impact on OLS. No Impact on IFPs.
Liverpool	No Impact on OLS. No Impact on IFPs.	No Impact on OLS. No Impact on IFPs.
Warton	No Impact on OLS. No Impact on IFPs.	No Impact on OLS. No Impact on IFPs.
Isle of Man	No Impact on OLS. No Impact on IFPs.	No Impact on OLS. **Potential impact on ATCSMAC 1600ft SMAA.** MOCA needs increasing from 1600ft to 2200ft. See Section 5.2.1 **Potential impact on IFP NDB(L)/DME RWY26 for DME I-RY Inoperative (CAT C, D).** Base turn MOCA needs increasing from 2000ft to 2200ft. See Section 5.2.11. Other IFPs unaffected.
Valley	No Impact on OLS. **Potential impact on ATCSMAC 1500ft QNH 1400ft QFE SMAA.** MOCA needs increasing to 2300ft QNH 2200ft QFE. See Section 6.2.1 **Potential impact on MSA VYL 25NM NW Sector.** MOCA needs increasing from 1900ft to 2200ft. See Section 6.2.21 Other IFPs unaffected.	No Impact on OLS. **Potential impact on ATCSMAC 1500ft QNH 1400ft QFE SMAA.** MOCA needs increasing to 2300ft QNH 2200ft QFE. See Section 6.2.1 Other IFPs unaffected.
Blackpool	No Impact on OLS. **Potential impact on MSA 25NM NDB(L) BPL SW Sector.** MOCA needs	No Impact on OLS. No Impact on IFPs.

	increasing from 2000ft to 2200ft. See Section 7.2.10. Other IFPs unaffected.	
Walney	No Impact on OLS. No Impact on IFPs.	No Impact on OLS. **Potential impact on MSA 25NM NDB(L) WL SW Sector.** MOCA needs increasing from 1800ft to 2200ft. See Section 8.2.10. Other IFPs unaffected.

Table 1 - Conclusions Summary

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1 Introduction

1.1 Overview

Osprey CSL has been commissioned by RPS Energy to assess the potential impact of Mona Offshore Wind Project and the Morgan Generation Assets, in relation to the airports at: Manchester, Liverpool John Lennon, Isle of Man Ronaldsway, BAE Warton, Blackpool, Walney and RAF Valley, with turbine tip heights of 364m Above Mean Sea Level (AMSL)*.
This report includes assessment of the potential impact the windfarms may have in relation to the Obstacle Limitation Surfaces (OLS) and the Instrument Flight Procedures (IFPs) at each airport.

1.2 Scope

This report assesses the windfarms in relation to the OLS and IFPs at each airport and has been completed with the use of the latest published procedures in the State Aeronautical Information Publication (AIP), AIRAC 08/2023 effective date 10 AUG 2023 and AIRAC 09/2023 effective date 07 SEP 2023. Also the UK Miliary AIP, AIRAC Cycle 2308, effective date 10 AUG 23 and AIRAC cycle 2309 effective date 07 SEP 23.

The survey data used is the SLC Aerodrome Survey Report dated Sep 2021 for Manchester Airport, Paul Fassam Geomatics Survey Report dated Sep 2021 for Liverpool Airport, Pell Frischmann Survey Report dated Sep 2021 for RAF Valley and Pell Frischmann Survey Report dated Aug 2021 for BAE Warton. For the remaining airfields, the key point to define the procedures were sourced from the AIP. Autodesk AutoCAD, ASD PD Toolkit and ICAO Software was used to compile drawings and evaluate the potential impact.

1.3 Data Provided by Client

The client provided shapefiles for each of the proposed windfarms which were converted to Lat/Long files in UTM84-30N using Global Mapper software to provide a compatible format which could be uploaded into AutoCAD.

The client provided estimated maximum turbine tip elevations of 364m above Lowest Astronomical Tide (LAT) for both developments. This was confirmed via email on the 5th SEP 2023.

We have considered LAT as AMSL for assessment purposes in this report.

UK Airports use AMSL as the reference datum for OLS and IFP surfaces, so this report considers the elevation of the windfarms at AMSL (which is more restrictive than using the height of the windfarms at LAT) and therefore offers more protection.

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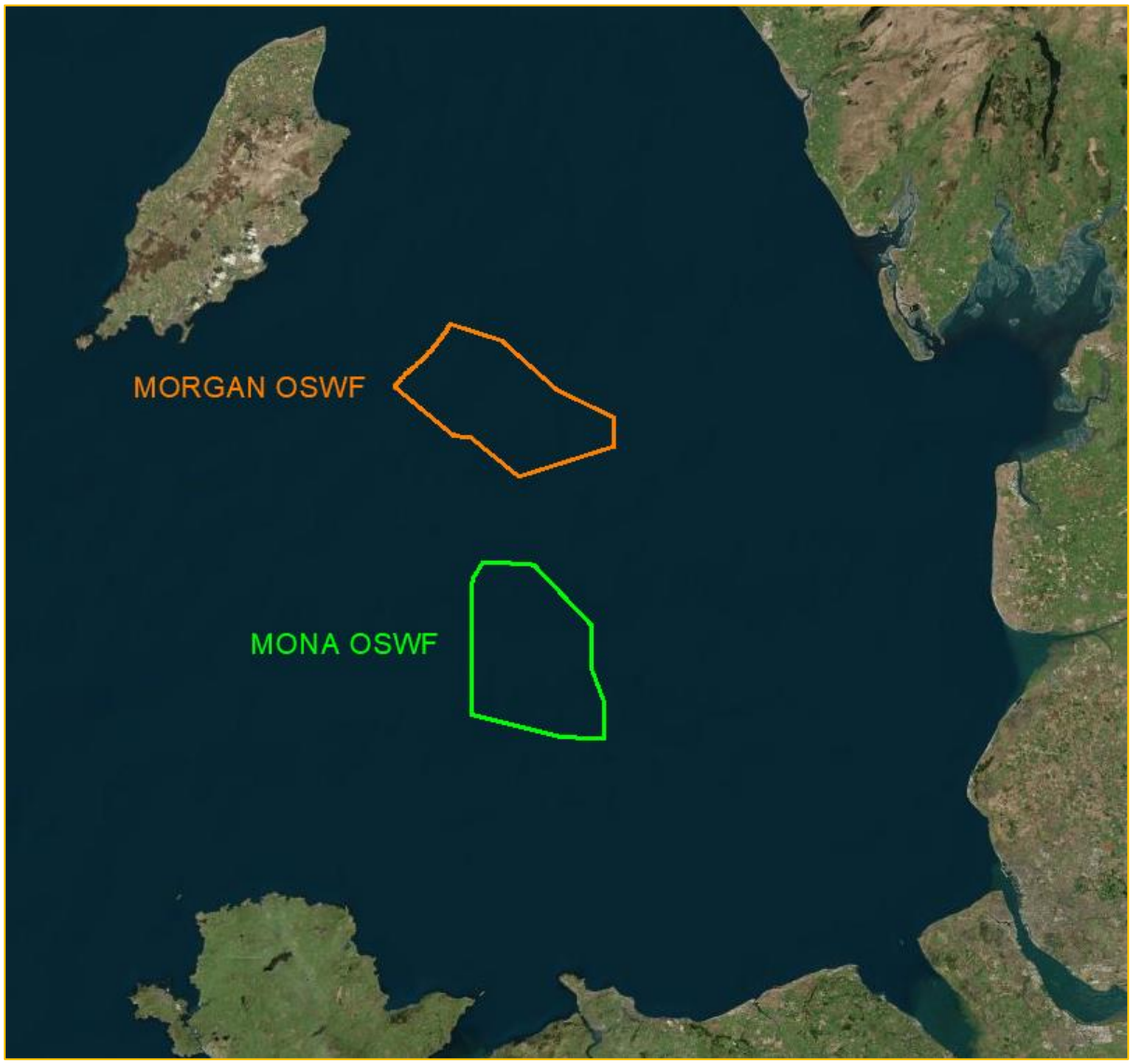

Figure 1 – Development Boundaries

All Figures shown in this report that contain an Aerial Map Background, are from Autodesk AutoCAD 2019 embedded Online Maps Data.
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© CNES (2022) Distribution Airbus DS
© 2022 Earthstar Geographics SIO

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1.4 Obstacle and Orientation

The site location was added to the AutoCAD Model with distance to the airports shown below:

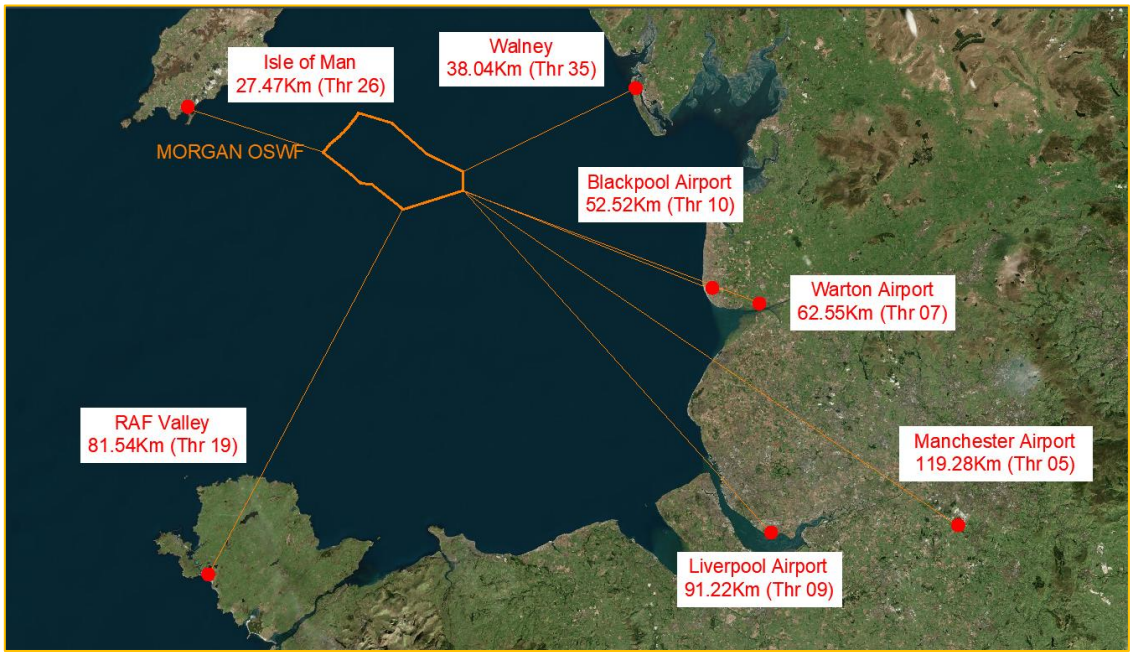

Figure 2 - Location of Morgan Array Area in Relation to Airports

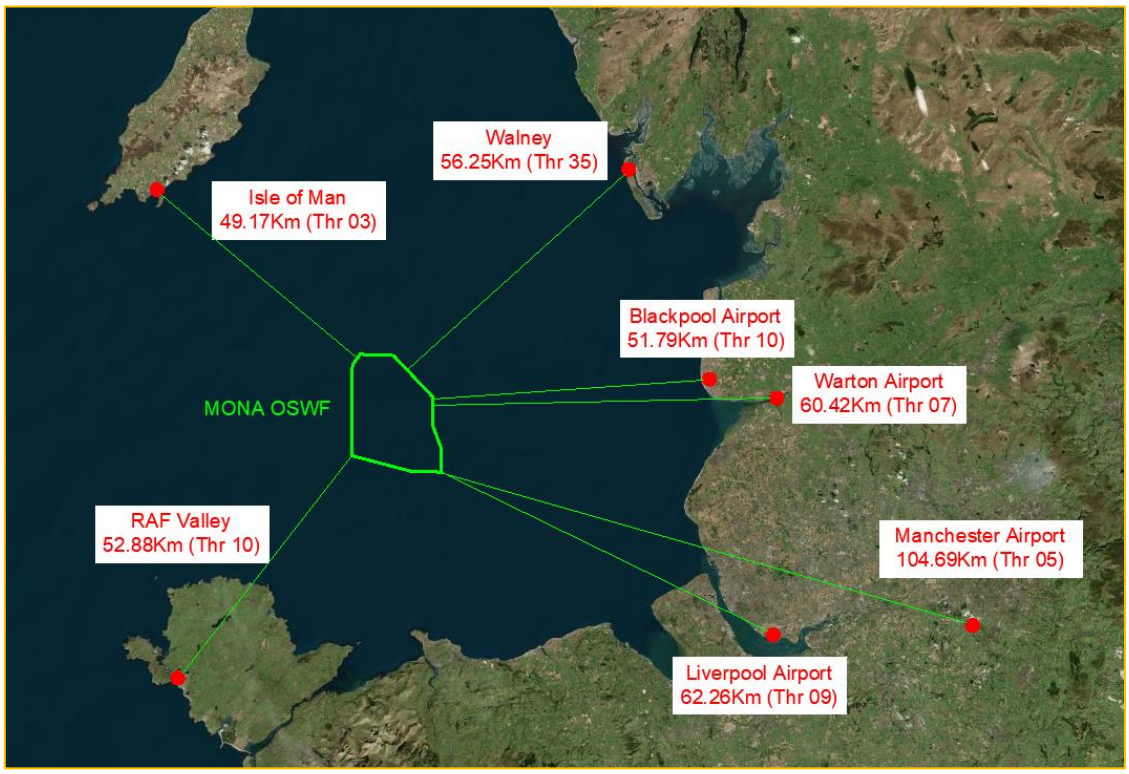

Figure 3 – Location of Mona Array Area in Relation to Airports

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2 Manchester Airport OLS and IFP Assessment

2.1 OLS Assessment

2.1.1 Overview

The OLS for Manchester Airport has been constructed in accordance with Annex 14 and CAP 168.

2.1.2 Runway Data Used

The following declared distances and threshold details are published in the AIP:

Runway designator	TORA	TODA	ASDA	LDA
1	2	3	4	5
05R	3047 M	3347 M	3047 M	2864 M
23L	3200 M	3500 M	3200 M	2864 M
23L	3121 M	3421 M	3121 M	
23L	2955 M	3255 M	2955 M	
23L	2849 M	3149 M	2849 M	
23L	2504 M	2804 M	2504 M	
05L	3014 M	3229 M	3014 M	2587 M
23R	2897 M	3197 M	2897 M	2714 M
05L	2771 M	2986 M	2771 M	
05L	2432 M	2647 M	2432 M	
05L	2036 M	2251 M	2036 M	
23R	2567 M	2867 M	2567 M	
23R	2121 M	2421 M	2121 M	

Figure 4 - Declared Distances

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Designations RWY Number	True bearing	Dimensions of RWY	Surface of RWY/ SWY/ Strength (PCN)	THR co-ordinates/ THR Geoid undulation	THR elevation/ Highest elevation of TDZ of precision APP RWY	Slope of RWY/ SWY
1	2	3	4	5	6	7
05L	051.06°	3048 x 45 M	RWY surface: Concrete and asphalt, Non grooved PCN 94/F/C/W/T	532051.20N 0021715.95W 167.0 FT	THR 212.0 FT	05L - 0.49% Up 23R - 0.49% Down
23R	231.09°	3048 x 45 M	RWY surface: Concrete and asphalt, Non grooved PCN 94/F/C/W/T	532140.75N 0021533.41W 167.0 FT	THR 249.0 FT	05L - 0.49% Up 23R - 0.49% Down
05R	051.04°	3050 x 45 M	RWY surface: Concrete and asphalt, Grooved PCN 79/F/C/W/T	531955.10N 0021838.38W 167.0 FT	THR 186.0 FT	05R - 0.46% Up 23L - 0.48% Down
23L	231.07°	3050 x 45 M	RWY surface: Concrete and asphalt, Grooved PCN 79/F/C/W/T	532053.35N 0021637.95W 167.0 FT	THR 227.0 FT	05R - 0.46% Up 23L - 0.48% Down

Figure 5 - Threshold Details

Runway 05L, 23R and 05R have ILS approaches and all runways are more than1800m in length.

Runway 05L is a CODE 4, Precision Instrument Runway

Runway 23R is a CODE 4, Precision Instrument Runway

Runway 05R is a CODE 4, Precision Instrument Runway **(Lowest Threshold, 56.77m)**

Runway 23L is a CODE 4, Non-Precision Runway

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2.1.3 OLS Construction

The OLS for Manchester Airport is shown below along with an image in relation to the proposed windfarm locations.

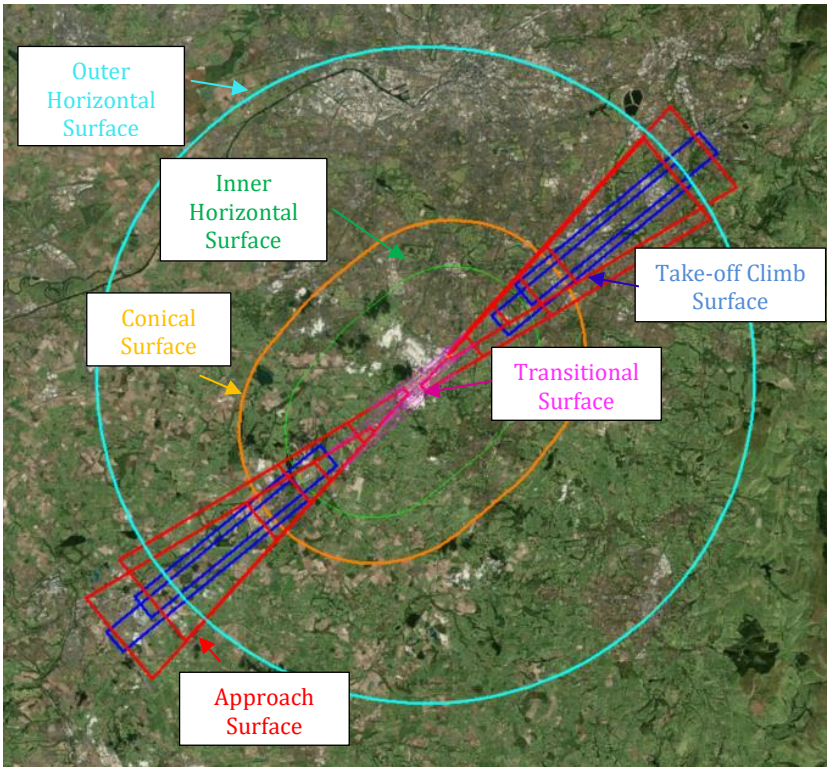

Figure 6 – OLS for Manchester Airport

Figure 7 - Manchester OLS in Relation to Windfarms

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2.1.4 OLS Analysis

The OLS for Manchester Airport lies entirely outside of the boundaries of both windfarms and is not affected by the development.

The windfarms will have no impact on the OLS for Manchester Airport.

2.2 IFP Assessment

The ATCSMAC and IFPs assessed are as follows:

AIRAC 08/2023 (Effective 10 AUG 2023)

- AD 2.EGCC-5-1 ATC SURVEILLANCE MINIMUM ALTITUDE CHART (18 MAY 23);
- AD 2.EGCC-6-1 SID MONTY 1R 1S 1Y 1Z (18 MAY 23);
- AD 2.EGCC-6-2 SID ASMIM 1S 1Z/KUXEM 1R 1Y/EKLAD 1R 1Y (18 MAY 23);
- AD 2.EGCC-6-3 SID LISTO 2S 2Z (18 MAY 23);
- AD 2.EGCC-6-4 SID LISTO 2R 2Y (18 MAY 23);
- AD 2.EGCC-6-5 SID POL 5R 4S 1Y 1Z (18 MAY 23);
- AD 2.EGCC-6-6 SID SONEX 1R 1Y/DESIG 1S 1Z (18 MAY 23);
- AD 2.EGCC-6-7 SID SANBA 1R 1Y (18 MAY 23);
- AD 2.EGCC-7-1 STAR RNAV1 (DME/DME or GNSS) LAKEY 1M SETEL 1M TILNI 1M (23 MAR 23);
- AD 2.EGCC-7-2 STAR RNAV1 (DME/DME or GNSS) LIBSO 1M OTBED 1M (23 MAR 23);
- AD 2.EGCC-7-3 STAR RNAV1 (DME/DME or GNSS) MAKUX 1M MALUD 1M AXCIS 1M PENIL 1M (23 MAR 23);
- AD 2.EGCC-7-4 STAR RNAV1 (DME/DME or GNSS) ELVOS 1M LESTA 1M (23 MAR 23);
- AD 2.EGCC-8-1 ILS/DME (I-MC) RWY 05R (18 MAY 23);
- AD 2.EGCC-8-2 ILS/DME (MCT) RWY 05R (18 MAY 23);
- AD 2.EGCC-8-3 LOC/DME (I-MC) RWY 05R (18 MAY 23);
- AD 2.EGCC-8-4 VOR/DME RWY 05R (18 MAY 23);
- AD 2.EGCC-8-5 ILS/DME (I-MM) RWY 05L (18 MAY 23);
- AD 2.EGCC-8-6 ILS/DME (MCT) RWY 05L (18 MAY 23);
- AD 2.EGCC-8-7 LOC/DME RWY 05L (18 MAY 23);
- AD 2.EGCC-8-8 VOR/DME RWY 05L (18 MAY 23);
- AD 2.EGCC-8-9 ILS/DME (I-NN) RWY 23R (18 MAY 23);
- AD 2.EGCC-8-10 ILS/DME (MCT) RWY 23R (18 MAY 23);
- AD 2.EGCC-8-11 LOC/DME RWY 23R (18 MAY 23);
- AD 2.EGCC-8-12 VOR/DME RWY 23R (18 MAY 23);
- AD 2.EGCC-8-13 VOR/DME RWY 23L (18 MAY 23);
- AD 2.EGCC-8-14 RNP RWY 23L (18 MAY 23).

Additionally, the following were checked:

- Visual Circling
- Holding
- Visual Segment Surface (VSS)
- Minimum Sector Altitudes (MSA)

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2.2.1 AD 2.EGCC-5-1 ATC SURVEILLANCE MINIMUM ALTITUDE CHART

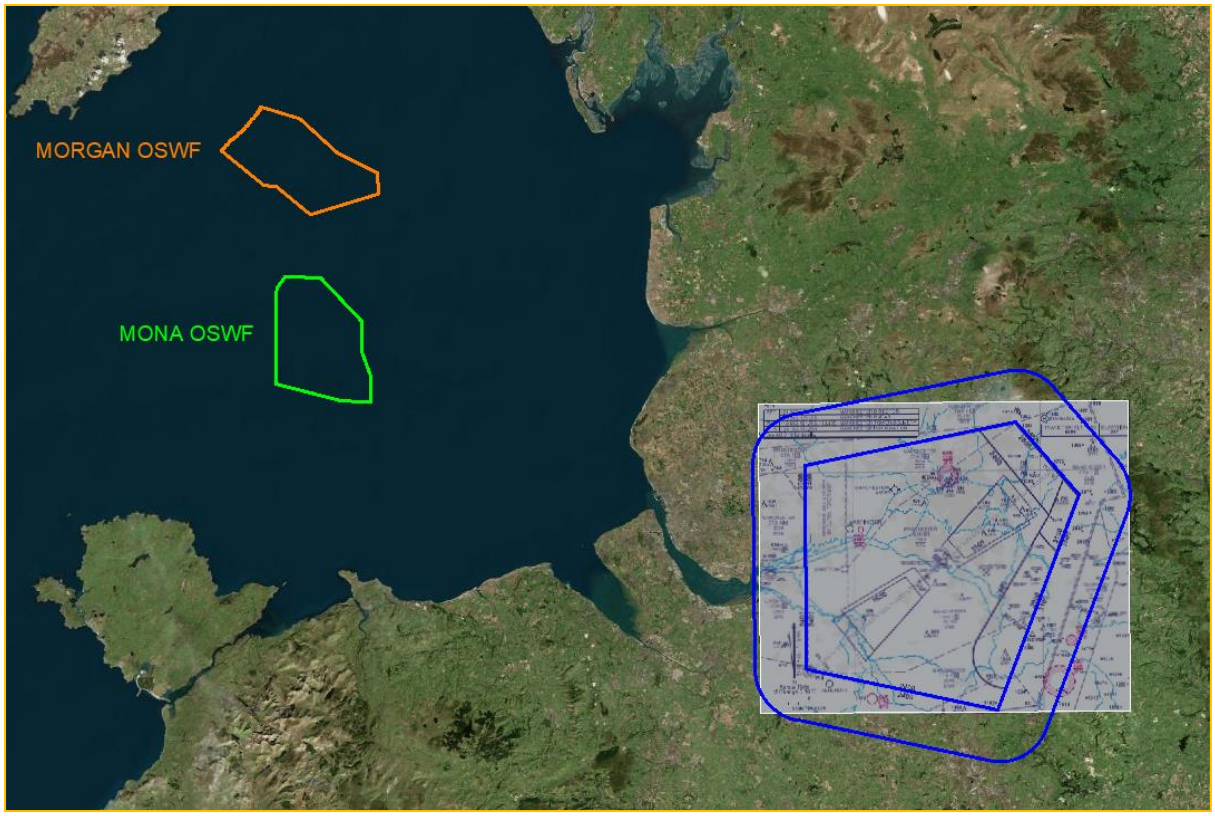

Figure 8 – Windfarms in Relation to ATCSMAC

Both windfarms lie outside the lateral buffer of all Surveillance Minimum Altitude Areas (SMAAs).

The proposed Windfarm would not impact Manchester Airport's ATCSMAC.

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2.2.2 SIDs (Departures)

Both windfarms are located outside the initial departure splays for all departures.

Figure 9 – Initial Departure Splays

Aircraft in a turn would have to be at a minimum altitude of 757ft.

The closest point between the most restrictive Manchester DER (Departure End of Runway) and the closest windfarm (Mona) point is 103632.70m. Over such distance, minus 150m (width of departure areas at DER), aircraft would have climbed an altitude of 0.033 * 103482.7m = 3414.93m / 11203ft above DER.

This provides sufficient clearance as the maximum MOC for SIDs is 300m and therefore aircraft should be at a minimum of 364m + 300m = 664m / 2179ft AMSL to safely clear the obstacle.

There is no impact on the Departures.

2.2.3 STARs (Arrivals)

All Arrivals terminate at or above FL070.

The maximum possible elevation of the windfarms, before affecting the Minimum Initial Altitude of FL070, has been calculated.

7000ft = 2133.6m

2133.6m – 300m Minimum Obstacle Clearance (MOC) = 1833.6m AMSL.

The maximum elevation of both windfarms (364m) is below this altitude; therefore, the procedure would be unaffected.

The proposed windfarms will have no impact on any of published Arrival Procedures.

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2.2.4 ILS/DME (I-MC) RWY 05R

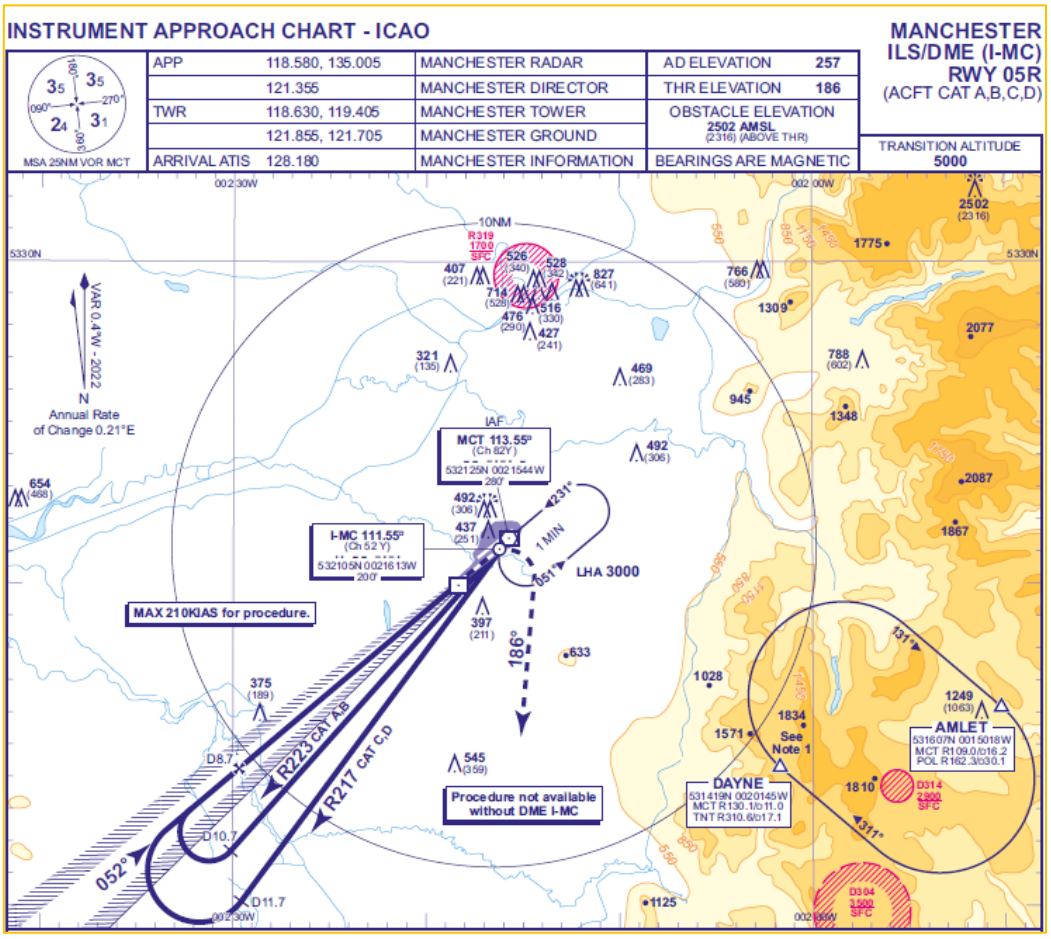

Figure 10 – ILS/DME (I-MC) RWY 05R Procedure

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the ILS/DME Procedure to Runway 05R.

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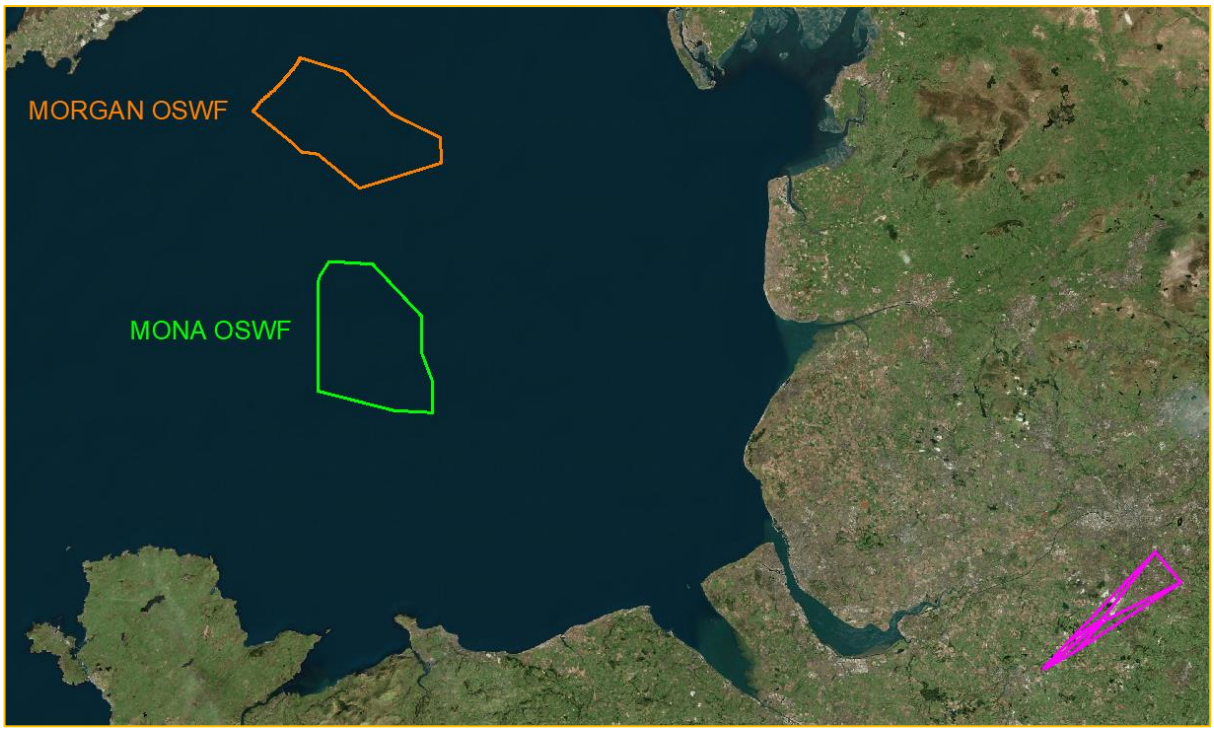

Figure 11 – ILS/DME (I-MC) RWY 05R OAS

Additionally, the procedure features two reversals: a CAT A,B and a CAT C,D base turn. The minimum altitude within the base turns is 3000ft. Provided the obstacles were inside the protection areas (which is unlikely) the highest MOC required over the obstacles would be full Initial Approach MOC (300m). Therefore, aircraft should be at a minimum of 364m + 300m = 664m / 2179ft AMSL to safely clear the obstacles. As the minimum altitude within the base turn is 3000ft, this provides sufficient margin to clear the obstacles safely.

The proposed windfarms will not have an impact on the ILS/DME (I-MC) RWY 05R Procedure.

2.2.5 ILS/DME (MCT) RWY 05R

See Section 2.2.4.

The proposed windfarms will not have an impact on the ILS/DME (MCT) RWY 05R Procedure.

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2.2.6 LOC/DME (I-MC) RWY 05R

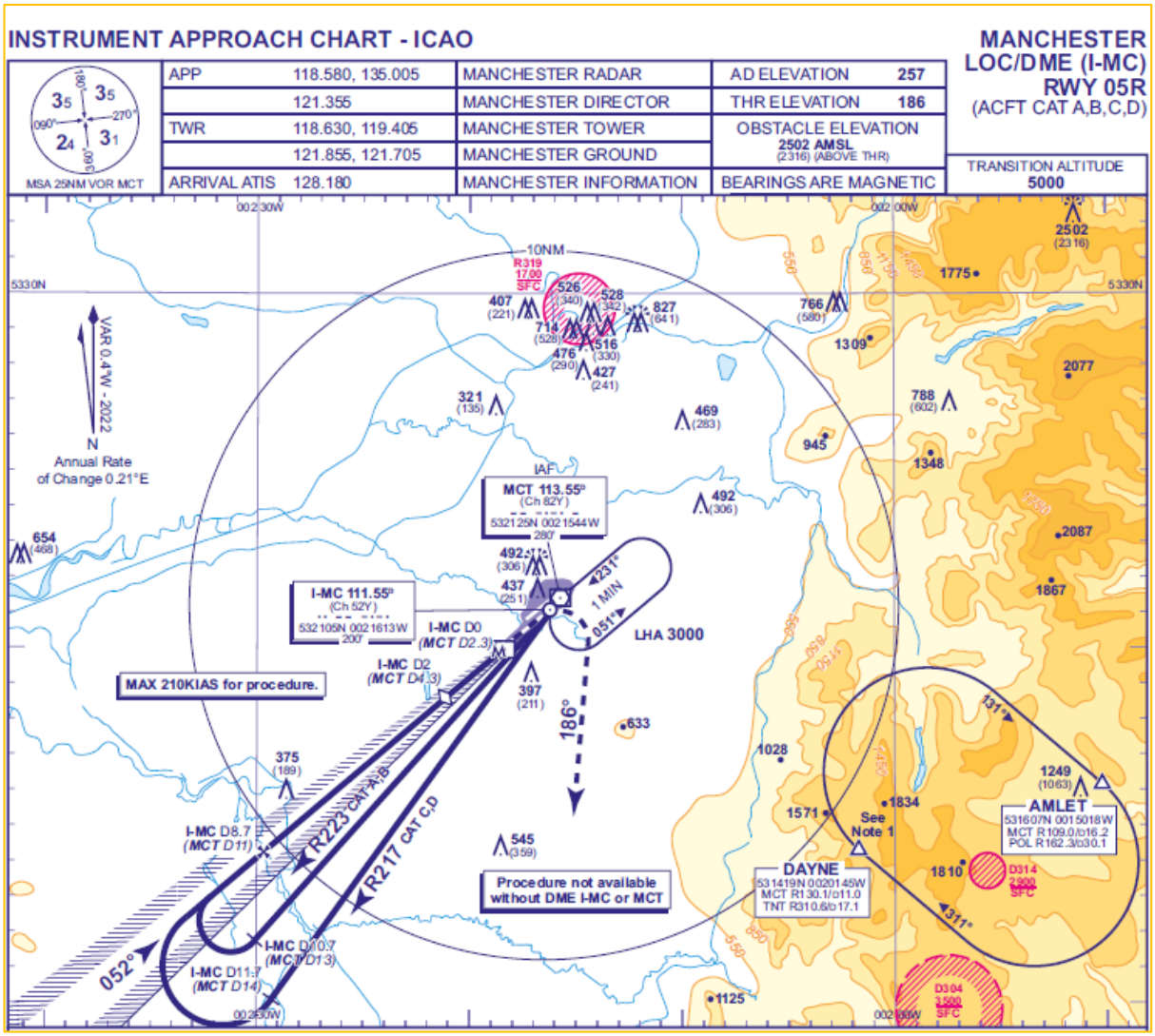

Figure 12 – LOC/DME (I-MC) RWY 05R Procedure

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the LOC Procedure to Runway 05R.

Additionally, base turns were assessed on Section 2.2.4, without any impact noted.

The proposed windfarms will not have an impact on the LOC/DME (I-MC) RWY 05R Procedure.

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2.2.7 VOR/DME RWY 05R

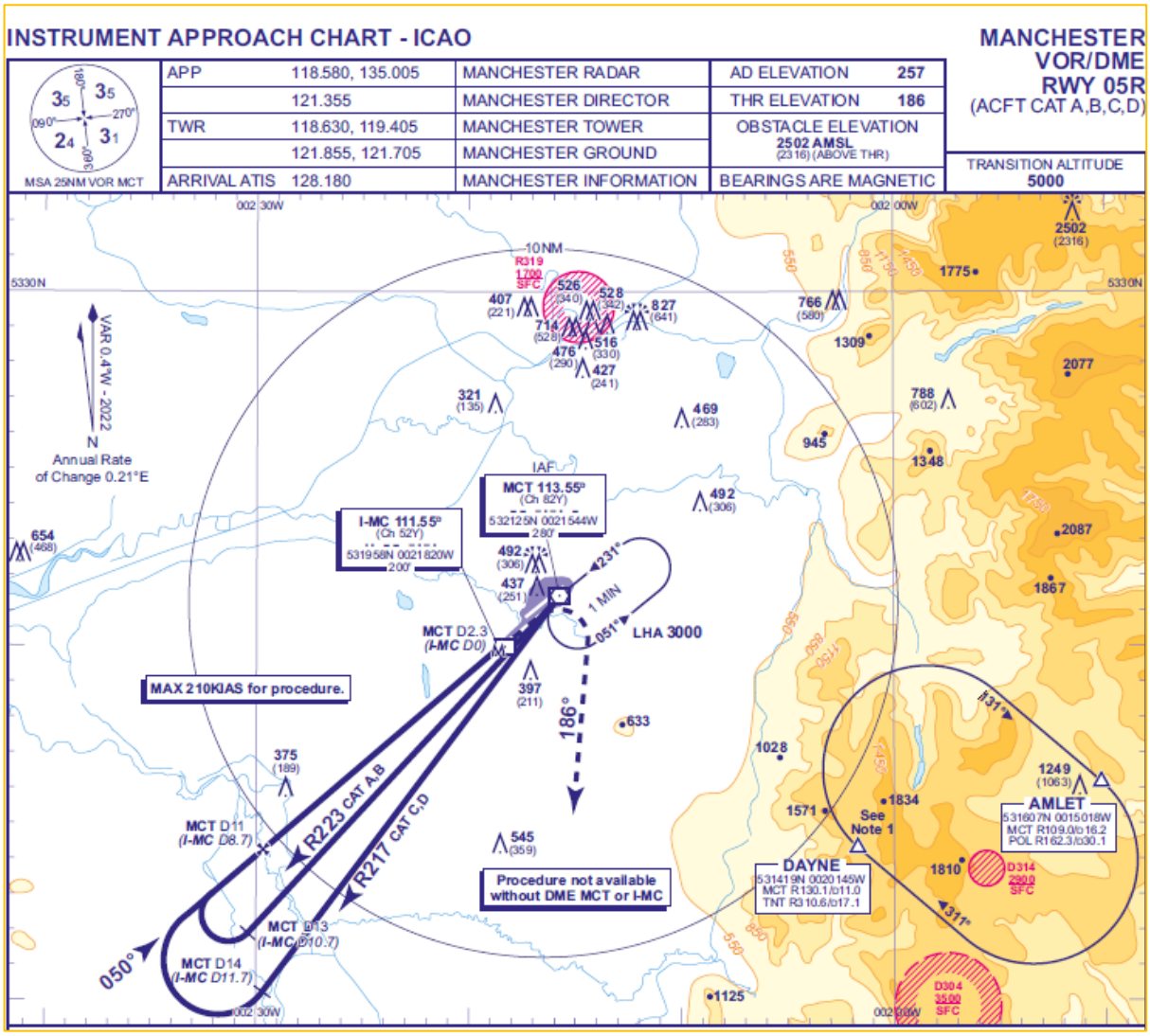

Figure 13 – VOR/DME RWY 05R Procedure

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the VOR/DME Procedure to Runway 05R.

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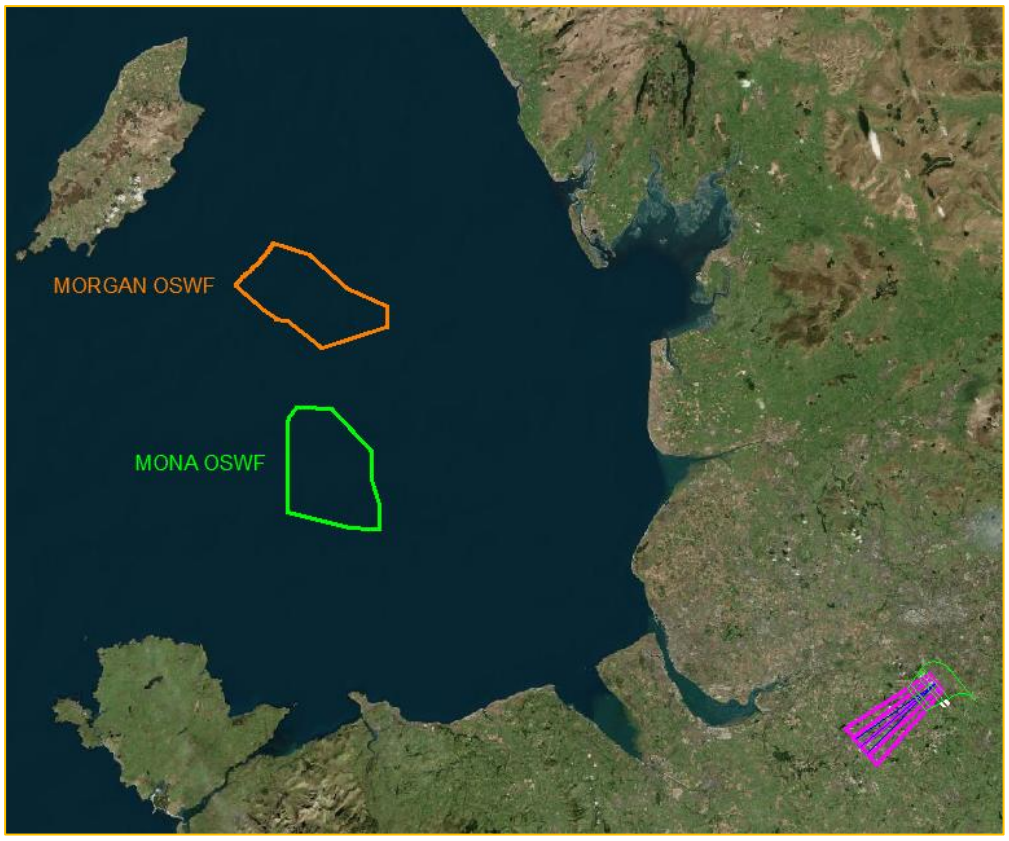

Figure 14 – VOR/DME RWY 05R Protection Areas

Additionally, the procedure features two reversals: a CAT A,B and a CAT C,D base turn. The minimum altitude within the base turns is 3000ft. Provided the obstacles were inside the protection areas (which is unlikely), the highest MOC required over the obstacles would be full Initial Approach MOC (300m). Therefore, aircraft should be at a minimum of 364m + 300m = 664m / 2179ft AMSL to safely clear the obstacles. As the minimum altitude within the base turn is 3000ft, this provides sufficient margin to clear the obstacles safely.

The proposed windfarms will not have an impact on the VOR/DME RWY 05R Procedure.

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2.2.8 ILS/DME (I-MM) RWY 05L

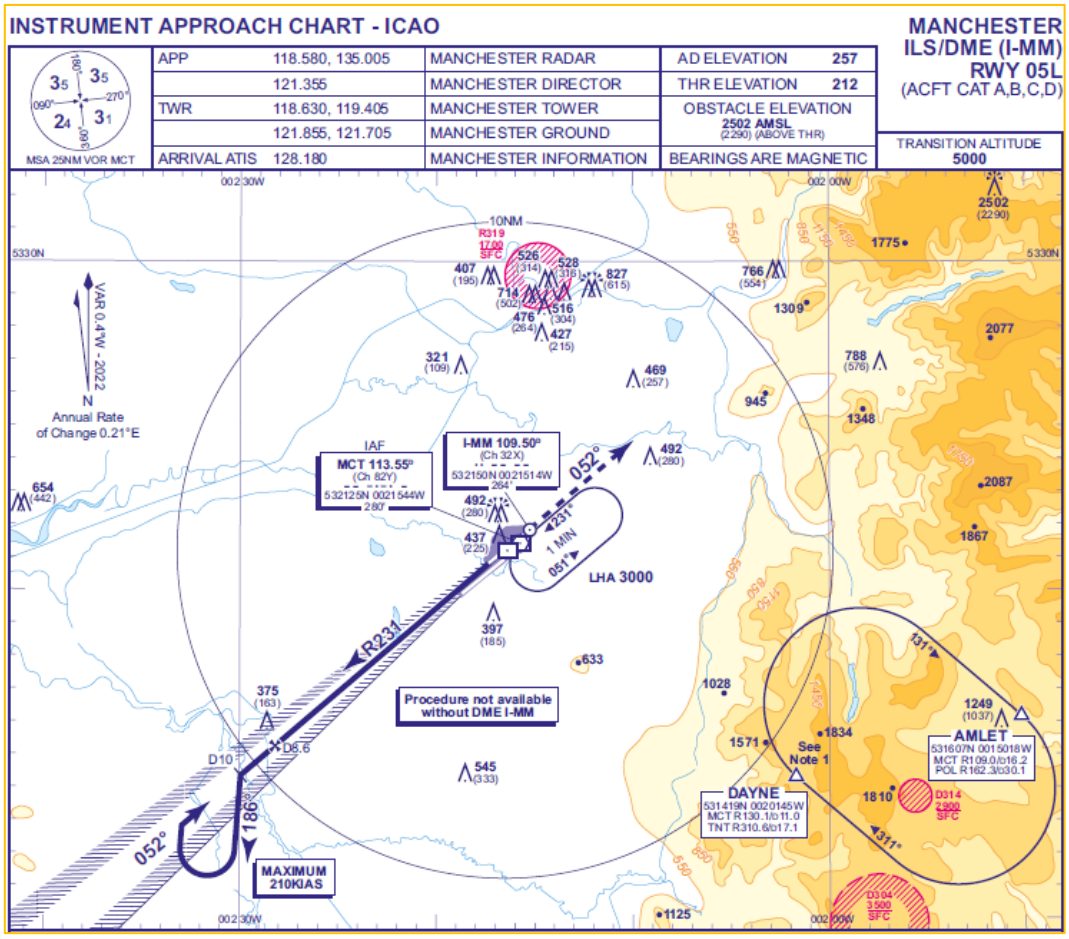

Figure 15 – ILS/DME (I-MM) RWY 05L

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the ILS/DME (CAT I and II) Procedure to Runway 05L.

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Figure 16 – ILS/DME (I-MM) CAT I & II RWY 05L OAS

Additionally, the procedure features a reversal published on the approach chart (45°/180° Procedure Turn). The minimum altitude within the reversal is 3000ft. Provided the obstacles were inside the protection areas (which is unlikely) the highest MOC required over the obstacles would be full Initial Approach MOC (300m). Therefore, aircraft should be at a minimum of 364m + 300m = 664m / 2179ft AMSL to safely clear the obstacles. As the minimum altitude within the reversal is 3000ft, this provides sufficient margin to clear the obstacles safely.

The proposed windfarms will not have an impact on the ILS/DME (I-MM) RWY 05L Procedure.

2.2.9 ILS/DME (MCT) RWY 05L

See Section 2.2.8.

The proposed windfarms will not have an impact on the ILS/DME (MCT) RWY 05L Procedure.

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2.2.10 LOC/DME RWY 05L

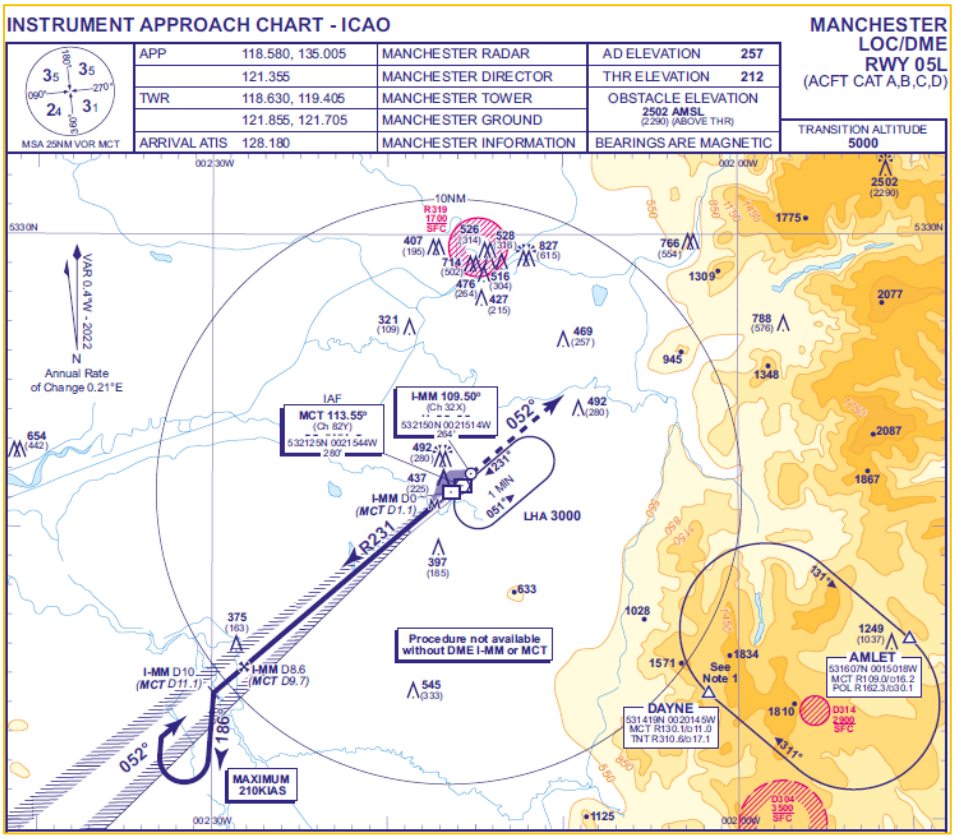

Figure 17 – LOC/DME RWY 05L Procedure

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the LOC Procedure to Runway 05L.

Additionally, the reversal was assessed on Section 2.2.8, without any impact noted.

The proposed windfarms will not have an impact on the LOC/DME RWY 05L Procedure.

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2.2.11 VOR/DME RWY 05L

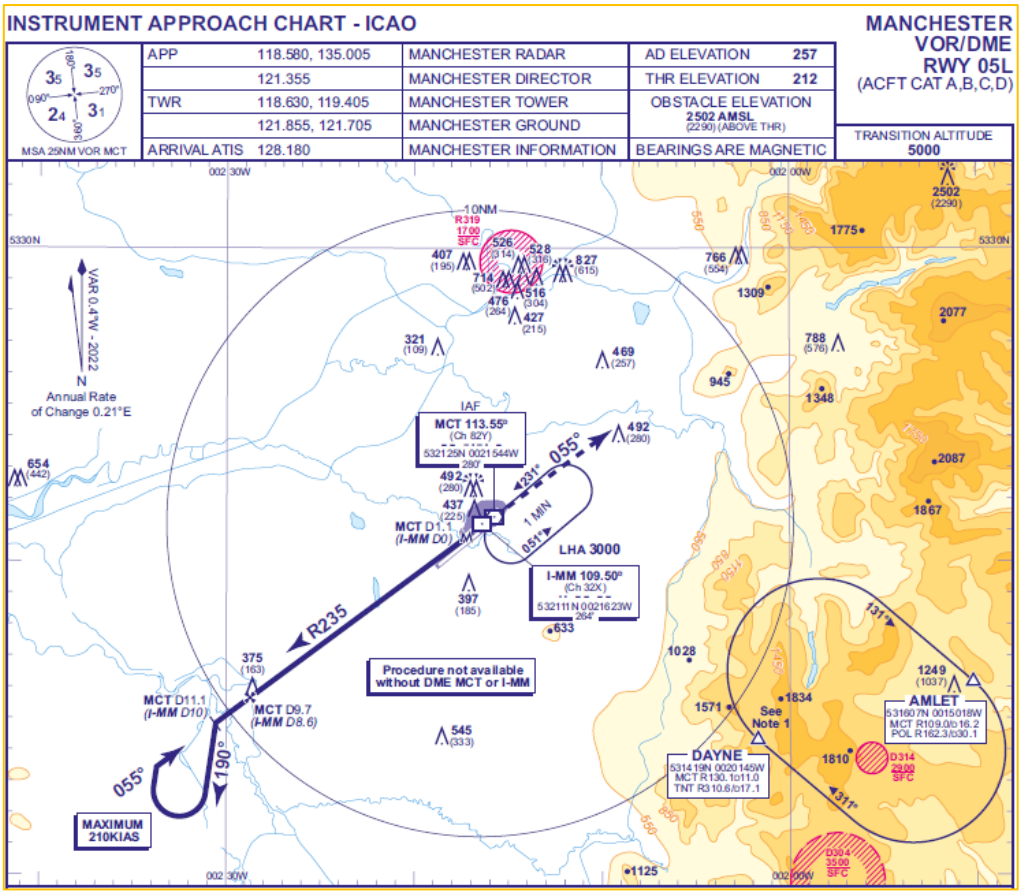

Figure 18 – VOR/DME RWY 05L Procedure

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the VOR/DME Procedure to Runway 05L.

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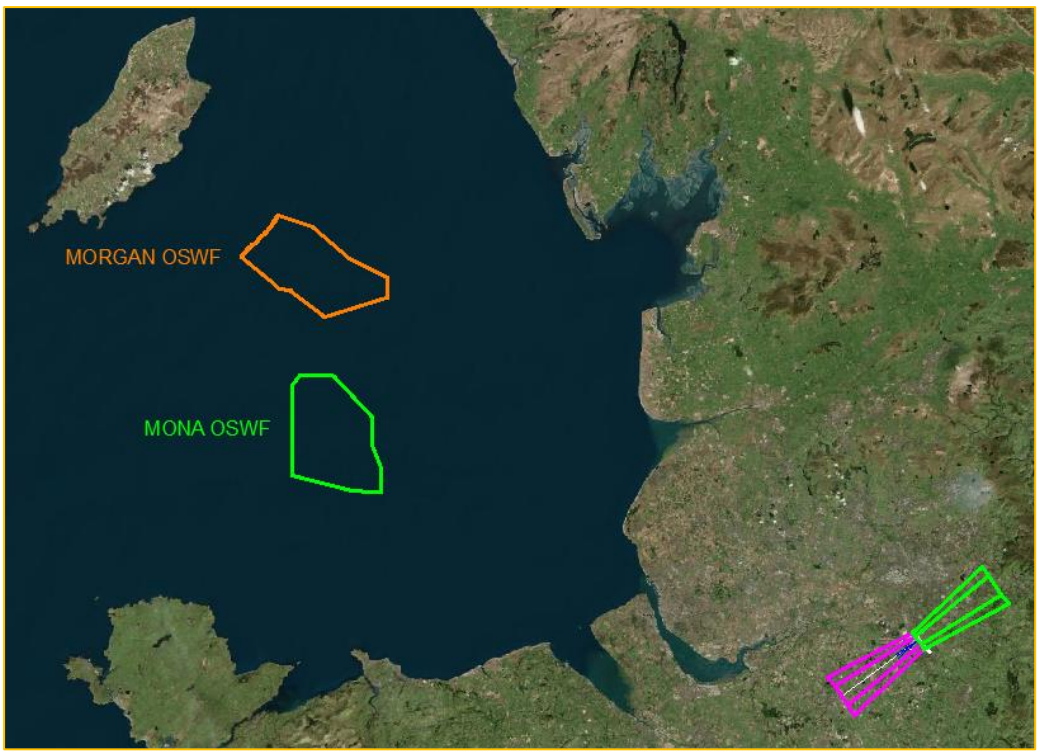

Figure 19 – VOR/DME RWY 05L Protection Areas

Additionally, the procedure features a reversal published on the approach chart (45°/180° Procedure Turn). The minimum altitude within the reversal is 3000ft. Provided the obstacles were inside the protection areas (which is unlikely), the highest MOC required over the obstacles would be full Initial Approach MOC (300m). Therefore, aircraft should be at a minimum of 364m + 300m = 664m / 2179ft AMSL to safely clear the obstacles. As the minimum altitude within the reversal is 3000ft, this provides sufficient margin to clear the obstacles safely.

The proposed windfarms will not have an impact on the VOR/DME RWY 05L Procedure.

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2.2.12 ILS/DME (I-NN) RWY 23R

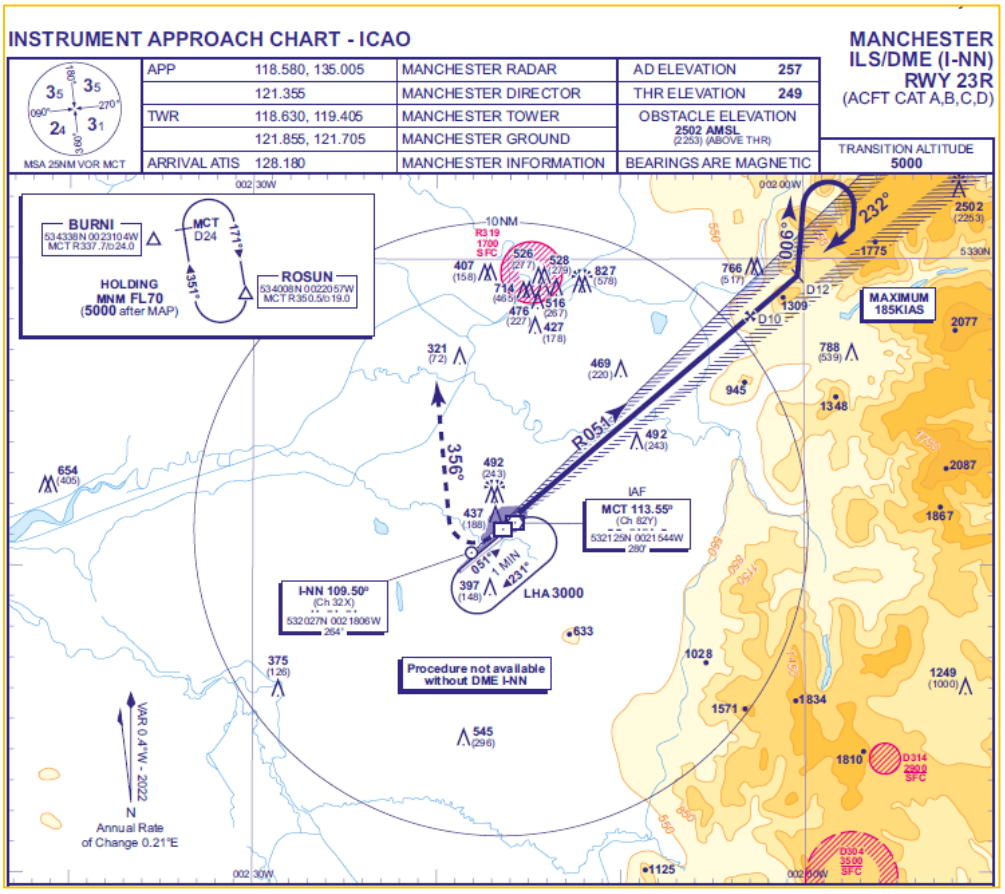

Figure 20 – ILS/DME (I-NN) RWY 23R

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the ILS/DME (CAT I and II) Procedure to Runway 23R.

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Figure 21 – ILS/DME (I-NN) CAT I & II RWY 23R OAS

Additionally, the procedure features a reversal published on the approach chart (45°/180° Procedure Turn). The minimum altitude within the reversal is 3500ft. Provided the obstacles were inside the protection areas (which is unlikely), the highest MOC required over the obstacles would be full Initial Approach MOC (300m). Therefore, aircraft should be at a minimum of 364m + 300m = 664m / 2179ft AMSL to safely clear the obstacles. As the minimum altitude within the reversal is 3500ft, this provides sufficient margin to clear the obstacles safely.

The proposed windfarms will not have an impact on the ILS/DME (I-NN) RWY 23R Procedure.

2.2.13 ILS/DME (MCT) RWY 23R

See Section 2.2.12.

The proposed windfarms will not have an impact on the ILS/DME (MCT) RWY 23R Procedure.

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2.2.14 LOC/DME RWY 23R

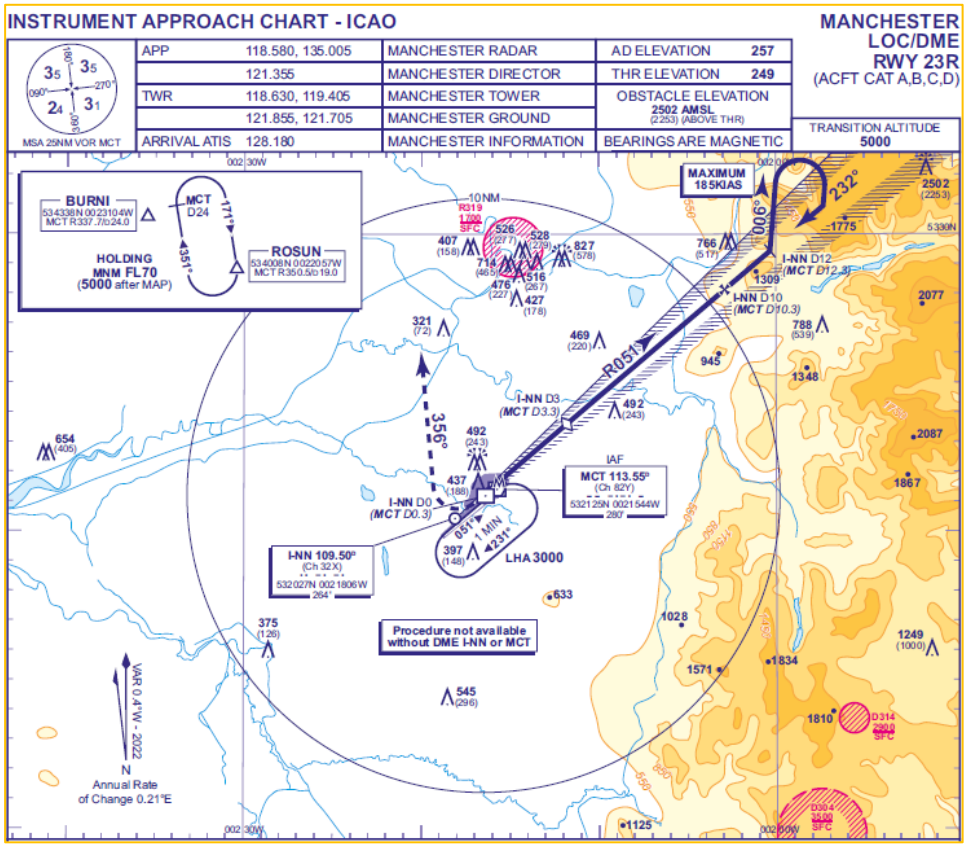

Figure 22 – LOC/DME RWY 23R

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the LOC Procedure to Runway 23R.

Additionally, the reversal was assessed on Section 2.2.12, without any impact noted.

The proposed windfarms will not have an impact on the LOC/DME RWY 23R Procedure.

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2.2.15 VOR/DME RWY 23R

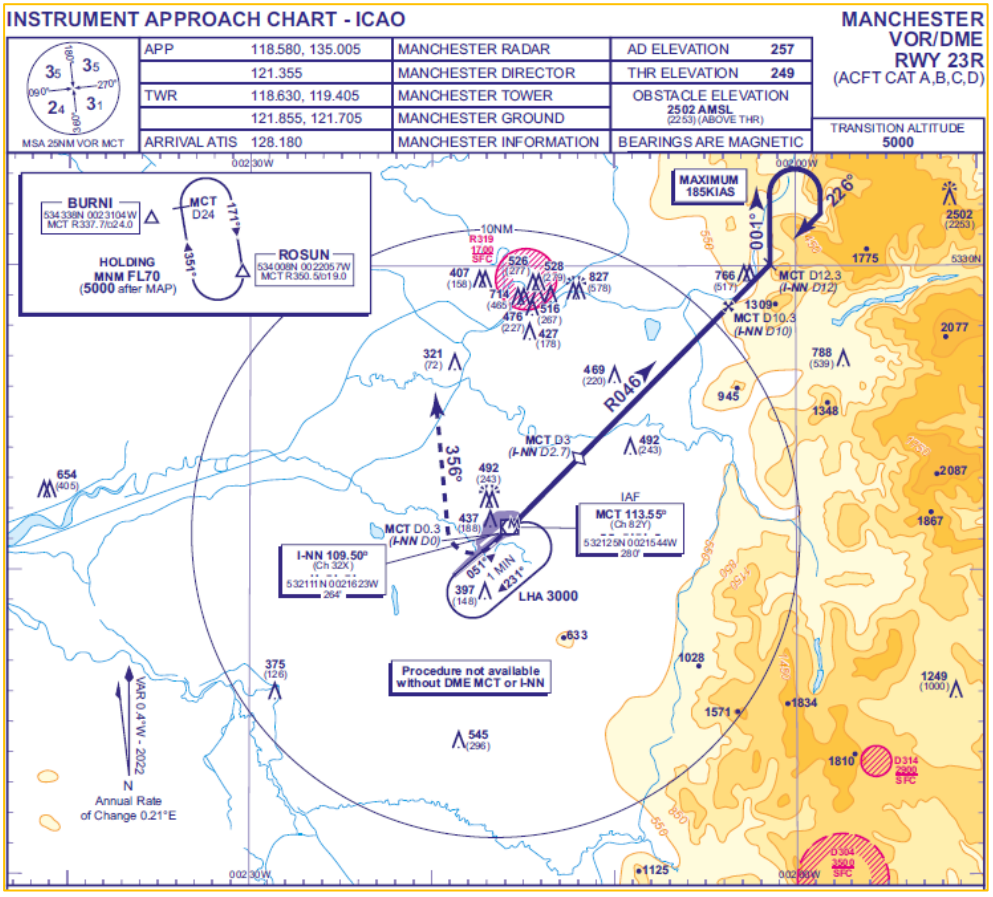

Figure 23 – VOR/DME RWY 23R

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the VOR/DME Procedure to Runway 23R.

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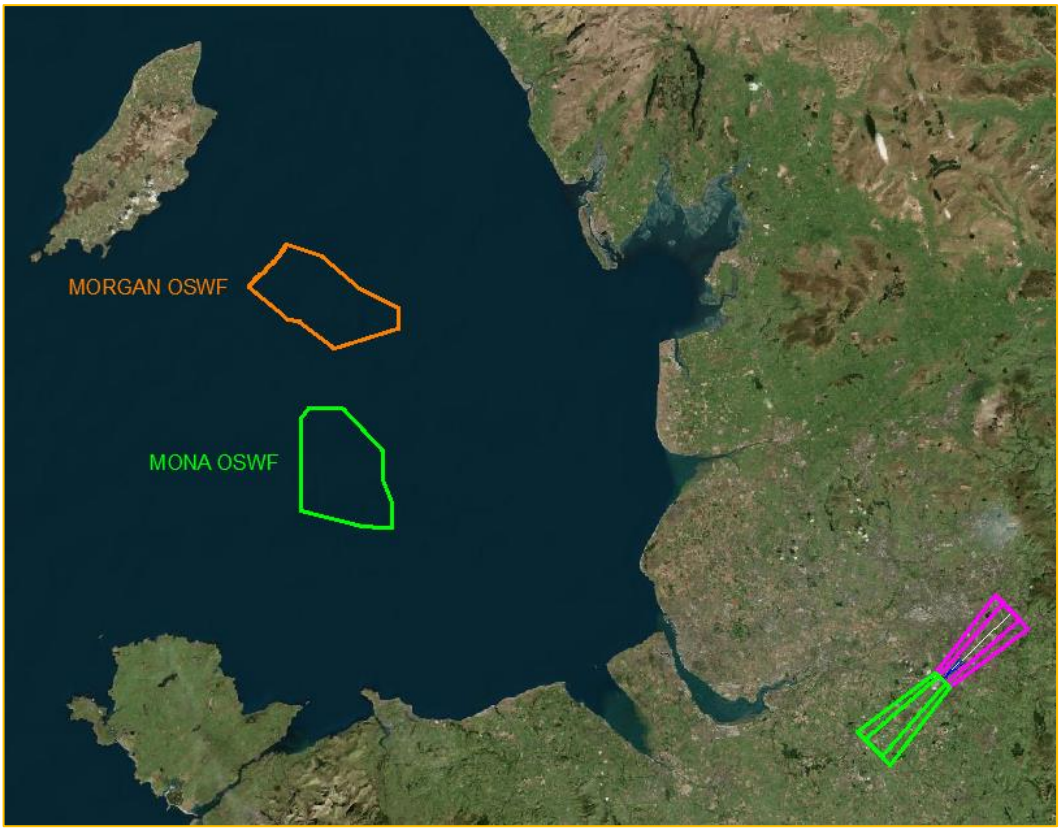

Figure 24 – VOR/DME RWY 23R Protection Areas

Additionally, the procedure features a reversal published on the approach chart (45°/180° Procedure Turn). The minimum altitude within the reversal is 3500ft. Provided the obstacles were inside the protection areas (which is unlikely), the highest MOC required over the obstacles would be full Initial Approach MOC (300m). Therefore, aircraft should be at a minimum of 364m + 300m = 664m / 2179ft AMSL to safely clear the obstacles. As the minimum altitude within the reversal is 3500ft, this provides sufficient margin to clear the obstacles safely.

The proposed windfarms will not have an impact on the VOR/DME RWY 23R Procedure.

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2.2.16 VOR/DME RWY 23L

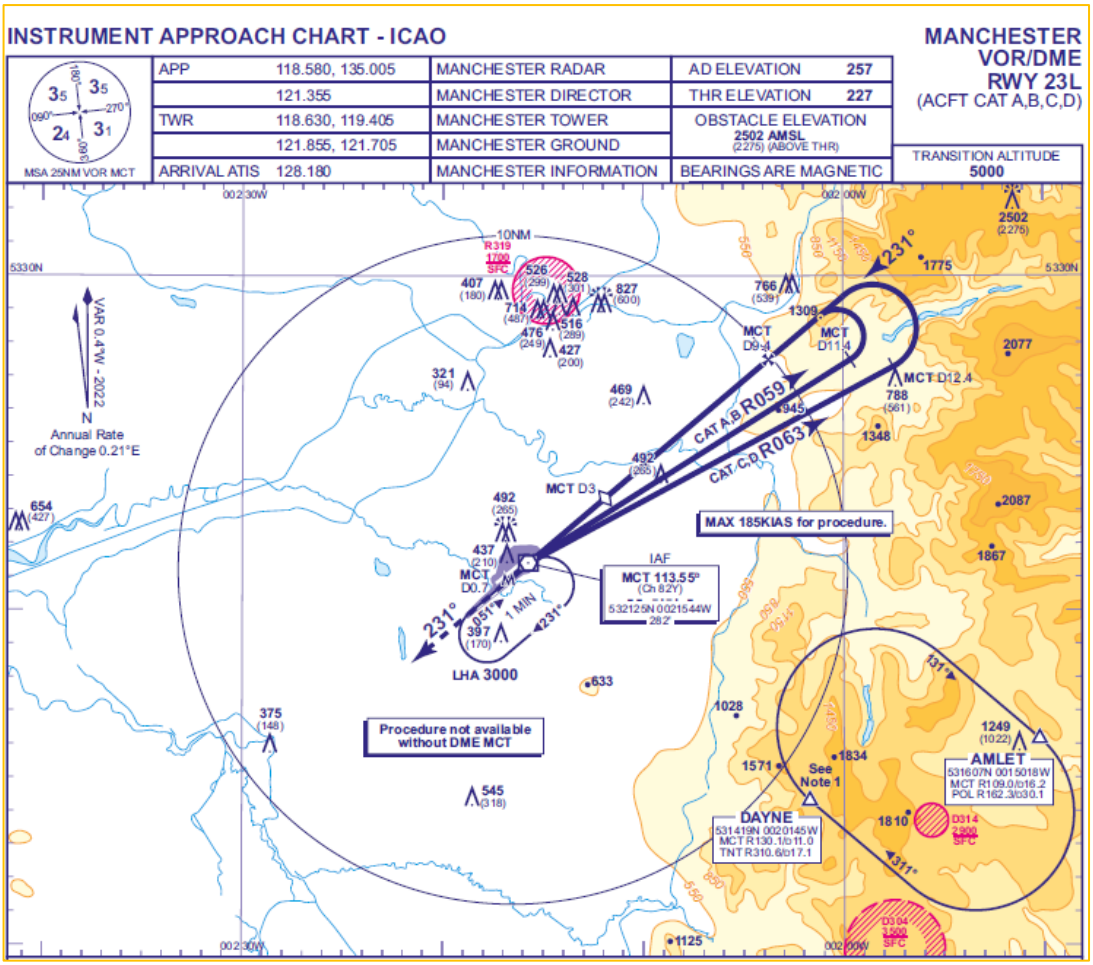

Figure 25 – VOR/DME RWY 23L

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the VOR/DME Procedure to Runway 23L.

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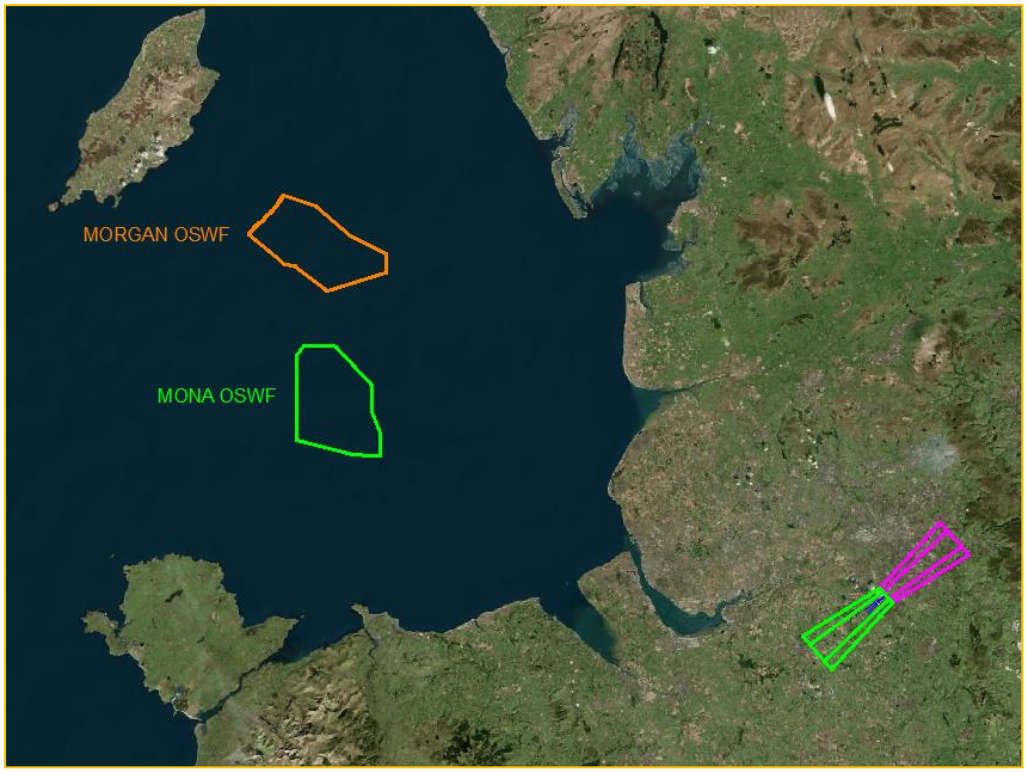

Figure 26 – VOR/DME RWY 23L Protection Areas

Additionally, the procedure features two reversals: a CAT A,B and a CAT C,D base turn. The minimum altitude within the base turns is 3500ft. Provided the obstacles were inside the protection areas (which is unlikely), the highest MOC required over the obstacles would be full Initial Approach MOC (300m). Therefore, aircraft should be at a minimum of 364m + 300m = 664m / 2179ft AMSL to safely clear the obstacles. As the minimum altitude within the base turn is 3500ft, this provides sufficient margin to clear the obstacles safely.

The proposed windfarms will not have an impact on the VOR/DME RWY 23L Procedure.

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2.2.17 RNP RWY 23L

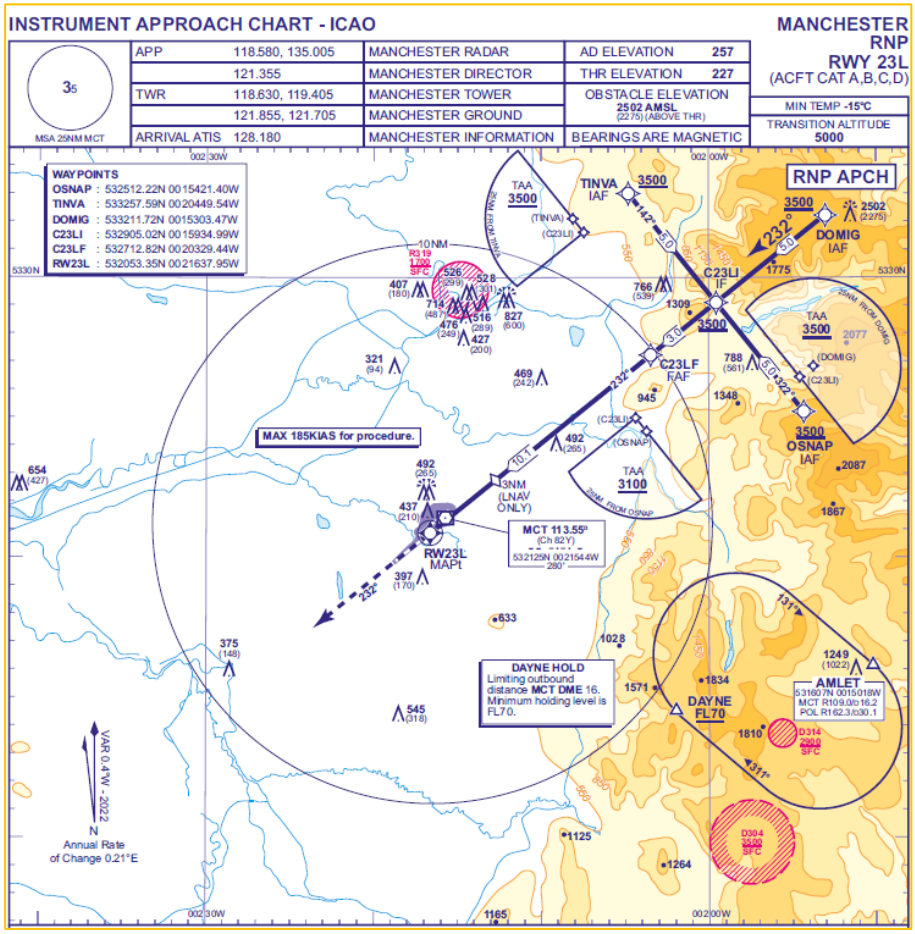

Figure 27 – RNP RWY 23L

Both windfarms (Morgan and Mona) lie outside the protection areas associated with the RNP Procedure to Runway 23L.

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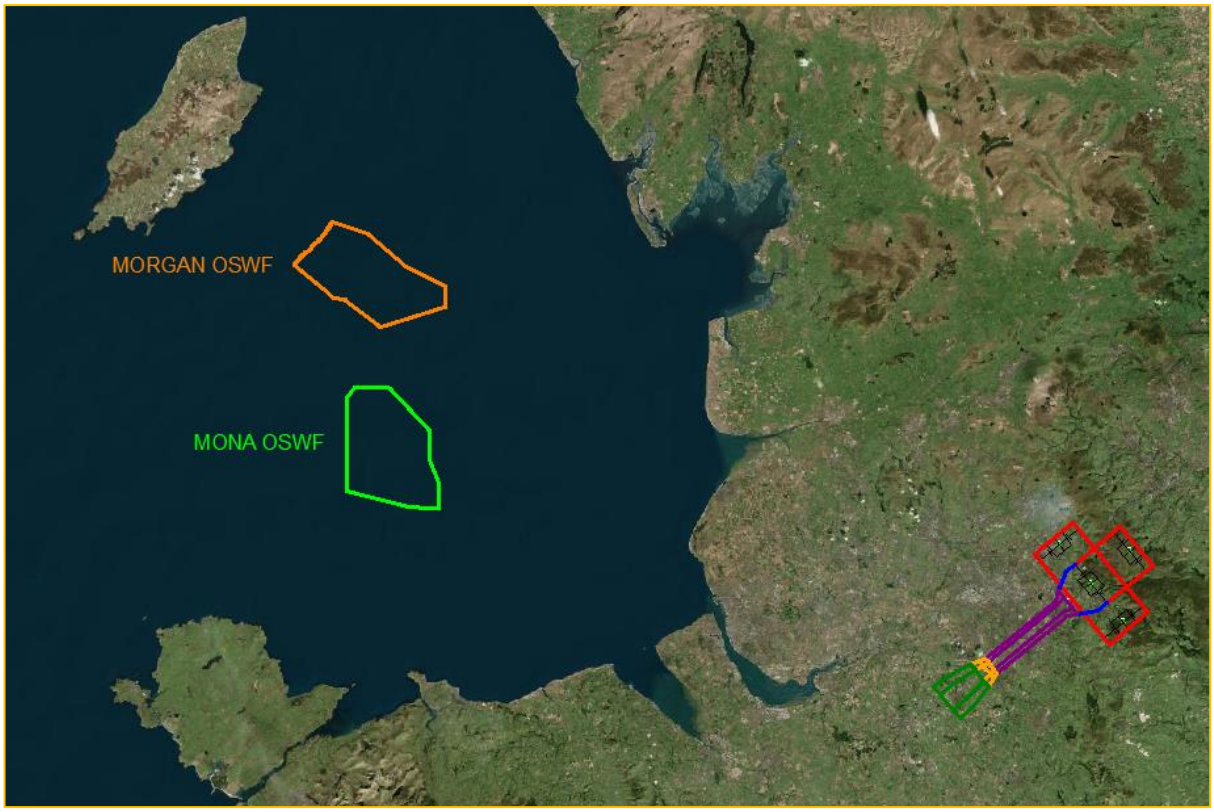

Figure 28 – RNP RWY 23L Protection Area

Additionally, Terminal Arrival Altitudes (TAAs) on each of the Initial Approach Fixes (IAFs; TINVA, OSNAP and DOMIG) have been constructed:

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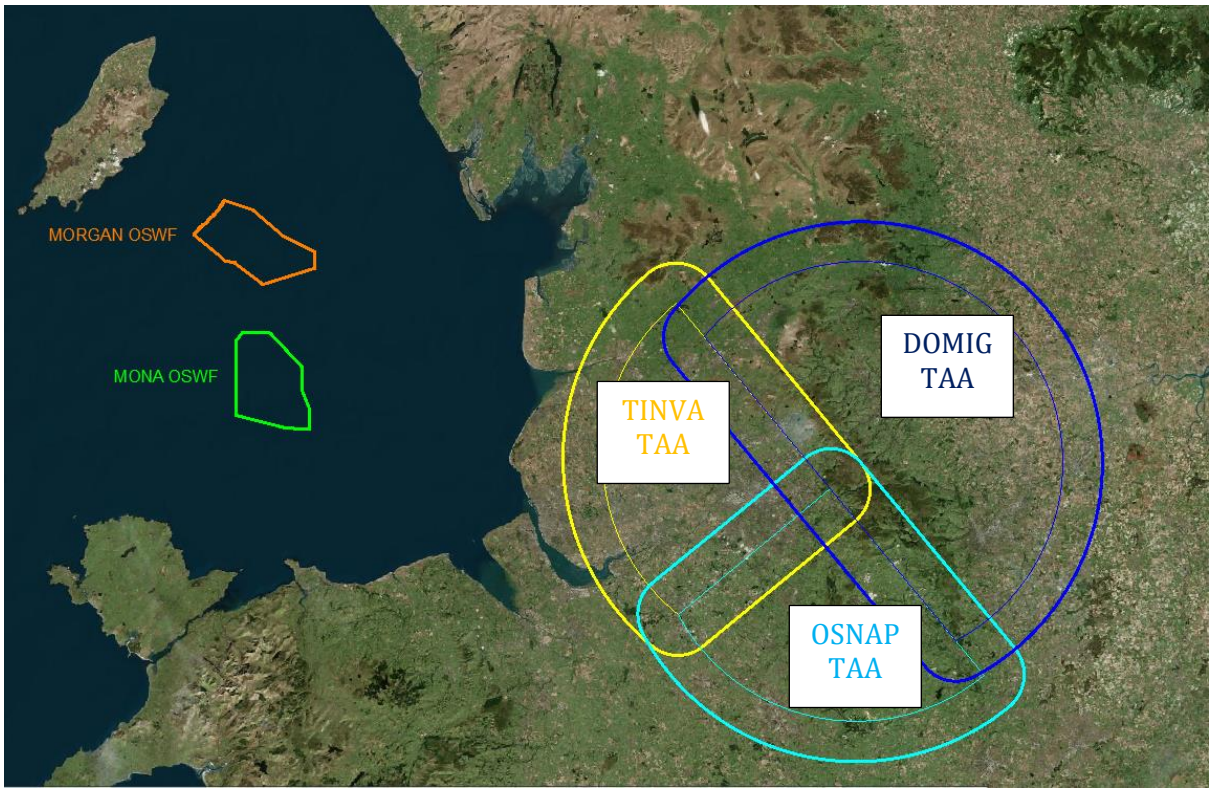

Figure 29 - Windfarms vs RNP RWY 23L TAAs

As both windfarms are outside the protection areas for the TAAs, they will not cause an impact.

The proposed windfarms will not have an impact on the RNP RWY 23L Procedure.

2.2.18 Visual Manoeuvring (Circling)

The proposed windfarms are outside the Visual Circling VM(C) Obstacle Clearance areas for all aircraft categories (A, B, C and D).

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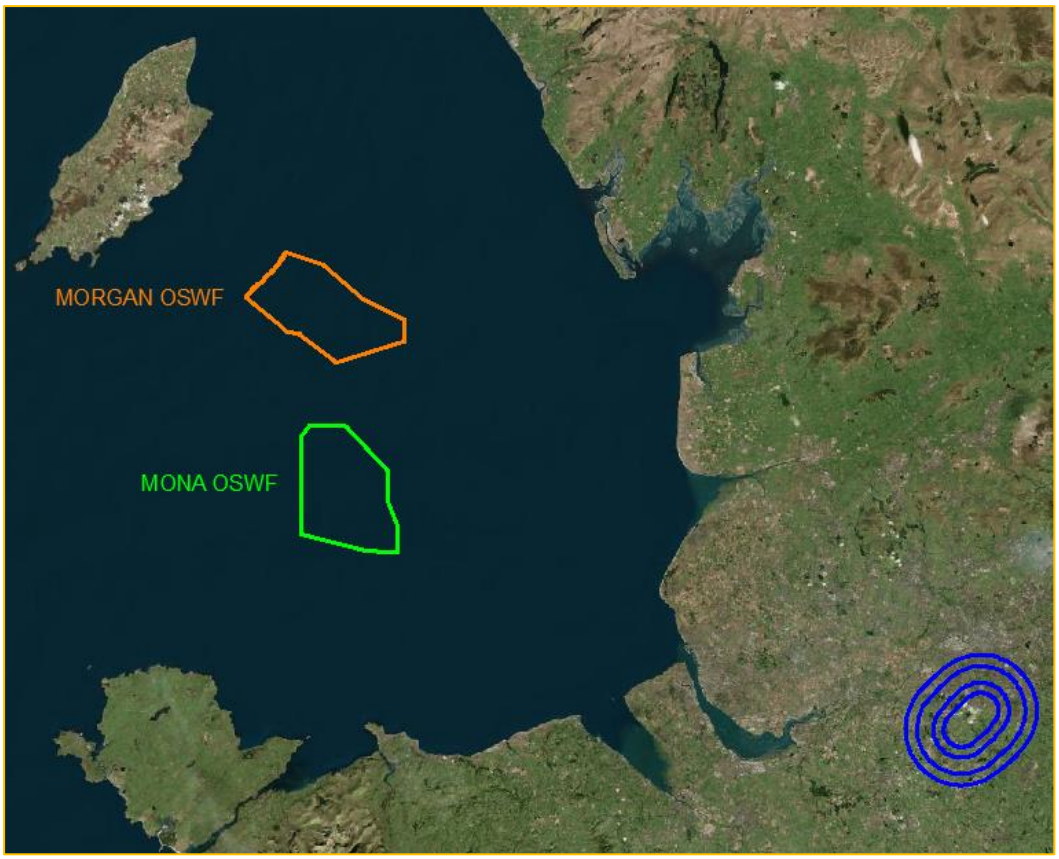

Figure 30 – Circling Protection Area

The proposed windfarms would have no impact on the Visual Circling.

2.2.19 Visual Segment Surface (VSS)

The proposed windfarms lie outside the lateral confines of VSS for all Runways.

The proposed windfarms would have no impact on the VSS for Manchester Airport Runways.

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2.2.20 Holding

The Lowest Holding Altitude (LHA) for any of the Manchester Holds is 3000ft.

The maximum possible elevation of the windfarms, before affecting the LHA of 3000ft, has been calculated.

- 3000ft = 914.4m
- 914.4m – 300m MOC = 614.4m AMSL. The maximum windfarm elevation is below this altitude.

The proposed windfarms would have no impact on any of the holds for Manchester Airport.

2.2.21 Minimum Sector Altitude (MSA)

MSA 25NM VOR MCT

The Morgan and Mona Windfarms lie outside the MSA protection areas for all sectors and their associated buffers.

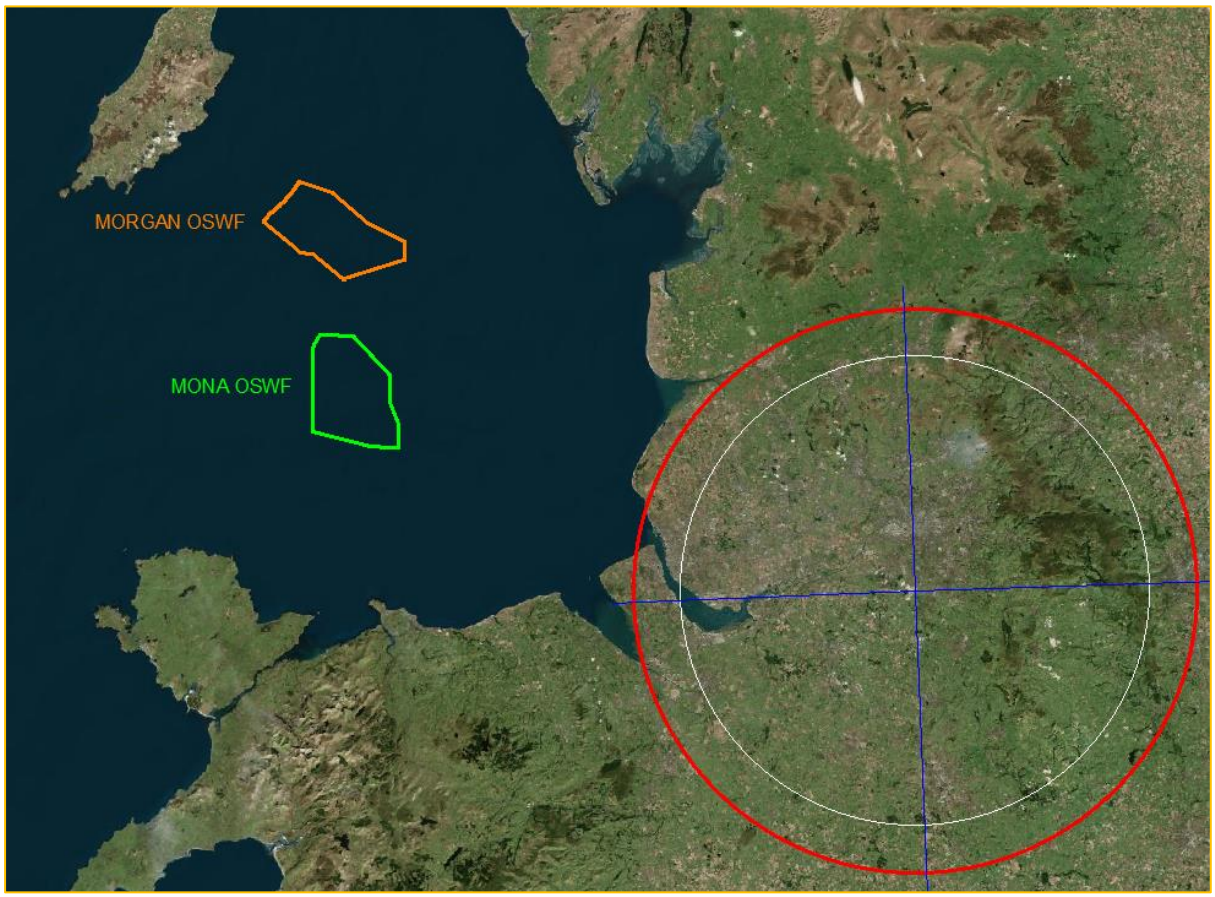

Figure 31 – VOR MCT MSA vs Windfarms

The proposed windfarms would have no impact on the published VOR MCT MSA.

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MSA 25NM ARP

We have additionally protected for an MSA based on the ARP owing to the fact the minimum levels shown outside the ATCSMAC are based on the ARP as per note 4 in the ATCSMAC chart:

"4. Minimum Sector Altitudes are based on obstacles and spot heights within 25NM of the Aerodrome Reference Point"

The Morgan and Mona Windfarms lie outside the MSA protection areas for all sectors and their associated buffers.

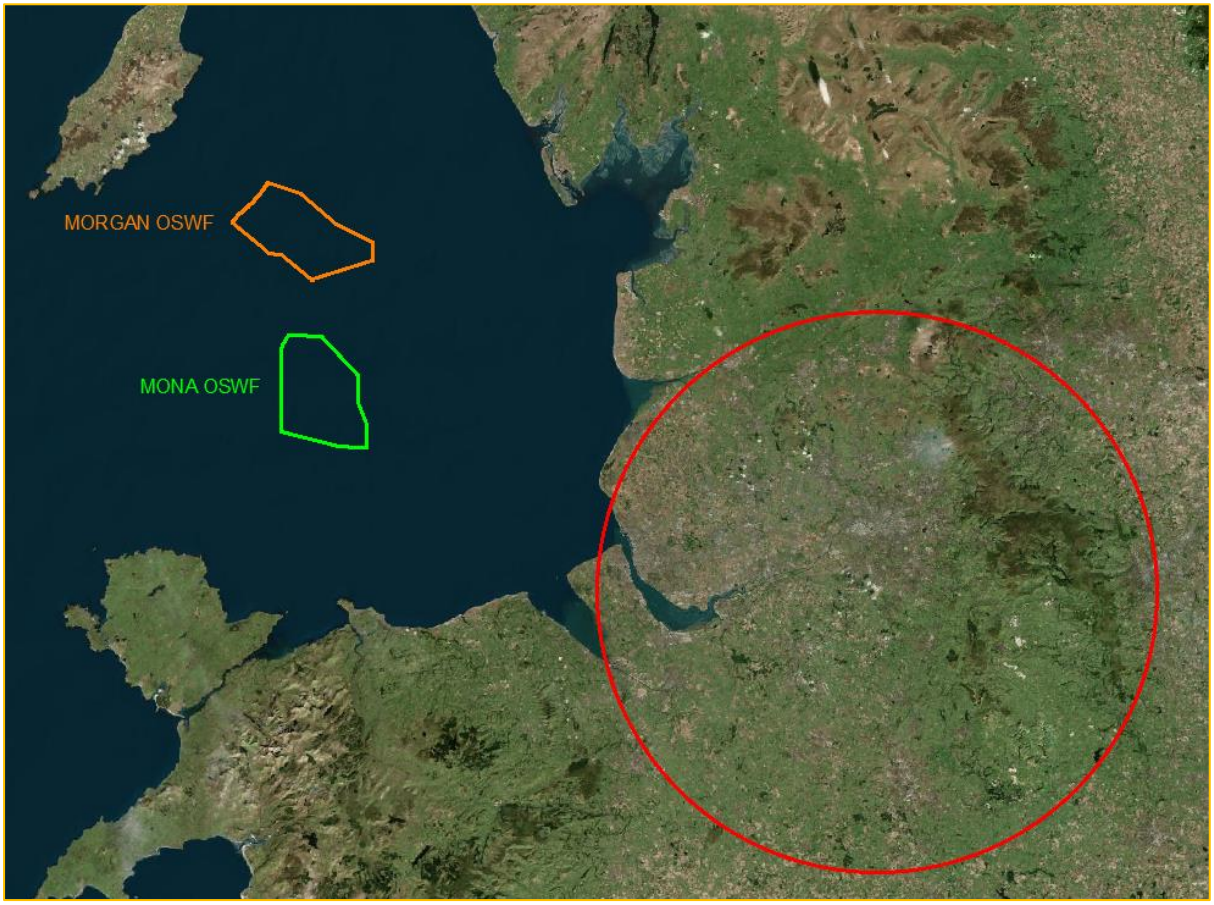

Figure 32 –ARP MSA vs Windfarms

The proposed windfarms would have no impact on the published ARP MSA.

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3 Liverpool John Lennon Airport OLS and IFP Assessment

3.1 OLS Assessment

3.1.1 Overview

The OLS for Liverpool Airport has been constructed in accordance with Annex 14 and CAP 168.

3.1.2 Runway Data Used

The following declared distances and threshold details are published in the AIP:

Runway designator	TORA	TODA	ASDA	LDA
1	2	3	4	5
09	2163 M	2364 M	2163 M	2102 M
27	2286 M	3429 M	2292 M	2286 M
09	1990 M	2191 M	1990 M	
27	2066 M	3099 M	2072 M	

Figure 33 - Declared Distances

Designations RWY Number	True bearing	Dimensions of RWY	Surface of RWY/ SWY/ Strength (PCN)	THR co-ordinates/ THR Geoid undulation	THR elevation/ Highest elevation of TDZ of precision APP RWY	Slope of RWY/ SWY
1	2	3	4	5	6	7
09	085.59°	2286 x 46 M	RWY surface: Asphalt, Grooved PCN 77/F/C/W/T	531958.39N 0025157.61W 171.0 FT	THR 59.6 FT	RWY 09 0.78% Up RWY 27 0.78% Up
27	265.62°	2286 x 46 M	RWY surface: Asphalt, Grooved PCN 77/F/C/W/T SWY surface: Asphalt PCN 77/F/C/W/T	532003.90N 0024957.76W 170.8 FT	THR 77.8 FT	RWY 09 0.78% Up RWY 27 0.78% Up

Figure 34 - Threshold Details

Runways 09 and 27 have ILS approaches and both runways are more than 1800m in length.

Runway 09 is a CODE 4, Precision Instrument Runway (**Lowest threshold, 18.16m**)

Runway 27 is a CODE 4, Precision Instrument Runway

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3.1.3 OLS Construction

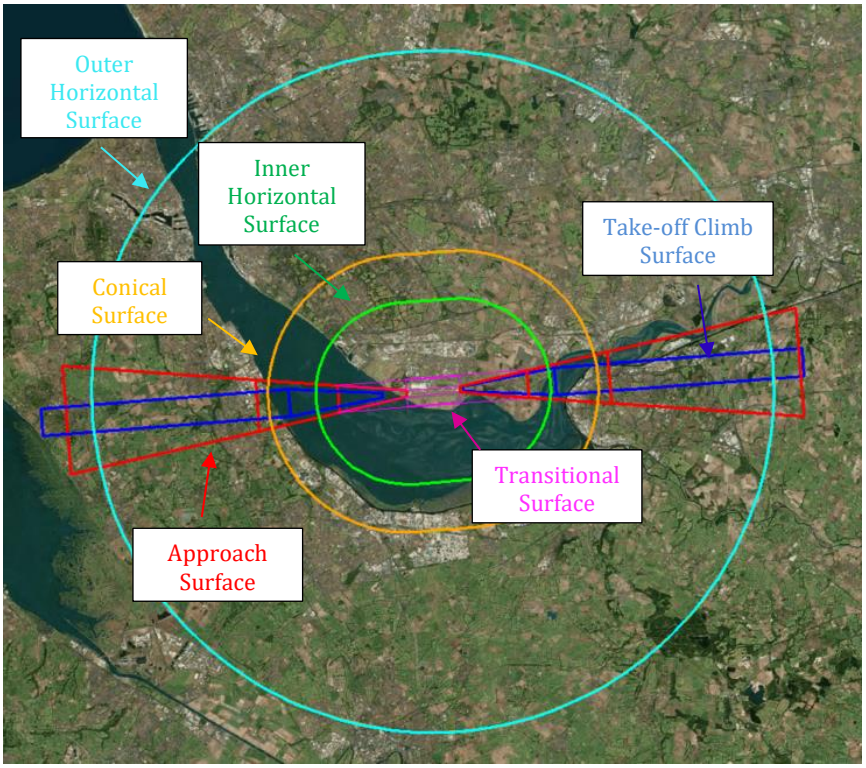

Figure 35 - OLS for Liverpool Airport

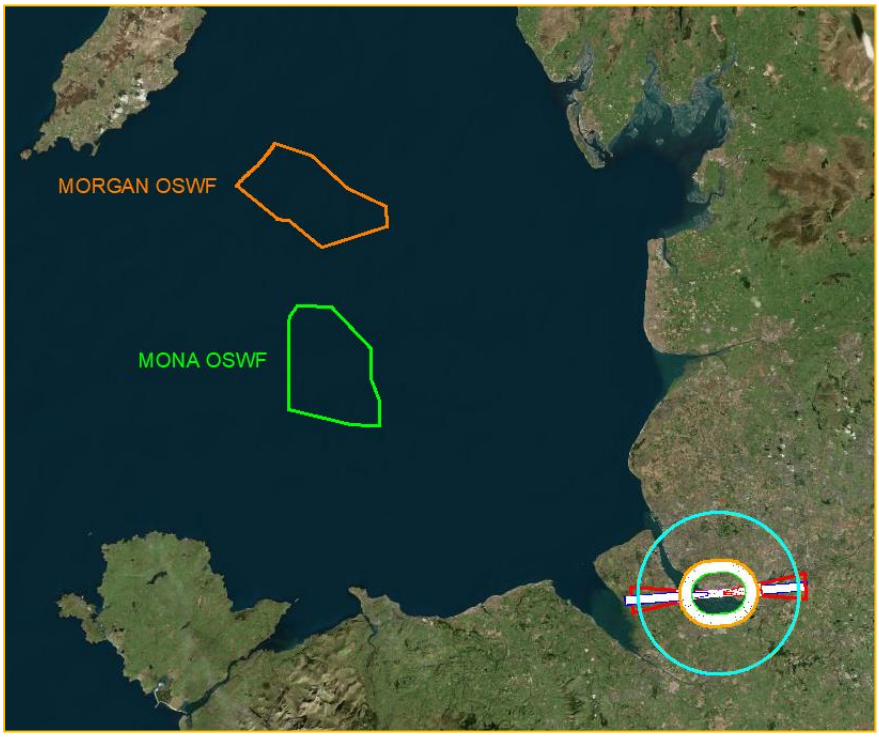

Figure 36 - Liverpool OLS in Relation to Windfarms

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3.1.4 OLS Analysis

The OLS for Liverpool Airport lies entirely outside of the boundaries of both windfarms and is not affected by the development.

The windfarms will have no impact on the OLS for Liverpool Airport.

3.2 IFP Assessment

The ATCSMAC and IFPs assessed are as follows:

AIRAC 08/2023 (Effective 10 AUG 2023)

- AD 2.EGGP-5-1 ATCSMAC (18 MAY 2023);
- AD 2.EGGP-6-1 SID POLE HILL (01 DEC 2022);
- AD 2.EGGP-6-2 SID REXAM (15 JUN 2023);
- AD 2.EGGP-6-3 SID BARTN 1T 1V (15 JUN 2023);
- AD 2.EGGP-6-4 SID WALLASEY/NANTI (15 JUN 2023);
- AD 2.EGGP-7-1 STAR RNAV1 (DME/DME or GNSS) GASKO 1L LAKEY 1L LIBSO 1L POL 1L VEGUS 1L (23 MAR 2023);
- AD 2.EGGP-7-2 STAR RNAV1 (DME/DME or GNSS) BOFUM 1L PENIL 1L (23 MAR 2023);
- AD 2.EGGP-7-3 STAR RNAV1 (DME/DME or GNSS) ELVOS 1L LESTA 1L PEPZE 1L (20 APR 2023);
- AD 2.EGGP-8-1 ILS/DME/NDB(L) RWY 09 (15 JUN 2023);
- AD 2.EGGP-8-2 LOC/DME/NDB(L) RWY 09 (15 JUN 2023);
- AD 2.EGGP-8-3 SRA RTR 2NM RWY 09 (17 JUN 2021);
- AD 2.EGGP-8-4 RNP RWY 09 (17 JUN 2021);
- AD 2.EGGP-8-5 ILS/DME/NDB(L) RWY 27 (17 JUN 2021);
- AD 2.EGGP-8-6 LOC/DME/NDB(L) RWY 27 (17 JUN 2021);
- AD 2.EGGP-8-7 SRA RTR 2NM RWY 27 (17 JUN 2021);
- AD 2.EGGP-8-8 RNP RWY 27 (17 JUN 2021);
- AD 2.EGGP-8-9 NDB(L)/DME RWY 27 (17 JUN 2021).

Additionally, the following were checked:

- Visual Circling
- Holding
- Visual Segment Surface (VSS)
- Minimum Sector Altitudes (MSA)

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3.2.1 AD 2.EGGP-5-1 ATCSMAC

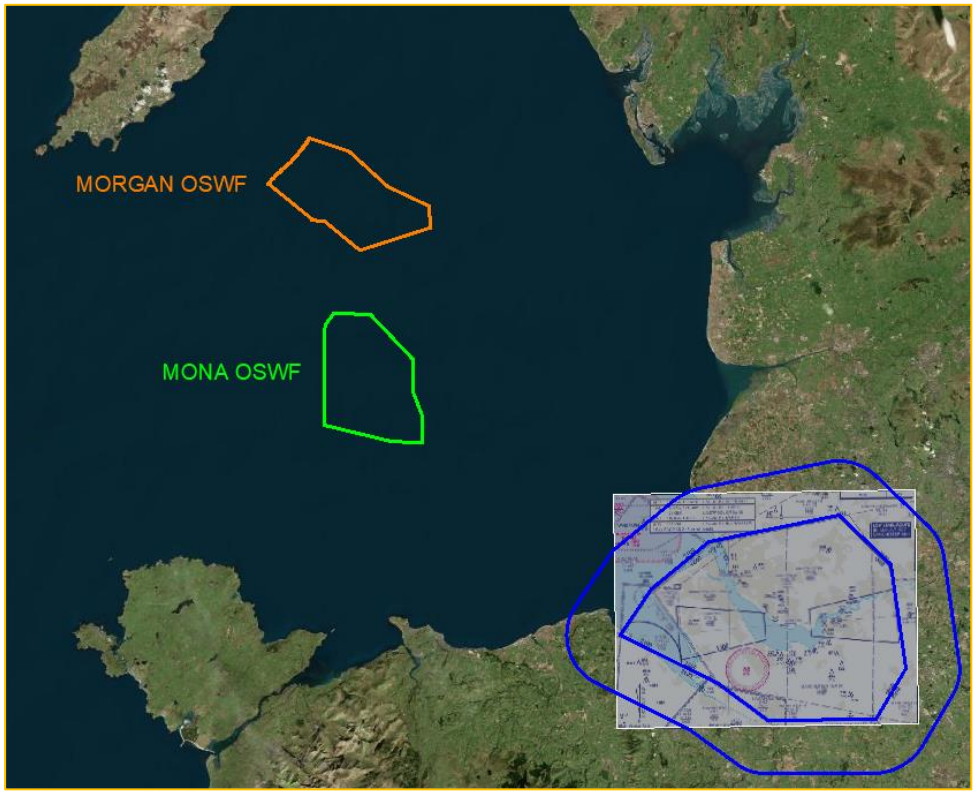

Figure 37 - Windfarms in Relation to ATCSMAC

The Windfarm developments lie outside the lateral buffer of all Surveillance Minimum Altitude Areas (SMAAs).

The windfarms would not impact Liverpool Airport's ATCSMAC.

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3.2.2 AD 2.EGGP-6-1 SID POLE HILL

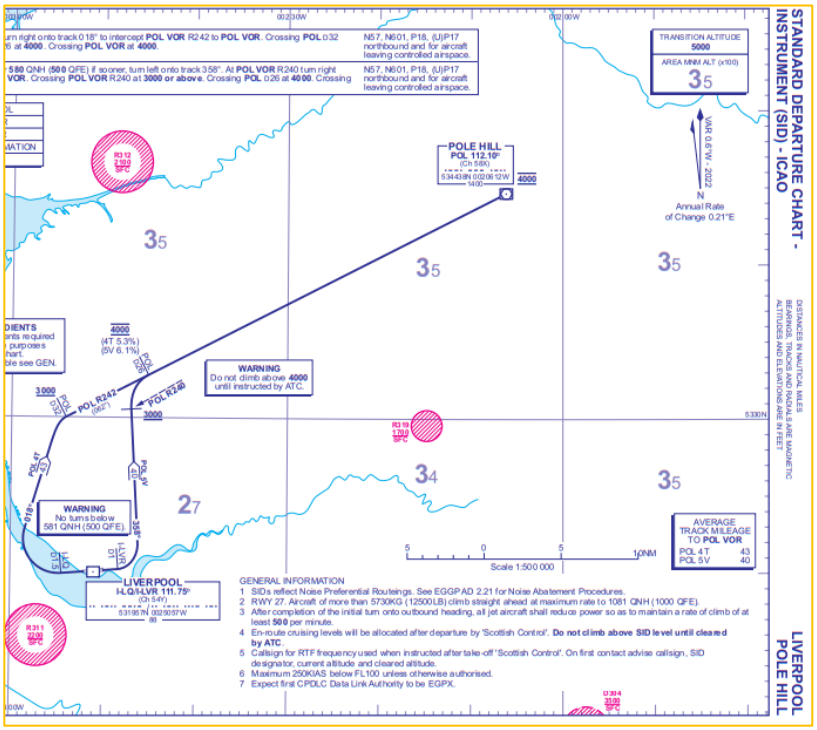

Figure 38 - SID POLE HILL 5V 4T Procedure

Straight Departure Areas (SIDs)

Both Windfarms (Morgan and Mona) lie outside the Straight Protection Areas for the SIDs departing RWY 09 and 27 to POLE HILL.

Figure 39 - SID POL 5V RWY 09 Turn Area in Relation to Windfarms

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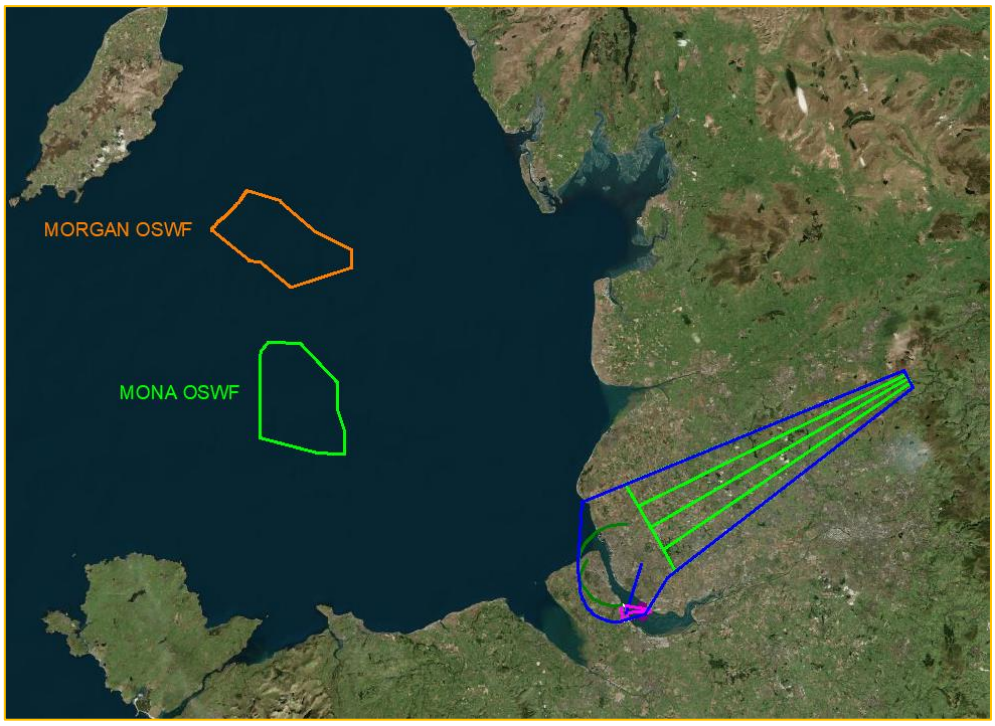

Figure 40 - SID POL 4T RWY 27 Turn Area in Relation to Windfarms

Turn Areas

The POL 5V procedure, departing RWY 09, turns left initially before a right turn, heading north-east, away from the windfarms and would not be affected.

The POL 4T procedure, departing RWY 27, turns right and continues north-east, heading away from the windfarms and would not be affected.

The proposed windfarms would have no impact on the SID POLE HILL 5V and 4T procedures.

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3.2.3 AD 2.EGGP-6-2 SID REXAM

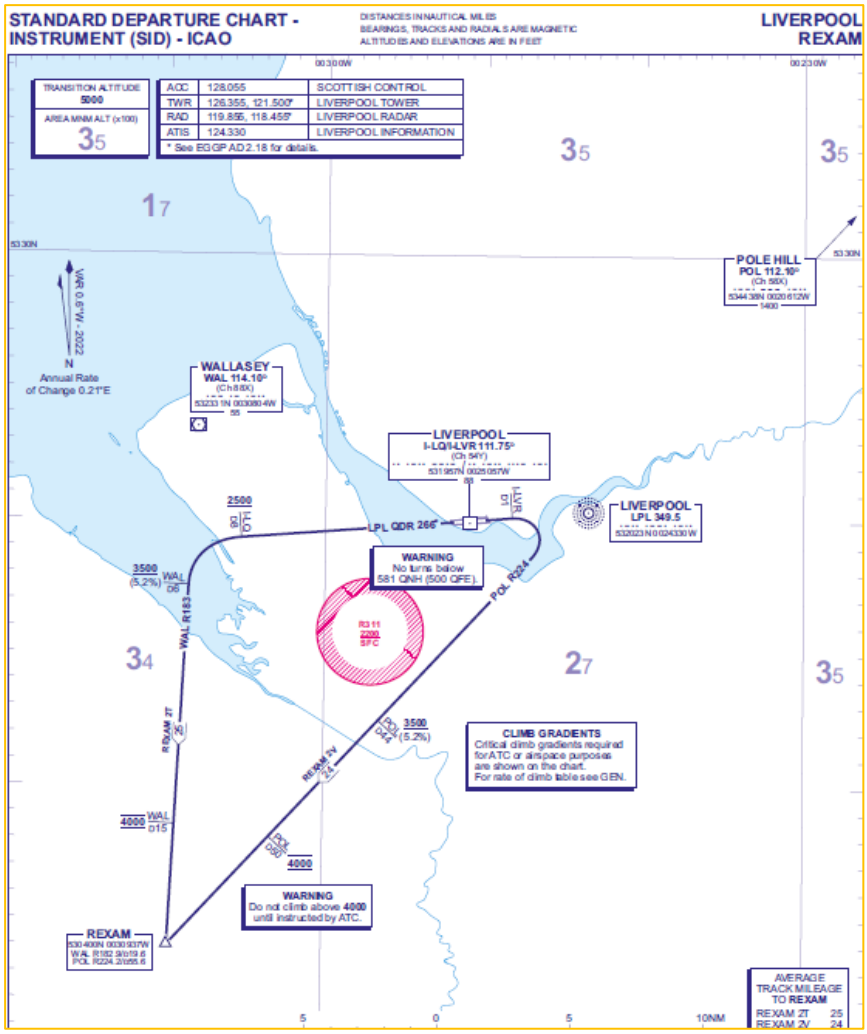

Figure 41 - SID REXAM 2V 2T Procedure

Straight Departure Areas (SIDs)

Both Windfarms (Morgan and Mona) lie outside the Straight Protection Areas for the SIDs departing RWY 09 and 27 to REXAM.

Turn Areas

The REXAM 2V procedure, departing RWY 09, turns right and continues south-west, away from the windfarms and would not be affected.

The REXAM 2T procedure, departing RWY 27, turns left and continues south, heading away from the windfarms and would not be affected.

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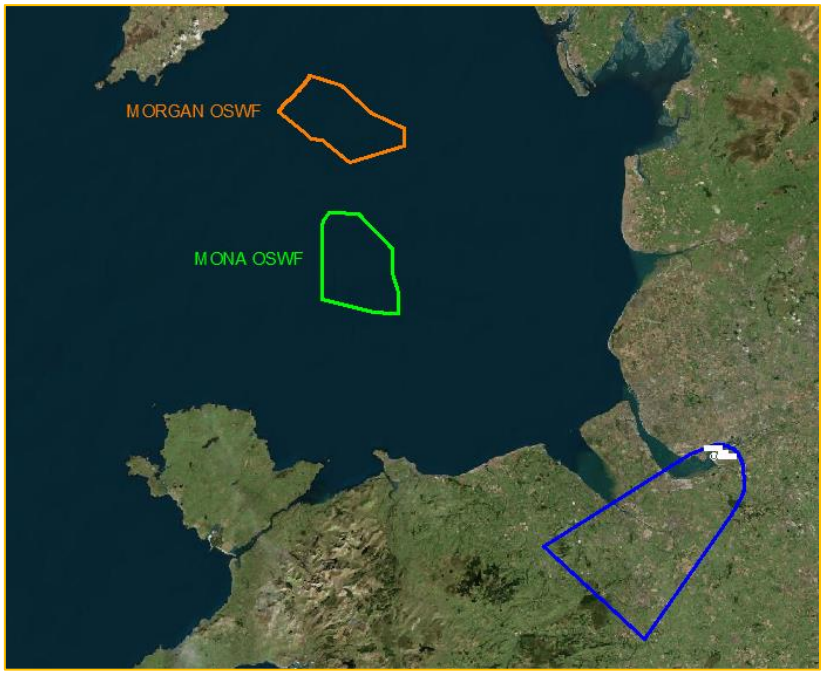

Figure 42 - SID REXAM 2V RWY 09 Turn Area in Relation to Windfarms

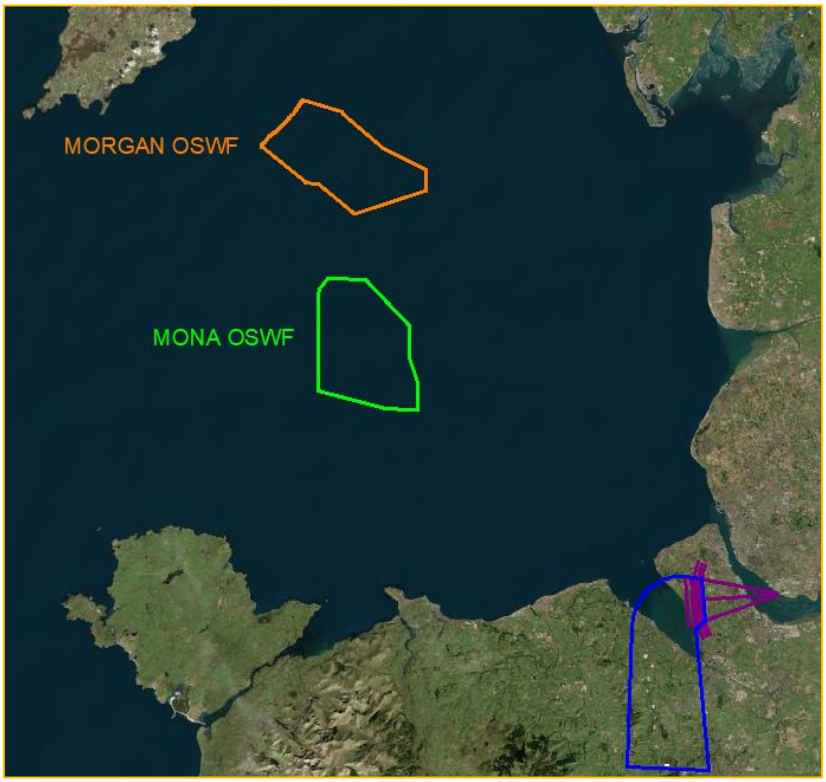

Figure 43 - SID REXAM 2T RWY 27 Turn Area in Relation to Windfarms

The proposed windfarms would have no impact on the SID REXAM 2V and 2T procedures.

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3.2.4 AD 2.EGGP-6-3 SID BARTN 1T 1V

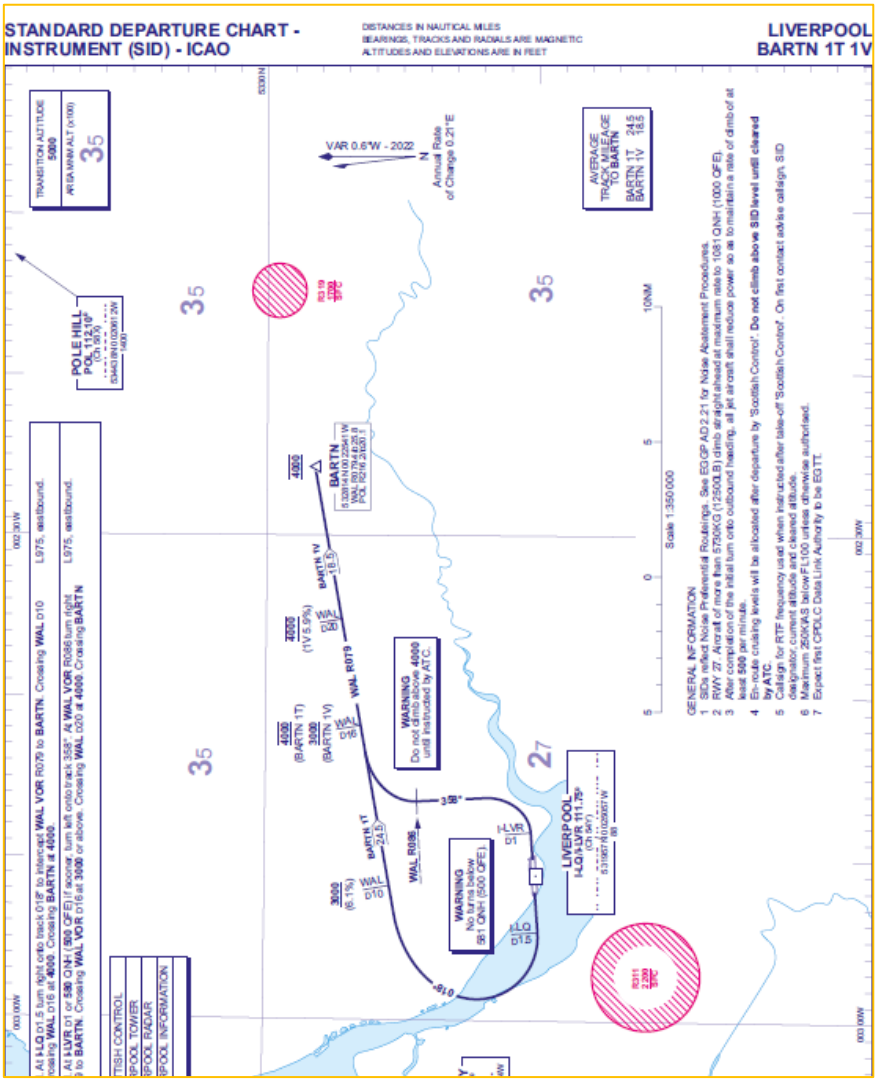

Figure 44 - SID BARTN 1T 1V Procedure

Straight Departure Areas (SIDs)

Both Windfarms (Morgan and Mona) lie outside the Straight Protection Areas for the SIDs departing RWY 09 and 27 to BARTN.

Turn Areas

The BARTN 1V procedure, departing RWY 09, turns left and continues east, away from the windfarms and would not be affected.

The BARTN 1T procedure, departing RWY 27, turns right and continues east, away from the windfarms and would not be affected.

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Figure 45 - SID BARTN 1V RWY 09 Protection Area in Relation to Windfarms

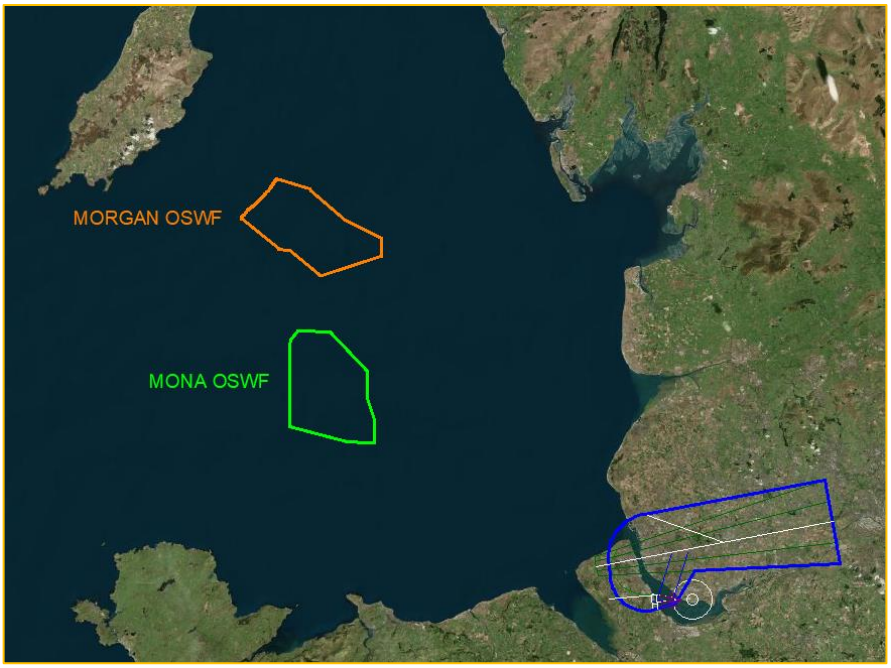

Figure 46 - SID BARTN 1T RWY 27 Protection Area in Relation to Windfarms

The proposed windfarms would have no impact on the SID BARTN 1V and 1T procedures.

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3.2.5 AD 2.EGGP-6-4 SID WALLASEY/NANTI

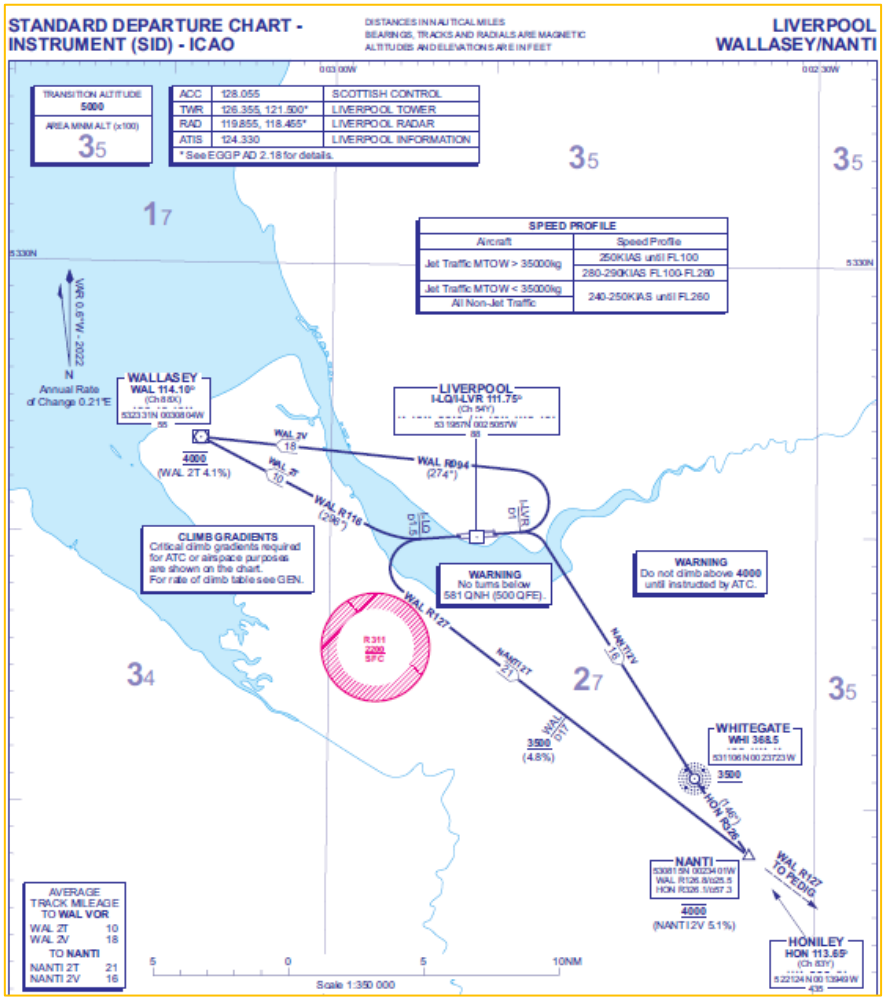

Figure 47 - SID WALLASEY 2T 2V and NANTI 2T 2V Procedure

Straight Departure Areas (SIDs)

Both Windfarms (Morgan and Mona) lie outside the Straight Protection Areas for the SIDs departing RWY 09 and 27 towards WALLASEY and NANTI.

Turn Areas for WALLASEY 2V and NANTI 2V

The WALLASEY 2V procedure, departing RWY 09, turns left and continues west towards WALLASEY VOR where aircraft climb to 4000ft and would not be affected.

The NANTI 2V procedure, departing RWY 09, turns right, away from the windfarms, continuing south-east and would not be affected.

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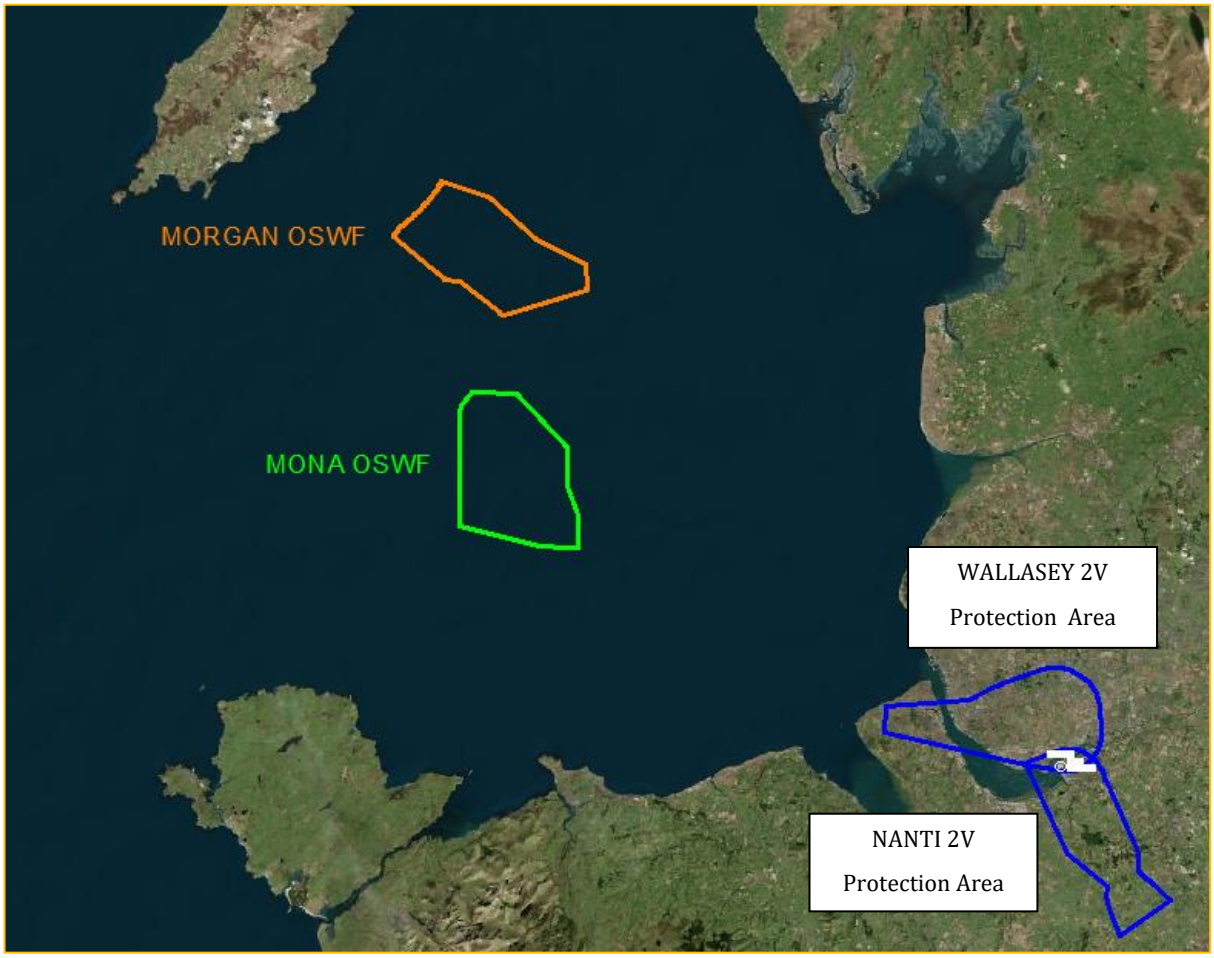

Figure 48 - SID WALLASEY 2V and NANTI 2V RWY 09 Protection Areas in Relation to Windfarms

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Turn Areas for WALLASEY 2T and NANTI 2T

The WALLASEY 2T procedure, departing RWY 27, turns right and continues west towards WALLASEY VOR where aircraft climb to 4000ft and would not be affected.

The NANTI 2T procedure, departing RWY 27, turns left, away from the windfarms, continuing south-east, away from the windfarms and would not be affected.

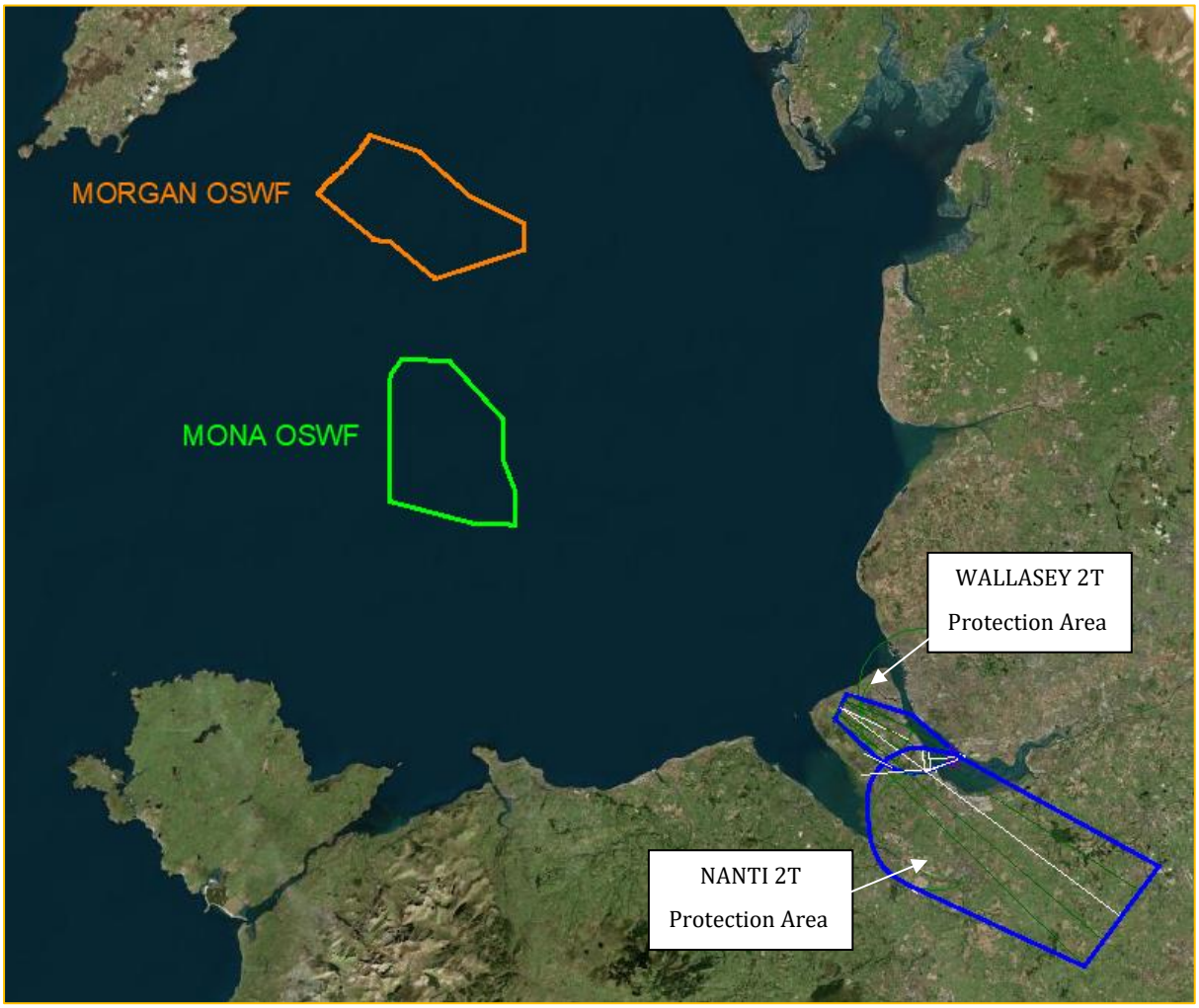

Figure 49 - SID WALLASEY 2T and NANTI 2T RWY 27 Protection Areas in Relation to Windfarms

The proposed windfarm development would have no impact on the SIDs WALLASEY and NANTI procedures.

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3.2.6 AD 2.EGGP-7-1 STAR RNAV1 (DME/DME or GNSS) GASKO 1L LAKEY 1L LIBSO 1L POL 1L VEGUS 1L;

AD 2.EGGP-7-2 STAR RNAV1 (DME/DME or GNSS) BOFUM 1L PENIL 1L;

AD 2.EGGP-7-3 STAR RNAV1 (DME/DME or GNSS) ELVOS 1L LESTA 1L PEPZE 1L.

The 7-1 and 7-2 STARs terminate at TIPOD and 7-3 terminates at KEGUN both at FL70.

Using the Windfarm elevation of 364m and MOC of 300m, the windfarms produce a MOCA of:

364m + 300m = 664m / 2179ft AMSL.

This is below the termination altitude of the STARs at 7000ft.

The Windfarm development would have no impact on the published STARs.

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3.2.7 AD 2.EGGP-8-1 ILS/DME/NDB(L) RWY 09

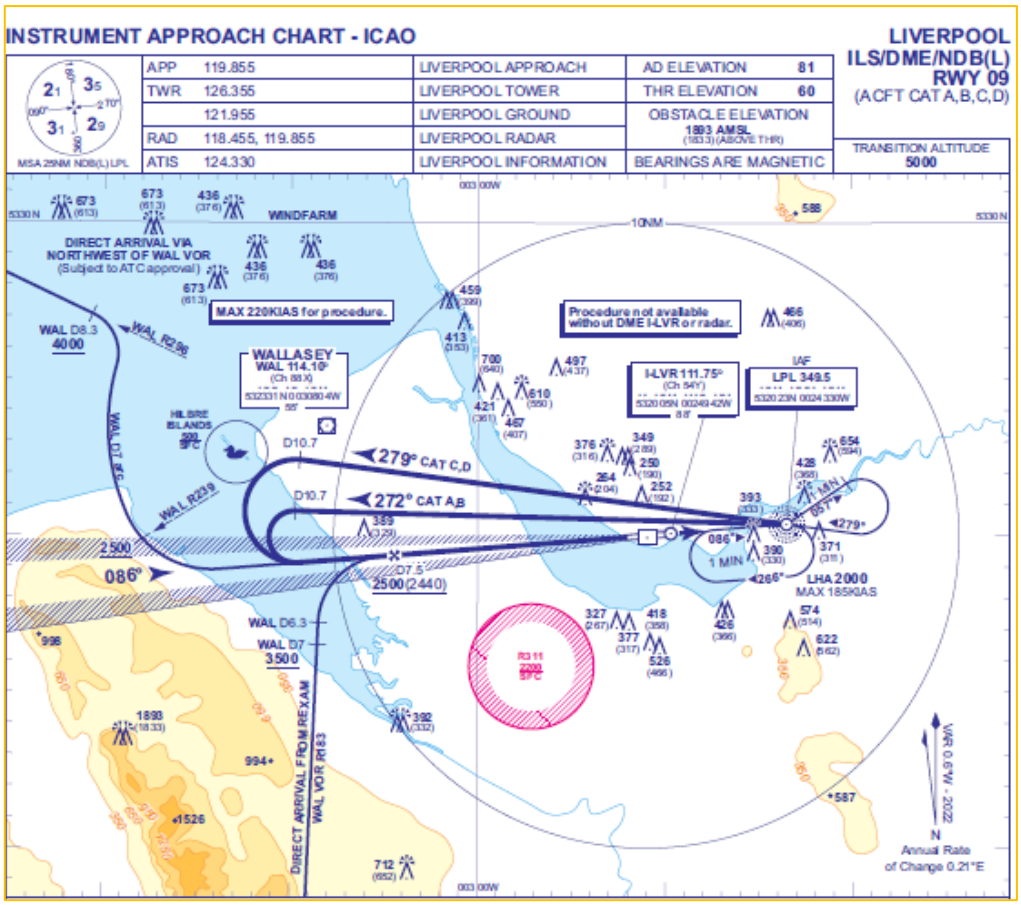

Figure 50 - ILS/DME/NDB(L) RWY 09 Procedure

The altitude for Direct arrivals procedure via WALLASEY and REXAM is published as 'At or Above 2500ft'.
The MOCA required at the windfarms using the elevation of 364m and maximum MOC of 300m is 364 + 300m = 664m / 2179ft AMSL, which is below the arrival altitude and would have no impact on the arrival to the procedure.
Both Windfarms (Morgan and Mona) lie outside the protection areas for the ILS/DME/NDB(L) procedure, including the Missed Approach, and would have no impact.

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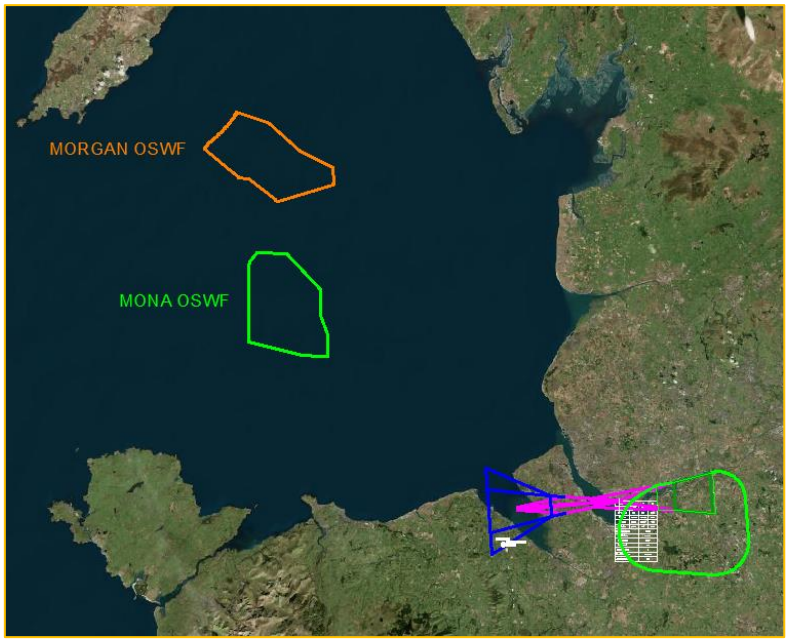

Figure 51 - ILS/DME/NDB(L) RWY 09 Procedure Protection Areas

Additionally, the protection areas for both Base turns published on the chart have been constructed, including the Base turn outbound form the NDB(L) LPL Hold and the Base turn inbound to I-LVR DME for both CAT A&B and CAT C&D aircraft:

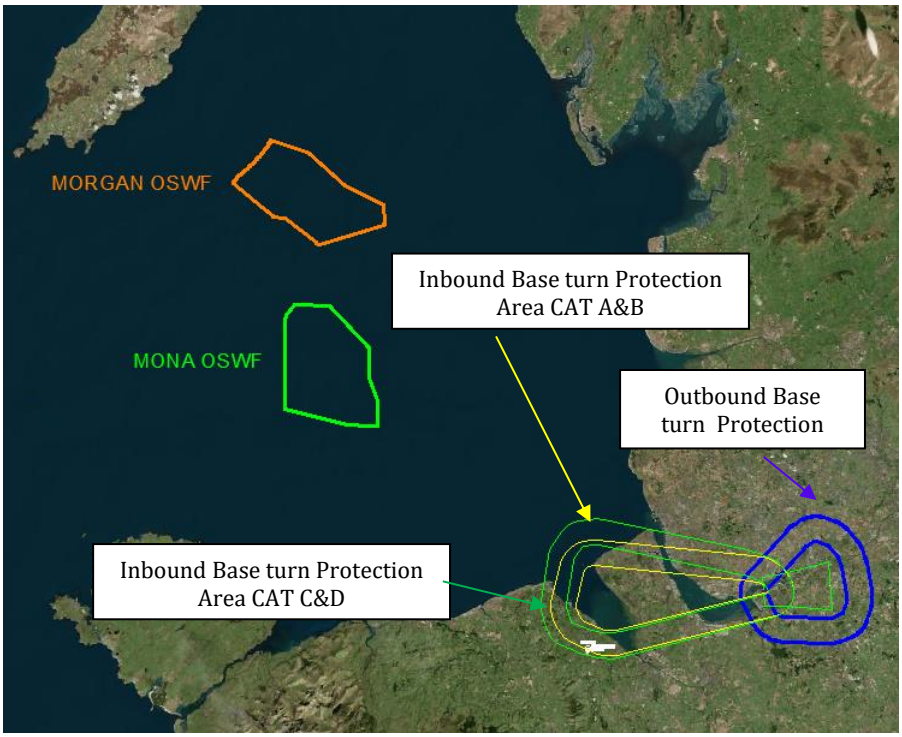

Figure 52 - ILS/DME/NDB(L) RWY 09 Base turn Protection Areas

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Both Windfarms lie outside the protection area for all Base turns associated with the procedure and will have no impact.

The proposed windfarms would not impact the published ILS/DME/NDB(L) RWY 09 procedure.

3.2.8 AD 2.EGGP-8-2 LOC/DME/NDB(L) RWY 09

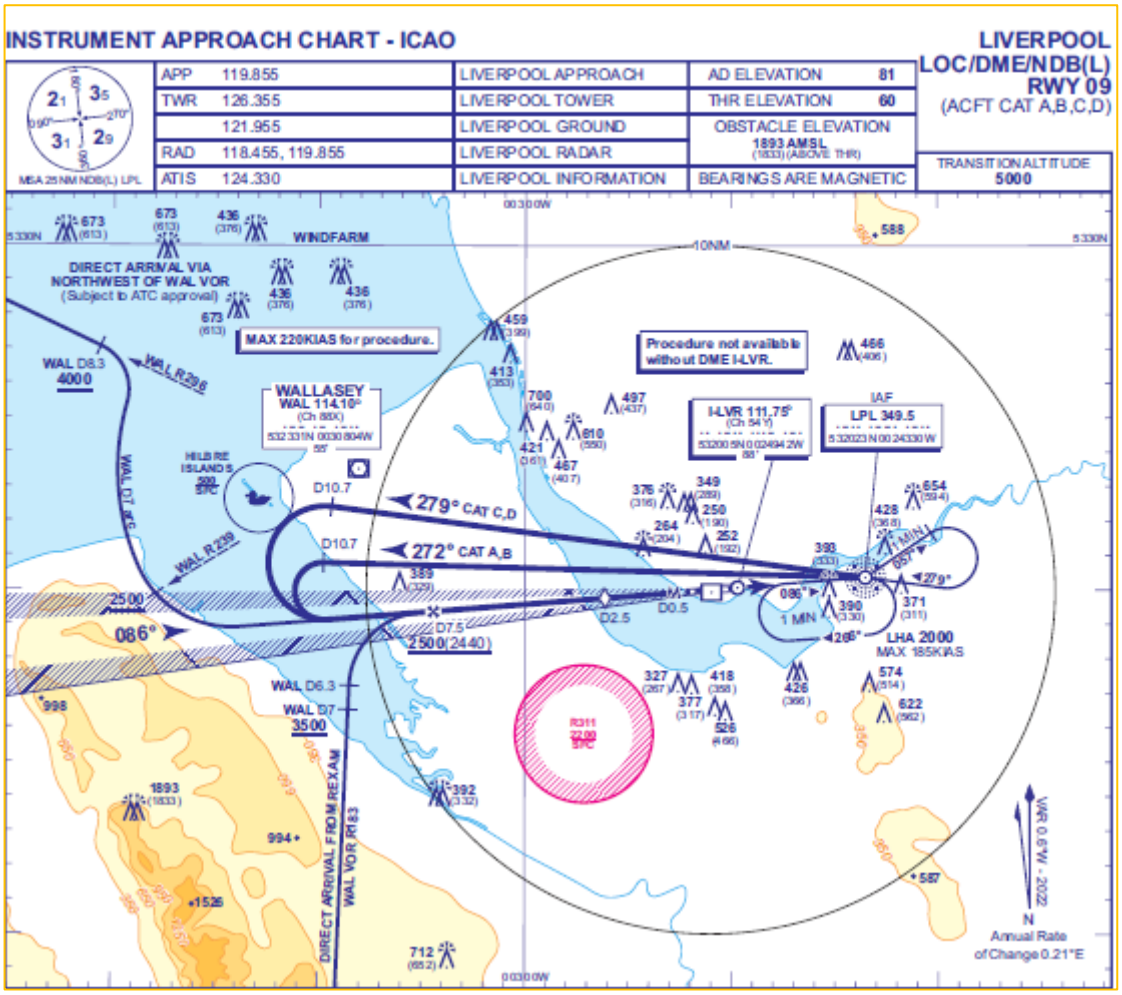

Figure 53 - LOC/DME/NDB(L) RWY 09 Procedure

The Direct arrivals altitude and Base turn protection area are common to the ILS/DME/NDB(L) RWY 09 procedure as shown in Figure 51 and Figure 52 and is not affected.

The proposed windfarms would not impact the published LOC/DME/NDB(L) RWY 09 procedure.

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3.2.9 AD 2.EGGP-8-3 SRA RTR 2NM RWY 09

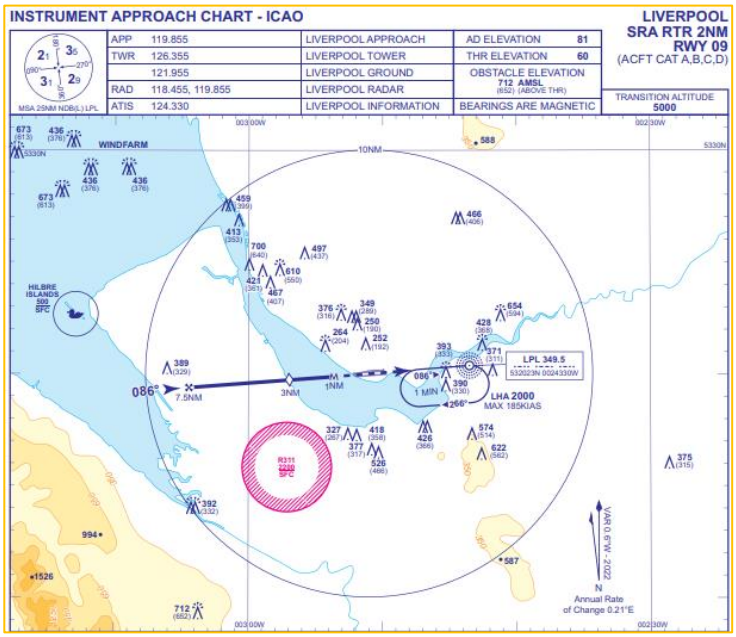

Figure 54 - SRA RTR 2NM RWY 09 Procedure

Both Windfarms lie outside the protection areas for the SRA to Runway 09.

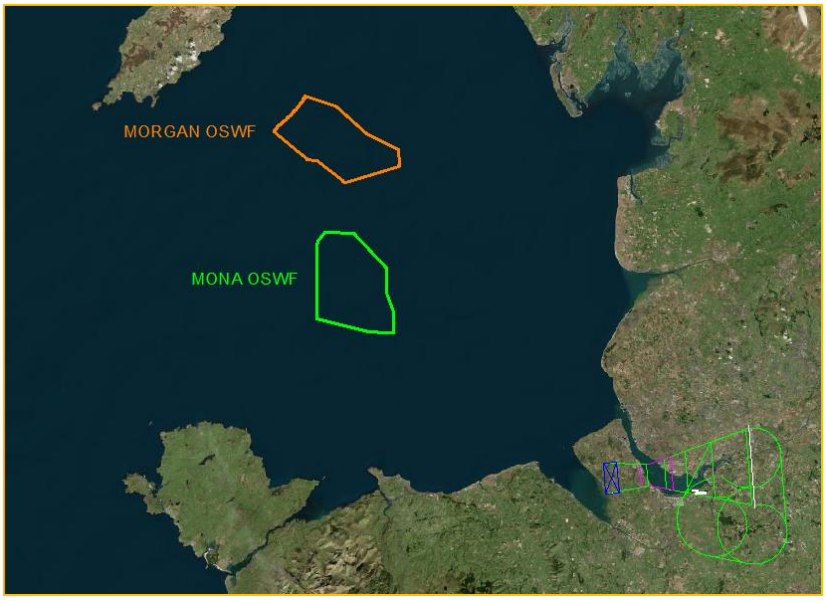

Figure 55 - SRA RTR 2NM RWY 09 Protection Areas

The proposed windfarms would not impact the published SRA RTR 2NM RWY 09 procedure.

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3.2.10 AD 2.EGGP-8-4 RNP RWY 09

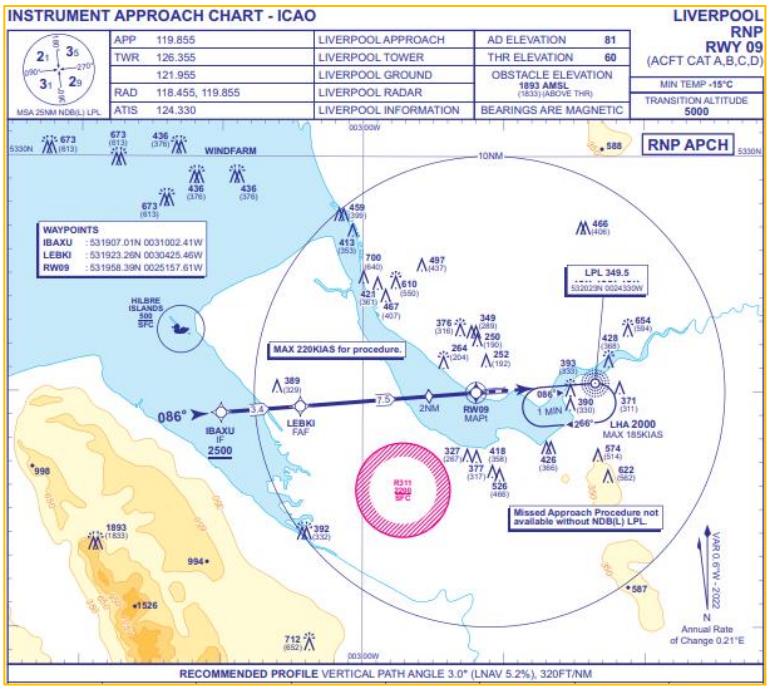

Figure 56 - RNP RWY 09 Procedure

Arrival to the RNP RWY 09 procedure is published as *'At or Above 2500ft'* and would not be affected.

Both windfarms lie outside the protection areas associated to the RNP Procedure to Runway 09.

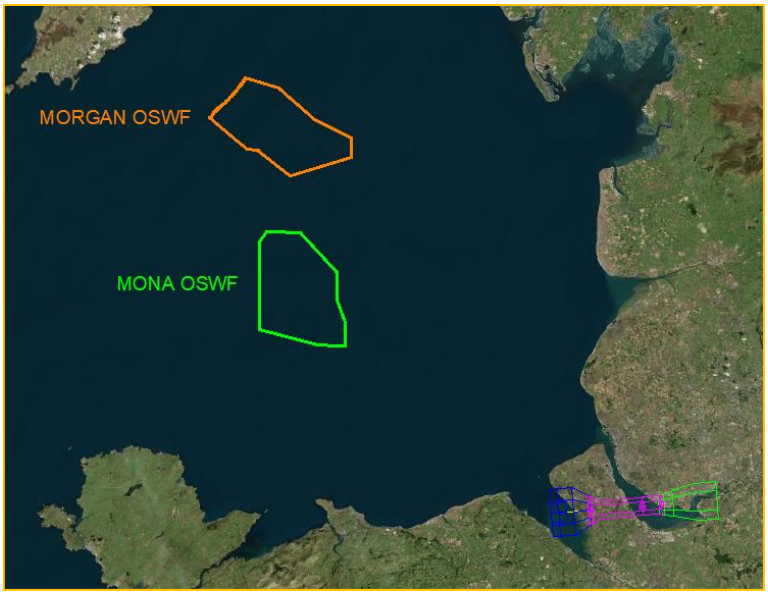

Figure 57 - RNP RWY 09 Protection Areas

The proposed windfarms would not impact the published RNP RWY 09 procedure.

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3.2.11 AD 2.EGGP-8-5 ILS/DME/NDB(L) RWY 27

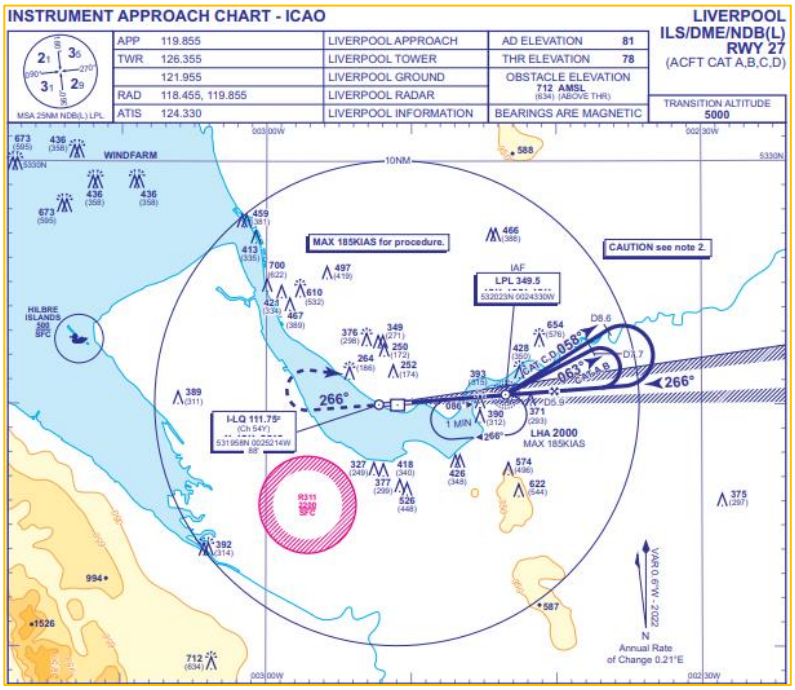

Figure 58 - ILS/DME/NDB(L) RWY 27 Procedure

Arrival at the procedure is published as '*At or Above 2500ft*' which is above the required MOCA for the windfarms.

Both windfarms lie outside the protection areas for the ILS/DME/NDB(L) Procedure to Runway 27, including the Missed Approach which climbs to the west before turning right towards NDB(L) LPL and will not be affected.

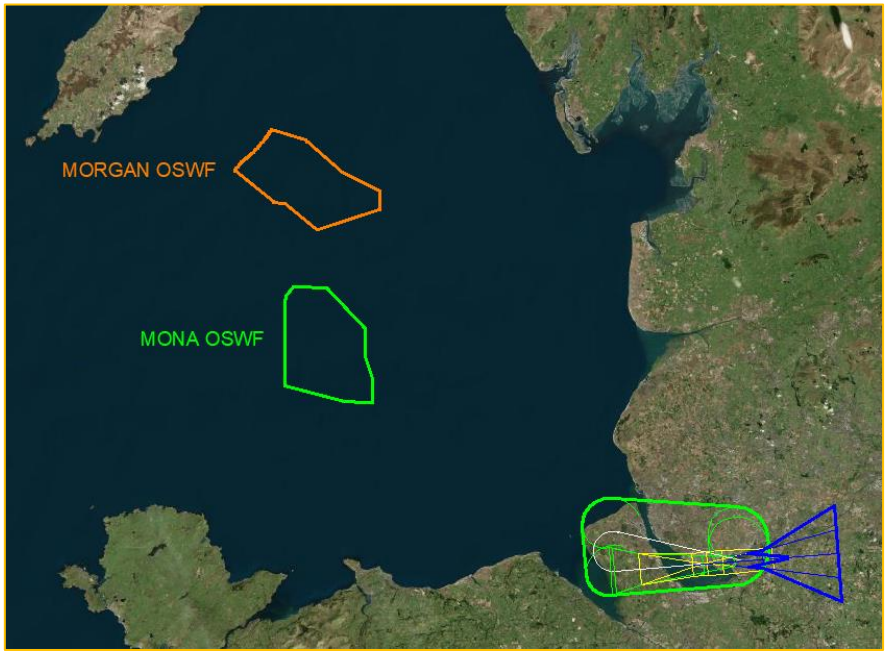

Figure 59 - ILS/DME/NDB(L) RWY 27 Protection Areas

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Additionally, the protection areas for the Base turns published on the chart have been constructed for both CAT A&B and CAT C&D aircraft:

Figure 60 - ILS/DME/NDB(L) RWY 27 Base turn Protection Areas

The proposed windfarms would not impact the published ILS/DME/NDB(L) RWY 27 procedure.

3.2.12 AD 2.EGGP-8-6 LOC/DME/NDB(L) RWY 27

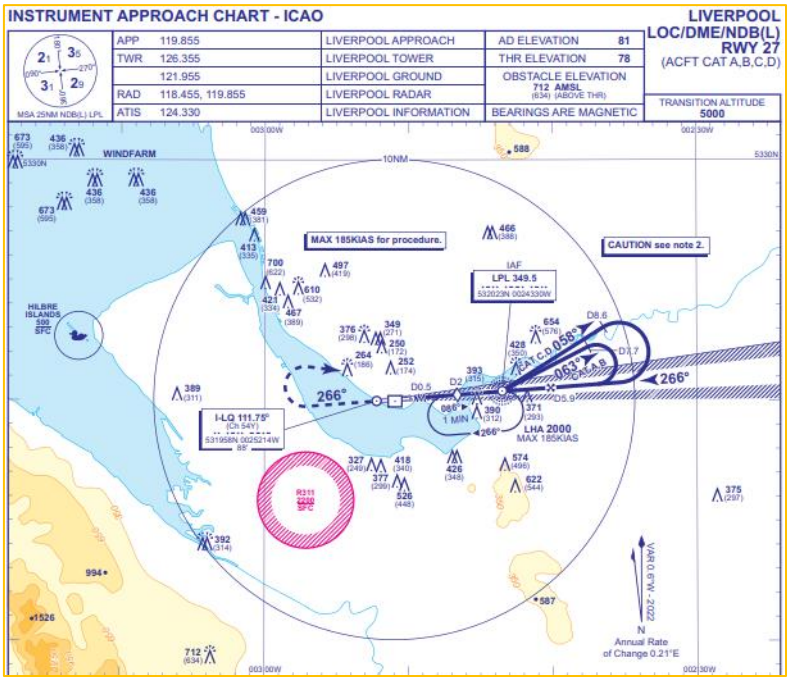

Figure 61 - LOC/DME/NDB(L) RWY 27 Procedure

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Arrival at the procedure is '*At or Above 2500ft*' which is above the required MOCA for the windfarms using the elevation of 364m + 300m MOC = 664m / 2179ft AMSL and would not be affected.

Both windfarms lie outside the protection areas for all aircraft categories for the published LOC/DME/NDB(L) Runway 27 procedure, specifically the Missed Approach which climbs to the west before turning right towards NDB(L) LPL.

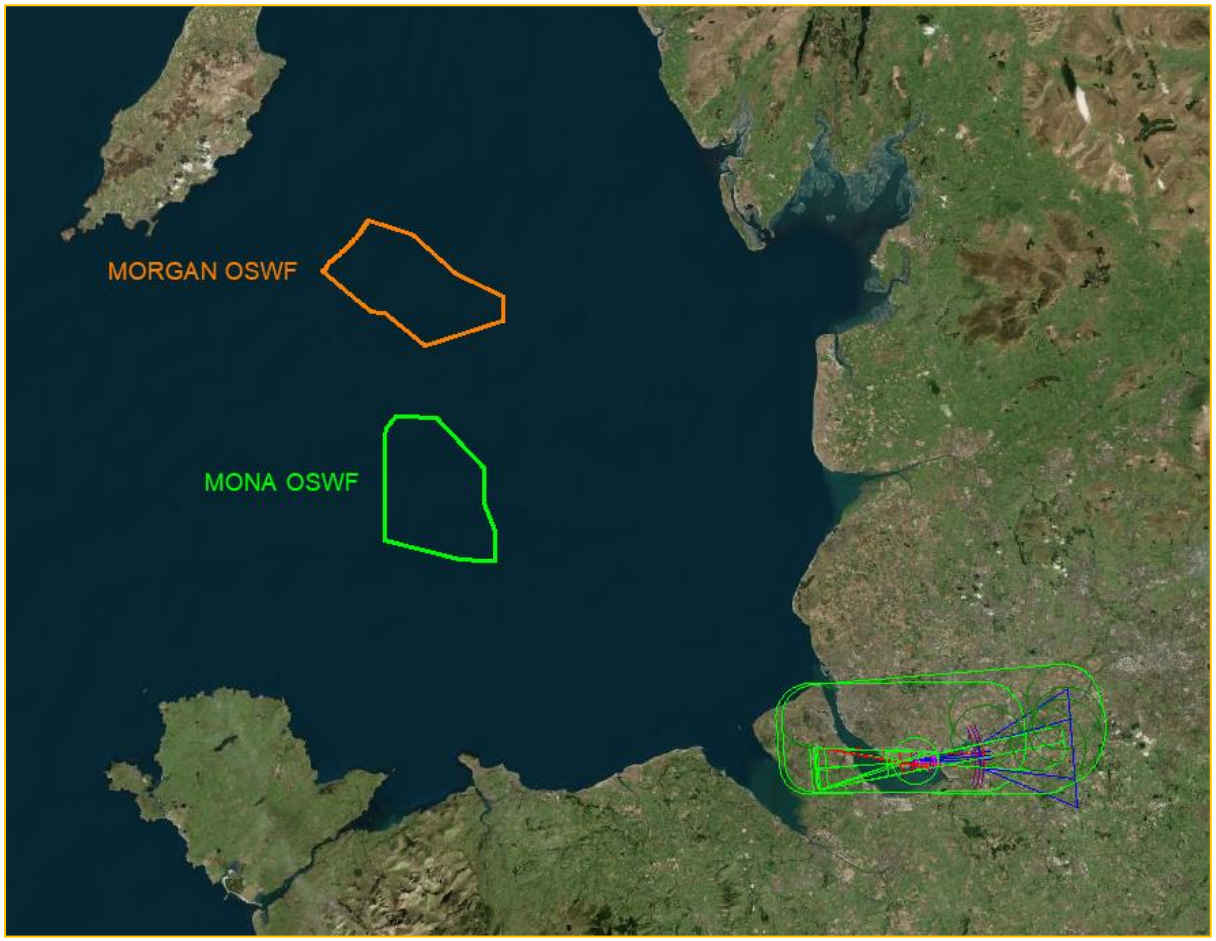

Figure 62 - LOC/DME/NDB(L) RWY 27 Protection Area

The windfarms lie outside the protection areas for the Base turn for Runway 27 as shown in Figure 60 and will not be affected.

The proposed windfarms would not impact the published LOC/DME/NDB(L) RWY 27 procedure.

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3.2.13 AD 2.EGGP-8-7 SRA RTR 2NM RWY 27

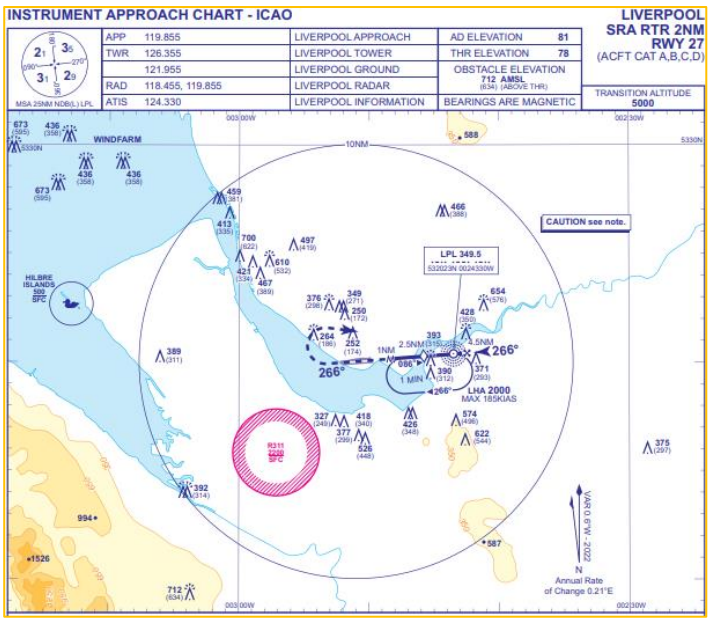

Figure 63 - SRA RTR 2NM RWY 27 Procedure

The initial and Intermediate Approach are directed by radar with no minima published on the chart (covered by ATCSMAC).

Both windfarms lie outside the protection areas for the SRA RWY 27 and Hold Procedures for Runway 27 and will not be affected.

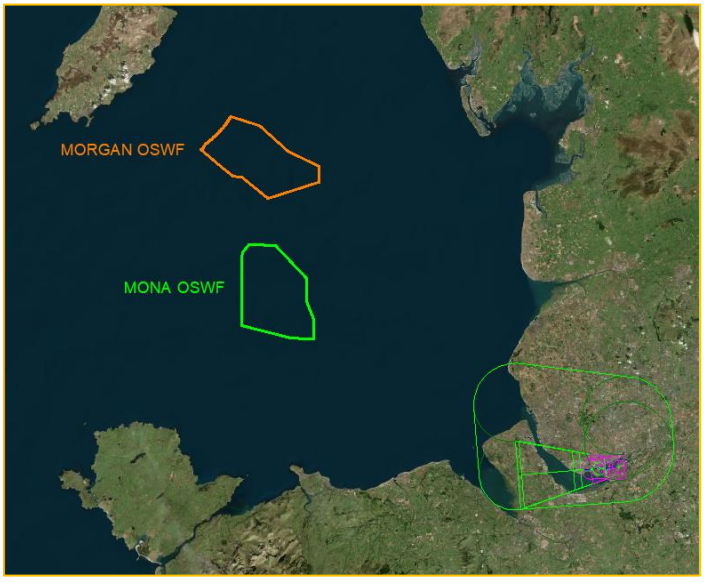

Figure 64 - SRA RTR 2NM RWY 27 Protection Area

The proposed windfarms would not impact the published SRA RTR 2NM RWY 27 procedure.

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3.2.14 AD 2.EGGP-8-8 RNP RWY 27

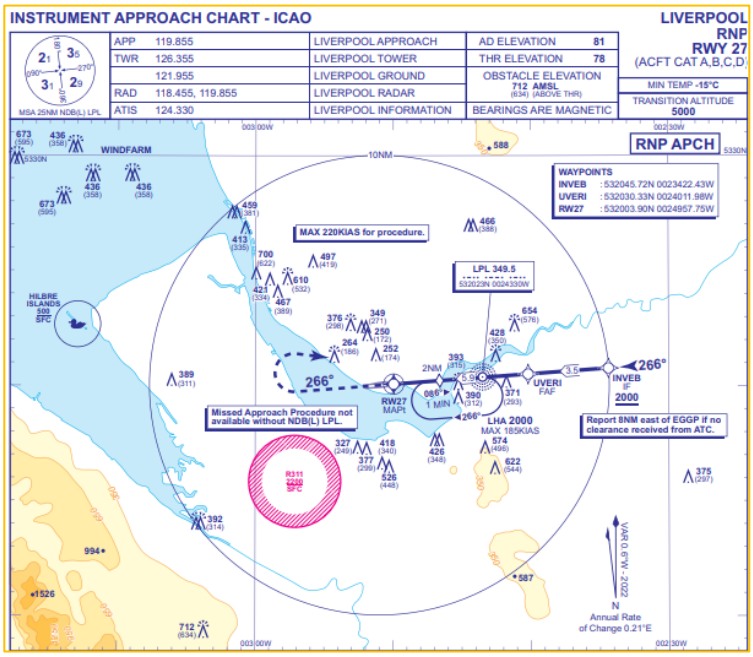

Figure 65 - RNP RWY 27 Procedure

Arrival to the RNP RWY 27 procedure is published as '*At or Above 2500ft*' and would not be affected.

Both windfarms lie outside the protection areas associated to the RNP Procedure to Runway 27.

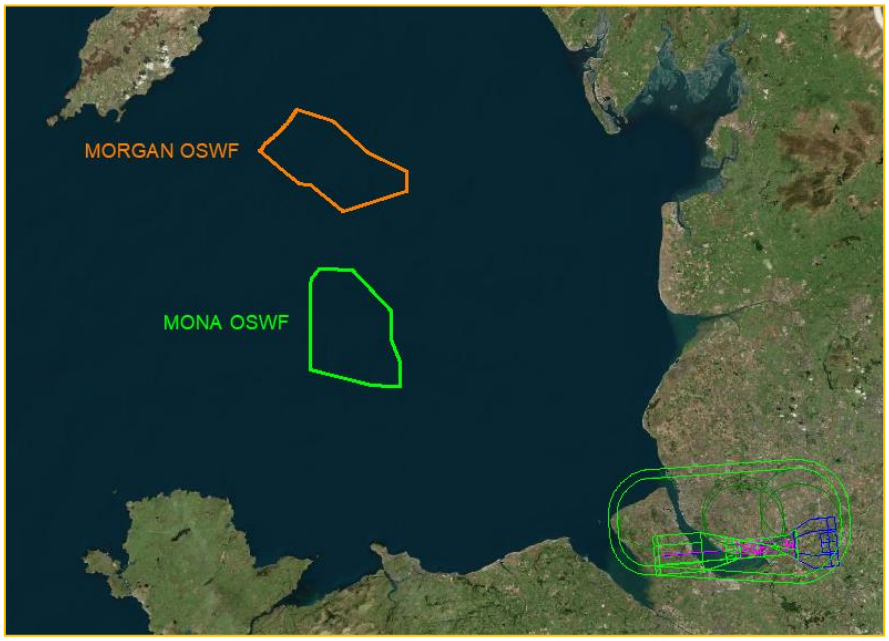

Figure 66 - RNP RWY 27 Protection Area

The Windfarm would not impact the published RNP RWY 27 procedure.

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3.2.15 AD 2.EGGP-8-9 NDB(L)/DME RWY 27

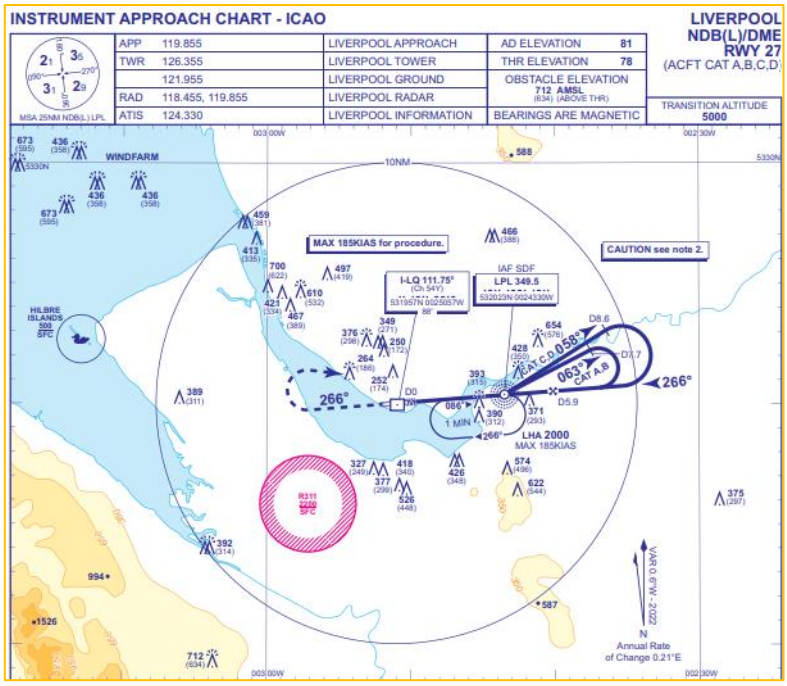

Figure 67 - NDB(L)/DME RWY 27 Procedure

Arrival to the NBD(L)/DME RWY 27 procedure is published as *'At or Above 2500ft'* and would not be affected.

Both windfarms lie outside the protection areas associated to the Procedure to Runway 27. Also, the windfarms lie outside the protection areas for the Base turn for Runway 27 as shown in Figure 60 and will not be affected.

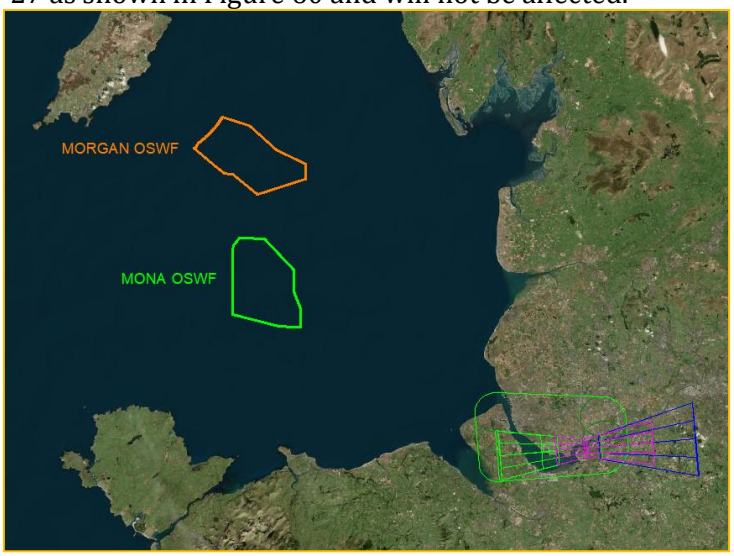

Figure 68 - NDB(L)/ DME RWY 27 Procedure

The Windfarm would not impact the published NDB(L) DME RWY 27 procedure.

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3.2.16 Visual Circling

Both windfarms are outside the Visual Circling VM(C) Obstacle Clearance areas for all aircraft categories (A, B, C and D).

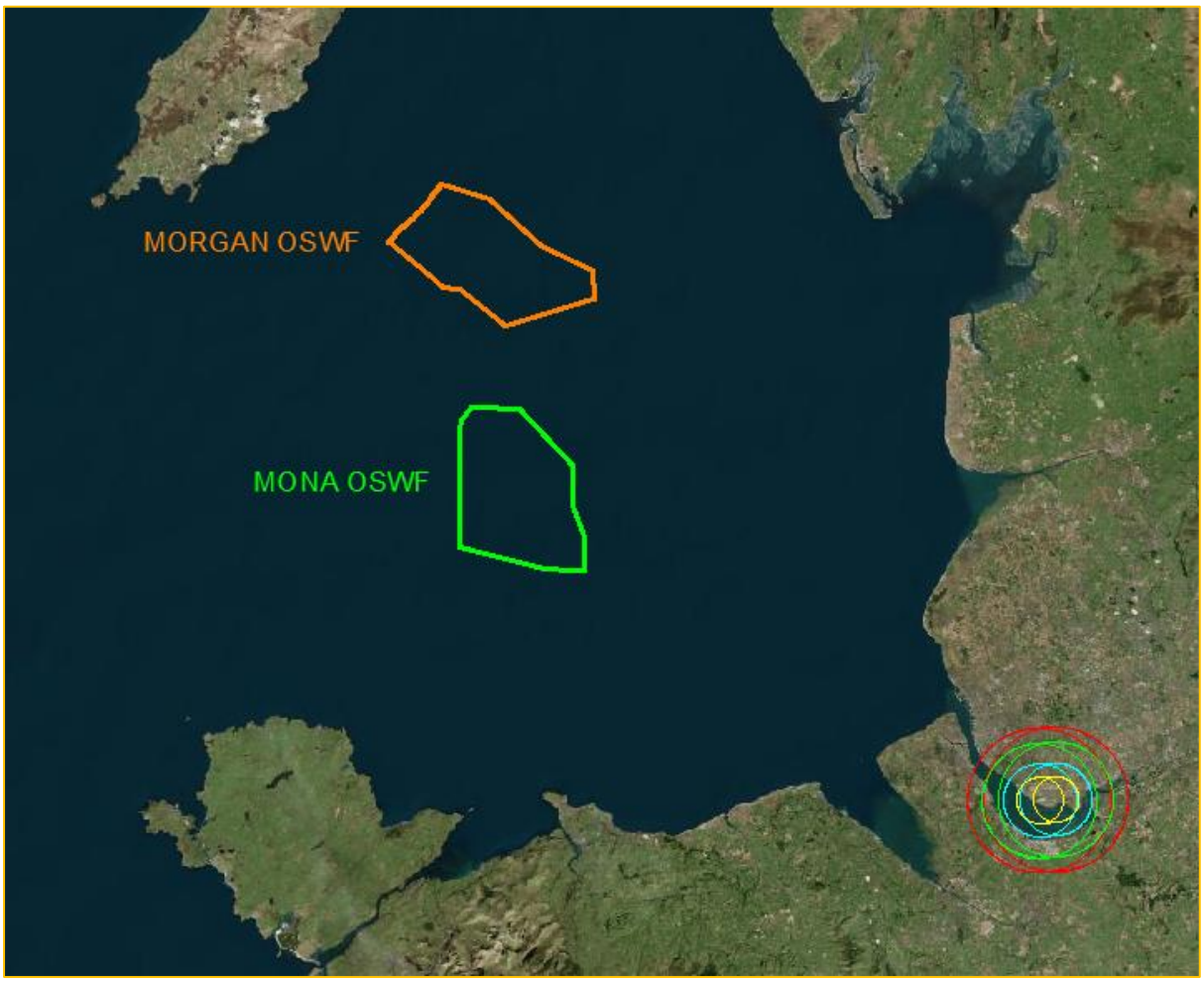

Figure 69 - Visual Circling Protection Areas

The proposed windfarms would have no impact on the Visual Circling.

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3.2.17 Holding

NDB(L) LPL Hold

The NDB(L) LPL Hold has an existing Lowest Holding Altitude (LHA) of 2000ft.

With a maximum MOC of 300m the proposed Windfarm would potentially impact the hold:

364m + 300m MOC = 664m / 2179ft AMSL

Existing Lowest Holding Altitude (LHA) = 2000ft

However, further analysis has deemed that both windfarms lie outside the protection areas associated to the NDB(L) LPL Hold, including its buffers – therefore there will be no impact on the NDB(L) LPL Hold.

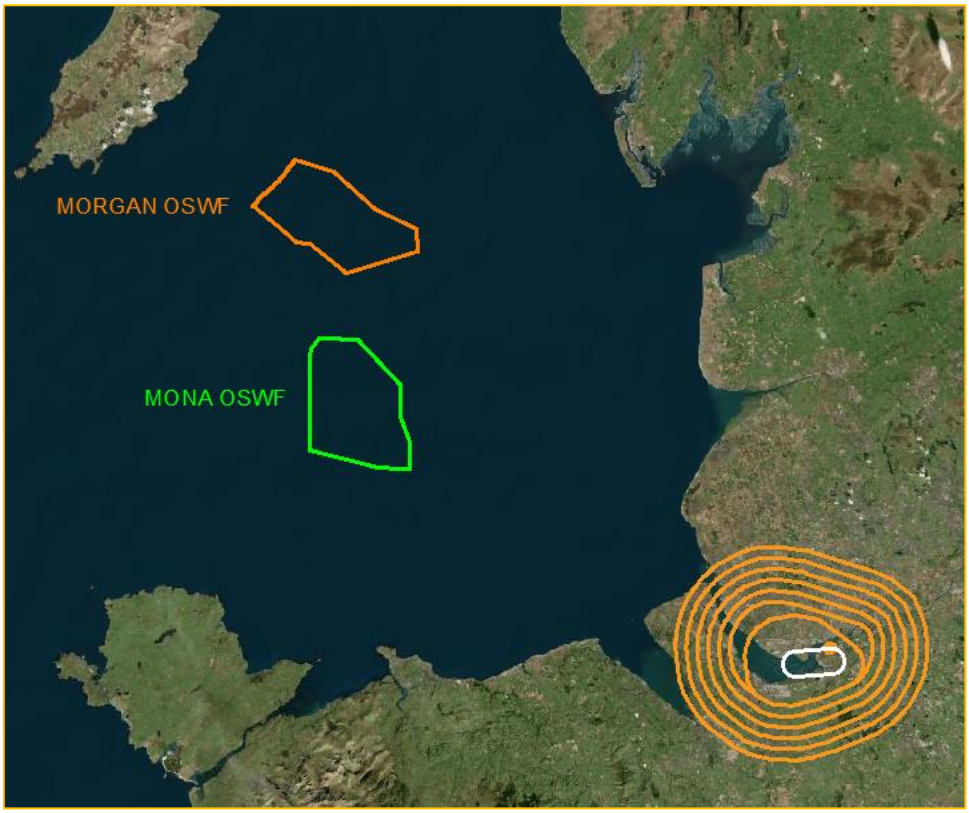

Figure 70 - NDB(L) LPL Hold and Protection Area and Buffers

The proposed windfarms would have no impact on the NDB(L) LPL Hold for Liverpool Airport.

3.2.18 Visual Segment Surface (VSS)

Both windfarms lie outside the lateral confines of VSS for all Runways.

The proposed windfarms would have no impact on the VSS for Liverpool Airport Runways.

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3.2.19 Minimum Sector Altitudes (MSA)

MSA 25NM NDB(L) LPL

The windfarms lie outside the MSA 25NM NDB(L) LPL including the buffer and will have no impact.

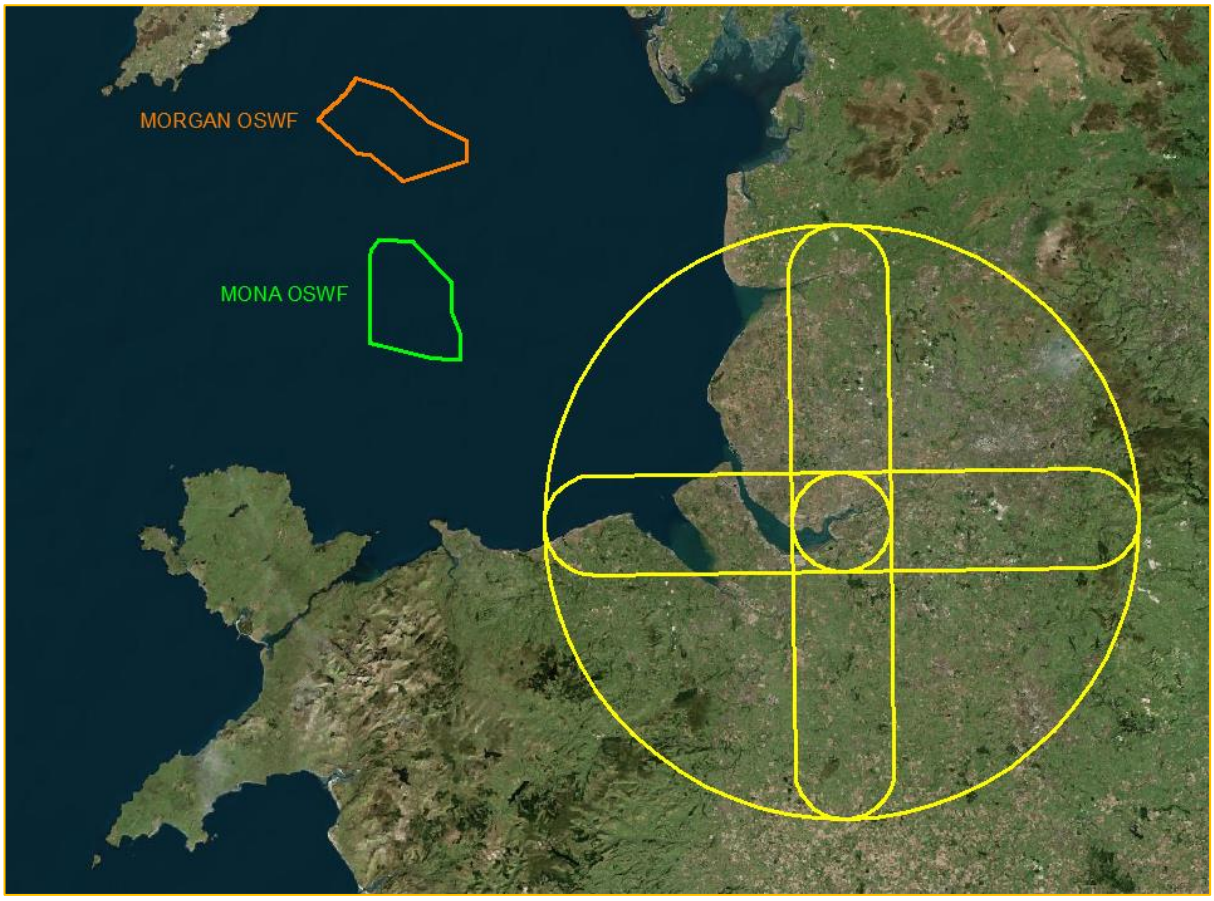

Figure 71 - MSA NDB(L) LPL Area including Buffer

The proposed windfarms would have no impact on the published NDB(L) LPL MSA.

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MSA 25NM ARP

We have additionally protected for an MSA of 25NM based on the ARP as this was used for the ATCSMAC at Liverpool.

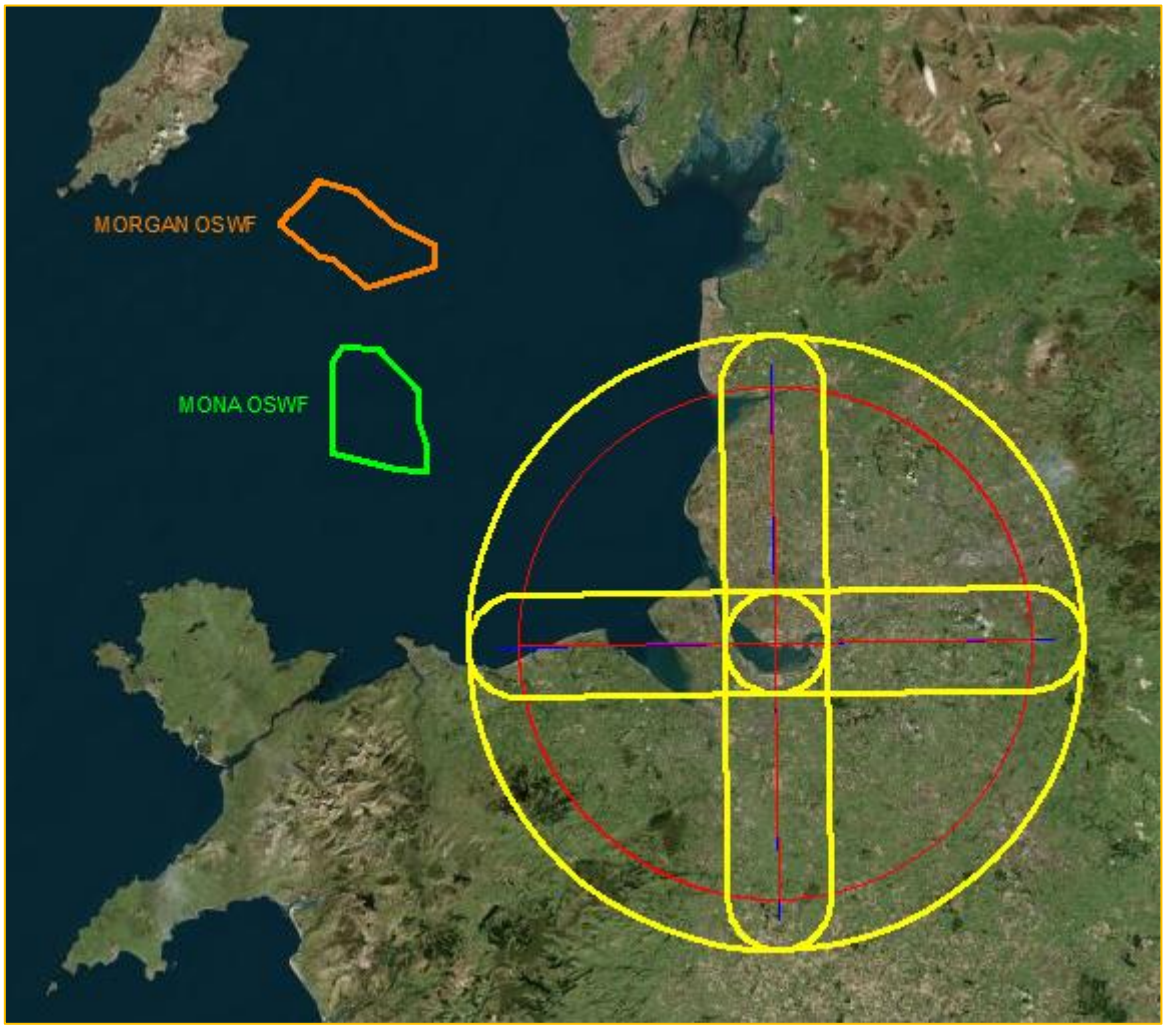

Figure 72 - MSA 25NM ARP

The proposed windfarms would have no impact on the MSA 25NM from the ARP.

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4 BAE Warton Airport OLS and IFP Assessment

4.1 OLS Assessment

4.1.1 Overview

The OLS for Warton Airport has been constructed in accordance with Annex 14 and CAP 168.

4.1.2 Runway Data Used

The following declared distances and threshold details are published in the AIP:

Runway designator	TORA	TODA	ASDA	LDA
1	2	3	4	5
07	2420 M	2697 M	2420 M	2356 M
25	2341 M	2490 M	2341 M	2341 M

Figure 73 - Declared Distances

Designations RWY Number	True bearing	Dimensions of RWY	Surface of RWY/ SWY/ Strength (PCN)	THR co-ordinates/ THR Geoid undulation	THR elevation/ Highest elevation of TDZ of precision APP RWY	Slope of RWY/ SWY
1	2	3	4	5	6	7
07	071.15°	2422 x 46 M	RWY surface: Asphalt, Grooved PCN 47/F/C/W/T	534429.78N 0025401.22W 171.0 FT	THR 30.1 FT	RWY 07 0.003% Up RWY 25 0.003% Down
25	251.18°	2422 x 46 M	RWY surface: Asphalt, Grooved PCN 47/F/C/W/T	534454.39N 0025159.51W 171.0 FT	THR 54.5 FT	RWY 07 0.003% Up RWY 25 0.003% Down

Figure 74 - Threshold Distances

Runway 07 is a CODE 4, Non-Precision Runway (**Lowest threshold, 9.18m**)

Runway 27 is a CODE 4, Precision Instrument Runway

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4.1.3 OLS Construction

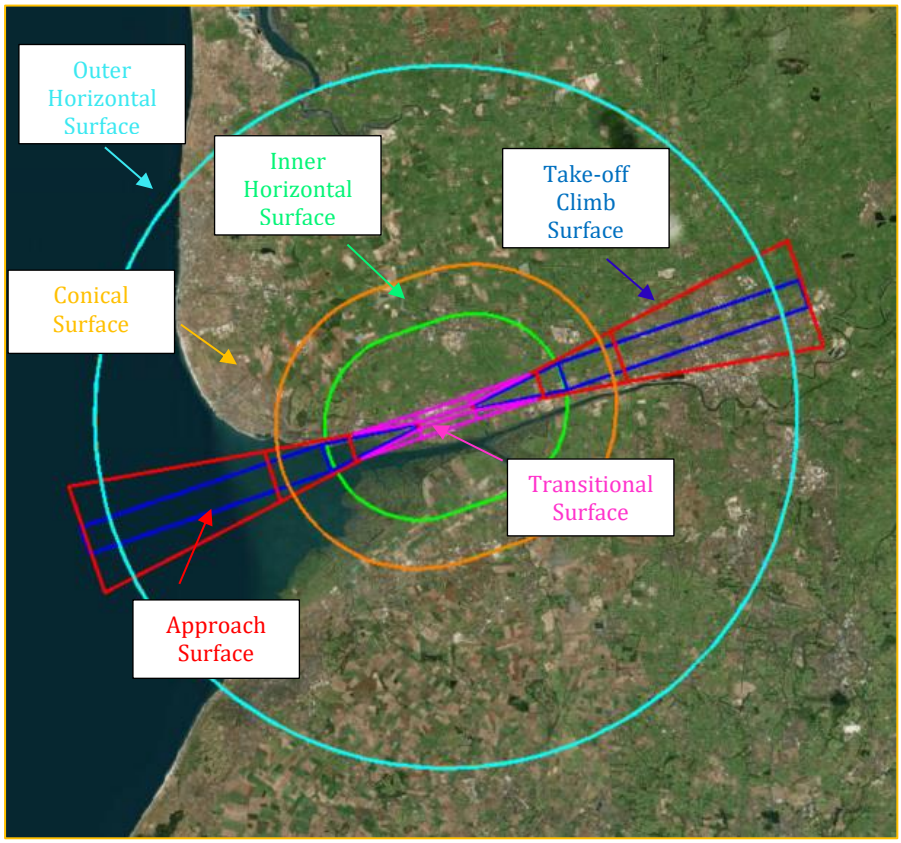

Figure 75 - OLS for Warton Airport

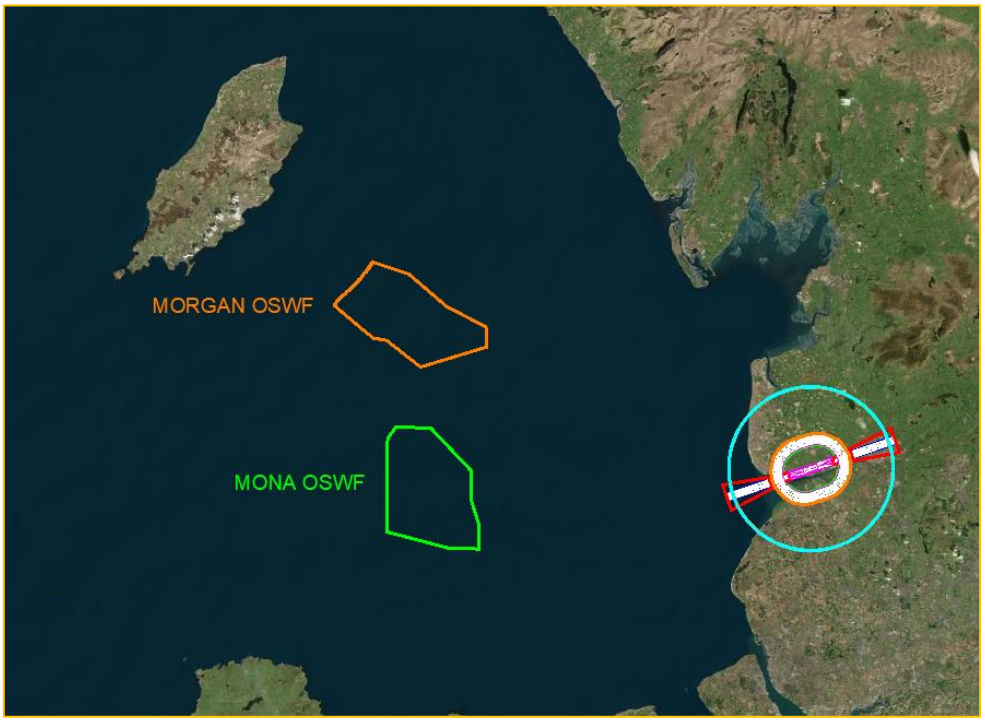

Figure 76 - Warton OLS in Relation to Windfarms

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4.1.4 OLS Analysis

Both windfarms lie entirely outside of the boundaries of the OLS for Warton, and it is not affected by the development.

The proposed windfarms will have no impact on the OLS for Warton Airport.

4.2 IFP Assessment

Warton is a Civilian aerodrome with Military aerodrome charts.

The ATCSMAC and IFPs assessed are as follows:

Procedures from the UK Civil AIP

AIRAC 08/2023 (Effective 10 AUG 2023)

- AD 2.EGNO-5-1 ATCSMAC (17 JUN 21)

Procedures from the UK Mil AIP

AIRAC 2309 (Effective 07 SEP 23 to 05 OCT 23)

- AD 2 EGNO-1-5 ATC Surveillance MNM Altitude (23 FEB 23);
- AD 2 EGNO-1-7 SRA RWY 07 0.5NM (29 DEC 22);
- AD 2 EGNO-1-8 SRA RWY07 2NM (29 DEC 22);
- AD 2 EGNO-1-9 SRA RWY 25 0.5NM (29 DEC 22);
- AD 2 EGNO-1-10 SRA RWY 25 2NM (29 DEC 22);
- AD 2 EGNO-1-11 NDB to ILS/DME RWY 25 (29 DEC 22);
- AD 2 EGNO-1-12 TAC to ILS/DME RWY 25 (29 DEC 22);
- AD 2 EGNO-1-13 HI-TAC to ILS/DME RWY 25 (29 DEC 22);
- AD 2 EGNO-1-14 DCT ARR POL to ILS/DME RWY 25 (29 DEC 22);
- AD 2 EGNO-1-15 NDB/DME RWY 07 (29 DEC 22);
- AD 2 EGNO-1-16 NDB RWY 07 (29 DEC 22);
- AD 2 EGNO-1-17 DCT ARR WAL to NDB/DME RWY 07 (29 DEC 22);
- AD 2 EGNO-1-18 TAC RWY 07 (29 DEC 22);
- AD 2 EGNO-1-19 TAC RWY 25 (29 DEC 22);
- AD 2 EGNO-1-20 HI-TAC RWY 07 (29 DEC 22);
- AD 2 EGNO-1- 21 HI TAC RWY 25 (29 DEC 22).

Additionally, the following were checked:

- Visual Circling
- Holding
- Visual Segment Surface (VSS)
- Minimum Sector Altitudes (MSA)

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4.2.1 AD 2 EGNO-1-5 ATCSMAC

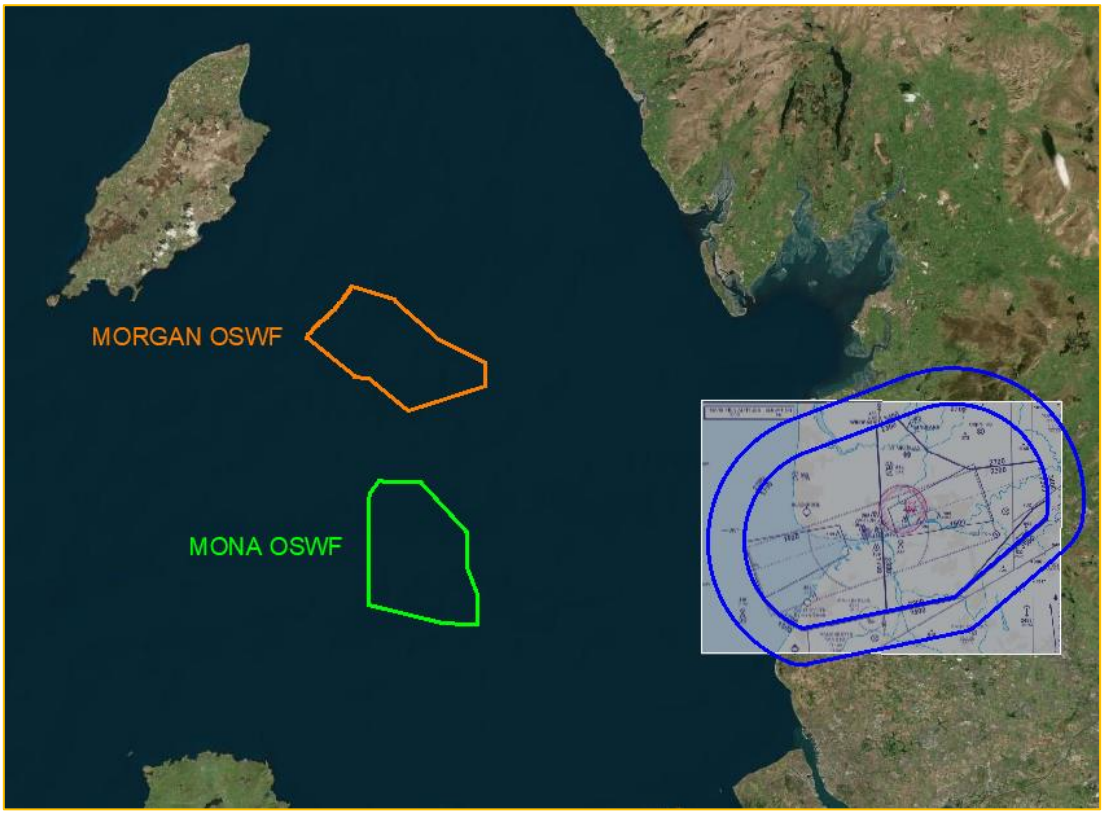

Figure 77 - Windfarms in Relation to ATCSMAC

The Civil and Military ATCSMAC are identical so only one assessment is necessary.

Both windfarms lie outside the lateral buffer of all Surveillance Minimum Altitude Areas (SMAAs).

The proposed windfarms would not impact Warton Airport's ATCSMAC.

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4.2.2 AD 2 EGNO-1-7 SRA RWY 07 0.5NM

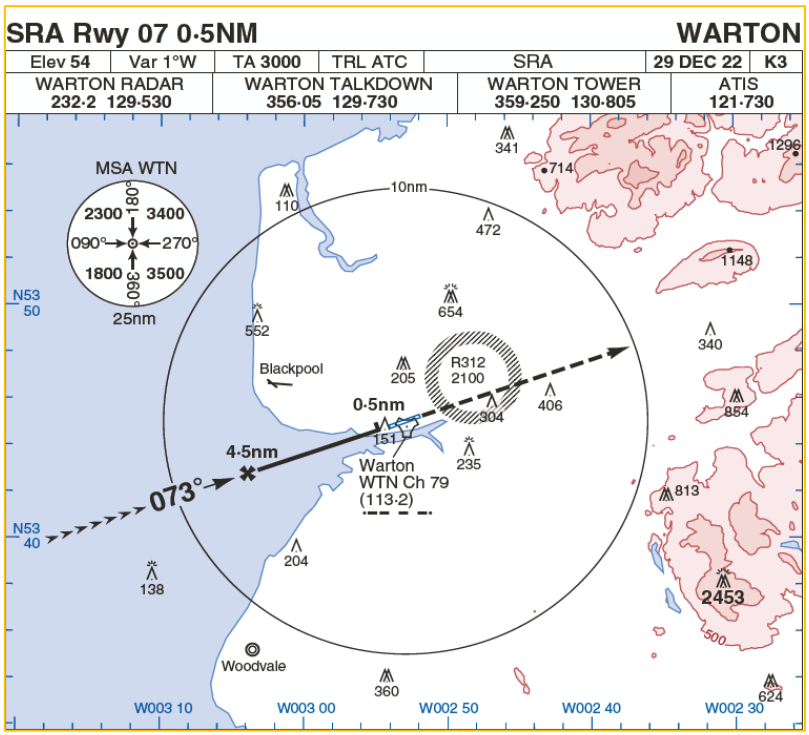

Figure 78 - SRA RWY 07 0.5NM Procedure

Both windfarms lie outside the protection areas for the SRA procedure to runway 07 with a Missed Approach Point at 0.5NM.

The Missed Approach continues east, away from the windfarms and climbs to 3400ft, common to the MSA WTN north-east sector, and will not be affected.

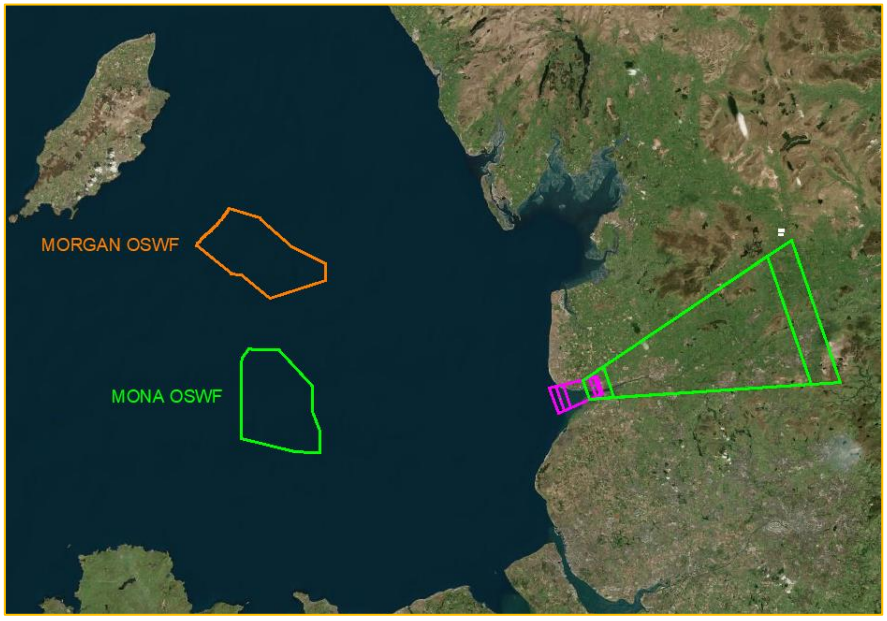

Figure 79 - SRA RWY 07 0.5NM Protection Areas

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Arrival to the procedure could be conducted using the ATCSMAC OR MSA to conduct radar vectoring until reaching the FAF at 1500ft.

The ATCSMAC has been considered in section 4.2.1 and the MSA WTN in section 4.2.20.

The proposed windfarms would not impact the published SRA RWY 07 0.5NM procedure.

4.2.3 AD 2 EGNO-1-8 SRA RWY 07 2NM

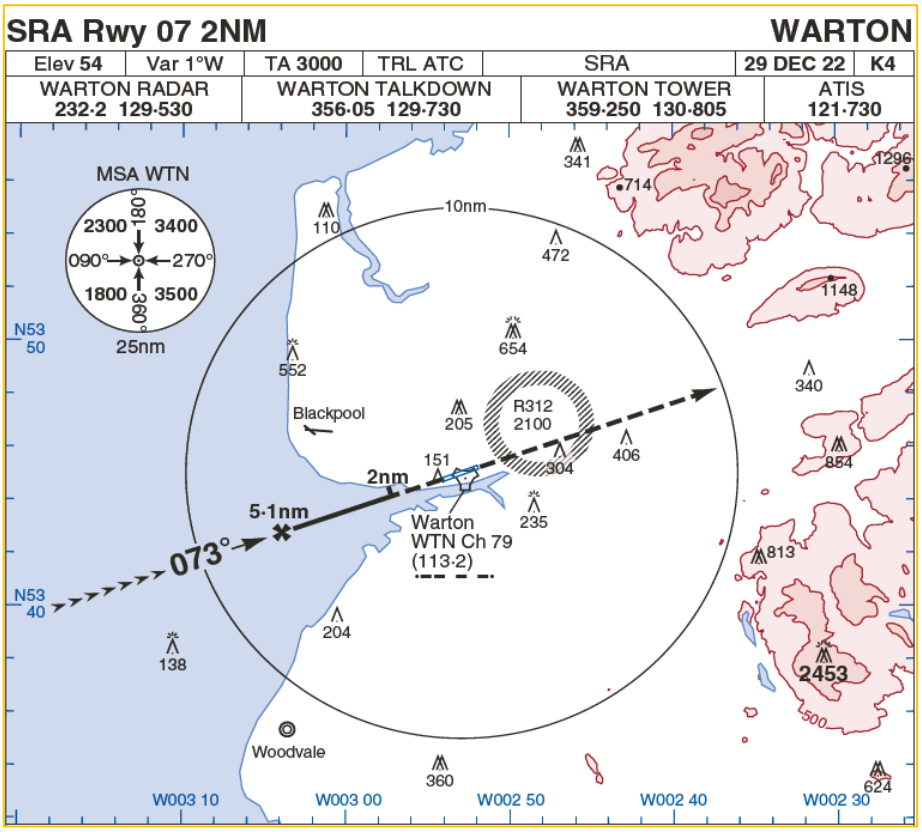

Figure 80 - SRA RWY 07 2NM Procedure

Both windfarms lie outside the protection areas for the SRA procedure to runway 07 with a Missed Approach Point at 2NM.

The Missed Approach continues east, away from the windfarms and climbs to 3400ft, common to the MSA WTN north-east sector, and will not be affected.

Arrival to the procedure could be conducted using the ATCSMAC OR MSA to conduct radar vectoring until reaching the FAF at 1700ft.

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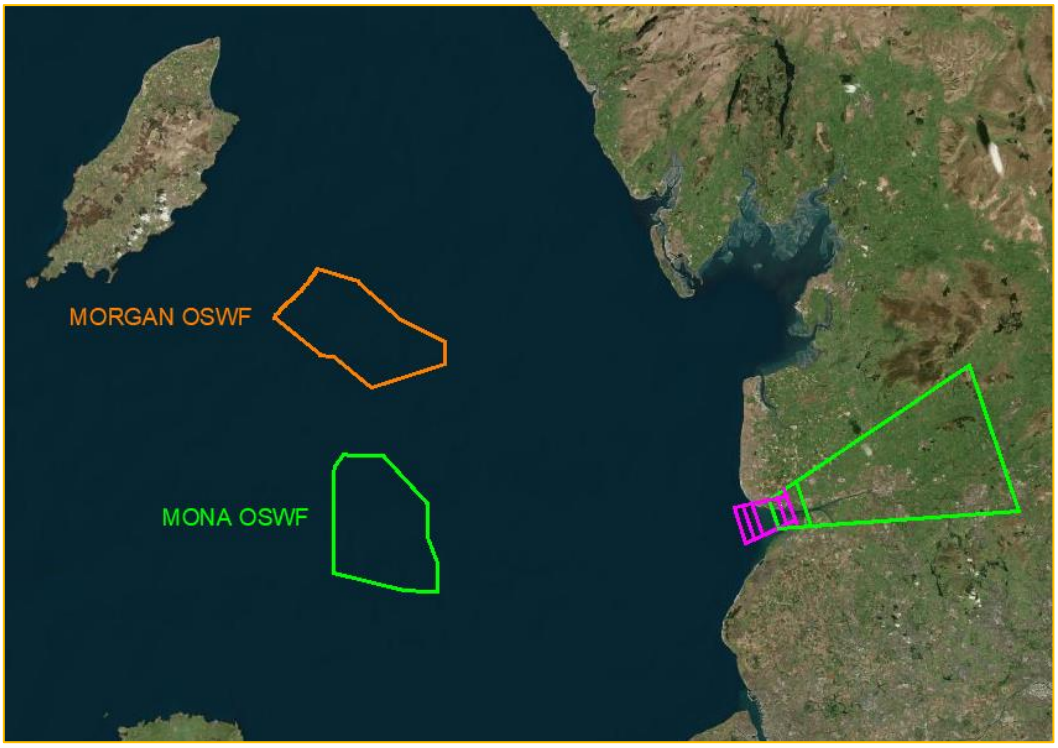

Figure 81 - SRA RWY 07 2NM Protection Areas

The proposed windfarms would not impact the published SRA RWY 07 2NM procedure.

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4.2.4 AD 2 EGNO-1-9 SRA RWY 25 0.5NM

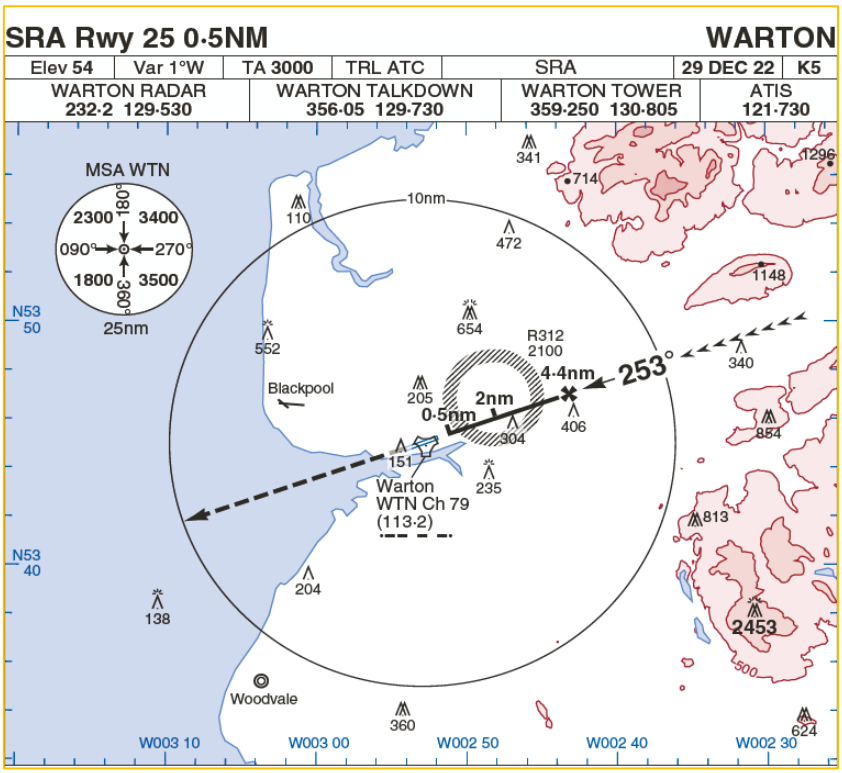

Figure 82 - SRA RWY 25 0.5NM Procedure

Both windfarms lie outside the protection areas for the SRA procedure to runway 25 with a Missed Approach Point at 0.5NM.

The Missed Approach text is as follows:

'Climb on Rwy Tr to 2000 1950'.

Aircraft are required to climb to 2000ft QNH in the Missed Approach, ahead on the runway track, towards the vicinity of the Mona development, as shown in Figure 83.

Both windfarms are outside of the protection for the Warton MSA's and as such will not impact the Missed Approach Procedure.

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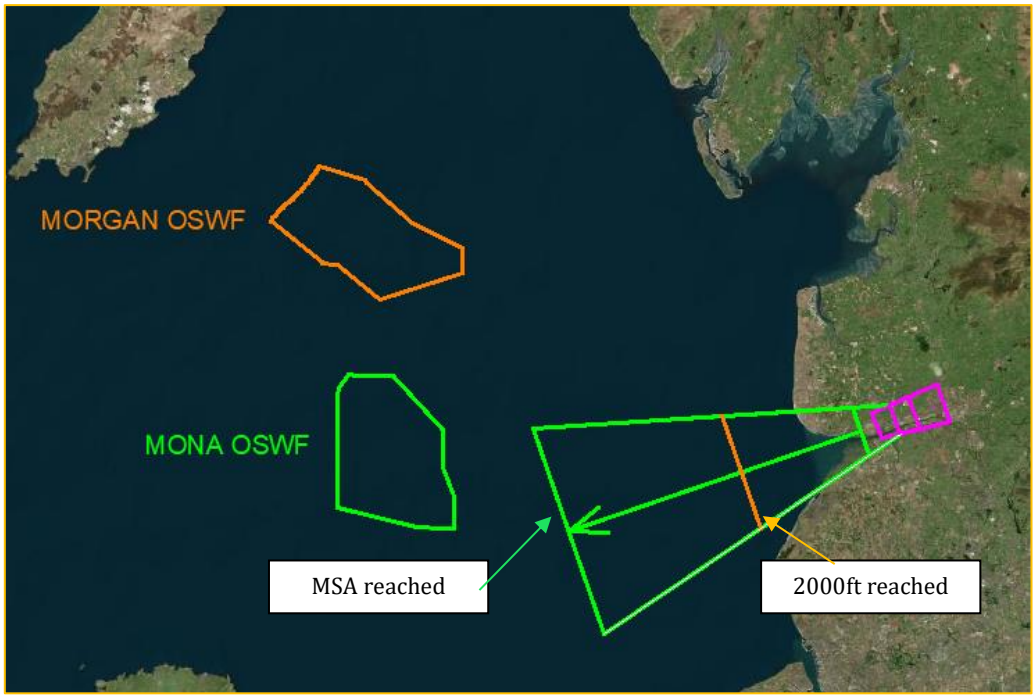

Figure 83 - SRA RWY 25 0.5NM Protection Areas

The proposed windfarms would not impact the published SRA RWY 25 0.5NM procedure.

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4.2.5 AD 2 EGNO-1-10 SRA RWY 25 2NM

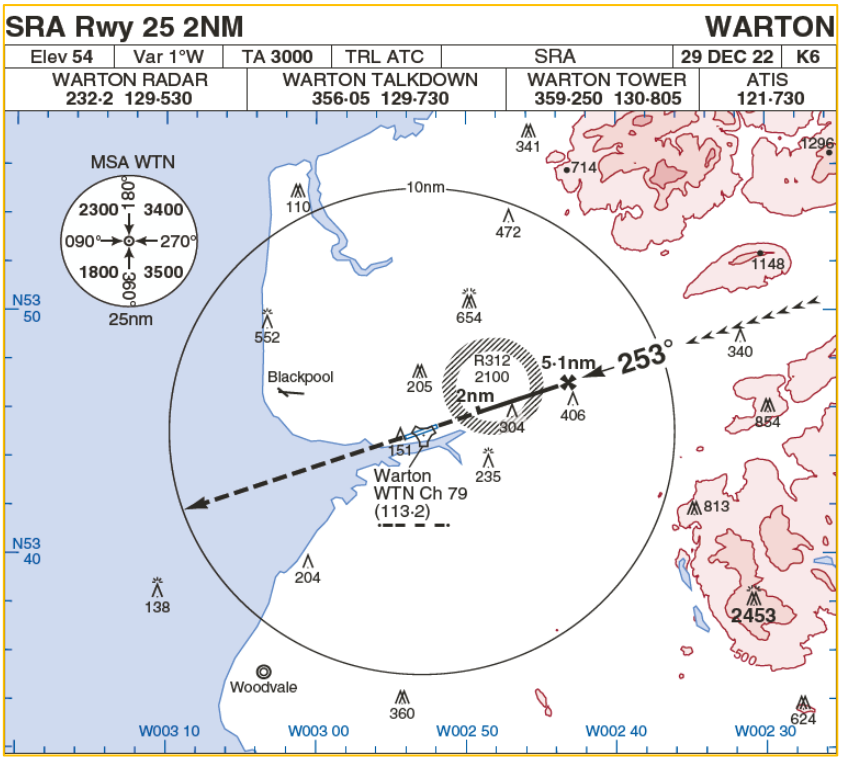

Figure 84 - SRA RWY 25 2NM Procedure

Both windfarms lie outside the protection areas for the SRA procedure to runway 25 with a Missed Approach Point at 2NM.

The Missed Approach text is as follows:

'Climb on Rwy Tr to 2000 1950'.

Aircraft are required to climb to 2000ft QNH in the Missed Approach, ahead on the runway track, towards the vicinity of the Mona development as shown in Figure 85.

Both windfarms are outside of the protection for the Warton MSA's and as such will not impact the Missed Approach Procedure.

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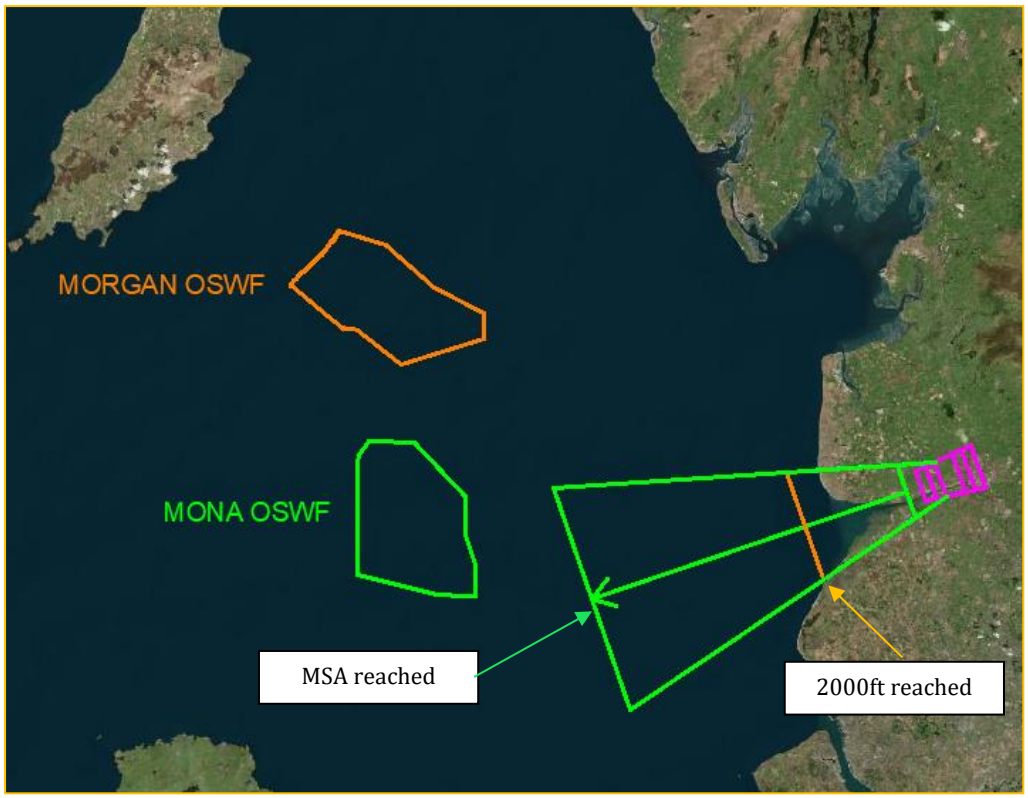

Figure 85 - SRA RWY 25 2NM Protection Area

The proposed windfarms would not impact the published SRA RWY 25 2NM procedure.

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4.2.6 AD 2 EGNO-1-11 NDB to ILS/DME RWY 25

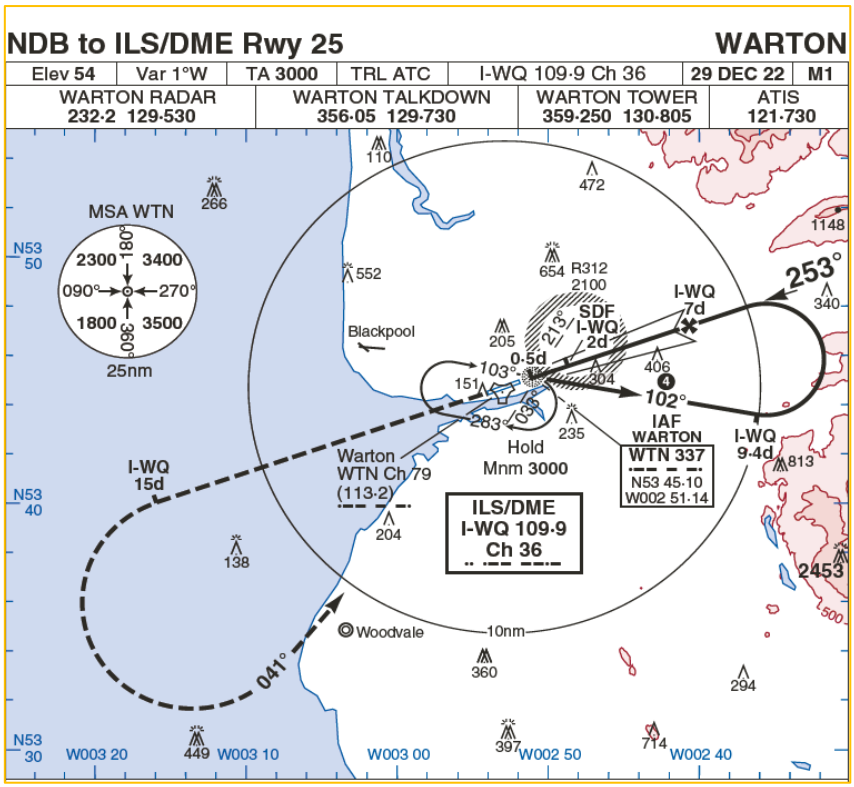

Figure 86 - NDB to ILS/DME RWY 25 Procedure

Both windfarms lie outside the protection areas for the NDB to ILS/DME RWY procedure to runway 25 and will have no impact.

This includes the Missed Approach which climbs to 3000ft and turns left, away from the windfarms.

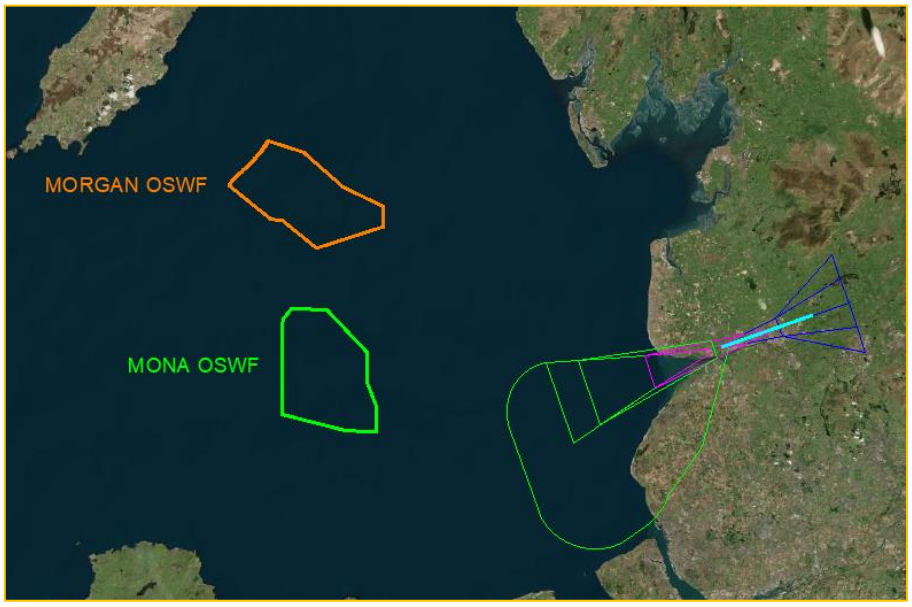

Figure 87 - NDB to ILS/DME RWY 25 Protection Areas

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Additionally, the reversal procedure from NDB WTN, published on the approach chart has been constructed:

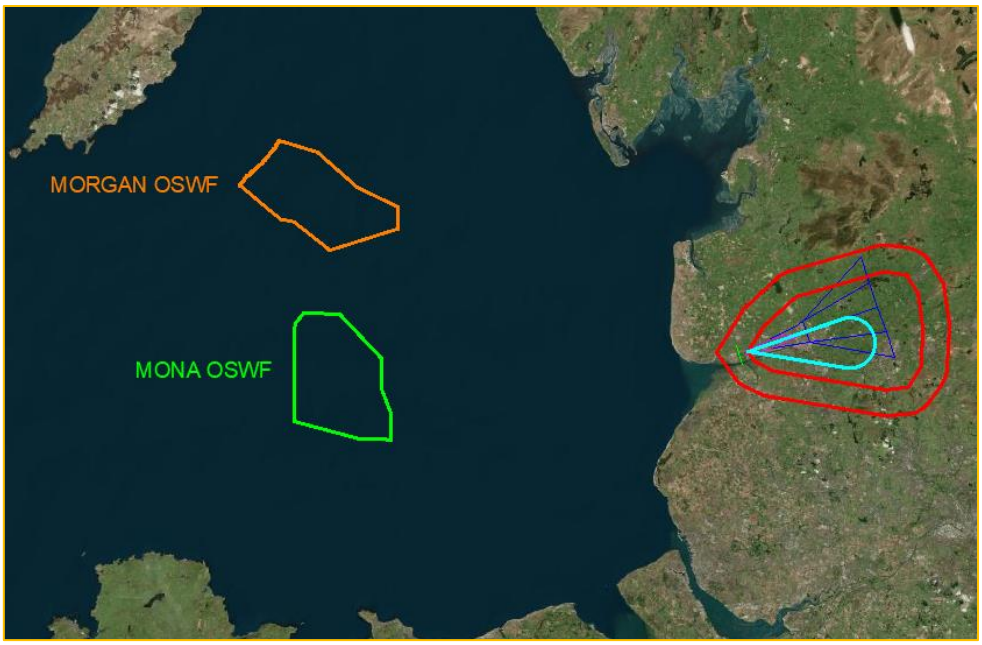

Figure 88 - NDB to ILS/DME RWY 25 Base turn Protection Area

Both windfarms lie outside the protection area for the Base turn and will not impact the reversal procedure.

The Hold from NDB WTN has been considered in section 4.2.18.

The proposed windfarms will not impact the published NDB to ILS/DME RWY 25 procedure.

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4.2.7 AD 2 EGNO-1-12 TAC to ILS/DME RWY 25

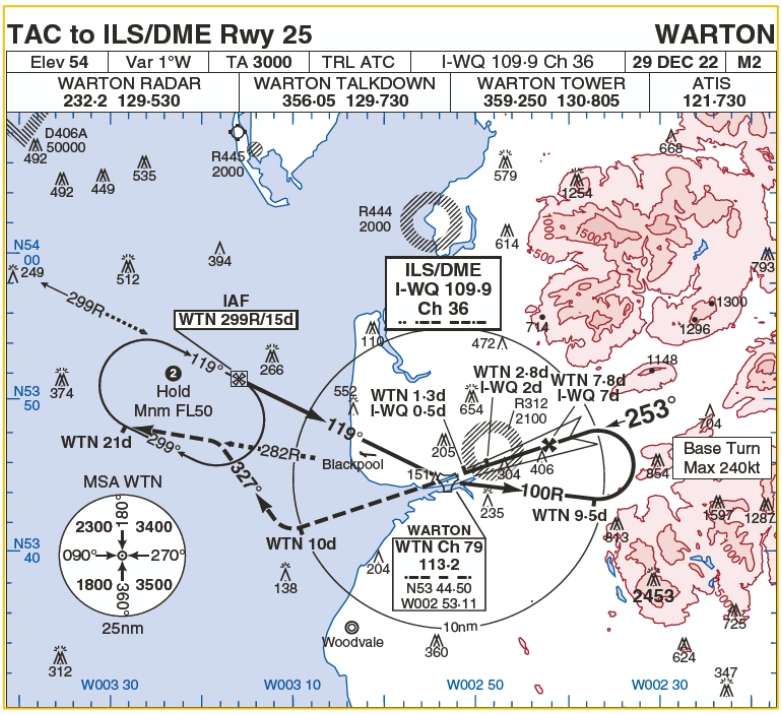

Figure 89 - TAC to ILS/DME RWY 25

Both windfarms lie outside the protection area for the TACAN approach to ILS/DME to Runway 25, including the Missed Approach area and will have no impact to the procedure.

Aircraft will be at 5000ft at the IAF at the NDB WTN Hold which is above the MOCA required at the windfarms. The procedure then heads east, away from the windfarms.

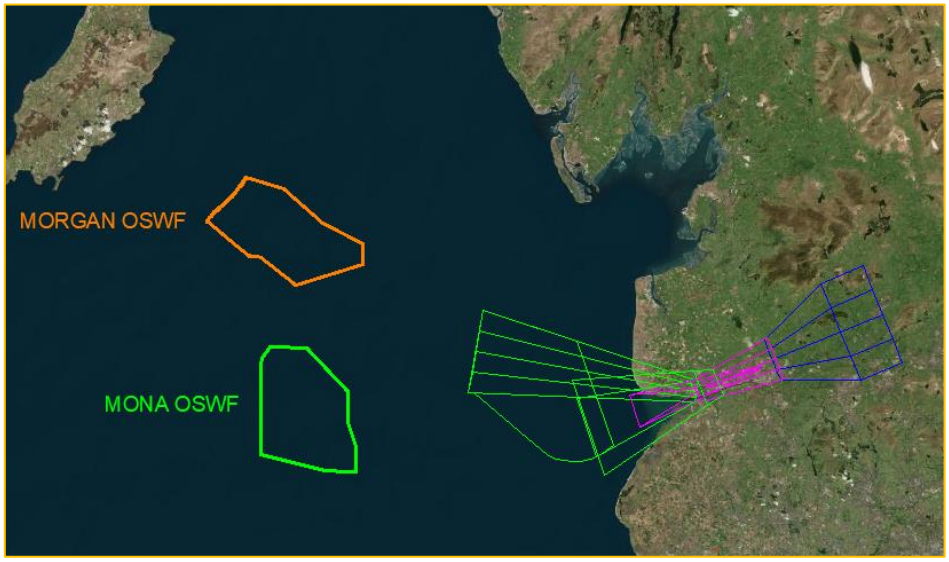

Figure 90 - TAC to ILS/DME RWY 25 Protection Areas

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Additionally, the procedure features a reversal Base turn. The minimum altitude within the Base turn is 2560ft which is above the MOCA required at the windfarms which will have no impact to the procedure.

The proposed windfarms will not impact the published TAC to ILS/DME RWY 25 procedure.

4.2.8 AD 2 EGNO-1-13 HI-TAC to ILS/DME RWY 25

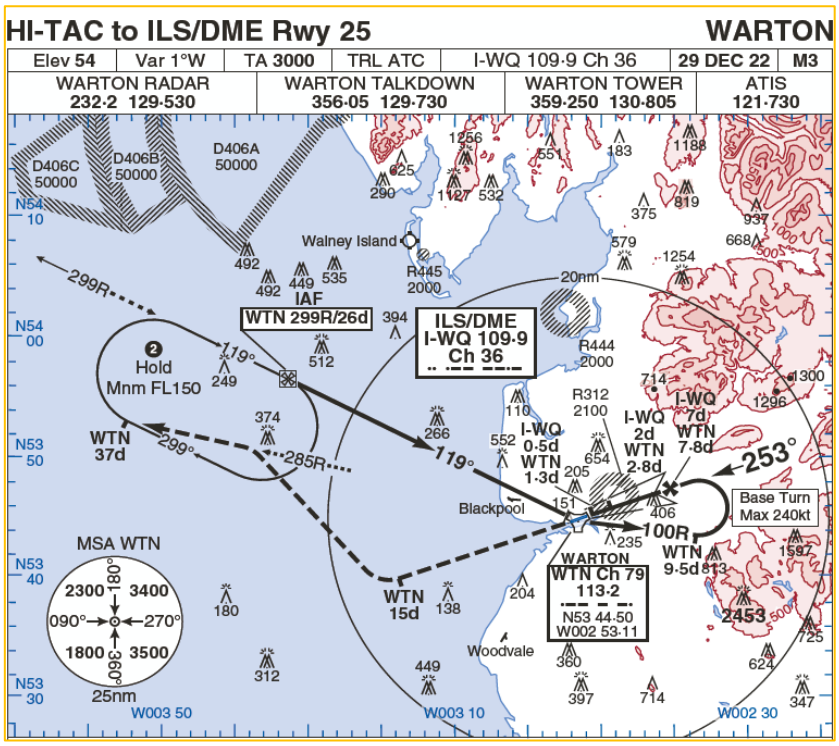

Figure 91 – HI-TAC to ILS/DME RWY 25

Both windfarms lie outside the protection areas for the ILS as considered in section 4.2.7 and will have no impact.

However, both windfarms lie within the protection area of the Final Missed Approach area associated with the HI-TAC to ILS/DME RWY 25 and could potentially impact the procedure:

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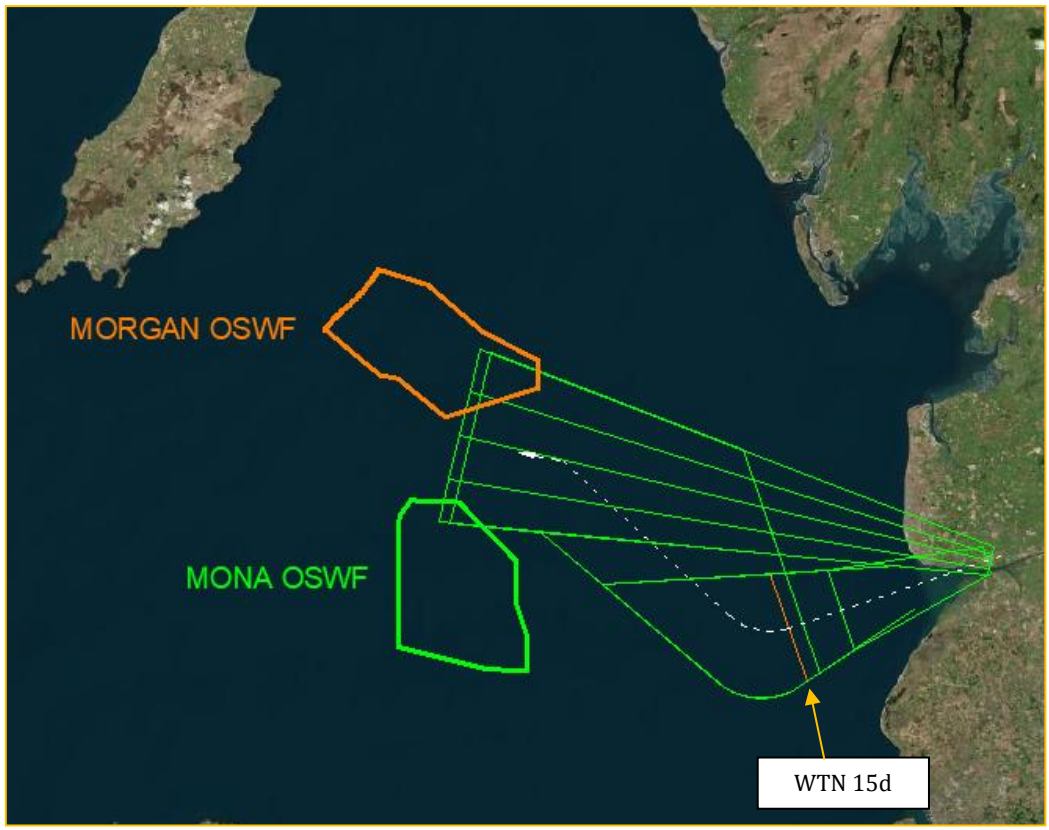

Figure 92 - HI-TAC to ILS/DME, Final Missed Approach Protection Areas

This Missed Approach Text is as follows:

Climb on Rwy Tr to 2060 2000. At WTN 15d right onto 285R oubd, climbing to FL150 and join high WTN hold at 285R/37d.

Aircraft are required to climb to 2060ft before turning at WTN 15d which is shown in figure 92 and are, at this point, already above the MOCA required at the windfarms.

Using the MOC for the Missed Approach of 50m and Windfarm elevation of 364m, aircraft should be at a minimum altitude of 364m + 50m = 414m / 1358ft to safely clear the obstacle.

The High WTN Hold has a minimum altitude of FL150 and will not be affected and is considered in section 4.2.18.

The proposed windfarms will not impact the published HI-TAC to ILS/DME RWY 25 procedure.

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4.2.9 AD 2 EGNO-1-14 DCT ARR POL to ILS/DME RWY 25

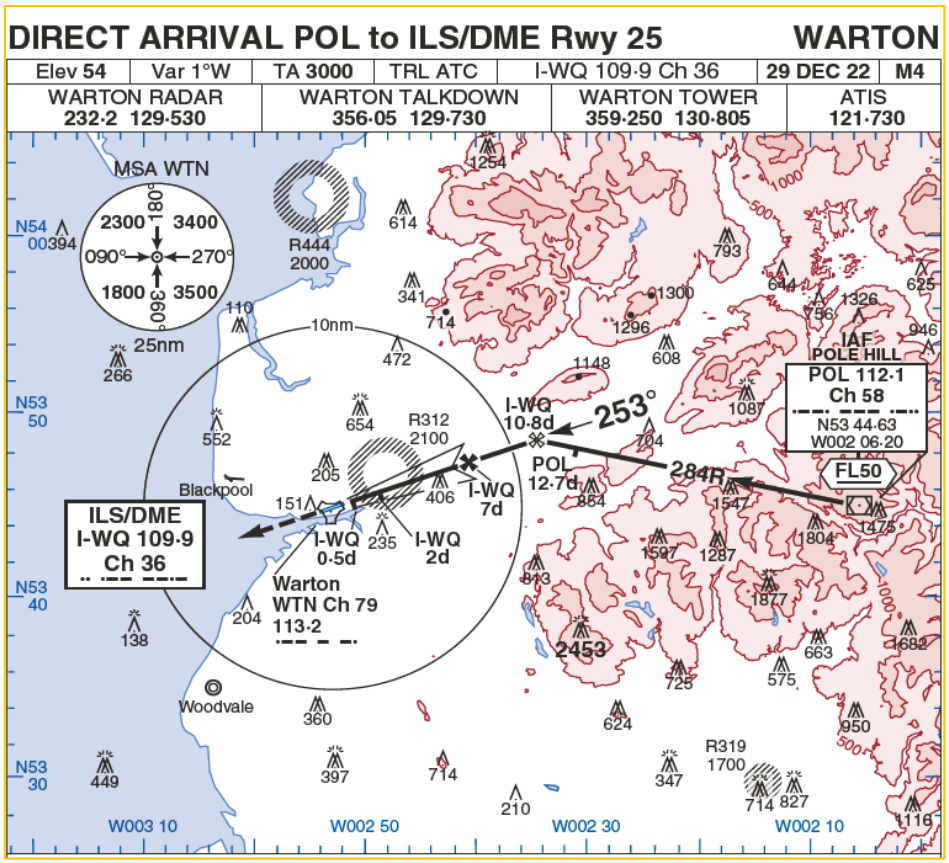

Figure 93 - DIRECT ARRIVAL POL to ILS/DME RWY 25 Procedure

Both windfarms lie outside the protection areas associated with the Direct Arrival procedure from POL VOR to the ILS/DME for runway 25.

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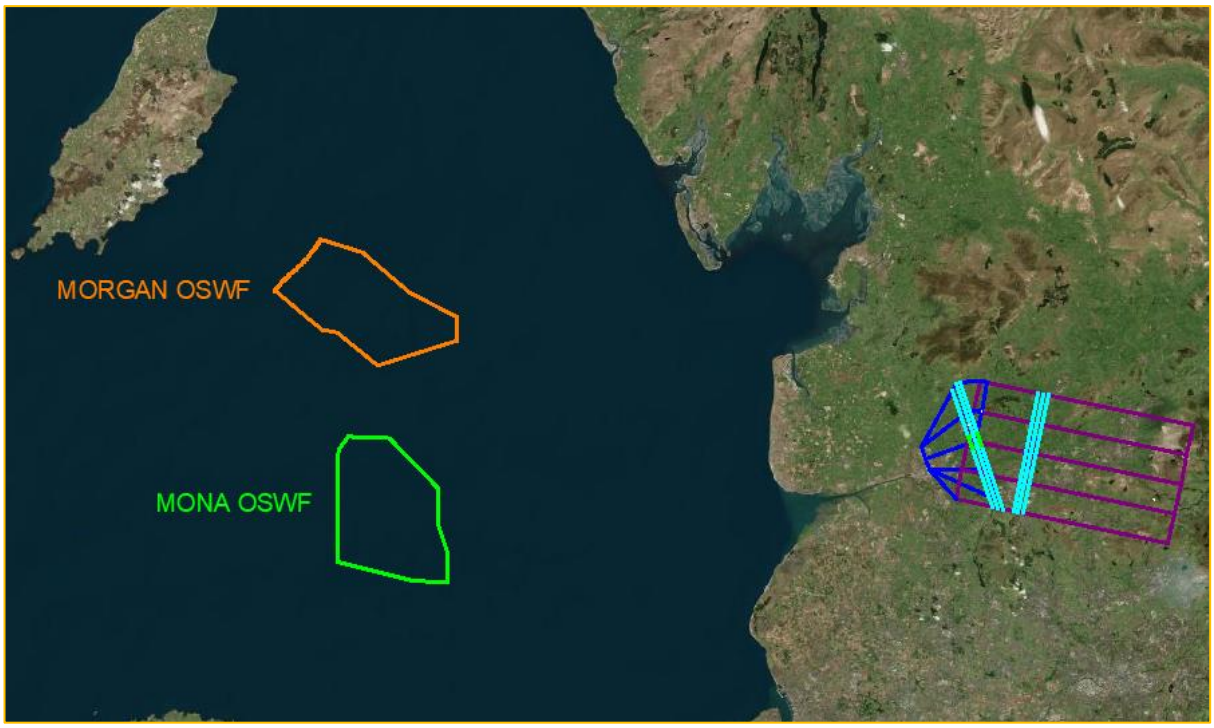

Figure 94 - DIRECT ARRIVAL from POL to ILS/DME RWY 25 Protection Areas

The DME/ILS procedure protection areas has already been assessed along with the Missed Approach in section 4.2.7 and will not be affected.

The proposed windfarms will not impact the published DIRECT ARRIVAL POL to ILS/DME RWY 25 procedure.

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4.2.10 AD 2 EGNO-1-15 NDB/DME RWY 07

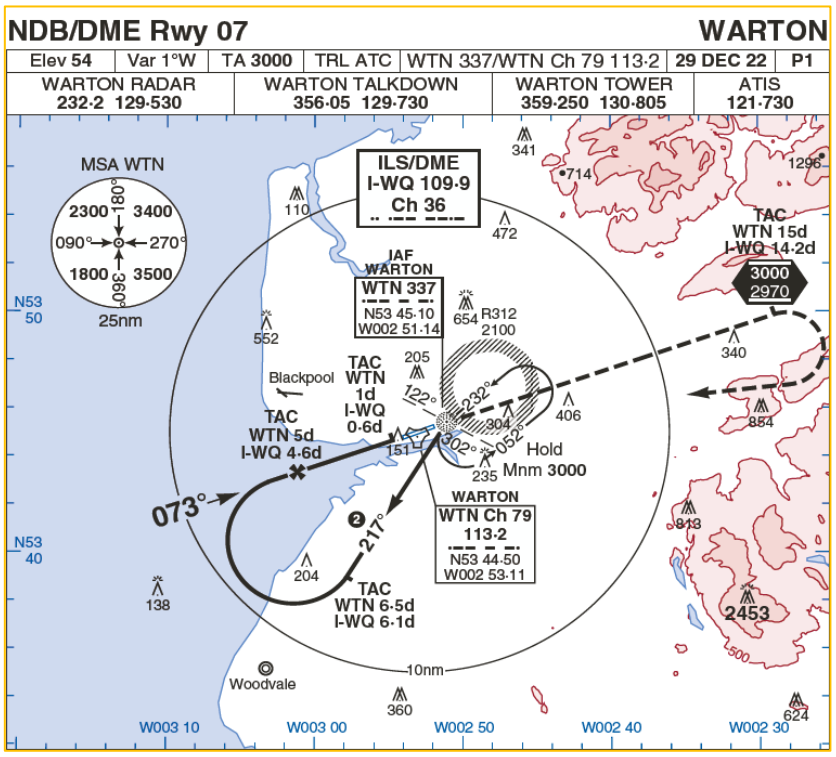

Figure 95 - NDB/DME RWY 07 Procedure

Both windfarms lie outside the protection areas for the NDB/DME procedure to runway 07, including the Missed Approach which heads east, away from the windfarms and will have no impact.

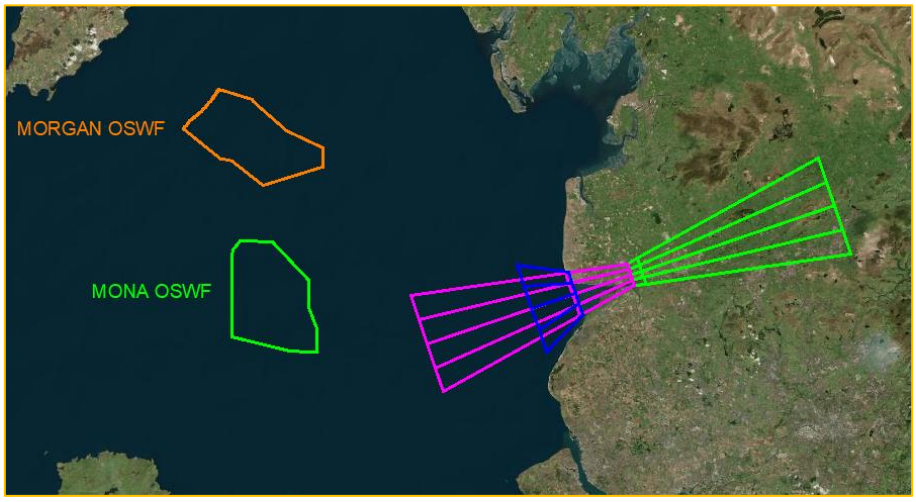

Figure 96 - NDB/DME RWY 07 Protection Areas

The procedure reversals published on the approach chart allows aircraft to descend to 1530ft at the FAF. The protection area for the Base turn has been constructed:

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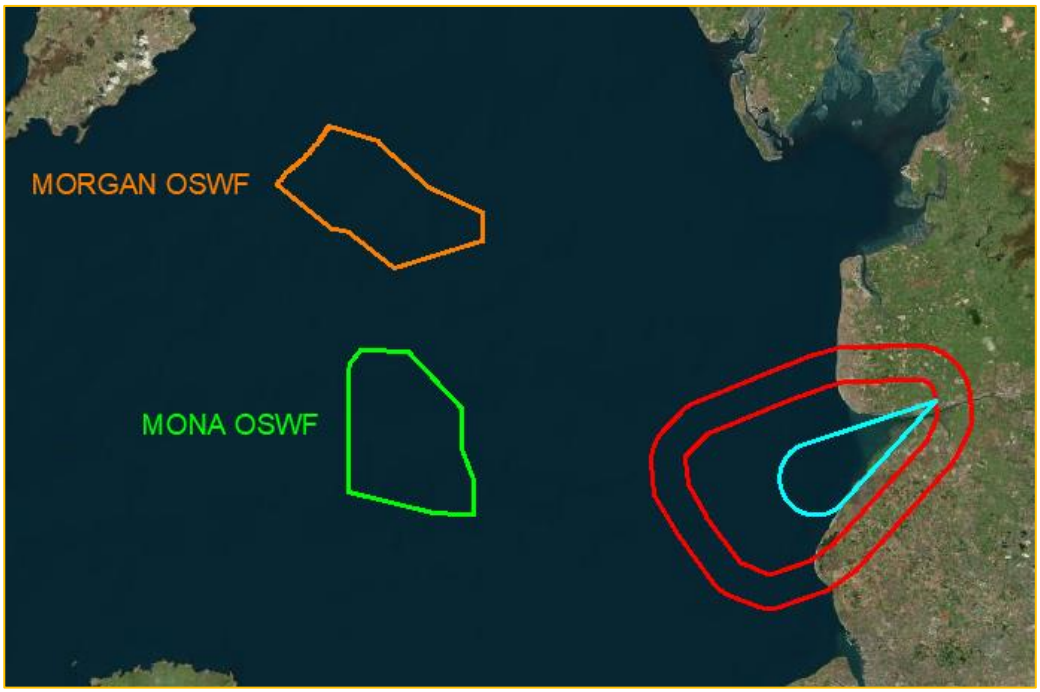

Figure 97 – NDB/DME RWY 07 NDB WTN Base turn Protection Areas

Both windfarms lie outside the protection area for the procedure reversal published on the NDB/DME RWY 07 chart. The NDB WTN Hold has been considered in section 4.2.18.

The proposed windfarms will not impact the published NDB/DME RWY 07 procedure.

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4.2.11 AD 2 EGNO-1-16 NDB RWY 07

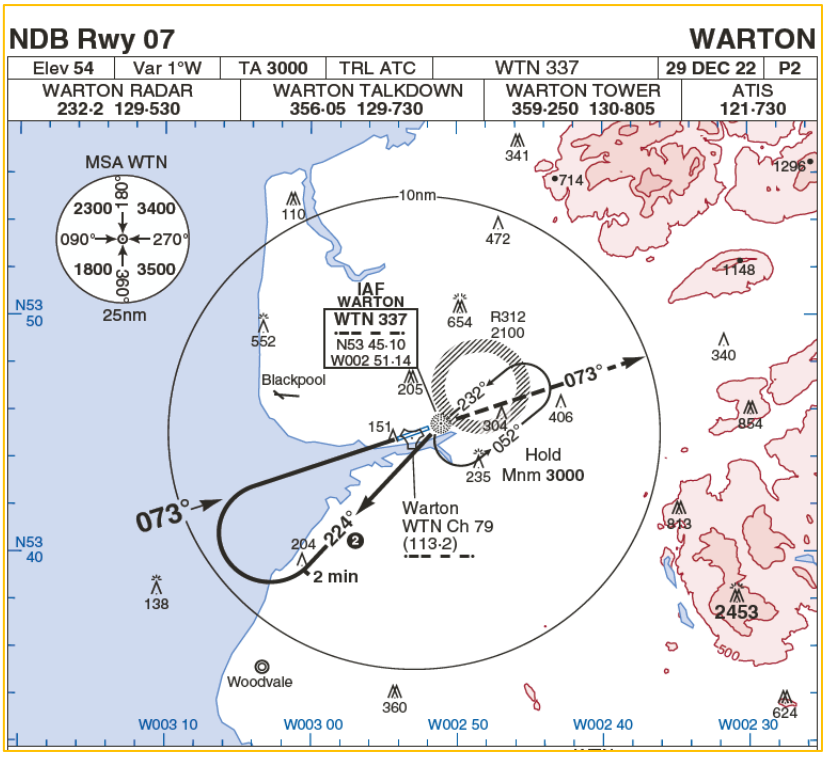

Figure 98 - NDB RWY 07 Procedure

Both windfarms lie outside the protection areas for the NDB procedure to runway 07 and will have no impact.

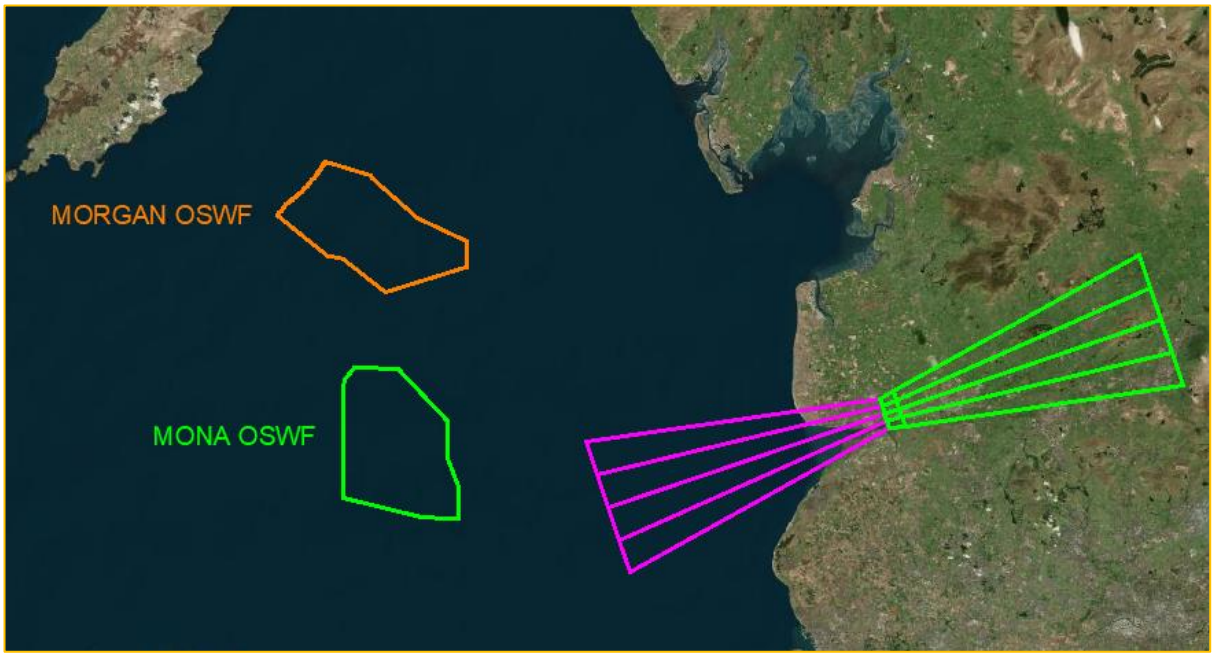

Figure 99 - NDB RWY 07 Protection Areas

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The procedure reversals published on the approach chart allows aircraft to descend to 1730ft in the Base turn. The protection area for the base turn has been constructed:

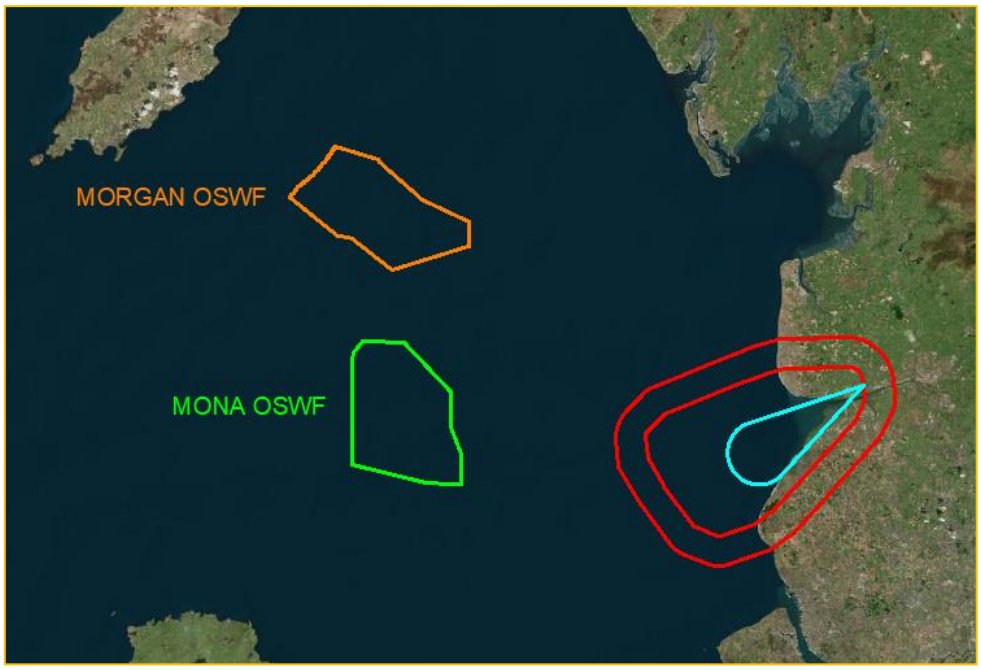

Figure 100 - NDB RWY 07 Base turn Protection Area

Both windfarms lie outside the protection area for the procedure reversal published on the NDB RWY 07 chart.

The proposed windfarms will not impact the published NDB RWY 07 procedure.

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4.2.12 AD 2 EGNO-1-17 DCT ARR WAL to NDB/DME RWY 07

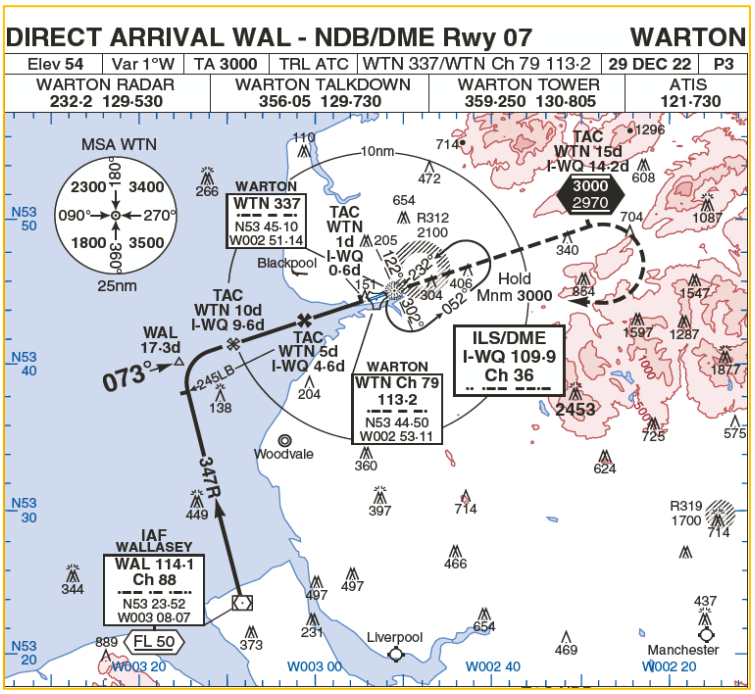

Figure 101 - DIRECT ARRIVAL WAL - NDB/DME RWY 07 Procedure

Both windfarms lie outside the protection areas for the DIRECT ARRIVAL from WAL VOR to the NDB/DME procedure to runway 07, which has already been assessed in section 4.2.10 and will have no impact.

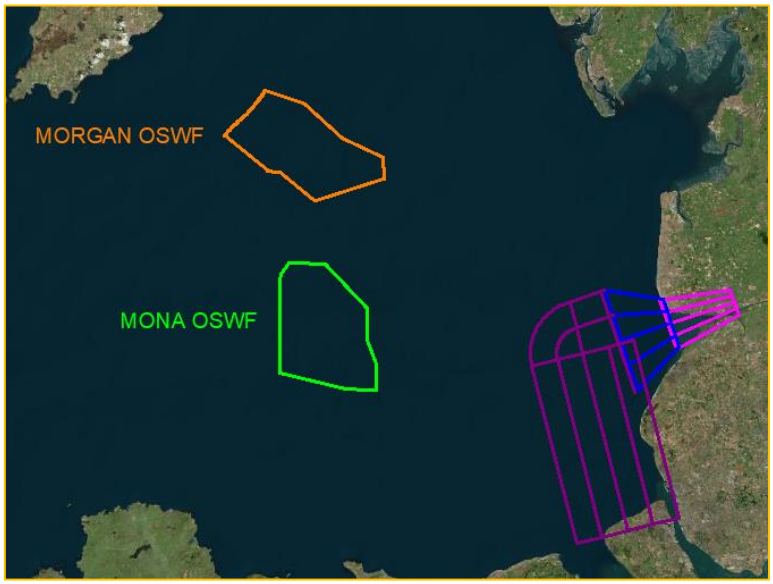

Figure 102 - DIRECT ARRIVAL WAL to NDB/DME RWY 07 Protection Areas

The proposed windfarms will not impact the published DIRECT ARRIVAL WAL to NDB/DME RWY 07 procedure.

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4.2.13 AD 2 EGNO-1-18 TAC RWY 07

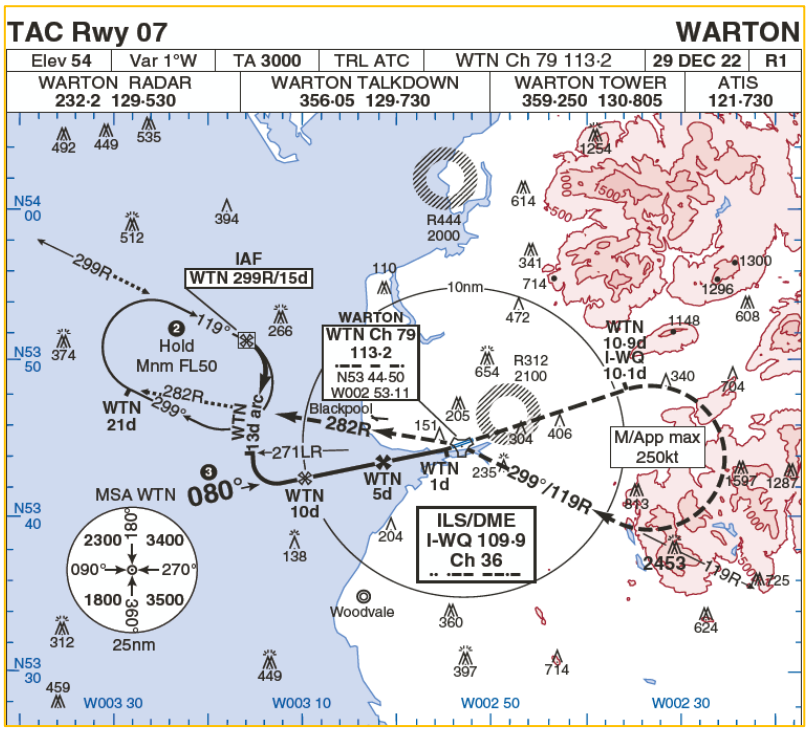

Figure 103 - TAC RWY 07 Procedure

The windfarms lie outside of the protection areas for the TAC approach procedure, including the Missed Approach, and will have no impact.

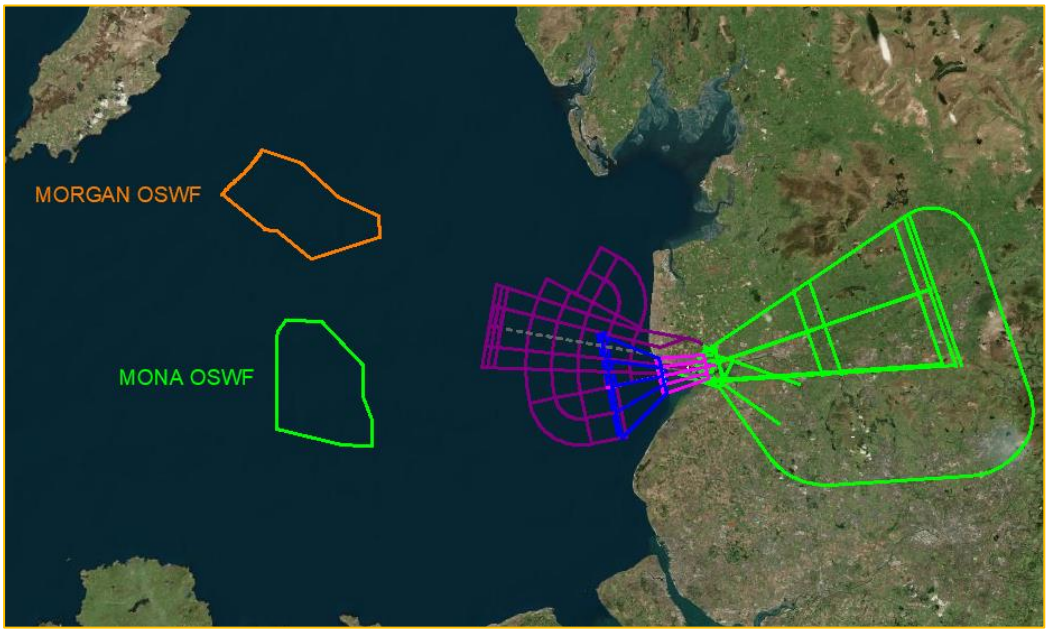

Figure 104 - TAC RWY 07 Protection Areas

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Arrival to the procedure is via the IAF at the WTN Hold at a minimum altitude of FL50 and will not be affected.

The proposed windfarms will not impact the published TAC RWY 07 procedure.

4.2.14 AD 2 EGNO-1-19 TAC RWY 25

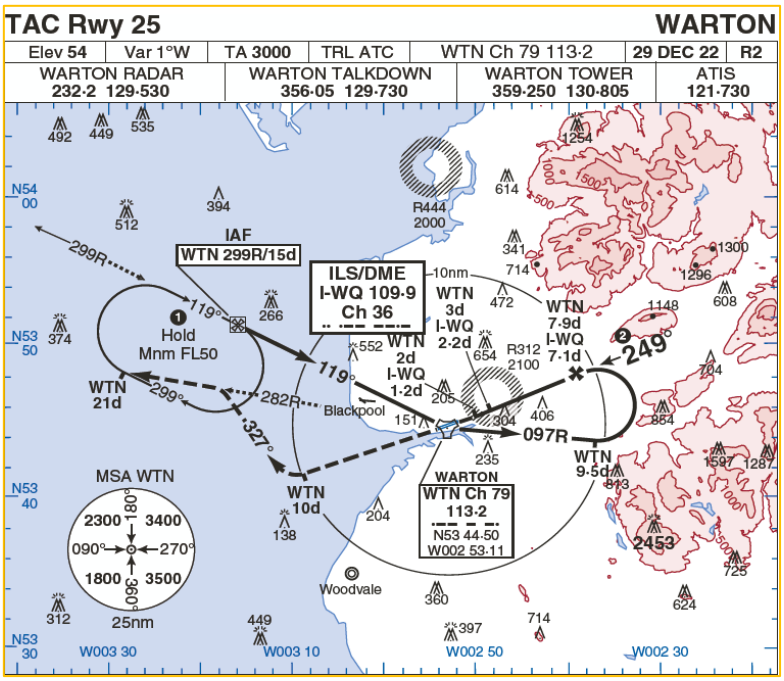

Figure 105 - TAC RWY 25 Procedure

The windfarms lie outside of the protection areas for the TAC approach procedure, including the Missed Approach, and will have no impact.

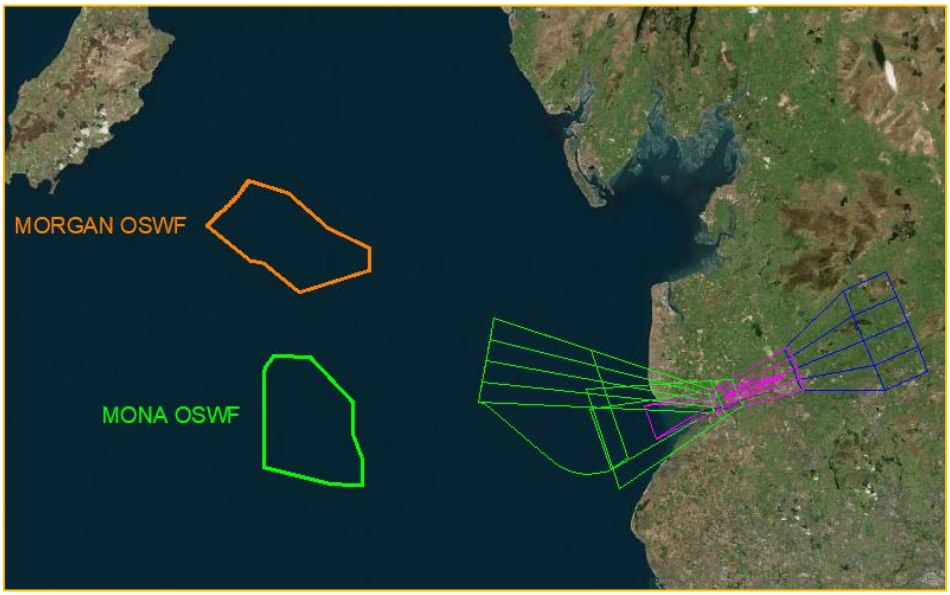

Figure 106 - TAC RWY 25 Protection Areas

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Arrival to the procedure is via the IAF at the WTN Hold at a minimum altitude of FL50 and will not be affected.

The proposed windfarms will not impact the published TAC RWY 25 procedure.

4.2.15 AD 2 EGNO-1-20 HI-TAC RWY 07

The TAC approach procedure to runway 07 has been assessed in section 4.2.13 and will not be affected by the windfarms.

Arrival to the procedure via the IAF at WTN Hold is at FL150 is above the MOCA required at the windfarms.

The proposed windfarms will not impact the published HI-TAC RWY 07 procedure.

4.2.16 AD 2 EGNO-1- 21 HI TAC RWY 25

The TAC approach procedure to runway 25 has been assessed in section 4.2.14 and will not be affected by the windfarms.

Arrival to the procedure via the IAF at WTN Hold at FL150 and is above the MOCA required at the windfarms.

The proposed windfarms will not impact the published HI-TAC RWY 25 procedure.

4.2.17 Visual Circling

Both windfarms are outside the Visual Circling VM(C) Obstacle Clearance areas for all aircraft categories (A, B, C, D and E).

Figure 107 - Visual Circling

The proposed windfarms would have no impact on the Visual Circling at Warton.

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4.2.18 Holding

NDB WTN Hold (All Entries)

The NDB WTN Hold has a published minimum altitude of 3000ft.

With a maximum MOC of 300m, the windfarms would not impact the hold:

- 364m + 300m MOC = 664m / 2179ft AMSL
- Published minimum altitude = 3000ft

WTN IAF Hold

The WTN IAF Hold has a published minimum altitude of FL50.

With a maximum MOC of 300m, the windfarms would not impact the hold:

- 364m + 300m MOC = 664m / 2179ft AMSL
- Published minimum altitude = 5000ft

High WTN Hold

The High WTN Hold has a published minimum altitude of FL150.

With s maximum MOC of 300m, the windfarms would not impact the hold:

- 364m + 300m MOC = 664m / 2179ft AMSL
- Published minimum altitude = 15000ft

The proposed windfarms would have no impact on any of the holds for Warton Airport.

4.2.19 Visual Segment Surface (VSS)

Both windfarms lie outside the lateral confines of VSS for all Runways.

The proposed windfarms would have no impact on the VSS for Warton Airport Runways.

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4.2.20 Minimum Sector Altitudes (MSA)

WTN TAC MSA 25NM

Both windfarms are beyond the extent of the WTN TAC MSA 25NM.

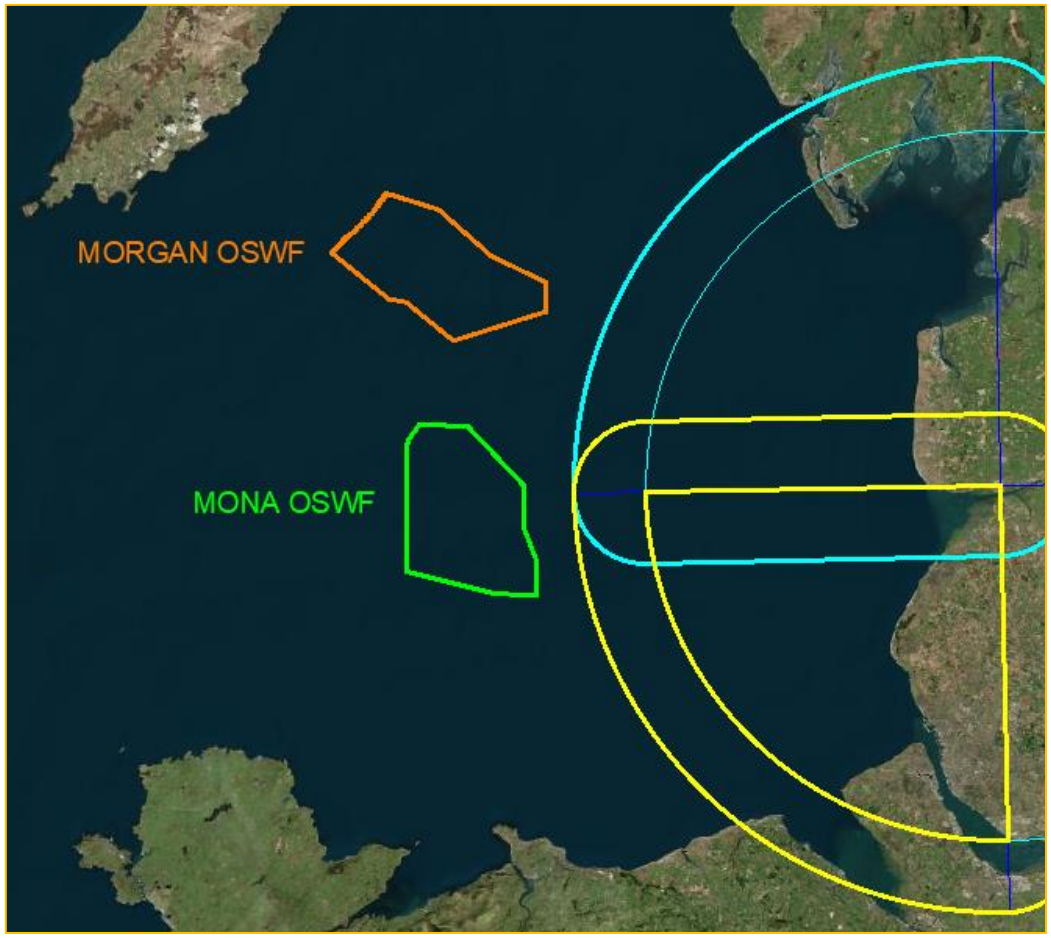

Figure 108 - WTN TAC MSA 25NM

The proposed windfarms would have no impact on the published WTN TAC MSA.

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WTN NDB MSA 25NM

Both windfarms are beyond the extent of the WTN NDB MSA 25NM.

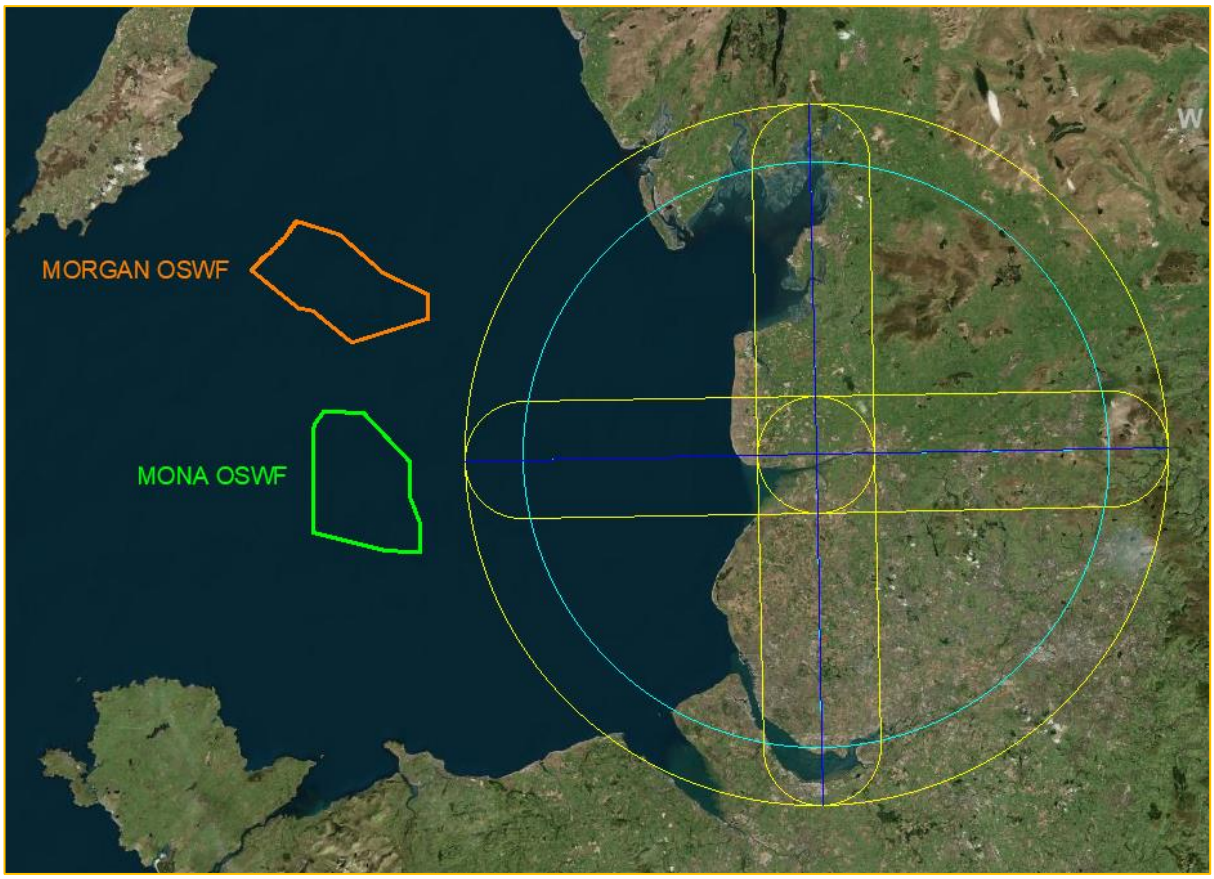

Figure 109 - WTN NDB MSA 25NM

The proposed windfarms would have no impact on the WTN NDB MSA 25NM.

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5 Isle of Man Ronaldsway Airport OLS and IFP Assessment

5.1 OLS Assessment

5.1.1 Overview

The OLS for Isle of Man Airport has been constructed in accordance with Annex 14 and CAP 168.

5.1.2 Runway Data Used

The following declared distances and threshold details are published in the AIP:

Runway designator	TORA	TODA	ASDA	LDA	Remarks
1	2	3	4	5	6
08	1877 M	2815 M	1877 M	1586 M	
26	1909 M	2057 M	1909 M	1613 M	
08	1754 M	2631 M	1754 M		Full width departures
08	1495 M	2242 M	1495 M		Take-off from intersection of Taxiway Bravo
26	1759 M	1907 M	1759 M		Full width departures
26	1470 M	1618 M	1470 M		Take-off from intersection of Taxiway Kilo
03	1199 M	1199 M	1199 M	1105 M	
21	1105 M	1199 M	1105 M	1105 M	

Figure 110 - Declared Distances

Designations RWY Number	True bearing	Dimensions of RWY	Surface of RWY/ SWY/ Strength (PCN)	THR co-ordinates/ THR Geoid undulation	THR elevation/ Highest elevation of TDZ of precision APP RWY	Slope of RWY/ SWY
1	2	3	4	5	6	7
03	027.96°	1199 x 46 M	RWY surface: Asphalt PCN 28/F/B/X/T	540442.70N 0043751.73W 181.0 FT	THR 23.7 FT	
21	207.97°	1199 x 46 M	RWY surface: Asphalt PCN 28/F/B/X/T	540514.27N 0043723.22W 181.0 FT	THR 52.5 FT	
08	077.96°	1837 x 46 M	RWY surface: Asphalt PCN 48/F/C/X/T	540454.97N 0043804.49W 181.0 FT	THR 30.1 FT	
26	257.98°	1837 x 46 M	RWY surface: Asphalt PCN 48/F/C/X/T	540505.25N 0043642.55W 181.0 FT	THR 33.4 FT	

Figure 111 - Threshold Details

Runways 08 and 26 have ILS approaches and both runways are more than 1800m in length. Runways 03 and 21 are less than 1199m in length.

Runway 08 is a CODE 4, Precision Instrument Runway

Runway 26 is a CODE 4, Precision Instrument Runway

Runway 03 is a CODE 2, Non-Precision Runway (**Lowest threshold, 7.22m**)

Runway 21 is a CODE 2, Non-Precision Runway

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5.1.3 OLS Construction

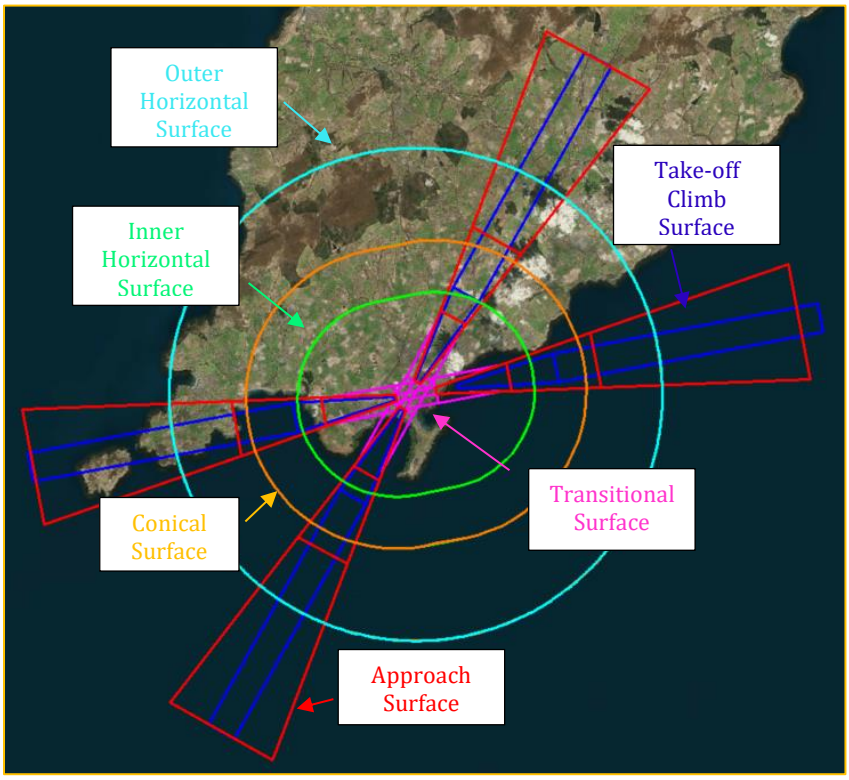

Figure 112 - OLS for Isle of Man Airport

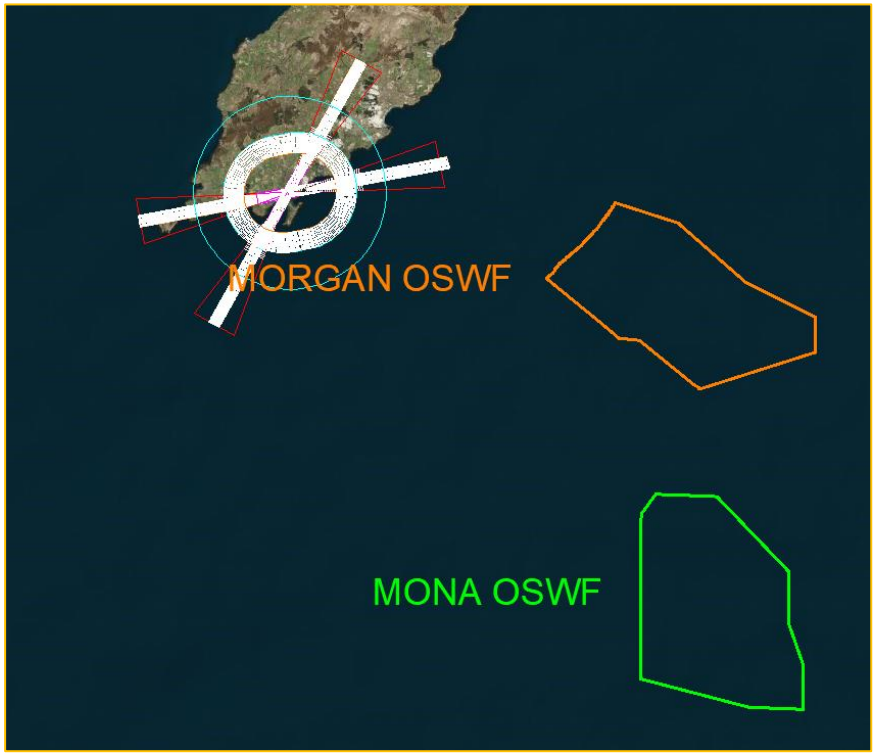

Figure 113 - Isle of Man OLS in Relation to Windfarms

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5.1.4 OLS Analysis

The OLS for Isle of Man Airport lies entirely outside of the boundaries of both windfarms and is not affected by the development.

The proposed windfarms will have no impact on the OLS for Isle of Man Airport.

5.2 IFP Assessment

The ATCSMAC and IFPs assessed are as follows:

AIRAC 09/2023 (Effective 07 SEP 2023)

- AD 2.EGNS-5-1 ATCSMAC (24 MAR 22);
- AD 2.EGNS-8-1 SRA RTR 2NM RWY 03 (07 Sep 2023);
- AD 2.EGNS-8-2 OFFSET ILS/DME RWY 08 (07 Sep 2023);
- AD 2.EGNS-8-3 OFFSET LOC/DME RWY 08 (07 Sep 2023);
- AD 2.EGNS-8-4 SRA RTR 2NM RWY 08 (07 Sep 2023);
- AD 2.EGNS-8-5 VOR/DME RWY 08 (07 Sep 2023);
- AD 2.EGNS-8-6 NDB(L)/DME RWY 08 (07 Sep 2023);
- AD 2.EGNS-8-7 ILS/DME RWY 26 (07 Sep 2023);
- AD 2.EGNS-8-8 LOC/DME RWY 26 (07 Sep 2023);
- AD 2.EGNS-8-9 SRA RTR 2NM RWY 26 (07 Sep 2023);
- AD 2.EGNS-8-10 NDB(L)/DME RWY 26 (07 Sep 2023).

Additionally, the following were checked:

- Visual Circling
- Holding
- Visual Segment Surface (VSS)
- Minimum Sector Altitudes (MSA)

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5.2.1 AD 2.EGNS-5-1 ATCSMAC

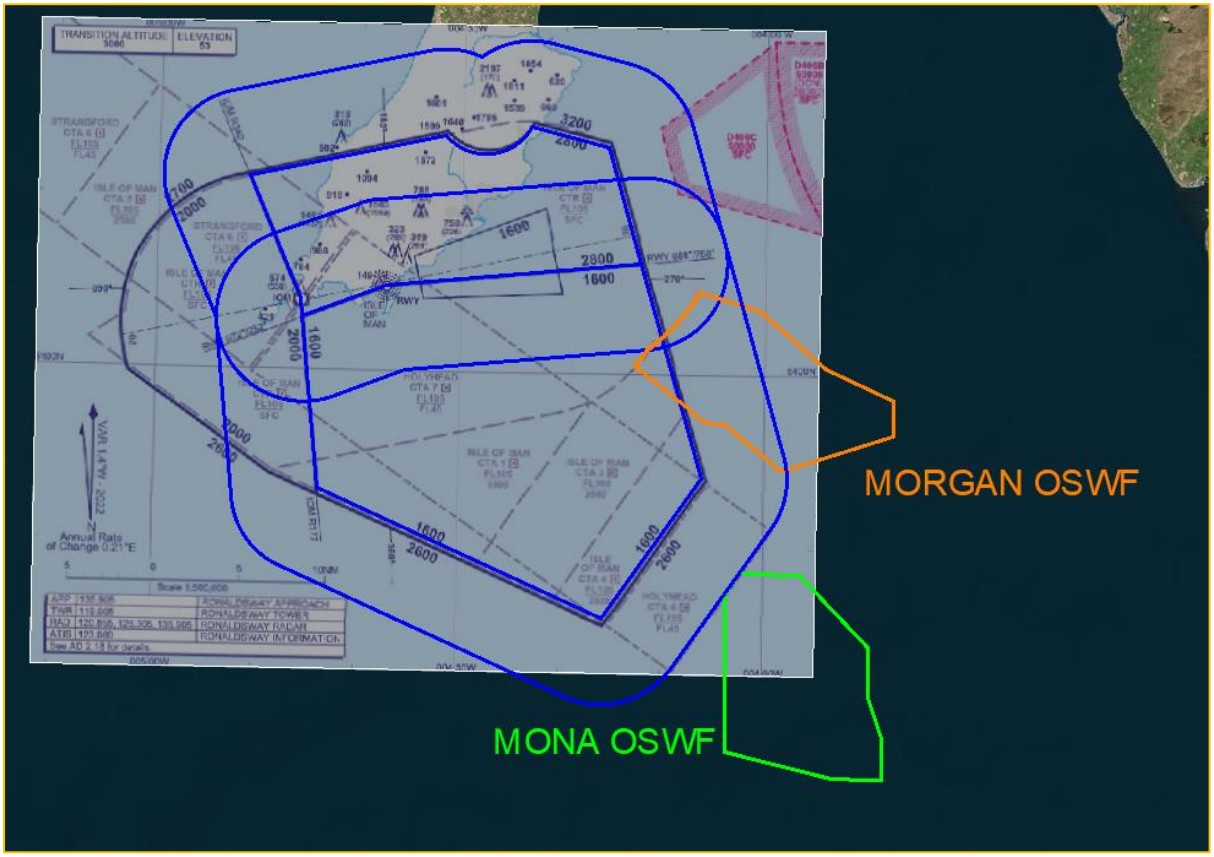

Figure 114 - Windfarms in Relation to ATCSMAC

The Morgan windfarm development is within the lateral confines of the SMAA (Surveillance Minimum Altitude Area) which has a 5NM buffer applied. The area has a MOCA (Minimum Obstacle Clearance Altitude) of 1600ft.

The Morgan Windfarm development also lies in the buffer area of the 2800ft area.

Using the development elevation of 364m AMSL, the development produces an OCA of 364m + 300m MOC (Minimum Obstacle Clearance) = 664m / 2179ft AMSL.

The Morgan development would have a potential impact on the Isle of Man's ATCSMAC and would require the 1600ft area to be raised to 2200ft.

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5.2.2 SRA RTR 2NM RWY 03

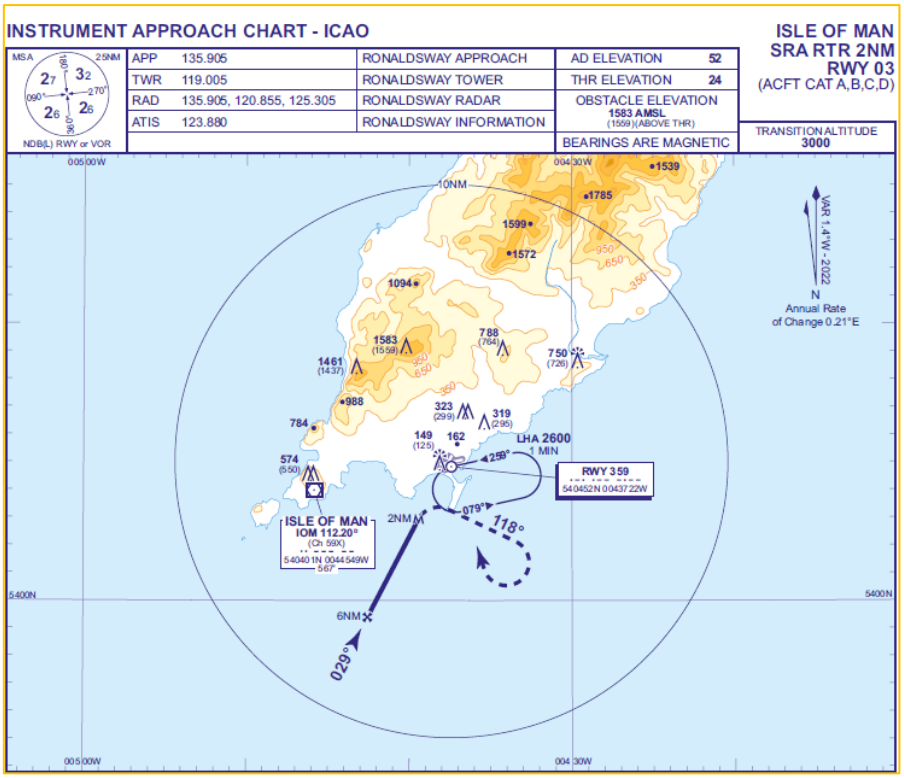

Figure 115 - SRA RWY03

The Mona windfarm lies outside the protection areas associated to SRA Procedure to Runway 03 and therefore will not impact the procedure.

The Morgan windfarm lies within the protection areas associated to the Final Missed Approach and could potentially impact the procedure:

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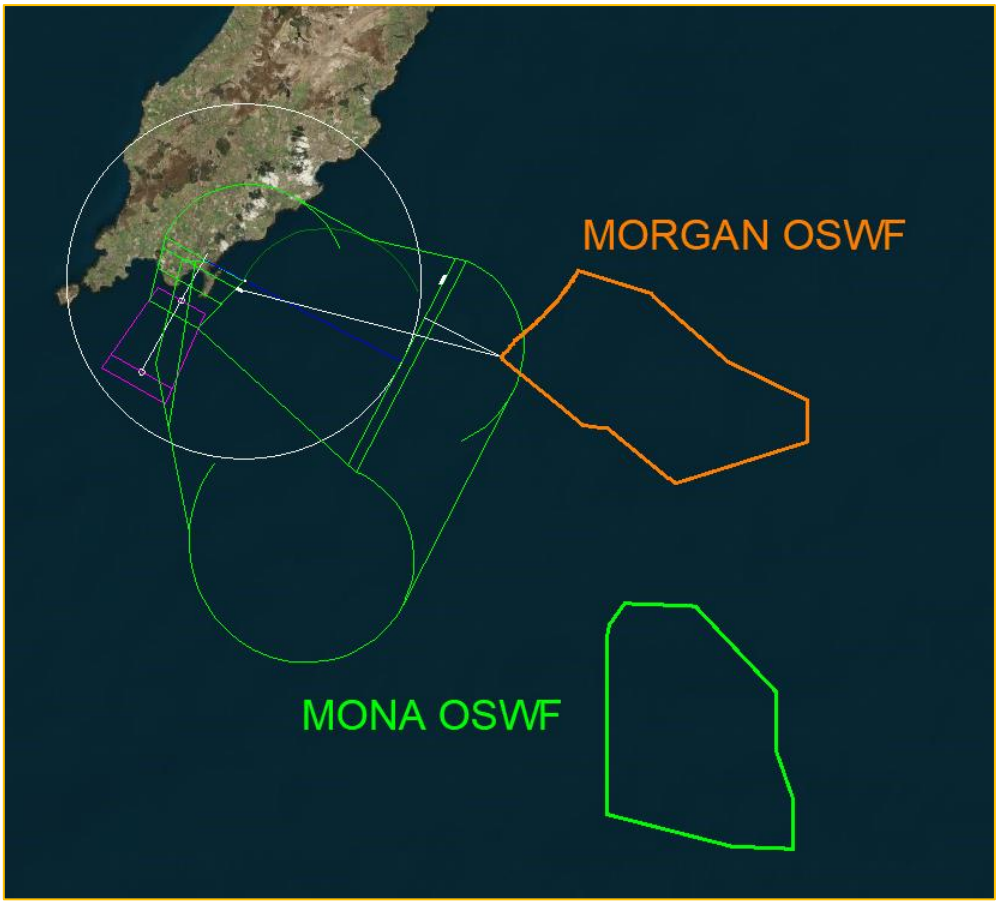

Figure 116 - Morgan and Mona Windfarm vs SRA RWY 03 Protection Areas

The Missed Approach text is as follows:

Continuous climb to 3000, from the MAPt climbing right turn onto track 118° then when passing 2000 right turn to NDB(L) RWY at 3000 or as directed.

The procedure OCA is 680ft and therefore aircraft would not be allowed to turn lower than that.

The shortest distance from the 680ft TIA to the Morgan Windfarm is 24817.29m. With a 2.5% Missed Approach Climb Gradient, aircraft would be at 680ft + 0.025*24817.29m = 827.69m / 2715ft at the obstacle.

Additionally, the shortest distance from the second 2000ft TIA to the Morgan Windfarm has been measured to be 7814.42m. With a 2.5% Missed Approach Climb Gradient, aircraft would be at 2000ft + 0.025*7814.42m = 804.96m / 2640ft at the obstacle.

Both calculations provide sufficient clearance as the MOC for the Final Missed Approach is 50m and therefore aircraft should be at a minimum of 364m + 50m = 414m / 1359ft to safely clear the obstacle.

The proposed windfarms will not have an impact on the SRA RWY 03 Procedure.

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5.2.3 OFFSET ILS/DME RWY 08

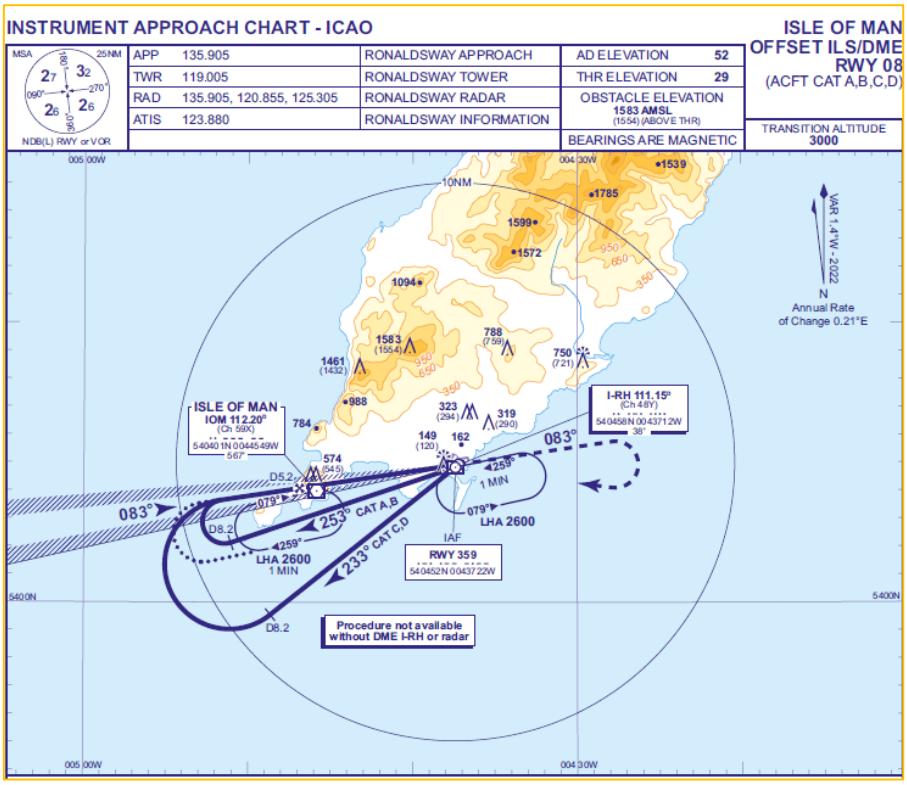

Figure 117 - OFFSET ILS/DME RWY08

The Mona windfarm lies outside the protection areas associated to the Offset ILS to Runway 08 and therefore will not impact the procedure.

The Morgan windfarm lies outside the ILS OAS but within the protection areas associated to the Final Missed Approach and could potentially impact the procedure:

COMMERCIAL IN CONFIDENCE

COMMERCIAL IN CONFIDENCE

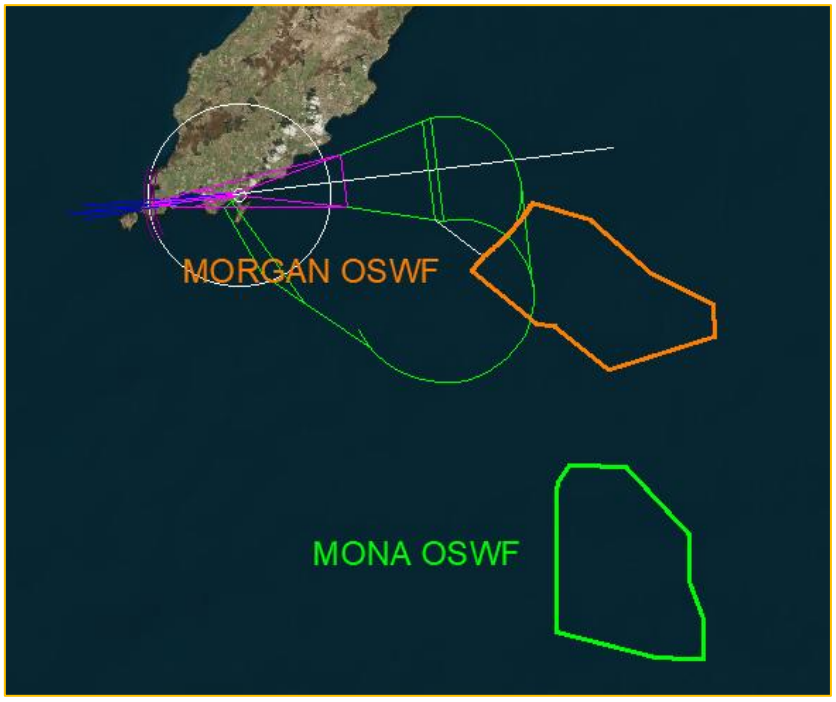

Figure 118 - Morgan and Mona Windfarm vs OFFSET ILS/DME RWY 08 Protection Areas

The Missed Approach text is as follows:

Continuous climb to 3000, initially straight ahead to 2000 then right turn to NDB(L) RWY at 3000 or as directed.

The shortest distance from the 2000ft TIA to the Morgan Windfarm has been measured to be 6969.58m. With a 2.5% Missed Approach Climb Gradient, aircraft would be at 2000ft + 0.025*6969.58m = 783.83m / 2571ft at the obstacle.

This provides sufficient clearance as the MOC for the Final Missed Approach is 50m and therefore aircraft should be at a minimum of 364m + 50m = 414m / 1359ft to safely clear the obstacle.

Additionally, procedure reversals published on the approach chart (CAT A,B & CAT C,D Base turns and the Alternative Extended Holding Pattern, as per the textual note in the chart) from IOM VOR have been constructed:

COMMERCIAL IN CONFIDENCE

COMMERCIAL IN CONFIDENCE

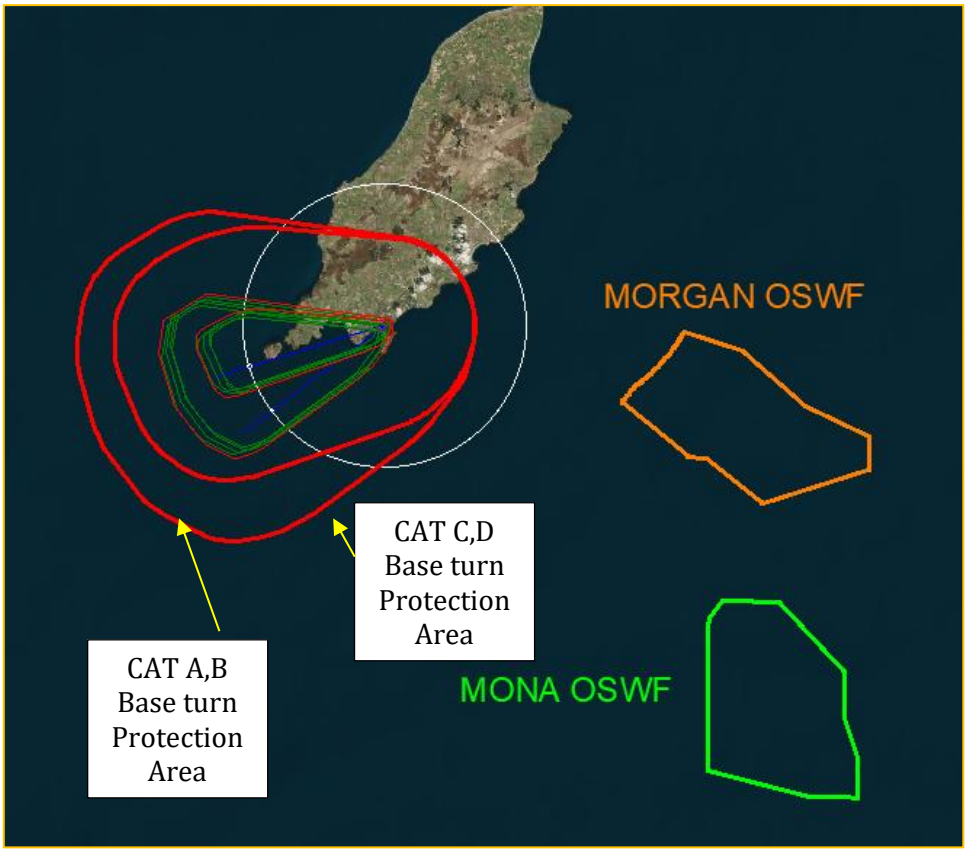

Figure 119 - Windfarms vs OFFSET ILS/DME RWY 08 Base turns

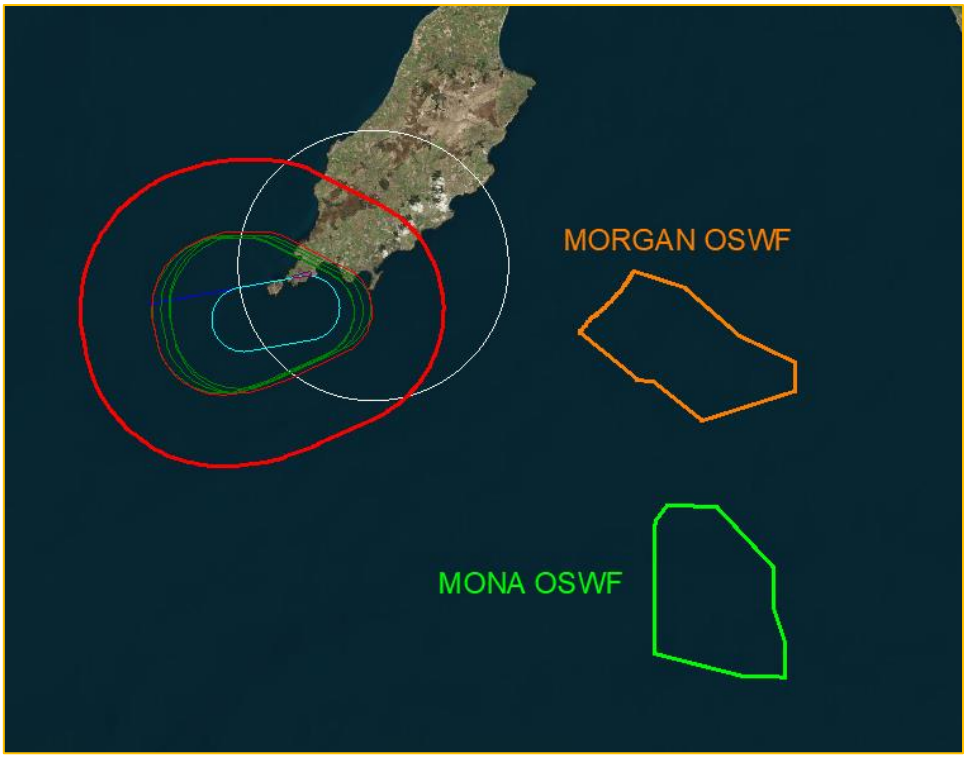

Figure 120 - Windfarms vs OFFSET ILS/DME RWY 08 Extended Holding

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As both windfarms are outside the protection areas for the base turn and the extended holding, they will not impact the reversals.

The proposed windfarms will not have an impact on the OFFSET ILS/DME RWY 08 Procedure.

5.2.4 OFFSET LOC/DME RWY 08

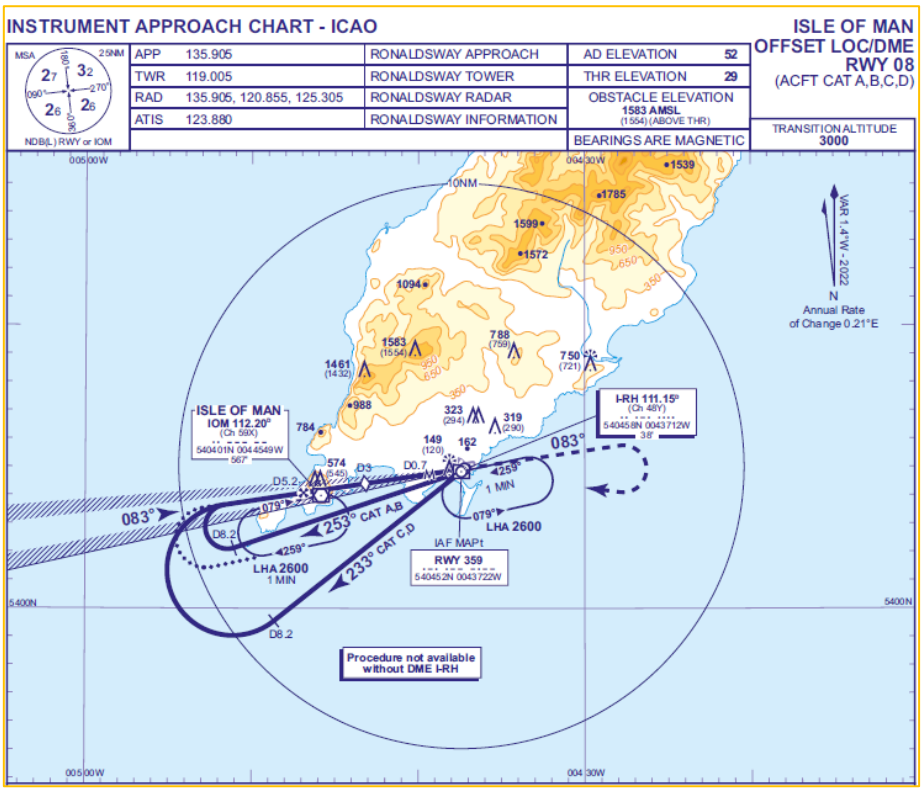

Figure 121 - OFFSET LOC/DME RWY 08

The Mona windfarm lies outside the protection areas associated to the Offset LOC to Runway 08 and therefore will not impact the procedure.

The Morgan windfarm lies outside the Final Approach Areas but within the protection areas associated to the Final Missed Approach and could potentially impact the procedure:

COMMERCIAL IN CONFIDENCE

COMMERCIAL IN CONFIDENCE

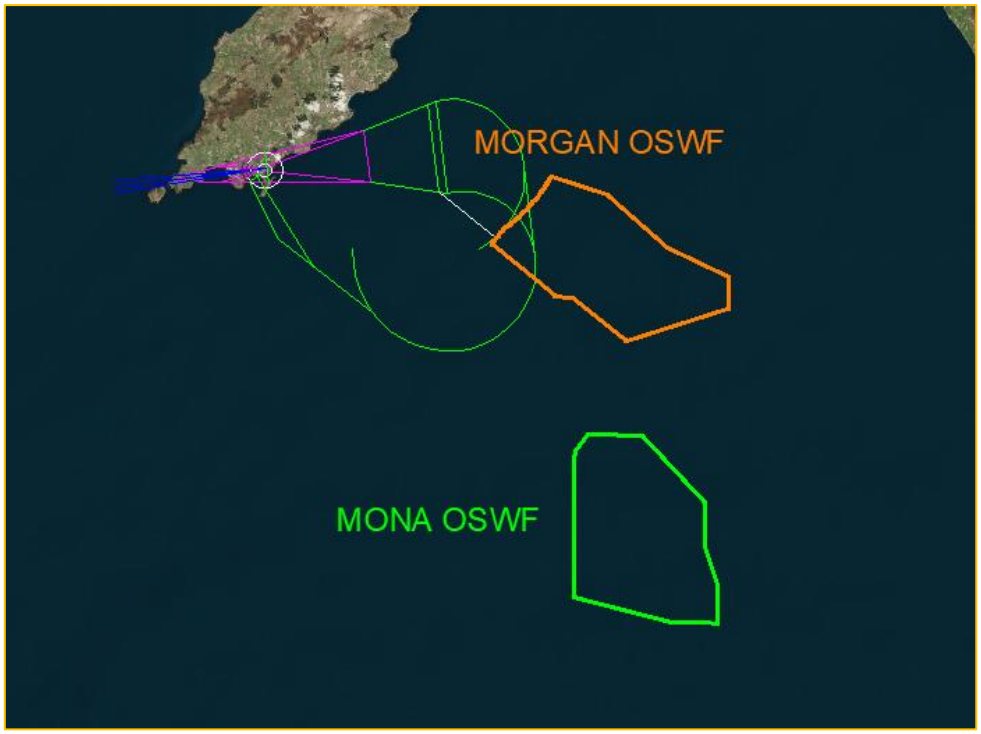

Figure 122 - Morgan and Mona Windfarm vs OFFSET LOC/DME RWY 08 Protection Areas

The Missed Approach text is as follows:

Continuous climb to 3000, initially straight ahead to 2000 then right turn to NDB(L) RWY at 3000 or as directed.

The shortest distance from the 2000ft TIA to the Morgan Windfarm has been measured to be 8645.55m. With a 2.5% Missed Approach Climb Gradient, aircraft would be at 2000ft + 0.025*8645.55m = 825.73m / 2709ft at the obstacle.

This provides sufficient clearance as the MOC for the Final Missed Approach is 50m and therefore aircraft should be at a minimum of 364m + 50m = 414m / 1359ft to safely clear the obstacle.

Additionally, procedure reversals published on the approach chart (CAT A,B & CAT C,D Base turns and the Alternative Extended Holding Pattern, as per the textual note in the chart) from IOM VOR have already been assessed in Section 5.2.3 and are not impacted.

The proposed windfarms will not have an impact on the OFFSET LOC/DME RWY 08 Procedure.

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5.2.5 SRA RTR 2NM RWY 08

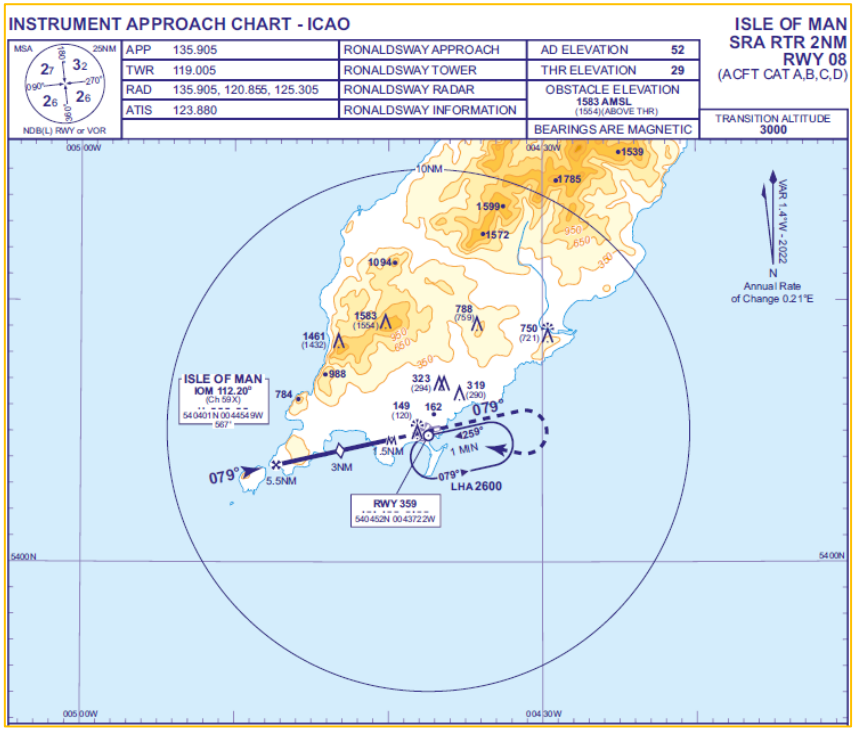

Figure 123 - SRA RWY 08

The Mona windfarm lies outside the protection areas associated to the SRA to Runway 08 and therefore will not impact the procedure.

The Morgan windfarm lies within the protection areas associated to the Final Missed Approach and could potentially impact the procedure:

COMMERCIAL IN CONFIDENCE

COMMERCIAL IN CONFIDENCE

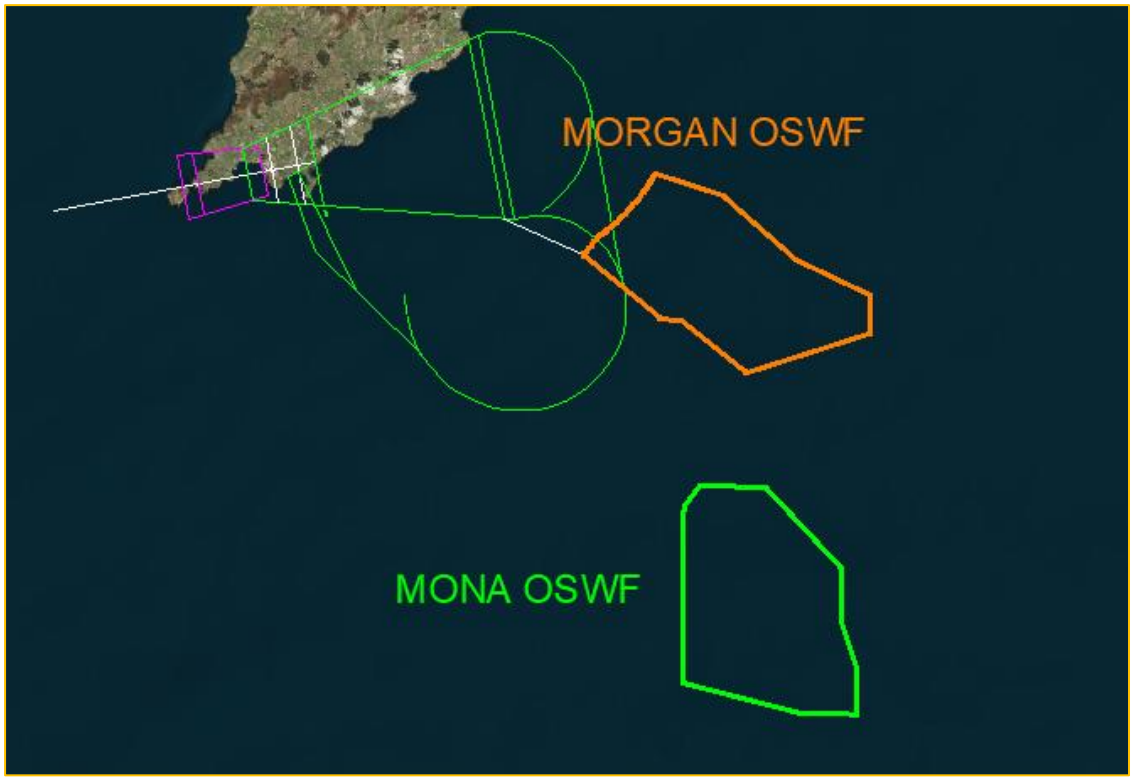

Figure 124 - Morgan and Mona Windfarm vs SRA RWY 08 Protection Areas

The Missed Approach text is as follows:

Continuous climb to 3000, initially straight ahead 2000 then right turn to NDB(L) RWY at 3000 or as directed.

The shortest distance from the 2000ft TIA to the Morgan Windfarm is 8476.58m. With a 2.5% Missed Approach Climb Gradient, aircraft would be at 2000ft + 0.025*8476.58m = 821.51m / 2695ft at the obstacle.

This provides sufficient clearance as the MOC for the Final Missed Approach is 50m and therefore aircraft should be at a minimum of 364m + 50m = 414m / 1359ft to safely clear the obstacle.

The proposed windfarms will not have an impact on the SRA RWY 08 Procedure.

COMMERCIAL IN CONFIDENCE

COMMERCIAL IN CONFIDENCE

5.2.6 VOR/DME RWY 08

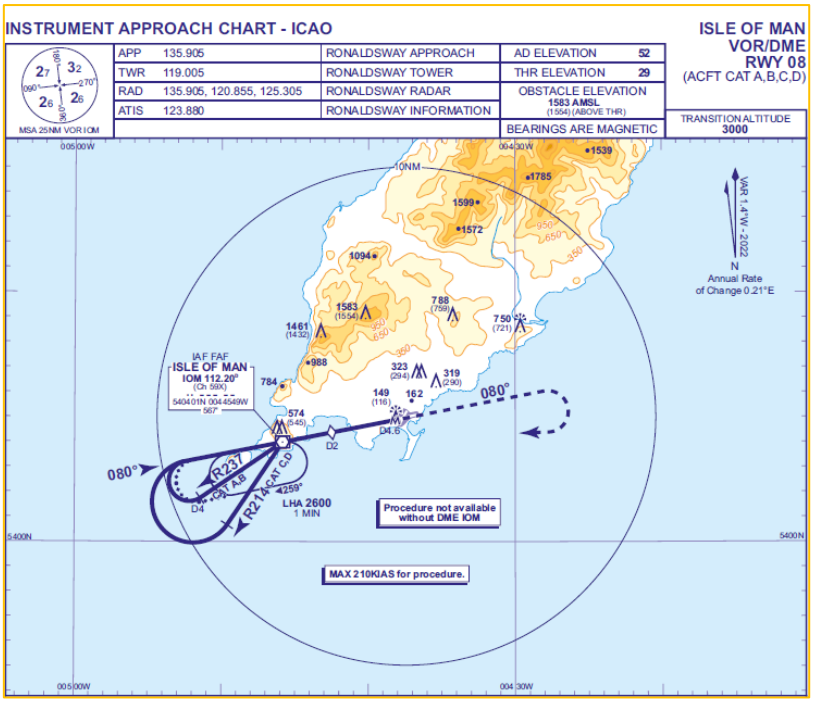

Figure 125 - VOR/DME RWY 08

The Mona windfarm lies outside the protection areas associated to the VOR/DME to Runway 08 and therefore will not impact the procedure.

The Morgan windfarm lies outside the Final Approach Areas but within the protection areas associated to the Final Missed Approach and could potentially impact the procedure:

COMMERCIAL IN CONFIDENCE

COMMERCIAL IN CONFIDENCE

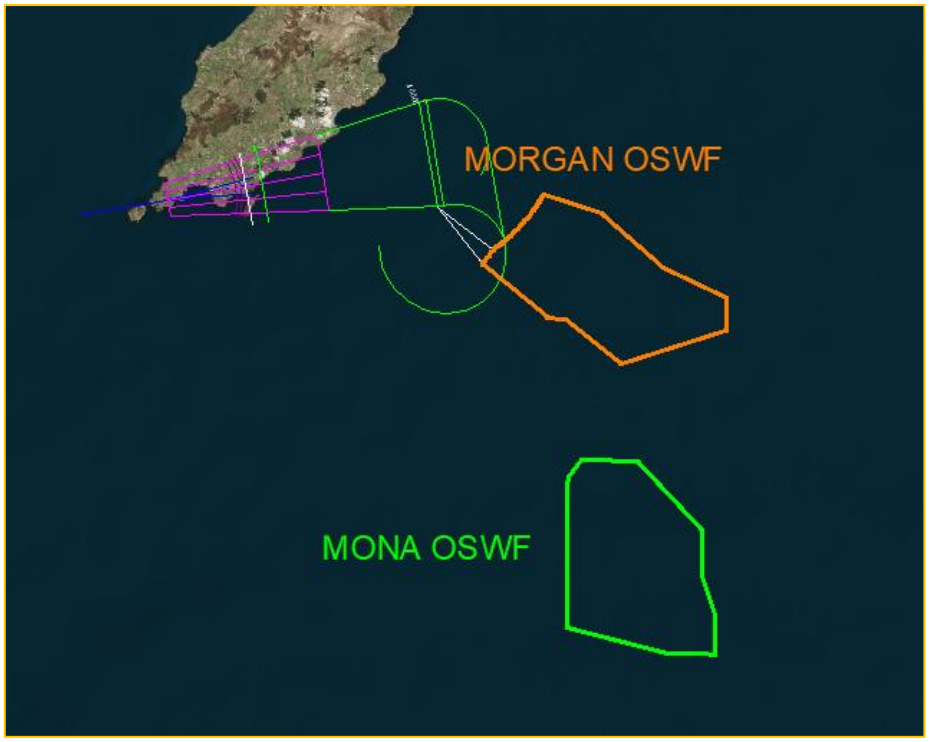

Figure 126 - Morgan and Mona Windfarm vs VOR/DME RWY 08 Protection Areas

The Missed Approach text is as follows:

Continuous climb to 3000, initially on IOM VOR R080 to 2000 then turn right to VOR IOM at 3000 or as directed.

The shortest distance from the 2000ft TIA to the Morgan Windfarm has been measured to be 8081.75m. With a 2.5% Missed Approach Climb Gradient, aircraft would be at 2000ft + 0.025*8081.75m = 811.64m / 2662ft at the obstacle.

This provides sufficient clearance as the MOC for the Final Missed Approach is 50m and therefore aircraft should be at a minimum of 364m + 50m = 414m / 1359ft to safely clear the obstacle.

Additionally, procedure reversals published on the approach chart (CAT A,B & CAT C,D Base turns and the Alternative Extended Holding Pattern, as per the textual note in the chart) from IOM VOR have been constructed:

COMMERCIAL IN CONFIDENCE

COMMERCIAL IN CONFIDENCE

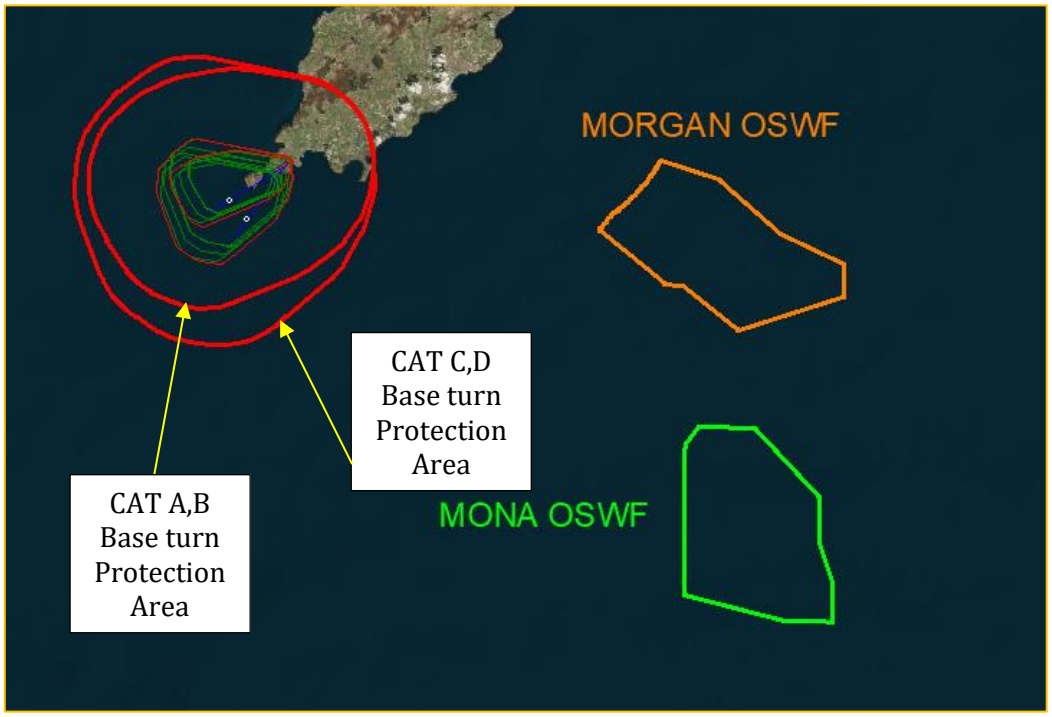

Figure 127 - Windfarms vs VOR/DME RWY 08 Base turns

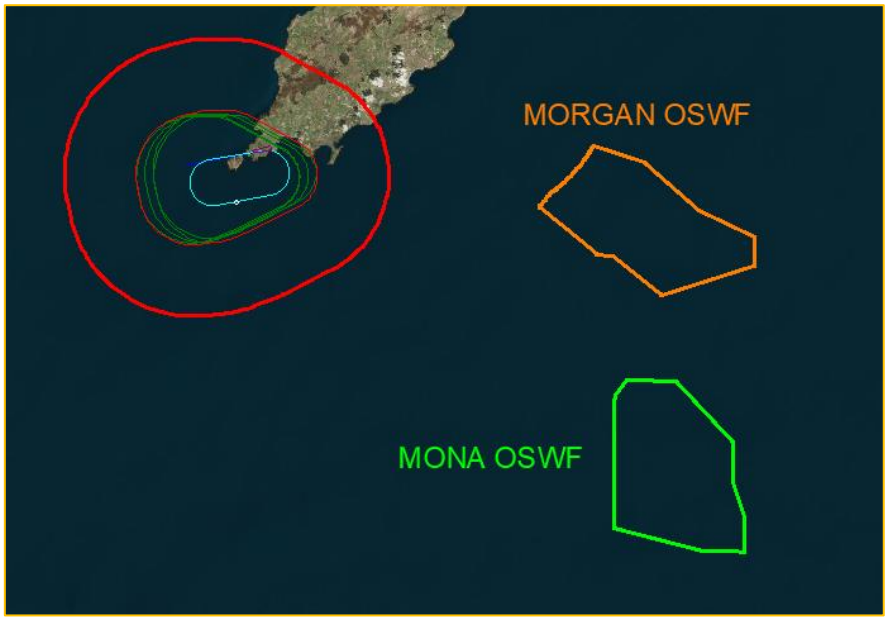

Figure 128 - Windfarms vs VOR/DME RWY 08 Extended Holding

As both windfarms are outside the protection areas for the base turn and the extended holding, they will not impact the reversals.

The proposed windfarms will not have an impact on the VOR/DME RWY 08 Procedure.

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5.2.7 NDB(L)/DME RWY 08

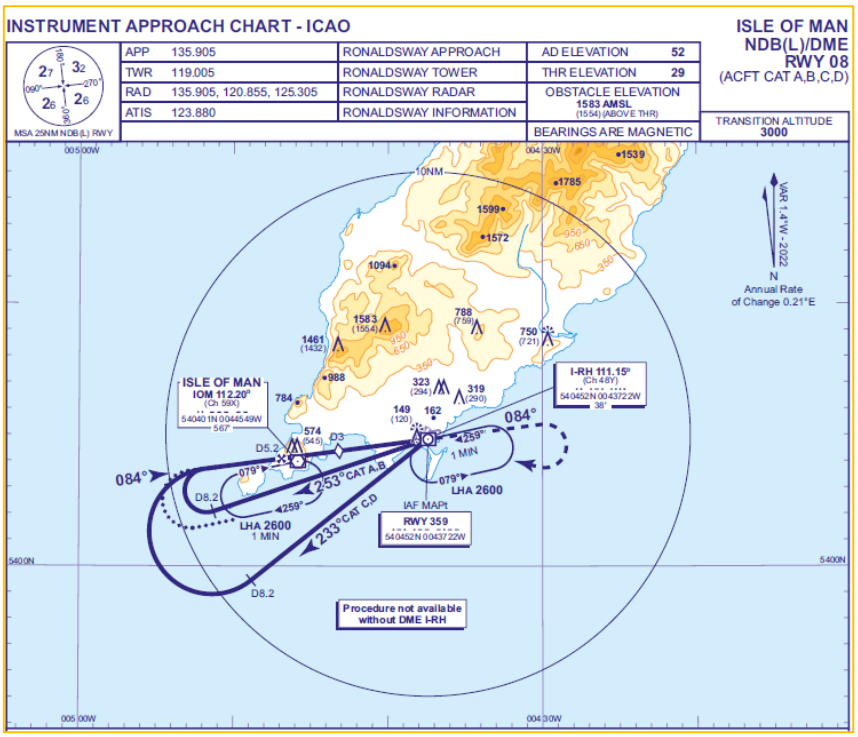

Figure 129 - NDB(L)/DME RWY 08

The Mona windfarm lies outside the protection areas associated to the NDB(L)/DME to Runway 08 and therefore will not impact the procedure.

The Morgan windfarm lies outside the Final Approach Areas but within the protection areas associated to the Final Missed Approach and could potentially impact the procedure:

COMMERCIAL IN CONFIDENCE

COMMERCIAL IN CONFIDENCE

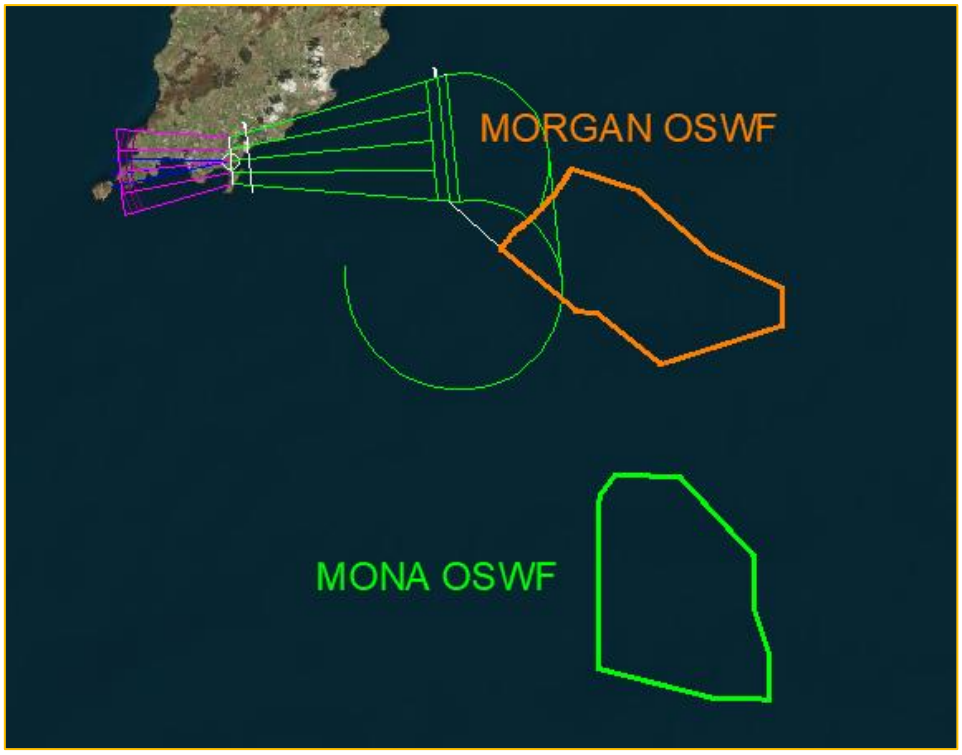

Figure 130 - Morgan and Mona Windfarm vs NDB(L)/DME RWY 08 Protection Areas

The Missed Approach text is as follows:

Continuous climb to 3000, initially on NDB(L) RWY QDM 084° to 2000 then turn right to NDB(L) RWY at 3000 or as directed.

The shortest distance from the 2000ft TIA to the Morgan Windfarm has been measured to be 6859.47m. With a 2.5% Missed Approach Climb Gradient, aircraft would be at 2000ft + 0.025*6859.47m = 781.08m / 2562ft at the obstacle.

This provides sufficient clearance as the MOC for the Final Missed Approach is 50m and therefore aircraft should be at a minimum of 364m + 50m = 414m / 1359ft to safely clear the obstacle.

Additionally, procedure reversals published on the approach chart (CAT A,B & CAT C,D Base turns and the Alternative Extended Holding Pattern, as per the textual note in the chart) from IOM VOR have been constructed:

COMMERCIAL IN CONFIDENCE

COMMERCIAL IN CONFIDENCE

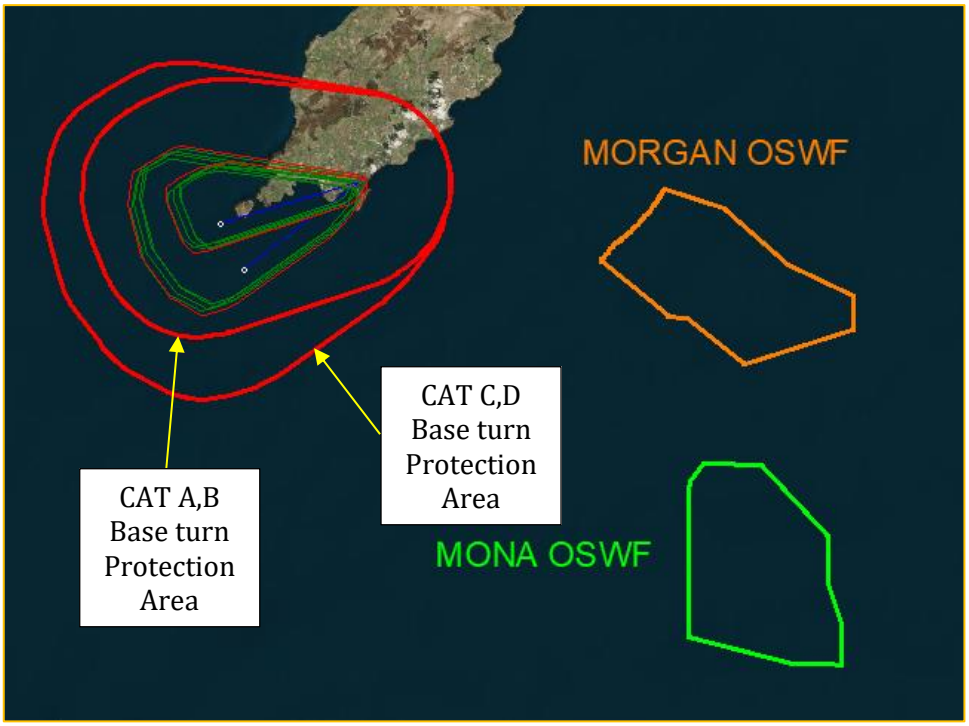

Figure 131 - Windfarms vs NDB(L)/DME RWY 08 Base turns

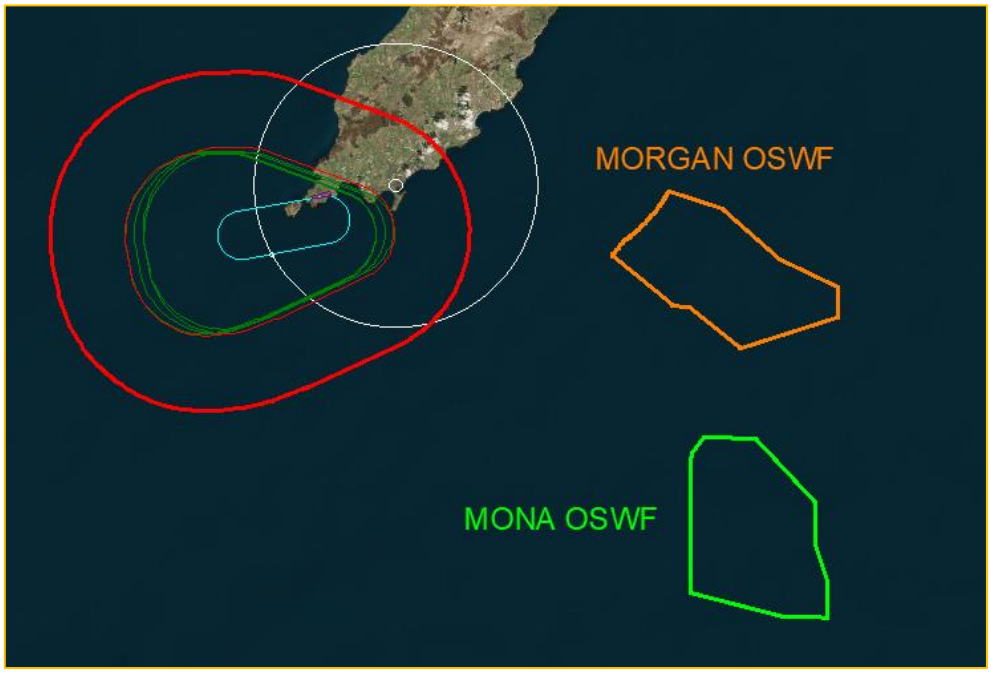

Figure 132 - Windfarms vs NDB(L)/DME RWY 08 Extended Holding

As both windfarms are outside the protection areas for the base turn and the extended holding, they will not impact the reversals.

The proposed windfarms will not have an impact on the NDB(L)/DME RWY 08 Procedure.

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COMMERCIAL IN CONFIDENCE

5.2.8 ILS/DME RWY 26

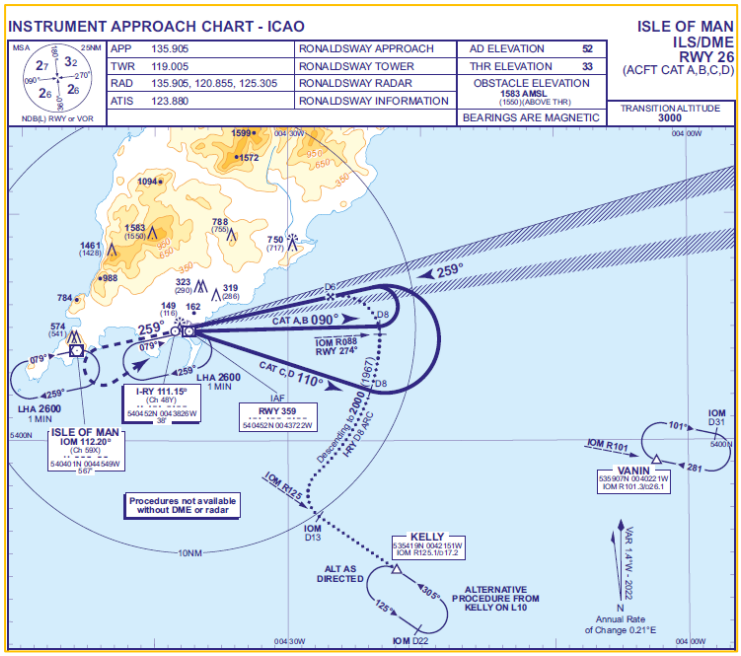

Figure 133 - ILS/DME RWY 26

Both windfarms (Morgan and Mona) lie outside the final approach and missed approach protection areas associated to the ILS/DME Procedure to Runway 26.

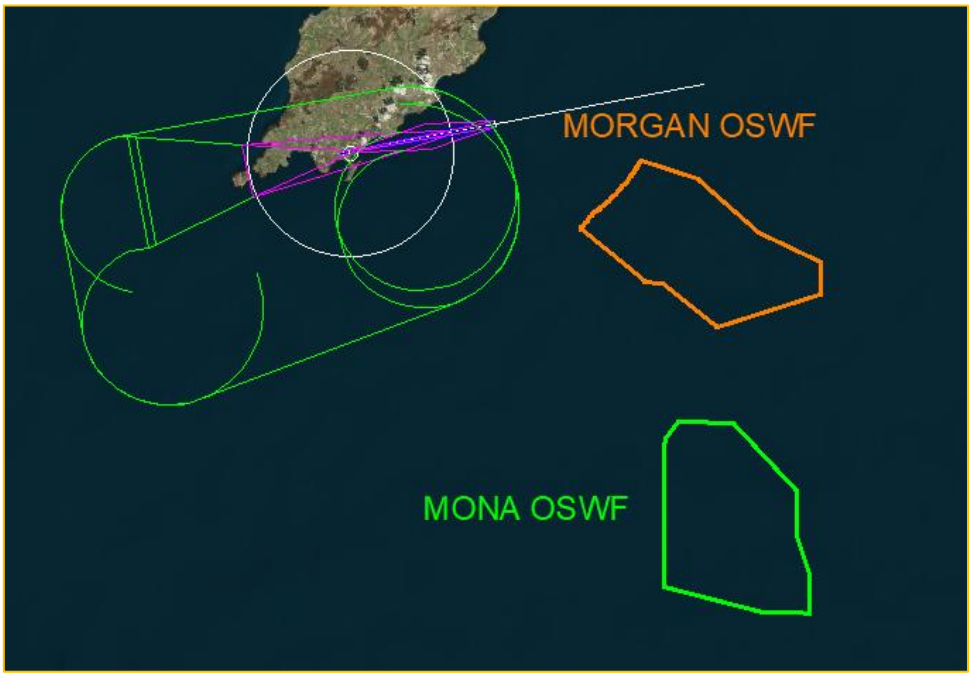

Figure 134 - Morgan and Mona Windfarm vs ILS/DME RWY 26 Protection Areas

Additionally, procedure reversals published on the approach chart (CAT A,B & CAT C,D Base turns) from NDB(L) RWY have been constructed:

COMMERCIAL IN CONFIDENCE

COMMERCIAL IN CONFIDENCE

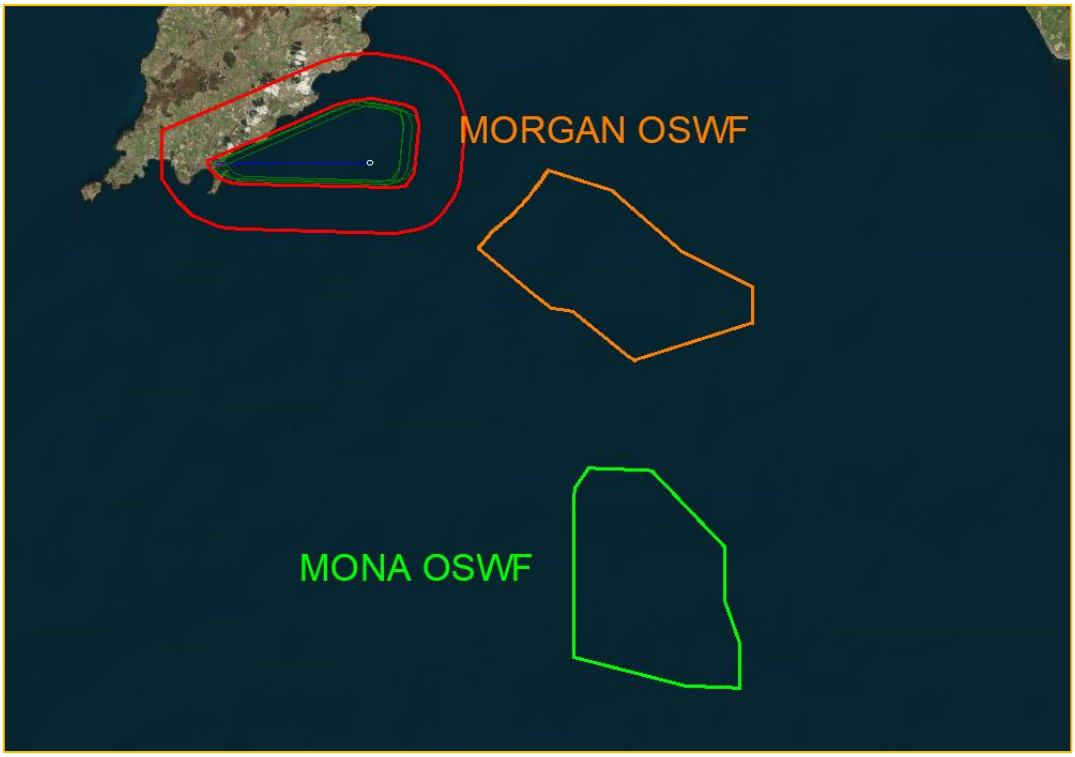

Figure 135 - Windfarms vs ILS/DME RWY 26 Base turn CAT A,B

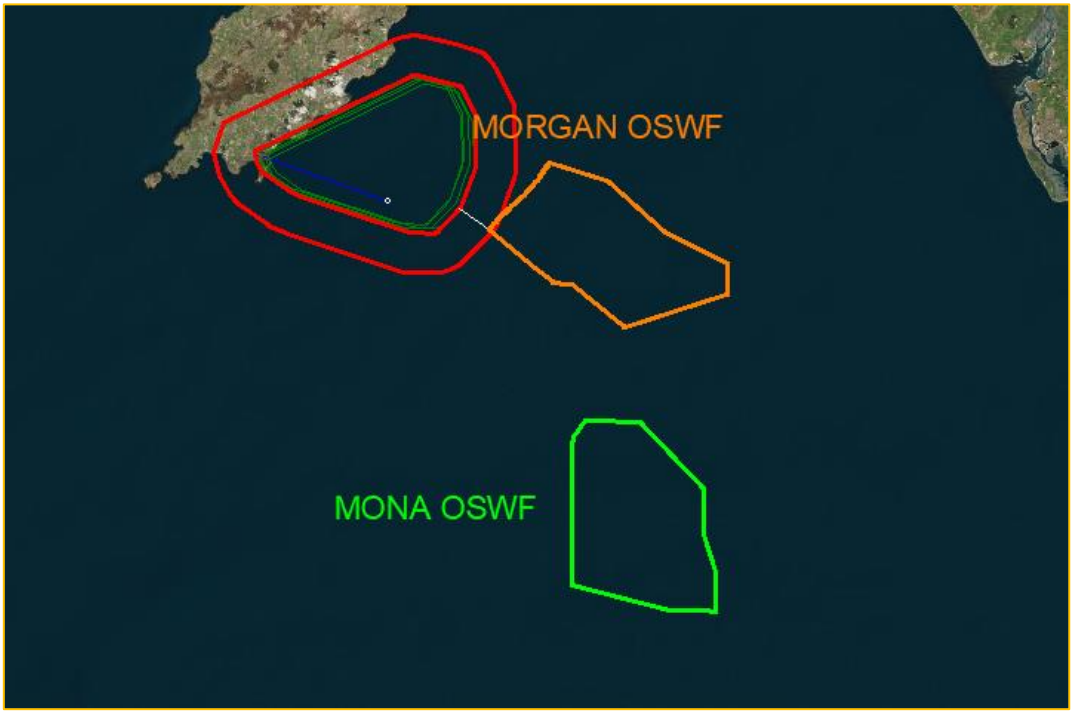

Figure 136 - Windfarms vs ILS/DME RWY 26 Base turn CAT C,D

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As can be observed in the above figures, both windfarms are outside the protection areas for the CAT A, B base turn and therefore they will not impact such reversal.

However, the Morgan Windfarm is within the secondary protection areas of the CAT C, D base turn. The highest secondary MOC required over the obstacles would be 9.91% of the full Initial Approach MOC (300m); 0.091*300 = 27.3m. Therefore, aircraft should be at a minimum of 364m + 27.3m = 391.3m / 1284ft to safely clear the obstacle. As the minimum altitude within the base turn is 2000ft, this provides sufficient margin to clear the obstacle safely.

Alternative Procedure from KELLY on L10

The chart features a note specifying *'Arrival not below 3000 or MSA whichever is the higher'.*

Obstacles would need to be higher than 3000ft – 300m (614.4m) to potentially impact any arrival. As the maximum turbine elevation is 364m, arrivals will not be impacted.

However, the KELLY arrival features a DME arc from I-RY of 8NM, where aircraft can start descending to 2000ft when stablished on the arc.

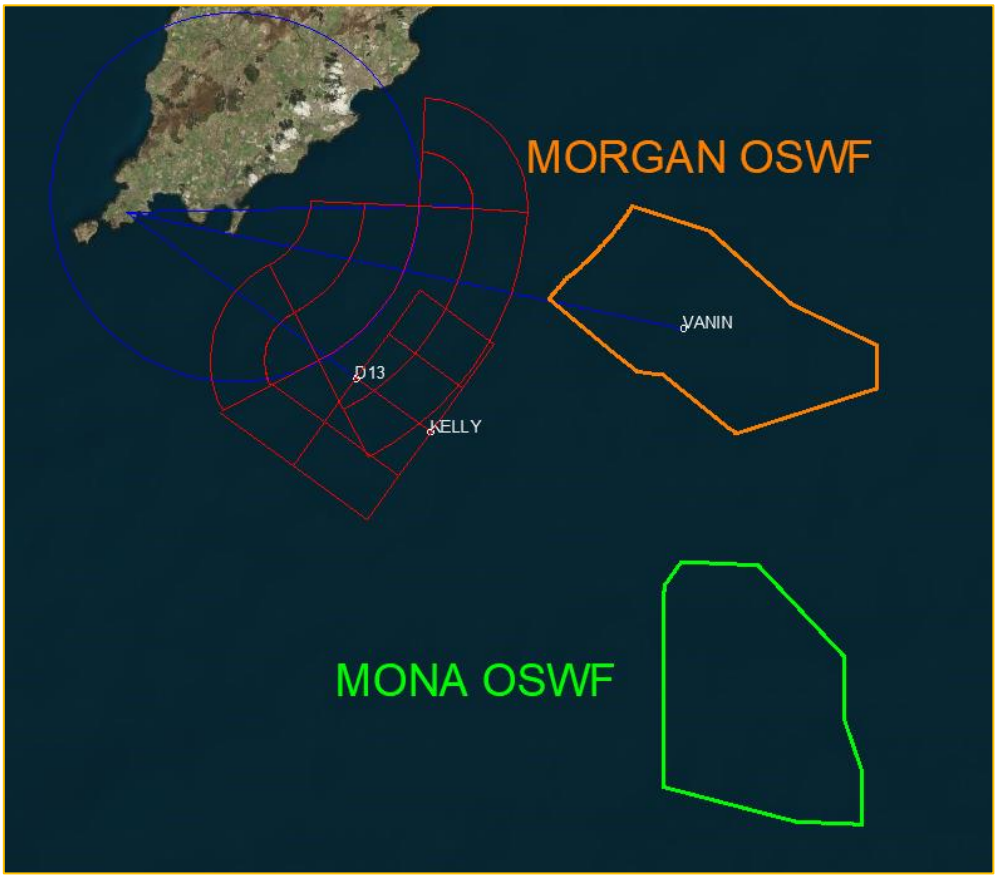

Figure 137 - Windfarms vs Direct Arrivals from KELLY

As both windfarms are outside the protection areas for the Direct Arrivals from KELLY, they will not impact the arrival.

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COMMERCIAL IN CONFIDENCE

Alternative Procedure from VOR IOM

FROM OVERHEAD VOR IOM: Descend as required to 3000 inbound to NDB(L) RWY on QDM 079°, then continue as for full procedure.

As the Direct Arrival from VOR IOM is fully above 3000ft before continuing as per the already assessed procedure, obstacles lower than 614.4m would not cause any impact.

The proposed windfarms will not have an impact on the ILS/DME RWY 26 Procedure.

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5.2.9 LOC/DME RWY 26

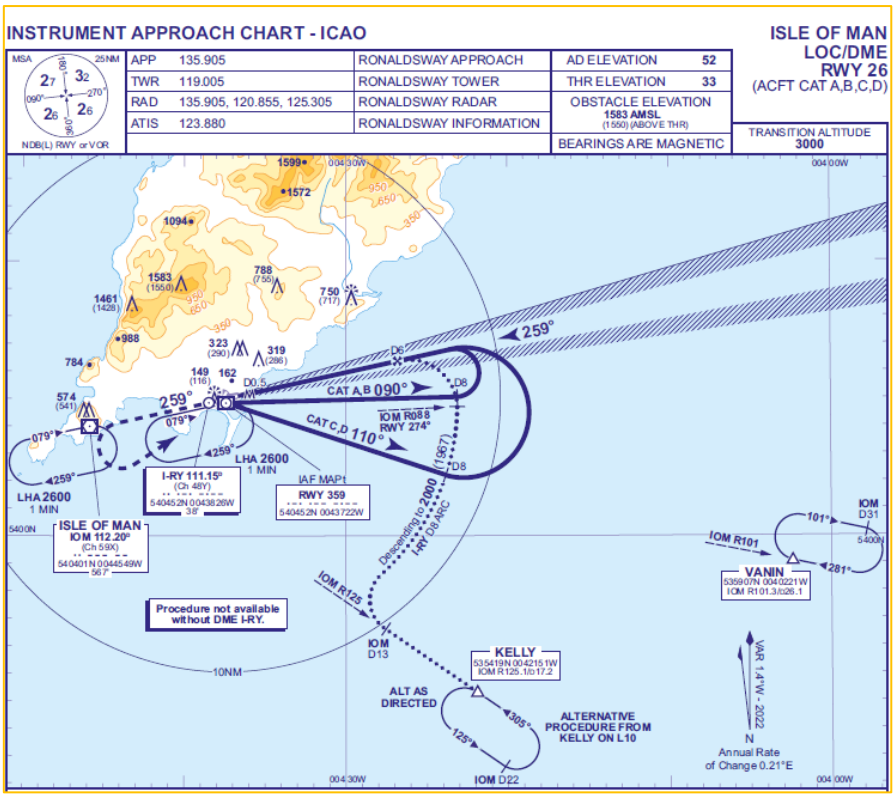

Figure 138 - LOC/DME RWY 26

Both windfarms (Morgan and Mona) lie outside the final approach and missed approach protection areas associated to the LOC/DME Procedure to Runway 26.

COMMERCIAL IN CONFIDENCE

COMMERCIAL IN CONFIDENCE

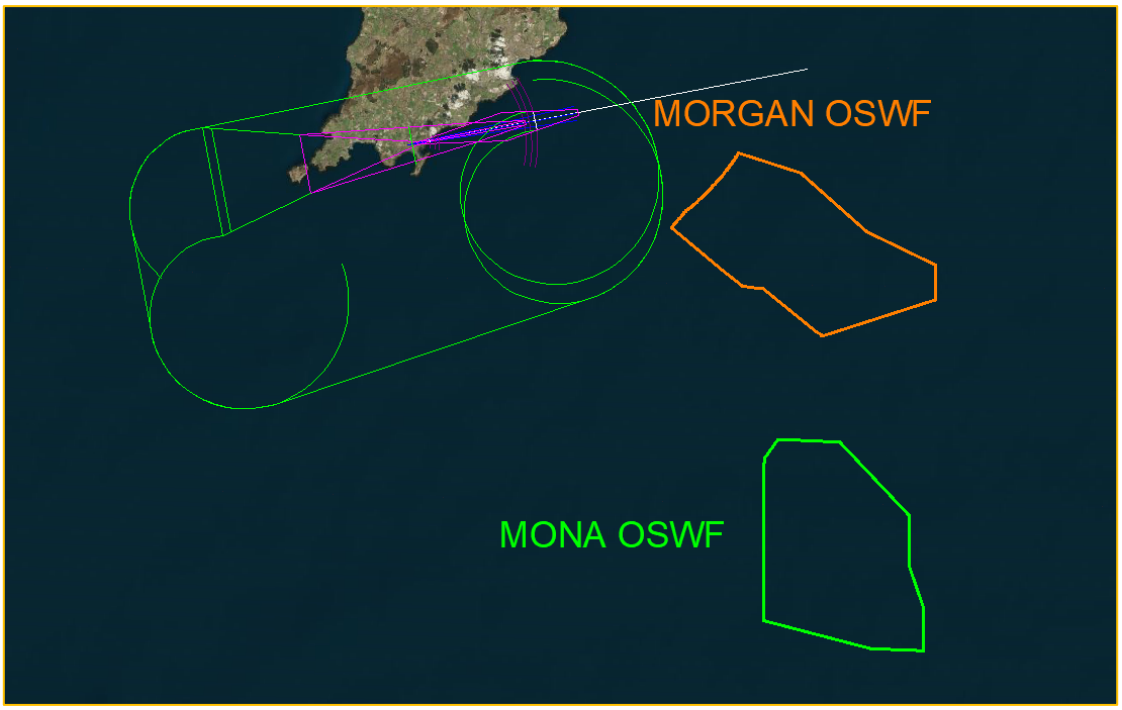

Figure 139 - Morgan and Mona Windfarm vs LOC/DME RWY 26 Protection Areas

Additionally, procedure reversals published on the approach chart (CAT A,B & CAT C,D Base turns) and the Direct Arrivals from IOM VOR and KELLY have already been assessed in Section 5.2.8 and are not impacted.

The proposed windfarms will not have an impact on the LOC/DME RWY 26 Procedure.

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5.2.10 SRA RTR 2NM RWY 26

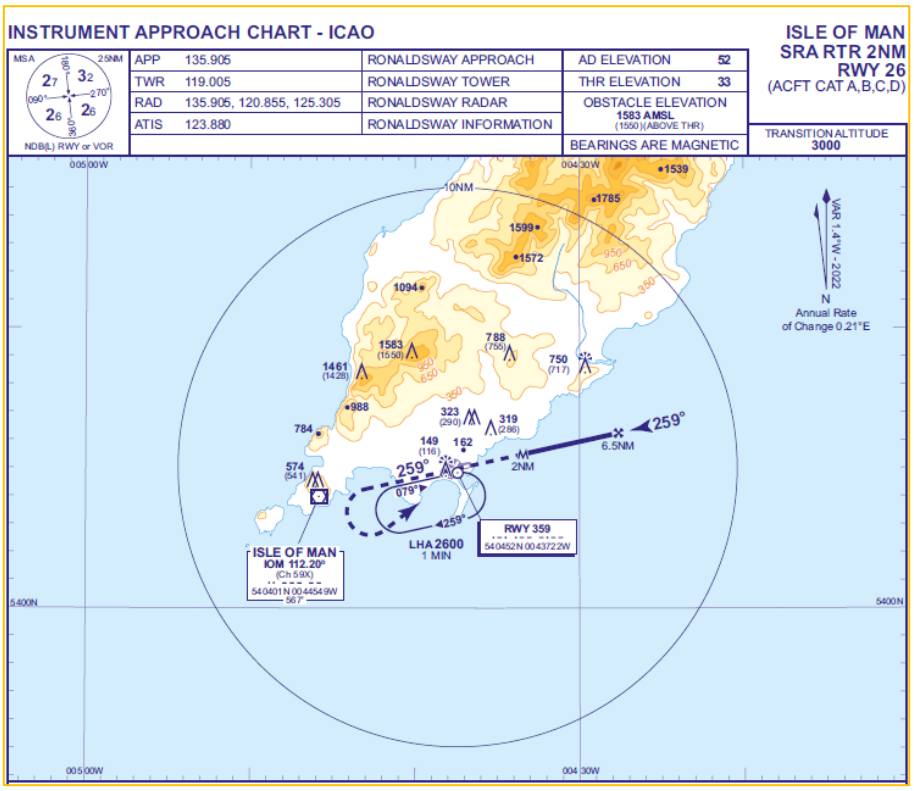

Figure 140 - SRA RTR 2NM RWY 26

The Mona windfarm lies outside the protection areas associated to the SRA to Runway 26 and therefore will not impact the procedure.

The Morgan windfarm lies within the protection areas associated to the Final Missed Approach and could potentially impact the procedure:

COMMERCIAL IN CONFIDENCE

COMMERCIAL IN CONFIDENCE

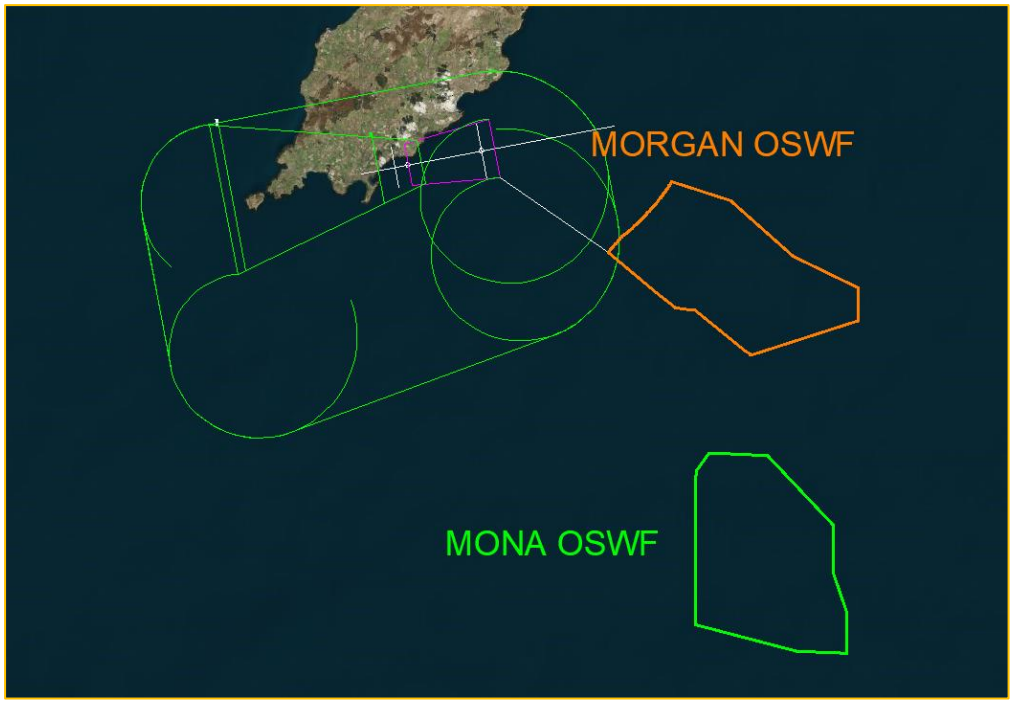

Figure 141 - Morgan and Mona Windfarm vs SRA RWY 26 Protection Areas

The Missed Approach text is as follows:

Continuous climb to 3000, initially straight ahead 2000 then turn left to NDB(L) RWY at 3000 or as directed.

The shortest distance from the 2000ft TIA to the Morgan Windfarm is 14634.86m. With a 2.5% Missed Approach Climb Gradient, aircraft would be at 2000ft + 0.025*14634.86m = 975.47m / 3200ft at the obstacle.

This provides sufficient clearance as the MOC for the Final Missed Approach is 50m and therefore aircraft should be at a minimum of 364m + 50m = 414m / 1359ft to safely clear the obstacle.

The proposed windfarms will not have an impact on the SRA RWY 26 Procedure.

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COMMERCIAL IN CONFIDENCE

5.2.11 NDB(L)/DME RWY 26

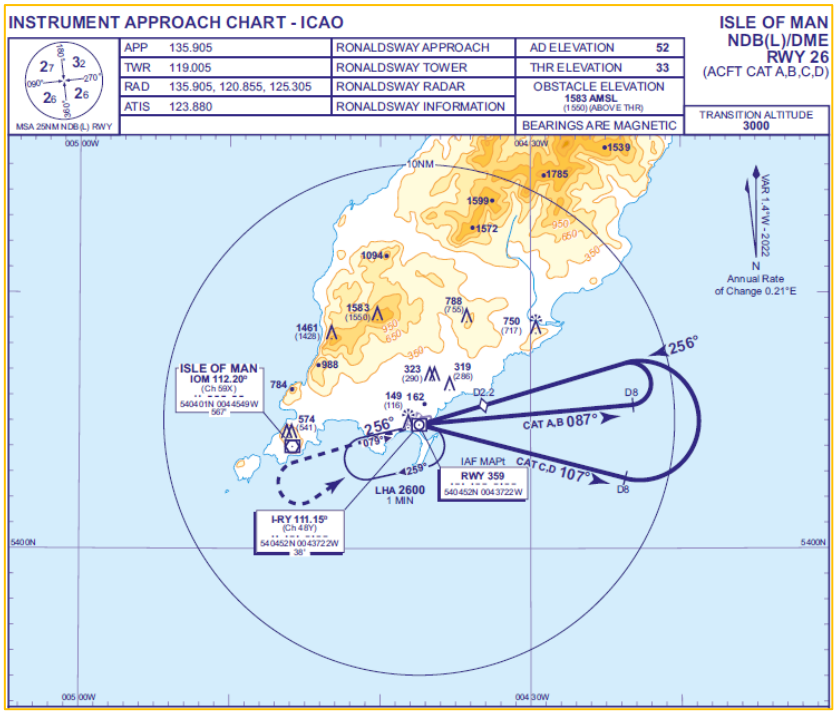

Figure 142 - NDB(L)/DME RWY 26

DME I-RY Operative

The Mona windfarm lies outside the protection areas associated to the NDB(L)/DME to Runway 26 and therefore will not impact the procedure.

The Morgan windfarm lies outside the Final Approach Areas but within the protection areas associated to the Final Missed Approach and could potentially impact the procedure:

COMMERCIAL IN CONFIDENCE

COMMERCIAL IN CONFIDENCE

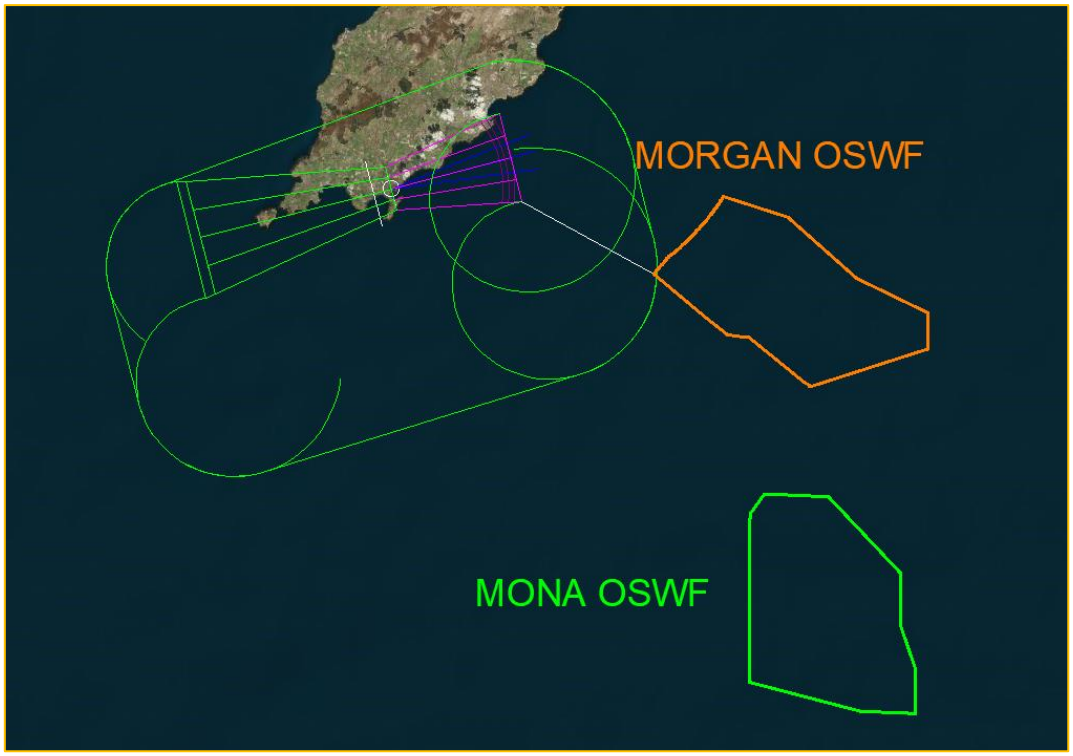

Figure 143 - Morgan and Mona Windfarm vs NDB(L)/DME RWY 26 Protection Areas

The Missed Approach text is as follows:

Continuous climb to 3000, initially on NDB(L) RWY QDM 256° to 2000 then left turn to NDB(L) RWY at 3000 or as directed.

The shortest distance from the 2000ft TIA to the Morgan Windfarm has been measured to be 15257.82m. With a 2.5% Missed Approach Climb Gradient, aircraft would be at 2000ft + 0.025*15257.82m = 991.04m / 3251ft at the obstacle.

This provides sufficient clearance as the MOC for the Final Missed Approach is 50m and therefore aircraft should be at a minimum of 364m + 50m = 414m / 1359ft to safely clear the obstacle.

Additionally, procedure reversals published on the approach chart (CAT A,B & CAT C,D Base turns) have been constructed:

COMMERCIAL IN CONFIDENCE

COMMERCIAL IN CONFIDENCE

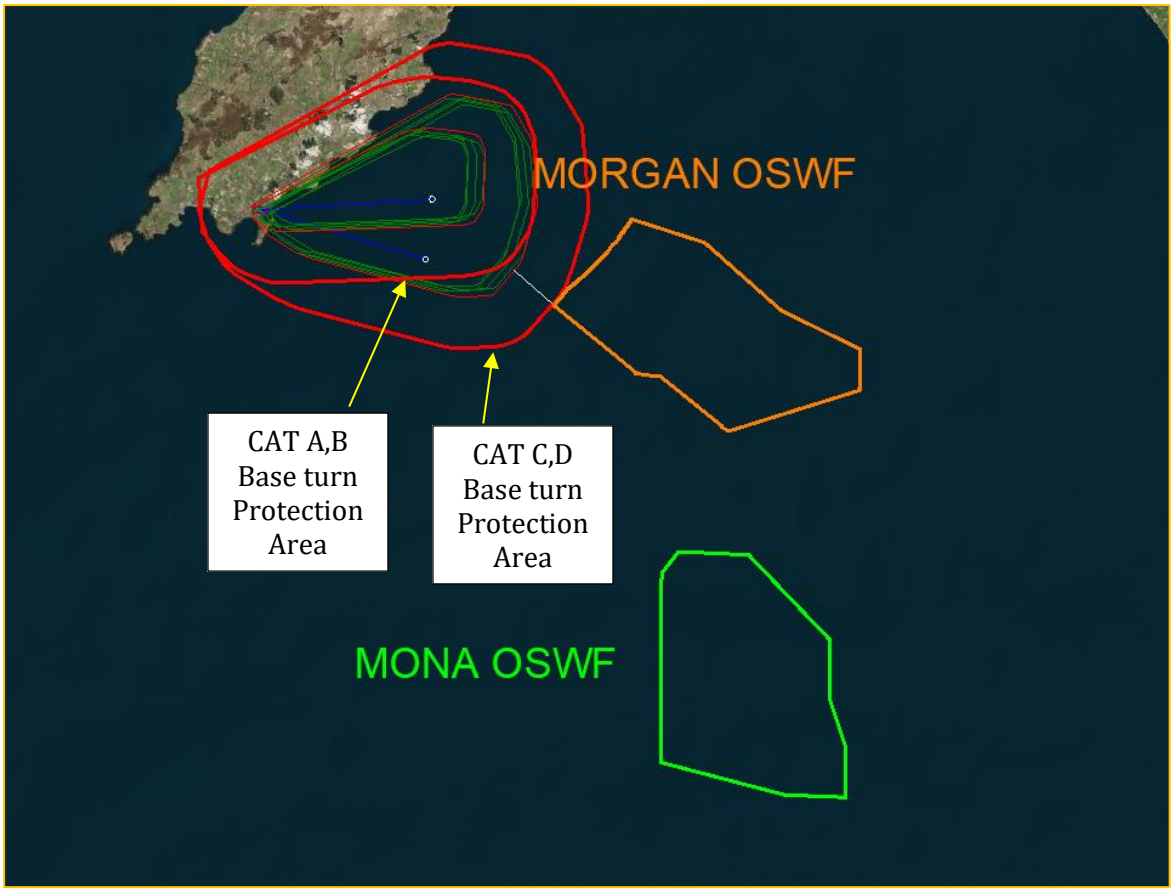

Figure 144 - Windfarms vs NDB(L)/DME RWY 26 Base turns

As both windfarms are outside the protection areas for the base turn and the extended holding, they will not impact the reversals.

The proposed windfarms will not have an impact on the NDB(L)/DME RWY 26 (With DME I-RY Operative) Procedure.

DME I-RY Inoperative

The Mona windfarm lies outside the protection areas associated to the NDB(L)/DME to Runway 26 and therefore will not impact the procedure.

The Morgan windfarm lies within the protection areas associated to the Final Missed Approach and could potentially impact the procedure:

COMMERCIAL IN CONFIDENCE

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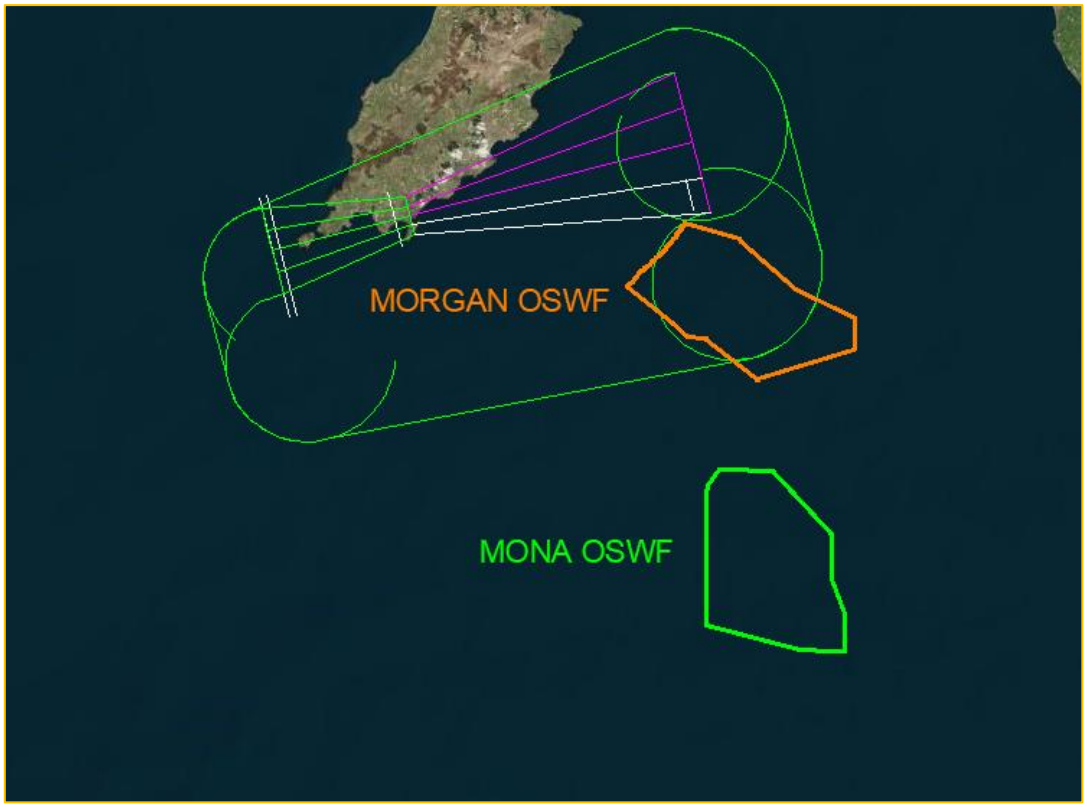

Figure 145 - Morgan and Mona Windfarm vs NDB(L)/DME RWY 26 (NO DME) Protection Areas

When DME I-RY is inoperative or cannot be used for aircraft flying the NDB(L)/DME RWY 26 Approach, there is no defined FAF (Final Approach Fix) and therefore the final approach areas extend to the edge of the Base turn primary protection area. Therefore, we will analyse base turns in the first instance.

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CAT A,B

The CAT A,B procedure reversal published on the approach chart has been constructed:

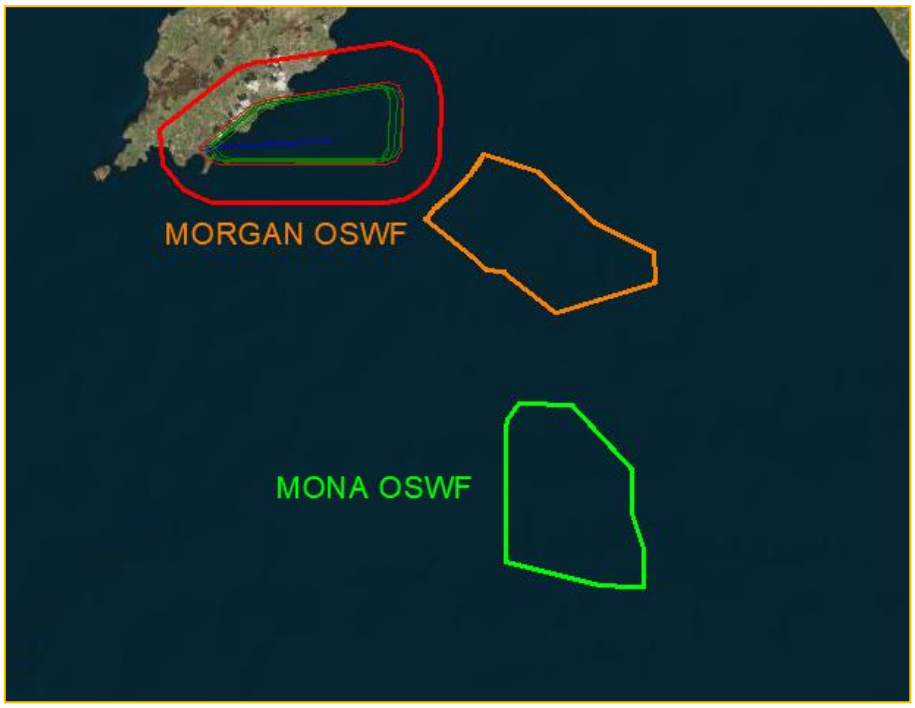

Figure 146 - Windfarms vs NDB(L)/DME RWY 26 Base turn CAT A,B (NO DME; 3 MIN)

As can be observed in the above figure, both windfarms are outside the protection areas for the CAT A, B base turn and therefore will not impact the reversal.

The final approach areas have been extended to the edge of the primary area for the CAT A,B base turn:

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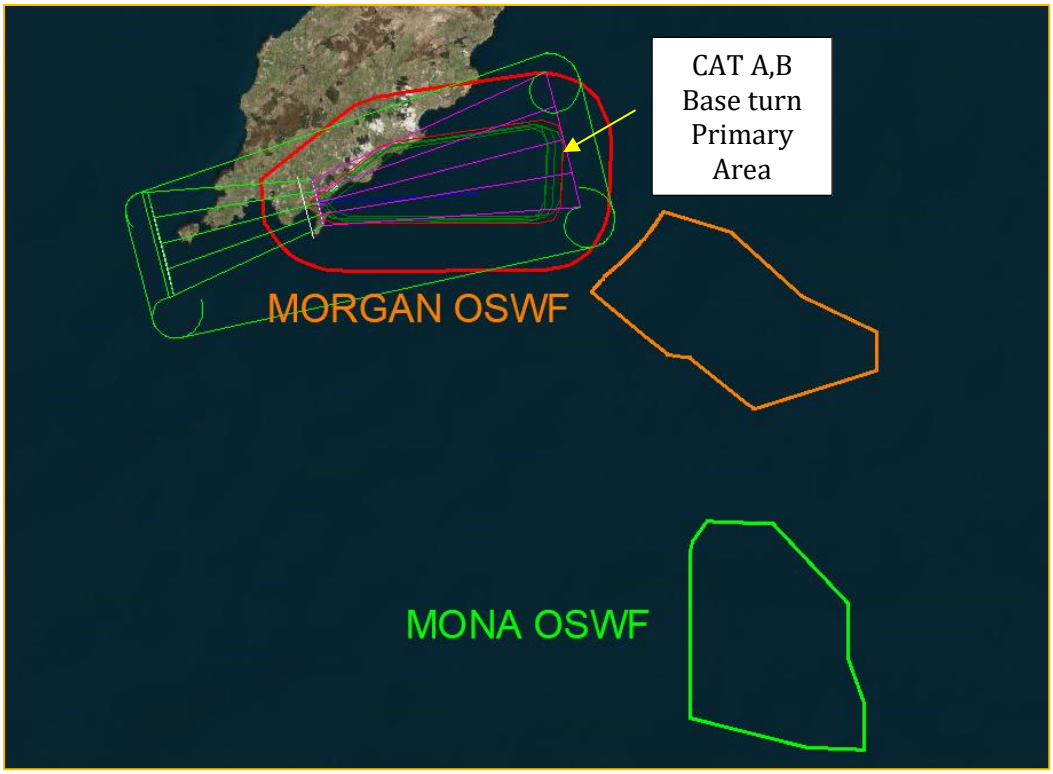

Figure 147 - Windfarms vs NDB(L)/DME RWY 26 (NO DME) CAT A,B

As can be observed in the above figure, both windfarms are outside the protection areas for the CAT A, B final and missed approach, therefore they will not impact the Procedure.

CAT C,D

The CAT C,D procedure reversal published on the approach chart has been constructed:

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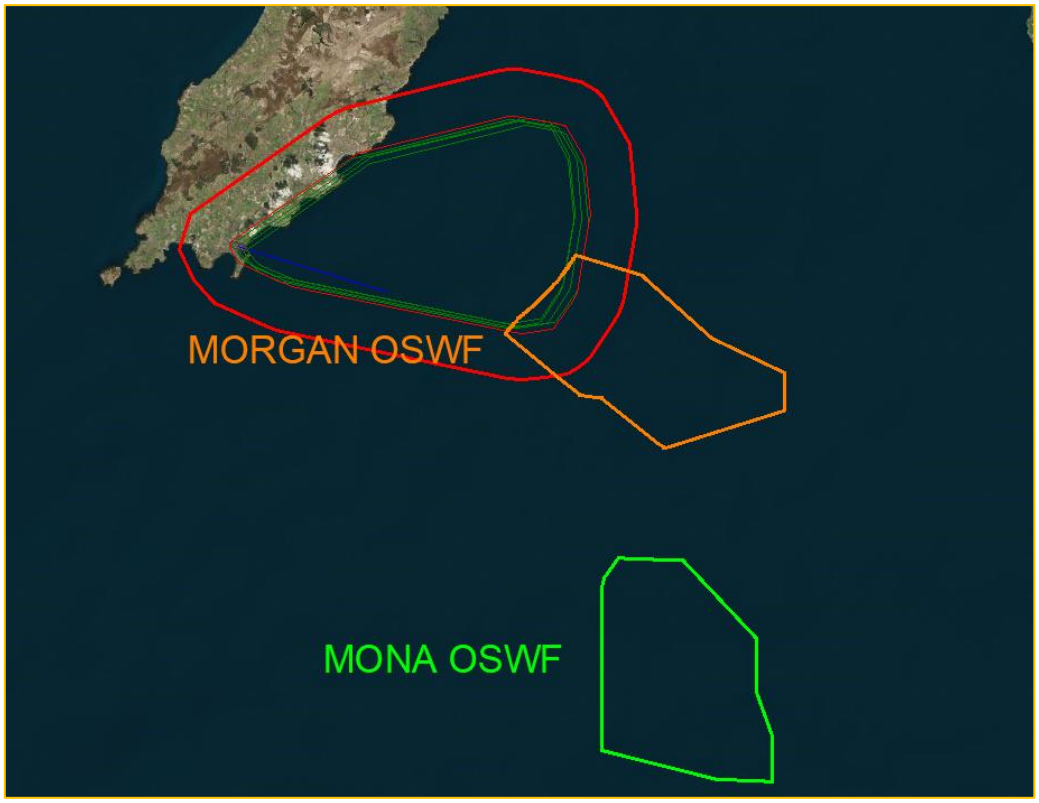

Figure 148 - Windfarms vs NDB(L)/DME RWY 26 Base turn CAT C,D (NO DME; 2.5 MIN)

As can be observed in the above figure, the Mona windfarm is outside the protection areas for the CAT C, D base turn and therefore it will not impact such reversal.

However, the Morgan Windfarm is within the primary protection areas of the CAT C, D base turn. The MOC required over the obstacles would be 100% of the full Initial Approach MOC (300m). Therefore, aircraft should be at a minimum of 364m + 300m = 664m / 2179ft AMSL to safely clear the obstacle. As the minimum altitude within the base turn is 2000ft, this does not provide sufficient margin to clear the obstacle safely.

The minimum altitude within the base turn would require increasing to 2200ft, which could have knock-on effects on the procedure if this leads to a change in the Final Approach Altitude.

The final approach areas have been extended to the edge of the primary area for the CAT C, D base turn:

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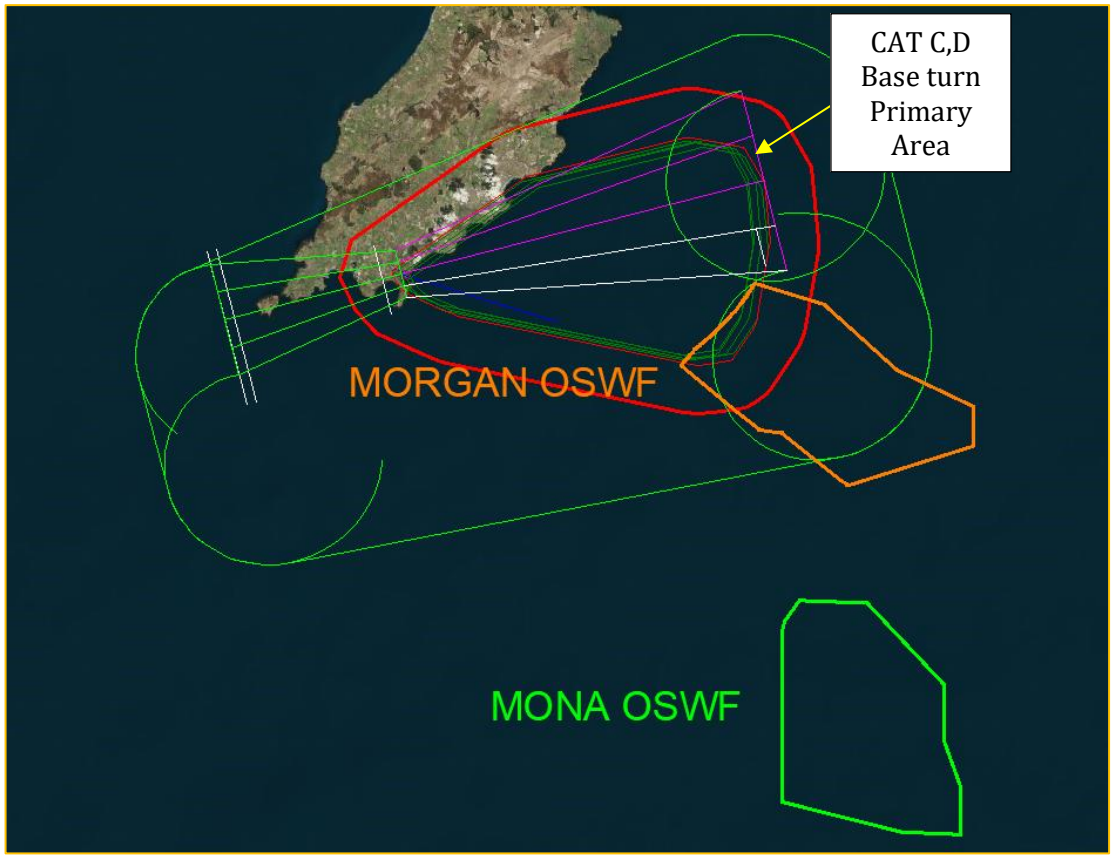

Figure 149 - Windfarms vs NDB(L)/DME RWY 26 (NO DME) CAT C, D

As can be observed in the above figure, the Mona windfarm is outside the protection areas for the CAT C, D final and missed approach, therefore it will not impact the Procedure.

The Morgan Windfarm is outside of the protection areas of the CAT C,D Final Approach.

The Missed Approach text is as follows:

Continuous climb to 3000, initially on NDB(L) RWY QDM 256° to 2000 then left turn to NDB(L) RWY at 3000 or as directed.

The Morgan Windfarm is just outside the TIA and would require a 50m MOC. Therefore, aircraft should be at a minimum of 364m + 50m = 414m / 1359ft to safely clear the obstacle. This is achieved as the turning altitude is 2000ft.

The proposed windfarms will not have an impact on the NDB(L)/DME RWY 26 (With DME I-RY Operative) Procedure for aircraft Categories A and B.

The proposed windfarms will have a potential impact on the NDB(L)/DME RWY 26 (With DME I-RY Operative) Procedure for aircraft Categories C and D, specifically a potential impact on the MOCA for the base turn.

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5.2.12 Visual Circling

The proposed windfarms are outside the Visual Circling VM(C) Obstacle Clearance areas for all aircraft categories (A, B, C and D).

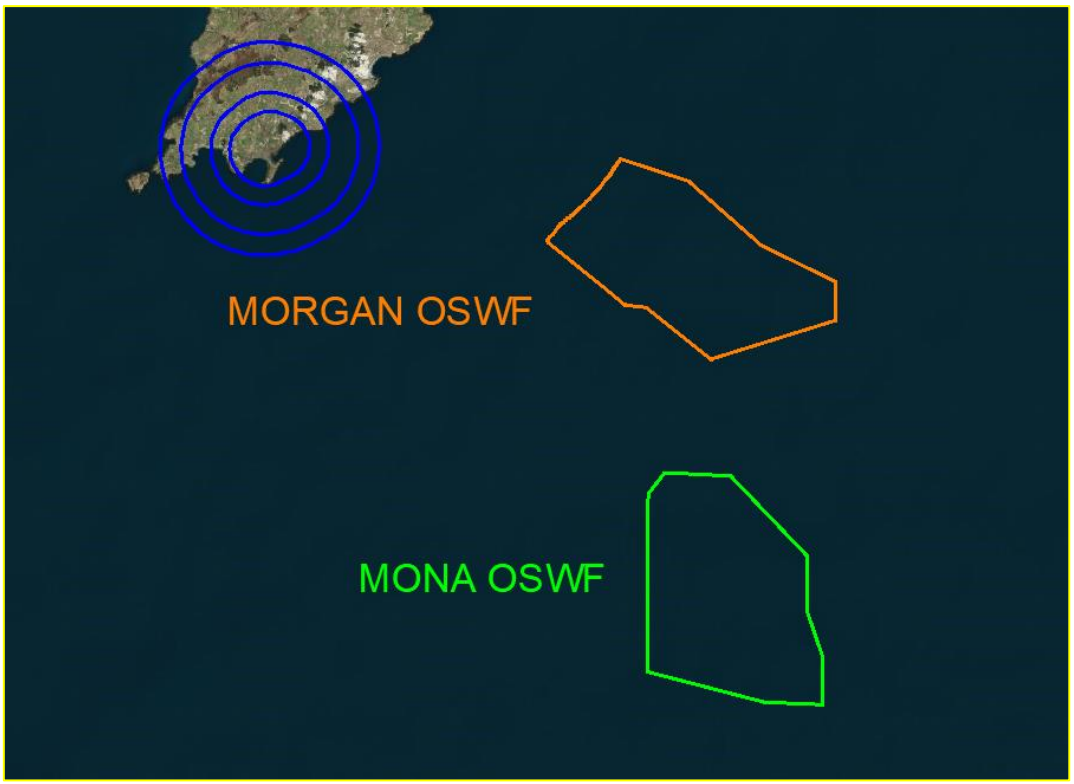

Figure 150 – Visual Circling

The proposed windfarms would have no impact on the Visual Circling.

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5.2.13 Holding

NDB(L) RWY Holds

The NDB(L) RWY Holds have an existing Lowest Holding Altitude (LHA) of 2600ft.

With a maximum MOC of 300m the proposed turbines would not impact the hold:

- 364m + 300m MOC = 664m / 2179ft
- Existing Lowest Holding Altitude (LHA) = 2600ft

VOR IOM Hold

The VOR IOM Hold has an existing Lowest Holding Altitude (LHA) of 2600ft.

With a maximum MOC of 300m the proposed turbines would not impact the hold:

- 364m + 300m MOC = 664m / 2179ft
- Existing Lowest Holding Altitude (LHA) = 2600ft

VANIN & KELLY Holds

The VANIN and KELLY Holds do not have an existing Lowest Holding Altitude (LHA) Published.

However, they are part of the arrival, and the following note is present on the charts: *'Arrival not below 3000 or MSA whichever is the higher'.*

With a maximum MOC of 300m the proposed turbines would not impact the holds:

- 364m + 300m MOC = 664m / 2179ft
- Derived Lowest Holding Altitude (LHA) by Chart Notes = Higher between 3000ft and MSA.

The proposed windfarms would have no impact on any of the holds for Isle of Man Airport.

5.2.14 Visual Segment Surface (VSS)

The proposed windfarms lie outside the lateral confines of VSS for all Runways.

The proposed windfarms would have no impact on the VSS for Isle of Man Airport Runways.

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5.2.15 Minimum Sector Altitudes

MSA 25NM NDB(L) RWY

Both the Mona and Morgan Windfarms lie within the south-eastern quarter of the MSA 25NM NDB(L) RWY, which published MSA is 2600ft. Additionally, the Morgan Windfarm lies within the north-eastern quarter of the MSA 25NM NDB(L) RWY, which published MSA is 3200ft.

The windfarms do not need to be considered towards any other sectors of the MSA as are outside their protection areas and associated buffers.

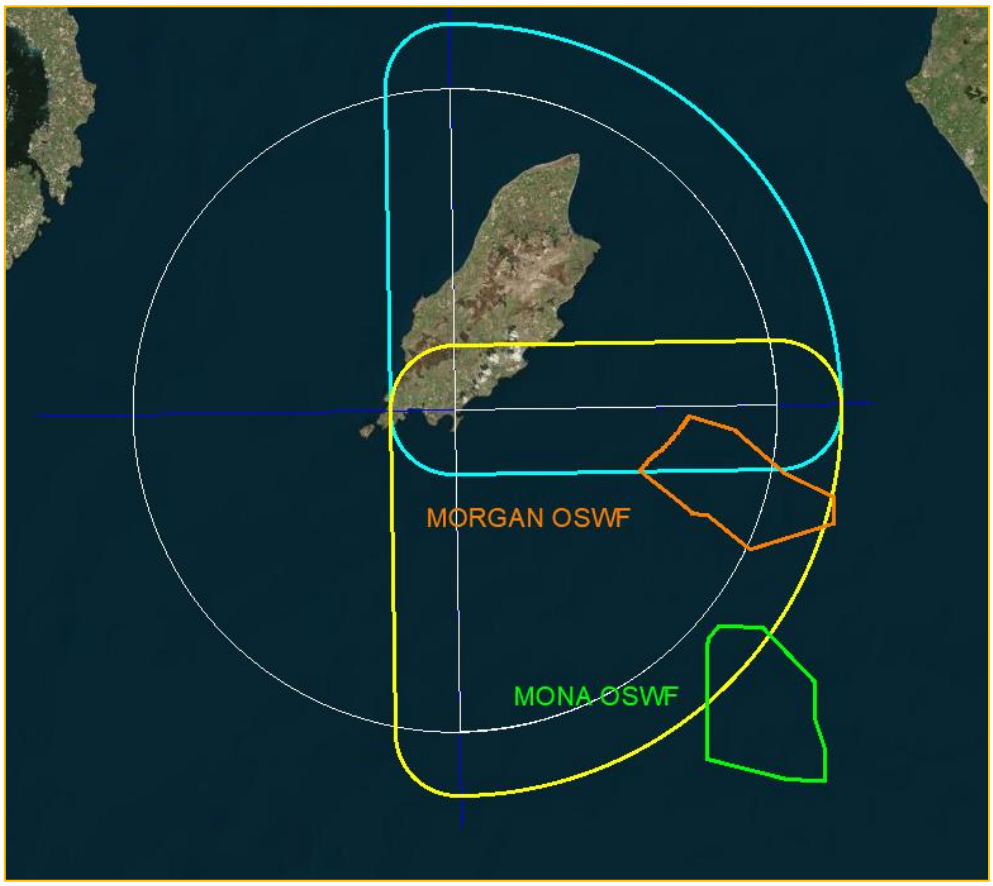

Figure 151 – NDB(L) RWY vs Windfarms

The proposed windfarms would produce a MOCA of 364m + 300m = 664m / 2179ft AMSL for the north-eastern and south-eastern quadrants.

This is below the NE quadrant published MSA which has a MOCA of 3200ft, and below the SE quadrant published MSA which has a MOCA of 2600ft.

The proposed windfarms would have no impact on the published NDB(L) RWY MSA.

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MSA 25NM VOR IOM

The Mona Windfarm is outside the VOR IOM MSA.

The Morgan Windfarms lies within the south-eastern quarter of the MSA 25NM VOR IOM, which published MSA is 2600ft. Additionally, the Morgan Windfarm lies within the north-eastern quarter of the MSA 25NM VOR IOM, which published MSA is 3200ft.

The windfarms do not need to be considered towards any other sectors of the MSA as are outside their protection areas and associated buffers.

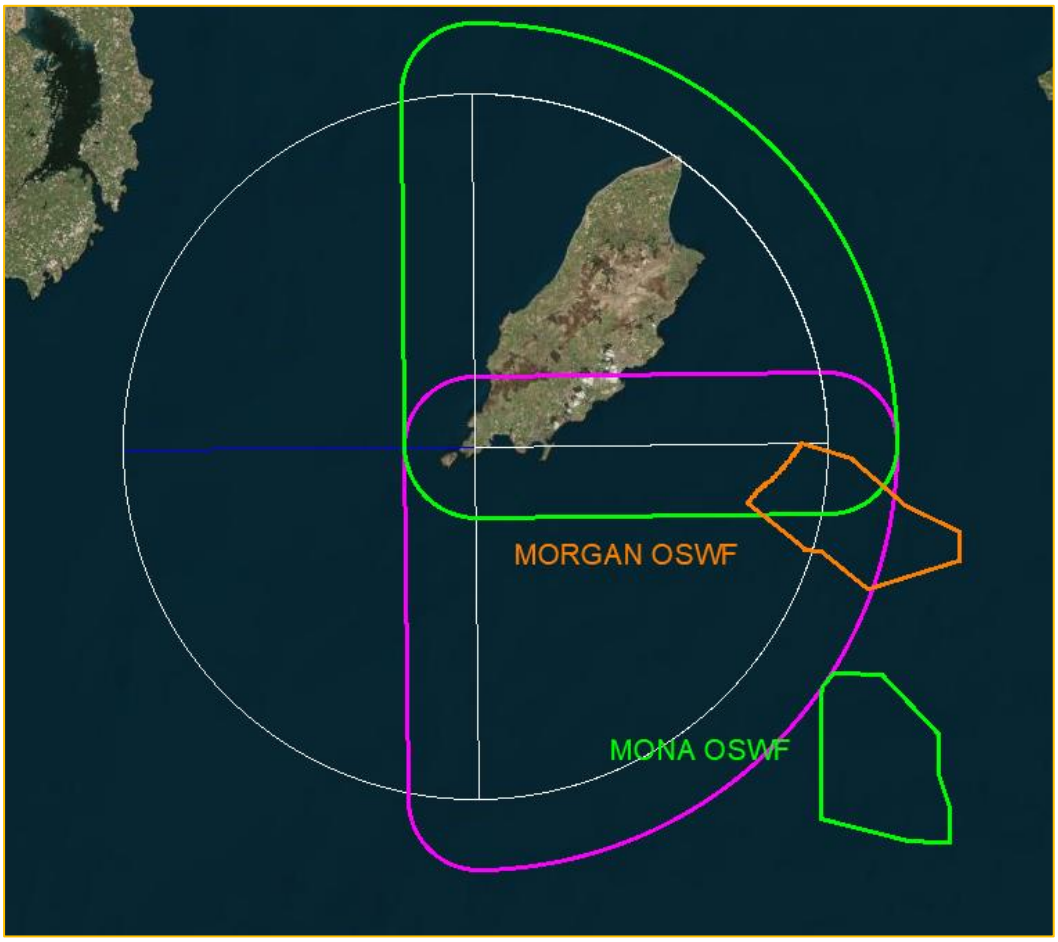

Figure 152 – VOR IOM vs Windfarms

The proposed windfarms would produce a MOCA of 364m + 300m = 664m / 2179ft AMSL for the north-eastern and south-eastern quadrants.

This is below the NE quadrant published MSA which has a MOCA of 3200ft, and below the SE quadrant published MSA which has a MOCA of 2600ft.

The proposed windfarms would have no impact on the published VOR IOM MSA.

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MSA 25NM ARP

We have additionally protected for an MSA based on the ARP owing to the fact the minimum levels shown outside the ATCSMAC are based on the ARP as per note 4 in the ATCSMAC chart:

"4. Minimum Sector Altitudes are based on obstacles and spot heights within 25NM of the Aerodrome Reference Point"

Both the Mona and Morgan Windfarms lie within the south-eastern quarter of the MSA 25NM ARP, which published MSA is 2600ft. Additionally, the Morgan Windfarm lies within the north-eastern quarter of the MSA 25NM ARP, which published MSA is 3200ft.

The windfarms do not need to be considered towards any other sectors of the MSA as are outside their protection areas and associated buffers.

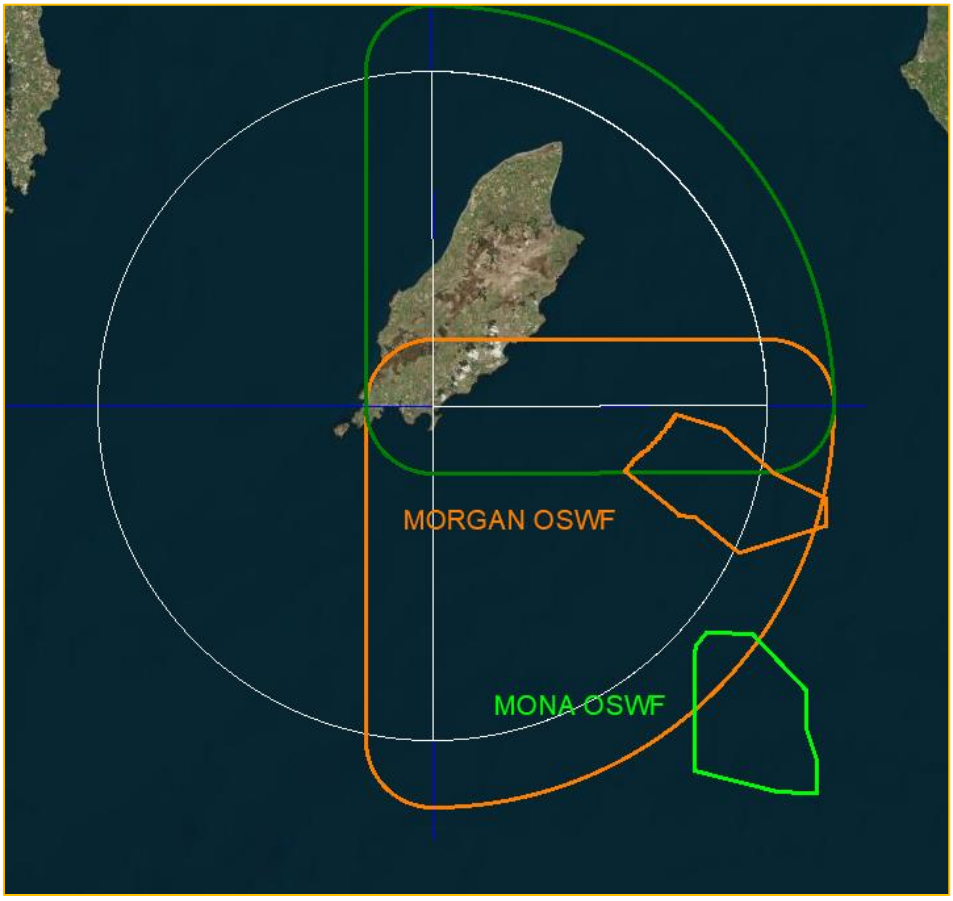

Figure 153 –ARP MSA vs Windfarms

The proposed windfarms would produce a MOCA of 364m + 300m = 664m / 2179ft AMSL for the north-eastern and south-eastern quadrants.

This is below the NE quadrant published MSA which has a MOCA of 3200ft, and below the SE quadrant published MSA which has a MOCA of 2600ft.

The proposed windfarms would have no impact on the published ARP MSA.

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6 RAF Valley Airport OLS and IFP Assessment

6.1 OLS Assessment

6.1.1 Overview

The OLS for RAF Valley Airport has been constructed in accordance with Annex 14 and CAP 168.

6.1.2 Runway Data Used

The following declared distances and threshold details are published in the in the Mil AIP:

Runway	TORA (m)	TODA (m)	ASDA (m)	LDA (m)	Remarks
1	2	3	4	5	6
13	2,290	2,295	2,290	2,290	TORA = Thr 13 to Thr 31 TODA = Thr 13 to 5nm past Thr 31 ASDA = Thr 13 to Thr 31 LDA = Thr 13 to Thr 31
31	2,290	2,295	2,290	2,290	TORA = Thr 31 to Thr 13 TODA = Thr 31 to Arrestor ASDA = Thr 31 to Thr 13 LDA = Thr 31 to Thr 13
01	1,572	1,600	1,572	1,572	TORA = Thr 01 to Thr 19 TODA = Thr 01 to Arrestor ASDA = Thr 01 to Thr 19 LDA = Thr 01 to Thr 19
19	1,572	1,585	1,572	1,572	TORA = Thr 19 to Thr 01 TODA = Thr 19 to Arrestor ASDA = Thr 19 to Thr 01 LDA = Thr 19 to Thr 01

Figure 154 - Declared Distances

Designations Runway Number	True and MAG bearing	Dimensions of Runway (m)	Strength (PCN) and surface of Runway and stopway	Threshold co-ordinates
1	2	3	4	5
13	130°24'41" GEO 132°16'41" MAG	2290 x 45	32·5/F/A/W/T Asphalt 41·6/R/C/W/T Concrete	N53 15 13·65 W004 32 46·89
31RH	310°25'56" GEO 312°17'56" MAG	2290 x 45	32·5/F/A/W/T Asphalt 41·6/R/C/W/T Concrete	N53 14 25·61 W004 31 12·86
01	006°18'43" GEO 008°10'43" MAG	1572 x 45	PCN 10 Asphalt/Concrete	N53 14 36·63 W004 32 25·61
19 RH	186°18'51" GEO 188°10'51" MAG	1572 x 45	PCN 10 Asphalt/Concrete	N53 15 27·16 W004 32 16·29

Figure 155 - Threshold Details

Runway 13 is a CODE 4, Precision Instrument Runway

Runway 31 is a CODE 4, Precision Instrument Runway (**Lowest threshold, 7.04m**)

Runway 01 is a CODE 3, Non-Precision Runway

Runway 19 is a CODE 3, Non-Precision Runway

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6.1.3 OLS Construction

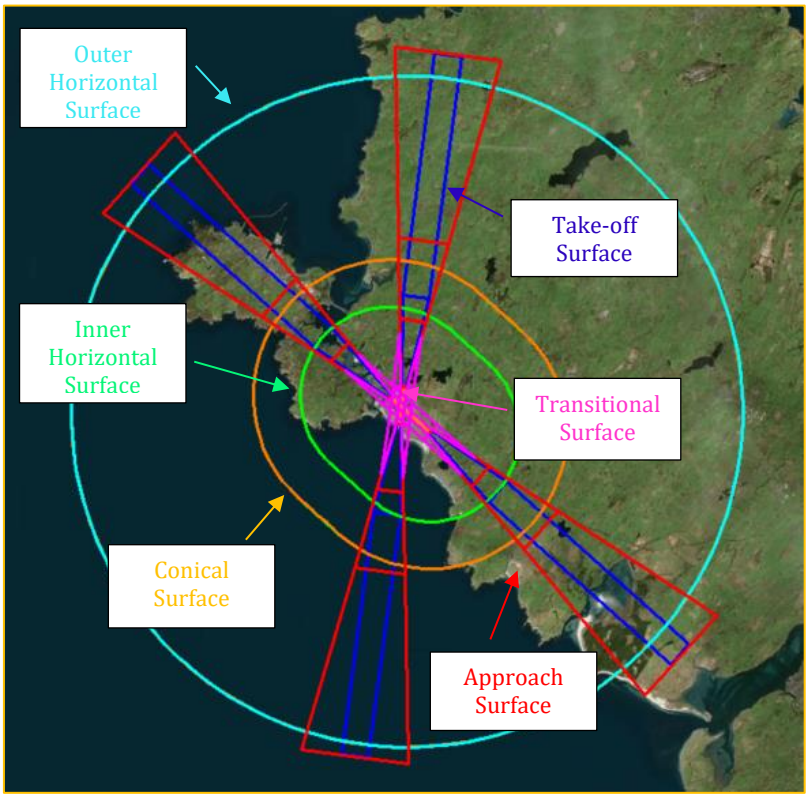

Figure 156 - OLS for RAF Valley Airfield

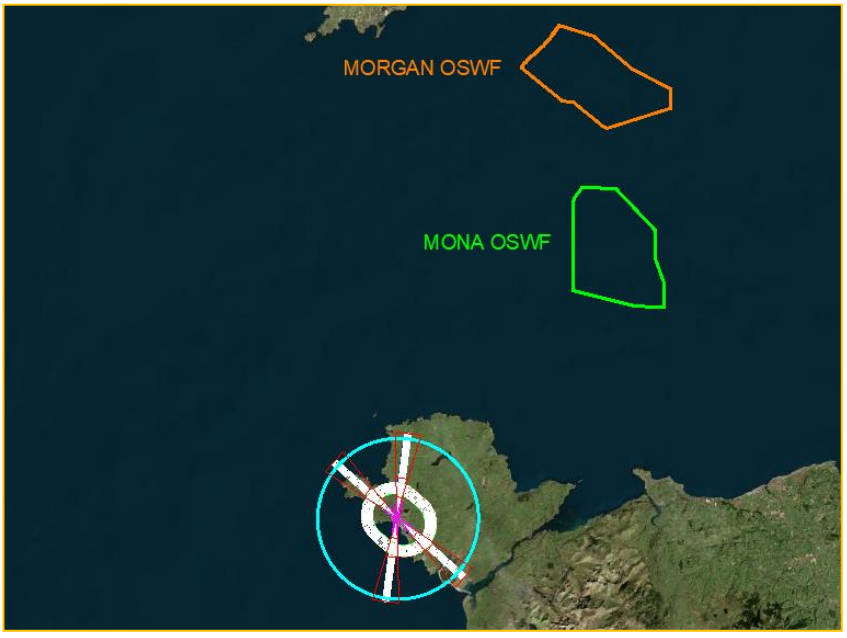

Figure 157 - RAF Valley OLS in Relation to Windfarms

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6.1.4 OLS Analysis

The OLS for RAF Valley lies entirely outside of the boundaries of both Windfarms and is not affected by the development.

The proposed windfarms will have no impact on the OLS for RAF Valley Airfield.

6.2 IFP Assessment

The IFPs assessed are as follows:

AIRAC 2309 (Effective 07 SEP 23 to 05 OCT 23)

- AD 2 EGOV-1-13 EAST MID (23 FEB 23);
- AD 2 EGOV-1-14 SOUTH MID (23 FEB 23);
- AD 2 EGOV-1-16 TAC to PAR RWY 13 (Point X-Ray Hold) (07 SEP 23);
- AD 2 EGOV-1-17 TAC to PAR RWY 19 (Point X-Ray Hold) (07 SEP 23);
- AD 2 EGOV-1-18 TAC to PAR RWY 31 (Point Alpha Hold) (23 FEB 23);
- AD 2 EGOV-1-19 PAR RWY 13 (23 FEB 23);
- AD 2 EGOV-1-20 PAR RWY 19 (23 FEB 23);
- AD 2 EGOV-1-21 PAR RWY 31 (23 FEB 23);
- AD 2 EGOV-1-22 SRA RWY 01 (23 FEB 23);
- AD 2 EGOV-1-23 SRA RWY 13 (23 FEB 23);
- AD 2 EGOV-1-24 SRA RWY 19 (23 FEB 23);
- AD 2 EGOV-1-25 SRA RWY 31 (23 FEB 23);
- AD 2 EGOV-1-26 ATCSMAC (23 FEB 23);
- AD 2 EGOV-1-27 TAC to ILS/DME RWY 13 (Point X-Ray Hold) (07 SEP 23);
- AD 2 EGOV-1-28 TAC RWY 01 (Point Alpha Hold) (23 FEB 23);
- AD 2 EGOV-1-29 TAC RWY 13 (Point X-Ray Hold) (07 SEP 23);
- AD 2 EGOV-1-30 TAC RWY 19 (Point X-Ray Hold) (07 SEP 23).

Additionally, the following were checked:

- Visual Circling
- Holding
- Visual Segment Surfaces (VSS)
- Minimum Sector Altitudes (MSA)

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6.2.1 AD 2 EGOV-1-26 ATCSMAC

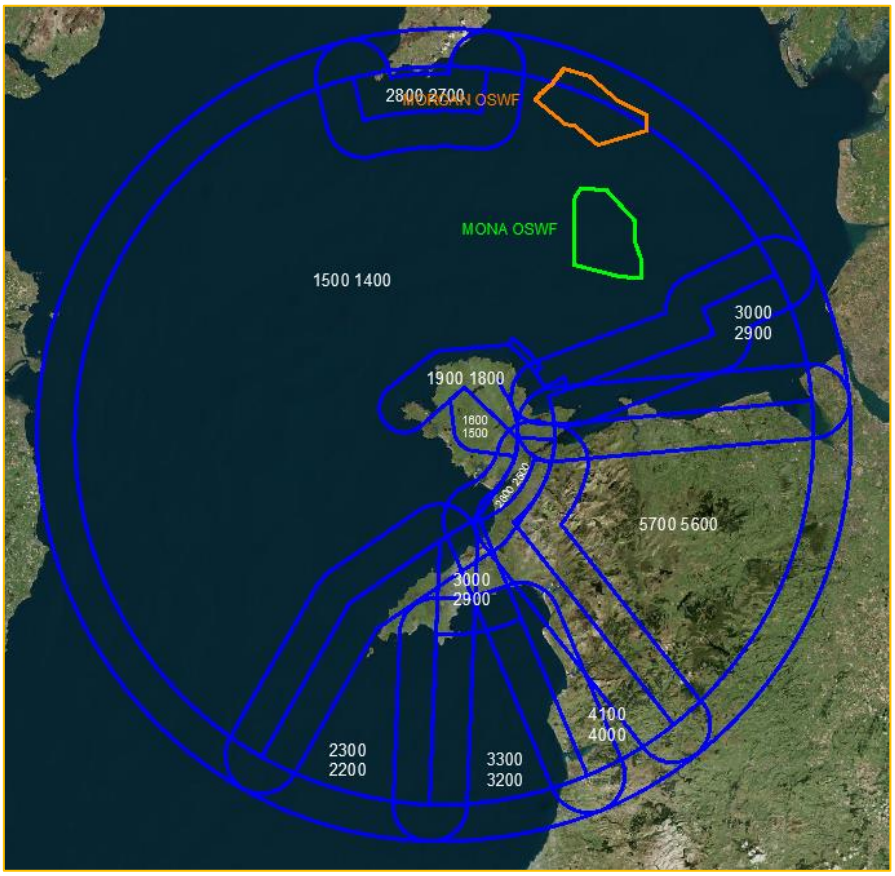

Figure 158 - Windfarms in Relation to ATCSMAC

Both windfarm developments lie within the lateral confines of the Outside SMAA (Surveillance Minimum Altitude Area) which has a 5NM buffer applied. The area has a MOCA (Minimum Obstacle Clearance Altitude) of 1500ft.

Using the development elevation of 364m AMSL, the development produces an OCA of 364m + 300m MOC (Minimum Obstacle Clearance) = 664m / 2179ft AMSL.

Current, Published OCA/OCH derived from existing controlling obstacle:
OCA = 1435ft, rounding to **1500ft**

OCH = 1399ft, rounding to **1400ft.**

Required MOCA using development elevation of 364m AMSL:

364m + 300m (MOC) = 664m / 2179ft AMSL

Airfield elevation at Valley = 36ft

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Military Procedures

QFE = 2179ft – 36ft = 2143ft, rounding to **2200ft**

QNH = 2200ft + 36ft = 2236ft, rounding to **2300ft**

The developments would have a potential impact on RAF Valley's ATCSMAC and would require the 1500ft QNH/1400ft QFE area to be raised to 2300ft QNH/2200ft QFE.

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6.2.2 AD 2 EGOV-1-13 EAST MID

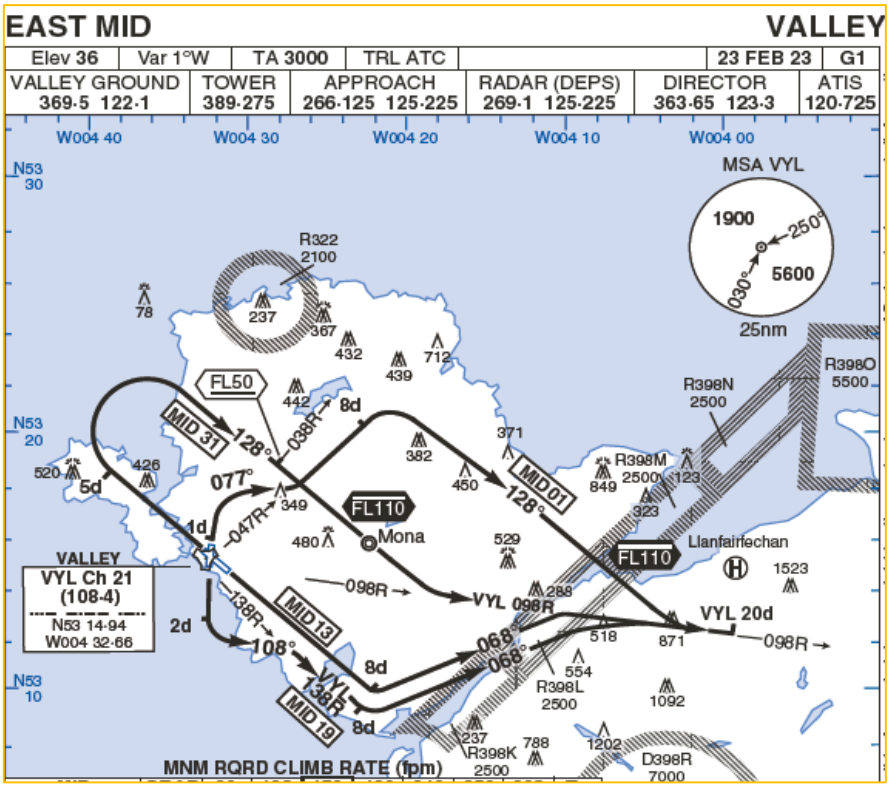

Figure 159 - East MID Procedure

Straight Departure

Both windfarms lie outside the Straight Departure protection areas for the MIDs departing to the east from Runways 01, 13, 19 and 31.

Turn Areas

The MID 01 procedure turns right and continues away from the windfarms and would have no impact.

The MID 13 procedure departs to the south-east and continues away from the windfarms and would be unaffected.

The MID 19 procedure departs to the south and continues away from the windfarms and would be unaffected.

The MID 31 procedure departs to the north-west but then turns right, away from the windfarms and would be unaffected.

The proposed windfarms would have no impact on the EAST MID procedures.

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6.2.3 AD 2 EGOV-1-14 SOUTH MID

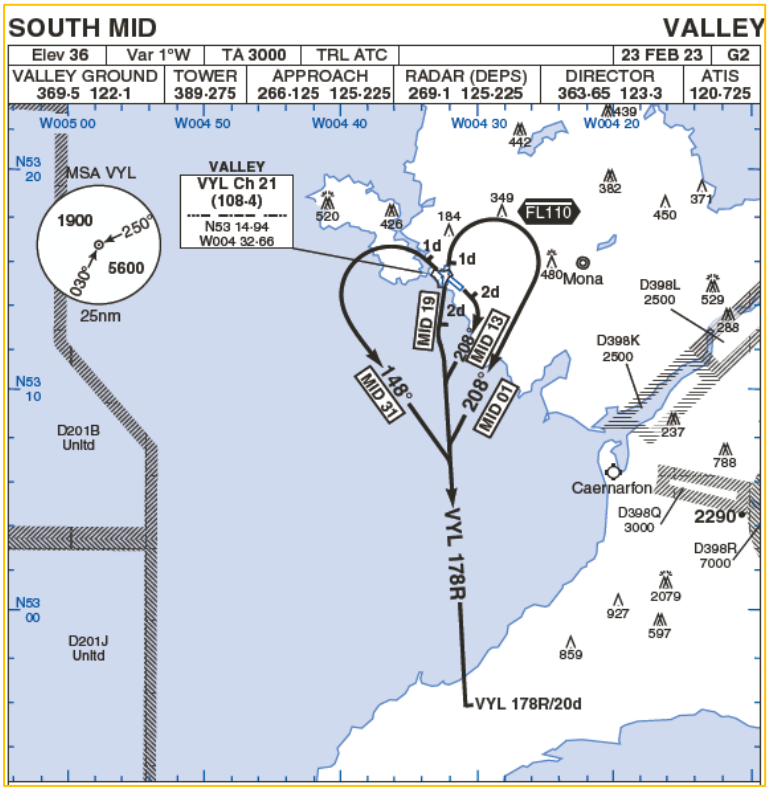

Figure 160 - SOUTH MID Procedure

Straight Departure

Both windfarms lie outside the Straight Departure protection areas for the MIDs departing to the south from Runways 01, 13, 19 and 31.

Turn Area

The MID 01 and 13 procedures turn right and head south, away from the windfarms and would not be affected.

The MID 19 and 31 procedures turn left and head south, away from the windfarms and would not be affected.

The proposed windfarms would have no impact on the SOUTH MID procedures.

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6.2.4 AD 2 EGOV-1-16 TAC to PAR RWY 13 (Point X-Ray Hold)

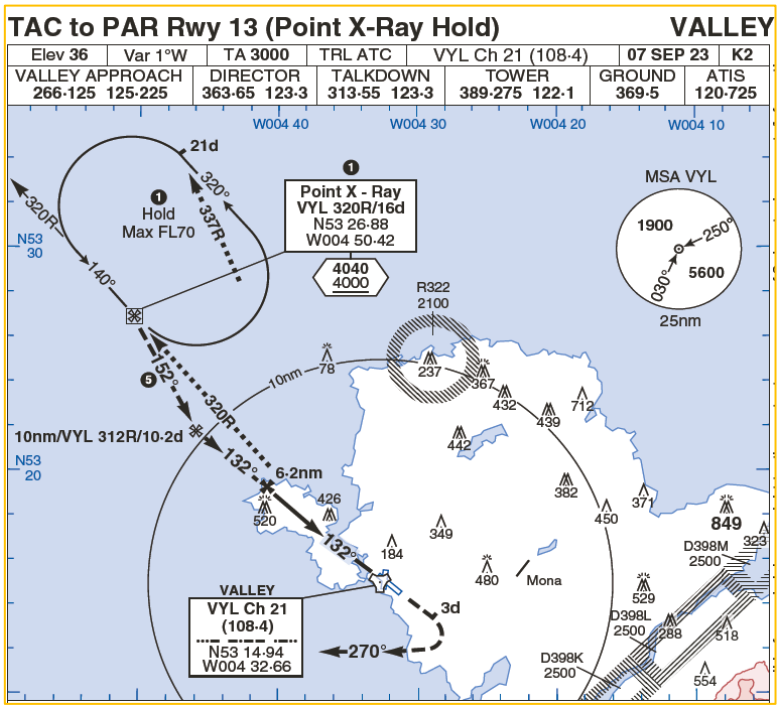

Figure 161 - TAC to PAR RWY 13 (Point X-Ray Hold) Procedure

Both windfarms lie outside the protection areas for the TAC to PAR Procedure to Runway 13 where the initial approach tracks south from the IAF at Point X-Ray Hold before reaching the IF at 2040ft.

The procedure then turns away from the windfarms after the Missed Approach and would not be affected.

POINT X-RAY Hold has been considered in section 6.2.19.

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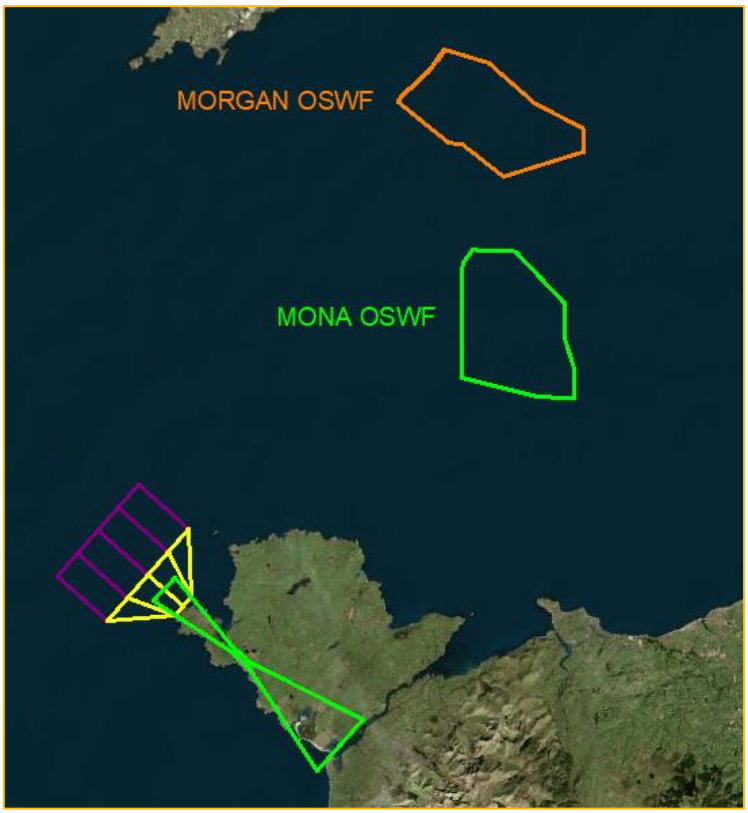

Figure 162 - TAC to PAR RWY 13 Protection Areas

The proposed windfarms would have no impact on the TAC to PAR RWY 13 procedure.

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6.2.5 AD 2 EGOV-1-17 TAC to PAR RWY 19 (Point X-Ray Hold)

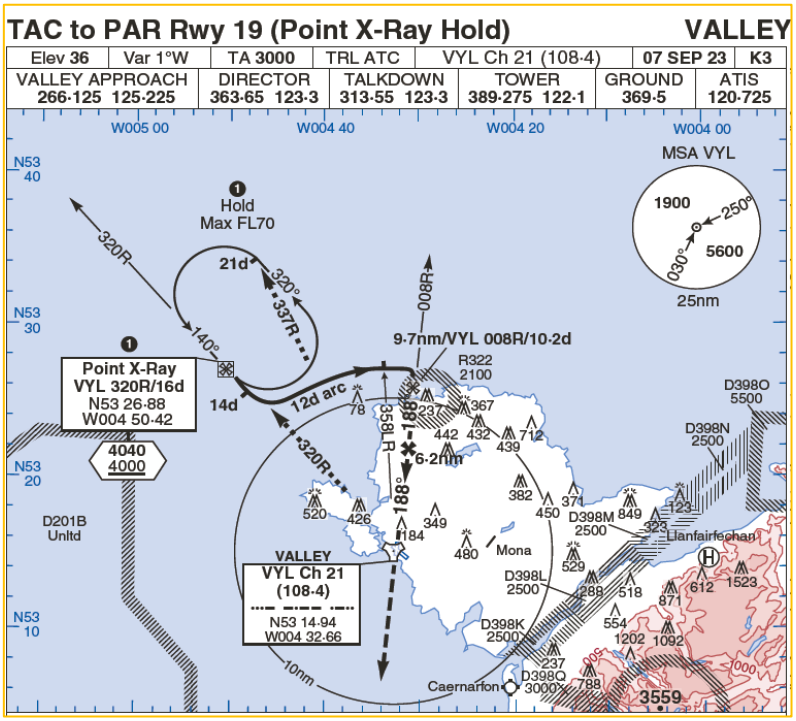

Figure 163 - TAC to PAR RWY 19 (Point X-Ray Hold) Procedure

Both windfarms lie outside the protection areas for the TAC to PAR Procedure to Runway 19 where the initial approach tracks east from the IAF at Point X-Ray Hold before reaching the IF at 2040ft.

The procedure then turns south, away from the windfarms and would not be affected.

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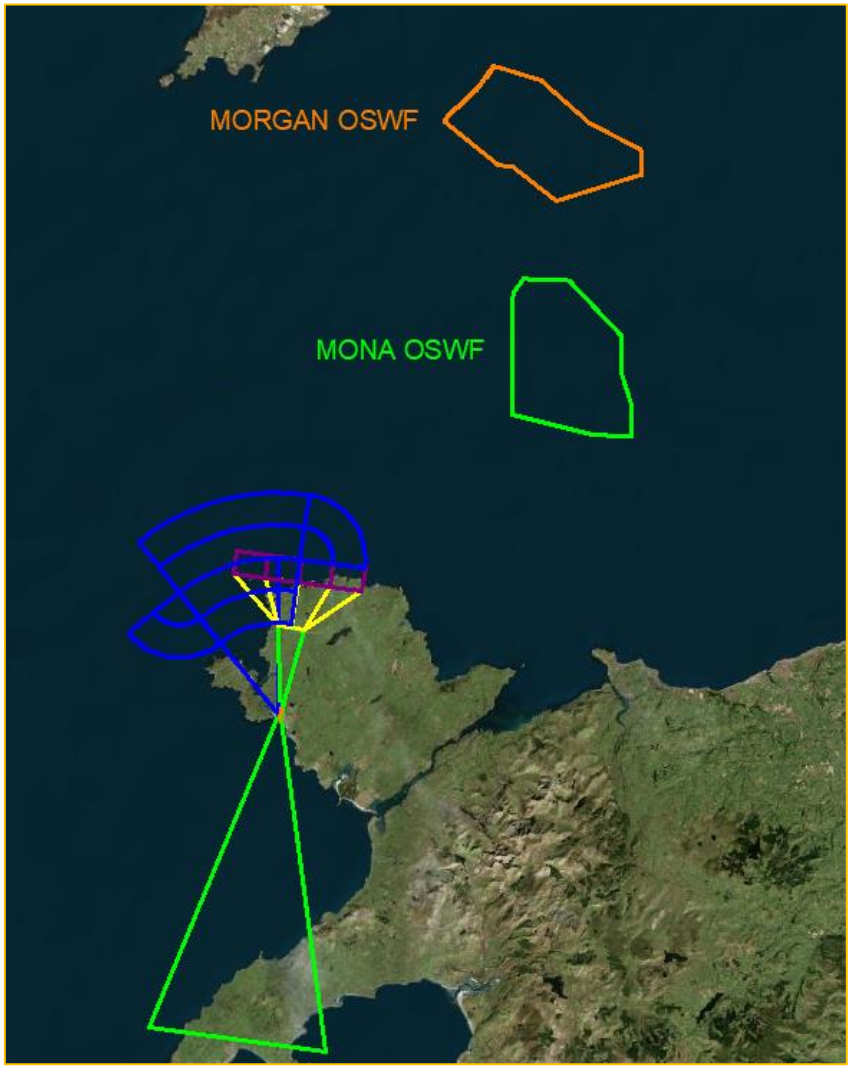

Figure 164 - TAC to PAR RWY 19 Protection Areas

The proposed windfarms would have no impact on the TAC to PAR RWY 19 procedure.

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6.2.6 AD 2 EGOV-1-18 TAC to PAR RWY 31 (Point Alpha Hold)

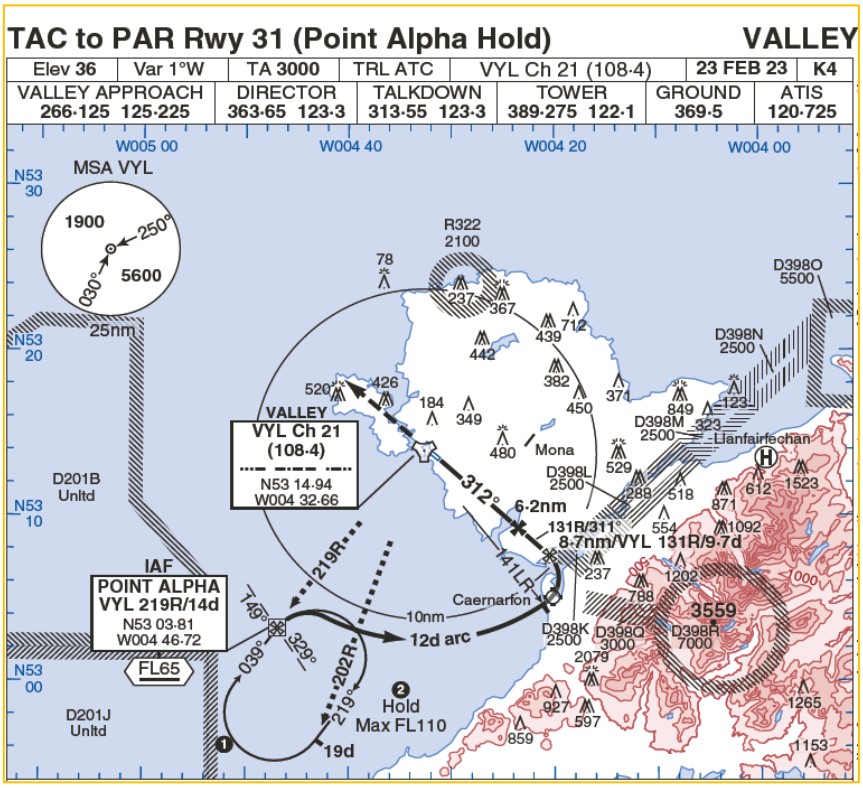

Figure 165 - TAC to PAR RWY 31 (POINT ALPHA Hold) Procedure

Both windfarms lie outside the protection areas for the TAC to PAR Procedure to Runway 31 where the initial approach tracks east initially from the IAF at Point Alpha Hold before reaching the IF at 2530ft which is above the 2179ft MOCA required at the windfarms.

The procedure tracks away from the windfarms after the Missed Approach, away from the windfarms and climbing to 2530ft and would not be affected.

POINT ALPHA Hold has been considered in section 6.2.19.

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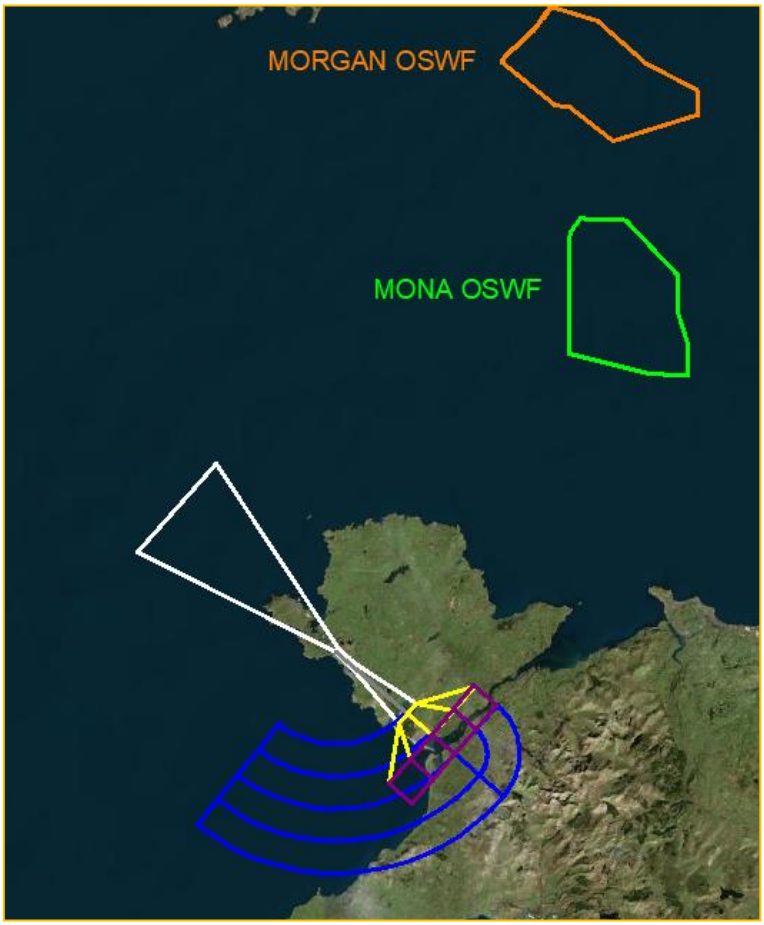

Figure 166 - TAC to PAR RWY 31 Protection Areas

The proposed windfarms would have no impact on the TAC to PAR RWY 31 procedure.

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6.2.7 AD 2 EGOV-1-19 PAR RWY 13

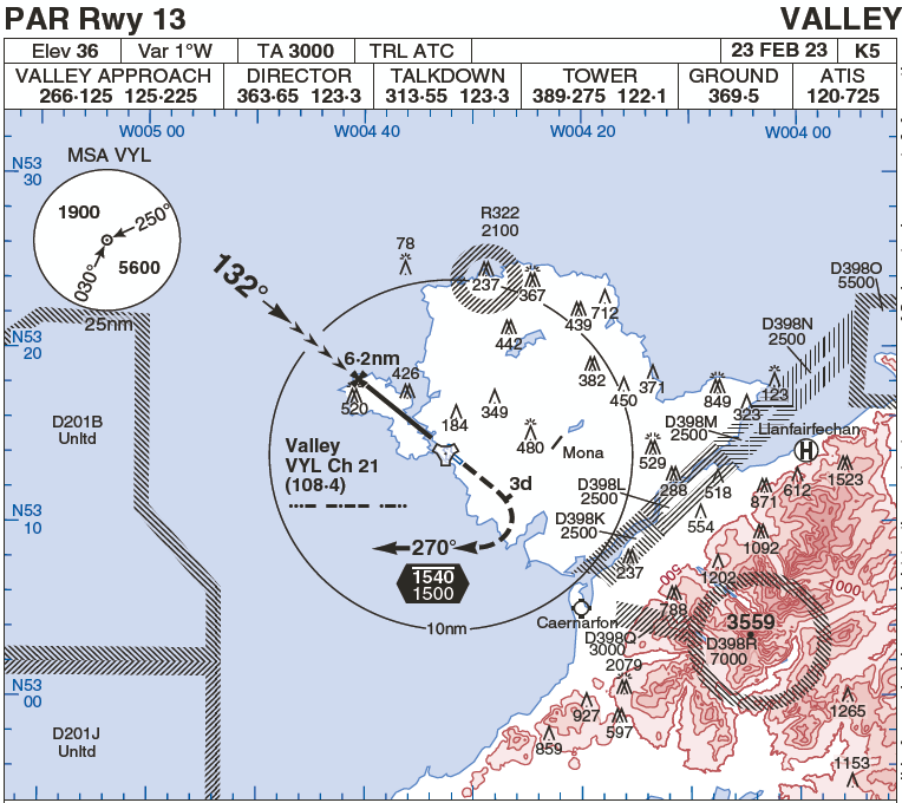

Figure 167 - PAR RWY 13 Procedure

Both windfarms are outside the protection area for the PAR procedure to Runway 13, including the Missed Approach which turns away from the windfarms.

However, arrival to the procedure could be conducted using the ATCSMAC or MSA VYL to conduct radar vectoring until reaching the FAF at 2040ft.

Both windfarms lie within the ATCSMAC 1400ft/1500ft area which has been assessed separately in section 6.2.1.

Additionally, the Mona development lies within the 1900ft buffer area of the NW sector MSA VYL which has been assessed separately in section 6.2.21.

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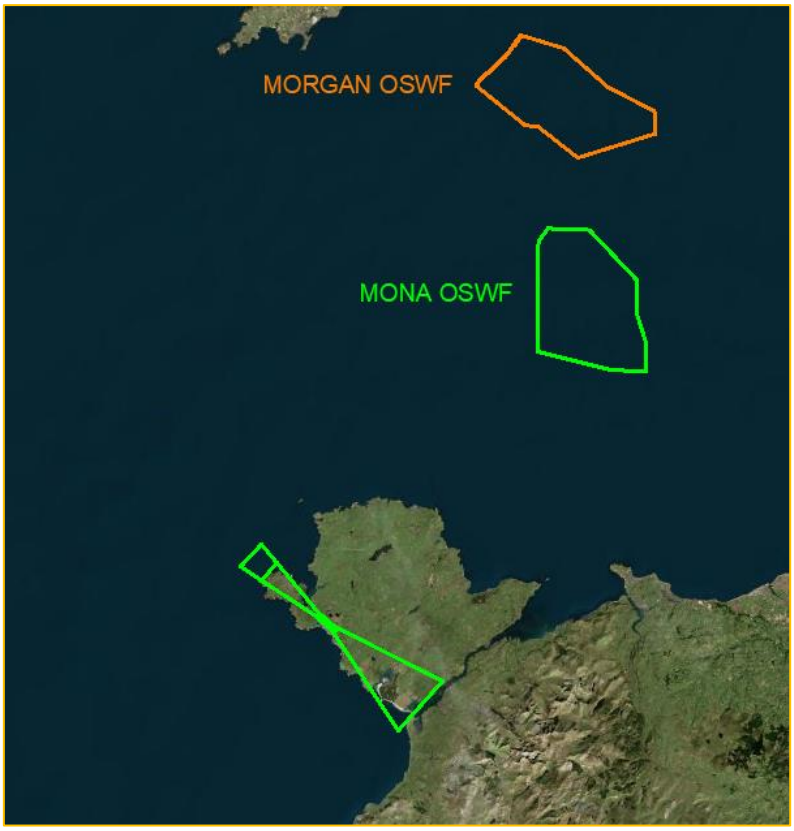

Figure 168 - PAR RWY 13 Protection Areas

The proposed windfarms would have no impact on the PAR RWY 13 procedure.

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6.2.8 AD 2 EGOV-1-20 PAR RWY 19

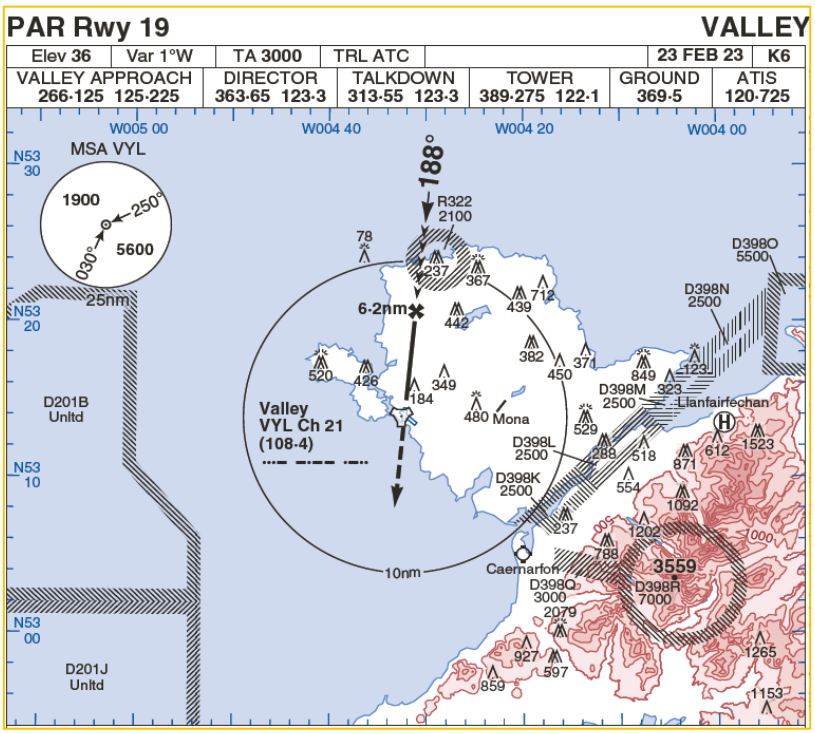

Figure 169 - PAR RWY 19 Procedure

Both windfarms are outside the protection area for the PAR procedure to Runway 19, including the Missed Approach which tracks south, away from the windfarms.

However, arrival to the procedure could be conducted using the ATCSMAC or MSA VYL to conduct radar vectoring until reaching the FAF at 2040ft.

Both windfarms lie within the ATCSMAC 1400ft/1500ft area which has been assessed separately in section 6.2.1.

Additionally, the Mona development lies within the 1900ft buffer area of the NW MSA VYL which has been assessed separately in section 6.2.21.

COMMERCIAL IN CONFIDENCE

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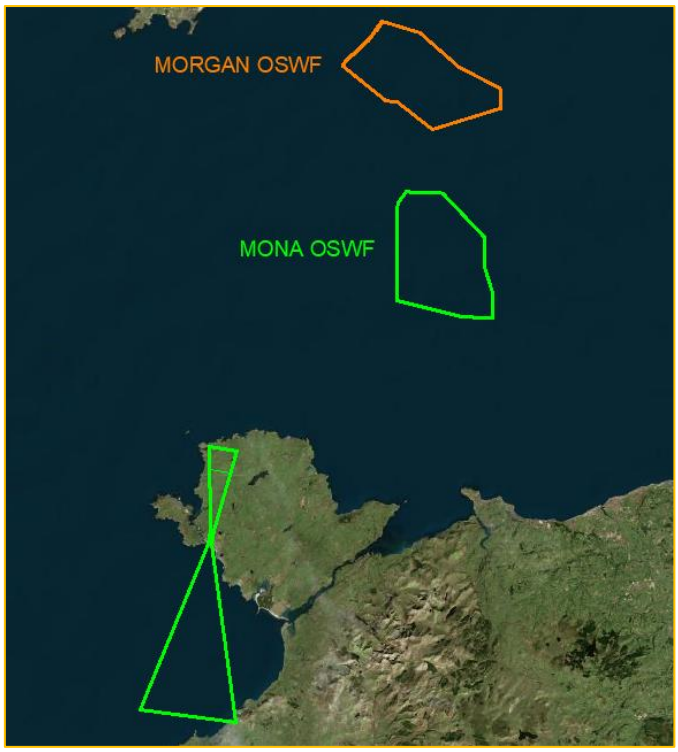

Figure 170 - PAR RWY 19 Protection Areas

The proposed windfarms would have no impact on the PAR RWY 19 procedure.

6.2.9 AD 2 EGOV-1-21 PAR RWY 31

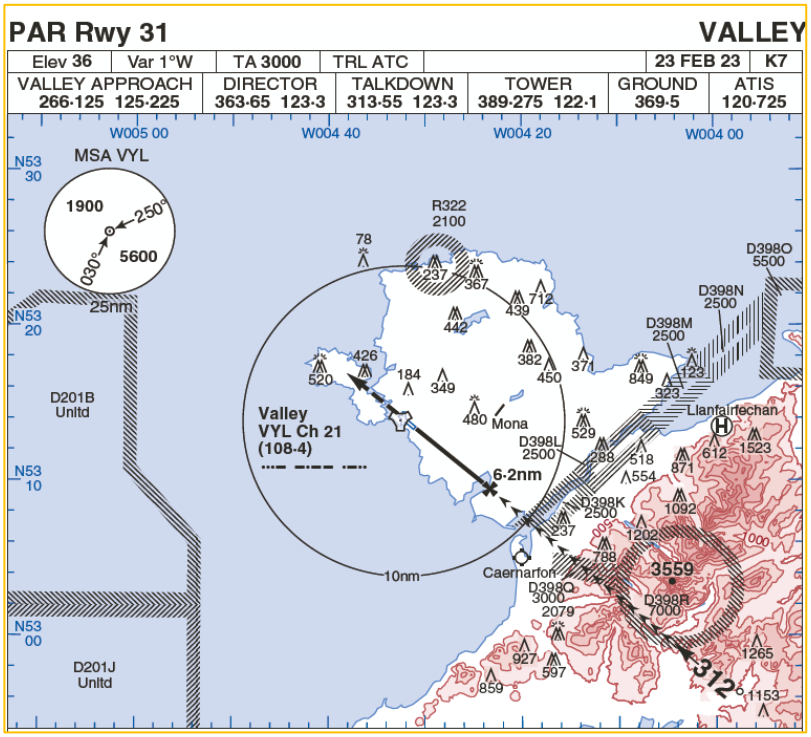

Figure 171 - PAR RWY 31 Procedure

COMMERCIAL IN CONFIDENCE

COMMERCIAL IN CONFIDENCE

Both windfarms lie outside the protection areas for the PAR procedure to runway 31, including the Missed Approach which tracks west, away from the windfarms and climbs to 2530ft which is above the MOCA required at the windfarms.

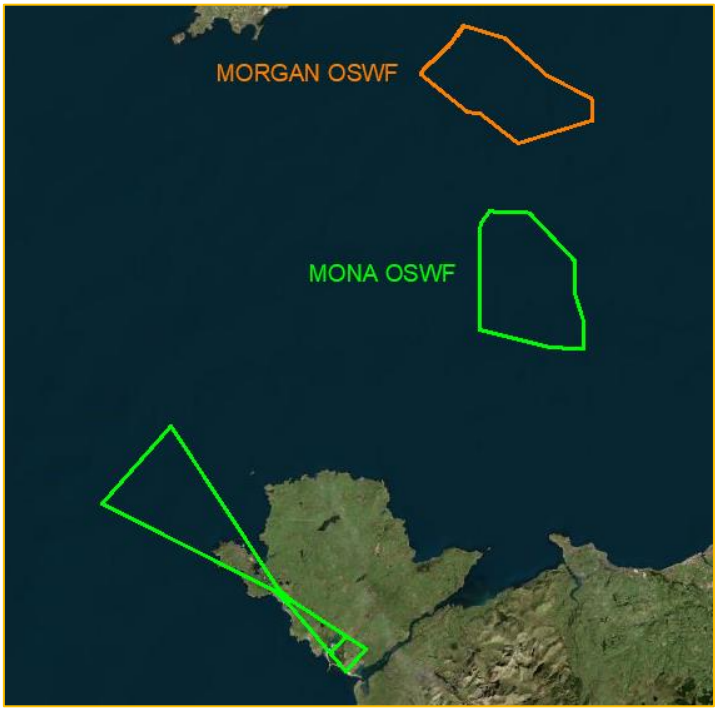

Figure 172 - PAR RWY 31 Protection Areas

The proposed windfarms would have no impact on the PAR RWY 31 procedure.

COMMERCIAL IN CONFIDENCE

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6.2.10 AD 2 EGOV-1-22 SRA RWY 01

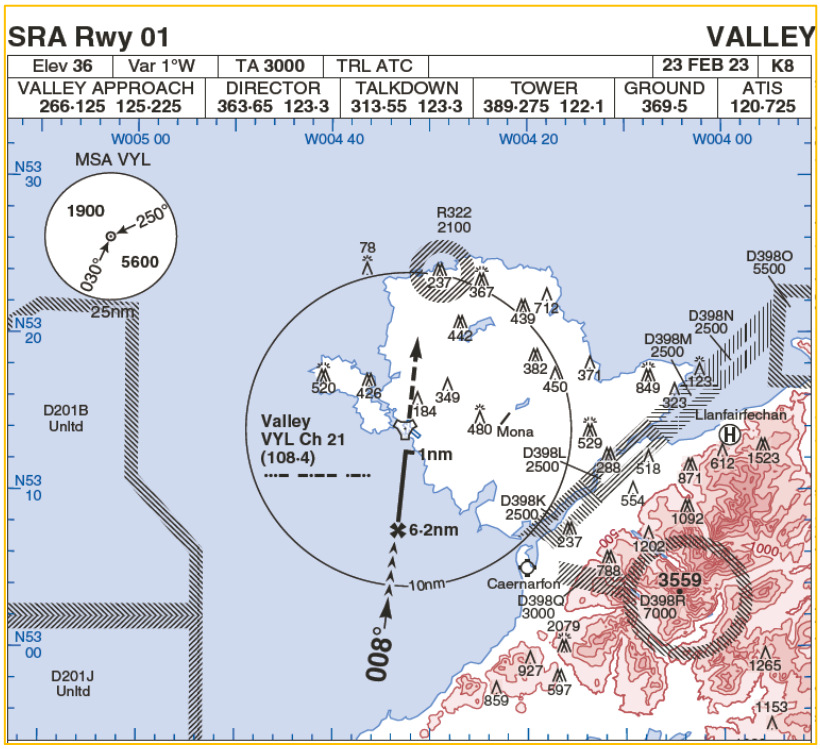

Figure 173 - SRA RWY 01 Procedure

Both windfarms lie outside the protection area for the SRA procedure to runway 01.

This includes the Missed Approach which tracks north, towards the vicinity of the windfarms where aircraft are required to climb to 2520ft which is above the MOCA required at the windfarms.

However, arrival to the procedure could be conducted using the ATCSMAC or MSA VYL to conduct radar vectoring until reaching the FAF at 2020ft.

Both windfarms lie within the ATCSMAC 1400ft/1500ft area which has been assessed separately in section 6.2.1.

Additionally, the Mona development lies within the 1900ft buffer area of the MSA VYL which has been assessed separately in section 6.2.21.

COMMERCIAL IN CONFIDENCE

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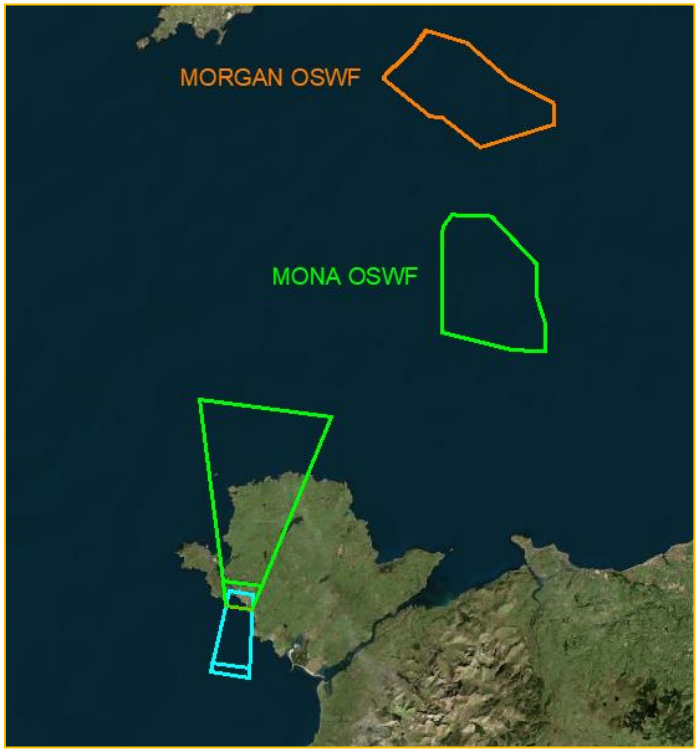

Figure 174 - SRA RWY 01 Protection Areas

The proposed windfarms would have no impact on the SRA RWY 01 procedure.

6.2.11 AD 2 EGOV-1-23 SRA RWY 13

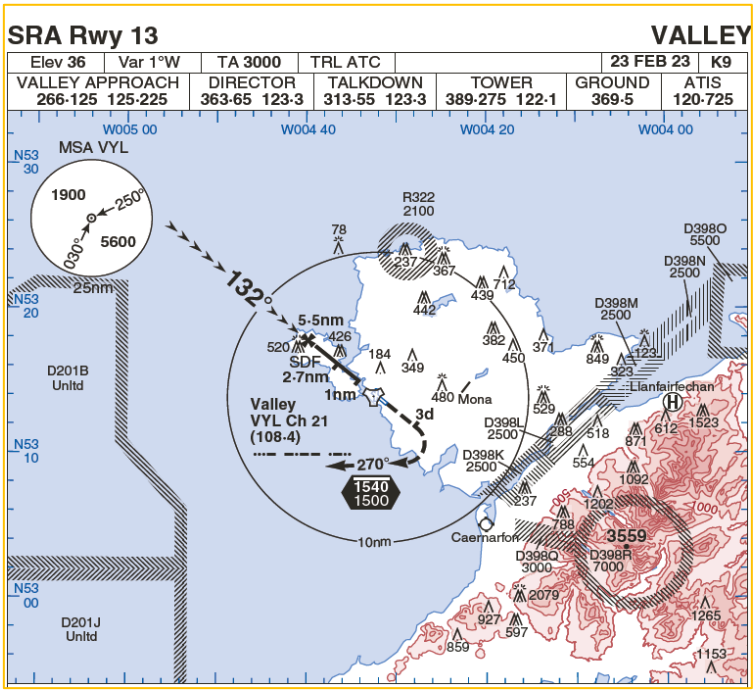

Figure 175 - SRA RWY 13 Procedure

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Both windfarms are outside the protection area for the SRA procedure to Runway 13, including the Missed Approach which tracks south-east before turning right, away from the windfarms.

However, arrival to the procedure could be conducted using the ATCSMAC or MSA VYL to conduct radar vectoring until reaching the FAF at 1840ft.

Both windfarms lie within the ATCSMAC 1400ft/1500ft area which has been assessed separately in section 6.2.1.

Additionally, the Mona development lies within the 1900ft buffer area of the MSA VYL which has been assessed separately in section 6.2.21.

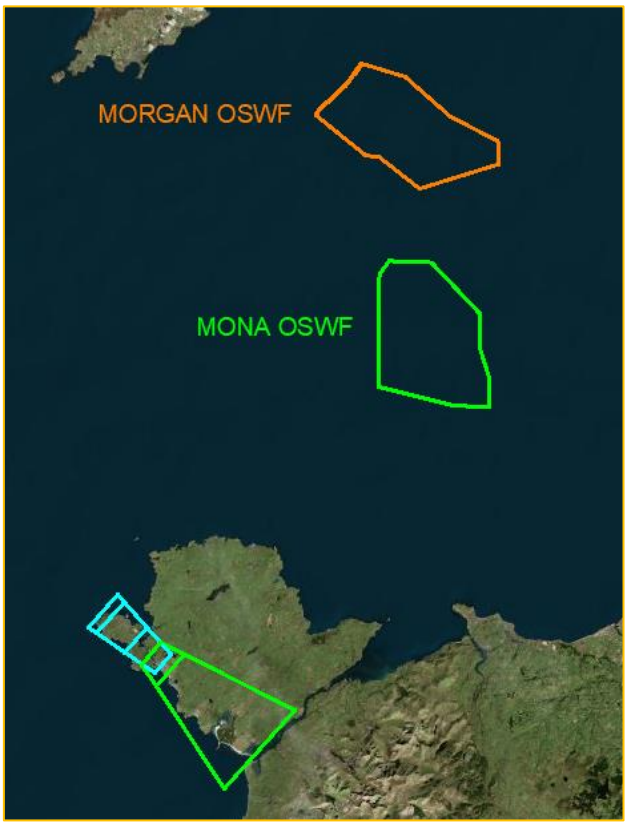

Figure 176 - SRA RWY 13 Protection Areas

The proposed windfarms would have no impact on the SRA RWY 13 procedure.

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6.2.12 AD 2 EGOV-1-24 SRA RWY 19

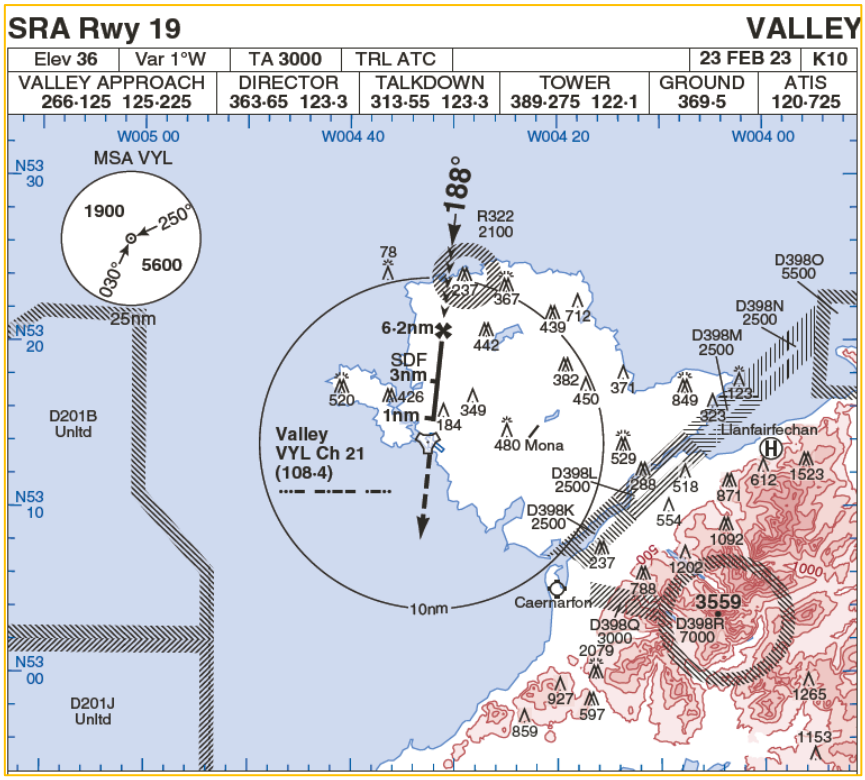

Figure 177 - SRA RWY 19 Procedure

Both windfarms are outside the protection area for the SRA procedure to Runway 19, including the Missed Approach which tracks south, away from the windfarms and requires aircraft to climb to 2540ft.

However, arrival to the procedure could be conducted using the ATCSMAC or MSA VYL to conduct radar vectoring until reaching the FAF at 2040ft.

Both windfarms lie within the ATCSMAC 1400ft/1500ft area which has been assessed separately in section 6.2.1.

Additionally, the Mona development lies within the 1900ft buffer area of the MSA VYL which has been assessed separately in section 6.2.21.

COMMERCIAL IN CONFIDENCE

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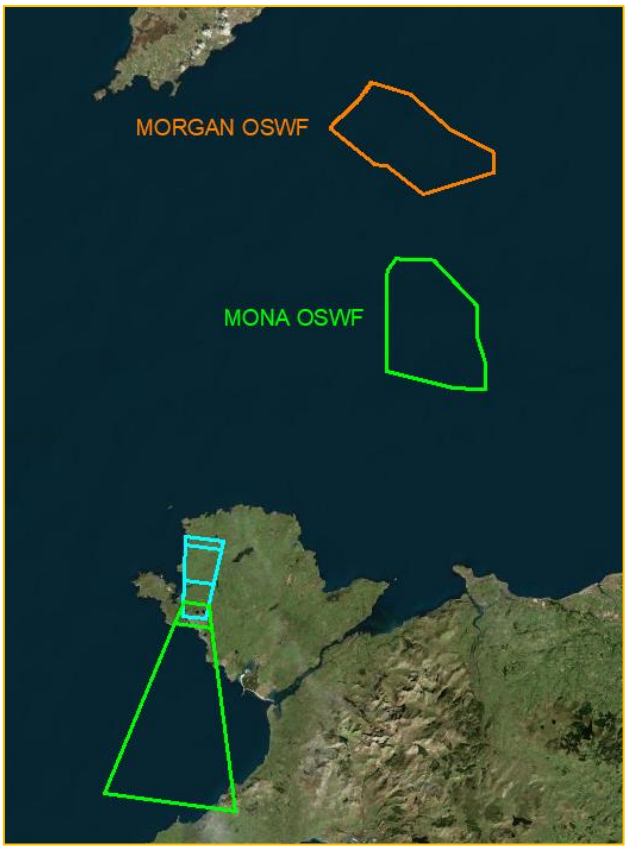

Figure 178 - SRA RWY 19 Protection Areas

The proposed windfarms would have no impact on the SRA RWY 19 procedure.

6.2.13 AD 2 EGOV-1-25 SRA RWY 31

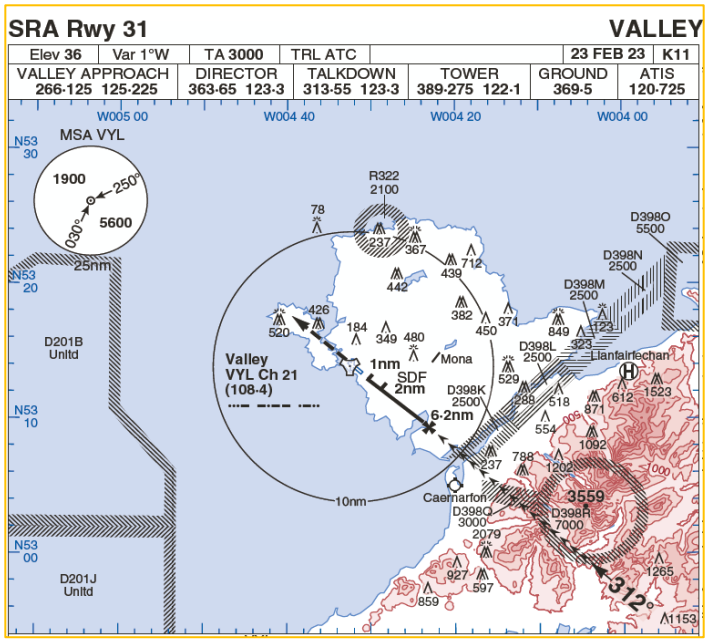

Figure 179 - SRA RWY 31 Procedure

COMMERCIAL IN CONFIDENCE

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Both windfarms lie outside the protection areas for the SRA procedure to runway 31, including the Missed Approach which tracks west, away from the windfarms and climbs to 2530ft which is above the MOCA required at the windfarms.

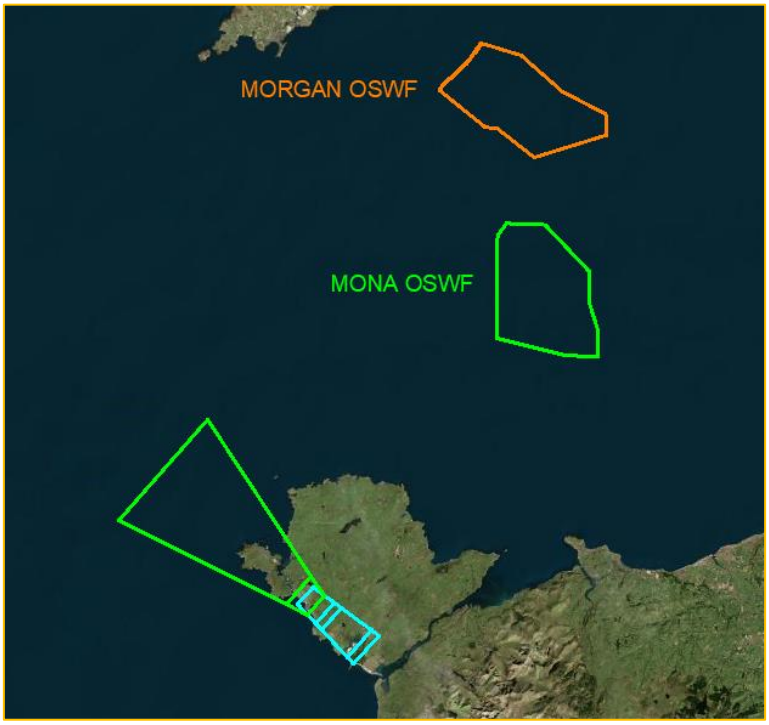

Figure 180 - SRA RWY 31 Protection Areas

Arrival to the procedure from the east lies in the 5600ft south-east sector of the MSA which would offer protection from the windfarms which lie in the 1900ft NW sector.

The proposed windfarms would have no impact on the SRA RWY 31 procedure.

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6.2.14 AD 2 EGOV-1-27 TAC to ILS/DME RWY 13 (Point X-Ray Hold)

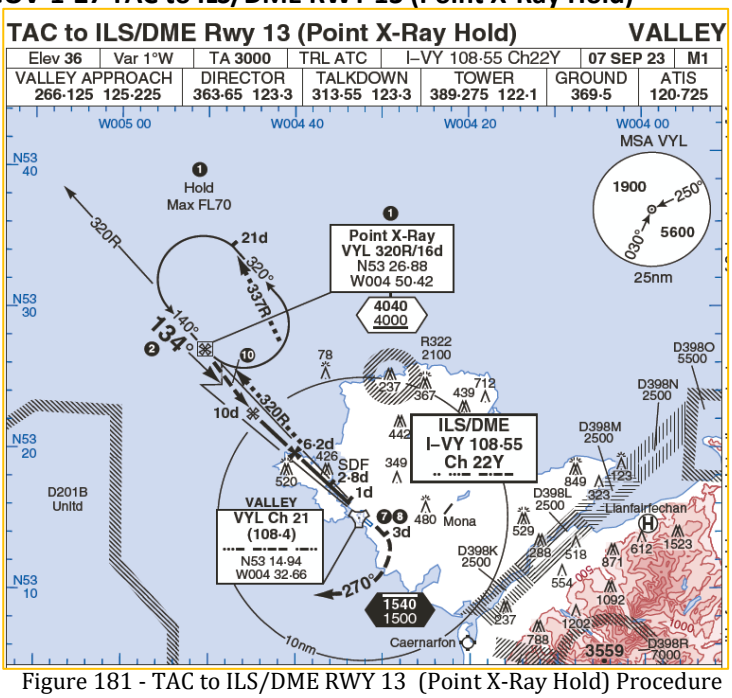

Figure 181 - TAC to ILS/DME RWY 13 (Point X-Ray Hold) Procedure

Both windfarms lie outside the protection areas for the TAC to ILS/DME procedure to runway 13 which arrives from the Hold at Point X-Ray.

The Missed Approach continues ahead on the runway track and turns right, away from the windfarms and will not be affected.

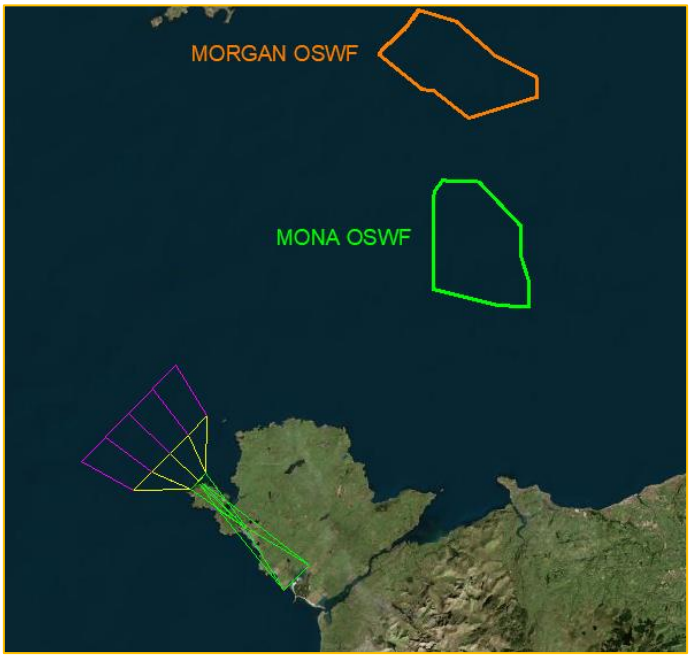

Figure 182 - TAC to ILS/DME RWY 13 (Point X-Ray Hold) Protection Areas

The proposed windfarms would have no impact on the TAC to ILS/DME RWY 13 (Point X-Ray Hold) Procedure.

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6.2.15 AD 2 EGOV-1-28 TAC RWY 01 (Point Alpha Hold)

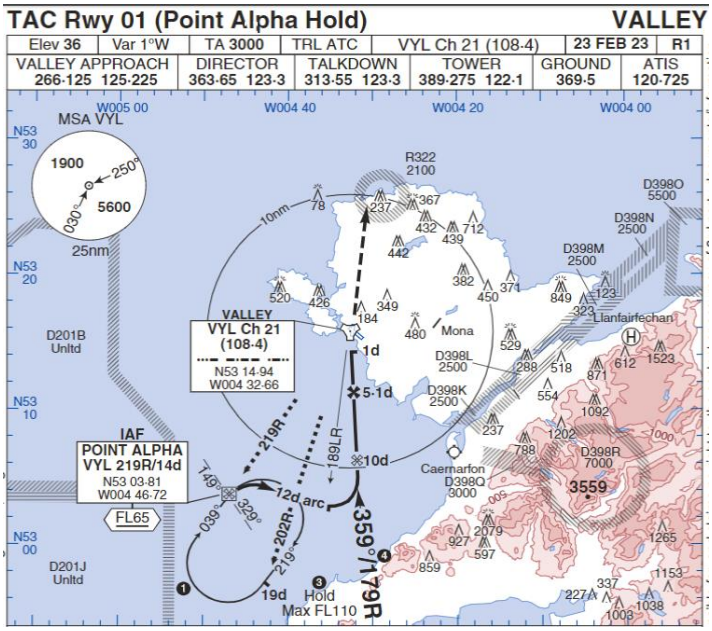

Figure 183 - TAC RWY 01 (Point Alpha Hold) Procedure

The TAC RWY 01 Procedure has an initial altitude of 2520ft at the IF.

With a maximum MOC of 300m the proposed turbines require a MOCA of:

364m + 300m MOC = 664m / 2179ft AMSL, which is below the procedure altitude for TAC RWY 01.

The Missed Approach tracks north, towards the vicinity of the windfarms where aircraft are required to climb to 2520ft which is above the MOCA required at the windfarms.

The proposed windfarms would have no impact on the TAC RWY 01 (Point Alpha Hold) Procedure.

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6.2.16 AD 2 EGOV-1-29 TAC RWY 13 (Point X-Ray Hold)

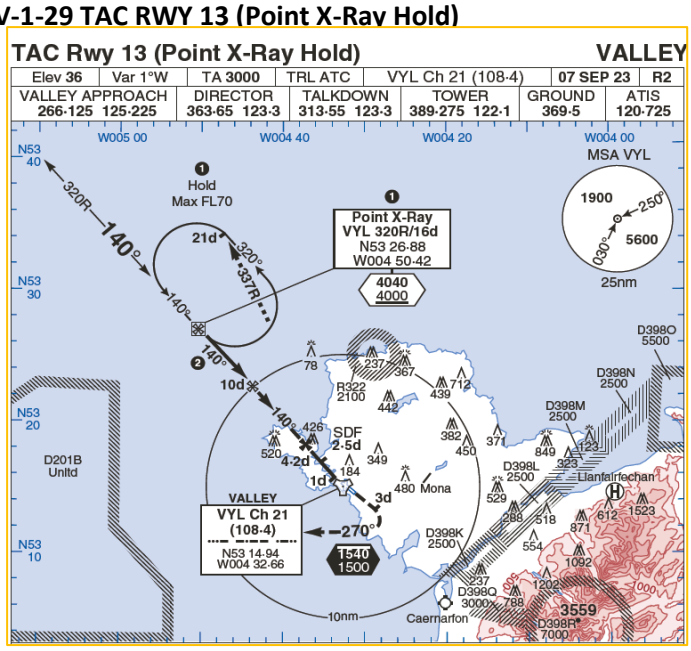

Figure 184 - TAC RWY 13 (Point X-Ray Hold) Procedure

Both windfarms lie outside the protection areas for the TAC procedure to runway 13 which arrives from the Point X-Ray Hold.

The Missed Approach climbs ahead on runway track before turning right, away from the windfarms and would not be affected.

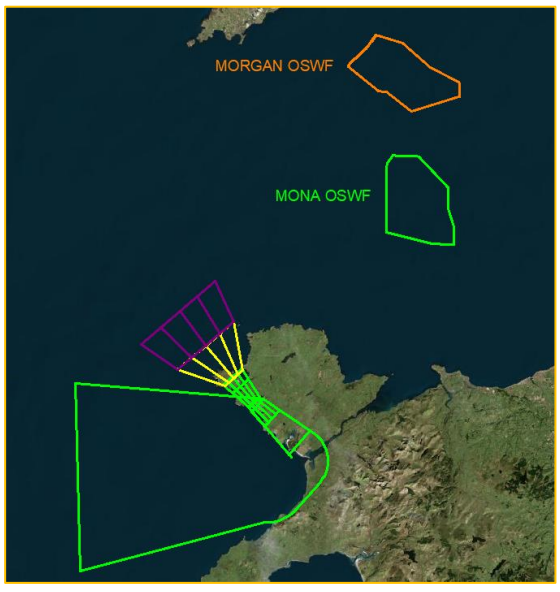

Figure 185 - TAC RWY 13 (Point X-Ray Hold) Protection Areas

The proposed windfarms would have no impact on the TAC RWY 13 (Point X-Ray Hold) procedure.

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6.2.17 AD 2 EGOV-1-30 TAC RWY 19 (Point X-Ray Hold)

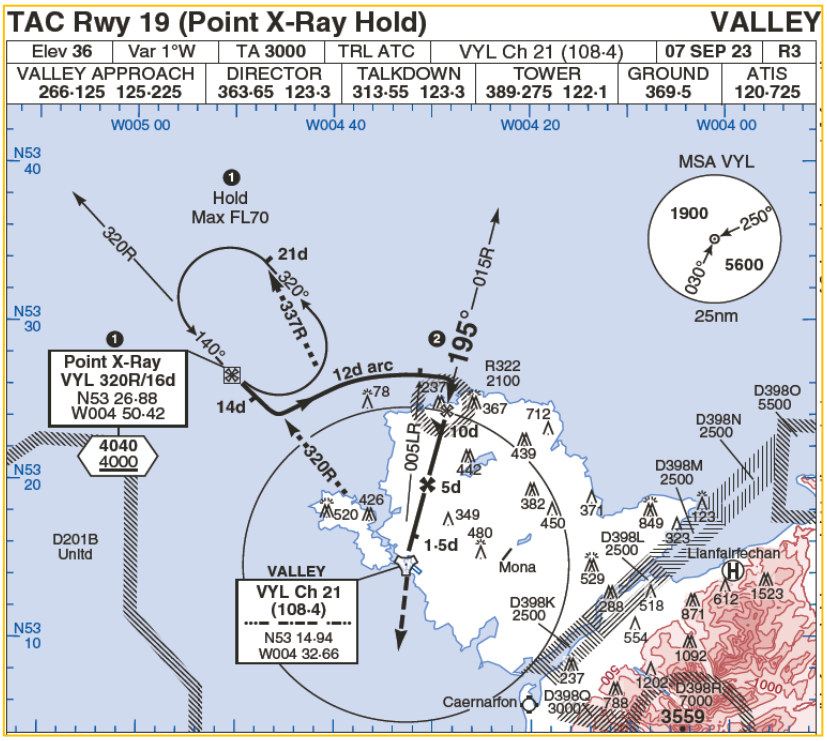

Figure 186 - TAC RWY 19 (Point X-Ray Hold) Procedure

Both windfarms lie outside the protection areas for the TAC procedure to runway 19 which arrives from the Point X-Ray Hold.

The Missed Approach tracks south, away from the windfarms and climbs to 2540ft so is not affected.

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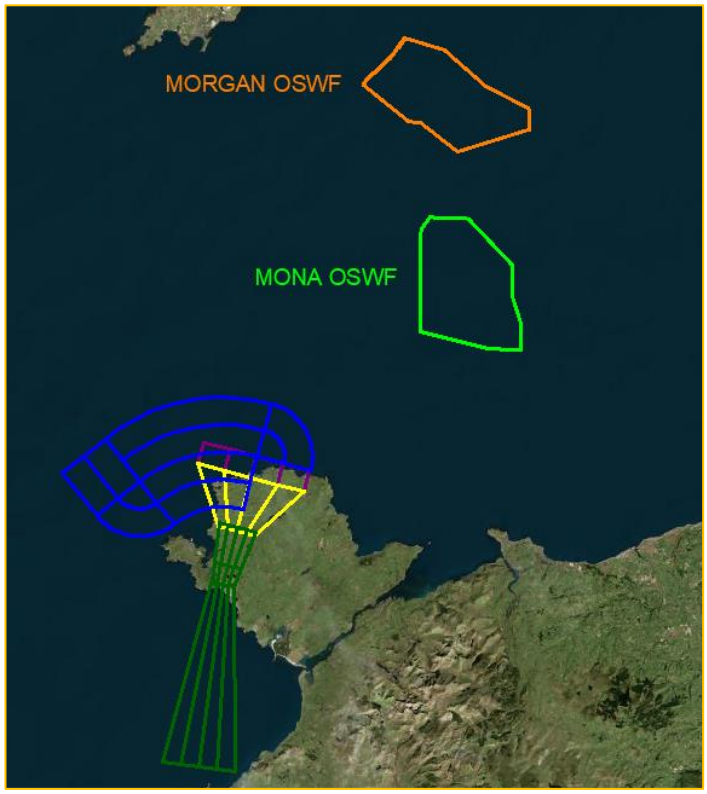

Figure 187 - TAC RWY 19 (Point X-Ray Hold) Protection Areas

The proposed windfarms would have no impact on the TAC RWY 19 (Point X-Ray Hold) procedure.

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6.2.18 Visual Circling

Both windfarms are outside the Visual Circling VM(C) Obstacle Clearance areas for all aircraft categories (A, B, C and D).

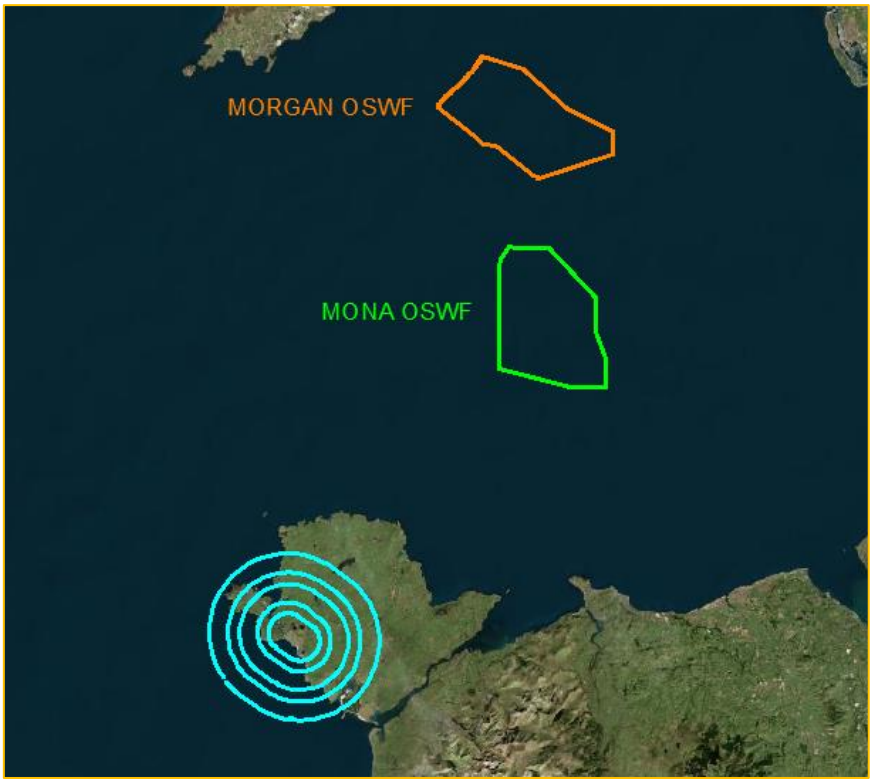

Figure 188 - Visual Circling Protection Area

The proposed windfarms would have no impact on the Visual Circling at RAF Valley.

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6.2.19 Holding

Point X-Ray Hold

Both windfarms lie outside the protection areas associated to the Point X-Ray Hold, including its buffers – therefore there will be no impact on the Point X-Ray Hold.

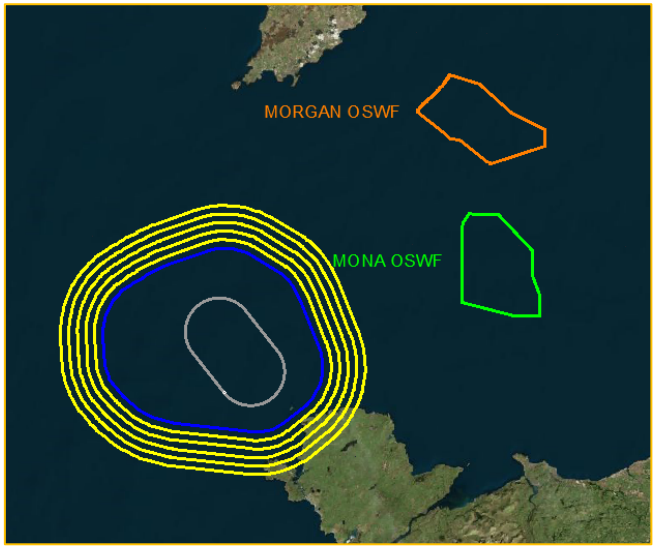

Figure 189 - Point X-Ray Hold Protection Areas and Buffers

Point Alpha Hold

Both windfarms lie outside the protection areas associated to the Point Alpha Hold, including its buffers – therefore there will be no impact on the Point Alpha Hold.

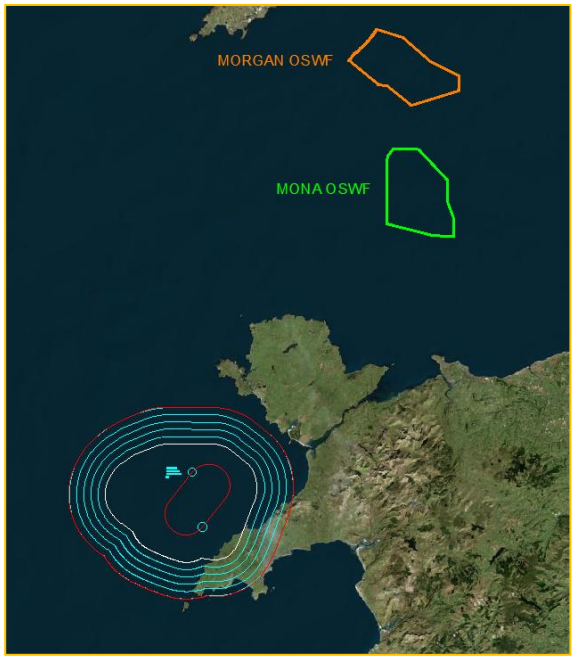

Figure 190 - Point Alpha Hold Protection Area and Buffers

The proposed windfarms would have no impact on any of the holds for RAF Valley.

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6.2.20 Visual Segment Surface (VSS)

The proposed windfarms lie outside the lateral confines of VSS for all Runways.

The proposed windfarms would have no impact on the VSS for RAF Valley's Runways.

6.2.21 Minimum Sector Altitudes

MSA VYL 25NM

The Mona Windfarm lies within the buffer area of the north-west sector of the MSA VYL 25NM which has a published MSA of 1900ft.

The windfarms do not need to be considered towards the south-east sector of the MSA as they are outside the protection areas.

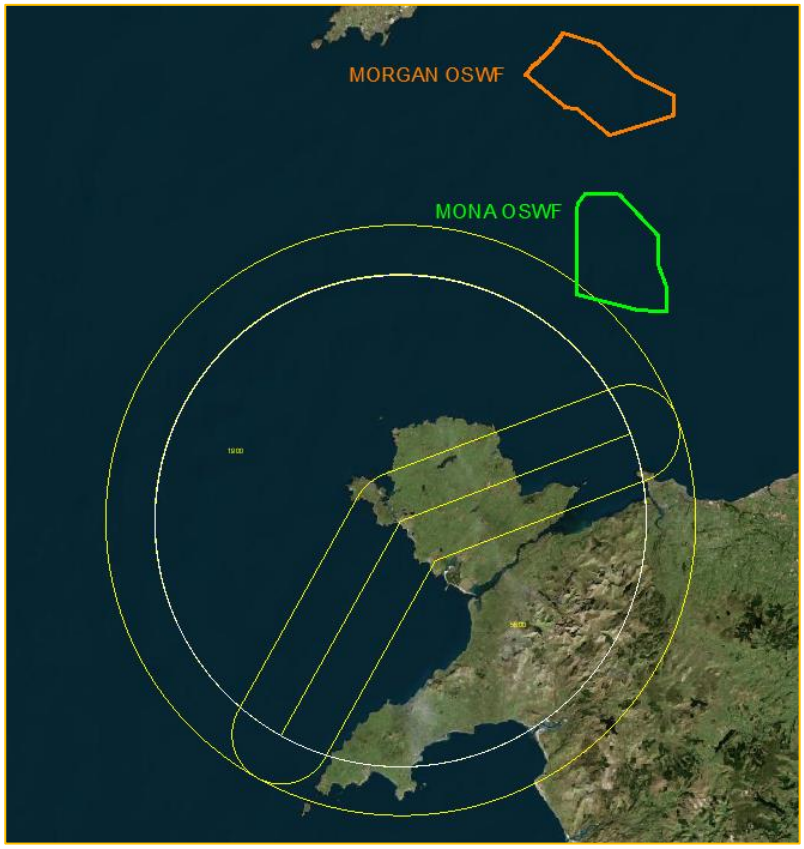

Figure 191 - MSA VYL 25NM and Buffer Area

The Windfarm produces a MOCA of 364m + 300m MOC = 664m / 2179ft AMSL for the north-west sector and would potentially impact the current published MOCA in this sector.

This is above the published MSA for the north-west sector which has a MOCA of 1900ft which would need to be increased to 2200ft to clear Mona Windfarm.

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7 Blackpool Airport OLS and IFP Assessment

7.1 OLS Assessment

7.1.1 Overview

The OLS for Blackpool Airport has been constructed in accordance with Annex 14 and CAP 168.

7.1.2 Runway Data Used

The following declared distances and threshold details are published in the AIP:

Runway designator	TORA	TODA	ASDA	LDA	Remarks
1	2	3	4	5	6
10	1868 M	2170 M	1868 M	1868 M	
28	1868 M	2129 M	1868 M	1868 M	
10	1452 M	1754 M	1452 M		Take-off from intersection of Taxiway Delta.
10	1017 M	1319 M	1017 M		Take-off from intersection of Taxiway Echo.
28	866 M	1127 M	866 M		Take-off from intersection of Taxiway Echo.
13	998 M	1077 M	998 M	970 M	
31	852 M	852 M	970 M	970 M	ASDA/LDA ends 24 M before end of pavement.

Figure 192 - Declared Distances

Designations RWY Number	True bearing	Dimensions of RWY	Surface of RWY/ SWY/ Strength (PCN)	THR co-ordinates/ THR Geoid undulation	THR elevation/ Highest elevation of TDZ of precision APP RWY	Slope of RWY/ SWY
1	2	3	4	5	6	7
10	094.63°	1868 x 45 M	RWY surface: Asphalt PCN 33/F/A/W/T	534620.06N 0030233.67W 171.6 FT	THR 31.8 FT	
28	274.66°	1868 x 45 M	RWY surface: Asphalt PCN 33/F/A/W/T	534615.16N 0030051.98W 171.5 FT	THR 28.0 FT TDZ 29.1 FT	
13	127.30°	998 x 24 M	RWY surface: Asphalt PCN 14/F/A/W/T	534625.45N 0030231.30W 171.6 FT	THR 32.1 FT	
31	307.31°	998 x 24 M	RWY surface: Asphalt PCN 14/F/A/W/T	534608.74N 0030154.29W 171.6 FT	THR 31.1 FT	

Figure 193 - Threshold Details

Runway 28 has precision approaches and is more than 1800m in length, as is RW10. Runways 13 and 31 are less than 1199m in length.

Runway 10 is a CODE 4, Non-Precision Runway

Runway 28 is a CODE 4, Precision Instrument Runway (**Lowest threshold, 8.53m**)

Runway 13 is a CODE 2, Non-Precision Runway

Runway 31 is a CODE 2, Non-Precision Runway

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7.1.3 OLS Construction

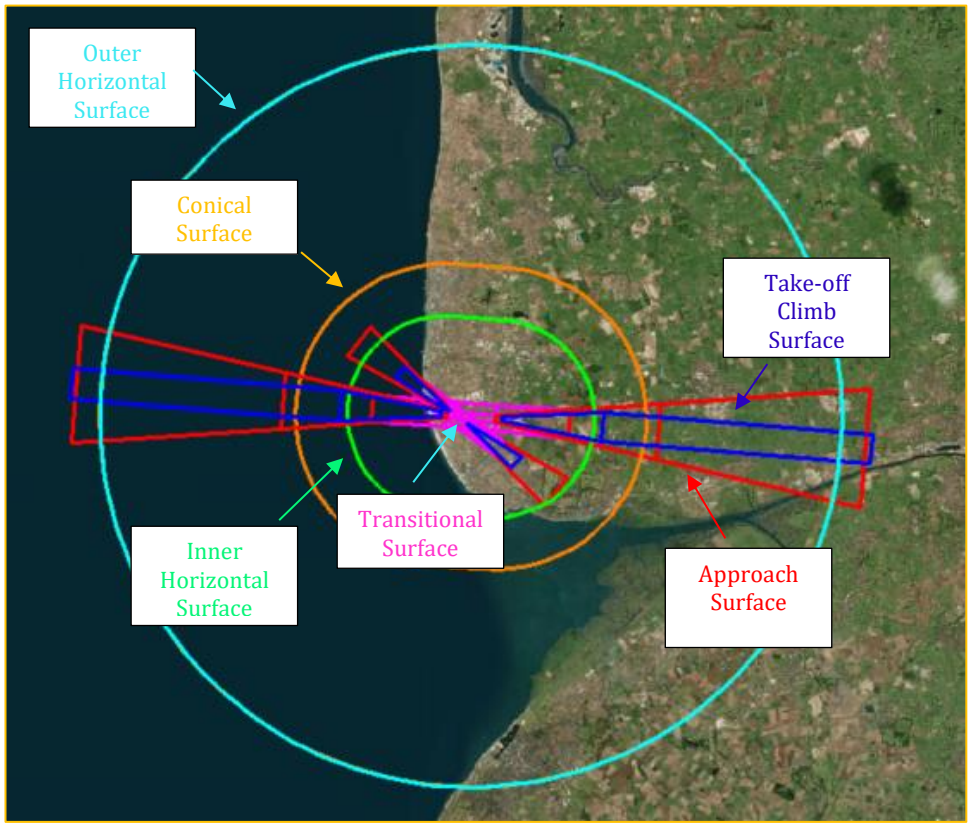

Figure 194 - OLS for Blackpool Airport

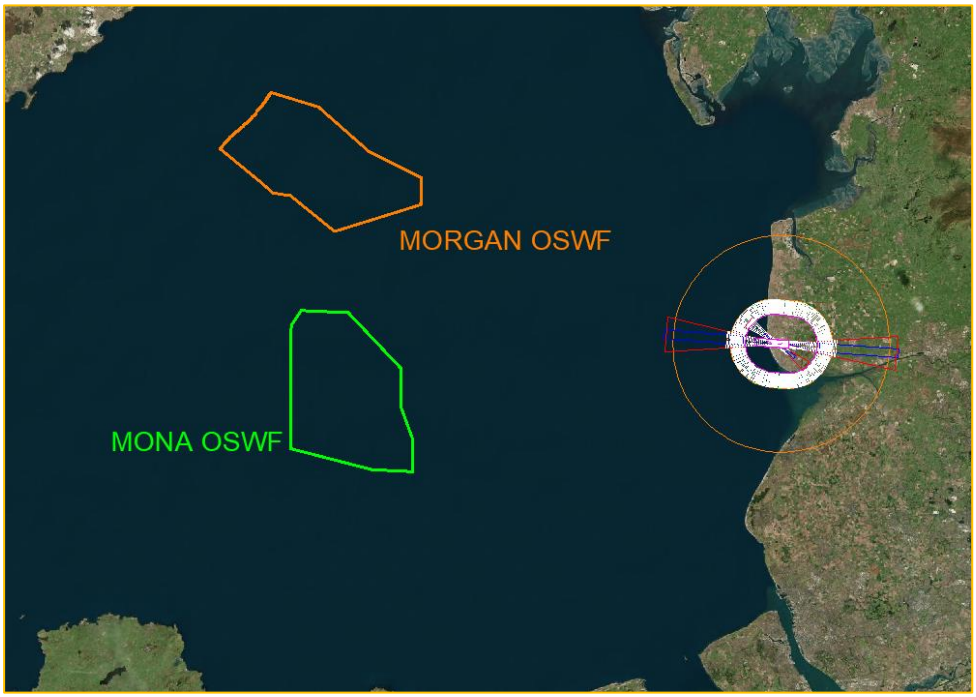

Figure 195 - Blackpool OLS in Relation to Windfarms

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7.1.4 OLS Analysis

The OLS for Blackpool Airport lies entirely outside of the boundaries of both windfarms and is not affected by the development.

The proposed windfarms will have no impact on the OLS for Blackpool Airport.

7.2 IFP Analysis

The IFPs assessed are as follows:

AIRAC 09/2023 (Effective 07 SEP 2023)

- AD 2.EGNH-8-1 NDB(L)/DME RWY 10 (06 OCT 22)
- AD 2.EGNH-8-2 NDB(L) RWY 10 (06 OCT 22)
- AD 2.EGNH-8-3 ILS/DME RWY 28 (06 OCT 22)
- AD 2.EGNH-8-4 LOC/DME RWY 28 (06 OCT 22)
- AD 2.EGNH-8-5 RNP RWY 28 (06 OCT 22)
- AD 2.EGNH-8-6 NDB(L)/DME RWY 28 (06 OCT 22)

Additionally, the following were checked:

- Visual Circling
- Holding
- Visual Segment Surface (VSS)
- Minimum Sector Altitudes (MSA)

7.2.1 NDB(L)/DME RWY 10 (06 OCT 22)

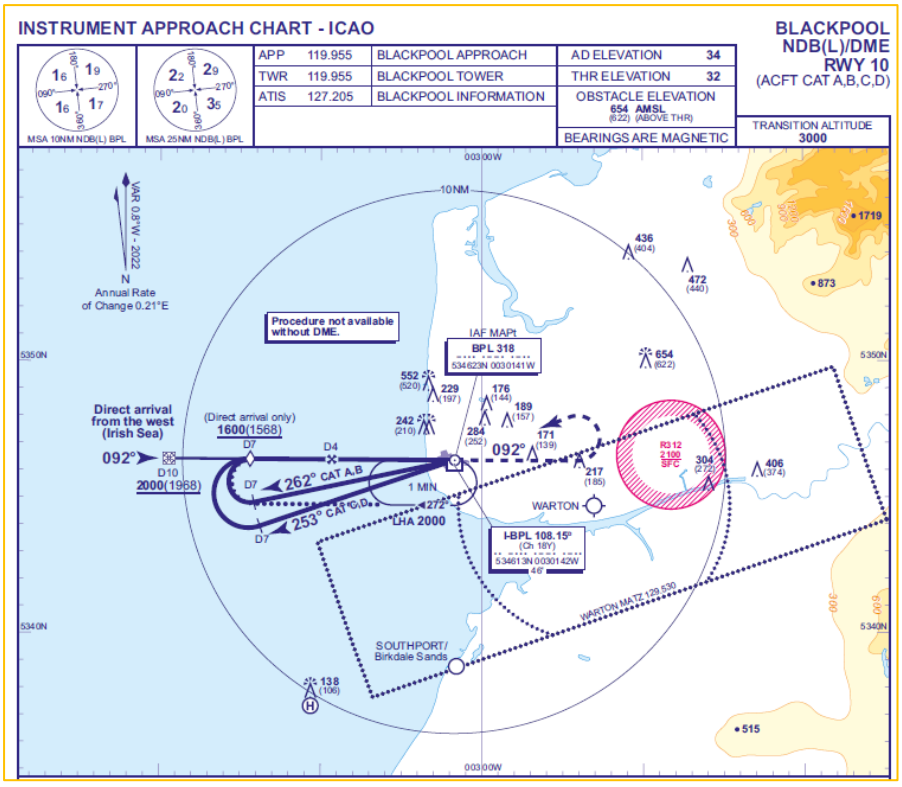

Figure 196 - NDB(L)/DME RWY 10 Procedure

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Both windfarms (Morgan and Mona) lie outside the protection areas associated to the NDB(L)/DME Procedure to Runway 10 (Including Arrival from IAF I-BPL DME 10).

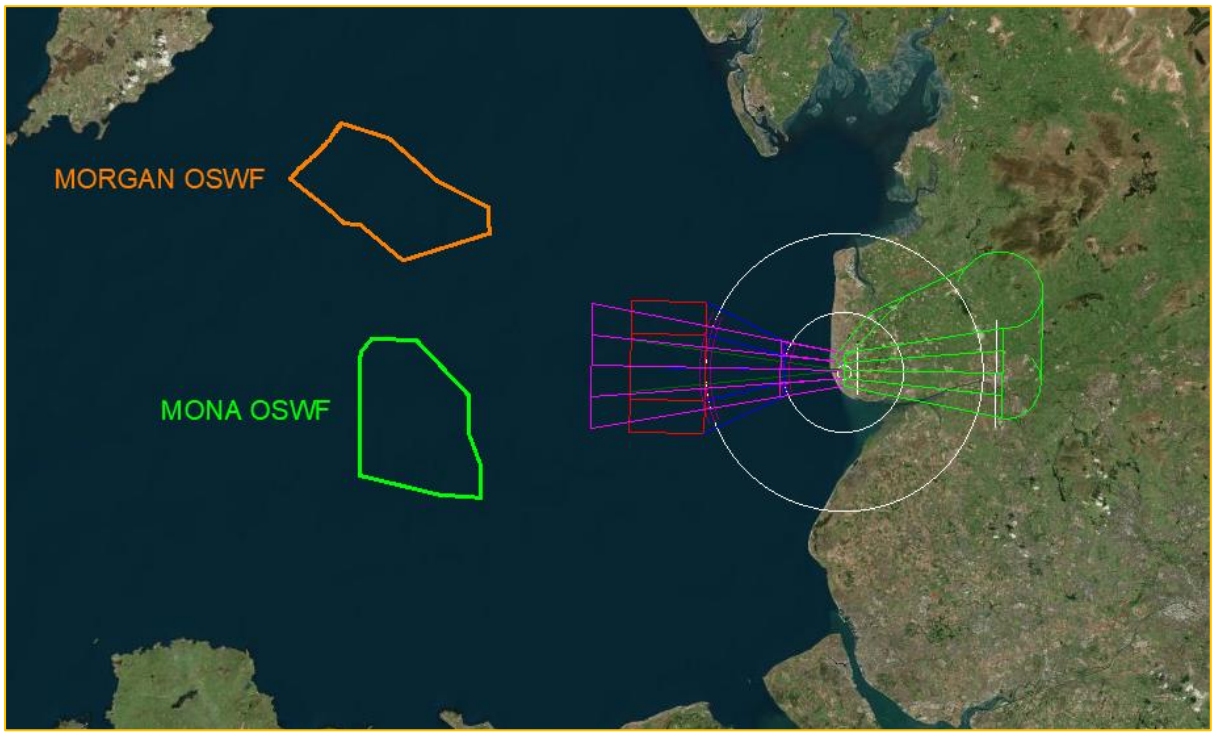

Figure 197 - Morgan and Mona Windfarm vs NDB(L)/DME RWY 10 Protection Areas

Additionally, procedure reversals published on the approach chart (CAT A,B & CAT C,D Base turns and the Alternative Extended Holding Pattern, as per the textual note in the chart) from IAF NDB(L) BPL have been constructed:

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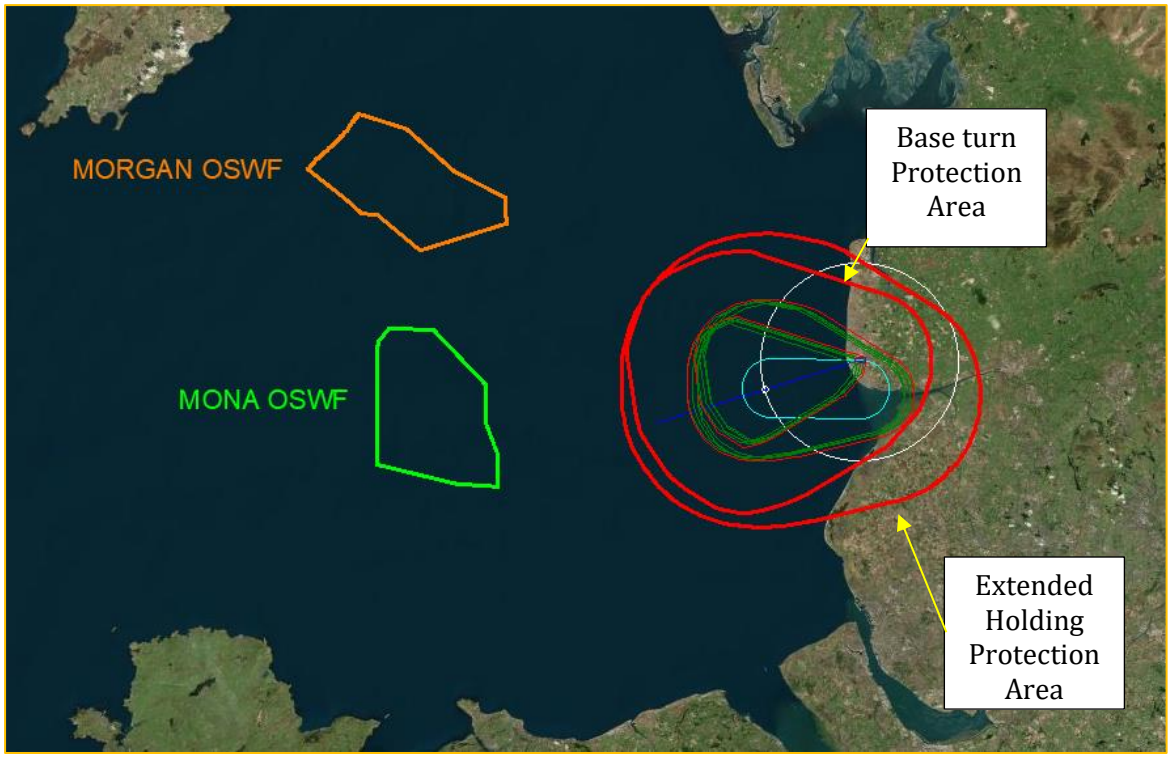

Figure 198 - Windfarms vs NDB(L)/DME RWY 10 Base turn & Extended Holding

As both windfarms are outside the protection areas for the Base turn and the extended holding, they will not impact the reversals.

The NDB(L)/DME RWY10 has been assessed for approaches starting at IAF I-BPL DME 10, which are safe for the current 'at or above' 2000ft altitude restriction. However, aircraft on a direct arrival from the West (Irish Sea), until reaching the IAF I-BPL DME 10, would be covered by the MSA NDB(L) BPL Assessment, which has been done separately – See Section 7.2.10.

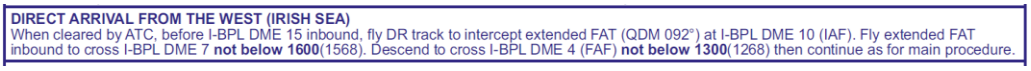

Figure 199 - NDB(L)/DME RWY 10 - Direct Arrival from the West.

The proposed windfarms will not have an impact on the NDB(L)/DME RWY 10 Procedure.

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7.2.2 NDB(L) RWY 10

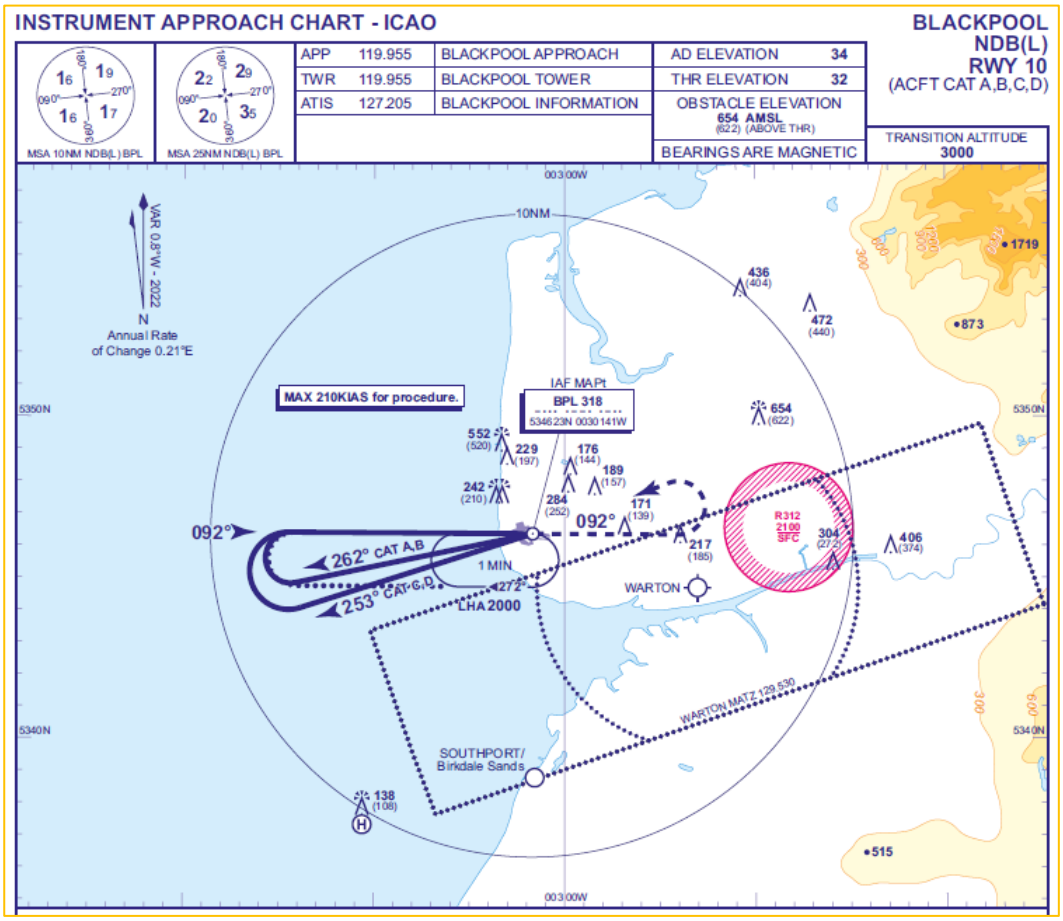

Figure 200 - NDB(L) RWY 10 Procedure

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the NDB(L) Procedure to Runway 10.

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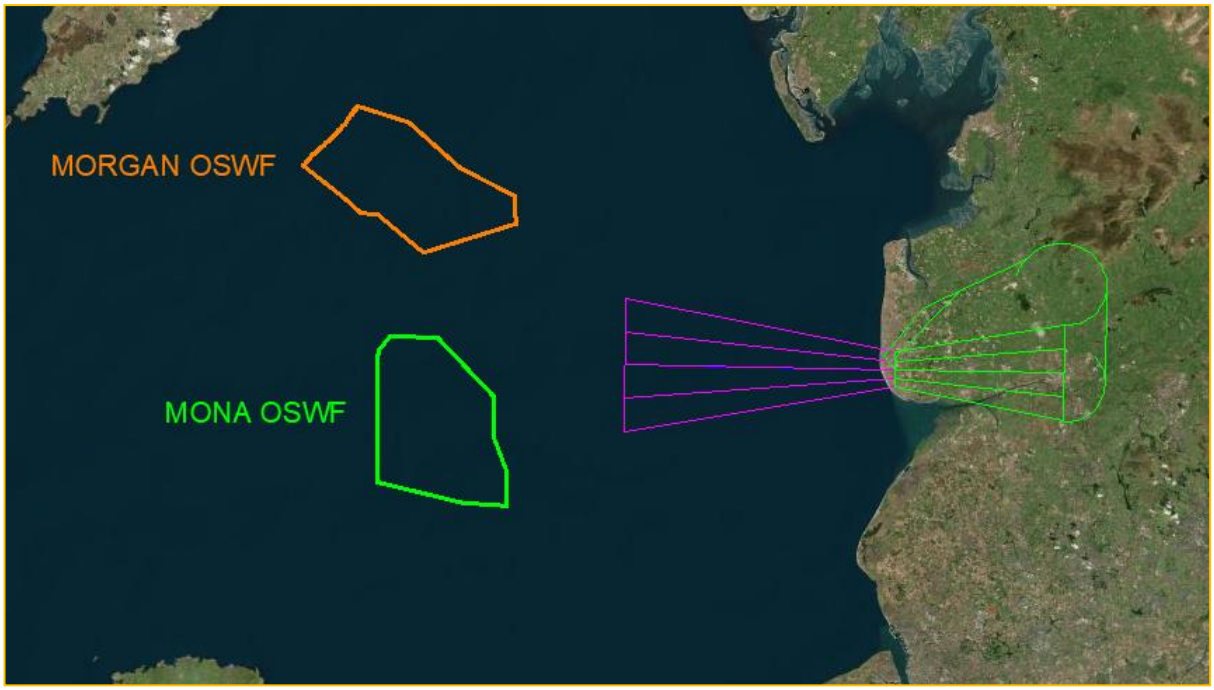

Figure 201 - Morgan and Mona Windfarm vs NDB(L) RWY 10 Protection Areas

Additionally, procedure reversals published on the approach chart (CAT A,B & CAT C,D Base turns and the Alternative Extended Holding Pattern, as per the textual note in the chart) from IAF NDB(L) BPL have been constructed:

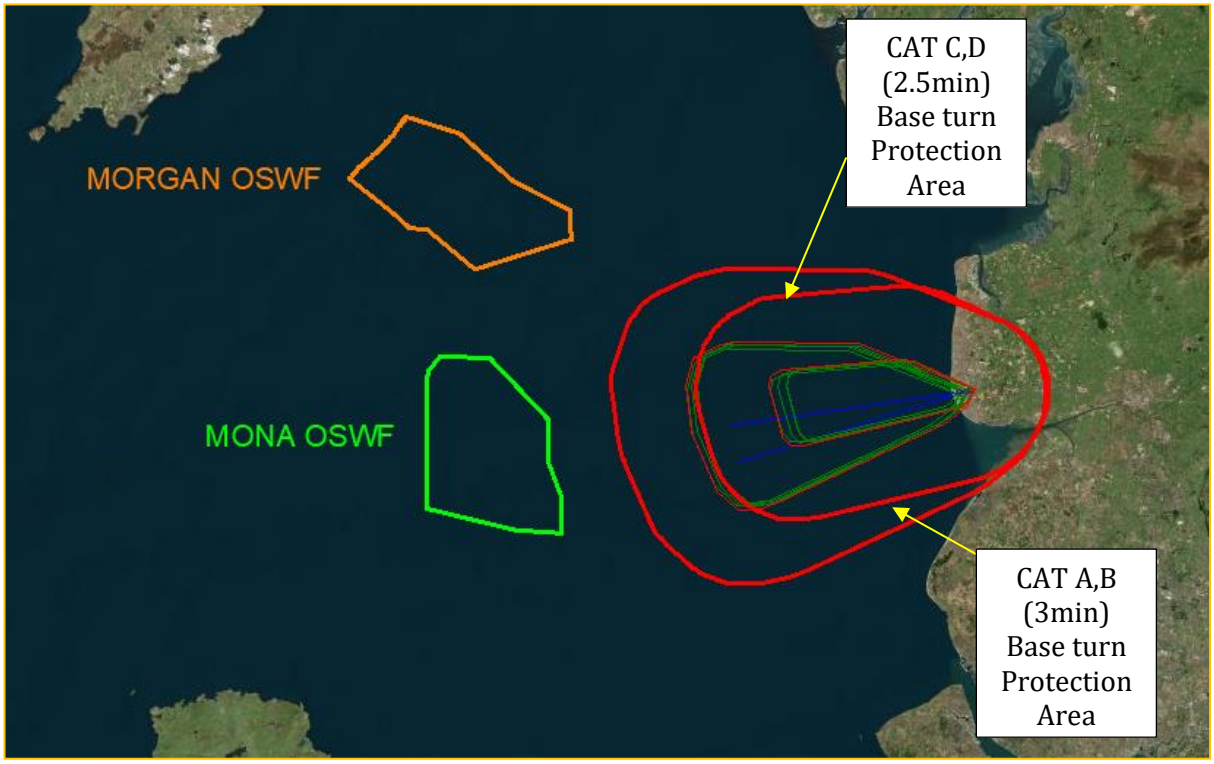

Figure 202 - Windfarms vs NDB(L) RWY 10 Base turns

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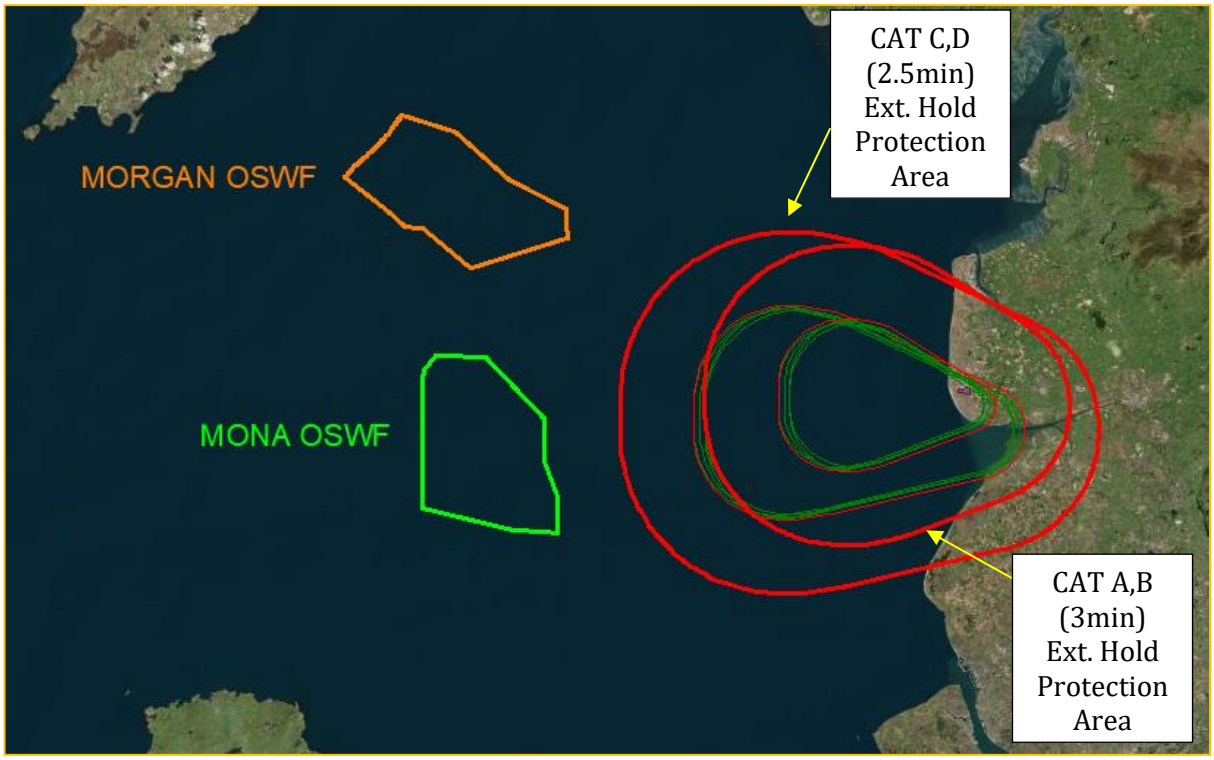

Figure 203 - Windfarms vs NDB(L) RWY 10 Extended Holdings

As both windfarms are outside the protection areas for the base turns and the extended holdings, they will not impact the reversals.

The proposed windfarms will not have an impact on the NDB(L) RWY 10 Procedure.

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7.2.3 ILS/DME RWY 28

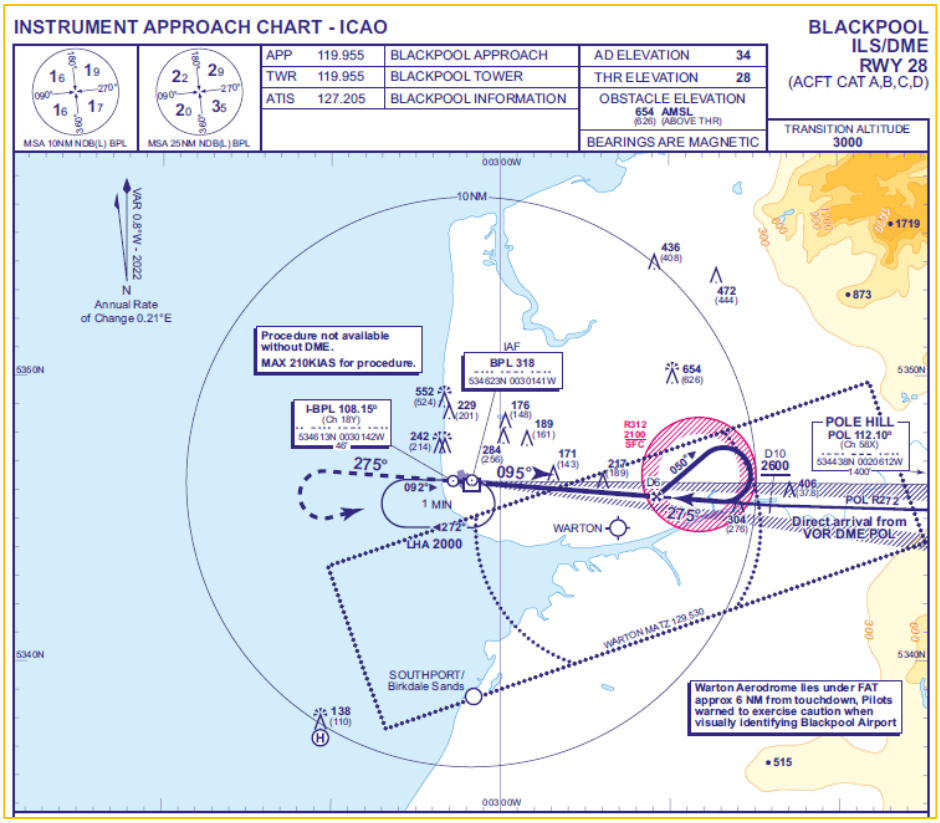

Figure 204 - ILS/DME RWY 28

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the ILS/DME Procedure to Runway 28.

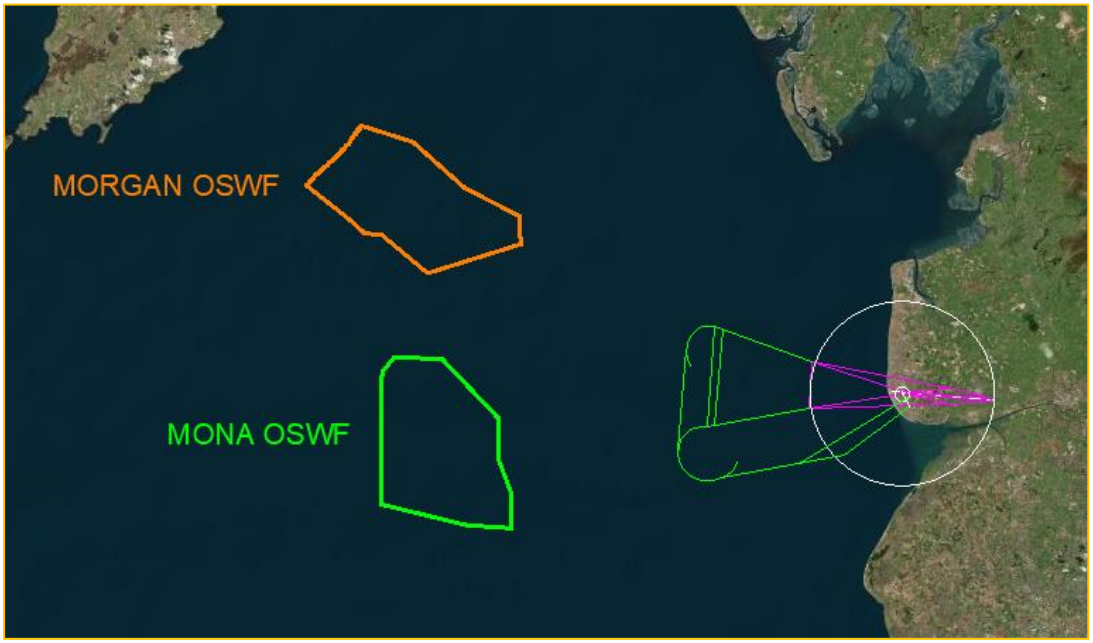

Figure 205 - Morgan and Mona Windfarm vs ILS/DME RWY 28 Protection Areas

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Additionally, procedure reversal published on the approach chart (45°/180° Procedure Turn) from IAF NDB(L) BPL have been constructed:

Figure 206 - Windfarms vs ILS/DME RWY 28 Reversal

As both windfarms are outside the protection areas for the reversal, they will not cause an impact.

The proposed windfarms will not have an impact on the ILS/DME RWY 28 Procedure.

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7.2.4 LOC/DME RWY 28

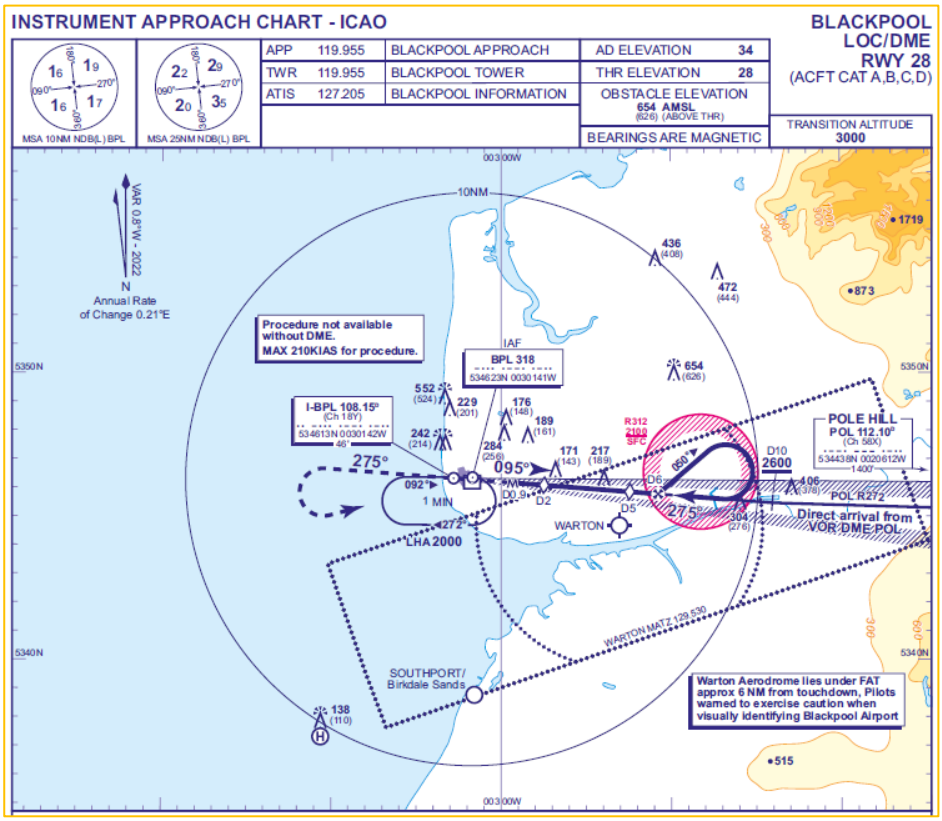

Figure 207 - LOC/DME RWY 28 Procedure

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the LOC/DME Procedure to Runway 28.

Figure 208 - Morgan and Mona Windfarm vs LOC/DME RWY 28 Protection Areas

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The procedure reversal published on the approach chart (45°/180° Procedure Turn) from IAF NDB(L) BPL has already been assessed in Section 7.2.3 and it is not impacted.

The proposed windfarms will not have an impact on the LOC/DME RWY 28 Procedure.

7.2.5 RNP RWY 28

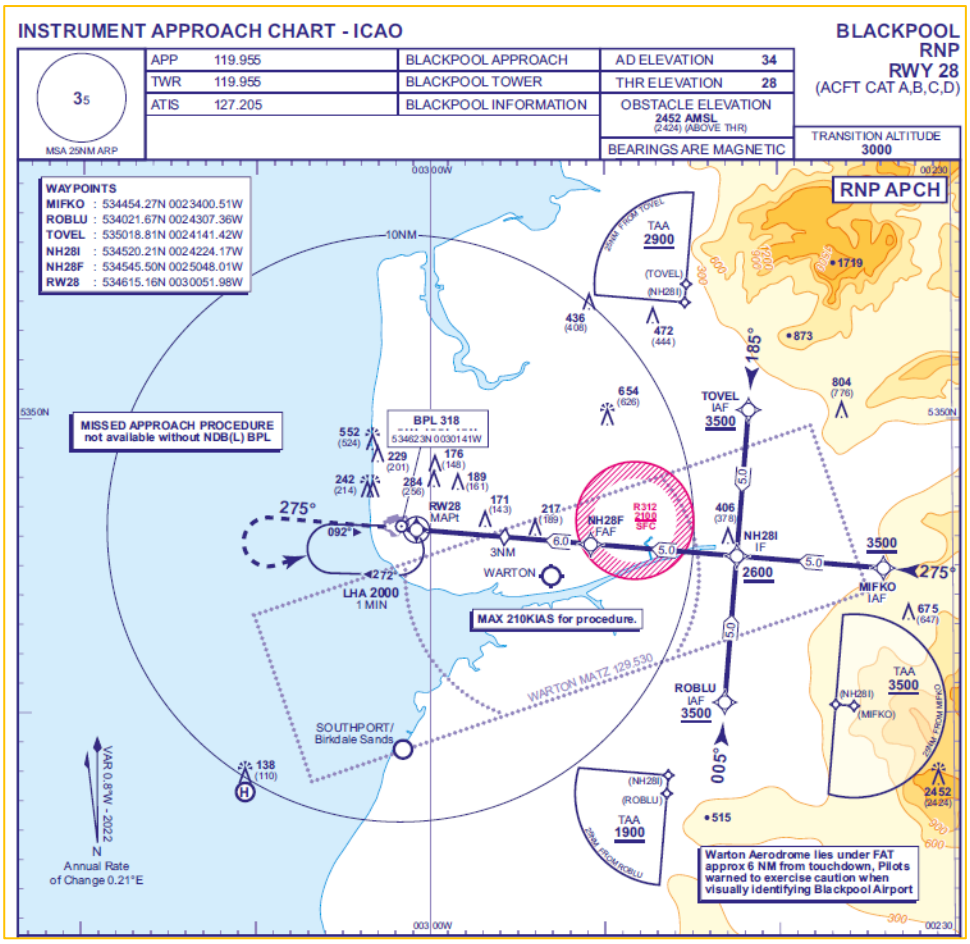

Figure 209 - RNP RWY 28 Procedure

Both windfarms lie outside the protection areas associated to the RNP Procedure to Runway 28.

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Figure 210 - Morgan and Mona Windfarm vs RNP RWY 28 Protection Areas

Additionally, Terminal Arrival Altitudes (TAAs) on each of the Initial Approach Fixes (IAFs; TOVEL, MIFKO and ROBLU) have been constructed:

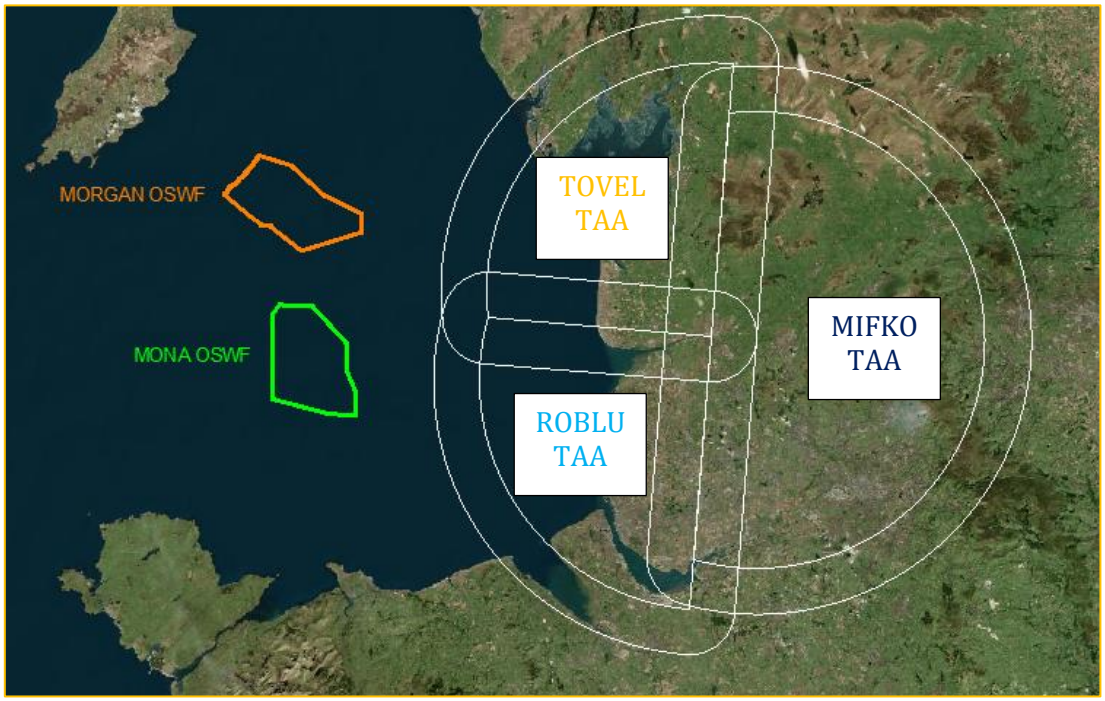

Figure 211 - Windfarms vs RNP RWY 28 TAAs

As both windfarms are outside the protection areas for the TAAs, they will not cause an impact.

The proposed windfarms will not have an impact on the RNP RWY 28 Procedure.

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7.2.6 NDB(L)/DME RWY 28

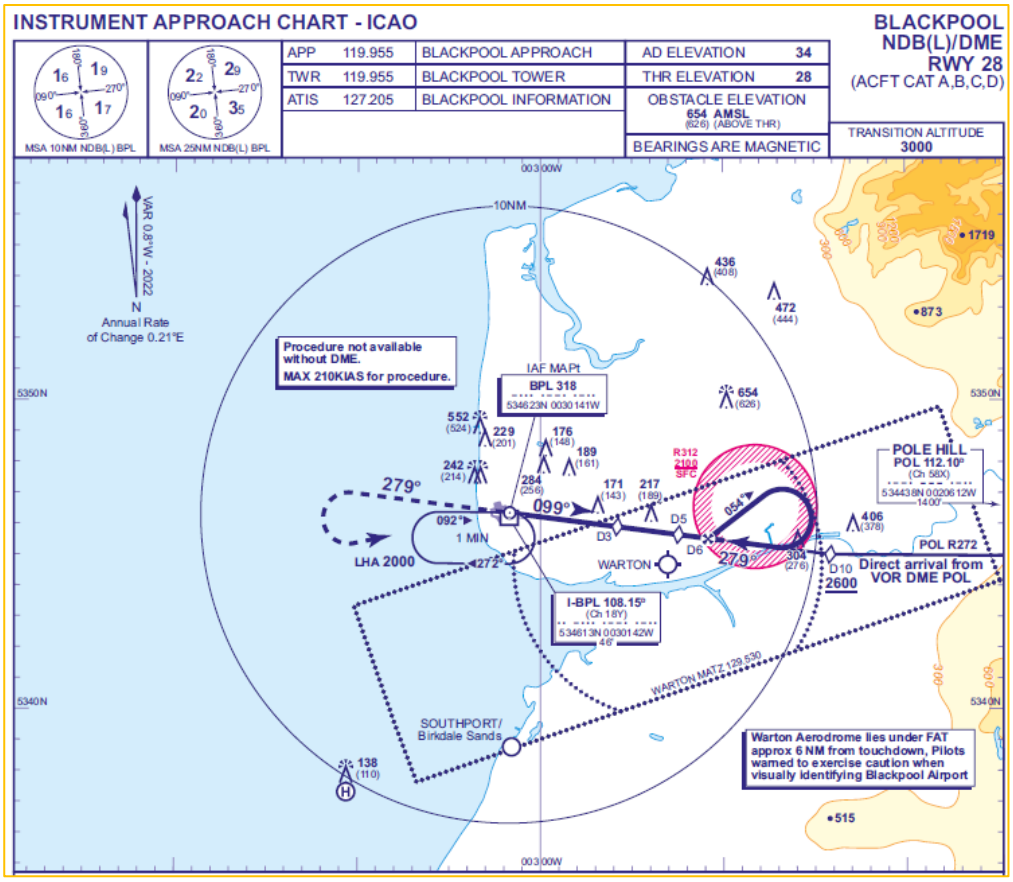

Figure 212 - NDB(L)/DME RWY 28 Procedure

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the NDB(L)/DME Procedure to Runway 28.

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Figure 213 - Morgan and Mona Windfarm vs NDB(L)/DME RWY 28 Protection Areas

The procedure reversal published on the approach chart (45°/180° Procedure Turn) from IAF NDB(L) BPL has already been assessed in Section 7.2.3 and it is not impacted.

The proposed windfarms will not have an impact on the NDB(L)/DME RWY 28 Procedure.

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7.2.7 Visual Circling

Both windfarms are outside the Visual Circling VM(C) Obstacle Clearance areas for all aircraft categories (A, B, C and D).

Figure 214 – Visual Circling Protection Area

The proposed windfarms would have no impact on the Visual Circling.

7.2.8 Holding

NDB(L) BPL Hold

The NDB(L) BPL Hold has an existing Lowest Holding Altitude (LHA) of 2000ft.

With a maximum MOC of 300m the proposed turbines would potentially impact the hold:

- 364 + 300m MOC = 664m / 2179ft AMSL
- Existing Lowest Holding Altitude (LHA) = 2000ft

However, further analysis has deemed that both windfarms lie outside the protection areas associated to the NDB(L) BPL Hold, including its buffers – therefore there will be no impact on the NDB(L) BPL Hold.

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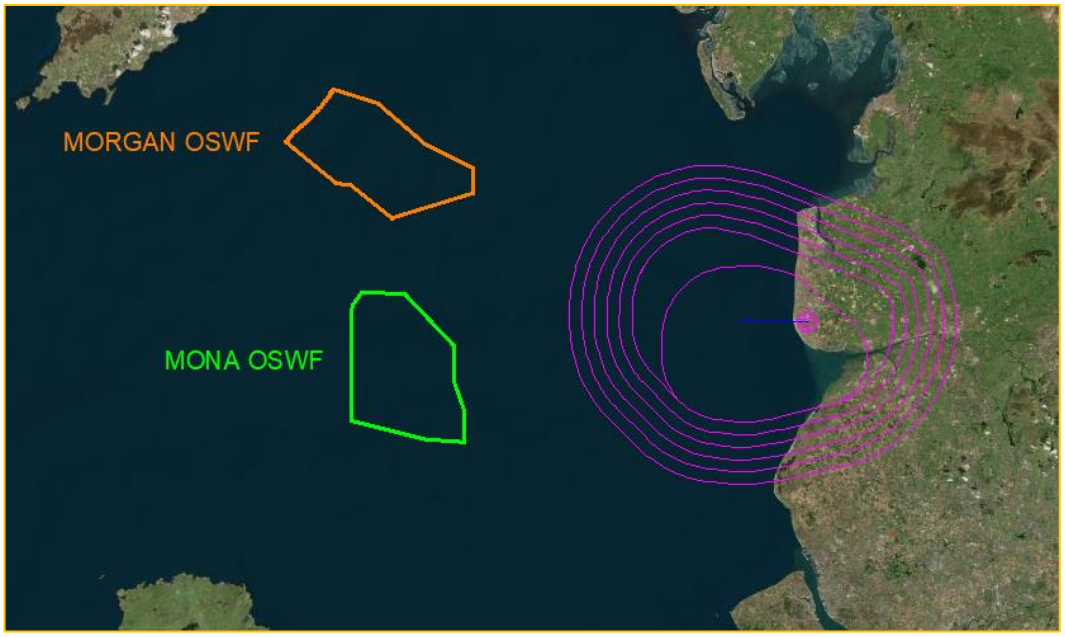

Figure 215 - NDB(L) BPL Hold Protection Area and Buffers

The proposed windfarms would have no impact on any of the holds for Blackpool Airport.

7.2.9 Visual Segment Surface (VSS)

Both windfarms lie outside the lateral confines of VSS for all Runways.

The proposed windfarms would have no impact on the VSS for Blackpool Airport Runways.

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7.2.10 Minimum Sector Altitudes

MSA 25NM NDB(L) BPL

The Morgan Windfarm lies within the north-western quarter of the MSA 25NM NDB(L) BPL, which published MSA is 2200ft. Additionally, the Mona Windfarm lies within both the north-western and south-western quarters of the MSA 25NM NDB(L) BPL, which published MSAs are 2200ft and 2000ft respectively. The windfarms do not need to be considered towards any other sectors of the MSA as are outside their protection areas and associated buffers (including the 10NM sub-sectors).

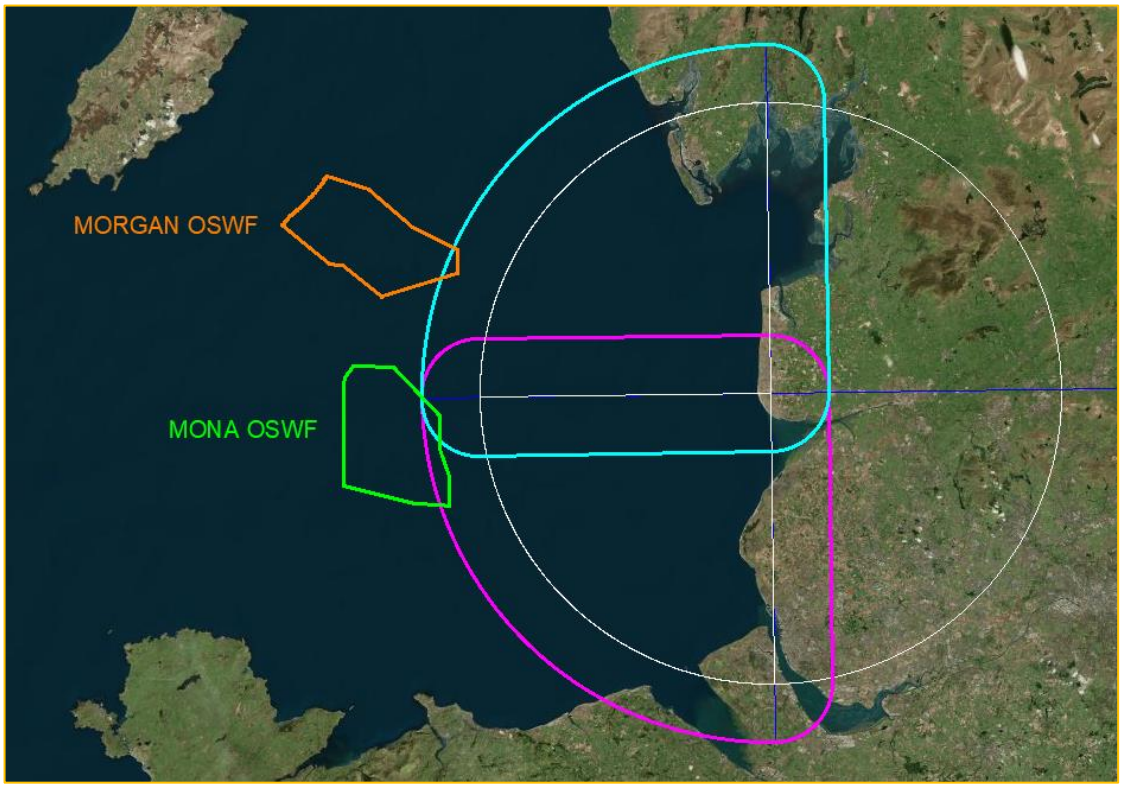

Figure 216 – NDB(L) BPL vs Windfarms

The proposed windfarms would produce a MOCA of 364m + 300m = 664m / 2179ft AMSL for the north-western and south-western quadrants.

This is below the NE quadrant published MSA which has a MOCA of 2200ft.

However, this is above the SW quadrant published MSA which has a MOCA of 2000ft which will need to be increased to 2200ft to clear the wind turbines.

This could indirectly, potentially impact the altitude restriction at the IAF I-BPL 10 for the NDB(L)/DME Approach to Runway 10, which might need to be increased to 2200ft.

The proposed windfarms would cause a potential impact on the published NDB(L) BPL MSA.

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MSA 25NM ARP

We have additionally protected for an MSA based on the ARP because it is used on the RNP Procedures to Runway 28.

The proposed windfarms lie within single sector MSA 25NM ARP, which published MSA is 3500ft.

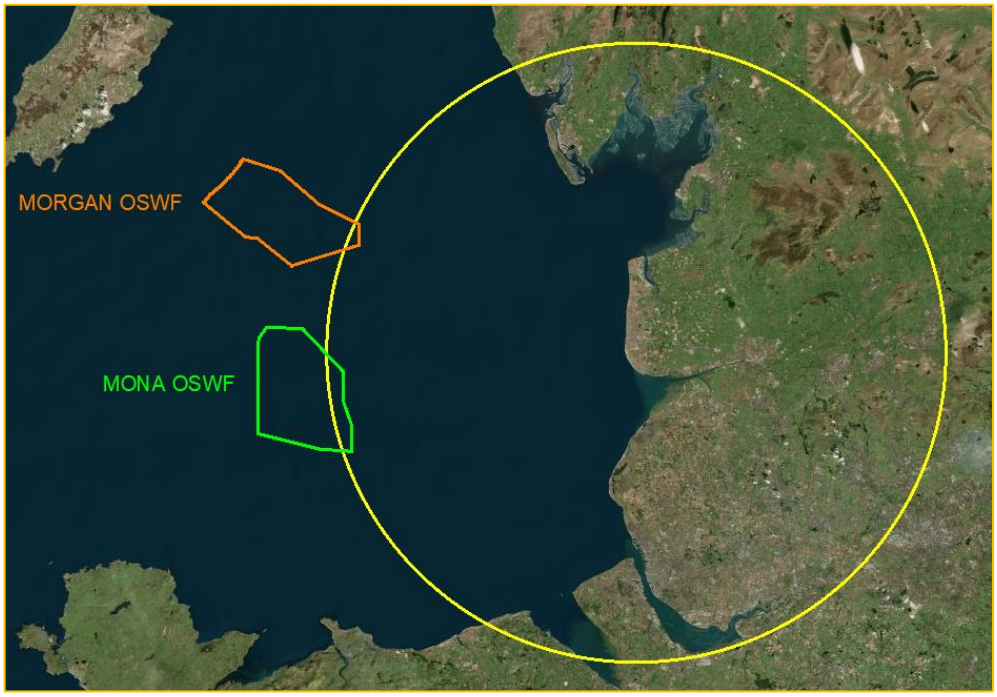

Figure 217 –ARP MSA vs Windfarms

The proposed windfarms would produce a MOCA of 364m + 300m = 664m / 2179ft AMSL for MSA ARP. This is below the currently published MSA ARP which has a MOCA of 3500ft.

The proposed windfarms would have no impact on the published ARP MSA.

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8 Walney Airport OLS and IFP Assessment

8.1 OLS Assessment

8.1.1 Overview

The OLS for Walney Airport has been constructed in accordance with Annex 14 and CAP 168.

8.1.2 Runway Data Used

The following declared distances and threshold details are published in the AIP:

Runway designator	TORA	TODA	ASDA	LDA	Remarks
1	2	3	4	5	6
17	1011 M	1199 M	1011 M	1011 M	
35	1058 M	1191 M	1058 M	998 M	TORA, TODA and ASDA include a starter extension of 60 x 22 M.

Figure 218 - Declared Distances

Designations RWY Number	True bearing	Dimensions of RWY	Surface of RWY/ SWY/ Strength (PCN)	THR co-ordinates/ THR Geoid undulation	THR elevation/ Highest elevation of TDZ of precision APP RWY	Slope of RWY/ SWY
1	2	3	4	5	6	7
05					THR 37.0 FT	
23					THR 25.6 FT	
17	166.10°	1011 x 44 M	RWY surface: Asphalt PCN 5/R/A/Y/T	540759.25N 0031609.47W 173.4 FT	THR 33.0 FT	
35	346.11°	1011 x 44 M	RWY surface: Asphalt PCN 5/R/A/Y/T	540727.50N 0031556.09W 173.4 FT	THR 43.7 FT TDZ 43.7 FT	

Figure 219 - Threshold Details

Runway 17 is a CODE 2, Non-Precision Runway

Runway 35 is a CODE 2, Precision Instrument Runway (**Lowest threshold, 10.06m**)

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8.1.3 OLS Construction

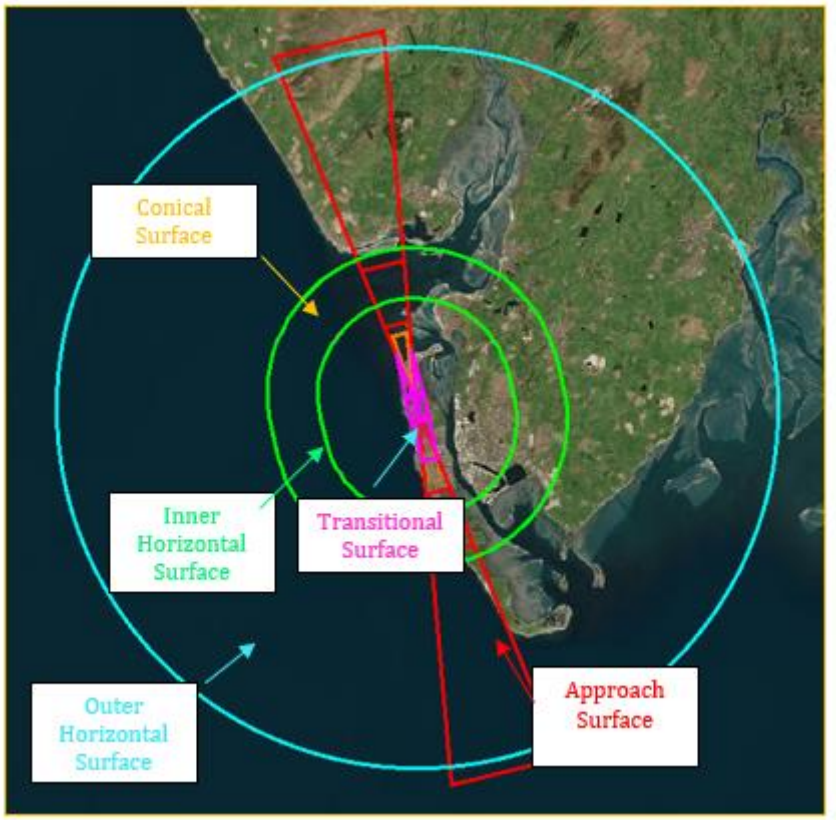

Figure 220 - OLS for Walney Airport

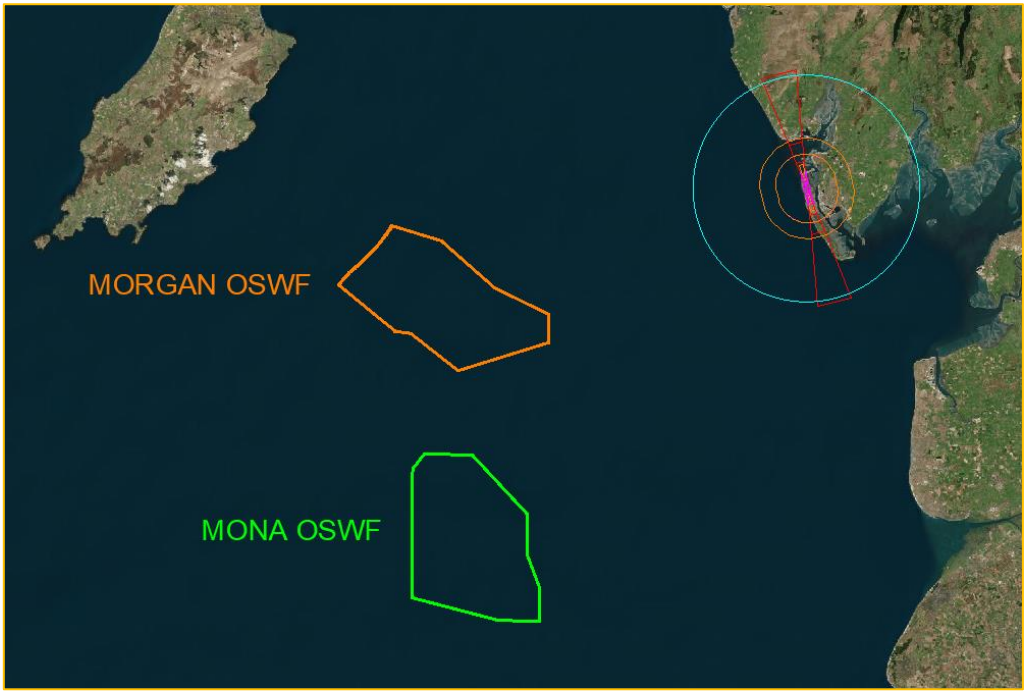

Figure 221 - Walney OLS in Relation to Windfarms

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8.1.4 OLS Analysis

The OLS for Walney Airport lies entirely outside of the boundaries of both windfarms and is not affected by the development.

The proposed windfarms will have no impact on the OLS for Walney Airport.

8.2 IFP Analysis

The IFPs assessed are as follows:

AIRAC 09/2023 (Effective 07 SEP 2023)

- AD 2.EGNL-8-1 RNP 17 (08 SEP 22)
- AD 2.EGNL-8-2 ILS/DME/NDB(L) 35 (08 SEP 22)
- AD 2.EGNL-8-3 LOC/DME/NDB(L) 35 (08 SEP 22)
- AD 2.EGNL-8-4 RNP 35 (08 SEP 22)
- AD 2.EGNL-8-5 NDB(L)/DME 35 (08 SEP 22)
- AD 2.EGNL-8-6 NDB(L)/DME TO AERODROME (08 SEP 22)

Additionally, the following were checked:

- Visual Circling
- Holding
- Visual Segment Surface (VSS)
- Minimum Sector Altitudes (MSA)

8.2.1 RNP RWY17

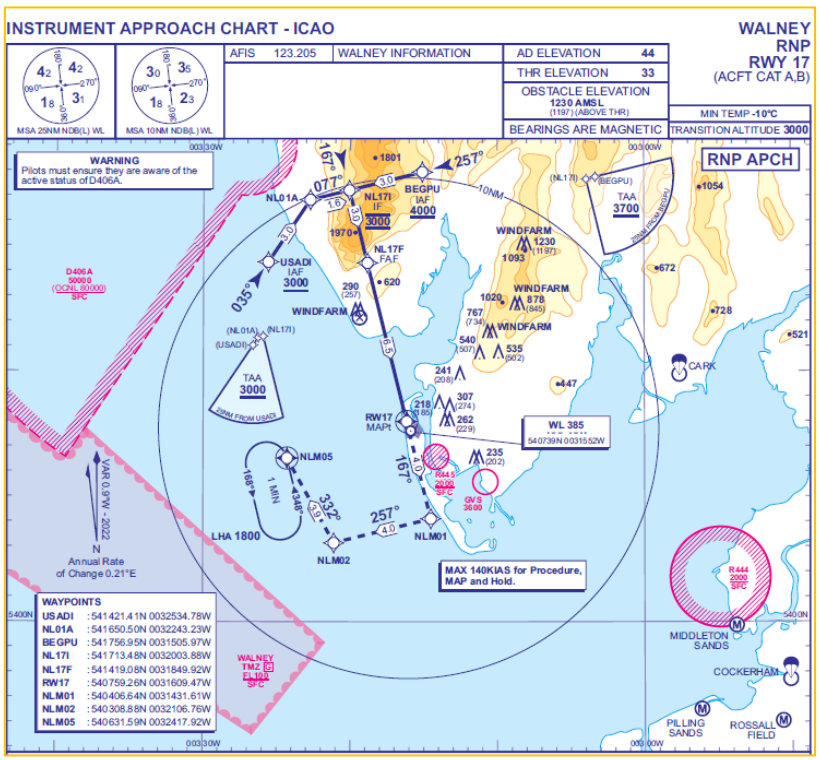

Figure 222 – RNP RWY 17 Procedure

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Both windfarms (Morgan and Mona) lie outside the protection areas associated to the RNP Procedure to Runway 17. This includes the hold protection.

Note: Even if the windfarms are inside the 5NM lateral buffers for TAAs, the MOCA for the Windfarms is 364m + 300m MOC = 664m / 2179ft AMSL which is lower than the altitude for the USADI TAA (3000ft).

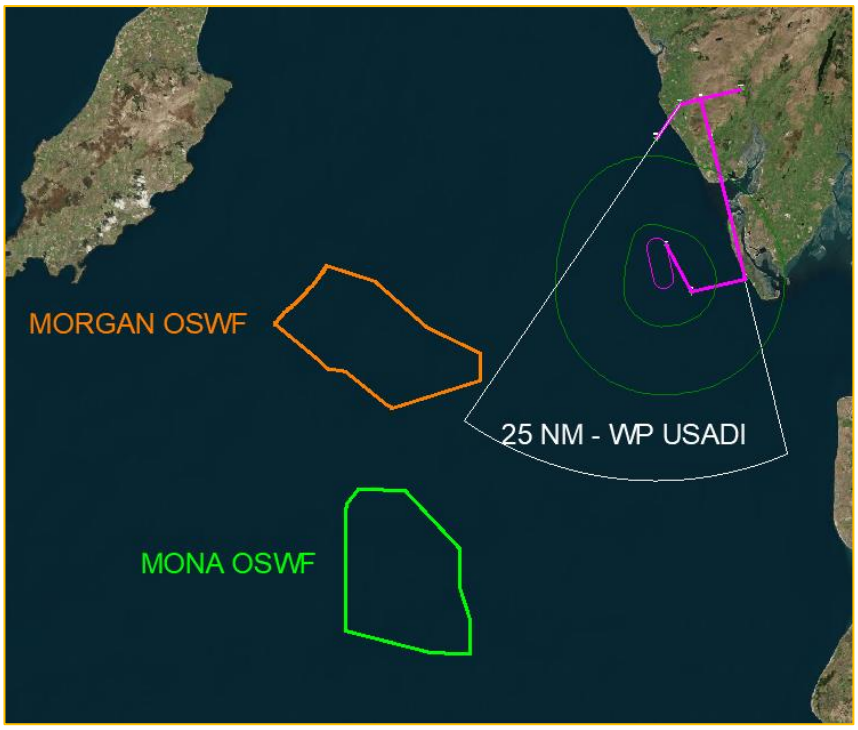

Figure 223 - RNP RWY 17 Protection Areas

The proposed windfarms will not have an impact on the RNP 17 Procedure.

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8.2.2 ILS/DME/NDB(L) RWY 35

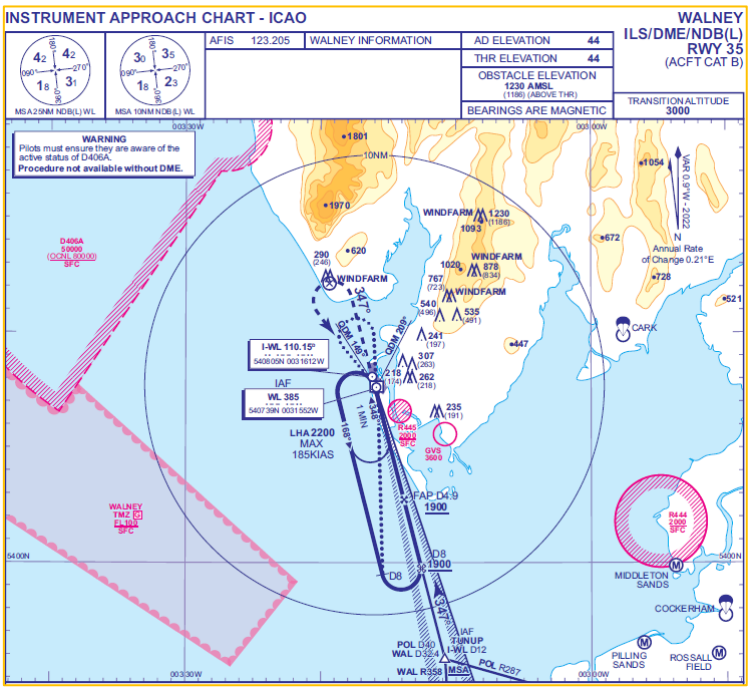

Figure 224 - ILS/DME/NDB(L) RWY 35

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the ILS/DME Procedure to Runway 35.

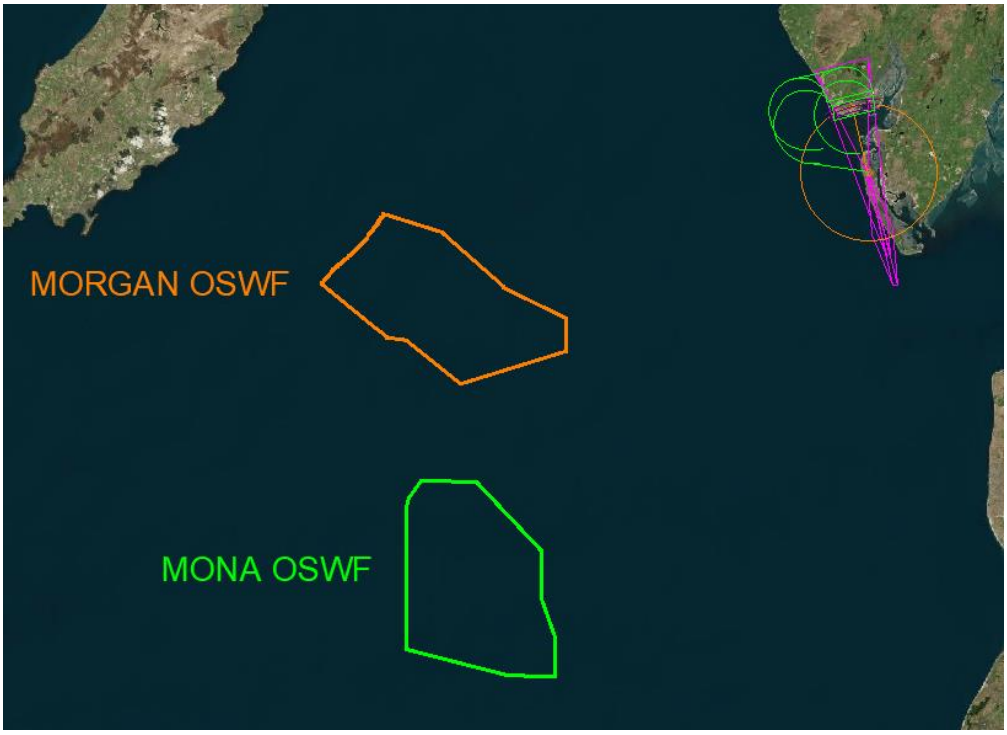

Figure 225 - Morgan and Mona Windfarm vs ILS/DME RWY 35 Protection Areas

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Additionally, all the reversal procedures published on the approach chart have been constructed:

- Primary Racetrack overhead NDB(L) WL.
- Alternative Base Turn Procedure overhead NDB(L) WL.
- Alternative base turn procedure direct entry overhead NDB(L) WL.

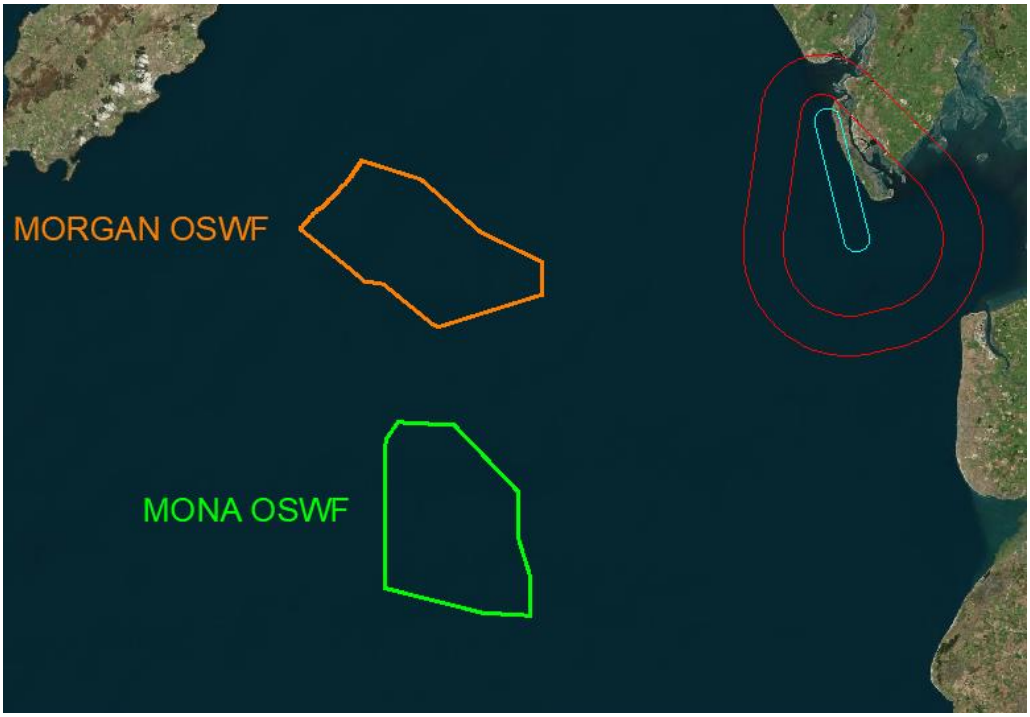

Figure 226 - Windfarms vs ILS/DME RWY 35 Primary Reversal

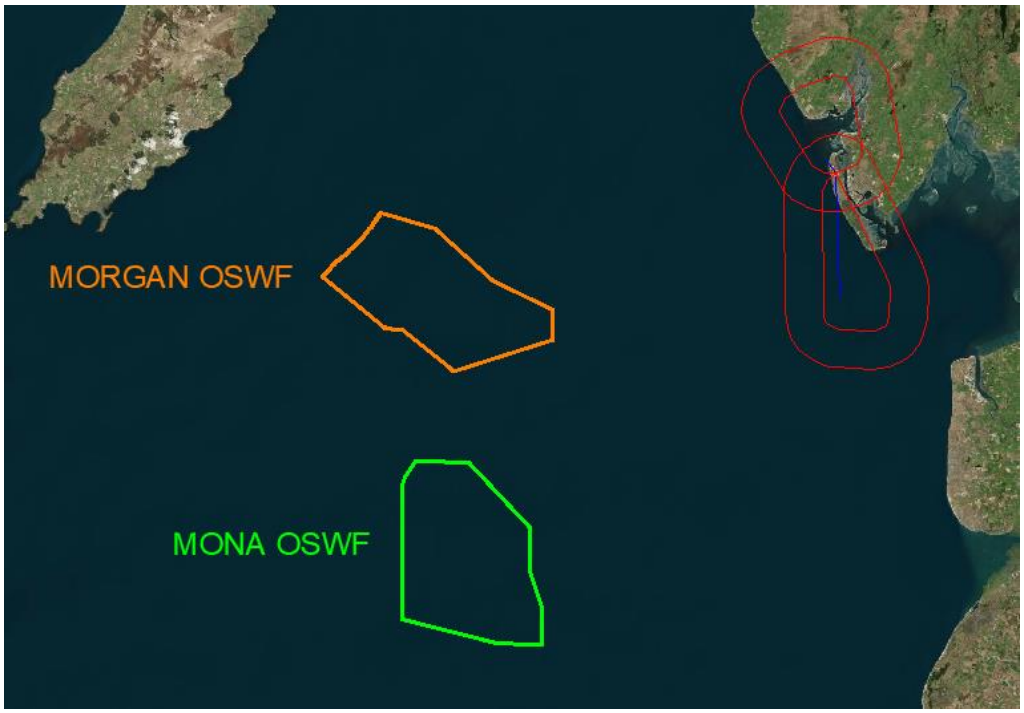

Figure 227 – Windfarms vs ILS/DME RWY 35 Alternative Baseturn Reversals

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As both windfarms are outside the protection areas for the reversals, they will not cause an impact.

The proposed windfarms will not have an impact on the ILS/DME/NDB(L) RWY 35 Procedure.

8.2.3 LOC/DME/NDB(L) RWY 35

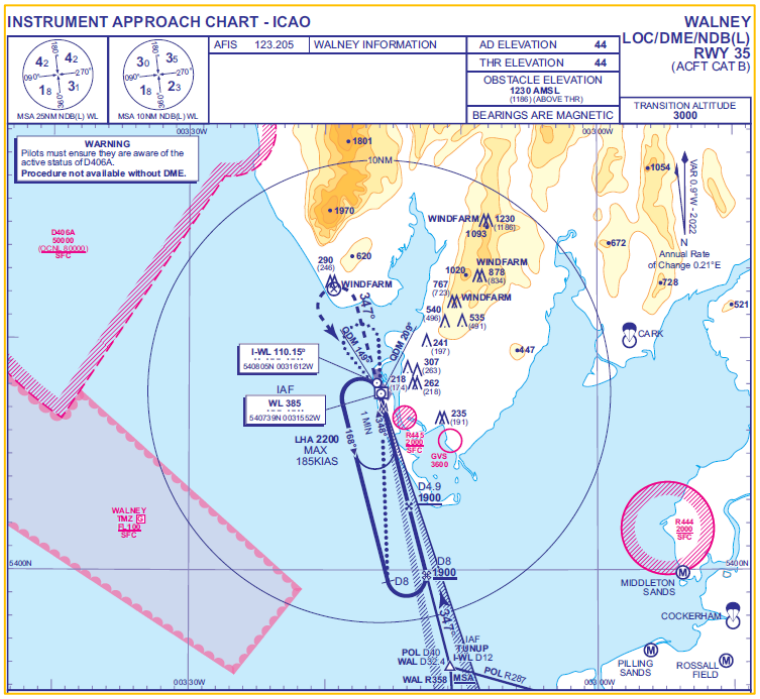

Figure 228 - LOC/DME/NDB(L) RWY 35

The protection areas for the LOC RWY 35 Procedure are common to the ones from the ILS RWY 35 in the previous section.

As both windfarms are outside the protection areas for the procedure and reversals, they will not cause an impact.

The proposed windfarms will not have an impact on the LOC/DME/NDB(L) RWY 35 Procedure.

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8.2.4 RNP RWY 35

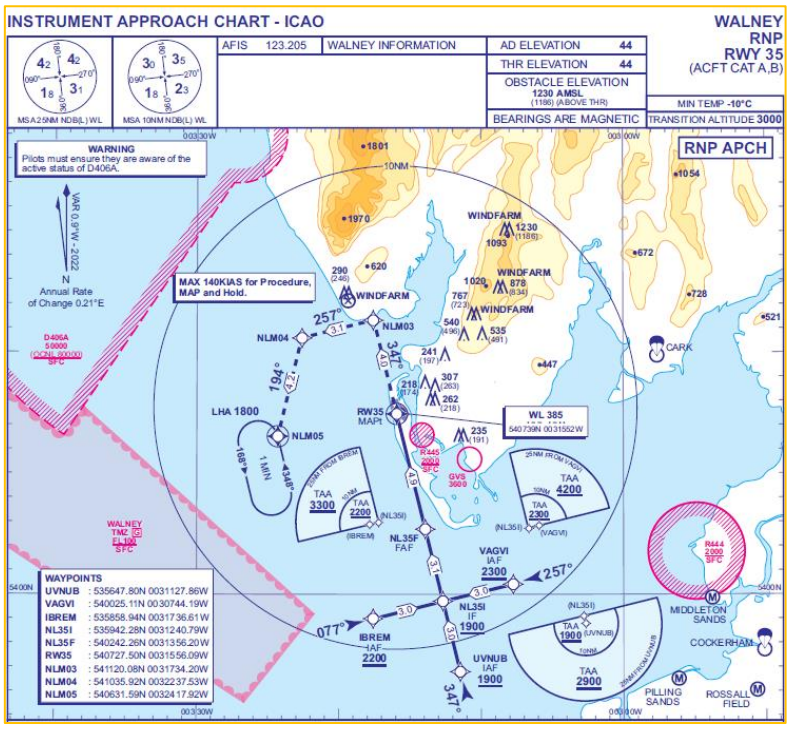

Figure 229 - RNP RWY 35

Both windfarms lie outside the protection areas associated to the RNP Procedure to Runway 35. This includes the hold protection.

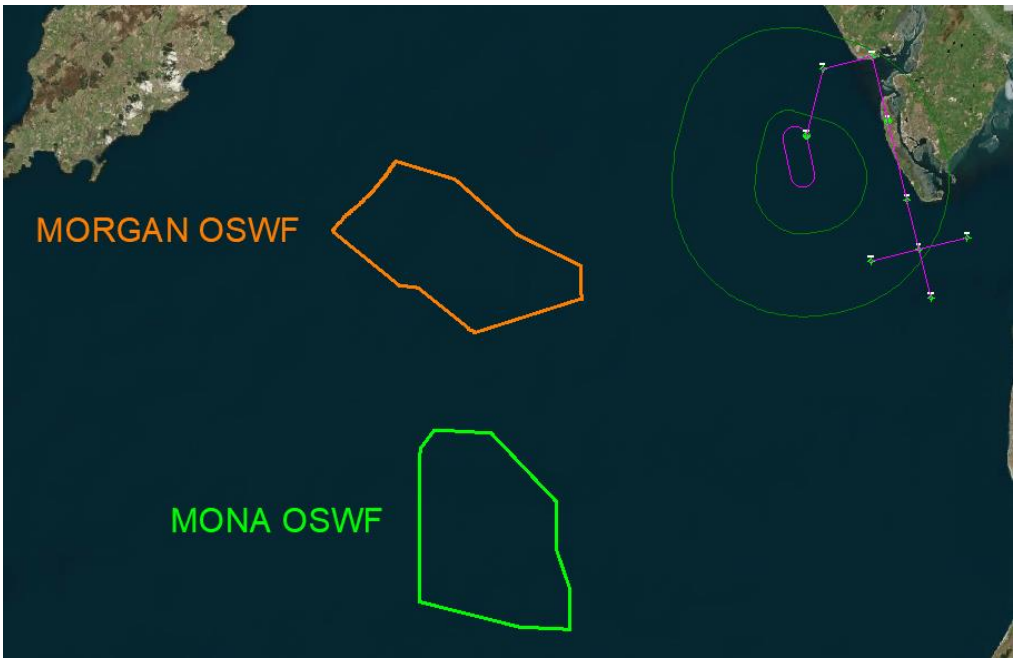

Figure 230 - Morgan and Mona Windfarm vs RNP RWY 35

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Additionally, Terminal Arrival Altitudes (TAAs) on each of the Initial Approach Fixes (IAFs; IBREM, UVNUB and VAGVI) have been constructed:

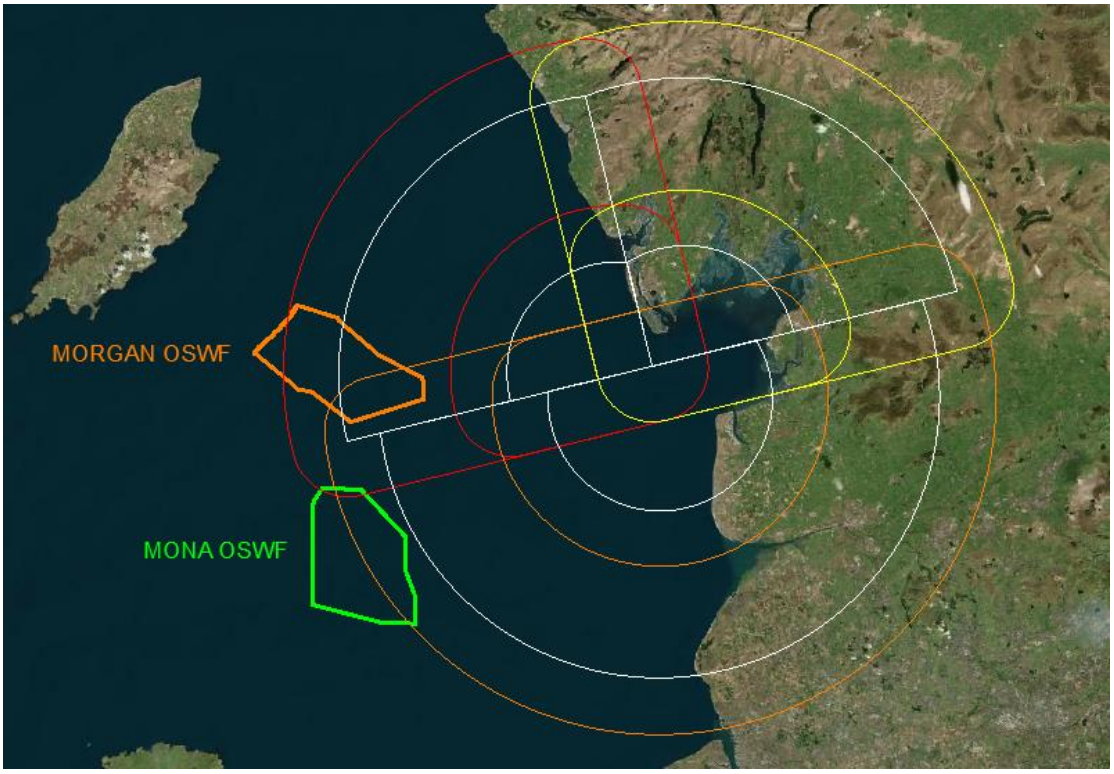

Figure 231 - Windfarms vs RNP RWY 35 TAAs

Both windfarms are within the protection areas for the 25NM TAAs of IBREM and UVNUB. They remain outside all remaining TAAs, including the 10NM sub-sectors, which are therefore not affected.

The MOCA for the Windfarms is: 364m + 300m MOC = 664m / 2179ft AMSL which is lower than the published 25NM TAA of IBREM (3300ft) and of UVNUB (2900ft).

The proposed windfarms will not have an impact on the RNP RWY 35 Procedure.

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8.2.5 NDB(L)/DME RWY 35

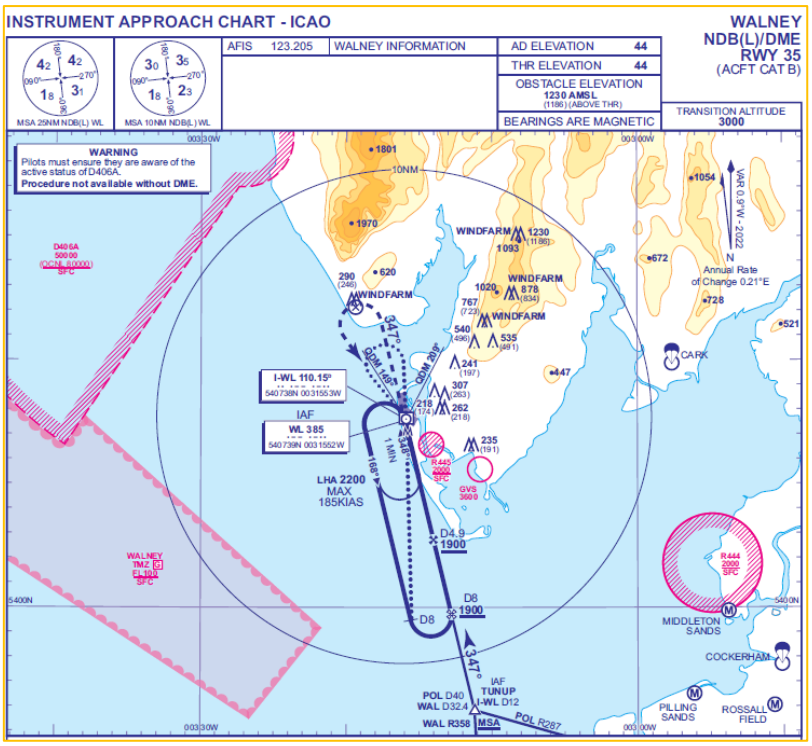

Figure 232 – NDB(L)/DME RWY 35

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the NDB(L)/DME Procedure to Runway 35.

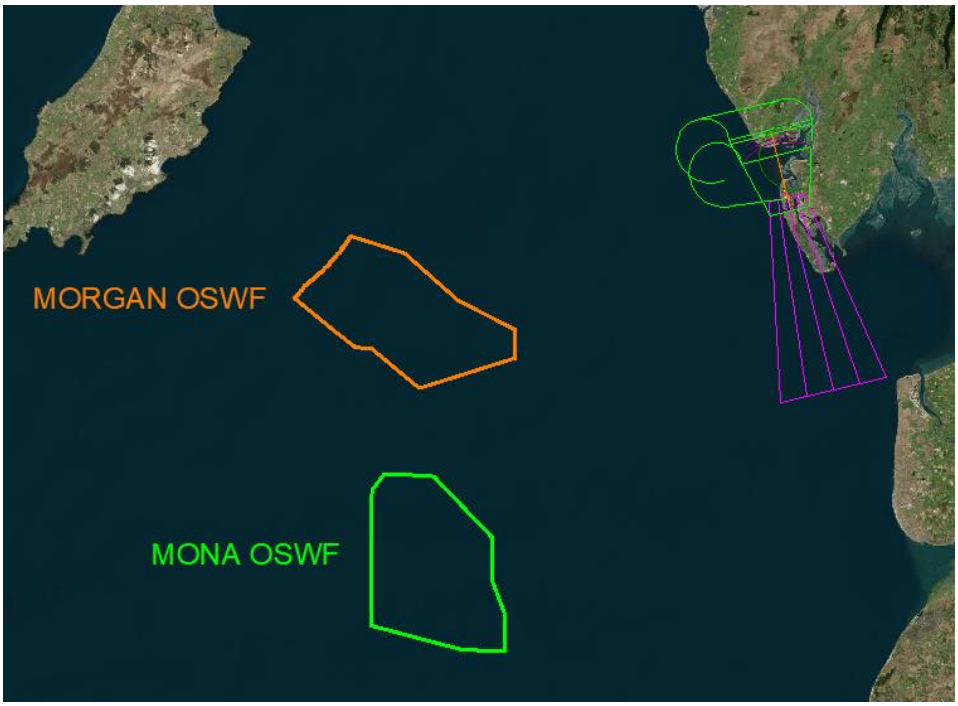

Figure 233 - Morgan and Mona Windfarm vs NDB(L)/DME RWY 35 Protection Areas

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Additionally, all the reversal procedures published on the approach chart have been constructed:

- Primary Racetrack overhead NDB(L) WL.
- Alternative Base Turn Procedure overhead NDB(L) WL.
- Alternative base turn procedure direct entry overhead NDB(L) WL.

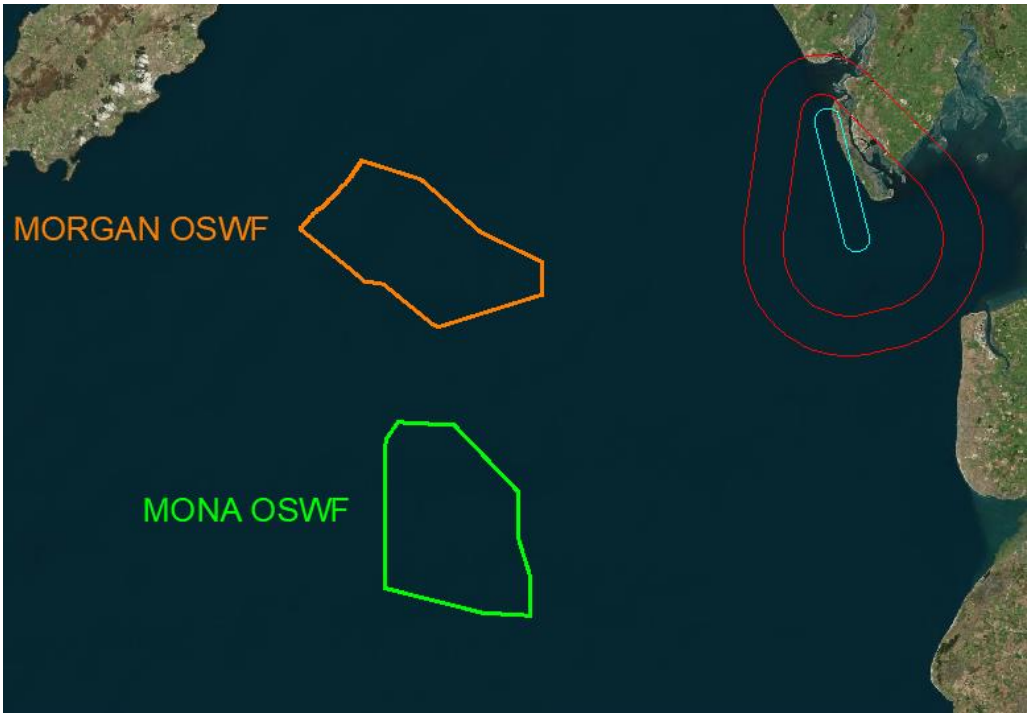

Figure 234 - Windfarms vs NDB(L)/DME RWY 35 Primary Reversal

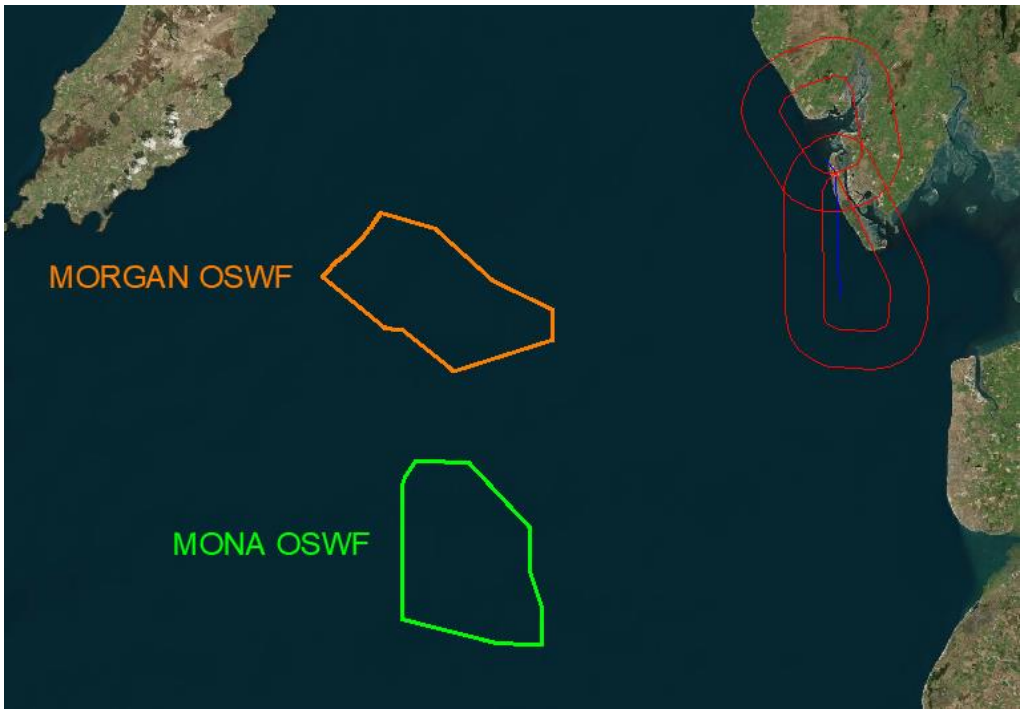

Figure 235 – Windfarms vs NDB(L)/DME RWY 35 Alternative Baseturn Reversals

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As both windfarms are outside the protection areas for the reversals, they will not cause an impact.

The proposed windfarms will not have an impact on the NDB(L)/DME RWY 35 Procedure.

8.2.6 NDB(L)/DME TO AERODROME

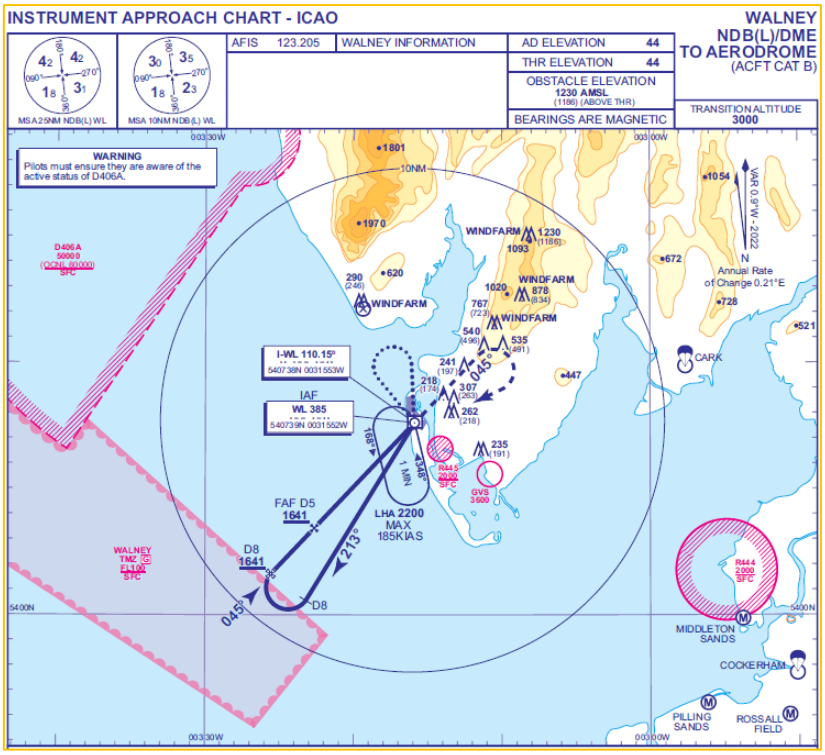

Figure 236 - NDB(L)/DME to Aerodrome

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the NDB(L)/DME Procedure to Aerodrome:

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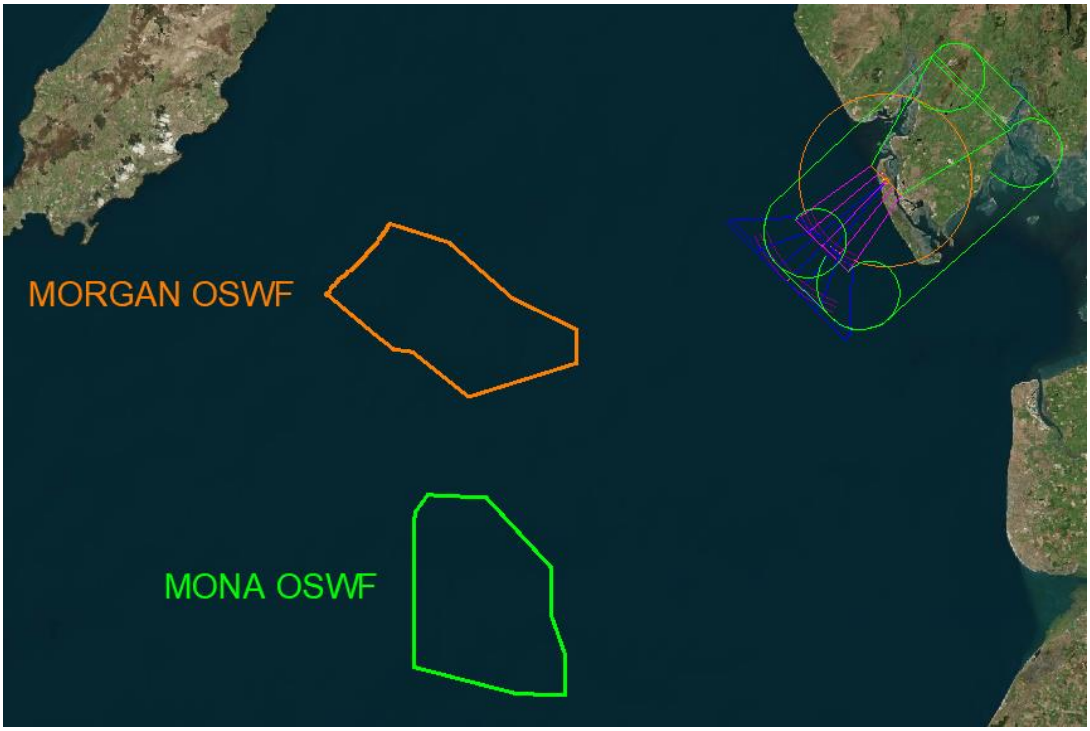

Figure 237 – Windfarm vs NDB(L)/DME to Aerodrome

Additionally, all the reversal procedures published on the approach chart have been constructed:

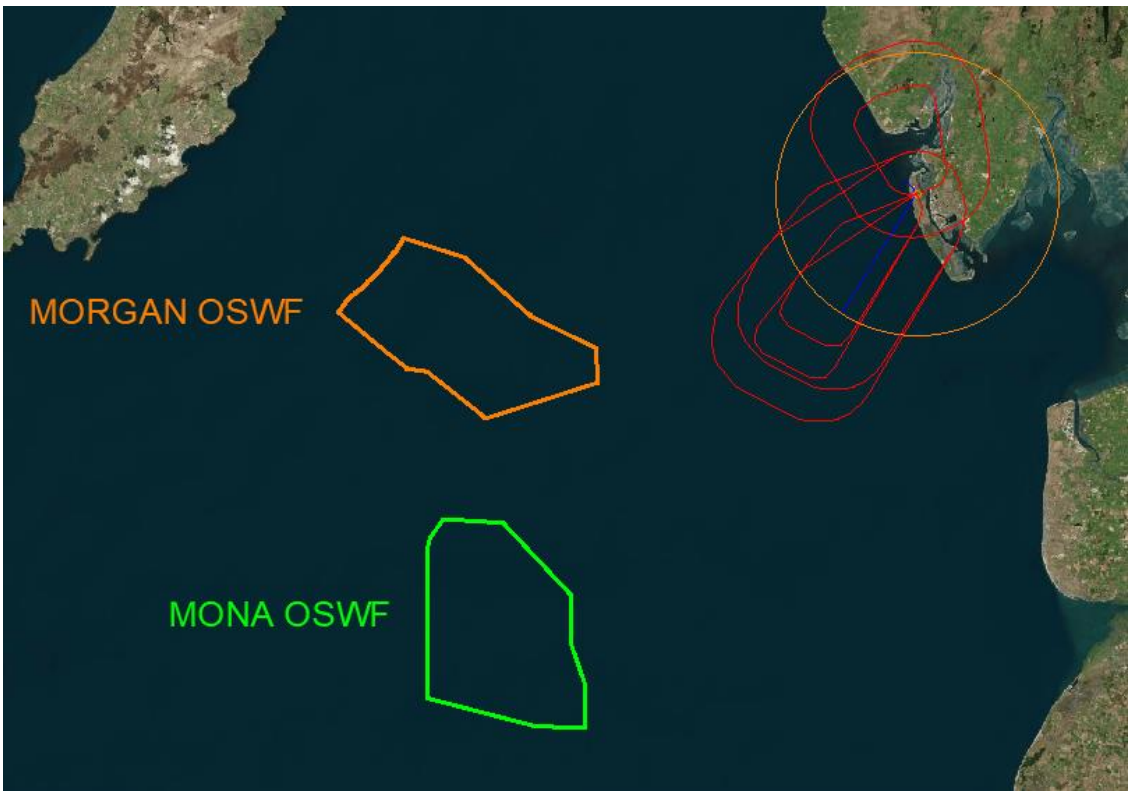

Figure 238 - Windfarms vs NDB(L)/DME to Aerodrome Reversals

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As both windfarms are outside the protection areas for the reversals, they will not cause an impact.

Also note the extension of the NDB Navaid Splay into the timed baseturn (NO DME Case, NO FAF) is also unaffected as windfarms are not within the timed baseturn areas.

The proposed windfarms will not have an impact on the NDB(L)/DME to Aerodrome Procedure.

8.2.7 Visual Circling

Both windfarms lie outside the lateral boundaries of the CAT A and B Circling Areas:

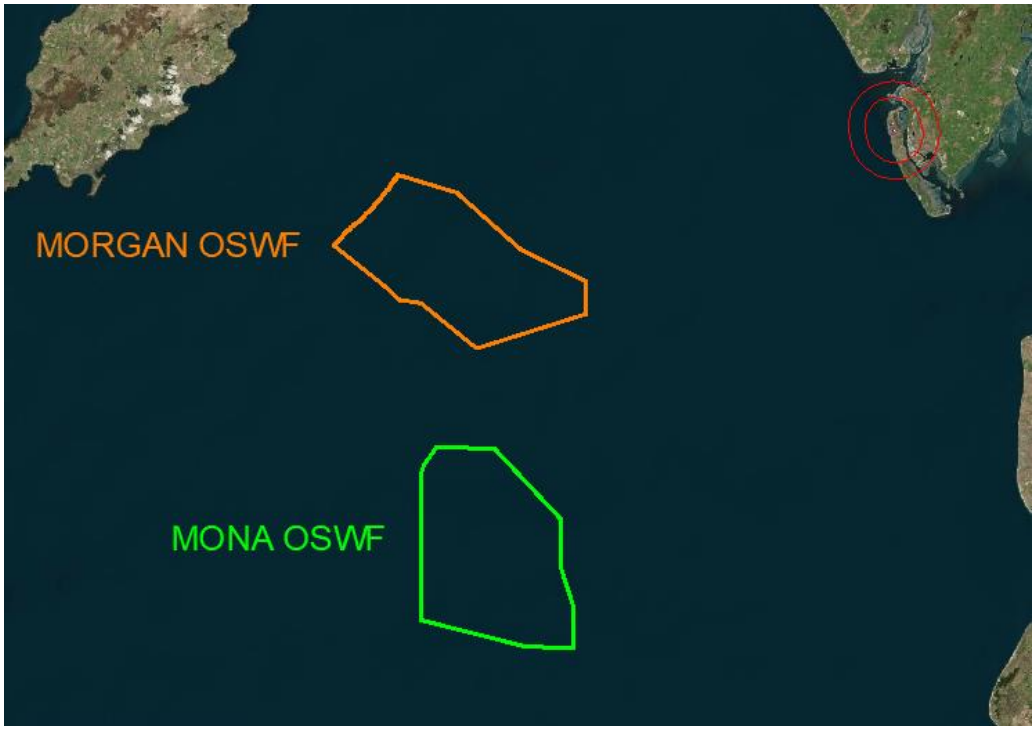

Figure 239 - Windfarms vs Circling

The proposed windfarms will not have an impact on the Visual Circling.

8.2.8 Holding

The RNP Holds have been assessed as part of the RNP Procedures – no impact was noted.

The Lowest Holding Altitude (LHA) for the rest of holds is 2200ft.

Note: MOCA for the Windfarms is: 364m + 300m MOC = 664m / 2179ft AMSL which is lower than the LHA.

The proposed windfarms would have no impact on the Holds for Walney Airport.

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8.2.9 Visual Segment Surface (VSS)

Both windfarms lie outside the lateral confines of VSS for all Runways.

The proposed windfarms would have no impact on the VSS for Walney Airport Runways.

8.2.10 Minimum Sector Altitudes (MSA)

MSA 10NM NDB(L) WL

Both windfarms are beyond the 10NM MSA Sub-Sector protection area:

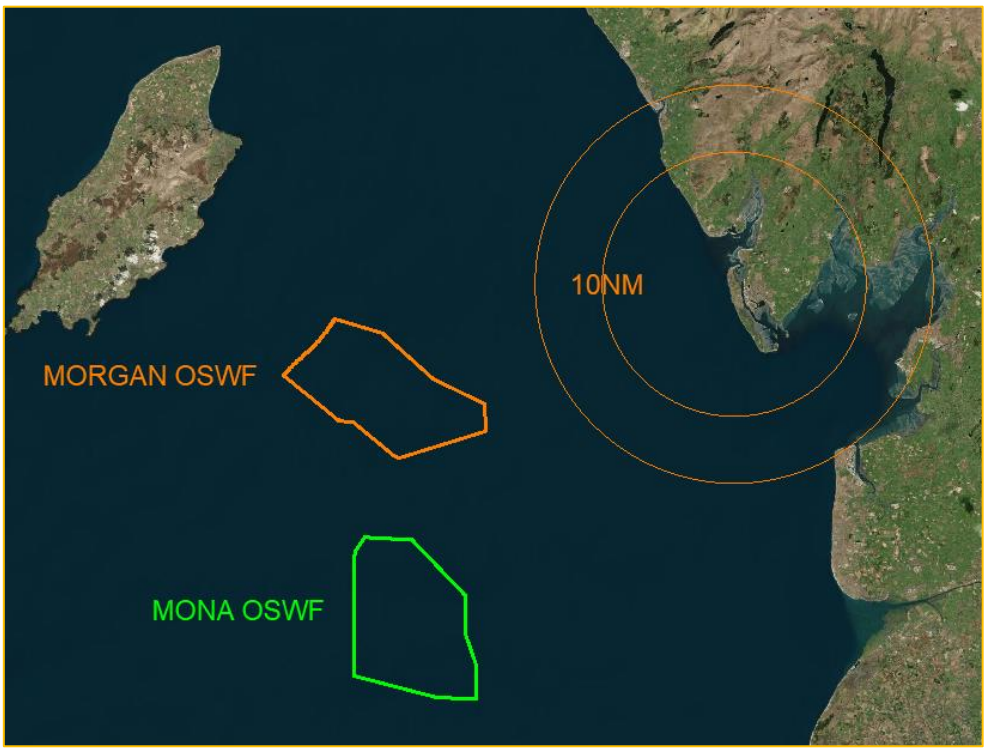

Figure 240 – Windfarms vs MSA 10NM NDB(L) WL

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The Morgan Windfarm lies within the south west quarter of the MSA 25NM NDB(L) WL, the published MSA is 1800ft. The Morgan Windfarm is also in the buffer area for the north east quarter which has a published minima of 4200ft. The Mona Windfarm is outside of the MSA protection area:

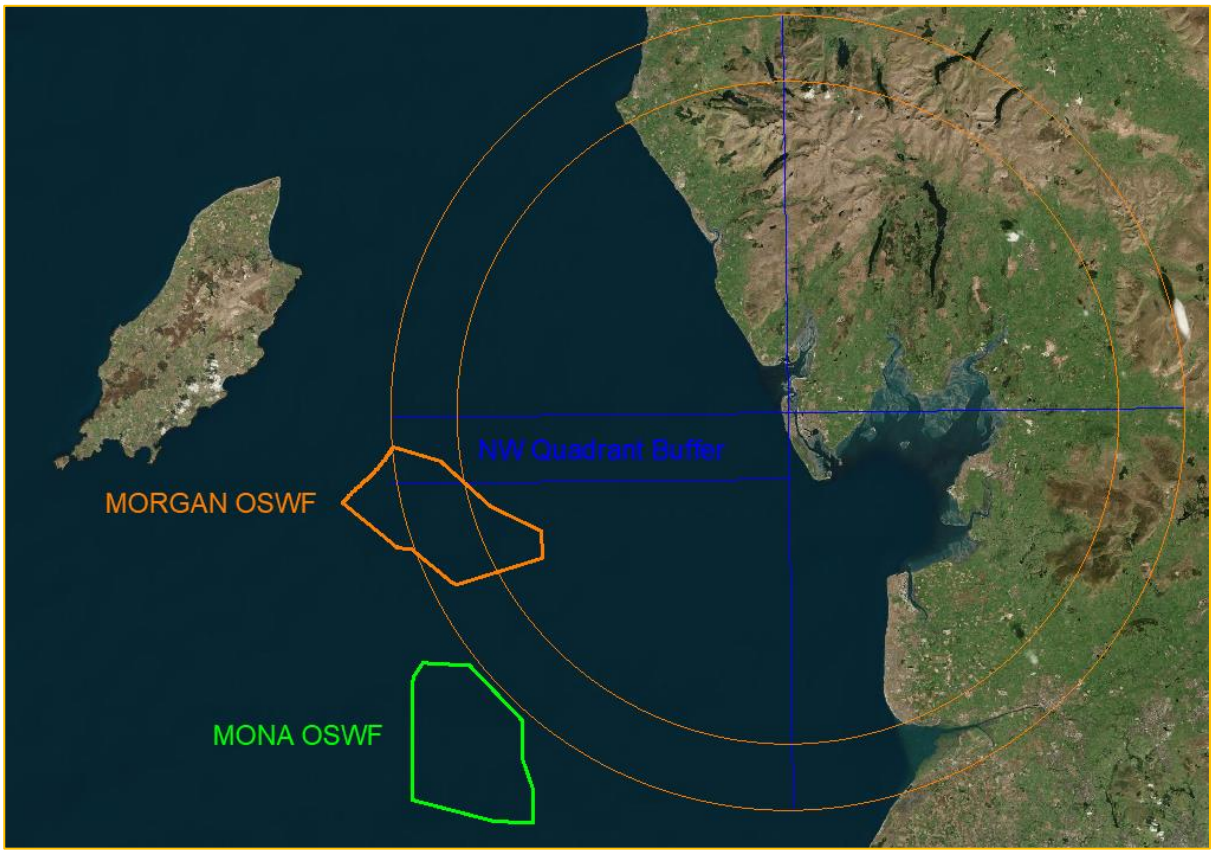

Figure 241 – Windfarms vs MSA 25NM NDB(L) WL

The proposed Morgan windfarm would produce a MOCA of 364m + 300m = 664m / 2179ft AMSL for the north-western and south-western quadrants.

This is below the north west quadrant published MSA which has a MOCA of 4200ft.

However, this is above the SW quadrant published MSA which has a MOCA of 1800ft which will need to be increased to 2200ft to clear the wind turbines.

The proposed windfarms would cause a potential impact on the published NDB(L) WL MSA.

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9 Summary

None of the windfarms affects the OLS of the airports analysed in this report.

For a summary of the Potential Impact to IFPs see below table:

Airport	Mona Offshore Wind Project	Morgan Generation Assets
Manchester	No Impact on OLS. No Impact on IFPs.	No Impact on OLS. No Impact on IFPs.
Liverpool	No Impact on OLS. No Impact on IFPs.	No Impact on OLS. No Impact on IFPs.
Warton	No Impact on OLS. No Impact on IFPs.	No Impact on OLS. No Impact on IFPs.
Isle of Man	No Impact on OLS. No Impact on IFPs.	No Impact on OLS. **Potential impact on ATCSMAC 1600ft SMAA.** MOCA needs increasing from 1600ft to 2200ft. See Section 5.2.1 **Potential impact on IFP NDB(L)/DME RWY26 for DME I-RY Inoperative (CAT C, D).** Base turn MOCA needs increasing from 2000ft to 2200ft. See Section 5.2.11. Other IFPs unaffected.
Valley	No Impact on OLS. **Potential impact on ATCSMAC 1500ft QNH 1400ft QFE SMAA.** MOCA needs increasing to 2300ft QNH 2200ft QFE. See Section 6.2.1 **Potential impact on MSA VYL 25NM NW Sector.** MOCA needs increasing from 1900ft to 2200ft. See Section 6.2.21 Other IFPs unaffected.	No Impact on OLS. **Potential impact on ATCSMAC 1500ft QNH 1400ft QFE SMAA.** MOCA needs increasing to 2300ft QNH 2200ft QFE. See Section 6.2.1 Other IFPs unaffected.

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Blackpool	No Impact on OLS. **Potential impact on MSA 25NM NDB(L) BPL SW Sector.** MOCA needs increasing from 2000ft to 2200ft. See Section 7.2.10. Other IFPs unaffected.	No Impact on OLS. No Impact on IFPs.
Walney	No Impact on OLS. No Impact on IFPs.	No Impact on OLS. **Potential impact on MSA 25NM NDB(L) WL SW Sector.** MOCA needs increasing from 1800ft to 2200ft. See Section 8.2.10. Other IFPs unaffected.

Table 2 - Conclusions Summary

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