# Bellrock Offshore Wind Farm

# Wind Farm Development Area

## Environmental Impact Assessment Report - Volume IV

## Appendix 13.1: Airspace Analysis and Radar Modelling

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## Glossary of Terminology

| Term | Definition |
|---|---|
| Applicant | Bellrock Offshore Wind Farm Limited, the legal entity submitting Section 36 Consent and Marine Licence applications for Bellrock Wind Farm Development Area. |
| Bellrock Offshore Wind Farm<br>(or the Bellrock Project) | An offshore wind farm capable of exporting up to 1.8 GW of renewable energy to the National Electricity Transmission System.<br>The Wind Farm Development Area is located 120 km east of Stonehaven, and will connect to the National Electricity Transmission System at the proposed SSEN Transmission Hurlie substation, west of Stonehaven in Aberdeenshire. The Bellrock Offshore Wind Farm comprises of the following Development Areas:<br>▪ Wind Farm Development Area;<br>▪ Offshore Transmission Development Area; and<br>▪ Onshore Transmission Development Area. |
| Controlled Airspace | Defined airspace within which pilots must follow ATC instructions. In the United Kingdom, Classes A, C, D, and E are areas of controlled airspace. |
| Development Area | For consenting purposes, the area for which separate consents and/or Marine Licences will be sought by the Applicant, comprising:<br>▪ Wind Farm Development Area;<br>▪ Offshore Transmission Development Area; and<br>▪ Onshore Transmission Development Area. |
| Flight Information Region (FIR) | Airspace managed by a controlling authority with responsibility for ensuring air traffic services are provided to aircraft flying within it. |
| Primary Surveillance Radar (PSR) | A radar system that measures the bearing and distance of targets using the detected reflections of radio signals. |
| Secondary Surveillance Radar (SSR) | A radar system that transmits interrogation pulses and receives transmitted responses from suitably equipped targets. |
| Uncontrolled Airspace | Defined airspace in which ATC does not exercise exclusive authority but may provide basic information services to aircraft in radio contact. In the United Kingdom, Class G is uncontrolled airspace. |
| Wet Storage | The temporary storage of floating substructures and/or floating offshore units prior to their transportation to the Wind Farm Development Area. |
| Wind Farm Infrastructure | Infrastructure located within the Wind Farm Development Area including wind turbine generators; floating substructures, station keeping systems and associated scour protection; inter-array cables and associated cable protection; subsea cable hubs; and ancillary infrastructure including buoys (including activities associated with the Wind Farm Infrastructure construction, operation and maintenance, and decommissioning). |

| Term | Definition |
|---|---|
| Wind turbine generator | A wind turbine generator converts wind energy into electrical energy. The main components include rotor assembly (composed of three blades and a hub); nacelle (containing the generator, shaft and gearbox, power electronic converter and transformer); and a tower (containing lifting equipment and switchgear). |

## Glossary of Abbreviations

| Term | Definition |
|---|---|
| AARA | Air-to-air refuelling area |
| AD | Air Defence |
| AIP | Aeronautical information publication |
| MSL | Mean Sea Level |
| ATC | Air traffic control |
| ATDI | Advanced Topographic Development and Images |
| ATS | Air traffic services |
| CAA | Civil Aviation Authority |
| CAP | Civil aviation publication |
| CNS | Communications, Navigation and Surveillance |
| CTA | Control area |
| DA | Danger area |
| DESNZ | Department for Energy Security and Net Zero |
| DIO | Defence Infrastructure Organisation |
| DTM | Digital terrain model |
| EIA | Environmental impact assessment |
| FIR | Flight information region |
| FL | Flight level |
| HMRI | Helicopter Main Routing Indicator |
| IFR | Instrument flight rules |
| $km^2$ | Square kilometre |
| LFA | Low flying area |
| MGN | Marine Guidance Note |
| MOD | Ministry of Defence |
| nm | Nautical mile |
| OSA | Offshore safety area |
| PSR | Primary surveillance radar |

| Term | Definition |
|---|---|
| RLoS | Radar Line of Sight |
| RRH | Remote radar head |
| SAR | Search and Rescue |
| SSR | Secondary surveillance radar |
| TMZ | Transponder mandatory zone |
| TRA | Temporary Reserved Area |
| UK | United Kingdom |
| VFR | Visual flight rules |
| WFDA | Wind Farm Development Area |
| WTG | Wind turbine generator |

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# 1 Introduction

## 1.1 Overview

1. This Airspace Analysis and Radar Modelling Report is an Appendix to **Chapter 13: Aviation and Radar (Volume II)** of the Bellrock Wind Farm Development Area (WFDA) environmental impact assessment (EIA) Report. It provides detailed airspace analysis and radar modelling, identifying where there may be grounds for objection by aviation stakeholders, and considers possible mitigation options, if required. This technical report informs and supports the assessment of the Wind Farm Infrastructure within the Bellrock WFDA on aviation and radar.

2. The Bellrock WFDA is located 120 km east of Stonehaven (116 km southeast of Peterhead) and occupies an area of 280 square kilometres ($km^2$). Full details of the Wind Farm Infrastructure considered in the Bellrock WFDA EIA Report is provided in **Chapter 4: Project Description (Volume II)**.

3. This report has been prepared by Cyrrus Limited.

## 1.2 Effects of Wind Turbine Generators on Aviation

4. Primary surveillance radars (PSRs) are radar systems that measure the bearing and distance of targets using the detected reflections of radio signals; i.e. they are a form of non-cooperative surveillance, not relying on the target to respond (in contrast to secondary surveillance radar). Wind turbine generators (WTGs) can be problematic for aviation PSRs as many PSRs are unable to differentiate between wanted aircraft targets and unwanted clutter targets introduced by the presence of WTGs that are within Radar Line of Sight (RLoS).

5. Secondary surveillance radars (SSRs) are radar systems that transmit interrogation pulses and receive transmitted responses from suitably equipped targets; i.e. they are a form of cooperative surveillance. SSRs are less affected by WTGs, but WTG towers can cause physical blanking and diffracting effects, and reflections which can result in the SSR outputting false targets when WTGs are in close proximity (i.e. less than 16 km) from the SSR radar head.

6. The significance of any radar impact depends on the airspace usage and the nature of the air traffic services (ATS) provided in that airspace. The classification of the airspace in the vicinity of the Bellrock WFDA and the uses of that airspace are set out in **Section 2**.

7. Radar impacts may be mitigated by either operational or technical solutions or a combination of both. In either case, the efficacy and acceptability of any operational and/or technical mitigation options can only be determined through consultation with radar operators and ATS providers.

8. The towing of a floating offshore unit (FOU) (a combined WTG and floating substructure) from port(s)/wet storage area(s) to the Bellrock WFDA may temporarily impact on civil and military airfields and their Communications, Navigation and Surveillance (CNS) infrastructure and associated Obstacle Limitation Surfaces and Instrument Flight Procedures. Consultation will be required with potentially impacted airfields when the port(s)/wet storage area(s) options for Bellrock WFDA have been identified. Providing WTGs do not rotate during towing and towing does not exceed 10 knots, the towing of WTGs should not reach a high enough speed to generate clutter on PSR systems.

9. The creation of a new obstacle environment increases the risk of collision for military low flying aircraft, helicopters in support of the oil and gas industry and search and rescue (SAR) operations.

10. Helicopter activities in support of the Bellrock WFDA may raise the overall level of traffic in the area and increase the likelihood of aircraft-to-aircraft collision.

# 2 Airspace Analysis

## 2.1 Scope

11. This airspace analysis is a review of potential impacts on aviation from the Wind Farm Infrastructure located within the Bellrock WFDA. All information has been referenced from the United Kingdom (UK) aeronautical information publication (AIP) (Civil Aviation Authority (CAA), 2026), and the UK Military AIP (Ministry of Defence (MOD), 2026) and is therefore the latest information available at the time of writing. Additional information has been sourced from UK CAA publications as noted within this report. The types of airspace and limitations on use are also identified.

12. Aviation measure altitude in feet above mean sea level (MSL). For the purpose of this airspace analysis,(**Section 2**) a maximum tip height of 1,200 ft above MSL has been assumed for all WTGs, the equivalent of 335 m above highest astronomical tide (HAT[1]) or 337 m above MSL rounded up to the nearest 100 ft. Details on the WTGs are provided in **Table 3.1**. This analysis identifies areas of potential impact which are assessed within **Chapter 13: Aviation and Radar (Volume II)**.

## 2.2 Airspace Classification

13. In general, airspace can be characterised as either controlled or uncontrolled airspace. Aircraft in controlled airspace are positively managed by air traffic control (ATC) the entire time they are within that designated area. This type of airspace is generally used by airlines and corporate aviation. Aircraft in uncontrolled airspace are operating within a framework of rules but are not controlled by ATC, although many pilots flying in this environment can choose to report their position, altitude, and intentions to ATC to benefit from enhanced situational awareness. Users of this type of airspace tend to be small aircraft engaged in training or private (social) flying, or military aircraft engaged in low flying training.

14. In addition, special use airspace is designated for specific activities. Limitations on airspace access may be imposed on other non-participatory aircraft. An example of such airspace would be a danger area (DA) established for military flight training.

15. There are five classes of airspace in the UK, namely Classes A, C, D, E and G. Classes A to E are controlled airspace whereas Class G is uncontrolled airspace. Class A is the most strictly regulated controlled airspace whereby aircraft are controlled by ATC, compliance with ATC clearance is mandatory, and aircraft are flown and navigated solely with reference to aircraft instruments (i.e. under Instrument Flight Rules (IFR)). Certain onboard equipment is also a prerequisite. Flight in Class G airspace is generally visual, meaning pilots fly and navigate with reference to the natural

[1] Radar modelling is undertaken using the maximum tip height above MSL as the tidal level reference. For FSS designs that move with the tide (i.e. semi-submersible platform and barge) the maximum tip height on the horizon will be during HAT. Within the Bellrock WFDA, HAT is 1.32 m higher than MSL (rounded to 2 m). Therefore for the purpose of RLoS modelling, an equivalent maximum tip height above MSL has been adopted to ensure the RLoS modelling reflects the maximum tip height on the horizon).

horizon and terrain features (i.e. under Visual Flight Rules (VFR)). Pilots are required to keep minimum separation distances from notified obstacles, including WTGs, and may only fly within the minimum weather and visibility criteria.

## 2.3 Aircraft Vertical Reference

16. An aircraft's vertical reference above the ground or sea can be either an altitude above MSL or, above a designated altitude, i.e. a flight level (FL). An aircraft's altitude, expressed in feet, is based on the last known verified local barometric pressure. A FL, expressed in 100 ft increments, is based on a common international barometric pressure setting of 1,013.2 hectopascals. With aircraft using a common vertical datum, safe separation can be achieved by either ATC or between pilots of different aircraft through adherence to Section 3 of the Standardised European Rules of the Air (CAA, 2024), and use of Traffic Alert and Collision Avoidance System.

17. The airspace where vertical reference changes from altitude to FL and vice versa is known as the Transition Layer and consists of a (lower) Transition Altitude and (higher) Transition Level. In the UK airspace the Transition Altitude is set at 3,000 ft above MSL, except in certain specified airspace where it is higher.

18. The vertical limits of airspace are defined in terms of either altitudes or FLs, with airspace commonly having a lower limit expressed as an altitude and an upper limit expressed as a FL.

## 2.4 Current Airspace Baseline

19. The Bellrock WFDA lies fully within the Scottish flight information region (FIR), airspace regulated by the UK CAA. The boundary between the Scottish FIR and London FIR, also regulated by the UK CAA, is located approximately 197 km to the south of the Bellrock WFDA. Located approximately 224 km to the northeast of the Bellrock WFDA is the Polaris FIR boundary, regulated by CAA Norway. The boundaries of surrounding FIRs are shown in **Figure 13.1.1 (Annex 1)**.

20. NATS (En-Route) is the monopoly provider of en-route civil ATS within the Scottish and London FIRs and operates a network of radar facilities which provide en-route information on airborne traffic for both civil and military ATC.

21. A portion of Scottish FIR airspace known as North Sea Area II is delegated to CAA Norway. Within this area, CAA Norway provide ATS to all aircraft from sea level to an altitude of FL 85 (approximately 8,500 ft above MSL). Procedures and communications within this area are as if the airspace was an integral part of the Polaris FIR regulated by CAA Norway. North Sea Area II lies approximately 126 km to the east of the Bellrock WFDA and is presented in **Figure 13.1.2 (Annex 1)**.

22. Immediately surrounding the Bellrock WFDA is Class G uncontrolled airspace. This airspace extends from sea level to FL195 (approximately 19,500 ft above MSL).

23. This airspace is used by both civil and military aircraft, predominantly for low-level flight operations and generally by aircraft flying under VFR. Aircraft operate under one of two flight rules: VFR or IFR. VFR flight is conducted with visual reference to the natural horizon, whereas IFR requires reference solely to aircraft instrumentation. In Class G uncontrolled airspace, the pilot is responsible for maintaining a safe distance from terrain, obstacles, and other aircraft.

24. Above FL 195 (approximately 19,500 ft above MSL) is Class C controlled airspace in the form of a Temporary Reserved Area (TRA). This airspace, specifically TRA 007B, has an upper vertical limit of FL 245 (approximately 24,500 ft above MSL) and is available for use by both military and civil aircraft, though its main use is to accommodate VFR military flying activity. Above the TRA the upper limit of Class C airspace is FL 660 (approximately 66,000 ft above MSL). TRA 007B is shown in **Figure 13.1.3 (Annex 1)**.

25. Laterally, the nearest controlled airspace to the Bellrock WFDA is the Moray control area (CTA) which is divided into CTAs 1 to 17. Of these elements, the closest to the Bellrock WFDA is Moray CTA 2, located 82 km to the northwest as shown in **Figure 13.1.3 (Annex 1)**. Moray CTA 2 has a lower limit of FL 105 and an upper limit of FL 195 (approximately 10,500 ft and 19,500 ft above MSL respectively). This is Class E controlled airspace and a transponder mandatory zone (TMZ). Within a TMZ, the carriage and operation of aircraft transponder equipment is mandatory. This enables such aircraft to be detected and tracked by SSR systems. Transponder carriage is mandatory in UK airspace above FL 100 (approximately 10,000 ft above MSL).

26. The Seagreen TMZ (Phase 1) is located 82.1 km to the west of the Bellrock WFDA, as shown in **Figure 13.1.3 (Annex 1)**. This airspace is defined from sea level to an upper limit of FL 100 (approximately 10,000 ft above MSL) and was established to mitigate the impact on PSR coverage of the Seagreen Offshore Wind Farm.

27. ATS routes are airways along which aircraft fly navigating via ground based electronic aids, or, increasingly, global navigation satellite system waypoints. ATS routes are used where high levels of traffic move between areas. They may be standalone sections or embedded, either wholly or in part, within a segment of airspace.

28. The nearest lower ATS route is P600, located 91.5 km to the northwest of the Bellrock WFDA as shown in **Figure 13.1.3 (Annex 1)**. There are no upper ATS routes within the Upper-class C airspace above the Bellrock WFDA, which is designated as Free Route Airspace between FL 255 and FL 660 (approximately 25,500 ft and 66,000 ft above MSL) respectively.

## 2.5 Special Use Airspace

29. The Bellrock WFDA lies beneath the Central DA Complex, one of four DA complexes in UK airspace that provide segregated airspace for military training. These areas of airspace are not permanently active but are activated on request by the MOD/Royal Air Force. Specifically, the Bellrock WFDA is located underneath EGD613B and EGD613C as shown in **Figure 13.1.4 (Annex 1)**.

30. When activated, EGD613B and EGD613C have vertical limits from FL 100 up to FL 660 (approximately 10,000 ft and 66,000 ft above MSL respectively). Activities within EGD613B and EGD613C includes high energy manoeuvres, ordnance, munitions and explosives.

31. Located to the northwest, north and south of the Bellrock WFDA are air-to-air refuelling areas (AARAs) 3, 4, and 5 respectively. AARAs are areas within which fuel is transferred from tanker aircraft to receiver aircraft under a radar control service provided by military controllers based at Swanwick, England. Area 4 and Area 5 have vertical limits of FL 70 to FL 240 (approximately 7,000 ft to 24,000 ft above MSL respectively). Area 3 is the closest AARA and has vertical limits of FL 100 to FL 290 (approximately 10,000 ft to 29,000 ft above MSL), located 75.6 km to the northeast of the Bellrock WFDA.

32. Within their scoping representation (**Appendix 1.2: Bellrock WFDA Scoping Opinion (Volume IV)** and **Table 13.2** in **Chapter 13: Aviation and Radar (Volume II)**), the DIO confirmed that the Bellrock WFDA is not contained within the vertical limits of any practice and exercise areas.

33. The UK is divided into 20 separate low flying areas (LFAs). Low flying occurs in most parts of the UK at any height up to 2,000 ft above the surface. This activity is mostly concentrated between 250 ft and 500 ft. The entirety of the Bellrock WFDA is located within LFA 14 for day low flying as shown in **Figure 13.1.5 (Annex 1)**.

34. Low flying training may be undertaken at night. Most night-time flying by MOD aircraft is undertaken by crews equipped with night vision goggles, therefore infrared aviation warning lights that meet MOD requirements will be necessary for wind farms located within Night-Time LFAs. The nearest Night-Time LFA (LFA 1D) is located approximately 101 km to the west of the Bellrock WFDA as shown in **Figure 13.1.5 (Annex 1)**. The Bellrock WFDA will be fitted with MOD accredited aviation safety lighting in addition to visible aviation lighting required by the CAA under the Air Navigation Order 2016.

## 2.6 Helicopter Main Routing Indicators

35. Most of the Bellrock WFDA is located within Aberdeen offshore safety area (OSA), which has a vertical limit of sea level to FL 100 (approximately 10,000 ft above MSL). The Aberdeen OSA contains a network of offshore routes over the North Sea that are flown by helicopters in support of oil and gas installations. These routes are published on charts as Helicopter Main Routing Indicators (HMRIs) and, together with the OSA, alert other airspace users of the potential for frequent low level helicopter traffic.

36. These routes have no lateral dimensions and assume the background airspace classification within which they lie (namely, Class G uncontrolled airspace). HMRIs within the central North Sea generally extend from 1,500 ft above MSL to FL 60 (approximately 6,000 ft above MSL), however where helicopter icing conditions or other flight safety considerations are present, they may force helicopters to operate below 1,500 ft above MSL.

37. The CAA publication civil aviation publication (CAP) 764 Policy and Guidelines on Wind Turbines (CAA, 2025) advises that planned obstacles overlapping an HMRI route centreline should be consulted upon with the helicopter operators and air navigation service provider (i.e. Aberdeen ATC).

38. Overlapping the Bellrock WFDA are the centrelines for HMRIs 113 and 116. The overlapping HMRIs and are displayed within **Figure 13.1.6 (Annex 1)**. The Applicant engaged Offshore Helicopter Services UK Limited and received a response via e-mail, 30 January 2026, stating that the Bellrock WFDA in isolation would not present too many significant issues. Offshore Helicopter Services UK Limited also stated that the broader concern lies with the end result once all offshore wind farms have been installed.

39. Helicopters operating under IFR must maintain at least 1,000 ft vertical clearance above the highest obstacles within 5 nm and would therefore need to transit the Bellrock WFDA at a minimum of 2,100 ft above MSL for the maximum blade tip height of approximately 1,100 ft above MSL. Helicopters flying under VFR must maintain a minimum of 500 ft separation from obstacles.

40. The ability for a helicopter to fly over WTGs depends on the icing level, and on days of low cloud base helicopters could be required to fly lower and extend their routings around the Bellrock WFDA.

41. Aberdeen ATC, part of the NATS group, provides ATC services to helicopters operating in support of the North Sea oil and gas industry.

## 2.7 Offshore Helidecks

42. To help achieve a safe operating environment, CAP 764 (CAA, 2025) guidance establishes a 9 nm consultation zone for planned obstacles around offshore helicopter destinations. Within 9 nm, obstacles such as WTGs can potentially impact upon the feasibility of helicopters to safely fly low visibility or missed approach procedures at their associated helideck site. The nearest active offshore helideck is Catcher, located 13.3 nm (24.6 km) to the east of the Bellrock WFDA as shown in **Figure 13.1.7 (Annex 1)**. The Bellrock WFDA is therefore located outside of the nearest 9 nm consultation zone.

## 2.8 Search and Rescue

43. SAR operations are a highly specialised undertaking involving not only aviation assets, but also small boats, ships, and shore-based personnel. SAR operations are generally carried out in extremely challenging conditions and at all times of the day and night. There are 10 helicopter SAR bases around the UK with Bristow Group providing helicopters and aircrew on behalf of the Maritime Coastguard Agency.

44. The nearest SAR helicopter base is Inverness Airport, located 245 km to the north northwest of the Bellrock WFDA. Its helicopters provide rescue services for both offshore and land-based incidents. The random nature of people, watercraft and aircraft in distress make it difficult to determine the routes taken by SAR aircraft.

45. The Maritime Coastguard Agency sets out its requirements for wind farms with regards to SAR in Marine Guidance Note (MGN) 654 Annex 5 – Offshore Renewable Energy Installations: Requirements, guidance and operational considerations for SAR and Emergency Response. The Applicant will fully comply with MGN 654.

# 3 Radar Line of Sight Assessment

## 3.1 Technical Data

### 3.1.1 Wind Turbine Generator Parameters

46. The maximum number of WTGs considered within the Bellrock WFDA is 132. There are two WTG designs considered within the Bellrock WFDA, each with a different maximum tip height. The design parameters for each WTG type are shown in **Table 3.1**.

**Table 3.1: Wind Turbine Generator Parameters**

| Parameter | WTG Type 1 | WTG Type 2 |
|---|---|---|
| Maximum tip height (above HAT)[1] | 271 m | 335 m |
| Equivalent maximum tip height for the purpose of RLoS modelling (above MSL)[1] | 273 m | 337 m |
| Rotor diameter | 236 m | 300 m |

Notes:

[1] Radar modelling is undertaken using the maximum tip height above MSL as the tidal level reference. For FSS designs that move with the tide (i.e. semi-submersible platform and barge) the maximum tip height on the horizon will be during HAT. For the Tension Leg Platform FSS design, which is restrained by tensioned moorings and does not notably move with the tide, these parameters will be within the stated project design envelope. Within the Bellrock WFDA, HAT is 1.32 m higher than MSL (rounded to 2 m). Therefore for the purpose of RLoS modelling, an equivalent maximum tip height above MSL has been adopted to ensure the RLoS modelling reflects the maximum tip height on the horizon.

### 3.1.2 Terrain Data

47. RLoS modelling is undertaken using 3D 25 m resolution Advanced Topographic Development and Images (ATDI) digital terrain models (DTM) data.

### 3.1.3 Analysis Tools

48. The following software has been used to undertake the RLoS assessment:

- ATDI HTZ Communications V2023.12.2 release 1498; and
- Blue Marble Global Mapper V26.0 geographic information system.

### 3.1.4 Mapping Datum

49. UTM30 (ETRS89 datum) is used as a common working datum for geodetic references.

50. Where necessary, mapping datum transformations are made using Global Mapper or Grid Inquest II Coordinate Transformation Program.

51. All heights stated in this document are above MSL (Newlyn datum) unless stated otherwise.

### 3.1.5 Radar Data

52. Antenna heights, models and locations have been collected from the following sources:

- Data held on file by Cyrrus Limited from previous surveys;
- MOD Height Survey Data (Military AIP);
- Ofcom Protected Radar List (August 2024); and
- NATS self-assessment maps.

## 3.2 Methodology

53. The maximum WTG tip height considered at Scoping phase (see **Appendix 1.1: Bellrock WFDA Scoping Report (Volume IV)**) was 400 m above MSL. Through design refinement undertaken by the Applicant subsequent to the scoping phase, the maximum WTG tip height been reduced to 337 m above MSL which will reduce the likelihood of WTG detection by radars. Therefore, this RLoS Assessment reassesses the impact of the Bellrock WFDA on radars scoped in during the scoping stage; radars scoped out during the scoping stage have not been considered further.

54. RLoS is determined by use of a radar propagation model, ATDI HTZ Communications, using 3D DTM data with 25 m horizontal resolution. The antenna locations and antenna heights are loaded into HTZ Communications. HTZ Communications uses the location, antenna height, DTM, and the Earth's curvature to produce a RLoS coverage for the desired receiver height. The coverage produced highlights the area within which the radar will be able to detect objects of the specified height (receiver height). Under certain atmospheric conditions it is possible for radars to detect objects that are beyond the radar horizon – this is known as anomalous propagation (anaprop). The theoretical desk-based RLoS modelling below does not include consideration of anaprop but rather provides a general indication of likely WTG visibility.

55. Note that by using a DTM, no account is taken of possible further shielding of the WTGs due to the presence of structures or vegetation that may lie between the radar and the WTGs. It is assumed that WTGs will occupy the full extent of the Bellrock WFDA. Thus, the RLoS assessments are worst-case results.

56. For PSR, the principal source of adverse wind farm effects are the WTG blades, therefore RLoS is calculated for the equivalent maximum blade tip heights for WTG Type 1 and WTG Type 2 (see **Table 3.1**).

## 3.3 Military Air Defence Radar

57. The closest military Air Defence (AD) radar to the Bellrock WFDA is remote radar head (RRH) Buchan, located 117.2 km to the northwest. RLoS analysis indicates that Type 2 WTGs with an equivalent maximum tip height of 337 m above MSL positioned within the northwest of the Bellrock WFDA, will be within RLoS of RRH Buchan, with the area of overlap being 3.93 $km^2$ (being 1.4% of the total Bellrock WFDA of 280 $km^2$). Type 1 WTGs with an equivalent maximum tip height of 273 m above MSL will not be within RLoS of RRH Buchan. RRH Buchan RLoS for 273 m and 337 m equivalent maximum tip heights are shown in **Figure 13.1.8 (Annex 1)**.

58. RLoS modelling also shows that an equivalent tip height of 320 m above MSL (and below) will not be within RLoS of RRH Buchan.

59. In their Scoping representation (**Appendix 1.2: Bellrock WFDA Scoping Opinion (Volume IV)** and **Table 13.2** in **Chapter 13: Aviation and Radar (Volume II)**), the Defence Infrastructure Organisation (DIO) concluded that WTGs presented within the Scoping configuration would be in RLoS of RRH Buchan and that such impact to the Buchan AD radar would need to be addressed through a suitable technical mitigation solution and stated that such technical mitigation solution would be the responsibility of the Applicant. The Applicant notes that there will only be a requirement for technical mitigation if:

- The WTGs are in RLoS; and
- It is demonstrated sufficiently in advance of the commencement of construction that such RLoS impacts have a detrimental impact on the MOD's ability to perform Defence Task 1 (i.e. surveillance activities in support of defence of the realm).

## 3.4 NATS Radar

60. The closest NATS radar to the Bellrock WFDA is Perwinnes, located 124.2 km to the west. Within their scoping representation (**Appendix 1.2: Bellrock WFDA Scoping Opinion (Volume IV)** and Table 13.2 in **Chapter 13: Aviation and Radar (Volume II)**), NATS completed a technical and operational assessment of the Bellrock WFDA. Using the maximum tip height presented at Scoping of 400 m above MSL, NATS identified a technical impact on Perwinnes, that is, some WTGs of the Scoping configuration would be in RLoS of Perwinnes. Users of this radar, NATS Prestwick Centre ATC, Military ATC, and Aberdeen ATC, deemed this operational impact as 'unacceptable'.

61. RLoS modelling indicates that WTGs with an equivalent maximum tip height of 337 m above MSL (reduced from 400 m through design refinement) will not be within RLoS of Perwinnes, as shown in **Figure 13.1.9 (Annex 1)**. With a lower equivalent maximum tip height of 337 m above MSL, there may be no technical impact to Perwinnes from the Bellrock Wind Farm Infrastructure. NATS advised by e-mail on 6 November 2025, that an equivalent maximum tip height of 337 m above MSL, would be below RLoS and the detection probability would low enough that it would not draw a NATS objection.

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# Annex 1: Figures

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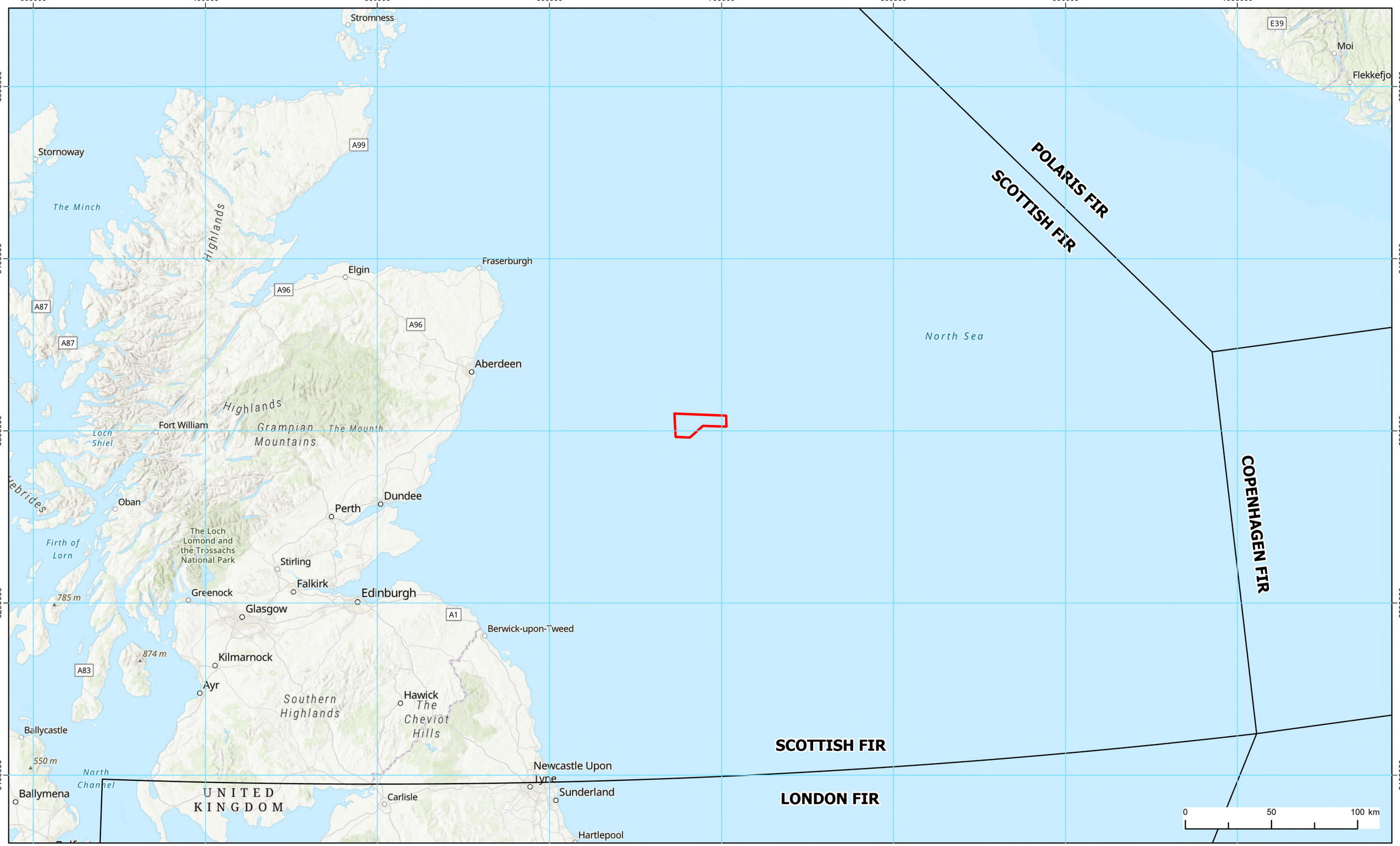


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Bellrock


Legend:
- Bellrock Wind Farm Development Area
- Flight Information Region (FIR) Boundaries

| REV | DATE | STATUS | DRW | CHK | APR |
|---|---|---|---|---|---|
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Scale @ A3
1:2,000,000

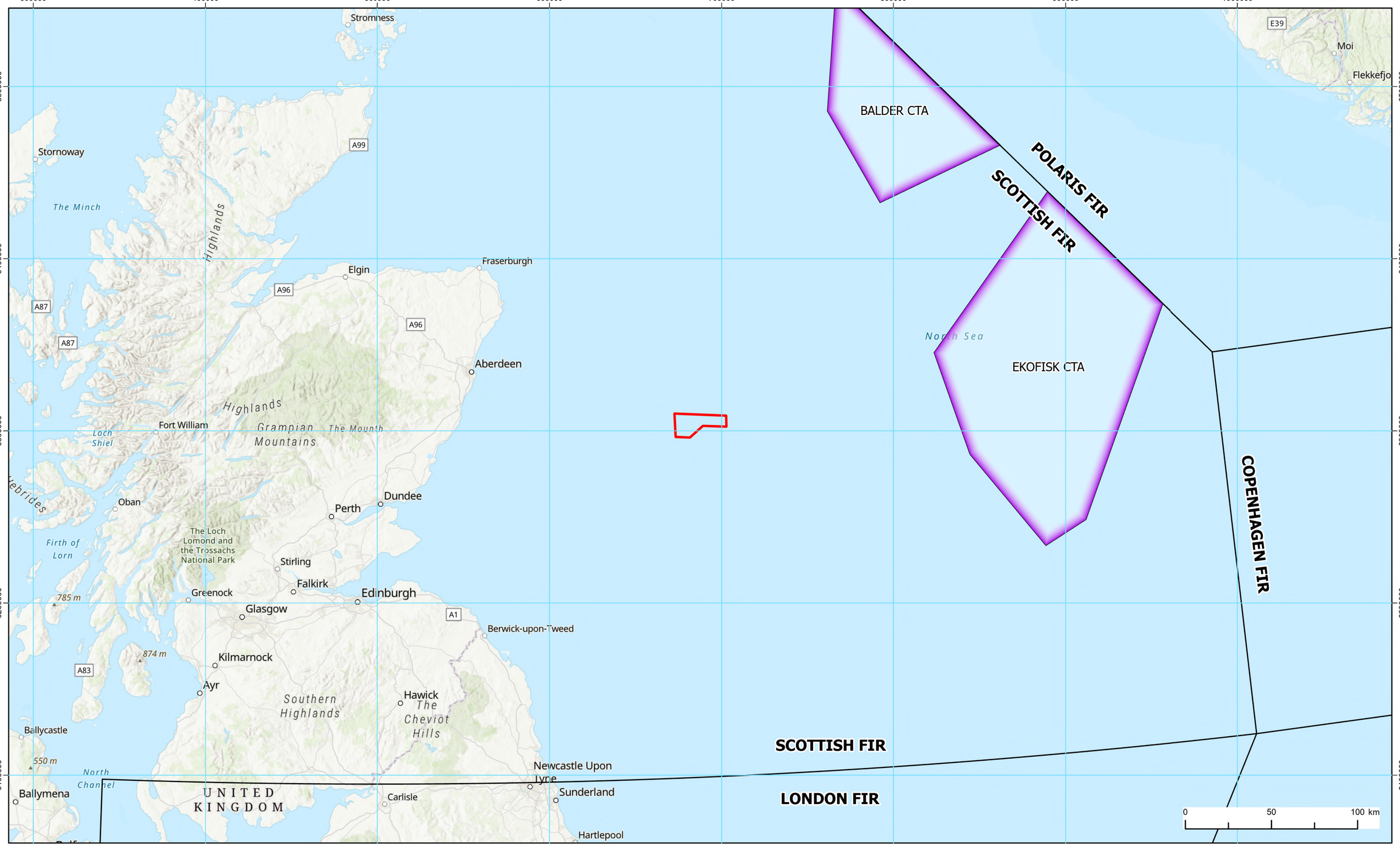
Figure Title:
**Flight Information Region (FIR) Boundaries**

Project:
Bellrock Wind Farm Development Area (WFDA)

Report:
EIA Report
Appendix 13.1: Airspace Analysis and Radar Modelling

Drawing No.: RHDV_BEL_CST_REP_0003_001

**Figure 13.1.1**

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Bellrock


Legend:
- Bellrock Wind Farm Development Area
- Control Area (CTA) Norweigan Air Traffic Service (ATS)
- Flight Information Region (FIR) Boundaries

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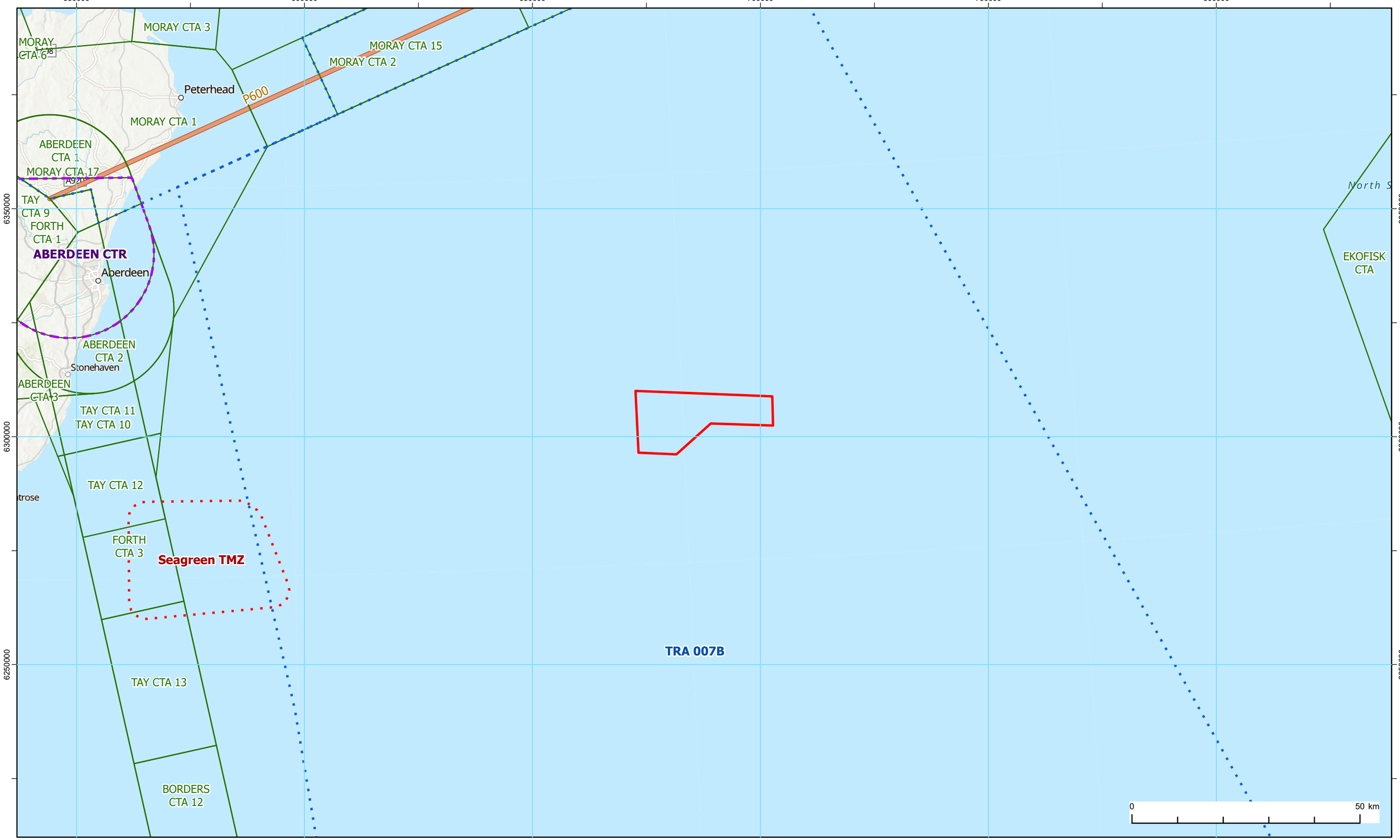
Figure Title:
**Delegation of Air Traffic Services Responsibilities and Flight Information Region (FIR) Boundaries**

Project:
Bellrock Wind Farm Development Area (WFDA)

Report:
EIA Report
Appendix 13.1: Airspace Analysis and Radar Modelling

Drawing No.: RHDV_BEL_CST_REP_0003_002

**Figure 13.1.2**

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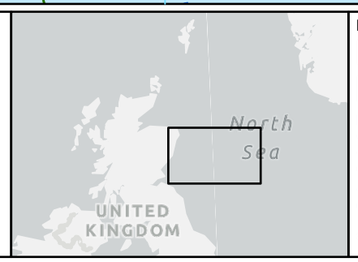


Legend:
- Bellrock Wind Farm Development Area
- Control Area (CTA)
- Control Zone (CTR)
- Transponder Mandatory Zones (TMZ)
- Temporary Reserved Areas (TRA)
- P600

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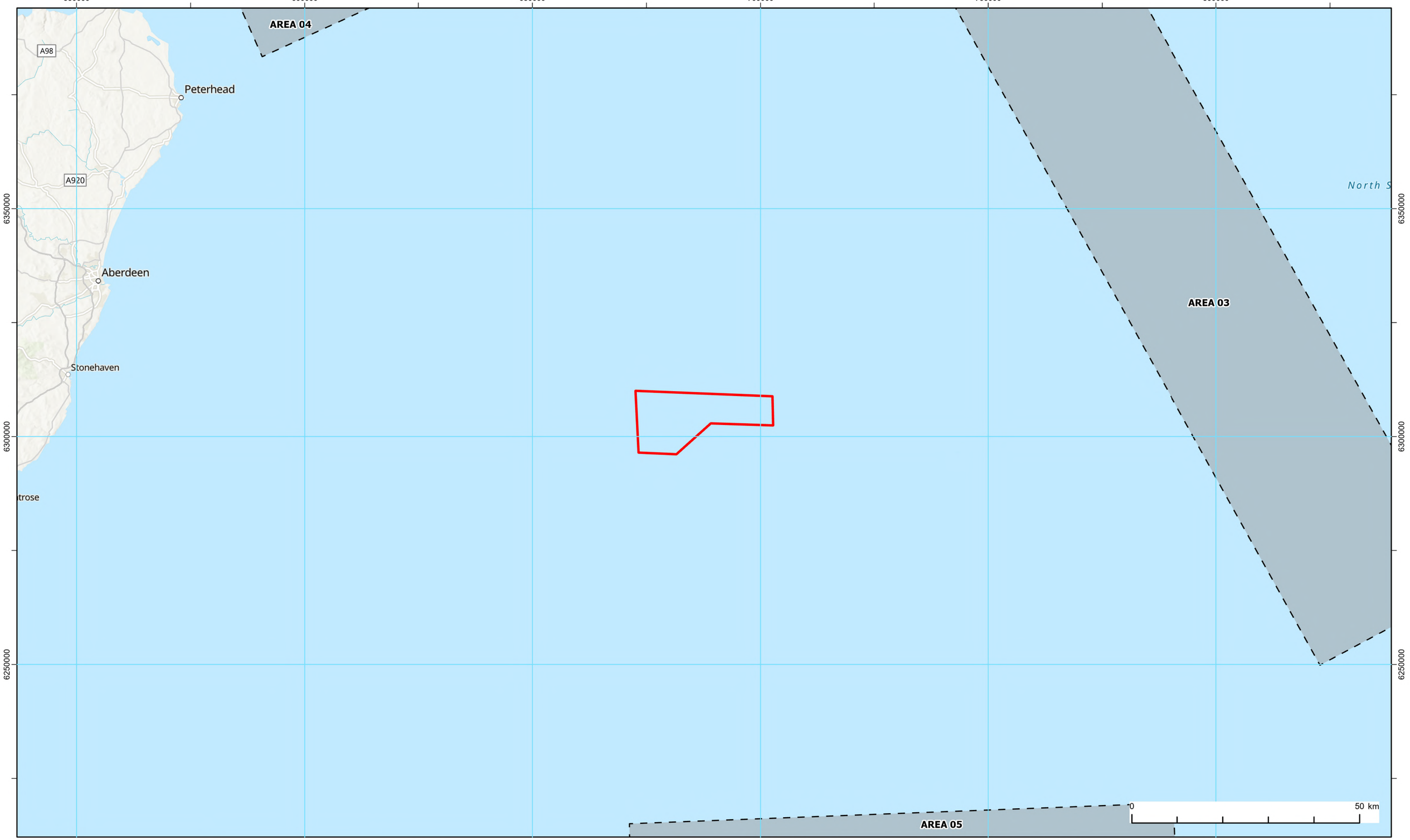
Figure Title:
**Controlled Airspace**

Project:
Bellrock Wind Farm Development Area (WFDA)

Report:
EIA Report
Appendix 13.1: Airspace Analysis and Radar Modelling

Drawing No.: RHDV_BEL_CST_REP_0003_003

**Figure 13.1.3**

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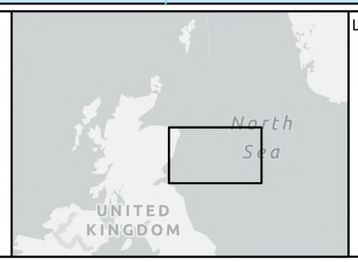
Bellrock




Legend:

- Bellrock Wind Farm Development Area
- Air to Air Refuelling Areas

| REV | DATE | STATUS | DRW | CHK | APR |
|---|---|---|---|---|---|
| 1 | 31/03/2026 | Final | DL | ES | BMcG |

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Figure Title:

**Military Airspace**

Project:

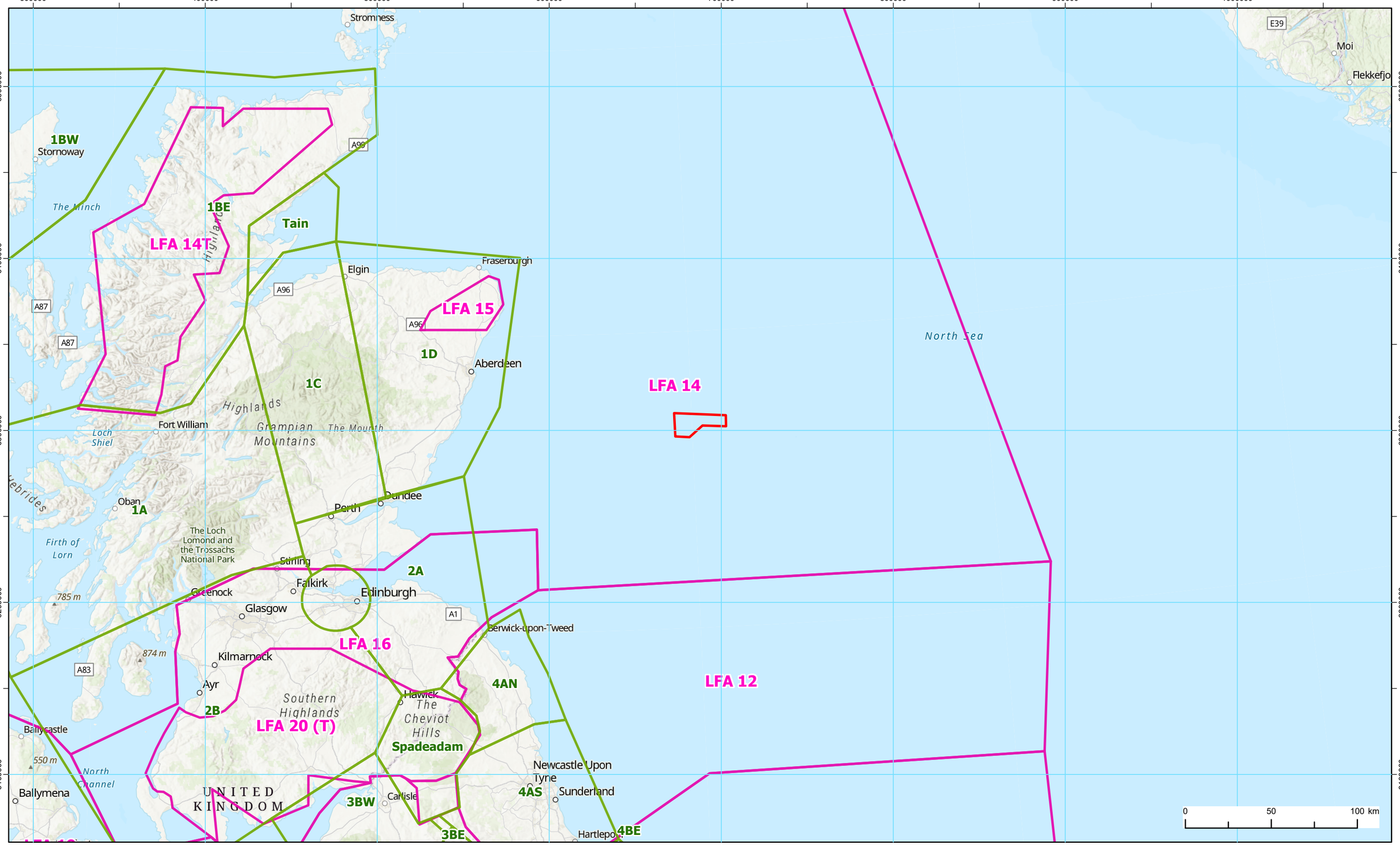
Bellrock Wind Farm Development Area (WFDA)

Report:

EIA Report
Appendix 13.1: Airspace Analysis and Radar Modelling

Drawing No.: RHDV_BEL_CST_REP_0003_004

**Figure 13.1.4**

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Bellrock

Legend:
- Bellrock Wind Farm Development Area
- Military Low Flying Areas (Day)
- Military Low Flying Areas (Night)

| REV | DATE | STATUS | DRW | CHK | APR |
|---|---|---|---|---|---|
| 1 | 31/03/2026 | Final | DL | ES | BMcG |

Coordinate System: WGS 1984 UTM Zone 30N

Source:



Scale @ A3
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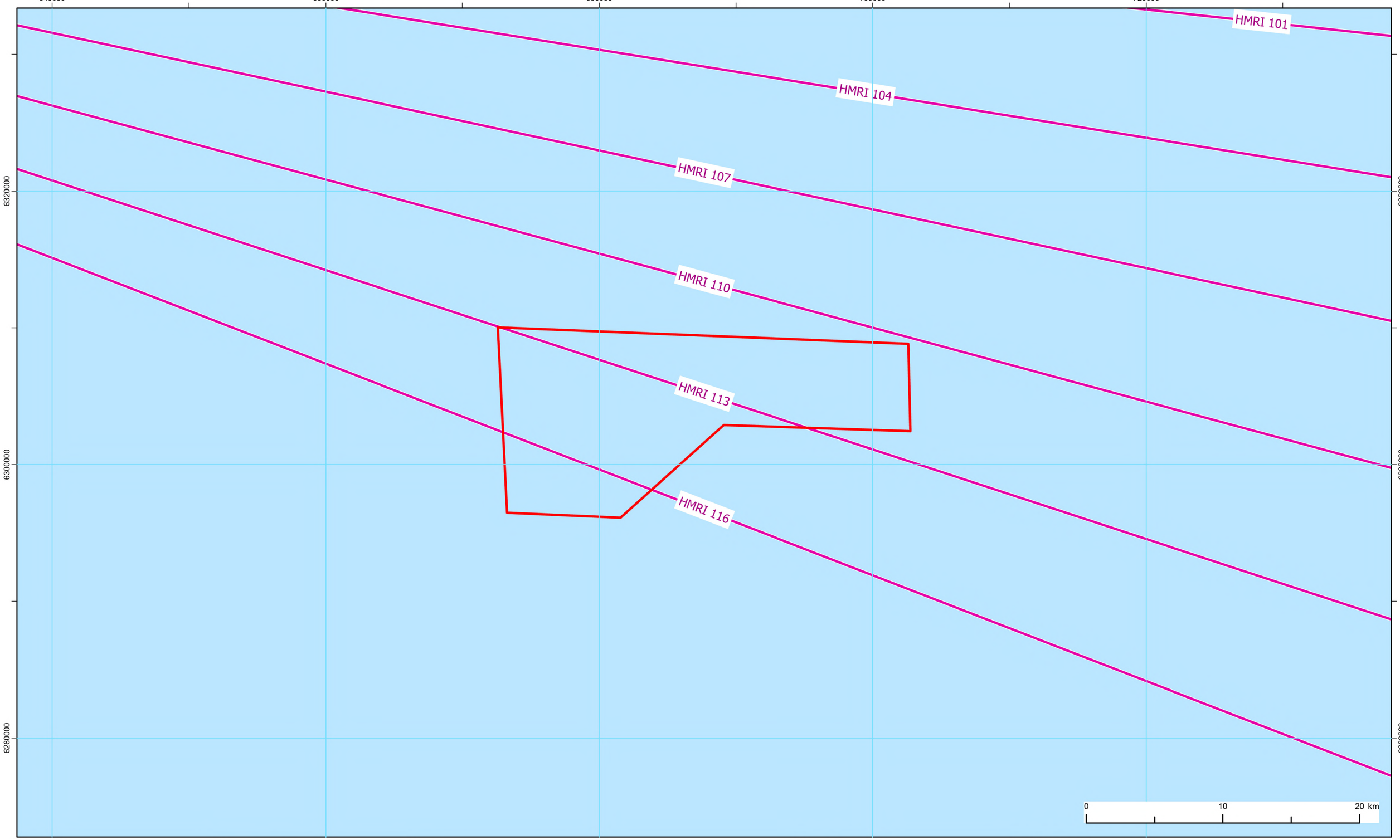
Figure Title:
**Military Low Flying Areas (Day and Night)**

Project:
Bellrock Wind Farm Development Area (WFDA)

Report:
EIA Report
Appendix 13.1: Airspace Analysis and Radar Modelling

Drawing No.: RHDV_BEL_CST_REP_0003_005

**Figure 13.1.5**

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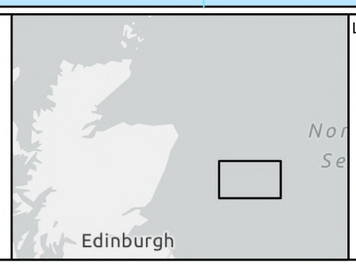
Bellrock




Legend:
- Bellrock Wind Farm Development Area
- Helicopter Main Routing Indicators (HMRI) Centrelines

| REV | DATE | STATUS | DRW | CHK | APR |
|---|---|---|---|---|---|
| 1 | 31/03/2026 | Final | DL | ES | BMcG |

Coordinate System: WGS 1984 UTM Zone 30N

Source:



Scale @ A3
1:250,000

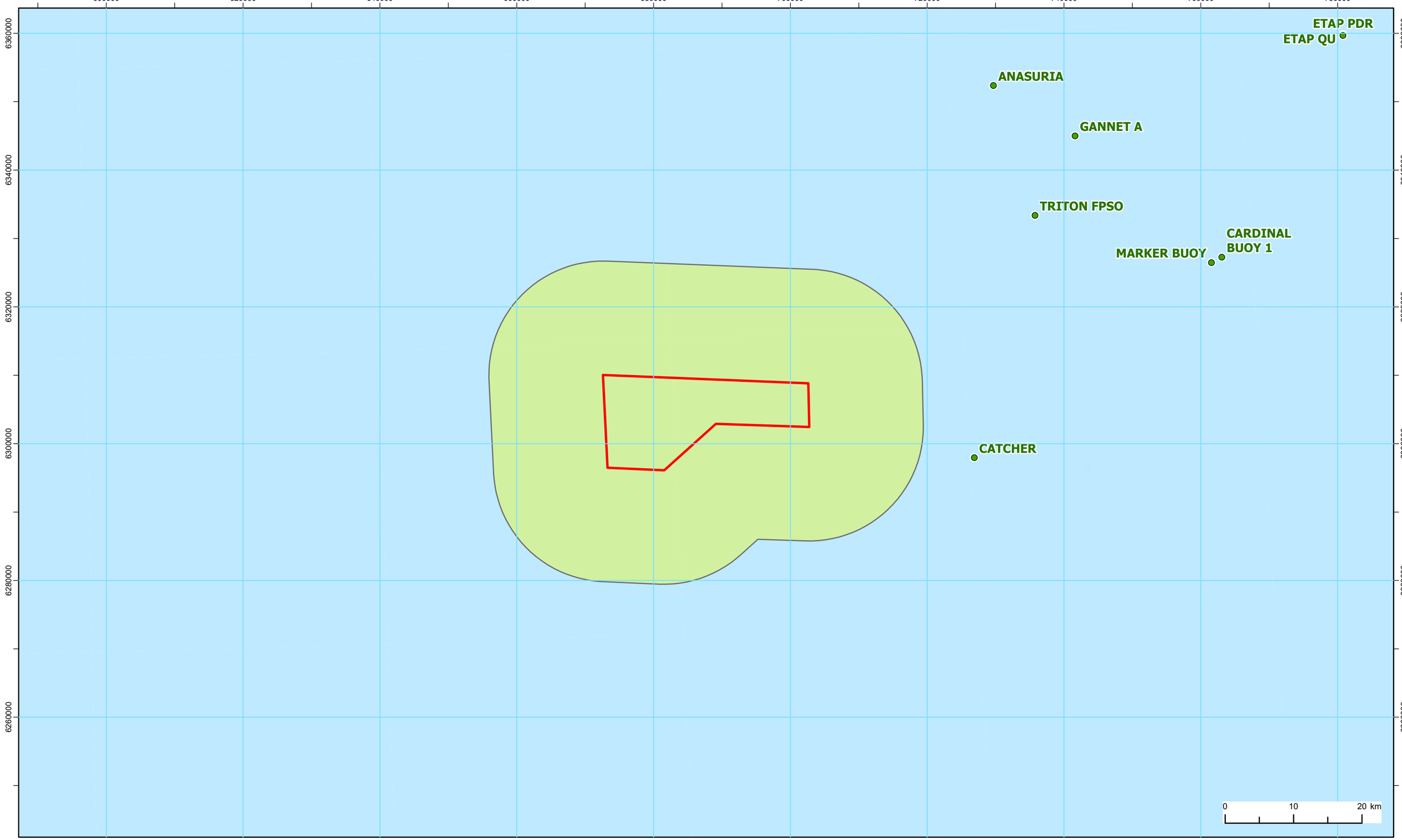
Figure Title:
**Helicopter Main Routing Indicators (HMRI) Centreline**

Project:
Bellrock Wind Farm Development Area (WFDA)

Report:
EIA Report
Appendix 13.1: Airspace Analysis and Radar Modelling

Drawing No.: RHDV_BEL_CST_REP_0003_007

**Figure 13.1.6**

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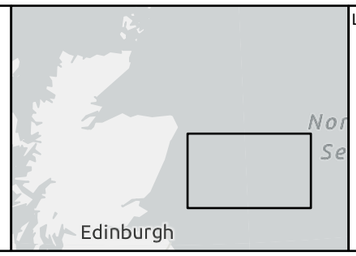
Bellrock




Legend:

- Bellrock Wind Farm Development Area
- Active Offshore Oil and Gas Helidecks
- Bellrock WFDA 9 nm Consultation Zone

| REV | DATE | STATUS | DRW | CHK | APR |
|---|---|---|---|---|---|
| 1 | 31/03/2026 | Final | DL | ES | BMcG |

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Scale @ A3
1:500,000

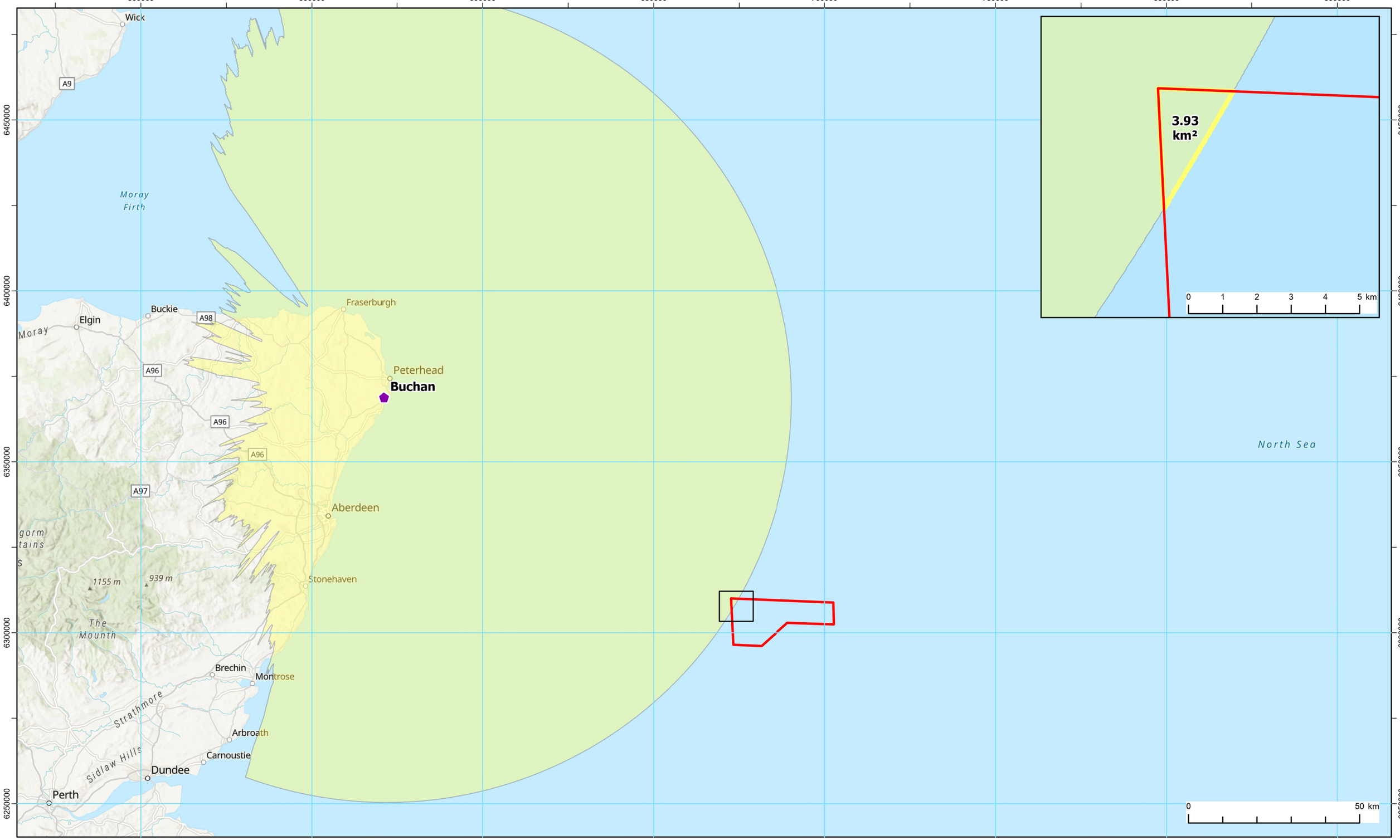
Figure Title:
**Offshore Oil and Gas Platforms with 9 nm Consultation Zone**

Project:
Bellrock Wind Farm Development Area (WFDA)

Report:
EIA Report
Appendix 13.1: Airspace Analysis and Radar Modelling

Drawing No.: RHDV_BEL_CST_REP_0003_008

**Figure 13.1.7**





Legend:

- Bellrock Wind Farm Development Area
- Air Defence Radar
- Buchan Radar Line of Sight (RLoS) - Blade Tip 337 m AMSL

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Figure Title:

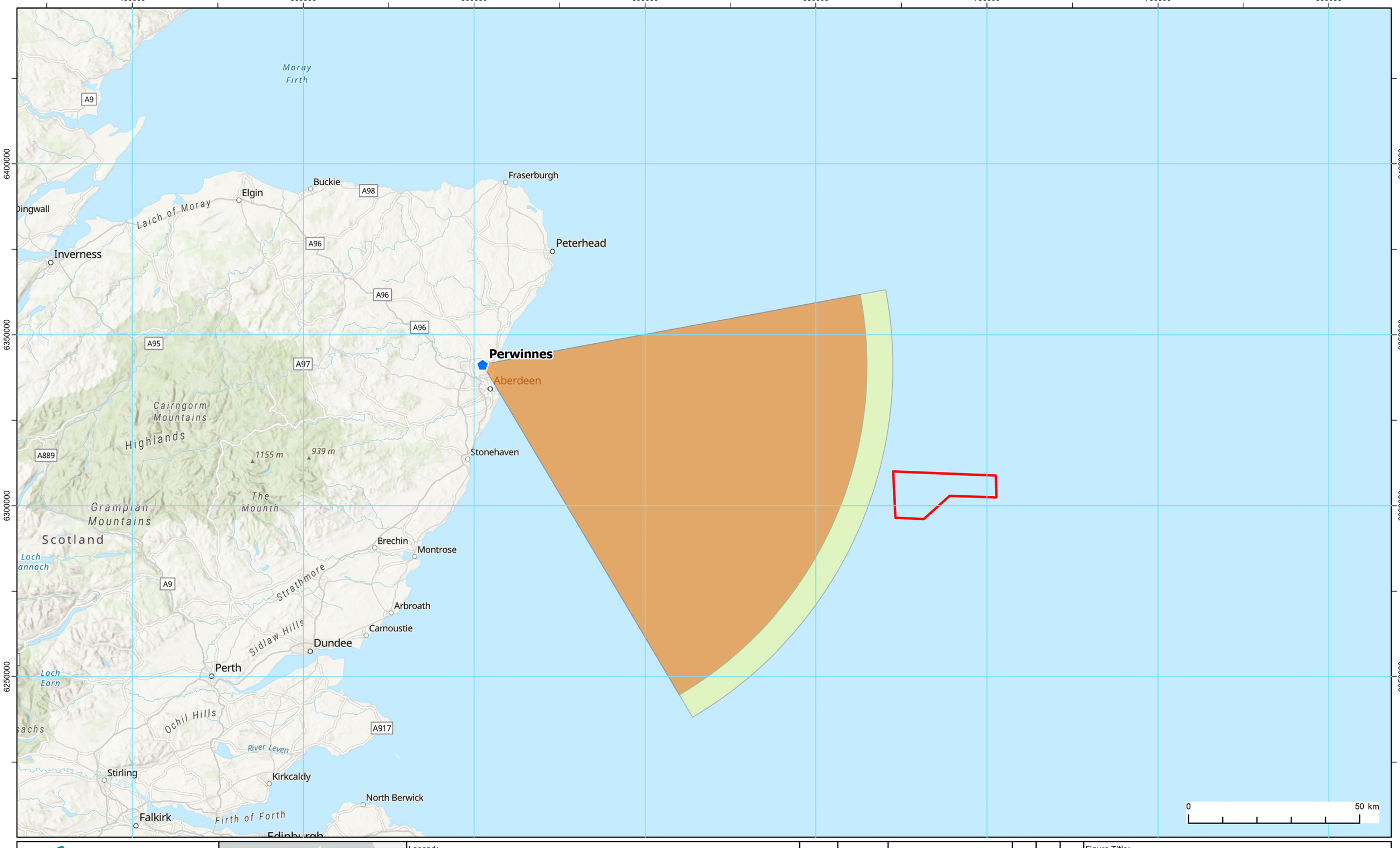
**Remote Radar Head (RRH) Buchan Radar Line of Sight (RLoS)**

Project: Bellrock Wind Farm Development Area (WFDA)

Report: EIA Report Appendix 13.1: Airspace Analysis and Radar Modelling

Drawing No.: RHDV_BEL_CST_REP_0003_009

**Figure 13.1.8**





Legend:

- Bellrock Wind Farm Development Area
- NATS Radar
- Perwinnes Radar Line of Sight (RLoS) - Blade Tip 273 m Above Mean Sea Level
- Perwinnes Radar Line of Sight (RLoS) - Blade Tip 337 m Above Mean Sea Level

| REV | DATE | STATUS | DRW | CHK | APR |
|---|---|---|---|---|---|
| 1 | 31/03/2026 | Final | DL | ES | BMcG |

Coordinate System: WGS 1984 UTM Zone 30N

Source:



Scale @ A3

1:1,000,000

Figure Title:

**NATS Perwinnes Radar Line of Sight (RLoS)**

Project: Bellrock Wind Farm Development Area (WFDA)

Report: EIA Report Appendix 13.1: Airspace Analysis and Radar Modelling

Drawing No.: RHDV_BEL_CST_REP_0003_010

**Figure 13.1.9**