GREEN VOLT

Chapter 16
Aviation and Radar

Offshore EIA Report: Volume 1

Revision history

Revision	Date	Description	Prepared	Checked	Approved
1	19/08/2022	First draft	RW (Flotation Energy)	CM (Royal HaskoningDHV)	VC (Flotation Energy)
2	26/09/2022	Second draft	PP (Royal HaskoningDHV)	CM (Royal HaskoningDHV)	VC (Flotation Energy)
3	20/12/2022	Final for submission	CM (Royal HaskoningDHV)	JM (Royal HaskoningDHV)	VC (Flotation Energy)

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Acronyms

Acronym	Description
ADR	Air Defence Radar
AMSL	Above Mean Sea Level
ANSP	Air Navigation Service Providers
AS	Aviation Specification
ATC	Air Traffic Control
ATS	Air Traffic Services
BEIS	Department for Business, Energy and Industrial Strategy
CAA	Civil Aviation Authority
CNS	Communication, Navigation and Surveillance
DfT	Department for Transport
EIA	Environmental Impact Assessment
ERCoP	Emergency Response Co-operation Plan
FL	Flight Level
HMR	Helicopter Main Routes
IFP	Instrument Flight Procedure
IFR	Instrument Flight Rules
LoS	Line of Sight
MAA	Military Aviation Authority
MCA	Maritime and Coastguard Agency
MHWS	Mean High Water Springs
MoD	Ministry of Defence
MS- LOT	Marine Scotland Licensing and Operations Team
NAIZ	Non-Auto Initiation Zone
NATS	National Air Traffic Service

nm	Nautical Mile
NOTAM	Notice to Air Missions
NVG	Night Vision Goggles
OREI	Offshore Renewable Energy Installations
OWIC	Offshore Wind Industry Council
PEXA	Practice and Exercise Areas
PSR	Primary Surveillance Radar
RAF	Royal Air Force
SAR	Search and Rescue
SMS	Safety Management System
SSR	Secondary Surveillance Radar
TMZ	Transponder Mandatory Zone
UK	United Kingdom
UXO	Unexploded Ordnance
VFR	Visual Flight Rules
VHF	Very High Frequency
WAM	Wide Area Multilateration
WTG	Wind Turbine Generator

Glossary

Term	Description
Applicant	Green Volt Offshore Windfarm Ltd.
Buzzard	Buzzard Platform Complex.
Buzzard Export Cable Corridor	The area in which the export cables will be laid, from the perimeter of the Windfarm Site to Buzzard Platform Complex.
Green Volt Offshore Windfarm	Offshore windfarm including associated onshore and offshore infrastructure development (Combined On and Offshore Green Volt Projects).
Horizontal Directional Drilling	Mechanism for installation of export cable at landfall.
Inter-array cables	Cables which link the wind turbines to each other and the offshore substation platform.
Landfall Export Cable Corridor	The area in which the export cables will be laid, from the perimeter of the Windfarm Site to landfall.
Mean High Water Springs	At its highest and 'Neaps' or 'Neap tides' when the tidal range is at its lowest. The height of Mean High Water Springs (MHWS) is the average throughout the year, of two successive high waters, during a 24-hour period in each month when the range of the tide is at its greatest (Spring tides).
Moorings	Mechanism by which wind turbine generators are fixed to the seabed.
NorthConnect Parallel Export Cable Corridor Option	Landfall Export Cable Corridor between NorthConnect Parallel Landfall and point of separation from St Fergus South Export Cable Corridor Option.
NorthConnect Parallel Landfall	Southern landfall option where the offshore export cables come ashore.
Offshore Development Area	Encompasses i) Windfarm Site, including offshore substation platform ii) Offshore Export Cable Corridor to Landfall, iii) Export Cable Corridor to Buzzard Platform Complex.
Offshore export cables	The cables which would bring electricity from the offshore substation platform to the Landfall or to the Buzzard Platform Complex.
Offshore Export Cable Corridor	The proposed offshore area in which the export cables will be laid, from offshore substation to landfall or to the Buzzard Platform Complex.
Offshore infrastructure	All of the offshore infrastructure, including wind turbine generators, offshore substation platform and all inter-array and export cables.
Offshore substation platform	A fixed structure located within the Windfarm Site, containing electrical equipment to aggregate the power from the wind turbine generators and convert it into a more suitable form for export to shore.
Onshore Export Cable Corridor	The proposed onshore area in which the export cables will be laid, from landfall to the onshore substation.

Project	Green Volt Offshore Windfarm project as a whole, including associated onshore and offshore infrastructure development.
Safety zones	An area around a structure or vessel which must be avoided.
St Fergus South Export Cable Corridor Option	Landfall Export Cable Corridor between St Fergus South Landfall and point of separation from NorthConnect Parallel Export Cable Corridor Option.
St Fergus South Landfall	Northern landfall option where the offshore export cables come ashore.
Windfarm Site	The area within which the wind turbine generators, offshore substation platform and inter-array cables will be present.

CHAPTER 16: AVIATION AND RADAR

16.1 Introduction

1. Offshore wind farms can cause radar clutter (i.e. false returns or unwanted echoes) and interference to aviation radar signals creating potential conflict between the requirement for the United Kingdom (UK) to produce clean energy, and the safeguarding of UK airspace. A Ministry of Defence (MoD) trial in 2005 found that clutter on a radar display, caused by wind farms, was highly detrimental to the safe provision of Air Traffic Services (ATS) (RAF 2005). The trial found that an Air Traffic Control (ATC) operator would be unable to differentiate between radar returns from a rotating wind turbine generator (WTG) blade and those from a moving aircraft, resulting in the operator being obliged to treat WTG blade induced radar returns as though they were unidentified aircraft (ORE Catapult 2022).

2. Since this assessment offshore wind developers have been required to undertake engagement with key relevant stakeholders and then undertake the necessary assessment to ensure potential impacts are identified as part of the Environmental Impact Assessment (EIA) process. Developers are encouraged to take advantage of pre-planning services offered by consultees such as the MoD and National Air Traffic Service (NATS). Following these assessments, the onus is on the developer to consult with the relevant aviation stakeholders (identified in the Marine Scotland Licensing Operations Team (MS-LOT) **Scoping Opinion** (MS-LOT, 2022) (**Appendix 1.1**) to determine whether mitigation is feasible.

3. The construction and operation of offshore wind turbines has the potential to create adverse impacts on both aircraft and Communication, Navigation and Surveillance (CNS) provision. Such impacts can include:

    - Physical obstruction to low flying, in particular offshore helicopter operations including search and rescue (SAR);
    - Interference with navigation equipment;
    - Interference with military and civil ATC radar, both primary and secondary; and
    - Interference to military Air Defence Radar (ADR) systems.

4. This chapter considers these potential impacts of the Project (in this instance the Project refers to the offshore elements of the Green Volt Offshore Windfarm only, up to Mean High Water Springs (MHWS)). This chapter outlines the key policy and regulations that must be considered, the baseline conditions both for the military and civilian stakeholders, the site design implications for the placement of the turbines at the site, the mitigation measures that could be required to achieve consent and finally it provides a review of cumulative impacts from other offshore wind installations.

5. This is a standalone chapter but a number of confidential reports and documents will be used to help support consultation and engagement with the key stakeholders that cannot be reported within this chapter. This chapter was prepared by Floatation Energy and Royal HaskoningDHV based upon technical input from Wind Business Support Ltd.

16.2 Legislation, Guidance and Policy

6. The list below details the most significant guidance documents with regard to the potential impacts of the Project on aviation. Other documents exist that relate to this topic and specific guidance is available from other parties, notably NATS (which provides self-assessment maps for aviation issues) and the MoD (which provides a preplanning service advising of potential aviation issues for wind developments.

- Scottish Government (2009): National Planning Framework for Scotland;
- Scottish Government (2020): Scottish Planning Policy;
- Scottish Government (2020): Offshore wind policy statement;
- Civil Aviation Authority (CAA) (2020): CAP 738: Safeguarding of Aerodromes, 3rd edition
- CAA (2021): CAP 393: Air Navigation. The Order and the Regulations, 6th edition;
- CAA (2022): CAP 168: Licensing of Aerodromes, 12th edition; and
- CAA (2016): CAP 764: CAA Policy and Guidelines on Wind Turbines, 6th edition.

16.3 Consultation

7. Consultation was undertaken during and following the submittal of the **Offshore Scoping Report** (Royal HaskoningDHV 2021) (**Appendix 1.2**), with MS-LOT providing formal feedback in the **Scoping Opinion** (**Appendix 1.1**). This included feedback from statutory and non-statutory consultees that responded to the **Offshore Scoping Report**. From this document three key stakeholders were identified:

    - Aberdeen Airport;
    - MoD and
    - NATS.

8. It should be noted that the CAA was consulted by MS-LOT as part of Scoping, but did not provide a response for the **Scoping Opinion**.

9. Consultation with all the relevant stakeholders is continuing and will form part of the ongoing stakeholder engagement and will result in separate confidential assessments which will be used by the stakeholders to confirm their acceptance of the project mitigation measures proposed. A summary of consultation undertaken is presented in **Table 16.1.**

Table 16.1 Summary of consultation relevant to aviation and radar

Consultee	Date / Document	Comment	Response / where addressed in the EIA Report
Marine Scotland Licensing Operations Team (MS-LOT)	April 2022 Offshore Scoping Opinion	**[Ref: 5.20.1] Civil Aviation, Military, Unexploded Ordnance and Communication:** With regards to baseline characterisation, the Scottish Ministers are content with the data sources listed in Table 7.18 of the Scoping Report. However, the Scottish Ministers draw attention to the representation from the MOD regarding anticipated effects of the Proposed Development on military practice and exercise areas. Should further information become available regarding the impact of the Proposed Development on military activity, the Scottish Ministers advise that the Developer must engage further with the MOD on this point.	Where any new information becomes available regarding the impact of the Project on military activity, the Applicant will engage further with the MoD

Consultee	Date / Document	Comment	Response / where addressed in the EIA Report
Marine Scotland Licensing Operations Team (MS-LOT)	April 2022 Offshore Scoping Opinion	**[Ref: 5.20.2] Civil Aviation, Military, Unexploded Ordnance and Communication:** In Table 7.19 of the Scoping Report the Developer summarises the potential impacts to civil aviation, military, UXO, and communication to be scoped in and out of the EIA Report during different phases of the Proposed Development. The Scottish Ministers agree with the Developer but highlight the representations from Aberdeen Airport, NATS and the MOD which must be fully addressed by the Developer including the points raised below.	Comments from Aberdeen Airport, NATS and the MoD are addressed in this table (**Table 16.1**)
Marine Scotland Licensing Operations Team (MS-LOT)	April 2022 Offshore Scoping Opinion	**[Ref: 5.20.3] Civil Aviation, Military, Unexploded Ordnance and Communication:** The Scottish Ministers direct the Developer to the representation from the MOD where it states that the Developer has appropriately identified the use of airspace for defence purposes in the vicinity of the Proposed Development. The Scottish Ministers agree with the points raised by the MOD regarding primary surveillance radars and air defence radars and advise that these must be fully addressed in the EIA Report, including technical mitigations.	A separate and confidential SERCO report will be submitted to the MoD. This will evaluate the use of the technical mitigation capability built into the Royal Air Force (RAF) Buchan Air Defence radar. Additional discussions with the MoD in regard to the temporary and enduring technical solutions are ongoing.
Marine Scotland Licensing Operations Team (MS-LOT)	April 2022 Offshore Scoping Opinion	**[Ref: 5.20.4] Civil Aviation, Military, Unexploded Ordnance and Communication:** In Section 7.7.4.3 of the Scoping Report, the Developer outlines its commitment to the mandatory requirements for lighting of offshore wind turbines. With regards to this, the MOD requests that the Proposed Development is fitted with MOD accredited aviation safety lighting in accordance with the CAA Air Navigation Order 2016. The Scottish Ministers agree, and whilst the CAA has not provided any representation, the Scottish Ministers advise that the Developer must seek engagement with the CAA.	The Applicant can confirm that appropriate aviation lighting will be installed on the turbines in line with the Air Navigation Order 2016 (see **Section 16.7.1.3).** Confirmation of lighting requirements would assume to be covered in the post-consent discharge requirement for a Lighting and Marking Plan that will be approved by all key stakeholders (including marine navigation) ahead of construction commencing and would allow the most up to date guidance to be implemented at that time.
Marine Scotland Licensing Operations Team (MS-LOT)	April 2022 Offshore Scoping Opinion	**[Ref: 5.20.5] Civil Aviation, Military, Unexploded Ordnance and Communication:** The Scottish Ministers direct the Developer	Aberdeen Airport has since stated that the Windfarm Site is likely to be outside the IFP safeguarding area and that in any event there

Consultee	Date / Document	Comment	Response / where addressed in the EIA Report
		to the representation received from Aberdeen Airport regarding Instrument Flight Procedures ("IFPs"). The Scottish Ministers agree and advise that impacts on IFPs must be taken into account within the assessment of aviation impacts and interference in the EIA Report.	would be no impacts for turbines under 300 m tall (the maximum turbine height would be 264 m). A formal revised response was outstanding at the time of submission.
Marine Scotland Licensing Operations Team (MS-LOT)	April 2022 Offshore Scoping Opinion	**[Ref: 5.20.6] Civil Aviation, Military, Unexploded Ordnance and Communication:** The Scottish Ministers also highlight the representation from NATS which predicts that the Proposed Development is likely to generate false primary plots and also a reduction in the probability of Alanshill and Perwinnes RADAR to detect real aircraft. NATS also advises that the Proposed Development is likely to have considerable adverse impacts on air traffic control at both Prestwick and Aberdeen. NATS states that no impact is anticipated on NATS' navigational aids and radio communications infrastructure. The NATS representation states that it objects to the Proposed Development and the Scottish Ministers therefore advise that the Developer must consider this factor and address the NATS representation in full.	Green Volt Offshore Windfarm Limited (the Applicant) will seek to work with NATS, the CAA and the Offshore Wind Industry Council (OWIC) in co-ordinating the airspace change required to mitigate the impacts of both this and other offshore developments in the region. Further details are provided in **Section 16.7.3.1**.
Aberdeen Airport	21st December 2021 Representation to MS-LOT during consultation on Offshore Scoping Opinion	The proposed location is located within the wind farm consultation zone for Aberdeen Airport and as such aviation impacts should be considered as part of the EIA.	The impact on Aberdeen Airport from the Windfarm Site has been assessed within this chapter and consultation with the airport has been undertaken (**see Section 16.7.3.2**).
Aberdeen Airport	21st December 2021 Representation to MS-LOT during consultation on Offshore Scoping Opinion	It is also within the instrument flight procedures safeguarding area and impacts on Instrument Flight Procedures (IFP) should be considered as part of the EIA.	Aberdeen Airport has since stated that the Windfarm Site is likely to be outside the IFP safeguarding area and that in any event there would be no impacts for turbines under 300 m tall (the maximum turbine height would be 264 m). A formal revised response was outstanding at the time of submission.
Aberdeen Airport	21st December 2021 Representation to MS-LOT during consultation on Offshore Scoping Opinion	Our position with regard to this proposal will only be confirmed once the turbine details are finalized and we have been consulted on a full planning	The Applicant will continue engagement with Aberdeen International Airport and will consult Aberdeen

Consultee	Date / Document	Comment	Response / where addressed in the EIA Report
		application. At that time we will carry out a full safeguarding impact assessment and will consider our position in light of, inter alia, operation impact and cumulative effects.	International Airport on the full planning application.
BT	22nd December 2021 Representation to MS-LOT during consultation on Offshore Scoping Opinion	We have studied the wind farm proposal using the co-ordinates below with respect to EMC and related problems to BT point-to-point microwave radio links. The conclusion is that the Project indicated should not cause interference to BT's current and presently planned radio network.	No impact identified from this stakeholder. No further action currently required.
Ministry of Defence (MoD)	14th February 2022 Representation to MS-LOT during consultation on Offshore Scoping Opinion	The use of airspace in the vicinity of the proposed development for defence purposes has been appropriately identified. The Scoping Report highlights some of the aviation and radar systems that may be affected by the proposed wind farm and the MOD is identified as a relevant receptor in Chapter 7.7.2.2 Aviation and Radar of the Scoping Report.	Noted
MoD	14th February 2022 Representation to MS-LOT during consultation on Offshore Scoping Opinion	The Green Volt Scoping report identifies that the proposed turbines have the potential to be detectable by and adversely affect both military and civil primary surveillance radars (PSR), in the wider region. The report also notes that the development has the potential to have an impact on the operation and capability of the Air Defence Radars (ADR) at RAF Buchan. The impact on the MoD radar systems may require a technical mitigation which should be provided by the applicant.	A separate and confidential SERCO report will be submitted to the MoD. This will evaluate the use of the technical mitigation capability built into the RAF Buchan Air Defence radar. Additional discussions with the MoD in regard to the temporary and enduring technical solutions are ongoing.
MoD	14th February 2022 Representation to MS-LOT during consultation on Offshore Scoping Opinion	Impact on military activity has been recognised in chapter 7.7.2.1 of the scoping report. The designated site area, as shown on figure 7.19, identified military Practice and Exercise Areas (PEXA). At this time, it is not anticipated that the development would have any substantial impact though further assessment will take place when additional information is available.	The Applicant notes that the MoD have confirmed no impact on the PEXA. The MoD will be continued to be consulted on the Project as it develops.
MoD	14th February 2022 Representation to MS-LOT	The potential presence of unexploded ordnance (UXO)	Pre-construction surveys will be undertaken for UXO.

Consultee	Date / Document	Comment	Response / where addressed in the EIA Report
	during consultation on Offshore Scoping Opinion	has been identified as a relevant consideration in section 7.7.2.7. The potential presence of UXO and disposal sites is also a relevant consideration to the installation of cables and other intrusive works that may be undertaken in the maritime environment.	Refer to **Chapter 5: Project Description** (including **Appendix 5.1**), **Chapter 10: Fish and Shellfish Ecology** and **Chapter 11: Marine Mammals**
MoD	14th February 2022 Representation to MS-LOT during consultation on Offshore Scoping Opinion	Impact on military low flying has been scoped in and the applicant states in the scoping report that they are committed to lighting and charting the turbines. In the interest of air safety, the MoD would request that the development be fitted with MoD accredited aviation safety lighting in accordance with the civil aviation authority, Air Navigation Order 2016.	The Applicant can confirm that appropriate aviation lighting will be installed on the turbines in line with the Air Navigation Order 2016 (see **Section 16.7.1.3**). Confirmation of lighting requirements would assume to be covered in the post-consent discharge requirement for a Lighting and Marking Plan that will be approved by all key stakeholders (including marine navigation) ahead of construction commencing and would allow the most up to date guidance to be implemented at that time.
MoD	14th February 2022 Representation to MS-LOT during consultation on Offshore Scoping Opinion	In relation to the onshore element of the proposal, chapter 2.2.3 of the scoping report identifies the landfall zones have not been determined. Ongoing consultation is request once the location has been finalised.	This will be undertaken as part of the onshore EIA work, but consultation is currently ongoing with the MoD on this.
MoD	Pre Application consultation email 10th August 2022	I can confirm that MoD has no concerns or comments at this stage in your preparation of this development proposal for the export cable and associated rock deposits for in-trench burial of the cable. The MoD should be consulted at the next stage of this application to enable defence maritime navigational interests to be considered.	Noted. The MoD will be continued to be consulted on the Project as it develops
NATS	20th December 2021 Representation to MS-LOT during consultation on Offshore Scoping Opinion	NATS (En Route) plc objects to the proposal as per report TOPA SG32512. The proposed development is predicted to cause impacts to the PSRs at Alanshill and Pwerinnes. The impacts have been assessed as unacceptable to both the Prestwick control centre and to NATS Aberdeen. Consultation should be undertaken with NATS before planning permission is granted	The Applicant will seek to work with NATS, the CAA and the Offshore Wind Industry Council (OWIC) in co-ordinating the airspace change required to mitigate the impacts of both this and other offshore developments in the region. Further details are provided in **Section 16.7.3.1**.

Consultee	Date / Document	Comment	Response / where addressed in the EIA Report
NATS	20th December 2021 Representation to MS-LOT during consultation on Offshore Scoping Opinion	NATS confirm there is no anticipated impact on the NATS navigational aids and radio communications infrastructure.	No assessment required.
NATS	Pre Application consultation email 27th July 2022	"NATS position remains as detailed in our email of 20/12/21 attached (see below) Our Ref: SG32512 (Technical and Operational Assessment included as attachment) Dear Sir/Madam We refer to the application above. The proposed development has been examined by our technical safeguarding teams and conflicts with our safeguarding criteria. Accordingly, NATS (En Route) plc objects to the proposal. The reasons for NATS's objection are outlined in the attached report TOPA SG32512. We would like to take this opportunity to draw your attention to the legal obligation of local authorities to consult NATS before granting planning permission. The obligation to consult arises in respect of certain applications that would affect a technical site operated by or on behalf of NATS (such sites being identified by safeguarding plans that are issued to local planning authorities). In the event that any recommendations made by NATS are not accepted, local authorities are obliged to follow the relevant directions within Planning Circular 2 2003 - Scottish Planning Series: Town and Country Planning (Safeguarded Aerodromes, Technical Sites and Military Explosives Storage Areas) (Scotland) Direction 2003 or Annex 1 - The Town And Country Planning (Safeguarded Aerodromes, Technical Sites And Military Explosives Storage Areas) Direction 2002. These directions require that the planning authority notify both NATS and the Civil Aviation Authority ("CAA") of their intention. As this further notification is intended to allow	NATS' position with regard to this proposal will only be confirmed once the turbine details are finalised and they have been consulted on a full planning application. At that time they will carry out a full safeguarding impact assessment and will consider their position in light of, inter alia, operation impact and cumulative effects.

Consultee	Date / Document	Comment	Response / where addressed in the EIA Report
		the CAA to consider whether further scrutiny is required, the notification should be provided prior to any granting of permission. It should also be noted that the failure to consult NATS, or to take into account NATS's comments when determining a planning application, could cause serious safety risks for air traffic."	
Office of Communications (OFCOM)	Email 12th June 2021 PAC consultation email 8th October 2022	OFCOM no longer provide response to scoping or EIA and only provide links to the spectrum information system to allow offshore wind developers to identify any relevant licensees or services.	Noted and as the Project engineering progresses the address links for the licensees will be utilised as appropriate and further queries will be addressed to the noted spectrum licensing team.

16.4 Assessment Methodology

16.4.1 Impact Assessment Methodology

16.4.1.1 Technical Assessment

10. The requirement is for the Project to have no significant residual effects on aviation infrastructure. This is addressed through consultation with all relevant stakeholders within the consenting process. The task of the developer is to independently assess the potential impacts and where significant effects may occur, to enter a dialogue with the affected stakeholders prior to application submission as far as possible. Whilst the aim of this pre-application dialogue is to enable the approval of all stakeholders, typically solutions are identified but do not reach full maturity in terms of the assessment by the stakeholders and the contracting of mitigation where required, until after submission. The stakeholders consider dialogue a higher priority and more meaningful, once project design iterations are completed and a live application exists.

11. An initial scoping study identified those stakeholders potentially affected by the Project. The scoping process involves considering all military and civil aerodromes in the wider area out to circa 80km, all radar installations out to the limit of their range, all navigational aids, air-ground-air communications stations and low flying activities. A key sensitivity is the visibility of the turbines to those radars potentially affected. Consequently, studies have been conducted prior to submission to assess the visibility of the Project to all relevant radars in the area.

12. Radar visibility is initially determined using a radar Line of Sight (LoS) analysis. The terrain profile between the radar antenna and the turbine tip is extracted from a digital terrain map. This is interrogated to establish whether or not the terrain blocks the direct path between these points and if so by how much. Refraction arising from atmospheric variations is estimated by using a standard 4/3rds earth radius curvature model. If there is a high degree of screening, i.e. the turbine tip falls well below the LoS path, then there should be no radar impacts. Contrastingly, if the turbine clearly projects above the LoS then there are likely to be impacts. In marginal cases a more robust analysis is required that additionally takes account of both specific radar and turbine characteristics and radar diffraction around the terrain. Both these methods of analysis are conducted as required to generate a robust result. It has been found that offshore turbines can impact radar at greater ranges than

initially expected due to anomalous propagation effects. NATS and the MoD have the required information and are best placed to determine the potential for impacts to their own radar infrastructure.

13. The scoping process identified NATS, Aberdeen Airport, the CAA and the MoD as relevant stakeholders. The CAA did not provide a response to MS-LOT when consulted for the **Scoping Opinion** (**Appendix 1.1**).

14. Whilst an aviation impact assessment has been conducted as described above, it is recognised that the individual stakeholder assessments are the most important in establishing the degree and acceptability of any impacts.

16.4.1.2 EIA

15. As stated above, the requirement is for the Project to have no significant residual e on aviation infrastructure. In assessing the significance of the effects from the Project, it was necessary to identify whether or not there would be an impact on aviation operations. The aviation industry is highly regulated and subject to numerous mandatory standards, checks and safety requirements (e.g. CAA CAP requirements), many international in nature and requiring the issue of operating licenses.

16. In all cases, the sensitivity or magnitude of the impact on operations can only be identified by the appropriate aviation organisation conforming to the Risk Classification Scheme used to quantify and qualify the severity and likelihood of a hazard occurring. The Risk Classification Scheme is a fundamental element of an aviation organisation's Safety Management System (SMS), which must be acceptable to, and approved by, the UK CAA or the Military Aviation Authority (MAA), as appropriate. As such, for the purposes of this assessment, no detailed grading has been made of the magnitude of the impact or sensitivity of the receptor on the basis that *no potential reduction in aviation safety can be tolerated*.

17. Therefore, for this assessment effect are considered either **not significant** (for which no further action is required) or **significant** (which will require mitigation to reduce the impact to not significant).

16.4.2 Cumulative Impact Assessment

18. The Applicant has been in consultation with MS-LOT to identify a list of other projects which together with the development may result in potential cumulative or in-combination impacts. The list of these projects including details of their status at the time of the Offshore EIA Report are presented in **Chapter 20: Transboundary and Cumulative Impacts.**

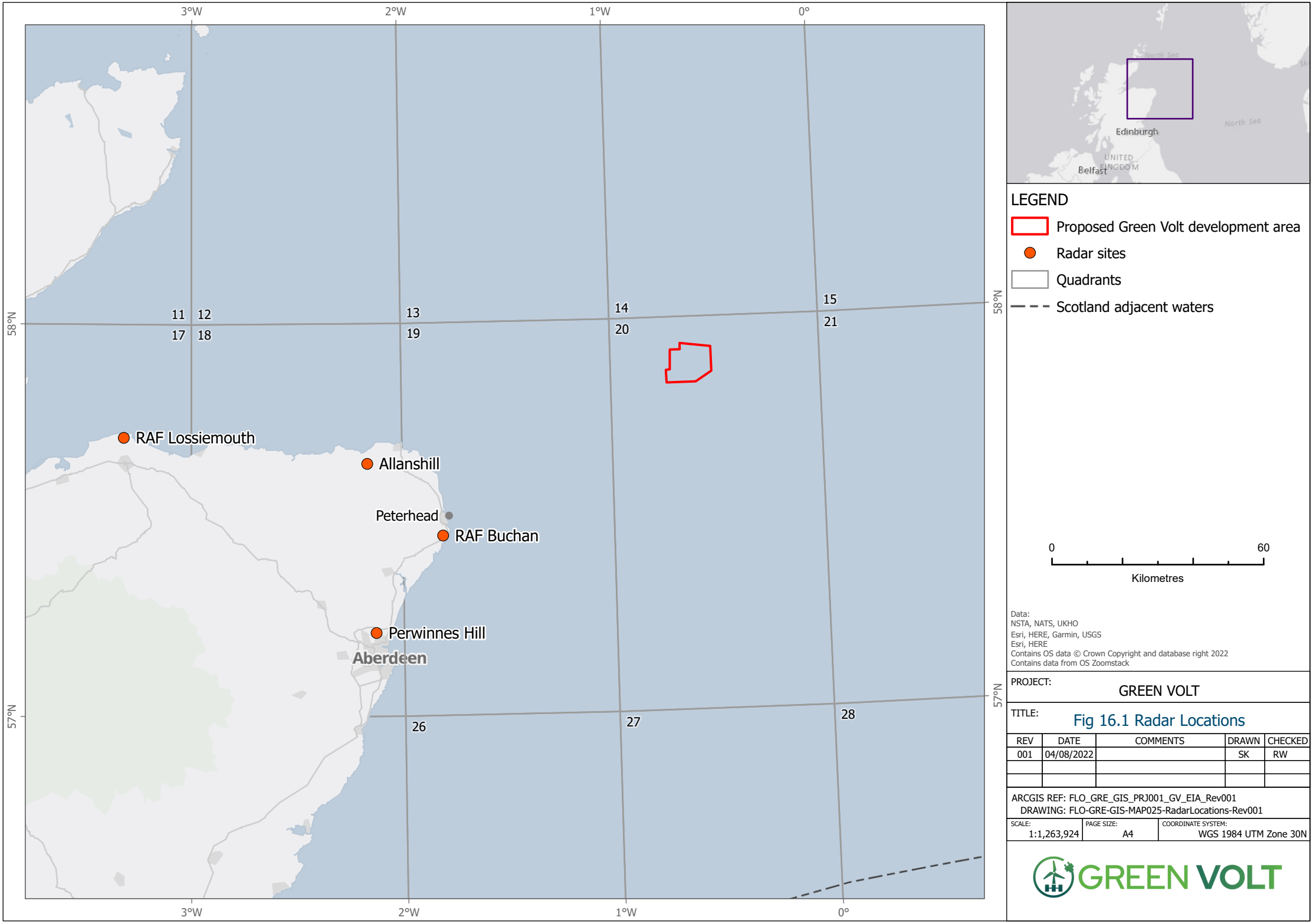
16.4.3 Transboundary Impact Assessment

19. Given the distance from other countries' airspace or infrastructure it is considered that there is no pathway for transboundary impact, and this is not considered further in this Chapter.

16.5 Scope

16.5.1 Study Area

20. The radar impact zone is a reflection of the location of the Project and the location of the identified radar transmitters and commercial airports that could be impacted by the WTGs (**Figure 16.1**). This includes both civil and military radars.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RAF Lossiemouth
Allanshill
Peterhead
RAF Buchan
Perwinnes Hill
Aberdeen
North Sea
Edinburgh
UNITED KINGDOM
Belfast
LEGEND
Proposed Green Volt development area
Radar sites
Quadrants
Scotland adjacent waters
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Kilometres
Data:
NSTA, NATS, UKHO
Esri, HERE, Garmin, USGS
Esri, HERE
Contains OS data © Crown Copyright and database right 2022
Contains data from OS Zoomstack
PROJECT:
GREEN VOLT
TITLE:
Fig 16.1 Radar Locations
REV
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COMMENTS
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04/08/2022
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SCALE:
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PAGE SIZE:
A4
COORDINATE SYSTEM:
WGS 1984 UTM Zone 30N
GREEN VOLT

16.5.2 Data Sources

21. The NATS self-assessment tool was used to provide indicative evidence of impacts to civil radar system. This assessment has been undertaken using the most up to date NATS self-assessment information.

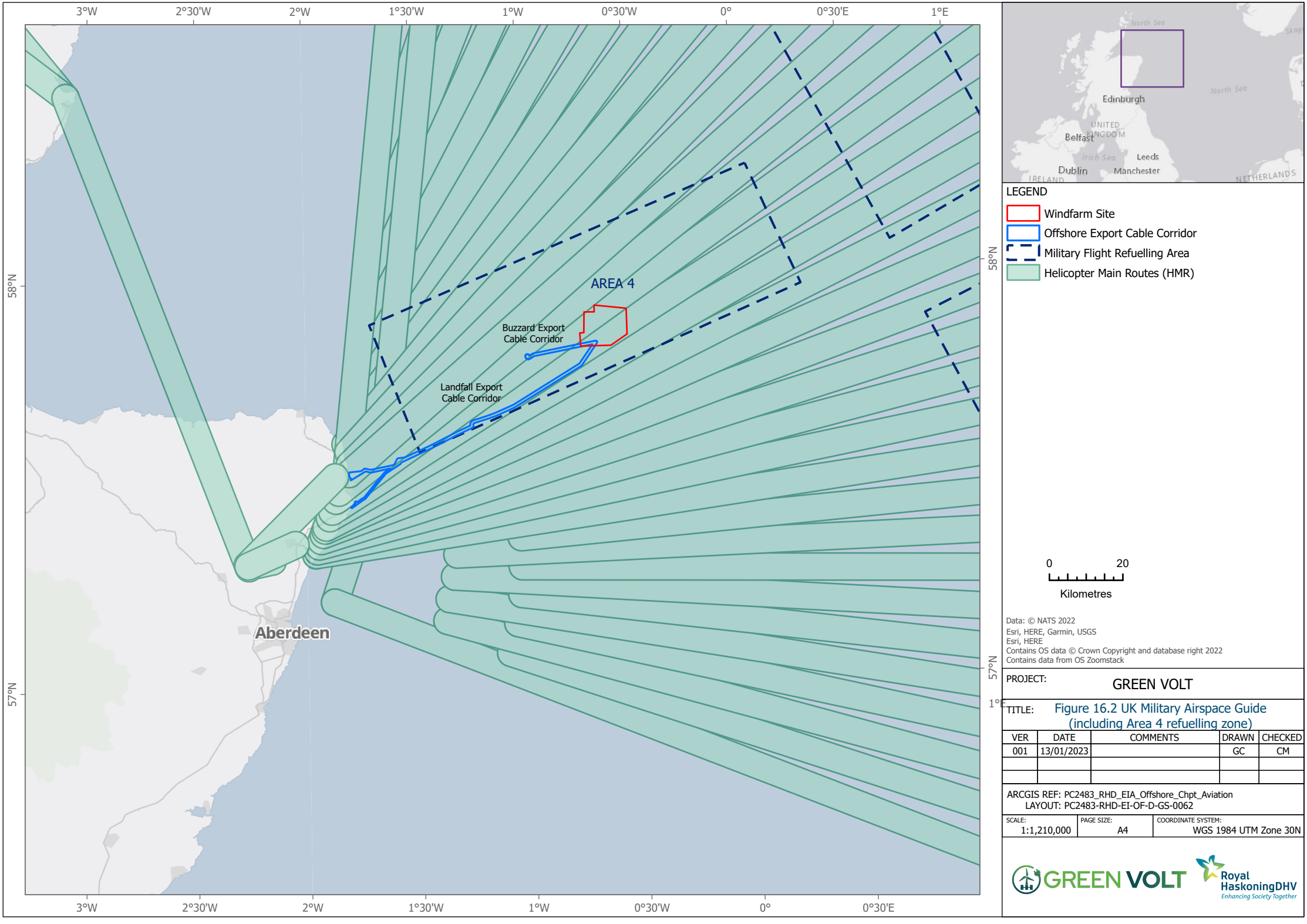
16.5.3 Assumptions and Limitations

22. The NATS self-assessment tool was used to provide indicative evidence of impacts to civil radar system using the worst case for the Project. The actual impacts can only be confirmed once the turbine details are finalised and a full safeguarding impact assessment can be undertaken.

23. In terms of mitigation, **Section 16.7.3.1** highlights the uncertainties around what a final solution would look like and that this will be dependent upon post-consent consultation.

16.6 Existing Environment

24. The site lies 80 km off the Aberdeenshire coast, approximately 112 km northeast of Aberdeen Airport. It lies underneath uncontrolled airspace, class G, remote from any danger areas of restricted areas. It does lie underneath military flight refuelling area 4, activated by Notice to Air Missions (NOTAM) and operating between 7,000 ft and 24,000 ft (see **Figure 16.2**). It is also directly underneath two of the offshore helicopter main routes (HMR), which radiate in a spoke structure from Aberdeen via the north-south arteries called HMR ECHO and HMR WHISKY.



PROJECT: GREEN VOLT

TITLE: Figure 16.2 UK Military Airspace Guide (including Area 4 refuelling zone)

VER	DATE	COMMENTS	DRAWN	CHECKED
001	13/01/2023		GC	CM

ARCGIS REF: PC2483_RHD_EIA_Offshore_Chpt_Aviation
LAYOUT: PC2483-RHD-EI-OF-D-GS-0062

SCALE:	PAGE SIZE:	COORDINATE SYSTEM:
1:1,210,000	A4	WGS 1984 UTM Zone 30N

GREEN VOLT

Royal HaskoningDHV
Enhancing Society Together

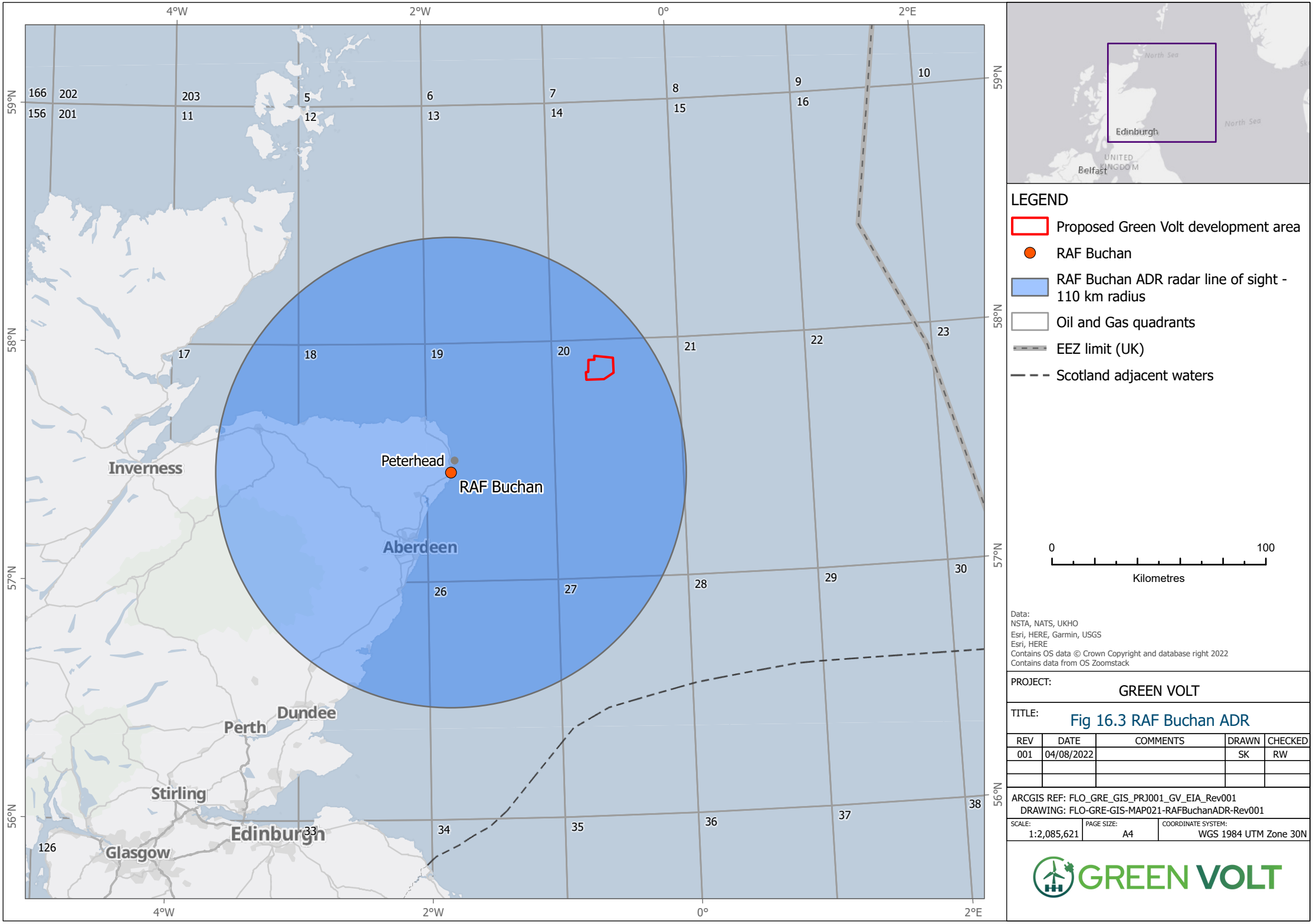
25. With regard to aviation and radar concerns for offshore wind developments, the key receptors are military and civil radar and airspace used by helicopters servicing the oil and gas platforms.

26. In the case of this Project, the affected receptors have been identified as (**Figure 16.3** to **Figure 16.6**):

- A single military air defence radar (RAF Buchan) located approximately 4 km south of Peterhead;
- Two civil enroute radar (Allanshill and Perwinnes Hill) operated by NATS, located approximately 9 km southwest of Fraserburgh and 6 km north of Aberdeen respectively;
- Aberdeen Airport; and
- Helicopter routes from the mainland (see **Figure 16.6**) over the North Sea that radiate out from the helicopter base in Aberdeen to service the oil and gas platforms.

27. The Buchan radar is safeguarded by the UK MoD. It is a Type-92 long-range air defence radar manufactured by Lockheed Martin, designed to provide 360-degree, low level through to high level, primary surveillance coverage as one of a network of six static homeland defence radars. It was upgraded in 2015 with a LM TPS-77 processor in order to mitigate wind turbine impacts.

28. The two civil radar are operated and safeguarded by NATS, providing radar based air navigation surveillance for both Aberdeen Airport approach and en-route services, including helicopters operating over the North Sea.



PROJECT: GREEN VOLT

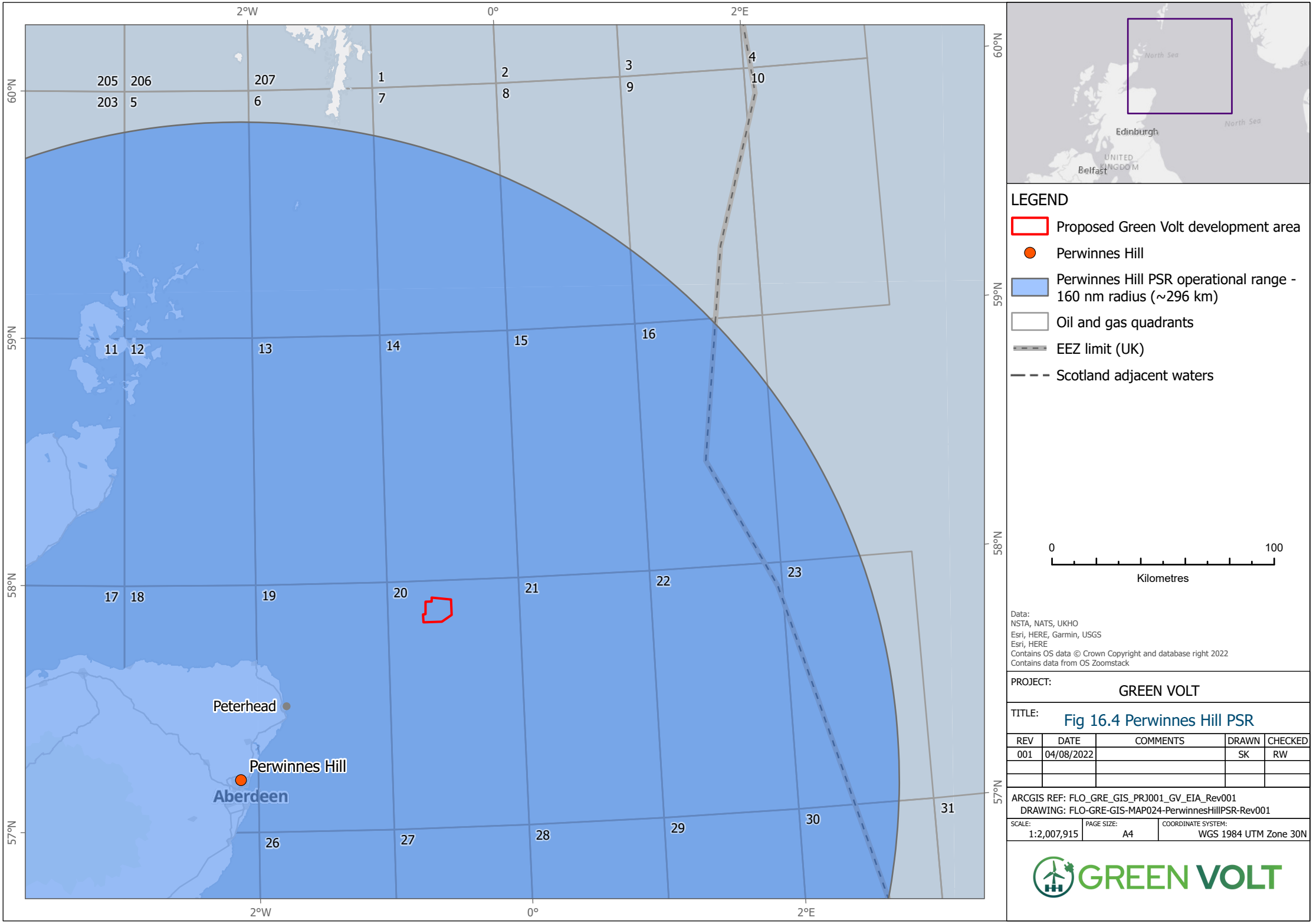
TITLE: Fig 16.3 RAF Buchan ADR

REV	DATE	COMMENTS	DRAWN	CHECKED
001	04/08/2022		SK	RW

ARCGIS REF: FLO_GRE_GIS_PRJ001_GV_EIA_Rev001
DRAWING: FLO-GRE-GIS-MAP021-RAFBuchanADR-Rev001

SCALE:	PAGE SIZE:	COORDINATE SYSTEM:
1:2,085,621	A4	WGS 1984 UTM Zone 30N

GREEN VOLT



PROJECT: GREEN VOLT

TITLE: Fig 16.4 Perwinnes Hill PSR

REV	DATE	COMMENTS	DRAWN	CHECKED
001	04/08/2022		SK	RW

ARCGIS REF: FLO_GRE_GIS_PRJ001_GV_EIA_Rev001
DRAWING: FLO-GRE-GIS-MAP024-PerwinnesHillPSR-Rev001

SCALE:	PAGE SIZE:	COORDINATE SYSTEM:
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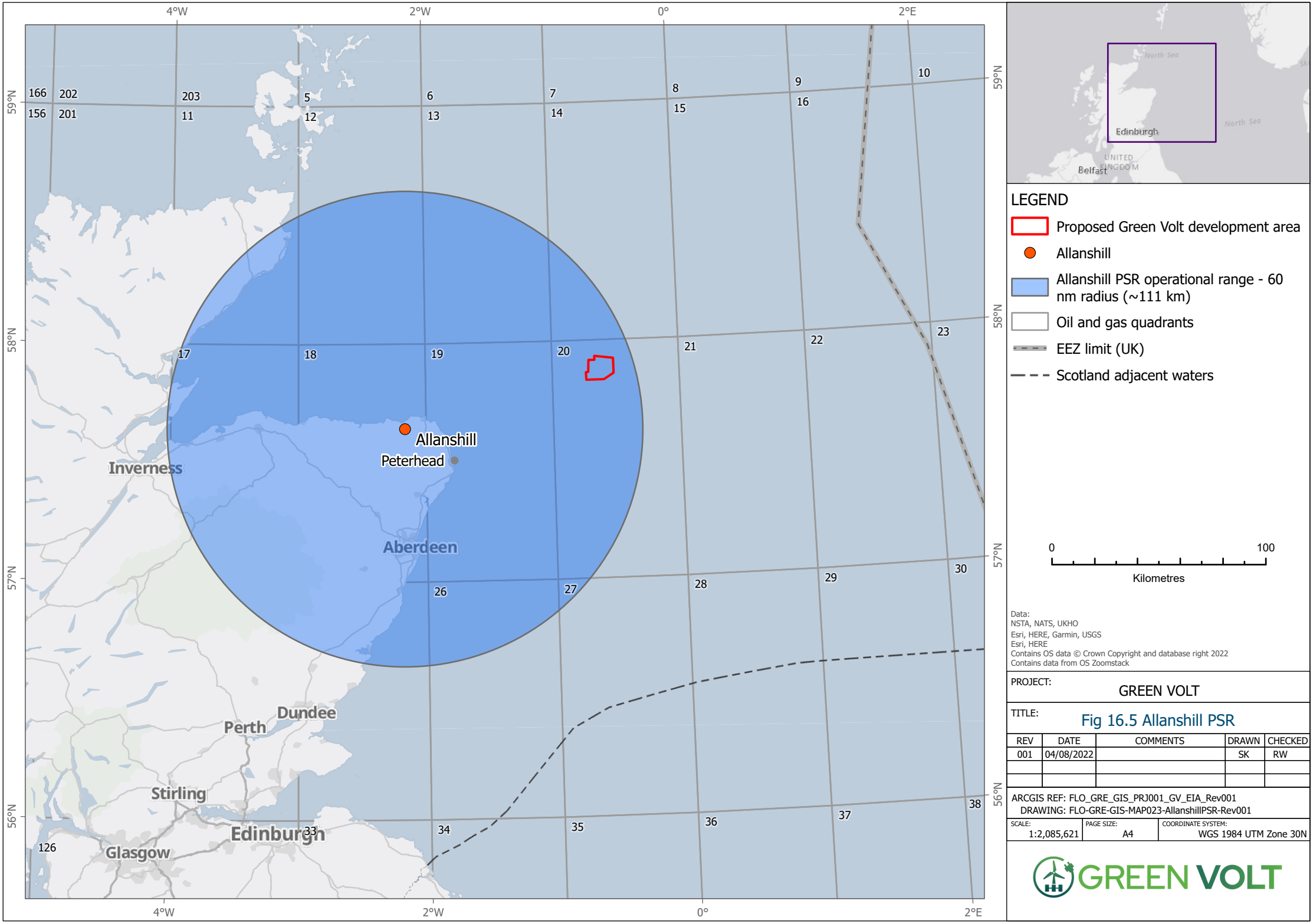
GREEN VOLT



PROJECT: GREEN VOLT

TITLE: Fig 16.5 Allanshill PSR

REV	DATE	COMMENTS	DRAWN	CHECKED
001	04/08/2022		SK	RW

ARCGIS REF: FLO_GRE_GIS_PRJ001_GV_EIA_Rev001
DRAWING: FLO-GRE-GIS-MAP023-AllanshillPSR-Rev001

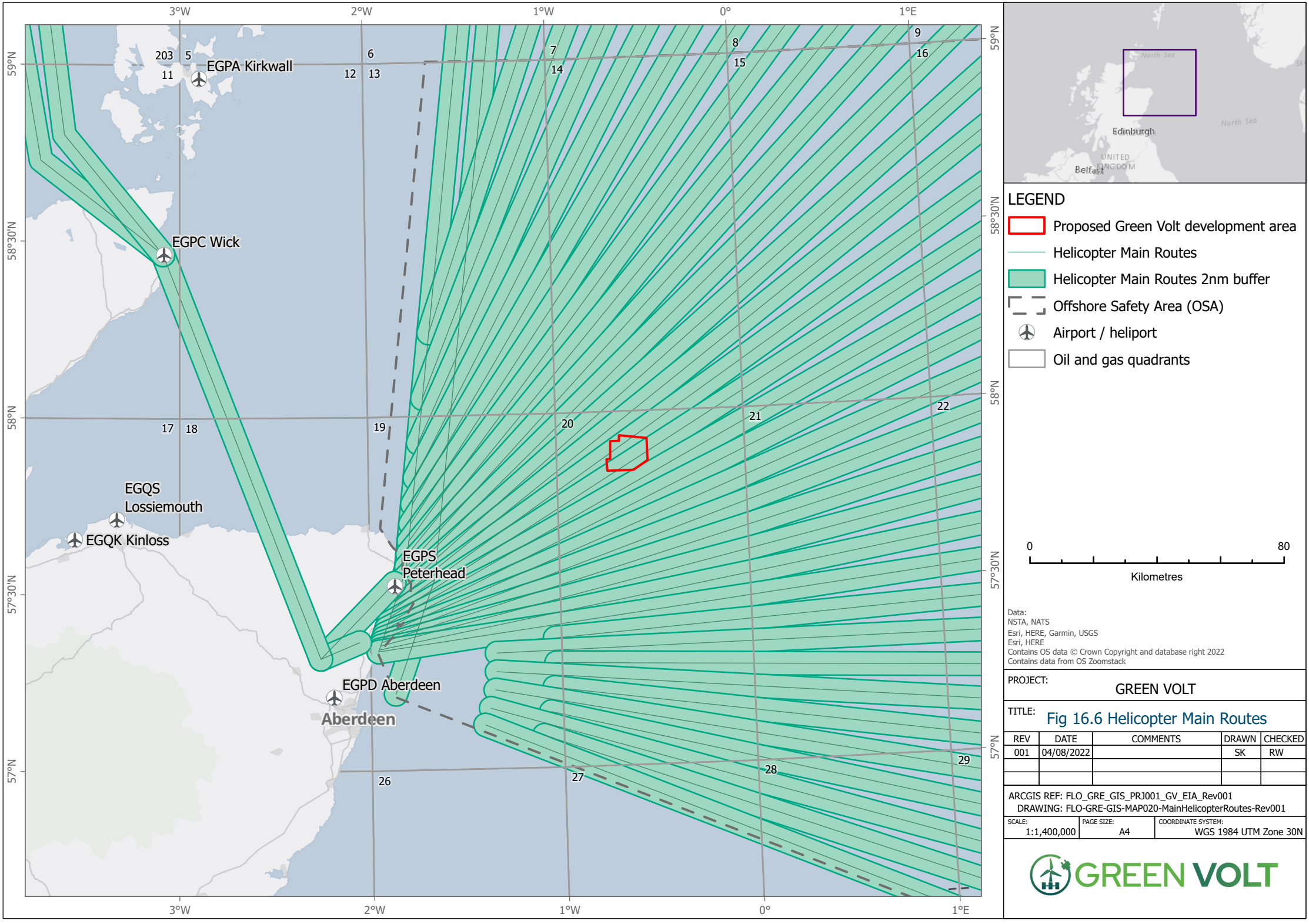
SCALE:	PAGE SIZE:	COORDINATE SYSTEM:
1:2,085,621	A4	WGS 1984 UTM Zone 30N

GREEN VOLT

29. A number of potential helicopter routes pass in the vicinity of the Offshore Development Area and therefore this receptor has been included in this EIA Report. There is also a potential impact to helicopter routes during the towing phase and this has been considered within this Chapter.

30. HMRs have no airspace status and assume the background airspace classification. Utilised by the Air Navigation Service Providers (ANSP) and helicopter operators for flight planning and management purposes, HMRs have no lateral dimensions but generally extend vertically from 1,500 ft above mean sea level (AMSL) to flight level (FL) 85 over the northern North Sea. Whilst compliance with the HMR structure is not compulsory, in the general interests of flight safety, civil helicopter pilots are strongly encouraged to plan their flights using HMRs wherever possible. NATS Aberdeen view the retention of the HMR route structure as worthwhile, not only as a planning tool but to provide operational safety redundancy in the in the event of a failure of the multilateration coverage, using secondary radars.

31. Offshore helicopters, routing from UK mainland, will use direct routing rather than HMRs where the ATC coverage is comprehensive. However, in the case of the northern North Sea in the area to the east and north of Aberdeen ATC coverage is less comprehensive and routing is generally along HMR. Where and when HMRs are used, inbound and outbound helicopter flights are height de-conflicted (by 500 ft) to minimise the risk of collision.



Data:
NSTA, NATS
Esri, HERE, Garmin, USGS
Esri, HERE

PROJECT: GREEN VOLT

TITLE: Fig 16.6 Helicopter Main Routes

REV	DATE	COMMENTS	DRAWN	CHECKED
001	04/08/2022		SK	RW

ARCGIS REF: FLO_GRE_GIS_PRJ001_GV_EIA_Rev001
DRAWING: FLO-GRE-GIS-MAP020-MainHelicopterRoutes-Rev001

SCALE:	PAGE SIZE:	COORDINATE SYSTEM:
1:1,400,000	A4	WGS 1984 UTM Zone 30N

GREEN VOLT

16.6.1 Anticipated Trends in Baseline Conditions

32. The use of the northern North Sea as oil and gas is decommissioned and offshore wind develops may lead to changes in helicopter use in time. The Applicant has not been made aware of any specific likely changes to the baseline through consultation to date.

16.7 Potential Impacts and Mitigation

33. The Project submitted an **Offshore Scoping Report** (**Appendix 1.2**) to Scottish Ministers on 15th November 2021, which outlined a baseline understanding of the potential impacts of the Project. The Project received a **Scoping Opinion** from MS-LOT in April 2022 (**Appendix 1.1**). **Table 16.2** presents the impacts that were proposed to be scoped out in the **Offshore Scoping Report** and the impacts that the **Scoping Opinion** require to be scoped in for the Offshore EIA Report.

Table 16.2 Potential impacts scoped in or out of the EIA for aviation and radar

Potential Impact	Construction		O&M		Decommissioning	
	Scoping Report	Scoping Opinion	Scoping Report	Scoping Opinion	Scoping Report	Scoping Opinion
Interference with long term military exercise or danger areas	x	x	x	x	x	x
Interference with aviation	✓	✓	✓	✓	✓	✓
Interference with radar	✓	✓	✓	✓	✓	✓
Potential impact on low flying (including SAR helicopter operations) due to obstacles	✓	✓	✓	✓	✓	✓
UXO	x	x	x	x	x	x

34. The wind turbines are the only source of potential impact for this topic, therefore, aside from tow routes during tow in the construction phase, only the Windfarm Site itself is relevant to this assessment.

35. Wind turbines interfere with aviation radar because of the movement of the blades. Radars are complex pieces of equipment, designed and set-up with the specific aim of seeing aircraft but not displaying land, static objects or weather systems. For this reason, when a turbine's blades are not rotating, it does not generate radar impacts that are of concern. It becomes a large static structure, similar to tall buildings, towers and pylons, not affecting the functionality of the radar.

36. During the construction, once the turbines are on site, the blades will not be rotating.

37. The turbines will be towed to their final positions from the construction port (location currently unconfirmed). The maximum speed during the tow will be 3.5 knots (1.8 m/s), which should not generate any radar returns, i.e. display on the radar. Radars have speed filters to remove road and sea traffic returns which will also remove returns from the turbines during towing. For this reason, the

operators of the radars potentially affected do not have concerns about this phase of the development (Aberdeen Airport).

38. During the tow the turbines will present a temporary obstruction. Therefore, details of the tow route and the times at which the tow will take place will be made available to relevant stakeholders.

39. The decommissioning phase will closely match the construction phase with the same impacts and mitigation measures in place. This will also require approval from MS-LOT and Scottish Government at the time.

40. The only impacts of significant concern to the stakeholders, are those occurring during the operational phase of the development. Impacts occurring during construction and decommissioning can more readily be managed as temporary and without significant radar impacts.

41. A summary of the potential impacts assessed is provided in **Table 16.3.**

Table 16.3 Potential impact pathways on aviation and radar receptors

Green Volt Project Phase	Potential Impact Pathways	Receptor
Construction	Temporary obstruction during tow	Helicopter main routes
O&M	Radar impact	• Military and civilian Radar • Aberdeen Airport
	Flight operation	Helicopter main routes
Decommissioning	Temporary obstruction during tow	Helicopter main routes

16.7.1 Embedded Mitigation

16.7.1.1 Construction

42. During the tow to site details of the tow route and the times at which the tow will take place will be made available to NATS and the helicopter operators prior to the tow taking place (these will be weather dependent) via NOTAM.

43. The temporary introduction of new, tall obstacles presents a collision risk if not mitigated. Mitigation will be in the form of notification to airspace users and aviation obstacle lighting during conditions of poor visibility, as deployed by tall cranes. Notification is conducted through the formal NOTAM process. These measures have been used effectively for Kincardine Offshore Wind Farm, previously.

16.7.1.2 Search and Rescue Operations

44. Information on SAR requirements can be found in “Offshore Renewable Energy Installations: Requirements, guidance and operational considerations for SAR and Emergency Response” (Maritime and Coastguard Agency (MCA), November 2021).

45. The MCA has statutory obligations to provide SAR services in and around Offshore Renewable Energy Installations (OREI) in UK waters, using both SAR helicopters and emergency response vessels. Turbine layouts of every offshore renewable energy project with floating and/or surface piercing devices and structures must be designed to allow safe transit through OREIs by SAR helicopters operating at low altitude in bad weather.

46. For wind farms generally, the SAR access requirement is that a SAR helicopter can fly from one side of a wind farm to the other, or to a Helicopter Refuge Area in the case of larger wind farms. The aircraft entering from outside the wind farm at altitudes below 500 feet, to either conduct searches amongst turbines or to access a location or turbine within the field. Given the distance offshore of the

Project, helicopters may be the only viable means of SAR. While in clear weather, searches can be conducted from above the maximum blade tip height, operations in poor weather and rescues themselves may necessitate SAR operations within the wind farm below blade tip height. When long transits to a SAR area are required, the presence of wind farms along the transit route can provide obstacles to SAR helicopters if conditions do not permit transits to be flown above maximum blade height. SAR aircraft would be highly unlikely to descend into a windfarm from above and would use available SAR lanes to transit the wind farm where expeditious to do so.

47. The low-level helicopter paths through an offshore wind farm are termed ‘SAR access lanes’. For practical purposes this means that there shall be no structures in the wind farm or on the boundary that present an obstacle or risk to SAR helicopters flying along such ‘SAR access lanes’. This depends on the type and size of turbine used, the overall shape, size and geographical coverage of a wind farm, and any proximity to other wind farms. The spacing between internal turbines, and those on the boundary at the end of ‘SAR access lanes’, will be discussed with the MCA prior to the final design of a layout.

48. The MCA has provided the following guidance to mitigate SAR risks:

1. Turbines are positioned in straight lines with a common orientation across the whole development, creating safe lanes for SAR access; SAR lanes.
2. The initial layout, at least, should be based on two orientations of SAR lanes.
3. Curved or non-linear designs should be avoided.
4. SAR lanes should be at least 500m wide between blade tips, allowing for any surface drift.
5. The wind farm should be fitted with lighting that is controllable from the development control room and which is night vision goggle (NVG) compatible.
6. The control room for the development should be equipped with very high frequency (VHF) (air and maritime) communications with remote antennas in the wind farm to facilitate SAR communications.
7. Turbines should be marked with geographically logical numbering to facilitate navigation within the wind farm.
8. Substations and meteorological masts should be aligned with turbines so as not to impede SAR lanes.
9. Where possible, SAR lanes should be aligned with those of adjacent wind turbine developments or buffer zones created.

49. These guidelines will be observed in designing the site and managed within the Emergency Response Co-operation Plan (ERCoP). Visual Flight rules (VFR) corridors no less than 1 nm wide, will be established that meet SAR access lane requirements, also serving as transit corridors and facilitating construction or maintenance flights.

16.7.1.3 Aviation Obstacle Lighting

50. Article 223 of the Air Navigation Order 2016 (last amended 13 April 2022 by the Air Navigation (Amendment) Order 2022) stipulates that offshore wind turbines within UK territorial waters, with a height of 60 m or more above the highest astronomical tide (HAT), must be fitted with obstacle lighting, primarily for night-time use. The maximum blade tip height of the WTGs at the Windfarm Site will be between 242 m and 264 m above HAT.

51. The article requires medium intensity (2,000 candela) steady red lighting mounted on the top of each nacelle and requires for some downward spillage of light. The article also allows for the CAA to permit that only turbines on the periphery of any wind farm need to be equipped with aviation warning lighting.

52. If four or more WTGs are located together in the same group, with the permission of the CAA, only those on the periphery of the group need be fitted with a light and such lighting, where achievable

shall be spaced at longitudinal intervals not exceeding 900 m. Note that where turbines are spaced at intervals greater than 900 m this simply equates to adjacent turbines.

16.7.2 Worst Case

For the purposes of this assessment the worst case is simply the relevant project parameters:

- Up to 35 turbines (with the indicative positions listed in **Table 16.4**); and
- Blade tip height maximum 264 m (242 m rotor diameter and 22 m above water surface clearance).

Table 16.4 Indicative turbine locations used in the NATS self-assessment

Turbine Number	Easting (BNG)	Northing (BNG)	Longitude (WGS84)	Latitude (WGS84)
1	477382.0644	884525.3144	57.843818	-0.696358
2	476426.6058	885923.8942	57.856543	-0.712001
3	479736.0928	884082.1694	57.839425	-0.65686
4	478780.6361	885480.7444	57.852154	-0.672488
5	477825.1811	886879.3227	57.864882	-0.688126
6	476869.7276	888277.9058	57.877607	-0.703776
7	481134.6602	885037.5955	57.847753	-0.632984
8	480179.2069	886436.1702	57.860486	-0.648607
9	479223.7561	887834.7479	57.873216	-0.66424
10	478268.3061	889233.3295	57.885945	-0.679885
11	477312.8583	890631.9143	57.898672	-0.69554
12	483488.6748	884594.4509	57.843341	-0.593491
13	482533.2255	885993.0198	57.856078	-0.609097
14	481577.7769	887391.5919	57.868813	-0.624715
15	480622.3297	888790.1679	57.881546	-0.640343
16	479666.8838	890188.7483	57.894278	-0.655983
17	478711.4391	891587.3323	57.907007	-0.671633
18	484887.2351	885549.8717	57.851657	-0.569598
19	483931.7893	886948.4388	57.864397	-0.585199
20	482976.3444	888347.0098	57.877135	-0.600812
21	482020.9015	889745.5852	57.889872	-0.616435
22	481065.4604	891144.1636	57.902606	-0.63207
23	480110.0191	892542.7453	57.915338	-0.647715
24	486285.7945	886505.2892	57.859969	-0.545694
25	485330.3521	887903.8538	57.872712	-0.56129
26	484374.9111	889302.424	57.885453	-0.576898
27	483419.4714	890700.9967	57.898192	-0.592516
28	482464.0338	892099.5747	57.91093	-0.608146
29	481508.5977	893498.1558	57.923665	-0.623786
30	486728.9127	888859.2657	57.881023	-0.537371
31	485773.4766	890257.8339	57.893766	-0.552973
32	484818.0417	891656.4058	57.906509	-0.568587

Turbine Number	Easting (BNG)	Northing (BNG)	Longitude (WGS84)	Latitude (WGS84)
33	483862.6072	893054.9821	57.919249	-0.584211
34	487172.0406	891213.2398	57.902075	-0.529037
35	486216.6094	892611.8106	57.91482	-0.544646

16.7.3 Potential Impacts during Operation

16.7.3.1 Impact O1: Radar Impacts

53. Wind turbines affect all aviation PSR in broadly the same ways, though the degree and extent of the impacts can vary. Where a wind farm, rather than individual turbines, is detectable by a radar the effects are:

- the generation of radar clutter and false tracks;
- a reduction in the probability of detection of aircraft in an area extending beyond the wind farm; and
- the distortion and seduction of established aircraft tracks when transiting the wind farm.

54. Wind turbines have blades moving at a similar speed to aircraft, therefore the radar filters do not remove the signals. Also, wind turbines are very large structures, by comparison with aircraft, and so the size of the reflected signal back to the radar can also be very large. Because the radar detects a large signal from a moving object it can be displayed as a target on the radar screen, giving the impression that there is an aircraft at the WTG location when in fact there is not. This is known as a false return or radar clutter. When several WTG units are located in close proximity to one another, these false returns can appear contiguous and produce what looks like an aircraft track on the radar screen or cause an actual aircraft track to deviate.

55. Radar clutter is a problem for air traffic controllers. Whilst a controller may suspect that the returns are false and not associated with a genuine aircraft, it is none the less possible that they are from an aircraft and so they must avoid routing other aircraft in the area to ensure there is no collision. This causes operational impacts in sterilising airspace, increasing aircraft miles, airtime and emissions. It also increases controller loading with the need to assess a more complicated air picture. In the case of NATS they can also object because the primary radar clutter acts to make the secondary radar returns less discernible.

56. The size of the return signals can raise the radar processor thresholds of the area leading to a decrease in the probability of detection of return signals of lower magnitude from an aircraft. This can result in aircraft being detected later than would otherwise be the case and even in aircraft disappearing from the display with tracks being dropped.

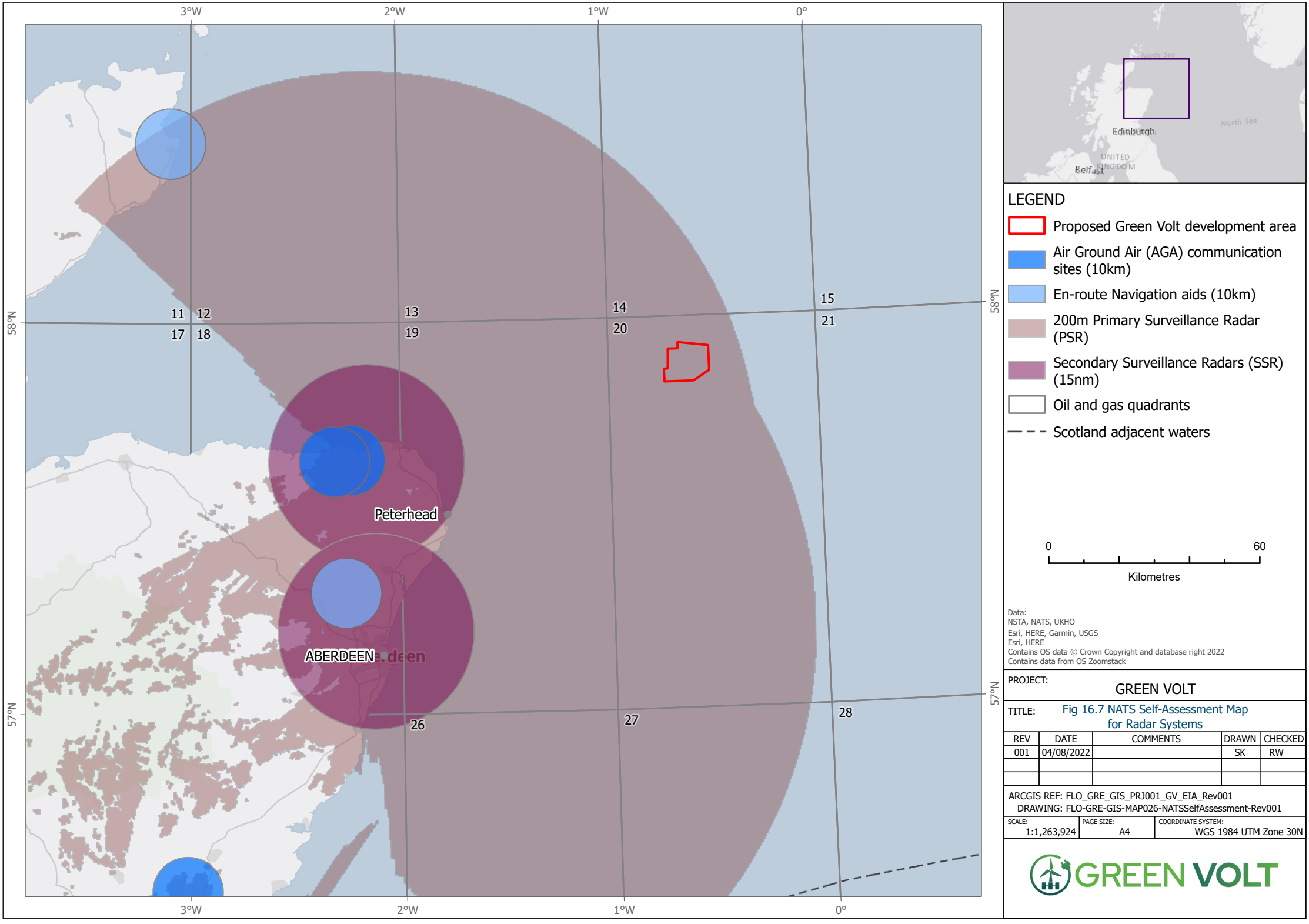
57. In their Scoping responses NATS, Aberdeen Airport and the MoD confirmed that the following radar and aviation assets could be impacted by the Project:

- Alanshill civil en-route radar;
- Perwinnes civil en-route radar; and
- RAF Buchan military air defence radar.

58. The NATS self-assessment tool was used to provide indicative evidence of impacts to civil radar system. This assessment has been undertaken using the most up to date NATS self-assessment information and worst case parameters for the Project (see **Section 16.7.2**).

59. It should be noted that the higher the turbine blade, the greater the potential impacts it can have on radar systems and therefore the Applicant has used the worst case option to be conservative in this self-assessment. This self-assessment map is shown below and indicates that the development site is located at the outer edge of the potential impact zone (as per the NATS self-assessment data).

60. The NATS self-assessment map (**Figure 16.7**) clearly shows the development site is outside of the secondary surveillance radar (SSR) used by NATS and Aberdeen airport. Therefore, the only impacts from the NATS self-assessment are for the two PSRs noted by stakeholders in the **Scoping Opinion** (Perwinnes and Allanshill) (**Appendix 1.1**).



PROJECT: GREEN VOLT

TITLE: Fig 16.7 NATS Self-Assessment Map for Radar Systems

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001	04/08/2022		SK	RW

ARCGIS REF: FLO_GRE_GIS_PRJ001_GV_EIA_Rev001
DRAWING: FLO-GRE-GIS-MAP026-NATSSelfAssessment-Rev001

SCALE:	PAGE SIZE:	COORDINATE SYSTEM:
1:1,263,924	A4	WGS 1984 UTM Zone 30N

GREEN VOLT

RAF Buchan military air defence radar

61. Both the self-assessment and the MoD scoping response noted that the Windfarm Site is visible to and expected to have an impact on the Buchan radar system. Both radar clutter generation and a reduced probability of detection are of concern and mitigation is required to address both of these effects.

62. The majority of UK ADR have been replaced or upgraded to provide a built-in wind farm mitigation capability. Whilst other east coast ADR were replaced with a Lockheed Martin TPS-77 radar, in the case of RAF Buchan the Type 92 processors were replaced with those of TPS-77 with the antenna remaining unchanged. This provided the same mitigation capability. The mitigation this introduced was the ability to establish a three-dimensional (3-D) Non-Auto Initiation Zone (NAIZ) over the wind farm and to a limited height. The ability to limit the height of the NAIZ is derived from the overall 3-D capability of these radars, which unlike normal air traffic control radars, can determine at what height a radar return is, be it from an aircraft or from a wind turbine. A NAIZ allows the tracks of aircraft first detected outside of the zone to continue to be tracked across the zone, whilst preventing any new aircraft tracks from being established. This supresses radar clutter and track formation arising from the wind farm whilst allowing the continued detection of aircraft.

63. The NAIZ does not fully mitigate all the impacts because an aircraft flying low enough will still have a reduced probability of detection.

64. The effectiveness of the NAIZ mitigation, within a so-called Aviation Specification (AS) area, can be assessed by SERCO, a large organisation providing services to the UK MoD. They model both the local effects and the overall demands on the radar systems. The main report generated is passed to the MoD confidentially, with a less detailed report going to the sponsoring developer. SERCO are currently undertaking a detailed assessment of the impacts of the WTGs on this radar system, which will allow the MoD to make an informed decision on the efficacy of the mitigation. The use of a NAIZ and an AS area has the potential to provide a satisfactory interim mitigation solution. In its statement of June 2019 on the current position with ADR, the MoD said[1], "*the MoD has accepted localised derogation in performance, which has been based on the principle of an 'Aviation Specification' (AS) and tolerable risk. If operationally acceptable the AS, is the minimum requirement to be met; improved mitigation would always be preferable and support the MoDs commitment to defence of the UK." (MoD, 2019, MoD, 2020).*

65. The Applicant proposes the use of a NAIZ and an AS area as an interim solution and continue to engage with the MoD and the Offshore Wind Energy Council to enable the use of new solutions on the Project as the enduring solution. Once the mitigation is agreed and implemented, it is considered that the effect of the Project impacts will be **not significant**.

NATS primary surveillance radars

66. The self-assessment found that WTGs across the entire site would be likely to be detectable by the NATS PSR at Alanshill and that mitigation would be required. It determined that there was no radar LOS to the Perwinnes radar, but that propagation effects across large water bodies could render the WTGs as detectable at times.

67. The NATS scoping response determined that the Windfarm Site would be detectable by both the Alanshill and Perwinnes radars, that the effects would be unacceptable (and **significant**) and hence that mitigation would be required.

68. The primary concern of NATS is the generation of displayed radar clutter. This can be mitigated by the implementation of a plot suppression zone, often called a blank. A blank removes all radar returns

[1] *https://www.pagerpower.com/news/mod-air-defence-radar-mitigation-update-june-2019/*

from a specified area and so whilst it is fully effective in removing the unwanted radar clutter from the wind farm, it also removes all genuine aircraft returns.

69. This can be mitigated through the use of the unaffected SSR, within the Wide Area Multilateration (WAM) system used by both NATS and Aberdeen Airport. SSR relies on aircraft carrying an operating transponder, which sends a signal to the secondary radar receiver providing details of the aircraft identity and location including altitude. Whilst primary radar detects all aircraft, secondary radar only detects aircraft operating a transponder. A collision risk remains where aircraft not using a transponder may be in the area. The risk of aircraft flying this far offshore without a transponder is very low but cannot be assumed to be zero.

70. For this reason, secondary radar can only be relied upon to enable air traffic control to separate all air traffic, where the use of transponders is compulsory. Such an airspace environment exists, called a Transponder Mandatory Zone (TMZ).

71. All relevant operational offshore wind farms use primary radar blanking, combined with a TMZs to mitigate the primary radar impacts. This is also the case for all relevant consented offshore wind farms yet to be constructed.

72. The rapid growth of offshore wind in the UK means a co-ordinated approach to the implementation of TMZs is being adopted. A new 'Surveillance and Airspace' programme on civil aviation has been established by the OWIC. Working with the Department for Transport (DfT), Department for Business, Energy and Industrial Strategy (BEIS), MoD, the CAA, and NATS; OWIC is looking to establish a strategic solution around offshore TMZs and publish a study on the future requirements for offshore aviation CNS. The Applicant is engaging with this process through the OWIC radar impact assessment group.

73. This use of a blank combined with a TMZ in the vicinity of the wind farm and an extension of the NATS/Aberdeen WAM system is the mitigation anticipated for the Project. This will enable NATS to withdraw its objections, with the inclusion of a suitable radar mitigation scheme condition applied to the consent. Once the mitigation is agreed and implemented, it is considered that the effect of the Project impacts will be **not significant**.

16.7.3.2 Impact O2: Aberdeen Airport

74. The Windfarm Site is located within the wind farm consultation zone for Aberdeen Airport. In its scoping response the Aberdeen Airport stated that aviation impacts should be considered as part of the EIA. It also said that the development is within the instrument flight procedures safeguarding area and impacts on Instrument Flight Procedures (IFPs) should be considered as part of the EIA.

75. The self- assessment determined that the issues affecting Aberdeen Airport are impacts to PSRs and to HMRs.

76. Aberdeen Airport uses the NATS radars at Alanshill and Perwinnes to provide air navigation services, with NATS as the ANSP. The mitigation proposed for impacts to these radars is detailed in **Section 16.7.3.1** above. As NATS and Aberdeen use the same radars, the mitigation will be effective for both parties. This will enable the airport to withdraw its objections, with the inclusion of a suitable radar mitigation scheme condition applied to the consent. Once the mitigation is agreed and implemented, it is considered that the effect of the Project impacts will be **not significant**.

77. The Airport's position with regard to this proposal will only be confirmed once the turbine details are finalised and they have been consulted on a full planning application. At that time they will carry out a full safeguarding impact assessment. Since the scoping response, the airport has confirmed that the development will not impact IFPs.

78. Impacts to HMRs are considered separately in **Section 16.7.3.3.**

16.7.3.3 Impact O3: Helicopter Main Routes

79. The site lies directly beneath two of the offshore HMRs, which radiate in from Aberdeen. Whilst HMRs have no airspace classification, it is understood that Aberdeen Airport wish to maintain the HMR structure, as a planning tool but also to provide operational safety redundancy in the in the event of a failure of the WAM system.

80. Helicopters using the HMRs routinely fly at between 2,000 ft and 3,000 ft, depending upon the meteorological conditions prevailing. Hence, under these normal conditions the aircraft are operating in excess of 1,000 ft above the 250 m (820 ft) turbines. These flights can operate over the Windfarm Site, with a minimum altitude of 1,900 ft flying instrument flight rules (IFR) and as low as 1,400 ft VFR. Under these circumstances there are no impacts to the use of the HMRs.

81. However, under 'icing conditions', helicopters may need to operate below 2000ft and under these circumstances the use of HMRs can be affected. Helicopters without heated blades have limited icing capability, enabling then to fly in temperatures down to -6ºC with no time limit, but a need to monitor ice accumulation. Below -6ºC they can fly for five minutes. On days of low cloud base, with the 0º isotherm at or below 2,000 ft, the aircraft must be able to descend to a clear area below cloud and with a positive temperature to safely de-ice if necessary. In practice, at the distance that the Project is offshore, the occasions where they are forced to fly low will be 'very rare'.

82. CAP 764 (CAA, 2016) suggests that an area 2 nm either side of an HMR should be maintained clear of obstacles for safety purposes. However, for the purpose of transiting wind turbine developments under VFR, corridors may be established that are no less than 1 nm wide. Like all aircraft, helicopters are required by the Standardised Rules of the Air Regulation to avoid turbines and other offshore wind farm structures by a minimum distance of 500 ft.

83. Mitigation of HMR impacts may be achieved through one or a combination of the following:

- Redesign the HMRs to avoid the wind farm completely;
- Redesign the HMRs to include corridors through the wind farm;
- Agree tactical routing for use under icing conditions; and / or
- Use helicopters approved for specified icing conditions compatible with overflying turbines.

84. The most practical and appropriate mitigation will be determined through dialogue with the key stakeholders, including the helicopter operators. Given the compact nature of the development and the expected rarity of conditions demanding flight below 2000ft, there is an option for the helicopters to carry more fuel and fly around the wind farm. This can be supplemented with VFR corridors, which also serve the purposes of facilitating SAR operations and helicopter support to the wind farm. Once the mitigation is agreed and implemented, it is considered that the effect of the Project impacts will be **not significant**.

85. In order to facilitate construction or maintenance flights within the boundaries of the wind farm, consideration will be given to the use of flight corridors being built into the development layout plans. Such corridors to be oriented and their width designed in consultation with the helicopter operators, noting that it will be governed by the VFR performance of the aircraft in use.

16.8 Cumulative Impacts

86. The closest wind turbine development, the Hywind Scotland Pilot Park, is located 55 km to the southwest of the Project and no cumulative impacts are expected from this site due to its location and size (five turbines and approximately 4 km^2). All other offshore wind farm projects (constructed or scoped) are considered to be of sufficient distance from the development site that they would have no impact on the in-combination impacts from the Project. This will require confirmation following the

full NATS assessment for the Project. In addition, it should be noted that all consented projects have demonstrated that they either have no significant effects or all impacts have been mitigated to the satisfaction of stakeholders.

87. The Applicant note that a number of ScotWind developments are planned, with the closest being located on the NE7 plan option area (which is seven kilometres to the north of the Windfarm Site). However, at this time no information (via scoping opinion at the time of writing this assessment) is available to undertake an appropriate cumulative assessment for the development. The ScotWind developments will undertake their own project-alone and cumulative assessments as part of their EIA process, therefore potential cumulative impacts based on detailed information will be undertaken at that point.

16.9 Summary

88. For all the potential impacts identified either standard mitigation has been embedded to avoid impact or potential mitigation solutions have been proposed. The Applicant will work together with stakeholders to develop the mitigation measures once the project design has been confirmed and a final assessment is possible.

89. Currently the Joint Air Defence and offshore wind task force set up between the MoD and OWIC is collaborating together to identify a number of potential future enduring mitigation solutions for future offshore wind farms around the UK. There is now a recognition that wind turbines and radar need to co-exist and that a permanent technical solution needs to be found to allow the delivery. This workstream is currently expected to be delivered in late 2020s or early 2030s, after the construction of the Green Volt Offshore Windfarm.

90. **Table 16.5** presents a summary of impacts identified for civil and military radar and helicopter operations.

Table 16.5 Potential impacts identified for civil and military radar and helicopter operations

Potential Impact	Receptor	Significance of Effect	Mitigation	Residual Effect
Construction				
Temporary obstruction during tow	Helicopter main routes	Not significant	NOTAM notifications	Not significant
Operation				
Radar impact	Military and civilian Radar	Significant	Upgrade to current radar system both technical and equipment	Not significant Initial solution is temporary to the radar impact and an enduring solution is expected to follow in late 2020s/early 2030s (as per the OWIC working group timelines)
Radar impact	Aberdeen Airport	Significant	Upgrade to radar (software)	Not significant
Flight operation	Helicopter main routes	Not significant	Mitigation options include layout of the site, rerouting of helicopter routes and NOTAM notifications	Not significant
Decommissioning				
Temporary obstruction during tow	Helicopter main routes	Not significant	NOTAM notifications	Not significant
Cumulative				
None identified				
Transboundary				
None identified				

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