Berwick Bank Wind Farm

ACP-2022-094

Engagement Document

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1 Engagement – Scope and Purpose

1.1 Introduction

Welcome to the Engagement Document for the Berwick Bank Wind Farm Airspace Change Proposal (ACP). In this document we will explain the background to our engagement, we will tell you what we are engaging on and we will explain how you can play your part and have your say.

This engagement is open to everyone; if there is anyone you know who you feel may be affected by these proposed changes, and you believe that they may not have heard about our engagement, then please feel free to share this document with them or let them know that they can find all the information regarding this engagement on the Civil Aviation Authority (CAA) airspace change portal.

This document forms part of the document set required in accordance with the requirements of the CAP 1616 airspace change process. For previous stages of the airspace change process, including the Statement of Need, Design Principles and Design Options, please see the CAA Airspace Change portal detailing the progress of this proposal and how we have arrived at the options presented in this document.

1.2 Aim of the Airspace Change Proposal

This ACP is sponsored by us, Berwick Bank Wind Farms Limited, referred to in this Engagement Document as the Change Sponsor.

We intend to develop an offshore wind farm in the Outer Firth of Forth which will be capable of providing power to over 6 million homes[1]. This ACP does not discuss the principle of the development itself. That has been established through an application to Scottish Ministers under the Electricity Act 1989.

As part of the process to apply for this development, the Change Sponsor commissioned an Environmental Impact Assessment Report, within which, aviation was a factor to be considered. As part of that report, it was identified that the wind turbine generators (WTGs) could have a negative impact on the Air Traffic Services (ATS) provided by Ministry of Defence (MOD) Leuchars Station, Aberdeen Offshore and Prestwick Centre. In order to mitigate these impacts, this ACP was established to identify and implement an airspace solution that mitigates any effect the wind farm may have on the ATS capabilities of the three units. MOD Leuchars Station are served by the Leuchars Primary Surveillance Radar (PSR) and Aberdeen Offshore and Prestwick Centre are served by the Perwinnes PSR.

[1] *6 million homes powered per annum based on Typical Domestic Consumption Values (Medium Electricity Profile Class 1, 2,900kWh per household; OFGEM, January 2020), minimum projected 50% wind load factor, and projected installed capacity of up to 4.1GW. All homes in Scotland based on Household Estimates Scotland 2019 (National Records of Scotland, June 2020).

2 Berwick Bank Wind Farm Development

2.1 Background

The Change Sponsor is proposing a wind farm site in the North Sea, in the Outer Firth of Forth. This wind farm has the potential to deliver up to 4.1 gigawatt (GW) of installed capacity, making it one of the largest offshore opportunities in the world. The site is located approximately 47 nautical miles (nm) to the south-east of Aberdeen Airport and 31nm to the east of MOD Leuchars Station. Berwick Bank will consist of up to 307 wind turbines with a maximum blade tip height of 355 metres (m) above lowest astronomical tide (LAT). Figure 1 below provides the location of the proposed Berwick Bank Wind Farm site.

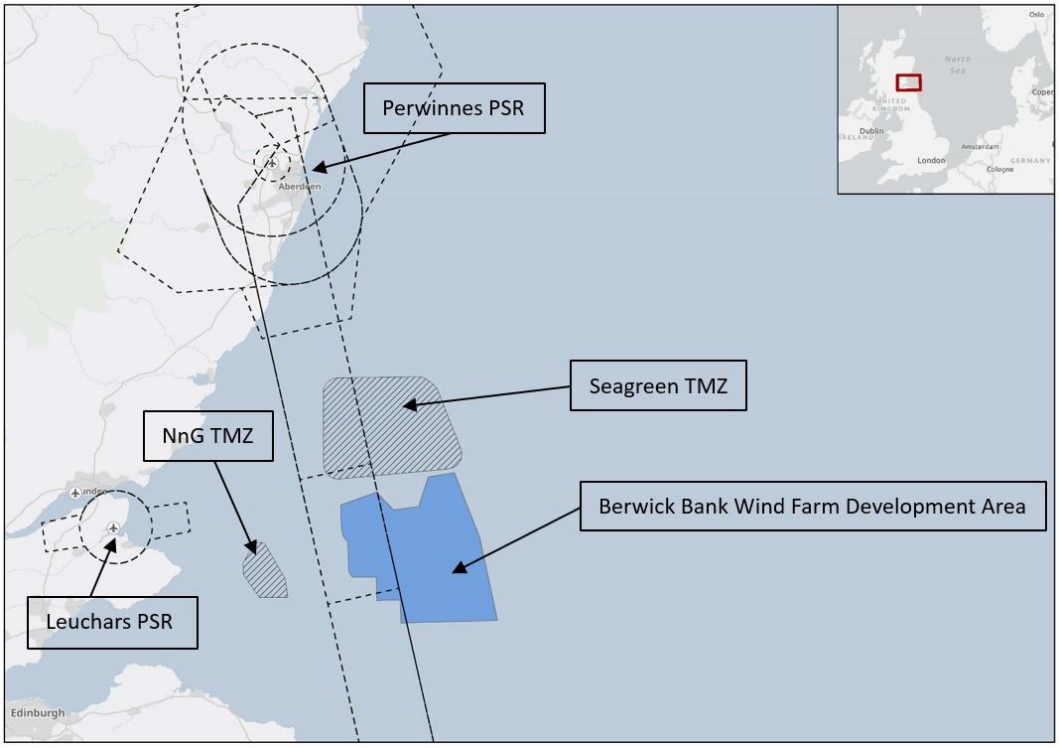


Figure 1 - Berwick Bank Wind Farm Location

2.2 Why We Need an Airspace Solution

When providing an ATS, Air Traffic Controllers (ATC) are able to use information provided by two radar systems; these are generally used together but can be used as individual systems if required. These systems are known as the Primary Surveillance Radar (PSR) and the Secondary Surveillance Radar (SSR).

2.2.1 Primary Surveillance Radar

The PSR is a conventional radar sensor that illuminates a large portion of space with an electromagnetic wave and receives back the reflected waves from targets within that space. Primary radar detects all aircraft (and other objects, such as flocks of birds, weather phenomena, other environmental factors, and wind turbines) without selection. It detects and reports the position of anything that reflects its transmitted radio signals, including the rotating blades of the wind turbines. It indicates the position of targets but does not identify them.

2.2.2 Secondary Surveillance Radar

SSR works together with transponders which are installed on the aircraft. The ground based SSR radar interrogates the transponder which transmits an electronic signal which is captured by the radar. The information transmitted by the transponder identifies the aircraft along with details as to the aircraft's altitude.

2.2.3 Primary Radar Interference

Because wind turbines blades are moving targets, it is hard for a PSR to distinguish them from aircraft. Radar data processing connects returns from successive sweeps of the radar, and from this infers speed. Multiple wind turbines in a wind farm create multiple radar returns and these can appear as stationary or rapidly moving primary returns on the radar display. Therefore, a solution is required to mitigate the impact of the development upon the operation of the PSR's operated at both Leuchars and Aberdeen. These PSRs are utilised in providing ATS at MOD Leuchars Station, Aberdeen Offshore and Prestwick Centre. The presence of a wind farm will have no impact on a SSR since this system relies on electronic signals transmitted from a transponder unit.

As a result, radar detectable wind turbines cause a significant amount of radar false plots, or clutter, as the rotating blades can trigger the Doppler threshold (e.g., minimum shift in signal frequency) of the Radar Data Processor (RDP) and therefore may be interpreted as aircraft targets. Significant effects have been observed on radar sensitivity caused by the substantial Radar Cross Section (RCS) of the wind turbines structural components (blades, tower, and nacelle) which can exceed that of a large aircraft; the effect 'blinds' the radar (or the operator) to required targets in the immediate vicinity of the wind turbine. False plots and reduced radar sensitivity may reduce the effectiveness of radar to an unacceptable level. This can therefore create an operational effect on ATC by compromising the provision of a safe radar service to participating aircraft and detection of aircraft targets.

Stationary objects do not cause an effect to radar systems as radar processing techniques remove stationary objects from the radar display; therefore, radar detectable wind turbines only create effect to radar once they are in operation.

Generally, the larger a wind turbine is, the larger its RCS will be to a radar. This results in more energy being reflected and an increased chance of it creating unwanted returns (clutter). This clutter will be processed by the radar and presented to the air traffic controller on their Radar Data Display Screens (RDDS). Additionally, the blades of wind turbines rotate which give an indication that the target is moving with respect to the radar and thus defeating doppler processing techniques. This issue can be further compounded by a large number of wind turbines located

together which cause a cumulative effect over a greater volume with higher densities of clutter produced.

The generalised effects wind turbines have on radar systems are as follows:

- Twinkling appearance/blade flash effect which can distract a controller.
- Masking of true aircraft targets by increased clutter on an RDDS.
- Increase in unwanted targets or false aircraft tracks.
- Receiver saturation.
- Target desensitisation causing loss of valid targets that are of a small RCS.
- Shadowing behind the wind turbines caused by physical obstruction (blocking of radar transmitted signal).
- Degradation of tracking capabilities including track seduction.
- Degradation of target processing capability and processing overload.

Radar detectability of wind turbines does not automatically provide justification for an objection from radar stakeholders. Other factors will determine the nature and severity of the operational impact on the receptor e.g.:

- The consideration of airspace structure and classification in the wind turbine vicinity.
- The operational significance of the airspace to the operator.
- The range of the development from the radar source.
- Aircraft traffic patterns and procedures.
- The type of radar service provided to air traffic using the airspace.

Wind turbine derived clutter appearing on radar displays through primary radar returns can affect the safe provision of an ATS as it can mask aircraft from the air traffic controller and/or prevent the controller from accurately identifying aircraft under control. In some cases, radar reflections from the wind turbines can affect the performance of the radar system itself. In providing a safe ATS, an air traffic controller must maintain standard separation distances between aircraft that are under control and those radar returns that are unknown or not in receipt of a radar service. Depending on the ATS being provided, the controller will need to provide a minimum of 5 nm radar separation between an aircraft receiving a radar derived ATS and any unwanted radar returns that have the potential to obscure unknown aircraft targets. The radar clutter presented on radar displays that would be associated with radar detectability of the development would require aircraft to be manoeuvred away from desired aircraft track to achieve the appropriate lateral separation criteria. Without specific wind turbine mitigation processing capabilities, radars cannot distinguish between returns from wind turbines (false returns, or 'clutter') and those from aircraft. Air traffic controllers are required to assume that actual aircraft targets could be lost over the location of a wind farm; furthermore, identification of aircraft under control could be lost or interrupted.

In the event that no mitigating actions are implemented for Berwick Bank, the clutter created by the detectability of the operational wind turbines will affect the safe and effective provision of a radar based ATS by MOD Leuchars Station, Aberdeen

Offshore and Prestwick Centre as identified in the Environmental Impact Assessment that was commissioned before the ACP was started. Notwithstanding the technical impact on the radar based ATS provision, there will also be an unrecognised overall benefit to the wider UK economy in terms of more jobs and investment, and there will also be an unrecognised environmental benefit to the UK in terms of the removal of 8 million tonnes of carbon dioxide per year, which is similar to removing all of Scotland's annual car emissions[2].

Each of these individual effects reduces the overall effectiveness of the primary radar in detecting targets, which can result in the misidentification of aircraft, loss of track position, and loss of track identity as aircraft symbols and track history may be obscured. These in turn can affect the accuracy and timeliness of controller instructions and potentially cause serious safety and operational issues to ATC and the flying community operating within the area of wind turbine induced radar clutter.

If mitigation is not introduced, MOD Leuchars Station, Aberdeen Offshore and Prestwick Centre air traffic controllers would be required to limit or suspend the ATC radar services that they provide to aviation operating within the vicinity of the development area. Furthermore, dependent on the type of radar service being provided, controllers would be required to vector all aircraft around the wind turbine induced radar clutter which would inevitably lead to greater track distances flown, an increase in both pilot and controller workloads, greater fuel burn and an increase in nitrogen dioxide (NO_2) and carbon dioxide (CO_2) emissions through extended routing around the area of wind turbine clutter. Emissions calculated using the most up to date aviation data from July 2023 indicates that the average re-route of an aircraft would increase greenhouse gas (GHG) emissions by approximately 96kg CO_2e per year. This amount is insignificant when judged against the already detailed 8 million tonnes of carbon dioxide removal per year that the Wind Farm would generate. All calculations and aviation data is available to view on the ACP Portal.

The proposed mitigation is to deploy Range Azimuth Gating (RAG) on the Leuchars and Aberdeen PSR's to remove all primary radar returns from the wind turbines at the wind farm. RAG radar blanking blocks any primary radar return within selected ranges and azimuth sectors. This can be mapped to suppress plots within wind turbine clutter regions. However, the primary blanking in any area is complete, which means that the RAG will also remove primary radar returns from aircraft within the blanked area. To mitigate against this removal of primary radar coverage, it will be necessary to establish an airspace solution over the consented wind farm so that aircraft can be visible to ATC via another means.

2.3 Current Airspace Environment

The proposed site for the Berwick Bank Wind Farm, shown in red outline in Figure 2, is located within Class G airspace, which is established from ground level to Flight Level (FL)195 (approximately 19,500 feet (ft)). The airspace around the site is uncontrolled airspace where aircraft are permitted to fly without the need to submit a Flight Plan, be in radio contact with ATC or display any type of electronic

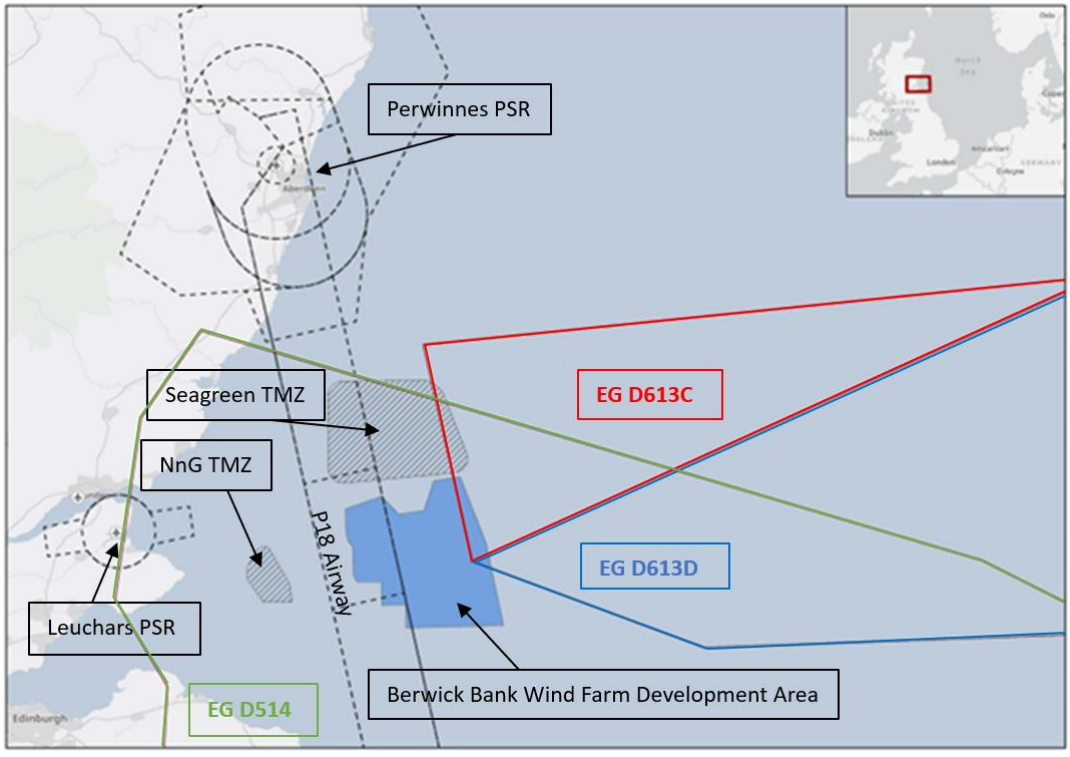
[2] https://bvgassociates.com/berwick-bank-wind-farm-impact-on-the-scottish-economy/

conspicuity that would allow the aircraft to be detected by ATC. There are no set routes and aircraft are free to fly anywhere, unrestricted and in any direction, as long as they abide by the weather minima stipulated for flight under Visual Flight Rules (VFR). Aircraft flying under Instrument Flight Rules (IFR) and in receipt of an ATS are also permitted to fly through this airspace. In this case, the air traffic controller will need to provide directional information to the aircraft to provide a minimum of 5 nm separation between the aircraft receiving a radar derived ATS and any unidentified aircraft in the area.

To the north of the proposed site, there is an already established Transponder Mandatory Zone (TMZ), and this is called the Seagreen TMZ. To the west of the proposed development area is the NnG[3] TMZ, both of which are active from Surface (SFC) to FL100 (approximately 10,000ft).

Above the proposed development site is an airway, P18, which routes roughly north to south. The part of the route that passes above the development area is classed as a conditional route (CDR), meaning that it is not always active, and at its lowest level over the development area it starts being active from FL135 (approximately 13,500ft) to FL255 (approximately 25,500ft). This airway is classed as Class D airspace and is generally used by commercial air transport for routing between airports and other airway structures.

Also above the proposed development area is the newly established danger area, EG D514 which was established on 22 February 2024. This danger area is operational when required between FL85 (approximately 8,500ft) up to FL660 (approximately 66,000ft), and will be used by military aircraft, or other such aircraft operating in conjunction with a military exercise.



[3] Neart na Gaoithe

Figure 2 – Airspace in the Vicinity of the Berwick Bank Development Area

In the UK, CAA Policy states that all civilian aircraft must operate a transponder above FL100 (approximately 10,000 ft). A transponder is a piece of electronic equipment that transmits a signal that identifies the aircraft, along with details of the aircraft's altitude. This signal is interrogated by a ground based SSR, which displays the information to ATC.

An initial qualitative traffic survey was produced at Stage 2 which used previous traffic surveys of the area from 2015, 2018 and 2023, which concluded that the proposed area for Berwick Bank featured low traffic levels. The most recent 2023 2-Week study observed 1 GA aircraft passing through the proposed Berwick Bank TMZ site. This traffic survey is available to view on the ACP portal.

2.4 Current Airspace Usage

At the previous stage of the airspace change process, the Change Sponsor conducted a detailed analysis of air traffic movements within the area surrounding the proposed wind farm development. The aim of the analysis was to determine the type and density of transiting traffic in the area and estimate the number of aircraft potentially affected by the proposed airspace solutions. The analysis was conducted using data from previous 2015, 2018 and 2023 aviation studies in the same area. The survey was conducted for a period of 8 weeks, 2 separate weeks in 2015, a 4-week survey in 2018, and a final 2-week survey in July 2023 which was expected to be a busy period for recreational flights in the area and therefore representative of a higher use period. In addition to the 2015 survey, Royal Air Force (RAF) Leuchars (now MOD Leuchars Station) provided figures covering a 4-month period which detailed the types of radar/non-radar service transiting aircraft were receiving, and also detailed whether the aircraft was operating a transponder. From this 4-month analysis period, it was found that approximately 1.6% of the aircraft that RAF Leuchars dealt with didn't operate a transponder. This was in their whole area of responsibility within 40nm of the airfield and not just in the area of the proposed development site.

2.5 Results

From this most recent traffic survey, based upon the data analysed, it was be deduced that the airspace around the wind farm is a low-density air traffic environment. The Change Sponsor has concluded that all aircraft operating a transponder **will not** be affected by the establishment of the TMZ. For non-transponding aircraft, the Change Sponsor believes that any change could affect up to one non-transponding aircraft every 11 days. However, this is likely to be lower due to the already established Seagreen TMZ to the north of the proposed Berwick Bank TMZ which non-transponder aircraft must already avoid. The Change Sponsor the TMZ.

2.6 Stakeholders

Stakeholders are third-party groups or individuals interested in an ACP.

The Change Sponsor has identified the key stakeholder organisations and individuals that could be potentially being affected by the proposal. The Engagement Strategy document details all the stakeholders that we have targeted to participate in this engagement. The Engagement Strategy can be found on the airspace change portal alongside this document.

For details on how to respond to this engagement see Section 5 on page 12.

2.7 Justification

The justification for this airspace change is to enable the construction of the Berwick Bank Wind Farm.

The wind farm is expected to provide a vast environmental benefit by saving 8 million tonnes of CO_2 emissions per annum, compared to the calculated increase of 96kg CO_2e per annum for the increased track mileage of non-transponder aircraft, which will only be realised if the wind farm is built and the airspace change is implemented.

The objectives of this proposal are to:

- Ensure effective mitigation is implemented to maintain aviation safety.
- Ensure that there is no increased risk to ATC's ability to detect aircraft conflictions.

2.8 Options for Engagement

After the previous development stage of the airspace change process, one option remained for progression:

- Transponder Mandatory Zone (TMZ) Option 7(G)[4] – RAG blanking and simplified polygon TMZ 'rubber banded[5].' TMZ is extended to include a 2nm buffer (as applicable) which to the North joins together with the established Seagreen TMZ (Section 4).

[4] Refer to Section 4 of this document for a detailed synopsis of the option
[5] 'Rubber Banded' means a shape that is smoother than if each boundary point was joined by a straight line

3 Option 7 (G) - TMZ

3.1 Option 7(G)

Figure 3 provides an illustration of Option 7(G). It combines the advantages of a simplified TMZ shape with the benefit of a 2nm buffer. The addition of a larger buffer to the north allows the TMZ to join with the Seagreen TMZ in one continuous shape. This mitigates completely the risk of choke points being developed between separate TMZs. This option provides one continuous shape that will be easily defined on aeronautical charts and Aircraft Electronic Flight Information system (EFIS). The addition of the 2nm buffer also allows the PSR to re-establish a target/plot once an aircraft has exited the RAG (blanked) area. Aircraft entering the TMZ will be required to be equipped with and operate SSR transponder equipment . The TMZ would be operational from surface to FL 100 (approximately 10,000ft)

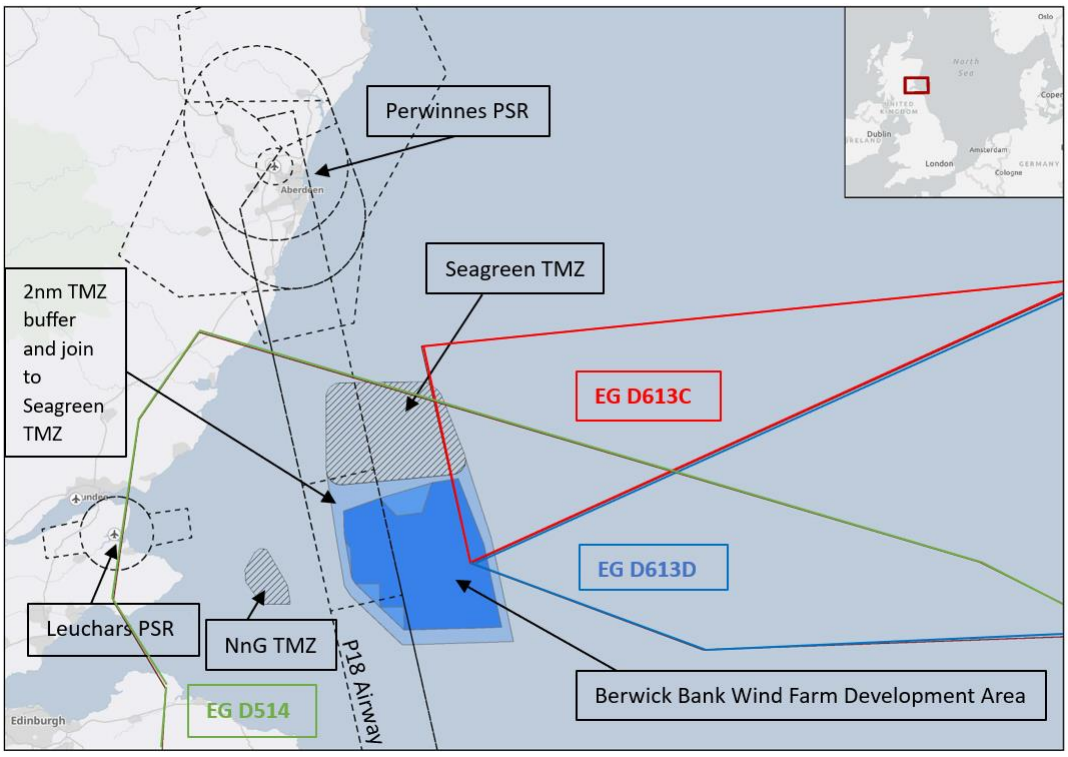


Figure 3 - Option 7(G)

3.2 Options Appraisal

The combination of a TMZ, RAG blanking and a buffer which also attaches to the already established Seagreen TMZ to the north means that this solution not only reduces the amount of primary radar clutter visible to controllers using the Leuchars and Perwinnes PSR, but also provides one continuous TMZ solution for both wind farm areas. The main objective of this option is to provide a known traffic

environment within the immediate and wider vicinity of the wind farm through the use of aircraft transponders. Additional procedural mitigation may be developed by the controlling authority (if one is to be established) to allow aircraft that are not fitted with a transponder to transit through the airspace. It is acknowledged that should an appropriate procedure be unavailable, any non-participating aircraft would be required to route around the TMZ, leading to increased track length, fuel burn and fuel costs.

This acceptable design option provides the least complex TMZ layout as it combines the Seagreen TMZ to the north which may help to reduce the impact on controller and pilot workload by making it more simplified, and more readily identifiable on both map and moving map in the aircraft.

This option also aligns with the MOD Air Traffic Management (ATM) Safeguarding statement which stated:

"Post consulting the Air Defence and Electronic Warfare Systems (ADEWS) Windfarm subject matter expert (SME), Leuchars Deputy Senior Air Traffic Control Officer (DSATCO) and the Aquila commissioning engineer for the Watchman at Leuchars: The Watchman PSR does have a limitation of only being able to blank out 2 Range Azimuth Gated (RAG) polygon areas. These are currently used for Seagreen and NnG[6]"

3.3 Conclusion

Considering the technical restrictions that were stated by the ATM Safeguarding Team, the Change Sponsor believes that this is the only option that offers the required mitigation for the clutter that would occur from the WTGs at the Berwick Bank Wind Farm. The Change Sponsor has considered multiple options of TMZ, but those have been discounted due to this specific technical requirement. These options are fully detailed in the design options document, and are considered further in the design principles evaluation, and in the transition document, all of which can be read alongside this document. A simplified overview is also provided in the next section.

[6] Neart Na Gaoithe

4 Simplified Overview of Previous Options

4.1 Introduction

As part of this ACP, the Change Sponsor was required to design options that would help to mitigate the clutter generated at the wind farm site. In the design options document, the Change Sponsor generated 14 options. These options were sent out to a variety of stakeholders to gain any relevant feedback. Following the feedback, a design principles evaluation document was produced, which looked at each of the design options in turn against a set of principles that had been developed earlier in the ACP, which looked at, amongst other things, safety, environmental impact, and operational impact. Each design option was evaluated against the 10 design principles, and were deemed to have either met, partially met, or not met that principle. The Change Sponsor decided that an option would progress to the next stage as long as it had met or partially met a design principle. Any option that didn't meet a design principle was subsequently discounted. After this action, the Change Sponsor was able to continue the process with 5 viable options. All of the options related to various types and dimensions of a RAG blanked area and an associated TMZ. After this exercise took place, the Change Sponsor was informed of the technical restriction on the Leuchars PSR, and therefore had to discount 4 of the 5 TMZ options, leaving just Option 7(G), which is detailed in the previous section as the only viable option based on the technical requirement. The entire process as detailed above can be read in greater detail on the ACP portal, in the following documents.

- Design Options
- Design Principles Evaluation
- Transition Document

And it is recommended that these are read in conjunction with this wider Engagement Document.

5 How to Participate

5.1 How to Respond to this Engagement

5.1.1 Engagement Period

The engagement will begin on Monday 8th April 2024 and will run for 6 weeks. All comments must be received via the media listed below by midnight on 19th May 2024. This engagement is not limited to those individuals and organisations that we have contacted directly, anyone may respond.

5.1.2 Responding to This Engagement

This engagement is being conducted by Berwick Bank, using an engagement feedback document that is available at the following link.

Berwick Bank Wind Farm Engagement Feedback Form

This document can be opened, completed, and submitted on any electronic device. After completing all the required sections, the document will prompt you to submit. After submission, the document will again ask for you to verify your name and email address and you must follow the directions fully to ensure your feedback is registered. A copy of your feedback form will also be emailed to you at the email address provided for your future reference.

All supporting documents for this ACP can be found through the CAA Airspace Change Portal at the following link.

Airspace change proposal public view (caa.co.uk)

The CAA's Airspace Regulation Department will oversee the engagement and ensure that it adheres to the CAP 1616 process and government guidelines. All comments made on the feedback document will appear in the public domain and the CAA will also act as moderator for the comments.

5.1.3 Responding by Post

Respondents can submit a postal response to the engagement. We will not commit to respond to all postal responses directly; however, respondents are welcome to include a stamped addressed envelope if they do require a reply or an acknowledgement of receipt. Proof of postage is not proof of delivery and we will be otherwise unable to acknowledge receipt of responses. We have provided a Feedback Form for postal responses, which can be found at Appendix A1 at the end of this document. If you wish to supply more information on paper by post, please enclose it with your completed feedback form. Postal responses can be sent to the following address:

Aviation Manager
C/O Berwick Bank Project Team,
1 Waterloo Street,
Glasgow.
G2 6AY.

Written responses are to be received by the close of the engagement on 19th May 2024.

5.2 Reversion Statement

Should the proposal be approved and implemented, it would not be possible to revert to the pre-implementation state without affecting ATC operations unless a technical mitigation solution had been identified, tested, and implemented. The proposed changes would be considered permanent until a technical mitigation scheme is developed and implemented to the satisfaction of both MOD Leuchars Station, Aberdeen Offshore and Prestwick Centre.

In the unlikely event that there are unexpected issues caused by this proposal, then short notice changes could be made via a Notice to Aviation (NOTAM). For a permanent reversion, the changes would have to be reversed by incorporating this into an appropriate future Aeronautical Information Regulation and Control (AIRAC) date to align with National Air Traffic Service's (NATS) engineering updates; of which there are only four a year.

The Change Sponsor considers the proposed Option 7(G) to be the preferred option as this option fits the requirements stated by the Air Traffic Management (ATM) Safeguarding Team and meets the design principles developed at the start of the ACP process.

5.3 Compliance with the Airspace Change Process

This proposal is confirmed by the CAA as Level 3.

If you have questions or comments regarding the conduct of the airspace change process (such as adherence to the CAP1616 process), please contact the CAA:

Airspace Regulation
Ref: ACP 2022-094
Safety and Airspace Regulation Group
Aviation House,
Beehive Ring Road,
Crawley,
West Sussex.
RH6 0YR.

Form FCS 1521 –UK Airspace Report can be used for this purpose.

Note: These contact details must not be used for your response to this engagement. If you do so, your response may be delayed or missed out, reducing its effectiveness.

5.4 What Happens Next

After the engagement period closes, we will analyse the feedback received and publish a report on the CAA Airspace Change Portal summarising the findings of the engagement activity.

We will consider those findings, determine if the airspace design needs to change in light of the feedback, and, if needed, publish a second report detailing the amended design.

Finally, we will submit an Airspace Change Proposal to the CAA based on this engagement document and the engagement summary.

The CAA will then study the proposal to decide if it has merit and will publish a decision on its website.

If the CAA approves this ACP, we plan to implement the changes by Q1 2025; however, this will be dependent on future site development work.

5.5 Thank You

Thank you for taking the time to consider the information in this document. A reminder that if you, or anyone you know, requires this information in an alternative format, please write to us at the following address:

Aviation Manager
C/O Berwick Bank Project Team,
1 Waterloo Street,
Glasgow.
G2 6AY.

A1 Postal Response Form

Your Name:	
Your Postcode:	
Your Email Address:	
Select one of the following boxes and check as applicable:	
I am responding as an individual. ☐	I am responding on behalf of an organisation. ☐ Organisation Name: _____ Position in Organisation _____
If you wish your response to be published anonymously your personal details will be redacted and only be seen by the CAA.	
Yes – I want my response to be published with my details. ☐	No – I want my response to be published anonymously. ☐
Feedback Section	
Please provide comments on Option 7G to allow us to understand your thoughts on the introduction of this mitigation to the Berwick Bank Wind Farm. Please consider: • What do you believe will be the impact of the TMZ on your operation? • How often do you think these impacts will occur to you or others? • Do you have any suggested mitigations or design changes you think should be considered? • Do you think there may be any unintended consequences of the TMZ?	

Please provide your evidence below:
If you require any additional space to provide your responses, please feel free to write your feedback on additional blank sheets of paper and include with these response sheets.
Please Post to: Aviation Manager, C/O Berwick Bank Project Team, 1 Waterloo Street, Glasgow. G2 6AY.

A2 Glossary

Term	Meaning and Description
ACP	Airspace Change Proposal - A formal process by which changes to the design or structure of airspace are proposed and evaluated. This process involves collaboration between aviation stakeholders, regulatory authorities, and the public to assess the potential impacts of proposed changes and make informed decisions.
ADEWS	Air Defence and Electronic Warfare Systems
AIRAC	Aeronautical Information Regulation and Control - It is a system that governs the publication of aeronautical information, including changes to navigation procedures, airspace designations, and other critical data used by pilots and air traffic controllers. The AIRAC system is crucial for maintaining the accuracy and consistency of aeronautical information worldwide.
ANSP	Air Navigation Service Provider - An organisation or agency responsible for managing and providing air traffic control, navigation, and other air traffic services within a specific airspace region.
ATC	Air Traffic Control - A service provided by ground-based controllers to guide and manage the movement of aircraft within airspace. ATC ensures safe separation between aircraft, issues clearances, and provides assistance to pilots, contributing to the overall safety and efficiency of air travel.
ATM	Air Traffic Management – This encompasses various services and technologies designed to manage air traffic from departure to arrival.
ATS	Air Traffic Service - A system that provides for the safe and efficient movement of aircraft within airspace.
CAA	Civil Aviation Authority - A UK Government regulatory body responsible for overseeing and ensuring the safety, security, and efficiency of civil aviation activities within the United Kingdom.
CO_2	Carbon Dioxide - A colourless, odourless gas that is naturally present in Earth's atmosphere. It is produced through the respiration of animals and plants, as well as through the combustion of fossil fuels. Monitoring and reducing CO_2 emissions are essential for addressing environmental concerns and mitigating global warming.

Term	Meaning and Description
CO_2e	Carbon dioxide equivalent is a term for describing different greenhouse gases in a common unit. For any quantity and type of greenhouse gas, CO_2e signifies the amount of CO_2 which would have the equivalent global warming impact
DSATCO	Deputy Senior Air Traffic Control Officer – 2nd in command of an aviation tower or radar unit.
EFIS	Electronic Flight Information System - A modern aircraft cockpit system that electronically displays and integrates essential flight information such as attitude, airspeed, altitude, navigation, and other data on electronic displays.
FL	Flight Level - A standard measure of altitude used in aviation, particularly in high-altitude cruising. Flight Level is expressed in hundreds of feet and is based on a standard atmospheric pressure at sea level.
GA	General Aviation - A term used to describe civil aviation activities other than scheduled air services and non-scheduled air transport operations. This could include, private flying, recreational flying, flight training and agricultural aviation.
GW	Gigawatt - A unit of power equal to one billion watts, commonly used to measure the capacity or output of electrical power plants, renewable energy installations, or large industrial facilities.
IFR	Instrument Flight Rules - A set of regulations and procedures under which a pilot operates an aircraft by relying on instruments and navigation aids rather than visual reference to the ground. IFR is used when weather conditions do not meet the requirements for Visual Flight Rules (VFR) or when a pilot chooses to operate under instrument conditions for safety or other reasons.
LAT	Lowest Astronomical Tide - The lowest level that the sea is predicted to reach under normal meteorological conditions and under the gravitational influences of the sun and moon. It serves as a reference point for charting and mapping tidal elevations, particularly in nautical and coastal engineering contexts.
m	Metre - The basic unit of length in the metric system, equal to 100 centimetres or approximately 3.28 feet.
MOD	Ministry of Defence - The UK Government department responsible for overseeing the United Kingdom's defence and military affairs.

Term	Meaning and Description
NATS	National Air Traffic Service – They are the United Kingdom's leading provider of air traffic control (ATC) and related services.
nm	Nautical mile - A unit of measurement used in navigation and aviation, equal to one minute of latitude. It is approximately 1.15 statute miles or 1.85 kilometres.
NO_2	Nitrogen Dioxide - A reddish-brown gas that is a component of air pollution. Nitrogen dioxide can contribute to respiratory problems and is a key component in the formation of smog and acid rain.
NOTAM	Notice To Aviation - It is a notice containing important information that pilots and other personnel in the aviation industry need to be aware of for the safe conduct of flights.
PSR	Primary Surveillance Radar - A radar system that detects and tracks aircraft by directly measuring the reflected radio waves from the aircraft's surface. It is a fundamental component of air traffic control systems for monitoring and managing airspace.
RAG (Blanking)	Range Azimuth Gating (Blanking) – It is a technique used in radar systems to suppress or "blank out" unwanted returns from certain ranges and azimuths. This is done to filter out clutter or interference that might otherwise degrade the radar's performance.
RAF	Royal Air Force - The aerial warfare branch of the United Kingdom's armed forces.
RCS	Radar Cross Section - A measure of the reflectivity of an object to radar signals, indicating how detectable and visible the object is to radar systems.
RDDS	Radar Data Display Screen - A visual interface used by air traffic controllers to observe and manage radar information. This screen presents real-time data from radar systems, showing the positions, movements, and identification information of aircraft within a specific airspace.
RDP	Radar Data Processor - A computer system or device that processes and analyses the raw radar data received from radar sensors. It translates radar returns into meaningful information, such as aircraft positions, velocities, and other relevant parameters.
SFC	Surface – This generally refers to the ground or the immediate area at ground level.

Term	Meaning and Description
SME	Subject Matter Expert - An individual who has extensive knowledge, expertise, and experience in a specific field or subject area.
SSR	Secondary Surveillance Radar - A radar system used in air traffic control that not only detects and tracks aircraft but also requests and receives additional information from transponders aboard the aircraft. This additional data may include the aircraft's identity, altitude, and other parameters. SSR enhances the accuracy and efficiency of air traffic management by providing more comprehensive information about the tracked aircraft.
TMZ	Transponder Mandatory Zone – A piece of airspace where aircraft are required to have an operating transponder on board and to actively reply to radar interrogations. This requirement enhances air traffic control's ability to identify and track aircraft within the designated zone.
VFR	Visual Flight Rules - A set of regulations under which a pilot operates an aircraft in weather conditions generally clear enough to allow the pilot to see where the aircraft is going. In VFR conditions, pilots navigate and control the aircraft by visual reference to the ground and other landmarks, rather than relying solely on instruments.
WTG	Wind Turbine Generator - A device that converts the kinetic energy of wind into electrical power by utilising the rotation of large blades connected to a generator.

Table 1 - Glossary including description