Aberdeen International Airport

FASI-N Airspace Change Proposal

Stage 3 Full Options Appraisal

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1. Introduction

1.1.1 Aberdeen International Airport (referred to as 'Aberdeen Airport' or 'we' throughout this document) is undertaking an Airspace Change Proposal (ACP) to provide resilience to its operation and to support the widespread introduction of new routes based on satellite navigation, known as Performance Based Navigation (PBN). The airspace change will also take the opportunity to review existing controlled airspace boundaries and classifications.

1.1.2 This ACP will enable Aberdeen Airport to meet the UK's Airspace Modernisation Strategy (AMS), which sets out the initiatives which the aviation industry, in particular airports, should progress to modernise the UK's airspace structure and route network. The ACP is required to follow a process set out by the Civil Aviation Authority (CAA) in a document called CAP1616.

Alongside this Full Options Appraisal and the associated consultation material, Aberdeen Airport has produced a Terminology Explained Document which can be found on the Citizen Space Consultation website. It may be beneficial to have this document open whilst reading this Full Options Appraisal.

1.2 The CAP1616 airspace change process

1.2.1 Airspace change sponsors are required to follow the process in a document called 'CAP1616[1] Airspace Design: Guidance on the regulatory process for changing airspace design, including community engagement requirements'. This is published by the Civil Aviation Authority (CAA).

1.2.2 The guidance sets out the process for the airspace change process, which a change sponsor of any permanent change to the published airspace design must follow. The airspace change process is split into 7 Stages.

1.2.3 Figure 1 shows an overview of the stages of the CAP1616 process and also provides an indicative timeline for the remaining stages. The following section provides more detail on the work undertaken to date.

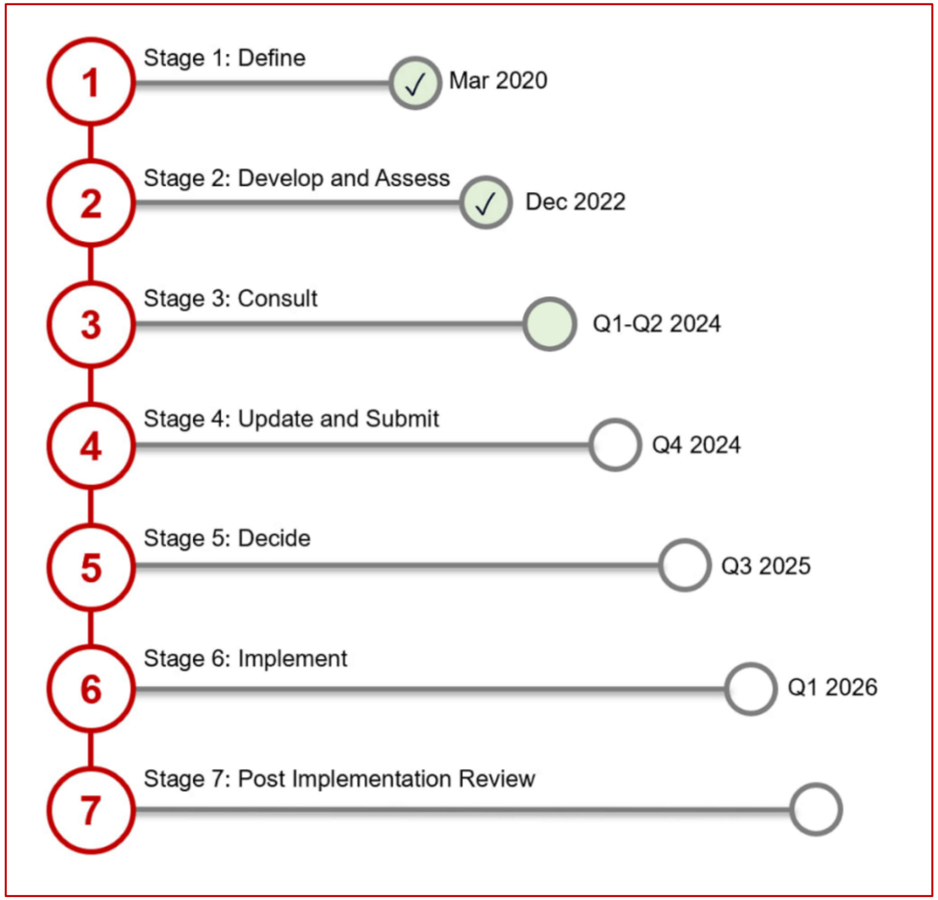

Figure 1 CAP1616 Process and an indicative timeline for this ACP

[1] Edition 4. For the purposes of Stage 3, Aberdeen Airport is required to follow the guidance outlined in Edition 4 of CAP1616. From Stage 4 onwards, the ACP will transfer across to the guidance outlined in Edition 5.

1.3 Aberdeen Airport Airspace Change Proposal

1.3.1 This Airspace Change Proposal is required to follow the CAP1616 process detailed in the section above. Table 1 below summarises the CAP1616 stages already undertaken for this ACP and the stage we are at now, providing links to previous submission documents with further information.

Airspace Change Stage	Summary	Link to Documents (Also available on the ACP portal)
Stage 1A	In November 2019, Aberdeen Airport submitted the following Statement of Need (SoN) to the CAA.	Statement of Need on CAA's Airspace Change Portal
	Aberdeen Airport participated in an assessment meeting with the CAA on 19 November 2019 as part of Step 1A of the CAP1616 process. The purpose of the assessment meeting is for the change sponsor to present and discuss their SoN and to enable the CAA to consider whether the proposal falls within the scope of the formal airspace change process.	Assessment meeting minutes
Stage 1B	At Stage 1B Aberdeen Airport developed a set of design principles with identified stakeholders. The aim of the design principles is to provide high-level criteria that the proposed airspace design options should meet. They also provide a means of analysing the impact of different design options and a framework for choosing between or prioritising options. The final design principles outlined within the Stage 1B submission are also shown here in this document.	Stage 1B Design Principle Submission Report
Stage 2A	Stage 2A requires change sponsors to develop and assess options for the airspace change. In Stage 2A, Aberdeen Airport developed a comprehensive list of options that address the Statement of Need and that align with the design principles from Stage 1. We then shared those options with our stakeholder representatives (the same ones engaged with on the Design Principles). Finally, we qualitatively assessed all options developed against the Design Principles and produced a Design Principle Evaluation (DPE). Our Comprehensive List of Options was then shortlisted before progressing to Stage 2B.	Stage 2A DPE Submission Document
Stage 2B	At Stage 2B an airspace change sponsor is required to undertake an Initial Options Appraisal (IOA) of the airspace change options which proceed from Stage 2A. The IOA initially described the options under assessment and the baseline option, followed by explaining the methodology used to assess each option, and then the IOA outcome. At the end of the document we explain, based on the IOA, the options which were taken forward to Stage 3 and the preferred option.	Stage 2B IOA Document
Withdrawal of Aberdeen from the Airspace Change	In September 2023 the Airspace Change Organising Group (ACOG) wrote to the co-sponsors (CAA and DfT) with advice on the proposed withdrawal of Aberdeen Airport from the UK Airspace Modernisation masterplan. The CAA subsequently accepted the proposal.	ACOG Advice to the CAA CAA acceptance to withdraw Aberdeen Airport from the UK

Airspace Change Stage	Summary	Link to Documents (Also available on the ACP portal)
Masterplan	Aberdeen Airport's ACP was de-coupled from the masterplan because the proposal no longer had interdependencies with the NERL ACP for the airspace above 7000ft. In addition to this, there were no interdependencies with the other Scottish cluster sponsors (Glasgow and Edinburgh Airports). Withdrawal from the Masterplan allows this ACP to progress on a separate, quicker, timeline than the rest of the Scottish cluster, and does not require Iteration 3 of the Masterplan to be published prior to a Stage 3 gateway. Nonetheless, the ACP does still continue to make a valuable contribution to airspace modernisation in the UK.	Airspace Modernisation Masterplan
Resubmission of Statement of Need	Following acceptance of the proposal to withdraw, in October 2023 Aberdeen Airport also submitted a revised Statement of Need (SoN). Aberdeen's original SoN referred to meeting the requirements of (EU) 2018/1048 and removing reliance on PTH and ADN VORs due to NATS (En Route) plc (NERL)'s navigation aid rationalisation programme. Since submitting the SoN, the UK has withdrawn from the EU, and NERL have notified Aberdeen Airport there is no longer the intention to withdraw the ADN VOR. The reliance on PTH VOR has already been resolved. With these developments in mind, it was prudent to update the Statement of Need to reflect intentions going forwards. All Stage 2 engagement and the development of our Comprehensive List of Options was undertaken in line with this revised Statement of Need.	Revised Statement of Need
Stage 3A	At Stage 3A, an airspace change sponsor is required to plan for stakeholder consultation and engagement by preparing a Consultation Strategy, Consultation documents, and a Full Options Appraisal (FOA). The FOA is the second-phase appraisal, following the IOA at Stage 2B, with more rigorous analysis of the impacts and benefits of the proposed airspace change options. The following sections of the document initially describe the options taken forward from Stage 2B and how they have been developed further following technical Instrument Flight Procedure (IFP) design. It then describes the options under assessment at Stage 3 and the baseline 'do nothing' option, followed by explaining the methodology used to assess each option, and then the FOA outcome. At the end of the document we explain, based on the outcome of the FOA, our preferred option.	This document

Table 1: Aberdeen Airport ACP to date

2. Understanding Performance Based Navigation (PBN)

2.1.1 Performance based navigation (PBN) improves the accuracy of where aircraft fly by using modern satellite navigation rather than outdated, less accurate, ground-based navigation aids (conventional navigation). This means that when aircraft fly PBN routes, they are typically more concentrated over a narrower area compared to when they are tactically controlled (vectored) by ATC.

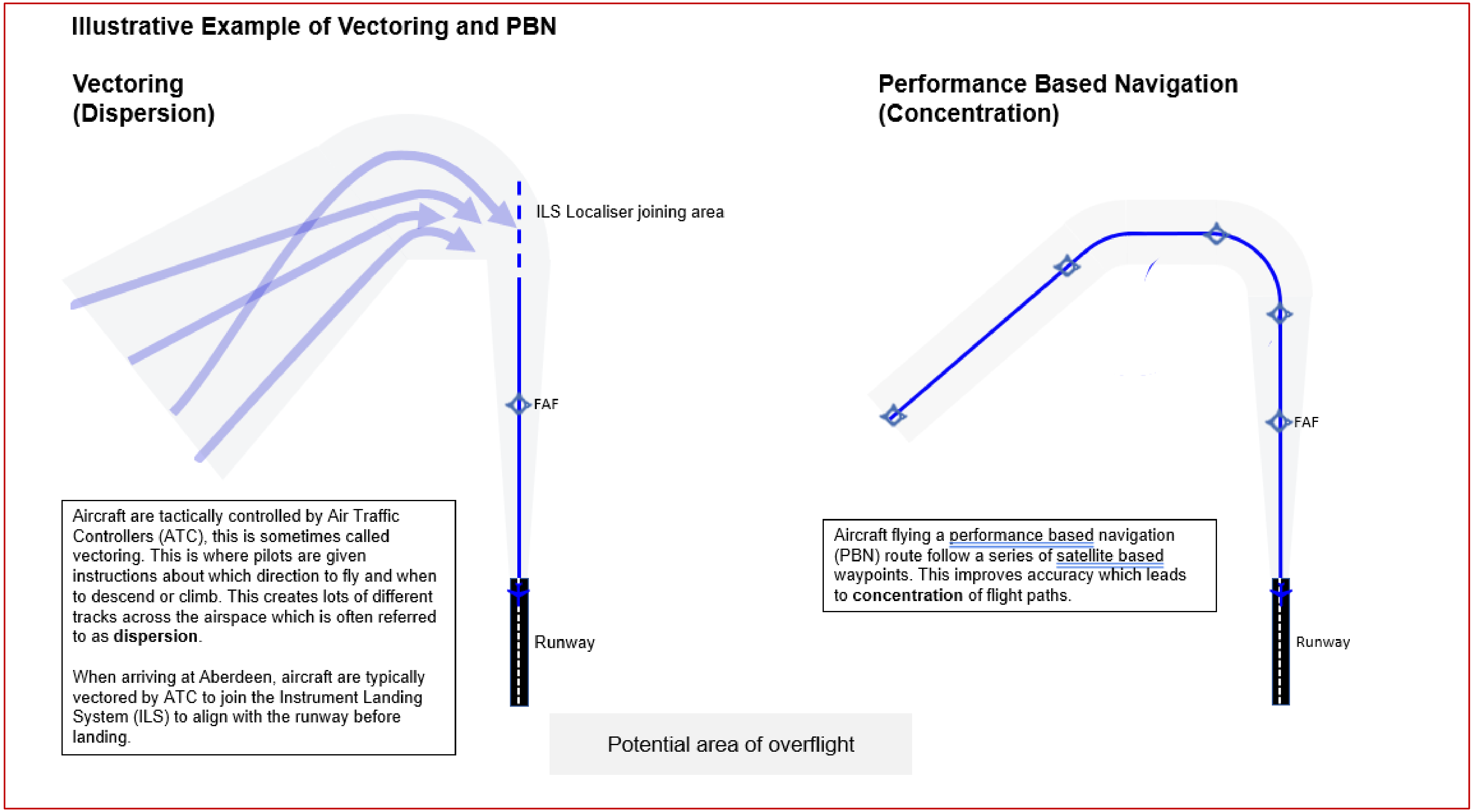

Figure 2 Illustrative Example of Vectoring and PBN

PBN approaches

2.1.2 Required Navigation Performance (RNP) approaches use a series of satellite-based waypoints which aircraft follow to fly the overall Instrument Approach Procedure (IAP). Aircraft join the IAP at the Initial Approach Fix (IAF) waypoint before proceeding to the Intermediate Fix (IF). Aircraft then turn to the Final Approach Fix (FAF) and descend to either land or undertake a missed approach – this part of the PBN procedure is aligned with the runway centreline (the 'final approach') and accurately replicates the same lateral and vertical path as the existing final approach already flown today at Aberdeen.

2.1.3 PBN offers different types of waypoint which mean that sometimes aircraft predict the turn (flyby) before a waypoint rather than navigating directly overhead the waypoint before turning (fly over).

2.1.4 When designing RNP approaches, certain layouts of the waypoints are considered in order to optimise arrivals. They can be designed to continue to rely on vectors to final approach, or they can have PBN paths prior to final approach, referred to as T-bars. The 'bars' of these layouts can be designed to suit the requirements of the approach and they do not have to be symmetrical, although the layouts do have to follow the rules contained within PANS-OPs[2].

2.1.5 An illustrative example of a T-Bar layout is shown in the figure opposite. The light blue semi circles show the directions from which aircraft can be vectored to join the Initial Approach Fix (IAF). Aircraft then follow the waypoints which are designed, where possible, to allow for continuous descent before landing.

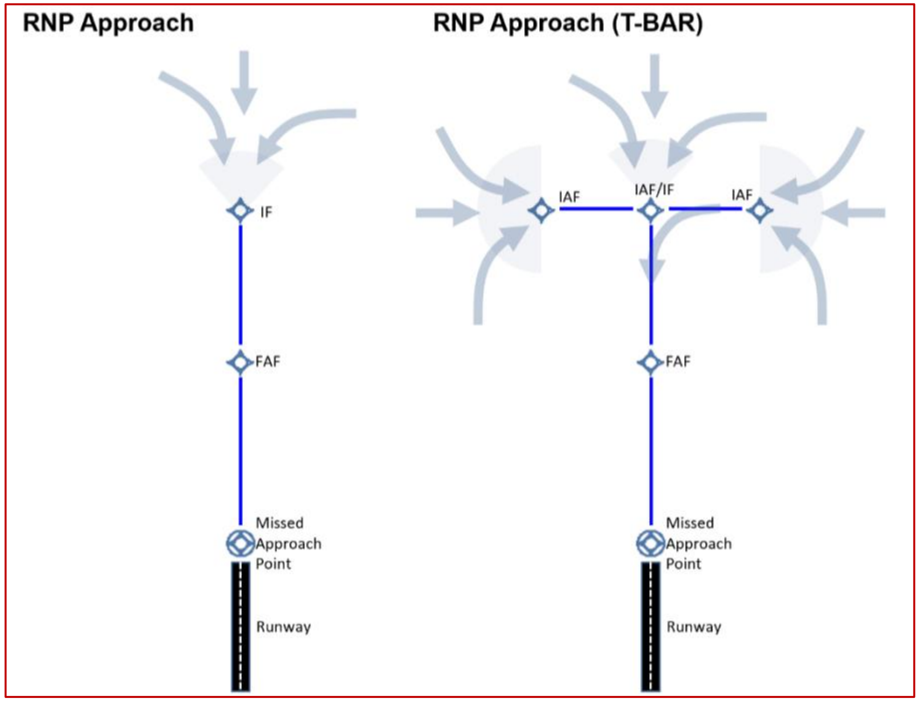

Figure 3 Illustrative examples of RNP approach and T-Bar

[2] International Civil Aviation Organisation (ICAO) rules used for designing instrument approach and departure routes

2.1.6 There is also an illustrative example of an RNP approach with Radius to Fix (RF). The RF allows aircraft to very accurately fly in an arc of fixed radius around a point, direct to the Final Approach Fix (FAF). This type of approach can reduce track mileage and improve the accuracy of centreline adherence around the turn. The majority of aircraft are equipped to fly RNP approach but not all aircraft are equipped to fly RF procedures. RNP approaches with RF are referred to as 'curved approaches' within this document.

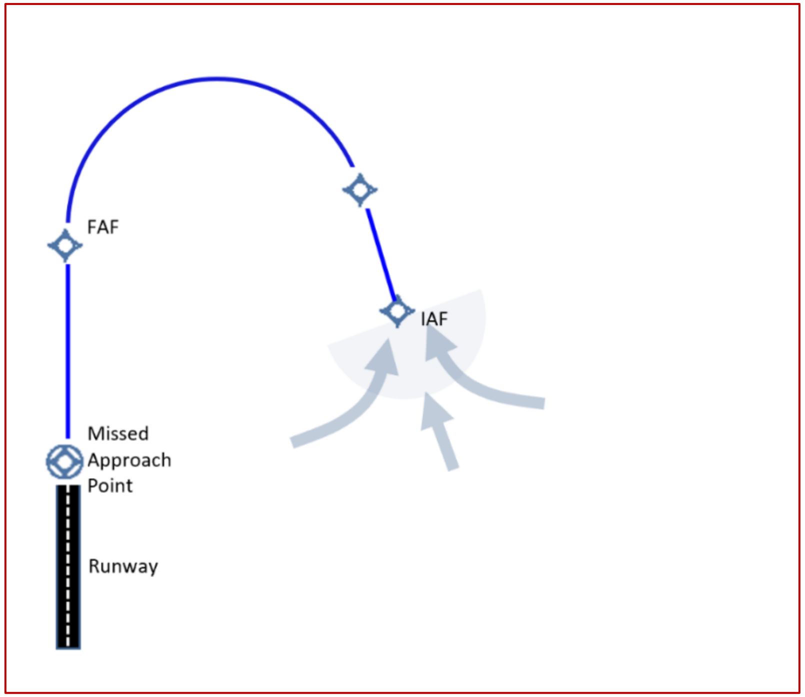

Figure 4 Illustrative example of RNP Approach with Radius to Fix (Curved Approach)

3. Overview of options development and appraisal leading to this FOA

3.1 Development and evaluation of the Comprehensive List of Options

3.1.1 The initial Comprehensive List of Options for the ACP included 10 arrivals options (3 options for runway 34 and 5 options for runway 16, and 2 baseline 'do nothing' options) and an option for reducing the volume of Controlled Airspace (CAS) alongside a CAS 'do nothing' baseline scenario. When developing these options, the aim was to meet Aberdeen Airport's Stage 1A Statement of Need and the Stage 1B Design Principles.

3.1.2 As part of Stage 2A, we undertook a Design Principle Evaluation (DPE) where we evaluated each option against each Design Principle. The DPE is the first opportunity within the CAP1616 process to shortlist options before progressing to the IOA. The outcome of our Stage 2A Design Principle Evaluation was that we chose to take forward all of the options on the comprehensive list, with the exception of the two baseline 'do nothing' scenarios. The baseline scenarios were discounted as they did not align with the AMS, address the Statement of Need, or provide Aberdeen Airport with any additional resilience.

3.1.3 **Although the 2 baseline 'do nothing' scenarios (runway 16 arrivals 'do nothing', and runway 34 arrivals 'do nothing') did not progress as options, CAP1616 requires the baseline scenario to be appraised in both the Stage 2B IOA and this Stage 3A FOA as it provides a means of testing the options against the current day operations to better understand and highlight the benefits and impacts of each new option. The baseline will also continue to be appraised as part of the Final Options Appraisal at Stage 4.**

Stage 2B Initial Options Appraisal

3.1.4 Following the DPE the options then proceeded to the Stage 2B Initial Options Appraisal (IOA). This is the first of three phases of appraisal within the CAP1616 process. The conclusion from the Initial Options Appraisal is shown in the table below:

Table 2 Stage 2 Options: Design Principle Evaluation and Initial Options Appraisal Outcomes

Stage 2 Options

Runway 16 (Continued / Discontinued)

Option name	DPE	IOA
Runway 16 Baseline 'Do nothing'	✗	
Runway 16 Arrival Option 1 – Vectors to Final Approach	✓	✓
Runway 16 Arrival Option 2 – Inner T Bar	✓	✗
Runway 16 Arrival Option 3 – Outer T Bar	✓	✓
Runway 16 Arrival Option 4 – Curved Approach from the West	✓	✓
Runway 16 Arrival Option 5 – Curved Approach from the East	✓	✓

Runway 34 (Continued / Discontinued)

Option name	DPE	IOA
Runway 34 Baseline 'Do nothing'	✗	
Runway 34 Arrival Option 1 – Vectors to Final Approach	✓	✓
Runway 34 Arrival Option 2 – T Bar	✓	✓
Runway 34 Arrival Option 3 – Curved Approach from the East	✓	✓

Controlled Airspace

Option name	DPE	IOA
Existing CAS 'Do nothing'	✓	✓
CAS Option 1 Raise portion of CTA 3 to 4500ft	✓	✓

All airspace design options in this document are subject to change throughout the airspace change process as options are matured in detail and refined in accordance with safety requirements, our design principles, our appraisals and stakeholder engagement and consultation.

3.2 Options for this Stage 3 Full Options Appraisal

3.2.1 As part of the Stage 3 Full Options Appraisal (FOA), airspace change sponsors are required to generate analysis which reflects the overall airport's air traffic operation (taking into account operations from all runways including arrivals and departures). Ahead of the FOA, we have therefore combined the Stage 2 options into options for appraisal at Stage 3:

Table 3 Stage 3 Options Configuration

Stage 3 Options Configuration

Stage 2 Option name		Stage 2 Option name	Stage 3 Option
Runway 16 Arrival Option 1 – Vectors to Final Approach	+	Runway 34 Arrival Option 1 – Vectors to Final Approach	**Vectors to Final Approach**
Runway 16 Arrival Option 3 – Outer T Bar	+	Runway 34 Arrival Option 2 – T Bar	**T-Bars**
Runway 16 Arrival Option 4 – Curved Approach from the West	+	Runway 34 Arrival Option 3 – Curved Approach from the East	**T-Bars and Curved Approaches**
			Controlled Airspace
			Existing CAS 'Do nothing'
			CAS Option 1 Raise portion of CTA 3 to 4500ft

- Differing options on each runway end, for example to have Vectors to final approach on runway 16 and T-Bar on runway 34, have not been generated because of the increased risk of confusion for ATC and pilots which leads to safety concerns.
- As noted in the IOA, runway 16 option 4 and runway 34 option 3 use a type of PBN capability called RF (Radius to Fix) however not all airlines are able to fly these curved approaches. These options have therefore been combined with the T-Bars when creating the Stage 3 option to ensure a solution suitable for the majority of operations.
- CAS Option 1 is independent of all three PBN arrival options so for the purposes of the FOA it has been assessed separately.

Runway 16 arrival option 5 – curved approach from the east

3.2.2 The table above does not include the runway 16 arrival option 5 – curved approach from the east which was continued from Stage 2B. In preparation for Stage 3 further discussions took place with ATC around the safety and operability of the options ahead of the main safety assessment. It was found that this runway 16 curved approach from the East would generate increased workload for ATC resulting from the interactions between aircraft being positioned towards this curved approach and other vectored aircraft in the area, predominantly helicopter traffic arriving from the North Sea. ATC anticipated that to mitigate this safety risk, there would be a change to vectoring within the wider area of both fixed wing and rotary traffic. This is very much outside the scope of this ACP, which focuses on resilience and offering modern PBN approaches for Aberdeen rather than redesign of the airspace. As a result of this, the option would not meet Design Principle 1 ('The airspace design and its operation must be as safe or safer than today for all airspace users that are affected by the airspace change') and Design Principle 3 ('Design Options should minimise the change to tracks over the ground of aircraft arriving and departing from Aberdeen').

3.2.3 Although the IOA did demonstrate that this option could offer some track mileage / fuel burn / greenhouse gas emission benefits, it is important to note this would be for a very small % of aircraft and it would only apply to aircraft arriving from the south east which are also a small percentage of overall arrivals. When this is weighed against the disbenefits in terms of safety, ATC workload, and impacts to noise, the Runway 16 arrival option 5 – curved approach from the east was discontinued at the start of the Stage 3 process and did not progress to this FOA.

3.2.4 For the purposes of transparency, we have included some high-level information in the table below against each appraisal category to support the discontinuation of this option.

Table 4 runway 16 arrival option 5 discontinuation

Group	Impact
Communities	Noise impact on health and quality of life
The IOA found that aircraft flying the curved approach would result in a small redistribution of traffic between 7000-5000ft over areas already overflown today. From c.5000ft, there is increased frequency of overflight at lower altitudes over some areas already overflown today. Owing to the small number of flights operating the RNP approach with RF, and this occurring largely over sparsely populated areas, any impacts of this were not expected to be significant (and are outside the L_{Aeq} Lowest Observable Adverse Effect Level (LOAEL) contours).	

Group	Impact
Further investigation into the ATC operability of the option has established that in order to manage the increased workload generated by this option, there would be changes to vectoring patterns within the wider airspace. This means that, as well as a change to tracks over the ground for the small % of aircraft flying the curved approach, there would also be changes to tracks over the ground for other aircraft arriving using the ILS or visually. It is also anticipated there could be changes to tracks over the ground for some departing helicopter traffic. As noted above, redesign of the airspace and changes to the tracks of departures is outside of the scope of the ACP. It would also mean the option would not meet Design Principle 3 (‘Design Options should minimise the change to tracks over the ground of aircraft arriving and departing from Aberdeen’).	
Communities	Air quality
No impact; no lateral changes below 1000ft and no changes to number of aircraft flying an approach.	
Wider society / General Aviation/ commercial airlines	Greenhouse gas impact/fuel burn
The IOA found that this curved approach would offer a c.2nm reduction in track mileage and so this option could offer some track mileage / fuel burn / greenhouse gas emission benefits, but it is important to note this would be for a very small % of aircraft and it would only apply to aircraft arriving from the south east which are also a small percentage of overall arrivals. Since the IOA, the further investigation into the ATC operability has established that this curved approach would increase complexity within the airspace in order to integrate traffic (particularly helicopters) with aircraft flying the curved approaches. This means that there are wider impacts and these could result in increased track mileage, or potentially holding for helicopter traffic, which could have disbenefits compared to the ‘do nothing’ baseline.	
Wider society	Capacity/resilience
The option would improve resilience and therefore offer some opportunities for reduced airline operating costs and increased operating revenue however only for aircraft/operators capable of flying RNP Approach RF. The other remaining options also offer improved resilience and this curved approach does not offer any improvements which differentiate it from the other shortlisted options.	
General Aviation	Access
Not expected to impact general aviation and the option is compatible with CAS Option 1. This curved approach does not offer any improvements which differentiate it from the other shortlisted options.	
Commercial airlines / Airport / Air Navigation Service Provider (ANSP)	Training costs, other costs, infrastructure costs, operational costs, deployment costs
This curved approach does not offer any improvements which differentiate it from the other shortlisted options in terms of costs. (See IOA for full details around costs).	

Group	Impact
All	Safety
In preparation for Stage 3 further discussions took place with ATC around the safety and operability of the options. It was found that this runway 16 curved approach from the east would generate increased workload for ATC resulting from the interactions between aircraft being positioned towards this curved approach and other vectored aircraft in the area, predominantly helicopter traffic arriving and departing from/to the North Sea. ATC anticipated that to mitigate this safety risk, there would be a change to vectoring within the wider area of both fixed wing and rotary traffic, and overall it was concluded that there would be an overall increase in complexity as a result of aircraft flying this curved approach. As a result of this, the option would not meet Design Principle 1 (‘The airspace design and its operation must be as safe or safer than today for all airspace users that are affected by the airspace change’).	
All	Performance against the vision and parameters/strategic objectives of the AMS
The safety assessment highlighted that this option would result in an increase in complexity and a risk to safety which does not align with the aims of the Airspace Modernisation Strategy.	

Evolution of the options

3.2.5 Within the Stage 2B IOA, it was noted that there may be opportunities to refine two of the options as part of the detailed IFP design development at Stage 3. Extracts from the document are shown below:

IOA Conclusion, Page 60, Runway 16 Outer T-Bar Option 3
Although there is a small increase in track mileage for arrivals from RATPU, for the purposes of this IOA track mileage has been rounded to the nearest nm and as part of the preparation of the IFPs for the Stage 3 full options appraisal, we will explore whether the procedure can be refined to enable similar track mileage to today.

IOA Conclusion, Page 61, Runway 34 T-Bar Option 2
The IOA has shown that the western T-Bar of Option 2 is located slightly to the north but still within the main area of concentration of the existing arrival swathe. This location results in a small increase in population overflown when comparing the centreline data however owing to only c. 1 fixed wing arrival per day using the western T-Bar on average, any impacts are not expected to be significant (and are outside the L_{Aeq} LOAEL contours). There may also be opportunities as part of IFP development in Stage 3 for the T-Bar to be positioned a fraction to the south to align with the existing overflight swathe more closely.

Evolution of runway 16 outer T-Bar option 3

3.2.6 Analysis of the option has identified that the position of the western 'T' is within the existing swathe of concentration, and it is the distance between the IAF and the IF which is driving the small increase in track mileage. In the baseline, the average centreline from the RATPU waypoint (see figure 5) turns onto base leg slightly east of the position of the T-Bar IAF. As part of the IFP development of the option, the possibility of shortening the distance between the IAF and the IF has been explored however this segment of the procedure is already at the minimum distance in order to be PANS-Ops compliant and therefore it cannot be shortened. As noted in the IOA, the track mileage calculations were rounded and the analysis within the Full Options Appraisal will provide an opportunity to review in further detail the potential greenhouse gas emission impacts of this T-Bar option.

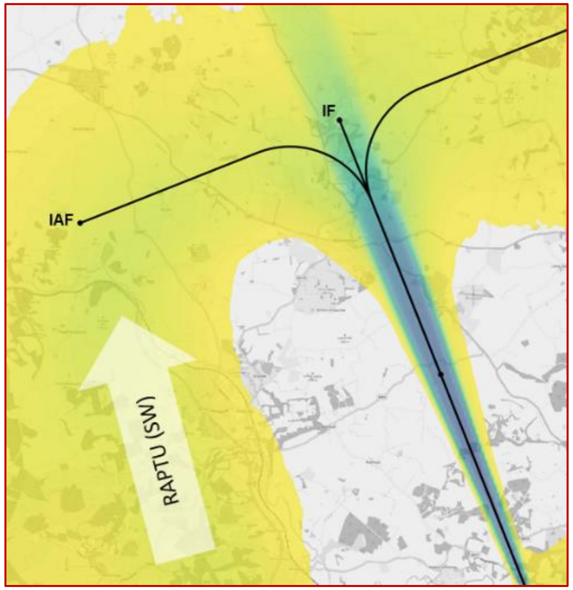

Figure 5 Runway 16 Outer T-Bar Option 3

Evolution of runway 34 T-Bar option 2

3.2.7 As part of the IFP development of the option, the IF and IAF position of the T-Bar was moved 0.4nm back along the extended final approach track axis in order to align with the existing swathe of arrivals more closely and to better avoid population. When developing the option, IFP designers used population density map underlays, the overflight contours generated as part of the IOA, and heatmaps of the existing arrivals swathe, to determine the location.

3.2.8 In Figure 6 opposite, the Stage 2 option is shown with blue lines and the evolved Stage 3 options are shown in black. The existing arrival swathe heatmap is shown from yellow to purple. Areas of dense population are shown from green to red.

3.2.9 The FOA will provide an opportunity to assess this option in further detail.

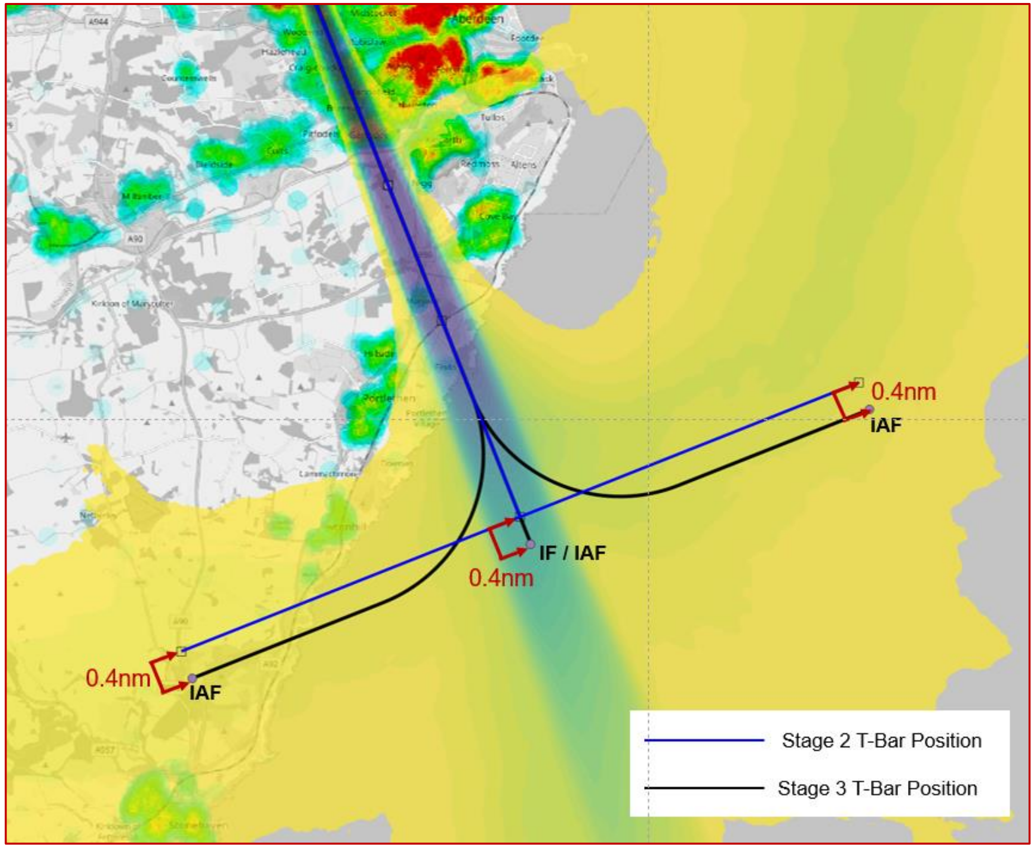

Figure 6 Evolution of Runway 34 T-Bar Option between Stage 2 and Stage 3

Curved approaches

3.2.10 PANS OPS requires the intermediate segment of a curved approach procedure to have a minimum distance between the Intermediate Fix (IF) and Final Approach Fix (FAF) of 2NM and a maximum distance of 10NM. The procedure images shown within the IOA showed these minimum and maximum IFs.

3.2.11 For the purposes of this FOA, the Instrument Flight Procedures (IFPs) for the curved approaches have been developed in further detail. This development included considering the proximity of the procedures to CAS boundaries and the CAA Controlled Airspace containment policies and Aberdeen Airport's ATC Surveillance Minimum Altitude Chart (ATSMAC), as well as Aberdeen's existing arrivals swathe. The Initial Approach Fix (IAF) and the IF of the procedures have been positioned accordingly. Also as part of the detailed design development, the procedural centreline of the curved approaches has changed laterally marginally. Figure 7 below shows the difference between the Stage 2 curved approach nominal centrelines and the Stage 3 procedure centrelines.

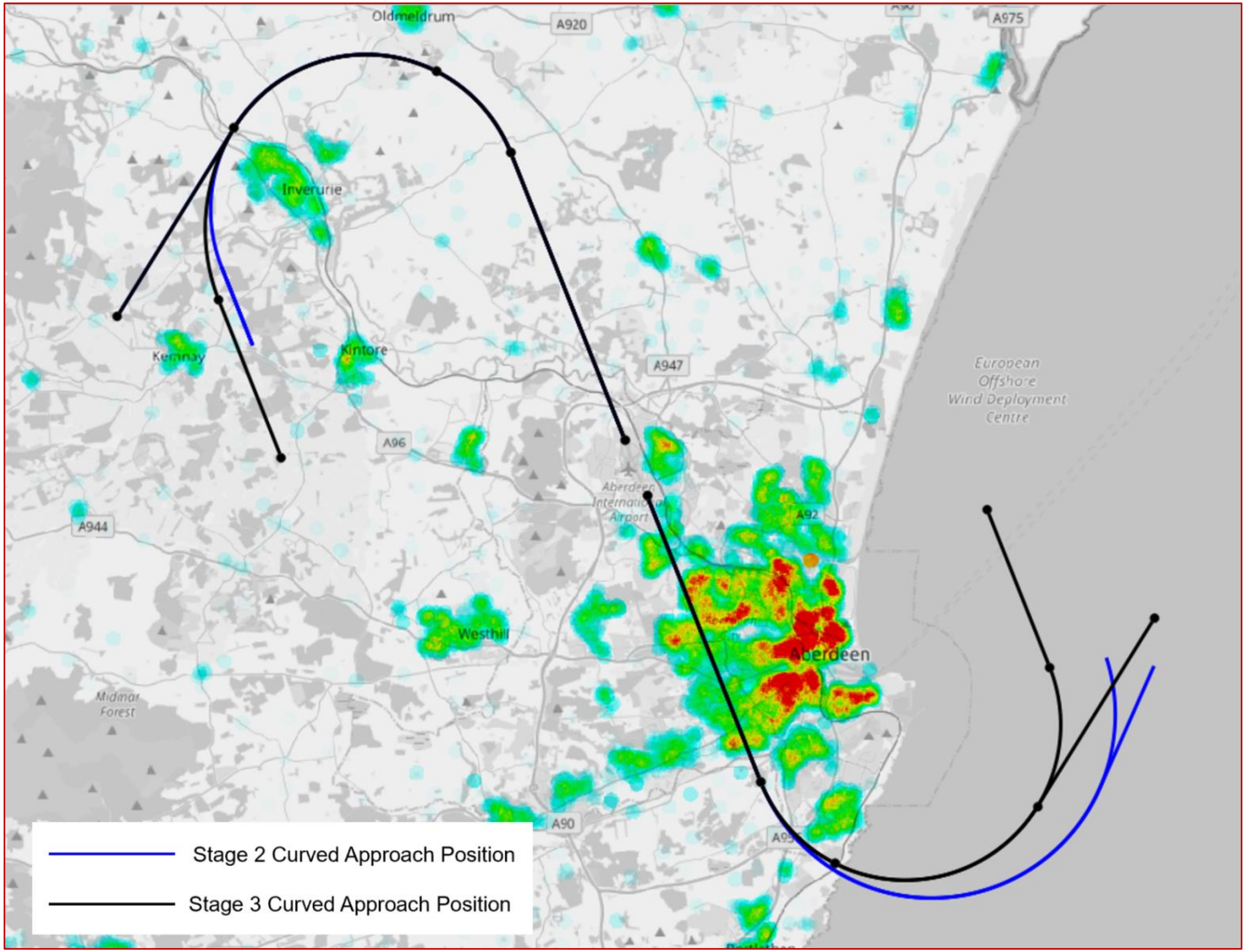

Figure 7 Lateral difference between Stage 2 and Stage 3 runway 34 curved approach design

Vectors to RNP approach

3.2.12 Detailed design development of the vectors to RNP approach options has determined that the IAF/IF of the two RNP approaches needs to move backward in order to be safely operable.

3.2.13 The distance between the IF and the FAF is constrained by IFP design, the minimum stabilisation distance (MSD) as required by PANS OPS, and it is also constrained by the boundaries of controlled airspace (CAS). As part of the detailed design development ATC noted that, based on the design presented in Stage 2, aircraft could not descend as per the procedure due to the limitations within the Air Traffic Control Surveillance Minimum Altitude Chart (ATCSMAC). Subsequently, the IF of the procedures had to be moved further out, in order to achieve the descent and be safely operable within the ATC environment. Figure 8 shows the differences between the Stage 2 and Stage 3 designs and the FOA will provide an opportunity to assess this option in further detail.

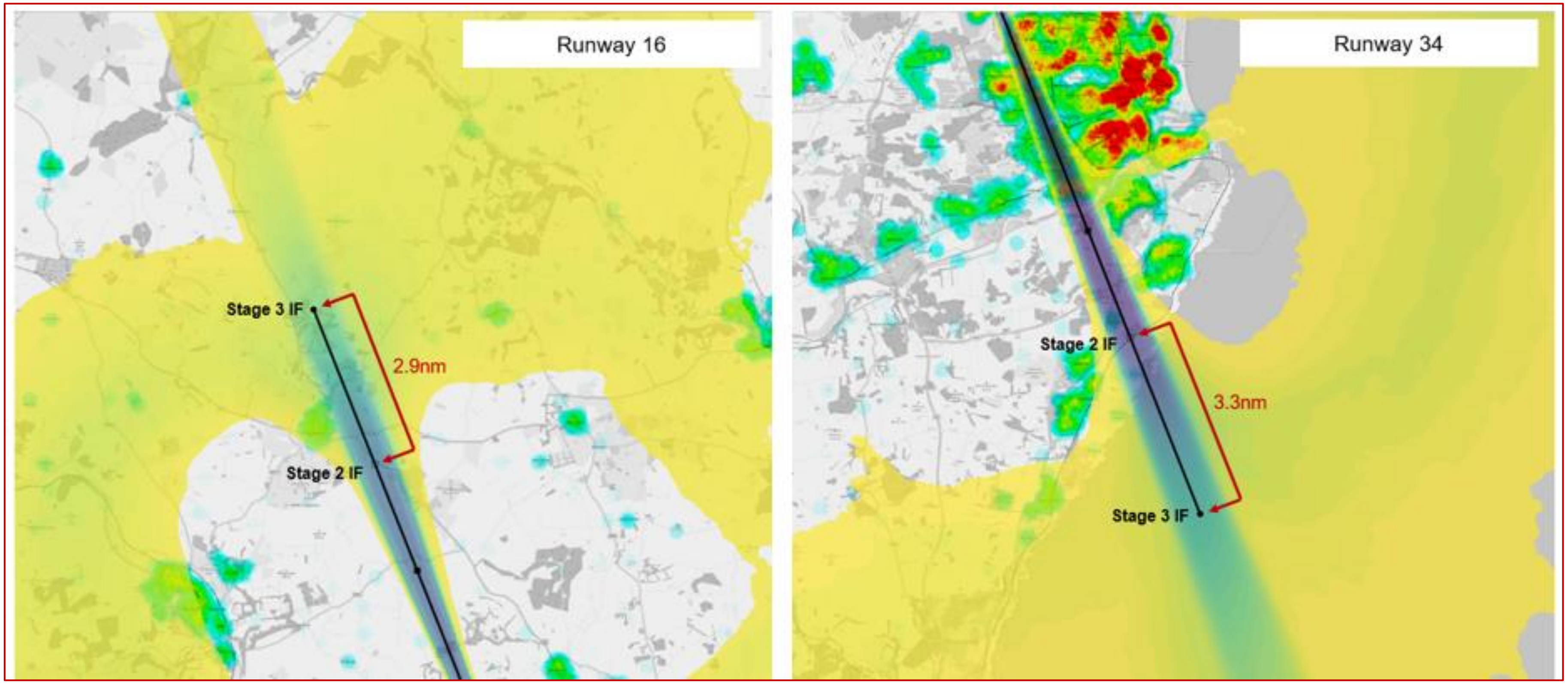

Figure 8 Updated IF position of vectors to RNP approach option following detailed design development.

Missed approaches and PBN hold

3.2.14 The PBN arrival options also require a missed approach procedure with an associated hold. Typically when introducing PBN arrival procedures, unless there is a strong safety reason to deviate, PBN missed approaches replicate a similar missed approach procedure to the ILS procedure (as much as PANS OPS procedure design allows). This reduces safety risk for ATC and pilots.

3.2.15 Ahead of the Full Options Appraisal, as part of the detailed design development, IFP designers have reviewed the missed approach procedures for the options and developed suitable missed approach procedures. These aim to replicate what happens today as part of an ILS procedure at Aberdeen Airport. For full details, please see the option descriptions within the Full Options Appraisal section of this document.

CAS option 1

3.2.16 Detailed analytical work and discussions with ATC identified that there was an opportunity to increase the area of airspace that could potentially be released as part of this airspace change proposal. Accordingly, the eastern boundary of CAS option 1 was moved further east. The diagram in Figure 9 shows the boundary presented at Stage 2 in orange and the proposed boundary at Stage 3 in red. For more information about CAS option 1 please see the Full Options Appraisal section.

Figure 9 Stage 2 and Stage 3 proposed airspace volume

4. Full Options Appraisal methodology

4.1 Baseline inputs

4.1.1 As part of this FOA, CAP1616 requires airspace change sponsors to set a baseline which is used for environmental evaluation of the options. CAP1616 explains that this will be a 'do nothing' scenario and will largely reflect the current-day scenario, although taking due consideration of known or anticipated factors that might affect that baseline, for example a planned housing development close to an airport, forecast growth in air traffic, or expected changes in airlines' fleet mix.

4.1.2 The Step 3A FOA must then, where appropriate quantitively, and otherwise qualitatively, appraise the difference between a pre-implementation ('do nothing') scenario and a post-implementation scenario, ensuring that the periods are comparable. The following subsections provide information which has been used to generate the baseline scenario. The full baseline appraisal is shown in the Full Options Appraisal section of this document.

Traffic forecast

- The options within the ACP do not seek to increase movements at Aberdeen Airport; the purpose of the change is to provide resilience and meet the requirements of the Airspace Modernisation Strategy. Therefore, the traffic forecast applied 'without ACP' will remain the same 'with ACP'.

- At present the implementation date for the Aberdeen ACP is anticipated to be in Q1 2026. This FOA will therefore qualitatively and quantitatively describe the baseline and the anticipated factors that are expected to impact it, such as any forecast growth, fleet mix changes and planned developments based on implementation in 2026. CAP1616 also requires airspace change sponsors to forecast growth 10 years following the year of implementation.

- Aberdeen airport does not usually forecast out more than 5 years ahead. For the purposes of this Full Options Appraisal, we have taken actual Electronic Flight Strip Data (EFPS data) from 2022 and then used Aberdeen Airport's long term business plan[3] 5-year traffic predictions to apply growth to this data. This 5 year forecast is based on business intelligence and information including frequency of route operated, new routes, stopping routes, anticipated changes in fleet mix and speed of covid recovery. Beyond 5 years, this is grown by a small forecast annual average per annum, informed by previous years, given less certainty. Aberdeen Airport has no planning/section 106 agreements which would affect our forecast. No growth has been assumed for Helicopters.

[3] The Aberdeen Airport Traffic Forecast has been updated based on the Long Term Business Plan (LTBP) and therefore the movement numbers published within the IOA have been updated within this FOA. There are no significant changes in movement numbers between the Stage 2 and Stage 3 forecasts.

- Within the IOA, modal split data (data about runway direction) was provided based on actual 2022 data. For the purposes of the more detailed analysis within the FOA, the modal split has been updated based on the average split over 10 years' worth of data with runway 16 being used 60% of the year, and runway 34 being used 40% of the year.
- Note that whilst Table 5 presents annual movement numbers, the noise modelling is based on movement numbers within the 92-day summer period from 16 June to 15 September inclusive.

- Table 5 below provides an overview of these forecast movement numbers:

Table 5 Traffic Forecast

Year	2022	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
		1	2	3	4	5	6	7	8	9	10
	Per year										
Total movements	74,163	85,505	85,690	85,892	86,095	86,298	86,502	86,707	86,914	87,120	87,328
Total fixed wing arrivals	19,548	25,241	25,333	25,435	25,537	25,639	25,741	25,844	25,948	26,051	26,156
Total helicopter arrivals	17,675	17,675	17,675	17,675	17,675	17,675	17,675	17,675	17,675	17,675	17,675
Total fixed wing departures	19,396	25,045	25,138	25,238	25,339	25,440	25,542	25,644	25,747	25,850	25,953
Total helicopter departures	17,544	17,544	17,544	17,544	17,544	17,544	17,544	17,544	17,544	17,544	17,544
	Average per Day										
Fixed Wing Arrivals per day (c.60%)	54	69	69	70	70	70	71	71	71	71	72
Helicopter Arrivals per day (c.40%)	48	48	48	48	48	48	48	48	48	48	48
	Average per day Runway 16										
Fixed Wing Arrivals per day RWY16 (c.60%)	32	41	42	42	42	42	42	42	43	43	43
Helicopter Arrivals per day RWY16 (c.40%)	29	29	29	29	29	29	29	29	29	29	29
	Average per day Runway 34										
Fixed Wing Arrivals per day RWY34 (c.60%)	21	28	28	28	28	28	28	28	28	29	29
Helicopter Arrivals per day RWY34 (c.40%)	19	19	19	19	19	19	19	19	19	19	19

- The number of helicopter movements above represent the total average number of helicopter arrivals when the main landing runway is either 16 or 34 at Aberdeen. Not all of these helicopter movements actually used runway 16 or 34. In total, around 77% of all helicopter arrivals use the main landing runway, the remaining 23% use the much smaller visual runways 14,18,23,32 and 36. as articulated in Figure 10 and Figure 11. In Table 5, Figure 11, and Figure 12 all arrivals from the north (RWY16, RWY14, RWY18, RWY23, and H) have been grouped into the total helicopter count for RWY16 and all arrivals from the south (RWY34, RWY32 and RWY36) have been grouped into the total helicopter count for RWY34.

Fleet mix

4.1.3 As noted above, Aberdeen Airport has taken flight data from 2022 and grown this to reflect a 2026 forecast for the year of implementation. The fleet mix of this data has been adjusted to account for expected airline fleet changes. This includes transitions from A320-100/200 to A320 Neos, Embraer E195-E2 to B737-700 winglets, Embraer-145 to ATR72 212 A and ATR 42-500 to Jetstream 41.

Movement information

4.1.4 Aberdeen Airport has one main runway for fixed wing traffic and helicopter traffic is also able to arrive visually onto three other runways. Aircraft arriving onto Aberdeen's main runway (runway 16 and runway 34) are within the scope of this ACP although all helicopter movements have been included within the noise modelling, in line with the runway modal split distribution in Figure 10. Figures 11 and 12 (shown on the following pages) show the average number of movements per day across the 92-day summer period[4] 2035. These figures vary slightly from the figure in Table 5 which are based on the annual period.

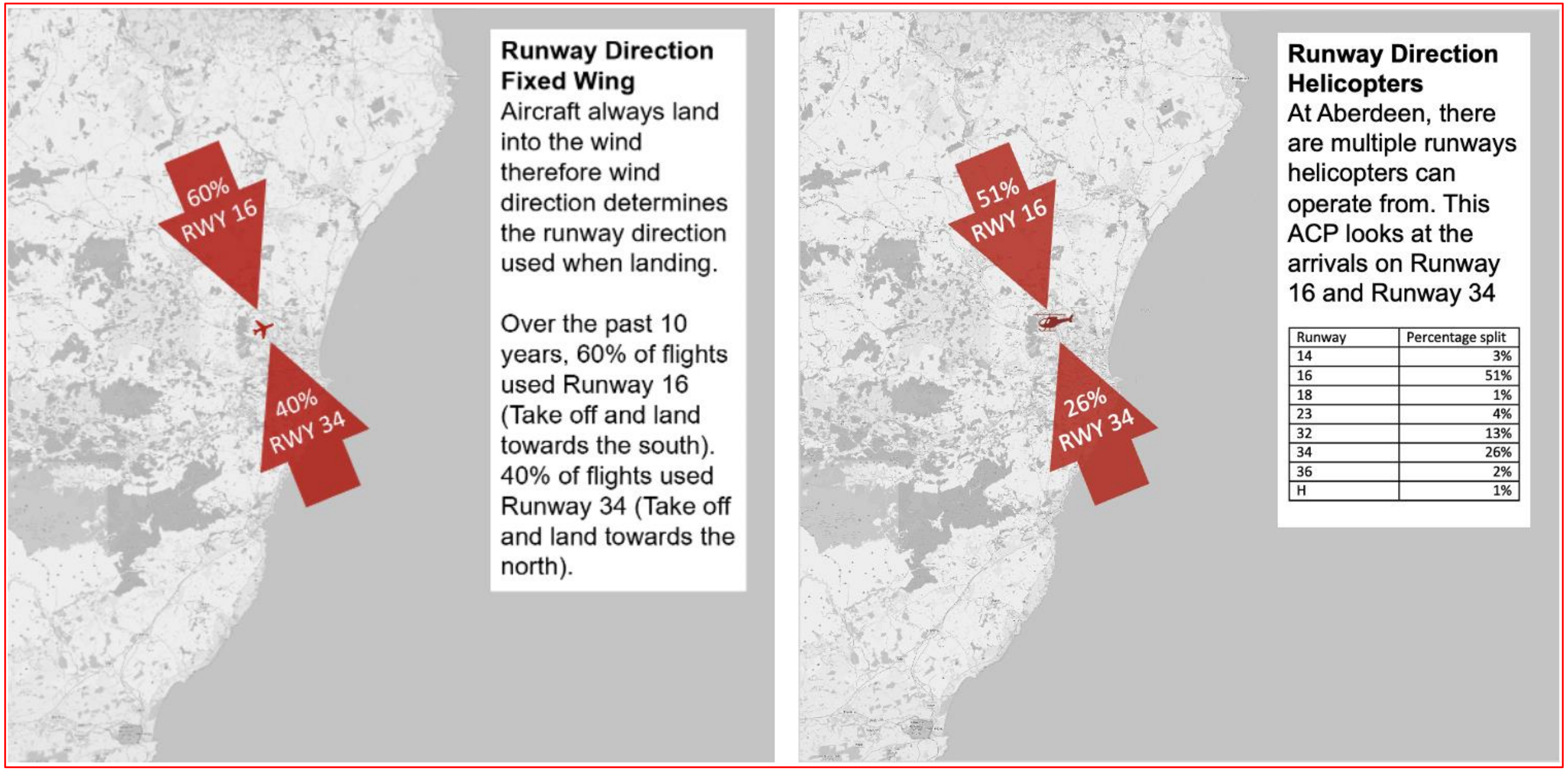

Figure 10 Modal split and Helicopter usage of Runway 16/34

[4] 16th June – 15th September

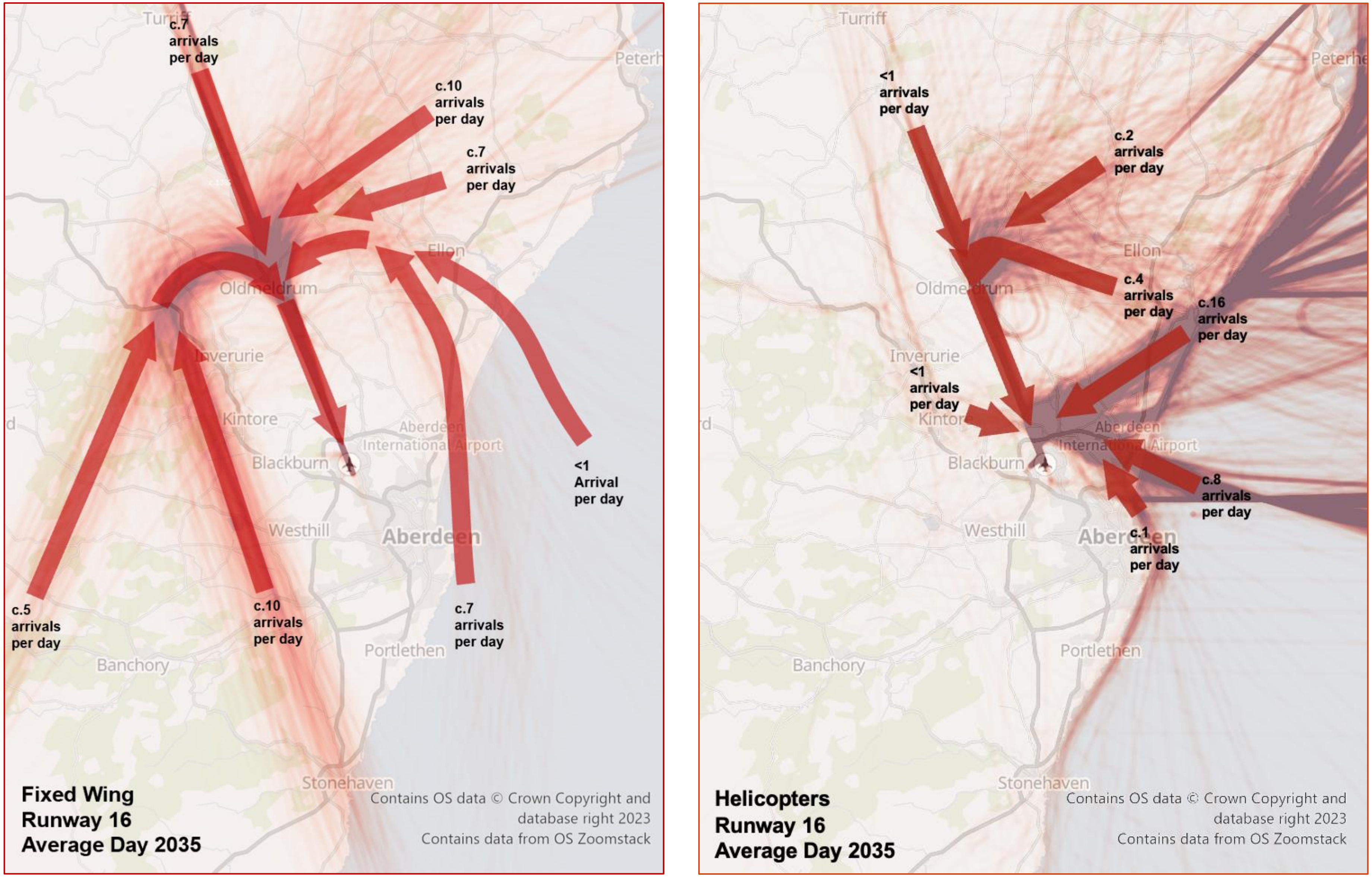

Figure 11: Average RWY 16 movements per summer day 2035. Fixed wing 46 arrivals. Helicopters 31 arrivals

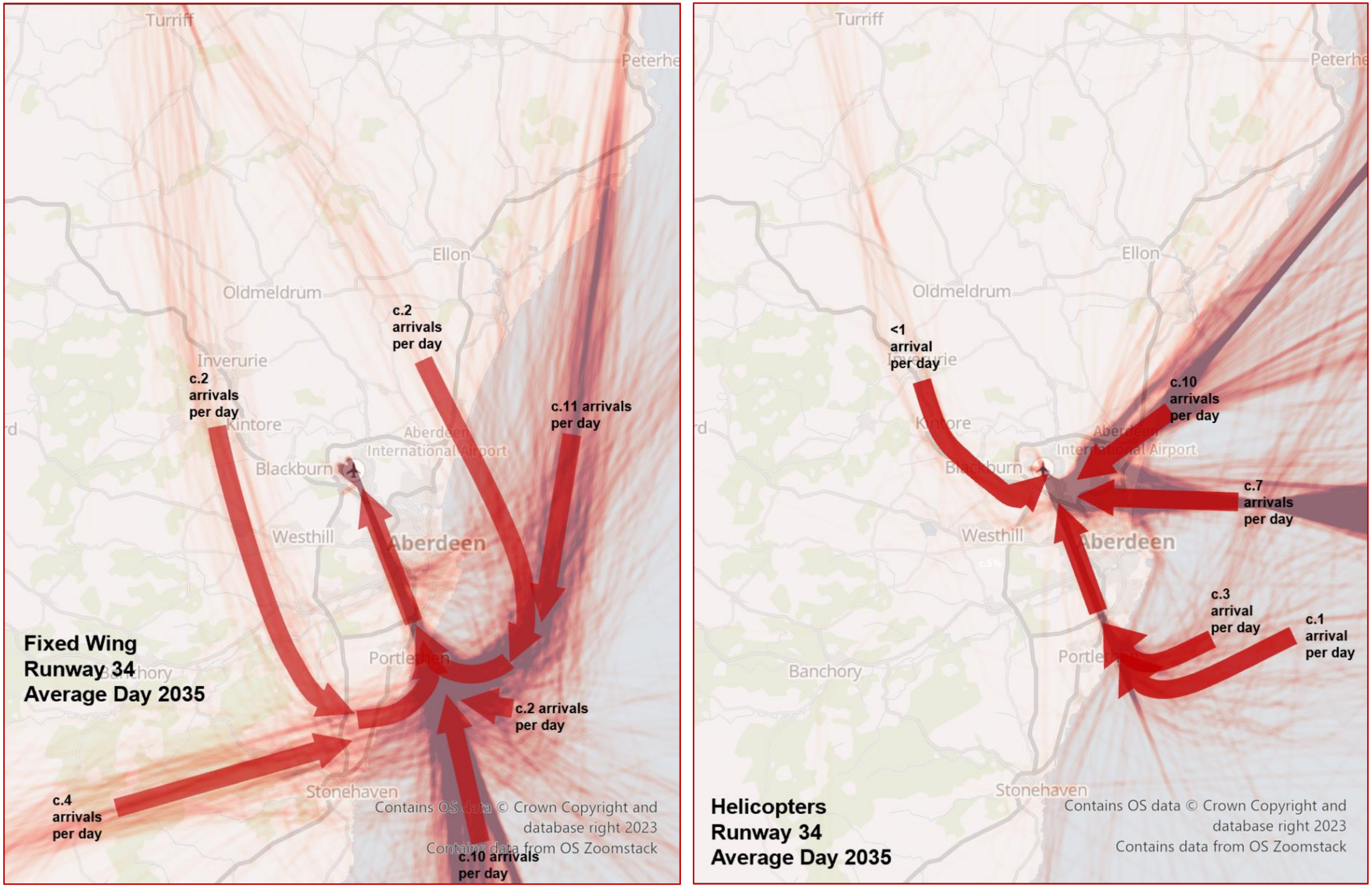

Figure 12: Average RWY 34 movements per summer day 2035. Fixed Wing 31 arrivals, Helis, 21 arrivals

Hold usage

4.1.5 Some aircraft arriving at Aberdeen have to hold. A hold is an airspace structure where aircraft circle whilst waiting to land. As part of the ILS approach procedures, there are two holds used by fixed wing aircraft (runway 16: ADN, and runway 34: DOWNI/ATF). Holds are used either when there is a lot of traffic in the airspace, and hence aircraft have to queue to land, or when aircraft are unable to land which could be due to poor visibility or the runway being temporarily unavailable.

4.1.6 In preparation for this FOA, we have looked at 2022 flight track data around hold usage which showed that c.1% of arriving fixed wing traffic used the holds. When considering the movement forecast data, this equates to less than one flight per day on average using the holds.

Missed approaches

4.1.7 Missed approaches occur when it is judged that an approach cannot be continued to a safe landing. Aircraft may undertake a missed approach when the weather or visibility make it difficult to land, or when the aircraft is not correctly stabilised and aligned with the runway. Sometimes missed approaches also occur if the runway is temporarily blocked, or it is unsafe to land. In the event of a missed approach, aircraft fly a defined procedure.

4.1.8 To help estimate hold usage for the RNP approach procedures, we looked at data for the number of aircraft flying missed approaches. In 2022, c.1.7% of arriving fixed wing aircraft flew a missed approach procedure.

ILS outages

4.1.9 The proposed PBN procedures would mainly be used in the event of an ILS outage at Aberdeen Airport and therefore in preparation for this Full Options Appraisal, we have looked at historic data around the ILS availability. In the last 5 years, there has been 1 unplanned ILS outage which lasted for 6 hours. In addition to this, the ILS is taken out of service for planned maintenance for around 5 hours per month, and up to 14 hours on a 6 monthly basis (however it is important to note that these often occur at night, or in periods when there are very few aircraft arriving/departing from Aberdeen Airport). We have factored this information in when considering how often we anticipate the PBN procedures will be operated.

Expected PBN usage

- The PBN procedures proposed as part of this ACP are intended to be operated alongside the existing approaches at Aberdeen Airport and we expect the vast majority of arrivals will continue to be vectored to the ILS, as they do today. The RNP approaches are required largely for resilience purposes to cover the eventuality of loss of the ILS due to fault or maintenance however some pilots may elect to fly an RNP approach for training purposes even with a serviceable ILS.

- We expect c.1-5% of arrivals into Aberdeen could elect to fly the RNP approaches; however, from experience at other airports, RNP approach uptake is likely to be closer to the lower end of this assumption given the ILS will remain available. **For this FOA, we will assess using an optimistic estimate of 5% of arrivals to fly the RNP procedures.**

- Within the IOA we anticipated that, owing to the shorter track mileage and associated fuel burn savings, more operators would elect to fly the curved approaches if available and it was estimated that 10% of arrivals could elect to fly a curved approach. Since then, further engagement has been undertaken with airlines who have informed the airport that despite the curved approaches offering track mileage savings, they would not be considered a preferred approach unless there are very clear visibility conditions. Airlines also noted that although there are track mile savings, there is very little flying time difference between a curved approach and an ILS approach, and therefore the ILS would remain the preferred. **The estimate for aircraft flying the curved approaches has therefore been adjusted for this Full Options Appraisal to an optimistic c.3% of arriving aircraft.**

- Feedback from helicopter operators has suggested that the PBN procedures would only be used for training purposes and therefore we have **optimistically estimated c.5% of helicopter flights could use the RNP procedures**. Helicopter use of the curved approaches is limited to the eastern curved approach for runway 34, as the western curved approach for runway 16 would add significant track mileage for helicopters.

- When considering the future use of missed approaches and holds, the RNP approach procedures are not expected to result in an increase in holding or in the number of missed approaches flown. The RNP missed approach procedures replicate the existing ILS missed approach procedures and, if required, aircraft would fly a hold predicated on the existing conventional ground beacon (ADN VOR) (although the vast majority of operators will be flying a FMS overlay of the hold procedure).

- Within the Full Options Appraisal section, we have provided operational diagrams which show the number of aircraft expected to fly the PBN procedures from the various broad arrival directions serving Aberdeen Airport.

Planned developments

4.1.10 As part of our preparation of the baseline, we have identified noise sensitive planned developments in the area surrounding Aberdeen Airport so that these can be incorporated as part of the appraisal of the benefits and impacts of each option. These developments have been identified through a search of the Aberdeen City Council and Aberdeenshire Council planning portals. The locations and details of the identified planned developments are shown in Figure 13 and Table 6 below.

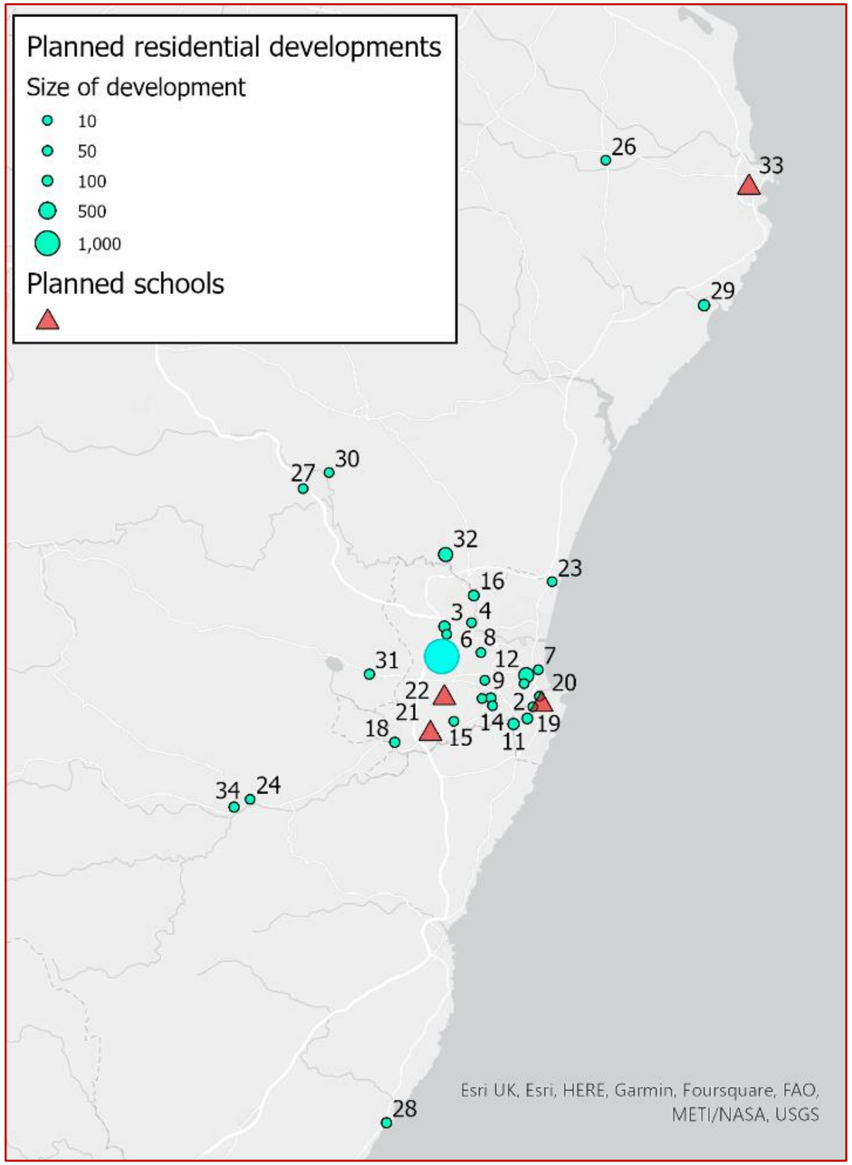

Figure 13: Planned Developments around Aberdeen Airport

Table 6 Planned developments around Aberdeen Airport

ID	Ref	Local Authority	Location	Type of Development	Size of Development	Latest Status (if known)	Further information
1	231300/DPP	Aberdeen City Council	Site Of Former Nursery Oscar Road Aberdeen AB11 8ER	Residential	20	Application Submitted	Project Website Aberdeen Live Article
2	230685/DPP	Aberdeen City Council	Banks O'Dee Nursing Home Abbotswell Road Aberdeen AB12 3AB	Residential	24	Application Submitted	
3		Aberdeen City Council	Craibstone Estate Aberdeen AB21 9YA	Residential	134	Application Submitted	CALA Website
4	230297/PPP	Aberdeen City Council	Waterton House Stoneywood Terrace Stoneywood Aberdeen AB21 9HX	Residential Plots	16	Application Submitted (March 2023)	
5	230275/DPP	Aberdeen City Council	Rear Of Amicable House 250/252 Union Street Aberdeen	Residential Flats	21 (9 stories)	Application Submitted (March 2023)	Urban Realm article
6	230173/PPP	Aberdeen City Council	Land At Greenferns Sites AB16 7RU & AB15 8TZ	Residential	1,650	Application submitted (Feb 2022)	Aberdeen CC article Project website
7	221074/DPP	Aberdeen City Council	56 Park Road Aberdeen AB24 5NY	Residential	29	Application Submitted (Aug 2022)	Review
8	221025/PPP	Aberdeen City Council	Northfield Parish Church Byron Crescent Aberdeen AB16 7EX	Residential - Flats	16	Application Submitted (Aug 2022)	Aberdeen Live Article
9	220990/PPP	Aberdeen City Council	Summerhill Parish Church Stronsay Drive Aberdeen AB15 6JL	Residential – Flats	14	Application Submitted	

ID	Ref	Local Authority	Location	Type of Development	Size of Development	Latest Status (if known)	Further information
10	211476/DPP	Aberdeen City Council	Former Bucksburn Nursing Home And Associated Land Newhills Road Aberdeen AB21 9SQ	Residential	19	Application Submitted	
11	231076/PAN	Aberdeen City Council	Land to south and west of deeside brae Aberdeen AB12 5UE	Residential	150	Proposal of Application Notice (August 2023)	
12	230514/DPP	Aberdeen City Council	John Street City Centre Aberdeen AB25 1LE	Residential - Purpose Built Student Accommodation (PBSA)	383	Approved (Sept 2023)	
13	211528/DPP	Aberdeen City Council	Site Of Former Treetops Hotel 161 Springfield Road Aberdeen AB15 7SA	Residential	44 (Houses) 33 (flats)	Approved (June 2023)	
14	221310/DPP	Aberdeen City Council	Former Braeside Primary School Braeside Place Aberdeen AB15 7TX	Residential	30	Approved (June 2023)	
15	220211/DPP	Aberdeen City Council	Carnoc Whithom Cairnlee Road, Aberdeen	Residential	20	Approved (Nov 2023)	
16	221232/DPP	Aberdeen City Council	Site Of Former Cordyce School Riverview Drive Dyce Aberdeen	Residential	91	Approved (Aug 2023)	
17	211773/DPP	Aberdeen City Council	Area F3, Pinewood. Site Adjacent to Countesswells Road	Residential	17	Approved (Feb 2023)	
18	190314/PP	Aberdeen City Council	Site OP51 Off Cornyhaugh Road Peterculter	Residential	44	Approved (Sept 2022)	
19	N/A	Aberdeen City Council	Kincorth	Residential	99	In development (July 2023)	News Article
20	N/A	Aberdeen City Council	Tullos Cir, Aberdeen AB11 8HD	New School	-	Open	News Article

ID	Ref	Local Authority	Location	Type of Development	Size of Development	Latest Status (if known)	Further information
21		Aberdeen City Council	Agricola St, Milltimber AB13 0BF	New School	•	Open (May 2022)	News Article
22		Aberdeen City Council	Wisely Pl, Aberdeen AB15 8NF	New School	•	Open (April 2023)	News Article
23	APP/2022/2672	Aberdeenshire Council	OP 1 Site Land to the East Of Blackdog Industrial Estate Blackdog Aberdeenshire	Residential	32	Approved (April 2023)	Project Website
24	APP/2022/2529	Aberdeenshire Council	Land To East of Woodend Barn Arts Centre Banchory AB31 5QA	Residential	14	Approved (August 2023)	
25	APP/2022/2408	Aberdeenshire Council	Plots 80, 81, 86, 92, 93, 94, 95, 96, 97 And 87 Site At Phase 5 Crichie Meadows Stuartfield AB43 7EJ	Residential	10	Approved (December 2023)	Project Website
26	APP/2022/2282	Aberdeenshire Council	Phase 1E - OP1 Nether Aden Mintlaw Peterhead Aberdeenshire AB42 5BT	Residential	33	Approved (March 2023)	Project Website
27	APP/2022/2169	Aberdeenshire Council	Westgate South Residential Development Blackhall Road Inverurie AB51 5QF	Residential	6 (Houses) 4 (Flats)	Approved (September 2023)	Project Website
28	APP/2022/2125	Aberdeenshire Council	Land To East of Brae Road Gourdon DD10 0LX	Residential	49	Approved (September 2023)	Project Website
29	APP/2022/2058	Aberdeenshire Council	OP1 Site Nethermill Cruden Bay Aberdeenshire AB42 0AD	Residential	123	Approved (May 2023)	Project Website

ID	Ref	Local Authority	Location	Type of Development	Size of Development	Latest Status (if known)	Further information
30	APP/2023/0480	Aberdeenshire Council	Site At Uryside Phase 2 Osprey Heights Development Oldmeldrum Road Inverurie Aberdeenshire AB51 6BB	Residential	17	Approved (July 2023)	Project Website
31	APP/2022/1062	Aberdeenshire Council	Land To the North of Burnland Park and South of Straik Road Elrick Westhill AB32 6AE	Residential	50	Approved (April 2023)	Project Website
32	APP/2022/1636	Aberdeenshire Council	Land West of Hillbrae Way Newmachar Aberdeenshir *AB21 0JN*	Residential	323	Approved (August 2023)	
33	APP/2023/1660	Aberdeenshire Council	Land At Kinmundy Sports Ground Kinmundy Road Peterhead Aberdeenshire	Leisure Facilities and School	NA	Application Submitted	Project Website
34	APP/2023/0908	Aberdeenshire Council	Land To Northwest of Hill of Banchory Upper Lochton Banchory Aberdeenshire AB31 5UF	Residential	78	Application Submitted	News Article
35	APP/2023/0562	Aberdeenshire Council	Land To the North of Cairn Close Memsie Fraserburgh AB43 7FE	Residential	35	Application Submitted	Project Website

4.2 Full Options Appraisal methodology

4.2.1 At Stage 3A, CAP1616 requires sponsors to carry out a full assessment of the benefits and impacts of each option, tested against the 'do nothing' baseline scenario. The purpose of this appraisal is to highlight the change to sponsors, stakeholders and the CAA, and set out the relative differences between the impacts, both positive and negative, of each option.

Full Options Appraisal methodology

4.2.2 Our assessment criteria shown in Table 7 below have been categorised based on the example in CAP1616 Appendix E, however we have added an additional category called 'Airspace Modernisation Strategy' to assess the options against the aims and objectives of the AMS. We will follow this table structure across the appraisal of all of our options. The table below also presents the FOA methodology that will be followed. This methodology will be used to compare the airspace change options against the baseline.

Table 7 FOA assessment criteria and methodology

Group	Impact	Level of analysis
Communities	Noise impact on health and quality of life	Quantitative

Noise:
A quantitative assessment of changes to noise impacts compared with the 'do nothing' baseline. The noise assessment has been undertaken using CAP1616 primary and secondary noise metrics. CAP1616 (B54) explains: *When considering noise impacts, the CAA will weight the outcomes from 'primary' metrics over 'secondary' metrics. Primary metrics will be those that are used to quantify significant noise impacts, such as WebTAG outputs. Secondary metrics will be those that are not being used to determine significant impacts but which are still able to convey noise effects, such as N65 contours and Lmax levels. While not a noise metric, overflight contours will be a secondary metric for the purposes of decision-making.*

The following subsections describe these noise metrics.

Primary noise metrics: Total adverse effects on people
Adverse effects related to health and quality of life are assessed using a risk-based approach above the 51dB $L_{Aeq,16hr}$ daytime and 45dB $L_{Aeq,8hr}$ night-time lowest observable adverse effect level (LOAEL). The total adverse effects of noise on people is determined using the Department for Transport's suite of TAG tools, specifically the TAG noise workbook - aviation. The TAG noise assessment calculates monetised values for different health outcomes from changes in L_{Aeq} noise exposure. As per CAA guidance, changes below the LOAEL (51dB $L_{Aeq,16hr}$ daytime and 45dB $L_{Aeq,8hr}$ night-time) have not been included in the TAG assessment.

TAG assessments have been conducted for each option as part of this Full Options Appraisal and are presented as an overall net present value (NPV, £) along with NPVs for different health effects.

Primary noise metrics: L_{Aeq} contours
L_{Aeq} contours are the equivalent sound level of aircraft noise in dBA. This is based on the daily average movements that take place in the 16-hour period (07:00-23:00 local time) or 8-hour period (23:00-07:00) during the 92-day period 16 June to 15 September inclusive. This metric is the measure of noise exposure adopted by Government for the purposes of considering adverse effects from aircraft noise. It forms the basis of the Government's policies in relation to aircraft noise. The contours are generated based on all arrivals and departures to/from Aberdeen Airport.

L_{Aeq} contours have been generated in 3dB intervals from 51dB $L_{Aeq,16hr}$ and 45dB $L_{Aeq,8hr}$ for the baseline and for each option as part of this Full Options Appraisal. The 55dB $L_{Aeq,8hr}$ is also reported as this represents the night-time Significant Observed Adverse Effect Level (SOAEL).

Secondary noise metrics: noise events above 65dB and 60 dB L_{Amax} (N65 and N60)
N60 and N65 are noise metrics which respectively describe the number (N) of aircraft noise events above a noise level of 60dB L_{Amax} in the night-time period and 65dB L_{Amax} for the daytime period. These are event-based metrics, which can be used to better understand the number of noise events that occur and their location.

N65 and N60 contours ranging from 5 events have been generated for the baseline and for each option as part of this Full Options Appraisal.

Secondary noise metrics: overflight contours
Overflight contours are generated using the CAA's 48.5 degree definition of overflight as outline in CAP1498, this means 'an aircraft in flight passing an observer at an elevation angle of 48.5˚ from the ground at an altitude below 7000ft'.

Overflight contours for flights below 7000ft ranging from 5 events have been generated for the baseline and for each option as part of this Full Options Appraisal. Although overflight contours are not considered a noise metric, they do enable calculation of the number of times a location may be considered to be overflown. This is an event-based metric, which can be used to better understand the number of noise events that occur and their location.

Colour coding of noise data results
Within this FOA document, the outcomes of the noise analysis have been compared against the baseline, and a comparison table provided (full data tables are available in technical Appendix A). The results have been colour coded whereby any improvements against the baseline are green, and disbenefits are red, and any results the same as the baseline are neutral (grey).

The colour coding helps identify where options perform differently from the baseline however it is very important to consider this colour coding does not account for the scale of the changes which in most cases are very small differences between the option and the baseline.

CAP2091 and noise modelling methodology
Noise modelling for this Full Options Appraisal has been conducted in accordance with the guidance outlined in CAP1616a and the minimum standards for noise modelling mandated in CAP2091[5]. Around 40% of the Aberdeen fleet are helicopters, with around 1% of helicopter arrivals using the new PBN routes. Considering this, helicopter noise has been included as part of the noise modelling.

As previously agreed through engagement with the CAA, all noise modelling has been conducted to meet CAP2091 'Category C' requirements. This has subsequently been confirmed based on the population within the LOAEL contours produced for this Full Options Appraisal. Consequently, the noise models include:

[5] CAP2091: CAA Policy on Minimum Standards for Noise Modelling

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Group	Impact	Level of analysis

- Flight profiles incorporating adjustments in altitudes, speeds, climb rates, and approach angles based on local track-keeping data for major aircraft types.
- Arrival and departure track centrelines determined from local track-keeping data.
- Dispersion around the track centrelines derived from local track-keeping data.

All noise modelling has been conducted using the Federal Aviation Administration's (FAA) Aviation Environmental Design Tool (AEDT) version 3e. AEDT is identified in CAP1616a as a “recognised and validated noise model”. The methodologies for noise, aircraft flight profile, and flight path computation in AEDT 3e adhere to the standards set by the European Civil Aviation Conference (ECAC) Doc 29 (4th Edition)[6] and the International Civil Aviation Organization (ICAO) Doc 9911 (2nd Edition)[7]. AEDT is also compatible with Commission Directive (EU) 2020/367 as the Directive mirrors the calculation method set out in ECAC Doc 29.

The fixed-wing Noise-Power-Distance (NPD) data utilised in AEDT 3e, which is the basis of the AEDT noise calculation method, is derived from the Aircraft Noise and Performance (ANP) Database v2.3. Additionally, AEDT incorporates data for 26 helicopter models, accompanied by a list of recommended substitutions for helicopters not covered in the database. However, these helicopters do not form part of the ANP database. Following engagement with the CAA, it has been advised that the CAA considers the CNOSSOS-EU[8] approach and the helicopter data contained in EU Directive 2020/367 Appendix I as best practice for the calculation of helicopter noise.

EU Directive 2020/367 specifies that, for helicopter noise calculation, the same method used for fixed-wing aircraft may be applied, with the condition that helicopters are treated as propeller aircraft, and engine-installation effects associated with jet aircraft are not included in the calculation. The helicopter data in EU Directive 2020/367 Appendix I, encompassing NPD curves, profiles, and spectral classes, has been integrated into AEDT for the assessment of helicopter noise around Aberdeen Airport. All helicopter-specific corrections, including directivity and advancing tip mach number corrections, have been disabled in the model, rendering the AEDT helicopter calculation method equivalent to the CNOSSOS-EU approach.

The aircraft types, numbers of movements, track usage, and temporal distribution of operations used in the model have been derived from the 92-day summer period of the forecasts described in Section 4.1. The generic helicopter data in EU Directive 2020/367 Appendix I is categorised in terms of the maximum take-off weight, which has been used to assign each helicopter type in the forecasts to one of the five generic helicopter classes.

All fixed-wing noise modelling has been produced for a 10-year average fixed-wing modal split of 60% westerly and 40% easterly. This 10-year average fixed-wing modal split has been derived from annual (365 days) modal split data from 2013 to 2022. Annual data has been used to provide a long-term average as long-term 92-day modal split data is not currently available. However, the 10-year average modal split has been checked against the last three years’ 92-day summer modal splits which are readily available (2021 – 2023) and the difference between the 10-year annual average and the 3-year 92-day summer average is less than 1%. Given the very limited nature of the noise impact between airspace options, and the fact that more long-term data is available for the annual average, it is considered appropriate and proportionate to use the 10-year annual average for fixed wing noise modelling.

Due to the unavailability of historic runway use data for helicopters, the models reflect helicopter runway use during the 92-day summer 2022 period.

Terrain adjustments have been included in the noise calculations using the OS Terrain 50 product. As per the guidance in CAP1616a, these adjustments are limited to geometrical corrections for aircraft-receiver distances and elevation angles.

In accordance with CAP2091, under Category C, aircraft flight profiles are adjusted based on the standard ICAO dataset for the primary noise-dominant aircraft types, covering over 75 percent of the total noise energy produced at the airport. The identification of the main noise-dominant aircraft types has been derived from the quota count (QC) values of the airport fleet and the 92-day summer 2022 flight schedule. Notably, helicopters are the main contributor to the airport's total QC. Among fixed-wing aircraft, the top ten contributors account for 85% of the total fixed-wing QC and therefore exceed the requirement to cover over 75% of the total noise energy.

The figure below shows the cumulative percentage of total QC by aircraft type – the red box indicates the primary noise-dominant fixed-wing aircraft types identified. Flight profiles for these ten fixed-wing aircraft, along with all helicopters, have been modified to align with Category C requirements.

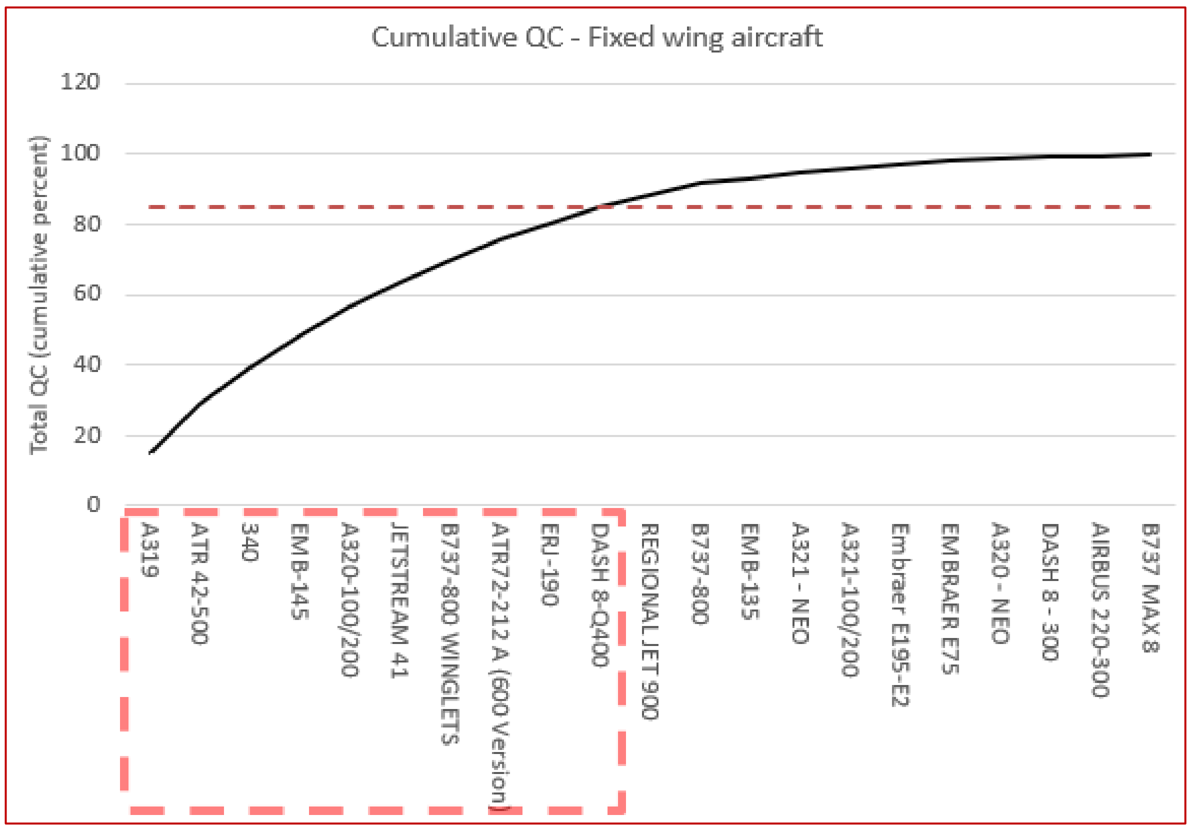

Figure 14:Primary noise-dominant aircraft types based on total QC

The flight profiles for the primary noise-dominant aircraft types have been adjusted to match the average vertical profile for each aircraft type. The average profiles have been calculated through analysis of Aberdeen Airport's track-keeping data over the 92-day summer 2022 period (16 June 2022 to 15 September 2022). Adjustments have been made to the aircraft take-off weight, flap settings, climb rates, and airspeeds, utilising the closest matching standard ICAO profile for each aircraft as a starting point. Separate profiles have been created for different aircraft stage lengths. An example of a modified profile created for

[6] European Civil Aviation Conference (2016). ECAC Doc 29 Report on Standard Method of Computing Noise Contours Around Civil Airports.
[7] ICAO Doc 9911, “Recommended Method for Computing Noise Contours around Airports”, Second edition, 2018.
[8] https://op.europa.eu/en/publication-detail/-/publication/80bca144-bd3a-46fb-8beb-47e16ab603db

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Group	Impact	Level of analysis

a Saab 340 aircraft, compared to the calculated average profile and the standard ICAO profile, is shown in Figure 15 below. This demonstrates that the modified profile closely matches the average profile from track-keeping data and represents a substantial improvement compared to the standard ICAO profile.

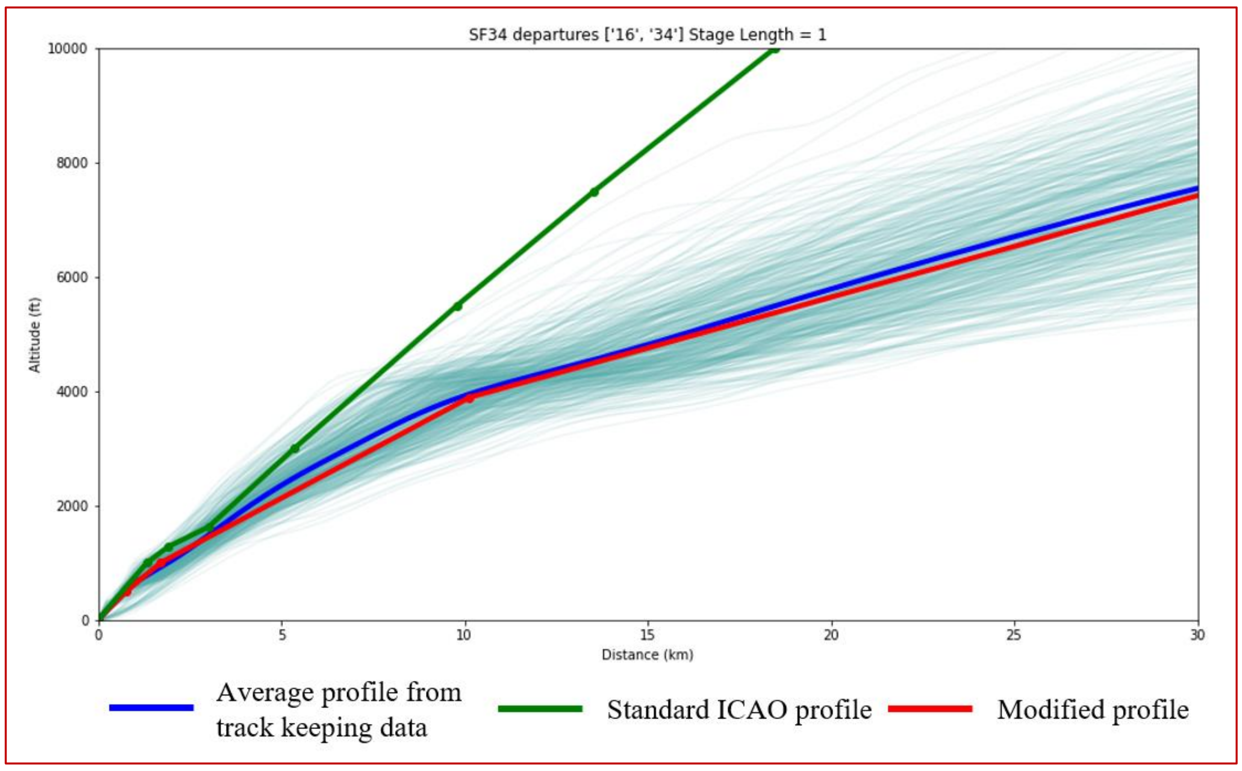

Figure 15 Modified flight profile for a Saab 340 aircraft

Departure and arrival centrelines, along with the typical lateral dispersion around the centrelines, have been calculated from Aberdeen Airport's track-keeping data during the 92-day summer 2022 period. Lateral dispersion in the noise model is represented by up to four subtracks on either side of the track centreline. The centrelines and dispersed subtracks have been programmatically calculated using BridgeNet International's Volans software via the following method.

Using the runway orientation as an initial guide, a perpendicular 'gate' is formed at a user specified offset from the end of the runway. 'Gate penetrations' by each flight track through the gate are computed and statistical computations are formed to generate a new heading, based upon the distribution of penetration offsets from the gate centre point and the prior gate centre. This process is then repeated for a user-specified number of nautical miles, generating a "back-bone" Nominal Track. Processing parameters allow the user to specify gate width, gate width growth, and outlier rejection metrics as the algorithm progresses. Once a back-bone track has been established, another pass through the flight tracks is performed to compute sub-tracks. Based on the user-specified number of desired sub-tracks, a statistical distribution of gate penetrations is computed, and each track is assigned to a sub-track. A single representative nominal sub-track is then formed using all flight tracks within a given sub-track.

Where the track data has not been sufficiently uniform to programmatically generate a track centreline (i.e. in situations where multiple tracks intersect each other), the centreline has been drawn manually based on the density of tracks. Operations have been distributed across the subtracks based on a normal distribution. The figures below show the calculated centrelines (solid lines) and dispersed subtracks (white dashed lines), overlayed against the summer 2022 track-keeping data (transparent lines).

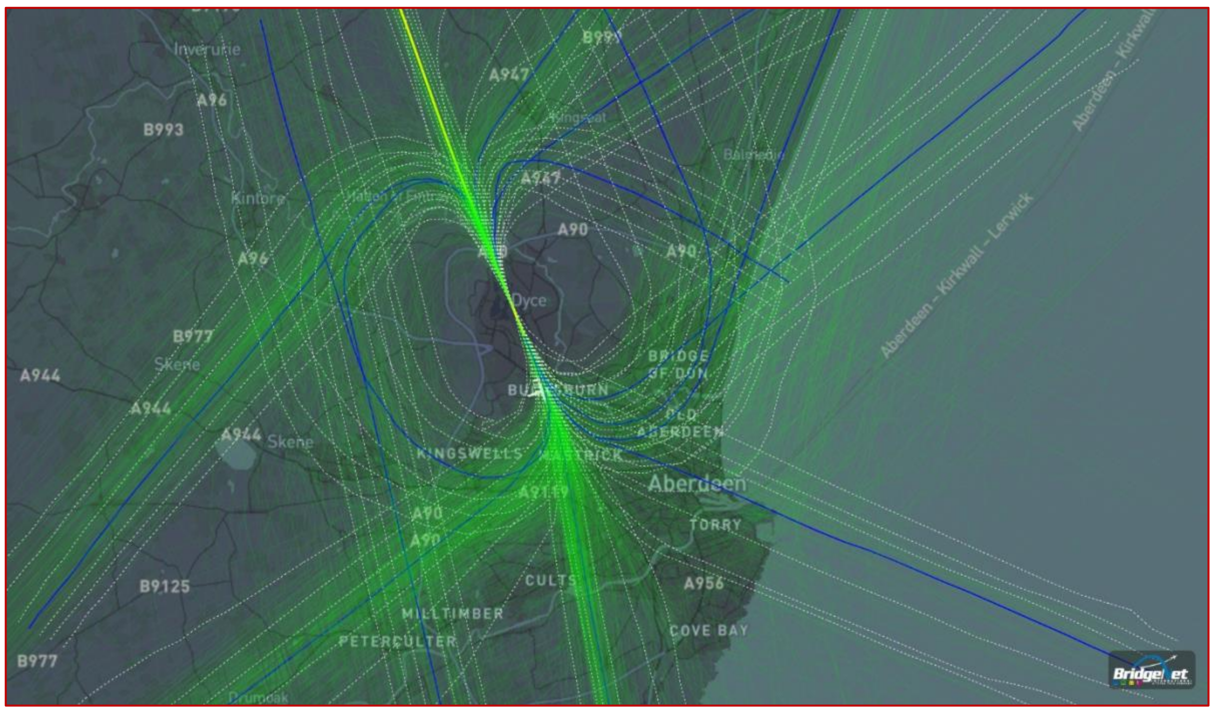

Figure 16 Fixed wing departure track centrelines

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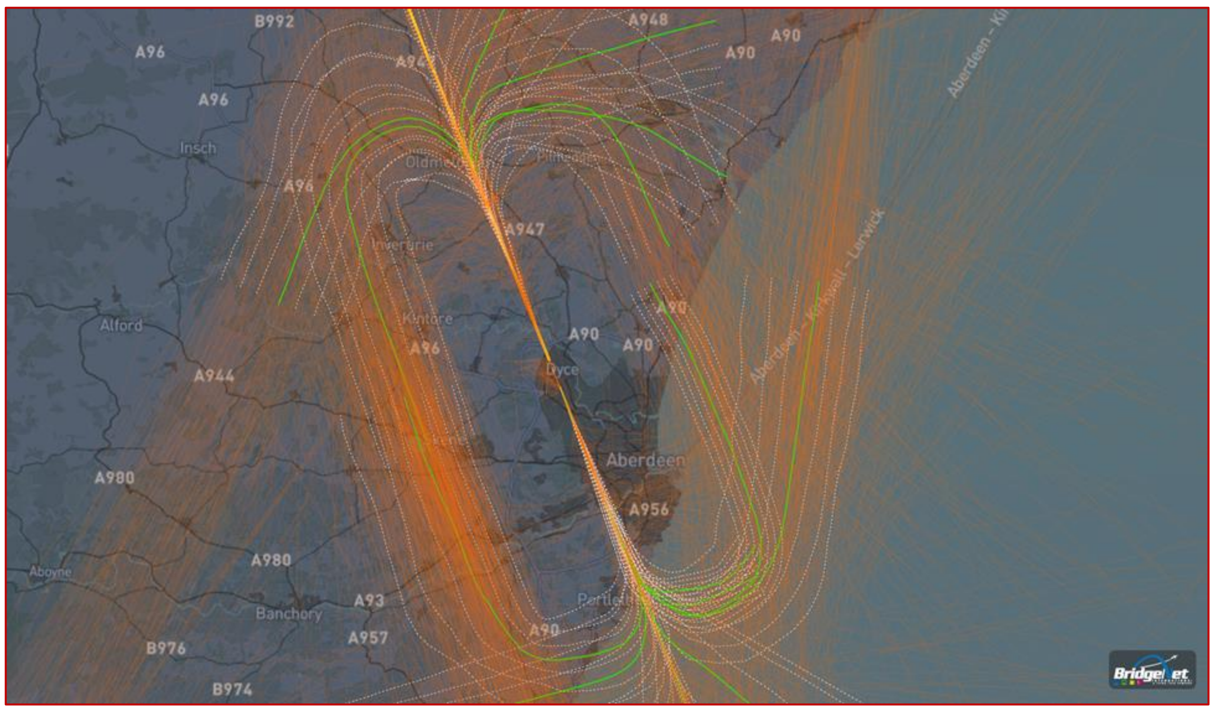

Figure 17 Fixed wing arrival track centrelines

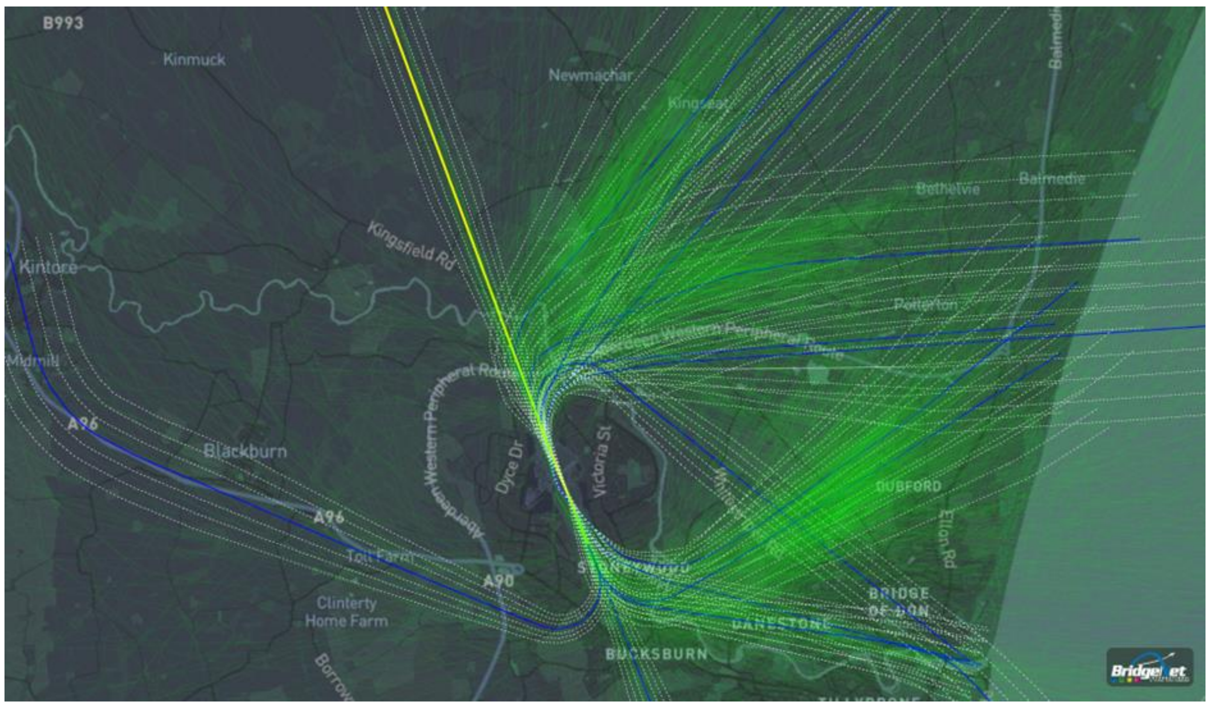

Figure 18 Helicopter departure track centrelines

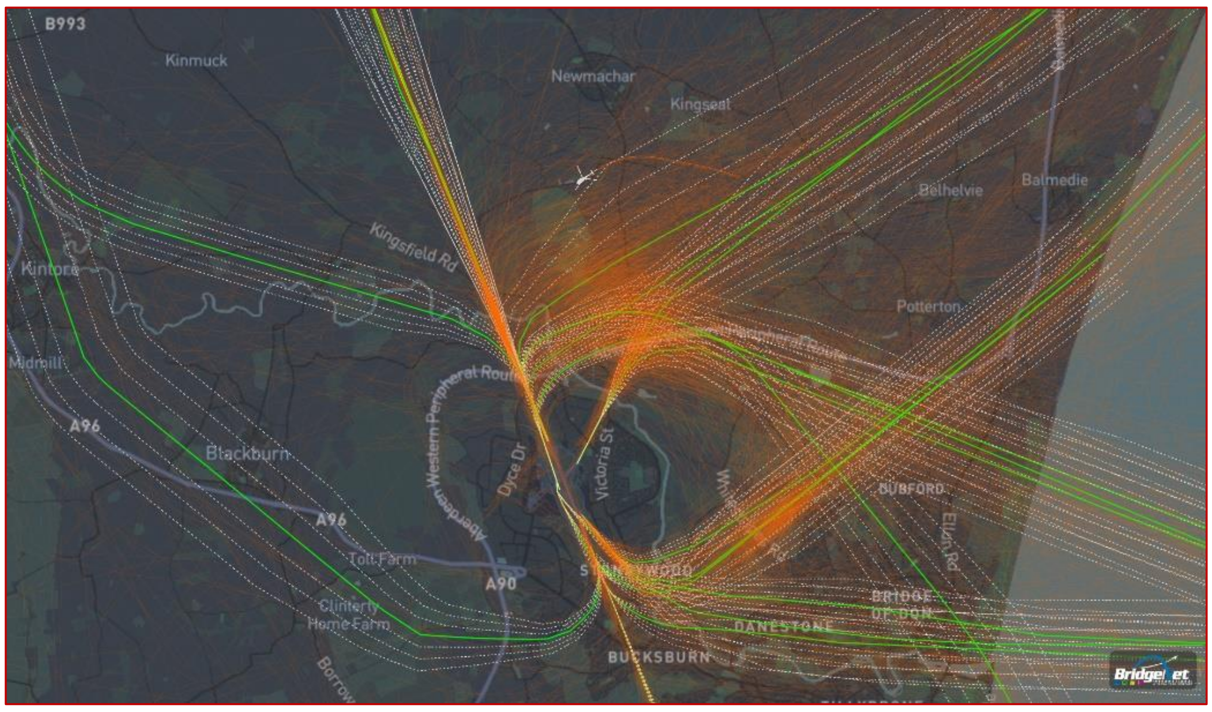

Figure 19 Helicopter arrival track centrelines

Lateral dispersion assumptions for the new PBN approaches are a conservative estimate based on professional judgement, informed by track data for two airports with RNAV1 SIDS. Whilst this is not necessarily a direct correlation to PBN approaches and there is an absence of RF data, it has been used to help inform expected dispersion. This corresponds to a maximum dispersion of +/- 0.5 nm for fly-by turns, +/- 0.3 nm for RF curves, and +/- 0.1 nm on straight segments including final approach.

Considering the above adjustments, it is considered that the modelling undertaken meets the requirements of CAP2091 Category C and the guidance set out in CAP1616a.

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Group	Impact	Level of analysis

Meteorological data for the modelling has been sourced from historic METAR data for Aberdeen Airport (accessed via the Iowa Environmental Mesonet). Meteorological conditions (temperature, relative humidity, pressure, sea level pressure, and wind speed) have been included in the noise calculations as a 10-year average over the 92-day summer period.

L_{Aeq} contours have been calculated over a 100m x 100m regularly spaced grid of receivers at a height of 1.2m from local ground level, as per the guidance on the use of AEDT contained in CAP1616a. Due to the wider spatial extent of the N65 and N60 contours, these have been calculated over a 200m x 200m regularly spaced grid of receivers at a height of 1.2m from local ground level.

CAP1498 overflights
Overflights have been calculated for all aircraft operations below 7000ft. The same CAP2091 Category C standards used for the noise modelling described in the previous section have been applied in the calculation of overflights including modified flight profiles for the primary noise-dominant aircraft types, lateral dispersion, and terrain adjustments. As recommended in CAP1616a, a threshold angle of 48.5° has been used in the calculation of overflights. Overflight contours have been calculated over a 200m x 200m regularly spaced grid of receivers at a height of 1.2m from local ground level.

Additional noise metrics
CAP1616 outlines several "additional optional noise metrics" for explaining and portraying noise impacts to affected communities. The metrics include 100% mode L_{Aeq} contours and difference contours. As all changes occur outside the LOAEL contour, these additional metrics have not been incorporated into the assessment as they do not offer additional insights into noise impacts. Considering that there are no material differences between the options in terms of noise impacts, this is considered proportionate to the likely noise effects of the change under consideration [CAP1616 B4].

Population and noise sensitive building counts
Population counts within the calculated noise contours have been generated from the latest 2023 population data supplied by CACI Ltd. This data has been supplemented with the planned residential developments described in Section 0. A population per dwelling of 2.19 (calculated from the CACI dataset) has been applied to each of the planned developments to estimate the number of individuals in each development.

Counts of non-residential noise sensitive buildings within the calculated noise contours have been generated from the latest 2023 PointX data. The PointX classification codes included in the assessment are shown in the table below and cover schools, hospitals, care homes, and places of worship. This data has been supplemented with the planned non-residential developments described in Section 3.1.5.

PointX classification code	Description	Noise sensitive building type
05310375	First, primary and infant schools	School
05310376	Further education establishments	
05310377	Independent and preparatory schools	
05310379	Broad age range and secondary state schools	
05310380	Special schools and colleges	
05310381	Higher education establishments	
05310382	Unspecified and other schools	
05310801	Pupil Referral Units	
05280780	Accident and Emergency hospitals	Hospital
05280371	Hospitals	
05280373	Nursing and residential care homes	Care home
06340459	Places of worship	Places of worship

Table 8 Noise sensitive building types considered in the assessment

TAG assessment
The November 2023 version of the TAG noise workbook - aviation has been used to calculate monetised noise impacts. $L_{Aeq,16hr}$ and $L_{Aeq,8hr}$ has been calculated at individual population receptors at a height of 1.2m from local ground level directly for the baseline and for each airspace change option. The number of individuals experiencing an increase or decrease in L_{Aeq} with airspace change and without airspace change for year 1 and year 10 have been input into the workbook in 1dB bands. As per CAA guidance, changes below the lowest observed adverse effect level (LOAEL) (51dB $L_{Aeq,16hr}$ daytime and 45dB $L_{Aeq,8hr}$ night-time) have not been input into the workbook. This assessment method in the workbook has been set to 'individual' and appraisal period has been set to 10-year. Monetised values have been output in 2010 prices for consistency with the example presented in CAP1616a.

Communities	Tranquillity	Quantitative

CAP1616 states that "*explicit consideration of any changes to routes and/or traffic patterns that may affect either an Area of Outstanding Natural Beauty (AONB)*[9] *or a National Park, with specific regard to impacts upon tranquillity*". In the context of this ACP, there are no National Parks or National Scenic Areas (NSAs) within the scope of the proposed changes. The closest national park, the Cairngorms, is overflown at altitudes above 7000ft. This has been verified using the Scottish Government's catalogue of spatial data.

CAP1616 further states that impacts on "*any locally identified 'tranquil' areas that are identified through community engagement and are subsequently reflected within an airspace change proposal's design principles*" must be considered. Aberdeen Planning Guidance 2023: Noise identifies several Candidate Quiet Areas (CQA) and the Scottish Government's catalogue of spatial data provides information on the locations of country parks, regional parks, gardens and designated landscapes. The potential impacts on these areas have been evaluated by calculating the total number of unique areas within the L_{Aeq}, N_x, and overflights below 7000ft contours, as well as the total area (in km²) intersected by these contours.

[9] National Scenic Areas (NSA) in Scotland

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Group	Impact	Level of analysis
Communities	Biodiversity	Quantitative

Habitats Regulations Assessment (HRA) screening

An early screening assessment has been undertaken to determine whether a Habitats Regulations Assessment (HRA) is required as part of the Aberdeen Airport airspace change proposal.

CAP2527[10] provides a Habitats Regulations screening assessment of European Sites potentially affected by the Airspace Change Masterplan[11].. The report establishes a precautionary Zone of Influence (ZoI)[12] with a radius of 18km from each airport boundary in the Masterplan. This radius is based on the potential impacts listed below and the conservative assumption that all aircraft, whether departing or arriving, will be at altitudes greater than 3,000ft at distances greater than 18km from the airfield. A justification for the ZoI for each of the impacts is provided in CAP2527.

- Increases in the atmospheric concentration and deposition of nitrogen (18km ZoI);
- Aircraft collision with wildlife (birds and bats) (13km ZoI); and,
- Presence of aircraft / aircraft noise (18km ZoI).

The table below details the six European Sites within the CAP2527 precautionary ZoI for Aberdeen Airport.

Table 9 European Sites within the Aberdeen Airport ZoI

European site	Distance from airport
Loch of Skene Ramsar	9.4km
Loch of Skene SPA	9.4km
Red Moss of Netherley SAC	16.8km
River Dee SAC	8.5km
Sands of Forvie SAC	16.4km
Ythan Estuary, Sands of Forvie and Meikle Loch SPA	7.2km

The figure to the right shows the European Sites within the CAP2527 ZoI (dashed red line) and the proposed airspace change options (solid black lines). Of the six European Sites, only the River Dee SAC is overflown by the airspace change options within the ZoI and below 3000ft.

The airspace design options overflying the River Dee SAC are all on final approach. This means that, compared to the baseline situation, the options under consideration in this Full Options Appraisal:

- will not increase the number of aircraft movements overflying any European Site below 3000ft;
- will not change the altitude of aircraft overflying any European Site below 3000ft; and,
- will not change the lateral dispersion of aircraft overflying any European Site below 3000ft.

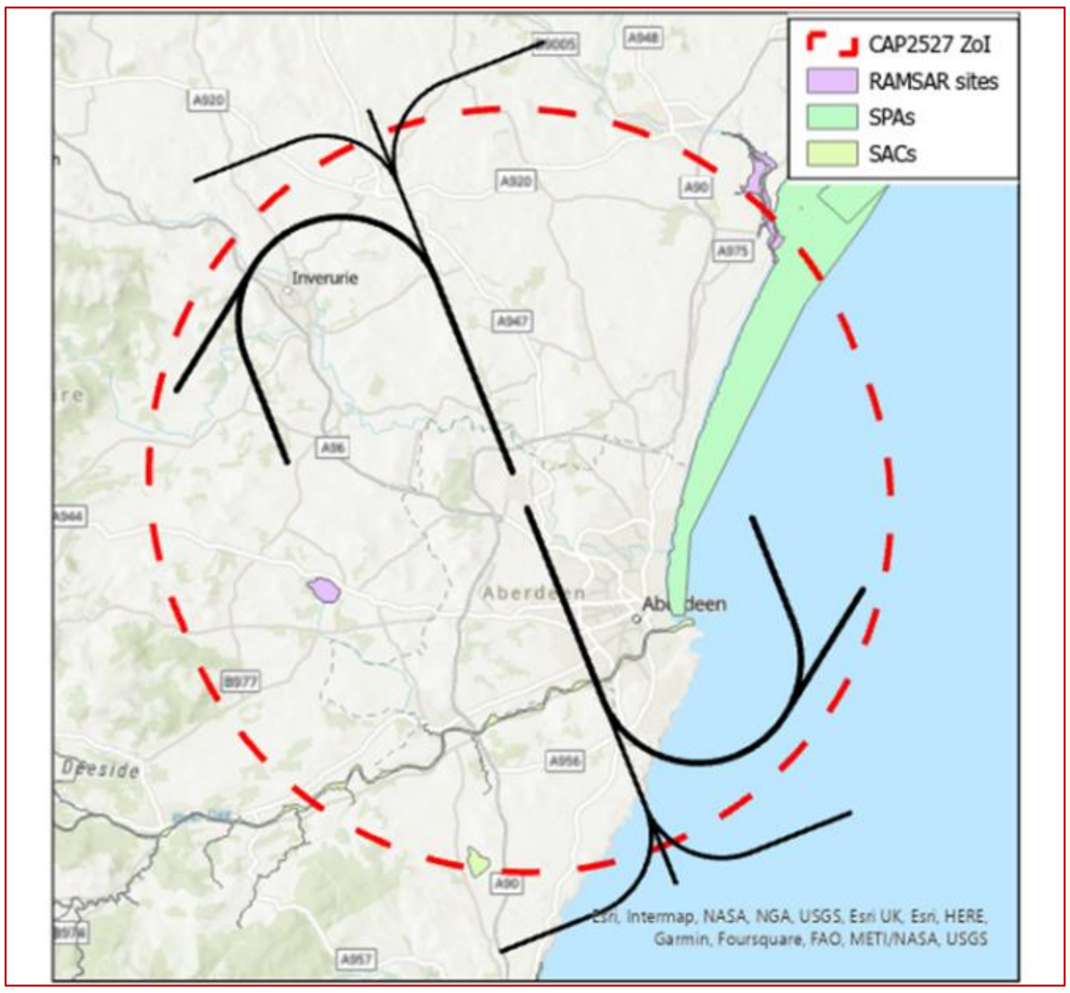

Figure 20 European Sites within the Aberdeen Airport ZoI

Considering that the options result in no change to air traffic movements overflying any European Site below 3000ft compared to the baseline situation, a Habitats Regulations Assessment can be screened out.

Communities	Air quality	Qualitative

CAP 1616a Airspace Change: Environmental requirements technical annex (para 1.96 and 1.97) states: "*Due to the effects of mixing and dispersion, emissions from aircraft above 1,000 feet are unlikely to have a significant impact on local air quality. Therefore, the impact of airspace design on local air quality is generally negligible compared to changes in the volume of air traffic, and local transport infrastructures feeding the airport. However, airspace change sponsors must include consideration of whether local air quality could be impacted when assessing airspace change proposals.*

Change sponsors must produce information on local air quality impacts only where there is the possibility of pollutants breaching legal limits following the implementation of an airspace change (or worsening an existing breach of legal limits). The CAA deems that this is only likely to become a possibility where:

- *there is likely to a change in aviation emissions (by volume or location) below 1,000 feet, and*
- *the location of the emissions is within or adjacent to an identified AQMA."*

For arrivals, aircraft are at or below 1000ft when they are aligned with the final approach track and therefore there are no lateral changes to aviation emissions for any of the options. As the ACP does not seek to increase capacity for Aberdeen, there will be no change to the volume of Aviation Emissions.

For the purposes of the FOA therefore a qualitative statement has been made around air quality.

Wider Society	Greenhouse gas impact	Quantitative

Fuel burn for fixed wing aircraft has been calculated using the Aviation Environmental Design Tool (AEDT) version 3e. For fixed wing aircraft, AEDT calculates the fuel consumed over each flight path segment using the Base of Aircraft Data (BADA) version 3.15 model and the Senzig-Fleming-Iovinelli (SFI) method[13]. However, unlike fixed wing aircraft, helicopters lack internationally accepted fuel burn calculation methods. Aberdeen Airport has provided fuel usage data for an S92 helicopter across various phases of departure and approach procedures. This data includes fuel burn for take-off, initial climb (up to 450m), climb-out (450-1000m), approach, holding, and landing procedures, along with the duration the helicopter operates in each phase. In total, the fuel burn data covers a duration of 350 seconds for departure operations and 540 seconds for arrival operations. Based on radar data from the 92-day summer 2022 period, these

[10] CAA (2023) CAP2527 Airspace Change Masterplan: Habitats Regulations Screening Report

[11] At the time of publication, Aberdeen airport was part of the Airspace Change Masterplan. Aberdeen's ACP has subsequently been de-coupled from the masterplan because the proposal no longer has interdependencies with the NERL ACP for the airspace above 7000ft

[12] The Chartered Institute of Ecology and Environmental Management (CIEEM) defines a ZoI as "the area over which ecological features may be affected by biophysical changes as a result of the proposed project and associated activities".

[13] FAA (2022). Aviation Environmental Design Tool (AEDT) Version 3e Technical Manual.

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Group	Impact	Level of analysis

durations encompass approximately the first 22.3km of departure operations (see Figure 21) and the final 31.4km of arrival operations (see Figure 22). Assessing helicopter fuel burn using data from a single helicopter type and the operational modes covered is considered a proportionate approach for this ACP. This is because beyond this distance, the differences between existing and future tracks are minimal, there's no anticipated change in the number of helicopter operations between assessment years, and the total number of helicopters expected to fly the new routes is small (approximately 1% of helicopter arrivals will use the new routes, resulting in a change in overall helicopter track miles flown of around 0.1%).

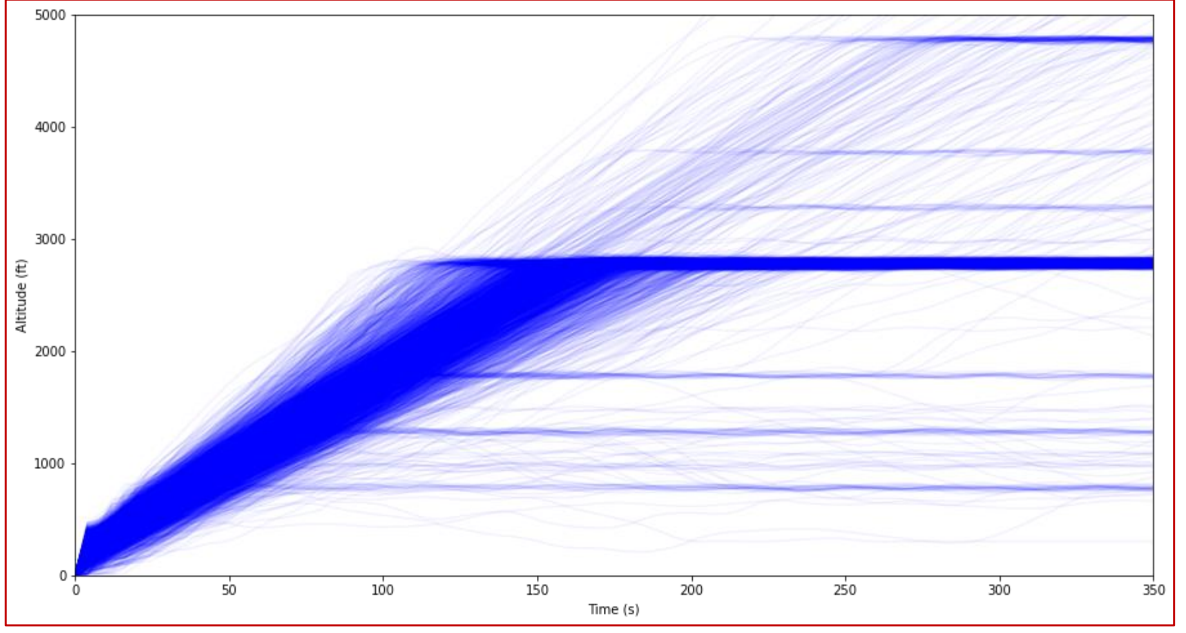

Figure 21 Altitude profile of helicopter departures as a function of time over the 92-day summer 2022 period.

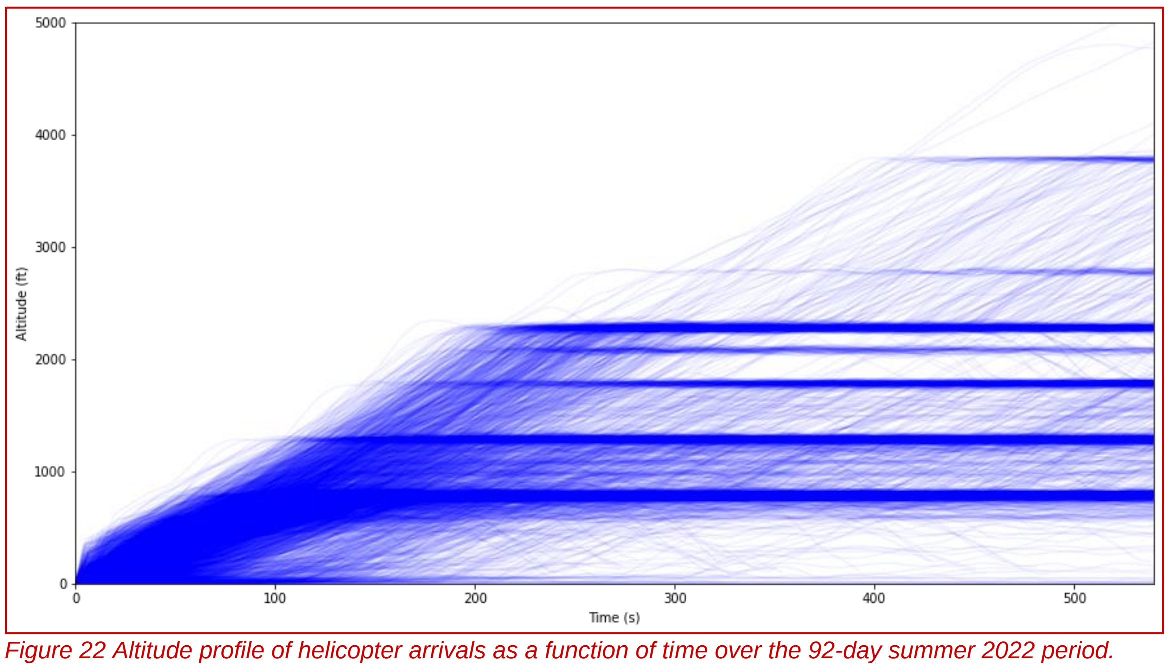

Figure 22 Altitude profile of helicopter arrivals as a function of time over the 92-day summer 2022 period.

Model inputs, including aircraft types, the numbers of movements, and track usage were derived from the forecasts detailed in Section 0. Aircraft flight profiles have been sourced from the ANP v2.3 database. Aircraft types in the fuel burn modelling have been categorised into Aircraft Modelling Categories (MCATs), grouping similar types based on short/long haul, narrow/wide body, and the number and type of engines. The ADMS-Airport (air quality modelling software) user guide[14] serves as the reference for these categories (pg98-99 and Table 6.35).

Category	Description	Representative aircraft	Notes
A1	Medium / short range jet aircraft	E145 (Embraer ERJ-145)	Representative of all Embraer medium/short range aircraft
A2		A319 (Airbus A319)	Representative of all Airbus medium/short range aircraft
A3		B738 (Boeing 737-800)	Representative of all Boeing medium/short range aircraft
A4		CRJ9 (Bombardier CRJ900)	Representative of all other medium/short range aircraft
B	Business jet aircraft	C56X (Cessna 560X Citation Excel)	Representative of all other business jet aircraft
E1	Piston engine aircraft	C172 (Cessna 172 Skyhawk)	Representative of all Cessna and Piper piston engine aircraft
E3		P68 (Partenavia P68)	Representative of all other piston engine aircraft
F1	Turboprop engine aircraft	AT76 (ATR-72-600)	Representative of all ATR turboprop engine aircraft
F2		SF34 (Saab 340)	Representative of all Saab turboprop engine aircraft
F3		JS41 (BAe Jetstream 41)	Representative of all BAe and Bombardier turboprop engine aircraft
F5		BE20 (Hawker Beechcraft King Air 200)	Representative of all other turboprop engine aircraft

Departure and arrival centrelines for the baseline situation have been calculated from Aberdeen Airport's track-keeping data using BridgeNet International's Volans software (see the noise modelling methodology for further details). To ensure a like for like comparison between the different airspace change options

[14] Cambridge Environmental Research Consultants Ltd (2020). ADMS-Airport User Guide.

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<table>
<tr><th>Group</th><th>Impact</th><th>Level of analysis</th></tr>
<tr><td colspan="3">and the ‘do nothing’ scenarios, the existing and proposed track centrelines used in the greenhouse gas assessment have been extended to common endpoints in the network.

The mass of carbon dioxide equivalent in tonnes (tCO_2e) emitted for the do-nothing and three do-something options has been calculated by multiplying the mass (in tonnes) of kerosene burned during flight by a factor of 3.18 (tonnes of CO_2e / tonne of fuel), as set out in CAP1616a[15] (para 1.86). Throughout the report the term greenhouse gas emissions or GHG refers to carbon dioxide equivalent (CO_2e) emissions.

Since 2012, greenhouse gas emissions from domestic flights and flights departing and arriving at UK airports from the European Economic Area (EEA) and Gibraltar have been included in either the EU Emissions Trading System (ETS) or the UK ETS, following the exit of the UK from the European Union (EU) in 2021[16]. Therefore, greenhouse gas emissions have been categorised into ‘traded’, including those traded under the UK ETS, and the remainder categorised as ‘non-traded’, and includes those emissions associated with international flights that are not traded under the UK ETS.

In alignment with the Department for Energy Security and Net Zero (DESNZ) guidance on greenhouse gas emissions valuation[17], the change in emissions (from ’do nothing‘ to do-something) for each option has been valued using the TAG Greenhouse Gasses Workbook[18]. The TAG workbook[18] is an excel tool developed by the Department for Transport to calculate the monetised impacts of CO_2e assessments, among other environmental assessments, in appraisal schemes and utilises the carbon appraisal values derived from the TAG data book[19]. For the purposes of this assessment, the annual mass of CO_2e estimated to be released to the atmosphere has been linearly interpolated between the values derived for the opening year of 2026 and interim year of 2035.

Additionally, from 2024, all greenhouse gas emissions from international flights above 85% of the 2019 baseline will incur offsetting obligations under Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)[16]. Therefore, as previously agreed with the CAA, an additional TAG assessment has been undertaken for completeness that takes CORSIA traded emissions into account.

It should be noted that airport’s 2019 international flight emissions were not calculated using a detailed ‘bottom-up’ approach combining AGS reported flight numbers, aircraft fleet mix and destination information. Instead, a high-level estimate was made based on the fact that 2019 total aircraft movements at Aberdeen (91,284 ATMs[20]) were 23% higher than those in 2022 (74,083 ATMs). Hence the same ratio (23%) was applied to the airport’s 2022 international aviation emissions (463 tCO_2e) to estimate 2019 total international emissions (570 tCO_2e). The calculation assumes that the mix between domestic, EEA and international flights remains the same between 2022 to 2019. This method was deemed reasonable because international flights at Aberdeen represent approximately only 1% of all ATMs. The TAG methodology, otherwise, follows the method described in the previous paragraph. In this case, since non-traded emissions for the do-nothing scenario and do-something scenario options are capped at 85% of 2019 international emissions, with the remainder of the international emissions considered traded under CORSIA, the overall assessment score (£) is always zero since there is no change in non-traded emissions.</td></tr>
<tr><td>Wider society</td><td>Capacity/resilience</td><td>Qualitative</td></tr>
<tr><td colspan="3">The introduction of PBN arrivals at Aberdeen was prompted by the requirement to meet the Airspace Modernisation Strategy however they also provide resilience in the event of an ILS outage. Historic information suggests unplanned ILS outages are very rare (one unplanned event lasting 6 hours in the last 5 years), and planned maintenance is coordinated around quiet times of day to minimise impacts. The assessment will therefore qualitatively describe any benefits or impacts to resilience compared with the ‘do nothing’ baseline as it would not be proportionate to attempt to quantify the resilience benefit for such a small average outage per year. None of the options developed seek to increase capacity at the airport; the purpose of the change is to provide resilience and meet the requirements of the Airspace Modernisation Strategy.</td></tr>
<tr><td>General Aviation</td><td>Access</td><td>Quantitative and qualitative</td></tr>
<tr><td colspan="3">Within the PBN arrival option assessment, a qualitative assessment of changes to GA access to controlled airspace compared with the ‘do nothing’ baseline has been undertaken. This assessment considers whether each option has the potential to require more/less CAS, and/or affect existing helicopter routes.

CAS option 1 has been assessed independently of the other PBN arrival options. It could be applied to any of the three options or be deployed independently from them. This assessment includes the quantitative volume of CAS to be released compared to the baseline, alongside a qualitative assessment of the potential positive benefits and negative impacts of the option.</td></tr>
<tr><td>General Aviation/commercial airlines</td><td>Economic impact from increased effective capacity</td><td>Qualitative</td></tr>
<tr><td colspan="3">It is not intended that this Airspace Change will facilitate any future growth for the airport or offer any increased capacity; the purpose of the change is to provide resilience and meet the requirements of the Airspace Modernisation Strategy. With this in mind, a qualitative statement will be made around the options’ economic impact from capacity.</td></tr>
<tr><td>General Aviation/commercial airlines</td><td>Fuel burn</td><td>Quantitative</td></tr>
<tr><td colspan="3">Total fuel burn has been calculated using AEDT 3e using the same methodology as the greenhouse gas assessment. Fuel burn has been monetised based on a price of £636.60 per tonne. This value had been calculated from the IATA jet fuel price[21] of $824.35 per tonne and a currency conversion rate of 1USD = GBP0.79 from Reuters[22] (both as of 01/01/2024).</td></tr>
<tr><td>Commercial airlines</td><td>Training costs</td><td>Qualitative</td></tr>
<tr><td colspan="3">A qualitative assessment of changes to commercial airline training costs compared with the ‘do nothing’ baseline. RNP approach procedures are in regular use across the UK and globally and are part of ‘business as usual' for air transport pilots. There is therefore not anticipated to be any significant training costs for airlines and therefore a qualitative assessment has been undertaken.</td></tr>
<tr><td>Commercial airlines</td><td>Other costs</td><td>Qualitative</td></tr>
<tr><td colspan="3">A qualitative assessment of changes to other relevant commercial airline costs compared with the ‘do nothing' baseline. No other costs have been identified as a result of the options, and hence a qualitative statement has been made.</td></tr>
<tr><td>Airport/ANSP</td><td>Infrastructure costs</td><td>Quantitative</td></tr>
<tr><td colspan="3">A quantitative assessment of changes to ANSP infrastructure costs compared with the ‘do nothing’ baseline.</td></tr>
<tr><td>Airport/ANSP</td><td>Operational costs</td><td>Quantitative</td></tr>
</table>

[15] CAA (2020) CAP 1616a Airspace Change: Environmental requirements technical annex. Available at: https://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=8128
[16] Department for Transport (2023) TAG Unit A5.2: Aviation Appraisal. Available at: https://assets.publishing.service.gov.uk/media/655b76b2d03a8d000d07fcde/tag-unit-A5-2-aviation-appraisal.pdf
[17] Department for Energy Security and Net Zero (2023) Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal. Available at: https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal
[18] Department for Transport (2023) TAG: environmental impacts worksheets. Available at: https://www.gov.uk/government/publications/tag-environmental-impacts-worksheets
[19] Department for Transport (2023) TAG data book. Available at: https://www.gov.uk/government/publications/tag-data-book
[20] UK CAA (2023) UK airport data 2019. Available at: https://www.caa.co.uk/data-and-analysis/uk-aviation-market/airports/uk-airport-data/
[21] https://www.iata.org/en/publications/economics/fuel-monitor/
[22] https://www.reuters.com/markets/currencies/

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<table>
<tr><th>Group</th><th>Impact</th><th>Level of analysis</th></tr>
<tr><td colspan="3">A quantitative assessment of changes to ANSP operational costs compared with the ‘do nothing’ baseline.</td></tr>
<tr><td>Airport/ANSP</td><td>Deployment costs</td><td>Quantitative</td></tr>
<tr><td colspan="3">A quantitative assessment of ANSP deployment costs compared with the ‘do nothing’ baseline.</td></tr>
<tr><td>All</td><td>Safety</td><td>Qualitative</td></tr>
<tr><td colspan="3">A qualitative safety assessment of each option will be undertaken which compares against the baseline. This has been informed by a Hazard Identification workshop undertaken by NATS, who are the Air Navigation Service Provides (ANSP) at Aberdeen Airport. The qualitative assessment has been split into three categories:

Procedure operability: This takes information from the Hazard Identification workshop and other SME feedback around safety and compares against the ‘do nothing’ baseline.

Procedure design: This assesses the option against PANS OPS criteria. This is the regulation used when designing procedures within the UK.

Specification of approaches: This part of the assessment looks at whether the specification of the approach (for example an RNP approach compared to a VOR/DME approach) offers any enhanced safety compared to the types of approaches promulgated at Aberdeen today.</td></tr>
<tr><td>All</td><td>Performance against the vision and parameters/strategic objectives of the AMS</td><td>Qualitative</td></tr>
<tr><td colspan="3">A qualitative assessment of how the design option strikes a balance, considering the AMS vision and objectives. This assessment is informed by the other IOA assessment categories and aims to summarise these rather than replicate the full information already shown within the FOA.

The vision of the Airspace Modernisation Strategy is to ‘Deliver quicker, quieter and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace’. The strategy sets out four objectives to achieve the vision:

Safety: Maintaining and, where possible, improving the UK’s high levels of aviation safety has priority over all other ‘ends’ to be achieved by airspace modernisation.

Integration of diverse users: Airspace modernisation should wherever possible satisfy the requirements of operators and owners of all classes of aircraft, including the accommodation of existing users (such as commercial, General Aviation, military, taking into account interests of national security) and new or rapidly developing users (such as remotely piloted aircraft systems, advanced air mobility, spacecraft, high-altitude platform systems).

Simplification, reducing complexity and improving efficiency: Consistent with the safe operation of aircraft, airspace modernisation should wherever possible secure the most efficient use of airspace and the expeditious flow of traffic, accommodating new demand and improving system resilience to the benefit of airspace users, thus improving choice and value for money for consumers.

Environmental sustainability: Environmental sustainability will be an overarching principle applied through all airspace modernisation activities. Modernisation should deliver the Government’s key environmental objectives with respect to air navigation as set out in the Government’s Air Navigation Guidance and, in doing so, will take account of the interests of all stakeholders affected by the use of airspace.</td></tr>
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5. Full Options Appraisal

5.1 Baseline 'Do nothing'

Baseline 'Do nothing' description

5.1.1 This section describes the baseline 'do nothing' scenario which will be used to compare each option's performance.

5.1.2 The figures show the swathes of arrivals to Aberdeen's easterly runway (16) and westerly runway (34). There are no published centrelines flown other than on final approach and therefore all arrivals are vectored by ATC onto a closing heading to establish on the ILS localiser. Typically, aircraft are joining final approach between 8 and 12nm from touchdown although there are variances to this. Some helicopter traffic[23] flies the ILS approaches and joins within the same swathe as fixed wing traffic, albeit at lower altitude, with the remaining helicopter traffic taking a more direct visual approach when weather conditions allow. Alongside the ILS procedures, Aberdeen Airport also promulgates VOR/DME approaches for runway 16 and runway 34, and an NDB/DME approach for runway 34.

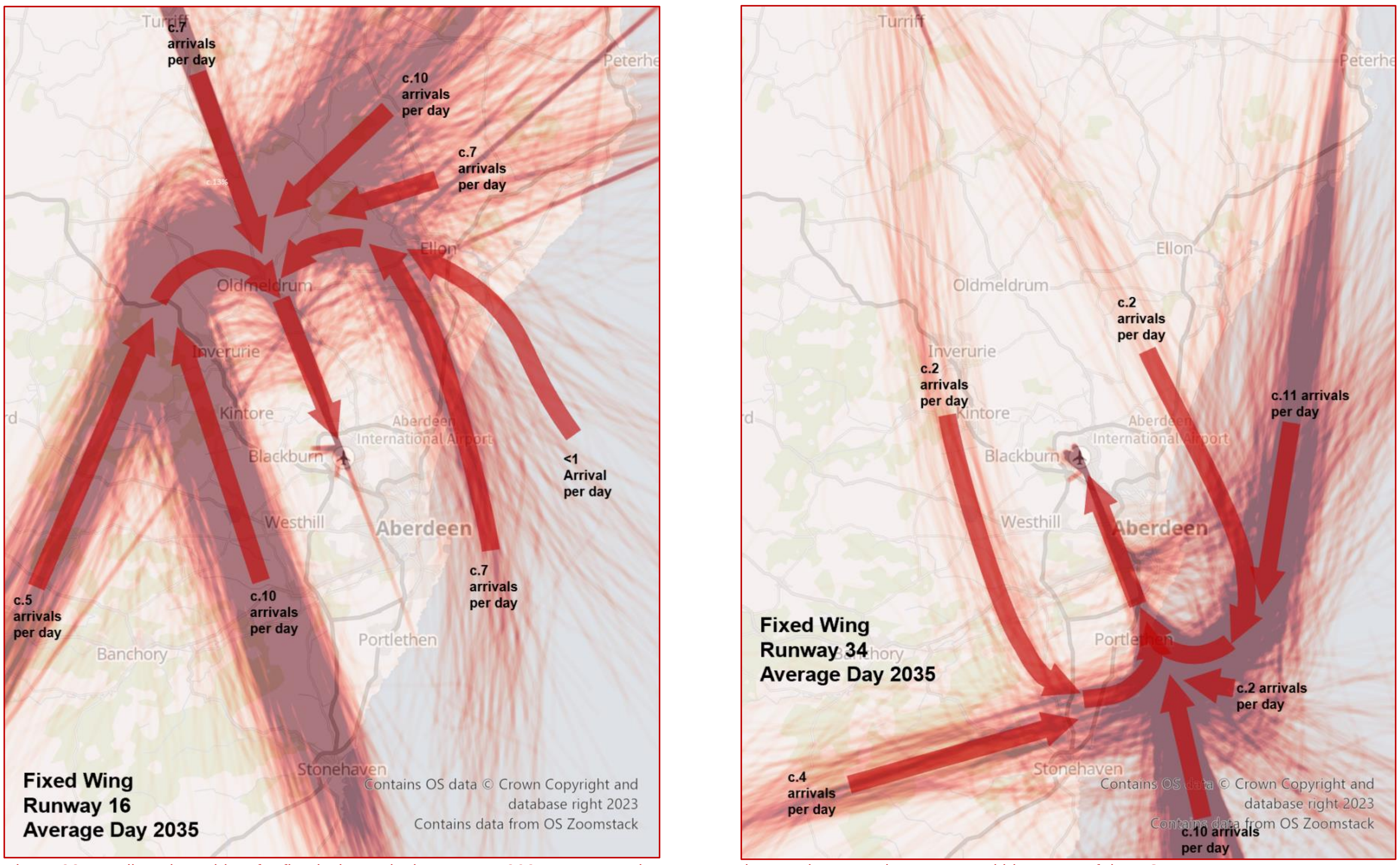

Figure 23 Baseline 'do nothing' for fixed wing arrivals, summer 2035. Note: No departure tracks are shown as they are not within scope of the ACP

[23] Note helicopter use of the ILS is very weather dependent; in clear visibility helicopters are likely to arrive under VFR and take a more direct route to the airfield whereas in poor visibility almost all helicopters would use the ILS.

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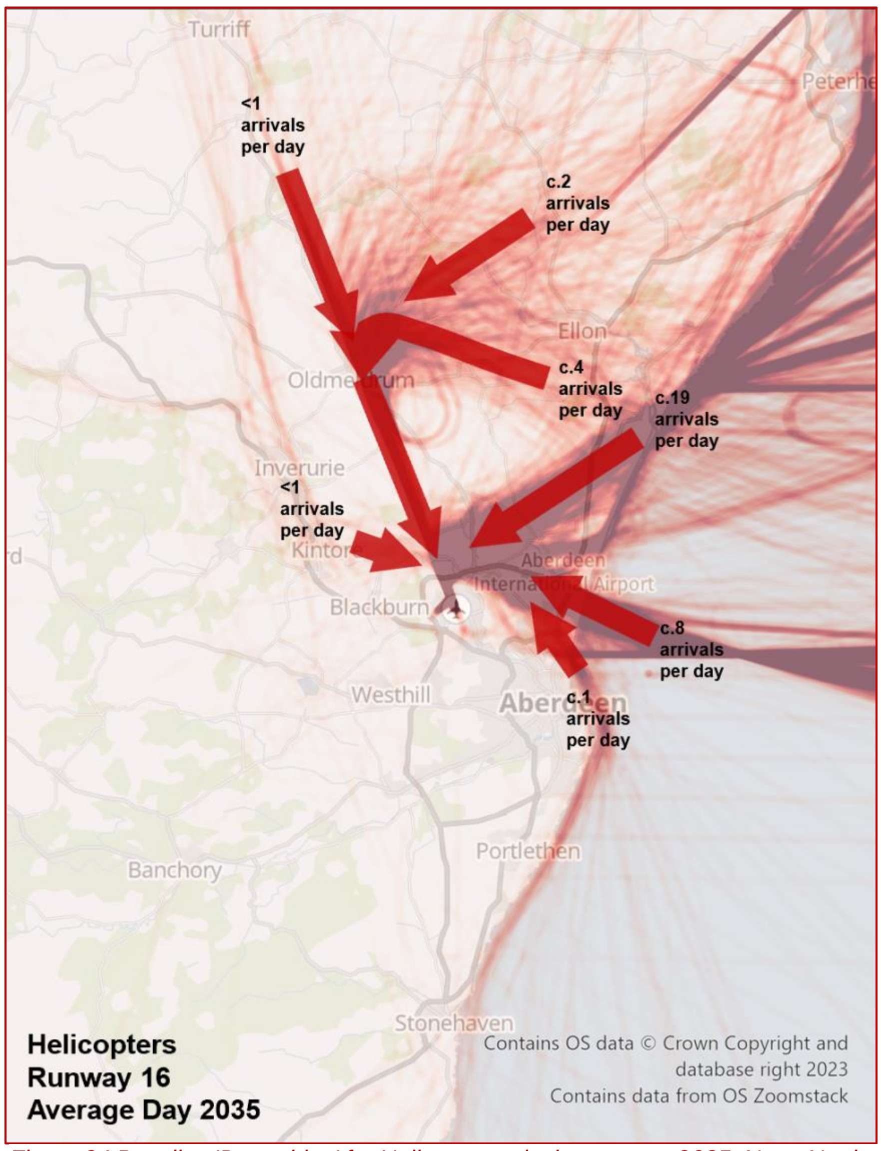

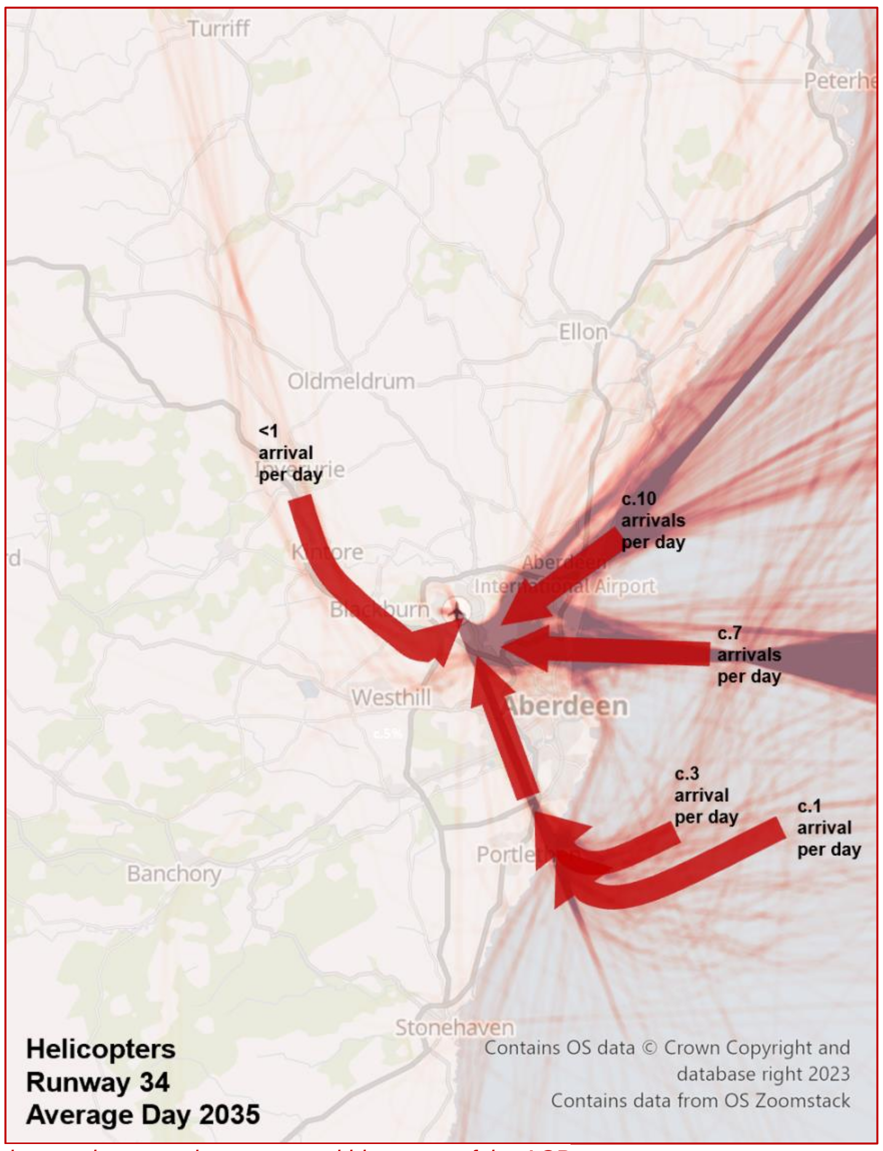

Figure 24 Baseline 'Do nothing' for Helicopter arrivals, summer 2035. Note: No departure tracks are shown as they are not within scope of the ACP

5.1.3 The ILS procedures have two associated holds; ADN and DOWNI/ATF which are predicated on the ADN VOR and ATF NDB. On average, c.1% of arriving fixed wing traffic are expected to use the holds; however, hold use is dependent on weather and traffic conditions.

5.1.4 The images below show the published ILS procedures at Aberdeen. For full details, please see section EGPD Section 2.24 of the eAIP:

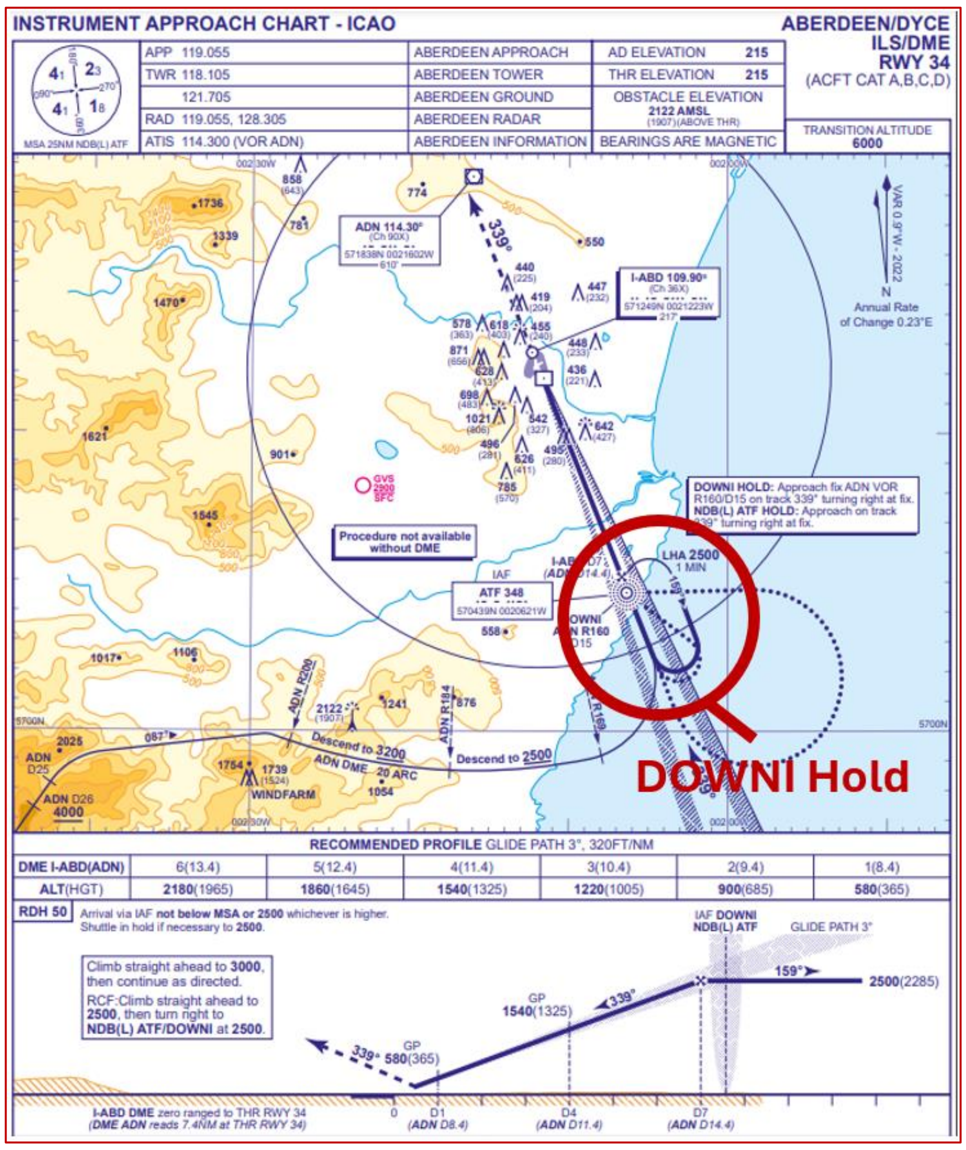

Figure 25 runway 16 and runway 34 ILS approach charts. Source: EGPD Section 2.24 of the eAIP

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Full Options Appraisal

Group	Impact	Level of analysis
Communities	Noise impact on health and quality of life	Quantitative

TAG outcomes
Information about the changes in L_{Aeq} contours compared to the baseline L_{Aeq} contours will be used to generate TAG outcomes for the options. There is no TAG outcome for the baseline given this is the 'do nothing' scenario.

L_{Aeq} contours
The following tables show L_{Aeq} noise contour data for the 'do nothing' pre-implementation scenario for the year of implementation and 10 years following implementation. For each contour band, the area of the contour is presented along with the population and number of potentially noise sensitive buildings within each band. The contour figures can be found in Technical Appendix A. **Within Technical Appendix A we have also presented the contour data for the current airspace (2022) as required by CAP1616.**

Year	Scenario	Metric	Contour	Area (km2)	Total population	No. of care homes	No. of hospitals	No. of listed buildings	No. of places of worship	No. of schools
2026	DN	$L_{Aeq, 16hr}$	51	56.40	33800	12	0	80	6	12
			54	19.10	10600	1	0	18	1	5
			57	8.10	4200	0	0	11	0	2
			60	4.00	1000	0	0	4	0	1
			63	2.10	0	0	0	0	0	0

Year	Scenario	Metric	Contour	Area (km2)	Total population	No. of care homes	No. of hospitals	No. of listed buildings	No. of places of worship	No. of schools
2035	DN	$L_{Aeq, 16hr}$	51	56.90	34400	12	0	80	6	12
			54	19.30	11000	1	0	18	1	5
			57	8.20	4200	0	0	11	0	2
			60	4.00	1100	0	0	4	0	1
			63	2.10	0	0	0	0	0	0

Year	Scenario	Metric	Contour	Area (km2)	Total population	No. of care homes	No. of places of worship	No. of listed buildings	No. of places of worship	No. of schools
2026	DN	$L_{Aeq, 8hr}$	45	28.00	26600	7	0	30	5	10
			48	14.70	12300	2	0	18	1	6
			51	8.00	5400	0	0	9	0	3
			54	4.10	1300	0	0	4	0	1
			55	3.30	700	0	0	0	0	0
			57	2.10	0	0	0	0	0	0

Year	Scenario	Metric	Contour	Area (km2)	Total population	No. of care homes	No. of hospitals	No. of listed buildings	No. of places of worship	No. of schools
2035	DN	$L_{Aeq, 8hr}$	45	28.60	27300	7	0	30	5	11
			48	15.00	12800	2	0	18	1	6
			51	8.20	5500	1	0	9	0	3
			54	4.20	1400	0	0	5	0	1
			55	3.40	900	0	0	0	0	0
			57	2.20	100	0	0	0	0	0

N60 N65 contours
The following tables show N65 and N60 noise contour data for the 'do nothing' pre-implementation scenario for the year of implementation and 10 years following implementation. For each contour band, the area within the contour is presented along with the population and number of potentially noise sensitive buildings within each band. The contour figures can be found in Technical Appendix A.

Year	Scenario	Metric	Contour	Area (km2)	Total population	No. of care homes	No. of hospitals	No. of listed buildings	No. of places of worship	No. of schools
2026	DN	N65	5	565.70	111000	26	0	306	32	41
			10	222.40	86900	20	0	152	22	28
			20	60.80	52400	14	0	84	16	15
			50	15.20	11500	0	0	18	1	5
			100	4.60	1100	0	0	4	0	0

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Group	Impact	Level of analysis

Year	Scenario	Metric	Contour	Area (km2)	Total population	No. of care homes	No. of hospitals	No. of listed buildings	No. of places of worship	No. of schools
2035	DN	N65	5	567.10	112300	26	0	308	32	41
			10	223.10	88000	22	0	155	22	29
			20	61.50	52800	14	0	84	16	15
			50	15.60	12100	1	0	18	1	5
			100	5.00	1500	0	0	5	0	0

Year	Scenario	Metric	Contour	Area (km2)	Total population	No. of care homes	No. of hospitals	No. of listed buildings	No. of places of worship	No. of schools
2026	DN	N60	5	33.20	34000	5	0	38	7	11
			10	14.20	13200	1	0	19	1	4
			20	2.20	300	0	0	0	0	0

Year	Scenario	Metric	Contour	Area (km2)	Total population	No. of care homes	No. of hospitals	No. of listed buildings	No. of places of worship	No. of schools
2035	DN	N60	5	34.00	35000	6	0	39	7	11
			10	14.90	13700	1	0	20	1	4
			20	2.70	300	0	0	0	0	0

Overflight contours
The following table shows overflight contour data for the 'do nothing' pre-implementation scenario for the year of implementation and 10 years following implementation. For each contour band, the area within the contour is presented along with the population and number of potentially noise sensitive buildings within each band. The contour figures can be found in Technical Appendix A.

Year	Scenario	Metric	Contour	Area (km2)	Total population	No. of care homes	No. of hospitals	No. of listed buildings	No. of places of worship	No. of schools
2026	DN	N65	5	565.70	111000	26	0	306	32	41
			10	222.40	86900	20	0	152	22	28
			20	60.80	52400	14	0	84	16	15
			50	15.20	11500	0	0	18	1	5
			100	4.60	1100	0	0	4	0	0

Year	Scenario	Contour	Scenario	Area (km2)	Total population	No. of care homes	No. of hospitals	No. of listed buildings	No. of places of worship	No. of schools
2035	DN	N65	5	567.10	112300	26	0	308	32	41
			10	223.10	88000	22	0	155	22	29
			20	61.50	52800	14	0	84	16	15
			50	15.60	12100	1	0	18	1	5
			100	5.00	1500	0	0	5	0	0

Noise:
Currently there are no published arrival routes at Aberdeen other than on final approach. Aircraft arriving onto runway 16 and runway 34 are vectored by Aberdeen ATC to join the ILS localiser. Typically, aircraft join the final approach, where they are aligned with the runway centreline, at around 8-12nm (15-22km). The vectoring by ATC creates broad dispersion across the airspace between 7000ft and joining the final approach at around 3500ft-2500ft.

Runway 16
This broad area of dispersion between 7000ft and around 3500-2500ft overflies the areas of Kintore, Kemnay, Inverurie, Rothienorman, Methlick, Ellon and Pitmedden. Aircraft arriving from the north overfly Turriff and Tulloch and the eastern parts of Oldmeldrum. The areas of Oldmeldrum and Tarves are located under the base leg turns. Aircraft then join the final approach where the swathe then narrows as aircraft fly the extended runway centreline before landing. There are no dense areas of population under the final approach, although there are the lower populated areas of Whiterashes, Stralock and Middleton.

Runway 34
This broad area of dispersion between 7000ft and around 3500-2500ft largely overflies the sea however arrivals from the west overfly the areas of Newtonhilll and the northern parts of Stonehaven. From the north, there is so little traffic that it does not show on the average heat map however the track data shows, close to 7000ft, the areas of Peterculter, Drumoak and Milltimber are overflown. Portlethen and Cove Bay are overflown as part of the base leg turns. Aircraft then join the final approach where the swathe narrows as aircraft fly the extended runway centreline before landing. This overflies Findon, the eastern part of Cults and the western areas of Aberdeen such as the Bridge of Dee, Rubislaw, and Bucksburn.

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Group	Impact	Level of analysis
Wider society	**Tranquillity**	Quantitative

The following tables show the area and number of locations/spaces that are relevant to the consideration of tranquillity and sit within the L_{Aeq}, N65, N60 and overflight contours.

Year	Scenario	Metric	Contour	Country parks		Candidate Quiet Area (CQA)		Gardens & Designated Landscapes		National Parks		National Scenic Area (NSA)	
				Total	Area (km²)	Total	Area (km²)	Total	Area (km²)	Total	Area (km²)	Total	Area (km²)
2026	DN	$L_{Aeq, 16hr}$	51	1	0.00	1	0.10	0	0.00	0	0.00	0	0.00
			54	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			57	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			60	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			63	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Year	Scenario	Metric	Contour	Country parks		Candidate Quiet Area (CQA)		Gardens & Designated Landscapes		National Parks		National Scenic Area (NSA)	
				Total	Area (km²)	Total	Area (km²)	Total	Area (km²)	Total	Area (km²)	Total	Area (km²)
2035	DN	$L_{Aeq, 16hr}$	51	1	0.00	1	0.10	0	0.00	0	0.00	0	0.00
			54	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			57	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			60	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			63	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Year	Scenario	Metric	Contour	Country parks		Candidate Quiet Area (CQA)		Gardens & Designated Landscapes		National Parks		National Scenic Area (NSA)	
				Total	Area (km²)	Total	Area (km²)	Total	Area (km²)	Total	Area (km²)	Total	Area (km²)
2026	DN	$L_{Aeq, 8hr}$	45	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			48	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			51	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			54	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			55	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			57	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Year	Scenario	Metric	Contour	Country parks		Candidate Quiet Area (CQA)		Gardens & Designated Landscapes		National Parks		National Scenic Area (NSA)	
				Total	Area (km²)	Total	Area (km²)	Total	Area (km²)	Total	Area (km²)	Total	Area (km²)
2035	DN	$L_{Aeq, 8hr}$	45	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			48	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			51	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			54	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			55	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Year	Scenario	Metric	Contour	Country parks		Candidate Quiet Area (CQA)		Gardens & Designated Landscapes		National Parks		National Scenic Area (NSA)	
				Total	Area (km²)	Total	Area (km²)	Total	Area (km²)	Total	Area (km²)	Total	Area (km²)
2026	DN	N60	5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			10	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			20	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

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Group	Impact	Level of analysis

Year	Scenario	Metric	Contour	Country parks		Candidate Quiet Area (CQA)		Gardens & Designated Landscapes		National Parks		National Scenic Area (NSA)	
				Total	Area (km^2)	Total	Area (km^2)	Total	Area (km^2)	Total	Area (km^2)	Total	Area (km^2)
2035	DN	N60	5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			10	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			20	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Year	Scenario	Metric	Contour	Country parks		Candidate Quiet Area (CQA)		Gardens & Designated Landscapes		National Parks		National Scenic Area (NSA)	
				Total	Area (km^2)	Total	Area (km^2)	Total	Area (km^2)	Total	Area (km^2)	Total	Area (km^2)
2026	DN	N65	5	1	0.70	3	0.70	1	0.20	0	0.00	0	0.00
			10	1	0.60	3	0.50	1	0.00	0	0.00	0	0.00
			20	1	0.00	2	0.10	1	0.00	0	0.00	0	0.00
			50	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			100	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Year	Scenario	Metric	Contour	Country parks		Candidate Quiet Area (CQA)		Gardens & Designated Landscapes		National Parks		National Scenic Area (NSA)	
				Total	Area (km^2)	Total	Area (km^2)	Total	Area (km^2)	Total	Area (km^2)	Total	Area (km^2)
2035	DN	N65	5	1	0.70	3	0.70	1	0.20	0	0.00	0	0.00
			10	1	0.60	3	0.50	1	0.00	0	0.00	0	0.00
			20	1	0.00	2	0.10	1	0.00	0	0.00	0	0.00
			50	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			100	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Year	Scenario	Metric	Contour	Country parks		Candidate Quiet Area (CQA)		Gardens & Designated Landscapes		National Parks		National Scenic Area (NSA)	
				Total	Area (km^2)	Total	Area (km^2)	Total	Area (km^2)	Total	Area (km^2)	Total	Area (km^2)
2026	DN	Overflights (24hr)	5	1	0.70	3	0.70	7	8.90	0	0.00	0	0.00
			10	1	0.70	2	0.50	1	0.70	0	0.00	0	0.00
			20	1	0.30	2	0.20	0	0.00	0	0.00	0	0.00
			50	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Year	Scenario	Metric	Contour	Country parks		Candidate Quiet Area (CQA)		Gardens & Designated Landscapes		National Parks		National Scenic Area (NSA)	
				Total	Area (km^2)	Total	Area (km^2)	Total	Area (km^2)	Total	Area (km^2)	Total	Area (km^2)
2035	DN	Overflights (24hr)	5	1	0.70	3	0.80	7	9.80	0	0.00	0	0.00
			10	1	0.70	2	0.50	1	0.80	0	0.00	0	0.00
			20	1	0.40	2	0.20	0	0.00	0	0.00	0	0.00
			50	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Group	Impact	Level of analysis
Wider society	Biodiversity	Quantitative

Aircraft aligned with the extended runway centreline on final approach overfly the River Dee SAC. A Habitats Screening Assessment (HRA) has been undertaken to understand potential impacts to biodiversity and more information about this can be found in the FOA methodology section.

Group	Impact	Level of analysis
Communities	Air quality	Qualitative

Aircraft arriving at Aberdeen fly a standard 3-degree angle of approach and descend through 1000ft typically between 5 - 7km before the landing threshold. This is in the last stages of the final approach when aircraft are aligned with the runway centreline.

On runway 34 parts of Aberdeen City Centre are within an Air Quality Management Area located approximately 2.4km from the landing threshold.

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Group	Impact	Level of analysis
Wider society	Greenhouse gas impact	Qualitative

TAG outcomes
Information about the changes in carbon emissions will be used to generate TAG outcomes for the options. There is no TAG outcome for the baseline given this is the 'do nothing' scenario.

Fuel burn data

Scenario	Year	Fuel use (t)	Fuel cost (£)
Do nothing	2026	18,221	11,866,099
Do nothing	2035	18,694	12,174,230

Greenhouse Gas (GHG) emissions data

Scenario	Year	Total GHG emissions (tCO_2e)	International GHG emissions (tCO_2e)	Traded (Domestic) GHG emissions (tCO_2e)	Traded (EEA) GHG emissions (tCO_2e)	UKETS Traded GHG emissions (tCO_2e)	GHG emissions per flight (tCO_2e)
Do nothing	2026	57,942	485	46,349	11,017	57,366	0.68
Do nothing	2035	59,447	594	47,437	11,416	58,852	0.68

The table above is based on the vast majority of IFR arrivals at Aberdeen flying an ILS approach as they do in the baseline today; however, the proposed PBN arrival options are predominately for resilience and so will most likely be used in the event of an ILS outage. With this in mind, alongside the data above, Aberdeen has generated some data around fuel burn and carbon emissions of a VOR/DME approach, which would be flown in the event of an ILS outage.

Owing to the frequency of ILS outages, it is not possible to meaningfully incorporate an outage scenario into the carbon emission data above, which is required to be based on an annual forecast by CAP1616. Therefore we have generated data for a single day of arrivals summarised by runway end which can be compared against each option.

Option	Year	RWY16		RWY34		Total	
		Fuel (t)	Carbon (tCO_2e)	Fuel (t)	Carbon (tCO_2e)	Fuel (t)	Carbon (tCO_2e)
VOR (Do nothing)	2026	8.0	25.4	5.1	16.1	13.1	41.5
VOR (Do nothing)	2035	8.3	26.3	5.3	16.7	13.5	43.0

Group	Impact	Level of analysis
Wider society	Capacity/resilience	Qualitative

Aberdeen Airport currently promulgates ILS/DME, LOC/DME and VOR/DME approaches for runway 16, and ILS/DME, LOC/DME, VOR/DME and NDB/DME approaches for runway 34. These approaches are dependent on conventional ground based navigation equipment. The most common approach, the ILS/DME is dependent on the ADN VOR as well as the ILS. During period of ILS u/s, aircraft typically fly a VOR/DME approach.

Group	Impact	Level of analysis
General Aviation	Access	Qualitative and quantitative

This baseline scenario would not offer any change from the existing Controlled Airspace (CAS) arrangements in place today. The options will be compared against this existing scenario. (See existing CAS 'Do nothing' section for further details).

Group	Impact	Level of analysis
General Aviation/commercial airlines	Economic impact from increased effective capacity	Qualitative

It is not intended that this Airspace Change will facilitate any future growth for the airport or offer any increased capacity; the purpose of the change is to provide resilience and meet the requirements of the Airspace Modernisation Strategy.

Group	Impact	Level of analysis
General Aviation/commercial airlines	Fuel burn	Quantitative

Please see Greenhouse Gas assessment above.

Group	Impact	Level of analysis
Commercial airlines	Training costs	Qualitative

As this option is already in operation, there are no training costs anticipated as there will be no change; later in this FOA we will estimate the difference between our options and this baseline.

Group	Impact	Level of analysis
Commercial airlines	Other costs	Qualitative

As this option is already in operation, there are no other costs anticipated as there will be no change; later in this FOA we will estimate the difference between our options and this baseline.

Group	Impact	Level of analysis
Airport/ANSP	Infrastructure costs	Qualitative

As this option is already in operation, there are no infrastructure costs anticipated as there will be no change; later in this FOA we will estimate the difference between our options and this baseline.

Group	Impact	Level of analysis
Airport/ANSP	Operational costs	Qualitative

As this option is already in operation, there are no operational costs anticipated as there will be no change; later in this FOA we will estimate the difference between our options and this baseline.

Group	Impact	Level of analysis
Airport/ANSP	Deployment costs	Qualitative

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Group	Impact	Level of analysis
As this option is already in operation, there are no deployment costs anticipated as there will be no change; later in this FOA we will estimate the difference between our options and this baseline.		
All	Safety	Qualitative
The baseline is already in safe operation and there are no safety concerns raised at this time.		
All	Performance against the vision and parameters/strategic objectives of the AMS	Qualitative
Whilst vectoring of arrivals is a perfectly reasonable option in a future operating environment, doing nothing with arrivals will not align with the AMS as it would not offer Aberdeen any modern PBN procedures. The following qualitative assessment looks at the four objectives of the Airspace Modernisation Strategy: **Safety:** The ‘do nothing’ option will maintain but not improve aviation safety. **Integration of diverse users:** The ‘do nothing’ would not enable any reductions in the volume or classification of CAS. **Simplification, reducing complexity and improving efficiency:** The ‘do nothing’ option does not offer any opportunities to reduce complexity or improve efficiency. **Environmental sustainability:** The ‘do nothing’ option does not offer any opportunities to improve noise and/or greenhouse gas emissions.		

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5.2 Vectors to final approach

Option description

5.2.1 This option would continue to see those arrivals wishing to fly an RNP approach vectored to final approach as they are today. The only difference would be whereas with the ILS, the arrivals have flexibility in where they join final approach from 8nm and beyond, RNP approach arrivals would be vectored to join final approach in the same location, at the Initial Fix (IF), usually with a closing heading of no greater than 45˚. The IF has been positioned so those arrivals would join final approach at around 10.5nm, keeping the vectored arrival swathes consistent with the baseline. The vast majority of aircraft (95%+) would continue to arrive as they do today.

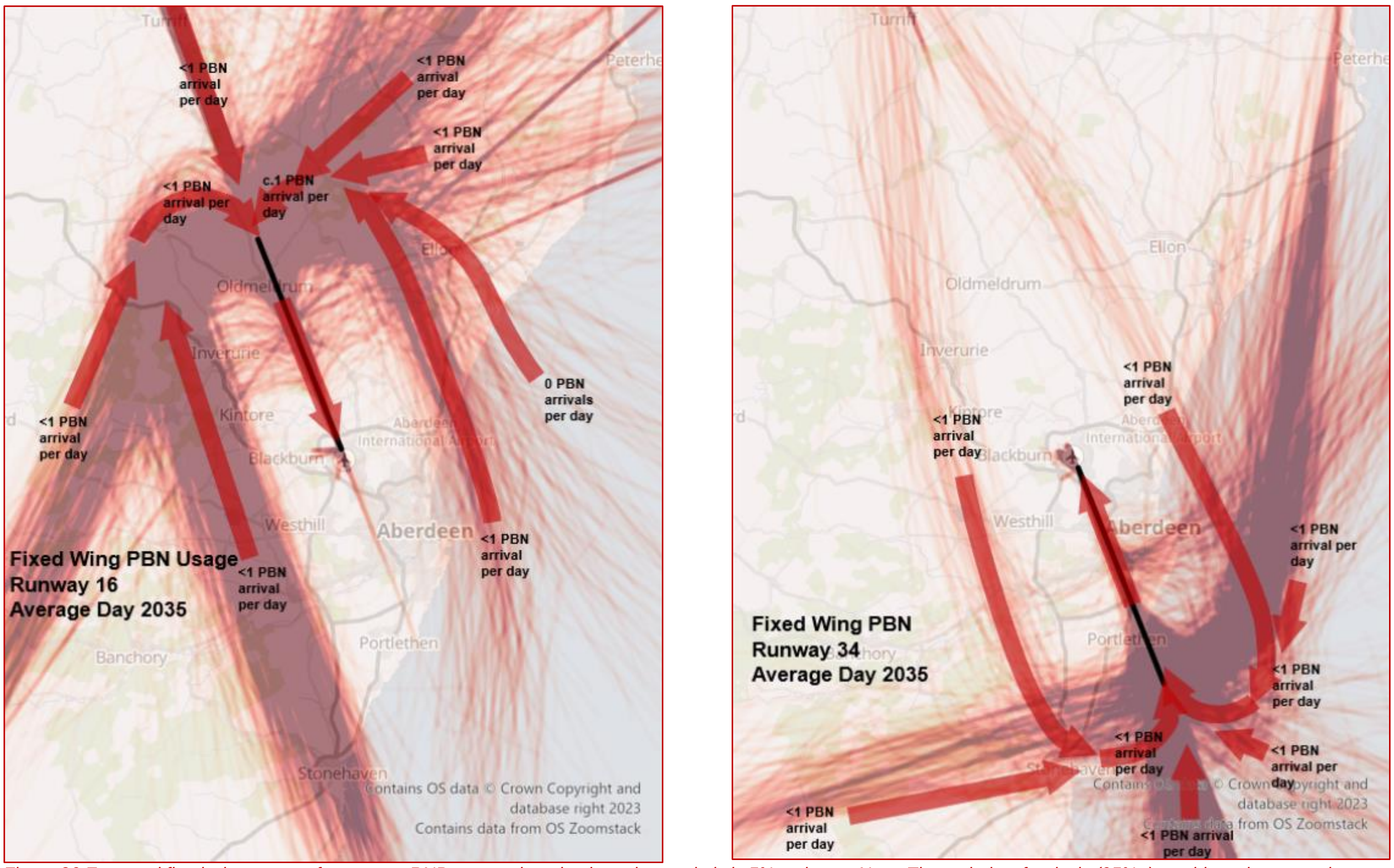

Figure 26 Expected fixed wing usage of vectors to RNP approach option based on optimistic 5% estimate. Note: The majority of arrivals (95%+) would continue to arrive as they do within the baseline.

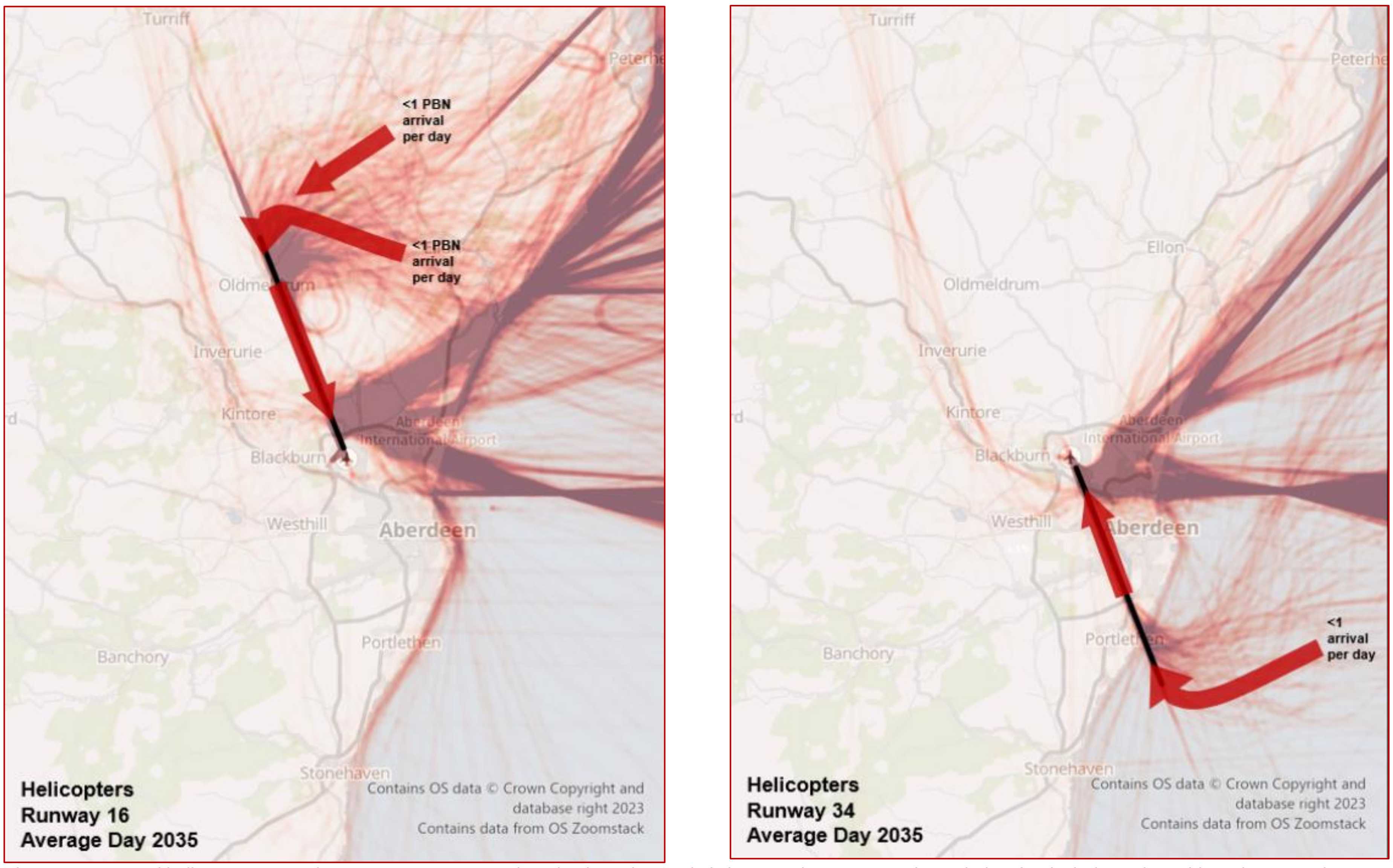

Figure 27 Expected helicopter usage of vectors to RNP approach option based on optimistic 5% estimate. Note: The majority of arrivals (95%+) would continue to arrive as they do within the baseline.

5.2.2 The following figure shows a draft indicative chart for the vectors to final approach procedures with the associated missed approach procedures. Sections of the chart have been redacted as the CAA does not permit draft charts to be published as part of an ACP. If any industry stakeholders require more information in order to be able to comment on the proposals, please do get in contact with us via airspace@aiairport.com.

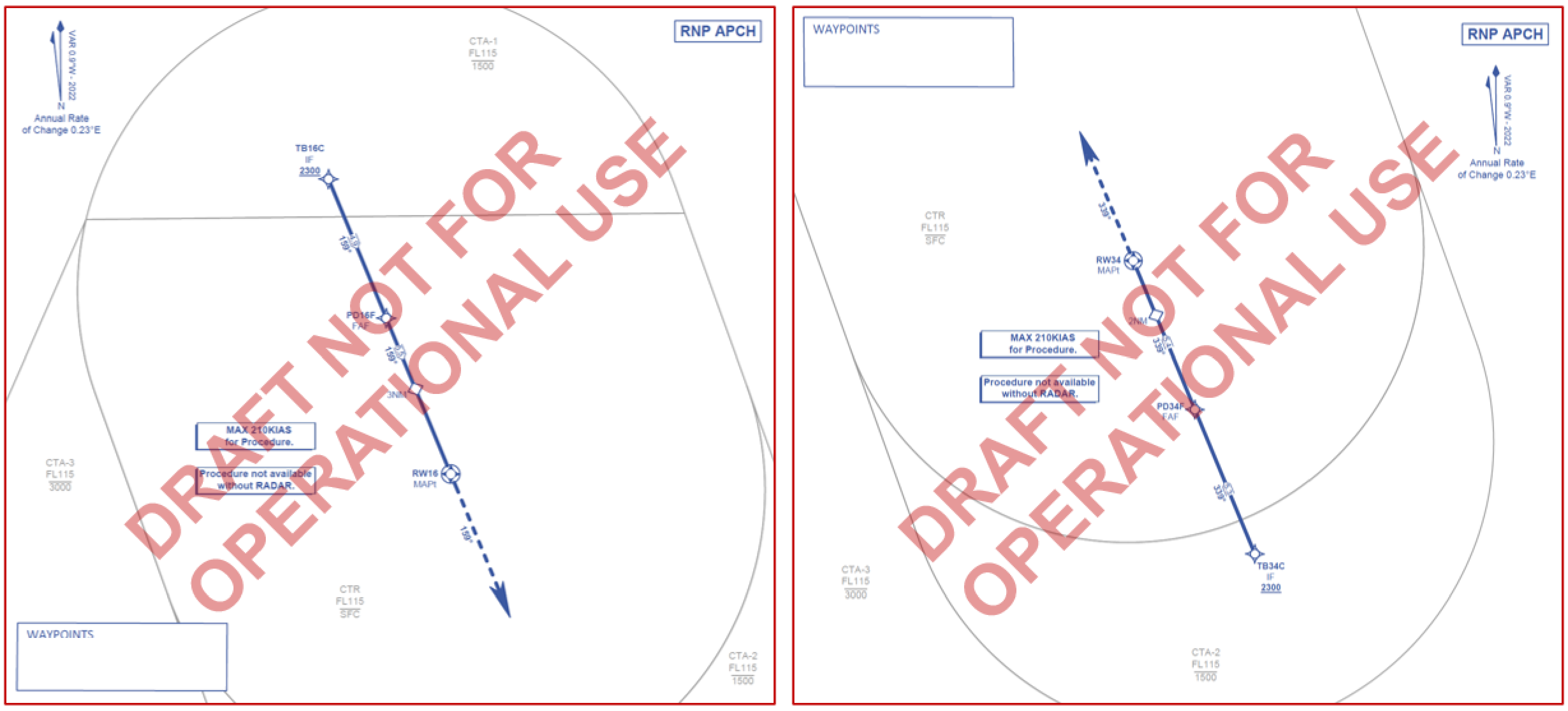

Figure 28 Vectors to Final Approach: Draft Indicative Chart Information, with Missed Approach

Full Options Appraisal

Group	Impact	Level of analysis
Communities	Noise impact on health and quality of life	Qualitative and quantitative

For the purposes of the noise assessment data, Option A = Vectors to final approach

TAG outcomes
TAG has been used to assess total noise impacts over a 10-year appraisal period. The monetised net present value (NPV) of noise changes of this option is -£3,082 (2010 prices). It is important to highlight that this result is influenced by a limited number of receptors transitioning between 1dB bands in the TAG evaluation due to noise variations of less than 0.1dB. These changes are negligible beyond the accuracy of any noise model. Therefore the TAG outcome for this option is not considered to be material to the assessment.

It is also important to note that the TAG methodology is based on analysis in 1dB bands whereas the L_{Aeq} contour data is presented in 3dB bands as required by CAP1616. This means that the numbers in the TAG tables and the number in the L_{Aeq} contour tables cannot be directly compared. For example there may be individuals that experience a small noise change that moves them from 1dB band to another, but they remain within the same, wider, 3dB band. This does not affect the way the assessment is undertaken, it is simply a difference in the way the data is summarised.

Scenario	NPV Total	NPV Sleep	NPV Amenity	NPV AMI	NPV Stroke	NPV Dementia	Individuals experiencing increased daytime noise in forecast year	Individuals experiencing reduced daytime noise in forecast year	Individuals experiencing increased nighttime noise in forecast year	Individuals experiencing reduced nighttime noise in forecast year
Option A	-£3,082	-£4,156	£852	£0	£89	£133	47	27	0	19

L_{Aeq} contours

The following table shows the difference between the option L_{Aeq} performance and the baseline for year of implementation and 10 years following implementation.

Year	Scenario	Metric	Contour	Area (km²)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2026	Opt A Comparison	$L_{Aeq,\,16hr}$	51	0.10	0	0	0	0	0	0
			54	0.00	0	0	0	0	0	0
			57	0.00	0	0	0	0	0	0
			60	0.00	0	0	0	0	0	0
			63	0.00	0	0	0	0	0	0

Year	Scenario	Metric	Contour	Area (km²)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2035		$L_{Aeq,\,16hr}$	51	0.00	0	0	0	0	0	0

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	Opt A Comparison		54	0.00	-100	0	0	0	0	0
			57	0.00	0	0	0	0	0	0
			60	0.00	0	0	0	0	0	0
			63	0.00	0	0	0	0	0	0

Year	Scenario	Metric	Contour	Area (km²)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2026	Opt A Comparison	$L_{Aeq, 8hr}$	45	0.00	0	0	0	0	0	0
			48	0.00	0	0	0	0	0	0
			51	0.00	0	0	0	0	0	0
			54	0.00	0	0	0	0	0	0
			55	0.00	0	0	0	0	0	0

Year	Scenario	Metric	Contour	Area (km²)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2035	Opt A Comparison	$L_{Aeq, 8hr}$	45	0.00	0	0	0	0	0	0
			48	0.00	0	0	0	0	0	0
			51	0.00	0	0	0	0	0	0
			54	0.00	0	0	0	0	0	0
			55	0.00	0	0	0	0	0	0

N60 N65 contours

The following table shows the difference between the option N65/N60 performance and the baseline for year of implementation and 10 years following implementation:

Year	Scenario	Metric	Contour	Area (km²)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2026	Opt A Comparison	N65	5	-0.50	0	0	0	0	0	0
			10	-0.10	100	0	0	1	0	0
			20	0.00	0	0	0	0	0	0
			50	0.00	0	0	0	0	0	0
			100	0.00	0	0	0	0	0	0

Year	Scenario	Metric	Contour	Area (km²)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2035	Opt A Comparison	N65	5	-0.60	0	0	0	1	0	0
			10	-0.10	0	0	0	1	0	0
			20	0.00	100	0	0	0	0	0
			50	0.00	0	0	0	0	0	0
			100	0.00	0	0	0	0	0	0

Year	Scenario	Metric	Contour	Area (km²)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2026	Opt A Comparison	N60	5	0.00	0	0	0	0	0	0
			10	0.00	0	0	0	0	0	0
			20	0.00	0	0	0	0	0	0

Year	Scenario	Metric	Contour	Area (km²)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2035	Opt A Comparison	N60	5	0.00	0	0	0	0	0	0
			10	0.00	0	0	0	0	0	0
			20	0.00	0	0	0	0	0	0

Overflight contours
The following table shows the difference between the option overflight performance and the baseline, for year of implementation and 10 years following implementation:

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Group	Impact	Level of analysis

Year	Scenario	Metric	Contour	Area (km^2)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2026	Opt A Comparison	Overflights (24hr)	5	-8.10	-900	0	0	-2	0	1
			10	0.00	-200	0	0	0	0	0
			20	0.40	0	0	0	0	0	0
			50	0.00	0	0	0	0	0	0

Year	Scenario	Metric	Contour	Area (km^2)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2035	Opt A Comparison	Overflights (24hr)	5	-8.60	-1300	0	0	-3	-1	1
			10	-0.60	0	0	0	0	0	0
			20	0.50	0	0	0	0	0	0
			50	0.10	0	0	0	0	0	0

Noise summary

When operating the PBN approach, aircraft will be vectored towards a fixed waypoint (IF) rather than the ILS localiser (where there is a broader area of dispersion around joining the final approach). Aircraft will be able to join the waypoint up to 45º either side of the extended centreline. 95%+ of traffic would continue to fly as they do in the baseline (as they do today). This option is not expected to impact flight paths from aircraft departing from Aberdeen.

For aircraft flying the vectors to RNP approach option, joining at a fixed waypoint may lead to a very small redistribution of noise however analysis has shown the average tracks of arriving aircraft align very closely with the position of the IF and, also given the small number of aircraft expected to fly the PBN arrival procedure, any change is anticipated to be so small it would not be material.

This is reflected in the primary noise data which shows no changes in the L_{Aeq} contour data between the option and the baseline, with the exception of two very marginal differences in the $L_{Aeq,16hr}$ outcomes. This marginal difference is due to the small increase in concentration around the IF for RWY16 arrivals and is negligible in terms of the potential for adverse noise effects.

Similarly, although the TAG analysis shows that there is a cost associated with this option, it is important to highlight that this result is influenced by a limited number of receptors transitioning between 1dB bands in the TAG evaluation due to noise variations of less than 0.1dB. These changes are negligible beyond the accuracy of any noise model. Therefore, the TAG outcome for this option is not considered to be material to the assessment.

The secondary N60 metric shows no changes in contour data and the N65 metrics suggests very marginal differences which are not anticipated to be material.

Finally the overflight data, which is generated between 0-7000ft, shows marginal differences in the lower frequency 5 and 10 per day contours which result in improvements to the number of people overflown compared to the baseline. It is important to note however that these improvements are based on an optimistic 5% of arriving aircraft flying the PBN procedures.

Overall, it is concluded that this option is not expected to result in any significant or material positive benefits or negative impacts to noise.

Wider society	**Tranquillity**	Quantitative

There are no changes in the number or area of locations/spaces that are relevant to the consideration of tranquillity within the L_{Aeq}, N65 and N60 contours (please see technical appendix A for full data tables). The Government's *Planning Practice Guidance – noise*[24] notes that at noise exposure below the LOAEL *"Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life."* It is therefore considered that as there are no material differences in noise levels within the L_{Aeq} contours that there are no material impacts to tranquillity.

Overflight data shows very small changes to the area of already overflown designated gardens and landscapes within the 5 flights per day contour. However no new areas are overflown and the scale of the change to the area already overflown is not considered to be a material impact.

Year	Scenario	Metric	Contour	Country parks		CQA		Gardens & Designated Landscapes		National Parks		NSA	
				Total	Area (km2)	Total	Area (km2)	Total	Area (km2)	Total	Area (km2)	Total	Area (km2)
2026	Opt A Comparison	Overflights_24hr	5	0	0.00	0	0.00	0	0.90	0	0.00	0	0.00
			10	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			20	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			50	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Year	Scenario	Metric	Contour	Country parks		CQA		Gardens & Designated Landscapes		National Parks		NSA	
				Total	Area (km2)	Total	Area (km2)	Total	Area (km2)	Total	Area (km2)	Total	Area (km2)
2035	Opt A Comparison	Overflights_24hr	5	0	0.00	0	0.00	0	1.20	0	0.00	0	0.00
			10	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			20	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

[24] https://www.gov.uk/guidance/noise--2 (Whilst PPG-N is not Scottish Government guidance, it provides useful information on how to apply the concept of LOAELs which are part of UK airspace policy and hence apply to Scotland)

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Group	Impact	Level of analysis

			50	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Wider society	Biodiversity	Qualitative
This option overflies the River Dee SAC on final approach. The option will not increase the number of aircraft movements, will not change the altitude of aircraft, and will not change the lateral dispersion of aircraft overflying any the European Site below 3000ft. Considering this, the option is not likely to result in significant biodiversity effects on any European Site.		
Communities	Air quality	Qualitative
Impacts to air quality are considered for changes below 1000ft. This option does not change lateral flight paths below 1000ft and therefore there is no anticipated change or impact to air quality as a result of this option.		
Wider society	Greenhouse gas impact	Qualitative and quantitative

No change to the profiles of inbound or outbound aircraft is expected as a result of this option. This option is not expected to impact aircraft departing from Aberdeen.

TAG outcomes

TAG has been used to assess the greenhouse gas impact over a 10-year appraisal period. The change in carbon dioxide emissions over the appraisal period is 185.3t, of which 183.4t is traded. The monetised net present value (NPV) of carbon dioxide equivalent emissions of this option is -£205 (2010 prices).

Fuel burn data
The following tables show annual Fuel Burn, and the associated cost:

Scenario	Year	Fuel use (t) (Annual)	Fuel cost (£) (Annual)
Do nothing	2026	18,221	11,866,099
Vectors to final approach	2026	18,227	11,869,827
Difference:		*+6*	*+3,728*

Scenario	Year	Fuel use (t) (Annual)	Fuel cost (£) (Annual)
Do nothing	2035	18,694	12,174,230
Vectors to final approach	2035	18,700	12,178,094
Difference:		*+6*	*+3,864*

Greenhouse gas emissions data

Scenario	Year	Total GHG emissions (tCO_2e)	International GHG emissions (tCO_2e)	Traded (Domestic) GHG emissions (tCO_2e)	Traded (EEA) GHG emissions (tCO_2e)	UKETS Traded GHG emissions (tCO_2e)	GHG emissions per flight (tCO_2e)
Do nothing	2026	57,942	576	46,349	11,017	57,366	0.68
Vectors to final approach	2026	57,961	576	46,363	11,021	57,384	0.68
Difference:		*+19*	*0*	*+14*	*+4*	*+18*	*0*

Scenario	Year	Total GHG emissions (tCO_2e)	International GHG emissions (tCO_2e)	Traded (Domestic) GHG emissions (tCO_2e)	Traded (EEA) GHG emissions (tCO_2e)	UKETS Traded GHG emissions (tCO_2e)	GHG emissions per flight (tCO_2e)
Do nothing	2035	59,447	594	47,437	11,416	58,852	0.68
Vectors to final approach	2035	59,466	595	47,451	11,420	58,871	0.68
Difference:		*+19*	*+1*	*+14*	*+4*	*+19*	*0*

The tables above are based on the vast majority of IFR arrivals at Aberdeen flying an ILS approach as they do in the baseline today and it assumes an optimistic 5% of arrivals will fly the PBN approach option. However, the proposed PBN arrival options are predominately for resilience and so will most likely be used in the event of an ILS outage. With this in mind, Aberdeen has generated some data around fuel burn and carbon emissions of a VOR/DME approach, which would be flown in the event of an ILS outage.

Owing to the frequency of ILS outages, it is not possible to meaningfully incorporate an outage scenario into the carbon emission data above, which is required to be based on an annual forecast by CAP1616. Therefore, we have generated data for a single day of arrivals summarised by runway end which has been compared against the option.

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Group	Impact	Level of analysis

Option	Year	RWY16		RWY34		Total	
		Fuel (t) (Day)	Carbon (tCO_2e) (Day)	Fuel (t) (Day)	Carbon (tCO_2e) (Day)	Fuel (t) (Day)	Carbon (tCO_2e) (Day)
VOR/DME approach	2026	8.0	25.4	5.1	16.1	13.1	41.5
Vectors to final approach	2026	7.8	24.7	4.7	15.1	12.5	39.8
T-Bars	2026	7.6	24.3	4.6	14.8	12.3	39.0
VOR/DME approach	2035	8.3	26.3	5.3	16.7	13.5	43.0
Vectors to final approach	2035	8.1	25.6	4.9	15.6	13.0	41.2

Summary
When considering 5% of aircraft flying the vectors to final approach option, the fuel burn and carbon emissions data shows a small negative impact (less than 0.1% increase in total emissions between the do something and baseline scenarios, of which the majority are traded) to annualised fuel use and carbon emissions as required by CAP1616 however, as noted in this FOA, 5% usage is considered an optimistic estimate and therefore any negative impacts are likely to be smaller than stated in the data above. Considering this, the impact of this option on fuel burn and greenhouse gas emissions is not considered to be material to the assessment.

The RNP procedures are most likely to be flown in a resilience scenario when the ILS is unavailable and in this case, the option offers fuel burn and carbon emission improvements compared to the VOR/DME approach which is used today.

Wider society	Capacity/resilience	Qualitative

The introduction of PBN satellite-based approaches at Aberdeen would improve resilience in the event of ground-based navigation aid outage which may reduce delays and diversions.

Although this ACP does not seek to increase capacity at Aberdeen, in the event of an ILS outage, the implementation of vectors to an RNP approach would enable a workload reduction for Aberdeen ATC which means ATC may have greater capacity to handle traffic compared to current day where aircraft would fly a VOR/DME or NDB approach.

General Aviation	Access	Qualitative

This option is not expected to directly impact General Aviation; the procedures would be contained within existing CAS, and aircraft would continue to be vectored onto final approach as they are within the baseline. If CAS Option 1 is progressed this option would be compatible with it, resulting in a reduction in CAS volume.

The option is not expected to impact the helicopter routes to and from Aberdeen Airport.

General Aviation/commercial airlines	Economic impact from increased effective capacity	Qualitative

This option is not expected to alter the airspace capacity at Aberdeen; the purpose is to provide resilience and meet the requirements of the Airspace Modernisation Strategy. The availability of PBN procedures provides resilience to the loss of the ILS which could reduce the number of diversions owing to improved minima over the remaining conventional approach procedures. This is expected to enable a reduction in operational costs for airlines however given the historic data around ILS outages, it would not be proportionate to try to quantify this.

General Aviation/commercial airlines	Fuel burn	Quantitative

Please see greenhouse gas assessment above.

Commercial airlines	Training costs	Qualitative

Procedures are introduced worldwide as part of an AIRAC cycle. As part of this cycle, airlines update their procedures accordingly and undertake training if required. This arrival option is not anticipated to require any additional training costs for airlines.

Commercial airlines	Other costs	Qualitative

No other airline costs are foreseen.

Airport/ANSP	Infrastructure costs	Quantitative

The initial deployment phase of the ACP may require some minor ATC system engineering amendments which are anticipated to cost £70,000.

Airport/ANSP	Operational costs	Quantitative

The availability of PBN procedures provides resilience to the loss of the ILS which could reduce the number of diversions owing to improved minima over the remaining conventional approach procedures. This may offer increased operating revenue to Aberdeen in the event of an ILS outage during poor weather however given the historic data around ILS outages, it would not be proportionate to try to quantify this.

The vectors to final approach procedures will require ongoing procedure design review as part of the mandatory 5 year review cycle. This is anticipated to cost £8,000 every 5 years.

Airport/ANSP	Deployment costs	Quantitative

This option is expected to require a small amount of training cost for Air Traffic Controllers at Aberdeen ATC which is estimated to cost £15,000.

All	Safety	Qualitative

Procedure operability: This option is expected to be as safe as the baseline and no other safety concerns have been raised. This is because the option is very similar to what happens today and has been designed to be operated in line with the existing ATCSMAC boundaries and levels. This was an important request from ATC when considering the various options. This option would offer some ATC workload benefits in the event of ILS u/s as VOR approaches do generate higher workload than RNP Approaches.
Procedure design: Procedures will be designed by UK Approved Procedure Design Organisation and validated in accordance with CAA Policy.

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Group	Impact	Level of analysis
Non-Precision Approaches: Implementation of RNP Approach procedures can be expected to enhance safety in the event of ILS unserviceability where operators would otherwise be reliant on Non-Precision Approaches (NPA). PBN approaches are widely claimed to enhance safety over NPAs through reducing the risk of Controlled Flight Into Terrain (CFIT).		
All	Performance against the vision and parameters/strategic objectives of the AMS	Qualitative
The following qualitative assessment looks at the four objectives of the Airspace Modernisation Strategy: **Safety:** ATC workload is expected to remain similar to the baseline however PBN approaches do offer improved safety compared to NPA's in the event of an ILS outage. **Integration of diverse users:** This option offers operators arriving at Aberdeen greater resilience in the event of an ILS outage. With regards to other airspace users, the option is wholly contained within existing CAS and would be compatible with the proposed reduction in CAS outlined in CAS Option 1. **Simplification, reducing complexity and improving efficiency:** This option offers resilience in the event of ground based navigation aid outages. It does not seek to increase capacity at Aberdeen Airport; the purpose of the change is to provide resilience, reduce dependencies on VORs, and offer PBN procedures which meet the AMS. The option would be operated very similarly to how aircraft arrive today and therefore there are not any opportunities for simplification, reducing complexity, or decreasing ATC workload through day to day operations although there are some workload benefits in the event of ILS u/s. **Environmental sustainability:** This option would have no material change in terms of noise, carbon emissions and air quality when compared against the baseline.		

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5.3 T-Bars

Option description

5.3.1 This option would see those arrivals wishing to fly an RNP approach vectored towards an Initial Approach Fix (IAF) positioned on base-leg from either side of final approach or in the centre of the T-bar. The runway 16 IAFs have been positioned consistent with a c.10nm join onto final approach. The runway 34 IAFs have been positioned consistent with an c.11nm final approach joining point. The vast majority of aircraft (95%+) would continue to arrive as they do today.

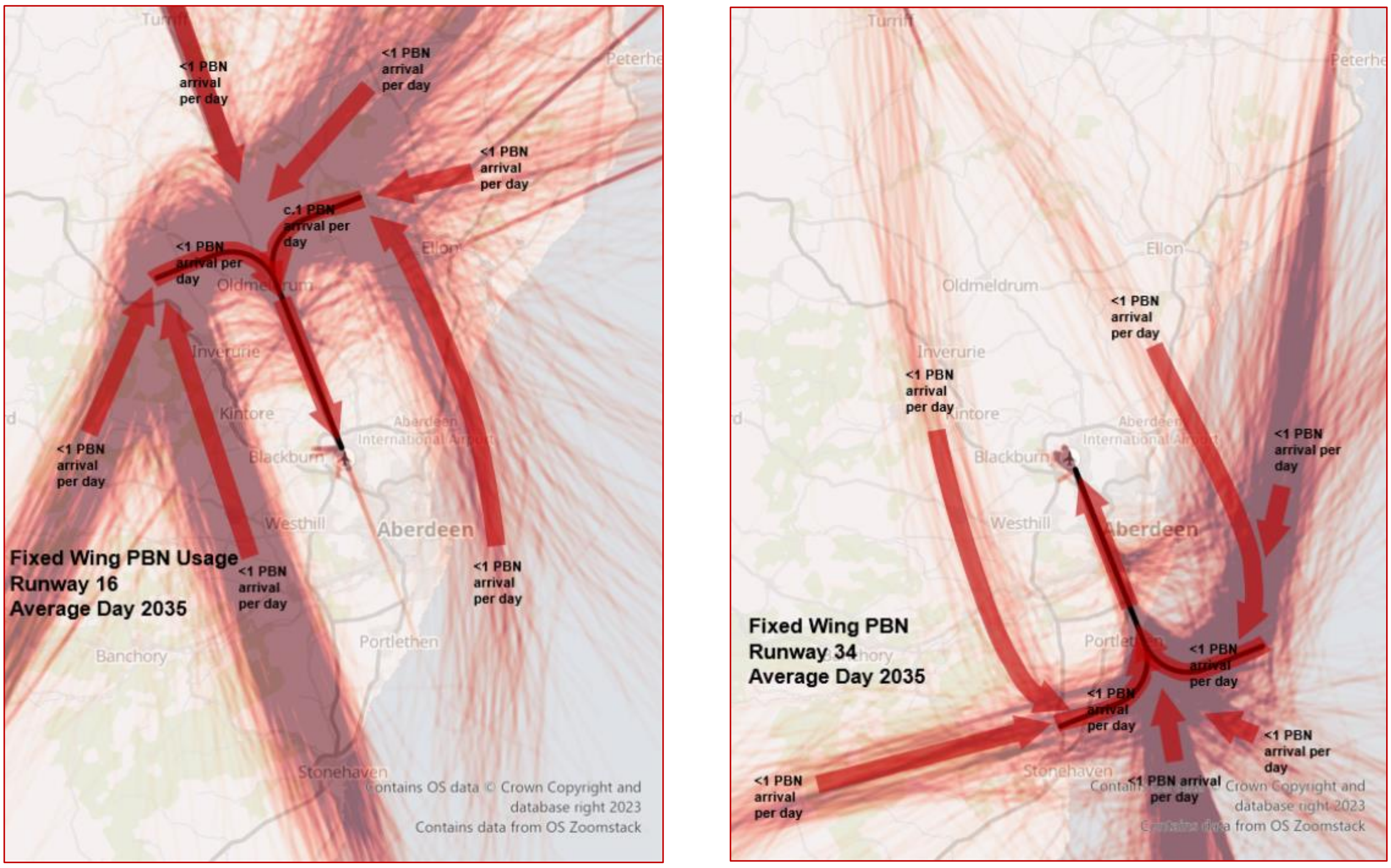

Figure 29 Expected fixed wing usage of T-Bar Option based on optimistic 5% estimate. Note: The majority of arrivals (95%+) would continue to arrive as they do within the baseline.

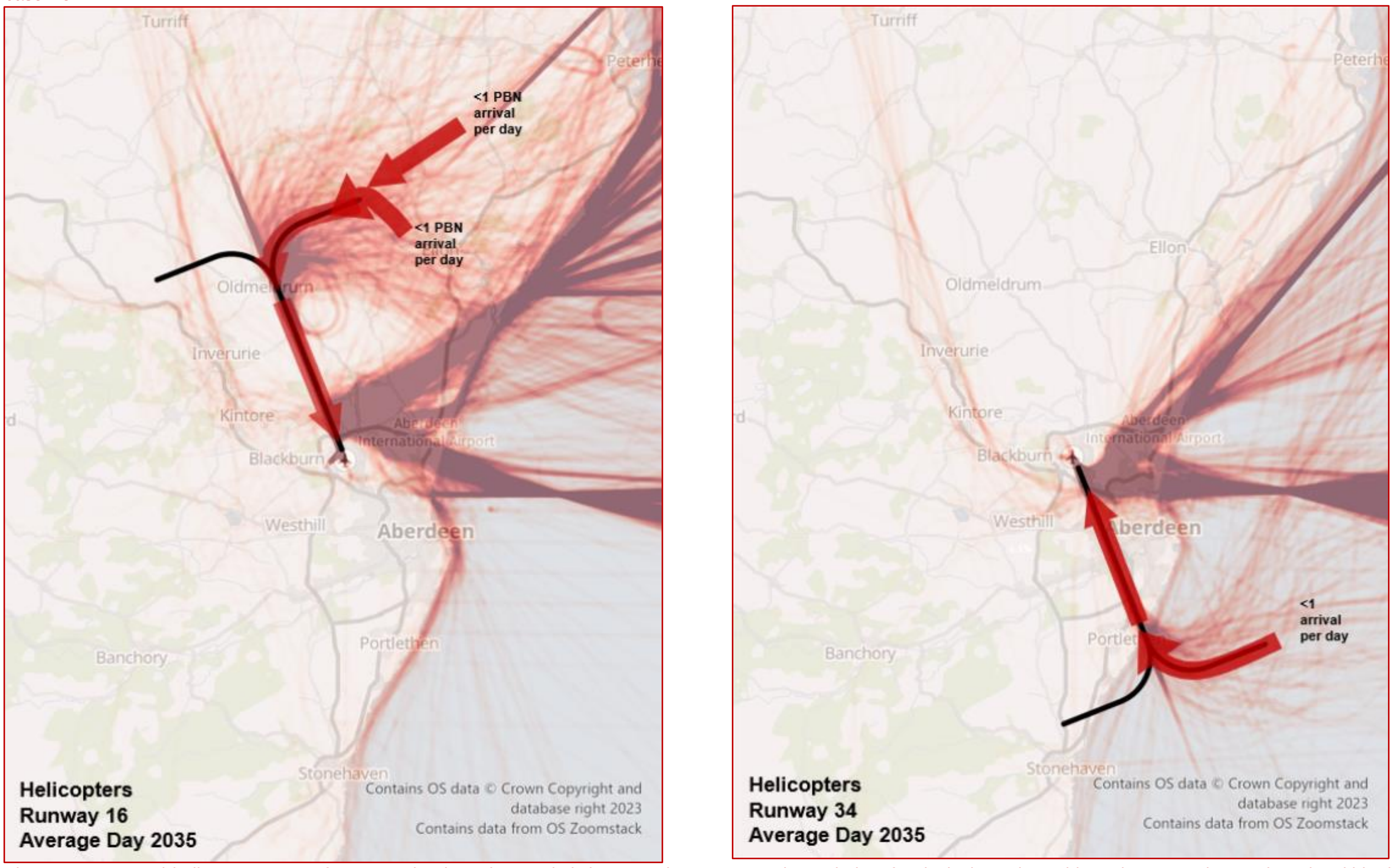

Figure 30 Expected helicopter usage of T-Bar option based on optimistic 5% estimate. Note: The majority of arrivals (95%+) would continue to arrive as they do within the baseline.

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5.3.2 The following figure shows a draft indicative chart for the T-Bar RNP approach procedures with the associated missed approach procedures. Sections of the chart have been redacted as the CAA does not permit draft charts to be published as part of an ACP. If any stakeholders require more information in order to be able to comment on the proposals, please do get in contact with us via airspace@aiairport.com.

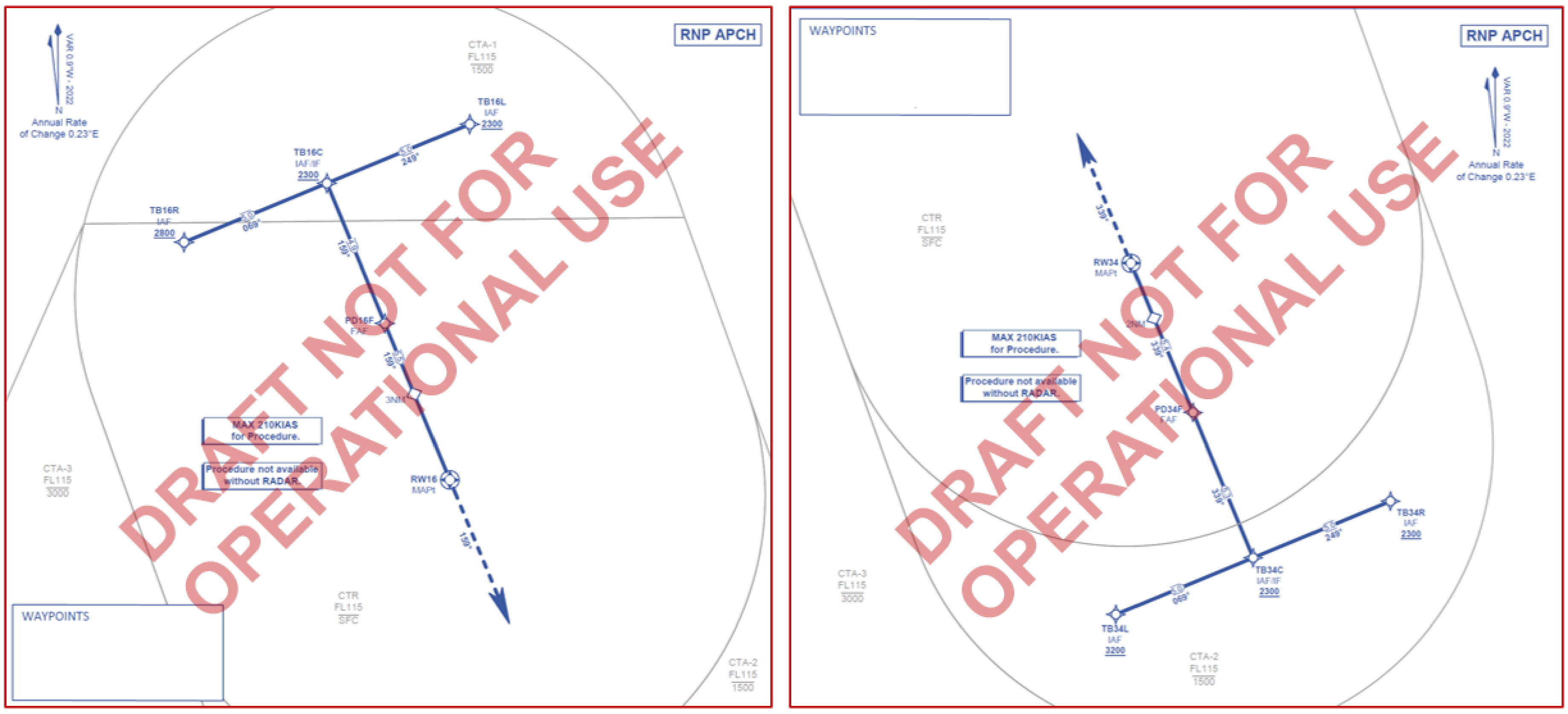

Figure 31 T-Bar: Draft Indicative Chart Information, with Missed Approach

Full Options Appraisal

Group	Impact	Level of analysis
Communities	Noise impact on health and quality of life	Qualitative and quantitative

For the purposes of the noise assessment data, option B = T-Bars

TAG outcomes

TAG has been used to assess total noise impacts over a 10-year appraisal period. The monetised net present value (NPV) of noise changes of this option is -£1,831 (2010 prices). It is important to highlight that this result is influenced by a limited number of receptors transitioning between 1dB bands in the TAG evaluation due to noise variations of less than 0.1dB. These changes are negligible beyond the accuracy of any noise model. Therefore the TAG outcome for this option is not considered to be material to the assessment.

It is also important to note that the TAG methodology is based on analysis in 1dB bands whereas the L_{Aeq} contour data is presented in 3dB bands as required by CAP1616. This means that the numbers in the TAG tables and the number in the L_{Aeq} contour tables cannot be directly compared. For example there may be individuals that experience a small noise change that moves them from 1dB band to another, but they remain within the same, wider, 3dB band. This does not affect the way the assessment is undertaken, it is simply a difference in the way the data is summarised.

Scenario	NPV Total	NPV Sleep	NPV Amenity	NPV AMI	NPV Stroke	NPV Dementia	Individuals experiencing increased daytime noise in forecast year	Individuals experiencing reduced daytime noise in forecast year	Individuals experiencing increased nighttime noise in forecast year	Individuals experiencing reduced nighttime noise in forecast year
Option B	-£1,831	-£2,905	£852	£0	£89	£133	47	27	0	19

L_{Aeq} contours

The following table shows the difference between the option L_{Aeq} performance and the baseline for year of implementation and 10 years following implementation:

Year	Scenario	Metric	Contour	Area (km²)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2026	Opt B Comparison	$L_{Aeq, 16hr}$	51	0.00	0	0	0	0	0	0
			54	0.00	0	0	0	0	0	0
			57	0.00	0	0	0	0	0	0
			60	0.00	0	0	0	0	0	0
			63	0.00	0	0	0	0	0	0

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Group	Impact	Level of analysis

Year	Scenario	Metric	Contour	Area (km²)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2035	Opt B Comparison	$L_{Aeq, 16hr}$	51	0.00	0	0	0	0	0	0
			54	0.00	0	0	0	0	0	0
			57	0.00	0	0	0	0	0	0
			60	0.00	0	0	0	0	0	0
			63	0.00	0	0	0	0	0	0

Year	Scenario	Metric	Contour	Area (km²)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2026	Opt B Comparison	$L_{Aeq, 8hr}$	45	0.00	0	0	0	0	0	0
			48	0.00	0	0	0	0	0	0
			51	0.00	0	0	0	0	0	0
			54	0.00	0	0	0	0	0	0
			55	0.00	0	0	0	0	0	0
			57	0.00	0	0	0	0	0	0

Year	Scenario	Metric	Contour	Area (km²)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2035	Opt B Comparison	$L_{Aeq, 8hr}$	45	0.00	0	0	0	0	0	0
			48	0.00	0	0	0	0	0	0
			51	0.00	0	0	0	0	0	0
			54	0.00	0	0	0	0	0	0
			55	0.00	0	0	0	0	0	0
			57	0.00	0	0	0	0	0	0

N60 N65 contours

The following table shows the difference between the option N65/N60 performance and the baseline for year of implementation and 10 years following implementation:

Year	Scenario	Metric	Contour	Area (km²)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2026	Opt B Comparison	N65	5	0.50	0	0	0	0	0	0
			10	0.00	-100	0	0	0	0	0
			20	0.00	0	0	0	0	0	0
			50	0.00	0	0	0	0	0	0
			100	0.00	0	0	0	0	0	0

Year	Scenario	Metric	Contour	Area (km²)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2035	Opt B Comparison	N65	5	0.50	100	0	0	0	0	0
			10	0.00	0	0	0	0	0	0
			20	0.00	0	0	0	0	0	0
			50	0.00	0	0	0	0	0	0
			100	0.00	0	0	0	0	0	0

Year	Scenario	Metric	Contour	Area (km²)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2026	Opt B Comparison	N60	5	0.00	0	0	0	0	0	0
			10	0.00	0	0	0	0	0	0
			20	0.00	0	0	0	0	0	0

Year	Scenario	Metric	Contour	Area (km²)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2035	Opt B Comparison	N60	5	0.00	0	0	0	0	0	0
			10	0.00	0	0	0	0	0	0
			20	0.00	0	0	0	0	0	0

Overflight contours

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Group	Impact	Level of analysis

The following table shows the difference between the option overflight performance and the baseline, for year of implementation and 10 years following implementation:

Year	Scenario	Metric	Contour	Area (km^2)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2026	Opt B Comparison	Overflights (24hr)	5	7.30	400	0	0	2	0	-1
			10	-1.40	0	0	0	0	0	0
			20	-0.30	0	0	0	0	0	0
			50	0.00	0	0	0	0	0	0

Year	Scenario	Metric	Contour	Area (km^2)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2035	Opt B Comparison	Overflights (24hr)	5	9.00	300	0	0	1	0	-1
			10	-1.10	100	0	0	0	0	0
			20	-0.40	0	0	0	0	0	0
			50	0.00	0	0	0	0	0	0

Noise summary
When operating the PBN approach, aircraft will initially continue to be vectored from above 7000ft until joining the IAFs of the PBN procedure at approximately 5000ft. As aircraft will be vectored onto these fixed waypoints, this may to a small redistribution of flight tracks. The T-Bars and the northern IAF/IF are located within the concentrated parts of the existing swathe and therefore it is anticipated that any noise redistribution here would be very small. As only c.5% of arrivals are anticipated to use the RNP approach procedures, this 5% of traffic will be split between the various arrival directions, and given they will join within the existing swathe, this is expected to result in noise change so minimal that it will not be material.

Once aircraft have joined the PBN procedure at the IAF, there will be some concentration of tracks along the RNP approach base leg which will result in a small change in noise distribution however owing to how few aircraft are expected to fly the T-Bars on average, and how the T-Bars are located within the existing arrival swathes, we expect any change to be almost imperceptible. Beyond base leg, aircraft will fly the same final approach track as they do today.

All noise changes within the LOAEL contours are less than 0.1dB at any given postcode receptor, which is negligible in terms of the potential for adverse noise effects. This is reflected in the primary noise data which shows no changes in the L_{Aeq} contour data between the option and the baseline.

Similarly, although the TAG analysis shows that there is a cost associated with this option, it is important to highlight that this result is influenced by a limited number of receptors transitioning between 1dB bands in the TAG evaluation due to noise variations of less than 0.1dB. These changes are negligible beyond the accuracy of any noise model. Therefore the TAG outcome for this option is not considered to be material to the assessment.

The secondary N60 metric shows no changes in contour data and the N65 metrics suggests very marginal differences which are not anticipated to be material.

Finally the overflight data, which is generated between 0-7000ft, shows marginal differences in the lower frequency 5 and 10 per day contours which result in some increases to the number of people overflown compared to the baseline. It is important to note however that these increases are based on an optimistic 5% of arriving aircraft flying the PBN procedures.

Overall, it is concluded that this option is not expected to result in any significant or material positive benefits or negative impacts to noise.

Wider society	**Tranquillity**	Quantitative

There are no changes in the number or area of locations/spaces that are relevant to the consideration of tranquillity within the L_{Aeq}, N60 and N65 contours (please see technical appendix A for full data tables). The Government's *Planning Practice Guidance – noise*[25] notes that at noise exposure below the LOAEL *"Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life."* It is therefore considered that as there are no material differences in noise levels within the L_{Aeq} contours that there are no material impacts to tranquillity.

Overflight data shows very small changes to designated gardens and landscapes within the 5 flights per day contour. However, the scale of the change to the area already overflown is not considered to be a material impact. .

Year	Scenario	Metric	Contour	Country parks		CQA		Gardens & Designated Landscapes		National Parks		NSA	
				Total	Area (km^2)	Total	Area (km^2)	Total	Area (km^2)	Total	Area (km^2)	Total	Area (km^2)
2026	Opt B Comparison	Overflights_24hr	5	0	0.00	0	0.00	0	0.20	0	0.00	0	0.00
			10	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			20	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			50	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Year	Scenario	Metric	Contour	Country parks	CQA	Gardens & Designated Landscapes	National Parks	NSA

[25] https://www.gov.uk/guidance/noise--2

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Group	Impact	Level of analysis

				Total	Area (km^2)	Total	Area (km^2)	Total	Area (km^2)	Total	Area (km^2)	Total	Area (km^2)
2035	Opt B Comparison	Overflights_24hr	5	1	0.00	0	0.00	0	0.40	0	0.00	0	0.00
			10	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			20	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			50	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Wider society	Biodiversity	Quantitative

This option overflies the River Dee SAC on final approach. The option will not increase the number of aircraft movements, will not change the altitude of aircraft, and will not change the lateral dispersion of aircraft overflying any the European Site below 3000ft. Considering this, the option is not likely to result in significant biodiversity effects on any European Site.

Communities	Air quality	Qualitative

Impacts to air quality are considered for changes below 1000ft. This option does not change lateral flight paths below 1000ft and therefore there is no anticipated change or impact to air quality as a result of this option.

Wider society	Greenhouse gas impact	Quantitative

No change to the profiles of inbound or outbound aircraft is expected as a result of this option. This option is not expected to impact aircraft departing from Aberdeen.

TAG outcomes
TAG has been used to assess the greenhouse gas impact over a 10-year appraisal period. The change in carbon dioxide emissions over the appraisal period is 44.7t, of which 44.3t is traded. The monetised net present value (NPV) of carbon dioxide equivalent emissions of this option is -£50 (2010 prices).

Fuel burn data

The following tables show annual Fuel Burn, and the associated cost:

Scenario	Year	Fuel use (t) (Annual)	Fuel cost (£) (Annual)
Do nothing	2026	18,221	11,866,099
T-Bars	2026	18,222	11,866,998
Difference:		*+1*	*+899*

Scenario	Year	Fuel use (t) (Annual)	Fuel cost (£) (Annual)
Do nothing	2035	18,694	12,174,230
T-Bars	2035	18,695	12,175,163
Difference:		*+1*	*+933*

Greenhouse Gas (GHG) emissions data

Scenario	Year	Total GHG emissions (tCO_2e)	International GHG emissions (tCO_2e)	Traded (Domestic) GHG emissions (tCO_2e)	Traded (EEA) GHG emissions (tCO_2e)	UKETS Traded GHG emissions (tCO_2e)	GHG emissions per flight (tCO_2e)
Do nothing	2026	57,942	576	46,349	11,017	57,366	0.68
T-Bars	2026	57,947	576	46,353	11,018	57,370	0.68
Difference:		*+5*	*0*	*+4*	*+1*	*+4*	*0*

Scenario	Year	Total GHG emissions (tCO_2e)	International GHG emissions (tCO_2e)	Traded (Domestic) GHG emissions (tCO_2e)	Traded (EEA) GHG emissions (tCO_2e)	UKETS Traded GHG emissions (tCO_2e)	GHG emissions per flight (tCO_2e)
Do nothing	2035	59,447	594	47,437	11,416	58,852	0.68
T-Bars	2035	59,452	595	47,440	11,417	58,857	0.68
Difference:		*+5*	*+1*	*+3*	*+1*	*+5*	*0*

The table above is based on the vast majority of IFR arrivals at Aberdeen flying an ILS approach as they do in the baseline today and it assumes an optimistic 5% of arrivals will fly the PBN approach option. However, the proposed PBN arrival options are predominately for resilience and so will most likely be used in the event of an ILS outage. With this in mind, Aberdeen has generated some data around fuel burn and carbon emissions of a VOR/DME approach, which would be flown in the event of an ILS outage.

Owing to the frequency of ILS outages, it is not possible to meaningfully incorporate an outage scenario into the carbon emission data above, which is required to be based on an annual forecast by CAP1616. Therefore, we have generated data for a single day of arrivals summarised by runway end which has been compared against the option.

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Group	Impact	Level of analysis

Option	Year	RWY16 Fuel (t) (Day)	RWY16 Carbon (tCO_2e) (Day)	RWY34 Fuel (t) (Day)	RWY34 Carbon (tCO_2e) (Day)	Total Fuel (t) (Day)	Total Carbon (tCO_2e) (Day)
VOR/DME Approach	2026	8.0	25.4	5.1	16.1	13.1	41.5
T-Bars	2026	7.6	24.3	4.6	14.8	12.3	39.0
VOR/DME Approach	2035	8.3	26.3	5.3	16.7	13.5	43.0
T-Bars	2035	7.9	25.1	4.8	15.3	12.7	40.4

Summary
When considering 5% of aircraft flying the T-Bar option, the fuel burn and carbon emissions data shows a small negative impact (less than 0.1% increase in total emissions between the do something and baseline scenarios, of which the majority are traded) to annualised fuel use and carbon emissions as required by CAP1616, however, as noted in this FOA, 5% usage is considered an optimistic estimate and therefore any negative impacts are likely to be smaller than stated in the data above. Considering this, the impact of this option on fuel burn and greenhouse gas emissions is not considered to be material to the assessment.

The RNP procedures are most likely to be flown in a resilience scenario when the ILS is unavailable and in this case, the option offers fuel burn and carbon emission improvements compared to the VOR/DME approach which is used today.

Group	Impact	Level of analysis
Wider society	Capacity/resilience	Qualitative

The introduction of PBN satellite-based approaches at Aberdeen would improve resilience in the event of ground-based navigation aid outage which may reduce delays and diversions. In addition to this, it would reduce Aberdeen's dependencies on conventional VORs which are outdated.

Although this ACP does not seek to increase capacity at Aberdeen, the implementation of the T-Bars would enable a workload reduction for Aberdeen ATC. This means in the event of ILS u/s, ATC may have greater capacity to handle traffic compared to current day where aircraft would fly a VOR/DME approach.

Group	Impact	Level of analysis
General Aviation	Access	Qualitative

This option is not expected to directly impact General Aviation; the procedure would be contained within existing CAS and aircraft would be vectored onto the RNP Approach T-Bar similar to the baseline. If CAS Option 1 is progressed this arrival option would be compatible with it, resulting in a reduction in CAS volume. The option is not expected to impact the published Helicopter routes to and from Aberdeen Airport.

Group	Impact	Level of analysis
General Aviation/commercial airlines	Economic impact from increased effective capacity	Qualitative

This option is not expected to alter the airspace capacity at Aberdeen; the purpose is to provide resilience and meet the requirements of the Airspace Modernisation Strategy. The availability of PBN procedures provides resilience to the loss of the ILS which should reduce the number of diversions owing to improved minima over the remaining conventional approach procedures. This is expected to enable a reduction in operational costs for airlines however given the historic data around ILS outages, it would not be proportionate to try to quantify this.

As noted in the capacity assessment, this option may improve capacity in the event of ILS u/s however as explained above, given the ILS has only been u/s for 6 hours in the last 5 years (unplanned), it would not be proportionate to attempt to quantify this.

Group	Impact	Level of analysis
General Aviation/commercial airlines	Fuel burn	Quantitative

Please see greenhouse gas assessment above.

Group	Impact	Level of analysis
Commercial airlines	Training costs	Qualitative

Procedures are introduced worldwide as part of an AIRAC cycle. As part of this cycle, airlines update their procedures accordingly and undertake training if required. This arrival option is not anticipated to require any additional training costs for airlines.

Group	Impact	Level of analysis
Commercial airlines	Other costs	Qualitative

No other airline costs are foreseen.

Group	Impact	Level of analysis
Airport/ANSP	Infrastructure costs	Quantitative

The initial deployment phase of the ACP may require some minor ATC system engineering amendments which are anticipated to cost £70,000.

Group	Impact	Level of analysis
Airport/ANSP	Operational costs	Quantitative

The availability of PBN procedures provides resilience to the loss of the ILS which could reduce the number of diversions owing to improved minima over the remaining conventional approach procedures. This may offer increased operating revenue to Aberdeen in the event of an ILS outage during poor weather however given the historic data around ILS outages, it would not be proportionate to try to quantify this.

The vectors to final approach procedures will require ongoing procedure design review as part of the mandatory 5 year review cycle. This is anticipated to cost £8,000 every 5 years.

Group	Impact	Level of analysis
Airport/ANSP	Deployment costs	Quantitative

This option is expected to require a small amount of training cost for Air Traffic Controllers at Aberdeen ATC which is estimated to cost £15,000.

Group	Impact	Level of analysis
All	Safety	Qualitative

Procedure operability: In the event of an ILS outage, this option would offer a small reduction in controller workload however further detailed safety analysis undertaken with ATC has raised concerns over increased complexity within the wider airspace around Aberdeen Airport as a result of implementing the T-Bar option. There are two main areas of safety risk; a risk to increasing complexity handling helicopter operations, and a risk with having IAF altitudes which are different to the existing levels ATC would usually descend aircraft to.

Helicopter operations
On both runways, ATC have raised a safety concern with having to climb helicopters to TAA altitudes to establish at an IF/IAF. This could present icing issues to the H175 fleet in winter conditions but also has the potential to introduce additional risk of separation loss against outbound helicopters at

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Group	Impact	Level of analysis

3000ft. This happens to a degree today, but the higher levels prescribed at TB16L and TB34R (IAF waypoints on the T-Bar) would aggravate the situation making effective management of that risk slightly harder and increasing complexity within the airspace.

IAF altitudes

CAP785B says that the procedure altitude applied to an IAP IAF or IAF/IF Fix/WP must be at or above the procedure MSA or TAA. This would result in different minimum levels at the proposed IAFs than ATC would usually descend aircraft to at that point. ATC requested that the new procedures have the same minimum levels at the IAFs that they tactically descend aircraft to, as per their ATCSMAC. We sought CAA IFP guidance to see if this was acceptable and were advised it was not. ATC have therefore raised concerns that the T-Bars would introduce added complications, changes to vectoring practices and potential confusion for ATC and pilots. These issues were heightened owing to the low frequency of use of the RNP APPROACH procedures and therefore increased risk of confusion owing to lack of familiarity with the different levels. Such issues could only have been uncovered earlier (i.e. in Stage 2) had detailed IFP design, charting and ATC safety investigations been performed at that stage.

Overall, ATC concluded that the T-Bars would introduce an undesirable level of complication, especially when considering the negligible differences in other benefits compared to the straight-in options. which do not present similar IAF altitude issues.

Procedure Design: Procedures will be designed by UK Approved Procedure Design Organisation and validated in accordance with CAA Policy.

Non-Precision Approaches: Implementation of RNP Approach procedures can be expected to enhance safety in the event of ILS unserviceability where operators would otherwise be reliant on Non-Precision Approaches (NPA). PBN approaches are widely claimed to enhance safety over NPAs through reducing the risk of Controlled Flight Into Terrain (CFIT).

All	Performance against the vision and parameters/strategic objectives of the AMS	Qualitative

The following qualitative assessment looks at the four objectives of the Airspace Modernisation Strategy:

Safety: ATC have raised concerns with additional complexity created by the T-Bar option (please see safety assessment for further information).

Integration of diverse users: This option offers operators arriving at Aberdeen greater resilience in the event of an ILS outage. With regards to other airspace users, the option is wholly contained within existing CAS and would be compatible with the proposed reduction in CAS outlined in CAS Option 1.

Simplification, reducing complexity and improving efficiency: This option offers resilience in the event of ground based navigation aid outages. It does not seek to increase capacity at Aberdeen Airport; the purpose of the change is to provide resilience, reduce dependencies on VORs, and offer PBN procedures which meet the AMS. The safety assessment has identified that the option has the potential to increase complexity within the airspace and as a result there may be increases in ATC workload.

Environmental sustainability: This option would have no material change in terms of noise, carbon emissions and air quality when compared against the baseline.

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5.4 Curved approaches and T-Bars

Option description

5.4.1 This option would see two types of PBN approach available to arrivals; curved approaches and T-Bars. The curved approaches use a type of PBN called Radius to Fix (RF). The RF allows aircraft to fly in an arc of fixed radius around a point, direct to the Final Approach Fix (FAF). Not all aircraft are able to fly curved approaches and therefore, in order to provide full resilience, they would need to be implemented alongside an alternative PBN approach option (T-Bars). The T-Bars within this option are the same T-Bars presented in the section above.

5.4.2 For the purposes of assessment, it is estimated that an optimistic c.5% of traffic may fly PBN approaches; around 3% would fly the curved approaches and the other 2% would fly the T-Bars. Given the location of the curved approaches, not all traffic would use these i.e. an aircraft arriving from the east would be highly unlikely to use a curved approach on runway 16 as the eastern T-Bar would offer a more direct route to land. The figure below provides an overview of the expected usage of these approaches:

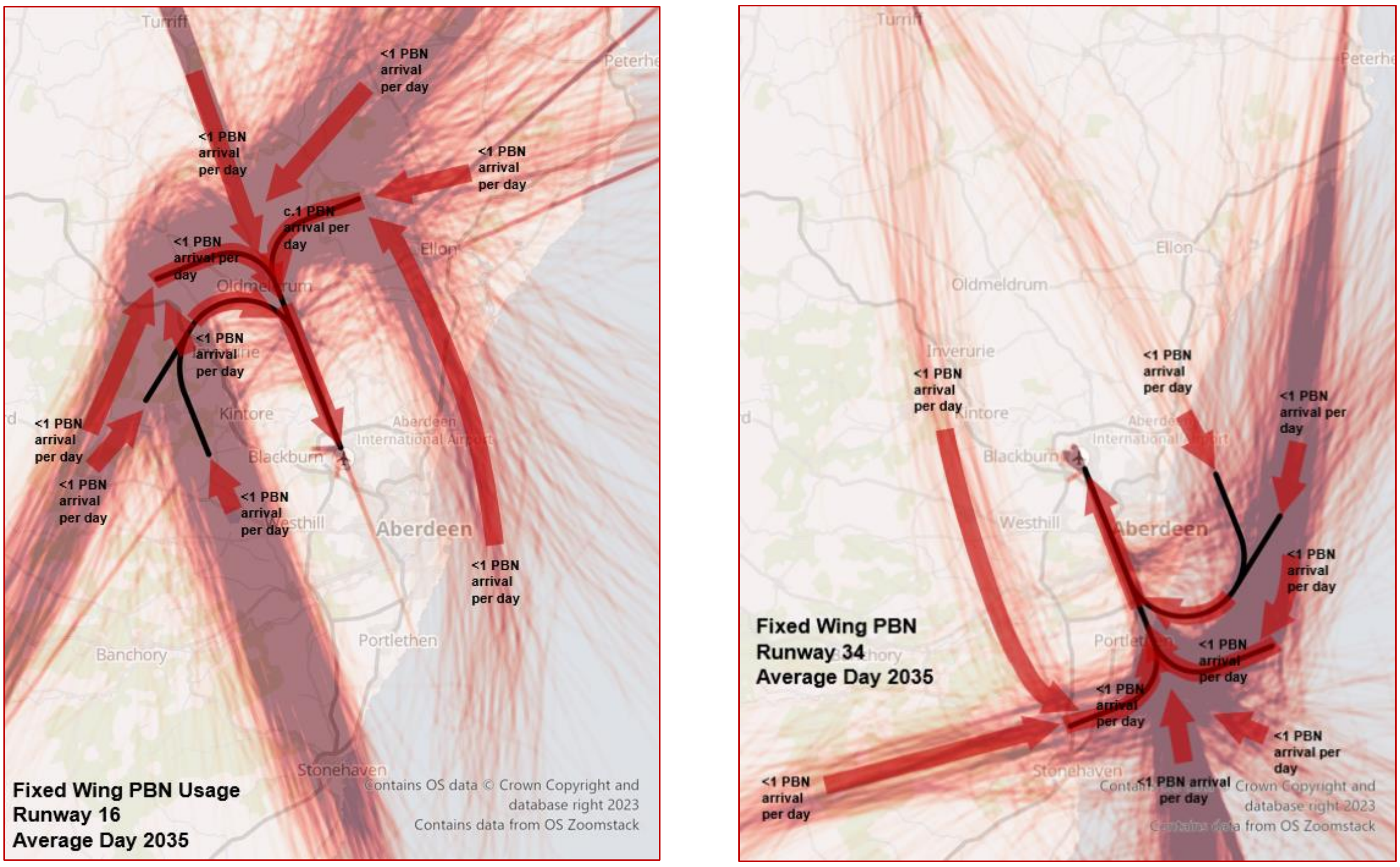

Figure 32 Expected fixed wing usage of Curved Approach with T-Bar Option based on optimistic 5% estimate. Note: The majority of arrivals (95%+) would continue to arrive as they do within the baseline.

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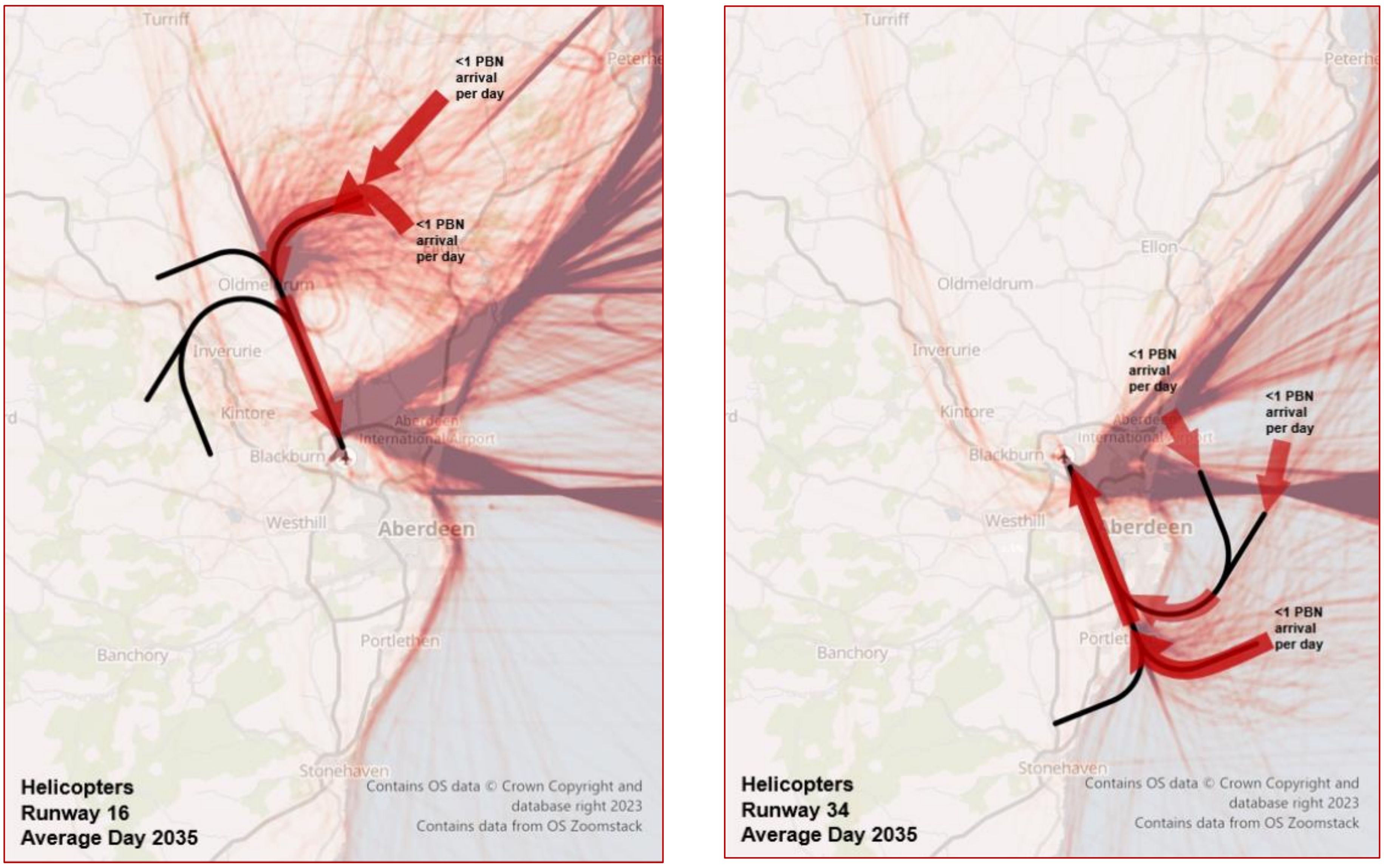

Figure 33 Expected helicopter usage of Curved Approach with T-Bar Option based on optimistic 5% estimate. Note: The majority of arrivals (95%+) would continue to arrive as they do within the baseline.

5.4.3 The following figure shows a draft indicative chart for the T-Bar RNP approach procedures and the curved approach procedures with the associated missed approach procedures. Sections of the charts have been redacted as the CAA does not permit draft charts to be published as part of an ACP. If any stakeholders require more information in order to be able to comment on the proposals, please do get in contact with us via airspace@aiairport.com.

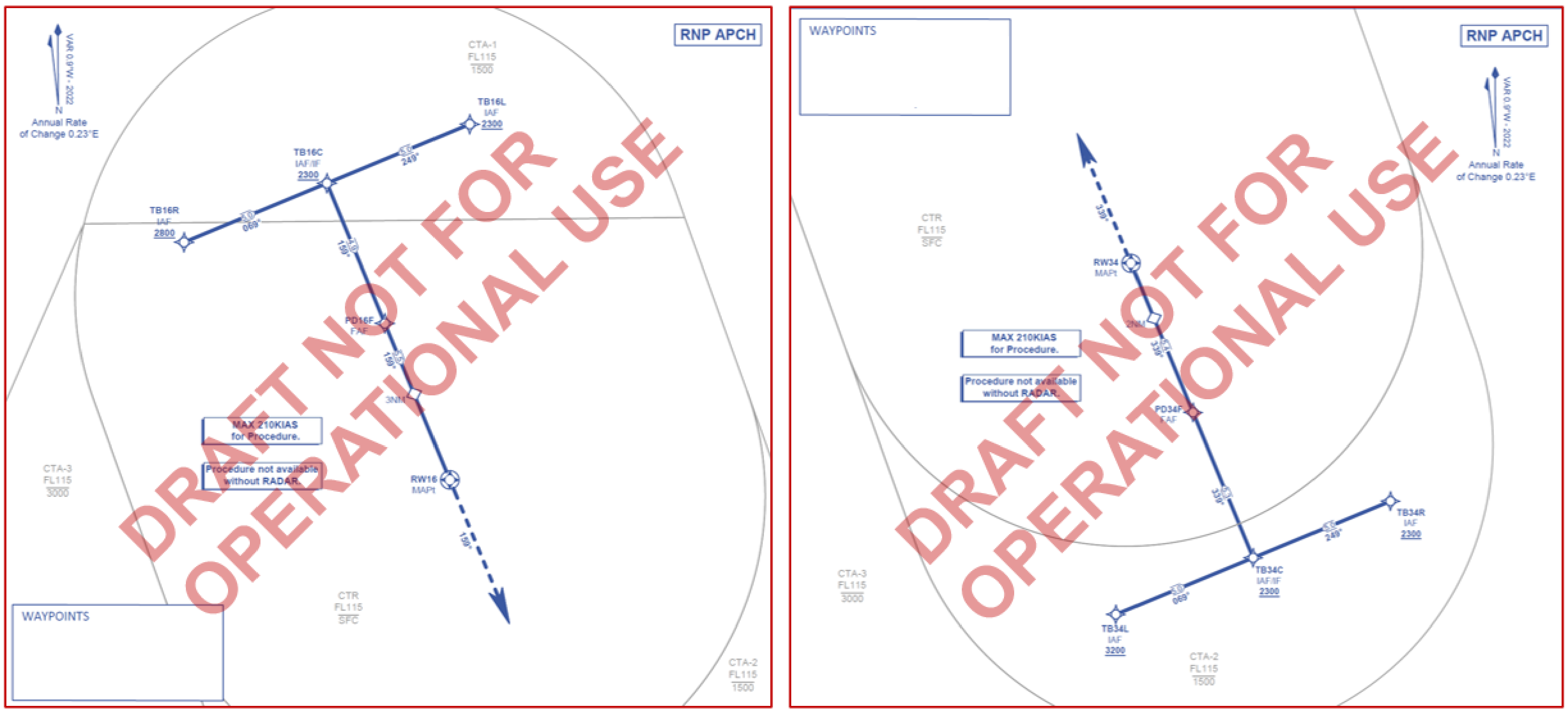

Figure 34 T-Bar: Draft Indicative Chart Information, with Missed Approach

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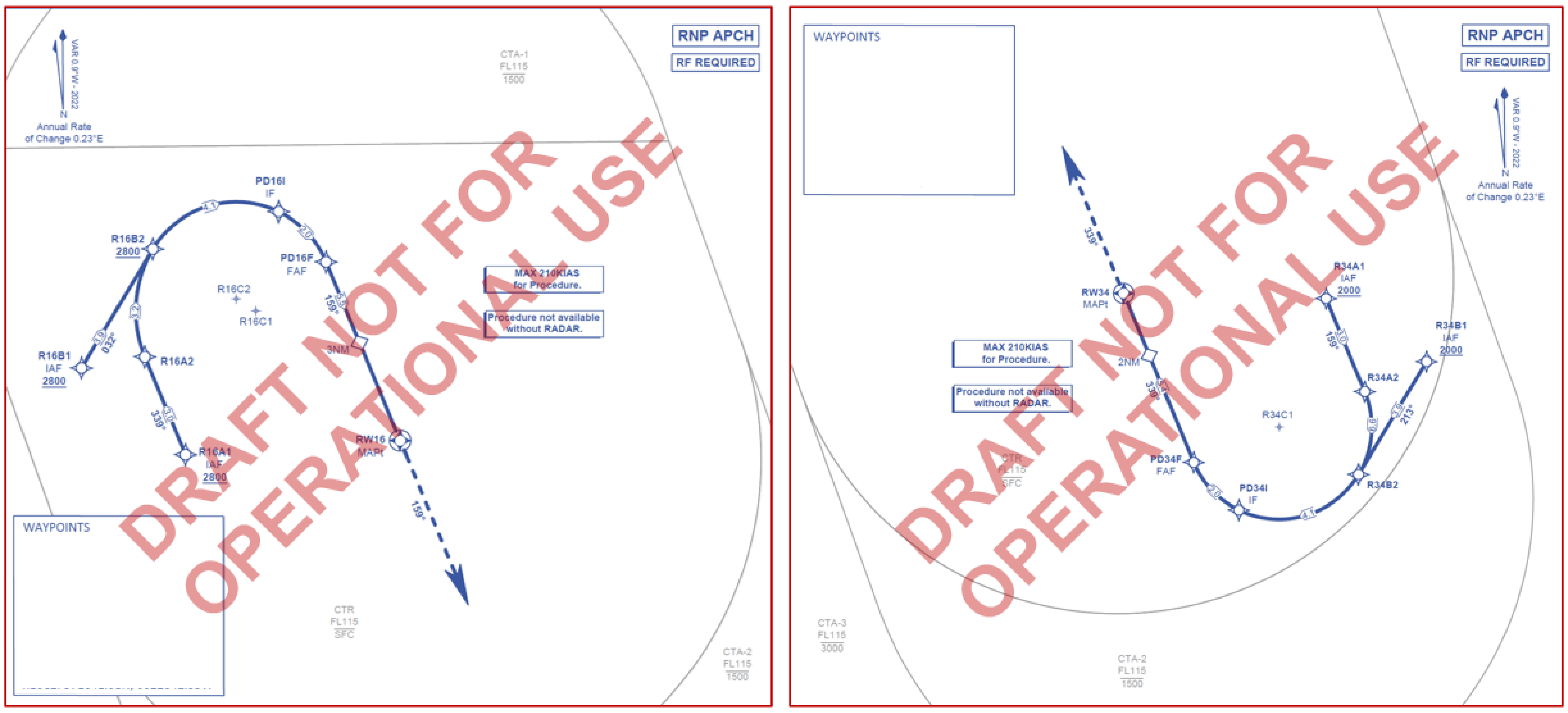

Figure 35 Curved Approaches: Draft Indicative Chart Information, with Missed Approach

Full Options Appraisal

Group	Impact	Level of analysis
Communities	Noise impact on health and quality of life	Qualitative and partly quantitative

For the purposes of the noise assessment data, Option C = Curved approaches with T-Bars

TAG outcomes

TAG has been used to assess total noise impacts over a 10-year appraisal period. The monetised net present value (NPV) of noise changes of this option is -£3,082 (2010 prices). It is important to highlight that this result is influenced by a limited number of receptors transitioning between 1dB bands in the TAG evaluation due to noise variations of less than 0.1dB. These changes are negligible beyond the accuracy of any noise model. Therefore the TAG outcome for this option is not considered to be material to the assessment.

It is also important to note that the TAG methodology is based on analysis in 1dB bands whereas the L_{Aeq} contour data is presented in 3dB bands as required by CAP1616. This means that the numbers in the TAG tables and the number in the L_{Aeq} contour tables cannot be directly compared. For example there may be individuals that experience a small noise change that moves them from 1dB band to another, but they remain within the same, wider, 3dB band. This does not affect the way the assessment is undertaken, it is simply a difference in the way the data is summarised.

Scenario	NPV Total	NPV Sleep	NPV Amenity	NPV AMI	NPV Stroke	NPV Dementia	Individuals experiencing increased daytime noise in forecast year	Individuals experiencing reduced daytime noise in forecast year	Individuals experiencing increased nighttime noise in forecast year	Individuals experiencing reduced nighttime noise in forecast year
Option C	-£3,082	-£4,156	£852	£0	£89	£133	47	27	0	19

L_{Aeq} contours

The following table shows the difference between the option L_{Aeq} performance and the baseline for year of implementation and 10 years following implementation.

Year	Scenario	Metric	Contour	Area (km²)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2026	Opt C Comparison	$L_{Aeq, 16hr}$	51	0.00	0	0	0	0	0	0
			54	0.00	0	0	0	0	0	0
			57	0.00	0	0	0	0	0	0
			60	0.00	0	0	0	0	0	0
			63	0.00	0	0	0	0	0	0

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Group				Impact					Level of analysis	
Year	Scenario	Metric	Contour	Area (km^2)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2035	Opt C Comparison	$L_{Aeq, 16hr}$	51	0.00	0	0	0	0	0	0
			54	0.00	0	0	0	0	0	0
			57	0.00	0	0	0	0	0	0
			60	0.00	0	0	0	0	0	0
			63	0.00	0	0	0	0	0	0

Year	Scenario	Metric	Contour	Area (km^2)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2026	Opt C Comparison	$L_{Aeq, 8hr}$	45	0.00	0	0	0	0	0	0
			48	0.00	0	0	0	0	0	0
			51	0.00	0	0	0	0	0	0
			54	0.00	0	0	0	0	0	0
			55	0.00	0	0	0	0	0	0
			57	0.00	0	0	0	0	0	0

Year	Scenario	Metric	Contour	Area (km^2)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2035	Opt C Comparison	$L_{Aeq, 8hr}$	45	0.00	0	0	0	0	0	0
			48	0.00	0	0	0	0	0	0
			51	0.00	0	0	0	0	0	0
			54	0.00	0	0	0	0	0	0
			55	0.00	0	0	0	0	0	0
			57	0.00	0	0	0	0	0	0

N60 N65 contours

The following table shows the difference between the option N65/N60 performance and the baseline for year of implementation and 10 years following implementation:

Year	Scenario	Metric	Contour	Area (km^2)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2026	Opt C Comparison	N65	5	0.00	0	0	0	0	0	0
			10	0.00	0	0	0	0	0	0
			20	0.00	0	0	0	0	0	0
			50	0.00	0	0	0	0	0	0
			100	0.00	0	0	0	0	0	0

Year	Scenario	Metric	Contour	Area (km^2)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2035	Opt C Comparison	N65	5	0.00	0	0	0	0	0	0
			10	0.00	0	0	0	0	0	0
			20	0.00	0	0	0	0	0	0
			50	0.00	0	0	0	0	0	0
			100	0.00	0	0	0	0	0	0

Year	Scenario	Metric	Contour	Area (km^2)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2026	Opt C Comparison	N60	5	0.00	0	0	0	0	0	0
			10	0.00	0	0	0	0	0	0
			20	0.00	0	0	0	0	0	0

Year	Scenario	Metric	Contour	Area (km^2)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2035	Opt C Comparison	N60	5	0.00	0	0	0	0	0	0
			10	0.00	0	0	0	0	0	0
			20	0.00	0	0	0	0	0	0

Overflight contours

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Group	Impact	Level of analysis

The following table shows the difference between the option overflight performance and the baseline, for year of implementation and 10 years following implementation:

Year	Scenario	Metric	Contour	Area (km²)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2026	Opt C Comparison	Overflights (24hr)	5	-0.20	0	0	0	0	0	0
			10	0.10	0	0	0	0	0	0
			20	-0.20	0	0	0	0	0	0
			50	0.00	0	0	0	0	0	0

Year	Scenario	Metric	Contour	Area (km²)	Total population	Number of carehomes	Number of hospitals	Number of listed buildings	Number of places of worship	Number of schools
2035	Opt C Comparison	Overflights (24hr)	5	-1.00	0	0	0	0	0	0
			10	0.10	-100	0	0	0	0	0
			20	-0.10	0	0	0	0	0	0
			50	0.00	0	0	0	0	0	0

Noise summary
When operating the curved approach onto runway 16, aircraft will initially continue to be vectored from 7000ft until joining the two IAFs at c.5000ft. The IAFs are located within the existing overflight swathe shown on the heatmap; however, when joining aircraft will be c.1000-2000ft lower in altitude at that geographical location than in the baseline because of the reduced distance to the runway threshold. The location of the IAFs is likely to result in small changes in vectoring / dispersion patterns for the c.3% of fixed wing arrivals which may fly the RNP approach with RF route between 7000-c.5000ft although this would occur in areas already overflown today.

Once established on the approach, the concentration enabled by PBN and the RF arc would mean aircraft would very accurately fly around the arc onto final approach. These areas are overflown by arrivals today, but the RF arc would result in a change to the distribution of noise. Aircraft would then turn to join the final approach extended centreline before flying the same final approach track as in the baseline. Owing to the small number of flights operating the RNP RF route, and this occurring largely over sparsely populated areas, the impacts of this are not expected to be significant (and are outside the L_{Aeq} contours). Beyond the FAF, aircraft will fly the same final approach as they do in the baseline.

When operating the curved approach onto runway 34 aircraft will initially be vectored from above 7000ft until joining the IAF at c. 5000ft. It is anticipated that the fixed wing arrivals with RF capabilities from the north and north east could elect to fly this curved approach option. The majority of helicopters arrive at Aberdeen from the north-east and east, and this curved approach is expected to be predominantly used by helicopters arriving from the NE.

The initial parts of the approach from the IAF to the IF occur over the water. The concentration enabled by PBN and the RF arc would mean aircraft would very accurately fly around the arc onto final approach. The centreline of the arc largely avoids populated areas, however there is a small amount of overflight of Cove Bay which could result in a small increase in in frequency of overflight for this area. The curved approach does however avoid the populated area of Marywell which is directly under the final approach in the baseline as well as the eastern parts of Portlethen Village and the area of Findon.

Owing to the small number of flights operating the RNP RF route, and this occurring largely over sparsely populated areas, the overall positive benefits and negative impacts of this route are not expected to be significant. Beyond the FAF, aircraft will fly the same final approach as they do in the baseline.

When operating the PBN T-Bar approach, aircraft will initially continue to be vectored from above 7000ft until joining the IAFs of the PBN procedure at approximately 5000ft. As aircraft will be vectored onto these fixed waypoints, this may to a small redistribution of flight tracks. The T-Bars and the northern IAF/IF are located within the concentrated parts of the existing swathe and therefore it is anticipated that any noise redistribution here would be very small. As only c.5% of arrivals are anticipated to use the RNP approach procedures, this 5% of traffic will be split between the various arrival directions, and given they will join within the existing swathe, this is expected to result in noise change so small that it will not be material.

Once aircraft have joined the PBN procedure at the IAF, there will be some concentration of tracks along the RNP approach base leg which will result in a small change in noise distribution however owing to how few aircraft are expected to fly the T-Bars on average, and how the T-Bars are located within the existing arrival swathes, we expected any change to be almost imperceptible. Beyond the base leg, aircraft will fly the same final approach track as they do today. All noise changes within the LOAEL contours are less than 0.1dB at any given postcode receptor, which is negligible in terms of the potential for adverse noise effects. This is reflected in the primary noise data which shows no changes in the L_{Aeq} contour data between the option and the baseline.

Similarly, although the TAG analysis shows that there is a cost associated with this option, it is important to highlight that this result is influenced by a limited number of receptors transitioning between 1dB bands in the TAG evaluation due to noise variations of less than 0.1dB. These changes are negligible beyond the accuracy of any noise model. Therefore the TAG outcome for this option is not considered to be material to the assessment.

The secondary N60 metric shows no changes in contour data and the N65 metrics suggests very marginal differences which are not anticipated to be material.

Finally the overflight data, which is generated between 0-7000ft, shows a very marginal difference in population in the 10 per day contour which result in a small decrease to the number of people overflown compared to the baseline. It is important to note however that this is based on an optimistic assumption of 5% of arriving aircraft flying the PBN procedures.

Overall, it is concluded that this option is not expected to result in any significant or material positive benefits or negative impacts to noise.

Wider society	**Tranquillity**	Quantitative

There are no changes in the number or area of locations/spaces that are relevant to the consideration of tranquillity within the L_{Aeq}, N60 and N65 contours (please see technical appendix A for full data tables). The Government's *Planning Practice Guidance – noise*[26] notes that at noise exposure below the LOAEL *"Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life."* It is therefore considered that as there are no material differences in noise levels within the L_{Aeq} contours that there are no material impacts to tranquillity.

[26] https://www.gov.uk/guidance/noise--2

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Group	Impact	Level of analysis

Overflight data shows a very small benefit to designated gardens and landscapes within the 5 flights per day contour however overall there is no change material to tranquillity within the L_{Aeq} contours and the N60/N65 metrics which form the main basis of assessing noise.

Year	Scenario	Metric	Contour	Country parks		CQA		Gardens & Designated Landscapes		National Parks		NSA	
				Total	Area (km²)	Total	Area (km²)	Total	Area (km²)	Total	Area (km²)	Total	Area (km²)
2026	Opt C Comparison	Overflights (24hr)	5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			10	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			20	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			50	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Year	Scenario	Metric	Contour	Country parks		CQA		Gardens & Designated Landscapes		National Parks		NSA	
				Total	Area (km²)	Total	Area (km²)	Total	Area (km²)	Total	Area (km²)	Total	Area (km²)
2035	Opt C Comparison	Overflights (24hr)	5	0	0.00	0	0.00	0	-0.20	0	0.00	0	0.00
			10	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			20	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			50	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Overflight data shows a very small benefit to designated gardens and landscapes within the 5 flights per day contour however overall there is no change to tranquillity within the LAeq contours and the N60/N65 metrics which form the main basis of assessing noise.

Wider society	Biodiversity	Quantitative

This option overflies the River Dee SAC on final approach. The option will not increase the number of aircraft movements, will not change the altitude of aircraft, and will not change the lateral dispersion of aircraft overflying any the European Site below 3000ft. Considering this, the option is not likely to result in significant biodiversity effects on any European Site.

Communities	Air quality	Qualitative

Impacts to air quality are considered for changes below 1000ft. This option does not change lateral flight paths below 1000ft and therefore there is no anticipated change or impact to air quality as a result of this option.

Wider society	Greenhouse gas impact	Quantitative

TAG outcomes
TAG has been used to assess the greenhouse gas impact over a 10-year appraisal period. The change in carbon dioxide emissions over the appraisal period is 1.4t, of which 1.4t is traded. The monetised net present value (NPV) of carbon dioxide equivalent emissions of this option is -£9 (2010 prices).

Fuel burn data

The following table shows annual fuel burn, and the associated cost:

Scenario	Year	Fuel use (t)	Fuel cost (£)
Do nothing	2026	18,221	11,866,099
Curved approaches with T-Bars	2026	18,221	11,866,072
Difference:		*0*	*-27*

Scenario	Year	Fuel use (t)	Fuel cost (£)
Do nothing	2035	18,694	12,174,230
Curved approaches with T-Bars	2035	18,694	12,174,202
Difference:		*0*	*-28*

Greenhouse Gas (GHG) data

Scenario	Year	Total GHG emissions (tCO_2e)	International GHG emissions (tCO_2e)	Traded (Domestic) GHG emissions (tCO_2e)	Traded (EEA) GHG emissions (tCO_2e)	UKETS Traded GHG emissions (tCO_2e)	GHG emissions per flight (tCO_2e)
Do nothing	2026	57,942	576	46,349	11,017	57,366	0.68
Curved approaches with T-Bars	2026	57,942	576	46,349	11,017	57,366	0.68

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Group	Impact	Level of analysis

Difference:	*0*	*0*	*0*	*0*	*0*	*0*

Scenario	Year	Total GHG emissions (tCO_2e)	International GHG emissions (tCO_2e)	Traded (Domestic) GHG emissions (tCO_2e)	Traded (EEA) GHG emissions (tCO_2e)	UKETS Traded GHG emissions (tCO_2e)	GHG emissions per flight (tCO_2e)
Do nothing	2035	59,447	594	47,437	11,416	58,852	0.68
Curved approaches with T-Bars	2035	59,447	595	47,437	11,416	58,852	0.68
Difference:		*0*	*+1*	*0*	*0*	*0*	*0*

The tables above are based on the vast majority of IFR arrivals at Aberdeen flying an ILS approach as they do in the baseline today and it assumes an optimistic 5% of arrivals will fly the PBN approach option. However, the proposed PBN arrival options are predominately for resilience and so will most likely be used in the event of an ILS outage. With this in mind, Aberdeen has generated some data around fuel burn and carbon emissions of a VOR/DME approach, which would be flown in the event of an ILS outage.

Owing to the frequency of ILS outages, it is not possible to meaningfully incorporate an outage scenario into the carbon emission data above, which is required to be based on an annual forecast by CAP1616. Therefore, we have generated data for a single day of arrivals summarised by runway end which has been compared against the option.

Option	Year	RWY16		RWY34		Total	
		Fuel (t) (Day)	Carbon (tCO_2e) (Day)	Fuel (t) (Day)	Carbon (tCO_2e) (Day)	Fuel (t) (Day)	Carbon (tCO_2e) (Day)
VOR/DME approach	2026	8.0	25.4	5.1	16.1	13.1	41.5
T-Bars and curved approaches	2026	7.5	23.9	4.6	14.5	12.1	38.4
VOR/DME approach	2035	8.3	26.3	5.3	16.7	13.5	43.0
T-Bars and curved approaches	2035	7.8	24.8	4.7	15.0	12.5	39.8

Summary
When considering 5% of aircraft flying the curved approach with T-Bar option, the annualised fuel burn and carbon emissions data required by CAP16161 shows very small changes in fuel use and carbon emissions and it can be concluded the option overall offers similar performance to what happens today. Considering this, the impact of this option on fuel burn and greenhouse gas emissions is not considered to be material to the assessment.

The RNP procedures are most likely to be flown in a resilience scenario when the ILS is unavailable and in this case, the option offers fuel burn and carbon emission improvements compared to the VOR/DME approach which is used today.

Wider society	Capacity/resilience	Qualitative

The introduction of PBN satellite-based approaches at Aberdeen would improve resilience in the event of ground-based navigation aid outage which may reduce delays and diversions. In addition to this, it would reduce Aberdeen's dependencies on conventional VORs which are outdated.

Although this ACP does not seek to increase capacity at Aberdeen, the implementation of the T-Bars would enable a workload reduction for Aberdeen ATC. This means in the event of ILS u/s, ATC may have greater capacity to handle traffic compared to current day where aircraft would fly a VOR/DME approach.

General Aviation	Access	Qualitative

This option is not expected to directly impact General Aviation; the procedure would be contained within existing CAS and aircraft would be vectored onto the RNP approach T-Bar similar to the baseline. If CAS Option 1 is progressed this arrival option would be compatible with it, resulting in a reduction in CAS volume. The option is not expected to impact the helicopter routes to and from Aberdeen Airport.

General Aviation/commercial airlines	Economic impact from increased effective capacity	Qualitative

This option is not expected to alter the airspace capacity at Aberdeen; the purpose is to provide resilience and meet the requirements of the Airspace Modernisation Strategy. The availability of PBN procedures provides resilience to the loss of the ILS which should reduce the number of diversions owing to improved minima over the remaining conventional approach procedures. This is expected to enable a reduction in operational costs for airlines however given the historic data around ILS outages, it would not be proportionate to try to quantify this.

As noted in the capacity assessment, this option may improve capacity in the event of ILS u/s however as explained above, given the ILS has only been u/s for 6 hours in the last 5 years (unplanned), it would not be proportionate to attempt to quantify this.

General Aviation/commercial airlines	Fuel burn	Qualitative

Please see greenhouse gas assessment above.

Commercial airlines	Training costs	Qualitative

Procedures are introduced worldwide as part of an AIRAC cycle. As part of this cycle, airlines update their procedures accordingly and undertake training if required. This arrival option is not anticipated to require any additional training costs for airlines.

Commercial airlines	Other costs	Qualitative

No other airline costs are foreseen.

Airport/ANSP	Infrastructure costs	Quantitative

The initial deployment phase of the ACP may require some minor ATC system engineering amendments which are anticipated to cost £70,000.

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Group	Impact	Level of analysis
Airport/ANSP	Operational costs	Quantitative

The availability of PBN procedures provides resilience to the loss of the ILS which could reduce the number of diversions owing to improved minima over the remaining conventional approach procedures. This may offer increased operating revenue to Aberdeen in the event of an ILS outage during poor weather however given the historic data around ILS outages, it would not be proportionate to try to quantify this.

The vectors to final approach procedures will require ongoing procedure design review as part of the mandatory 5 year review cycle. This is anticipated to cost £12,000 every 5 years.

Group	Impact	Level of analysis
Airport/ANSP	Deployment costs	Quantitative

This option is expected to require a small amount of training cost for Air Traffic Controllers at Aberdeen ATC which is estimated to cost £15,000.

Group	Impact	Level of analysis
All	Safety	Qualitative

Procedure operability: In the event of an ILS outage, this option would offer a small reduction in controller workload however further detailed safety analysis undertaken with ATC has raised concerns over increased complexity within the wider airspace around Aberdeen Airport as a result of implementing the curved approaches and T-Bar option. There are two main areas of safety risk; a risk to helicopter operations, and a risk with having IAF altitudes which are different to the existing levels ATC would usually descend aircraft to.

Helicopter operations
On both runways, ATC have raised a safety concern with having to climb helicopters to TAA altitudes to establish at an IF/IAF. This could present icing issues to the H175 fleet in winter conditions but also has the potential to introduce additional risk of separation loss against outbound helicopters at 3000ft. This happens to a degree today, but the higher levels prescribed at TB16L and TB34R (IAF waypoints on the T-Bar) would aggravate the situation making effective management of that risk slightly harder and increasing complexity within the airspace.

IAF altitudes
CAP785B says that the procedure altitude applied to an IAP IAF or IAF/IF Fix/WP must be at or above the procedure MSA or TAA. This would result in different minimum levels at the proposed IAFs than ATC would usually descend aircraft to at that point. ATC requested that the new procedures have the same minimum levels at the IAFs that they tactically descend aircraft to, as per their ATCSMAC. We sought CAA IFP guidance to see if this was acceptable and were advised it was not. ATC have therefore raised concerns that the T-Bars would introduce added complications, changes to vectoring practices and potential confusion for ATC and Pilots. These issues were heightened owing to the low frequency of use of the RNP APPROACH procedures and therefore increased risk of confusion owing to lack of familiarity with the different levels.

The above risks are mainly associated with the T-Bar element of the option however the introduction of curved approaches alongside the T-Bars only then increases the complexity of the airspace as ATC manage aircraft onto these additional procedures, alongside the T-Bars and existing approaches. Such issues could only have been uncovered earlier (i.e. in Stage 2) had detailed IFP design, charting and ATC safety investigations been performed at that stage.

Overall, ATC concluded that the T-Bars would introduce an undesirable level of complication, especially when considering the negligible differences in other benefits compared to the straight-in options which do not present similar IAF altitude issues.

Group	Impact	Level of analysis
All	Performance against the vision and parameters/strategic objectives of the AMS	Qualitative

The following qualitative assessment looks at the four objectives of the Airspace Modernisation Strategy:

Safety: ATC have raised concerns with additional complexity created by the option (please see safety assessment for further information).

Integration of diverse users: This option offers operators arriving at Aberdeen greater resilience in the event of an ILS outage. With regards to other airspace users, the option is wholly contained within existing CAS and would be compatible with the proposed reduction in CAS outlined in CAS Option 1.

Simplification, reducing complexity and improving efficiency: This option offers resilience in the event of ground based navigation aid outages. It does not seek to increase capacity at Aberdeen Airport; the purpose of the change is to provide resilience, reduce dependencies on VORs, and offer PBN procedures which meet the AMS. The safety assessment has identified that the option has the potential to increase complexity within the airspace and as a result there may be increases in ATC workload.

Environmental sustainability: This option would have no material change in terms of noise, carbon emissions and air quality when compared against the baseline.

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5.5 Existing Controlled Airspace (CAS) 'do nothing' and CAS assessment methodology

Option description

5.5.1 The Controlled Airspace (CAS) structure will remain as it is today. Please see section AD 2 EGPD (AD 2.EGPD-4-1) of the eAIP for the Class D Airspace chart.

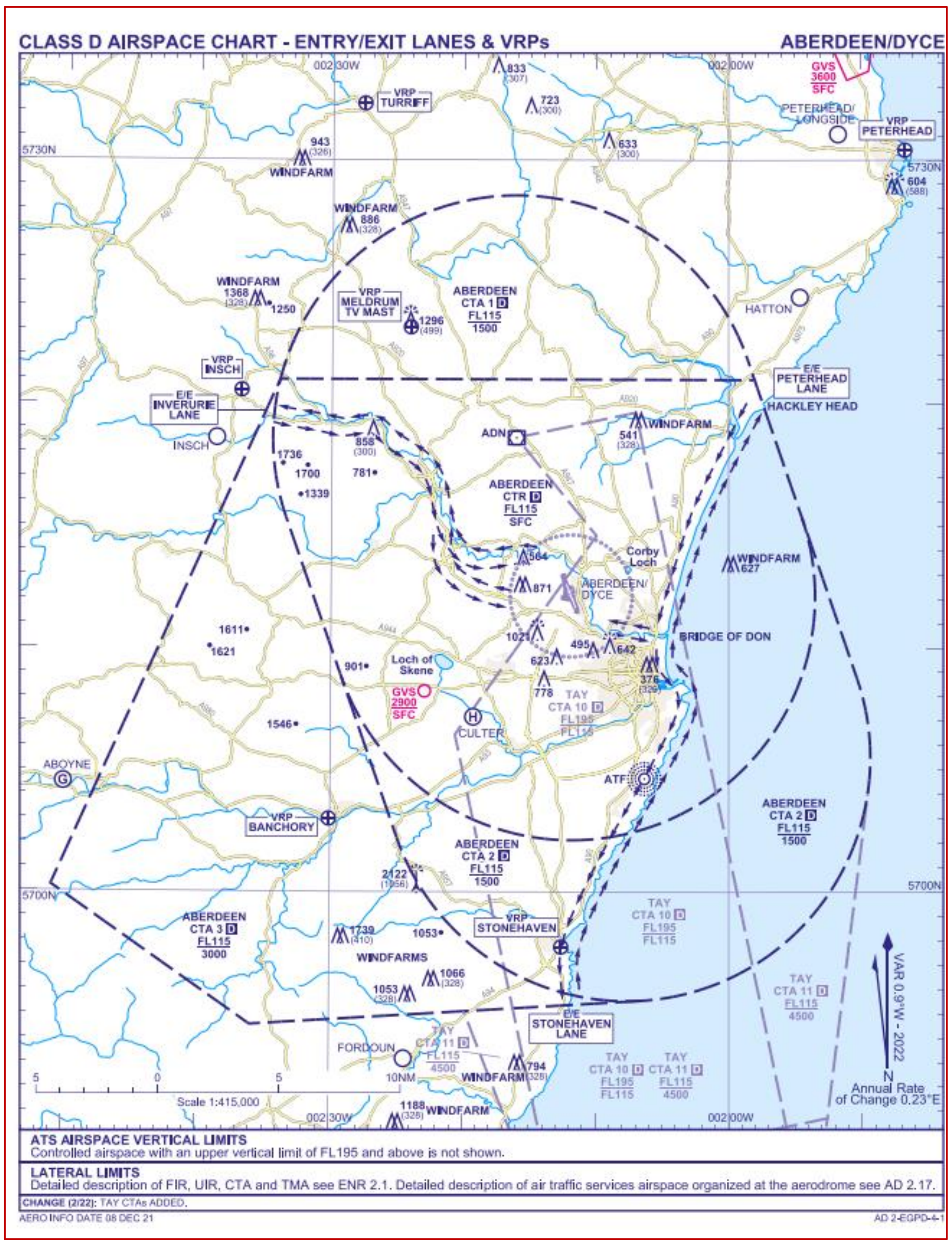

Figure 36 Aberdeen's Existing Class D Airspace Chart

Full Options Appraisal

5.5.2 The following table presents the existing 'do nothing' pre-implementation baseline for the CAS scenario. It also outlines the methodology used to assess CAS Option 1 against the baseline.

Group	Impact	Level of analysis
Communities	Noise impact on health and quality of life	Qualitative
This option is the 'do nothing' for the existing CAS structure. Aircraft departing and arriving at Aberdeen will continue to fly as they do today (see Baseline Inputs and Baseline 'Do nothing' section for further details). CAS Option 1 will be compared against this baseline to understand if altering the CAS will result in any changes to tracks over the ground to and from Aberdeen Airport, and subsequently noise below 7000ft.		
Communities	Air quality	Qualitative
This option is the 'do nothing' for the existing CAS structure. Aircraft departing and arriving at Aberdeen will continue to fly as they do today. Impacts to air quality are considered for changes below 1000ft. CAS Option 1 will be compared against this baseline to understand if altering the CAS will result in any changes to tracks below 1000ft.		
Wider society	Tranquillity	Qualitative
This option is the 'do nothing' for the existing CAS structure. Aircraft departing and arriving at Aberdeen will continue to fly as they do today (see Baseline Inputs and Baseline 'Do nothing' section for further details). CAS Option 1 will be compared against this baseline to understand if altering the CAS will result in any changes to tracks over the ground to and from Aberdeen Airport, and subsequently tranquillity below 7000ft.		
Wider society	Biodiversity	Qualitative
This option is the 'do nothing' for the existing CAS structure. Aircraft departing and arriving at Aberdeen will continue to fly as they do today (see Baseline Inputs and Baseline 'Do nothing' section for further details). CAS Option 1 will be compared against this baseline to understand if altering the CAS will result in any changes to tracks over the ground to and from Aberdeen Airport, and subsequently biodiversity below 3000ft.		
Wider society	Greenhouse gas impact	Qualitative
This option is the 'do nothing' for the existing CAS structure. Aircraft departing and arriving at Aberdeen will continue to fly as they do today (see Baseline Inputs and Baseline 'Do nothing' section for further details). CAS Option 1 will be compared against this baseline to understand if altering the CAS will result in any changes to track length, and subsequently to fuel burn and CO_2e emissions.		
Wider society	Capacity/resilience	Qualitative

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<table>
<tr><th>Group</th><th>Impact</th><th>Level of analysis</th></tr>
<tr><td colspan="3">The existing CAS does not constrain capacity or resilience. CAS Option 1 will be compared against this baseline to understand if altering CAS will result in any changes to capacity/resilience for Aberdeen Airport.</td></tr>
<tr><td>General Aviation</td><td>Access</td><td>Qualitative</td></tr>
<tr><td colspan="3">There are various GA airfields that are located close to controlled airspace, or under the base of controlled airspace.
There are also a small number of GA airfields within the control zone:
• Whiterashes: close to the ADN and the final approach track for runway 16.
• Peterculter: helicopter training site.
• Aberdeen Royal Infirmary (ARI): located underneath the final approach track for runway 34.
• Trump Golf Course: a helicopter landing site near Balmedie on the coast to the east of the airfield.

There is known to be a high amount of gliding traffic on the edges of controlled airspace at Aberdeen; Deeside Gliding Club lays to the west of the aerodrome and is a base for extensive wave soaring both locally and throughout the Scottish Highlands. Highland Gliding Club and Insch Airfield lies to the north-west. The dense activity around Deeside Gliding Club generates traffic that navigates around or underneath CTA3. Figure 37 shows a gliding activity heatmap generated by Airspace4All which helps to illustrate density of glider operations around the Aberdeen CTR/CTAs.

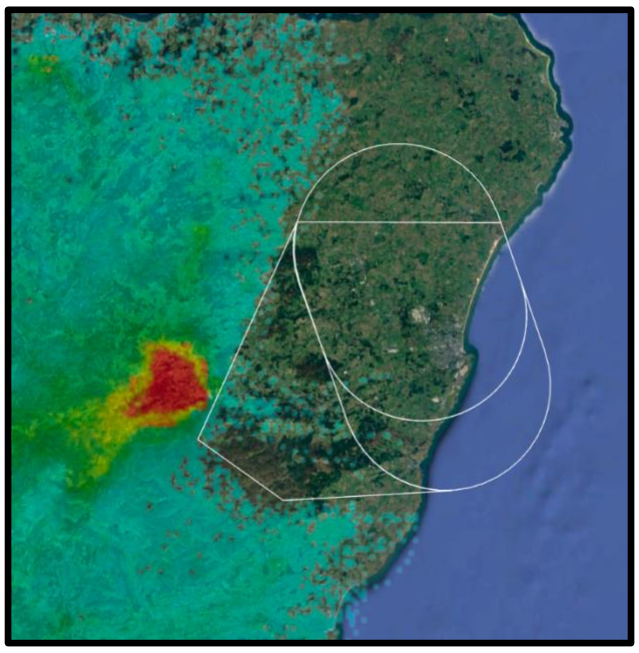
Figure 37 Gliding Activity Heatmap (Source: Airspace4All)

Airspace4All also published a piece of work on VFR Significant Areas (VSA) which highlighted two areas, 'Aberdeen Coastal Corridor' and the 'Inverness – Aberdeen Coastal Corridor' which have been identified as being particularly important to VFR operations, i.e. General Aviation (GA). These areas do not have any official status but are intended to highlight the importance of a particular area so that any future airspace development plans can take due account of the GA activity. For more information, please see our Stage 2A document on the <u>CAA Airspace Change Portal</u>.</td></tr>
<tr><td>General Aviation/commercial airlines</td><td>Economic impact from increased effective capacity</td><td>Qualitative</td></tr>
<tr><td colspan="3">Doing nothing will not enable any increased effective capacity; later in this FOA we will estimate the difference between CAS Option 1 and this baseline.</td></tr>
<tr><td>General Aviation/commercial airlines</td><td>Fuel burn</td><td>Qualitative</td></tr>
<tr><td colspan="3">This option is the 'do nothing' for the existing CAS structure. Aircraft departing and arriving at Aberdeen will continue to fly as they do today (see <u>Baseline Inputs</u> and <u>Baseline 'Do nothing' section</u> for further details). Option 1 will be compared against this baseline to understand if altering the CAS will result in any changes to track length, and subsequently to fuel burn.</td></tr>
<tr><td>Commercial airlines</td><td>Training costs</td><td>Qualitative</td></tr>
<tr><td colspan="3">As this option is already in operation, there are no training costs anticipated as there will be no change; later in this FOA we will estimate the difference between CAS Option 1 and this baseline.</td></tr>
<tr><td>Commercial airlines</td><td>Other costs</td><td>Qualitative</td></tr>
<tr><td colspan="3">As this option is already in operation, there are no other costs anticipated as there will be no change; later in this FOA we will estimate the difference between CAS Option 1 and this baseline.</td></tr>
<tr><td>Airport/ANSP</td><td>Infrastructure costs</td><td>Qualitative</td></tr>
<tr><td colspan="3">As this option is already in operation, there are no infrastructure costs anticipated as there will be no change; later in this FOA we will estimate the difference between CAS Option 1 and this baseline.</td></tr>
<tr><td>Airport/ANSP</td><td>Operational costs</td><td>Qualitative</td></tr>
<tr><td colspan="3">As this option is already in operation, there are no operational costs anticipated as there will be no change; later in this FOA we will estimate the difference between CAS Option 1 and this baseline.</td></tr>
<tr><td>Airport/ANSP</td><td>Deployment costs</td><td>Qualitative</td></tr>
<tr><td colspan="3">As this option is already in operation, there are no deployment costs anticipated as there will be no change; later in this FOA we will estimate the difference between CAS Option 1 and this baseline.</td></tr>
<tr><td>All</td><td>Safety</td><td>Qualitative</td></tr>
<tr><td colspan="3">The baseline is already in safe operation and there are no safety concerns raised at this time. Later in this FOA we will assess whether altering the CAS would result in any impacts to safety. This includes SME review of the proposal and also review of Aberdeen's Instrument Flight Procedures (IFPs) to ensure Aberdeen's existing procedures would continue to be safely contained within CAS.</td></tr>
<tr><td>All</td><td>Performance against the vision and parameters/strategic objectives of the AMS</td><td>Qualitative</td></tr>
<tr><td colspan="3">The following qualitative assessment looks at the four objectives of the Airspace Modernisation Strategy:

Safety: The 'do nothing' option will maintain but not improve aviation safety.

Integration of diverse users: The 'do nothing' would not enable any reductions in the volume or classification of CAS.

Simplification, reducing complexity and improving efficiency: The 'do nothing' option does not offer any opportunities to reduce complexity or improve efficiency.

Environmental sustainability: The 'do nothing' option does not offer any changes to noise and/or greenhouse gas emissions.</td></tr>
</table>

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Group	Impact	Level of analysis
Later in this FOA we will qualitatively assess the positive benefits and negative impacts of CAS Option 1 against this assessment. The conclusions about how CAS Option 1 performs against the AMS will be informed by the assessments within the FOA.		

5.6 CAS Option 1: raise portion of CTA 3 to 4500ft

Option description

5.6.1 CAS Option 1 proposes to raise the base of a SW portion of CTA 3, shown in red outline on the chart opposite, from 3000ft to 4500ft.

5.6.2 Analysis of surveillance data followed by conversations with Aberdeen ATC identified a section of CTA 3 which was underutilised.

5.6.3 The figure illustrates the section of CTA 3 that will be considered for declassification from Class D to Class G airspace between 3000ft and 4500ft. The remaining section from 4500ft to FL115 will be called CTA-4.

5.6.4 The data showed that there were not any fixed wing or rotary wing departures from Aberdeen which used the airspace proposed to be released. For arrivals, there was on average 1 fixed wing and 1 rotary wing aircraft a week within the airspace (around 0.2% of Aberdeen's arrivals).

Figure 38: Aberdeen CTA map with proposed change

Full Options Appraisal

Group	Impact	Level of analysis
Communities	Noise impact on health and quality of life	Qualitative
The section of airspace proposed to be raised to 4500ft has been identified by ATC as being under-used and then confirmed using radar data. Analysis of this data showed that the profiles of aircraft departing from Aberdeen are currently above this volume. For arrivals, very occasionally there is an aircraft within this volume however in this is so infrequent (less than 2 aircraft a week on average) that it would not impact quantified noise metrics which look at an average day. Furthermore this very small number of aircraft would be higher in future, and therefore would present a very small noise benefit. Overall, we conclude that raising this portion of CTA 3 would have no material impact on the noise from aircraft arriving and departing from Aberdeen; there would be no material changes to tracks over the ground, aircraft profiles, and subsequently noise from Aberdeen Airport's operation, are expected as a result of implementing this option.		
Communities	Air quality	Qualitative
CAS Option 1 is not expected to materially alter tracks over the ground for aircraft arriving and departing from Aberdeen below 1000ft and therefore this option is not expected to have any impacts on air quality from Aberdeen Airport's operation.		
Wider society	Tranquillity	Qualitative
The noise analysis has demonstrated that there will be no material changes to tracks over the ground as a result of releasing a portion of CAS and therefore there are no material changes expected to tranquillity.		
Wider society	Biodiversity	Qualitative
There will be no change to tracks over the ground below 3000ft and therefore no impacts to biodiversity are anticipated.		
Wider society	Greenhouse gas impact	Qualitative
CAS Option 1 is not expected to alter tracks over the ground for aircraft arriving and departing from Aberdeen and therefore this option is not expected to have any impacts to greenhouse gas impact from Aberdeen Airport's operation. However, it may enable more fuel efficient routings by GA, catering for flight up to 4400ft, instead of 2900ft.		

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Group	Impact	Level of analysis
Wider society	Capacity/resilience	Qualitative
CAS Option 1 is not expected to change the capacity or resilience within the airspace compared to the 'do nothing' baseline.		
General Aviation	Access	Quantitative
CAS Option 1 would result in the release of 27.8nm ^{3} of class D controlled airspace within Aberdeen's CTA 3. The increase of the base of this part of CTA3 would enable improved soaring profiles for flights to/from Deeside Gliding Club at Aboyne. In addition to this, it would enable GA transiting the airspace to remain outside of controlled airspace at a higher altitude than today.		
General Aviation/commercial airlines	Economic impact from increased effective capacity	Qualitative
CAS Option 1 does not offer any increased capacity for Aberdeen Airport compared to the 'do nothing' baseline.		
General Aviation/commercial airlines	Fuel Burn	Qualitative
CAS Option 1 is not expected to materially alter tracks over the ground for aircraft arriving and departing from Aberdeen and therefore this option is not expected to have any impacts to fuel burn from Aberdeen Airport's operation.		
Commercial airlines	Training costs	Qualitative
This option is not expected to result in any additional training costs for airlines; aircraft will continue to operate as they within the baseline. Updated charts reflecting the changes to the CAS will be introduced as part of an AIRAC cycle.		
Commercial airlines	Other costs	Qualitative
No other airline costs are foreseen.		
Airport/ANSP	Infrastructure costs	Qualitative
No infrastructure costs are foreseen.		
Airport/ANSP	Operational costs	Qualitative
No operational costs are foreseen.		
Airport/ANSP	Deployment costs	Qualitative
This option is expected to require a small amount of effort for NATS at Aberdeen ATC to update documentation, ATC procedures and ATC systems to reflect the new CAS structure; however this cost would be incorporated as part of the wider changes should PBN approaches be introduced. There will also be some airport IFP cost to update some procedures to reflect the increased base of CAS (see safety assessment below).		
All	Safety	Qualitative
One of Aberdeen Airport's published procedures will require amending to ensure procedural CAS containment. This is the Direct Arrival from Airway P600 annotated on the ILS/DME RWY 34, LOC/DME RWY 34 and VOR/DME RWY 34 charts published on the EGPD eAIP. The Direct Arrivals are very infrequently flown, usually only on request for training purposes by pilots. The changes to the charts would ensure aircraft remain slightly higher for longer on intermediate approach to ensure CAS containment. The release in this volume of CAS is expected to improve safety for General Aviation users operating outside of CAS. This is because the release could be expected to decrease congestion in the surrounding class G airspace.		
All	Performance against the vision and parameters/strategic objectives of the AMS	Qualitative
Safety: Expected to maintain safety of operations to/from Aberdeen Airport, subject to small amendments to the Direct Arrival from Airway P600 noted in the safety assessment. **Integration of diverse users:** Would enable the release of CAS which reduces Aberdeen's CAS volume and results in an area of airspace being reclassified. **Simplification, reducing complexity and improving efficiency:** No change to capacity, efficiency or resilience at Aberdeen Airport is anticipated. **Environmental sustainability:** Is not expected to positively benefit or negatively impact aircraft arriving or departing from Aberdeen. The release of the section of CAS may offer some fuel savings for general aviation using the airspace.		

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6. FOA conclusion

6.1.1 The following sections provide an overview of the outcome of the FOA before explaining whether an option has been progressed into the Stage 3 Consultation and the rationale around this.

6.1 Cost Benefit Analysis

6.1.1 As part of the FOA, Airspace Change Sponsors are required to produce a Cost Benefit Analysis (CBA) which looks at the monetised costs associated with the ACP and produces a Net Present Value (NPV) for each option. The tables on the following pages are based on the example provided in CAP1616 Table E3 and E4 using a social time preference rate to discount at 3.5%. This rate is set by the Government. For noise and CO_2e, the values are taken directly from the WebTAG workbooks before any discounting is applied and after setting the output price year to 2023. For fuel burn, the jet fuel price is based on the week ending 5 Jan 2024 and the GBP to USD conversion rate from 1 Jan 2024.

6.1.2 When reviewing these costs, please note that they have been generated based on an optimistic 5% of aircraft flying the PBN procedures and we expect this number to be lower.

6.1.3 Although the cost benefit analysis shows that there are noise costs associated with each option, it is important to highlight that this result is influenced by a limited number of receptors transitioning between 1dB bands in the TAG evaluation due to noise variations of less than 0.1dB. These changes are negligible beyond the accuracy of any noise model. Therefore the noise costs are not considered to be material to the assessment.

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Vectors to final approach

6.1.3 The following table shows the monetised costs associated with the vectors to final approach option. Note this is based on 5% of aircraft flying the procedures and the figures have been rounded to the nearest pound.

Table 10 Monetised outcomes: vectors to final approach

Year	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Net Present Value (£)
CBA year	1	2	3	4	5	6	7	8	9	10	
Discount factor	1	0.9662	0.93355	0.9019	0.8714	0.8420	0.8135	0.7860	0.7594	0.7337	
Net community benefit (Noise) £	-1239	-1089	-947	-813	-688	-570	-459	-355	-257	-166	-6584
Net community benefit (CO_2e) £	-51	-50	-49	-48	-48	-47	-46	-46	-45	-44	-474
Net airspace users benefit (Fuel costs)	-3741	-3629	-3520	-3414	-3312	-3213	-3117	-3023	-2932	-2844	-32745
Net infrastructure cost £	**-70,000**										-70000
Net operational cost £					-8,000					-8,000	-16000
Net deployment cost £	-15,000										-15000
Present value £	-90031	-4767	-4516	-4276	-12047	-3830	-3622	-3423	-3234	-11054	**-140802**

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T-Bars

6.1.4 The following table shows the monetised costs associated with the T-Bar option. Note this is based on 5% of aircraft flying the procedures and the figures have been rounded to the nearest pound.

Table 11 Monetised outcomes: T-Bars

Year	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**Net Present Value (£)**
CBA year	1	2	3	4	5	6	7	8	9	10	
Discount factor	1	0.9662	0.93355	0.9019	0.8714	0.8420	0.8135	0.7860	0.7594	0.7337	
Net community benefit (Noise) £	-650	-582	-519	-459	-402	-349	-299	-252	-208	-166	-3885
Net community benefit (CO_2e) £	-12	-12	-12	-12	-12	-12	-11	-11	-11	-11	-117
Net airspace users benefit (Fuel costs)	-903	-876	-849	-824	-799	-775	-752	-729	-707	-686	-7901
Net infrastructure cost £	**-70,000**										-70,000
Net operational cost £					-8,000					-8,000	-16,000
Net deployment cost £	-15,000										-15,000
Present value (rounded to the nearest whole £1000	-86565	-1470	-1380	-1294	-9213	-1136	-1062	-993	-926	-8863	**-112902**
Cost Benefit ratio	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

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Curved approaches and T-Bars

6.1.5 The following table shows the monetised costs associated with the curved approach and T-Bar option. Note this is based on 5% of aircraft flying the procedures and the figures have been rounded to the nearest pound.

Table 12 Monetised outcomes: curved approaches and T-Bars

Year	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Net Present Value (£)
CBA year	1	2	3	4	5	6	7	8	9	10	
Discount factor	1	0.9662	0.93355	0.9019	0.8714	0.842	0.8135	0.786	0.7594	0.7337	
Net community benefit (Noise) £	-1239	-1089	-947	-813	-688	-570	-459	-355	-257	-166	-6584
Net community benefit (CO_2e) £	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-21
Net airspace users benefit (Fuel costs)	27	27	26	25	24	24	23	22	21	21	240
Net infrastructure cost £	-70,000										-70,000
Net operational cost £					-12,000					-12,000	-24,000
Net deployment cost £	-15,000										-15,000
Present value (rounded to the nearest whole £1000	-86214	-1064	-923	-790	-12666	-548	-438	-335	-238	-12147	**-115365**
Cost Benefit ratio	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

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6.2 Preferred Option for consultation and rationale

PBN arrivals

6.2.1 In the section above we have presented the Net Present Value (NPV) of each option as required by CAP1616. However, the threshold for continuing or discontinuing an option to consultation may not be based on a monetised quantitative assessment alone but may also come down to the other quantitative and qualitative appraisals and professional judgment, as there are many factors to balance.

6.2.2 In the first instance when reviewing each option, we have considered the safety assessment. Safety is considered the highest priority and this is also reflected in Aberdeen's Design Principle 1*: The airspace design and its operation must be as safe or safer than today for all airspace users that are affected by the airspace change*.

6.2.3 For both the T-Bar and curved approaches with T-Bar options, the safety assessment identified two areas of increased risk compared to the baseline. This was a risk to increasing complexity handling helicopter operations, and a risk with having IAF minimum altitudes which are different to the existing levels ATC would usually descend aircraft to which would also increase complexity within the airspace. Overall, the safety assessment concluded that both options would introduce complication within the airspace, which could lead to increased workload, changes in vectoring practices and potential for confusion for ATC and Pilots.

6.2.4 We are aware that this outcome is different to the outcomes presented in the Stage 2 Initial Options Appraisal (IOA) safety assessment for these options. This is because the shortlist of options taken from Stage 2 are developed and refined at Stage 3, and this includes detailed IFP designs and charting development as well as ATC undertaking more detailed safety investigations.

6.2.5 When considering the vectors to RNP approach option, the safety assessment found that the option is expected to be as safe as the baseline and no other safety concerns have been raised. This is because the option is very similar to what happens today and has been designed to be operated in line with the existing ATCSMAC boundaries and levels.

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6.2.6 Given this safety assessment, we were inclined to take the vectors to RNP approach option to consultation and discontinue the T-Bar and curved approach with T-Bar option; however, we did also consider the consequences of this against the other categories within the FOA. The conclusions below look at the main categories which differentiate the three options – please see the full FOA tables for the full assessments.

6.2.7 When considering the other main FOA categories and assessments which differentiate the three options such as noise, fuel burn, and CO_2e emissions, all three options NPV showed a cost with implementing the ACP, with no material benefits for each option.

6.2.8 The noise assessment concluded that there were no material changes to the primary metrics for any of the three options and in terms of the secondary metrics, again there would be little material change. When looking to the Government's altitude based priorities, section 3.3b says '*where options for route design from the ground to below 4,000 feet are similar in terms of the number of people affected by total adverse noise effects, preference should be given to that option which is most consistent with existing published airspace arrangements'.* In the case of the three options, the vectors to RNP approach option offers the closest to the existing airspace arrangements within the constraints of PBN design.

6.2.9 When considering the fuel burn and CO_2e emissions assessments, the vectors to RNP approach option and T-Bar option showed a very small increase (less than 0.1% increase in total emissions between the do something and baseline scenarios, of which the majority are traded) in both categories, however given this was calculated based on an optimistic 5% usage and when the procedures are used for resilience (in lieu of conventional VOR approaches) they offer a fuel burn benefit. Overall it was concluded that there was no material changes to fuel burn and CO_2e as a result of these options. The curved approaches showed an almost neutral result against the baseline; this was because although the curved approaches would offer track mileage benefits, they would be used by so few aircraft that any benefits were immaterial.

6.2.10 **Overall, the differences between the three options were so negligible in terms of noise, fuel burn and CO_2e emissions that when balanced against the outcome of the safety assessment, which showed increased level of complication and increased safety risk for the T-Bar and curved approaches with T-Bar option, it was considered appropriate to discontinue these options at this stage and only progress the vectors to RNP approach option as our preferred option for consultation.**

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CAS Option 1

6.2.11 The FOA of CAS Option 1 has demonstrated there are benefits to General Aviation (GA) stakeholders from the release of a portion of CTA-3 and there are otherwise only marginal, almost indefinable, benefits and impacts to noise, fuel burn, CO_2e for aircraft arriving at Aberdeen. Aircraft departing from Aberdeen will not be impacted. **As such, we propose to take CAS Option 1 forward for consultation.**

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Document ends

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