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TABLES

INTRODUCTION

15.1 This Chapter of the EIA Report has been prepared by Osprey Consulting Services Ltd (Osprey), a technical consultancy providing aviation expertise to the wind industry. The Chapter identifies and assesses the potential effects that the proposed development may have on civilian and military aviation safeguarding, and if required, the mitigation measures to be implemented to prevent, reduce or offset any potential adverse effects.

15.2 The potential effects of wind turbines on aviation interests have been widely publicised but the primary concern is one of safety. There are innumerable subtleties in the actual effects but there are two dominant scenarios that may lead to objection from aviation stakeholders:

- wind turbines can present a physical obstruction at, or close to, an aerodrome or other aviation activities such as military and civil low flying operations; and
- impacts on aviation radar systems and the provision of a radar-based Air Traffic Service (ATS). Wind turbine derived radar clutter (unwanted radar returns) appearing on radar displays can affect the air traffic controller's ability to differentiate between aircraft and those radar returns resulting from the detection of wind turbines. Furthermore, the appearance of multiple false targets in close proximity can generate false aircraft tracks and seduce those returns from real aircraft away from the true aircraft position. Unmitigated, these effects persist for the lifetime of the operational wind farm.

LEGISLATION, PLANNING POLICY AND GUIDANCE

15.3 All national and development plan policies and other considerations of relevance to the proposed development are outlined in Chapter 4: Planning Policy. The assessment of the likely significant effects has been undertaken in accordance with relevant and applicable legislation, policies and technical standards.

15.4 Of specific relevance to the technical assessments provided in this chapter, the Scottish Planning Policy (Ref. 15.1) notes that considerations in the determination of applications for energy infrastructure developments are likely to include "*impacts on aviation and defence interests and seismological recording"* (paragraph 169). The Scottish Government's Online Renewables Planning Advice regarding onshore wind turbines (Ref 15.2) includes guidance regarding potential impacts on aviation safeguarding and the need for aviation and military authorities to be consulted regarding proposed wind energy developments as well as other requirements.

Aviation Industry Policy/Guidance

15.5 A variety of aviation publications contain information and guidance relating to the potential effects of an onshore wind development on aviation stakeholders. The following documents informed the desk-based study of the potential impacts of the proposed development:

- Civil Aviation Publication (CAP) 168: Licensing of Aerodromes sets out the standards required at UK licensed aerodromes relating to its management systems, operational procedures, physical characteristics, assessment and treatment of obstacles, and visual aids (Ref. 15.3)

- CAP 393: The Air Navigation Order (ANO) 2016 and Regulations regulates aviation standards and aircraft navigation, covering aircraft, air crew, passengers, cargo, air traffic services and aerodromes. It also includes legal requirements for lighting and marking of obstacles. It is edited by the Legal Advisers Department of the Civil Aviation Authority (CAA) (Ref 15.4);
- CAP 764: Policy and Guidelines on Wind Turbines provides assistance to aviation stakeholders to help understand and address wind energy related issues, thereby ensuring greater consistency in the consideration of the potential impact of proposed wind farm developments (Ref. 15.5) and
- CAP 670: Air Traffic Services Safety Requirements sets out the safety regulatory framework and requirements associated with the provision of an air traffic service (Ref 15.6).

Other Aviation Policy/Guidance

15.6 In addition to relevant policies and technical guidance, the assessment has been informed by key secondary data sources including:

- CAA Visual Flight Rules Charts which provides topographical information on aerodromes, airspace and areas of Air traffic Control (ATC) responsibilities;
- CAA Policy Statement for the Lighting of Wind Turbine Generators in the UK with a maximum blade tip height at or in excess of 150 m above ground level (agl) (Ref. 15.7);
- The Ministry of Defence (MOD) Low Flying Handbook;
- RenewableUK (Ref. 15.8) has issued guidance as follows:
    - to facilitate safe visual flight, day or night, in the vicinity of anemometer masts and/or wind turbines, information regarding construction should be passed to the Defence Geographic Centre (DGC) and the General Aviation Awareness Council (GAAC) at least 10 weeks in advance of the erection or removal of an anemometer mast or first turbine. This should then be followed up on the day with confirmation that the activity has taken place; data should include location, height (of all structures over 150 feet (ft)), date of erection, date of removal and lighting type (none, infra-red or lighting brightness); and
    - information on the proposed development should be circulated to relevant military and aviation stakeholders including NATS and the MOD. Information on potential aviation obstructions will be disseminated within the civil UK Integrated Aeronautical Information Package (UK IAIP) (Ref 15.9), the main resource for information and flight procedures at all licensed UK airports as well as airspace, en-route procedures, charts and other air navigation information and the Military Aeronautical Information Publication (Mil AIP) (Ref. 15.10).

SCOPE AND CONSULTATION

15.7 During 2017, Osprey completed a desk top study on an initial proposal for 16 wind turbines at a blade tip height of 149.9 metres (m) agl and completed pre-application consultation with a number of aviation stakeholders which might be impacted by the operation of the proposed development wind turbines. Consultation for the proposed development was undertaken with

statutory and non-statutory bodies during 2017 and 2018 as set out in Chapter 6: Scoping and Consultation, and the 2017 EIA Scoping Opinion provided consultation responses from a number of aviation stakeholders.

15.8 The Applicant has reduced the number of turbines to 14 at an increased blade tip height of up to 180 m agl and has consulted with relevant stakeholders to consider the changes to the proposals through an updated Scoping Report, submitted in October 2018. The key issues which arose during the 2017 Scoping Opinion and subsequent consultation with stakeholders on the proposed variation as outlined in the 2018 Scoping Report and Opinion are provided in Table 15-1 below.

Table 15-1
Key Issues

Consultee	Summary of Key Issues
NATS	NATS responded to the Scoping Report during April 2017 and within their response included the results of a NATS Technical and Operational Assessment (TOPA) completed on the proposed development. NATS objected to the proposed development at a blade tip height of 149.9m agl based on a predicted unacceptable impact to the Allanshill Primary Surveillance Radar (PSR). NATS responded to the variation to the Scoping Report during October 2018, in which the results of an updated NATS TOPA at the increased blade tip height were provided. No change to the previous unacceptable impact to the Allanshill PSR was predicted. A Primary Radar Mitigation Scheme (PRMS) has been recognised by NATS as mitigation for the effect to the Allanshill PSR, commercial negotiations between the Applicant and NATS are continuing.
MOD	The MOD was contacted for a response to Scoping during April 2017. The Defence Infrastructure Organisation (DIO) stated that the MOD would object to the proposed development based upon an unacceptable impact on the Buchan Air Defence Radar (ADR). A request that the perimeter turbines be fitted with MOD accredited 25 candela omni-directional red lighting or infra-red lighting was also included in the response. During July 2017, DIO were provided with the coordinates and Above Ordnance Datum (AOD) of a 16-turbine layout within the Site. DIO confirmed by email during September 2017 that the Buchan ADR has been upgraded to a radar standard which will provide inherent mitigation capability. In order to assess if the inherent mitigation provided by the upgraded Buchan ADR would be a suitable mitigation solution for the proposed development, DIO would require a site-specific mitigation report in order to complete their technical and operational assessment in order to confirm if mitigation would be acceptable. The Applicant submitted technical mitigation proposal to address the unacceptable affects that the 16 turbine wind farm would have on the ADR. This technical mitigation proposal, specific to the 16 turbine wind farm, was assessed and accepted by the MOD for the purposes of allowing discussions on a Grampian style planning condition. When consulted on the development variation (14 wind turbines, up to 180 m agl blade tip), the MOD objected to the proposal in 2018 based on the creation of an unacceptable impact to the Buchan ADR to which the mitigation scheme agreed for the 16 turbine layout would not be applicable to. DIO requested that the proposed development be fitted with aviation lighting as required by the CAA. Consultation with DIO is ongoing in order to establish that a suitable radar mitigation solution is applied before construction commences.

Consultee	Summary of Key Issues
Aberdeen International Airport	Aberdeen responded to the Scoping Report during April 2017. The airport stated that its position would be confirmed once the design freeze layout had been provided and after its own internal radar assessment analysis was completed, in order to assess operational and cumulative effects of the proposed development. During July 2017, the airport was provided with the coordinates and AOD of the design freeze layout in order that the airport Safeguarding Team could complete its own assessment of the potential impacts that the proposed development may create to Aberdeen Communication, Navigation and Surveillance (CNS) infrastructure at the airport. Aberdeen responded to the variation Scoping Report during October 2018 stating that they would provide an opinion on the development at full planning application.

15.9 Scoping consultation responses have been reviewed to confirm the likely effects and affected receptors which require to be considered in the EIA at the increased blade tip height. This Chapter presents a summary of the results of a revised desk-based assessment which was undertaken to identify any potential additional impacts to aviation stakeholders in the area of the proposed development which may be created by the increase in blade tip height. It provides an objective assessment of the effects and any necessary mitigation measures if they are required.

15.10 In order to confirm which aviation radar stakeholders could be scoped out of the assessment, radar performance and propagation modelling (radar Line of Sight (LoS)) has been undertaken to determine the theoretical detection of wind turbines by the region's radar infrastructure at the increased blade tip height of up to 180m agl. Osprey utilised the Advanced Topographic Development and Images (ATDI) ICS LT (Version 4.3.3) tool, in order to model the terrain elevation profile between the identified PSR systems and wind turbine positions within the proposed development. This provides a graphical representation of the intervening terrain and theoretical direct LoS to the region's radar, to determine the affected radar systems within the regional baseline.

15.11 The LoS analysis is a limited and theoretical desk-based study. In reality there are variable levels of signal diffraction and attenuation within a given radar environment that can influence the probability of a turbine being detected by a particular radar. The analysis is designed to give an indication of the likelihood of the turbine being detected, such that the operational significance of the wind farm relative to nearby aviation stakeholders can be assessed.

15.12 Conclusions of the assessment indicate that radar systems operated NATS at Perwinnes would not theoretically detect the wind turbines assessed and this radar system is therefore not considered further. However, the Royal Air Force (RAF) Lossiemouth ATC PSR (operated by the MoD) would intermittently theoretically detect one of the wind turbines within the Site. The MOD has not objected based on an impact to the RAF Lossiemouth PSR or to military low flying exercises and therefore neither of these military receptors is considered further.

Effects Scoped Out

15.13 A number of consultees and receptors were scoped out from the consultation and final assessment of effects process as follows:

- the system/stakeholder is located outside of the standard consultation distances stated in

CAP 764 (Ref. 15.5); or

- conclusions of radar line of sight analysis indicate that assessed radar systems would not detect the proposed development turbines.
- response provided in the 2018 Scoping Opinion.

15.14 NATS provides ATS at some airports in the UK, as well as to traffic en-route within UK airspace. Radar LoS analysis has concluded that although the NATS Allanshill PSR would theoretically detect the turbines of the proposed development, the NATS Perwinnes PSR would not theoretically detect the turbines; additionally, the NATS TOPA did not predict an impact to the Perwinnes PSR and therefore the Perwinnes PSR is scoped out of the assessment.

15.15 At a range approximately 69 kilometres (km) from the centre of the proposed development the location of Inverness Airport precludes any potential impact to the airport safeguarded surfaces or flight procedures; furthermore, the Inverness PSR would not theoretically detect the blade tips of the proposed development and therefore no impact to operations conducted at Inverness Airport are expected. Inverness Airport is therefore scoped out of the assessment.

15.16 Royal Air Force (RAF) Lossiemouth is a military airfield located on the western edge of the town of Lossiemouth, Morayshire and is located approximately 45km from the centre of the proposed development. The airfield operates ATC radar for the provision of ATC radar services to aircraft operating in the vicinity of the proposed development. The RAF Lossiemouth PSR would theoretically detect one of the proposed development turbines; however, the MOD has not predicted an impact to RAF Lossiemouth operations within its response to scoping. Therefore, the impact to RAF Lossiemouth, including the operations utilising the PSR, are scoped out of the assessment.

15.17 The United Kingdom Low Flying System (UKLFS) covers the open airspace of the whole UK below 2,000 ft above ground level (agl). Low Flying by military aircraft is permitted within established low flying areas which exclude large urban areas. The MOD has not raised any concerns regarding impacts on the UKLFS within its response to scoping; however, it has requested specific aviation lighting to be fitted in accordance with CAA regulations which is expected to mitigate any obstruction impact created by the proposed development; therefore as appropriate lighting of wind turbines at or above 150m agl is regulated and required by the CAA, the UKLFS is scoped out of the assessment and is not considered further.

15.18 Insch Aerodrome is home to the Grampian Microlight and Flying Club and is a private unlicensed non-radar equipped aerodrome which operates a grass runway with a length 547m. The closest turbine to Insch Aerodrome (Turbine 14 (T14)) would be located approximately 18.1km on a bearing of 294° from the centre of the aerodrome's runway. Insch Aerodrome is outwith the standard consultation distances stated in CAP 764 for an aerodrome of this type; no impact to operations conducted at the aerodrome is predicted. Insch Aerodrome is therefore scoped out of the assessment.

15.19 Aboyne Aerodrome is home to the Deeside Gliding Club which has operated from the airfield for over 50 years. The unlicensed aerodrome is non-radar equipped and has a published maximum runway length of 540m. The closest turbine to Aboyne Aerodrome (T5) would be at a distance of approximately 33.5km on a bearing of 350° (measured from the centre of the closest runway at Aboyne Aerodrome – Runway 09N). Due to the distance from the proposed development which is outwith the standard consultation distances stated in CAP 764 for an aerodrome of this type no

impact is predicted on operations conducted at the aerodrome. Aboyne Aerodrome is therefore scoped out of the assessment.

15.20 Those receptors taken forward to the assessment are provided in Table 15-2.

Table 15-2
Summary of Receptors Taken Forward to the Assessment

Receptor	Scoped Into Impact Assessment?
NATS Allanshill PSR	**Yes**
NATS Perwinnes PSR	No
Inverness Airport	No
MOD Buchan ADR	**Yes**
Aberdeen International Airport PSR	**Yes**
RAF Lossiemouth	No
UK Military Low Flying System	No
Insch Aerodrome	No
Aboyne Aerodrome	No

APPROACH AND METHODS

15.21 In order to determine the baseline environment, potential aviation stakeholders have been identified in accordance with guidance provided by the CAA within CAP 764 (Ref. 15.5). The extents of expected effects quoted in the guidance are used as a guide and a minimum; the guidance states that any wind turbine development within 30km of an aerodrome with a surveillance radar facility, might impact on aerodrome related operations. The guidance goes on to say that the distance can, however, be far greater than 30km depending upon several factors including the type and coverage of the radar and the particular operation at the aerodrome. Objections from beyond the recommended aviation stakeholder consultation distances can potentially be sustainable and valid; the threshold used for identifying potential aviation stakeholders is not a definitive limit on the extent of potential impacts arising from the proposed development.

15.22 This assessment considers all radar systems that are predicted to be impacted by the detectability of wind turbines placed within the developable area, as well as military areas of operation and operations conducted at Aberdeen International Airport. For each identified receptor, the physical obstruction and/or radar effect, and then subsequently the operational impacts were considered along with any other potential effects. This assessment has been informed by the results of baseline studies, response to scoping, results of a radar LoS analysis and consultation, and with reference to the existing evidence base regarding the effects of onshore wind farm development.

15.23 PSR relies on reflected electromagnetic radiation, and does not require any cooperation by the target under surveillance. The PSR sends out a signal, and times how long it takes the signal to be

reflected back, and then calculates the distance of an object from the radar. The amount of energy that an object reflects back is related to the object's Radar Cross Section (RCS). In terms of wind turbines, generally, the larger a turbine is, the larger its RCS will be. Once the wind turbine is operational and rotating, the moving blades will result in more energy being reflected and an increased chance of it creating unwanted returns (non-aircraft), known as 'clutter' to be presented on the radar display. This issue is compounded by increasing numbers, and density of distribution, of wind turbines that, due to their radar detectability, have the potential to create a cumulative effect of increased radar clutter over a greater area, inducing possible radar saturation and loss of real aircraft targets.

15.24 The PSRs considered in the assessment cannot distinguish between returns from wind turbines (false returns, or 'clutter') and those from aircraft, therefore the air traffic controller is required to assume that actual aircraft targets could exist within the clutter, and that identification of aircraft under control could be lost or mis-identified. In many cases, the controller would need to provide a minimum of five nautical miles (NM) lateral separation between aircraft and radar clutter (in case it is masking a real aircraft target) which could lead to greater track distance being flown by aircraft and an increase environmental effects (fuel burn) and controller and aircrew workloads.

15.25 During construction, and prior to commissioning, turbine blades would not be rotational. Radar processors can filter out static objects; the infrastructure would not be processed and presented onto aviation radar control displays. Therefore, there would be no impacts on air traffic radar and service provision during these phases. The worst-case scenario for impacts on radar services assumes the maximum blade tip height of up to 180m agl and the largest area of turbines; creating the largest impact from a radar and obstruction perspective. Any aspects of the infrastructure that are lower in height than the turbines and within the development boundary would not create an incremental effect on aviation interests. Consideration will be given to the notifying the relevant organisations of the height and location of turbine towers, cranes and other construction/decommissioning infrastructure to ensure safe air navigation.

15.26 Obstacles inside and outside an airport's boundary can affect operations, including take-off, landing, and arrival and departure procedures. The CAA issues regulatory guidance on how aerodromes should manage operations in relation to obstacles and the licensing of an aerodrome depends on the extent to which these areas are free from current or new obstacles. The regulatory guidance states that certain 3-dimensional planes within local airspace must be defined to assess the significance of existing or proposed obstacles within the vicinity of an aerodrome; these are Obstacle Limitation Surfaces (OLS). The OLS are determined according to the classification of the aerodrome, its runway length and extend to a maximum radius of 15,000 metres (m) from the airfield reference point (usually the centre point of the runways). The wind turbines are not located close to any aerodromes in this regard and therefore physical safeguarding of aerodromes is outside scope of the assessment.

Study Area

15.27 The operational range of radar varies with radar type or operations therefore the study areas are defined on a case by case basis. Whilst not definitive, CAP 764 (Ref. 15.5) provides criteria for initial guidance in assessing whether any wind turbine development might have an impact on aerodrome related operations. Consideration of the proposed development's potential to impact on aviation stakeholders and receptors has been undertaken in accordance with the standard consultation distances stated in CAP 764 as follows:

- within 30km of an aerodrome with surveillance radar, although it is acknowledged that the distance quoted in CAP 764 (Ref.15.5) can be greater than 30km dependent on a number of factors at individual aerodromes, including type and coverage of radar utilised. Aberdeen International Airport operates a PSR and although outside of the CAP 764 standard consultation distance, consideration of the potential impact is considered in the assessment;
- airspace coincident with published Instrument Flight Procedures (IFP) to take into account the requirement for an aerodrome to protect its IFPs. There is no such airspace overlaying the proposed development;
- within 17km of a none-radar equipped licensed aerodrome with a runway of 1,100m or more. There are no such aerodromes within 17km of the proposed development;
- within 5km of a none-radar equipped licensed aerodrome with a runway less than 1,100m. There are no such aerodromes in the study area;
- within 4km of a none-radar equipped unlicensed aerodrome with a runway of more than 800m. There are no such aerodromes within 4km of the study area;
- within 3km of a none-radar equipped unlicensed aerodrome with a runway less than 800m. There are no such aerodromes within 3km of the proposed development; and
- development of wind turbines within 10km of a gliding site or where the maximum height of the structure is within a 50:1 angle of a gliding site, as this will present additional considerations beyond those associated with powered aircraft.

15.28 The figures above are for initial guidance and do not represent definitive ranges when considering the potential impacts to aviation stakeholders. The study area encapsulates the proposed development; however, consideration has been given to any aviation infrastructure where the proposed development lies within operational range of that infrastructure.

Information and Data Sources

15.29 Other data sources and guidance considered during the desktop assessment of the baseline conditions include the following:

- CAA Visual Flight Rules Chart (Ref. 15.11); and
- MOD UK Low Flying Area Priority Maps (Ref. 15.12).

Assessment Methods

15.30 In assessing the significance of the effects from the proposed development on aviation operations an analysis was completed which involved a systematic review of the charts, data and regulatory articles available. The assessment identified all potential aviation stakeholders, the location of their operations and procedures relative to the proposed development. It then considered the possible options that could mitigate the effect on the operations of the identified aviation stakeholders if required.

Sensitivity of Receptor

15.31 The sensitivity of a receptor is subjective in aviation terms and therefore difficult to quantify. Whereas an ADR system would be an obvious high value and high sensitivity receptor (due to its role in UK national security), the sensitivity of a local aerodrome can also often be rated high if the planning authority considers the receptor to be a significant asset to the area. The identified receptors in this analysis are considered to have a high sensitivity to effects, given their safety critical function. Table 15-3 below provides the definition of terms relating to the sensitivity of aviation receptors.

Table 15-3
Definition of Terms Relating to the Sensitivity of Aviation Receptors

Receptor Sensitivity/Importance	Description/Reason
High	Receptor provides a service which is of high value to the local, regional or national economy, and/or the receptor is generally vulnerable to impacts that may arise from the proposed development, and/or recoverability is slow and/or costly.
Medium	Receptor provides a service which is of moderate value to the local, regional or national economy, and/or the receptor is somewhat vulnerable to impacts that may arise from the proposed development, and/or has moderate to high levels of recoverability.
Low	Receptor provides a service which is of low value to the local, regional or national economy, and/or the receptor is not generally vulnerable to impacts that may arise from the proposed development, and/or has high recoverability.
Negligible	Receptor provides a service which is of negligible value to the local, regional or national economy, and/or the receptor is not vulnerable to impacts that may arise from the proposed development, and/or has high recoverability.

Magnitude Criteria

15.32 The magnitude of the potential effect on aviation and radar receptors was assessed using the method and terminology given in Table 15-4.

Table 15-4
Magnitude of Aviation Impact Definitions

Magnitude	Definition
High	Total loss of ability to carry on activities and/or impact is of extended physical extent and/or long term duration (i.e. total life of proposed development and/or frequency of repetition is continuous and/or the effect is not reversible for the proposed development).
Medium	Loss or alteration to significant portions of key components of current activity and/or physical extent of impact is moderate and/or medium term duration (i.e. operational period) and/or frequency of repetition is medium to continuous and/or the effect is not reversible for the phase of the proposed development.

Magnitude	Definition
Low	Minor shift away from baseline, leading to a reduction in level of activity that may be undertaken and/or physical extent of impact is low and/or short to medium term duration (i.e. construction period) and/or frequency of repetition is low to continuous and/or the effect is not reversible for the phase of the proposed development.
Negligible	Very slight change from baseline condition and/or physical extent of impact is negligible and/or short-term duration (i.e. less than two years) and/or frequency of repetition is negligible to continuous and/or the effect is reversible.
No Change	No change from baseline conditions.

Significance Criteria

15.33 Significance criteria for aviation impacts are typically difficult to establish; they are not strictly based on the sensitivity of the receptor or magnitude of change but on whether the industry regulations for safe obstacle avoidance or radar separation (from radar clutter) can be maintained in the presence of wind turbines.

15.34 Any anticipated impact upon aviation stakeholders which results in restricted operations is considered to be of significance. The following approach identified in Table 15-5 below, was used and summarises the assessment of significance, with any effect of moderate or major significance reflecting a significant effect in respect of the EIA Regulations.

Table 15-5
Significance of Potential Effects

		Magnitude			
		High	Medium	Low	Negligible
Sensitivity	High	**Major**	**Major**	**Moderate**	Minor
	Medium	**Major**	**Moderate**	Minor	Minor
	Low	**Moderate**	Minor	Minor	Negligible
	Negligible	Minor	Negligible	Negligible	Negligible

15.35 The determined effects were informed by the results of the desk-based assessment and additional consultation, with reference to recorded effects of wind turbine developments on aviation receptors.

Assumptions, Limitations and Confidence

15.36 The receptors selected as relevant to the assessment of effects, including radar were based upon an initial desktop screening exercise. Each receptor has been considered and scoped in or out on the basis of effect–receptor pathway, professional knowledge, data confidence and the temporal and spatial scales involved. There are no limitations in the completion of the assessment however line of sight conclusions are based on theoretical results.

EXISTING AVIATION BASELINE CONDITIONS

Study Area – Airspace Environment

15.37 In the UK Flight Information Region (FIR) and Upper Information Region (UIR), airspace is classified as A to G in accordance with International Civil Aviation Organisation (ICAO) standards (there is no airspace designated as Class B or Class F in the UK FIR/UIRs). Airspace Classes A, C, D and E are variants of Controlled Airspace (CAS) in which generically aircraft require an ATC clearance to operate within. Class G Airspace is airspace in which aircraft can operate without any clearance required or being in contact with ATC.

15.38 The classification and controlling authority of the various airspace sectors in the region of the proposed development are described and categorised as follows:

- Class G airspace up to Flight Level (FL) 195 overhead the proposed development (approximately 19,500 ft above mean sea level); any aircraft can operate in this area of uncontrolled airspace without any requirement to be in communication with an ATC Unit. Pilots of aircraft operating in Class G airspace are ultimately responsible for seeing and avoiding other aircraft, terrain and obstructions.
- Temporary Reserved Area (TRA) 008B is established from FL 195 up to FL 245. Activity within TRA 008B includes military air combat, training exercises and supersonic flight. Air Defence Units using radar data supplied from the Buchan ADR or military ATC at the Scottish (Prestwick) Area Control Centre (ACC) are responsible for navigation services and support to aircraft activity within TRA 008B during notified activity times.
    - Outside the times that TRA 008B is active, the airspace reverts to Class C CAS and NATS is responsible for the provision of navigation services to aircraft in transit above FL 195 over the Site.
- Class C CAS is established above FL 245; all aircraft operating in this airspace must be in receipt of an ATS from NATS, military controllers located at a NATS ACC or under the control of military air defence controllers. Also;
    - above the Site, the Scottish TRA Gliding (G) North Upper and Lower (including the Aboyne Area) is established from FL 195 to support the regions gliding operations and can be activated when required.
- in addition, the proposed development would be located within Low Flying Area (LFA) 14, the largest in the UK and covers mainland Scotland north of the Central Region, the Western Isles, Orkney and Shetland.

Identified Radar and Aviation Receptors Assessed

15.39 Identification of receptors was based upon:

- a desktop assessment utilising documentation listed in, but not limited by, paragraph 15.5 (above);
- results provided in the Scoping Opinion;
- consultation with relevant stakeholders; and

- consideration of key legislative and planning information and professional judgement.

15.40 Osprey considered the potential for the proposed development to have an effect on the following aviation interests; there are no other identified aviation stakeholders that would be potentially impacted by the proposed development.

NATS

15.41 NATS operates a number of long-range PSR systems positioned to provide maximum coverage of UK airspace. Wind farm developments have the potential to impact NATS radar and operations and by association other users of radar data supplied by NATS. The NATS Allanshill PSR which is located to the south west of Fraserburgh is the only NATS long range PSR that is predicted to detect the operational blade tips of the proposed development. In its reply to the request for a Scoping Opinion, NATS stated that the proposed development would conflict with its safeguarding criteria and accordingly NATS objected to the proposed development based on the results of a NATS TOPA. The TOPA predicts an unacceptable impact to the Allanshill PSR.

MOD

15.42 The MOD operates a series of fixed ADR that feed into the Control and Reporting Centres (CRC) at RAF Boulmer and RAF Scampton, where the UK Recognised Air Picture (RAP) which monitors UK airspace for intruders, is produced. The Buchan ADR is located approximately 68km from the centre of the proposed development. In response to the request for a Scoping Opinion, DIO whom safeguards MOD assets stated that the MOD objects to the proposed development, based on a predicted unacceptable impact to the Buchan ADR.

Aberdeen International Airport

15.43 Aberdeen International Airport is located at Dyce, a suburb of Aberdeen, Scotland. A total of just over 3 million passengers used the airport in 2017[1]. ATC services are provided to Aberdeen under contract by NATS, and data from the Perwinnes and Allanshill PSRs is utilised to provide ATC radar services from the airport. The proposed development is located approximately 48km from the centre of the airport's main runway. Radar operations at Aberdeen are unique in that operations are split into two control elements:

- Terminal Control - services provided to aircraft arriving and departing the airport and in the local vicinity; and
- En Route Control - services provided to aircraft in support of the offshore oil and gas industries in the wider area.

FUTURE BASELINE

15.44 It is anticipated that the airspace would continue to be used by the identified aviation stakeholders, and the baseline would remain as currently defined.

[1] Latest figures available

ASSESSMENT OF EFFECTS

NATS Allanshill PSR

Construction Effects

15.45 During construction, and prior to commissioning wind turbine blades would not be rotational. As a result, the infrastructure would not be processed and presented onto Radar Data Display Screens (RDDS) by the radar. Therefore, there would be no impacts on the Allanshill PSR system during the construction phase.

Operational Effects

15.46 The proposed development would be theoretically detectable to the NATS Allanshill PSR. Turbines detectable by a PSR system might degrade the system by creating false targets, reduce system sensitivity, create radar shadowing behind the turbines and saturate the radar receiver leading to clutter which could potentially conceal real aircraft targets. The sensitivity of the receptor is medium. The magnitude of impact is assessed as medium; therefore, the impacts would be of moderate significance, which would be a **Significant** effect in EIA terms.

Decommissioning Effects

15.47 Any agreed mitigation would be maintained until the last turbine is non-operational in the decommissioning phase, or as agreed with the aviation stakeholder. Once all turbines are stationary the decommissioning infrastructure is not predicted to affect the radar system, or be processed and presented as clutter on the RDDS by the radar.

MOD Buchan ADR

Construction Effects

15.48 During construction, and prior to commissioning wind turbine blades would not be rotational. Radar reflections from the static infrastructure would not be processed as moving targets and subsequently not be presented onto a RDDS by the radar. There would be no impact to the Buchan ADR during the construction phase.

Operational Effects

15.49 The proposed development would be theoretically detectable to the MOD Buchan ADR. Turbines detectable by the ADR system are likely to degrade the system by creating false targets, reduce system sensitivity, create radar shadowing behind the turbines and saturate the radar receiver leading to clutter potentially concealing real aircraft targets. The sensitivity of the receptor is medium. The magnitude of impacts is assessed as medium; therefore, the impacts would be of moderate significance, which would be a **Significant** effect in EIA terms.

Decommissioning Effects

15.50 Any agreed mitigation would be maintained until the last turbine is non-operational in the

decommissioning phase, or as agreed with the aviation stakeholder. Once all turbines are stationary the decommissioning infrastructure is not predicted to affect the radar system or be processed and presented as clutter on the RDDS by the radar.

Aberdeen International Airport PSR

Construction Effects

15.51 During construction, and prior to commissioning turbine blades would not be rotational. Radar reflections from the static infrastructure would not be processed as moving targets and subsequently presented onto a RDDS by the radar. There would be no impact to the Aberdeen International Airport PSR during the construction phase.

Operational Effects

15.52 The Allanshill PSR is utilised by the airport for the provision of radar-based ATC services. NATS provide ATC services under contract to the airport. The NATS TOPA states that any impact created to the En-Route element of the ATC service provided is acceptable. However, as there are two control elements provided by the airport, it is a requirement that other users of NATS infrastructure (Aberdeen Airport) are consulted to ascertain whether the anticipated impact to the Allanshill PSR is acceptable to their operations or not. Turbine clutter appearing on a radar display can affect the safe provision of an ATS by the airport, as it can mask unidentified aircraft from the air traffic controller and/or prevent accurate identification of aircraft under control, or the identification/tracking of conflicting aircraft.

15.53 Aberdeen ATC utilise data from both the Allanshill and Perwinnes PSR systems in the provision of a radar derived ATS. A radar LoS analysis has been completed between the blade tips of the proposed development and the Allanshill and Perwinnes PSR; results indicate that only the Allanshill PSR would theoretically detect the turbines. Aberdeen has previously responded to a request for a Scoping Opinion on the proposed development. The airport safeguarding team responded to the 2018 Scoping Opinion which stated that the position of the airport would be confirmed once the turbine details were finalised and consultation on a full planning application has been submitted.

15.54 The sensitivity of the receptor is medium. Aberdeen Airport has not provided a conclusive opinion to the scoping request therefore the magnitude of impacts is assessed as medium; impact would be of moderate significance, which would be considered **Significant** effect in EIA terms.

Decommissioning Effects

15.55 Any agreed required mitigation would be maintained until the last turbine is non-operational in the decommissioning phase, or as agreed with the aviation stakeholder. Once all turbines are stationary the decommissioning infrastructure is not predicted to affect the radar system or be processed and presented as clutter on the RDDS by the radar.

Mitigation

NATS Allanshill PSR

15.56 A technical solution has been recognised by NATS to mitigate En Route operational impacts; it involves the implementation of a plot suppression zone which comprises blanking of the Allanshill PSR and providing infill coverage from the Perwinnes PSR. This solution is known as blocking infill. Blocking infill uses 'terrain shielding' such that the remote sensor cannot detect the turbines due to intervening terrain, thus providing clutter-free returns from the area above the turbines. The Applicant has entered contract negotiations with NATS for technical mitigation of the Allanshill PSR. The technical mitigation solution would remove turbine effects to the Allanshill PSR.

MOD Buchan ADR

15.57 The Buchan ADR has been upgraded to TPS77 radar standard which is able to provide an inherent mitigation capability. The upgraded radar should have resilience, utilising hardware and software, to wind turbine induced clutter through the use of pulse Doppler processing. However, where the inherent radar performance is not considered to be satisfactory for ADR purposes, the TPS77 has an enhanced signal processing capability which enables the implementation of a Non-Automatic Initiation Zone (NAIZ).

15.58 A NAIZ prevents the radar from automatically creating tracks from any returns that originate within the NAIZ. In creating an NAIZ around a wind farm, none of the turbine returns are processed, thereby significantly reducing the possibility of unwanted tracks. Tracks which have been formed from returns originating outside the NAIZ (an aircraft transiting through the NAIZ), would still be tracked as it transits through the NAIZ.

15.59 The MOD have previously assessed and accepted a mitigation solution based on a NAIZ technical solution for the 16 wind turbine layout. However, the MOD Scoping Opinion for the 14 wind turbine layout reversed their previous acceptance of the mitigation solution as the wind farm parameters had changed. The Applicant is in discussion with the MOD in order to reach agreement that the suggested mitigation solution provides a volume of airspace above the proposed development which achieves agreed performance metric when the mitigation is in place; a technical mitigation solution would be agreed with the UK MOD prior to construction of the proposed development.

Embedded Mitigation

15.60 Embedded mitigation would relate to the fitment of aviation lighting, notification of works within the scoping boundary and dissemination of activities to aviation stakeholders as detailed in paragraph 15.8.

Residual Effects

15.61 It is anticipated that the potential risk posed to civil and military radar systems would be wholly and successfully mitigated through the application of technical mitigation solutions. Following the application of the mitigation solutions the overall impact to individual operations utilising data from the Allanshill PSR and the Buchan ADR would be **Not Significant** in EIA terms.

SUMMARY OF PREDICTED EFFECTS

15.62 The proposed development is within the operational range of a number of aviation stakeholder radar systems. At a maximum blade tip height of up to 180m agl, the proposed development is considered to be theoretically detectable by the NATS Allanshill PSR and the MOD Buchan ADR and be in an area that would have an operational significance to radar based air traffic and air defence services.

15.63 NATS have identified a PRMS for the Allanshill PSR which comprises blanking of the affected region of the Allanshill PSR over the proposed development and providing infill coverage from the Perwinnes PSR (which does not detect the proposed development wind turbines). The implementation of the PRMS would ensure that the proposed development would have an insignificant residual effect on the utilisation of the PSR to NATS and Aberdeen Airport En route operations.

15.64 The Buchan ADR has been upgraded to TPS77 standard; TPS77 is able to provide an inherent mitigation capability. Where the inherent radar performance is not considered to be satisfactory for ADR purposes, the TPS77 has an enhanced signal processing capability which enables the implementation of a NAIZ. Consultation with the MOD is currently ongoing; the MOD will be required to establish if NAIZ technology could mitigate the effects of the proposed development, based on an internal investigation of the technical solution based on individual turbines coordinates. The evaluation will confirm the most efficient use of NAIZ mitigation technology and once implemented would reduce the impact of the proposed development to a negligible level.

15.65 Aberdeen ATC utilise the Allanshill PSR in the provision of radar services. It is expected that the identified NATS mitigation capability would also mitigate any effect on Aberdeen operations and infrastructure.

15.66 In conclusion, the Applicant acknowledges that the proposed development would be likely to have an effect on the Allanshill PSR and the Buchan ADR systems. Agreement on the use of identified mitigation options will likely conclude in the proposed development having an insignificant residual effect on NATS and MOD infrastructure and operations.

CUMULATIVE EFFECTS

15.67 Cumulative effects refer to potential effects upon receptors arising from the proposed development when considered alongside other proposed developments and activities and any other reasonably foreseeable projects. In this context the term projects is considered to refer to any project with comparable effects on radar and aviation interests.

15.68 There are a number of other operational and proposed wind farms, at various stages in the planning process, within the vicinity of the proposed development. It is known that Air Navigation Service Providers (ANSPs) have concerns regarding the increasing impact of wind turbines on radar and operations in the region. Without mitigation, the proposed development would have cumulative effects on the Allanshill PSR and the Buchan ADR systems in combination with these other projects, in terms of the area affected by radar clutter and the distances between areas of clutter on the RDDS. Discussions are ongoing with NATS and the MOD regarding potential mitigation measures. Following implementation of mitigation, it can be expected that the stand-

alone and cumulative effects of the proposed development on the Allanshill PSR and the Buchan ADR systems would be reduced to an insignificant level in EIA terms.

STATEMENT OF SIGNIFICANCE

15.69 It is highly likely that technical mitigation solutions could be implemented to resolve any predicted significant effects of the proposed development on the Allanshill PSR and the Buchan ADR. NATS En Route have identified a PRMS for the Allanshill PSR; contract negotiations are currently ongoing between NATS and the Applicant for implementation of the mitigation solution. It is expected that the NATS identified mitigation capability would also mitigate any effect on Aberdeen International Airport operations and infrastructure. Furthermore, Osprey considers that with the collaboration of the MOD, a technically and operationally acceptable mitigation solution could be implemented for the Buchan ADR prior to the operation of the proposed development. Following the implementation of the mitigation measures there would be no significant effects in EIA terms.

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