19 WIND FARM AVIATION

19.1 INTRODUCTION

1. This Section of the ES evaluates the effects of the Wind Farm on aviation receptors and activities. The assessment has been undertaken by SSE Renewables with technical support from Osprey Consulting Services and Helios and includes an assessment of cumulative effects.

2. This Section of the ES is supported by the following documents:

- Annex 19A: Beatrice and Moray Offshore Wind Farms Helicopter Impact Assessment.

3. This Section includes the following elements:

- Assessment Methodology;
- Baseline Description;
- Development Design Mitigation;
- Assessment of Potential Effects;
- Mitigation Measures and Residual Effects;
- Summary of Effects; and
- Assessment of Cumulative Effects; and
- References.

19.2 POLICY AND PLANS

4. A variety of civil aviation publications contain information and guidance relating to the potential effects of an offshore wind development on aviation stakeholders. The following documents were consulted during the assessment process:

- Civil Aviation Policy (CAP) 393 Air Navigation: The Order and the Regulations;
- CAP 437 Offshore Helicopter Landing Areas – Guidance on Standards;
- CAP 670 ATS Safety Requirements;
- CAP 764 CAA Policy and Guidelines on Wind Turbines; and
- UK Aeronautical Information Publications (Civil and Military).

19.3 ASSESSMENT METHODOLOGY

19.3.1 CONSULTATION

5. Consultation responses are summarised in **Error! Reference source not found.**.

Table 19.1 Summary of Consultation Undertaken

Consultee	Summary of Consultation Response	Project Response
Highlands and Islands Airports Ltd (HIAL)	Wind turbines located in the north western portion of the Wind Farm Site have the potential to affect the instrument approach procedures to HIAL Wick Airport as they may present a physical obstruction to the height clearance parameters in use.	Two meetings were held with HIAL Wick Airport management to clarify the potential effects and agree the method for assessing the effect and devising suitable mitigation.
Civil Aviation Authority (CAA)	Wind turbines have the potential to effect helicopter operations in the Moray Firth within 6 NM (11.1 km) of platform helidecks.	Consultation was initiated with helicopter operators and platform operators.
Offshore Helicopter Operators and Platform Operators	Wind turbines have the potential to affect helicopter approach and departure procedures to helidecks and emergency evacuations.	Bond Offshore Helicopters, Bristow Helicopters, and CHC Scotia are the local offshore helicopter operators and, as such, they have been consulted along with Wood Group which operates the Beatrice and Jacky platforms on behalf of Ithaca. Ithaca was also consulted. A summary of meetings held is included in Table 19.2.
Ministry Of Defence (MOD) and Defence Infrastructure Organisation (DIO)	The MOD and DIO were consulted early on in the development process through the standard consultation pro forma and indicated an intention to object to the development based on the anticipated effect on the RAF Lossiemouth Primary Surveillance Radar (PSR).	Impact Assessment and Mitigation study was commissioned from Osprey which confirmed the effect and identified possible mitigation options. Findings are summarised in the relevant Sections.
NATS En-Route Limited (NERL)	NERL were consulted early on in the development process through the standard consultation proforma and indicated an intention to object to the development based on the conflict to their safeguarding criteria, specifically, the effect on the NERL Allanshill PSR.	There has been frequent engagement with NERL to agree a plan to assess the affect of the development on the NERL Allanshill PSR. It was agreed that the potential effect on Secondary Surveillance Radar (SSR) was to be scoped out as effects are generally not experienced further than 24 km from a SSR. Upon discussion with NERL, it was agreed that assessment and agreement of mitigation options should occur in 2012 when the suitability of emerging mitigation technologies would be better understood by both organisations.

Table 19.2 Summary of Consultation Undertaken with Helicopter and Oil Platform Stakeholders

Consultee	Date	Meeting
CHC Scotia	March 2011	Project Introduction – gained information on use of Helicopter Main Route (HMR) and approach procedures to helidecks.
Bond Offshore	March 2011	Project Introduction – gained further information on use of HMR and approach procedures to helidecks.
Wood Group	May 2011	Project Introduction – confirmed flight schedules to helidecks, use of Jacky platform, discussion of current arrangements for access and evacuation.
Bond Offshore Bristow CHC Scotia Ithaca Wood Group	August 2011	Hazard Identification workshop.
Bond Offshore CHC Scotia	September 2011	Preliminary impact assessment and potential mitigation discussion.
Bond Offshore Bristow	November 2011	Impact assessment and mitigation presentation – parties attending agreed findings in principle; Bond, Bristow and CHC approved report in following weeks.
Talisman Wood Group	January 2012	Impact assessment and mitigation presentation – attendees to discuss findings of assessment and mitigation with helicopter operators.

19.3.2 SCOPE OF ASSESSMENT

6. All potential aviation effects have been assessed for the operational phase of the Wind Farm. The potential effects of the Wind Farm identified in this assessment relate to the physical obstruction of airspace by wind turbines and/or the effects of the presence of wind turbines upon radar or other navigational systems. These effects have the potential to occur from the time of the erection of the first turbine during construction. As a result, all effects assessed in this Section will be of the same, or a lesser magnitude during construction and decommissioning and therefore only operational effects have been considered in this assessment.

19.3.2.1 Geographical Scope

7. The aviation effects of the Wind Farm have been assessed at various ranges for aviation receptors and their assets. The ranges within which the assessment has been undertaken were informed by the guidance, the capabilities of the relevant aviation equipment and the relevant stakeholders' area of operational responsibility as follows:

- HIAL Wick Airport - The effects on HIAL Wick Airport standard arrivals and departures procedures within 30 km of the airfield have been assessed;
- MOD radar - Radar line of sight effects on the RAF Lossiemouth PSR have been assessed, as the Wind Farm Site lies within the 40 NM (74.1 km) declared area of operational responsibility for RAF Lossiemouth. There are no other MOD PSRs within 40 NM (74.1 km) of the Wind Farm Site;

- NERL - The effect on NERL PSR systems has been assessed out to 150 km from the Wind Farm Site and therefore includes the PSR at Allanshill. Additionally, the impact on any controlled airspace within 5 NM (9.3 km) of the Wind Farm Site has been assessed; and
- Offshore helicopter operations - The effects on offshore helicopter operations and the ability to conduct approaches to platforms in the Beatrice field was assessed within 9 NM (16.7 km) of any offshore platform with a helideck or with the ability to sustain a helideck as part of jack-up operations. Additionally, the effect on offshore helicopters was assessed within 5 NM (9.3 km) either side of the defined centreline of a HMR.

19.3.2.2 Receptors Scoped Out of the Assessment

8. HIAL Wick Airport does not have an on-site PSR but it is equipped with a Non-Directional (Radio) Beacon (NDB), a VHF Omni-directional radio range (VOR) and Distance Measuring Equipment (DME). The Wind Farm Site is of sufficient distance from the three aforementioned navigation aids that there will be no effect on their operational effectiveness and effects on these navigational aids have therefore been scoped out of the assessment.

9. The potential effect on local secondary surveillance radar (SSR) stations has been scoped out of the assessment. CAA advice contained within CAP 764 states that turbines within 24 km of an SSR station have the potential to affect the radar station, although the majority of effects are likely to be observed within 10 km of the SSR. There are no SSR systems within 24 km of the Wind Farm Site and therefore SSRs have been scoped out of the assessment.

10. Effects on MOD low flying aircraft operations within active Danger Areas were scoped out as the Wind Farm Site is outside the three-dimensional space bounded by the Danger Areas as shown in Figure 19.1:

- D 807;
- D809(S);
- D712D; and
- D712C.

19.3.3 METHODOLOGY

11. The potential effects of the Wind Farm have been assessed through consultation and desk-based technical assessments. Where cumulative aviation issues have been identified in relation to the neighbouring Moray Firth Round 3 Zone, BOWL has collaborated with the MORL development team. The general approach to wind farm development is to avoid adverse effects on aviation infrastructure operators and receptors where possible, or to find appropriate technical mitigation solutions where this cannot be achieved. These solutions should be agreed between BOWL and the infrastructure owner/operator, and consultation will often continue through the consenting process.

12. Following this approach, it is inappropriate to apply significance criteria to these effects, as on agreement of an appropriate technical solution the mitigated effect

will be either no effect, or a negligible effect which should be deemed to be acceptable to the relevant infrastructure operator.

19.3.4 WORST CASE

13. For the assessments of potential effects in this Section, it is presumed that the entirety of the area of the Wind Farm Site will be populated with wind turbines at the maximum tip height of 198.4 m above LAT.

14. The realistic worst case scenarios in terms of aviation effects involve the largest turbine tip heights; this increases the likelihood of wind turbine visibility to radar systems and of the wind turbines presenting a physical obstruction to aircraft. Therefore a theoretically solid 3-dimensional shape up to 198.4 m LAT has been considered as the realistic worst-case scenario.

15. Where the potential effects using the realistic worst case are found to be unacceptable by the operators of specific receptors, further analysis has been undertaken to find if the effects could become acceptable at lower blade tip heights within the Rochdale Envelope.

19.3.5 ASSESSMENT LIMITATIONS

16. Ideally the meteorological data used in the analysis of effects on helicopter platform approaches would be in-field; however, in-field meteorological data is only retained by helicopter operators for a period of one month. In order to obtain long term meteorological data to inform the assessment, nearest airfield METARS (meteorological aerodrome report) data was gathered from HIAL Wick Airport and RAF Lossiemouth. The data was broadly found to be consistent for both locations, however, the RAF Lossiemouth data shows higher incidence of visual approach conditions. Therefore, the HIAL Wick Airport data was used for analysis in order to assess the worse-case, i.e. greatest effect on instrument approaches. This data is expected to be an appropriate and robust representation of conditions in-field.

19.4 BASELINE DESCRIPTION

17. The following receptors have been identified:

- HIAL Wick Airport;
- MOD radar - RAF Lossiemouth PSR;
- NERL radar – NERL Allanshill PSR;
- Minimum Safe Altitude;
- Helicopter Main Routes; and
- Helicopter Approach Procedures to offshore platforms.

19.4.1 INSTRUMENT APPROACH PROCEDURES AT HIAL WICK AIRPORT

18. Aircraft approach procedures to HIAL Wick Airport were obtained from HIAL. The aircraft approach profiles at HIAL Wick Airport have been designed taking into account the tallest obstacles in the region, with descent heights (procedure minima) and points calculated accordingly.

19. Aircraft are categorised based largely on aircraft design and size. Category A aircraft are predominantly smaller and slower than higher category aircraft which

are generally faster and have a wider rate of turn. The majority of aircraft using HIAL Wick Airport are Category A or B, with smaller numbers of Category C and Category D aircraft. Aircraft of a category greater than Category D cannot be accommodated at HIAL Wick Airport.

20. There are a number of published instrument approach procedures to HIAL Wick Airport which have the potential to transit in proximity to the Wind Farm Site. Procedures of this nature are designed to provide aircraft in flight with 5 NM (9.3 km) lateral separation from tall obstacles. Approaches to runway 31 (an approach direction of 310°), as designed, will routinely cause aircraft to pass within 5 NM (9.3 km) of the north west of the Wind Farm Site (Figures 19.2 to 19.5). Aviation regulations stipulate that 1,000 ft (305 m) vertical separation must be maintained between aircraft flying under instrument flight rules (IFR) and any obstacles.

21. As currently published, the direct arrivals approaches to VOR/DME and to NDB(L)/DME runway 31 (Figures 19.3 and 19.5) route aircraft along a DME arc 8 NM (14.8 km) from the airport at an altitude not below 1,800 ft (549 m) , or a height of not below 1,636 ft (499 m). The HIAL Wick Airport VOR/DME and NDB(L)/DME approaches to runway 31, shown in Figures 19.2 and 19.4, route aircraft along specified radials away from HIAL Wick Airport and towards the Wind Farm Site at an altitude of not below 1,600 ft (489 m) (a height not below 1,486 ft (453 m)) before turning back towards HIAL Wick Airport at a range of 7 NM (13 km) from the runway. Category C and D aircraft fly a wider approach pattern owing to their wider rate of turn.

19.4.2 PRIMARY SURVEILLANCE RADAR SYSTEMS AT RAF LOSSIEMOUTH AND NERL ALLANSHILL

22. Two PSRs with the potential to be affected by the Wind Farm were identified through consultation and desk-based survey. These were RAF Lossiemouth PSR, approximately 56 km to the south south-west of the Wind Farm Site and NERL Allanshill PSR, approximately 82 km to the south-east of the Wind Farm Site (Figure 19.1). There is an active RAF airfield at RAF Lossiemouth which requires surveillance radar. NERL Allanshill is the primary source of surveillance radar used to the north and east of Aberdeen.

23. Visibility of a wind farm to a PSR can create phenomena which degrade the effectiveness of the radar systems, which may include the following effects:

- Wind turbines can cause false radar returns, known as clutter, which can distract air traffic controllers. They can complicate the distinguishing of real aircraft and increase controller workload. High levels of clutter can also obscure display symbology, decreasing the situational awareness of air traffic controllers using the affected radar data;
- Wind turbines can also cause conditions leading to loss of radar sensitivity in detection to the extent that aircraft radar returns can be completely lost; and
- Wind turbines can present an obstruction to a radar signal in the same way as any other structure. Airspace behind wind turbines can be blocked or

'shadowed', which can result in a decreased ability of a radar system to identify aircraft above, within or behind a wind farm.

19.4.3 MINIMUM SAFE ALTITUDE

24. The current minimum safe altitude (MSA) for aircraft operations in Instrument Meteorological Conditions (IMC), essentially poor weather, in the Moray Firth region is 1,500 ft (457 m). This allows for 1,000 ft (305 m) clearance from en-route obstacles. The MSA dictates the height at which instrument approaches commence and is therefore relevant to the Helicopter Main Route assessment (Section 19.6.4) and Helicopter Approaches Procedures to Helidecks (Section 19.6.5).

19.4.4 HELICOPTER MAIN ROUTES

25. HMRs provide a network of offshore routes utilised by civilian helicopters. Desk-based survey identified HMR X-RAY as having potential to be affected by the Wind Farm (Figure 19.6).

26. Wind turbines can affect operations associated with HMRs but the effect will depend on the degree of wind turbine proliferation. A large number of wind turbines beneath an HMR could force a helicopter to fly higher in order to maintain safe vertical separation from wind turbines (1,000 ft (305 m) clearance from en-route obstacles). The ability of a helicopter to fly higher would be dependent on the icing level (i.e. the altitude at which there is a risk of ice accumulating and affecting the performance of an aircraft).

19.4.5 HELICOPTER APPROACH PROCEDURES TO HELIDECKS

27. Aviation data relating to the approach procedures to the Beatrice field offshore platforms has been collected from the offshore helicopter operators. Meteorological data has also been gathered from RAF Lossiemouth and from HIAL Wick Airport to inform the assessment of the potential effect of the Wind Farm on helicopter approaches to the platform helidecks in the Moray Firth. Further information on this data can be found in Section 1.5 of Annex 19A.

28. Wind turbine developments within 9 NM (16.7 km) of an offshore helicopter destination, such as oil or gas platforms, can affect a flight crew's ability to safely conduct essential instrument flight procedures in poor weather conditions. This can also affect the integrity of offshore platform safety cases where emergency scenarios are based on the use of helicopters to evacuate the platform. Operations in Visual Meteorological Conditions (VMC), which is essentially good weather conditions, have also been considered in this assessment.

29. An analysis of meteorological data from HIAL Wick Airport was undertaken to establish year-long VMC averages of approach procedures in relation to weather conditions. It was calculated that an average of 87% of approaches to the Beatrice platforms will occur in VMC. An average of 1% of approaches will occur in wind less conditions and an average of 1% of approaches will have to be abandoned due to poor weather in-field. 9.4% of approaches will be undertaken in poor weather conditions (IMC) with a wind component.

30. There are four offshore platforms within 9 NM (16.7 km) of the Wind Farm. Their locations and Flight Schedules are given in Table 19.3.

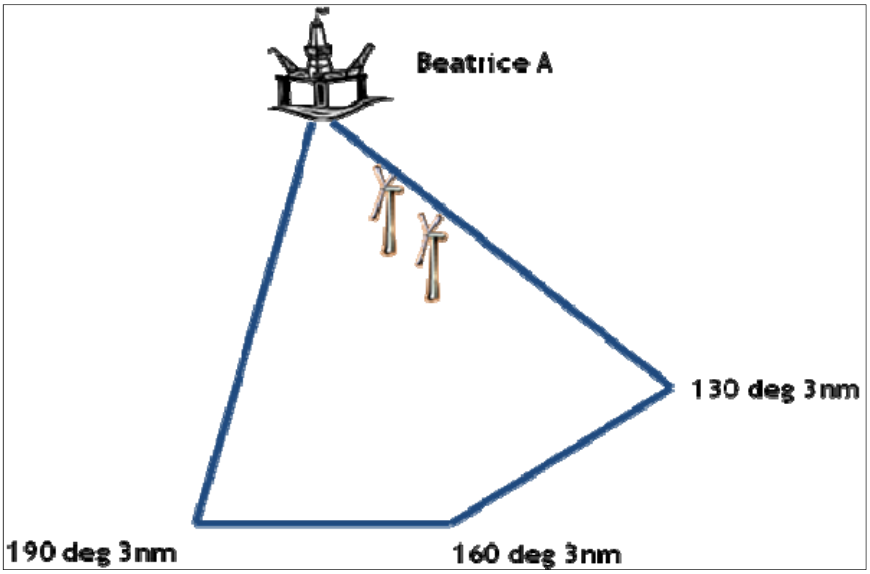
Table 19.3 Offshore Platform Locations and Flight Schedules

Offshore Platform	Approximate Distance and Direction from Wind Farm Site	Frequency of Flights	Total Flights per Annum
Beatrice A	5.3 NM (9.8 km) south west	3 per week, year round	156
Beatrice B	2.5 NM (4.6 km)) south west	3 visits per month requiring 2 flights per day	72
Beatrice C	7.7 NM (14.2 km) south west	3 visits every 3 months requiring 2 flights per visit	16
Jacky	Adjacent to the south west	2 flights per week when jack-up present alongside (for up to 8 weeks per year)	16

31. There are helidecks established on Beatrice platforms A, B and C. Whilst there is no permanently established helideck on Jacky, there is a capability to establish one in the event of jack-up operations, when a mobile drilling rig with a helideck would be alongside the Jack platform. Figure 19.6 shows the location of the four platforms in relation to the Wind Farm Site.

32. There are two existing wind turbines within the Beatrice field which are located to the south east of the Beatrice A platform. These two turbines already constrain instrument approaches and approaches conducted at night into the Beatrice A helideck where restrictions exist between the 130° and 190° radials out to 3 NM (5.6 km) from the platform (Plate 19.1).

Plate 19.1 Existing Turbines south east of the Beatrice A Platform



33. There is an Obstacle Free Zone (OFZ) established in the form of a 210° uninterrupted arc around a helideck in which obstacles are controlled. Historically an OFZ is protected to a range of 1 km (0.5 NM); however, it is now protected based

on the engine inoperative performance of an aircraft as well as a range of other factors. As a result, the final OFZs around the Beatrice and Jacky platforms could be of a radius in excess of 1 km (0.5 NM).

34. Further baseline information for helicopter approach procedures to helidecks can be found in Section 2 of Annex 19A.

19.4.5.1 Airborne Radar Approach

Airborne Radar Approach Procedures

35. The Airborne Radar Approach (ARA) is a weather radar approach that forms the basis for almost all low visibility approaches flown offshore over the North Sea. The onboard weather radar is used to provide a radar return which indicates the location of the required offshore platform. More detail on approach procedures to helidecks is contained within Annex 19A.

Airborne Weather Radar Onboard Offshore Helicopters

36. Many helicopter types which operate in the Moray Firth region are fitted with airborne weather radar. This weather radar can be used to conduct an instrument approach to offshore platforms in poor visibility. The radar is designed to display weather phenomena, such as rain, as well as obstacles such as the oil or gas platform and wind turbines. There is potential for the volume of targets generated by wind turbines, platforms and weather to hamper a flight crew's ability to correctly distinguish the location of the required destination platform.

19.5 DEVELOPMENT DESIGN MITIGATION

37. The Wind Farm will be equipped with a lighting scheme which fulfils the requirements set out in Article 220 of CAP 393 Air Navigation: The Order and the Regulations and as detailed to support winching operations at the wind farm. The lighting scheme will be agreed with aviation stakeholders and developed in accordance with the most current policy and strategy articulated by the CAA and the DECC. The assessment of effects contained in this Section assumes that the lighting requirements described in this Section will be applied to the Wind Farm.

19.5.1 REQUIREMENT FOR LIGHTING WIND TURBINE GENERATORS IN UK TERRITORIAL WATERS

38. The CAA legislates in Article 220 of CAP 393 that obstacle lighting is to be fitted on offshore turbines with a height of 60 m or more above the highest astronomical tide. At least one medium intensity steady red light (2,000 candela) should be positioned as close as possible to the top of the fixed structure with a requirement for some downward spillage of light. Where four or more wind turbines are located together in the same group, with the permission of the CAA, only those on the periphery of the group need be fitted with obstruction lighting.

19.5.1.1 Future Lighting Requirements

39. The CAA published the Directorate of Airspace Policy's Policy Statement, The Lighting of Wind Turbine Generators in United Kingdom Territorial Waters, in August 2010 which expanded on aviation lighting requirements but acknowledged

the potential effect on maritime interests if the aviation lighting was visible below the horizontal. The document clarifies that there is no intention of changing the lighting intensity specifications as laid down in Article 220, but there is potential for investigating the use of flashing lighting schemes to ensure that aviation lighting is clearly distinguishable from maritime lighting.

40. Instead of utilising steady red lighting there may be a move towards installing flashing red lighting which displays a Morse Code 'W'. It is likely that, if flashing lighting is deemed appropriate, the flash sequence on each turbine within the same wind farm development would be required to be synchronized.

19.5.1.2 Winching Operations

41. Helicopter winching into wind turbine platforms can be conducted during daylight hours and in visual meteorological conditions. Lighting to facilitate helicopter winching operations is to consist of low intensity (16-60 candela) steady green lighting which is used to indicate that the pilot is safe to operate.

42. If the turbines are equipped with 2,000 candela steady red lighting in accordance with Article 220, and the lighting is displayed during the day, then there is no further lighting requirement. However, if the lighting is only displayed at night, or there is no lighting, then low intensity (50-2,000 candela) steady red obstruction lighting should be fitted on the top of the nacelle and should be displayed when winching operations are anticipated. There is no requirement for such lighting to be displayed below nacelle height.

19.5.1.3 Search and Rescue Operations

43. The Maritime and Coastguard Agency (MCA) advise that for search and rescue operations, providing that turbines are lit for the purposes of Article 220 or with lighting to support winching operations, there is no additional lighting requirement. However, the MCA requests that: "*all lights should be under the control of the wind farm control centre or, out of hours, a person who has rapid access to control of the wind farm lighting and turbines so that they can be switched off/on as required by the emergency situation*".

19.6 ASSESSMENT OF POTENTIAL EFFECTS

19.6.1 INSTRUMENT APPROACH PROCEDURES AT HIAL WICK AIRPORT

44. The potential effects of the Wind Farm on existing published instrument approach procedures at HIAL Wick Airport were assessed by analysing the realistic worst-case outlined in Section 19.3.4. This analysis identified that wind turbines located in the north western portion of the Wind Farm Site have the potential to affect the instrument approach procedures to HIAL Wick Airport as they may present a physical obstruction to the height clearance parameters in use. There are a number of published approach procedures to HIAL Wick Airport which have the potential to transit in proximity to the Wind Farm Site. Approaches to runway 31, as currently designed, will routinely cause aircraft to pass within 5 NM (9.3 km) of wind turbines in the north west of the Wind Farm Site (Figures 19.2 to 19.5).

45. The Directorate of Airspace Policy (DAP), on behalf of HIAL Wick Airport, assessed the potential effect of the Wind Farm. It was agreed that there will be no infringement of the airport's obstacle limitation surfaces, no effect on standard departure profiles from the airport, and no effect on Category A and B aircraft conducting instrument approaches to runway 31 at the airport. However, there will be an effect on the ability for Category C and D aircraft to make approaches to runway 31 following the current published procedures.

46. Category C and D aircraft fly a wider rate of turn and for the realistic worst case layout assessed, the defined minima would need to be approximately 16.4 m higher to be met (i.e. the defined minima can be met for wind turbine tip heights of 182 m LAT and below).

47. Turbines in the north western sector of the Wind Farm Site will have the potential to have the greatest effect on published procedures at HIAL Wick Airport. All of the potential wind turbine tip heights detailed within the Rochdale Envelope will require an increase in the height of the current defined procedure minima at the airport in this eventuality; this increase was confirmed as being unacceptable to HIAL and the aircraft operators and therefore mitigation is required.

19.6.2 PRIMARY SURVEILLANCE RADAR SYSTEMS AT RAF LOSSIEMOUTH AND NERL ALLANSHILL

19.6.2.1 RAF Lossiemouth PSR

48. A large proportion of the Wind Farm Site at the full range of wind turbine tip heights defined within the Rochdale Envelope is theoretically visible to the RAF Lossiemouth PSR.

19.6.2.2 NERL Allanshill PSR

49. A large proportion of the Wind Farm Site at the full range of wind turbine tip heights defined within the Rochdale Envelope is theoretically visible to the Allanshill PSR.

19.6.2.3 PSR Degradation

50. The theoretical visibility of wind turbines within the Wind Farm Site will cause unwanted radar returns to be presented on the PSRs at RAF Lossiemouth and NERL Allanshill. This will likely hamper an air traffic controller's ability to distinguish aircraft returns from those created by the Wind Farm. There is less potential for the Wind Farm to cause a 'shadow' effect on the radar as the more northerly section of the Wind Farm Site is assessed to be on the extent of the available radar coverage where the curvature of the earth is a factor in shielding some of the wind turbines from the radar sensors.

51. Civilian and Military air traffic controllers can provide a Deconfliction Service, a Procedural Service or a Traffic Service to aircraft in the Moray Firth region. Both a Traffic Service and a Deconfliction Service require the use of a radar system. The system from which the primary radar data is derived can be affected by the presence of wind turbines. These turbines can degrade the efficacy of the air traffic control radar service being provided in the region of the Wind Farm.

52. Therefore, in the absence of mitigation, it is likely that the Wind Farm would have an unacceptable effect upon the PSRs at RAF Lossiemouth and NERL Allanshill.

19.6.3 MINIMUM SAFE ALTITUDE

53. The current MSA for helicopter operations in IMC in the Moray Firth region is 1,500 ft (457 m), allowing for 1,000 ft (305 m) clearance from en-route obstacles. The realistic worst case turbine blade tip heights at the Wind Farm are 198.4 m (approximately 650 ft) LAT, therefore the existing MSA would be infringed by approximately 200 ft (61 m).

19.6.4 HELICOPTER MAIN ROUTES

54. The section of HMR X-RAY which has the potential to conflict with wind turbines at the Wind Farm lies between Aberdeen and Wick (Figure 19.1). Consultation with helicopter operators in the Moray Firth confirmed that aircraft fly along the HMR between 2,000 ft (610 m) and 3,000 ft (914 m), depending on prevailing meteorological conditions. This altitude band is sufficient to prevent any helicopters operating on the HMR from coming into direct physical conflict with wind turbines within the Wind Farm Site under normal operating conditions.

55. In icing conditions helicopter pilots of aircraft not equipped with an anti-icing capability may elect to transit at lower altitudes, below the HMR, to avoid the 0° isotherm. The presence of turbines which may infringe the MSA has the potential to limit the transit options available to these pilots.

19.6.5 HELICOPTER APPROACH PROCEDURES TO HELIDECKS

19.6.5.1 Airborne Weather Radar Onboard Offshore Helicopters

56. The potential effects of the Wind Farm turbines on the airborne weather radar were considered and discussed through direct liaison with offshore helicopter operators during the HAZID (hazard identification) workshop, held in August 2011, with representatives from BOWL, MORL, Wood Group, Ithaca, the three offshore helicopter companies that operate in the Moray Firth area (Bond Air Services, Bristows and CHC Scotia).

57. The airborne weather radar is designed to sense and present information pertaining to weather and obstacles. The Wind Farm will not prevent the radar from sensing or presenting obstructions, indeed the wind turbines will be presented on the radar display along with other obstacles in the field.

58. The presence of the Wind Farm has the potential to add clutter to the radar screen making the position of the platforms more difficult to discern, however, with GPS assistance it will still be possible to identify the platform locations.

19.6.5.2 Airborne Radar Approach Procedures

59. The effect on helicopter approaches to the Beatrice and Jacky platform helidecks were assessed by determining the sectors in which instrument approaches to the platforms occur in IMC. It was then confirmed which approaches will be affected during the HAZID workshop. Specific issues were considered for each platform, including the potential helideck which will be present in the event of jack-up

operations at Jacky. This was followed by analysis of meteorological and wind data to determine the frequency of these approaches.

60. The consultation sought to identify potential issues in maintaining normal operations to the Beatrice and Jacky offshore platforms in the presence of the Wind Farm.

61. Detailed assessment is presented in Section 3 of Annex 19A and suggests that, in the absence of mitigation, wind turbines within the Wind Farm Site would prevent the following approximate numbers of flights reaching the offshore platforms:

- Beatrice A 0.1% of helicopter flights (approximately 1 flight in 5 years);
- Beatrice B 0.8% of flights (approximately 1 flight in 2 years);
- Beatrice C 0.1% of flights (negligible); and
- Jacky 7.7% of flights (approximately 1 flight per year).

62. Consultation is ongoing with the offshore helicopter operators. Information to be confirmed includes the required vertical and horizontal separation distances required from the Wind Farm. Additionally, information is needed to understand the performance capabilities of typical in field aircraft that have suffered single engine failure. This information is necessary to clarify how close the wind turbines could theoretically be placed to an OFZ.

63. In the absence of mitigation, anticipated numbers of flights likely to be prevented from reaching the platforms has been calculated to be no more than one flight per year for any of the platforms assessed. Consultation is ongoing with the helicopter operators to determine the acceptability of this predicted effect, also taking into account the cumulative assessment presented in Section 19.10.

19.7 MITIGATION MEASURES AND RESIDUAL EFFECTS

19.7.1 INSTRUMENT APPROACH PROCEDURES AT HIAL WICK AIRPORT

64. Owing to the relatively small number of Category C and D aircraft movements at HIAL Wick Airport, the effects can be mitigated by rationalising the HIAL Wick Airport instrument flying procedures. The removal of the wider approach procedures for Category C and D aircraft will allow the proposed development at the maximum wind turbine tip height of 198.4 m LAT to co-exist safely with aircraft operations to and from HIAL Wick Airport.

65. This rationalisation of procedures is currently ongoing with the procedural redesign work currently being conducted by DAP on behalf of HIAL Wick Airport. The new rationalised and amended procedures are expected to be published and in everyday use well in advance of the determination of the Wind Farm.

66. Following the rationalisation of the instrument approach procedures at HIAL Wick Airport there will be no residual effect.

19.7.2 PRIMARY SURVEILLANCE RADAR (PSR)

19.7.2.1 Potential Mitigation Solutions

67. There are a number of potential PSR mitigation solutions which are being considered, some of which are emerging technologies.

68. The MOD has stated a requirement for 'seamless integration' to be an integral factor in the acceptability of a mitigation solution. Wind developers have increasingly proposed radar in-fill mitigation solutions. A radar in-fill involves the removal of primary radar data where radar clutter is anticipated in the vicinity of a wind farm, and replacing it with an alternate radar source which is not affected by radar clutter. The MOD expressed concern that the integrity of the boundaries between these data sources needed protection to prevent boundary corruption which can lead to loss of radar plots, duplication of plots and misalignment of the synthetic video radar responses.

69. There is a requirement for data, which is inserted into an air traffic control radar video display to provide a radar picture over a wind turbine development within a designated area, to have smooth boundaries with no visible seams or joins. The infill patch must not display any form of boundary corruption for transponding or non-transponding aircraft which could lead to an MOD air traffic controller being unable to provide safe air traffic control services.

19.7.2.2 Holographic radar solution

70. BOWL is proposing to pursue the agreement of an appropriate consent condition prior to determination. A technical assessment has been conducted by Osprey Consulting Services Ltd and consultation is ongoing regarding agreement of a mitigation strategy and an appropriate consent condition with the MOD and MS.

71. The condition will be based on the deployment of a technology which is believed to be capable of satisfying the MOD's requirement for seamless integration and no degradation to their base of radar coverage. The MOD has yet to fully validate and accept into operational service any technology which wholly satisfies its policy towards seamless integration.

19.7.2.3 Raytheon Solution

72. The Raytheon Solution is a potential solution to mitigate the effect of the Wind Farm on the Allanshill PSR. This is a technical solution which can be deployed on an individual radar basis, which has been developed with funding support from The Crown Estate, DECC and the Aviation Investment Fund Company Ltd (of which SSE is a member). The wind industry is working closely with DECC, NATS and other governmental departments to agree a funding mechanism and roll-out programme for this solution. BOWL is proposing to pursue the agreement of a consent condition with NERL and MS prior to determination.

19.7.2.4 Transponder Mandatory Zones

73. Another alternative mitigation, either as a temporary solution until full deployment of a suitable technical solution or as permanent mitigation, with agreement from

the MOD and other local airspace users, would be the introduction of a Transponder Mandatory Zone (TMZ) in the airspace above the Wind Farm Site.

74. A TMZ is a designated area of airspace where it is mandatory for aircraft to carry a serviceable transponder which is switched on. A transponder is a piece of electronic equipment carried onboard an aircraft which responds when it is interrogated. This interrogation can come from other aircraft, if fitted with collision avoidance systems, or a ground based system such as SSR.

75. The application of a TMZ, temporary or otherwise, in Class G uncontrolled airspace raises questions relating to the 'ownership' of the TMZ and which controlling authority will have rights to allocate permission for aircraft to transit the TMZ. Additionally, the ability to suppress PSR radar returns in a sector, rather than between specific radials from a PSR system, will be dependent on the capabilities of the radar system and the willingness of stakeholders to accept degradation to its ability to detect PSR radar returns.

76. If a TMZ is sought overhead the Wind Farm Site, then there will be a residual adverse effect on the RAF Lossiemouth PSR due to the degradation of PSR radar return detection in the vicinity of the Wind Farm. On this basis, it is anticipated that the MOD would oppose any airspace change request relating to the creation of a TMZ overhead the Wind Farm Site.

77. If a TMZ is sought overhead the Wind Farm there may be a residual adverse effect on the Allanshill PSR as there is a possibility that there will be slight degradation to radar coverage and/or radar range which would influence the acceptability of this solution to NERL.

19.7.2.5 New Primary Surveillance Radar

78. If a suitable radar solution cannot be procured and/or the Raytheon Solution is deemed unacceptable, it may be preferable to procure a new PSR. This is likely to be a more acceptable permanent solution for the MOD than a TMZ.

79. The aim would be to select a system which has a wind farm filtering capability or one which can be placed in such a location that it is not within radar line of sight of the Beatrice Offshore Wind Farm wind turbines. The radar feed of the new PSR can then be integrated with the Allanshill PSR and RAF Lossiemouth PSR data in the form of a radar in-fill as described above. There will still be a requirement from the MOD for seamless integration of the radar data.

19.7.2.6 RAF Lossiemouth PSR

80. The Applicant will pursue the use of an emerging technology that satisfies the MOD's requirement for seamless integration and no degradation to the base of radar cover. Following the adoption of a suitable mitigation solution, there will be a negligible residual effect on the RAF Lossiemouth PSR.

19.7.2.7 NERL Allanshill PSR

81. There are a number of emerging technologies which BOWL could deploy to mitigate the effect on NERL's PSR system at Allanshill.

82. If a suitable technological solution can be procured then there will be a negligible residual effect on the Allanshill PSR.

19.7.2.8 Turbine Shutdown Protocol

83. The serviceability of any PSR mitigation solutions will need to be monitored. If they fail, it is likely that the aviation stakeholder(s) will require wind turbine blades to cease turning until the unserviceability of the solution is rectified. Any such wind turbine shutdown protocol will be agreed with the relevant aviation stakeholder(s) during the agreement of any consent conditions.

19.7.3 MINIMUM SAFE ALTITUDE

84. The MSA would need to be raised as a result of the presence of the Wind Farm. Presuming the highest wind turbine blade tip height of 198.4 m (approximately 650 ft) is selected, the MSA will be raised to 1,700 ft (518 m) to allow 1,000ft (305 m) clearance from the Wind Farm. Aviation charts and any other relevant documentation would be updated where necessary to reflect this change.

19.7.4 HELICOPTER MAIN ROUTES

85. Discussions between BOWL and the offshore helicopter operators concluded that there will be no effect of the Wind Farm on helicopter operations on HMR X-RAY as the MSA would be raised to 1,700 ft (518 m) (below the lowest altitude at which the HMR is flown).

86. It was established that not all of the helicopters operating to the Moray Firth platforms are equipped with anti-icing capability. However, those that lacked it would not fly along or below HMR X-RAY in forecast icing conditions as an overland option is available. Therefore, there will be no effect on HMR X-RAY as a result of the Wind Farm.

19.7.5 HELICOPTER APPROACH PROCEDURES TO HELIDECKS

87. Owing to the complexity of the aviation issues in the Beatrice field, and the requirement to propose a mitigation which considers the cumulative effects of the Beatrice Offshore Wind Farm and MORL, the mitigation measures are still under discussion with the relevant aviation stakeholders.

88. A number of mitigation options (as detailed in 19.7.5.2) will be presented to the platform operators for discussion and an acceptable mitigation solution will be agreed. Moray Firth helicopter operators have agreed these mitigation solutions are acceptable from an operational perspective. There is ongoing work to gather information to clarify the dimensions of OFZs associated with the platforms and the effect that they may have on acceptable wind turbine locations.

19.7.5.1 Airborne Weather Radar Onboard Offshore Helicopters

89. Consultation with the offshore helicopter operators is ongoing regarding the potential effect of wind turbine clutter on airborne weather radar. It is anticipated that through continued discussions it will be agreed that the effect will be manageable.

19.7.5.2 Airborne Radar Approach

90. A variety of mitigation solutions are detailed in Section 7 of Annex 19A, and these include:

- Undertaking the ARA with a Cross Wind Component;
- Shuttling;
- Circling Approaches; and
- Descent over wind turbines.

19.8 SUMMARY OF EFFECTS

91. Following agreement with the relevant stakeholders on mitigation requirements, there will be either no effect, or a negligible residual effect on aviation receptors and activities as a result of the Wind Farm.

19.9 ASSESSMENT OF CUMULATIVE EFFECTS

92. Given below is the assessment of cumulative effects upon aviation receptors and activities arising from the Wind Farm in conjunction with other existing or foreseeable planned project/development activities.

93. A CIADD (MFOWDG, 2011) was produced which set out the developments to be considered and the assessment method for each technical assessment and is the basis of this assessment. The CIADD is presented in Annex 5B.

19.9.1 SCOPE OF ASSESSMENT

94. The scope and method of this assessment was previously described in the CIADD (MFOWDG, 2011). This remains unchanged from the method presented in the CIADD (Annex 5B).

95. The assessment of cumulative effects has used the same assessment criteria as presented in Section 19.3.3.

96. The assessment of cumulative effects has been made against the existing baseline conditions as presented in Section 19.4 for the Wind Farm.

97. In consultation with HIAL Wick Airport, effects upon instrument approach procedures at HIAL Wick Airport have been scoped out of the cumulative assessment, as of the developments considered in the cumulative assessment, the airport only has the potential to be affected by the Wind Farm.

19.9.1.1 Geographical Scope

98. As presented in the CIADD the geographical extent of the study area for the cumulative assessment is a maximum of 150 km from the Wind Farm and Moray Firth Round 3 Zone. The other geographic ranges presented in this assessment are the same as those presented in Section 19.3.2 and are applied where Beatrice Offshore Wind Farm and at least one other development lie within the assessment range.

19.9.1.2 Developments Considered in Assessment

99. Section 4.9.8 of the CIADD (MFOWDG, 2011) (Annex 5B) presented the developments for which it was considered an assessment of cumulative effects with the BOWL project should be undertaken for Aviation and MOD. These were:

- Other Offshore Wind Farms and Infrastructure:
  - Individual sites within the Moray Firth Round 3 Zone Eastern Development area;
  - Moray Firth Round 3 Zone Western Development area; and
  - Other offshore wind farms.
- Oil and Gas Developments:
  - Beatrice and Jacky platforms and associated infrastructure; and
- Onshore Windfarms.

100. With the exception of Moray Firth Round 3 Zone all other developments were scoped out for further assessment due to the distance of any relevant sites from the Wind Farm. The Beatrice demonstrator turbines and Beatrice and Jacky oil platforms were considered in the Baseline Description (Section 19.4) for BOWL in isolation as they are integral to the procedures currently in place for helicopter approaches.

19.9.2 CONSULTATION

101. The CIADD (MFOWDG, 2011) was presented to MS and other consultees in April 2011 for comment (Annex 5A, Table A5).

102. A summary of consultation relating to cumulative effects is included in Table 19.4.

Table 19.4 Summary of Cumulative Consultation Responses

Consultee	Summary of Consultation Response	Project Response
Offshore Helicopter Operators and Platform Operators	Consultation and assessment must consider both the Beatrice Offshore Wind Farm and Moray Firth Round 3 zone sites.	It was agreed that the methodology would involve a cumulative approach incorporating assessment and mitigation options.
NERL	MORL and BOWL should work together to agree a plan to assess the effect of the developments on the Allanshill PSR.	Upon discussion with NERL, it was agreed that assessment and agreement of mitigation options should occur in 2012 when the suitability of emerging mitigation technologies would be better understood by both organisations.

19.9.3 PREDICTED EFFECTS

103. Potential cumulative effects which have been considered in this Section include the following:

- Effect on PSR Systems;
- Obstruction of Helicopter Main Routes; and
- Obstruction of Helicopter Approach Procedures to Helidecks.

19.9.3.1 RAF Lossiemouth and NERL Allanshill PSR

104. A large proportion of both Wind Farm Sites, at the full range of turbine tip heights defined within the Rochdale Envelopes, are theoretically visible to the RAF Lossiemouth and NERL Allanshill PSRs.

105. There is also potential for there to be significant shadowing of the radar signals 'behind' the two development areas owing to the potential high number of turbines within the two sites.

106. As a result, the effect of the Wind Farm and Moray Firth Round 3 Zone upon the RAF Lossiemouth and Allanshill PSRs is likely to be unacceptable to the MOD and NERL and mitigation for the cumulative effect upon these PSRs will be required.

19.9.3.2 Helicopter Main Routes

107. Discussions between BOWL, MORL and the offshore helicopter operators concluded that there will be no effect from the Wind Farms on helicopter operations on HMR X-RAY as the MSA would be raised to 1,700 ft (518 m) (below the lowest altitude at which the HMR is flown). It was established that not all of the helicopters operating to the Moray Firth platforms are equipped with anti-icing capability; however, those that lacked it would not fly along or below HMR X-RAY in forecast icing conditions as an overland option is available.

108. As a result there will be no effect on HMR X-RAY as a result of the Wind Farms.

19.9.3.3 Helicopter Approach Procedures to Helidecks

109. The full detailed assessment of the cumulative effect of the obstruction of Helicopter approaches to helidecks can be found in Section 6 of Annex 19A.

110. Initial cumulative assessment work suggests that the wind turbines at Beatrice Offshore Wind Farm and within the Moray Firth Round 3 Zone development areas will cumulatively prevent the following numbers of flights:

- Beatrice A 2.2% of helicopter flights (approximately 3 to 4 flights per year);
- Beatrice B 5.1% of flights (approximately 3 to 4 flights per year);
- Beatrice C 2.2% of flights (approximately 1 flight in 2 years); and
- Jacky 7.7% of flights (approximately 1 flight per year).

111. Through consultation, given the proximity of both Wind Farm Sites to the three Beatrice platforms and the Jacky platform, the cumulative effect of the Wind Farm and the Moray Firth Round 3 Zone on helicopter approach procedures in the region has been identified as being unlikely to be acceptable to the helicopter operators, and therefore mitigation is required.

19.9.3.4 Effect on Airborne Weather Radar Onboard Offshore Helicopters

112. The addition of the wind turbines of the Moray Firth Round 3 Zone development will have the potential to further clutter the radar screen making the position of the platforms more difficult to discern; however, with GPS assistance, it will still be possible to identify the platform locations. As per BOWL in isolation, it is

anticipated that through continued discussions it will be agreed that the effect will be manageable.

19.9.4 MITIGATION MEASURES AND RESIDUAL CUMULATIVE EFFECTS

113. The cumulative mitigation measures are the same as those proposed for the Wind Farm in isolation, as described in Section 19.7. All residual cumulative effects will be negligible following mitigation.

19.9.5 SUMMARY OF CUMULATIVE EFFECTS

114. Following agreement with the relevant stakeholders on mitigation requirements, there will be a negligible residual cumulative effect on aviation receptors and activities as a result of the Wind Farms.

19.10 SUMMARY

115. Following the application of appropriate mitigation, to be agreed through ongoing consultation, there will be either no effect, or a negligible residual effect on all aviation receptors and activities, both for the Wind Farm in isolation, and cumulatively with other existing, proposed and future developments.

19.11 REFERENCES

116. Civil Aviation Policy (CAP) 393 Air Navigation: The Order and the Regulations;

117. CAP 437 Offshore Helicopter Landing Areas – Guidance on Standards;

118. CAP 670 ATS Safety Requirements;

119. CAP 764 CAA Policy and Guidelines on Wind Turbines; and

120. UK Aeronautical Information Publications (Civil and Military).