



# Clashindarroch II Windfarm

## Proposal for a Variation from Obstruction Lighting Requirements of the Air Navigation Order

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## Executive Summary

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Vattenfall Wind Power Limited (Vattenfall) is proposing the development of the Clashindarroch II Windfarm in which Wind Turbine Generator (WTG) blade tip heights will be at 180 metres (m) above ground level (agl). The statutory requirement, dictates that structures at or above 150 m agl must be lit in accordance with the regulatory guidance contained in the following documents:

- International Civil Aviation Organisation (ICAO) Annex 14: Aerodrome Design and Operations – Chapter 6 [Reference 1].
- Civil Aviation Authority (CAA) Civil Aviation Publication (CAP) 393: The Air Navigation Order (ANO) 2016 and Regulations [Reference 2].
- CAA Statement for the Lighting of Onshore Wind Turbine Generators in the United Kingdom with a maximum blade tip height at or in excess of 150 m agl [Reference 3].

The regulatory requirement to light all WTGs at or above 150 m presents a conflict with the requirements to minimise environmental impact, specifically landscape and visual impacts. The reason for exploring the option for fewer lights or lighting of a lower intensity is to protect the visual amenity of the local environment and to minimise any impact on nocturnal wildlife in rural areas. The Clashindarroch II Windfarm has been submitted for a planning decision, the development has received consultation response which raises aviation lighting as a concern for landscaping and visual impact.

The Landscape and Visual Impact Assessment (LVIA) completed as part of the Environmental Impact Assessment Report (EIAR) [Reference 4] has explored a study area of 40 kilometres (km) distance from the outermost WTGs of the proposed development. The purpose of the LVIA was to identify, predict and evaluate potential impacts associated with the proposed development and considered all landscape receptors of which the addition of aviation lighting to the WTGs (as required by the ANO and the Policy set out by the CAA) was assessed. The results of the assessment of the fitment of aviation lighting to the proposed development are as follows:

- Aviation lighting as required by the ANO, would contrast with the generally dark rural context of the site.
- Several existing sources of artificial light exist in the study area (settlements, dispersed properties, WTGs and industrial premises) however the fitment of aviation lighting as required by the ANO, would introduce a new baseline source of lighting which would be seen typically above or towards the horizon which would increase their relative prominence.
- Significant adverse effects in relation to lighting on landscape character and visual amenity for the limited parts of the LVIA study area.

The regulations contained in the ANO for the lighting of en-route obstacles (i.e. those away from the vicinity of an aerodrome) provide the following statement:

*“A permission may be granted for the purposes of this article for a particular case or class of cases or generally”.*

The Clashindarroch II Windfarm would be located adjacent to the operational Clashindarroch Windfarm which consists of 18 WTGs at a WTG blade tip height of 100 m agl. No visible lighting is fitted to the operational Clashindarroch Windfarm however on a request from the Ministry of Defence (MOD), Clashindarroch is fitted with Infra-Red (IR) lighting (not visible to the naked eye) to the perimeter WTGs (eight in total) however, the IR lighting does not identify the highest WTG above mean sea level (amsl) in the group. Due to the local topographical environment, a number of the proposed Clashindarroch II WTGs will be lower in height (amsl) than the existing WTGs of the operational Clashindarroch Windfarm; therefore, by fitting 2000 candela (cd) aviation lighting to every WTG in the proposed development has the potential to confuse aircrews to which is the tallest obstacle in the region.

Two lighting schemes were developed for the proposed development and were provided to consultees with aviation stakeholders who are likely to operate in the vicinity of the proposed development as follows:

1. Option 1 marks the four corners of the proposed development with 25 cd/combi lighting.
2. Option 2 marks the four corners of the proposed development with 25 cd/combi lighting with the addition of IR lighting to selected WTGs to mark the perimeter of the site layout of WTGs.

## Conclusions

Twelve aviation stakeholders were consulted; 5 responses were received. Two stated that they had no preference, one (a civilian General Aviation (GA) flying training establishment) was content with Option 1, whilst 2 (which are/or will shortly become Night Vision Device (NVD) equipped organisations) requested that Option 2 be implemented. Taking into consideration of aviation stakeholder response Vattenfall requests that the CAA grants permission to fit aviation lighting to the proposed development as follows:

- 25 cd/combi lighting marking the four corners of the proposed development WTGs (T1, T5, T6 and T12); and
- IR lighting (to MOD specification) to mark the perimeter of the proposed development (T8, T9, T11 and T14).

It is further requested that no intermediate lights be fitted to the WTG towers for the reason stated at Section 5.3 in the report.

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# 1 Introduction

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## 1.1 Background

Tall en-route obstacles, such as Wind Turbine Generators (WTGs), can present a significant navigational hazard to aircraft and therefore necessitate aviation warning lighting. Vattenfall Wind Power Ltd (Vattenfall) understand the current lighting requirements for tall (at or above 150 metres above ground level (agl)) onshore WTGs and how these requirements can practicably be met. Any potential adjustment to aviation warning lighting to accommodate tall WTGs would need to reflect the WTGs unique, semi-permanent nature in the topographical environment. As a result, Vattenfall are keen to understand potential scope for adjustment of the requirements of regulatory documents for the fitment of aviation lighting and how and a reduced lighting scheme may interact with aviation operations conducted in the vicinity of proposed Clashindarroch II Windfarm (the proposed development).

## 1.2 Civil Aviation Authority (CAA) Policy on WTG Developments

The CAA policy on WTG developments is provided online<sup>1</sup> and is summarised below:

- *Wind turbine developments and aviation need to co-exist in order for the UK to achieve its binding European targets and enhance energy security, whilst meeting national and international transport policies. However, safety of the air is paramount and will not be compromised. As the independent aviation regulator, the CAA is well placed to provide support to both the aviation industry and the wind energy industry.*
- *Due to the complex nature of aviation operations, and the impact of local environmental constraints, all instances of potential negative impact of proposed wind turbine developments on aviation operations must be considered on a case-by-case basis.*
- *To provide the best and most timely advice to aviation and wider wind development stakeholders through consultation, the publication of Civil Aviation Publication (CAP) 764 (CAA Policy and Guidelines on Wind Turbines) and its associated web pages is provided on the CAA web site.*

Further information and guidance is provided in the following documents:

- International Civil Aviation Organisation (ICAO) Annex 14: Aerodrome Design and Operations – Chapter 6 [Reference 1].
- CAA CAP 393: The Air Navigation Order (ANO) 2016 and Regulations [Reference 2]
- CAA Statement for the Lighting of Onshore WTG in the United Kingdom with a maximum blade tip height at or in excess of 150 m agl [Reference 3].
- CAA CAP 764 Policy and Guidance on Wind Turbines [Reference 5].

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<sup>1</sup> <https://www.caa.co.uk/Safety-initiatives-and-resources/Safety-projects/Windfarms/Windfarms/>

### 1.2.1 ICAO Annex 14: Aerodrome Design and Operations - Chapter 6

ICAO is a specialist agency of the United Nations, which is responsible for the safe, efficient and orderly operation and future progression of international civil aviation. ICAO Document Annex 14 Volume 1 (Aerodrome Design and Operations) deals specifically with obstacle restriction and removal within the airspace surrounding aerodromes. The UK civil en-route lighting requirements for tall structures reaching to or greater than 150 m agl, including WTGs, are predicated on the ICAO Volume 1 stipulations. Paragraph 4.3.1 states that:

*‘Arrangements should be made to enable the appropriate authority to be consulted concerning proposed construction beyond the limits of the obstacle limitation surfaces that extend above a height established by that authority, in order to permit an aeronautical study of the effect of such construction on the operation of aeroplanes’.*

The appropriate authority in this case is the UK CAA.

The ICAO document Paragraph 4.3.2 Objects Outside the Obstacle Limitation Surfaces stipulates that although structures of 150 m or greater are routinely considered an obstacle, a procedure can be put in place to allow the assessment of individual structures or developments, to determine if they are in fact located so to pose a potential hazard to airspace navigability. It suggests that if an aeronautical study indicates that the proposed structures would not pose an obstacle to aviation operations, less stringent lighting requirements may be more applicable. The ANO (Article 222 (6)) and Annex 14 (Paragraphs 4.3.1 and 4.3.2) allow a variation to be considered and provision of an exemption from obstacle lighting requirements based on an aeronautical study.

This document will provide a such an aeronautical study to provide a basis for consideration and approval for lighting the proposed development other than in accordance with the ANO.

### 1.2.2 CAA Policy Statement for the Lighting of Onshore WTGs in the United Kingdom with a maximum blade tip height at or in excess of 150 m Above Ground Level

The CAA states the following requirements for the lighting of WTGs at or above 150 m agl within their Policy Statement:

- *‘The need for aviation warning lights depends in the first instance upon any particular structure’s location in relationship to an aerodrome. If a structure penetrates the obstacle limitation surfaces of an aerodrome, it is for the aerodrome operator to assess the need for warning lights’.*

The Clashindarroch II Windfarm is outside of any aerodrome obstacle limitation surfaces.

### 1.2.3 Town and Country Planning Direction

The Town and Country Planning (safeguarded aerodromes, technical sites and military explosives storage areas) Direction 2002, stipulates that the CAA is responsible for recording all air navigation obstacles within the UK for the maintenance of air safety. Full details of any obstacle extending to 300 feet (approximately 91.4 m) agl or greater, are published to enable pilot notification and are identified on aeronautical maps and charts. In terms of tall en-route structures,



such as WTGs, the Direction refers to the CAA requirements stipulated in the ANO [Reference 2] which states for the lighting of en-route obstacles that:

222.—(1) The person in charge of an en-route obstacle must ensure that it is fitted with medium intensity steady red lights positioned as close as possible to the top of the obstacle and at intermediate levels spaced so far as practicable equally between the top lights and ground level with an interval of not more than 52 metres.

(2) The person in charge of an en-route obstacle must, subject to paragraph (3), ensure that by night the lights required to be fitted by this article are displayed.

(3) In the event of the failure of any light which is required by this article to be displayed by night the person in charge must repair or replace the light as soon as reasonably practicable.

(4) At each level on the obstacle where lights are required to be fitted, sufficient lights must be fitted and arranged so as to show when displayed in all directions.

(5) In any particular case the CAA may direct that an en-route obstacle must be fitted with and must display such additional lights in such positions and at such times as it may specify.

(6) A permission may be granted for the purposes of this article for a particular case or class of cases or generally.

(7) This article does not apply to any en-route obstacle for which the CAA has granted a permission to the person in charge permitting that person not to fit and display lights in accordance with this article.

(8) In this article, an “en-route obstacle” means any building, structure or erection, the height of which is 150 metres or more above ground level, but it does not include a building, structure or erection—

(a) which is in the vicinity of a national licensed aerodrome or an EASA certificated aerodrome; and

(b) to which section 47 of the Civil Aviation Act 1982 (warning of presence of obstructions near licensed aerodromes) applies.

This document forms a proposal for a variation under terms of Article 222 (6) and 222 (7) of the CAA CAP 393 The Air Navigation Order (ANO) 2016 and Regulations [Reference 2].

### 1.3 Purpose and Scope

During 2018, Osprey met with the CAA to facilitate dialogue on the possibility of variation or exemption from the statutory instruction for the lighting of onshore WTGs at or above 150 m agl. The conclusions of the meeting were that the CAA are willing to accept an aeronautical study on a case by case basis for a request for a variation/exemption in lighting requirements for onshore WTG developments at or above 150 m agl. The CAA would then assess the study and provide a decision on a case by case basis if a variation to statutory lighting can be provided. This report provides an aeronautical study which provides a balanced opinion assessing the Clashindarroch II Windfarm proposal. The study has considered location, windfarm parameters and the use of airspace in which the windfarm is located and has

provided an opinion based on aviation stakeholder response on the possibility/ability/applicability of individual windfarm lighting solutions.

Onshore wind energy development required to be lit in line with current regulations has the potential to cause a significant environmental, landscape and visual impact, raising objection that could potentially lead to individual sites not being able to progress satisfactorily toward the gaining of planning consent. Following the Section 36 Electricity Act application for the proposed development in December 2019, Vattenfall (the applicant) has received consultation response which raises aviation lighting as a concern for landscaping and visual impact.

In order to minimise landscape and visual amenity effects, Vattenfall are seeking permission to a variation that does not necessitate the full lighting requirements contained in the guidance and regulatory documents listed above, Osprey Consulting Services Limited (Osprey) are assisting Vattenfall in seeking the variation from the CAA. Osprey has conducted an Aviation Study of the onshore aviation lighting requirements applicable to the proposed development as a basis for the CAA to consider granting permission to fit aviation lighting to the proposed Development outside of the requirements of the ANO.

The current baseline aviation environment has been considered and hazards to aviation activity have been identified with the aim being to demonstrate to the CAA that all scenarios have been considered and acceptably mitigated to support the proposal of a modified lighting requirement.

The scope of this document, and the activities described within, is limited to the safeguarding of air operations in the vicinity of the proposed wind energy development known as the Clashindarroch II Windfarm.

## 1.4 Structure of this Document

This document is structured into six sections, and one annex, as outlined below:

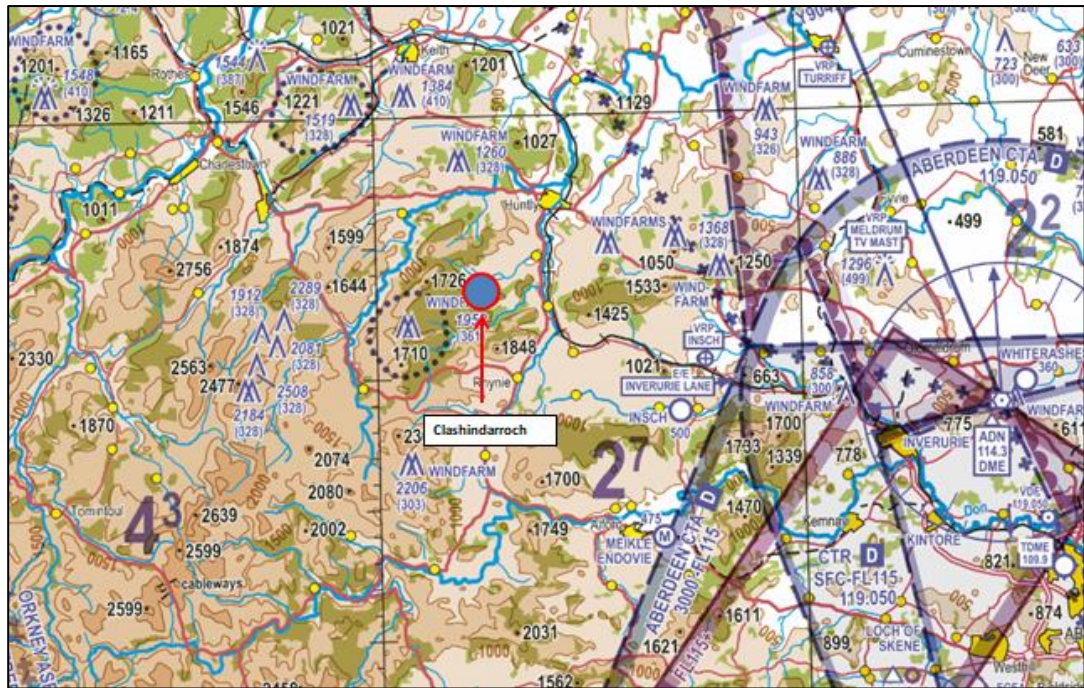
- Section 1 – Introduction.
- Section 2 – The Proposed Development Parameters and Location.
- Section 3 – Operational Aviation Environment and Interactions.
- Section 4 – The Obstacle Environment – Adjacent Windfarms.
- Section 5 – Consultation.
- Section 6 – Provides the Lighting Variation Conclusions.
- Section 7 – Lists the References.

There is one Annex which provides a copy of the consultation letter provided to aviation stakeholders.

## 2 Clashindarroch II Windfarm

### 2.1 Overview

The Clashindarroch II Windfarm will be adjacent to the operational (2015) Clashindarroch Windfarm which consists of 18 WTGs at a blade tip height of 110 m agl. The proposed development will be located approximately 5 nautical miles (NM) south west of Huntly, Aberdeenshire and northeast of the operational Clashindarroch Windfarm. The development area of Clashindarroch II extends to 1560ha, with the proposed WTGs located in the southern part of the site, the site is predominately covered by commercial forestry but has some areas of open moorland and ancient woodland. Immediately surrounding the WTG layout, the terrain is undulating and sparsely populated. **Error! Reference source not found.** provides the approximate location of the Clashindarroch II Windfarm which is situated 30 nautical miles (NM) due west of the Aberdeen Airport Airfield Reference Point (ARP).



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Figure 1 Location of Clashindarroch II (not to scale)

The proposed development is in a predominantly rural area; the Cairngorms National Park is located approximately 20 NM to the southwest of the site. The nearest town Huntly has a population of 4,810 (2016, the latest details available) an increase of 0.16% since 2011. Nearby settlements include Rhynie, Haugh of Glass and Cabrach. The entire site is located within the Aberdeenshire Council (AC) administrative boundary and is managed by Forestry and Land Scotland (FLS) on behalf of the Scottish Government.

The proposed development has seen several iterations of layout and a previous planned blade tip height of 149.5 m agl; throughout iteration of the WTG layout, the site development boundary has not changed. Due to developments in WTG technology an increase in WTG blade tip height will provide the best wind yield from the site and Clashindarroch II will therefore consist of 14 WTGs, with a tip height of 180 m agl. The layout presented in Figure 2 (LCLON 046) below is considered within this Report and is being proposed through planning application.

## 2.2 Proposed Wind Turbine Generators

The proposed development will consist of 14 WTGs adjacent to a wind energy development that has been operational with 18 WTGs since 2015 (Clashindarroch Windfarm). Coordinates of the proposed development WTGs provided in the layout LCLON046 as illustrated in Figure 2 are listed in Table 1 below.

WTG No.	Easting	Northing	Elevation of land (m)(amsl)
1	344086	833617	390
2	343640	831705	358
3	343415	832583	393
4	344357	832735	375
5	344076	831659	381
6	344821	833268	342
7	344002	832977	344
8	343603	833107	396
9	344460	833440	359
10	344118	832206	417
11	343713	832298	429
12	342964	832151	388
13	343286	831912	384
14	344533	832177	393

Table 1 Proposed WTG Positions Clashindarroch II

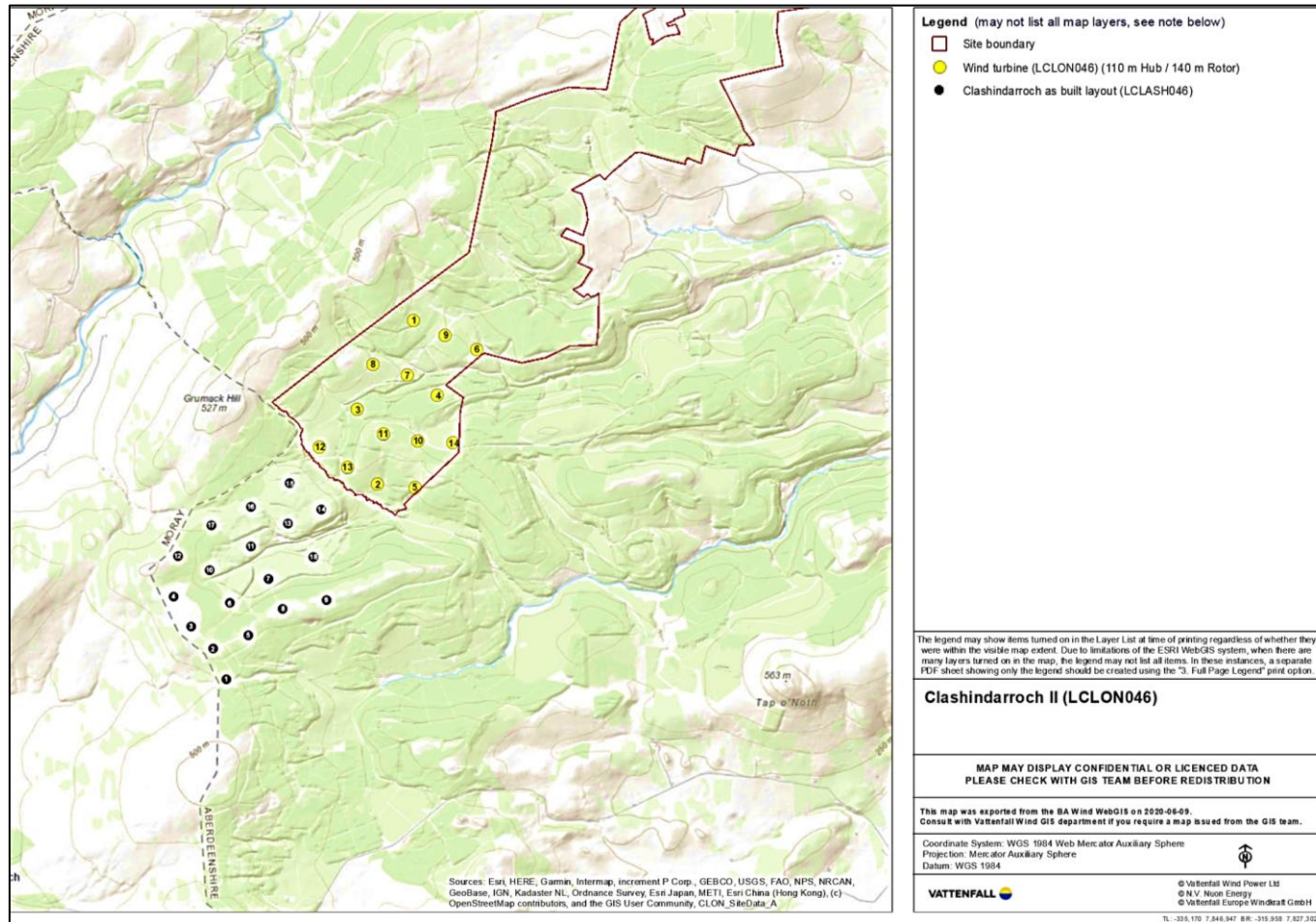


Figure 2 Clashindarroch II WTG Layout (yellow markers), Operational Clashindarroch WTG (black markers)

## 2.3 Scoping

On 5 April 2017 SLR Consulting Limited on behalf of Vattenfall requested a Scoping Opinion of the proposed development. This request was accompanied by a Scoping Report. At that time the proposal was for up to 16 WTGs each having a maximum blade tip height of up to 149.9 m agl, with the total generating capacity proposed to be in excess of 50MW when considered with the existing Clashindarroch Wind Farm. A consultation was carried out by the Energy Consents Unit of the Scottish Government and a Scoping Opinion was sent to SLR Limited on 3 July 2017. On 22 June 2018 SLR Limited contacted the Energy Consents Unit and informed them there had been a reconsideration on the final design. The proposal would be for 14 WTG with tip height of 180 m agl. It was agreed that a further consultation would be carried out and that this would address the revisions to the project only. The following paragraphs provide the response received for the proposed development relevant to the proposal for a variation to the fitment of aviation lighting required by the ANO. The results of consultation on other aviation impacts (communication, navigation and surveillance) beyond the requirement to fit aviation lighting to the WTGs will be subject to the normal regulatory processes and are therefore outside the scope of this report.

### 2.3.1 Ministry of Defence

The MOD responded to this Scoping exercise at 149.5 m agl with a request that the perimeter WTGs be fitted with MOD accredited 25 candela (cd) omni-directional red lighting **or** Infrared (IR) lighting with an optimised flash pattern of 60 flashes per minute of 200 microsecond (ms) to 500 ms duration at the highest practicable point. This 'standard' request is in line with the MOD Lighting Guidance published during November 2014 [Reference 6].

With regard to the aviation lighting of Clashindarroch II at the increased blade tip height of 180 m agl, the MOD provided a revised Scoping Opinion<sup>2</sup> [Reference 6] stating that they will request that all WTGs are fitted with aviation safety lighting in accordance with the CAA requirements.

### 2.3.2 Aberdeen Airport

Aberdeen Airport responded to the revised development Scoping Report [Reference 7] during November 2018 stating that the revisions contained in the Scoping Report have been examined from an aerodrome safeguarding perspective and their (Aberdeen) position remains as detailed previously to the Scottish Energy Consents Unit (ECU) during May 2017. The airport's position will only be confirmed once WTG details are finalised and when they have been consulted on a full planning application. At that time, they will carry out a full radar impact assessment and will consider their position in light of, inter alia, operation impact and cumulative effects. At 30 NM from the Aberdeen Airport ARP no impact is expected to Aberdeen Airport

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<sup>2</sup> Available at:

<https://group.vattenfall.com/uk/contentassets/d15ecaca6f5d424b8bf5c8bc4f62c61d/volume-2---chapter-6---scoping-and-consultation.pdf>

operations if a variation to extant lighting requirements is provided for the Clashindarroch II Windfarm.

### **2.3.3 CAA**

No record of response from the CAA is provided within the revised Scoping Opinion (which is provided online<sup>3</sup>) for the revised development of 180 m WTGs. However, the CAA has published its position within CAP 393 [Reference 2] and Policy Statement [Reference 3].

## **2.4 Project Timelines**

Vattenfall submitted a Section 36 Electricity Act application to the Scottish Government in December 2019<sup>4</sup> and if the project was consented, would start construction in 2022 with the project becoming operational in April 2024. Full operation of the development will commence when all WTGs are commissioned.

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<sup>3</sup> Available at:

<https://group.vattenfall.com/uk/contentassets/d15ecaca6f5d424b8bf5c8bc4f62c61d/volume-2---chapter-6---scoping-and-consultation.pdf>

<sup>4</sup> <https://group.vattenfall.com/uk/what-we-do/our-projects/clashindarrochII/planning-application-documents>

## 3 Operational Environment

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### 3.1 Aviation Baseline Environment Applicable to the Request

The airspace around the proposed development is Class G, Uncontrolled Airspace up to Flight Level (FL) 195 (approximately 19,500 feet (ft) above mean sea level (amsl)). Any aircraft can operate in this area without any requirement to be in communication with an Air Traffic Service (ATS) Unit. At the location and operating at an altitude which might bring aircraft into conflict with the WTGs, pilots would be flying under VFR<sup>5</sup>. Under these rules, pilots are ultimately responsible for their own separation from other aircraft, obstacles and terrain. Aircraft operating under VFR do so within Visual Meteorological Conditions (VMC); CAP 493 Manual of Air Traffic Services – Section 1 (Reference 8) stipulates the VMC requirement for aircraft to operate under VFR. For VFR flight within Class G uncontrolled airspace at or below 3,000 ft amsl, aircraft are required to remain clear of cloud and in sight of the surface at all times and have an inflight visibility of 5 km. Controlled airspace is established above FL 195 above the development, this airspace has no significance to the consideration of the conclusions of this Report.

#### 3.1.1 Royal Air Force Lossiemouth

In the Class G airspace above the proposed development, Royal Air Force (RAF) Lossiemouth provides a Lower Airspace Radar Service (LARS) up to FL 100 to pilots on request. Military and civilian controllers at NATS Area Control Centres and Air Defence Controllers operate above that level. LARS (which is available to aircraft within radar and radio coverage) is provided from RAF Lossiemouth between 0900 and 1700 hours. LARS provides participating pilots with a radar element of the UK Flight Information Services (UK FIS) and allows air traffic controllers to utilise radar data to assist in the provision of advice and useful information for the safe and efficient conduct of flight. Based aircraft at Lossiemouth are involved in the air defence role at high to medium levels however, if they were to be low flying in the area of the proposed development aircraft would enter the UK military low flying system.

#### 3.1.2 UK Military Low Flying System

In addition to the airspace detailed in Section 3.1 above, the proposed development will be situated within the UK low flying system which is sub-divided in to 20 Low Flying Areas (LFA). The proposed development will lie within the lateral boundary of LFA 14 which covers a large area of mainland Scotland north of the central region, the Western Isles, Orkney and Shetland.

For safety and administrative purposes, the low flying system is managed differently at night; the UK night low flying system is divided into Allocated Region (AR) and Rotary Wing Regions (RWR). ARs are sub-divided into 20 Night Sectors,

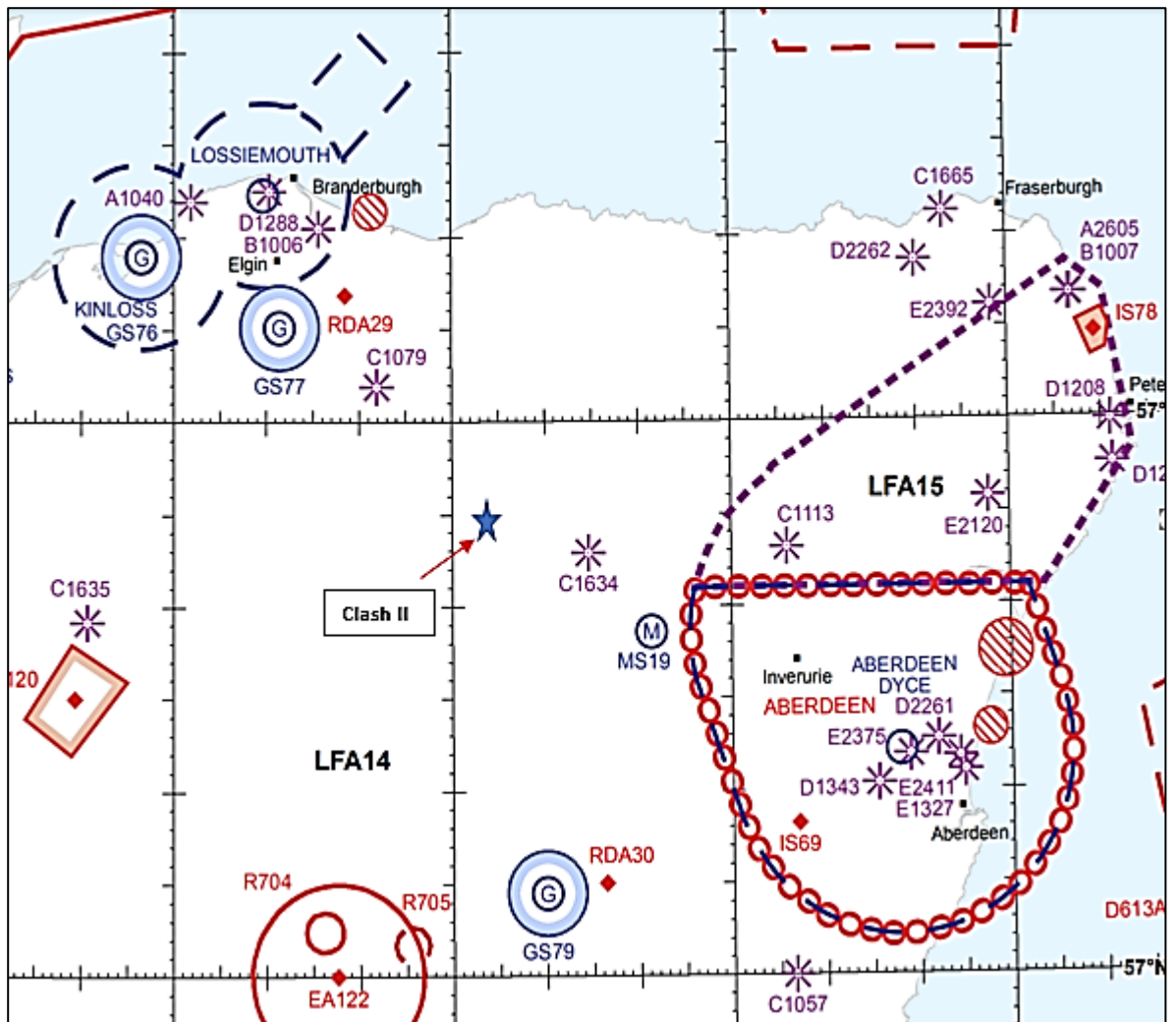
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<sup>5</sup> A set of regulations under which a pilot operates an aircraft in weather conditions clear enough to allow the pilot to see where the aircraft is going; the pilot must be able to operate the aircraft with visual reference to the ground, and by visually avoiding obstructions and other flying machines.



deconfliction in these night sectors is managed procedurally in time and space through the allocation of discrete sectors to flying units or squadrons for sole use.

Activity in the low flying areas is regulated by the Military Aviation Authority (MAA) with booking into areas managed by the Low Flying Booking Cell at RAF Wittering, Cambs. Safeguarding of low flying areas is achieved by the Defence Infrastructure Organisation (DIO) in conjunction with the Low Flying Subject Matter Expert (SME) at RAF Wittering. Figure 3 provides an illustration of the approximate location of the windfarm site within the day region LFA 14 (not to scale).



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Figure 3 LFA 14 (day)

The proposed development is located in a unrestricted area of the LFA for day and night use, no flow arrows restrict direction of flow of aircraft furthermore, there are no areas to be avoided (industrial sites, congested areas, glider sites or other establishments) in the vicinity of the proposed development.

The UK Low Flying System (UKLFS) are areas enabling military pilots to practice low-level flying tactics. Low flying is permitted across the majority of the UK except for major conurbations, civil airports and around certain key industrial and medical sites. Except when authorised, military aircraft will not enter the UKLFS without a serviceable transponder (which assist in aircraft identification); aircraft monitor a specific designated radio frequency whilst operating within the system at low level (fixed wing - below 2,000 feet agl). Military aircraft will not operate at low level in the region of the development unless they are part of this managed environment with the necessary safeguards in place. All obstructions are catalogued within the Digital Version Obstruction Database (DVOF) which is maintained by the Defence Geographic Centre (DGC) and is used as a source data for digital Mission Planning Systems (MPS), aeronautical charts and documents and is the source data for the UKLFS within the UK Low Flying Hand Book [Reference 9].

### **3.1.3 Minor Aerodromes**

There are a limited number of General Aviation<sup>6</sup> (GA) aerodromes in the locality of the proposed development. Figure 4 provides an illustration of the location of the minor aerodromes located to the south and southeast of the Clashindarroch II Windfarm together with the Aberdeen Airport Inverurie Entry/Exit Lane.

### **3.1.4 Civilian Low-Level Operations**

The Police Scotland Air Support Unit is based at Glasgow City Airport and operates a single helicopter from its base. The Scottish Charity Air Ambulance service operates two helicopters from its Glasgow base, furthermore Gama Aviation operates the Scottish Air Ambulance service on behalf of the National Health Service. Responsibility for airborne helicopter Search and Rescue (SAR) rests with Bristow Group who were awarded the contract in 2013. They operate a number of helicopters from ten strategically located bases across the UK, the closest to the proposed development is located at Inverness Airport.

HJS Helicopters are based at Culter Helipad, five miles from Aberdeen. The company complete pilot training courses and type ratings.

Alexander Air Flight Training are a fixed wing flying school based at Aberdeen Airport. A CAA approved Aviation Training Organisation (ATO), they specialise in providing flying lessons for the Private Pilot's Licence (PPL), Night Rating, and Competency Based Instrument Rating (CBIR training).

A number of helicopter operators are based at Aberdeen Airport which in the main service the offshore Oil and Gas industries.

PDG Helicopters based throughout Scotland provide a diverse range of aviation services including aerial survey, hoisting and aerial film services and have a Head office at Inverness Airport.

An increasing majority of the helicopter operations and military low flying activities conducted in the area at night exclusively use Night Vision Devices (NVD).

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<sup>6</sup> General Aviation is defined by ICAO as 'all civil aviation aircraft operations with the exception of Commercial Air Traffic (CAT) or Aerial Work'.



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Figure 4 Minor Aerodromes and Inverurie Lane (not to scale)

- Microlight Flying takes place at Meikle Endovie, a small strip located on a bearing of 135°/12 NM from Clashindarroch II.
- The Grampian Microlight and General Aviation Flying Club is located at Insch Aerodrome which is on a bearing of 112°/9 NM from the eastern edge of the Clashindarroch II development area.
- The Deeside Gliding Club operates from Aboyne Airfield which is located over 18 NM south of the site.

There is no published lighting at any of the three unlicensed aerodromes listed above and therefore it is assumed that the aerodromes are not open at night. All minor aerodromes are out-with the consultation distances recommended in CAP 764 for an

aerodrome of the type and operations conducted, and will not be routinely effected by a variation to the lighting requirements stipulated within the ANO as the development area is sufficiently far enough away to be classified as an en-route obstruction.

The Inverurie Lane is a visual reference route used for the operation of aircraft to and from Aberdeen Airport. The lane is 3 NM wide with the centreline the Aberdeen/Inverness railway line extending from 571931N 0023510W (a point on the western boundary of the Aberdeen Control Zone (CTR)), this point is over 10 NM from the location of Clashindarroch II. Pilots using the lane are to 'keep clear from cloud and in sight of the ground' and are responsible for maintaining clearance from terrain and obstacles.

## 4 Obstacle Environment – Adjacent Windfarms

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### 4.1 Overview

There are a number of operational windfarms located close to and surrounding the proposed development. For the purpose of this assessment a 12 km radius<sup>7</sup> around the windfarm site was selected in order to establish which windfarms adjacent to the site may provide a cumulative effect to aircraft operations conducted at low level in the vicinity of the proposed development. Figure 5 below provides those windfarms overlaid onto an aviation chart which are considered in the establishment of the adjacent obstacle environment.

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<sup>7</sup> 12 km was selected based on professional judgement by the author and a military fast jet pilot with over 5,000 hours flying experience.

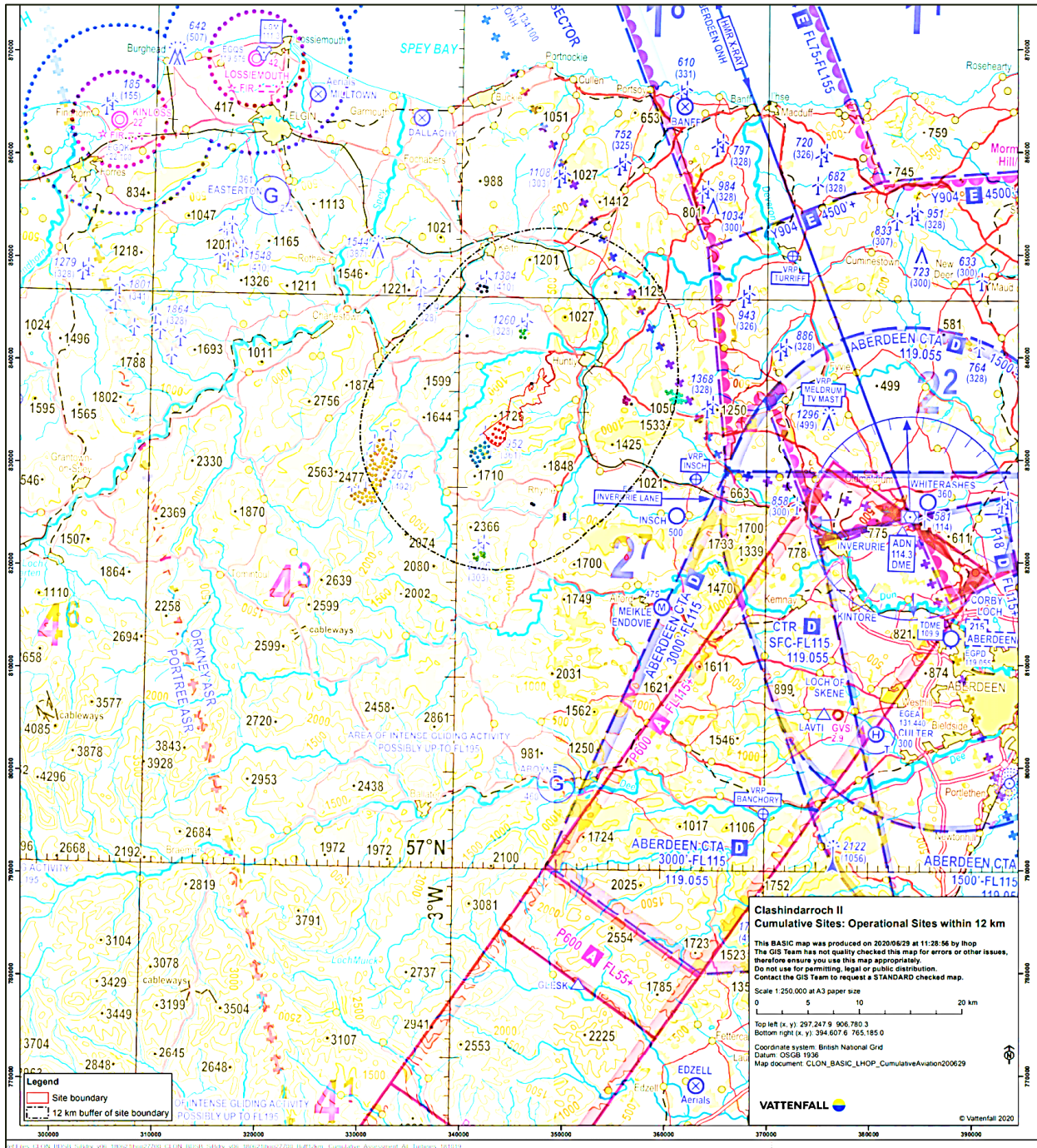


Figure 5 Operational Windfarms within a 12 km radius of Clashindarroch II

Details of the windfarms contained within the 12 km radius is provided in Figure 6 below.

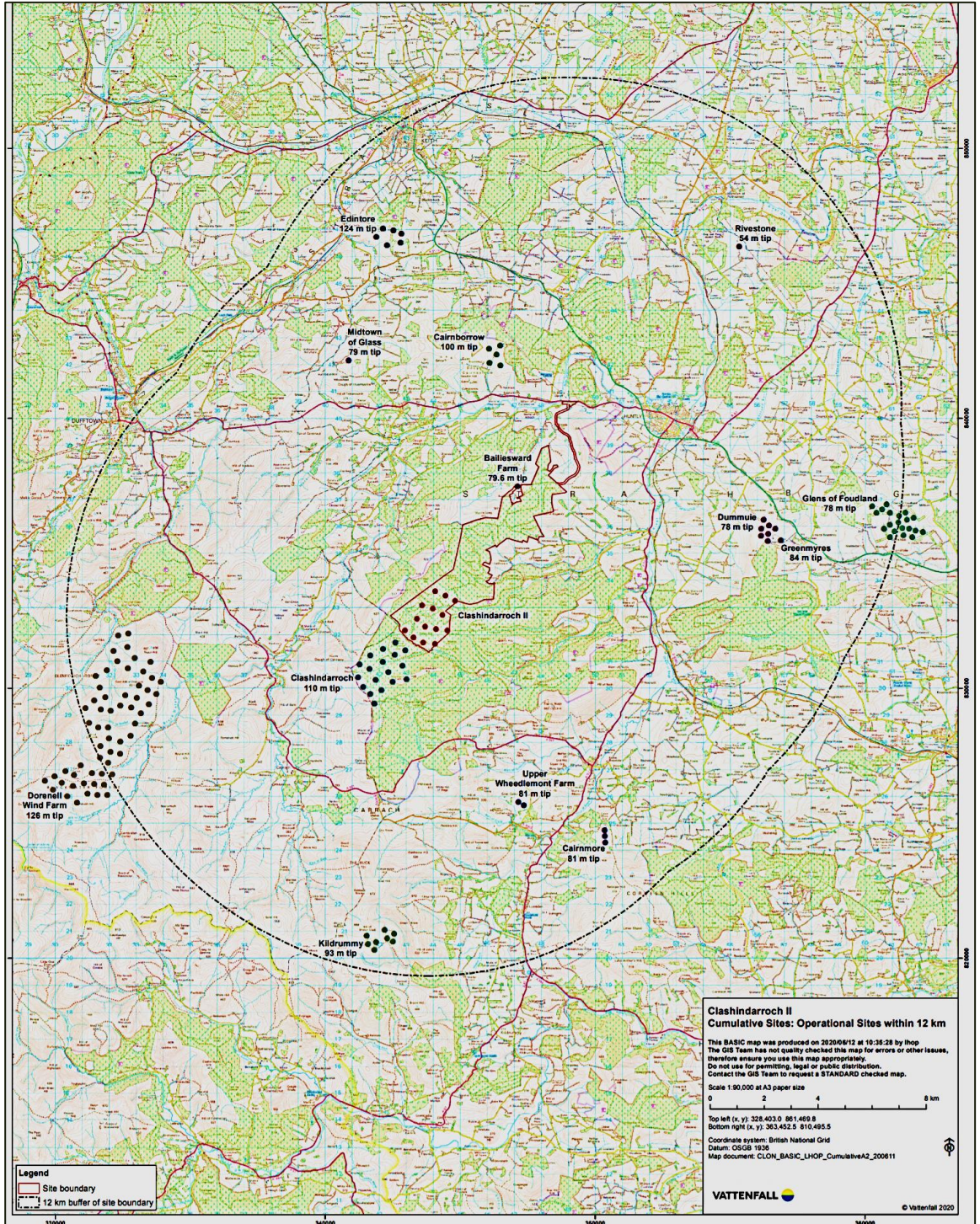


Figure 6 Operational Windfarms within 12 km radius of Clashindarroch II

Osprey has completed a search of planning applications and planning decision notices on adjacent operational windfarms in order to establish what aviation lighting was requested or subject to a planning condition for the operational windfarm sites surrounding the Clashindarroch II Windfarm. Table 2 below provides individual windfarm parameters and known aviation lighting requirements relevant to this study for the windfarms illustrated in Figure 6 above.



Scheme	Status	Number of WTGs	Blade Tip Height (m, agl)	Aviation Lighting Information
Midtown of Glass	Operational	1	79	No lighting requirement found on planning decision notice.
Glens of Foudland	Operational	19	78	No lighting requirement found on planning decision notice.
Upper Wheedlemont	Operational	2	81	25 cd on each WTG
Edintore	Operational	6	124	25 cd on each WTG
Dummuies	Operational	7	78	No planning information found
Greenmyres	Operational	1	84	No lighting requirement found on planning decision notice
Cairnbarrow	Operational	5	100	IR Only
Cairnmore	Operational	3	81	None
Dorenell	Operational	57	126	25 cd/IR combi on cardinal WTGs and 25 cd OR IR on the remainder of the perimeter WTGs
Balliesward Farm	Operational	1	79.6	None
Rivestone	Operational	1	54	25 cd or IR
Kildrummy	Operational	8	93	None

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Scheme	Status	Number of WTGs	Blade Tip Height (m, agl)	Aviation Lighting Information
Clashindarroch	Operational	18	110	IR on perimeter WTG

Table 2 Adjacent Windfarm Developments

The immediately adjacent and operational Clashindarroch Wind Farm consists of 18 WTG at a blade tip height of 110 m agl and which is fitted with Infra-Red (IR) lighting (invisible to the naked eye) only on specific WTGs as agreed with the MOD. A review of operational wind farms within 12 km indicates that all WTGs are below the height (agl) at which statutory lighting of WTGs would be mandatory however due to local topographical features, some of the WTGs in the adjacent developments are above the elevation of the proposed development. Adjacent wind farm developments are not lit or are fitted with a maximum of 25 cd/combi lighting and or IR lighting as required by the MOD. It is assumed that for those sites not subject to a planning condition then those sites will not be lit unless specifically requested by the MOD.

Table 3 provides a comparison of elevations of the Clashindarroch Windfarm and the proposed development.

Clashindarroch Windfarm				Clashindarroch II Windfarm			
WTG No.	Land Elevation (m) (amsl)	Blade Tip Height (agl)	Elevation (land +Blade tip) (m)(amsl)	WTG No.	Land Elevation (m) (amsl)	Blade Tip Height (agl)	Elevation (land +Blade tip) (m)(amsl)
1	450	110	560	1	390	180	570
2	476	110	586	2	358	180	538
3	488	110	598	3	393	180	573
4	482	110	592	4	375	180	555
5	460	110	570	5	381	180	561
6	447	110	557	6	342	180	522
7	423	110	533	7	344	180	524
8	477	110	587	8	396	180	576
9	478	110	588	9	359	180	539
10	440	110	550	10	417	180	597
11	418	110	528	11	429	180	609
12	480	110	590	12	388	180	568
13	414	110	524	13	384	180	564

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Clashindarroch Windfarm				Clashindarroch II Windfarm			
WTG No.	Land Elevation (m) (amsl)	Blade Tip Height (agl)	Elevation (land +Blade tip) (m)(amsl)	WTG No.	Land Elevation (m) (amsl)	Blade Tip Height (agl)	Elevation (land +Blade tip) (m)(amsl)
14	425	110	535	14	393	180	573
15	429	110	539				
16	419	110	529				
17	441	110	551				
18	397	110	507				

Table 3 Comparison of WTG elevation between the Clashindarroch Windfarm and the Proposed Development (tallest elevation in red text)

The WTG with the highest tip elevation in the operational Clashindarroch Windfarm is WTG 3 standing at an elevation<sup>8</sup> of 598 metres amsl; 13 of the proposed development WTG have a tip elevation of that below the highest WTG in the operational Clashindarroch Windfarm. The operational windfarm does not have visible aviation lighting.

The WTG with the highest tip elevation in the proposed development is WTG 11 which stands at an elevation of 609 m amsl (429 m + 180 m) (1998.03 ft), an increase of 11 m above the highest elevation of the tallest WTG in the operational Clashindarroch Windfarm thus necessitating a slight increase in the altitude for aircraft flying VFR over the area of the two windfarms.

The WTG with the lowest tip elevation in the proposed development is WTG 6, which is placed on land with an elevation of 342 m amsl resulting in an elevation for WTG 6 of 522 m amsl; the adjacent and operational Clashindarroch Wind Farm has 17 WTG that have tip elevations above the elevation of WTG 6 - none of these 17 WTG are fitted with visible (to the naked eye) aviation obstruction lighting.

To the southwest of the proposed development the land elevation raises steadily, the Dorenell Windfarm which is located within 12 km of the proposed development, has blade tips up to an elevation of 775 m amsl (2542.65 ft) which restricts low level flight to most aircraft in that area.

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<sup>8</sup> Elevation is measured from sea level

## 5 Consultation

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### 5.1 Overview

The purpose of consultation was to provide aviation stakeholders with information regarding the position and development parameters of the proposed development, and to invite comments on this application to the CAA for approval of a variation to the requirements of the ANO for the fitment of aviation obstruction lighting. Consultation with aviation stakeholders on this issue allowed Vattenfall to consider any related concerns that stakeholders may have in support of the development design on the fitment of aviation obstruction lighting. Consultation ran from the 23 July 2020 until the 21 August 2020 with a caveat that if no reply is received it will be assumed that individual stakeholders which did not respond, would be content with which ever individual scheme from the two provided is presented to the CAA for approval of a variation to the requirements of the ANO.

### 5.2 Consultees

A Consultation Letter was circulated to a total of 12 key aviation stakeholders which are likely to be utilising the low-level airspace at night in the vicinity of the proposed development as follows:

- Alexander Air Flight Training
- The MOD
- Aberdeen Airport
- CHC Helicopters
- Police Scotland Air Support Unit
- Scotland Charitable Air Ambulance
- HJS Helicopters
- Bristow Helicopters
- PDG Helicopters
- Gama Aviation
- Babcock Helicopters
- NHV Helicopters

### 5.3 WTG Lighting Proposed to Consultees

To ensure that the proposed development WTGs remain conspicuous to onshore helicopter operations, Search and Rescue (SAR), as well as military and other aviation activity, both during the day and at night. Vattenfall sought the opinion of stakeholders regarding two suggested lighting schemes with regard to the fitment of aviation obstruction lighting to facilitate situational awareness in relation to stakeholder operations in the vicinity of the proposed development.

Intermediate level lighting fitted to WTG towers allow aircrews to visually acquire WTGs at or greater than 150 m agl. The operational Clashindarroch Wind Farm includes unlit (to the naked eye) WTG with a blade tip height less than 150 m agl however, due to undulating terrain a number of the unlit WTG are higher in elevation above sea level than the proposed development. The fitment of intermediate lighting

to the proposed development has potential to provide confusing information to the pilot in the existing operational and topographical environment therefore Vattenfall proposes not to fit intermediate lighting to Clashindarroch II and seeks CAA approval.

Due to the isolated location of the proposed development in Class G airspace, the current fitment of aviation lighting of adjacent operational wind farm developments, the limited number of GA aerodromes in the locality, the likely infrequent operations conducted at night or in poor weather conditions by GA and the majority of night low level operations in the area of the development by night vision equipped aircraft; two possible variations (Figure 7 and Figure 8 below) to the requirement of the ANO and CAA Policy Statement for the lighting of the proposed development were judged appropriate for consideration by consultees.

Figure 7 below provides an illustration of Lighting Scheme 1 consulted against. Scheme 1 marks the four corners of Clashindarroch II (T1, T5, T6 and T12) with 25 candela/combination lighting (yellow pointers). The blue pointers in the figure illustrate those WTG which are fitted with IR lighting on the operational Clashindarroch Windfarm,.

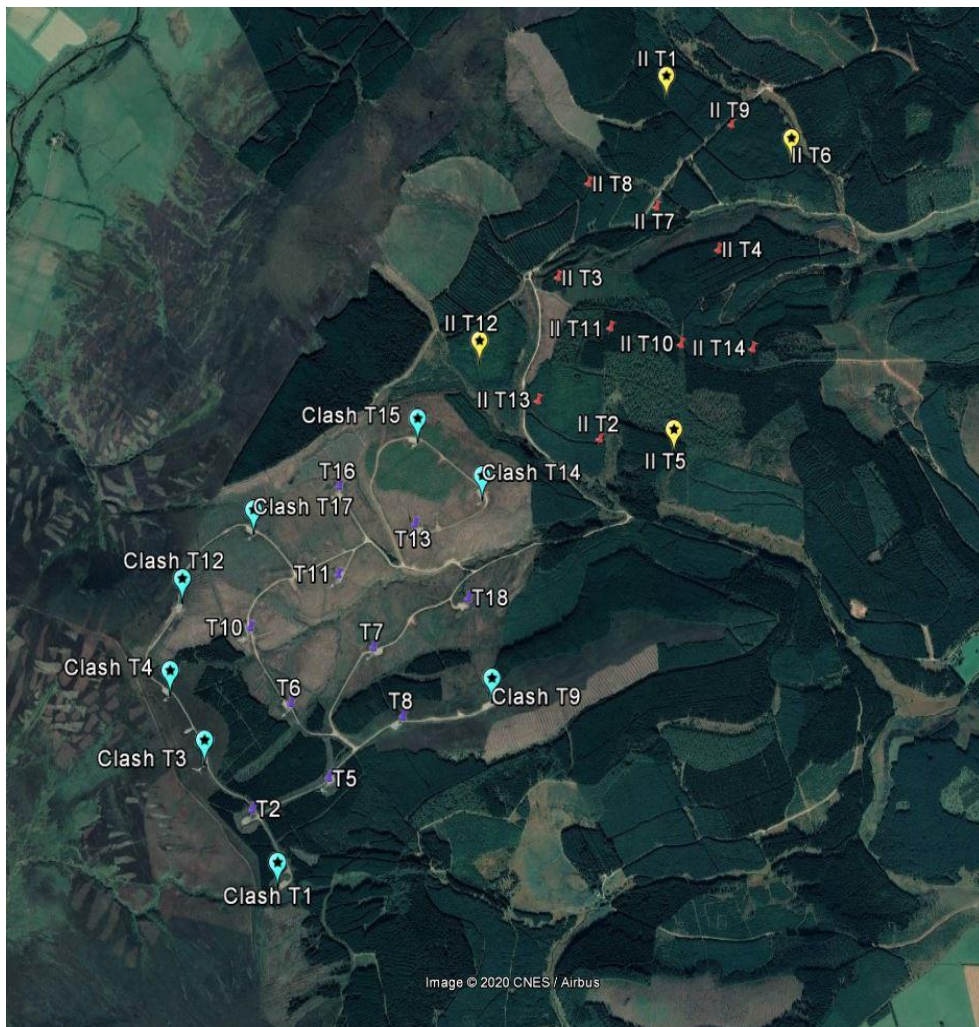


Figure 7 Lighting Option Scheme 1



Figure 8 below provides an illustration of Lighting Scheme 2 consulted against. Lighting Scheme 2 provides the lighting proposed in Scheme 1 with the **addition** of IR lighting to selected perimeter WTG (II T8, II T9 and II T14) to mark the perimeter of the proposed development.

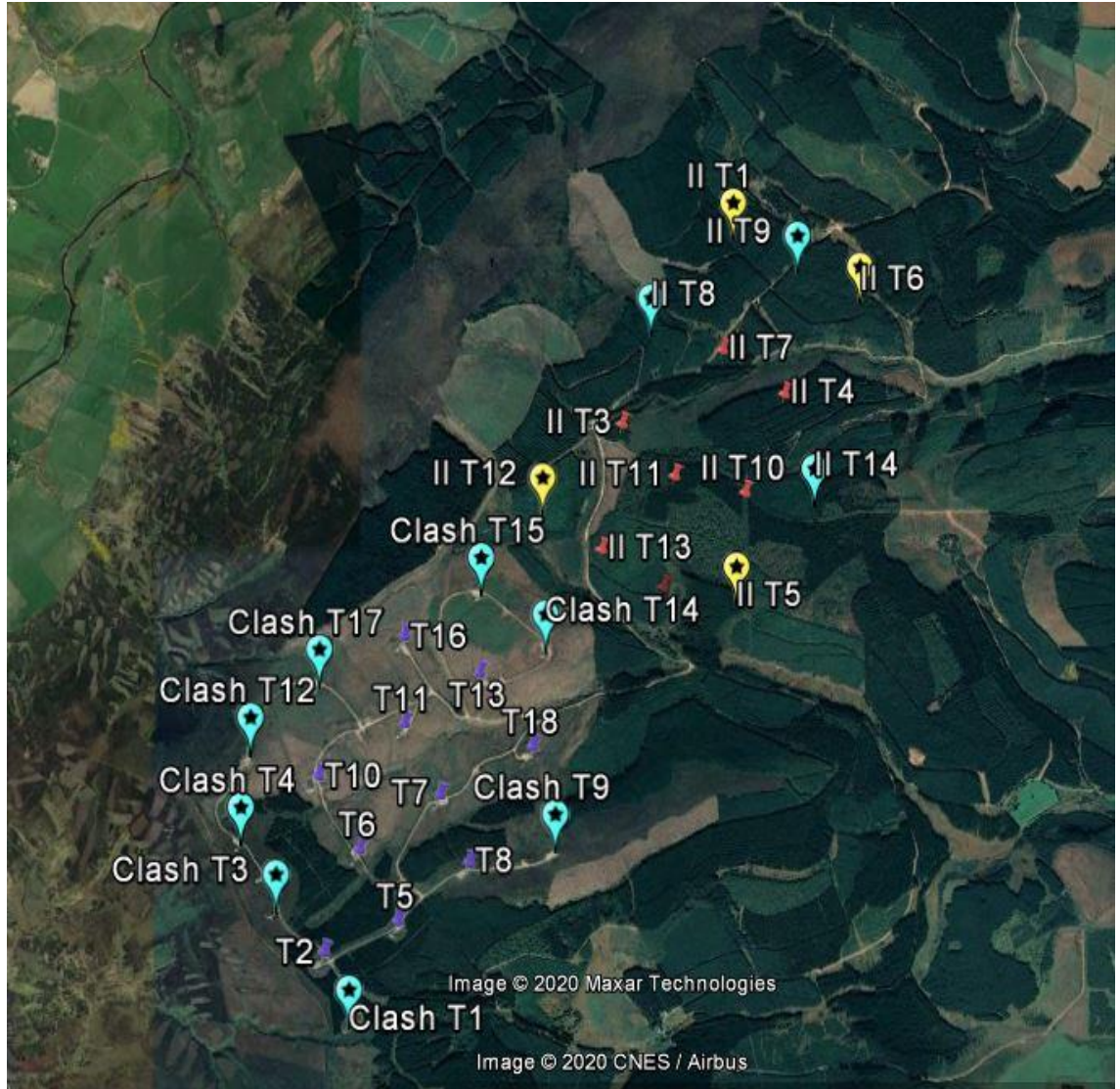


Figure 8 Lighting Option Scheme 2

Table 4 below provides a summary of consultee responses.

Consultee	Response
Alexander Air Flight Training	The Head of Training at Alexander Air stated that given the remote location and local terrain, Alexander Air were content with Lighting Scheme 1.
The MOD	The Defence Estates Safeguarding Manager stated that of the two schemes proposed, the MOD would endorse <b>Lighting Scheme 2</b> as the cardinal WTGs are lit with

Consultee	Response
	Combi Lighting and there are NVG lights placed on equidistant WTGs providing a more robust safety case for the development as a whole.
Aberdeen Airport	The Manager of Air Traffic Control stated that the proposed development will have no impact to the Aberdeen Airport operation.
CHC Helicopters	Client Relations stated that on behalf of the Manager Flight Operations that crews will be made aware of the proposed development. No preference for either lighting scheme was provided.
Police Scotland Air Support Unit	No Response
Scotland Charitable Air Ambulance (SCAA)	The Babcock Helicopters Regional Managing Pilot (Scotland) responded on behalf of the Scottish Charitable Air Ambulance and stated that they would be in favour of <b>Scheme 2</b> on the basis that the introduction of Night Vision Imaging System (NVIS) equipment to the SCAA operation is likely to occur in due course.
HJS Helicopters	No Response
Bristow Helicopters	No Response
PDG Helicopters	No Response
Gama Aviation	No Response
Babcock Helicopters	No Response
NHV Helicopters	No Response

Table 4 Consultee Response

In summary limited response was received however a caveat was provided in the consultation letter which stated that if no response was received, it would be assumed that there was no preference to the final lighting scheme to be presented to the CAA for approval. Although one preference was for Scheme 1, the response from the MOD and one of the air ambulance organisations generates a request for the fitment of aviation lighting to the proposed development of **Scheme 2**.

## 6 Lighting Variation Conclusions

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### 6.1 Overview

In preparation of this Report, a number of possible lighting variation designs to the requirement of the ANO and CAA Policy Statement for the lighting of WTGs at or in excess of 150 m agl were considered. The discussion considered the possibility of aircrew confusion associated with the IR fitted Clashindarroch Windfarm (consisting of a lower blade tip height) and visual acquisition of Clashindarroch II (which may be lit differently). The assessment concluded that irrespective of the lighting of Clashindarroch (the operational and proposed sites), aircrew would reasonably be expected to have obtained advance awareness of the two separate obstructions via the requirement for mission planning and the distinct marking of lit and unlit obstacles on aeronautical charts. Notwithstanding this, the assessment found that the risk of confusion could be mitigated further: a variation to the lighting requirements of the proposed development through the use of either fewer lights or lower intensity lighting will assist the pilot in visual acquisition of the unlit obstruction which forms the extant Clashindarroch Windfarm. The two lighting schemes presented for consultation were assessed as being the most suitable to maintain safe operations in the vicinity of the proposed development.

Currently the lighting requirement for tall onshore (150 m agl or greater) WTGs, considers WTGs similarly to isolated/individual structures, requiring the prescribed lighting of the WTG nacelle on each tower. There is no specific requirement for the UK lighting of tall WTGs that differs from any other obstacle of the prescribed height; such lighting applied to larger wind farm developments, particularly where the tall WTGs are closely spaced (as in the case of Clashindarroch II), may lead to possible distraction and disorientation due to the cumulative lighting effect. The ANO warns against the potential dangers of lights that dazzle or distract pilots.

Concerns have been raised by a number of statutory consultees regarding the landscape impact of aviation obstacle lights. Windfarm developers and operators potentially have two ways to tailor the required lighting. They can implement approved measures to reduce the environmental impact and they can conduct an aeronautical study to prove that a proposed deviation from the standards does not negatively affect flight safety.

The CAA, in terms of aerodrome and offshore aviation warning lighting requirements, and the MOD for en-route lighting within the lateral boundaries of the UKFLS, have both acknowledged the potential lighting impacts of larger developments and adjusted their requirements accordingly, applicable on a case-by-case basis. This includes perimeter-only lighting and cardinal WTG lighting, where applicable. Currently the UK en-route lighting requirement for onshore tall (150 m agl or greater) WTGs, considers WTGs similarly to isolated/individual structures, requiring the prescribed lighting of the WTG nacelle and intermediate levels, on each WTG. A response to Scoping from the MOD for the proposed development of 180 m agl blade tip height requested that all WTGs are fitted with aviation safety lighting in accordance with CAA requirements.

## 6.2 Night Flying Environment

The proposed development is in an area of airspace away from major airports and aerodromes. Civilian fixed wing flying by GA at night at an altitude to be in confliction with the development in undulating terrain and devoid of areas for a forced landing is unlikely. Flying under Visual Flight Rules (VFR) (i.e. weather conditions in which pilots will be able to see and avoid terrain, other aircraft and obstructions) at night by GA is likely to be avoided due to the possibility of changing weather conditions, terrain and the existing obstacle environment.

Commercial aircraft conducting night operations are likely to be flying under Instrument Flight Rules (IFR) at levels above the Minimum Safe Altitude and flying under their night rating qualification. Overland night flying may be undertaken by the Aberdeen based helicopter operators whom support the Oil and Gas industries however, none responded to consultation, with flight likely to be taken offshore under IFR above any possible icing level dependent on aircraft type. PDG Helicopters and HJS Helicopters did not respond to consultation

Low-level civilian flying in the area at night is likely to be restricted to helicopter SAR operations (whom have icing protection capability), Air Ambulance and/or Police airborne operations all of which are operated or will soon be operated with NVD with operators certified and proficient in the use of the equipment. The adjacent Clashindarroch Windfarm is not fitted with any visible aviation warning lighting with safe aircraft operations continuing to be completed however, the proposed development will be marked (subject to approval) with an element of visible lighting which will improve situation awareness of aircrews of all types.

## 6.3 Conclusions

It is considered that the lighting of WTGs as requested by consultees in Section 5 of this report would provide sufficient illumination to satisfy the requirements of aviation activity in the area of the proposed development whilst also providing a reduced environmental impact from that if each WTG was fitted with 2000 cd lighting as required by the ANO. Ensuring that all pilots operating aircraft in the region of the proposed development are aware of the location of the windfarm and the reduced lighting suggested through procedural or documentary means, will enable reduction of the risk to associated with the variation As Low As Reasonably Practicable (ALARP). These changes are predicted to include, but may not be limited to: pilot briefings, additional information given through CAA and GA forums, change to the relevant section of the UK Low Flying Hand Book and UK Integrated Aeronautical Information Publication (UKIAIP), Notice to Airmen (NOTAM) action and the charting and notification of the development in appropriate literature and charts. It remains the pilot's responsibility to identify and plan for potential obstructions affecting his intended route, including ensuring he is aware of the obstruction's lighting status to help him identify, see and avoid the obstructions.

The conclusions presented above are only valid for the development of the 14 WTGs proposed for the Clashindarroch II Windfarm at the location specified. Proliferation of WTG developments could cause an increase in safety risk and hence any further developments would be required to be assessed on a case-by-case basis.



## 7 References

Ref	Name	Origin
1	International Civil Aviation Organisation (ICAO) document Volume 1 (Aerodrome Design and Operations) of Annex 14 8 <sup>th</sup> Edition, July 2018	ICAO
2	CAP 393 The Air Navigation Order 2016 and Regulations Version 5.6, March 2019	CAA
3	CAA Policy Statement: Lighting of Onshore Wind Turbine Generators in the United Kingdom with a maximum blade tip height at or in excess of 150m Above Ground Level Issue Date June 2017	CAA
4	Landscape and Visual Impact Assessment (LVIA) completed as part of the Environmental Impact Assessment Report (EIAR) September 2018	SLR
5	CAP 764 Policy and Guidelines on Wind Turbines Version 6 February 2016	CAA
6	MOD Obstruction Lighting Guidance November 2014 Available online: <a href="http://www.renewableuk.com">http://www.renewableuk.com</a>	MOD
7	Clashindarroch II Windfarm Scoping Report August 2018	Vattenfall
8	CAP 493 – Manual Air Traffic Services – Part 1 Edition 7.0, November 2017	CAA
9	UK Military Low Flying Handbook AIRAC 09/2020	MOD

# A1 Consultation Letter

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By Email

Date: 23 July 2020

Ref: 71434 001 Issue 1

## **Clashindarroch II Wind Farm**

Dear Sir or Madam,

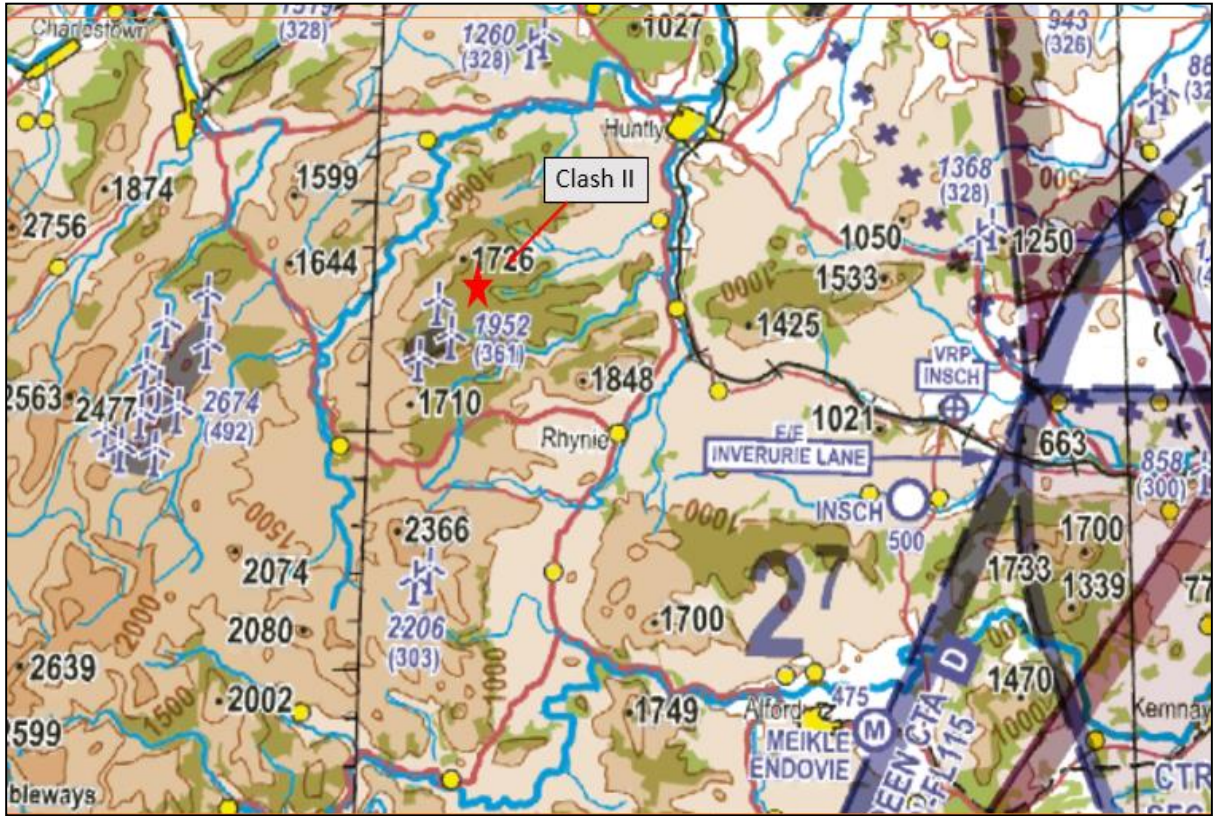
### **Purpose of this Memo**

Osprey Consulting Services Ltd (Osprey) is providing support to Vattenfall Wind Power Ltd (Vattenfall) who is developing the Clashindarroch II Wind Farm (Clash II). The purpose of this memo is to provide aviation stakeholders with information regarding the position and development parameters of Clash II, and to invite comments on a forthcoming application to the Civil Aviation Authority (CAA) for approval of a variation to the requirements of the Air Navigation Order 2016 and Regulations (ANO) for the fitment of aviation obstruction lighting for a wind farm development containing Wind Turbine Generators (WTG) at or above 150 metres (m) above ground level (agl). Consultation with aviation stakeholders on this issue allows Vattenfall to consider any related concerns that you may have in support of the development design on the fitment of aviation obstruction lighting.

## **Clashindarroch II Wind Farm**

Clash II will be located approximately 5 nautical miles (NM) south west of Huntly, Aberdeenshire and northeast of the operational Clashindarroch Wind Farm. The development will consist of 14 WTG with a blade tip height of 180m agl placed in an area of 1560 hectare (ha), with the proposed WTGs located in the southern part of the site. The site is located predominately in an area of commercial forestry but has some areas of sparsely populated open moorland and undulating ancient woodland and becomes operational during 2023.

Clash II will be an addition to the (operational 2015) Clashindarroch Wind Farm which consists of 18 WTG at a blade tip height of 110m agl and which is fitted with Infra-Red (IR) lighting only on specific WTGs as agreed with the Ministry of Defence (MoD). A review of operational wind farms within 12 kilometres indicates that (although information is limited) adjacent wind farm developments are not lit or are fitted with a maximum of 25 candela combination lighting and or IR lighting as required by the MoD. Figure 1 below provides the location of Clash II Wind Farm which is situated 30 nautical miles (NM) due west of the Aberdeen Airport Airfield Reference Point.



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Figure 9 Location of Clash II (not to scale)

The wind farm will be located within Class G airspace, within Low Flying Area (LFA) 14; controlled airspace is established above Flight Level (FL) 195.

### WTG Parameters

The co-ordinates of the 14 Clash II WTGs at a blade tip height of 180m agl are listed in Table 1.

WTG No.	Easting	Northing	Blade Tip Elevation (m) amsl
1	344086	833617	570
2	343640	831705	538
3	343415	832583	573
4	344357	832735	555
5	344076	831659	561
6	344821	833268	522



WTG No.	Easting	Northing	Blade Tip Elevation (m) amsl
7	344002	832977	524
8	343603	833107	576
9	344460	833440	539
10	344118	832206	597
11	343713	832298	609
12	342964	832151	568
13	343286	831912	564
14	344533	832177	573

Table 5 Clash II Coordinates and elevations

Clash II, WTG 6 has the lowest elevation of the development at 522m amsl. The adjacent and operational Clashindarroch Wind Farm has 17 WTG above the lowest elevation of Clash II, none of the 17 WTG are fitted with visible (to the naked eye) aviation obstruction lighting.

### Lighting Regulations of Relevance to the Lighting of Clash II WTGs

A list of reference documents is provided in Table 6 below.

Reference Document	
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.
CAP 393 The Air Navigation Order (ANO) 2016 and Regulations.	Sets out the provisions of the Air Navigation Order as amended together with regulations made under the Order. It is prepared for those concerned with day to day matters relating to air navigation that require an up to date version of the air navigation regulations and is edited by the Legal Advisers Department of the CAA. Article 222 (1) requires all en-route obstacles (defined as any construction, the height of which is 150m

Reference Document	
	or more agl), to be lit with medium intensity (2,000 candela) steady red lights.
EASA Safety Bulletin SIB No 2019-04.	EASA SIB No 2019-04 provides recommendations in order to mitigate safety risk related to the use of Light Emitting Diode (LED) obstacle lights.
ICAO Annex 14: Aerodrome Design and Operations – Chapter 6	Annex 14 deals specifically with obstacle restriction and removal within the airspace surrounding aerodromes. The UK civil en-route lighting requirements for tall structures reaching to or greater than 150m agl, including WTGs, are predicated on the ICAO Volume 1 stipulations. Annex 14 states that a procedure can be put in place to allow the assessment of individual structures or developments, to determine if they are in fact located to pose a potential hazard to airspace navigability. It suggests that if an aeronautical study indicates that the proposed structures would not pose an obstacle to aviation operations, less stringent lighting requirements may be more applicable. The UK CAA are the appropriate authority to grant such a permission.
CAA Policy Statement: Lighting of Onshore Wind Turbine Generators in the United Kingdom with a maximum blade tip height at or in excess of 150 metres Above Ground Level	The CAA Policy Statement provides guidance as to the application of the ANO with relation to onshore WTG with a maximum blade tip height at or above 150m agl. In the case of the lighting of ‘en-route obstacles’ it directs the reader to the ANO Article 222 (6) in which permission may be granted for the purposes of this article for a particular case or class of cases or generally. The CAA may grant permissions for aviation lighting schemes other than as specified in Article 222 (1).

Table 6- Reference Documents

### Requirements of the ANO for the Lighting of En-Route Obstacles

Article 222 (1) states:

The person in charge of an en-route obstacle must ensure that it is fitted with medium intensity steady red lights positioned as close as possible to the top of the obstacle and at intermediate

levels spaced so far as practicable equally between the top lights and ground level with an interval of not more than 52m.

Article 222 (4) states:

At each level on the obstacle where lights are required to be fitted, sufficient lights must be fitted and arranged to show when displayed in all directions.

Article 222 (5) (6) and (7) provides further information as follows:

(5) In any particular case the CAA may direct that an en-route obstacle must be fitted with and must display such additional lights in such positions and at such times as it may specify.

(6) A permission may be granted for the purposes of this article for a particular case or class of cases or generally.

(7) This article does not apply to any en-route obstacle for which the CAA has granted permission to the person in charge permitting that person not to fit and display lights in accordance with this article.

Article 222 (8) delineates an en-route obstacle as follows:

A building, structure or erection, the height of which is 150m or more above ground level, but it does not include a building, structure or erection—

- a) which is in the vicinity of a national licensed aerodrome or an EASA certificated aerodrome; and
- b) to which section 47 of the Civil Aviation Act 1982 (warning of presence of obstructions near licensed aerodromes) applies

### **WTG Lighting Proposed at Clash II**

Currently the lighting requirement for tall onshore (150m agl or greater) WTGs, considers WTGs similarly to isolated/individual structures, requiring the prescribed lighting of the WTG nacelle on each tower. There is no specific requirement for the UK lighting of tall WTGs that differs from any other obstacle of the prescribed height; such lighting applied to larger wind farm developments, particularly where the tall WTGs are closely spaced (as in the case of Clash II), may lead to possible distraction and disorientation due to the cumulative lighting effect. The ANO warns against the potential dangers of lights that dazzle or distract pilots.

Due to the isolated location of Clash II in Class G airspace, the current fitment of aviation lighting of adjacent operational wind farm developments, the limited number of General Aviation (GA) aerodromes in the locality, the likely infrequent operations conducted at night or in poor weather conditions by GA and the majority of night low level operations in the area of the development by night vision equipped aircraft; two possible variations (Figures 2 and 3 below) to the requirement of the ANO and CAA Policy Statement for the lighting of Clash II are considered appropriate for your consideration.

Intermediate level lighting fitted to wind turbine towers allow aircrews to visually acquire WTGs at or greater than 150 m agl. The operational Clashindarroch Wind Farm includes unlit (to the naked eye) WTG with a blade tip height less than 150m agl however, due to undulating terrain a number of the unlit WTG are higher in elevation above sea level than the proposed Clash II development. The fitment of intermediate lighting to Clash II has potential to provide confusing information to the pilot in the existing operational and topographical environment and therefore Vattenfall will propose not to fit intermediate lighting to Clash II.

The figures below illustrate the layout of Clash II (II T1 to II T T14) (red pointers) together with the layout of the operational Clashindarroch Wind Farm (Clash T1 to T18) (purple pointers) which is located to the southwest of Clash II. Clashindarroch Wind Farm is operational and is fitted with IR lighting only (invisible to the naked eye) on specific perimeter WTG only (T1, T3, T4, T9, T12, T14, T15 and T17) marked by lime green pointers in the figures.

**Proposed Lighting Option Scheme 1**

Scheme 1 marks the four corners of Clash II (T1, T5, T6 and T12) with 25 candela/combination lighting (yellow pointers).



Figure 10 Proposed Lighting Option Scheme 1

**Proposed Lighting Option Scheme 2**

As per Scheme 1 with the addition of IR lighting to selected perimeter WTG (II T8, II T9 and II T14).

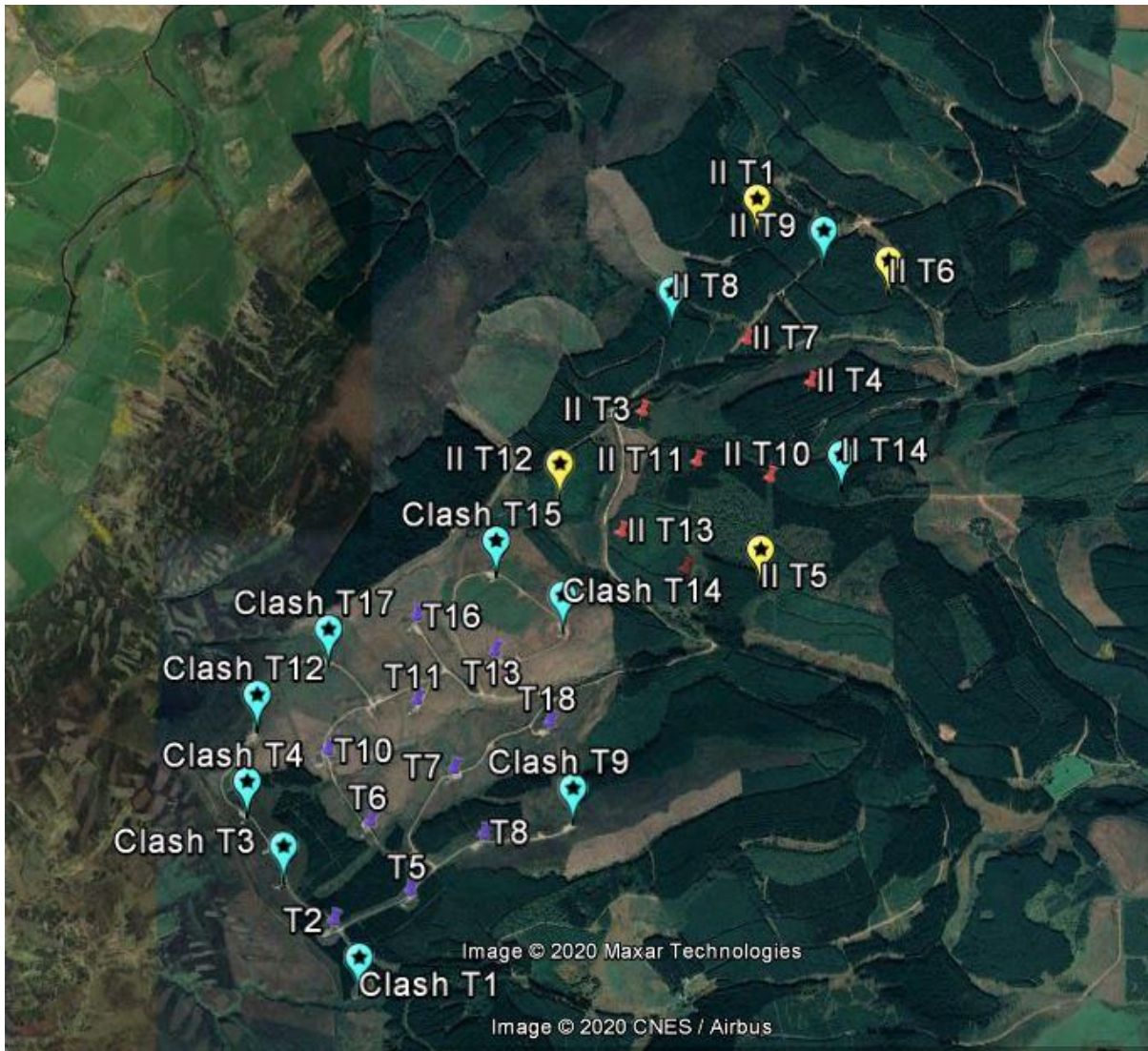


Figure 11 Proposed Lighting Option Scheme 2

### Next Steps

I hope that you have found the information regarding the proposed Clash II Wind Farm project useful. Vattenfall value the opportunity to engage with you as this provides the opportunity to consider your feedback in the design process (where appropriate) at this stage. To ensure that the Clash II WTG's remain conspicuous to onshore helicopter operations, Search and Rescue (SAR), as well as military and other aviation activity, both during the day and at night, Vattenfall are seeking your opinion regarding the two suggested lighting schemes with regard to the fitment of aviation obstruction lighting to facilitate situational awareness in relation to your operations in the vicinity of Clash II.

We would welcome your aviation stakeholder response on **which suggested lighting option scheme above** best suits your organisation for the safe and efficient conduct of flight in the vicinity of the development.

Vattenfall look forward to receiving your reply which should be sent by email to the address in the signature block below and no later than **21 August 2020**. If no reply is received it will be assumed that you are content with which ever individual scheme is presented to the CAA for approval of a variation to the requirements of the ANO.

Yours sincerely

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