

# 3 Site Selection & Design

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## 3. Site Selection & Design

### Executive Summary

This chapter sets out the design evolution process undertaken by the Applicant prior to arriving at the final Proposed Development design.

### 3.1 Introduction

3.1.1 This chapter sets out the design evolution process undertaken by the Applicant prior to arriving at the final Proposed Development design. The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended) require that the Environmental Impact Assessment Report (EIA Report) must include *“A description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects.”*

3.1.2 The final design of the Proposed Development represented in this EIA Report was arrived at following iterative consideration of many alternative design configurations. This chapter describes the design iteration process from which the Proposed Development design was selected.

3.1.3 This chapter is supported by the following figures:

- Figure 3.1 – Layout A
- Figure 3.2 – Layout B
- Figure 3.3 – Layout C
- Figure 3.4a – Layout D
- Figure 3.4b – Layout D with Key Constraints
- Figure 3.5 – Layout E
- Figure 3.6a – Layout F
- Figure 3.6b – Layout F with Key Constraints
- Figure 1.2 – Site Layout Plan
- Figure 3.7 – Site Layout with Key Constraints

### 3.2 Site Selection & Background

3.2.1 As set out in Chapter 1, an application for a previously proposed twenty-two turbine development was submitted to Scottish Ministers in December 2011 and was refused consent in November 2015.

3.2.2 The site was first considered for its potential for wind farm development in 2008, with the initial extent of the site covering the entire land owned by Sallachy Estate north of the Strath of Loin Site of Special Scientific Interest (SSSI). At this stage the total wind farm size being considered was 80 turbines with a total installed capacity of 240 MW.

3.2.3 The main sensitivities of the site identified following initial discussions with stakeholders, were ecological, ornithological, and landscape and visual impacts. Following this, a sensitivity study was performed for landscape and visual aspects, and from 2009 ornithological surveys were undertaken

for a total of 24 months. Following these initial surveys, a layout was developed which was taken forward in the Scoping Report submitted to Scottish Ministers in late 2010.

- 3.2.4 Following the receipt of responses from consultees within the Scoping Opinion and taking into account detailed surveys undertaken as part of the 2011 Environmental Impact Assessment, the layout underwent several design iterations, which are detailed in the Sallachy Wind Farm Environmental Statement (WKN AG, 2011). The main considerations in the design process were landscape and visual impacts, ornithology and hydrogeology. These resulted in a reduction in turbine height, number and installed capacity. The layout submitted to Scottish Ministers in 2011, detailed within the Sallachy Wind Farm Environmental Statement (WKN AG, 2011), comprised 22 turbines and an installed capacity of 66 MW (refer to Figure 3.1 and Layout A below).

### **3.3 Opportunities & Constraints**

#### ***Opportunities***

- 3.3.1 The Proposed Development site is considered to be a viable location for a wind farm development based on a number of benefits, detailed below.

#### Wind Resource

- 3.3.2 Initial analysis by the Applicant indicates that the site has potential for good wind resource and generation capacity.
- 3.3.3 The elevation of the site allows the turbines to sit around 300 m above sea level, providing good wind conditions.
- 3.3.4 The mean wind speed averaged over all turbine locations using mesoscale modelling techniques (MC2 = Mesoscale Compressible Community) is predicted to be between 7.3 and 7.8 m/s at a hub height of 83 m. Similar results are predicted from analysis performed using the Numerical Objective Analysis of Boundary Layer (NOABL) wind speed data base.

#### Existing Infrastructure

- 3.3.5 The site is close to a viable grid connection point, at a distance of less than 4 km, with connection cables between the turbines and the grid connection point proposed to be underground, therefore minimising further visual impact.
- 3.3.6 There is a pre-existing access track to the site which is currently connecting the Cassley Hydro Power scheme, and which minimises the requirement for construction of new tracks to connect the site to the road network.

#### Distance to Population

- 3.3.7 The closest settlement to the site is Lairg, at a distance of approximately 18.3 km, and with very few residential properties in close proximity. There are no residential properties within 2 km, the closest being approximately 2.4 km to the nearest turbine.
- 3.3.8 It is considered that this remoteness would minimise the impact on the local human population, as distance diminishes both the potential visual impact and any potential impacts from noise.

#### Designated Sites

- 3.3.9 There are no ecological, ornithological or cultural heritage designated sites within the site boundary.

### Land Use

- 3.3.10 The site is currently predominantly used for stalking by the landowners. During operation the site will continue to be open to livestock, with no restrictions bar controlled access to the substation and to areas of habitat management and restoration.

### **Constraints**

- 3.3.11 The main sensitivities of the site which have been identified and taken into consideration through the design iteration process are detailed below. These topics were fundamental to design optimisation and the final design takes careful consideration of these aspects.

### Landscape & Visual

- 3.3.12 The site sits within the Reay – Cassley Wild Land Area (WLA), an area of 560km<sup>2</sup> extending across north west Sutherland from Scourie in the north to Rosehall in the south. The site also has the potential to impact upon the following landscape features:

- Assynt-Coigach National Scenic Area (NSA) which lies approximately 5.2 km west to the nearest turbine; and
- Foinaven – Ben Hee WLA 5.8 km north to the nearest turbine.

- 3.3.13 More details of these are provided in Chapter 6.

### Ornithological & Ecological

- 3.3.14 The site is adjacent to the Strath an Loin SSSI which is part of the Caithness and Sutherland Special Protected Area (SPA), Special Area of Conservation (SAC) and Ramsar site. This is designated as a SSSI for the presence of blanket bog habitat and as an SPA for the presence of several sensitive bird species. Strath an Loin designated site has been completely and deliberately avoided by the Development Footprint.

- 3.3.15 Important wider countryside breeding bird habitats (along the main ridge) for species such as golden plover, dunlin and greenshank has also been considered by the design and completely avoided by bringing proposed turbines down from the ridge line and placing them part way down slope towards Loch Shin.

- 3.3.16 The site is characterised by blanket bog habitats and blanket bog in transition with wet heath. The type and condition of the habitat was taken into consideration during the iterative design process. Including avoidance of the better quality blanket bog habitat with bog pools along the main ridge line.

- 3.3.17 More details of these are in Chapters 7 and 8.

### Hydrogeological

- 3.3.18 The site is majority blanket bog habitat underlain with Class 1 and Class 2 peat. Site surveys have been undertaken to understand the extent of the depth of the peat on site and this has been taken into consideration during the iterative design process.

- 3.3.19 More details of this are provided in Chapter 12.

## **3.4 Design Principles**

- 3.4.1 Current best practice guidance provides a framework for the consideration of key design issues including turbine size, layout composition, wind farm design in relation to landscape character and designing for multiple wind farms (SNH, 2017).

3.4.2 The following principles were adopted during the design iterations made by the Applicant to ensure that the final design of the Proposed Development was the most suitable for the site:

- Considering the appearance of the turbines in key views from the WLA and NSA, and in relation to the wild land qualities and special landscape qualities of the NSA and WLA;
- Considering the appearance of the Proposed Development from other sensitive landscape and visual receptors (e.g. residential properties, mountains, roads);
- Avoiding inconsistent turbine spacing, such as relatively large gaps, outliers or excessive overlapping turbines to minimise visual confusion and ensure a balanced / compact array from key views;
- Maintaining a tip height below 150 m to negate the requirement for aviation lighting and reduce visual impacts at night, including effects on the WLA and NSA;
- Retaining a separation of at least 1 km from the closest residential dwellings;
- Maximising use of existing infrastructure on the site;
- Providing suitable stand-off distance to the neighbouring SPA / SAC / SSSI designated site;
- Maintaining a separation distance from a telecommunications link running across the site;
- Avoidance of areas of deep peat wherever possible;
- Taking account of locations of watercourses and ground conditions / topography; and
- Addressing all other environmental constraints and associated buffers.

## 3.5 Proposed Development Design Iterations

3.5.1 Following the selection of the site location, the Applicant has undertaken multiple design iterations of all aspects of the Proposed Development, including the site boundary, the turbine layout and the infrastructure layout. The Sallachy Wind Farm Environmental Statement (WKN AG, 2011) describes the design iteration process that led to the previously proposed twenty-two turbine layout. This section describes the principal design iterations that have been undertaken since 2011 as the Applicant has sought to maximise the number of turbines on site whilst minimising the environmental effects of the constraints identified.

### Layout A

3.5.2 The previously proposed layout (referred to as “Layout A”) consisted of 22 turbines, of 125 m tip height and a total installed capacity of 66 MW (refer to Figure 3.1).

3.5.3 This layout had an extensive spread of turbines across the ridge that separates Loch Shin and Glen Cassley, including turbines along the elevated ridgeline as well as the lower slopes on either side. This layout had a poor, unbalanced appearance with visual confusion caused by overlapping, clustering and gapping of turbines. The extensive spread of the site meant that a wide horizontal field of view was occupied by the turbines, with the Proposed Development affecting a notable proportion of many views (e.g. Landscape and Visual Viewpoints 2, 6 and 9). The variation in turbine base elevations resulted in a wide range of apparent tip heights and in some views (e.g. Viewpoints 2, 7 and 17), an eye-catching sense of turbines covering the full slope and encroaching notably towards the viewer. The turbines on the ridgeline appear prominent in views from a number of locations, including notably the A838 (as seen in Viewpoint 9).

3.5.4 As a result, a high level of visibility was gained from the NSA (see Viewpoint 2) and other sensitive receptors including residential properties in Overscaig (Viewpoint 9), the A838 (Viewpoints 6, 7 and

9) and the A836 (Viewpoint 17). There were a number of effects on the wild land qualities of the Reay-Cassley WLA (Viewpoint 2), and the direct physical effects on the WLA were also pronounced.

#### Layout B

- 3.5.5 Taking on board the issues noted above and feedback received in response to the 2011 ES and the subsequent addendum, the Applicant decreased the spread of the layout, therefore reducing the visibility of the development from the NSA. Layout A was split either side of the ridgeline from Moavally to Cnoc a' Bhaid Bhain, and it was considered that keeping to one side of this ridgeline would offer a more coherent layout.
- 3.5.6 The resulting layout removed the south-western turbines and retained the line of 11 turbines to the north-east (refer to Figure 3.2). This consequently reduced the site boundary by half and pulled the Proposed Development out of Glencassley estate to be wholly within the Sallachy estate.
- 3.5.7 The layout of the turbines in a single row improved the appearance of the Proposed Development from the majority of locations, resulting in a relatively simple appearance with considerably less gapping, clustering and overlapping than Layout A (e.g. Viewpoints 2, 9, 12 and 17). The sense of covering the full slope was avoided by the single row arrangement (e.g. Viewpoints 2, 7 and 17), and the reduced extent of the site to the south notably reduced the proportion of views affected by the turbines in a number of locations (e.g. Viewpoints 2 and 6). The containment of the turbines below the ridgeline also reduced the prominence of turbines on the skyline in some views.
- 3.5.8 However, several issues remained. The linear extent of the site, with 11 turbines in a row, meant that in some views the Proposed Development continued to affect a notable horizontal field of view (e.g. Viewpoints 9 and 12). The variable base elevation of the turbines also resulted in a somewhat unbalanced appearance from some locations, with turbines staggered on the slope (e.g. Viewpoints 7 and 17).
- 3.5.9 Overall, visibility and influence was greatly reduced and in many views the appearance of the Proposed Development was improved. Views from the NSA, properties in Overscaig, A836 and A838 were notably improved (Viewpoints 2, 6, 7 and 9) and effects on the Reay-Cassley WLA - both direct and perceptual – were greatly reduced due to the reduction in site area and the containment of the turbines to the north of the ridgeline.
- 3.5.10 The main issues remaining related to the linear extent of the site and the variable turbine base levels.
- 3.5.11 This layout was taken forward in pre-application consultation with The Highland Council (THC) in 2017.

#### Layout C

- 3.5.12 Layout C (shown in Figure 3.3) was developed following detailed landscape and visual studies undertaken by Optimised Environments (OPEN) and increased the separation distance from the turbines to the NSA. This brought the turbines to the eastern end of the site with nine turbines spaced across two rows and was predominantly influenced by landscape and visual constraints. This layout has not been described in detailed landscape and visual terms here as it did not take into account other technical or environmental constraints and was therefore not considered to be a fully viable layout. Layout D, the subsequent more resolved iteration, is described below.
- 3.5.13 The site boundary was also updated to include the proposed access track and locations being considered for associated infrastructure.
- 3.5.14 At the same time, with ever developing wind turbine technology and to optimise generation, the Applicant looked to consider the feasibility of utilising larger turbine models. The maximum tip height being considered therefore was increased from 125 m to 149.9 m. The threshold was maintained

below 150 m to negate the requirement for aviation lighting as this would introduce too great a visual impact.

- 3.5.15 This layout was taken forward in pre-application consultation with THC in 2020.

#### Layout D

- 3.5.16 Layout D (shown in Figure 3.4a) was developed following detailed review of the proposed turbine locations and initial environmental surveys including Phase 1 peat probing.
- 3.5.17 The south-eastern most turbine was moved north to increase the separation distance from the Strath an Loin SSSI, and adjacent turbines micro-sited to accommodate this move.
- 3.5.18 Initial access tracks and turbine hardstandings were designed, taking into consideration engineering and topographical constraints. This necessitated the movement of the several turbines to avoid impacting on watercourse buffers and allow sufficient space for the construction of infrastructure.
- 3.5.19 Turbines were also micro-sited to avoid areas indicated to be of deeper peat and to avoid impacting on potential ground water dependent terrestrial ecosystems (GWDTEs), while maintaining a separation distance from a telecommunications link running across the site. The various environmental constraints are shown on Figure 3.4b.
- 3.5.20 The double row of turbines in this layout had several key benefits: firstly, the concentration of turbines in a shorter double row reduced the horizontal field of view affected by the Proposed Development, particularly in views from the east and north-east (e.g. Viewpoints 9, 12 and 17); and secondly, the use of the eastern part of the site only ensured that the distance from the NSA was maximised.
- 3.5.21 However, this layout did result in other issues arising. When viewed from the west, north-west and south-east (e.g. Viewpoint 2 and 6) the double row of turbines can appear in two clusters, which can be eye-catching and affects a wider field of view. The double row leads to some overlapping and gapping in views where the rows are seen against each other (e.g. Viewpoints 7, 9, 12 and 17), and this also leads to the impression of the Proposed Development covering the full slope of the ridge, with encroachment towards viewpoints. Finally, the upper row of turbines had a relatively high base elevation, leading to some prominence on the skyline (e.g. Viewpoint 9).
- 3.5.22 The proposed increase in turbine height and rotor diameter in this layout is discernible in views. It is not, however, considered to notably increase the visual impact of the turbines, and the benefit of reducing the turbine numbers from 11 to nine due to the larger dimensions is considered to be of greater benefit.

#### Layout E

- 3.5.23 Layout E (shown in Figure 3.5) was developed following a review of the minimum spacing required between turbines for optimal performance. The western most turbine had been an outlier in several key views, and this layout iteration allowed turbines to be brought closer together to form a more visually coherent grouping.
- 3.5.24 The layout of the access tracks was redesigned to avoid track spurs heading down slope perpendicular to the contour lines. Tracks were realigned to run parallel to the contour lines where possible, while minimising the number of watercourse crossings. This also minimised the cut and fill required for track construction and was visually more in keeping with the topography of the surrounding landscape.

#### Layout F

- 3.5.25 Following further consultation with THC in September 2020, the layout was redesigned as it was considered that a single row of turbines would visually be an improvement on the previously proposed double row. It was felt to be essential to keep the turbines east of the area of ancient woodland,

towards the south-eastern end of the site and therefore maintain as much distance from the NSA as possible.

- 3.5.26 Layout F (shown in Figure 3.6a) pulled the proposed layout to a single row of turbines at an elevation of approximately 300 m AOD. This increased the separation distance from the turbines to the nearest residential properties across the loch, minimising any potential impact from noise, from shadow flicker, and to visual amenity.
- 3.5.27 Altering the track layout to a single line, rather than two parallel line reduced the land-take impact on habitats and peat.
- 3.5.28 The spacing of the turbines was further revised and proposed locations were chosen based on the understanding of peat depth, watercourses and ecological habitats across the site. The various environmental constraints are shown on Figure 3.6b.
- 3.5.29 Maintaining an elevation of approximately 300 m AOD also brought the turbines higher than had been previously proposed, ensuring a separation from the telecommunications link and maintaining a clear valley floor for low flying aircraft over the loch.

#### Final Layout

- 3.5.30 Final detailed peat probing and walkover surveys of the watercourses and ecological habitats were undertaken at proposed turbine locations during October 2020.
- 3.5.31 The layout was revised to bring the eastern most turbine (T1) away from the Strath an Loin SSSI. Turbines were micro-sited to align the turbines in a cohesive single row, which improved the visual impact from key views, while avoiding siting turbines in areas of deep peat or blanket bog habitat (refer to Figure 3.7).
- 3.5.32 The access tracks and hardstandings were redesigned for these final turbine locations to ensure that the proposed design was feasible from a construction and operation perspective.
- 3.5.33 In landscape and visual terms, this layout improves upon previous iterations in all respects. The turbines present a balanced and regular appearance with no gapping or clustering at the great majority of locations, including the most sensitive viewpoints (e.g. Viewpoints 2, 9 and 12). The broad uniformity of base locations ensures that the row of turbines is regular and displays no staggering or encroachment towards the viewer, while the elevation of the row (which is reduced from that of the upper row in the double row layouts) avoids and minimises prominence on the skyline (e.g. Viewpoint 9).
- 3.5.34 This layout improves upon the previous single row layout (Layout B) as it has a reduced extent (nine turbines rather than 11), a more balanced and regular appearance, and more consistent turbine elevation, which avoids the impression of staggering across the slope.
- 3.5.35 The final layout is considered especially in relation to the NSA and WLAs (particularly Reay-Cassley, WLA 34, but also Foinaven-Ben Hee, WLA 37). Whilst removing all visibility from the NSA and WLAs is not possible, the Proposed Development has been very specifically designed to minimise direct effects on the peatland slope area of the WLA within which it lies, and also the perceived effects on the wider WLAs and NSA. This has been achieved through a number of considerations that are described in the LVIA and summarised below:
- The Proposed Development has been specifically designed to have a compact, well-balanced, regular and even composition in key views from the NSA and WLAs. This ensures that it relates well to its landform setting and avoids eye-catching effects of gapping and clustering or overlapping that could increase its influence.

- The Proposed Development will have no direct effects on the NSA, and all effects will be perceived only, ensuring that the special landscape qualities that are dependent upon physical attributes of the NSA will not be affected by the Proposed Development. The nearest turbine in the Proposed Development lies approximately 5.2 km from the eastern edge of the NSA, at which distance the perceived influence of the turbines will be tempered by the other human influences, land management activity and attributes of the landscape.
- The Proposed Development is located just within the eastern periphery of the Reay-Cassley WLA where there are notable baseline human influences, both within and outwith the WLA. This gives them a stronger association with the developed Loch Shin area than with the NSA and the interior of the Reay-Cassley WLA, ensuring that the most remote and wild northern and western aspects of the NSA and WLAs remain unaffected by development.
- The low elevation of the turbines in relation to the majority of the NSA and WLA minimises their potential for intrusion and interruption of the landscape as they will not appear in a prominent skyline location from within the NSA or WLA.
- The Proposed Development is designed to utilise existing infrastructure, thus reducing the need for additional new tracks that could have direct and perceived effects on the NSA and WLAs. The substation compound has been located in close proximity to the existing hydro power station on the shore of Loch Shin where its effect will be minimised.
- The turbines in the Proposed Development have purposely been specified at below 150 m tip height in order to avoid the need for aviation lighting, which could increase effects on the NSA and WLA.

3.5.36 The final layout taken forward to application is shown in Figure 1.2, the visualisations within Volumes 3 and 4, and is described in detail in Chapter 4.

### ***Infrastructure***

3.5.37 The location of the borrow pit search area, temporary construction compound and indicative substation compound are shown on Figure 1.2. These have been considered through the iterative design process and have been sited to avoid watercourses, areas of deep peat and to minimise impacts on sensitive habitats. The substation compound has been sited down slope, on the loch edge near to the existing Hydro Power Station infrastructure, to minimise any visual impact. The use of upgraded existing tracks to gain access to the site is also beneficial as direct effects on the landscape, and visual or perceived effects on receptors including the NSA and WLAs, are minimised.

## **3.6 Do-Nothing Scenario**

3.6.1 Should the Proposed Development as described in Chapter 4 not be consented (the “do-nothing scenario”), it is anticipated that the Proposed Development site will not alter from the current baseline described in Chapters 6 to 14.

3.6.2 By not developing this site, the opportunity to generate approximately 116,362<sup>1</sup> MWh per annum of renewable energy, enough to power the equivalent of approximately 32,522<sup>2</sup> average UK households, and contribute to UK and Scottish Government’s net zero targets, would not be realised.

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<sup>1</sup> This has been calculated by multiplying the indicative installed capacity (49.9 MW) by the number of hours in a year (8760) by BEIS’s long-term average load factor for onshore wind (26.62%).

<sup>2</sup> This has been calculated by dividing the annual power output (116,362 MWh<sup>1</sup>) by the UK average domestic household consumption (3.578 MWh).

## **3.7 Summary**

- 3.7.1 The final Proposed Development layout has been informed by a robust design iteration process, taking into account potential environmental, landscape and visual impacts and their effects, and physical constraints. The information used to inform the design iteration process included baseline data, review of preliminary visualisations, ongoing impact assessments and wind yield optimisation.
- 3.7.2 The final turbine layout and scale has been designed to maximise renewable energy generation from the site, whilst keeping within acceptable limits for potential impacts on the environment.
- 3.7.3 The EIA Report is based on the final layout selected for the Proposed Development. The final layout comprises 9 turbines up to 149.9 m in height and associated access tracks, crane hardstandings, construction compounds, and a borrow pit search area.

### 3.8 References

Scottish Natural Heritage (2017). Siting and designing wind farms in the landscape. Version 3a.

Available at: <https://www.nature.scot/siting-and-designing-wind-farms-landscape-version-3a>

WKN AG (2011). Sallachy Wind Farm Environmental Statement.