

CHAPTER 2: SITE SELECTION AND DESIGN EVOLUTION

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2. Site Selection and Design Evolution

2.1 Introduction

2.1.1 This Chapter focuses on the environmental and technical factors considered by the Applicant as part of the design evolution of the Proposed Development.

2.2 Site Selection

2.2.1 The site, sitting adjacent to the operational Stronelaig Wind Farm and Glendoe Hydroelectric Scheme, is well known to the Applicant following the successful construction and on-going operation of these existing renewable assets. It is a site that has an excellent and proven wind resource, as well as extensive existing access tracks and other infrastructure connecting into the local road network that would be utilised during the construction and operational phases, thereby considerably reducing requirements for new tracks and other infrastructure.

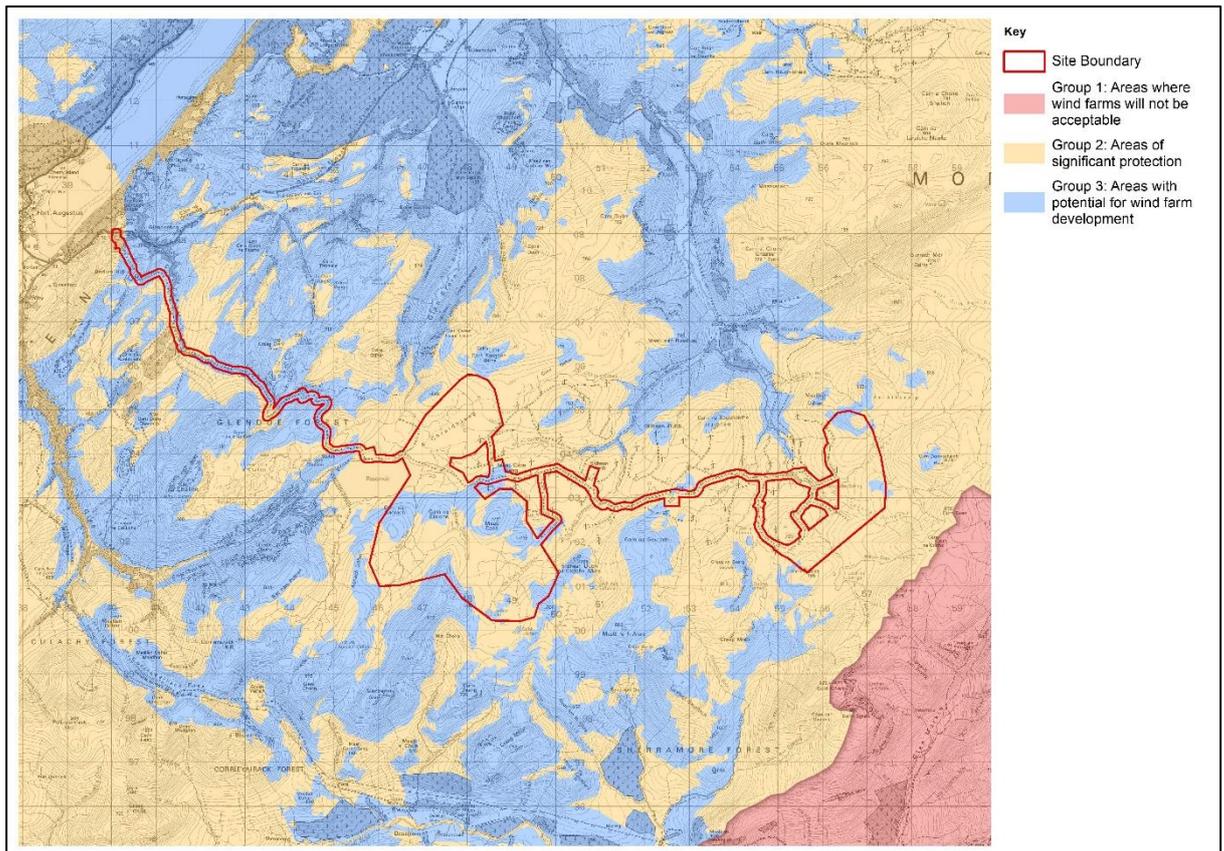
2.2.2 Following an agreement with landowners of both Glendoe and Garrogie Estates, a Proposed Development Area (PDA) was established whereby all technical and environmental studies would be focussed to determine where turbines could be located to maximise energy yield and minimise significant environmental effects. During the development of Stronelaig Wind Farm the area encompassing the majority of the western cluster was not available to the Applicant as a location for wind turbines.

2.2.3 Other factors leading to the selection of this site for the Proposed Development include:

- The Proposed Development is not situated in any areas designated for nature conservation, although there are a number of European and National designations in close proximity, namely Loch Knockie and nearby Lochs Special Protection Area (SPA), Monadhliath Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI). Figure 2.1: Natural Heritage Designations, illustrates those sites designated for natural heritage within the vicinity of the Proposed Development;
- The Proposed Development is not located within any areas covered by statutory landscape designations, although there are landscape designations and protected landscapes within the wider area. The Cairngorms National Park and the Monadhliath Wild Land Area (WLA) are located approximately 1km to the east of the Proposed Development at its closest point. Other WLAs are located within the wider area, as discussed within Chapter 7: Landscape and Visual Amenity. Furthermore, there are a number of landscapes identified of regional importance, referred to as Special Landscape Areas (SLAs). Figure 2.2: Designated and Protected Landscapes, illustrates designated and protected landscapes within the vicinity of the Proposed Development; and
- The Highland Council has developed Supplementary Guidance (SG), of particular relevance being the Onshore Wind Energy Supplementary Guidance (OWESG November 2016). Within OWESG, the Proposed Development lies partially in Group 2 (Areas of Significant Protection where wind farms may be appropriate in some circumstances, subject to the demonstration that any significant effects on the protected qualities of these areas can be substantially overcome by siting, design or other mitigation), and partially in Group 3 (where wind farms are likely to be acceptable, subject to detailed consideration) (Scottish Planning Policy (SPP) 2014) (see Plate 2.1). Of specific relevance to the Proposed Development, the Loch Ness Sensitivity Study within the OWESG sets out the potential for wind energy

development in LN6: Monadhliath ridge and tops, Rolling Uplands. This is the Landscape Character Area in which the Proposed Development sits, and it concludes that there is “limited scope for additional Large turbines within the existing pattern”. It also provides useful advice regarding the design of additional large turbines.

Plate 2.1: Proposed Development Site Boundary overlaid on the Onshore Wind Energy Supplementary Guidance



2.3 Design Considerations

- 2.3.1 Prior to arriving at a fixed design, consideration has been given to a range of factors including technical constraints, environmental constraints, economic factors and health and safety considerations. These factors have been determined by desk and field studies, consultation with stakeholders, and the knowledge and experience gained during the design development, construction and operational phases of both Stronelairg Wind Farm and Glendoe Hydroelectric Scheme. In addition, survey data collected specifically for the site has been utilised as part of detailed layout modelling undertaken through the use of AutoDesk Building Information Management (BIM) suite of infrastructure design software. This has been particularly useful in terms of designing the wind farm layout to avoid deeper areas of peat. This is discussed further in Section 2.4.
- 2.3.2 The applicant has used BIM principles and software for the first time in designing Cloiche. This has involved generating a highly detailed digital terrain model of the development area with LiDAR and aerial photography to produce a digital image of the site and visualised in AutoDesk Infracore. All further survey data, buffers, wind resource and

constraints were then layered into the model allowing a first pass design layout to be configured. Civil engineers, construction teams and operation teams were included to refine the design to increase the buildability of the design, reduce design errors and minimise earthworks. This process was enabled via the visualisations of Infracore where peat hags, track gradients, water crossings and other features could be assessed in the digital model, refined, exported to Civils 3D for detailed design and then re-imported to Infracore for further review. This iterative workflow continued, with feed in from the EIA team where appropriate, until a final design was achieved. This process has traditionally been conducted post-consent during design refinement.

2.3.3 Environmental considerations during the design process have included:

- Landscape character and visual amenity, particularly in relation to the Cairngorms National Park, Special Landscape Areas and Wild Land Areas;
- Sites designated for natural heritage, in particular, the Monadhliath SAC which lies adjacent to the site;
- Sensitive habitats, including ground water dependent terrestrial ecosystems, and areas of deeper peat;
- Protected species, including birds; and
- Hydrology and hydrogeology.

2.3.4 The site is remote from residential properties, the nearest of which is over 5km from the Proposed Development. Therefore, potential effects from noise during construction or operation of the wind farm have not been a key consideration during the design evolution phase, albeit potential effects have been considered (see Chapter 17: Noise) and there is no private water supply infrastructure within the vicinity of the Proposed Development.

2.3.5 Technical considerations during the design process have included:

- Steepness of slope;
- Peat depth;
- Watercourse crossings; and
- Wind resource.

2.3.6 Both environmental and technical considerations took cognisance of neighbouring developments (such as Stronelairg Wind Farm) during the design evolution process.

2.4 Design Evolution

2.4.1 There have been four principal stages in the evolution of the Proposed Development and the consideration of alternative layouts and turbine height. These stages are discussed below.

Pre Scoping (2017)

2.4.2 A high-level Landscape and Visual review was carried out in 2017 to identify the potential for additional large turbines adjacent to Stronelairg Wind Farm. This review explored opportunities for turbines to the north, east and west of Stronelairg Wind Farm and included a review of some of the turbines that had been originally proposed in the original Stronelairg Wind Farm application.

2.4.3 To the north, potential opportunities were identified in the areas around Carn na Saobhaide and Meall nan Ruadhag. However, after initial studies were undertaken, this

area was discounted due to technical constraints around steep slopes and potential visual impacts.

2.4.4 To the west, options for turbines on the Glendoe Estate had not previously been explored. Some ornithological concerns were raised about individual turbines, however, it was felt that these could be overcome through the design development stage and these areas were taken forward for further study. To the east, the area around Meallan Odhar was considered for development. Through the review, the most northern areas were discounted due to ornithological constraints. However, the more southern areas were considered suitable to be taken forward for further study.

2.4.5 The result of the high-level review led to the early identification of possible scope for further turbines to the west and east of the operational Stronelairg Wind Farm.

Scoping (August 2018)

2.4.6 At Scoping Stage, two separate PDAs (informed by the high-level landscape and visual review undertaken in 2017), were presented within the Cloiche Scoping Report (August 2018). There was no turbine layout included within the Scoping Report, however, a high-level technical review had indicated that up to 40 turbines could be considered for development within these areas. The maximum tip height of the turbines under consideration at this time was up to 175m.

2.4.7 The Proposed Development Areas presented at Scoping Stage ensured initial environmental and technical surveys carried out as part of the iterative EIA process covered the whole site being considered, to fully assist future design iterations.

Preliminary Design Workshop (June 2019)

2.4.8 Following preliminary analysis of environmental survey data collected as of June 2019, a design workshop was held to verify the key environmental constraints at the site. This included the preparation of a Zone of Theoretical (ZTV) diagram for an indicative layout and wirelines from key views and sensitive receptors, as well as consideration of peat depth data (Stage 1), habitat survey results (Phase 1, National Vegetation Classification (NVC) and Groundwater Dependent Terrestrial Ecosystems (GWDTE)), protected species survey results and ornithological survey data. A modelling exercise was also undertaken to establish any aviation (commercial or military) constraints for turbines up to 175m.

2.4.9 The design workshop provided an opportunity to discuss and highlight these key constraints prior to a preliminary design being established.

2.4.10 One of the main considerations at the design workshop was tip height. From a landscape and visual perspective, comparison was provided of the potential visibility of turbines at 175m tip height from key viewpoints, compared to turbines at circa 150m in height. It was also noted that turbines at 150m tip height or above would require a visible aviation lighting scheme to be incorporated.

Layout Options (August to October 2019)

2.4.11 During the months of August to October 2019 a number of layout options were considered and analysed prior to reaching a design fix. The key changes and modifications to the layout are described below. Reference should also be made to Technical Appendix 2.1: Design Statement which provides further information and comparative analysis of different layout and tip height options.

2.4.12 Initially, two layout options were developed by the Applicant’s wind resource team. These comprised a 40 turbine layout and a 32 turbine layout. Both layouts considered peat depth across the site and included a 50m buffer between turbines and watercourses. A 100m buffer was also applied to the Monadiath SAC. These two layout options are shown in Plate 2.2 and 2.3 below.

Plate 2.2: T40 Layout Options

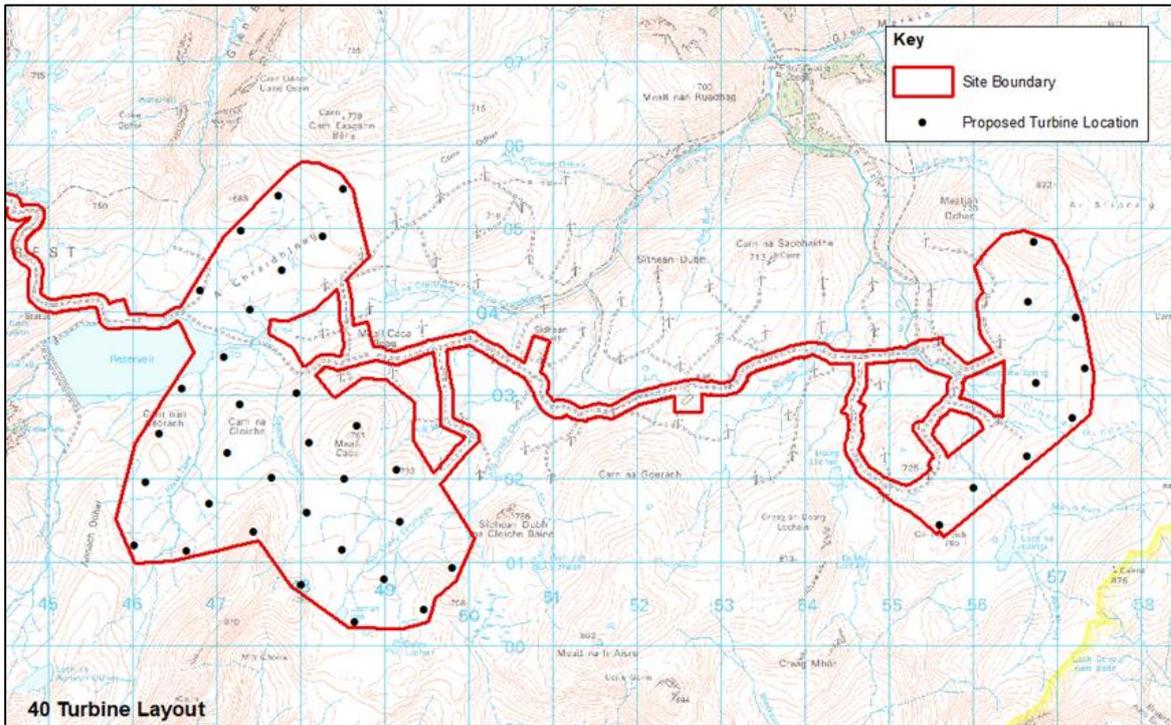
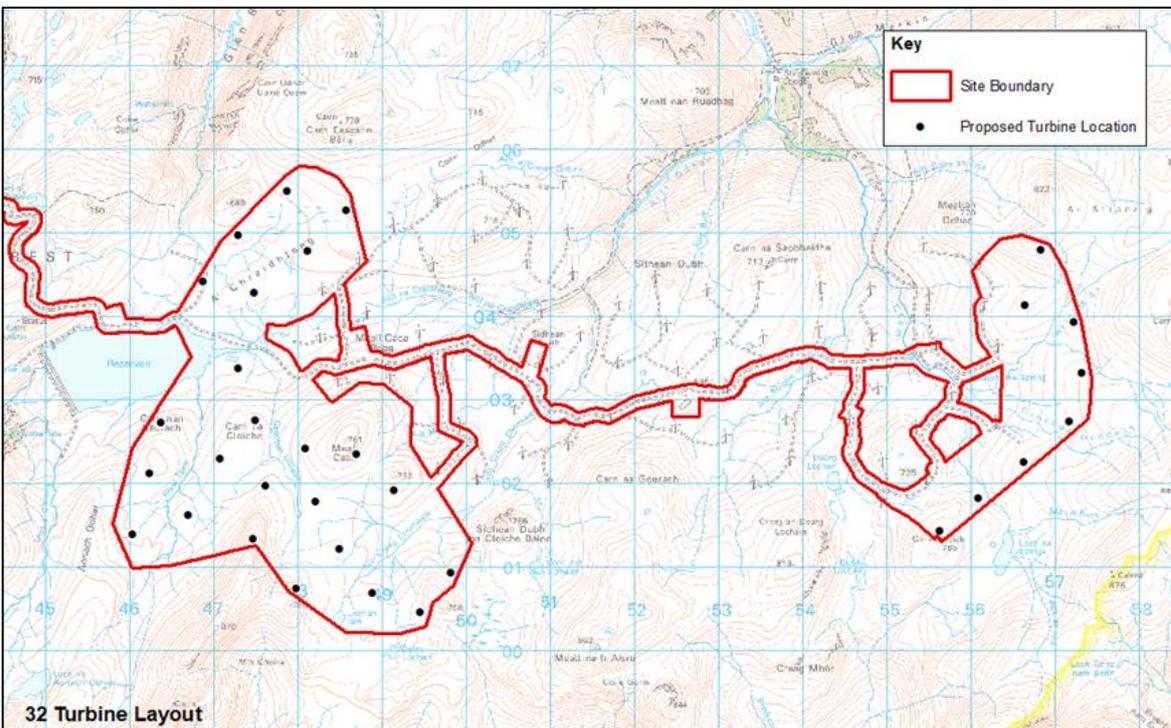
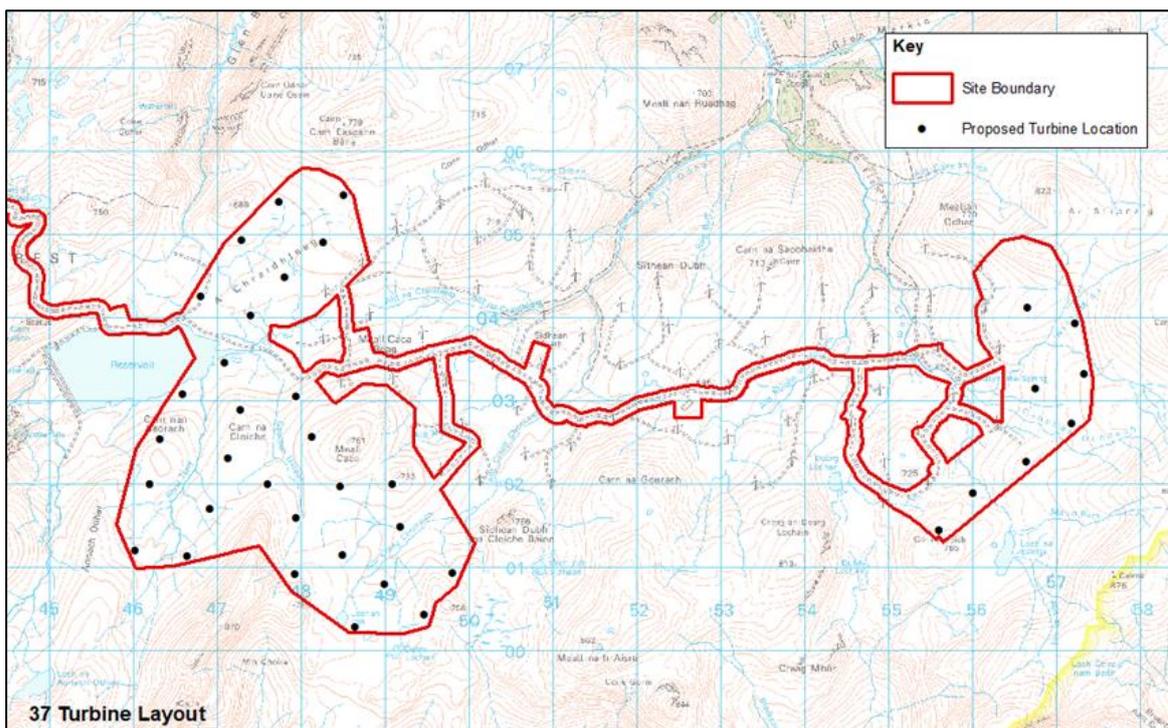


Plate 2.3: T32 Layout Option



- 2.4.13 A landscape and visual review of the two layout options was undertaken, considering the potential visual effect from key viewpoints, as well as the composition of the layouts, both in isolation and in combination with Stronelairg Wind Farm and other consented and operational wind farms in the vicinity.
- 2.4.14 Whilst the 32 turbine layout comprised fewer turbines compared with the 40 turbine layout, many of these turbines had been pushed towards the periphery of the site boundary, moving some of the turbines onto higher ground (compared with other turbines) to maximise energy yield. This had the effect of increasing the theoretical visibility of this layout on sensitive receptors such as the Cairngorms National Park and the Great Glen, including Urquhart Castle. Wireline analysis also noted that a number of turbines would appear very prominent from some viewpoints, including those within the vicinity of the sensitive receptors mentioned above.
- 2.4.15 Preliminary review of the 40 turbine layout identified three turbines that were considered to be particularly prominent from key viewpoints. These were subsequently removed from the layout as there was no opportunity to adjust their location to a position considered to be acceptable.
- 2.4.16 This exercise resulted in a modified 37 turbine layout being considered. This layout is shown in Plate 2.4.

Plate 2.4: Modified T37 Layout



- 2.4.17 Whilst some of the remaining 37 turbines were still prominent from sensitive receptors, it was felt that improvements to this layout could be made. As such, a number of turbine locations were adjusted slightly in order to achieve an improved composition and reduced visibility of turbines from key viewpoints, in relation to the scale and spacing of the existing development pattern, at the same time as minimising turbines breaching the skyline from views from the north side of Loch Ness as far as possible. Due consideration was also given to other constraints such as peat depth and watercourse buffers. In

general, it was felt that this modified 37 turbine layout appeared to be in proportion to the landscape and addressed some of the issues surrounding the prominence of particular turbines. Some potential constraints on sensitive bird species were however noted for further review and consideration of effects.

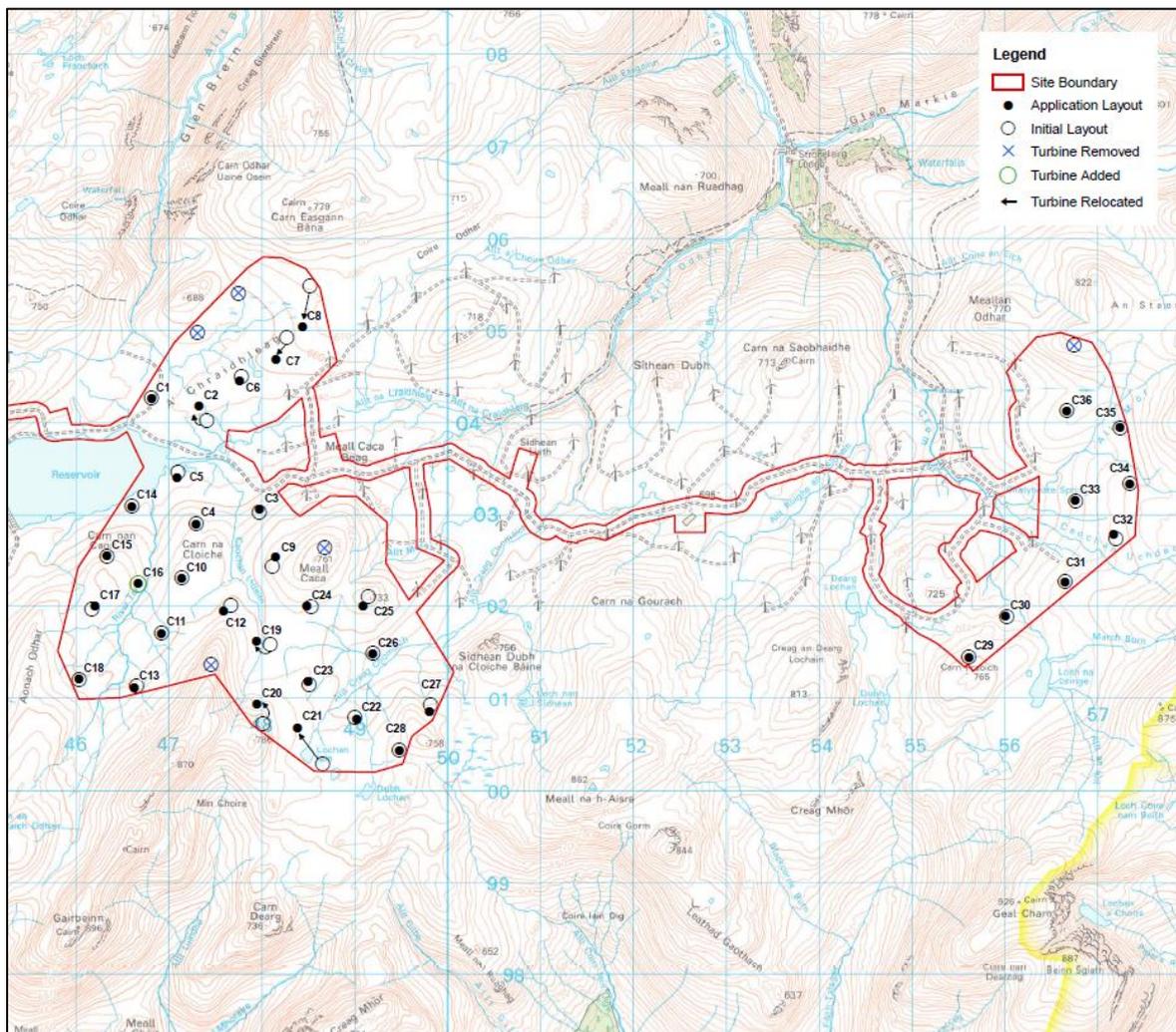
- 2.4.18 The layout options at this stage were focussed on turbine heights at circa 150m tip height, although consideration was also given to the potential for turbines up to 175m in height. From a landscape and visual perspective, the circa 150m tower height offered greater opportunity for minimising potential landscape and visual effects, particularly when considering the potential lighting requirements above 150m.
- 2.4.19 In parallel to the consideration of layout options, a transport review of different turbine heights was undertaken. Whilst the challenges associated with transporting turbines to site were well understood from the experiences gained at Stronelairg Wind Farm, further review was required given that turbine blades and tower sections proposed were larger than for Stronelairg Wind Farm.
- 2.4.20 The conclusion to this stage of the design evolution process was that the 37 turbine layout with turbines at circa 150m tip height should be taken forward for further technical and environmental review and refinement, and an infrastructure layout (including tracks and hardstandings) should be developed on this basis.

Infrastructure Layout (October to December 2019)

- 2.4.21 The final stage in the review of layout options involved detailed modelling of turbine locations and the internal track layout using the environmental survey data collected (including Stage 1 and Stage 2 peat depth data¹) and Lidar survey data within the InfraWorks software package.
- 2.4.22 A number of iterations were made to the layout at this stage. A key driver was to minimise disruption to peatland habitats therefore areas of deeper peat were avoided where practicable. Other notable modifications to the layout included:
- Deletion of two turbines to the north of the western cluster and relocation of another to minimise potential effects on Golden Eagle foraging;
 - Relocation of one turbine to the south of the western cluster to minimise potential effects on Greenshank; and
 - Inclusion of one additional turbine.
- 2.4.23 These modifications to the layout are shown in Plate 2.5.

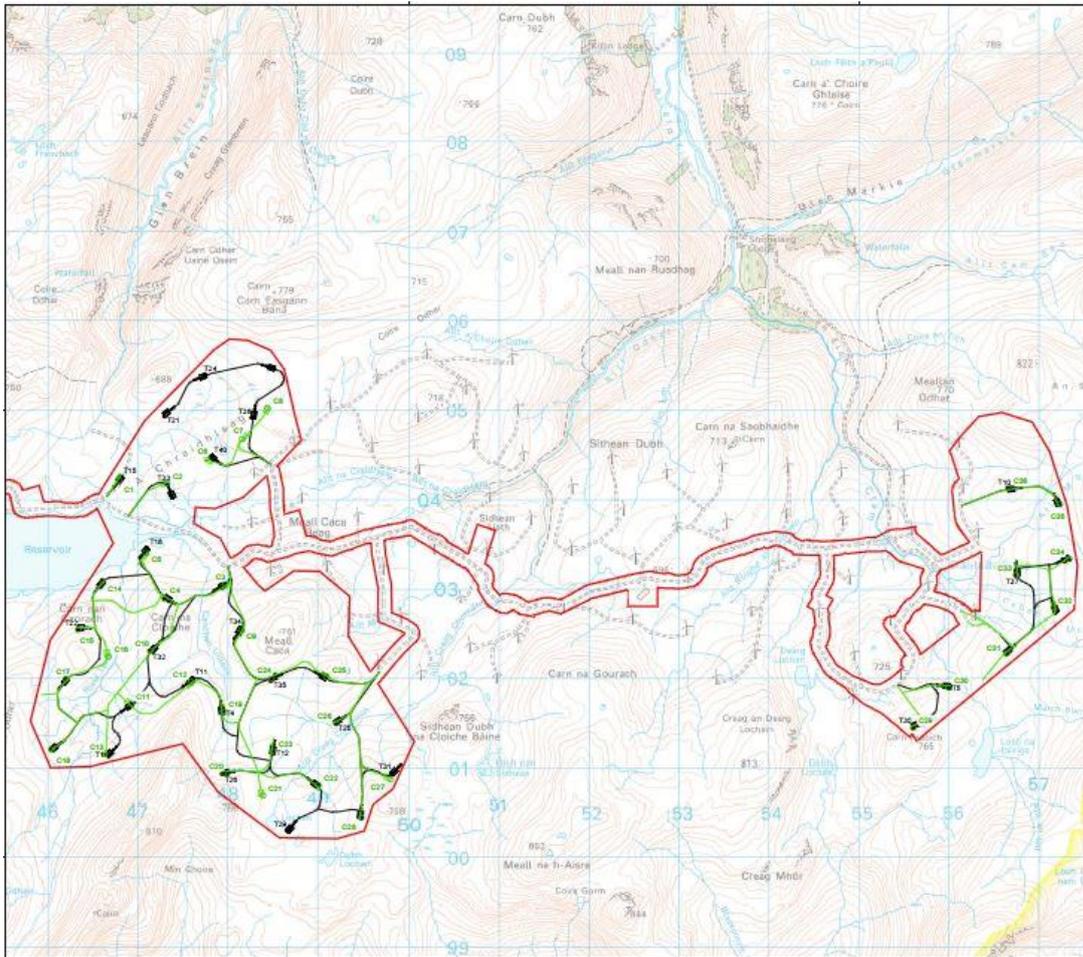
¹ Stage 1 (or Phase 1) peat probing is typically carried out across an entire site at lower resolution (e.g. on a 100m x 100m grid) to obtain peat depth measurements, while Stage 2 (or Phase 2) peat probing is typically targeted to development areas at a higher resolution (e.g. on a 10m x 10m grid).

Plate 2.5: Further Modifications to the Layout



2.4.24 Iterations were also made to the internal track layout to minimise watercourse crossings, and avoid sensitive habitats, water vole colonies and otter holts where practicable. A preliminary design fix was achieved in December 2019. Further consultation was undertaken with SEPA between January and March 2020 to provide Stage 2 Peat Depth data in relation to the preliminary design fix layout and seek opinion on the layout put forward. SEPA suggested minor alterations to the location of three turbines to minimise impacts on deeper areas of peat. These were duly made prior to a design fix being achieved.

2.4.25 All iterations of the internal track layout and turbine locations are shown on Plate 2.6.

Plate 2.6: All Design Iterations**Design Fix**

- 2.4.26 Design fix was achieved in March 2020. The final layout comprised 36 turbines with a tip height of 149.9m. The final layout is shown in Figure 3.1: The Proposed Development, and is assessed within this EIA Report.

2.5 References

The Highland Council, (2016). *Onshore Wind Energy Supplementary Guidance*. Available at:

https://www.highland.gov.uk/downloads/file/16949/onshore_wind_energy_supplementary_guidance-_nov_2016 (Accessed 23 January 2020).

The Scottish Government, (2014). *Scottish Planning Policy*. Available at: <https://www.gov.scot/publications/scottish-planning-policy/> (Accessed 23 January 2020).