# 3 Design Evolution and Alternatives

## 3.1 Introduction

3.1.1 This chapter of the EIAR provides information on how the Proposed Development site was identified by the Applicant, as well as the design iterations that were undertaken prior to arriving at the final development layout and design in accordance with the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (Scottish Government, 2017) (hereafter referred to as 'the EIA Regulations').

3.1.2 The iterative design process provides an opportunity to consider a range of environmental impacts and integrate technical and environmental considerations into the iterative design of the Proposed Development, allowing potential environmental effects to be considered, avoided and minimised. Environmental impacts are therefore considered within the Proposed Development design layout from the earliest stage.

3.1.3 This chapter draws on issues considered in more detail in the relevant technical chapters (**Chapters 6** to 14). This chapter does not pre-empt the conclusions of the later chapters, but rather explains how potential environmental impacts have informed the design of the Proposed Development.

3.1.4 The final design for the Proposed Development is described in detail in **Chapter 2: Project Description** and shown on **Figure 1.2**.

## 3.2 Site Location, Site Selection and Considerations of Alternatives

### Site Location

3.2.1 The Proposed Development is located on the Hill of Fare (British National Grid NJ 70063 02717) approximately 6 km north of Banchory (refer to **Figure 1.1**). A full description of the characteristics of the Proposed Development site are described in **Chapter 2: Proposed Development.**

### Site Selection

3.2.2 The Applicant utilises a sophisticated Geographic Information System (GIS) model for site selection which seeks to mirror planning, environmental, technical and commercial constraints. The GIS model is updated regularly when new data becomes available or when other factors change. Where available and appropriate, the GIS model incorporates published advice from statutory consultees. The Applicant's use of the GIS model enables objective and consistent treatment of the whole country to assist with site selection.

3.2.3 The GIS model is based upon a combination of generalised and graded suitability layers covering environmental, economic and technical aspects, known as 'key layers'. All key layers are assessed using a 0% – 100% suitability scale, represented by a 0 – 1 score, where 0 represents unsuitable and 1 represents 100% suitability.

3.2.4 The key layers included in the GIS model are as follows:

- wind speed;
- proximity to housing;
- natural and built heritage constraints; and
- slope constraint.

3.2.5 In addition, for each site, a visual sweep of the following 'informative layers' is carried out:

- national and local planning policy / development plans / spatial frameworks (discussed in **Chapter 5: Planning & Policy Context**);
- Ministry of Defence (MOD) tactical training areas;
- International, national and local designated sites;
- Desk based data for watercourses and peat;
- electromagnetic links and utilities;
- proximity to other wind farm sites (pre-planning, consented and operational); and
- other information gleaned from maps or knowledge of the area such as masts, undesignated parks, tourist attractions, etc.).

3.2.6 These informative layers are included in the GIS model to identify if there is potential for a wind farm.

### Consideration of Alternatives

3.2.7 As noted in Planning Advice Note (PAN) 1/2013, "*Whilst the Directive and the Regulations do not expressly require the applicant to study alternatives, those alternatives which are in any case considered as part of the project planning and design process must be assessed, and an outline of the main alternatives studied by the applicant included in the EIA Report. The EIA Report must also give an indication of the main reasons for the choice made, taking into account the environmental effects.*"

3.2.8 The Applicant uses a range of criteria to select sites for the development of renewable energy projects. As part of the growth plans for the development of renewable energy projects, the Applicant is continually assessing potential onshore wind farm sites. This involves a desk-based assessment utilising secondary data and GIS to identify constraints at a particular site. Sites that are not deemed suitable at one given time (i.e. 'the alternatives') may at a later date be re-assessed in respect of technical and environmental constraints and opportunities, as well as up to date planning policy. Hence, for commercial reasons and in accordance with PAN 1/2013, it is not possible to disclose the names or positions of the alternative sites.

3.2.9 The main alternatives including design, turbine specification, location, size and scale have been considered for the Proposed Development. **Section 3.4** explores these options and explains how the final design of the Proposed Development has evolved.

## 3.3 Key Issues and Constraints

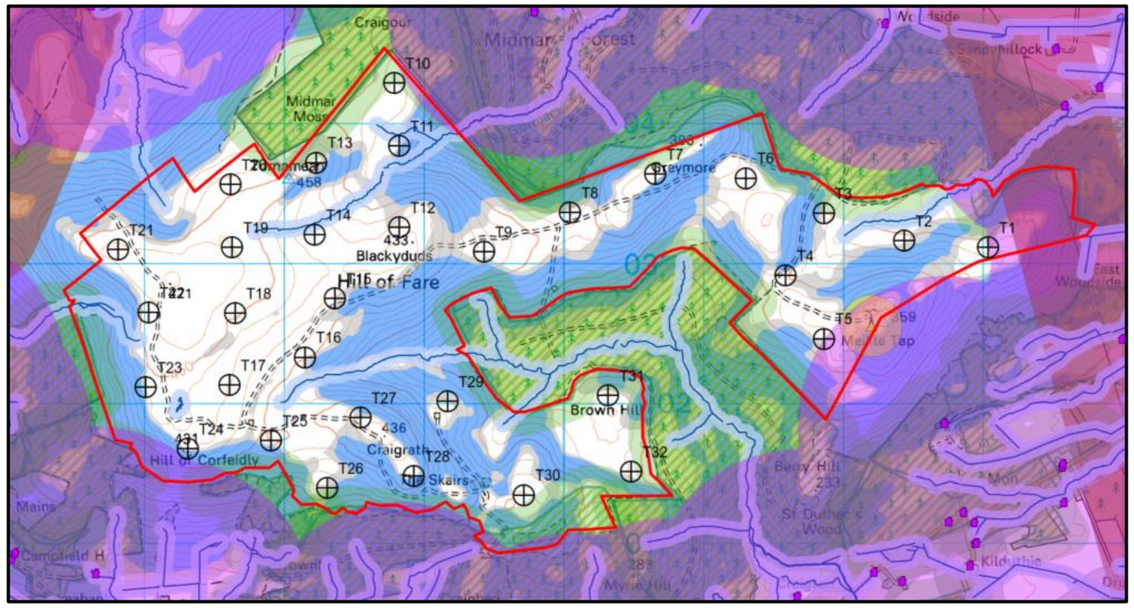
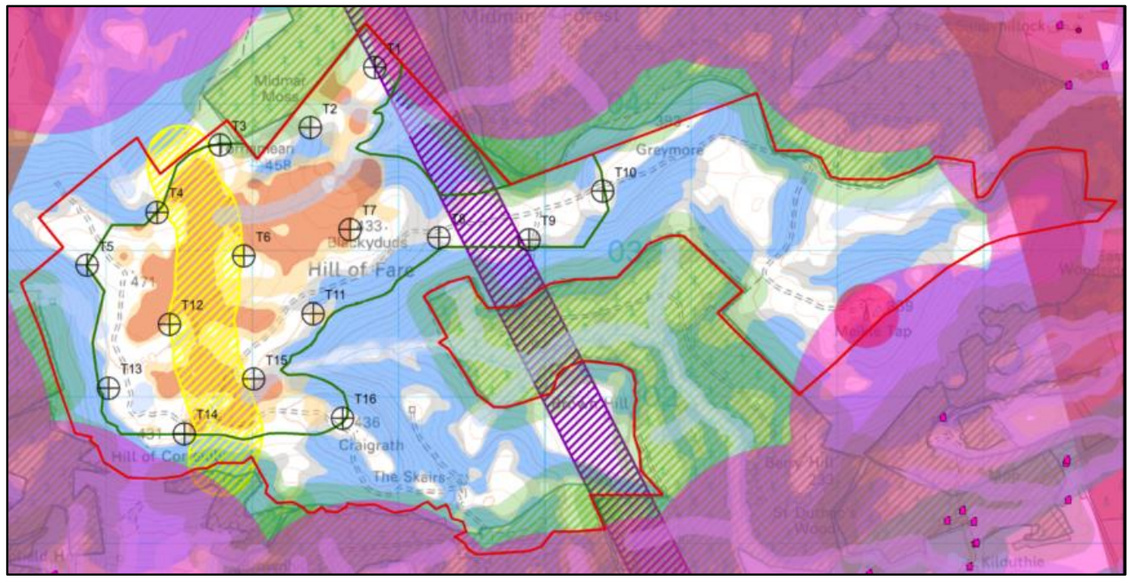
3.3.1 Once the site was identified, key issues and constraints for consideration in the design process were established through a combination of desk-based research, extensive field survey and consultation (through the EIA Scoping process). The design process considered the following key issues and constraints:

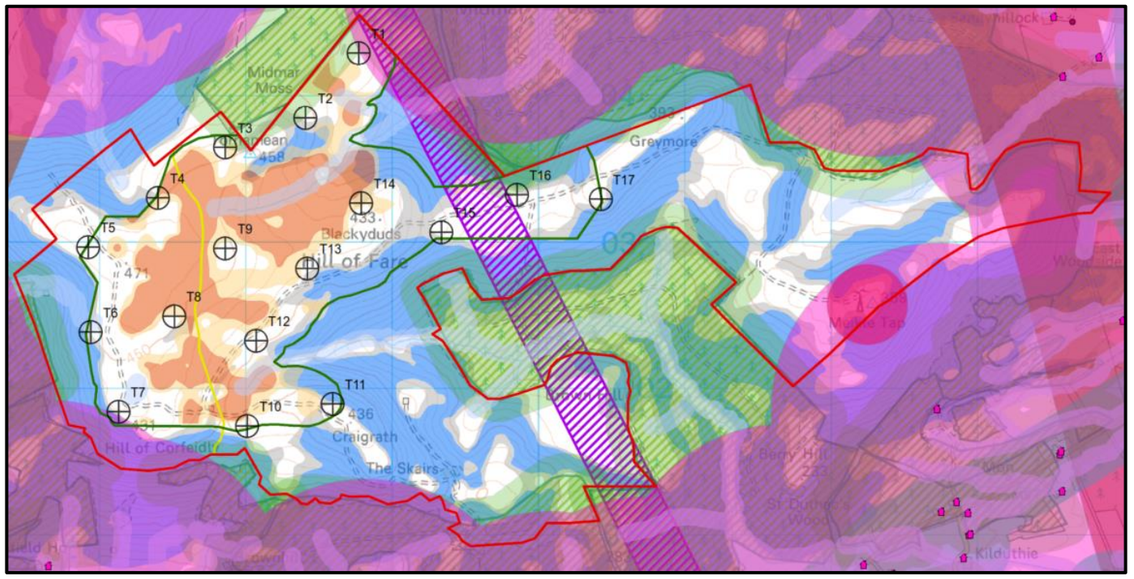
- landscape designations and visual amenity;
- archaeological and cultural heritage assets;
- sensitive fauna;
- sensitive habitats;
- watercourses, private water supplies and sensitive surface water features;
- topography and ground conditions;
- public road accessibility;
- recreational and tourist routes;
- proximity of residential properties;
- aviation and defence constraints; and
- presence of utilities.

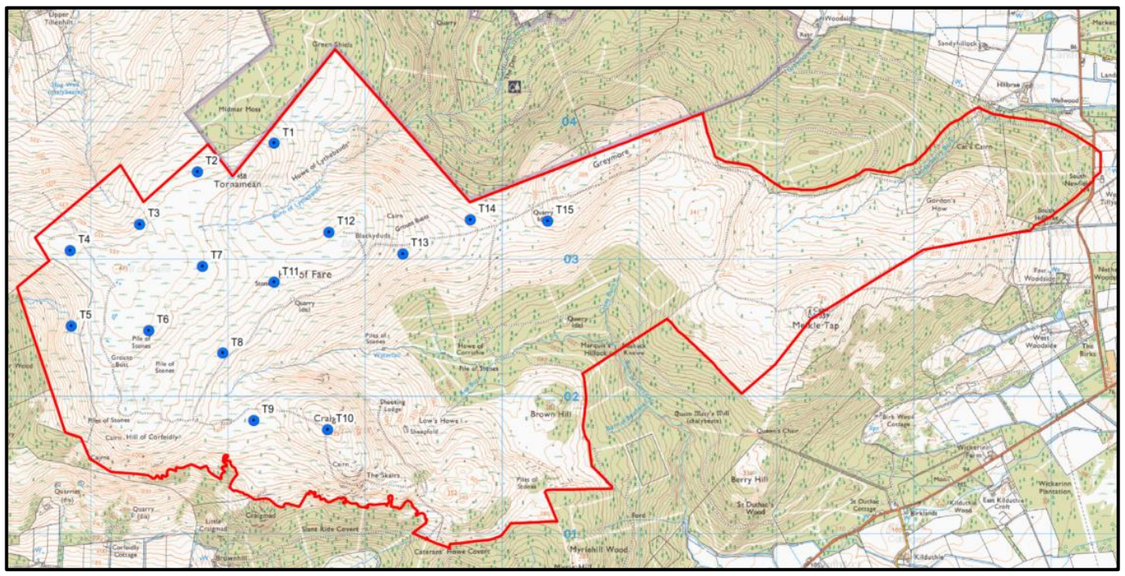
3.3.2 Information in respect of the survey work to identify various key issues and constraints and how they have contributed to the layout design has been investigated in greater detail in the technical chapters of this EIAR (**Chapters 6 to 14**).

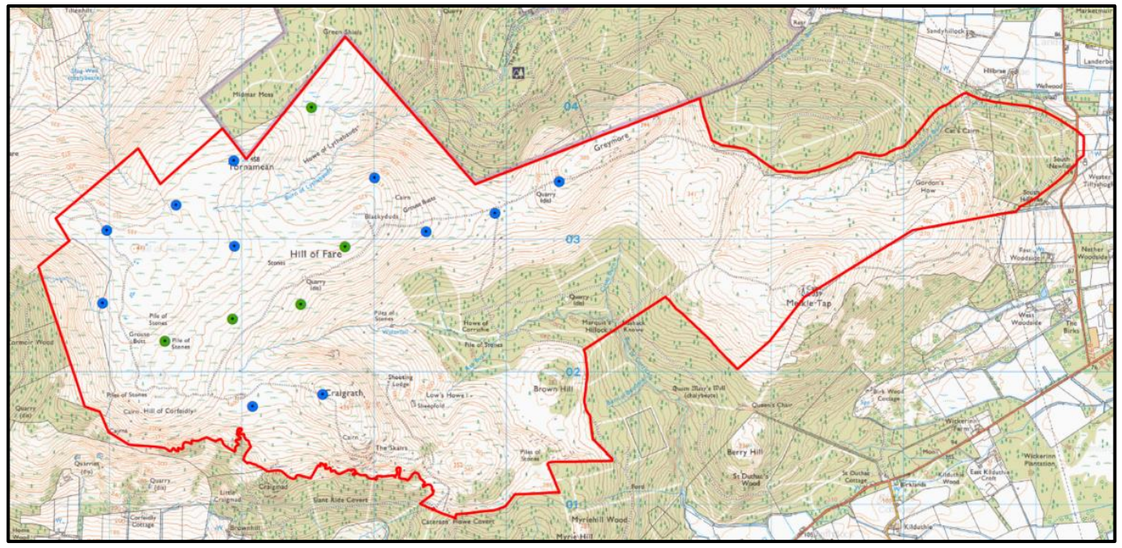
3.3.3 The identification of key issues and constraints during the iterative process has allowed for issues to be addressed and the careful placement of infrastructure for the Proposed Development within the site. The EIA team has been able to identify effective mitigation, with potentially significant adverse effects avoided or minimised as far as reasonably practicable through the design process. A summary of the design evolution and potential impacts addressed through the design process is provided in **Table 3.1**. **Table 3.2** categorises the potential impacts following the selection of the final design and where in the EIAR these are assessed in detail.

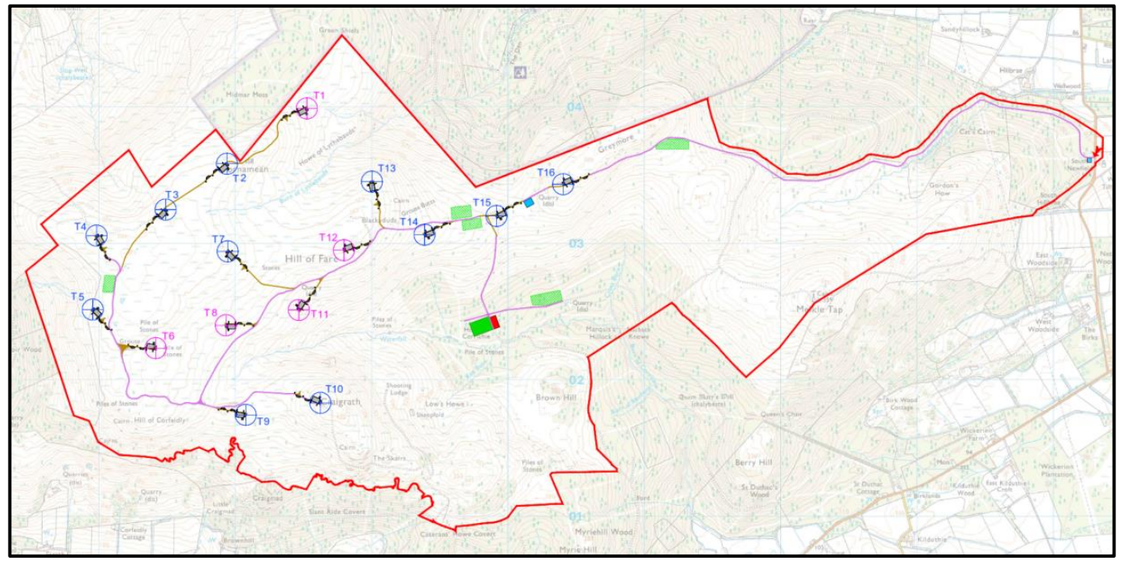
## Table 3.1: Summary of Design Evolution

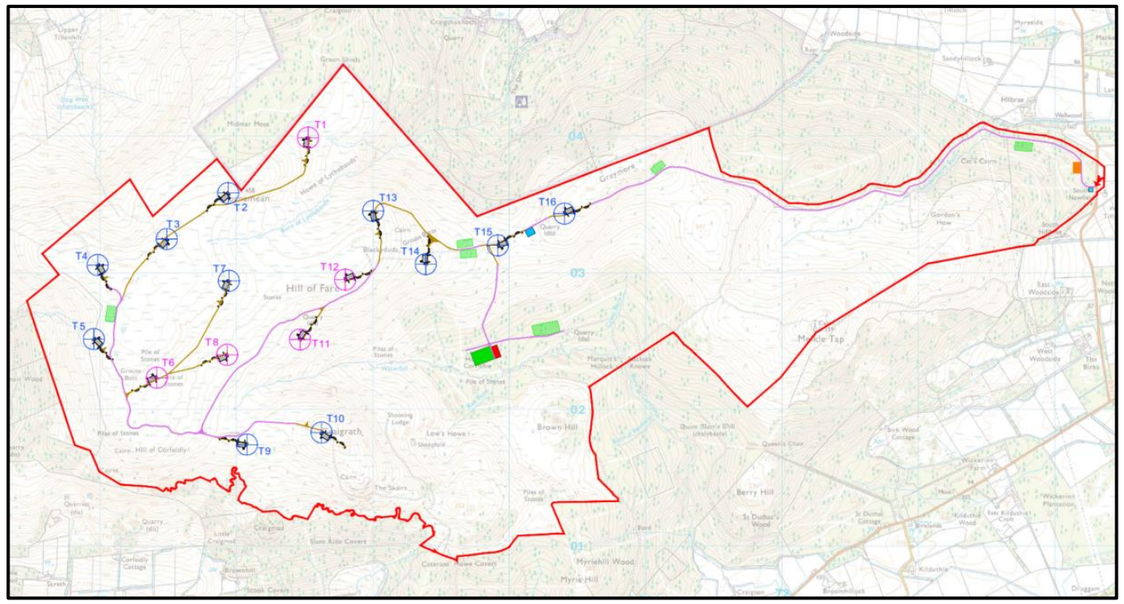
| Layout 1 – Assessment of Site Potential | |
|---|---|
|  | No. of turbines: 32<br>Turbine tip height: 200 m<br>Site capacity: 179.2 MW<br>First layout produced in Q3 2020 as a result of the GIS modelling, accounting for initial high level site constraints including watercourses, slope, housing, forestry edges and infrastructure including a mast and overhead line (OHL).<br>The project is progressed following approval from Applicant's internal process and agreement with the landowner. Two years' worth of ornithology site survey work commissioned. |
| **Layout 2 – Wind Turbine Developable Area** | **Notes** |
|  | No. of turbines: 16<br>Turbine tip height: 200 m<br>Site capacity: 96 MW<br>Feasibility studies undertaken in Q4 2020 for grid, planning and Landscape and Visual (L&V).<br>Following results of the L&V review a 'Wind Turbine Developable Area' is created as a high level guide to form a single coherent group of turbines on the west of the site (green boundary). This focussed the area for phase 1 peat survey work, the results of which informed the layout with turbines located to avoid deep peat (orange/brown areas on the west of the site).<br>An underground cable was confirmed on-site and buffered until more was understood of it (yellow hatching).<br>A micropath/microwave link was confirmed to pass through the site and was given a buffer from turbines (purple hatching). |

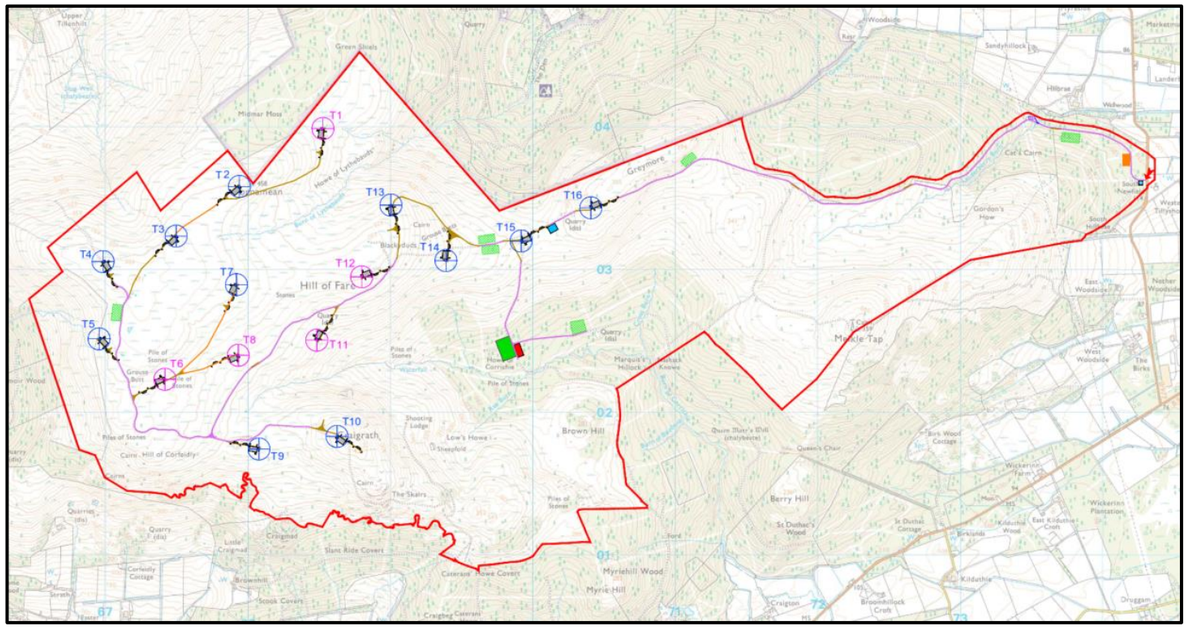
| Layout 3 - Scoping Layout | Notes |
|---|---|
|  | No. of turbines: 17<br>Turbine tip height: 250 m<br>Site capacity: 122.4 MW<br>Updated for submission to Scoping in Q2 2022.<br>Wind monitoring equipment installed on-site to gather wind conditions and inform background sound monitoring.<br>Potential for underground cable to be removed if required so buffer removed for time being.<br>With no topography to hide the turbines and market signals indicating trend towards taller turbines, the layout is progressed with tip heights of 250 m. At the time of Scoping submission, there were several projects across Scotland at different stages of the planning and development process at approximately this height, for example:<br>• Lethans Wind Farm, consented in 2020 with 220 m tip heights;<br>• Rothes III Wind Farm, proposed 225 m tip heights; and<br>• Dunside Wind Farm, scoped 260 m tip heights.<br>As part of a technical review, efficiencies in layout design were found with turbine spacing reduced to 3.5 Rotor Diameters (RD), thus freeing space for the 17th turbine. |

| Layout 4 - Design Workshop | Notes |
|---|---|
|  | No. of turbines: 15<br>Turbine tip height 242.5 m<br>Site capacity: 108 MW<br>EIA team brought together in a workshop to refine the layout in Q4 2022.<br>Results from habitat surveys and hydrological analysis provided data on potential Ground Water Dependent Terrestrial Ecosystems (GWDTE) for which the more sensitive areas are avoided.<br>In light of further L&V reviews, larger buffers were applied to properties and settlements which pushed turbines inward away from the southern, western and northern edges. This led to a reduction in the number of turbines including deletion of T7 from Layout 3.<br>In addition to these L&V constraints, an area of sensitive GWDTE was identified, the requirement for a watercourse crossing and traversing peat was identified and T1 from Layout 3 was deleted. Removing T1 also mitigated potential adverse setting effects upon cultural heritage assets outwith the site to the north including Barmekin Hill Fort.<br>Another constraint identified and treated with caution was an estimated area for the potential designation of a Battlefield. Historic Environment Scotland (HES) was considering an application to register a battlefield relating to the Battle of Corrichie and whilst there was no decision from HES and limited information to go on, turbines were set back from the glen leading from Hill of Fare to the Howe of Corrichie.<br>A buffer was re-applied to the underground cable with preference to leave it in-situ. This had no effect on layout.<br>To reduce potential L&V impacts on the Hill of Fare it was considered that the Battery Energy Storage System (BESS), Control Building and Substation could potentially be located in the more sheltered area of commercial forestry. The site boundary was adjusted and surveys commenced within this area. |

| Layout 5 - Turbine Layout Chill | Notes |
|---|---|
|  | No. of turbines: 16<br>Turbine tip height: 11 x 180 m & 5 x 200 m<br>Site capacity: 105.6 MW<br><br>Public feedback following the first round of public exhibitions was reviewed. Concern was raised over the height of the turbines. Consultation with aviation stakeholders also indicated that potential adverse effects upon both radar and instrument flight procedures could be mitigated by reducing the tip heights. Reducing the tip heights would also further lessen the potential impacts upon setting of cultural heritage assets and residential amenity.<br><br>In Q1 2023 a resultant layout of a mixed tip height scheme was produced. Owing to the reduced tip heights, turbine tip height related buffers were reduced and a 16th turbine could be fitted within the design. Tip heights of 180 m are the shortest heights that can be invested in with confidence of procuring in line with the estimated construction start date.<br><br>Background sound monitoring was commissioned. |

| Layout 6 - Preliminary Infrastructure Layout | Notes |
|---|---|
|  | No. of turbines: 16<br>Turbine tip height: 11x 180 m & 5 x 200 m<br>Site capacity: 105.6 MW<br><br>A preliminary infrastructure layout was produced including locations for the BESS, control building, substation, temporary enabling works compound, temporary construction compound, borrow pit search areas, crane hardstandings, turning heads and access tracks. The existing site entrance on the east was utilised and would be upgraded and existing access tracks were to be used as much as possible in the design.<br><br>Given the nature of the bedrock underlying the site, and the limited depth and extent of superficial cover, any adverse impacts on groundwater resulting from the Proposed Development would be limited, and spatially restricted to the footprint of the development infrastructure and immediate surrounds.<br><br>The borrow pit search areas were included to reduce reliance upon imported stone, impacting the road network through construction traffic. Search areas were identified, within which any resultant borrow pit would be located. Borrow pits would be much smaller than the overall search areas. Ground investigation work will be undertaken pre-construction to confirm final borrow pit sizes. |

| Layout 7 - Infrastructure Layout Chill | Notes |
|---|---|
|  | No. of turbines: 16<br>Turbine tip height: 11x 180 m & 5 x 200 m<br>Site capacity: 105.6 MW<br><br>HES determined the Battlefield would not be designated which removed any uncertainty for infrastructure locations within the Site with respect to cultural heritage.<br><br>A temporary concrete batching plant was added near the site entrance in case concrete can't be sourced close enough to site given the short period of time available for successfully completing turbine foundation pours. An additional borrow pit search area was added, which provides more potential for sourcing site-won stone for track upgrades and compounds. Whilst suppliers may be needed, inclusion of such infrastructure has potential to reduce impact on road network through reduced construction traffic importing concrete and aggregate. Whilst this infrastructure is within the Ancient Woodland designated area, the infrastructure is temporary and the forestry which is commercial by nature has already been destroyed by Storm Arwen and subsequently cleared.<br><br>The access track network was revised to ease transit of turbine delivery loads. Through the identification of sections of floating track, overall track length was reduced and impacts upon peat were minimised.<br><br>This chilled layout informed the on-site phase 2 peat survey coverage and final hydrological and cultural heritage walkovers.<br><br>Background sound surveys were completed and fed into modelling which confirmed the layout can meet appropriate sound limits at residential properties.<br><br>This Infrastructure Layout Chill was presented to the public in the final round of public exhibitions in June 2023. |

| Layout 8 - Design Freeze Layout | Notes |
|---|---|
|  | No. of turbines: 16<br>Turbine tip height: 11x 180 m & 5 x 200 m<br>Site capacity: 105.6 MW<br><br>Following the results of the phase 2 peat survey work, some infrastructure was microsited to avoid pockets of deep peat including:<br><br>• BESS area rotated 90 degrees to avoid a pocket of deep peat discovered in the SW corner;<br>• T3, T7 & T11 microsited away from deep peat; and<br>• Extent of borrow pit search area near the BESS was reduced in size to avoid deep peat.<br><br>It was confirmed with the landowner that the Temporary Enabling Works Compound that would be used during construction could also be used during operation as public car parking.<br><br>Passing places were added to spine access track.<br><br>Following micrositing, some infrastructure was located outwith the peat survey data range. Whilst these data gaps are minimal and can be surveyed pre-construction, additional surveys were commissioned to provide a complete dataset for consultees.<br><br>Discussions with the landowner concluded with an agreement for compensatory planting to be accommodated on-site. In addition, site-wide biodiversity enhancement and management practices have been agreed between the EIA team and the landowner including riparian tree planting, bracken control, self-seeding tree management and degraded peatland restoration.<br><br>An L&V residential amenity survey was undertaken to complete the photography work. |

## Table 3.2: Summary of Mitigation by Design

| Issue | Environmental Constraint / Potential Effect | Design Mitigation | Issues Remaining |
|---|---|---|---|
| Landscape and Visual | The following key landscape and visual sensitivities were identified in the vicinity of the site:<br>• potential impacts on landscape character as a result of the scale of the turbines in the landscape;<br>• potential impacts on the designated landscapes outwith the site, namely the Dee Valley Special landscape Area (SLA);<br>• potential impacts on visual amenity, particularly residential visual amenity, including from properties around Hill of Fare and from wider communities / settlements including Midmar, Echt, Banchory, Milton of Camfield and Torphins;<br>• potential impacts on the night time environment arising from the lighting of turbines. | The final layout of the Proposed Development has adopted the following design measures:<br>• the number of turbines has been reduced from 17 to 16 (turbine 1 was removed completely);<br>• turbine tip heights were scoped to be 250 m but have now been reduced to 200 m for five turbines and 180 m for 11 turbines;<br>• turbines 6 – 9 and turbines 12 -14 (as shown in the Scoping Layout - layout 3 in **Table 3.1** above) moved to be set back from ridgelines rather than sitting on ridges; and<br>• agreement of a reduced aviation lighting scheme with the CAA, resulting in only 7 turbines being fitted with visible aviation warning lighting located on the nacelle.<br>Throughout the design evolution of the Proposed Development, a key driver has been the consideration of potential landscape and visual effects on receptors including how the Proposed Development would relate to the existing landscape character. | The landscape and visual impacts of the Proposed Development are addressed further in **Chapter 6: Landscape and Visual Impact Assessment**. |
| Archaeology and Cultural Heritage | The following key archaeological and cultural heritage sensitivities were identified in the vicinity of the site:<br>• potential effects on the settings of designated heritage assets in the wider landscape namely Barmekin of Echt fort (SM57), Sunhoney stone circle (SM44) and Midmar Castle (including sundial, walled garden and outbuildings) (LB16262);<br>• potential effects on the setting of scheduled moments within the vicinity of the site; and<br>• cumulative effects on the settings of designated heritage assets in the wider landscape.<br>Within the Site there are 29 non-designated heritage assets (consisting of 10 separate Historic Environment Record (HER) entries). The following key archaeological and cultural heritage sensitivities were identified on the site:<br>• potential effects on regionally important asset (NJ60SE004/SLR86) and HER assets within the site boundary; and<br>• potential effects on the site of the Battle of Corrichie, which has undergone consideration by Historic Environmental Scotland (HES) for inclusion on the inventory of historic battlefields. This was refused by HES. | The final layout of the Proposed Development has adopted the following design measures:<br>• Deletion of the turbine 1 and movement of micro- siting of turbine 2 to reduce the potential indirect impacts on the hill fort and Midmar Castle;<br>• Siting turbines as far south as possible within the development area to reduce the potential impacts on setting from Midmar Castle, Sunhoney Stone Circle and Barmekin of Echt. Specifically, turbines 11,12 and 14 were moved to the southern sides of the ridgeline to utilise the topography where possible in line with siting turbine guidance (NatureScot, 2017); and<br>• HES concluded that the site of the Battle of Corrichie will not be included on the inventory of historic battlefields at this time.<br>While not a design mitigation and rather an enhancement, the Applicant is proposing to include a cultural heritage walking trail within the Proposed Development. Such a trail will enhance the ability to understand, appreciate and experience designated heritage assets in the area including Bamekin of Echt, Upper Broomhall and Sunhoney stone circle. | The archaeological and cultural heritage impacts of the Proposed Development are addressed further in **Chapter 7: Archaeology and Cultural Heritage**. |
| Ecology | The following key ecological sensitivities were identified in the vicinity of the site:<br>• potential effects on sensitive habitats through habitat loss, fragmentation and degradation, including peat forming habitats; | The Proposed Development has been designed to reduce the potential for ecological effects by avoiding more sensitive ecological interest features including:<br>• avoidance of areas of deeper peat and floating access tracks where not possible to divert away from deeper peat - this has | The ecological effects of the Proposed Development are addressed further in **Chapter 8: Ecology**. |

| Issue | Environmental Constraint / Potential Effect | Design Mitigation | Issues Remaining |
|---|---|---|---|
| | • potential effects on protected species e.g. mammals, bats, fish, etc.;<br>• cumulative effects as arising from the addition of the Proposed Development in combination with other relevant projects; and<br>• potential effects on statutory sites within 5 km designated for ecological interests. | reduced habitat loss of more sensitive, higher quality habitats such as blanket bog;<br>• avoidance of watercourses – these have been buffered by 50 m, apart from locations where access tracks unavoidably need to cross watercourses;<br>• avoidance of bat habitat features – buffers of 108 m (for 200 m tall turbines) and 87 m (for 180 m tall turbines) have been maintained between turbine blade tips and the nearest woodland edge, as set out in current NatureScot guidance (NatureScot et al. 2021); and<br>• Avoidance of badger setts – all setts found during the baseline surveys have been avoided by a minimum 100 m buffer. | |
| Ornithology | The following key ornithological sensitivities were identified in the vicinity of the site:<br>• short-term reduction in breeding or wintering bird populations due to construction disturbance (affecting breeding or foraging behaviour and potentially resulting in a reduction in productivity or survival);<br>• long-term reduction in breeding or wintering bird populations due to the loss/fragmentation of habitat critical for nesting or foraging;<br>• long-term reduction in breeding or wintering bird populations due to collision mortality;<br>• cumulative effects with other projects or activities that are constructed during the same period, and/or with projects or activities which pose either a potential collision risk or loss of habitat by displacement; and<br>• potential effects on statutory sites within 20 km designated for ornithological interests. | The Proposed Development has been designed to avoided more sensitive ornithological habitats.<br>No significant ornithological effects are expected as a result of the Proposed Development either during construction or operation. Nonetheless, best practice mitigation during construction would be followed through the appointment of an Ecological Clerk of Works (ECoW) and the production of a Construction Environmental Management Plan (CEMP), a Bird Disturbance Management Plan and a Biodiversity Enhancement and Management Plan. | The ornithological effects of the Proposed Development are addressed further in **Chapter 9: Ornithology**.<br>In addition, an Outline Biodiversity Enhancement and Management Plan is available in **Technical Appendix 8.5.** |
| Peat and Soils | The following key peat and soil sensitivities were identified in the vicinity of the site:<br>• potential effects of excavated peaty soils;<br>• potential effects of sliding of peatlands; and<br>• Potential effects on peatland habitats through habitat loss, fragmentation and degradation. | The Proposed Development has been designed to avoided areas of deeper peat reducing the habitat loss of more sensitive higher quality habitats such as blanket bog wherever possible.<br>Where access tracks cannot avoid areas of deeper peat the use of floating access track construction has been adopted to minimise impact.<br>The Proposed Development has been designed to avoid any areas of ground which may be subject to peat slide risk, where possible. The ground condition factors that were considered in the design of the Proposed Development were:<br>• identification of areas of peat to minimise incursion, protect from physical damage, minimise excavation and transportation of peat, reduce potential for peat instability and minimise potential soil carbon loss;<br>• identification of slope angles greater than 4˚- to minimise soil loss and potential instability; and<br>• avoidance of areas where initial peat stability concern was identified where possible – to avoid areas with possible instability issues and associated indirect effects on surface water. | The potential impacts on peat and soils due to the Proposed Development are addressed further in **Chapter 10: Hydrology, Geology, & Hydrogeological Assessment, Technical Appendix 10.1: Peat Slide Risk Assessment** and **Technical Appendix 10.2: Peat Management Plan**. |

| Issue | Environmental Constraint / Potential Effect | Design Mitigation | Issues Remaining |
|---|---|---|---|
| | | Proposals for peatland restoration have been included in the outline Biodiversity Enhancement and Habitat Management Plan, seeking to restore areas of degraded peatland habitats. | |
| Hydrology | The following key hydrological sensitivities were identified in the vicinity of the site:<br>• potential effects on designated sites due to potential changes in surface and/or groundwater quality and quantity;<br>• potential effects on the catchments due to changes in surface and/or groundwater quality and quantity;<br>• potential localised increase in flood risk due to watercourse crossings;<br>• potential effects on GWDTE through changes to site hydrogeology;<br>• potential effects on Public or Private Water Supply (PWS) abstractions due to potential changes in surface and/or groundwater quality and quantity; and<br>• potential for peat slide risk. | The Proposed Development has been designed to reduce the potential for hydrological impacts by avoiding more sensitive hydrological interest features including:<br>• avoidance of watercourses – these have been buffered by 50 m, apart from locations where access tracks unavoidably need to cross watercourses;<br>• minimising the number of watercourse crossings through the layout design process, with the result of one watercourse crossing which already exists and requires upgrading;<br>• avoidance of private water supply catchments – these have been buffered by at least 650 m to the nearest turbine locations.<br>• avoidance of high dependency GWDTE - areas with potential to be GWDTE were examined. They were found to be limited in extent across the site and mainly confined to the upland moorland areas and adjacent to watercourses. Areas of high potential for GWDTE have been avoided by site infrastructure across the site.<br>The Proposed Development incorporates good practice drainage design during construction and operation adopting a sustainable drainage system (SuDS) approach to control the rate, volume and quality of runoff from the Proposed Development. | The hydrology and hydrogeology effects of the Proposed Development are addressed further in: **Chapter 10: Geology, Hydrology and Hydrogeology Assessment**. |
| Topography | The following key topographical sensitivities were identified in the vicinity of the site:<br>• potential for peat slide risk;<br>• potential for deep cut / fill slopes around infrastructure; and<br>• potential for safety risks to personnel during construction and operation of the Proposed Development. | The Proposed Development has been designed to reduce the potential for topographical impacts by avoiding:<br>• areas of the site where the topography is greater than 12 % slope gradient for turbine and adjacent crane hardstand positioning;<br>• positioning the crane hardstand downslope of the proposed turbine location where other site constraints allow it;<br>• positioning the access track, adjacent to the crane hardstand at turbine locations, downhill to the crane hardstand when aligning parallel to the contours where other site constraints allow it; and<br>• aligning access tracks perpendicularly to slope gradients greater than 14 %. | The Peat Slide Risk Assessment in **Technical Appendix 10.1** provides a thorough review of risk at each of the infrastructure locations and provides additional mitigation where required. |
| Traffic and Transport | The following key transport sensitivities were identified in the vicinity of the site:<br>• Severance;<br>• Driver Delay;<br>• Pedestrian Delay and Amenity;<br>• Fear and Intimidation; and<br>• Accidents and Safety. | The Proposed Development has been designed to reduce the potential for transport effects by avoiding positioning turbines within the public roads buffer of 220 m (highest tip height + 10%). | The traffic and transport effects of the Proposed Development are addressed further in **Chapter 11: Access, Traffic and Transport Assessment**.<br>It is proposed that a Construction Traffic Management Plan (CTMP), Transport Management Plan and Path Management Plan are prepared post-consent to further mitigate any effects of the Proposed Development. |
| Acoustics | Potential effects at nearby properties due to operational and construction sound with potential for cumulative impact. | The Proposed Development has been designed to reduce the potential for sound effects by undertaking background sound monitoring to inform the baseline conditions, buffering turbines and the BESS at least 1,050 m from residential properties. | The sound effects of the Proposed Development are addressed further in **Chapter 12: Acoustics Assessment**. |

| Issue | Environmental Constraint / Potential Effect | Design Mitigation | Issues Remaining |
|---|---|---|---|
| | | | |
| Aviation | The Proposed Development has the potential to impact aviation operations at Aberdeen Airport. The proposed 'scoping layout' impacted the NATS En Route Limited (NERL) radar at Allanshill and the Air Traffic Control radar used by Aberdeen Airport at Perwinnes and two Surveillance Minimum Altitude Area (SMAA) charts within Aberdeen Airport's Instrument Flight Procedures. | The final layout of the Proposed Development reduced the height of the turbines so that they are not visible to the Allanshill radar such that it can be used as mitigate the turbine visibility to Perwinnes radar.<br>It also limits the Proposed Development to impact upon only one SMAA managed by Aberdeen Airport. | The aviation effects of the Proposed Development are addressed further **in Chapter 14: Aviation and Other Issues**. |
| Shadow Flicker | Potential effects of shadow flicker on residential receptors. | A shadow flicker module will be installed in the turbines that would shut down turbines during times when wind and climactic conditions are such that shadow flicker could occur. The assessment concludes that with the installation of a shadow flicker management system, no assessed properties would experience significant adverse residual effects. | The shadow flicker effects of the Proposed Development are addressed further in **Chapter 14: Aviation and Other Issues.** |
| Utilities | Potential effects on existing utilities within the site. | The Proposed Development has been designed taking into consideration the location of the following existing utilities:<br>• Underground 33kV cable; and<br>• Microwave link. | Utility crossings have been minimised as far as practicable. Where utility crossings are required, appropriate utility protection will be designed. The microwave link bisecting the site has been buffered and link operators confirm no impacts are predicted. |

## 3.4 Design Principles and Alternatives

3.4.1 The principles of the EIA process require that site selection and layout design be iterative and constraint-led, to ensure that potential environmental impacts as a result of the Proposed Development are avoided or minimised, as far as reasonably possible.

3.4.2 This section will review the principles of the layout design and alternatives options for the Proposed Development.

### Design Principles

3.4.3 As part of the iterative approach adopted by the Applicant, a number of design principles have been incorporated into the Proposed Development as standard practice, including the following:

- consideration of the underlying landscape and its scale;
- consideration of operational, consented and proposed wind turbines neighbouring the site;
- consideration of the size and scale of the Proposed Development appropriate to the location and proximity to residential properties;
- sensitive siting of the proposed infrastructure incorporating appropriate buffer distances from environmental and archaeological receptors to avoid or reduce effects;
- maximising the re-use of existing tracks as much as possible to access proposed turbine locations;
- optimising the alignment of new access tracks and hardstands taking due consideration of the topography of the site, to minimise cut and fill, minimise the impact on sensitive peatland habitats and reduce landscape and visual effects;
- adoption of floating access tracks to minimise disturbance of peat where appropriate;
- minimising watercourse crossings and encroachment on watercourse buffers;
- identifying areas for enhancement onsite including biodiversity;
- inclusion of borrow pit search areas to minimise the volume of the stone required to be imported to the site;
- using the latest turbine technology, consisting of more efficient and larger turbines where these can be reasonably accommodated within the landscape, as supported by the Onshore Wind Policy Statement (OWPS); and
- maximising the potential energy yield of the Proposed Development through the employment of co-located technology in optimal locations (wind and BESS).

### Alternative Sites

3.4.4 The Applicant uses a range of criteria to select sites for the development of renewable energy projects. As part of the growth plans for the development of renewable energy projects, the Applicant is continually assessing potential sites. The pipeline of potential sites is commercially sensitive and the sites are not considered to be alternatives to the Proposed Development's site. Alternative sites are therefore not considered further in the EIAR.

### Do Nothing

3.4.5 The "do nothing" scenario is a hypothetical alternative considered in the EIAR as a basis for comparing the development proposal under consideration. This scenario is considered to represent the current baseline situation as described in the individual chapters of this EIAR.

3.4.6 In the absence of the Proposed Development, it is anticipated that the site would continue to be managed as a combination of open heather moorland, some shooting and commercial forestry. It is expected that these land uses would continue on the site whether or not the Proposed Development proceeds.

### Infrastructure and Technology

3.4.7 Onshore wind continues to be the least expensive form of new renewable energy generation and the site has been predominantly selected for its potential including good wind resource to generate electricity from turbines.

3.4.8 Advances in turbine technology mean that larger, more efficient turbines are now being deployed and it is recognised that turbines will continue to increase in tip height and rotor diameter in order to maximise the generation of electricity. To ensure optimal capture of wind energy and associated generation of electricity, spacing between wind turbines increases with turbine size usually leading to fewer, more productive turbines across any given site.

3.4.9 Larger turbines are needed if onshore wind development is to continue making a contribution to both the UK and Scottish Government's renewable energy targets, particularly the commitment to net zero $CO_2$ emissions by 2045 (Scottish Government, 2019).

3.4.10 The necessity for larger turbines is also recognised in Section 3.6.1 of the OWPS 2022, which states: "*Meeting the ambition of a minimum installed capacity of 20 GW of onshore wind in Scotland by 2030 will require taller and more efficient turbines. This will change the landscape.*"

3.4.11 The use of larger but fewer turbines across any given site allows for greater efficiencies with respect to the civil infrastructure required per wind turbine and hence per megawatt produced. A site with large turbines requires fewer turbine foundations, crane hardstands and lengths of access track in comparison to the same site with a greater number of smaller turbines.

3.4.12 Furthermore, the supply of smaller turbines across Europe is already reducing, due to lack of demand. Manufacturers are recognising the world market is shifting to larger machines with development work focussing on larger turbines to maximise the generation of electricity. The onshore wind industry has experienced a reduction in supply of smaller turbines due to lack of demand from mainland Europe, where the tendency is to install turbines with tip heights of 180 m – 250 m to blade tip. Therefore, it is considered unlikely that a range of smaller turbines (e.g. 150 m to blade tip) would be available at competitive prices by the time the Proposed Development is ready to be constructed, should it be consented.

3.4.13 For these reasons, the final selection of the turbine tip height of up to 180 m and up to 200 m was considered to represent the best balance of tall turbines and design in the landscape. These considerations and the final selection of turbine height are described in **Table 3.1**.

3.4.14 There is a national requirement to balance the peaks and troughs associated with electricity supply and demand to avoid strains on transmission and distribution networks and to keep the electricity system stable. A battery energy storage system (BESS) is therefore proposed as part of the Proposed Development to support the flexible operation of the national grid and decarbonisation of electricity supply.

3.4.15 The BESS would store electrical energy through the use of batteries, contained alongside inverters (to convert the direct current (DC) from the batteries to alternating current (AC), suitable for exporting to the grid), within a self-contained building adjacent to the substation compound to allow easy connection to the grid and minimise energy losses.

### Biodiversity Enhancement

3.4.16 The OWPS 2022 states, in Section 3.5.6, that "*as the rate of onshore wind deployment increases in the coming years, we see a great opportunity for wind energy developments to further contribute significantly to our biodiversity ambition. By proactively managing intact habitats and the species they support, restoring degraded areas and improving connectivity between nature-rich areas, onshore wind projects will contribute to our climate change targets and help address the biodiversity crisis.*"

3.4.17 The Applicant is committed to not only meeting the net zero targets but positively to the regeneration of our natural environment and the inclusion of biodiversity enhancement measures as part of the Proposed Development.

## 3.5 Micrositing

3.5.1 In order to address any localised environmental sensitivities, unexpected ground conditions or technical issues that are found during detailed intrusive site investigations and construction, it is proposed that 100 m micrositing allowance around the turbine locations all other infrastructure is allowed. The technical assessments, presented in **Chapters 6 to 14**, have considered the potential for micrositing.

3.5.2 During construction, the need for any micrositing would be assessed and agreed with the on-site Ecological Clerk of Works (ECoW).

## 3.6 Summary

3.6.1 The final layout of the Proposed Development was the result of extensive iterative design work, to sensitively locate the turbines and the infrastructure required to facilitate construction and operation of the turbines.

3.6.2 In summary, the final layout of the Proposed Development presented achieves the following:

- minimises the proximity to and visibility from residential properties as well as the settlements surrounding the site as far as possible;
- reduces the setting impact on designated heritage assets within the vicinity of the site;
- sensitively locates infrastructure incorporating appropriate buffer distances from environmental and archaeological receptors to avoid or minimise effects;
- maximises the use of existing access tracks;
- optimises the alignment of new access tracks and hardstands to minimise cut and fill, minimise the impact on sensitive peatland habitats and reduce landscape and visual effects;
- adopts floating access tracks to further minimise disturbance of peatland;
- minimises watercourse crossings and protects watercourses from the potential impacts of constructing the Proposed Development;
- includes borrow pit search areas to minimise the volume of the stone required to be imported to the site;
- adopts of the latest turbine technology;

- maximises the potential for electricity generation through the adoption of turbines and energy storage technologies; and
- can be constructed and operated safely.

3.6.3 The final layout comprises eleven turbines of up to 180 m tip height and five turbines up to 200 m tip height, BESS and associated infrastructure, as shown in **Figure 1.2**.

3.6.4 The final layout of the Proposed Development overlain with the site key constraints as described above has been present in **Figure 3.1**. The potential effects of the resulting layout are addressed throughout **Chapters 6 to 14** of the EIAR.

3.6.5 The Proposed Development layout is considered to represent the most appropriate design, taking into account potential environmental impacts and physical constraints, while maximising the renewable energy generating capability of the site.

## 3.7 References

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