Fred. Olsen Renewables

# Chapter 4

## Site Design and Design Evolution

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# Glossary

| Term | Definition |
|---|---|
| Baseline | The existing conditions that prevail against which the effects of the Proposed Development are compared. |
| Environmental Impact Assessment | Environmental Impact Assessment (EIA) is a means of drawing together by the developer, in a systematic way, a description of the development and information relating to of the likely significant environmental effects arising from a proposed development |
| Environmental Impact Assessment Report | A document reporting the findings of the EIA and produced in accordance with the Electricity Works (Environmental Impact Assessment ) (Scotland) Regulations 2017 Regulation 5 |
| Landscape and Visual Impact Assessment | A separate but closely linked process that operates within the overall framework of the EIA. It specifically aims to ensure that all possible effects of change and development both on the landscape itself and on views and visual amenity are taken into account in decision making |
| Windy Standard Complex | The 'Windy Standard Complex' refers collectively to the operational existing Windy Standard I Wind Farm, Windy Standard II Wind Farm and the consented Windy Standard III Wind Farm |
| The Proposed Development | The Proposed Windy Standard I Repower Wind Farm |
| The Proposed Development Area | The area shown delineated by the red line boundary shown on Figure 1.2. |
| The Applicant | Fred. Olsen Renewables Limited |

# List of Abbreviations

| Abbreviation | Description |
|---|---|
| A&A | Advisory and Analytics |
| AILs | Abnormal Indivisible Loads |
| BAA | British Airports Advisory |
| BT | British Telecom |
| CAA | Civil Aviation Authority |
| CFD | Computational Fluid Dynamics |
| CfD | Contracts for Difference |
| CTMP | Construction Traffic Management Plan |
| DGC | Dumfries and Galloway Council |
| DGWLCS | Dumfries and Galloway Wind Farm Landscape Capacity Study |
| ECU | Energy Consents Unit |
| EIA | Environmental Impact Assessment |
| EIAR | Environmental Impact Assessment Report |
| FORL | Fred. Olsen Renewables Limited |
| GIS | Geographical Information Systems |
| GLVIA3 | Guidelines for Landscape and Visual Impact Assessment |
| GPA | Glasgow Prestwick Airport |
| GWDTE | Groundwater Dependent Terrestrial Ecosystems |
| HH | Hub Height |
| IPP | Interim Planning Policy |
| JRC | Joint Radio Company |
| LCA | Landscape Character Area |
| LCT | Landscape Character Type |
| LCoE | Levelized Cost of Energy |
| LGVs | Lightweight Goods Vehicles |
| LVIA | Landscape and Visual Impact Assessment |
| MoD | Ministry of Defence |
| NATS | National Air Traffic Services |
| Ofcom | Office of Communications |
| PAC | Pre-Application Consultation |
| PAN | Planning Advice Notice |
| PSR | Primary Surveillance Radar |
| RSA | Regional Scenic Area |
| RSPB | Royal Society for the Protection of Birds |
| SAC | Special Area of Conservation |
| SAMs | Scheduled Ancient Monuments |
| SDSO | Dark Sky Park the observatory |
| SEPA | Scottish Environment Protection Agency |
| SG | Supplementary Guidance |
| SH | Stephenson Halliday |
| SLA | Sensitive Landscape Areas |
| SNH | Scottish Natural Heritage |
| SPA | Special Protection Area |
| SPP | Scottish Planning Policy |
| SSSI | Site of Special Scientific Interest |
| TH | Tip Height |
| UKFS | The UK Forestry Standard |
| WAsP | Wind Atlas Analysis and Application Program |
| WSI | Windy Standard I |
| WSII | Windy Standard II |
| WSIII | Windy Standard III |

| Abbreviation | Description |
|---|---|
| ZTV | Zone of Theoretical Visibility |

## 4.1 INTRODUCTION

4.1.1 This chapter sets out the main stages followed in the design evolution of the Proposed Development. It describes how the site design, and evolution of the layout of the turbines and infrastructure design has evolved through the initial site selection process, discusses the identification of various constraints and site-specific factors, and highlights the key design criteria applied.

4.1.2 Planning Advice Note (PAN) 68: Design Statements explains the process of undertaking a design statement. Design and Access Statements are a statutory requirement for all major developments under the terms of the Planning etc. (Scotland) Act 2006. Although not a statutory requirement for the Proposed Development, for which an application will be submitted under Section 36 of the Electricity Act 1989, this chapter nonetheless explains the design process which has been undertaken to arrive at the proposed layout.

4.1.3 This Chapter refers to the following chapters (Volume 2) and figures (Volume 3):

- Chapter 2: Legal and Policy Context;
- Chapter 5: Project Description;
- Chapter 6: Landscape and Visual Impact Assessment;
- Chapter 12: Traffic and Transport;
- Chapter 14: Aviation and Existing Infrastructure.
- Figure 1.1: Regional Context;
- Figure 1.2: Site Location;
- Figure 1.3: Proposed Site layout; and

4.1.4 Figure 2.1: Spatial Framework Group Status.

## 4.2 CONSIDERATION OF ALTERNATIVES

4.2.1 Paragraph 5(2)(d) of The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 requires that the Environmental Impact Assessment Report (EIAR) includes a description of reasonable alternatives studied by the Applicant, which are relevant to the development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the development on the environment. As noted in 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 ES*[1]*. The ES must also give an indication of the main reasons for the choice made, taking into account the environmental effects*".

4.2.2 The Applicant has considered a number of alternative turbine layouts for the Proposed Development through an iterative design process described below. The finalised layout is the seventh iteration of the Proposed Development.

## 4.3 THE SITE SELECTION PROCESS

4.3.1 Natural Power were approached by the Applicant, Fred. Olsen Renewables Limited (FORL), with a proposal to repower the existing Windy Standard I (WSI) Wind Farm which will form a part of the present Windy Standard Complex (Windy Standard II (WS II) and Windy Standard III (WS III)). The Applicant has connections with this site over 25 years and knowledge gained during this period of the site's social, environmental and commercial suitability all pointed towards this being a viable place to develop further.

[1] Environmental Statement (ES) hereby referred to as Environmental Impact Assessment Report (EIAR) according to Scottish policy.

4.3.2 The Applicant undertook a rigorous site design process involving constraints mapping, site visits and continual review of technical, environmental and planning considerations. The Proposed Development Area passed all initial stages of site design and was then progressed through rigorous internal check systems prior to submission of Scoping,

## 4.4 PROGRESSING SITE DESIGN AT WINDY STANDARD I

4.4.1 Initial layouts for the Proposed Development were informed by the studies of the Windy Standard Complex. The Proposed Development Area was identified as a strong candidate for potential development, and met a number of key criteria including:

- Good estimated wind speeds;
- Good separation distance from dwellings;
- Good separation distance from cultural heritage assets;
- In line with Dumfries Galloway Council Local Development Plan (LDP) 2 guidance[2];
- Close proximity to an existing and viable grid connection;
- Potential to use existing infrastructure (e.g. access tracks), as far as practical;
- Topography of the Proposed Development Area is compatible with the construction of a commercial scale wind farm;
- Not within ecological designations of international or national importance;
- Suitable land area to accommodate generating capacity;
- No national designations; and
- In relation to onshore wind, SPP Table 1 'Spatial Frameworks', the Proposed Development is located in a Group 3 Area: areas with potential wind farm development (please see Figure 2.1, Volume 3 of the EIAR).

4.4.2 Initial feasibility assessments indicated that there was opportunity for further wind energy development in Carsphairn Forest at the Proposed Development site when the current development is decommissioned. The Proposed Development Area has also been assessed by comparison against a number of strategic constraints. Figure 1.1 introduced in Chapter 1: Introduction illustrates the regional context of the Proposed Development Area.

## 4.5 INITIAL FEASIBILITY ASSESSMENT

4.5.1 An initial feasibility assessment was undertaken after the site selection and suitability criteria identification process to further investigate site suitability at a high level. The initial feasibility assessment covered the topics listed below.

- Policy Context;
- Grid Connection;
- Proximity to Dwellings;
- Wind Resource;
- Land Use;
- Landscape and Visual;
- Cultural Heritage;
- Ecology and Ornithology;
- Hydrology;
- Noise;
- Access;
- Military and Civil Aviation; and
- Existing Infrastructure.

[2] Dumfries and Galloway Council [2019]. Local Development Plan [online] available at: Adopted Local Development Plan 2 (dumgal.gov.uk). Accessed 04/05/2022.

### Policy Context

4.5.2 For the feasibility assessment, a review was undertaken of design guidance documents and other standard texts on wind farm development, such as NatureScot guidance on 'Siting and Designing Wind Farms in the Landscape' (February 2017).

4.5.3 Dumfries and Galloway LDP 2 (2019) Policy[2] IN1: Renewable Energy states '*The Council will support development proposals for all renewable energy generation and/or storage which are located, sited and designed appropriately'.*

4.5.4 The LDP policies relevant to the Proposed Development can be found in Table 4.1:

**Table 4.1: LDP policies**

| LDP Policies | |
|---|---|
| Policy OP1: Development Considerations | Policy NE5: Species of International Importance |
| Policy ED10: Galloway and Southern Ayrshire Biosphere | Policy NE6: Sites of National Importance for Biodiversity and Geodiversity |
| Policy ED11: Dark Skies | Policy NE8: Trees and Development |
| Policy HE1: Listed Buildings | Policy NE11: Supporting the Water Environment |
| Policy HE2: Conservation Areas | Policy NE14: Carbon Rich Soil |
| Policy HE3: Archaeology | Policy NE15: Protection and Restoration of Peat Deposits as Carbon Sinks |
| Policy HE6: Gardens and Designed Landscapes | Policy CF4: Access Routes |
| Policy HE7: Historic Battlefields | Policy IN1: Renewable Energy |
| Policy NE1: National Scenic Areas | Policy IN2: Wind Energy |
| Policy NE2: Regional Scenic Areas | Policy IN7: Flooding and Development |
| Policy NE3: Areas of Wild Land | Policy IN8: Surface Water Drainage and Sustainable Drainage Systems (SuDS) |
| Policy NE4: Sites of International Importance for Biodiversity | Policy T1: Transport Infrastructure |

*Source: Savills, 2022*

Furthermore, Table 1 of the Scottish Planning Policy (SPP) sets out the specific criteria by which Spatial Frameworks for onshore wind energy proposals should be formed. Paragraph 163 of SPP states that the Spatial Framework is to be *'complemented by a more detailed and exacting development management process where the individual merits of an individual proposal will be carefully considered against the full range of environmental, community and cumulative impacts'*.

The SPP Spatial Framework categorises constraints and opportunities into three groups:

1. Group 1: Areas where wind farms will not be acceptable - '*National Parks and National Scenic Areas'*.
2. Group 2: Areas of significant protection - '*Recognising the need for significant protection, in these areas wind farms may be appropriate in some circumstances. Further consideration will be required to demonstrate that*

*any significant effects on the qualities of these areas can be substantially overcome by siting, design or other mitigation*.'

3. Group 3: Areas with potential for wind farm development - '*Beyond groups 1 and 2, wind farms are likely to be acceptable, subject to detailed consideration against identified policy criteria*.'

The majority of the Proposed Development Area is Group 3. The sole Group 2 interest is the mapped presence of carbon rich soils and deep peat based upon the Scottish Natural Heritage (SNH) (now NatureScot) Carbon and Peatland Map 2016 (see Figure 10.3).

4.5.5 A full review of legislation and planning policy has been provided in Chapter 2: Legal and Policy Context. The chapter provides an objective summary of the energy and planning policy considerations that have been taken into account in the preparation of the EIAR in order to ensure that it provides the appropriate information for the consideration of this application. A review of relevant legislation and planning policy will also be included in each individual technical chapter within the EIAR and within the Planning Statement (Volume 4 of the EIAR).

## Wind Resource

4.5.6 On-site wind resource is well known at the Proposed Development site and the wider Windy Standard Complex due to data from operational assets (the current WSI and WSII and on-site monitoring campaigns (WSIII)). Long term wind speed estimates for the Proposed Development Area have been based upon SCADA data available from the operational WSI Wind Farm and supplemented by mast and LIDAR data, measured in parts of the Windy Standard Complex adjacent to the Proposed Development Area.

4.5.7 The long-term estimate has been fed into Natural Power's VENTOS CFD© Computational Fluid Dynamics (CFD) model to model the wind flow conditions across the whole of the Proposed Development site. Given the topographical and meteorological complexity of the site, the CFD model was deemed the most appropriate approach to capturing the wind resource behaviour. Detailed assessments of the CFD results have given a good understanding of the wind flow regime surrounding the Proposed Development. The turbulence intensity, wind shear, inflow angle and veer across the site were assessed to inform the turbine layout design process (along with all relevant physical, environmental and technical constraints). The process was undertaken iteratively to arrive at the appropriate number, size and location of turbines for the Proposed Development to minimise project risks (turbine performance/operational issues) and maximise project efficiency and energy yield output. Energy yield assessments have been performed throughout the design process, indicating that the Proposed Development has the potential to deliver an economically viable wind energy development subject to further assessment.

## Land Use

4.5.8 Figure 1.1 (Volume 3 of the EIAR) shows the location and extent of the Proposed Development in a regional context. The Proposed Development is located within Carsphairn Forest, near Carsphairn in Dumfries and Galloway and will act as a replacement to the existing WSI Wind Farm. The site is owned by a single landowner.

4.5.9 The area within which the Proposed Development is situated is characterised by groups of rounded hills which rise in steps from relatively low-lying land (75 - 100 m) to 700 m. Today the summit area and much of its north-west slopes form part of the Windy Standard Complex. The Windy Standard Complex (Figure 1.2, Volume 3) is currently made up of three developments: WSI, WSII and WSIII. WSI is set to be decommissioned by 2027 and it is proposed to repower the site with new turbines. This is the subject of this application and assessed in this EIAR.

4.5.10 The existing turbines currently at the site of the Proposed Development will be removed, and the site will be reinstated except where infrastructure will be used for the Proposed Development.

## Landscape and Visual

4.5.11 Landscape and visual issues were considered in detail at an early stage of the project. A number of guidance documents were referred to inform the design albeit noting that some of these have since been replaced with new versions. These include:

- Dumfries and Galloway LDP2 2019;
- Technical Paper No 5: Preparation of a Wind Energy Diagram, which provided guidance that was used to compile the Dumfries and Galloway Structure plan (now intended to be formally replaced by the Dumfries and Galloway Supplementary Guidance (SG) 2);
- Third edition of Guidelines for Landscape and Visual Impact Assessment (GLVIA3) 2013;
- Dumfries and Galloway Interim Planning Policy (IPP): Wind Energy Development, which provides further guidance on the main factors that will be considered in reaching planning decisions (relevant parts of which are intended to be replaced by the SG); and
- Dumfries and Galloway Wind Farm Landscape Capacity Study (DGWLCS), which was used to inform the previous IPP and was adopted by Dumfries and Galloway Council (DGC) as SG alongside Supplementary Guidance, Part 1 Wind Energy Development: Development Management Considerations.

4.5.12 The initial feasibility assessment of landscape and visual impacts took place before the adoption of the LDP2 in 2019 and considered policies set out within the Dumfries and Galloway Structure Plan by fully assessing the landscape and visual impact of the Proposed Development. In addition, the initial feasibility assessment found that the majority of the Proposed Development is not subject to any constraining designations but is however located approximately 2 km from a Regional Scenic Area (RSA) and therefore further assessments would be required to assess the impact on this area.

## Cultural Heritage

4.5.13 During the initial feasibility assessment, the presence of cultural heritage receptors was investigated within and out with the site boundary. A full cultural heritage assessment is provided in Chapter 7 of the EIAR.

## Ecology and Ornithology

4.5.14 Pre-planning ecology assessments were conducted to assess the site connectivity with local statutory designated sites and to uncover existing records of raptor activity around the Proposed Development. A desk study of the Proposed Development was conducted, the results of which state that there are no designated ecological or ornithological constraints, such as Sites of Special Scientific Interest (SSSI), Special Protection Areas (SPA) or RAMSAR sites, within the site boundary. As a result of the pre-planning ecology assessment, the Proposed Development was considered unlikely to impact on designations nor have a significant impact on any target species. As such, the site was considered potentially suitable for wind energy development, subject to further detailed assessment. Potential significant effects upon ecology and ornithology are fully assessed in the Environmental Impact Assessment (EIA) and the findings are presented in Chapter 8: Ornithology and Chapter 9: Ecology.

## Hydrology

4.5.15 A desk study of the Proposed Development Area was conducted within the feasibility assessment. A number of watercourses were identified within the Proposed Development Area from the 1:10,000 Ordnance Survey maps, and a 50 m buffer from these watercourses was applied which excludes development within these areas.

4.5.16 A desk study and site reconnaissance survey identified potential geological and environmental conditions that may involve long-term or short-term geological processes. Potential effects upon Hydrology, Geology and

Hydrogeology including private water supplies and peat were fully assessed in the EIA and the results presented in Chapter 10: Hydrology, Geology and Hydrogeology.

## Access

4.5.17 Pre-planning access assessments were conducted to assess if access is deemed to be a significant risk. On site access up the main arterial access road was identified to be acceptable in EIA planning terms (as acceptable for the consented WSIII). The current tracks that spur off the main arterial access road to the Proposed Development are narrow and very steep in places, a degree of upgrading will be required for turbines larger than those that exist at WSI.

4.5.18 As a result of the pre-planning access assessment of the Proposed Development, it was decided the assessment will focus on impacts during the construction phase of the Proposed Development, providing a 'worst case' example of impacts on the local road network. This was due to the nature of the wind farm project where operational traffic is limited to only a very small number of Lightweight Goods Vehicles (LGVs) undertaking maintenance, and because future decommissioning activities are likely to generate smaller volumes of traffic compared to the construction phase.

4.5.19 A full access assessment is provided in Chapter 12: Traffic and Transport Assessment. This will be supplemented by an Access Route Assessment for delivery of the wind turbine Abnormal Indivisible Loads (AILs) (Appendix 12.1) and a Preliminary Construction Traffic Management Plan (CTMP) (Appendix 12.2).

## Military and Civil Aviation

4.5.20 The potential for the Proposed Development to interfere with military and civil aviation assets was considered during the feasibility phase. An assessment of DGC planning guidance maps indicated that the Proposed Development is located near to potential areas of aviation constraint. Further assessment found that a Ministry of Defence (MoD) Tactical Training Area is located near to the Proposed Development and that there was the potential for conflict with the Glasgow Prestwick Airport (GPA) radar. This was considered during the feasibility stage of the Proposed Development, and it was considered that such aviation constraints may impact on the Proposed Development subject to further assessment. As such, MoD, National Air Traffic Services (NATS), British Airports Authority (BAA), Civil Aviation Authority (CAA) and GPA were consulted and assessments were undertaken to confirm any risk of interference. The potential effects on military and civil aviation are presented in Chapter 13: Aviation and Existing Infrastructure.

## Existing Infrastructure

4.5.21 The presence of existing infrastructure such as service pipelines including the Scottish Water mains water supply pipe and cables, television transmission, mobile telephone networks and electromagnetic paths were considered in the initial feasibility study. Geographic Information System (GIS) data used within the initial feasibility study indicated that there were no existing infrastructure within the Proposed Development Area that would be impacted by the Proposed Development, subject to further assessment. In order to confirm this, it was recommended during the initial feasibility assessment that consultation with Scottish Water, Office of Communications (Ofcom), British Telecom (BT), and Joint Radio Company (JRC) be conducted to confirm that the Proposed Development would not interfere with any known existing infrastructure or microwave links. The potential impacts upon existing infrastructure were fully assessed in the EIA and the results are provided in Chapter 13: Aviation and Existing Infrastructure.

## Initial Site Feasibility Assessment Conclusion

4.5.22 The initial site feasibility assessment concluded that the Proposed Development Area offers good potential for a wind farm repower development. The initial feasibility assessment indicated that:

- The Proposed Development Area had a good wind resource;
- The Proposed Development was unlikely to impact on any ecological designations and target species;
- There was sufficient grid capacity;
- Visibility beyond 10 km would be limited;
- There were no direct and limited indirect impacts on archaeological and cultural heritage features; and
- The Proposed Development would not be expected to interfere with any known existing infrastructure.

4.5.23 However, further assessments were required to optimise the design and layout of the Proposed Development, these included, but were not limited to the following:

- Further in-depth assessment of the wind resource and wind flow characteristics of the site;
- Full Landscape and Visual Impact Assessment and Cumulative Assessment;
- Site visits;
- Phase 2 detailed peat depth surveys;
- Review and confirm existing public access;
- A thorough construction infrastructure study and site investigation to establish the presence and extent of anticipated constraints to construction site access and provide better understanding of the ground conditions;
- Consultation with GPA and MoD regarding potential aviation constraints; and
- Further on-site archaeological investigation.

# 4.6 THE CONSULTATION PROCESS

4.6.1 The consultation process commenced prior to Scoping in November 2020. In accordance with the Scoping Guidelines provided by the Scottish Government's Energy Consents Unit (ECU), the Applicant undertook initial pre-scoping meetings with NatureScot, DGC and the ECU to provide a general introduction to the site. The Scoping Report was submitted on 13th August 2021, after which statutory consultation responses were received. Non-statutory consultees were also engaged during the Scoping process; a full list of which can be found within the Pre-Application Consultation (PAC) Report, a supplementary document to the Section 36 application. Community consultations also began during the Scoping period with meetings; email and telephone communications; and two rounds of public exhibitions, using a mixture of online and in-person events dependent on evolving COVID-19 regulations.

4.6.2 The consultation process was carried out to:

- Identify any further key considerations and highlight concerns from statutory consultees;
- Clarify the key points raised during the initial feasibility assessment;
- Promote dialogue with both statutory and non-statutory consultees and other stakeholders concerning key issues; and
- Confirm and agree the proposed methods for survey, evaluation and assessment.

4.6.3 For a complete summary of PAC activities undertaken for the Proposed Development, see the PAC Report which accompanies this EIAR. Appendix S 'Gate Check Report' within the PAC report includes a table of consultee comments from Scoping and outlies how they have been addressed within the EIAR.

## Key Considerations Identified Through the Consultation Process

4.6.4 The consultation process confirmed that findings of the feasibility studies and showed that whilst the findings demonstrated the site is suitable for wind energy re-development some key issues should be prioritised during the design process:

- Aviation lighting;

- Wind Analysis;
- Landscape and visual; and
- How to utilise existing infrastructure from the Windy Standard Complex for the Proposed Development

4.6.5 All of the above concerns are fully addressed within the relevant chapters of this EIAR for the Proposed Development.

## 4.7 DESIGN EVOLUTION

4.7.1 This subsection describes the alternative layouts considered for the Proposed Development and discusses how the evolution of the site design and layout continued through the EIA process. The layout of the Proposed Development evolved, with input from Natural Power and from other expert contractors such as landscape architects and archaeologists. The site design process was guided by the findings of the baseline surveys, by the recommendations of the specialist consultants and by issues raised by statutory and non-statutory consultees.

4.7.2 The aim of the siting and design process was to arrive at a design that would minimise environmental effects, limit significant landscape and visual effects, be technically feasible, and economically viable using the best available techniques and engineering principles. The design optimised the site for the generation of low carbon and low-cost electricity to contribute to the national targets of decarbonising energy sources. The design process included selecting the number and size of turbines, the placement of turbines, the tracks and other associated infrastructure required whilst taking account of topographical, landscape and visual, cultural heritage, ecology, hydrology and peat concerns.

4.7.3 The location of individual turbines was guided by the technical requirements for construction and operation including the potential manufacturer's warranty requirements, slope angles and the nature of the topography in which the turbine is to be located. Siting was also guided by the results of the baseline studies Scoping exercise, with particular attention given to the likely landscape and visual effects, residential amenity and the hydrology and peat resource at the site.

4.7.4 Computer modelling of wind resource and constraints was used as a tool to aid the development of the designed layout. Additionally, wirelines were generated for views from sensitive locations around the site and used to 'test' the design in key views from the surrounding area.

4.7.5 The remainder of this chapter highlights the site design considerations and the key stages in the site design evolution, illustrating the iterative process that has resulted in the Proposed Development. Through each of the design iterations considered, key technical and environmental constraints and design criteria have been applied.

### Influence of the Policy Context

4.7.6 The full range of predicted impacts have been considered throughout this EIAR. A review of legislation and planning policy has been provided in Chapter 2: Legal and Policy Context and an assessment of such material is provided in the accompanying Planning Statement, as well as in individual EIAR chapters. A review was undertaken of design guidance documents and other standard texts on wind farm development such as the NatureScot (then SNH) guidance on 'Siting and Designing Windfarms in the Landscape' (Version 3a August 2017). These are considered further in Chapter 6: Landscape and Visual Impact Assessment.

4.7.7 The iterative design process was brought to a conclusion and the final 8-turbine design layout fixed when it was considered that an acceptable balance had been struck between the requirements of the Proposed Development in the context of policies and the various other environmental constraints and influences identified in this chapter. The requirements for the Proposed Development under the LDP Policy IN1: Renewable Energy is to provide sufficient detail within the Application on:

- Any associated infrastructure requirements including road and grid connections (where subject to planning consent);
- Environmental and other impacts associated with the construction and operational phases of the development including details of any visual impact, noise and odour issues;
- Relevant provisions for the restoration of the site;
- The scale of contribution to renewable energy generation targets;
- Effects on greenhouse gas emissions; and
- Net economic impact, including local and community socio-economic benefits such as employment, associated business and supply chain opportunities.

### Design Strategy Principals

4.7.8 The design strategy for the key elements of the Proposed Development has taken into account the following objectives:

- To maximise site efficiency and low carbon electricity production;
- To provide a turbine layout with simple form, which relates to the landscape character of the site and its surroundings;
- To avoid areas of constraint where practical;
- To create a turbine layout which reflects the scale of the landscape in which it is located;
- To avoid an overly complex and visually confusing layout;
- To achieve a balanced composition of the turbines against the landscape and skyline from key viewpoint locations;
- To reflect the pattern of nearby existing and proposed wind farms; and
- To give due consideration to turbine proportions.

4.7.9 In addition, noting the current economic climate which is influencing greater efficiency in electrical generation within a very competitive energy market and turbine availability from manufacturers, turbines of up to 200 m tip height (TH) are considered within the design of the Proposed Development. This scale of turbine with larger rotor diameters are capable of significantly increasing the total energy output and represent a realistic candidate turbine to allow this development being realised if consented. In addition, the land take of the Proposed Development is reduced as fewer turbines are required to generate a greater total energy output than turbines with lower TH. This also reduces the majority of the environmental impacts and the carbon footprint of the Proposed Development. There is a mixed baseline with extensive commercial forestry, varied topography and wind farms already demonstrating significant variations in size with everything from the existing WSI Wind Farm to South Kyle and other surrounding sites such as WSII, WSIII and Afton. This has been considered within the final design.

4.7.10 Key objectives specific to the Landscape and Visual Impact Assessment (LVIA) were also adopted for the Proposed Development and will be discussed within Chapter 6: Landscape and Visual Impact Assessment, of the EIAR.

### Constraints to Development

4.7.11 The main environmental considerations on site which have influenced the final design of the Proposed Development are:

- Watercourses;
- Wind flow;
- Ground conditions and topography;
- Protected species and habitat;
- Landscape and visual;

- Noise; and
- Cultural heritage.

### Watercourses

4.7.12 All mapped natural watercourses were marked as a constraint and a 50 m buffer was applied to protect watercourses from disturbance and potential effects on water quality during construction. Their locations were confirmed during site visits and the on-site track was designed to minimise watercourse crossings.

### Wind Flow

4.7.13 Site design and layout were tailored to ensure optimal turbine performance bearing in mind the local topography. This also included consideration of forestry and ensuring re-designs and suitable spacing of turbines was adhered to so as to not induce wake effect.

### Ground conditions and topography

4.7.14 The peat resource on-site was considered to be pertinent to the siting of the turbines and areas of slope greater than 10 degrees were avoided. Detailed desk-top investigations, a hydrological survey and peat survey of the area were undertaken to reveal any sensitive areas to wind farm construction activities. This investigation directly informed the design and led to detailed consideration of siting to avoid areas of potential sensitivity to peat.

### Protected species and habitat

4.7.15 No international, national or regional ecological designations are located within the Proposed Development Area. A phase one habitat survey was carried out to identify areas potentially sensitive to wind farm infrastructure. Full details are provided in Chapter 9: Ecology.

4.7.16 Ornithological surveys were undertaken over the site to identify any areas of potential constraint. Full details are provided in Chapter 8: Ornithology.

### Landscape and Visual

4.7.17 The design process took account of the potential landscape and visual effects. The design iterations that considered such effects are described below and further details are also provided in Chapter 6: Landscape and Visual Impact Assessment.

### Noise

4.7.18 A noise assessment was undertaken which included predictions of likely turbine noise levels across a range of wind speeds to demonstrate compliance with the Total ETSU-R-97 and Site-Specific Noise Limits. A cumulative noise assessment was also undertaken to consider the consented, operational and proposed wind farms within the vicinity of the Proposed Development. Further details are provided in Chapter 14: Noise.

### Cultural Heritage

4.7.19 Assessments of potential impacts upon cultural heritage during the EIA process informed the final layout of the Proposed Development. No significant impacts were determined. Further details are provided in Chapter 7: Cultural Heritage.

## Public Consultation

4.7.20 The principals of effective public engagement have been followed as described in PAN 3/2010: Community Engagement:

- Access to information;
- The opportunity to contribute ideas;
- The opportunity to take an active part in developing proposals and options;
- The opportunity to be consulted and make representatives on formal proposals and policies; and
- The opportunity to receive feedback and be informed about progress and outcomes.

4.7.21 The Applicant liaised with the local community both pre and post scoping and have continued this during the EIAR period, ensuring that communities were given additional information if required and that all queries from community councils, community groups and members of the community were answered and followed up if required.

4.7.22 As the early stage of the consultation coincided with the global COVID-19 pandemic, it was necessary to significantly adapt an approach away from the traditional 'village hall' led engagement to an online strategy designed to maximise opportunities to discuss plans and gather feedback. This approach reflected the Town and Country Planning (Miscellaneous Temporary Modifications) (Coronavirus) (Scotland) Regulations 2020 which came into force on 24 April 2020. Virtual online exhibitions took place on Monday 21st and Wednesday 23rd June 2021. A second round of in person exhibitions took place between Monday 15th to Thursday 18th November 2021 Details of these exhibitions and other stakeholder engagement can be found in the PAC Report.

## Iterative Design Process – Description of Initial Layout Designs

4.7.23 The iterative design approach aimed as far as practically possible to identify potential effects then avoid and mitigate the significant effects through careful siting and design of the Proposed Development. The design was repeatedly assessed and amended, balancing different environmental issues and consultee concerns made during early consultation. This embedded mitigation design process also considered advice contained within NatureScot's current guidance 'Siting and Designing Wind Farms in the Landscape' (Version 3a August 2017).

4.7.24 Initially Stephenson Halliday (SH) undertook a Landscape and Visual Feasibility Appraisal Stage One for WSI in 2018. Their design rationale was based on the following:

- Slope gradient;
- Placing a micropath buffer on Gallow Rig which reduces the developable area for turbines;
- The presence of an overhead power line, watercourses and other constraints far north of the site, reduces the extent of the developable area;
- Along the eastern edge, the developable area is reduced by slope and the 130 m buffer from Afton Wind turbines;
- Utilising the available ridges as far as possible; and
- Exploring areas of lower ground but this was considered unlikely due to turbine efficiency and from a layout perspective.

4.7.25 SH considered a number of scenarios for discussion as follows:

- 13-turbine layout using mixed height turbines comprising 149.9 m and 180 m (Layout one, Figure 4.1, Volume 3 of the EIAR);
- 15-turbine layout using mixed height turbines comprising 149.9 m and 180 m to explore the merit of moving /mitigating the micropath link (Layout two, Figure 4.2, Volume 3 of the EIAR));
- 150 m turbines along ridgelines, 180 m turbines on slightly lower ridges, and two larger turbines of 200 m on the lower parts of Gallow Rig; and
- A scheme which uses 180 m turbines consistently.

4.7.26 Based on SH assessments Natural Power suggested that any future design work of WSI took into account the current WSII layout and if possible, the future repowering of it, not just in terms of the fit of the WSI turbines alongside the operational WSII turbines but considering the long-term repowering of both sites in its entirety. Natural Power believed there was potential to achieve an improvement to the existing baseline and demonstrate

to statutory consultees that there will be a reduction in landscape and visual effects by simplifying the composition of turbines in the long term, rather than considering each site individually.

4.7.27 The second stage of the design process began with Natural Power proposing two layouts in 2019 (Figures 4.3 and 4.4). These layouts started to focus more on how the existing infrastructure from the Windy Standard Complex (the current WSI, WSII and WSIII) could be utilised. Layout three (Figure 4.3, Volume 3 of the EIAR) consisted of 20 turbines at 180 m to blade tip. Layout four (Figure 4.4, Volume 3 of the EIAR) consisted of 15 turbines at 180 m to blade tip. Layout four removed five turbines which reduced impacts on watercourses, it increased the overall site capacity factor and reduced cut and fill problems for construction. A further five turbines were removed in 2020 during an Advisory and Analytics (A&A) review to ensure there was enough spacing between turbines, that the wind sector management was at a suitable level and so the layout was financially viable.

4.7.28 The fifth stage design process began with the 10-turbine layout developed in the initial landscape and feasibility report. The layout was based on 132 m hub height (HH) and 200 m blade to TH. From this point, turbines were relocated, modified or removed from the layout using physical constraints, such as: steep slopes, watercourses, initial visual and landform sensitivities, whilst balancing the potential effects on landscape and visual amenity.

4.7.29 Natural Power and FORL then undertook extensive survey work (including peat probing, breeding bird surveys and Groundwater Dependant Terrestrial Ecosystems (GWDTE)) and reviewed layout five (Figure 4.5, Volume 3) which was a 10-turbine layout before proceeding to formal Scoping. During the review, one more turbine was removed based on the following:

- As the proposed TH increased to 200 m, the resultant assessment determined additional spacing was required between the turbines;
- To minimise the effects on forestry felling; and
- To avoid turbine hardstanding's being in close proximity to a watercourse.

4.7.30 Scoping was therefore based on a nine-turbine layout (Layout six, Figure 4.6, Volume 3).

4.7.31 After the Scoping Opinion and responses were reviewed, and additional discussions carried out with consultees, local communities and groups, a turbine was removed. From a landscape and visual point of view this helped the Proposed Development design by way of:

- Improved from a visually point of view at New Cumnock and the B729;
- 'Neaten' the landscape; and
- Become more visually appealing as fits in with the wider wind farm landscape.

4.7.32 Turbine 4 was also moved slightly to the east and turbine 3 to the west to improve the viewpoint from Benbrack. The movement of turbine 3 however meant that the turbine and hardstanding area was not fully assessed in the first round of ecology surveys conducted for the Proposed Development. Given the visual improvements to the scheme by moving turbine 3, the Applicant instructed ecologists to carry out further surveys to ensure the EIAR fully assessed the potential ecological impacts of the Proposed Development.

4.7.33 This concluded the iterative design process, and the design was frozen at eight turbines (Proposed Site Layout, Figure 1.3, Volume 3), forming the Proposed Development. The Proposed Development site boundary (as seen in Figure 1.3) was amended through the design process to keep the infrastructure within DGC.

4.7.34 The Proposed Development layout comprises of eight turbines with a blade to TH of up to 200 m (Figure 1.3, Volume 3). This current layout is considered a well-balanced design from key viewpoints and receptors, whilst also giving due consideration to other key environmental constraints and sensitivities, as well as construction limitations.

4.7.35 The whole scheme was centred round the existing turbine locations of the current WSI and to utilise infrastructure that is already on site. As seen in Figure 1.3, the location of the turbines have been chosen to follow the existing WSI forest track to minimise land being used for track upgrades. This is also the case for some of infrastructure used in the final design of the Proposed Development. For example, the construction compound was re-located from an area in close proximity of a watercourse to an area of presently disturbed ground that was used as a borrow pit as part of the current WSI development, further minimising the overall environmental impacts of the Proposed Development.

## 4.8 CONCLUSION

4.8.1 In line with good practice advice from the Scottish Government and procedures normally required for Major Developments under the Town and Country Planning (Development Management Procedure) (Scotland) Regulations 2013, the Proposed Development has been subject to a detailed and iterative design process. The final design has sought to balance the technical requirements of The Proposed Development with the environmental considerations identified by consultees and the public during early consultation. The residual impacts of the design process are considered in the relevant EIAR chapters.