Chapter 2

Site Description and Design Evolution

SCOTTISHPOWER RENEWABLES

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2.1 Executive Summary

1. The Site comprises part of the Achaglass and Gartnagrenach Estates towards the northern end of the Kintyre Peninsula within Argyll and Bute. It is located 11 km south of Tarbert, 2.5 km east of Clachan and 2.3 km south west of Whitehouse and it is located immediately to the east of the A83. The Freasdail (operational) and Eascairt (consented) windfarms are also both directly adjacent to the Site. The Site currently comprises an operating commercial forest, with forest tracks and small borrow pits, as well as open moorland. The Kintyre Way runs along the south eastern boundary of the Site.

2. The Site was selected due to meeting a number of criteria which SPR use to select renewable energy development projects. Importantly, the Site offers good wind potential for wind turbines, but it also provides suitable development potential for other renewable technologies such as solar and battery storage. As part of the site is a working forest, there is also good access and an existing network of forestry access tracks which could be incorporated into the proposed Development. In addition, many parts of the Site have already been affected by some form of development, be that forestry or agriculture. As a result, the Site does not have any environmental designations and the Site is also located away from other potentially significant environmentally protected areas.

3. SPR designed the proposed Development taking into account operational requirements and environmental and landscape constraints. In particular, landscape studies have been used to influence the design of the proposed Development. As information on the environmental, landscape and technical constraints has been collected by the EIA team, this information has been used to review and refine the design of the Site.

4. SPR started investigating a 35 wind turbine development with turbines of around 180 m tall (to horizontal turbine blade tip) prior to detailed EIA studies. This was reduced to 26 wind turbines of no more than 149.9 m tall (to horizontal turbine blade tip) ahead of a Scoping Report which was submitted to the Energy Consents Unit at the Scottish Government. Following consultee feedback and more detailed EIA studies, including baseline surveys and a landscape review from various locations on the Kintyre Peninsula agreed with consultees, SPR finalised on the Site design which comprises a layout of 19 turbines mostly at 149.9 m tall, except for three turbines which will be limited to 135 m tall to reduce the landscape and amenity impacts of the proposed Development.

5. The design of the solar arrays, battery storage and associated infrastructure, such as the substation and access tracks have also considered environmental constraints, and this has also been balanced by technical requirements. The EIA studies, including detailed site walkover surveys, have enabled the proposed Development to avoid the most valuable environmental areas. This includes avoiding parts of the open moorland which are important for birds (geese) and areas of deeper peat which are home to good quality plant habitats. Watercourses and habitats that rely on groundwater flows have also been avoided.

6. Taking these constraints into account and considering the construction requirements of such a project, SPR has developed a design which it believes is best suited to this site and its surroundings.

2.2 Introduction

7. This Chapter outlines how alternatives have been considered for the proposed Development. It describes the site selection process, outlines the design evolution and describes the renewable energy technology alternatives considered. In addition, this Chapter also provides a description of the Site and surrounding area.

8. The principles of the EIA process require that site selection and project design should be iterative and constraint-led, to ensure that potential negative environmental impacts, as a result of the proposed Development, are avoided or minimised, as far as reasonably possible. Schedule 4 (2) of the EIA Regulations, requires the consideration of reasonable alternatives in terms of site location and characteristics of the proposed Development. Regulation 40 (2)(c) of the EIA Regulations requires that an EIA report should include (in respect of alternatives studied by an applicant): *"The main alternatives studied by the applicant and the main reasons for his choice taking into account the effects on the environment."*.

9. This Chapter draws on issues considered in more detail in the relevant technical Chapters **(Chapters 7 to 15)**. However, it does not pre-empt the conclusions of the later Chapters. Instead, it explains how potential environmental effects which have emerged early in the EIA and through the studies by the EIA team have informed the design of the proposed Development.

10. The final design for the proposed Development is described in **Chapter 3 Proposed Development** and is shown on **Figure 3.1**.

2.3 Site and surroundings

2.3.1 Site description

11. The selected Site is part of the Achaglass and Gartnagrenach Estates and is located at the northern end of the Kintyre Peninsula, wholly within the Argyll and Bute Council administrative area, near the villages of Clachan and Whitehouse. The Site itself is centred on NGR 181302, 657098 and its location is shown on **Figure 1.1**.

12. The Site forms part of a ridgeline of relatively remote upland plateau, on the northern Kintyre Peninsula, comprising widespread coniferous plantation and some areas of open moorland. The Site is characterised by upland moorland/wet grassland within the eastern and south eastern extent of the Site, with commercial plantation forestry in the western extent of the Site, including Sheirdrim Hill. As the Site is partly a commercial forest, there are existing borrow pits and a series of forestry access tracks, including a main access haul track leading off the A83 on the northern side of the site.

13. The Site extends from the A83 in the north to the Larachmor Burn in the south, with a network of inland lochs and smaller watercourses contained within the site boundary. There are two lochs within the site (Loch Chorra-riabhaich and Loch Lurach) and several others in the immediate vicinity. Other large hills to the south include Cnoc Creagach (215 m AOD), Cnoc an t-Seallaidh Bhig (248 m AOD) Cruach Achaidh Ghlais (244 m AOD) and Cruach Tamalabh (242 m AOD). Topography generally rises to the south from circa 70 m AOD at the Site entrance, to circa 270 m AOD in the south east, particularly around Cruach nam Fiadh.

14. Access to the Site is via the A83 which runs past the northern and western ends of the Site. The B842 runs along the eastern side of the peninsula between Campbeltown and Cloanaig and the B8001 which runs north east to Kennacraig from Cloanaig. National Cycle Route (NCN) 78 also follows the B842 and the B8001. The Kintyre Way passes directly adjacent to the southern boundary of the Site.

2.3.2 Surrounding area

15. The immediate area surrounding the Site is rural in nature with land predominantly used for commercial forestry purposes and rural agriculture. The operational Freasdail windfarm is located directly adjacent to the Site to the north east and the consented Eascairt windfarm is located directly to the south east of the Site. The closest sizeable settlement is Tarbert, approximately 11 km north east of the Site, although there are smaller settlements nearby, including the villages of Clachan (approximately 2.5 km west of the nearest wind turbine), and Whitehouse (approximately 2.3 km north east of the nearest wind turbine). The immediate vicinity has relatively low population density, although there are a number of individual properties directly adjacent to the north and west.

16. The closest landscape designations out with the Site are the Knapdale / Melfort and West Kintyre (Coast) Areas of Panoramic Quality (APQs), approximately 3 km and 2.5 km to the north west and west respectively (See **Figure 2.1**). Further to the east, the North Arran National Scenic Area (NSA) and Wild Land Area (WLA) also fall within the study area. Tarbert Woods is the closest natural heritage designation and is a Special Area of Conservation (SAC) / Site of Special Scientific Interest (SSSI) (see **Figure 2.1**). There are no listed buildings or scheduled monuments within the Site.

17. There are five ecologically designated sites located within 5 km of the proposed Development which are as follows:

- Ardpatrick and Dunmore Woods Site of Special Scientific Interest (SSSI) – 1.6 km from Site;
- Tarbert Woods Special Area of Conservation (SAC) – 1.7 km from Site;
- Claonaig Wood SSSI – 2.2 km from Site;
- Inner Hebrides and the Minches SAC – 3.7 km from Site;
- Kintyre Goose Roosts Special Protection Area (SPA)/Ramsar/SSSI – 5 km from Site at its nearest point.

2.4 Site selection

18. SPR 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, SPR is continually assessing sites. This pipeline of potential sites is commercially sensitive which are not considered to be alternative sites to this proposed Development. Alternative sites are not considered further in the EIA Report.

19. However, in selecting sites, the criteria used by SPR to develop commercially viable projects include the following:

- suitable wind conditions for the installation of wind turbines;
- suitable solar irradiance for the installation of solar arrays
- availability of nearby grid connection with available capacity to accept new renewable energy generation;
- favourable topography and access to enable the construction of projects;
- planning policies which support the development of renewable energy;
- avoidance of significant environmental constraints where possible on site and/ or immediately surrounding, including protected sites for conservation and heritage, protected species and their habitats and deep peatlands;
- avoidance of the most sensitive landscapes; and
- areas that are sparsely populated to protect the residential amenity of residential areas and households.

20. A review of the site selection requirements for the Site found the following:

- initial desk based studies and wind monitoring onsite suggest that there is likely to be a good wind and solar resource and the Site is available for a renewable energy development;
- the grid network on the west coast of Scotland has been identified by SPR as requiring balancing services that would be suited to battery storage which would complement the solar development and wind turbines.
- there are large areas of flat/gentle sloping south facing land that are suitable for ground mounted solar
- it has good access from the public road network for construction traffic and wind turbine deliveries, particularly for longer blades which allows consideration of larger turbines to make the best use of the expected wind resource;
- there are no planning policies which, in principle, preclude wind energy or renewable energy development. The Site is partly located within an area which is considered to have potential for windfarm development subject to other policy considerations. Further information on this is provided in **Chapter 4 Renewable Energy and Planning Policy**;
- the proposed Development is located adjacent to existing wind turbines, clustering this type of renewables infrastructure in lands designated as suitable for this purpose within the Argyll and Bute region;
- it can make use of the existing forestry access tracks and windfarm access road for Cour Windfarm to minimise environmental impacts
- there are no international statutory designations for landscape and nature conservation in, or within close proximity of the Site. There is one National Scenic Area within the landscape study area. This is the North Arran NSA which is located 7.3 km south east of the Site. Other landscape designations considered in the landscape study area are the Knapdale/Melfort Areas of Panoramic Quality (APQs), approximately 1.8 km to the north west of the Site and the North Arran Special Landscape Area (SLA) to the south east;
- it can accommodate turbines and associated infrastructure without affecting sites designated for their natural or heritage interests such as SSSI, SAC, Special Protection Area (SPA) and nationally and locally protected monuments; and
- the nearest wind turbine is 1.05 km away from the nearest residential property, which is owned by Gartnagrenach estate.

21. In addition, Scottish Planning Policy (SPP) (June 2014) provides support for wind development in principle and encourages local authorities to guide developments towards appropriate locations. Paragraph 154 states that planning authorities *"should support the development of a diverse range of electricity generation from renewable energy technologies – including the expansion of renewable energy generation capacity".* Paragraph 155 also states that *"development plans should seek to ensure an area's full potential for electricity and heat from renewable sources is achieved, in line with national climate change targets."*

22. In response to these policy requirements A&BC has undertaken a landscape capacity study (2018) to identify those landscapes which, in principle, have the capacity to accommodate wind turbines. The Argyll and Bute Landscape Wind Energy Capacity Study 2017 (ABLWECS) updated the Argyll and Bute Landscape Wind Energy Capacity Study 2012. The proposed Development site is within LCT6: Upland Forest Moor Mosaic. The key characteristics of this area are described as *broad areas of undulating upland plateau lying within the interior of the Kintyre peninsula.* The ABLWECS states the following in relation to this LCT:

"*There is very limited scope for the Very Large typology (turbines >130m) to be accommodated. The narrow extent of this peninsula and its relatively low relief (especially in the northern part of this LCT) inhibits opportunities for turbines >150m high. Very large turbines in many locations would be likely to significantly intrude on views from both Gigha and Arran, considerably extending effects and potentially affecting the 'space and cluster' spatial patterns of existing wind farm development evident in the northern part of the peninsula in views from Arran. Turbines <150m may be able to be accommodated provided they are set well into the centre of the peninsula and occupy more contained sites which would minimise the effects of turbines of this size on the coastal fringes of Kintyre and on views from Arran and Gigha*".

23. The ABLWECS also describes the character of the Upland Forest Moor Mosaic Landscape as follows:

"*This land has a simple land cover of extensive coniferous forestry and moorland. It is sparsely settled and already accommodates operational and consented wind farm developments. Some of these key characteristics reduce sensitivity to large wind turbines although there are some more sensitive features. These include the more complex smaller scale hills and occasional narrow settled glens lying on the outer fringes of this upland plateau. More pronounced and rugged higher hills which lie within the core area of this landscape and the remote and little modified coast between Skipness and Tarbert would also be highly sensitive to wind energy development"*

24. In terms of the applicability of the 2017 ABLWECS's findings to individual sites, the study states, *"the purposes of assessing sensitivity in the wider arena of landscape planning is different to that undertaken as landscape and visual impact assessment which is specific to a particular project or development and its location".* Therefore, it should be reinforced that whilst the findings of the ABLWECS will be considered in the design of the proposed Development, it gives a broad-brush view on the relative sensitivity and capacity of windfarm development in the area, which should not be a substitute for individual and detailed landscape and visual assessment. A&BC through its policies is guiding the development of renewable energy, including wind turbines to the Site. The Site has, therefore, met the site selection criteria and was considered to represent a commercially viable option that warranted further investigation as a renewable energy development.

2.5 Technology, size & scale

25. The proposed Development would comprise 19 three-bladed horizontal axis turbines, 16 up to 149.9 m tip height and 3 up to 135 m tip height, with a combined rated output of around 114 MW, with the incorporation of around 20 MW of ground mounted Solar to give a total energy output of around 134 MW. The proposed Development also comprises around 38 MW of battery storage. Other technologies such as Hydrogen Storage, Hydro Power and EV charging were also considered but are not being taken forward within this development.

2.5.1 Wind turbines

26. Onshore wind continues to be the cheapest form of renewable energy and the site has been predominantly selected for its potential to generate energy from wind turbines. However, the challenge is to meet the Scottish Government targets within a context of limited Government support mechanisms for onshore wind. The supply of smaller wind turbines across Europe is already reducing, due to lack of demand as manufacturers are recognising the world market is shifting to larger machines with development work focussing on larger turbines to secure higher yields. The onshore wind industry has experienced a reduction in supply of smaller wind turbines due to lack of demand from mainland Europe, where the tendency is to install

wind turbines at higher tip heights (e.g. 175 – 240 m to blade tip). Therefore, it is highly unlikely that a range of smaller turbines (e.g. 120 m) would be available at competitive prices by the time the proposed Development is ready to be constructed, if consented.

27. Larger turbines will need to be considered if onshore wind development is to continue to make a contribution to both the UK and Scottish Government's renewable energy targets, particularly the recent announcement of net zero CO_2 emissions by 2045. The Scottish Government's Onshore Wind Policy Statement (December 2017) also challenges the industry to develop the first 'subsidy free onshore windfarm' which will only be possible if taller turbines are installed.

28. It was considered that taller turbines of 150 m and above would likely provide the optimum scale of the associated infrastructure required, subject to appropriate assessment of landscape impacts. Compared to smaller wind turbines the amount of concrete per MW produced would be less, and similarly the length of new access track (km) required per MW produced would also be less. Fewer but taller wind turbines would also reduce any forestry felling by increasing the rotor clearance above the tree canopy reducing the impacts upon existing forestry operations. Broadleaf planting in some areas could be brought forward in terms of the existing Site felling plan and thus the associated benefits of this planting will be realised sooner. Overall, whilst it was considered that taller wind turbines were the most appropriate and would better contribute to the Scottish Government's climate change targets, the assessment of landscape impacts would be the final limiting factor on the selected height of wind turbines.

29. The final selection of the turbine tip height of up to 149.9 m was considered to represent the best balance of tall turbines and design in the landscape. Furthermore, by limiting the wind turbines to 149.9 m it negates the need for visible lighting imposed by the Civil Aviation Authority for structures over 150 m. These considerations and the final selection of turbine height are described in **Section 2.6.2 Design layout evolution** of this Chapter.

2.5.2 Solar

30. The global horizontal irradiation (GHI) for the general location of the Site is calculated to be around 900 kWh/m^2 which although is slightly less than the UK average of 1,000 kWh/m^2, is still within levels considered viable for development.

31. Large parts of the site were also found to be potentially within design parameters (less than 5 degrees for north facing slopes and no more than 12 degrees for south facing slopes) suitable for the installation of ground mounted solar panels. It was considered that solar arrays should be investigated further and could co-exist with wind turbines. Key to investigating the positioning of solar would be the suitability of ground conditions, especially slopes, the presence of peat and the quality of habitats on the Site.

2.5.3 Battery Storage

32. 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 storage facility is therefore proposed at the site to support the flexible operation of the National Grid and decarbonisation of electricity supply.

33. The battery storage facility would store electrical energy through the use of batteries, contained alongside inverters within a self-contained building, adjacent to the onsite control building to allow easy connection to the grid.

2.5.4 Hydrogen storage

34. Similar to the requirements of the battery storage, a flat area of land in proximity to the proposed Development's substation would be required.

35. SPR is investigating the feasibility of incorporating a hydrogen production facility within the proposed Development at some point in the future. This process would use electricity produced by the renewable technologies to produce hydrogen from water which is then compressed and stored. This hydrogen could then be used for transportation or converted back to electricity when there is demand from the national grid. Any hydrogen facility would likely be located adjacent, or close, to the substation compound in structures very similar to shipping containers.

36. There are ongoing investigations into the feasibility of the use of hydrogen as fuel for transport throughout the west coast of Scotland, and the results of these feasibility studies will determine whether it would be feasible to include hydrogen production within the proposed Development. Consequently, hydrogen production is not included as part of this consent application. SPR will continue to monitor the feasibility of hydrogen storage and could bring a consent application forward in the future. As with the proposed Development, it would be the subject of appropriate assessment and consulted upon appropriately if proposed at a later date in the future.

2.6 Design evolution

37. This section of the EIA Report addresses the evolution of the design that SPR has gone through from first considering the whole of the Achaglass Forest Estate to arriving at the proposed layout and scale of the proposed Development on Achaglass and Gartnagrenach Estates.

2.6.1 Design evolution approach

38. The layout and design of the proposed Development follows an iterative design and environmental constraints led process aimed at optimising a renewable energy development that minimises environmental impacts but meets the commercial requirements of SPR. An iterative design approach works in tandem with the EIA process, whereby the design process facilitates incremental changes in layout and design resulting from a continually developing understanding of environmental constraints. This iterative approach allows potential environmental constraints, as they are identified, to be avoided or minimised through alterations in design. This approach is referred to within this EIA as mitigation 'embedded' in to the proposed Development or simply 'embedded mitigation'. Further information on embedded mitigation is explained within each technical Chapter of this EIA.

39. As part of the approach, a number of design principles and environmental measures have been implemented and incorporated into the proposed Development as standard practice, including the following:

- consideration of the form of the underlying landscape and its scale;
- sensitive siting of the proposed infrastructure incorporating appropriate buffer distances from environmental receptors to avoid or reduce effects on the environment;
- considering the size and scale of the proposed Development appropriate to the location and proximity to residential areas;
- re-using existing forestry tracks and borrow pits as much as possible to access proposed turbine locations;
- design of the tracks to minimise cut and fill, reducing landscape and visual effects as well as costs;
- inclusion and design of borrow pit(s) to minimise the amount of the material required to be imported to the Site; and
- potential for up to 50 m micrositing of infrastructure during construction to ensure the best possible location is chosen based on detailed Site investigations.

40. Throughout the design evolution of the proposed Development layout, a key driver was the consideration of potential landscape and visual effects on receptors and how the proposed Development would relate to the existing landscape character as well as existing windfarms in the landscape. In particular, regard has been taken to evaluate the scale and number of turbines proposed, cumulatively with existing windfarms in the area, in particular the operational site of Freasdail Windfarm directly to the north and Cour Windfarm 5 km to the south of the Site, as well as the consented Eascairt Windfarm to the south east. The landscape and visual effects potentially caused by the proposed Development have been considered extensively from key receptors during the design of the proposed Development.

41. Siting and Designing Windfarms in the Landscape (Version 3a) SNH states that:

"In a wind farm, turbines can be arranged in many different layouts. The layout should relate to the specific characteristics of the landscape - this means that the most suitable layout for every development will be different. For a small wind farm, this might comprise a single row of wind turbines along a ridge; while, for a larger development, a grid of wind turbines is often taken as the starting point, with the turbines spaced at minimum technical separation distances."

42. The solar development areas have been selected using a similar approach to the wind turbine layout by applying technical and environmental constraints to the Site. The principle criteria for solar development has been the identification of flat land and ideally south facing slopes. The general design parameters used have been as follows:

- Aspect (excludes all areas that are not within 135 and 210 degrees from north);
- Slope (North facing <5° and South facing <12°);
- Watercourses (20m buffer);

- Avoids NVC Habitats of M17, M15 and M23;
- Protected Species, in particular areas deemed suitable for Marsh Fritillary; and
- Peat greater than 1 m depth.

43. The substation and battery storage area also follow a similar requirement for positioning on flat land and avoiding sensitive habitats areas, deep peat and steep slopes. A construction and maintenance compound would also be required with similar design requirements, but its position would ideally need to be located near to the entrance and the development of the first wind turbine on entering the site.

44. The onsite access tracks have been designed to use existing tracks as far as possible; whilst minimising cut and fill requirements in order to reduce the amount of ground disturbance, amount of material required for construction, loss of sensitive habitats and landscape and visual effects, particularly during construction. All access tracks needed to be designed to follow routes which do not include excessive gradients. This is to aid the safe delivery of turbine components and associated parts.

45. Borrow pits would also be required as a source of rock to be used in the construction of the tracks, hardstandings and foundations. Borrow pit locations would need to minimise additional access tracks and provide easy opportunities to source suitable materials for construction. The total number and size of borrow pits was selected to meet the estimated volume of rock required to construct of the tracks, hardstandings and foundations.

2.6.2 Design evolution

46. SPR have been investigating the potential for a renewable energy development in this area since 2012, initially the Site was a windfarm wholly on Achaglass forest estate covering an area of 1528 ha as per **Figure 2.3**. However, following environmental surveys the Site now comprises a smaller area covering 1248 ha on Achaglass and Gartnagrenach Estates, as shown in **Figure 2.3** and with advances in technology now incorporates ground mounted solar and battery storage.

47. SPR commissioned SLR Consulting to carry out Landscape and Visual Feasibility Studies in 2018 for the Site. These studies examined various layouts for the Site in respect of landscape and visual considerations but taking account of known environmental and technical constraints, such as set back from watercourses and known designated environmental and heritage sites. An initial layout consisted of 35 turbines at 180 m to blade tip height.

48. SPR commissioned ornithological surveys of the site, which commenced in 2012 (not continuous), and also started monitoring wind speeds at the site in 2016. Data from these studies plus additional desk based environmental studies fed into a layout that was presented in a Scoping Report submitted to the ECU. Following consideration of this information and further landscape review, a reduced site boundary and 26 turbine layout with 149.9 m tall wind turbines was presented at Scoping.

49. The scoping layout and site boundary was further refined during the EIA process as site-based surveys were carried out and following consultation with consultees, in the form of responses to the Scoping Report (the Scoping Opinion), direct consultation with consultees and meetings with local community councils. Information collected during this stage of the design firstly fed into a 'Design Chill' layout of 19 turbines at 149.9 m. This layout also included areas of solar development and battery storage alongside possible substation locations. The Design Chill layout enabled the EIA and SPR technical team to undertake further studies and surveys and refine further the layouts including aspects such as borrow pit locations and access track alignments.

50. Following detailed review, a final 'Design Freeze' or Application layout has been developed which forms the basis of this application for consent. Whilst there has been no change in the number of turbines between the design freeze and design chill layouts, there have been a number of changes including change to positioning, scale of some turbines (ie, reduction in height), alignment of roads and selection of borrow pits and substation locations. The final design is based on a full understanding of the technical and environmental constraints. With this information, the final layout also comprises features to enhance the Site, including a Habitat Management Plan and enhanced access for recreation.

51. A summary of the evolving layouts and design, and the reasons for the changes and design decisions is presented in **Table 2.1. Figure 2.3** also illustrates the four layouts and visually illustrates how the design and site boundary has evolved through the design stages of the EIA process.

	Turbine Numbers	Tip height	Comments and reasons for design amendments
Initial layout (Pre-EIA studies)	35	180 m	Considered to be the maximum case scenario in terms of generation, whilst meeting noise and other desktop constraints. Following feedback from the ornithology surveys it became apparent that there were areas of the Site which were important for birds, in particular geese, which would not be suitable for development.
1st iteration (Scoping)	26	149.9 m	Scoping layout was informed by preliminary landscape studies which considered that a turbine height of 149.9 m would be the maximum height suitable for this site given its setting against other windfarms in the area with smaller turbines. A single access off the A83 utilising the existing access to the Achaglass Forest Estate and Cour windfarm was included.
2nd iteration (EIA studies)	19	149.9 m	'Design Chill' layout which was based on the emergence of environmental constraints from baseline studies and in response to feedback from consultees and local community groups. Site infrastructure was developed including options for substation, borrow pit and access track locations. Search areas were also identified for solar development. Consideration of an alternative site access off the A83 was included with a view to diverting HGV construction deliveries away from a cottage (Glebe cottage) at the existing access.
Application layout	19	135-149.9 m	'Design Freeze' layout which was based on the detailed examination of landscape views at key receptor locations and other detailed studies, such as habitat surveys, peat depth investigations and surveys for groundwater dependent terrestrial ecosystems (GWDTE). Of note, three turbines were reduced in size to 135 m to help balance the views of the site alongside the remaining site turbines and other nearby sites and further refinement of the site boundary. Two solar development areas were also refined based on the environmental constraints. Site infrastructure (access tracks and borrow pits) and locations of the substation, construction and maintenance compound and battery storage were also amended following detailed on-site investigations and walkover surveys. This layout also includes two accesses to the site from the A83, with one preferred option. A further feature of the final layout is access to the site for recreation (including access tracks, shelter and viewpoint), a bird hide, enhancement of archaeological features near to the Site and Kintyre Way and the development of a Habitat Management Plan to restore modified peat habitats.

Table 2.1: Description of the design evolution stages

2.7 Proposed consent application layout and design constraints

52. The proposed Development, which is described in detail in **Chapter 3 Proposed Development**, is the result of the previously described design evolution process. This section describes in more detail how this layout and design has been determined and outlines the environmental and technical constraints which have been taken into account.

53. The key constraints which were considered during the design process included:

- topography;
- identified landscapes and visual constraints;
- presence of ornithology, protected habitats and species;
- ground conditions (including peat);
- presence of watercourses, private water supplies and related infrastructure;
- presence of cultural heritage features;
- location of residential properties – proximity to noise sensitive receptors and potential for shadow flicker effects;
- aviation;
- key recreational and tourist routes;
- forestry; and
- presence of power lines, pipelines and telecommunications links.

54. In order to progress the design of the renewable energy development, a 'traffic light' based constraints plan **(Figure 2.2)** was developed whereby each constraint was assigned a red, amber or green category depending on their significance. A description of how the various environmental and technical disciplines have contributed to the design through detailed assessment is described below. Information in respect of the survey work undertaken is provided in the technical Chapters of this EIA Report **(Chapter 7 to 15)**.

2.7.1 Wind analysis

55. Wind analysis and efficiency modelling has been carried out by SPR throughout the design evolution process of the wind turbines to identify the areas of the Site likely to produce the highest yields and ensure the commercial viability of the scheme.

56. For turbines to work as effectively as possible, they must be suitably spaced relative to the predominant wind direction. If they are too close together in this direction, the wake effects from the wind turbines located on the upwind edge of the array will create turbulent air for the next row and so on through the array, reducing overall energy output. Conversely, if wind turbines are located too far apart the opportunity to maximise the capacity and, thereby, electricity generation from a site is reduced.

57. There is no industry standard for spacing, only manufacturer recommendations and rules of thumb. Six times rotor diameter on the predominant wind direction against four times rotor diameter cross wind (6D x 4D) is a common starting point. This is understood to provide a reasonable compromise between turbine proximity and site capacity without unduly compromising turbine operation. The proposed Development may, however, employ turbines which are not yet on the market. Therefore, a more flexible methodology utilising wind yield modelling was used to find the right balance of turbine efficiency and productivity over a wide variety of potential rotor diameters.

2.7.2 Topography

58. The site is undulating and the steepest areas of the Site (greater than 12 % slope gradient) have been avoided for the development of infrastructure. Slope stability has been taken into consideration to understand whether infrastructure could be located within certain areas of the Site. Where slope stability was identified as an issue, these areas were deemed to be unsuitable for infrastructure and have been avoided due to the potential for slope instability and peat slide risk.

2.7.3 Landscape character and visual amenity

59. The design of the wind turbine layout is a vital part of the landscape and visibility effects of a renewable energy development. Its appearance considered on its own, and its appearance within the context of Freasdail Windfarm and other cumulative sites were important considerations. Landscape and visual input to the design was based on SNH's Siting and Design Guidance (2017) and drawing on fieldwork observations. The following key landscape and visual sensitivities were identified in the vicinity of the Site:

- proximity to the NSAs;
- potential visibility from Wild Land Areas;
- potential visibility from nearby settlements as noted above, the A83, ferries to Arran and Ghiga and walkers on the Kintyre Way; and
- proximity to adjacent operational windfarm at Freasdail (11 turbines at 100 m blade tip height); consented Eascairt (13 turbines at 100 m blade tip height) as well as other cumulative windfarms in the wider surrounding area.

60. The final proposed Development layout has considered the following:

- reasonably consistent and balanced relationship with the large scale and simple landform of the Site when seen from the surrounding area;
- satisfactory relationship with the adjacent operational Freasdail Windfarm by being perceived as a discrete group of larger wind turbines adjacent to Freasdail Windfarm, which minimises visual confusion between the different sized turbines;
- reasonable degree of setback from the sensitive receptors; and
- minimal or acceptable effects on visual amenity for nearby settlements including Clachan, Whitehouse and Skipness, as well as the dispersed properties in proximity to the site.

61. Where possible, proposed excavation for access tracks and other infrastructure has been minimised and the location of the substation compounds and construction compound have been reviewed to minimise visual effects.

62. The landscape and visual effects of the proposed Development are addressed further in **Chapter 7 Landscape and Visual Impact Assessment**.

2.7.4 Ecology and ornithology

63. Ecological surveys have been carried out across the Site over the last few years, including a Phase 1 habitat survey, a National Vegetation Classification (NVC) Survey and protected species surveys (including badger, otter, water vole, wild cat and red squirrel). Sensitive ecological features, including habitats present within the Site and species which use the Site and appropriate buffers, have been avoided. Of most significance where areas of Annex 1 peatlands and areas suitable for Marsh Fritillary butterfly and these areas have been avoided. In addition, the recommended habitat standoff distances from blade swept path to key habitat features have been incorporated into the design to reduce collision risk to bats.

64. Areas with potential to be Groundwater Dependent Terrestrial Ecosystems (GWDTEs) were also examined. They were found to be limited in extent across the Site and mainly confined to forest rides and adjacent to watercourses. Confirmed GWDTE's were avoided by all site infrastructure.

65. Ornithology surveys have been carried out across the Site and surrounding area since December 2012 (not continuous), including vantage point watches; scarce breeding birds (for raptors, divers and any other species listed in Schedule 1 of the Wildlife and Countryside Act 1981); and winter walkovers for non-breeding birds. Suitable buffers were considered during the design evolution process and areas have been specifically avoided owing to the presence of geese.

66. The ecology and ornithology effects of the proposed Development are addressed further in **Chapter 8 Ecology** and **Chapter 9 Ornithology**.

2.7.5 Peat depth

67. As illustrated on SNH's Carbon and Peatland 2016 Map (SNH, 2016), the Site is shown to be partly located within Class 1 and 2 Priority Peatland Habitat. Site visits have confirmed the presence of peat and peatland habitats (**Chapter 8, Ecology**). Peat probing and habitat surveys were undertaken in 2019 and show that the peat is of variable condition and depth across the Site, with deeper peat occurring on the Site plateau and other shallow slope areas. The peat probing data is discussed in **Technical Appendix 10.1 Peat Landslide Hazard and Risk Assessment**.

68. A review of the peat depth data and habitat mapping, in conjunction with slope gradients, allowed areas of deep peat (typically greater than 2.5m) and those areas of less modified peat to be avoided where possible through the evolution of the design. Where possible, proposed wind turbines, ground mounted solar arrays and site infrastructure would be located within areas of peat less than 1 m deep. Six wind turbines and some sections of access track are located with Class 1 peatland, as illustrated on the SNH Carbon and Peatland map. However, as the peat depth and quality are variable, the layout of the scheme has focused on keeping the impacts and loss of the best quality peatland habitats to a minimum. Further details of peatland habitat loss and habitat management proposals for restoring modified peatland habitat can be found in **Chapter 8 Ecology**.

69. The proposed Development has also been designed to avoid any areas of which may be subject to peat slide risk. The ground condition constraints that were considered in the design of the proposed Development were:

- identification of peat depths in excess of 1.5 m – to minimise incursion, protect from physical damage, minimise excavation and transportation of peat, reduce potential for peat instability and minimise potential soil carbon loss;

- identification of slope angles greater than 5˚- to minimise soil loss and potential instability; and
- 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.

2.7.6 Hydrology and hydrogeology

70. In accordance with good industry practice, a 50 m buffer zone has been applied around all watercourses on the Site for wind turbines and 20 m around solar development areas. This reduces the risk of runoff and water pollution entering watercourses. In some cases, the use of existing tracks, which are already less than 50 m to a watercourse, have been identified as the best option for design, minimising the need for new tracks. Watercourse crossings have been minimised as far as possible; and where possible, existing crossings would be used. Existing culverts may be upgraded or replaced.

71. Data on private water supplies was obtained from A&BC and identified as a constraint to development. A 1 km radius of the Site boundary to any Private Water Supplies (PWS's) was established. Several PWS's were located within the 1 km radius and were assessed. The proposed Development respects a 250 m buffer applied to PWS's, where wind turbines have not been located.

72. The hydrology and hydrogeology effects of the proposed Development are addressed further in **Chapter 10 Hydrology, Hydrogeology, Geology and Soils.**

2.7.7 Cultural heritage features

73. Non-designated heritage assets were identified within the Site, which mainly relate to agricultural settlement and land division, and probably date to the post-medieval period. These features have been avoided with the inclusion of appropriate buffers as far as possible. SPR has also incorporated some of the heritage assets into the proposed Development by proposing to provide access and information boards for a number of features close to the Kintyre Way.

74. The cultural heritage effects of the proposed Development are addressed further in **Chapter 11 Archaeology and Cultural Heritage**.

2.7.8 Noise sensitive receptors

75. For the purposes of early constraints mapping, avoidance buffers of 1 km were applied to residential properties in the vicinity of the Site. These buffers were further refined during the design process based on expert noise advice. Using the background noise measurements, noise modelling was undertaken for the proposed turbine layout at various stages of the design process, to predict the likely sound level which would result from the proposed Development at nearby residential properties. The difference between measured background noise levels and predicted noise levels needs to be compliant with ETSU-R-97: 'The Assessment and Rating of Noise from Wind Farms' (Department for Trade and Industry (DTI), 1996) to avoid a significant impact. Applying design criteria in accordance with ETSU guidance ensures that no exceedances of acceptable noise levels would occur for the proposed Development.

76. The noise effects of the proposed Development are addressed further in **Chapter 13 Noise**.

2.7.9 Shadow flicker

77. The shadow flicker effects of the proposed Development are addressed further in **Chapter 15 Other Issues**.

2.7.10 Forestry

78. The commercial plantations of the Achaglass Estate Forest, and their existing forestry management plans for felling and planting, across much of the north and west of the Site have been considered in the design of the proposed Development. Forestry forms an integral part of the proposed Development as some trees would need to be felled, before planned plantation felling, around infrastructure positions to allow for construction of the development. A Forest Plan **(see Technical Appendix 3.2**) has been developed to illustrate the felling requirements and subsequent need for compensatory planting. Turbines have been 'keyholed' into the existing forestry, so that only the crops required for the infrastructure and its associated buffer zones will be cleared.

2.7.11 Telecommunications

79. Consultation with Joint Radio Company Ltd (JRC), OFCOM and BT raised no issues which could have potentially affected the proposed Development.

80. The effects of telecommunications on the proposed Development are addressed further in **Chapter 15 Other Issues.**

2.7.12 Infrastructure

81. A private 33kV underground power line runs south west to north east through the Site. A suitable buffer (50m) was included to ensure that no turbines were placed in the vicinity of the cable line. The Site tracks would pass over the cable.

2.8 Micrositing

82. In order to be able 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 agreement is sought for a 50 m micrositing allowance around all infrastructure. The technical assessments (presented in **Chapters 7 to 15**) have considered the potential for micrositing. It is considered that the proposed infrastructure could be microsited within 50 m without resulting in potential new effects with the exception of wind turbines 1, 3, 4, 7, and 11 which would not be moved in the direction of the nearest properties, but could be moved away by up to 50 m (**Figure 3.1**). For these turbines, due to the potential to increase landscape and amenity effects, no micrositing is being sought for these turbines. During construction, the need for any micrositing would be assessed and agreed with the onsite Environmental Clerk of Works (ECoW).

2.9 Conclusion

83. The EIA process has been an iterative one, so that constraints identified throughout the EIA and design process could be avoided and potential impacts of the proposed Development avoided or reduced.

84. In summary, the application design and layout represent a proposed development which achieves the following:

- maximises the renewable energy potential through the development of different renewable technologies;
- minimises the proximity to and visibility from residential properties as well as the settlements of Clachan to the south west, Whitehouse to the north and South Knapdale to the north west;
- minimises visibility from the more sensitive landscapes of South Knapdale, the Kintyre coasts and North Arran;
- minimises visibility and effect on recreational receptors including the Kintyre Way, National Cycle Routes (NCRs), ferry and transport routes;
- a layout that is reasonably balanced with group of wind turbines when seen from key receptor locations in the surrounding landscape;
- consideration of the cumulative landscape and visual impacts from the proposed Development in addition to the existing windfarms, as well as other nearby consented windfarms;
- is in accordance with the Argyll and Bute Landscape Capacity Study and the Argyll and Bute LDP;
- reduces the amount of felling and can be accommodated within the Forest Design Plan for the area;
- minimises and, where possible, avoids the loss of priority habitats and species, and creates opportunity for habitat enhancement which will be delivered by a Habitat Management Plan;
- protects watercourses from the potential impacts of constructing the Development; and
- can be engineered and constructed safely.

85. The final layout of the proposed Development is described in detail in **Chapter 3 Proposed Development** and shown on **Figure 3.1**. The potential effects of the resulting layout are addressed throughout **Chapters 7 to 15** of the EIA Report.

2.10 References

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