atmos CONSULTING

36405 R2

Environmental Impact Assessment

Sandy Knowe Wind Farm Extension

Chapter 3: Description of Development

ERG UK Holding Ltd

ERG

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Glossary of Terms

Term	Definition
The Applicant	ERG UK Holding Limited
The Agent	Atmos Consulting Limited
Environmental Impact Assessment	Environmental Impact Assessment (EIA) is a means of carrying out, in a systematic way, an assessment of the likely significant environmental effects from a development
Environmental Impact Assessment Regulations	The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (EIA Regulations)
Environmental Impact Assessment Report	A document reporting the findings of the EIA and produced in accordance with the EIA Regulations
The Proposed Development	The Sandy Knowe Wind Farm Extension
The Proposed Development Footprint	The area within which the Proposed Development will be located
The Proposed Development Site	The full application boundary including Sandy Knowe Wind Farm and Sandy Knowe Wind Farm Extension

List of Abbreviations

Abbreviation	Description
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
ECU	Energy Consents Unit

3 Description of Development

3.1 Introduction

This chapter describes the Proposed Development, including the current site conditions, the site selection and design process, and details the finalised design proposed in this application.

3.2 Site Selection and Design Evolution

3.2.1 Site Selection

Since the consented Sandy Knowe Wind Farm's project inception in 2011, high wind speeds have been continuously observed onsite. Through environmental and technical studies, the Applicant has found limited amounts of sensitive environments and species in the area. As such, the Applicant has identified an opportunity to extend the Sandy Knowe Wind Farm to utilise the existing available grid capacity. Furthermore, support for extending already consented / existing wind farms is noted within the Scottish Energy Strategy (Scottish Government, 2017) and the Draft NPF4 (Policy 19a, 19b).

The Proposed Development Site has been selected as suitable by the Applicant because it met the following criteria:

- There is a commercially viable grid connection maximising the available capacity of the connection already installed for Sandy Knowe Wind Farm;
- There is good wind speed;
- The Proposed Development location is in proximity to existing operational wind farms of similar scale and is in an area where wind turbines are already operating at a reasonable distance from the Site;
- The location is distant from nearest residential properties and settlement, and is compatible with residential receptor distribution;
- The Proposed Development Site has an established road access and access track network; and
- The Proposed Development Site itself does not support, or is in close proximity to, international or national, environmental, landscape or cultural heritage designations.

In accordance with Schedule 4 (2) of the EIA Regulations, and Regulation 5 of The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017, reasonable alternatives (in terms of project design, technology, location, size and scale and characteristics) of the Proposed Development should be considered. However, the rational for site selection of the Proposed Development was as an extension to Sandy Knowe Wind Farm based on spare grid capacity and infrastructure sharing being achieved. Therefore, alternative sites have not been considered.

As part of the development process the Applicant has reviewed and discounted alternative infrastructure siting (turbines, sections of new access track and access) due to a variety of factors including environmental, planning, technical and commercial constraints.

3.2.2 Site Design

The design of the Proposed Development has been driven by the objective of positioning the turbines and associated infrastructure so that it captures the maximum wind energy possible within a suitable area determined by environmental and technical constraints. The key constraints to site design, which were assessed during the design and scoping process, include:

- Landscape character and visual amenity;
- Ground conditions, topography and peat;
- Presence of protected habitats (including Groundwater Dependant Terrestrial Ecosystems (GWDTE)) and species;
- Proximity to noise sensitive receptors;
- Presence of watercourses, private water supplies and related infrastructure;
- Presence of sensitive ornithology receptors;
- Presence of sensitive cultural heritage features; and
- Proximity to suitable grid connection.

These constraints are discussed more in their relevant chapter.

Table 3.1 sets the key design iterations that have taken place since pre-application (Scoping Layout), receipt of the scoping opinion (Design Chill) and final layout (Design Freeze). The Design Evolution Layouts are shown on Figures 3-2a to 3-2c.

Table 3.1: Turbine Layout Design Iterations

Layout	No. of Turbines	Tip Height (m)	Design Changes
1 (Scoping Layout)	6	149.9m	Initial feasibility based on preliminary environmental and technical consideration with the intention of sharing infrastructure components with Sandy Knowe Wind Farm where practicable in order to minimise the potential impact on sensitive receptors.
2 (Design Chill)	6	125m to 149.9m	Turbines All turbine IDs renumbered to sequentially follow the Sandy Knowe turbine numbering. **T25** (previously T1) - Moved to shallow gradients on opposite side of communication link constraint. - Moved to shallower peat based on interpolated range surface. - Moved within broadly similar NVC habitats (M20a), but the new location increases the distance from highly GWDTE. **T26** (previously T2) - T25 has been moved to the opposite side of the communication link constraint therefore T26 required to be moved to maintain optimum turbine spacing. - Moved east to shallower gradients and avoiding additional watercourse crossing (with limited space for turbine construction area outside watercourse buffers). - Moved to slightly shallower peat based on interpolated range surface. - Moved within same habitat type (M20a). **T27** (previously T3) - Moved to small pocket of shallower peat (0.6-1m) based on interpolated range surface. - Moved to small strip of semi-improved grassland / non-qualifying NVC habitat. **T28** (previously T4) - Maximum tip height reduced from 149.9m to 125m to reduce residential amenity effects. **T29** (previously T5) - Moved south to increase distance from residential receptors and avoid peat >0.5m based on interpolated range surface. - Maximum tip height reduced from 149.9m to 125m to reduce residential amenity effects. - Moved further south to increase the distance from a sensitive ornithology constraint.

Layout	No. of Turbines	Tip Height (m)	Design Changes
2 (Design Chill)	6	125m to 149.9m	**T30** (previously T6) - Moved east to avoid flush habitat whilst maintaining distance to sensitive residential receptors; now located on modified bog. - Maximum tip height reduced from 149.9m to 125m to reduce residential amenity effects. <u>Hardstands</u> **T25** (previously T1) - Hardstand area introduced and positioned to avoid highly GWDTE and deeper areas of peat based on interpolated range surface. - Positioned cross slope to minimise cut and fill requirements. **T26** (previously T2) - Hardstand area introduced and positioned to avoid highly GWDTE. - Positioned to minimise cut and fill requirements based on slope. - Positioned to maintain a maximum buffer of 50m from watercourses. **T27** (previously T3) - Hardstand area introduced and positioned to avoid highly GWDTE and deeper areas of peat based on interpolated range surface. - Positioned cross slope to minimise cut and fill requirements. **T28** (previously T4) - Hardstand area introduced and positioned to avoid highly GWDTE and deeper areas of peat based on interpolated range surface. - Positioned cross slope to minimise cut and fill requirements. **T29** (previously T5) - Hardstand area introduced and positioned to avoid deeper areas of peat based on interpolated range surface. - Positioned cross slope to minimise cut and fill requirements. **T30** (previously T6) - Hardstand area introduced and positioned to avoid deeper areas of peat based on interpolated range surface.

Layout	No. of Turbines	Tip Height (m)	Design Changes
2 (Design Chill)	6	125m to 149.9m	Access Tracks Track between T25 and Sandy Knowe Wind Farm infrastructure has been re-routed to avoid deeper peat based on interpolated range surface. Given the movement of T25, the track between T25 and T26 was redesigned to avoid deep peat where possible based on interpolated range surface. The track between T26 and T27 has been routed on <0.5m peat depth based on based on interpolated range surface. Track west of T27 on the approach to T28 has been routed to maintain a maximum buffer of 50m from identified cultural heritage assets. To avoid M6 habitat, the three-way junction on the track approaching T29 and T30 has been removed and the track to T29 realigned to avoid the M6 habitat. Turning heads were then introduced at each turbine location at T29 and T30. Battery Storage Battery storage was considered as part of the design chill layout to be located in the area of the existing Temporary Construction Compound at Sandy Knowe.
3 (Design Freeze)	6	125m to 149.9m	Turbines **T25** - Moved approximately 5m southeast to marginally shallower peat. **T26** - No design iterations noted. **T27** - Moved 25m west to allow a better alignment of the hardstand while still in shallow peat following detailed peat probing. **T28** - Moved 15m southeast to shallower peat following detailed peat probing. - Turning head moved into shallow peat following detailed peat probing. **T29** - Moved turbine 28m southwest to allow for the hardstand realignment.

Layout	No. of Turbines	Tip Height (m)	Design Changes
3 (Design Freeze)	6	125m to 149.9.m	**T30** - Slight movement to take into consideration of the hardstand area movement. <u>Hardstands</u> **T25** - Hardstanding moved slightly southeast to keep temporary working areas outside GWDTE. **T26** - Hardstanding mirrored to place track on NW side of the hardstand area. This allows track alignment to avoid GWDTEs north and south of T26. - Tracks and turning head moved onto shallower peat areas following detailed probing. **T27** - Installation area rotated to avoid crossing watercourse whilst avoiding cultural heritage feature. **T28** - Installation area rotated to be slightly closer to orientation of contours without entering deeper peat. **T29** - Hardstanding mirrored to place track on NE side of the hardstand area and locate hardstanding on shallower peat. **T30** - Rotated the boom assembly points and reorientated hardstanding slightly (this required a 2m change to the turbine coordinate) to locate on locally shallower peat whilst avoiding sensitive habitats. <u>Access Tracks</u> Tracks between turbines microsited onto locally shallower peat where possible following detailed peat probing. Track between T27 and T28 has been realigned to avoid deeper areas of peat, including a section of floating track over peat

Layout	No. of Turbines	Tip Height (m)	Design Changes
3 (Design Chill)	6	125m to 149.9m	greater than 2m depth. This impinges slightly on the 20m cultural heritage receptor buffer zone. This asset is of low or negligible importance, however, provision for fencing/demarcation under archaeological supervision prior to construction commencing will be considered in Chapter 10 Cultural Heritage. T29 – T30 junction relocated to shallower peat. Borrow Pit The existing borrow pit that is used for the construction of Sandy Knowe Wind Farm has been considered as part of Design Freeze. It is proposed to use the existing borrow pit for peat reinstatement as part of the Peat Management Plan for the Proposed Development. This will be considered as part of Chapter 8 Hydrology, Hydrogeology and Soils. Battery Storage There are no amendments for battery storage. Application Boundary The Application boundary was modified to include the consented Sandy Knowe boundary ('The Proposed Development Site'). For the purpose of describing the Proposed Development, baseline conditions and survey extents, an area has been illustrated as the "Proposed Development Footprint" which encompasses the proposed infrastructure which includes any land used for turbines, hardstanding, site access or where construction work is carried out. It also includes areas of Sandy Knowe such as consented / constructed tracks, temporary construction compounds and substation.

Final layout Turbine location grid references are provided in Table 3.2.

Table 3.2: Turbine Location Co-ordinates and Base Elevations

Turbine ID	Easting	Northing	NGR	AOD (m)	Maximum tip height (m)
25 (Previously T1)	268087	610406	NS6808710406	428	149.9
26 (Previously T2)	268256	610644	NS6825610644	391	149.9

Turbine ID	Easting	Northing	NGR	AOD (m)	Maximum tip height (m)
27 (Previously T3)	268303	610952	NS6830310952	374	149.9
28 (Previously T4)	268492	611317	NS6849211317	345	125
29 (Previously T5)	269981	611218	NS6998111218	285	125
30 (Previously T6)	270462	610993	NS7046210993	271	125

3.3 Development Description

3.3.1 Development Outline

The Proposed Development **consists of three turbines up to a maximum 125m** tip height; **three turbines up to a maximum tip height of 149.9m; battery storage;** and associated infrastructure.

The associated infrastructure includes:

- Use of existing; consented / under construction access tracks;
- New access tracks;
- Construction of turbine foundations and crane hardstandings;
- Underground cabling;
- Use of an existing borrow pit;
- Reuse of two consented temporary storage compounds; and
- Three watercourse crossings.

The wind turbine generators will have an indicative output of approximately **21.6MW** and an **indicative battery storage capacity of 28.4MW. The combined export capacity will not exceed 50MW.** Indicative duration of the battery storage is between 1 – 4 hours, with the final duration confirmed at the time of procurement.

The Proposed Development has been designed with an operational life of 40 years at the end of which it will be decommissioned unless further consents are granted.

It is anticipated that approximately 3km of new track is likely to be required to service the turbines and associated infrastructure. No upgrades are proposed on the consented / constructed Sandy Knowe Wind Farm access tracks.

The Proposed Development components are summarised in Table 3.3. "Permanent Infrastructure" in the context of this EIAR means infrastructure that will be in place for the operational life of the Proposed Development. Following expiry of planning permission, the decommissioned above ground infrastructure will be removed and reinstated in an environmentally sensitive way agreed with statutory consultees. The above ground infrastructure is permanent only for the duration of the planning permission.

Once the turbines have been installed, the crane hardstand area around the turbines will remain in place as permanent infrastructure. The boom assembly areas, temporary track and hardstand working areas will be restored using the retained topsoil or turf.

The permanent and temporary infrastructure is shown on Figures 3-1a to 3-1d.

Table 3.3: Proposed Development Components

Proposed Development Components- Maximum Parameters	
Turbines	
Three wind turbines up to 125m to tip height and three turbines up to 149.9m, (with a rotor diameter of approximately 112m). The maximum rated output is approximately 21.6MW.	
Permanent Infrastructure	
New Access track, including 9 passing places (3 per km)	[3098m x 5.5m] + [9 x 20m x 5.5m] (18,029m^2 total)
Turbine Foundation (6 No.)	25m x 25m area (3,750m^2 total)

Crane Hardstanding (6 No.)	62.5m x 25m (1,320m² per hardstand, 7,920 m² total – this excludes the turbine foundation but includes the area around it, please see Figure 3-4)
Hardstanding for Battery Storage Compound	105m x 30m (3,150m² total)
Temporary Infrastructure	
Boom assembly areas, Hardstand working areas and Temporary Track (12)	155m² (1,860m² total)
Turning Heads (4)	542 (2,168m² total)
Total permanent land take	**32,849m²**
Total temporary land take	**4,028m²**
Total Length of reused access tracks	**6,500m**

3.3.2 Wind Turbines

The Proposed Development comprises six three-bladed horizontal axis wind turbines, ranging from 125m to 149.9m tip height. Indicative turbine dimensions are shown on Figure 3-3.

The final choice of turbine will be subject to a selection process which considers technical and commercial aspects of the turbine and will be based on the turbine models which are commercially available at the time of construction.

The wind turbine generator will be mounted on a tapered tubular steel tower and will consist of a nacelle containing the generator and associated equipment to which will be attached a hub and rotor assembly including three glass/carbon fibre-reinforced polyester blades.

Turbines are typically of a variable speed type so that the turbine rotor speed varies according with the energy available in the wind. Wind turbines typically generate power in wind speeds between 4 and 25 meters per second (m/s).

The turbine stops for high wind speed when the exponential mean wind speed averaged over 100 seconds is greater than 25m/s (i.e. over storm force 10).

Turbines are computer controlled and contain wind sensors to determine when there is sufficient wind speed for operation. The turbines are pitch regulated to ensure the blades are pitched in the optimum angle during production and standby situations. The rotor blades of all turbines will rotate in the same direction.

When operating, the rotational speed of the wind turbine blades is transferred and increased to drive the generator. This produces a three-phase power output typically of 690 Volts (V) which is transferred from the generator to the turbine transformer.

If necessary, the location of each turbine will be micro-sited to achieve more favourable ground conditions. This is discussed further in section 3.4.12.

3.3.3 Turbine Foundation

Actual turbine foundation design and dimensions will be specific to the site conditions as verified during the detailed geotechnical site investigation undertaken before commencing installation and once the final turbine type has been chosen and manufacturer's specification has been finalised.

It is proposed that the foundation for the turbine will comprise a standard concrete gravity foundation constructed on poured concrete with steel reinforcement. Each foundation will require approximately 1875m³ of steel reinforced concrete, and steel reinforcement. Concrete will be imported. The foundation will be in the order of approximately 25m x 25m in area and approximately 3m deep (Figure 3-4).

The ground excavation methods will vary depending on the local ground conditions and the nature of the surface vegetation. The general processes will be as follows:

- Topsoil/turf will be stripped and stored in order to be reused in restoration of the turbine construction area;
- Subsoil (if present) will be stripped and stored, keeping this material separate from the topsoil/turf;
- Excavation of turbine foundations will then take place followed by the installation of the steel reinforcement bars and casting of concrete; and
- After the foundation has been poured the area will be backfilled as soon as practicable with spoil, pending turbine installation.

3.3.4 Crane Hardstanding

It is expected that the wind turbine will be erected using a set of large all-terrain cranes. A set consists of the main lifting crane and the tail crane. The main lifting crane will have a lifting capacity of up to 850 tonnes while the second, or tail crane, will have a lifting capacity of up to 500 tonnes. The area for the crane hardstanding beside the turbine base will be approximately 62.5m x 25m. Indicative crane hardstand dimensions are shown on Figure 3-5.

Two cranes will lift turbine tower sections and blades from the delivery vehicles either onto temporary working areas for storage or directly into their assembly position. The larger crane will be used to lift the tower sections, turbine nacelle and the hub and blade assembly into their final positions. The tail crane will help to align and position the components whilst being installed.

3.3.5 Boom Assembly and Hardstand Working Areas

The temporary boom assembly and hardstand working areas are proposed for the construction of the Proposed Development. These will be used for ancillary equipment, vehicles and cranes during the erection of the wind turbine.

Once the turbine has been installed, the boom assembly areas and hardstand working areas will be restored using the retained topsoil or turf.

Indicative turbine installation area dimensions (including boom assembly and hardstand working areas) are shown on Figure 3-5.

3.3.6 Temporary Construction Compound

The Proposed Development will reuse two of the consented / constructed Temporary Construction Compounds of Sandy Knowe Wind Farm. As the infrastructure for Sandy Knowe Wind Farm has already been assessed and consented, the construction effects will not be considered within this EIA. However, the delay in restoration of temporary infrastructure will be considered within Chapter 5 LVIA and Chapter 6 Ecology.

These are shown on Figure 3-1a.

3.3.7 Battery Storage Area

A battery storage facility of approximately 28.4MW is proposed on the eastern temporary construction compound adjacent to the consented / constructed substation (Figure 3-1c). It would be installed after the completion of the construction of the Proposed Development's wind turbines on the hardstand created for the construction compound.

The battery storage facility would provide back-up power to the National Grid for the benefit of providing stability to the electricity supply network and the integration of more renewable energy generation.

Each battery storage unit is approximately 9.7m x 30.5m with a height of approximately 2.4m. Four units are envisaged on the existing temporary construction compound area. The indicative design uses a liquid cooled outdoor solution for the battery racks and is the maximum parameters for the Battery Energy Storage System (BESS), with the exact technology confirmed at the time of procurement.

Indicative energy storage facility units are shown on Figure 3-6.

3.3.8 Site Access

All construction traffic (including abnormal loads) will access the site via the existing Sandy Knowe Wind Farm north-western access point directly off the A76, while all other vehicles during operation will access the site from the existing/constructed north-eastern access via the Heads of the Valley Road.

The route for abnormal load vehicles will utilise the same route as Sandy Knowe Wind Farm, i.e. the vehicles will travel south along the A74(M) and M6 to junction 44, then turning back north along the M6 to exit at junction 22 of the A74(M). The vehicles will then travel along the A75 and A76 to the Proposed Development Site.

There are no proposals to upgrade the access to the Proposed Development Site.

Site access is discussed further in Chapter 9 Transport and Access.

3.3.9 Access Track

New Access Track

Approximately 3km of new access track will be constructed to the specification required by the wind turbine supplier. These will have a total width of up to 5.5m. The tracks will be designed to have sufficient radii for turning of the construction vehicles, abnormal loads and plant. The access tracks have been designed to avoid sensitive features.

The access tracks will be constructed using 'cut track' design. Topsoil is stripped to expose a suitable rock or sub-soil horizon on which to build the track. The track is then built up on a geotextile layer by laying and compacting crushed rock to a depth dependent on ground conditions and topography. Generally, the surface of the track will be flush with or raised slightly above the surrounding ground level.

An indicative track construction design is shown in Figure 3-7.

Where the presence of peat has been identified to be greater than 2m in depth, floating tracks are proposed to be used at the location(s). A layer of crushed stone

(0.5m – 1m, dependant on ground conditions) will be laid on geotextile/geogrid reinforcement to form the track, which results in the site track being raised above the peat surface. The tracks will be slightly wider as 1m verges will be required.

Soils removed from the excavated area will be stored separately in piles, no greater than 3m in height, directly adjacent to, or near the tracks on ground appropriate for storage of materials i.e. relatively dry and flat ground, a minimum of 50m away from any watercourses. Wherever possible, reinstatement will be carried out as track construction progresses.

Prior to the commencement of site construction, detailed engineering specification for the access track design will be submitted to the planning authority as part of a Planning Conditions Compliance Statement, which will include Construction Method Statements for all aspects of construction.

Access Track Drainage

The Access Track Drainage for the new access tracks will follow the design principles of the consented / under-construction tracks of Sandy Knowe Wind Farm.

The drainage design will comply with General Binding Rules (GBR's) 10, 11 and 21 for the track drainage, under the Water Environment (Controlled Activities) (Scotland) Regulations (CAR) 2011 (as amended) (Scottish Environment Protection Agency (SEPA), 2011).

Surface or sub-surface water flow within the vicinity of the access tracks and hardstanding areas will be routed into drainage channels or will flow across the hardstanding areas. The drainage channels will be situated on the upstream side of the infrastructure and run in parallel with them. These channels will pass under the hard areas, via small diameter carrier drains, to the downstream side where the run-off will percolate to the riparian zone.

The edges of the access tracks will be flush to allow the surface water from the road to route directly into the collection channels or infiltration trenches. On steeper sections of track, regular cross drains, connected to infiltration trenches, will be installed to collect surface run-off and ensure longitudinal flow is intercepted, thus avoiding rutting and subsequent breakup of the track surface. Trenches will maintain linear flows to downstream areas avoiding point discharge of large flows.

Where the access tracks follow contours, earthworks may be required to accommodate these. Where earthworks are required a collection ditch will be installed at the head of the cutting, with small stone check dams, incorporating sumps, to collect silt and prevent sediment transfer to watercourses.

Where turbines are located on steeper ground, collection drains will be located on the upstream side and will drain into either infiltration or filter trenches on the downstream side.

A Drainage Management Plan (DMP), which will detail proposed surface drainage measures to treat and deal with surface runoff from the site, will be designed in accordance with sustainable drainage systems (SuDS) principals. This plan will form part of a Construction Environmental Management Plan (CEMP) and in consultation with SEPA.

3.3.10 Watercourse Crossings

The Proposed Development has been designed to minimise works in the vicinity of mapped watercourses and to minimise the need for new water crossing in order to reduce the risk of pollution and changes to watercourse morphology.

Three watercourse crossings will be required for the proposed new access tracks within the Proposed Development Footprint: one within Polhote Burn (W1) and two tributaries to the Polhote Burn (W2 and W3). These locations are shown in Figure 3-1a and 3-1b.

The three watercourse crossings will be constructed by installing an arch/ bottomless culvert at each location. Figure 3-8 shows an indicative plan of this type of structure.

It is proposed that the final solution and detailed design for all water crossings will be addressed through an appropriately worded condition.

3.3.11 Borrow Pits

The Proposed Development includes the use of an existing borrow pit known as Borrow Pit D (BPD), for the excavation of on-site aggregate to be used in the construction of the Proposed Development and for peat reinstatement as it is considered there is sufficient space within its footprint to accommodate the residual peat excavated for the extension.

BPD has been the main source of aggregate during the construction of the original Sandy Knowe Wind Farm. BPD may have further reserves of stone aggregate that can be used in the construction of the Proposed Development. Aggregate volume estimates will be calculated pre-construction after Site Investigation works are undertaken. Prior to any excavation being undertaken, an updated Borrow Pit Scheme of Works and an updated Borrow Pit Restoration Plan for BPD will be prepared and agreed with the Local Authority and Statutory Consultees. Any extraction of aggregate will be within the existing boundaries of BPD.

The location and extent of BPD is shown on Figure 3-1a and 3-1b.

For the purpose of the Peat Management Plan (PMP) and to maximise the environmental benefits for peat reinstatement, it is proposed that excavated peat from the Proposed Development will be used in the restoration of BPD. The PMP is found in Appendix 8-2.

The traffic assessment Chapter 9 Transport and Access of this EIA assumes import of all aggregate to the Proposed Development Site as a worst-case scenario.

3.3.12 Electrical Connections

Cabling

The electrical power produced by the individual turbines will be fed to an onsite substation via underground cables. The Applicant has a grid connection agreement with the Transmission network operator for connection into Glenglass substation.

On site cabling will typically consist of array cables, predominantly at 11,000 or 33,000 volts (11KV or 33KV). The typical installation depth for cables of this voltage is approximately 0.5m as shown in Figure 3-7. It is anticipated these cables will be sited

within the footprint of the existing access track and will be suitably marked on the surface.

Approximately 9km of cabling will be required for the Proposed Development.

Substation

It is anticipated that the Proposed Development would be connected to the electricity network via the Sandy Knowe Wind Farm substation. There will be no requirement to upgrade the Transmission Network beyond the Sandy Knowe Wind Farm substation in order to facilitate the Proposed Development. The Substation already constructed for Sandy Knowe Wind Farm will house the necessary Switchgear for the Proposed Development.

SCADA System

A Supervisory Control and Data Acquisition (SCADA) system will be installed to gather information from each turbine and to enable each turbine to be controlled from an external location. A fibre optic communications cable will be laid adjacent to the power cables in the same cable trench to link the turbines to the SCADA system. The SCADA system allows remote monitoring of the turbines via a communication link.

3.3.13 Site Signage

The Proposed Development will have suitable signage to provide directions, contacts and health and safety information. There will be signs at the site entrance providing the operator's name, the name of the development and an emergency contact telephone number.

3.3.14 Micro-siting

The consented Sandy Knowe Wind Farm Condition 16 referred to a micro siting allowance for adjustment of turbine, crane pads, track and equipment positions to suit actual ground conditions is proposed. The condition is:

> *16. Micro-siting*
>
> *(1) That the wind turbines, crane pads, tracks, substation compound, and meteorological mast locations shall not be erected in any position other than the positions shown in the EIA Report , unless agreed by the Ecological Clerk of Works (ECoW) in consultation with the Planning Monitoring Officer.*
>
> *(2) Any such variation (micro-siting) shall not exceed 100 metres in any direction from that shown in the EIA Report . Any variation of between 50 metres and 100 metres shall only be permitted following prior written approval of the Council as planning authority (in consultation with the MOD, NATS, Glasgow Prestwick Airport and where relevant SEPA and / or SNH).*
>
> *(3) No later than one month after the date of First Commissioning an updated site plan showing the final position of all wind turbines, buildings, masts, areas of hardstanding, tracks and associated infrastructure forming part of the Development shall be submitted to the Planning Authority. The plan shall also specify areas where micro-siting has taken place and, for each instance, be accompanied by copies of the ECoW or Planning Authority's approval, as applicable.*

Consent is therefore sought for the same micro siting condition for the Proposed Development.

Any mitigation measure specified in this EIA Report will be applied during micro-siting of the turbines and associated infrastructure in order that there is no resultant significant adverse effect on protected species, habitats or hydrological features.

3.3.15 Construction Programme

Subject to receipt of consent and deemed planning permission and sign off of pre-commencement conditions; construction works are anticipated to commence in 2024 with a total duration estimated at approximately 12 months. The work would proceed in four phases as summarised in Table 3.4.

Table 3.4: Construction Programme

Phase	Summary of Works
Phase 1 (month 1); Enabling/Access Works;	Construction of new access routes from existing access tracks to the turbine locations .
Phase 2 (month 2 to 10); Development (Main Site)	Establishment of site facilities, turbine foundation and turbine cabling. Delivery of turbine components & installation with cranes.
Phase 3 (month 10 to 11); Testing and Commissioning	Testing and commissioning equipment and turbines.
Phase 4 (month 11 to 12); Reinstatement and Restoration	Removal of temporary facilities and re-instatement of temporary working areas. Restoration of working areas as set out in the Schedule of Mitigation and CEMP.

The proposed normal hours of operations for construction activity are between 07:00 - 19:00 Monday to Saturday, with deliveries on a Saturday restricted to the hours of 07:00 to 12:00. During the installation phase, there may be a requirement for extended working hours as some critical elements of installation cannot be stopped once started such as concrete pouring, this will be agreed in advance with Dumfries and Galloway Council.

3.3.16 Construction Methods

An outline Construction Environmental Management Plan (CEMP) for the Proposed Development has been prepared as part of the EIA Report (Appendix 14-1). The outline CEMP details the principles and procedures for the environmental management of the Proposed Development during construction. It is intended to be read as an indicative document, noting that the Final CEMP will be developed in collaboration with the planning authority and will comply with the terms of any planning consent and attendant planning conditions as well as any other relevant agreements and commitments made during the consenting process.

The outline CEMP is considered a live document and methods and processes provided in the document are for guidance only and will be expanded upon and/or amended prior to construction, once the Applicant has selected a main Contractor.

3.3.17 Construction Materials

The key materials required for the construction of the track, turbine foundation, hardstanding and cable trenches are as follows:

- Crushed stone;
- Geotextile;
- Cement;
- Sand;
- Concrete quality aggregate;
- Steel reinforcement; and
- Electrical cable.

Materials will be sourced and transported to the site from local suppliers, where possible.

The foundation concrete will be of a grade that accords with the turbine manufacturer's requirements.

3.3.18 Construction Movements

Various vehicle types are required during the construction stage of the Proposed Development. Of these, the majority will be standard road vehicles of similar type to those using local roads on a daily basis. However, the delivery of the main wind turbine components will require vehicles and transport configurations that are longer and/or wider and/or heavier than standard road vehicles.

3.3.19 Health and Safety

High standards of health and safety will be established and maintained throughout the project.

At all times activities will be undertaken in a manner compliant with applicable health and safety legislation and with relevant good practice as defined under applicable statutory approved codes of practice and guidance, including the Health and Safety at Work Act 1974, (HSE Executive, 1974) the Construction (Design and Management) Regulations 2015 (UK Government, 2015) the Work at Heights Regulations 2005 (as amended) etc, (UK Government, 2005); and Onshore Wind Health & Safety Guidelines (Renewable UK, 2015).

3.3.20 Environmental Management

The risk of potential environmental impact during the construction phase will be managed by the site manager, with specialist advice as required from an Ecological Clerk of Works (ECoW). The site manager will ensure that construction and activities are carried out in accordance with the CEMP and mitigation measures outlined in the EIA Report.

3.3.21 Waste Management

Waste will be removed off-site for safe disposal at a suitably licensed waste management facility in accordance with current waste management regulations. Wherever possible, excavated stone or soils will be re-used on site, primarily for the

restoration of disturbed ground. Details of this will be included within the CEMP, as agreed with Dumfries and Galloway Council and SEPA.

The main items of construction waste and their sources are:

- Hardcore, stone, gravel from temporary surfaces to facilitate construction waste, and concrete;
- Subsoil from excavations for foundations and roads;
- Timber from temporary supports, shuttering and product deliveries;
- Miscellaneous building materials left over from construction of the control building;
- Sanitary waste from chemical toilets (if used);
- Plastics packaging of material, and
- Lubricating oils, diesel - unused quantities at end of construction period.

Subsoil not required for reinstatement purposes will be collected at the end of the construction phase and disposed of according to best practice and existing waste legislation. Waste oils and diesel will be removed from the Proposed Development Site and disposed of by an approved waste contractor in accordance with provisions of the Special Waste Regulations 1996 (Scottish Government, 1996).

3.3.22 Post construction Restoration

Reinstatement will be undertaken as soon as practicable after each stage of the project is completed. Areas of the Proposed Development Site will be reinstated in accordance with planning condition requirements.

Materials and other temporary infrastructure will be removed off-site and one of the temporary construction areas will be reinstated. The proposed access tracks will be left in place after completion of the construction phase as they will provide access for maintenance, repairs and the eventual decommissioning phase.

Hardstanding areas at each turbine location will be retained for use in on-going maintenance operations, with the edges as far as possible blended to the adjacent contours with natural vegetation being allowed to re-establish.

The turbine foundations and the verges of tracks will be re-graded with topsoil (stored adjacent to each excavation) and then re-seeded or cultivated as appropriate. The temporary site office and compound, laydown and batching areas will be cleared of additionally placed hardcore and restored using peat and turves to a depth of approximately 0.7m.

The surface layer of soil and vegetation will be stripped separately from the lower soil layers, stored separately and replaced as intact as possible once the construction phase is complete. Turf material will be replaced as far as possible in similar locations to where it was removed.

3.4 Operation

3.4.1 Operational Lifespan

The Proposed Development will have an operational period of generation of up to 40 years.

3.4.2 Infrastructure Maintenance

On-going track maintenance will be undertaken to ensure that safe access is maintained. The wind turbines will also undergo regular maintenance to ensure safety, cleanliness and efficiency.

3.4.3 Waste Management

Wastes arising as a result of servicing and maintenance (e.g. lubricating oils, cooling oils, packaging from spare parts or equipment, unused paint etc.) will be removed from the Proposed Development Site and reused, recycled or disposed of in accordance with best practice and relevant regulations.

3.5 Decommissioning

Once the Proposed Development ceases operation after the period of generation, all major equipment above ground and structures' deemed permanent infrastructure in Table 3.3 will be removed from the Proposed Development Site. It is estimated that this process will take approximately 12 months. Unless otherwise agreed, the upper sections of the foundations will be removed to a depth which will permit the continuation of current land use practices.

Unless required in connection with ongoing land management operations, Tracks and crane hardstands will be left in situ and allowed to grass over, or would be covered with soil and reseeded.

All underground cables will be left in place and de-energised. The crane hardstanding adjacent to a turbine will be removed, if required, and reinstated.

3.5.1 Waste Management

The decommissioned turbine components will have sufficient salvage value to ensure their proper recycling. An important environmental issue in the decommissioning of the wind turbine will be the proper handling and disposal of potentially contaminating material (e.g. lubricating/cooling oils etc.). The Applicant undertakes to ensure that contaminating material will be removed from the Proposed Development in accordance with best practice and applicable regulations.

3.5.2 Site Reinstatement

At the expiry of the Proposed Development's lifespan of up to 40 years, it is proposed that the turbines and their transformers and the battery storage and its compound would be removed. The upper sections of the turbine foundations will be removed to a depth which will permit the continuation of current land use practises and backfilled with appropriate material. Peat or topsoil would be replaced, and the area reseeded. Tracks and crane hardstands will be left in situ and allowed to grass over or would be covered with soil and reseeded. Cabling would be left in-situ. At least six months prior to the decommissioning of the site, a Decommissioning Method Statement would be prepared, for agreement with the local authorities and relevant consultees.

3.6 Benefits of the Proposed Development

The Proposed Development will consist of six wind turbines with total rated output of up to 21.6MW. Based on an estimated capacity[1] factor of 35% (as set out in BEIS Digest of UK Energy Statistics (DUKES) Load factors for renewable electricity generation for 2020 (BEIS, 2021a)), the generation expected from the Proposed Development is in the region of 66,225 MWh per year.

Each unit of wind generated electricity will displace a unit of conventionally generated electricity, therefore, reducing emissions. Table 3.5 provides a breakdown of the estimated emissions displaced per annum and over the predicted 40-year lifetime of the project.

Table 3.5: Estimated Emissions Displaced by the Proposed Development

Emissions	Annual (tonnes equivalent)	Lifetime (tonnes equivalent)	Calculation
Carbon Dioxide (CO_2)	29,801	1,192,040	440kg of CO2 per MWh of Fossil fuel[2] 66,225 Mwh X 0.44t = CO2 saving tonnes

The Scottish Government's Online Carbon Calculator v1.6.1 was used to calculate the carbon payback period for the Proposed Development. When taking into consideration the potential carbon loss of various construction and operational phases such as peat extraction for access tracks, the Proposed Development is expected to payback the carbon cost in 2.6 years which represents 6.5% of the operational life of the Proposed Development.

The Scottish Government's Climate Change Plan (2018) states that by 2030 Scotland will have a largely decarbonised electricity system with a grid carbon intensity of 50g CO_2/kWh of generation (0.05kg CO_2/kWh) (p. 66). The carbon intensity of the Proposed Development is 16.77g CO_2/kWh (0.01677kg CO_2/kWh), which is below the 2030 carbon intensity target. The Proposed Development is anticipated to have an overall beneficial effect on climate change mitigation.

The results of the Carbon Calculator are presented in Appendix 3-1.

The benefit of displacement of emissions may also be described in terms of the number of equivalent homes to be supplied on an annual equivalence basis. The average domestic electricity consumption per household in Scotland is approximately 4MW annually (BEIS, 2021b). Given that the expected generation from the Proposed Development is 66,225 MW, the Proposed Development therefore generates electricity equivalent to that required to power approximately 16,555 households in Scotland annually.

The Proposed Development will also make a significant contribution to reducing Scotland's CO_2 emissions and contribute directly to the commitment to net-zero by

[1] Capacity factor is the ratio of the actual energy produced in a given period, to the hypothetical maximum possible, i.e. running full time at rated power.

[2] BEIS (2021a) Digest of UK Energy Statistics (DUKES) Estimated carbon dioxide emissions per GWh of electricity supplied in 2019. The 2020 emissions figures are provisional.

2045 and to efforts to reduce the extent and rate of global climate change reflected in the ecological and climate emergency declared by Dumfries and Galloway Council in June 2019.

The Proposed Development has the potential to have a beneficial effect on the local economy in terms of employment during the construction and operational stages. This is discussed further in Chapter 12.

The Applicant recognises that the Scottish Government Good Practice Principles For Community Benefits from Onshore Renewable Energy Developments (Scottish Government, 2019) advises that a voluntary community benefit package is being offered to communities near the Proposed Development. The Applicant therefore will provide £5,000 per MW of generating capacity (up to 21.6MW). This would amount to £108,000 per year and £4.32 million over the operational life of the wind farm. This is in addition to the community benefit fund of up to £432,000 per year from Sandy Knowe Wind Farm.

The Proposed Development will therefore, make a material contribution to reducing Scotland's CO_2 emissions, contribute directly to efforts to reduce the extent and rate of global climate change while also generating economic and social benefits.

3.7 References

BEIS (2021a) Digest of UK Energy Statistics (DUKES) 2021. Available at https://www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes [Accessed 02 February 2022]

BEIS (2021b) Subnational electricity consumption, Great Britain, 2005 - 2020. Available at https://www.gov.uk/government/statistical-data-sets/regional-and-local-authority-electricity-consumption-statistics [Accessed 02 February 2022]

Renewable UK (2015). Onshore Wind Health & Safety Guidelines. Retrieved from https://cdn.ymaws.com/www.renewableuk.com/resource/collection/AE19ECA8-5B2B-4AB5-96C7-ECF3F0462F75/OnshoreWind_HealthSafety_Guidelines.pdf [Accessed 17/02/2022]