2 Development Description

2.1 Introduction

2.1.1 This chapter provides a description of the Proposed Development for the purposes of identifying and assessing likely significant effects within individual technical chapters, including:

- the location of the Proposed Development;
- the physical characteristics of the development, including, the land-use requirements during the construction and operational phases;
- the main characteristics of the construction and operational phases of the development, having regard to the type and quantity of expected residues and emissions; and
- typical activities associated with the decommissioning of the Proposed Development.

2.1.2 This chapter is supported by the following Technical Appendices (TAs) which are presented in **Volume 4: Technical Appendices** of the EIAR:

- TA 2.1: Outline Construction Environmental Management Plan (CEMP)

2.1.3 **Figures 2.1 – 2.13** are presented in **EIAR Volume 2: Figures** of the EIAR and are referred to in the text as appropriate. The figures are as follows:

Figure	Title
2.1	Site Layout
2.2	Key Environmental Constraints
2.3	Indicative Turbine Geometry
2.4	Typical Turbine Foundation
2.5	Typical Crane Hardstanding Detail
2.6	Typical Access Track Detail
2.7a	Typical Substation Layout
2.7b	Typical Substation Elevations
2.8a	Operations Buildings Layout
2.8b	Operations Buildings Elevations
2.9	Typical Battery Storage Layout
2.10	Typical Battery Storage Elevations
2.11	Typical Cable Trench
2.12a	Typical LiDAR
2.12b	Typical LiDAR Unit Elevations
2.13	Typical Temporary Construction Compound Layout

2.2 Site Context

2.2.1 The 'Site' (defined by the red line boundary on (**Figure 1.1: Site Location** (**EIAR Volume 2**)) is approximately 1,103 hectares, located approximately 45 km west of Perth within the Drummond Estate and approximately 2.8 km east of Lochearnhead, Stirling, Scotland. The Site includes land within the Perth and Kinross local authority area and the Stirling local authority area. The wind turbine generator (WTG) array will be within Perth and Kinross, while the site entrance and a portion of the access track is located within the Stirling area.

2.2.2 **Figure 2.2 (EIAR Volume 2**) shows the key environmental constraints within the Site.

2.2.3 There are two valleys within the Site: Glen Tarken and Glen Beich. Glen Beich and Beich Burn form the western boundary of the Site. Most of the meandering burns within the Site drain into Loch Earn. The majority of the Site is an area of heathland and moorland or rough hill pasture. The southern edge of the Site has areas of arable land, forests, and woodland. On the western border of the Site is an area of Ancient Woodland (AW) **(Figure 2.2, EIAR Volume 2)**.

2.2.4 There are a number of watercourses that traverse the Site (**Figure 2.2, EIAR Volume 2**). The Site is drained by Beich Burn, Glentarken Burn and Allt an Fhionn, which flow southwards into the 10.1 km long Loch Earn, situated to the south of the Site. Two lochans are present in the northeast of the Site; Loch Eas Domhain and Lochan na Creige Ruahidhe.

2.2.5 Loch Lomond and the Trossachs National Park lies approximately 1 km to the west and south of the Proposed Development, from the nearest WTGs (**Figure 2.2, EIAR Volume 2**).

2.2.6 There are no Listed Buildings, Scheduled Monuments or Conservation Areas within the Site. The closest Listed Building is the Category B - Loch Earn, Dalveich Cottage which lies approximately 200 m west of the Site. The St Fillans Conservation Area lies approximately 1.8 km south of the Site, and Dundurn Fort, St Fillan's Hill is the closest Scheduled Monument which lies approximately 3.9 km south of the Site (**Figure 10.2, EIAR Volume 2**).

2.2.7 A number of environmental designations are present within 5 km of the Site including the River Tay Special Area of Conservation (SAC) and a number of Sites of Special Scientific Interest (SSSIs) designated for ecological features (**Figure 7.1, EIAR Volume 2**).

2.2.8 Peatland habitat is present across the Site, primarily formed of blanket bog, dry heath, grassland mosaics and small stands of other habitat types. In contrast, the access corridor contains more woodland, grassland, bracken, and wet heath (**Figures 7.3.1 – 7.3.16, EIAR Volume 2**).

2.3 Project Description

2.3.1 The Proposed Development would comprise of up to 12 Wind Turbine Generators (WTGs) and associated ancillary infrastructure, as detailed below, and illustrated on **Figure 2.1: Site Layout (EIAR Volume 2**). The Proposed Development would include the following key components:

- Up to 12 WTGs of up to 180 m tip height with internal transformers;
- WTG foundations;
- Battery Energy Storage Systems (BESS) with up to 50 MW capacity ;
- Crane hardstandings and associated laydown area at each wind WTG location;
- Up to approximately 15.6 km of on-site access tracks comprising up to 11.8 km of cut track, 2.8 km floated track and 1 km of upgraded existing track, to connect to ancillary site infrastructure;
- An on-site substation, operations and control building, welfare facilities and store;
- A network of underground cabling to connect each wind WTG to the on-site substation;
- Watercourse crossings;
- Telecommunications infrastructure;
- A LiDAR unit to collect meteorological and wind speed data, and associated hard stand; and
- Any other ancillary works required.

2.3.2 In addition to the permanent components, the construction phase would comprise the following temporary facilities:

- Site compound areas, including welfare facilities, site cabins, storage, and parking;
- Batching plant facilities for temporary on-site concrete batching;
- Up to six borrow pits; and
- Any other ancillary works required.

2.3.3 The locations of the proposed WTGs and other infrastructure may be subject to 'micrositing' as a result of additional constraints encountered during site works. This process allows for minor changes in WTG or infrastructure locations to respond to possible variations in ground conditions across the site and allows for further mitigation of localised potential environmental effects through avoidance of sensitive features. It is anticipated that a micrositing distance of up to 50 m for WTGs and all associated site infrastructure (including on-site access tracks) would form a condition accompanying any consent and would require agreement of the specialist advisors (e.g. the ECoW) as appropriate.

2.3.4 The Outline CEMP would include detailed guidance on the application of the proposed micrositing tolerance. An Outline CEMP is included in **TA 2.1 OCEMP (EIAR Volume 4).** Any repositioning would not unnecessarily encroach into environmentally constrained areas and would be carried out under the supervision of an ecological clerk of works (EcoW) as well as an appropriately experienced and qualified engineer.

2.3.5 The proposed location for all infrastructure is shown on **Figure 2.1: Site Layout (EIAR Volume 2).**

2.3.6 An Outline Biodiversity Enhancement Management Plan (BEMP) would be implemented as part of the Proposed Development to inform and guide the commencement of practical habitat creation and restoration techniques during construction, and to inform on-going habitat management throughout operation. The core aims of the BEMP, are to restore degraded blanket bog, wetland enhancement and bracken control within the Site and on other areas of Drummond Estate. A Biodiversity Net Gain (BNG) assessment is also captured with the Outline BEMP (**TA 7.7 OBEMP, EIAR Volume 4).**

Route to Site

2.3.7 The preferred access strategy for the delivery of WTG components proposes that all WTG abnormal loads would originate from Grangemouth, come along the M9 until Junction 10 where they would go via the A84, then on to Site via the A85. Access to the Site would be taken from a newly constructed Junction along the A85, approximately 2.8 km east of Lochearnhead (**Figure 11.1, EIAR Volume 2**).

2.3.8 For more information on the delivery route to the Site see **Chapter 11: Traffic and Transport (EIAR Volume 1).**

Land Take

2.3.9 Within the Site area, the permanent land take would be limited to the WTG foundations, substation and BESS hardstanding area, access tracks, and permanent crane hardstandings, accounting for approximately 2.1% of the total Site.

2.3.10 The anticipated land-take requirements are set out in **Table 2-1.**

Table 2-1: Anticipated Land Take Requirements

Wind Farm Element	Temporary Land Use (m^2)	Permanent Land Use (m^2)
WTG Foundations x12[1]	6240	7442
Hardstanding including permanent main Crane Pads and temporary auxiliary crane pads, temporary crane boom pads and temporary blades and towers laydown area. X 12[2]	42,690	34,680
Access tracks (Cut) – New	0	94,480
Access Tracks (Float) - New	0	24,011
Access Tracks - Upgrade	0	6,804
Access Tracks – Allowance for localsised widening	6,265	0
LiDAR Compound	0	17.5
Substation Platform permanent & temporary compounds with associated welfare, control & operational buildings, and BESS)	10,275	20,975
Temporary Construction & Laydown Compound(s)	27,500	0
Temporary Concrete batching plant	10,000	0
Cabling	39,915	
Borrow pits	69,230	0
Total Permanent Land Take m^2 (Minus area of overlap)	228,324.8	
Total Permanent Land Take Ha (Minus area of overlap)	22.84	
% of Site Area	2.1%	

2.4 Core Development Components

Wind Turbines and Turbine Layout

2.4.1 The Proposed Development comprises up to 12 three-bladed horizontal axis WTGs. The WTGs are automatically controlled to ensure each WTG faces directly into the wind; therefore, the orientation of the WTGs would alter with changes in wind direction.

2.4.2 The WTGs would generate electricity in wind speeds between approximately 3 and 32m/s (6.7 to 72 mph). At higher wind speeds, the WTGs would normally shut down for self-protection. A transformer would be required for each WTG, which would be located internally.

2.4.3 The coordinates of the proposed WTGs are shown in **Table 2-2**.

Table 2-2: WTG Locations

WTG Number	Easting	Northing
T01E	265223	729628
T02E	266658	730054
T03E	267291	729514
T04E	266515	729589
T05E	266047	730060
T06E	266176	728779
T08E	267965	727717
T10E	267615	728614
T11E	265270	730141
T16E	265826	729610
T20E	267133	728410
T21E	266664	728991

[1] Twelve WTGs

[2] Twelve WTG hardstanding elements

2.4.4 The final choice of WTG would be dependent on economics and available technology at the time of construction but would have a maximum blade tip height of up to 180 m. **Figure 2.3: Indicative WTG Geometry (EIAR Volume 2)** shows maximum dimensions and elevations for the proposed WTG. For the purposes of assessment within this EIA Report, where it has been necessary to identify a candidate WTG for assessment of a particular environmental topic (e.g. noise), this is specified within the relevant chapter and summarised in **Table 2-3**.

2.4.5 The EIAR has assumed, for the purpose of establishing a 'Rochdale Envelope' the WTG dimensions will be no greater than the dimensions outlined in **Table 2-3**. For Noise and Traffic and Transport chapters a specific model has been used to represent a reasonable worst-case scenario for the technical assessment.

Table 2-3: Candidate WTG used for Assessment

Topic	Nominal Rotor Diameter (m)	Nominal Hub Height (m)	Maximum Tip Height (m	WTG model
General	162	99	180	Not specified
Landscape and Visual	162	99	180	Not specified
Ornithology	162	99	180	Not specified
Ecology	162	99	180	Not specified
Geology, Peat, Hydrology and Hydrogeology	N/A	N/A	N/A	Not specified
Noise	162	99	180	Vestas V162 7.2 MW
Cultural Heritage	162	99	180	Not specified
Traffic and Transport	162	99	180	Vestas V162
Socio-economic and Tourism	N/A	N/A	N/A	Not specified
Aviation	162	99	180	Not specified
Television and Radio	162	99	180	Not specified

2.4.6 The WTG towers would be of tapering tubular rolled steel plate construction and the blades would be made from fibre-reinforced epoxy.

2.4.7 The wind WTG finish is normally semi-matt in white, off white, or light grey. Full details would be agreed with the ECU and Perth and Kinross Council (PKC) prior to the commencement of development.

WTG Foundations and Hardstanding

2.4.8 WTGs are typically fixed to steel reinforced concrete foundations, of gravity based or piled design, approximately 28.1 m in diameter. The WTG foundation shown on **Figure 2.4: Typical WTG Foundations (EIAR Volume 2)** is made up of a central excavation of approximately 38 (28 + 5 + 5)m diameter and an approximate depth of 3-5 m subject to prevailing ground conditions. Sloping batters would increase the excavated area to approximately 46 m diameter at ground level. An example of WTG foundation construction is illustrated on **Plates 2-1** to **2-4** below.

Construction of the WTG foundations would generally be formed as follows:

- Any peat turfs and peat would be excavated and stored separately. The remaining overburden would then be excavated down to formation level as determined by geotechnical studies and design. The excavation typically would be 3 m to 5 m deep by approximately 46 m in diameter.

- A temporary drainage system would be established according to the local gradient of either a pump or temporary ditch.
- The required level would be made up as required with compacted crushed rock placed in the base of the excavation to provide necessary bearing capacity.
- A layer of blinding concrete would be laid.
- A reinforcing steel 'cage' would be assembled (nominally 120 tonnes of steel reinforcement, per foundation).
- Shuttering would be assembled.
- Concrete (nominally 850 – 900 m^3 per foundation) would typically be in two pours; the first pour being the main base, approximately 90% of the foundation; the second pour being the remaining 10% of the foundation and would form the plinth section which sits on top of the main base.
- Once the concrete has cured sufficiently, the shuttering would be removed, and an electrical earthing mat installed.
- Approximately 1-2m of rock, or soil would be placed over the concrete foundations to provide additional bulk weight to the foundation.
- Following erection of the WTG, suitable overburden and turves would be used to landscape and reinstate those areas not required for maintenance.

Plate 2-1: WTG Foundation Construction - Excavation

Plate 2-2: WTG Foundation Construction – Steel Reinforcement

Plate 2-3: WTG Foundation Construction – Concrete Pour

Plate 2-4: Completed WTG Foundation (being backfilled)

2.4.9 Concrete for site construction, including WTG foundations, would mostly be batched on-site. Should any off-site batching be required, this would give rise to additional traffic movements **(Chapter 11: Traffic and Transport, EIAR Volume 1).**

2.4.10 During the erection of the WTGs, crane hardstanding areas would be required at each WTG's base **Figure 2.5: Typical Crane Hardstanding (EIAR Volume 2**). Typically, these would consist of one main area adjacent to the WTG position where the main WTG erection crane and assist crane would be located. There would be a requirement to use cranes on occasion during the operational phase of the Proposed Varied Development, so the main crane hardstanding would be retained. An example WTG Crane Hardstanding is illustrated on **Plate 2-5** below. The final size, design and layout of the crane hardstandings would be determined by the WTG supplier according to their preferred erection method, with micrositing to be exercised if required, under the supervision of an ECoW. In addition to the main hardstanding areas, other temporary areas would be formed and used during the assembly of the main crane boom, assembly of the rotor as well as a trestle area for WTG blades and an area for tower storage.

2.4.11 Hardstanding construction would involve stripping the topsoil (and peat where present) to expose a suitable bearing stratum on which to build the hardstanding. The hardstanding would then be constructed by placing and compacting suitable crushed rock (obtained from suitable on-site borrow pits) to the required level. The upper soil / peat horizon, together with any vegetation, would be suitably stored on site for reinstatement, if appropriate. The edges would, as far as possible, be blended to the adjacent contours, with natural vegetation being allowed to re-establish. A Peat Management Plan (PMP) for the Proposed Development will be prepared by the Principal Contractor appointed by the Applicant prior to construction (a draft PMP is included in **TA 8.2, EIAR Volume 4**).

Plate 2-5: WTG Crane Hardstandings

Turbine Lighting

2.4.12 The Proposed Development would require visible aviation lighting under the current Civil Aviation Authority (CAA) policy statement. An aviation lighting assessment was also carried out by Wind Farm Low Flying Aviation Consultants (WFLFAC) in order to ascertain the exact aviation lighting requirements for the Proposed Development (**TA 13.1, EIAR Volume 4**). The assessment proposed the visible and infra-red aviation lights to be installed on the Proposed Development's wind turbine generators (WTGs). The lighting proposal in the WFLFAC report has since been accepted and approved for installation by the Civil Aviation Authority (CAA). Further detail is provided in **Chapter 13: Aviation (EIAR Volume 1).**

Electrical Cabling

2.4.13 WTGs will be connected by electrical circuit 'arrays', with the output connecting to a new on-site substation. The cabling on site would be laid in trenches of varying width (depending on the number of cables) and approximately 1 m in depth, adjacent to the Site access tracks where suitable, or alternatively in agreement with PKC in consultation with SEPA and the appointed ECoW. These trenches would also carry earthing and communications cables.

Plate 2-6: Cable Trench

2.4.14 Cables would be laid directly in trenches with a sand surround and backfilled with excavated sub soil and peat topsoil (example cable trench shown on **Plate 2-7**). Alternatively, cable ducts could be installed, and trenches backfilled in the same manner, allowing cables to be pulled through following completion of the duct installation. Cables could also be installed directly into the ground by use of cable ploughs, subject to suitability of ground conditions.

2.4.15 BESS cabling would be contained within BESS and Substation platform areas. Typical cable trench detail is illustrated in **Figure 2.11: Typical Cable Trench (EIAR Volume 2).**

Battery Energy Storage

2.4.16 A BESS permanent compound area (approximately 0.7 ha) is proposed adjacent to the substation compound and would contain battery containers, switchgear container, power conversion systems, transformers, lighting and security fencing (**Figure 2.9: Typical Battery Storage Layout, EIAR Volume 2).** The compound would have two separate access points and hardstanding consisting of crushed stone to allow for access and maintenance during operation.

On-Site Substation Platform

2.4.17 The substation compound is on (**Figure 2.7a: Typical Substation Layout, EIAR Volume 2)** and would comprise a substation, operations and control building, including basic welfare facilities (e.g., a toilet and parking area) and storage. (**Figure 2.8a: Typical Ops Building Layout, EIAR Volume 2**). This would accommodate all the equipment necessary for automatic remote control and monitoring of the Proposed Development in addition to the grid transformer, electrical switchgear, fault protection, metering equipment and auxiliary equipment required to connect the Proposed Development to the electricity network. The control building and substation will be subject to detailed design, following consent and subject to detailed electrical design.

LiDAR

2.4.18 A Light Detection and Ranging (LiDAR) station would be constructed to collect meteorological data for the operational life of the Proposed Development and has been located to ensure it obtains the best quality data for the Site. **Figure 2.1 (EIAR Volume 2**) indicates the units location, and a typical plan and elevation are shown on **Figure 2.12a Proposed LiDAR Unit Plan (EIAR Volume 2)** and **Figure 2.12b: Proposed LiDAR Unit Elevation (EIAR Volume 2)**. It is assumed that the LiDAR would have an approximate reinforced concrete foundation of 4.7m x 3.7m.

2.4.19 The inclusion of LiDAR stations would negate the requirement for a permanent or temporary meteorological mast.

Temporary Construction Compounds and Laydown Areas

2.4.20 There are four proposed temporary construction compound locations. The main construction compound within the WTG array area, located in close proximity to the proposed substation platform and BESS areas, would require a hardstanding area of approximately 10,000 m^2. The access track construction compound would require a hardstanding area of approximately 2,500 m^2, which allows for staff parking, welfare facilities, and plant and material storage. Two laydown areas have also been identified and would require a total area of approximately 15,000 m^2. The compounds would be located as shown on **Figure 2.1: Site Layout (EIAR Volume 2).** Each compound area may include:

- access tracks and internal circulation routes for vehicles and pedestrians;
- lighting for security and safety during hours of darkness;
- surface water management measures;
- temporary office accommodation and welfare facilities (toilets, kitchen/canteen, drying rooms);
- storage facilities;
- maintenance and refuelling facilities;
- waste, recycling and materials management facilities;
- general laydown areas; and
- parking.

2.4.21 The indicative layout of a typical temporary construction compound is shown in **Figure 2.13: Typical Temporary Construction Compound Layout (EIAR Volume 2).**

On-Site Access Tracks

2.4.22 It is anticipated that the majority of site access tracks would be constructed with locally-won (on site) rock from borrow pits and where necessary, geotextiles with the surface course comprising of an unbound graded rock surfacing material. However, it is anticipated that the section of new access track between the Site access junction and the first borrow pit will be formed with imported material. Where borrow pits do not yield suitable material, it may be necessary to import material. This would be determined from detailed ground investigatory works.

2.4.23 Dependant on ground conditions, access tracks would be constructed using a combination of 'floating' or 'cut' track designs.

2.4.24 Approximately 15.6 km of new onsite access tracks (11.8 km of cut track, 2.8 km of floated track and 1 km of upgraded existing track) would be required to provide access to the Proposed Development (**Figure 2.1: Site Layout, EIAR Volume 2**)**.** Typical access track designs are shown in **Figure 2.6: Typical Access Track Detail, EIAR Volume 2**). Tracks would have a maximum 6 m running width plus a 0.5 m shoulder and embankment on each side, with appropriate widening on bends, at junctions and passing places. The estimated total permanent land take area for the new tracks would be approximately 11.9 ha.

2.4.25 A 'floating' track does not require excavation and would be required in areas over 1 m of peat depth, where feasible (see **Plate 2.7**). Geotextile material would be laid over the surface, followed by layers of crushed stone, to form the track suitable for the required site vehicles. This is a commonly used track construction installed across Scotland in peatland areas to ensure there is minimal disruption of the sub surface flow of water within the peat and to ensure no new drainage channels are formed.

Plate 2-7: Construction of Floating Track

2.4.26 A 'cut' track would be used in shallow peat (below 1 m) or areas of no peat. The vegetation and soil would typically be stripped to expose a suitable subsoil bearing layer on which the track (approximately 300 mm – 500 mm thick) would be constructed, compacting suitable crushed rock from locally- won (on site) graded rock from borrow pits to the required shape and thickness. The upper topsoil layer, together with turf, would be stored temporarily for use in landscaping and revegetating the track shoulders and track side drainage or other reinstatement (see **Plate 2-8**) works across the Site, where appropriate. Cross-sections of track are presented in **Figure 2.6: Typical Access Track Detail (EIAR Volume 2).**

Plate 2-8: Completed Track following Reinstatement Works

2.4.27 A draft PMP is included in **TA 8.2 (EIAR Volume 4)** which would be revised by the Principal Contractor appointed by the Applicant, prior to construction.

2.4.28 The on-site track layout will be designed to accommodate construction plant, WTG component deliveries and 4x4 vehicle traffic whilst minimising environmental disturbance and land take by avoiding areas of deeper peat and steep slopes wherever possible, avoiding, or minimising impact on areas of identified environmental constraints. Further details on mitigation through design is provided in **Table 3.1, Chapter 3 (EIAR Volume 1).**

2.4.29 Construction of site access tracks requires suitable drainage. Surface water run-off from the tracks would be via a crossfall into adjacent ditches and if required, settlement lagoons / ponds to attenuate flows and remove sediment before discharge to land. Further details are set out in **TA 2.1 OCEMP (EIAR Volume 4).**

2.4.30 The track layout will also be carefully designed to minimise the number of watercourse crossings where possible, see paragraph 6.1.16.

Borrow Pits

2.4.31 Borrow pit search areas have been identified as detailed in **Table 2-4** to supply material to construct the Proposed Development. The use of all of these borrow pits would provide a greater volume of rock than would be needed for the construction of the Proposed Development but the search areas identified allows for the current uncertainty on the quality of the rock at these locations. It is likely that only some of the borrow pit search areas would be required, and smaller areas than indicated actually excavated; however, for the purposes of the assessment the full extent of all six borrow pits will be assessed (**TA 8.3: Borrow Pit Assessment, EIAR Volume 4).**

Table 2-4: Borrow Pit Search Areas

Borrow Pit Search Area No.	Easting	Northing	Search Area (m^2)	Excavated Area (m^2)
1	267353	729369	51,221	9,080
2	266446	729544	81,030	28,125
3	264209	728703	63,772	8,240
4	262838	726964	9,483	6,905
5	262526	726259	7,275	7,100
6	262201	725416	13,122	9,780

2.4.32 Aggregate from rock extraction would be required for various purposes but primarily for track and hardstanding construction. If the aggregate on site is suitable then a proportion of this could be sourced from onsite borrow pits or from off-site quarries if required.

Connection to Grid

2.4.33 The Proposed Development's point of connection to the National Grid, is located at the on-site substation platform. The transmission licence holder provides the connection to the existing Transmission system, which is anticipated as comprising a combination of OHL and underground cable via Killin Substation, located approximately 9 km from the Site. The connection between the on-site substation and Killin substation is the responsibility of the transmission licence holder (Scottish and Southern Electricity Networks Transmission) and is subject to a separate consenting process.

2.5 Construction Activities

Construction Programme

2.5.1 The estimated construction period of the Proposed Development is approximately 18 months. This period is indicative only and may be subject to variation as a result of factors which include, but are not limited to, weather restrictions, ground conditions encountered through detailed investigation, WTG component and material delivery, timing of grid connection works and public highway constraints. However, this is considered to represent a realistic worst case for the purposes of assessment.

2.5.2 Construction by the Principal Contractor will begin following agreement of the detailed design and approval of any pre-commencement conditions with the appropriate consenting authority. Key construction activities will be carried out in line with the Construction Environmental Management Plan (CEMP) and will include:

- public road improvement and junction creation;
- construction of main site access track to borrow pits;
- excavation of borrow pits;
- construction of all access tracks;
- construction of the temporary construction compounds and laydown areas;
- design and construction of temporary and permanent drainage measures;
- installation of concrete batching plant;
- construction of WTG foundations, crane hardstandings and laydown areas;
- excavation of cable trenches;
- laying of electricity and communications cables in trenches;
- construction of substation platform and associated apparatus and, control and welfare building;
- construction of BESS;
- delivery, installation, testing and commissioning of wind WTGs and ancillary equipment; and
- site reinstatement, and restoration where possible.

2.5.3 The works are likely to follow the order as detailed above, however many activities will be undertaken concurrently to minimise the overall construction programme. Site restoration will be undertaken as soon as possible in affected areas to minimise disruption to land use. Where appropriate, measures to be delivered as a part of the BEMP (**TA 7.7, EIAR Volume 4**) will be implemented at the earliest practicable opportunity to maximise and expedite the potential for beneficial effects.

2.5.4 Further ground investigation surveys will be undertaken prior to the main construction works beginning onsite to determine the specific quality of rock and the rock head depth underlying the locations for site infrastructure. Initial site investigations have informed the design of the site access roads. Pre-construction surveys for protected species will be undertaken within the working areas and appropriate buffers, to identify changes from baseline conditions and ensure all appropriate mitigation measures are in place.

2.5.5 The appointed contractor will develop the details of the site design and construction methods in compliance with the Applicant's contract requirements and the EIAR.

2.5.6 The access tracks will be left in place following construction to provide permanent access for maintenance, repairs and eventual decommissioning of the Proposed Development. The construction works will be undertaken by a competent and experienced contractor in accordance with the project consent and any associated conditions and also in accordance with good industry practice. Prior to commencing construction, a more detailed construction and reinstatement programme will be submitted to the consenting authority.

2.5.7 Traffic movements associated with the construction of the Proposed Development including required Heavy Goods Vehicles (HGV) and heavy/abnormal load movements are described in **Chapter 11: Traffic and Transport (EIAR Volume 1)**.

2.5.8 An indicative construction programme is illustrated in **Table 2-5**: indicative 18 Month Construction Programme below.

Table 2-5: Indicative 18-Month Construction Programme

	Month																	
Task*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	■	■	■															
2	■	■	■	■	■	■	■											
3			■	■	■	■	■	■	■	■	■							
4							■	■	■	■	■							
5			■	■	■	■	■	■	■	■	■	■						
6										■	■	■	■					
7											■	■	■	■	■	■		
8													■	■	■	■	■	■

*Task: 1. Possible vegetation clearance 2. Site establishment / plant deliveries 3. Borrow pit working, access track construction and hardstanding areas 4. Foundations	5. Substation construction 6. Cabling 7. Erection and commissioning of WTGs 8. Site reinstatement & restoration

Hours of Work

2.5.9 The normal working hours will be as follows:

- Monday to Friday 0700-1900;
- Saturday 0700-1400; and
- no working on Sundays or public holidays without prior written approval from PKC.

2.5.10 No works, except for WTG delivery, the completion of WTG erection and commissioning or emergency work, will normally take place outside these hours, and any such out-of-hours works will be subject to prior agreement with PKC. The requirement for out-of-hours work could arise, for example, from delivery and unloading of abnormal loads or health and safety requirements, or to ensure optimal use is made of fair weather windows for the erection of WTG blades and the erection and dismantling of cranes.

Construction Traffic and Plant

2.5.11 During the construction period a range of vehicles will be accessing the Site via a newly constructed junction along the A85 (**TA 11.1 Annex A, EIAR Volume 4**)., approximately 2.8 km east of Lochearnhead Vehicles would include flat-bed trucks and HGVs delivering plant (such as; excavators, Moxy dump trucks, bull dozers and cranes) as well as smaller cars and vans associated with construction staff movement and equipment.

2.5.12 Vehicle movements associated with construction works would include:

- Cars and minibuses for transporting construction personnel to the site;
- HGVs for pre-construction delivery of site offices, construction equipment and materials;
- HGV abnormal load vehicles for delivery of the WTG components, grid transformers and base rings;
- Mobile road going cranes, used for the erection of the WTGs; and
- Standard HGVs for transporting electric cable, electrical plant BESS containers, steel reinforcement for foundations, construction plant fuel and other items and equipment.

2.5.13 A Traffic Management Plan (TMP) would be agreed in consultation with PKC and Transport Scotland. This would address the scheduling, routing and overall management of abnormal loads movements along with the programming and management of all other HGV movements **(TA 11.1: Traffic Assessment, EIAR Volume 4).**

2.5.14 During construction of the Proposed Development, there would be some restrictions to public access to parts of the Site for health and safety reasons. However, during operation, the tracks would be accessible to members of the public for non-motorised recreation in line with the Draft Recreation and Outdoor Access Plan (**TA 12.2, EIAR Volume 4**)**.**

2.5.15 The Proposed Development will lead to a temporary increase in traffic volumes on the Study Area during the construction phase. Traffic volumes will fall considerably outside the peak period of construction, which is anticipated to be in month ten of the programme. During month ten, there will be a total of 192 vehicle movements per day, comprising 144 two-way HGV movements and 48 two-way car / LGV movements.

2.5.16 This would equate to approximately 16 two-way total vehicles movements or 12 two-way HGV movements per hour, across a typical 12-hour day, assuming a flat traffic profile i.e. vehicles distributed evenly across the day. This increase will be temporary and will only occur during the construction phase. Further details on the Construction Traffic Management Plan (CTMP) are provided in **Chapter 11: Traffic and Transport (EIAR Volume 1).**

Watercourse Crossing Schedule

2.5.17 The layout of the access tracks has been developed to minimise the number of new watercourse crossing required. A total of 23 new watercourse crossings and one upgraded existing crossing would be utilised. All watercourse crossings will take into account the appropriate guidance[3]. 'All crossings will be designed to accommodate 1 in 200 year peak flows (including climate change allowance) in order to reduce the risk of flooding. The exact specifications of the watercourse crossings will be subject to detailed design following granting of consent. The final watercourse crossing designs will be compliant with the SEPA Guidelines.

2.5.18 Further details of the watercourses crossings are included in **Chapter 8: Geology, Peat, Hydrology and Hydrogeology (EIAR Volume 1)** and **TA 8.4 (EIAR Volume 4)**.

Standard Mitigation and Working Methods during Construction

Construction Environmental Management Plan

2.5.19 During construction, the Contractor will be required to operate under a detailed site specific Construction Environmental Management Plan (CEMP). The CEMP will be prepared and agreed with PKC (in consultation with NatureScot and SEPA as required) prior to commencement of construction. An OCEMP is provided in **TA 2.1 (EIAR Volume 4).**

2.5.20 The CEMP will implement all construction related committed environmental mitigation measures identified within this EIAR as well as any additional mitigation required by planning conditions. The CEMP will set out a variety of control measures for managing the potential environmental effects of construction works including control and management of noise, dust, surface water runoff, peat management, waste, storage of fuels and oils, pollution control and species protection plans. It will draw upon wind farm and general construction good practice, considering the legislation and guidance within, but not limited to, the following:

- CAR (as amended), and the requirement for a Construction Site Licence (and Pollution Prevention Plan);
- Forestry Commission (2017). 'The UK Forestry Standard: The governments' approach to sustainable forestry, 4th Edition. Forestry Commission';
- NatureScot (2019) 'Good Practice During Wind Farm Construction', a joint publication by Scottish Renewables, NatureScot, SEPA, Forestry Commission Scotland and Historic Environment Scotland, Marine Scotland Science, 4th Edition;

[3] Engineering in the Water Environment Good Practice Guide - River Crossings: Second Edition' (Scottish Environment Protection Agency: SEPA, 2010), 'River Crossings and Migratory Fish: Design Guidance' (Scottish Executive, 2012) and the 'The UK Forestry Standard, The government's approach to sustainable forestry (Forestry Commission, 2017).

- SEPA, Pollution Prevention Guidelines (PPG) and Guidance for Pollution Prevention (GPP);
- CIRIA Publications including CIRIA C768 (Guidance on the construction of SuDS), CIRIA C753 (The SuDS Manual), CIRIA 786 (Culverts, screen and outfall manual); and
- NatureScot (2015) 'Constructed Tracks in the Scottish Uplands', 2nd Edition.

Private Water Supplies

2.5.21 A review of Private Water Supplies (PWSs) has been undertaken for the Site and a 0.5 km buffer around the Site (**TA 8.6, EIAR Volume 4**). The assessment identified:

- one confirmed PWS source is potentially at risk of being impacted by the Proposed Development;
- the distribution pipework associated with one PWS is potentially at risk of being impacted by the Proposed Development; and
- two properties in connectivity to a PWS are not considered to be at risk from the Proposed Development.

2.5.22 Mitigation to prevent pollution impacts on any downstream PWS would be set out in a Water Management Plan which would form part of the CEMP, to ensure that the Proposed Development would not lead to significant impact to water abstraction and other hydrological receptors. The contents of the CEMP and the Water Management Plan would be consulted upon with SEPA and approved by the planning authority prior to commencement of works.

2.5.23 The CEMP is presented in **TA 2.1: OCEMP (EIAR Volume 4**) and the PWS assessment is presented in **TA 8.6 (EIAR Volume 4).**

Peat Management

2.5.24 **TA 8.2: PMP (EIAR Volume 4)**sets out the proposed working methods where the excavation of peat would be required and provides further details on potential volumes of peat excavated and the likely requirements for reinstatement. This provides details of the predicted volumes of peat that would be excavated for the Proposed Development, the characteristics of the peat that would be excavated, and how the excavated peat would be reused and managed. This document would be updated during the detailed design stage and agreed with SEPA prior to construction.

2.5.25 The detailed peat surveys across the site have identified that approximately 212,778 m^3 of peat would be excavated as part of the construction activities associated with the Proposed Development. The Outline PMP outlines how that peat would be recovered, managed, and reused within the site. Details on peatland restoration are provided on the Outline BEMP **TA 7.7 (EIAR Volume 4).**

Peat Slide Risk

2.5.26 **TA 8.1: Peat Landslide Hazard and Risk Assessment (PLHRA) (EIAR Volume 4)** provides further technical information on the likely risk and hazards associated with peat instability, and the proposed standard mitigation and working methods that would be implemented during construction to seek to avoid adverse effects associated with peat instability.

Site Reinstatement and Restoration

2.5.27 Reinstatement works are generally undertaken during construction (and immediate post-construction phase) and aim to address any areas of ground disturbance and changes to the landscape as part of the construction works. Reinstatement is undertaken as soon as practical following the construction works in each area, such as the re-dressing of road and track verges (and other areas that may be disturbed as a result of the construction process).

2.5.28 Reinstatement will form part of the contract obligations for the Principal Contractor and will include all temporary works, such as crane pads, borrow pits, temporary compounds and laydown areas.

2.5.29 Following removal of the construction equipment and temporary infrastructure, best practice techniques will be used to ensure soils are replaced in the order they were removed with original vegetation reinstated around the permanent hardstanding areas where possible. Restoration measures will be largely covered in the Site's BEMP (**TA 7.7, EIAR Volume 4**), where applicable. Re-seeding / hydro-seeding may be part of restoration works where reinstatement works are found to have been unsuccessful with regard to establishing plant growth.

2.6 Operation Management and Maintenance

Life of the Project

2.6.1 The expected operational life of the Proposed Development is 50 years from the date of commissioning. Routine maintenance, inspections and servicing would be carried out as required, including major component and blade inspections and following any unexpected events on site, such as generator or gearbox failure. Control systems would normally manage optimal generation performance for WTGs. This includes start-up, shut-down, rotor direction, blade angles etc. and to monitor equipment condition. The control systems would automatically shut the WTG or battery down should the need arise.

2.6.2 Track maintenance would be dependent on the volume and nature of site traffic and weather conditions. Safe access and management of silt run off would be maintained throughout the year as required. There would be no public vehicle access to site.

Operational Residues and Emissions

2.6.3 The EIA Regulations require that the EIAR provides an estimate, by type and quantity, of expected residues and emissions (such as water, air and soil and subsoil pollution, noise, vibration, light, heat, radiation and quantities and types of waste produced) resulting from the construction and operation of the Proposed Development. Decommissioning would be revisited in line with best practice at the time.

Table 2-6: Residues and Emissions

Topic	Potential Residue/Emission
Water	Construction: Occasional and low quantity discharges could arise from pumping, or over-pumping in order to dewater foundation excavations and borrow pits. Pollution sources could arise as a result of soil erosion or from oil/ fuel or chemical storage and use. All discharges would be managed in accordance with the Water Environment (Controlled Activities) (Scotland) Regulations 2011, as amended by The Water Environment (Miscellaneous) (Scotland) Regulations 2017. The proposals for water the control and management of water quality and quantity from the Proposed Development are presented in **TA 2.1: OCEMP (EIAR Volume 4)**.

Topic	Potential Residue/Emission
	Further detail on the surface water management proposed during construction is provided in **Chapter 8: Geology, Peat, Hydrology and Hydrogeology (EIAR Volume 1)**. Operation: No water emissions or pollution sources have been identified for the operational phase.
Air	Construction: The construction phase would require the transport of people and materials by road, with associated emissions to the atmosphere. There are no air quality management areas within the vicinity of the Site. A dust management plan will form part of the Outline CEMP, including various dust suppression measures such as damping down of the access tracks during prolonged dry periods. Overall, the quantity of air emissions is expected to be low relative to the general background air emissions from road traffic. No significant air emissions are anticipated. Operation: Due to the nature of the Proposed Development no significant point source or diffuse air emissions would be produced during its operation. The Proposed Development would contribute to provide renewable electricity, in turn displacing emissions associated with fossil fuel-based electricity generation elsewhere. The construction of the proposed infrastructure, and subsequent operation and decommissioning of the Proposed Development would include activities that either directly or indirectly result in CO_2 emissions. **TA 8.8: Carbon Calculator (EIAR Volume 4)** calculates the greenhouse gas emissions and carbon payback times for wind farm developments in Scottish peatlands and concludes that the Proposed Development would 'pay back' the carbon emissions associated with its construction, operation and decommissioning in a 0.9-year period (11 months).
Soil and Subsoil	Construction: Soil and subsoil excavation, handling and storage would be required during construction. All soil and subsoil would be stored temporarily for use in reinstatement, such that there would be no residue (surplus) remaining following the construction work. Further details on peat management are provided in **TA 8.2: Outline Peat Management Plan (EIAR Volume 4)**. Operation: No requirement for soil or subsoil excavation or handling during the operation phase has been identified. No pollution sources have been identified for the operational phase.
Noise and Vibration	Construction: Construction noise impacts have been largely scoped out of detailed assessment as typical noise limits referred to in relevant guidance (BS 5228-1:2009+A1:2014 – Code of Practice for Noise and Vibration Control on Construction and Open Sites) will be met at noise sensitive receptor locations in the vicinity of the Proposed Development. There may be temporary impacts associated with track construction and construction traffic accessing the Site and these have been considered in the assessment. Operation: Operational WTG noise impacts have been assessed in line with ETSU-R-97, The Assessment and Rating of Noise from Wind Farms, and the associated guidance provided by the Institute of Acoustics (IOA) document, A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise. Predicted operational noise levels have been compared with relevant noise limits for the Proposed Development acting in isolation. Predicted operational noise levels meet the relevant ETSU-R-97 noise limits and therefore operational noise impacts are considered to be not significant. Operational noise from the proposed substation and adjacent BESS is assessed in according to BS 4142:2014+A1:2019, Methods for rating and assessing industrial and commercial sound. The significance of the impact is assessed by comparing the rating sound level (i.e. the sound level at receptor locations including any relevant character corrections) with existing background sound levels. In this case a detailed assessment has been scoped out given the significant distances between the proposed BESS adjacent to the substation and residential receptor locations. Further details are provided in **Chapter 9: Noise (EIAR Volume 1)**.

Topic	Potential Residue/Emission
Light	Construction: **TA 2.1: OCEMP (EIAR Volume 4)** notes that where security (or other) lighting is employed, this will be directed away from any areas of scrub, hedgerow, woodland, or watercourses. Temporary lighting must be directed away from watercourses and an unlit corridor of 30 m either side of watercourses is maintained. Compound lighting shall face inwards, and downwards where practicable to reduce light pollution and impact to wildlife. Operation: It is proposed to install visible lighting on the WTGs in a pattern that would be acceptable to the Civil Aviation Authority (CAA) for aviation visibility purposes. An aviation lighting assessment was also carried out by Wind Farm Low Flying Aviation Consultants (WFLFAC) in order to ascertain the exact aviation lighting requirements for the Proposed Development. The assessment proposed the visible and infra-red aviation lights to be installed on the Proposed Development's wind turbine generators (WTGs)s. The reduced lighting proposal in the WFLFAC report has since been accepted and approved for installation by the CAA and the Ministry of Defence (MoD). Lighting requirements are discussed in **Chapter 13: Aviation (EIAR Volume 1).** Further consideration to the impacts of lighting is reported in **Chapter 5: Landscape and Visual (EIAR Volume 1)** The substation buildings are likely to be equipped with passive infra-red controlled security lighting. These would illuminate the substation compound area when activated. Any effect would be temporary and not expected to be significant during normal operation of the Proposed Development.
Heat and Radiation	No significant sources of heat and radiation have been identified during either the construction or operation phase of the Proposed Development.
Waste	Construction: **TA 2.1: OCEMP (EIAR Volume 4)** provides details on pollution prevention control and site waste management that would be implemented during construction. A Site Waste Management Plan would be designed to follow the principles of: Avoidance; Minimisation; Separable; Recyclable. Operation: The power generation aspect of the Proposed Development would not produce any waste emissions or pollutants. The general operation and maintenance of the Proposed Development has the potential to produce a small amount of waste. This is likely to be restricted to waste associated with the control building from employees and visiting contractors and the storage of oils and lubricants.

Disaster Resilience

2.6.4 The EIA Regulations require the consideration of the potential risks to human health, cultural heritage or the environment associated with the vulnerability of the Proposed Development to major accidents and disasters. This requirement is interpreted[4] as requiring the consideration of low likelihood but high consequence events which would result in serious harm or damage to environmental receptors. Given the nature of the Proposed Development, the potential for risks related to the vulnerability to major accidents and disasters are likely to be limited to those associated with extreme weather.

2.6.5 Wind WTGs, the substation plant and BESS system are specifically engineered to withstand extreme conditions. Their robust design features include:

- **Advanced Weather Monitoring**: Wind WTGs have integrated weather monitoring systems that enable them to adapt their operation based on prevailing wind conditions, ensuring optimal performance and resilience during storms.

[4] IEMA (2020) Major Accidents and Disasters in EIA: A Primer. Available at https://www.iema.net/media/brbdeibt/j27374_iema_major_accidents__disasters_final-1.pdf

- **Rugged Construction**: These structures are built to withstand high wind speeds. Advanced engineering techniques and materials, such as carbon fiber and steel, contribute to their ability to endure turbulent weather.
- **Flexible Blades**: Modern wind WTGs employ flexible blades that can adjust their pitch and orientation, optimizing energy production while minimizing potential damages from excessive wind forces.
- **Condition monitoring**: Detection systems and alarms installed in all BESS modules, providing early alerts and enabling investigations to take place before a fire can start.
- **Safety by Design**: Considerations for the battery chemistry, the siting of the facility, site design and compliance with industry standards as well as extensive factory and site compliance testing
- **Proven Safety:** All BESS manufactures used by SSER comply with UL9540A Cell Testing and will have completed a full scale fire test to provide evidence that the BESS contains are able to contain fire.

2.6.6 These features enable wind WTGs and BESS to continue generating power(when safe to operate) during and after extreme weather events providing a dependable source of electricity for emergency services, hospitals, and other critical infrastructure that play a vital role in disaster management.

2.6.7 In regard to ground conditions, a PLHRA (**TA 8.1, EIAR Volume 4**) has been prepared which provides further technical information on the likely risk and hazards associated with peat instability, and the proposed standard mitigation and working methods that would be implemented during construction to seek to avoid adverse effects associated with peat instability.

2.7 Decommissioning

2.7.1 At the end of the project's operational life, a decision will be made as to whether to refurbish, remove, or replace the WTGs and BESS. If refurbishment or replacement were to be chosen, relevant consent applications will be made.

2.7.2 To decommission the Proposed Development, the decommissioning period is anticipated to be approximately 12 months.

2.7.3 Decommissioning would entail the removal of WTG components, transformers, the substation, the BESS and associated buildings. It is anticipated that the access tracks and underground cables will be left in place and foundations removed to a depth of 0.5 m below ground level to avoid environmental effects from removal. A Decommissioning Plan will set out environmental protection measures and restoration principles in place at that time, which will be implemented. This plan would be approved by PKC.