TROSTON LOCH WIND FARM

EIA Report – Volume 1 – Main Text

Chapter 4

The Development

CHAPTER 4

4 THE DEVELOPMENT

4.1 INTRODUCTION

This Chapter of the Environmental Impact Assessment Report (EIA Report) provides a description of the proposed Troston Loch Wind Farm (the Development) which forms the basis of the assessments presented within Chapters 6 to 16. It provides details of the construction phase, the 30-year operational phase and decommissioning phase of the Development.

This Chapter includes an overview of the Development followed by a detailed description of the main components and their method of construction. Measures that have been built into the design of the Development to reduce effects, also known as 'embedded' mitigation measures, are set out in the previous chapter (**Chapter 3: Site Selection and Design**), and in this chapter. In addition to these embedded mitigation measures, **Chapters 6** to **16** present mitigation and enhancement measures where specifically relevant to their assessment topic.

This Chapter of the EIA Report is supported by the following figures provided in Volume 2a EIA Report Figures:

- Figure 4.1: Site Layout Plan;
- Figure 4.2: Typical Turbine;
- Figure 4.3: Typical Foundation;
- Figure 4.4: Typical Turbine Installation Area;
- Figure 4.5: Typical Cable Trench;
- Figure 4.6: Control Building Compound;
- Figure 4.7: Control Building Elevation;
- Figure 4.8: Construction Compound;
- Figure 4.9: Access Track;
- Figure 4.10: Watercourse Crossing;
- Figure 4.11: Indicative Temporary Bridge Detail;
- Figure 4.12: Proposed Site Entrance;
- Figure 4.13: Anemometry Mast;
- Figure 4.14: Borrow Pit 1 Plan and Profile; and
- Figure 4.15: Borrow Pit 2. Plan and Profile

This Chapter of the EIA Report is supported by the following Technical Appendix document provided in Volume 3 Technical Appendices:

- A4.1: Borrow Pit Assessment.

4.2 DESCRIPTION OF THE DEVELOPMENT AREA AND SURROUNDING LAND

4.3 OVERVIEW OF THE DEVELOPMENT

The Development would comprise up to 14 three-bladed horizontal axis turbines up to 149.9 m tip height. The Development includes all associated infrastructure including control building, incorporating the substation and battery storage, crane hardstanding, underground cabling, external transformer enclosures located adjacent to each turbine, temporary construction compound, up to two borrow pits, a permanent wind monitoring mast and laydown area as well as new and upgraded access tracks. The components of the Development are summarised in Table 4.1 and shown on Figure 4.1.

Table 4.1 Key Parameters of the Development

Element	Details
Turbines	Up to 14 turbines, each with a tip height of up to 149.9 m and a rotor diameter up to 133 m. Depending on the final turbine choice a small transformer will be located at the base of each turbine. Each turbine will have a foundation with a diameter of between 16 and 21 m, with a depth of 3 m.
Access Track	Access track to serve the construction and operation of the wind farm with width approximately 5 m, this will consist of approximately 8 km of upgraded track and 5 km of newly constructed track.
Electrical Infrastructure	A Substation building will be located towards to the south of the Site, measuring approximately 40 x 20 m. This building will also include the control building and a battery storage facility. The substation building will be located within a compound measuring approximately 60 x 60 m, which will also include any external electrical infrastructure and vehicle parking. Underground cabling, laid where possible alongside the access tracks, will link the turbine transformers to the onsite substation.
Crane Hardstanding	Crane hardstandings will be required adjacent to each turbine, this will consist of a main area of approximately 1400 m^2 at each turbine. In addition to the main hardstanding areas there will be additional flattened areas for crane assembly and turbine blade storage, however these will be temporary and only include small areas of hardstandings.
Temporary Construction Compound	A temporary construction compound will be required during the construction of the Development, forming an area of hardstanding providing space for portakabins, parking and lay down areas; this will measure approximately 80 x 60 m and be located in the north of the Site.
Borrow Pits	Up to two onsite borrow pits are proposed, however given that there is little new track with the majority consisting of upgrades, relatively little aggregate will be required when compared to a typical wind farm of this size, and the use of both borrow pits may not be required. One of the proposed borrow pits will involve extending an existing quarry.
Anemometry Mast	A 90 m anemometry mast will be constructed for the life span of the wind farm, with a small foundation of approximately 6 x 6 m.
Site Access	It is proposed to create a new access point off the B729 to serve the Development, located to the north of the Site.

It is estimated that the permanent footprint of the Development following restoration will be approximately 9.0 hectares. During the construction period is it estimated that a further 8.0 ha will be temporarily required, which includes the borrow pits, laydown areas and the construction compound which will be reinstated following the construction works.

4.4 THE DEVELOPMENT COMPONENTS

4.4.1 Wind Turbines

Consent is being sought for the erection of up to 14 three-bladed horizontal axis wind turbines with a maximum height from base to tip that will not exceed 149.9 m (with the blade in the vertical position). Figure 4.2 illustrates a typical turbine of this type. The blades will be made of fiberglass reinforced epoxy and mounted on a tapered tubular steel tower. The turbines will be light grey in colour and the finish of the tower and blades will be semi-gloss and semi-matt respectively.

The specific turbine is dependent on the final choice of turbine models available at the time of procurement and will be chosen with the aim of optimising renewable energy generation at the Site. However, the chosen turbines will have a maximum blade tip height of no more than 149.9 m as this is the upper limit of the environmental and planning parameters considered in the Environmental Impact Assessment (EIA).

Turbines are typically of a variable speed type, so that turbine rotor speed will vary according to the energy available in the wind. Turbines of the dimensions proposed typically have rotational speeds of between 6 and 14 revolutions per minute (rpm), depending on variations in wind speed, generating power for all wind speeds between 3 and 25 metres per second (m/s). At speeds greater than 25 m/s, the turbine reduces power output by pitching the blades out of the wind to protect the turbine from damage caused by high wind speeds. These very high wind conditions usually prevail for less than 1% of the year.

The turbines are computer controlled to ensure that at all times, the turbine faces directly into the wind to ensure optimum efficiency. The rotors of all 14 turbines will rotate in the same direction.

When operating, the rotational movement of the blades is transferred through the gearbox, to drive the generator. This produces a three-phase power output typically at 690 Volts (V), which is transferred from the generator to the turbine transformer. The turbines will be controlled and monitored from within the proposed control building and will also be remotely monitored where performance details and statistical information for each turbine will be recorded. Table 4.3 details the locations of each turbine.

During the construction phase, two cranes are typically required to install the turbines, consisting of a larger 800 – 1000 tonne main crane and a secondary 400 – 500 tonne crane. The cranes would use the crane hardstandings as described in the following section. The construction contractors would determine the actual cranes used following the turbine procurement process, together with the exact programme and number of teams on site.

The method for erecting each turbine would depend on the turbine supplier and site conditions. Turbine components would either be lifted directly off transportation units for erection or more typically stored adjacent to the crane hardstanding area. The tower sections are initially erected, followed by the nacelle and then the hub depending on the blade installation. The turbine blades would then be lifted individually and attached to the hub or if sufficient space is available would be attached to the hub at ground level then raised together and attached to the nacelle. The overall assembly process for each turbine takes approximately two to four days, depending on weather conditions.

Table 4.2 Wind Turbine Co-ordinates and Elevations

Turbine No.	Easting	Northing	Elevation (m) AOD
1	267126	588450	259
2	267511	588243	245
3	267538	589057	289
4	267951	588828	268
5	268029	589546	331

Turbine No.	Easting	Northing	Elevation (m) AOD
6	268447	589344	292
7	268224	588441	260
8	268541	589969	341
9	268963	589816	304
10	269433	589621	275
11	269031	590494	334
12	269553	590434	361
13	269947	590123	373
14	270358	589935	348

4.4.1.1 Turbine Foundations

It is proposed that the foundation for the turbines would comprise a standard concrete gravity foundation constructed on poured concrete with steel reinforcement. The foundation would require up to 612 m^3 of concrete per turbine base and up to 90 tonnes of steel reinforcement.

Each turbine foundation will consist of an octagonal or circular base approximately 6.5 m in diameter, on a foundation slab of up to approximately 20.8 m by 20.8 m which sits on the underlying rock or suitable substratum with a founding depth of between 1.8 and 3 in an 'inverted T' design. A typical turbine foundation is shown in Figure 4.3. The area of excavation is likely to be a maximum of 35 m x 35 m to allow for an excavated working area around the concrete turbine foundation.

The detailed design specification for the foundation would depend on the geotechnical site investigations undertaken during the enabling works to establish the nature of the subsoil condition at each turbine location. Each foundation would be designed separately according to the chosen turbine type and manufacturer specification.

The ground excavation methods would vary depending on the local ground conditions and the nature of the surface vegetation. The general processes would 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 would be backfilled as soon as practicable with spoil, pending turbine installation.

Once the turbines have been installed, the immediate construction area around the turbine bases would be restored using the retained topsoil or turf to within approximately 1 m of the tower bases. A 1 m wide gravel path would then be laid around the tower base. Material won from foundation excavations would, if suitable, be used in the landscaping of access tracks and other site infrastructure. If not suitable, it would be disposed of off-site to a suitably licensed facility.

4.4.1.2 Transformers and Cabling

Depending on the final choice of turbine, transformers will either be located within the turbine tower (with internal switchgear) or externally, close to the base of the tower. For the purposes of this assessment it has been assumed that the transformers will be located adjacent to each turbine. An external transformer will normally be placed within a glass reinforced plastic (GRP) housing, the size of housing will depend on the type of transformer selected but in general it will be approximately 3 m by 2.5 m in plan and 2.5 m in height above surrounding ground level, located adjacent to the turbine within the hardstanding area (Figure 4.2).

The transformers will be either oil-filled with a bunded footing to remove any risk of spillage or a solid cast resin type which is effectively non-polluting. The transformers will increase the electrical voltage from 690 V to 33 kilovolts (kV).

Turbines will typically be connected by 33 kV single phase power cables which will be laid in trenches alongside the access tracks, with a depth of 1 m. The excavated trenches will also include SCADA cables or fibre optic cables. This will allow interrogation and control of individual turbines as well as remote monitoring. A copper cable will also be located in the trench and will be connected to the substation and each turbine to provide an earthing system to provide protection from lightning strikes and electrical faults. The cables will be laid on a sand bed, then surrounded by further sand and backfilled using suitably graded material. Clay, or equivalent low permeability barriers, will be inserted into the cable trenches at regular intervals to avoid the trenches becoming preferential drainage pathways. Details of typical trenches are shown in Figure 4.5.

4.4.2 Crane Hardstandings

Each turbine requires an area of hardstanding adjacent to the turbine foundation to provide a stable base on which to site the turbine components and cranes for the erection of the turbine.

The main working area at each hardstanding area composed of crushed stone will be approximately 40 m x 35 m, the footprint of the main hardstanding will be approximately 1,400 m^2. There will be smaller temporary hardstanding areas which are required for the assembly of the main crane jib and 'blade fingers' which are required for the storage of the turbine blades.

A typical arrangement is shown in Figure 4.4, however, the final arrangement of the hardstanding will depend on the method of erection and exact specification of the cranes chosen by the turbine erection contractor. The hardstandings will be sufficiently level and with a suitable load-bearing capacity to ensure the safe storage of turbine components and operation of the cranes.

Surface water and groundwater levels will be managed to ensure that natural drainage patterns are maintained and that water levels within excavations do not rise beyond appropriate and safe limits. Various cable ducts and other ancillaries will be installed within the foundations and under the access track crossing points.

Construction of the temporary crane hardstanding would be similar to the construction of the site tracks as described in Section 4.4.3. Surplus excavated material would be reused elsewhere within the Site such as for track maintenance during construction or during borrow pit reinstatement. Similarly any surplus topsoil would be used to restore track edges or the borrow pits after construction.

The crane hardstanding would be left in place following construction in order to allow for the use of similar plant should major components need replacing during the operation of the Development. These would also be utilised during decommissioning at the end of the Development's life.

4.4.3 Access Tracks

Tracks will be required to enable the turbine components, construction materials and construction staff to be transported to their locations, and to enable access for subsequent maintenance visits. The proposed track layout is illustrated in Figure 4.1.

The access tracks have been designed to minimise environmental disturbance and land take wherever possible by avoiding areas of deep peat, environmental constraints identified during the EIA and limiting the number of watercourse crossings. In addition the Site has a relatively extensive network of good quality forestry tracks, and a key part of the design rationale has been to reuse the existing tracks where possible. The length of access track will total approximately 13 km which consists of approximately 8 km of upgraded track and 5 km of new track.

Access tracks will be approximately 5 m in width, with an additional 1 m verge on either side subject to local ground conditions. The tracks will be designed to have sufficient radii for turning of the construction vehicles, abnormal loads and plant. There is one exception to the track specifications, which consist of the upgraded track spur to the new borrow pit which will not be used by abnormal loads and therefore have reduced turning radii. Turning heads have been included the design as necessary to allow abnormal load vehicles and cranes to undertake turns during the turbine delivery and assembly process. These are incorporated into the crane hardstanding areas in order to minimise land take.

It is anticipated that access tracks would be constructed using a ‘cut track’ design. Topsoil is stripped to expose a suitable rock or sub-soil horizon on which to build the track. The track is 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.

Peat has been avoided where possible and it is unlikely that any floating track will be necessary. If required a floating track would be constructed for short sections of track where peat depths are identified to be greater than 1.0 m in depth. A layer of crushed stone (0.5 m – 1 m, dependent on ground conditions) would be laid on geotextile/geogrid reinforcement to form the track, which results in the site track being raised above the peat surface.

Soils removed from the excavated area would be stored separately in piles, no greater than 3 m 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 50 m away from any watercourses. Wherever possible, reinstatement will be carried out as track construction progresses.

The access track will be left in place after construction of the Development and can be used for agricultural or forestry access as well as access to the turbines for maintenance and repair works. Figure 4.9 illustrates a typical cut track design.

Prior to the commencement of site construction, a 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 (CMS) for all aspects of construction.

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

All access tracks will incorporate robust drainage, including drainage channels running adjacent to the tracks, either on one or both sides. The track would be designed with a crossfall towards the drainage channels to prevent a build-up of surface water and allowing the track to act as a watercourse. The make-up of the tracks will also be as permeable as possible to prevent any instances of surface water build up.

Cross drainage pipes will be installed at regular intervals to prevent flooding or surcharging of the drainage channels and to maintain natural drainage catchments.

The implementation of the drainage design will be developed in response to a risk appraisal undertaken by the contractor and will be proactive, rather than being reactive to any events arising once works commence. The design will reduce the risk of sedimentation (from loose material) and pollution (from accidental spillage) of all downstream watercourses.

4.4.4 Watercourse Crossings

As noted above, the track layout design has sought to limit the number of watercourse crossings, however given the nature of the Site and the principles of wind farm design a number of crossing points are required. There is a requirement for eight crossings for watercourses which are identified on 1:50k Ordnance Survey (OS) mapping. Of these, seven are existing crossing points as part of the existing track network which would require upgrading, while one would be subject to a new crossing. There are a further four smaller crossing points for watercourses not identified on OS 1:50k mapping, of which three are existing and would require upgrading, while one would be subject to a new crossing.

The type and design of each watercourse crossing will be dependent on the stream morphology, peak flows, local topography and ecological requirements, and will be chosen so as to avoid or minimise potential environmental effects. A typical watercourse crossing design is shown in Figure 4.10.

It is likely that culverting will be the most suitable crossing method; the design would be agreed with the Scottish Environment Protection Agency (SEPA) prior to construction.

Any crossing would be designed in accordance with Construction Industry Research and Information Association (CIRIA) Culvert design and operation guide (C689)[1], to ensure sufficient capacities.

In addition to the watercourse crossings on-site, there may be a requirement to install a temporary bridge crossing immediately to the south of the existing Smittons Bridge, 4.9 km to the northwest of the Development, which lies on the proposed construction delivery route. A temporary bridge would be required as part of reinforcements to the road network to facilitate the construction of the Development, should it be deemed that the current bridge structure is unsuitable. Such a temporary bridge would consist of a single span pre-fabricated Bailey type bridge, an indicative design is shown on Figure 4.11. The crossing would not require any construction activities or structure within the watercourse, while concrete abutments would be installed on the opposite banks of the watercourse. Once construction activities are complete the bridge would be removed, however the abutments would remain in situ for the lifespan of the Development.

Any watercourse crossing on or off-site would be subject to registration under The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended)[2] (CAR) and Water Environment (Miscellaneous) (Scotland) Regulations 2017[3].

[1] Culvert design and operation guide (C689) https://www.ciria.org/Resources/Free_publications/Culvert_design_and_operation_guide.aspx (access 21/11/2018)
[2] The Water Environment (Controlled Activities) (Scotland) Regulations 2011 http://www.legislation.gov.uk/ssi/2011/209/contents/made (accessed 21/11/2018)

4.4.5 Substation Compound including Battery Storage

The substation compound would be located on an area of crushed stone hardstanding measuring approximately 60 x 60 m. The compound is located relatively centrally with respect to the turbines in order to minimise electrical losses and cabling requirements, and on a relatively flat area of land, centred at approximately NGR 268150, 588980, as shown on Figure 4.1.

The substation compound would accommodate the substation building which contains the electrical infrastructure and control elements of the Development, as well as the battery storage facility, a fenced area including any external electrical switchgear and an area for vehicle parking and storage during the construction period. A typical arrangement is shown in Figure 4.6.

The principal element of the substation compound is the substation building, which will likely comprise a single storey unit measuring approximately 40 x 20 m with a pitched roof as shown in Figure 4.7. The building will be partitioned into two broad sections; a smaller 10 x 20 m section will include the control components, including metering equipment, switchgear, the central computer system and electrical control panels as well as welfare facilities, while the larger 30 x 20 m partition will include the battery storage elements.

The battery storage facility would have a capacity in the region of 20 megawatt hours (MWh) and would be able to import power from the national grid or wind turbines and export to the national grid as required providing a 'security buffer' to cope with supply and demand events. The substation building would house a number of batteries with the battery storage components contained in sealed units, associated air conditioning systems, an electrical room and a maintenance room.

The substation building will have its own foul drainage system. Surface water will drain via soakaway or other preferred SuDS method to be agreed with the Council.

The substation building will be constructed in keeping with the local built environment. The final designs for the buildings and compound will incorporate sustainable design features and will be agreed with the Council.

The underground cables from the wind turbines would be brought into the substation building in ducts. The ducts would guide the cables to the appropriate switchgear inside the building. Communications cables would enter in a similar manner.

In addition to the electrical infrastructure housed within the substation building, there will likely be a degree of external electrical switchgear located within the substation compound. Any external switchgear would be located within a security fence of up to 3 m height and served via a locked access gate.

Lighting will be kept to a minimum and will be limited to working areas only and will comply with health and safety requirements. Lighting will be down lit and linked to timers and movement sensors so that light pollution is kept to a minimum.

4.4.6 Grid Connection

The grid connection does not form part of the Section 36 consent application for the Development. The consent for the grid connection will be sought by the relevant owner/operator of the local distribution network, Scottish Power Energy Networks

[3] Water Environment (Miscellaneous) (Scotland) Regulations 2017. http://www.legislation.gov.uk/ssi/2017/389/contents/made (accessed 21/11/2018)

(SPEN). The Network Operator will be responsible for the consenting, construction and operation and maintenance of the grid connection.

4.4.7 Temporary Construction Compound

A temporary construction compound will be created for the duration of the build centred at approximately NGR 269250, 590700 as shown on Figure 4.1. This area has been chosen within a relatively level area of the Site, close to the Site entrance and with suitable separation distance from any environmental constraints identified during the EIA process. The area of the compound will measure approximately 80 x 60 m and will include space for:

- Portakabins for site office and staff welfare facilities with provision for sealed waste storage and removal;
- Areas for storing materials;
- Parking for project related vehicles; and
- Containerised storage for tools and spares.

A typical construction compound arrangement is shown on Figure 4.8. Welfare facilities for site personnel will be required during construction which would be located within the construction compound. Foul water and effluent would be treated either via septic tank with soakaway designed to SEPA guidelines (including GPP4) or by the use of chemical facilities with periodic material for off-site disposal. Any facilities would be subject to agreement with SEPA.

The area to be used for the construction compound would be stripped of topsoil to expose a suitable formation which will be stored for future re-instatement. A geosynthetic material base or similar will then be laid followed by a layer of suitable material then a further geosynthetic material laid prior to the top surface of blended fines.

Appropriate bunding arrangements will be employed in all areas where fuel and oil storage tanks will be situated, in order to prevent contamination of the surrounding soils, vegetation, surface water and ground water. The fuel storage area will be above ground with secondary containment in accordance with SEPA's GPP2 (Above Ground Oil Storage Tanks), PPG7 (Refuelling facilities) and GPP8 (Safe storage and disposal of fuel oils), and will be situated a minimum of 50 m from watercourses to reduce the risk of pollution of watercourses. Any contaminated run-off within the sealed bund will be removed to a licensed waste management facility.

Following completion of the construction phase the components of the compounds will be removed and the area fully restored.

4.4.8 Anemometry Mast

An operational anemometry mast will be installed at NGR 267163 588755 for the operational period of the Development. The anemometry mast will be used to provide on-going measurement of wind speed to provide information for the control and monitoring of the operation of the Development. The location of the mast has been selected to provide the best representation of wind speeds across the Site.

The anemometry mast will be 90 m in total height and will be of galvanised steel lattice construction. It will have a concrete foundation with approximate dimensions of 6 x 6 x 0.5 m and erected using an appropriately sized crane. A typical anemometer mast is shown in Figure 4.13. An access track is not required to serve the mast, as construction and operation can be undertaken by all-terrain vehicles.

4.4.9 Borrow Pits

It is the intention to source aggregate for the construction of access tracks, structural fill beneath turbine foundations, construction compounds and turbine hardstandings from on-site borrow pits as far as possible. By sourcing aggregate from within the Site, rather than an off-site quarry, this has the advantage of reducing the number of heavy goods vehicles (HGV) on public roads.

It is estimated that approximately 50,000 m^3 of stone (excluding aggregate for concrete) will be required as part of the construction of the Development.

Two potential borrow pits have been identified, it is estimated that these will have additional capacity to that required for construction materials which allows some flexibility in the use of borrow pits and it is therefore likely that the final borrow pit dimensions will be smaller than those presented, however for the purpose of the EIA Report it is assumed that both borrow pits are used to their full extents as worst case. One of the proposed borrow pits has previously been used for aggregate extraction and it is proposed to re-open this area. The second borrow pit has been identified on a small hillock with exposed rock which initial surveys have indicated as being of suitable material for aggregate extraction. Both borrow pits are located on the existing track network within the Site, which means they can be accessed early in the construction period. The locations of the borrow pits are shown in Figure 4.1 and detailed further in Figures 4.14 and 4.15. A Borrow Pit Assessment is also presented in Technical Appendix A4.1.

The locations of the two borrow pits have been influenced by environmental considerations to minimise the impacts on ecology, peatlands, cultural heritage, hydrology and landscape as described within the relevant technical chapters of this EIA Report. The final location, number and estimate of material from each potential site would be determined once full ground investigation works and testing have been completed. The borrow pits will require the use of plant to both extract and crush the resulting rock to the required grading. It is anticipated that most rock will be extracted by breakers however some blasting may be required. Precise details will be confirmed at the construction stage.

Following construction, the borrow pits will be restored. The restoration will include replacing any surplus or unused material, soil or turf materials to restore the slopes to a stable profile and allow regeneration. A restoration plan for the site, post construction, will be prepared by the Applicant and agreed with the Council and relevant statutory consultees.

4.4.10 Main Site Entrance

The main site entrance will be taken off the B729 which runs between Carsphairn and Moniaive. The new entrance will include a bellmouth junction for traffic to enter and egress the Site from the west. The site entrance point has been designed to maximise sight lines for vehicular movements entering and leaving the Site, final design will be agreed with the Council to ensure visibility splays are achieved. During construction a security hut will be located here to log visitors on and off site. Figure 4.12 shows the proposed arrangement at the site entrance.

The road network to the east of the site entrance is unsuitable for heavy goods vehicles and such vehicles will not enter or leave the Site from the eastbound direction.

4.4.11 Site Signage

During construction, the Site will have suitable signage to protect the health and safety of workers, contractors and the general public.

During construction and operation, the Site will have suitable signage to provide directions and health and safety information for workers. There will be a sign giving the operator's name, the name of the Development and an emergency contact telephone number. On the turbines and substation building, there will be further signs giving information about the component, potential hazards, the operator's name, the location grid reference and the emergency telephone number. The final location and design of the signage will be defined prior to the Development becoming operational.

4.4.12 Forestry Removal

The Development is largely located within commercial forestry plantation and would involve the felling of 61 ha of forestry within the Site.

The forest removal will be undertaken largely using conventional harvesting and or mulching for crops which are commercially unsuitable. Activities will be carried out using standard forest harvesting equipment with commercial timber removed from the Site.

Further details on the Forest Design for the Site are explored in Chapter 13 Forestry.

4.4.13 Micrositing

In the event that unsuitable ground conditions are encountered during the construction works, there may be a requirement to micro-site elements of the Development infrastructure. It is proposed that a 50 m micro-siting tolerance in any direction for turbines and other infrastructure is applied to the Development and that within this distance any changes will be subject to approval of the Ecological Clerk of Works (ECoW) with specialist archaeological advice as required. Beyond this distance, any relocation of Development components will require written approval from the Council.

The potential for micro-siting was considered when the detailed survey and assessment work was undertaken. For example, the habitat and archaeological surveys covered a wider area than just the footprint of the proposed turbine and access track locations (full details of survey areas can be found in the relevant assessment chapters). Any likely significant effects arising from micrositing have been considered in the preparation of this EIA Report, and specific areas to be avoided have been identified in technical chapters where necessary.

4.4.14 Restoration

Site restoration will involve the restoration of track and hardstanding verges, borrow pits and the temporary construction compound to provide a natural ground profile with non-geometric surfaces and tie-ins with existing undisturbed ground levels. Restoration will be undertaken at the earliest opportunity to minimise storage of turf and other materials. The key elements of the restoration plan are summarised below.

- Track and hardstanding verges on the downhill side will be covered with a layer of turf and associated soil, then left to allow natural succession to take place. This turf will be obtained from areas where shallow organic deposits or otherwise shallower peat deposits ('acrotelmic' peat) have been excavated. A mixture of habitats is expected to develop on track and hardstanding verges on the downhill and uphill sides, because of local variation in soil depth/type and the variety of drainage conditions that will be present, including wet heath, marshy grassland, dry heath and acid grassland;
- The borrow pit base(s) will be restored using 'catotelmic' peat (deeper than 1 m, where available) with a capping layer of turf/acrotelmic peat. It is expected that a modified version of blanket bog, and otherwise wet heath, will develop because of drainage inflows from surrounding land. The sides of the pits are expected to

develop into habitats including dry heath and acid grassland where soil is present on rock ledges; steeper rock faces will remain bare or colonise with mosses;

- The construction compound will be restored with peat / other organic deposits capped with a layer of associated turf. Due to the flat nature of the area where the compound will be located it is expected that a mixture of marshy grassland, wet heath along with dry heath/acid grassland will develop;
- Cable trenches would be similarly reinstated. Where practicable, vegetation over the width of the cable trenches would be lifted as turfs, and replaced after trenching operations, to reduce disturbance;
- The 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; and
- Hardstanding areas at each turbine location will be retained for use in ongoing maintenance operations, including component replacement as necessary, and the decommissioning phase.

4.5 CONSTRUCTION AND DEVELOPMENT PHASING

The on-site construction period is estimated at approximately 18 months in duration and would comprise the principal operations:

- Phased forestry felling to facilitate construction;
- Construction of access junction off the B729 (note forestry operations not subject to this access point), and initial section of track;
- Construction of the temporary construction compounds and laydown areas near the Site entrance;
- Extraction of stone from the onsite borrow pits;
- Upgrade of existing access tracks and construction of new access tracks, including watercourse crossing points;
- Construction of the substation compound area;
- Installation of temporary and permanent drainage;
- Construction of turbine foundations;
- Construction of crane hardstanding areas;
- Remedial works to the public highway to accommodate turbine deliveries;
- Delivery, erection and commissioning of wind turbines;
- Construction of the substation building, including control building and battery storage facility;
- Excavation of shallow cable trenches approximately 1 m off the edge of the track and cable laying adjacent to the access tracks and crane hardstandings for drainage;
- Connection of onsite electrical distribution cables;
- Commissioning of the site equipment; and
- Reinstatement of the borrow pits and the temporary construction compounds.

4.5.1 Construction Period

It is expected that many of the above operations will be carried out concurrently, although predominantly in the order identified, which will minimise the overall length of the construction programme. An indicative Construction Programme is illustrated in Chart 4.1.

The starting date for construction activities will largely be dependent upon the date that consent may be granted and grid availability; subsequently, the programme would be influenced by constraints on the timing and duration of any mitigation measures confirmed in the individual technical chapters or by the consent decision, as well factors such as weather and ground conditions experienced on the Site.

It is proposed that construction activities be limited to the working hours of 07:00 to 19:00 Monday to Friday and 07:00 to 13:00 on Saturdays, with the exception of any emergency working or turbine deliveries. During the installation phase, there may be the requirement for extended working as some critical elements of installation cannot be stopped once started, such as concrete pouring. This would be agreed in advance with the Council.

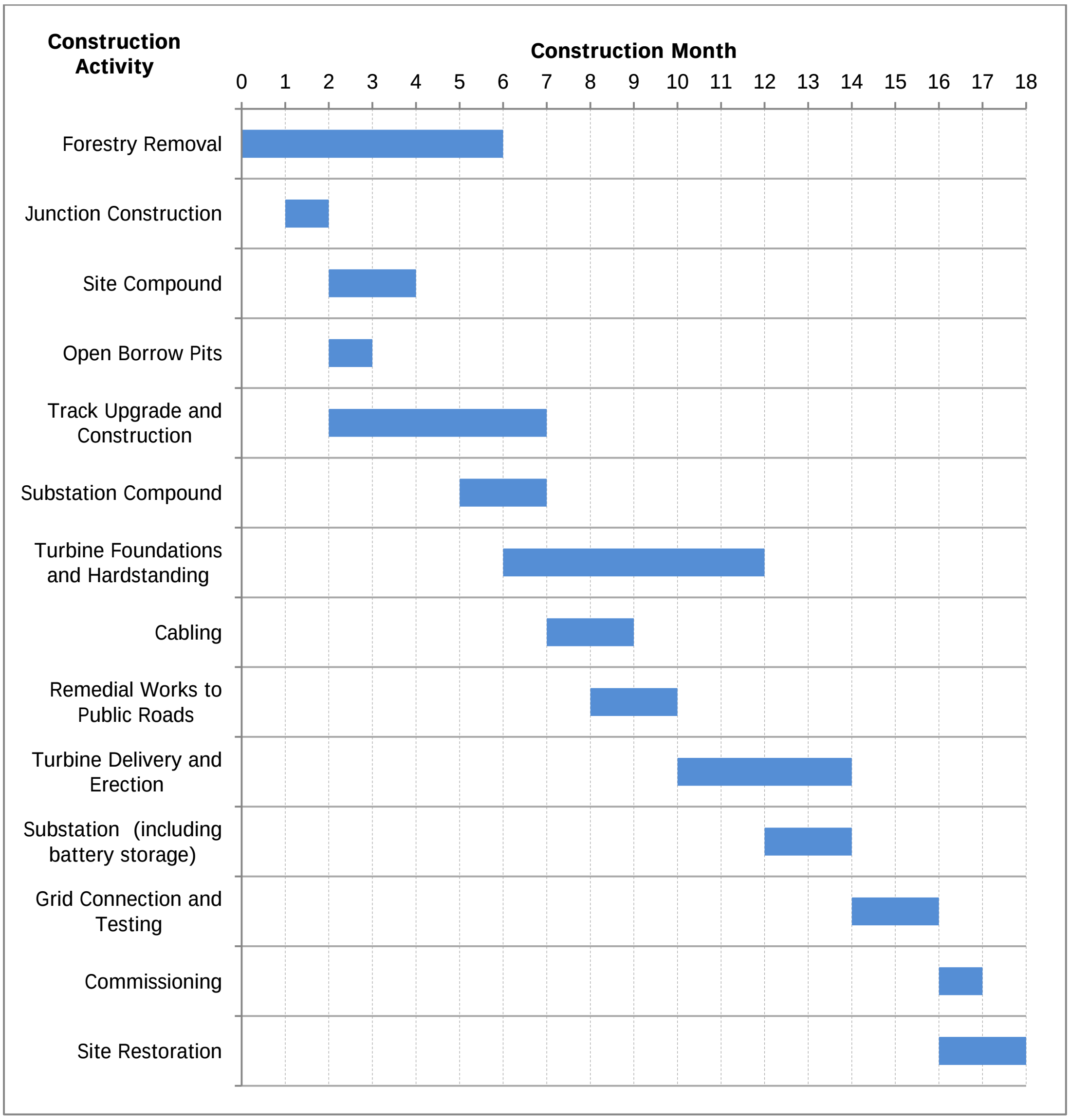

Chart 4.1 Indicative 18 Month Construction Programme

4.5.2 Construction Methods and Environmental Management

The construction phase will be controlled via a series of detailed method statements, which will be prepared by an Infrastructure Contractor appointed by the Applicant, who will have overall responsibility for environmental management on the construction site. While these method statements can only be formulated following detailed site investigation and detailed engineering design it is possible to indicate the outline of the methods that will be used, particularly in relation to environmental management.

The services of specialist advisors will be retained as appropriate, such as an archaeologist and ecologist, to be called on as required to advise on specific environmental issues. The appointed Infrastructure Contractor will ensure construction activities are carried out in accordance with the mitigation measures outlined in this EIA Report.

An outline CEMP is provided as Technical Appendix A9.1. This sets out the Applicant's standard outline requirements for inclusion within a detailed CEMP including guidance and best practice for adoption during construction of the Development. The outline CEMP provides an overview of the environmental management and construction best practice designed to reduce the potential for any environmental effects during construction.

Prior to construction a detailed CEMP would collate all measures required during construction to avoid and minimise environmental harm, it would include:

- Site induction and training;
- Working hours;
- Enabling works;
- Surface water and drainage management;
- Waste management;
- Wastewater and water supply monitoring and control;
- Oil and chemical delivery and storage;
- Water quality monitoring;
- Ecological protection measures;
- Construction noise management;
- Cultural heritage protection measures;
- Handling of excavated materials;
- Forest and woodland management;
- Reinstatement and restoration;
- Traffic management;
- Environment incident response and reporting;
- Use and extent of borrow pits;
- Method statements and risk assessments;
- Final drawings and details of access tracks; and
- Final drawings and details of turbine foundations.

To ensure that the mitigation and management measures detailed within this EIA Report are carried out, construction personnel and contractors will be required to adhere to the CEMP which will form an overarching document for all construction site management requirements.

Contractors will also be required to adhere to the following to minimise environmental effects of the construction process:

- Conditions required under the Consent and deemed planning permission;
- Requirements of statutory consultees including SEPA and Scottish Natural Heritage (SNH);
- Any other relevant mitigation measures identified in this EIA Report; and
- All relevant statutory requirements and published guidelines that reflect 'good practice'.

The Applicant will require that all contractors follow the requirements of ISO14001 - 'Environmental Management Systems - Specification and Guidance for Use', and will provide the following:

- Details of main contractor's corporate environmental policy;
- Assessment of environmental impacts during construction;
- Procedures and controls for environmental management;
- Environmental monitoring details and reporting systems;
- Schedule of contractual and legislative requirements; and
- Schedule of relevant consents, licences and authorisations.

The CEMP will be agreed with the relevant statutory bodies including SEPA, SNH and the Council prior to commencement of construction, and performance against the CEMP will be monitored by the Applicant's Construction Project Manager throughout the construction period.

Particular environmental impacts and associated mitigation measures required to be addressed within the CEMP are discussed in relevant sections of this EIA Report.

In addition, the CEMP will typically be supported by the following documents which apply to the construction process:

- Water Protection Plan;
- Peat Management Plan;
- Pollution Prevention Plan;
- Traffic Management Plan;
- Site Waste Management Plan; and
- Restoration Plan.

4.5.3 Construction Materials

The key materials which would be required for the construction of the track, turbine foundations, hardstanding areas and cable trenches are:

- Crushed stone;
- Geotextile;
- Cement;
- Sand;
- Concrete quality aggregate: high strength structural grade, which is not prone to substantial leaching of alkalis;
- Steel reinforcement; and
- Electrical cable.

All materials will be sourced and transported to the site from local suppliers, where possible, with the exception of materials sourced from onsite borrow pits.

4.5.4 Construction Movements

Various vehicle types are required during the construction stage of the Development, of these; the majority would be standard road vehicles of similar type to those using local roads on a daily basis. However, the delivery of some of the wind turbine components would require vehicles and transport configurations that are longer and/or wider and/or heavier than standard road vehicles, this is discussed in **Chapter 12 – Traffic and Transport**.

4.5.5 Waste Management

All 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. All details of this will be included within the CEMP, as agreed with the 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 Site and disposed of by an approved waste contractor in accordance with provisions of the Special Waste Regulations 1996.

In the event of the complete decommissioning of the wind turbines, all mechanical/electrical equipment will be removed from the Site, the control building will be removed, the concrete bases will be covered over with soil and any disturbed ground will be reinstated and reseeded. All cables would be cut off below ground level, de-energised, and left in-situ.

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

The infrastructure contractor will be required to prepare a Site Waste Management Plan (SWMP) to ensure that best practice principles are applied with regard to reducing, re-using and recycling of all materials.

4.5.6 Health and Safety Related Issues

Health and safety issues during construction and decommissioning fall under the Construction (Design and Management) (CDM) Regulations 2015[4]. Health and safety will be initially addressed as part of the Pre-Construction Information Pack prepared by the Applicant. The Contractor will be required to prepare a Construction Phase Plan (Health and Safety Plan) and to forward information to the Applicant during the works to enable the Health and Safety File to be completed.

Turbines are designed to be safe and are built to withstand extreme wind conditions. The turbines selected for the Development will have a proven record in terms of safety and reliability.

Day-to-day operational and maintenance activities will be co-ordinated with the private landowner's operational requirements.

Public access to the Site will be restricted throughout the construction working area during construction for health and safety reasons and will be reinstated following cessation of construction activities.

An Operations and Maintenance Manual for the design life of the Development will be prepared by the Contractor and will cover all operational and decommissioning procedures.

4.6 OPERATIONAL PHASE

The Development will have an operational lifespan of up to 30 years from full commissioning of the proposed turbines.

4.6.1 Turbine and Infrastructure Maintenance

Turbine maintenance will be carried out in accordance with the manufacturer's specification. The following routine turbine maintenance will be undertaken:

[4] Construction Design and Management Regulations 2015
http://www.hse.gov.uk/construction/cdm/2015/index.htm

- Initial service;
- Routine maintenance and servicing;
- Gearbox oil changes;
- Blade, gearbox and generator inspections; and
- Replacement of blades and components as required.

Operational site inspections will be undertaken on a weekly basis and the servicing of turbines will be undertaken as per the turbine manufacturer requirements, usually once per year, but with monthly visits by the manufacturer's servicing team.

Ongoing track maintenance will be undertaken to ensure safe access is maintained to all parts of the Development all year round.

All 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 Site and reused, recycled or disposed of in accordance with best practice.

4.6.2 Snow Clearance

Safe access to the Development is required year round. There is potential for the Development to experience snowfall and therefore clearance of snowdrifts may be necessary via grading of the track using suitable ploughing plant.

4.7 DECOMMISSIONING

As noted previously, the operational lifespan of the Development and associated infrastructure will be up to 30 years. Following this, an application may be submitted to retain or replace the turbines, or alternatively they will be decommissioned.

Decommissioning would involve the following:

- Dismantling and removal of the wind turbines and electrical equipment;
- Reinstatement of the turbine areas and associated hardstanding; and
- Demolition and removal of control building and compound.

Turbine components and electrical equipment would be dismantled and removed in a similar manner to their delivery and erection. Cranage would be used to dismantle the turbine towers and blades into sections which would then be transported from the site by HGV; i.e. the loads may not constitute abnormal loads. The nacelle is likely to require transport as an abnormal load, and a route assessment will be undertaken prior to decommissioning to identify the best route to remove the nacelle offsite. Turbine components would be broken up offsite in controlled environments ready for reuse, recycling or appropriate disposal.

The removal of the top 1 m of the turbine base and plinth would be undertaken, requiring an excavated trench around the upstand to provide a working area. Breakout of the top part of the plinth would be undertaken using an excavator-mounted jack hammer. The cables would be cut level with the remaining concrete. Once the broken out concrete has been removed, the area would be reinstated by backfilling with soil/peat to an agreed method statement, as outlined in Section 4.4.14 above.

A similar process would be undertaken for the substation building, with the equipment removed offsite for breaking up and appropriate disposal and the building demolished. The top one metre of the concrete foundation slab would be broken up and removed, and the ground reinstated with topsoil. However cut faces are likely to be retained, as there would be insufficient material to fully backfill the substation area.

The access tracks will be retained in situ at decommissioning for use by the landowner. The cables will also be left in situ.

Overall, it is estimated that the decommissioning period for the Development would be approximately eight months.