Fred. Olsen Renewables

Chapter 5

Project Description

Document history

Author	Emma Thackeray	12/01/2022
Checked	Louise Broatch	09/02/2022
Approved	Kirsty Clarke	17/11/2022

Client Details	
Contact	Julie Aitken
Client Name	Fred. Olsen Renewables Limited
Address	c/o Fred. Olsen Renewables Ltd.2nd Floor, 36 Broadway London, SW1H 0BN, United Kingdom

Issue	Date	Revision Details
A	29/04/2022	First Draft
B	18/05/2022	Second Draft
C	03/06/2022	Third Draft for Legal Review
D	15/11/2022	Final Draft for Submission

Contents

5.1 INTRODUCTION 3
5.2 DEVELOPMENT DESCRIPTION 3
5.3 SITE LAYOUT 3
5.4 PUBLIC ROAD ACCESS 4
5.5 DECOMMISSIONING AND RESTORATION OF EXISTING WINDY STANDARD I WIND FARM 4
5.6 CONSTRUCTION PHASE 4
Construction Timetable *4*
Typical Equipment Used at Site *5*
Construction Method Statement (CMS) 6
Wind Farm Construction 7
5.7 SPECIFICATION OF TURBINES 7
Description 7
Erection of Turbines 7
Operation 8
Environmental Considerations 8
5.8 TURBINE FOUNDATIONS 8
Construction 8
Environmental Considerations 8
5.9 PERMANENT CRANE HARDSTANDS 8
Description 8
Construction 8
Environmental Considerations 8
5.10 SITE TRACKS AND BORROW PITS 9
Description 9
Construction and Design 9
Environmental Considerations 9
5.11 ON-SITE CABLING, SUBSTATION AND CONTROL BUILDING 9
Description 9
Grid Connection *10*
Construction 10
Environmental Considerations 10
5.12 TEMPORARY CONSTRUCTION COMPOUND AND FACILITIES 10
Description 10

Construction Compounds *10*
Concrete Batch Plant *11*
Environmental Considerations **11**
5.13 SIGNAGE **11**
5.14 EMPLOYMENT DURING CONSTRUCTION **11**
Site Representatives and Support Staff **11**
5.15 SITE REINSTATEMENT **11**
Access Tracks **11**
Cable Trenches **11**
Turbine Foundations **12**
Crane Hardstands **12**
Construction Compound **12**
5.16 OPERATIONAL PHASE **12**
Maintenance Programme **12**
Storage and Use of Polluting Substances **12**
Employment during the Operational Phase **12**
Decommissioning **12**
Waste Management **13**
5.17 HEALTH AND SAFETY **13**
Health and Safety of Construction Workers **13**
Safety of the Public **14**
Operational Phase **14**
5.18 CONCLUSION **14**

Glossary

Term	Definition
Environmental Impact Assessment	Environmental Impact Assessment (EIA) is a means of drawing together by the developer, in a systematic way, a description of the development and information relating to of the likely significant environmental effects arising from a proposed development
Environmental Impact Assessment Report	A document reporting the findings of the EIA and produced in accordance with the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 Regulation 5
The Applicant	Fred. Olsen Renewables Limited
The Proposed Development	The Proposed Windy Standard I Repower Wind Farm
The Proposed Development Area	The area shown delineated by the red line boundary shown on Figure 1.2.

List of Abbreviations

Abbreviation	Description
CAA	Civil Aviation Authority
CDM	Construction Design Management
CEMP	Construction Environmental Management Plan
CMS	Construction Method Statement
ECoW	Ecological Clerk of Works
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
FCS	Forestry Commission Scotland
FLS	Forestry Land Scotland
HMP	Habitat Management Plan
HVAC	Heating, Ventilation, and Air Conditioning
kV	kiloVolts
LPA	Local Planning Authority
RAMS	Risk Assessments and Method Statements
SEPA	Scottish Environment Protection Agency
SNH	Scottish National Heritage
SCADA	Supervisory Control and Data Acquisition system
SuDS	Sustainable Drainage System
WTGs	Wind Turbine Generators

5.1 INTRODUCTION

5.1.1 This chapter sets out the detailed project description of the Proposed Development as summarised in Chapter 1: Introduction, including specifications of turbines, access tracks and electrical infrastructure. It also describes the general construction methodology, timescales, and typical construction equipment likely to be used. Operational and decommissioning phases are also described within this chapter.

5.1.2 The construction methods detailed below build on best practice methodologies developed at other wind farms to comply with Health and Safety requirements for construction and operations in addition to relevant environmental guidance including:

- Scottish Environment Protection Agency's (SEPA) Pollution Prevention Guidelines;
- Scottish Natural Heritage's (SNH) (now known as NatureScot however SNH branding still appears on some guidance documents) Good Practice During Wind Farm Construction; and,
- SNH/Forestry Commission Scotland's (FCS) (now known as Forestry and Land Scotland (FLS) however FCS branding still appears on some guidance documents) Floating Roads on Peat Guidance.

5.1.3 Further construction details and mitigation are provided below in Section 5.6: Construction Phase. The Construction Method Statement (CMS) incorporating a Construction Environmental Management Plan (CEMP) are described setting out in detail the individual items of works associated with the construction of the Proposed Development (see Chapter 10: Hydrology, Geology & Hydrogeology for further detail on the CMS related to hydrological impacts). These, along with other forms of embedded mitigation, have been designed in as part of the Proposed Development to avoid and reduce the environmental impacts of the proposal as far as it is practical to do so. The effect of this on the Environmental Impact Assessment (EIA) process is discussed throughout the remainder of this Environmental Impact Assessment Report (EIAR).

5.2 DEVELOPMENT DESCRIPTION

5.2.1 Figure 1.1 (Volume 3 of the EIAR) shows the location and extent of the Proposed Development in a regional context. The Proposed Development is located within Carsphairn Forest, near Carsphairn in Dumfries and Galloway and will act as a replacement to the existing Windy Standard I Wind Farm.

5.2.2 The application is for a wind farm comprising of up to 8 wind turbines with a blade tip of up to 200 m. Therefore, the Proposed Development has a total generation capacity of approximately 49.6 MW. The operational life for the wind farm is 35 years.

The Proposed Development includes habitat conservation and enhancement proposals There are limited opportunities within the Proposed Development Area and therefore a Habitat Management Plan (HMP) will be implemented across offsite locations to provide a positive impact to the local environment.

5.2.3 The application also includes associated infrastructure, including;

- Turbine infrastructure including turbine foundations, external transformer, crane pads and hardstand areas;
- Micro-siting allowance of turbines and associated infrastructure of up to 90 m;
- Widening approximately 14 km of existing access tracks:
- Batching plant;
- Approximately 7.3 km of new access tracks;
- Underground electricity cables;
- Signage;
- Temporary borrow pit areas;
- Temporary construction and storage compounds, laydown areas and ancillary infrastructure;
- Security gatehouse and parking area; and
- Drainage and drainage attenuation measures (as required).

5.2.4 It is intended that the Proposed Development will make use of some of the existing infrastructure on site including access tracks, the existing distribution and transmission substations, with their associated control buildings and compounds and the available capacity on the local transmission and distribution network with connection to the substations as shown on Figure 1.3: Proposed Site Layout (Volume 3).

5.3 SITE LAYOUT

5.3.1 Chapter 4: Site Design and Design Evolution provides details of the design process that resulted in the final layout.

5.3.2 The turbine layout and associated infrastructure is presented in Figure 1.3 (Volume 3). This figure illustrates the relevant elements, including locations for the proposed eight turbines, existing upgraded access tracks, hardstands, existing upgraded external transformers and new on-site access tracks, grid connection points, temporary hardstand areas, on site construction compound and laydown area, gatehouse location, potential storage and laydown area, temporary car park area, main construction compound, existing borrow pit locations and indicative proposed borrow pit search areas.

5.3.3 Micro-siting has been assessed to allow the exact turbine location and infrastructure to be modified post consent, following detailed ground investigation and ground clearance (within 90 m). Following a question to consultees within the scoping report (Appendix 1.1) on whether they accept the proposed micro-siting of 90 m, both Historic Environment Scotland and SEPA accepted the micro-siting in writing, no consultees objected.

5.3.4 The agreed distance would form a condition accompanying any consent and that it would be carried out under Ecological Clerk of Works (ECoW) supervision.

5.3.5 Table 5.1 below gives the centre point coordinates and proposed maximum tip height for each of the proposed turbines.

Table 1: Turbine coordinates (British National Grid)

Turbine Number	Easting	northing	Maximum Tip Height (m)
1	260482	603904	200
2	260864	603384	200
3	261887	601590	200
4	261460	601435	200
5	260282	601985	200
6	261102	601698	200
7	261332	602749	200
8	261643	602173	200

5.3.6 This layout including the micro-siting allowance was developed taking into account the ecological, hydrological, archaeological, topographical, landscape, visual and noise constraints whilst ensuring optimal wind resource (see Chapter 4: Site Design and Design Evolution for further details on site constraints which were taken into consideration).

5.3.7 The alternative layouts were tested from a series of 'design viewpoints' and the iterative process continued until key design objectives had been met to an appropriate degree. This process is set out in Chapter 4: Site Design and Design Evolution.

5.3.8 Each turbine location, although limited to some extent by on-site constraints, was considered according to its landscape and visual impact and the location modified until meeting the design strategy principles set out in Chapter 4: Site Design and Design Evolution and Chapter 6: Landscape and Visual as judged from a selection of key viewpoints

5.3.9 Once the layout was confirmed as being acceptable with respect to on-site interests (including ecology, hydrology, forestry, archaeology, aviation and existing land use/holdings), the layout was fixed, and the detailed assessment was continued and completed.

5.3.10 The total land take of the Proposed Development, after completion of reinstatement measures including: foundations, crane pads (see 5.15 of proposed reinstatement measures), upgraded site tracks and new sections of access track, are in total approximately 24.55 km. Indicative drawings for current available infrastructure technologies that suit site conditions are presented in Figure 5.1 – 5.8. Drawings include:

- indicative turbine general arrangement (Figure 5.1),
- indicative wind turbine foundation general arrangement (Figure 5.2),
- indicative wind turbine hardstanding general arrangement (Figure 5.3),
- indicative access track general arrangement (Figure 5.4a and 5.4b),
- indicative underground cabling general arrangement (Figure 5.5),
- indicative directional signage general arrangement (Figure 5.6),
- indicative construction compound general arrangement (Figure 5.7); and
- indicative batching plant compound general arrangement (Figure 5.8).

5.4 PUBLIC ROAD ACCESS

5.4.1 Chapter 12: Traffic and Transport Assessment details the public road network route proposed for the transportation of turbine components. The turbine delivery route would join the A713 and travel to site in a northerly direction. The proposed route for the major component deliveries is as follows:

- Loads would exit the King George V docks, Glasgow and join Kings Inch Drive northbound;
- Loads would continue on Kings Inch Drive before turning left onto the M8 slip road;
- Loads would merge onto the M8 at Junction 25A and continue east before departing and performing a
- U-turn back onto the M8 westbound at the Seaward Street Interchange;
- Loads would diverge from the M8 onto the M77 and continue on the M77 / A77 southbound;
- Loads would exit the A77 at Bankfield Roundabout at join the A713 southbound; and
- Loads would continue on the A713 before turning left into the site access junction north of Brochloch.

5.4.2 The condition of the public road along the access route and other roads would be surveyed and recorded prior to wind farm construction. Where required repair and maintenance work will be carried out on these roads during and following the construction period to rectify any identifiable damage which is directly attributable to the Proposed Development.

5.4.3 The impact of the Proposed Development construction and operation traffic on the public road system is assessed in Chapter 12: Traffic and Transport, Appendix 12.1: Abnormal Indivisible Load Route Survey and Appendix 12.2 Preliminary Construction Traffic Management Plan.

5.5 DECOMMISSIONING AND RESTORATION OF EXISTING WINDY STANDARD I WIND FARM

5.5.1 Prior to the construction of the Proposed Development commencing, work will be undertaken for the decommissioning and restoration of the existing Windy Standard I wind farm. The planning consent under which Windy Standard I is currently operated is issued by Dumfries and Galloway Council under Reference 18/1142/FUL. The consent provides for operation of the wind farm until 31 December 2027. Condition 1 provides for the wind farm to be decommissioned and the site restored when it has come to the end of its operational life under the existing consent. A detailed decommissioning plan will be prepared and agreed with Dumfries and Galloway Council as Planning Authority in accordance with Condition 1. The decommissioning and restoration of the existing Windy Standard I wind farm will be undertaken in accordance with the approved decommissioning plan in advance of the construction phase of the Proposed Development.

5.5.2 The decommissioning and restoration works for the existing Windy Standard I Wind Farm are anticipated to last 13 months. Current industry best practice will be employed during the decommissioning and restoration of the existing wind farm, with the key activities including:

- Dismantling and removal of all of the wind turbine generators (WTGs), met mast and any supporting above ground electrical equipment;
- Demolition and removal of all the WTG foundations to a level of 1 m below ground level;
- Restoration of all WTG crane hardstandings;
- Reinstatement, reseeding and aftercare of disturbed ground as a consequence of the above activities.

5.5.3 The existing access tracks will remain in-situ and form the basis for the access tracks for the Proposed Development. Likewise, the existing cables will be de-energised and left in-situ.

5.5.4 The decommissioning activities would seek to maximise the reuse and recycling of component materials from the removed infrastructure and ensure contaminated material (e.g. lubricating/cooling oils etc.) will be properly handled and removed from the development in accordance with the relevant current legislation and best practice.

5.5.5 Reinstatement of vegetation will be focused on natural regeneration vegetated turves or soils stripped and stored with their relevant seed bank. To encourage stabilisation and early establishment of vegetation cover, where available, topsoil and vegetation turves in-keeping with the surrounding vegetation type will be used to provide a dressing for the final surface. Reinstatement will be undertaken under the direction of the site Ecologist and will aim to create an even distribution of turves to promote seed dispersal. The Ecologist will determine the most suitable method to ensure turves are appropriately distributed and act as seed inoculums.

5.6 CONSTRUCTION PHASE

Construction Timetable

5.6.1 The construction period for the Proposed Development is envisaged to last for 22 months, from commencement of construction through to installation and commissioning of the turbines. Site reinstatement (as shown on the construction programme (see Table 5.2)) is ongoing to ensure reinstatement of any removed peat or habitat occurs as soon as possible and to minimise the duration of construction related cut and fill impacts on setting and views. Note grid connection is not included (see Section 5.11.3 for more information). Construction would consist of the following phases which, although presented in a typical sequence, may overlap or occur concurrently:

- Public highway improvements;
- Construction of a site storage compounds for off-loading materials and components, and to accommodate site offices and mess facilities. Depending on where the site storage compound is, normally some tracks would be required;

- Upgrades and construction of site tracks and excavation of cable trenches;
- Construction of turbine foundations and crane pads;
- Delivery and erection of turbine towers, and installation of nacelles and blades;
- Laying of on-site cabling;
- Installation of turbine transformers;
- Works to the on-site substation and control building;
- Testing and commissioning of the turbines and the wind farm electrical system; and
- Site reinstatement (on-going during works).

5.6.2 A typical 22-month construction programme is presented in Table 5.2.

Table 2: Construction timeline for a typical wind farm with eight turbines

Activity	Month																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Mobilisation to site		X																					
Forestry		X	X																				
Offsite AIL Enabling Works																							
Access / site tracks			X	X	X	X	X	X	X	X					X	X							
Crane Hard-Standing				X	X	X	X	X	X	X	X				X	X							
Misc Hardstands			X	X	X																		
Geogrids & Culverts			X	X	X	X																	
Turbine foundations							X	X	X	X													
Substation						X	X	X	X														
Cabling							X	X	X	X	X												
Turbine Abnormal Loads																	X	X	X	X			
Turbine Assembly, Commissioning and Testing																X	X	X	X	X	X		
Demob / Site clearance																						X	X

Source: Natural Power, 2022

** Restoration work around track edges, turbine bases and other areas of infrastructure will be on-going to ensure reinstatement of any peat substrate occurs as soon as possible.*

Typical Equipment Used at Site

5.6.3 The following is an indicative list of equipment that would be required to construct the Proposed Development. The equipment would be in use on the site or stored on site within the construction compound. Where appropriate, vehicles such as cranes, trucks, excavators and bulldozers may be secured and left on the track at appropriate working areas overnight.

- One 800/1000 tonne capacity crane and three 400/500 (or less) tonne capacity cranes. The 400/500 tonne cranes would be used for general construction duties such as the preparation of the reinforcement cages at the turbine bases and as tailing cranes for steerage during the turbine erection. The larger crane would be used for the turbine erection to lift the heavy components into place;
- Two 30/40 tonne 360-degree excavators. These would be used at borrow pits for excavating stone and for excavation of turbine foundations. Ripper buckets or hydraulic breakers may be used for the excavators winning stone from the borrow pits;
- Three smaller excavators in the range of 10 to 20 tonnes. These would be used for road construction and profiling, and restoration of verges, turbine foundations and for excavation of cable trenches;
- One tracked bulldozer. This would be used for a number of tasks such as stockpiling material from turbine excavations, management of stockpiles within the borrow pits, road construction, crane pad preparation and re-grading of the track running surface;
- Approximately four dump trucks. These would be used for moving material around the site, e.g. for moving excavated peat or soils from cut site tracks to any stretches of floating track over deeper peat, and stone from the borrow pits for track construction;
- One or two heavy duty vibrating rollers. The rollers are used to compact new roads, turbine foundation formations and are essential in compacting the crane pads and turbine backfill to the appropriate densities.
- One mobile concrete pump. The concrete pump would be used on-site during the concrete works for the turbine foundations. The pump would be lorry mounted and have a large boom to enable placement of the concrete within the turbine base excavations. The concrete wagons would reverse up to the rear of the pump and deliver the concrete into a hopper which would be connected to the pump. Using the pump allows a controlled and highly flexible method of pouring foundations;
- Two cable laying vehicles. This would comprise a lorry or tractor with a revolving drum attachment for laying of cables in trenches alongside site tracks and a tracked excavator with drum attachment for the offsite cabling on stretches where it is not routed alongside a new or existing track;
- Two small trucks or four-wheel drive vehicles with trailers. This would be used for the transporting of small loads around the site i.e. ducting pipes for cables in turbine foundations;
- Two minibuses and six four-wheel drive vehicles. These would be used for transporting construction workers and site managers around the site. These would be likely to leave the site on a regular basis transporting workers to and from their billets off-site;
- A number of other vehicles would bring loads to the site but would not themselves be stored at the site. These would include lorries with flatbed extendable trailers carrying all turbine components including transformers, lorries carrying cabling, steel rods for concrete reinforcement and concrete lorries with revolving drums;
- To prevent mud entering the public road system, if necessary, the wheels of all lorries leaving the site would be washed either using a manual spray or a wheel washing drive through unit;
- Cabins/Welfare Facilities. Due to the requirement under Health & Safety Legislation and the Construction Design Management (CDM) Regulations for welfare facilities on site and the exposed nature of the site, a number of cabins would be needed in the construction compound(s). These would have offices, canteens, drying-rooms, toilets and washing facilities. The units would be self-contained, and no discharge of drainage

would be made to the surrounding land unless otherwise agreed with SEPA and the local authority. Smaller, mobile self-contained units are likely to be required as work progresses throughout the site. These would be placed at suitable locations to tie in with the work interfaces as required. A typical layout of the construction compound area is presented in Figure 5.7 (Volume 3);

- Fuel & Chemical Storage. Fuel would be required for the vehicles, generators and other equipment on site. The storage facilities would typically comprise of a bunded concrete pit containing a lockable, bunded fuel tank and a separate lockable housing for the storage of construction chemicals. In addition, there would typically be a wheeled, double skinned bowser for transport of fuel to tracked vehicles. Drip trays would be used when refuelling vehicles on the site. Emergency spill kits would be kept on site adjacent to the fuel storage area and with the mobile bowser. A Principal Contractor would have a 24-hour emergency response company on standby in the event of a spillage incident. Vehicles would be refuelled at their working location to prevent loss of time and use of fuel returning to any designated refuelling areas. All previous stated measures would be used when refuelling vehicles, taking into account all guidance and pollution prevention measures, and the bowser operator would be suitably trained to deal with any spillage; and
- Construction Materials. A variety of materials would be utilised during the construction of the Proposed Development including, but not limited to; concrete, reinforcing steel, timber for joinery work and shuttering, stone and sand for road construction, general construction sundries and electricity cables. Wherever possible, the re-use of materials would be carried out, i.e. formwork to be re-used, excavated material from foundations to be reused in the preparation of crane pads and roads, topsoil for re-instatement and landscaping, etc. An indication of the materials used and the amount of resources (plant and labour) is generally included in the preparation of the CMS. Handling of potentially hazardous materials would be carried out in accordance with SEPA Pollution Prevention Guidelines, but particularly; Pollution Prevention Guidelines 6; Working at Construction and Demolition Sites: PPG6 concerning the delivery, handling and storage of materials. For example, the preparation of contingency plans and briefing operatives on the procedure to follow if a spillage occurs would be covered by the appointed civil engineering contractor, displayed on site and contained within the CMS document prior to construction commencing.

Construction Method Statement (CMS)

5.6.4 Prior to the commencement of construction, a CMS incorporating a CEMP would be produced setting out in detail the individual items of works associated with the construction of the Proposed Development (see Chapter 10: Hydrology, Geology & Hydrogeology for detail on the CMS). It would be prepared in accordance with the detail provided in this EIAR . This would ensure that each activity is carried out safely, in accordance with best practice and the relevant guidelines, and to minimise environmental impact, in accordance with SEPA's pollution prevention guidance. Typically, the document would cover the following topics:

- Site Health and Safety Plan;
- Risk Assessments and Method Statements (RAMS) to include for environmental considerations e.g. sympathetic construction methodology with regard to weather and ground conditions;
- Location and Description of Project;
- Consent and Regulation Approvals e.g. discharge of planning conditions;
- Pre-construction Survey Work Undertaken;
- Turbine Description/Specification;
- Construction Schedule;
- Public Highway Works;
- Site Tracks;
- Temporary Construction Compound;
- Crane Pads;
- Cable Trenches;
- Foundation Works;
- On-site Substation and Control Building;
- Borrow Pits;
- Monitoring and pre-commencement surveys- Ecological, Hydrological and Geotechnical, and Archaeological;
- Forestry Waste Management Plan;
- Emergency Procedures; and
- Pollution Control and Waste Management – potential waste material, materials that can be reused onsite or elsewhere and mitigation measures.

5.6.5 A site Waste Management Plan will be drawn up as part of the CMS prior to the commencement of construction. See section 5.6.15 for detail on waste management.

5.6.6 Previous experience of agreeing the construction methodology during the post-consent/pre-construction stage has proved effective in securing accurate and realistic method statements. At that stage in the project, additional data is available for consultation in the form of detailed site investigations. Furthermore, the civil engineering and the turbine supply contractors would have been chosen by this stage, enabling more detailed preparation of individual method statements. During the preparation of the CMS, correspondence and meetings with NatureScot, SEPA, local planning authority (LPA) and other relevant consultees would be undertaken to review the working methods proposed and if necessary, incorporate changes. This iterative process of preparing the CMS ensures that when construction commences there is a documented procedure and risk assessment. This makes monitoring of the construction activities, either by the appointed site representative or by the various bodies associated with the preparation of the document, more straightforward.

5.6.7 Each section of the CMS will provide a detailed description of the tasks to be completed along with risk assessments, where necessary, covering items such as waste management, pollution prevention, control of waters, nuisance and material use.

5.6.8 A section of the CMS regarding the handling and storage of peat would be prepared in accordance with recommendations from a suitably qualified geotechnical designer, ecologist and hydrologist following a detailed site investigation. Additional detailed ground investigation would be conducted prior to construction. In respect of matters regarding construction methodology and peat stability at the site, the following general recommendations would be adhered to and would form part of the overall CMS documentation:

- Environmental awareness training to be provided to all staff entering on to site which will include a basic environmental site induction;
- Avoid placing excavated material and local concentrated loads on peat slopes;
- Avoid uncontrolled concentrated water discharge onto peat slopes identified as being unsuitable for such discharge;
- Avoid unstable excavations. All excavations would be suitably supported to prevent collapse and development of tension cracks;
- Avoid placing fill and excavations in the vicinity of steeper slopes;
- During construction install and regularly monitor geotechnical instrumentation as appropriate, in areas of possible poor ground such as deeper peat deposits;
- Implement site reporting procedures to ensure that working practices are suitable for the encountered ground conditions. Ground conditions are to be assessed by a suitably experienced geotechnical engineer;

- Form a contingency plan to detail the level of response to observed poor ground conditions;
- Routine inspections of the wind farm site by maintenance personnel including an assessment of ground stability conditions; and
- Carry out an annual inspection of the site following completion of works by suitably experienced and qualified geotechnical personnel;

5.6.9 The Proposed Development site layout has been designed to maximise the use of the existing development infrastructure and reduce the impacts on the limited peat habitat areas. Very little peat has been recorded on site, and what peat there is on site is localised to turbines 1 and 2 (0.2 m deep). See Figure 10.4 for an interpolated peat map of the site. All procedures will follow best practice guidelines and the requirements of the CMS.

5.6.10 Other sections relating to site-specific items, including landslide hazard and geotechnical risk register identified during the pre-construction phase, could also form part of the CMS. It is intended that the CMS will be an evolving document and staged completion would be undertaken in line with the progression of construction. Updating of the document to reflect changes in the methods to be used would also be carried out, as and when necessary.

Wind Farm Construction

5.6.11 Construction of the Proposed Development would begin within a defined period following consent granted by the Scottish Government. The Applicant seeks a minimum 5-year period to allow time for the discharge of conditions, procurement of the turbine equipment and associated infrastructure delivery, before commencement of development.

Table 3: Construction elements

Construction Elements
Site investigation
Mobilisation of civil and electrical contractor
Tree Felling
Construction and upgrades to access and site tracks
On-site temporary construction compound and site storage compound
Track reinstatement
Excavation and construction of turbine foundations
On-site cabling
Upgrades to the substations control buildings and compounds
Preparation of crane pads
Installation of turbine transformers
Mobilisation of turbine supply contractor
Turbine delivery
Turbine erection
Reinstatement around turbines
Turbine fit-out
Connection to substation and grid connection
Commissioning of wind farm
Reliability testing
Demobilisation

5.6.12 Table 5.3 represents a simplistic process of the different construction elements given in chronological order. It should be noted that there will be a degree of overlap between individual elements. It should also be noted that these elements relate to permanent infrastructure. Some temporary works are required during the construction phase which are not included in this description due to their minor nature and duration, such as temporary hardstand areas for crane components, pads for supporting the rotors during construction in addition to the permanent crane pads and drainage measures in turbine excavations. **NOTE:** Pre-construction Geotechnical Investigation would require felling pre-commencement. This requirement is included in total felling allowance specified in EIAR Chapter 11: Forestry Assessment.

5.7 SPECIFICATION OF TURBINES

Description

5.7.1 The selected turbines would be of a modern design (see Figure 5.1) with three blades mounted on a horizontal axis, attached to a nacelle, housing the generator, gearbox and other operating equipment. The nacelles would be mounted on a tubular tower which allows access to the nacelle. It is expected that the turbine cut in wind speed will be around 3 m/s and will rotate clockwise.

5.7.1 It is anticipated that the Civil Aviation Authority (CAA) will require visible obstruction lighting on the turbines as they are higher than 150 m to blade tip. The Applicant is submitting a reduced lighting scheme where five of the turbines in the Proposed Development (T1, T3, T4, T5 and T7) will be fitted with visible aviation lighting in accordance with the Air Navigation Order (ANO) and CAA requirements. There is therefore potential for the Proposed Development to be visible at night (see Chapter 6: LVIA and Figure 6-9c for further details). A worst-case scenario has been assessed for the purpose of this EIAR, the scheme is to be as follows:

- turbines T1, T3, T4, T5 and T7 will have red, medium intensity visible lights mounted on the nacelle;
- 2,000 cd and 200 cd intensity lights have been assessed representing two worst-case situations: 2,000 cd represents the maximum intensity possible; 200 cd represents the maximum intensity that would be used when visibility exceeds 5 km; and
- the steady red medium intensity lighting fixed to the top of the nacelles may appear to flicker on and off with blade rotation when the turbine blades pass between the lights and the observer, dependent on wind direction and the position of the observer.

5.7.2 Wind turbine towers will likely be constructed from steel and the blades from fibreglass. It is proposed that the turbine tower, nacelle and blades be finished in a semi-matte, off-white/pale grey colour. Typical turbine specifications, of the type being considered for use on the site, are presented in Figure 5.1 (Volume 3). In order to comply with Health and Safety requirements for the site the Applicant would propose to apply identification numbers to the sides of the turbines. Numbers would be up to 1000 mm tall by 900 mm wide and would be positioned between 1.5 m and 3 m from ground level so to be visible from the approaching access track. Details of these would be agreed as part of the CMS.

5.7.3 External transformer housings will be situated adjacent to each of the turbine towers. The requirement for such structures, along with their dimensions, will vary based on the final turbine choice (some turbine types require two stacked transformer housings).

Erection of Turbines

5.7.4 Two types of cranes are required for the erection of the turbines; 800/1000-tonne capacity cranes and 400/500-tonne capacity tailing cranes. The cranes would use a typical crane hardstand as shown in Figure 5.3, although the final detail may vary depending on the exact make and model of turbine chosen.

5.7.5 Where possible, the delivery of the turbine components would be scheduled, weather dependent, to allow for direct lift off the transport trailers. Otherwise, turbine components would be stored on, or adjacent to, the crane pad

areas. Alternatively, components may be delivered to the construction compound for internal distribution by a separate tractor unit. The tower sections would be erected, followed by the nacelle and hub. Following erection of the tower sections and the nacelle, the blades would either, be lifted and attached individually to the hub in position, or the hub and blades would be raised together, as a unit, and attached to the nacelle. The cranes would then move to the next turbine location.

Operation

5.7.6 Once installed and fully commissioned, the wind turbines would operate automatically and can be controlled remotely or from the on-site metering building. Regular visits will be made by technicians to the infrastructure and turbines in four-wheel drive vehicles or similar. In addition, longer servicing visits would be required, typically every six months, along with unscheduled maintenance, as may be necessary. Occasional use of larger vehicles, such as cranes or lorries similar to those used during construction, may be necessary should there be a requirement for replacement of major turbine components.

5.7.7 Wind farm performance would be remotely monitored using the existing permanent anemometer masts, together with a Supervisory Control and Data Acquisition system (SCADA) that would monitor the individual turbines and the grid connection.

Environmental Considerations

5.7.8 All turbine transformers would be sited on bunded foundations that are able to contain 110 % of the oil contained within it. Any leaks from equipment within the nacelle would be contained within the turbine.

5.7.9 Infrastructure for the Proposed Development will have a very limited yet direct impact on some sensitive habitats, mainly, unimproved acid grassland, marshy grassland and wet modified bog resulting in some habitat loss. However, a HMP (as part of a unified land use plan) will be implemented to reduce any impacts from construction and to restore and enhance habitats during the operational phase of the project. This is provided within Chapter 9: Ecology.

5.8 TURBINE FOUNDATIONS

Construction

5.8.1 Reinforced concrete gravity foundations are envisaged for use for the proposed turbines. This foundation type is typically an inverted T shape consisting of a large pad with a protruding upstand with approximately 100 mm proud of the finished ground level. The pad is back filled with selected as-excavated material or stone material placed and compacted over the foundation. The base tower section of the turbine is subsequently connected to the foundation by using holding down bolts that are cast into the upstand section of the foundation. Stability of the turbine is provided through the weight of the foundation and the material replaced and compacted over it.

5.8.2 A typical turbine foundation specification is presented in Figure 5.2 (Volume 3). Detailed design specifications for each foundation would depend on the site-specific factors such as ground conditions, the specific turbine used and various other engineering considerations. Typically, a circular concrete base of approximately 29 m diameter usually suffices for turbines with the dimensions identified in Figures 5.1 (Volume 3). Combined with the protruding upstand, the overall depth of the foundation would be around 3 m - 3.5 m.

5.8.3 As part of the development of the foundation during the details design, rock anchor reinforced concrete foundations may be considered as a viable solution for some or all the proposed turbines. This is due to the existing wind farm utilising rock anchor foundations at some locations. This foundation type is a complex but efficient way to reduce concrete volume, steel tonnage and construction time. For the turbine size proposed, it is expected the structure dimensions would consist of a 10 m diameter base and 3 m of overall depth. The foundation type solution would be explored and developed further during the detail design phase once the ground investigation is completed, and the turbine model selected.

5.8.4 Following construction of the foundations, granular fill material will be placed over the foundation as ballast for stability. The top surface would be reinstated by dressing the area with a layer of topsoil material or peat, that was excavated from the turbine foundation area.

Environmental Considerations

5.8.5 Depending on the location specific conditions, the detailed design of the foundation may have different environmental considerations. If there is a high-water table at the foundation location, a drainage system may be installed around the foundation to prevent the build-up of water pressure under the foundation. Alternatively, in locations that were particularly sensitive to hydrological disturbance, a submerged foundation design could be employed which would not require a drainage system around the foundation.

5.8.6 Cement entering a watercourse can have a detrimental effect by drawing oxygen from the water and increasing its alkalinity. The batching plant will be situated away from watercourses, either within a borrow pit or at another secure location which would be agreed in advance with SEPA. Particular care would be taken when pouring concrete at turbine foundations in the vicinity of watercourses and in areas of deeper peat. SEPA's Pollution Prevention Guidelines 5: Works In, Near or Liable to Affect Watercourses as well as Pollution Prevention Guidelines 6: Working at Construction and Demolition Sites would be adhered to and SEPA will also be consulted during the preparation of the CMS to ensure that the appropriate measures are put in place. This may include construction of a settlement pit within the construction compound or elsewhere for treating rinse water from concrete lorries, and measures to prevent water from entering excavations in the vicinity of watercourses.

5.9 PERMANENT CRANE HARDSTANDS

Description

5.9.1 Permanent crane hardstands (pads) as well as temporary lay down areas will be constructed to facilitate the cranes required for the erection of turbine components. To provide stable, firm ground for safe operation of the cranes, areas of hardstand would be laid down on one side of each turbine foundation. These would need to be suitable for the outriggers of the respective cranes, leading to an area for simultaneous use of both cranes (as illustrated in Figure 5.3). Their locations will be finalised following further site investigation, but will maximise use of the access tracks, where possible, to minimise the carbon footprint of the Proposed Development.

Construction

5.9.2 Typically, construction of the hardstand areas would be similar to construction of the site tracks (on shallow soils) with 100-150 mm of topsoil removed and stored adjacent to the sites and remaining soil removed down to a suitable bearing stratum. If necessary reduced as part of the detailed design. The crushed stone would be sourced from the borrow pit location identified indicatively in Figure 1.2.

5.9.3 Additional temporary hardstands may be required at various stages during turbine construction and erection. This may include temporary hardstand to facilitate the erection of crane components, lattice boom or turbine components e.g. rotor assembly.

Environmental Considerations

5.9.4 Prior to excavation for the crane pad, the vegetation layer would be carefully removed.

5.9.5 The crane pad will be excavated to form a level, solid platform with suitable graded stone excavated from borrow pits and turbine foundation excavations. On completion of erection and installation works, it is proposed that the

areas of hardstand will remain as it may be required during the operational phase of the wind farm. It is envisaged that the surrounding grassland vegetation will re-colonise the area.

5.10 SITE TRACKS AND BORROW PITS

Description

5.10.1 The main existing access track onto site leaves the A713 and travels north-east towards site. The access route for turbine and other abnormal load delivery is assessed and discussed in Chapter 12: Traffic and Transport. The proposed route can be viewed in Figure 1.2: Site Location. The detailed assessment for component delivery minimises uncertainties or potential problems with delivery of abnormal loads using public roads. Figure 1.3: Proposed Site Layout shows the proposed turbine layout and the proposed new access track. The tracks allow for access around the site for general construction activities such as foundation works, implementing drainage measures, plant to dig new cable trenches and delivering turbine components. Thereafter, the access tracks would be utilised to access the site for operational and eventual decommissioning purposes.

5.10.2 It is expected that the majority of new stone for upgraded and new tracks will be won from borrow pits identified on site, either from previously used existing borrow pits or new locations. From initial site assessments, the potential borrow pits (existing and indicative) are shown on Figure 1.3, however final location(s) would be agreed as part of the CMS for the scheme and subject to detailed ground investigations to confirm suitability of material. Should further stone be required, any further borrow pit locations will be subject to the successful outcome of a relevant Mineral Extraction Licence application which would be made to the relevant authority. The final reinstatement of these borrow pits would be agreed with the local authority in consultation with NatureScot prior to reinstatement works commencing.

5.10.3 A total of approximately 27.8 km of access tracks will be utilised to access the wind farm, made up of a combination of existing, upgraded and new access tracks. Approximately 7.1 km of onsite access tracks is anticipated across the Proposed Development site. The proposed layout uses the alignment of the existing wind farm tracks however these existing tracks will be upgraded significantly to accommodate the new wind turbine components. This will result in effectively 4.9 km of newly constructed and 2.2 km of upgraded on-site tracks. These onsite access tracks would link the proposed turbines and supporting infrastructure.

Construction and Design

5.10.4 To provide access to the wind farm for the construction vehicles and turbine components, 14.2 km of existing access track would be used from the junction with the public road network would link to the onsite access tracks. This existing access would require minor upgrades including surface repairs and potential minor adjustments to localised areas to allow for the turbine component deliveries. In addition, 6.5 km of existing access tracks will be used to access the proposed development and the grid connection points at the existing substations. Again, these tracks will require minor upgrades to the running surface.

5.10.5 The design philosophy behind the track layout has taken into account a number of factors including, existing infrastructure, topography, hydrology, watercourse crossing, ground conditions and construction parameters and has been based on best practice methodology developed at other wind farm sites. The proposed track layout has been designed following an onsite review to maximise the use of the existing access tracks. Details of typical access track makeups can be found in Figures 5.4a and 5.4b and access routes existing and upgraded can be found in Figure 1.3.

Environmental Considerations

5.10.6 The initial stripping of topsoil for the new tracks and placement of stone material for construction of new tracks has the biggest potential to release sediment into watercourses. Therefore, using methods consistent with industry best practice will be put in place ahead of the track construction activities. Sediment will be transported the furthest by existing surface water channels and manmade drainage systems, therefore proactive mitigation measures would require these to be identified prior to the track construction. Within the channels and drains and any necessary settlement ponds, silt traps would be constructed prior to track construction. The silt traps would likely be constructed using straw/hay bales or specialized siltation fencing, pinned into place, allowing water to either percolate through the bale or flow over. Where machinery is required for any of these up-front activities, they will have low pressure bearing tracks. Sediment transport mitigation drainage systems will be subject to regular maintenance during the lifetime of the proposed wind farm. Chapter 10 provides an assessment of the potential effects on hydrology.

5.10.7 For construction of new sections of track, alternative methods will be utilised for different areas of the site, depending on site specific conditions. For each method, the track running width (excluding drainage channels and cable trenches) will be approximately 6 m wide, with the exact width depending on the local ground conditions. Track widths may be wider for short sections such as lengths with passing places and at sharp bends and track junctions. Where sections of new track or widened sections of upgraded tracks are constructed, they will generally be of excavated/cut construction type where overlying soil or peat material would be removed with a foundation formed on the underlying glacial till or the weathered rock horizon, as shown in Figures 5.4a and 5.4b (Volume 3 of the EIAR).

5.10.8 Tracks would be designed with a crossfall, towards the drainage ditches, to prevent build-up of water on the running surface. It is important that the water flowing along the drainage ditch is not able to build up enough volume and velocity to act as a major sediment transport route. To prevent this happening, cross drainage pipes would be placed under the road at regular intervals. This also helps minimise the effect the road construction will have on the hydrology in the adjacent area and prevent concentration of water flow higher in the catchments' area than would necessarily occur. The drainage ditch will also be blocked just above the cross-drainage inlet, thus preventing water from simply flowing past the inlet. Using stone available onsite, a head wall will be constructed to prevent erosion around the inlet. A silt trap will also be constructed at the inlet to the cross drainage, to minimise sediment entering the pipes. The outlet of the cross drainage would allow the water to filter through the adjacent vegetation.

5.10.9 For safety reasons, marker posts may be placed in the ground by the edge of the track in order to guide on-site vehicles during times of poor visibility or at night.

5.10.10 Tracks between turbines are required during the operational period of the proposed wind farm to allow for routine maintenance operations and the replacement of larger turbine/electrical components.

5.11 ON-SITE CABLING, SUBSTATION AND CONTROL BUILDING

Description

5.11.1 The wind turbines envisaged for use on the Proposed Development will generate electricity which will be converted via a transformer located within the turbine or immediately adjacent to the tower of each turbine. An example of a typical external transformer housing is provided in in Figure 5.1 (Volume 3 of the EIAR). Any external transformer would be linked to the turbines through cable ducts in the turbine foundations. Underground cable routes between turbines and the substation compound would generally follow track routes. These would be placed up to 2 m from the track verge and drainage ditches.

5.11.2 The wind turbines will connect into the existing distribution and transmission substations existing in the wider wind farm area. These existing buildings and compounds accommodate metering equipment, switchgear, transformers, the central computer system and electrical control panels. Additional metering and switchgear equipment will be required to connect the Proposed Development, but no significant works are required at either building to accommodate the proposed development

Grid Connection

5.11.3 Cables routed from the proposed turbines would be brought together via underground cables to the on-site substation. The electricity will there be connected to the grid. The grid connection corridor is likely to take the form of single circuit pole arrangement and routed offsite, which will be confirmed post-consent and form a separate application.

Construction

5.11.4 The wind turbines would be linked to the on-site electrical substation and metering/control building via underground cables placed in trenches. The route within the site would generally run adjacent to the route of on-site tracks where possible. The route would be marked above ground with clearly identified posts, spaced at suitable intervals along the length. This would be agreed as part of the CMS.

5.11.5 Cables would be laid from a drum attached to a suitable vehicle. Each cable would arrive as three insulated cores. These would be gathered in the trench and bound together along the entire length of the trench in a trefoil arrangement. Communication cables and earth tapes would also be laid in the same trench. The cables would be protected from mechanical damage by a sand bed and surround. Two layers of marker tape and/or tiles would be buried above the cables to prevent accidental excavation, and concrete marker posts would be placed at regular intervals to enable the cables to be located in the future. Typical underground cabling details can be found in Figure 5.5

5.11.6 Silt, scour and run-off could pose a problem as the cable trench can act as a preferential drainage channel. Backfilling of the trench should be carried out as soon as is practicable and the road drainage installed should be set up with suitable silt traps as the construction proceeds.

Environmental Considerations

5.11.7 Where cabling is required, pre-commencement surveys will be undertaken to give a contemporary assessment of any ecological and other environmental sensitivities and will inform the CMS. Pre-construction surveys, as per the rest of the development, will be carried out by the on-site ECoW to ensure construction will not have an unacceptable impact on any species of concern. Cabling will be carried out in a staged process, with vegetation and topsoil temporarily removed to be back filled as soon as the cables are laid. This method ensures vegetation is replaced as soon as possible and any disturbance during the works is kept to an absolute minimum and is temporary in nature.

5.11.8 Following the pre-commencement and pre-construction surveys (and due to the staged nature of the cabling process) the impact on habitats, the wider environment and any species of concern will be reduced to a minimum and will be a short-lived disturbance where it exists.

5.11.9 In areas where the surrounding soils are very coarse gravel or peat, the cable trench footprint shall have a geo-textile wrap placed within it to prohibit fines migrating from the backfill into the surrounding sub-soils. These areas shall be identified on site during the commencement of the works. Where surplus mineral soil material is present, this shall be transported back to the borrow pit for use in the reinstatement and final profiling.

5.11.10 On-site cable trenches would be located to minimise the area of disturbance, typically up to 5 m beyond the edge of the site track in case of multiple circuits. Trench excavation, cable laying and backfill would be carried out in a continuous operation (minimising the length of trench open at any one time) and may occur subsequent to the construction of on-site tracks or after the erection of turbines. Prior to excavation, the topsoil/turfs would be stripped and placed to the side in a temporary stockpile. Alternatively, cable ploughing may be adopted if ground conditions permit. The final choice of method will depend on the appointed contractor and the results of further site investigation.

5.11.11 Indicative details of the cable/service trenches are shown in Figure 5.5 (Volume 3). Cables would be laid in sand for protection with warning tapes/boards placed above to mitigate the risk of unintentional excavation. Impermeable barriers (plugs) would be placed in the sand layer at regular intervals to prevent the trench acting as a water conduit with more frequent spacing between plugs on steeper gradients.

5.11.12 In all cases, the cables would be buried to a minimum depth of approximately 1 m. Reinstatement would be carried out to relay the previously stripped top layer of peat turfs containing the seed bank, over the top of the cable trench. This reinstatement would be conducted following the backfilling of each cable trench section. At track crossings and within concrete foundations, the cables would be laid within plastic ducts. The final cable positions would be surveyed and supplied in 'as built' drawings for the Operations and Maintenance team.

5.11.13 Existing watercourses will be monitored during the works, both to prevent water entering the excavation, and also for runoff and silt escaping and entering these. These may need temporary diversions/piping until the track is complete and the watercourses can be reinstated.

5.11.14 On decommissioning of the Proposed Development, on-site cabling will be left in-situ, unless ducted. Most modern cables are aluminium and are relatively benign and inert; over time these will break down to clay. These can be electrically isolated and left in-situ, as is common practice.

5.12 TEMPORARY CONSTRUCTION COMPOUND AND FACILITIES

Description

5.12.1 During the construction phase of the Proposed Development, temporary compound and laydown areas will be required. The construction compounds and laydown areas have been positioned to utilise previously disturbed areas where possible to minimise their impact on the local environment. They will be built by carefully removing topsoil or peat turfs down to a firm substrate, laying down geotextile material (if required) and then constructing a working surface of stone extracted from the borrow pits. Any topsoil/peat would be stored adjacent to the site for reinstatement or used elsewhere on the site. The compounds will be reinstated with topsoil such that they can be re-used if needed during the operation phase for major maintenance or emergency works.

Construction Compounds

5.12.2 The dimensions of the construction compound will typically be approximately 100 m x 50 m and surrounded by a security fence. Due to the requirement under health and safety legislation, the CDM Regulations for welfare facilities on site, and the exposed nature of the site, a number of cabins would be needed in the construction compound. These would have offices, canteens, drying-rooms, toilets and washing facilities. An additional hardstand area will be provided for along the Polwhat Rig. This will allow workers to have office space and welfare facilities closer to the construction activities as well as providing storage and laydown areas. Smaller mobile, self-contained units are likely to be required as work progresses throughout the site. These would be placed at suitable locations to tie in with the work interfaces as required. A typical layout of the compound area is presented in Figure 5.7 (Volume 3) and the proposed location of the main construction compound and additional compound are shown on Figure 1.2. The compounds would be used, where necessary, for temporary storage of the various components and materials which are required for construction.

5.12.3 A settling pit/concrete washout bay and wheel wash will be included near the construction compound. When concrete lorries have deposited their loads, there is a requirement to wash out the inside of the concrete drum. This requires a few gallons of water that would then be washed out from the drum into a settlement pit. The size of this pit would depend upon the flow of concrete lorries up to the site (or within the site if an on-site batching plant is employed) but would be lined with an impermeable sheet and granular fill to assist in the settling process. The construction compound will be reinstated at the end of the wind farm construction period. The stored subsoil and the stored topsoil would be laid over the geomembrane separating it from the underlying stone surface and then reseeded using a seed mix selected or, where possible, turfs would be reinstated.

5.12.4 The settlement pit would be located away from watercourses with details included as part of the CMS following consultation with SEPA. Any drainage from these facilities would be collected and treated prior to discharge via the Sustainable Drainage System (SuDS). The washout bay would be maintained as necessary by replacing the granular fill with clean stone. At close of construction, all material within the washout bay would be removed from site and the area reinstated.

Concrete Batch Plant

5.12.5 A concrete batch plant allows for concrete to be mixed in-situ for use throughout the site and relieves pressure on the road network by avoiding additional transportation of materials onto the site during construction. This is proposed to be located on an existing hardstand area that has been used on previous construction projects. The proposed location is shown on Figure 5.8.

Environmental Considerations

5.12.6 Fuel would be required for the vehicles, generators and other equipment on site. The storage facilities would typically be comprised of a bunded concrete area containing a lockable, bunded fuel tank and a lockable housing for the storage of construction chemicals. In addition, there would typically be a wheeled, double-skinned bowser for transport of fuel to tracked vehicles. All construction equipment would be inspected on a daily basis to check for spillages. Drip trays would be used when refuelling vehicles on the site. Emergency spill kits would be kept on site adjacent to the fuel storage area and with the mobile bowser. Site operatives would be briefed on the emergency procedures to be undertaken in the event of a large spillage. The principal contractor would have a 24-hour emergency response company on standby in the event of a spillage incident. Vehicles would be refuelled at their working location to prevent loss of time and use of fuel returning to any designated refuelling areas. All previous stated measures would be used when refuelling vehicles and the bowser operator would be suitably trained to deal with any spillage. The units would be self-contained, and no discharge of drainage would be made to the surrounding land unless otherwise agreed with SEPA and the local authority.

5.12.7 Cement entering a watercourse can have a detrimental effect by drawing oxygen from the water and increasing its alkalinity. As noted, a previously used location for concrete batching is proposed and if on-site batching plant is required, it would be agreed with SEPA prior to construction.

5.13 SIGNAGE

5.13.1 Due to the isolated location of the Proposed Development and the industrial operations occurring during construction, signs are required on-site for safe day-to-day navigation for works traffic and personnel; access for emergency vehicles; and for the health and safety of the public. To further protect the health and safety of all those visiting the site a comprehensive risk assessment for visitors will be produced. Signage would consist of non-illuminated post and panel sign locations and non-illuminated turbine identification signs with a maximum of 3 signs per post facing at the Proposed Development. Signs would also be placed on the turbines to help identify them as indicated in Figure 5.6.

5.13.2 The signage on site would comprise of two elements; directional signs and roundels displaying the site speed limit. The directional and speed roundel sign measure 300 mm x 400 mm x 3 mm and 300 mm x 300 mm x 3 mm respectively, which will be mounted on a 2500 mm x 76 mm grey aluminium pole as shown on Figure 5.6. The poles will be set within a 460 mm deep concrete foundation as indicated in Figure 5.6. This will ensure the stability of the signs, in line with current guidance for such installations.

5.13.3 The sign fixtures allow back-to-back mounting and are used on sign locations where more than two signs are specified. The signs will be hard wearing using tamperproof fixtures, securing the signs in place. A high-quality typeface is used to maximise readability. The signage is uncluttered and designed to be legible from vehicle or from foot.

5.13.4 The exact number of signs required at any of the post locations will be decided post-consent, following a full review of the health and safety requirements and will be confirmed in the CMS.

5.14 EMPLOYMENT DURING CONSTRUCTION

5.14.1 During the construction period there will be construction operatives carrying out the works on site which have been described. There would be indirect local benefits arising from the construction phase, including use of hotels, Bed & Breakfasts and other accommodation, hire of local equipment and plant, temporary employment of local work force and potential contracting of local subcontractors. The Applicant seeks to spend a minimum of 30% of the contract value locally and have hosted a local supply chain event to support this. At the time of writing the Applicant is planning to host a second local supply chain event. The construction mobilisation would likely be spread over a 22-month period. Such effects are assessed in Chapter 12: Traffic and Transport and Chapter 15: Socio-economics.

Site Representatives and Support Staff

5.14.2 It is envisaged that the Proposed Development would employ a number of main contractors during construction; which would most likely be one for the civil infrastructure works, one for the electrical works, and one for the supply, erection and commissioning of the wind turbines - all of whom would be coordinated and overseen by a project manager. In order to monitor the progression, a number of site representatives would be employed full-time to ensure the quality and health and safety aspects of the construction, to ensure the development is carried out in accordance with the CMS methodologies, and to retain employment. The site representatives would be individuals with previous experience of wind farm construction and would, as required, be supported on site by a suitably qualified ecologist. The site representatives would carry out daily checks on the site to monitor on-going activities, particularly when subcontractors are being used on site. In addition to this, and in conjunction with the ecologist, and hydrologist, environmental audits of the site operations would be undertaken on a regular basis accompanied by representatives of the relevant contractors. Where necessary, additional specialists may attend the site including geotechnical and archaeological representatives.

5.14.3 In line with guidance, appropriately competent operatives would be employed for handling, storing and arranging for the disposal of potentially polluting substances. Licensed waste disposal companies would be used to dispose of potentially polluting wastes.

5.15 SITE REINSTATEMENT

Access Tracks

5.15.1 During track excavation works, where possible the vegetated top layer of material, which holds the seedbank, will be stripped and carefully set to the side of the worked area for re-use in the re-profiling and track verge reinstatement works. Where practical, if storage is required, the layers will be correctly stored in their respective soil/peat horizons, i.e. in the layers that they were stripped in, so when reinstated they can be put back in the correct order. If temporary storage of excavated materials is required, then such material will be stored safely, and the method of storage will not lead to any areas of additional disturbance.

Cable Trenches

5.15.2 The reinstatement and storage of any excavated materials for the cable trenches will involve replacement of previously stripped soils, vegetated layers or turves. Timing of trench reinstatement works will also take into account adjacent construction activities which may disturb any reinstatement works already carried out. The amount of time between the excavation of the trench and subsequent reinstatement following cable laying will be minimised as much as practically possible. The reason for this is that the longer the stripped turves are stored for the more they will degrade and become unsuitable for successful reinstatement. The optimum scenario for the

cable trench works will be to ensure that no cable trenches are excavated until the electrical contractor has their cables ready for installation on site.

Turbine Foundations

5.15.3 Reinstatement methods associated with turbine foundations will include where practical the storage of turves and topsoil around the perimeter of the foundation excavation. A plan showing where the material is to be stored will be created prior to the works commencing. In areas where storage of the turves or excavated material adjacent to the works is not possible, then the material will be taken to the nearest agreed storage areas as soon as possible.

Crane Hardstands

5.15.4 Due to the requirement for crane hardstands to remain in place, reinstatement of the crane hardstands will not take place. There will however be reinstatement of the areas around the crane pad and exposed batter slopes will be dressed using the stripping, storage and reinstatement methods described above where possible.

Construction Compound

5.15.5 All temporary construction areas will be reinstated as quickly as possible following construction. Following removal of temporary site accommodation, storage, equipment and materials, all areas will then be reinstated. Suitable materials, i.e. topsoil, will be replaced over the area in the correct order. The material used for the reinstatement works (often that which was excavated for the temporary construction area), will be stored and managed adjacent to the temporary construction areas but away from watercourses and other sensitive receptors. It is highly probable that the temporary construction areas, such as the site compound will be required for the duration of the construction period and may be required at times during the operation and decommissioning phases. Therefore, it is unlikely that any stripped turves would be suitable for reinstatement, as the vegetation would have decomposed if stored for any length of time. Vegetation will therefore be allowed to regenerate naturally.

5.16 OPERATIONAL PHASE

5.16.1 Operation of the Proposed Development would be mostly automated. Each individual turbine would operate independently of the other turbines. Turbine operation would be managed by control and monitoring systems. These systems control the rotational speed of each individual turbine and ensure its continued safe operation. Should any malfunction in operation occur or should wind speeds exceed safe limits, then the braking system of the wind turbine would automatically be applied, and each turbine would shut down to a safe condition.

5.16.2 If the cause of the shutdown is due to high wind speeds, then the turbine would automatically begin operation again once average wind speeds reduce to below 25 m/s. Under other causes of shutdown, for example through malfunction, the turbine would remain shut down in a safe condition (e.g. with the rotor blades orientated 90 degrees to the wind direction) until manually restarted by a member of the Operations and Maintenance team, following satisfactory inspection and/or repair.

5.16.3 The lifetime of the project is envisaged to be up to 35 years from completion of commissioning to commencement of decommissioning. To ensure that turbines continue to operate with acceptable reliability (i.e. with each turbine capable of operating on average, between 95 % and 98 % of the time), regular pre-planned maintenance and servicing programmes will be performed on each turbine. A typical maintenance programme is outlined below. Additionally, there may be a need to conduct irregular, ad hoc maintenance in the event of mechanical breakdowns.

5.16.4 Tracks giving access to turbines will be required during the operational period of the wind farm to allow for routine maintenance operations and occasional replacement of larger components. The access tracks and hardstand areas will be maintained throughout the operational phase to ensure they provide adequate access for operational activities including wind turbine maintenance and servicing activities.

Maintenance Programme

5.16.5 Maintenance regimes commonly begin shortly after commissioning with a 'post-construction' check on the torque levels of all bolts within the structure. This is normally performed 10 days after commissioning and again, 3 months after commissioning.

5.16.6 After this, minor and major service regimes continue on a six-monthly basis with both services being performed annually throughout the lifetime of the turbine.

5.16.7 Routine oil sampling and testing of lubricant maintains awareness of the integrity and condition of these lubricants. This allows cost-effective oil changes to be performed as the oil quality degrades. Routine oil sampling and testing of transformer oils is also performed in order to maintain awareness of the integrity of the electrical properties of these oils.

5.16.8 Maintenance of the high-voltage switchgear will also be conducted routinely, and annual checks will be performed.

5.16.9 In the case of major component maintenance being required, such as generator or blade replacement, large vehicles similar to those used during construction may need to return to site. These would be subject to similar conditions of planning as agreed for the initial construction period. From time to time, when such maintenance is being undertaken, it may be necessary to restrict access to areas close to the replacement turbine components in order to maintain the health and safety of visitors. In such cases, the areas affected would be clearly marked and fenced and alternative routes would be provided for any visitors seeking passage through the wind farm, where necessary.

5.16.10 All maintenance of any equipment item would be performed according to the original equipment manufacturer's stated schedules, and health and safety procedures.

5.16.11 All maintenance would also occur according to the environmental procedures aforementioned in this chapter.

Storage and Use of Polluting Substances

5.16.12 Storage of polluting substances at the site during the operational period of the Proposed Development would only take place where agreed with the relevant authorities in accordance with Control of Substances Hazardous to Health (COSHH) regulations. Generally, substances of this nature are transported in minimum quantities on an 'as required' basis.

Employment during the Operational Phase

5.16.13 It is envisaged that the turbines at the Proposed Development would be included within a wider portfolio of operational wind turbines and that persons and/or technicians would be on site as required. For the first few years of operation the turbines would be under warranty and maintenance would be performed by the turbine manufacturer. During annual servicing thereafter, the number of technicians on site would increase. The site would also support a site manager to be based in the local area. Other contract personnel would attend the site as required to maintain the civil and electrical infrastructure as well as carrying out duties in relation to ecological monitoring and reporting. Site personnel would make use of the onsite control building, which has been designed to include office space and welfare facilities. Chapter 15 assesses the socio-economic effects of the Proposed Development.

Decommissioning

5.16.14 At the expiry of the consent or the end of the Proposed Development's useful life, it is proposed that the turbines and transformers would be removed. The upper sections of the turbine foundations, to a depth of at least 1 m, would be removed and backfilled with appropriate material. Peat or topsoil would be replaced, and the area reseeded. Crane hardstands will be removed and the area suitably reinstated. Access tracks will be left in-situ for landowner use or reinstated by either allowing them to grass over or covered with soil and reseeded. Cabling

would be left in-situ, unless ducted. At least six months prior to the decommissioning of the site, a Decommissioning Method Statement would be prepared, for agreement with the local authorities and relevant consultees.

Waste Management

5.16.15 The Proposed Development will produce small amounts of general, municipal and hazardous waste during its construction, operation and decommissioning. Where waste is generated, the waste hierarchy will be applied:

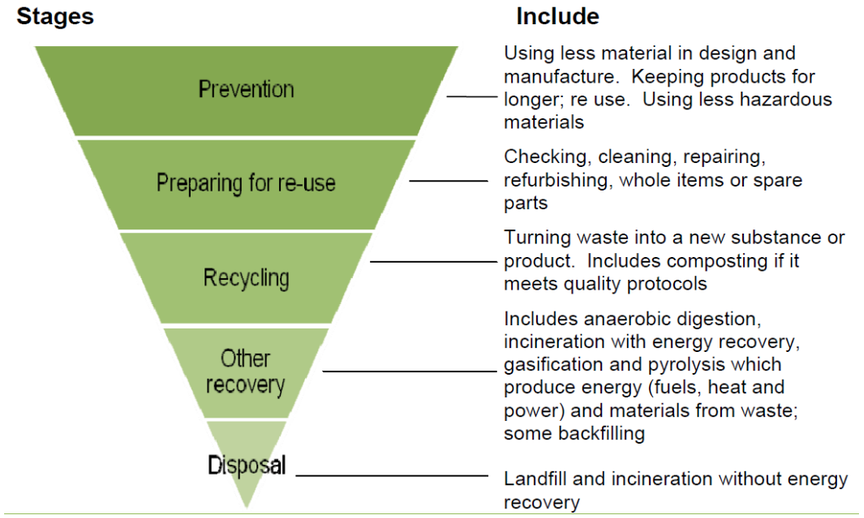

Plate 5.1: Waste Hierarchy

5.16.16 Waste materials generated during the construction phase include excavation waste such as vegetation, forestry residues, soil, stone, rock and similar materials. Excavated materials can be reused on site or elsewhere if it is deemed suitable for reuse. Excavated peat associated with development on peatland is not classed as waste if it is deemed suitable for a required and predetermined end-use as part of construction works and reinstatement on a site. Other construction waste streams include municipal waste from welfare facilities, including food waste, paper, plastics, glass, cardboard, paper, and other typically domestic refuse. Industrial waste chemicals, fuel, oil and polluted water from plant, vehicle and wheel washes may also be generated as a result of the Proposed Development.

5.16.17 The operational phase of the Proposed Development is unlikely to generate significant amounts of waste except for minor quantities of material collected during routine maintenance inspections. Waste streams during this phase include municipal waste, waste chemicals, fuel and oil, sewage and polluted water from vehicle and wheel washes.

5.16.18 During the decommissioning phase of the Proposed Development wastes includes demolition waste, turbine components, electrical cabling as well as municipal waste, waste chemicals, fuel and oil, sewage and polluted water. Wind turbines and electrical cables can be reused or materials recycled subject to potential ready markets for the material.

5.16.19 Measures will be put in place to ensure waste generated from the Proposed Development is kept to a minimum and does not have a significant cumulative effect on local waste management infrastructure. Such measures will be detailed fully within the CMS.

5.16.20 Embedded mitigation to reduce the quantity of waste from the Proposed Development will include the design of the Proposed Development in such a way that new turbines can be accessed by existing access tracks wherever possible, minimising the need to construct additional access tracks and reducing the potential for waste. All construction and decommissioning activities will be planned effectively to ensure that any materials associated with these activities are predicted well in advance, reducing the chance of over-ordering of materials which would result in waste.

5.16.21 Materials will be reused on site or elsewhere and materials will be sent for recycling where recycling facilities are available. Other measures to ensure that waste materials sent to local waste management facilities and to landfill are kept to a minimum include the nomination of an approved person(s) to be responsible for waste management on site; this will include the coordination of waste collection to suitable disposal and/or recycling facilities. In addition, a system to record and monitor waste will be implemented, keeping a record of reuse, recycling and disposal. It may also be possible to schedule certain activities that generate large volumes of waste to avoid overloading local infrastructure if other construction projects in the area are also producing large volumes.

5.16.22 Pollution prevention measures will also be put in place, and these will be detailed fully within individual chapters of the EIAR and within the CMS. Pollution prevention measures include:

- Storage of waste materials within the construction compound only. If waste materials are generated outside the construction compound, they will be taken to the compound on a daily basis;
- All waste products will be removed from site by registered waste carriers and taken to a waste management facility permitted to receive each specific waste type;
- Bonfires and the burning of waste products will be prohibited on-site;
- Labelled, double skinned waste tanks will be utilised for the storage of waste oils on-site;
- The waste storage area will be isolated from surface drains and bunded to contain any spillages; and
- A wastewater collection system will be used to prevent contamination of local water courses.

5.17 HEALTH AND SAFETY

Health and Safety of Construction Workers

5.17.1 The construction site will be managed and operated in accordance with Health and Safety at Work etc. Act 1974 and comply with relevant Health and Safety Regulations, including:

- The Management of Health and Safety at Work Regulations 1999;
- Construction (Design and Management) Regulations 2015; and
- Electricity Safety, Quality and Continuity Regulations 2002.

5.17.2 In awarding any civil, electrical or other contracts for the construction of the Proposed Development, the appointed contractor is obligated by law to follow the CDM Regulations implemented by the Health and Safety Executive (HSE). These are based on standard procedures that are adapted to take account of all site-specific requirements. The Regulations require due consideration is given to construction workers and the public, with risk assessments and method statements created to cover all risks identified including access rights across the site.

5.17.3 A Principal Designer (PD) will be contracted by the Client to take overall control of the pre-construction phase, and are responsible for planning, managing and coordinating health and safety for any pre-construction activities. The PD ensures all relevant information is provided to other CDM duty holders, seeking to identify, eliminate or control foreseeable risks, ensuring Designers comply with their duties as well as liaising with the Principal Contractor (PC) to help with planning, management and monitoring of the construction phase, including compiling of the Health and Safety File.

5.17.4 Under CDM 2015 the Client isn't expected to manage the project themselves, however they remain ultimately responsible and must ensure all required duty holders are appointed and that suitable arrangements are in place for the work to be carried out safety.

Safety of the Public

5.17.5 Throughout the construction phase of the Proposed Development the relevant statutory requirements would be adhered to. All potentially hazardous areas would be fenced off and all unattended machinery would be stored in the site compound or immobilised to prevent unauthorised use. In addition, temporary construction safety signs would be placed at each possible entrance to the site and in areas where there may be further danger, e.g. around settling lagoons and borrow pits.

5.17.6 Throughout construction, measures to manage diversion routes would be put in place. The diversion routes would be clearly marked and for safety reasons would direct the user away from any areas of construction.

Operational Phase

5.17.7 Wind farms have a proven track record for safety. A very small number of wind turbines have been known to suffer from mechanical damage through lightning strikes or mechanical failure. Experience on existing sites has shown that allowing the public to access an operating wind farm does not lead to a compromise in safety.

5.17.8 Companies supplying products and services to the wind energy industry operate to a series of international, European and British standards. A set of product standards for wind energy equipment has been developed by the International Electrotechnical Commission – IEC 16400. There are a number of British Standards that correspond to it, for example BS EN 61400-1: 1995 "Wind turbine generator systems – safety requirements".

5.17.9 The Applicant would commit to installing wind turbines and components that meet BS EN 61400-1: 1995 or IEC 16400 as appropriate.

5.17.10 Appropriate warning, directional and identification signs would be installed on the turbines, transformers and on-site electrical control building, and access to these would be restricted to wind farm personnel. At all times these facilities would be locked. Additionally, safety and/or directional signs would be placed at strategic points across the site area, particularly on any Rights of Way to inform members of the public that they are entering a wind farm area, to make them aware of potential hazards and provide direction for emergency services should the need arise. Any signage would be agreed with the relevant authorities prior to installation.

5.17.11 No resulting safety risks are expected as a result of public access to the Proposed Development site. Turbine models being considered for the site would operate automatically and have sensors to detect any instabilities or unsafe operation during high wind speeds. Should sensors placed on the nacelle and tower of the turbine detect any other malfunction in operation or should wind speeds increase over maximum operational thresholds, the brakes would be automatically applied in order to rapidly shut the turbine down.

5.17.12 If the cause of the shutdown was high wind speeds, then the turbine would automatically begin operation once the average wind speed reduced to within operational levels. Under other causes of shutdown, e.g. through malfunction, the turbine would remain shut down and in a safe condition (i.e. commonly with the blades oriented 90º to the wind direction) until restarted by a member of the operations and maintenance team following satisfactory investigation. This procedure ensures safe operation of turbines to protect members of the public walking, cycling or riding past turbines during the operational phase. In addition, the vibrometers in the nacelles would detect rotor imbalance in blades caused by icing and the wind turbine's control and monitoring system would shut the turbines down under these conditions. The turbines are also equipped with lightning protection equipment so that strikes will be conducted from the nacelle down the tower into the earth.

5.17.13 The safety features and record of wind turbines are identified above, and it is concluded that the proposed wind farm would not present a significant safety risk to the public.

5.18 CONCLUSION

5.18.1 This chapter has set out a description of the Proposed Development and provided details of the activities that will be undertaken throughout the construction, operation and decommissioning phases of the Proposed Development.

5.18.2 There is sufficient detail to provide consultees with a good understanding of the Proposed Development. Further construction details will be provided in the Construction Management Statement, which will be submitted by the principal contractor for approval by Dumfries and Galloway Council prior to the construction of the Proposed Development.