3 PROPOSED DEVELOPMENT

3.1 Site Description

3.1.1 The Proposed Mynydd Maen Wind Farm, hereafter referred to as the 'proposed wind farm' is located on common agricultural land between Newbridge and Cwmbran, partly in Caerphilly County Borough and partly in Torfaen County Borough. The proposed wind farm is centred at E325643 N197926. The location of the site is shown in Figure 1.1: Site Location Plan.

3.2 Proposed Development

3.2.1 The proposed wind farm comprises 13 horizontal axis wind turbines up to a maximum tip height of 149.9 m. The 13 turbines would have a total installed capacity of approximately 54.6 MW. The proposed wind farm would include an improved site entrance, new and upgraded access tracks, crane hardstandings, control building and substation compound, electricity transformers, underground cabling, and drainage works (see Figure 3.1: Infrastructure Layout). The proposed wind farm also includes the provision of new areas of common land to replace that occupied by the turbines and infrastructure. During construction there would be a number of temporary works including a construction compound with car parking, temporary crane hardstandings and welfare facilities.

3.2.2 The purpose of the proposed wind farm is the generation of renewable electricity. The proposed wind farm would generate electricity through onshore wind technology.

3.2.3 The Planning Application Boundary (red line boundary) is shown in Figure 1.2: Planning Application Boundary. This boundary contains the proposed wind farm, including positions of the turbines and associated infrastructure with 50 m micrositing, and the proposed upgrades required along the access route.

3.2.4 A detailed plan of the proposed wind farm showing the position of the turbines and other infrastructure is shown in Figure 3.1: Infrastructure Layout.

3.2.5 This chapter provides a description of the physical characteristics of the proposed wind farm for the purpose of identifying and assessing the main environmental impacts of the proposal.

3.2.6 In this chapter in order to differentiate between land take and infrastructure that will be present for the life time of the proposed wind farm, and land take which is only required for short term works during the construction period, the term 'permanent' is used to describe the former and 'temporary' used to describe the latter. However, it should be noted that the proposed wind farm would have a temporary operational lifetime of approximately 35 years from the date of commissioning, after which the above ground infrastructure would be removed and the land reinstated. Therefore, the effects are largely long-term temporary as opposed to permanent.

3.2.7 Planning permission is being sought for the proposed wind farm comprising the following:

- Thirteen three-bladed horizontal axis wind turbines, up to 149.9 m tip-height.
- Turbine foundations
- Hardstanding areas at each turbine location for use by cranes erecting and maintaining the turbines
- Approximately 8.18 km of new and upgraded tracks
- An upgraded site entrance off the public highway
- A wind farm substation and a network operator substation compound containing electrical apparatus and a control building

- On-site electrical and control network of underground (buried) cables
- Temporary construction compound
- Permanent and temporary drainage works
- Three potential borrow pit search areas
- Off-site road improvement works
- Associated ancillary works
- Secondary applications under section 16 and section 38 of the Commons Act 2006 will be submitted in association with this primary application

3.3 Site Layout and Flexibility

3.3.1 Although the design process and evolution seek to combine environmental and economic requirements, the Applicant would nevertheless wish some flexibility, where necessary, in micrositing the exact positions of the turbines and routes of on-site access tracks and associated infrastructure. Any repositioning would not encroach into environmentally constrained areas, but could, for example, avoid unrecorded archaeological features which might be revealed during the construction phase. Therefore, 50 m flexibility is requested in infrastructure positioning which might help mitigate any potential environmental effects. See Figure 3.1: Infrastructure Layout for details.

3.4 Project Description

Wind Turbines

3.4.2 The wind turbine industry is evolving at a remarkable rate. Designs continue to improve technically and economically. The most suitable turbine model for a particular location can change with time and therefore a final choice of machine for the proposed wind farm has not yet been made. The most suitable machine would be selected before construction, with a maximum tip height of 149.9 m.

3.4.3 For visual and acoustic assessment purposes, the most suitable current candidate turbines available in the market place at these tip heights have been selected. Most of the dominant wind turbine manufacturers are now producing turbines that are classed as suitable for the wind regimes typical of Wales and many are also producing turbines that meet the 149.9 m tip height specification for the proposed wind farm. Exact tower and blade dimensions vary marginally between manufacturers. A diagram of a typical turbine at these tip heights is given in Figure 3.2: Typical Wind Turbine Elevation.

3.4.4 Turbines begin generating automatically at a wind speed of around 3 to 4 metres per second (m/s) and have a shut-down wind speed of about 25 m/s. Each turbine would have a transformer and switchgear. The transformer's function is to raise the generation voltage from approximately 720 volts to the higher distribution level that is required to transport the electricity into the grid. Depending on the turbine supplier, the transformer and switchgear may be located inside or outside each turbine.

Foundations and Crane Hardstandings

3.4.5 The wind turbines would be erected on steel re-enforced concrete foundations. It is anticipated that the foundations would be of gravity base design, but there may be the requirement to use piled foundations where ground conditions dictate. Final base designs would be determined after a full geotechnical evaluation of each turbine location. Figure 3.3: Wind Turbine Foundation provides an illustration of a typical gravity base wind turbine foundation design.

3.4.6 During the erection of the turbines, crane hardstanding areas would be required at each turbine base. Please see Figure 3.4: Crane Hardstanding General Arrangement. Typically, these consist of one main permanent area of 1100 m^2 adjacent to the turbine position, where the main turbine erection crane would be located. The other areas, totalling 530 m^2, would be temporary and used during the assembly of the main crane jib. The hardstanding would be constructed using the same method as the excavated access tracks. This involves the topsoil being replaced with suitable structural fill to finished level.

3.4.7 After construction operations are complete, the temporary crane pad areas would be reinstated. There would be a requirement to use cranes on occasion during the operational phase of the proposed wind farm, so the main crane hardstanding (1100 m^2) would be retained to ease maintenance activities. This approach complies with current best practice guidance[1] which recommends crane hardstandings are left uncovered for the lifetime of the proposed wind farm.

Site Tracks

3.4.8 The on-site access track layout has been designed to minimise environmental disturbance by avoiding sensitive features and keeping the length of track commensurate with the minimum required for operational safety. The track route also takes cognisance of the various identified environmental constraints. A total of five watercourses are crossed. Approximately 8.18 km of new and upgraded access tracks are proposed to access the turbine locations. Access track running width would be 4.5 m, with 0.25 m shoulders either side. Where necessary, access track widths would be increased on bends to accommodate abnormal load deliveries. Typical access track designs are shown in Figure 3.5: Access Track Typical Details.

RES Control Building & Substation Compound

3.4.9 The layout and elevations of the proposed control building and substation compound are shown in Figure 3.6: Substation Building and Compound. The control building would be designed and constructed to the standard required by the distribution network operator (National Grid Electricity Distribution, NGED) for the accommodation of substation equipment.

3.4.10 The control building and substation compound would contain power quality improvement equipment, including two auxiliary transformers. The control building would accommodate metering equipment, switchgear, the central computer system and electrical control panels. A spare parts store room, and welfare facilities would also be located in the control building. The building would be attended by maintenance personnel on a regular basis.

3.4.11 Following an assessment of foul treatment options through a review of GPP4 Treatment and disposal of wastewater where there is no connection to the public foul sewer, it was determined that both the toilet, wash hand basin and sink should drain to a small package treatment plant located adjacent to the control building, with effluent to discharge to a soakaway (subject to infiltration tests). The foul treatment system would be constructed and located in accordance with the relevant Building Standards and agreed with the Local Authority.

3.4.12 Artificial lighting may be required for the Control Building and Substation Compound. If lighting is required, it would be designed in accordance with industry guidance. This would include careful consideration of the location of lighting, the type of lighting and the design of the lighting scheme to minimise the potential for adverse effects on the environment.

Description of Access

3.4.13 The proposed access route for the delivery of large turbine components, known as abnormal indivisible loads (AILs), is shown in Figure 10.1: Abnormal Load Delivery Route.

[1] SNH, Scottish Renewables, SEPA and the Forestry Commission Scotland (2010) "*Good Practice during Wind Farm Construction*"

3.4.14 Figure 10.2: Abnormal Load Route from Port to Abercarn Mountain Rd and Figure 10.3: Abnormal Load Route Abercarn Mountain Road shows a swept path analysis of all points along the turbine delivery route that require either overrun or oversail beyond the road edge, and relates to the public road network, where requirements are limited to temporary removal of street furniture and widening works at various points on the access route.

3.4.15 At the end of the construction period and in consultation with the local highways authority, any reinstatement required to any street furniture which may be removed or widening works on a temporary basis would be undertaken. In the unlikely event that a replacement blade is required during the operational phase of the Wind Farm, any works would be undertaken following consultation with the local highways authority.

3.4.16 Details of the proposed site entrance can be seen in Figure 3.7: Site Entrance.

3.4.17 Please see Chapter 10 for an assessment of Traffic, Transport and Access.

Temporary Compound

3.4.18 A temporary construction compound would be located on the site, as illustrated in Figure 3.1: Infrastructure Layout. Details of the temporary compound layout are included in Figure 3.8: Typical Temporary Construction Compound. The compound would include the following:

- Temporary portable cabins for office accommodation, monitoring of incoming vehicles and welfare facilities
- Self-contained toilets with provision for waste storage and removal
- Containerised storage areas for tools, small plant and parts
- An area for site vehicle parking and storage of larger material items
- A standing and turning area for vehicles making deliveries to the site
- A bunded area for storing fuels, oils and greases.

3.4.19 On completion of the construction work these facilities would be removed and the area reinstated.

Borrow Pit

3.4.20 Three potential borrow pits are proposed as a potential source of site won rock for use primarily in the construction of new and upgraded tracks and hardstandings. The location of the borrow pit areas of search are shown in Figure 3.1: Infrastructure Layout.

3.4.21 These areas of search are shown as the maximum potential area of borrow pit extraction, but it is not anticipated that these areas would be fully exploited. Three areas of search are shown as the nature and quality of the underlying geology would not be defined until the results of detailed pre-construction ground investigation are known. At this point, the exact extent of borrow pit extraction cannot be defined, however approximately 65,000m^3 of stone is estimated to be required from the borrow pits. Indicative borrow pit drawings for the proposed borrow pit areas are shown in Figure 3.9: Indicative Borrow Pit Details. On these drawings, indicative excavation areas are shown to illustrate the potential works if the materials within the search area(s) prove to be suitable for use in the construction of the proposed wind farm.

Electrical Connection

3.4.22 Assuming the use of the currently available models, each wind turbine would generate electricity at 720 V and would have an ancillary transformer located either within or outside the base of the tower to step up the voltage to the required on-site distribution voltage. Each turbine would be connected to adjacent turbines by underground cables.

3.4.23 The proposed wind farm substation would be located as shown in Figure 3.1: Infrastructure Layout. All power and control cabling on the Wind Farm would be buried underground in trenches located, where possible, along the route of site access tracks. These trenches would be partially backfilled with topsoil. The vegetation soil turves would be stripped and laid beside the trench and used to reinstate the trench to the original ground level immediately after the cables have been installed.

3.4.24 The connection of wind farms to the electrical network typically follows a separate consenting process and it is normally the responsibility of the network operator to progress the relevant consent, where required. RES has received a connection offer for Mynydd Maen Wind Farm from the network operator NGED including an indicative grid connection method and location directly adjacent to the on-site substation.

Common Land

3.4.25 Land cover on the Site consists of upland grassland, used as rough grazing, and is registered common land. Following the completion of construction of the proposed wind farm, grazing would be able to continue around the wind farm infrastructure. RES has undertaken detailed consultation with the commoners who may be affected by the proposed wind farm. RES seeks to de-register 14.48 ha of common land to make way for the wind farm infrastructure and would provide 14.50 ha of replacement land to be registered as common. This replacement land directly borders the existing common. These are currently subject to varied grazing regimes and the grassland within all of them is poor semi-improved acid or neutral in character, and heavily agriculturally modified. A secondary application under Section 16 of the Commons Act will be submitted along with the planning application to deregister the common land and provide the replacement land. A further secondary application under Section 38 of the Commons Act will be submitted to enable temporary works to be carried out during construction of the wind farm. The area of temporary construction works totals 44.32 ha, but this would not be all occupied at the same time, but on a rolling basis as construction progresses.

Temporary and Permanent Diversions to Public Rights of Way

3.4.26 There are several public rights of way crossing the site. Being unenclosed common land, all of the site is open access. Following consultation with Caerphilly County Borough Council and Torfaen County Borough Council, it may be necessary to divert some of these rights of way either permanently or temporarily during construction of the wind farm. Applications for rights of way diversions cannot be submitted with a DNS application and, where necessary, these applications will be submitted following determination of the DNS application.

3.4.27 There is potential for users of these routes to be affected by the construction activities as their safety could be compromised by the movement of heavy machinery. In order to mitigate or reduce such effects, temporary diversions may be required. Should planning permission for the proposed wind farm be granted, RES may lodge an application to divert the affected rights of way under the Town and Country Planning Act 1990, in consultation with Caerphilly County Borough Council and Torfaen County Borough Council.

3.4.28 Given the relatively short length of the diversions, the similar nature of the terrain and the fact that no environmentally constrained areas would be affected, effects of the proposed wind farm on public rights of way are not deemed to be significant. Effects on the footpaths from a landscape and visual perspective are considered in Chapter 5: Landscape and Visual.

3.5 Typical Construction Activities

3.5.1 Prior to commencement of construction, a Construction Environmental Management Plan (CEMP) would be prepared and implemented to set out the measures required to protect ecology and hydrology at the site during the construction phase. The detail of the CEMP would be prepared and agreed with the Local Authority prior to commencement of construction to incorporate best practice working methods. As a minimum, the following best practice construction methods would be adhered to:

- Where possible and in order to minimise impacts of earthworks, excavations will be kept to a minimum with granular material being reused where appropriate.
- Consideration will be given to weather conditions when stripping soil. For example, during periods of heavy rain (>25 mm in 24 hours), significant snow event (>75 mm lying) or an extended period of freezing conditions (ground penetration >100 mm), soil stripping works will be reviewed to take into account any adverse weather conditions and, where deemed applicable, works will cease until site conditions prevail that are compatible with this activity.
- Vegetated turves shall be stripped and stockpiled separately prior to excavation of topsoil in all work areas
- Vegetated turves will be reused as quickly as possible
- Excavations will be monitored for changing soils types to prevent cross mixing of soils in stockpiles
- Topsoil shall be stripped and stored carefully for use in reinstatement works, which shall be carried out as soon as possible after sections of work are complete. Topsoil will be stripped prior to excavation of subsoil in all work areas
- Any remaining subsoil will be excavated down to a suitable bearing stratum and set-aside for later use in landscaping, backfilling around structures and verge reinstatement
- Reinstatement will be ongoing as the works are constructed to minimise the amount of time in which any material will be stockpiled
- Where required, all stockpiled material will be sited in areas with zero or shallow peat depths and avoiding all 50 m watercourse buffer zones, and ecological and cultural heritage constraints
- All stockpiles shall be shaped to promote run-off. Detailed SUDS drainage and silt control methods shall be designed for each stockpile.
- Additionally, a “toolbox talk” will be provided by the site management team to highlight possible events causing slope instability and provide guidance on best practice when operating in areas of peat and/or increased slopes. In addition, a workforce engagement event shall be performed at least once for the project and shall be organised by the project team and be attended by RES and the project contractor’s workforce. The event will set and communicate the required safety culture and working practices for the project.
- If artificial construction phase lighting is required, it will be designed in accordance with industry guidance. This will include careful consideration of the location of lighting, the type of lighting and the design of the lighting scheme to minimise the potential for adverse effects on the environment.

Access Tracks

3.5.2 The access track itself would be constructed of inert material of suitable grade to withstand the expected traffic loading. Road construction techniques and roadside ditches would be designed to minimise the effect on natural hydrology as much as possible.

3.5.3 The depths of the ditches would be kept to the minimum required for free drainage of the road. Individual drain lengths would be minimised to avoid significant disruption of natural drainage patterns and avoid accumulation of large volumes of water within an individual drain.

3.5.4 Drains would not directly flow into watercourses, but into a buffer zone. Buffer zones are used to allow filtration of suspended solids in the water and reduction of runoff velocities. This reduces the sudden increase of flow and encourages deposition of sediments and allows pollutants to be filtered out.

3.5.5 As detailed in Chapter 10: Traffic, Transport and Access, construction activities would include ground clearance within various areas adjacent to the access road and new and upgraded access track. There would also be temporary disturbance on land surrounding the access tracks that would be subject to restoration once construction is complete.

Temporary Compound

3.5.6 The location of the temporary compound has been selected to avoid environmental constraints and for reasons of security, practicality and to obtain suitable ground conditions. The proposed temporary compound area would be constructed by top soil excavation in a similar manner to the access tracks, laying stone over a geotextile membrane.

3.5.7 During construction, temporary fencing would be erected as required, around the construction compound.

3.5.8 On completion of the construction phase work on the Wind Farm, the temporary construction compound infrastructure would be removed and reinstated.

Borrow Pit

3.5.9 The daily operation and management of the borrow pits would be the joint responsibility of RES and the contractor. The general methodology set out below for careful management of the borrow pits would be adhered to in order to minimise potential environmental impact.

3.5.10 A Borrow Pit Method Statement would be agreed with the Local Authority prior to the commencement of construction. Provisions for the control of surface run-off during construction (SuDs) would be maintained and the borrow pits would be fully reinstated in accordance with the Method Statement following completion of construction.

3.5.11 Excavation of material from the borrow pit will be carried out using standard quarrying techniques, which may include mechanical excavation. It is not anticipated that blasting of stone would be necessary in the borrow pits. However, as a worst case, blasting may occur up to 2-5 times a week for the first three months, before tapering off and becoming less frequent.

3.5.12 Appropriate dust suppression at the borrow pits and any materials storage areas would be provided as required.

3.5.13 Once operations are sufficiently underway, restoration would take place progressively behind the working area to encourage re-vegetation. This would minimise any impact to the surrounding environment by minimising the working area at any point in time.

Sustainable Drainage Systems

3.5.14 The drainage measures and Sustainable Drainage System (SuDS) designs have been directed by recommendations in Chapter 9: Hydrology and Hydrogeology and are included in the Sustainable Drainage Management Plan (SDMP) provided in Technical Appendix 9.1: Sustainable Drainage Management Plan Report.

3.5.15 The drainage system would be designed to mimic natural conditions to mitigate against increased flashiness in watercourses and reduce groundwater recharge. The SuDS would protect the status of watercourses and groundwater.

3.5.16 Construction would be carried out according to the SDMP. Pollution control measures during the construction phase would be included in the Construction Environmental Management Plan (CEMP), which would be agreed with the Local Authority before starting construction work on-site.

3.5.17 Mitigation measures to minimise the hydrological effect of constructing the access tracks have been identified in Chapter 9: Hydrology and Hydrogeology.

Crane Hardstandings

3.5.18 Figure 3.4: Crane Hardstanding General Arrangement shows the crane hardstanding layout configuration in plan. The hardstanding would be constructed using the same method as the excavated access tracks. This involves the topsoil and subsoil being replaced with imported stone, ensuring an adequate bearing capacity has been achieved to carry the anticipated loads. The final position of the hardstanding would be decided at detailed design stage and prior to construction and shall be based on a number of considerations, including: size of crane required, depth of excavation required, hydrological/ecological features in the vicinity, local topography (it is preferable to position the crane hardstanding on the same level, or higher level than the turbine foundation level since this eases lifting operations).

Turbine Foundations

3.5.19 The turbine towers are fixed to a concrete foundation. The foundation proposed in Figure 3.3: Wind Turbine Foundation comprises a gravity base design.

3.5.20 Each foundation typically consists of a tapered octagonal block of concrete with its base approximately 2.5-3.5 m below ground level. The volume of concrete used to make each foundation is typically 350-500 m^3, which is reinforced by approximately 40-55 tonnes of steel bar. The depth of the excavation below foundation varies for each turbine location according to the depth to suitable formation level. The excavation area for each foundation would be approximately 650-1000 m^2.

3.5.21 The foundation is typically poured in two parts, with a suitable construction joint between them. This would be detailed in the CEMP. Following the pouring and curing of the concrete, the foundation is backfilled with material which is initially excavated and meeting the density requirements, leaving only the tower plinth, typically 4.5 m – 5.5 m diameter, sitting above ground level. Surplus excavated material would be stored in appropriate areas identified in the CEMP prior to construction. The proposed plan would calculate generated excavated material and identify space for the excess volume of material.

3.5.22 The exact quantities of concrete, reinforcement, depth and dimensions would vary on the final choice of turbine model. In the detailed pre-construction design of each foundation, geotechnical tests are carried out to determine the strength of the subsoil layers beneath the turbines and the soil behaviour under loading over time. This information is used to confirm a final design and incorporates factors for safety.

3.5.23 An earthing mat or electrode consisting of up to three interconnected concentric rings of bare stranded copper conductor is laid around the foundation of each tower and transformer, approximately 0.5 m below the finished ground level. In addition, earthing rods padded by bentonite (a water retaining clay mineral) are required at set locations around the foundation, and are positioned vertically below the earthing mat. The number of rods and length is dependent upon the electrical resistivity of the soil which is confirmed during the site investigation, prior to construction.

3.5.24 Sulphate resistant cement, or higher cement content, within the concrete would be used if the site is identified to have waters with potentially low pH. This is so that they do not have a corrosive effect on turbine bases.

Wind Turbine Erection

3.5.25 Wind turbine towers, nacelles and turbine blades would be transported to the site as abnormal loads as described in Chapter 10: Traffic, Transport & Access. The tower sections and other turbine components would be stored at each turbine hardstanding until lifted into position.

3.5.26 The components would be lifted by adequately sized cranes and constructed in a modular fashion. Assembly, in general requires only fixing of bolts, torquing of nuts and electrical and hydraulic connections.

Cabling, Substation and Control Building

3.5.27 The location of the substation and control building is shown in Figure 3.1: Infrastructure Layout. Layout and elevation drawings for these buildings are presented in Figure 3.6: Substation Building and Compound. The equipment shown above ground in this figure is as required by the grid connection offer. All cabling between the turbines and the substation on the site would be connected using underground trenched cables. Where excavated, the top layer of soil would be removed and used to reinstate the excavation following the installation of the cables. Where cables are being laid in areas of peat, the various different layers would be separated and replaced appropriately. Cabling would generally run parallel to the adjacent site tracks. Figure 3.10: Typical Cable Trench Details presents a typical underground cable trench cross-section. In addition, and in an effort to ensure that the cable trench does not act as a preferential drain, impermeable bunds would be installed perpendicular to the cable direction at suitable intervals (taking into account local ground conditions and topography).

Re-instatement

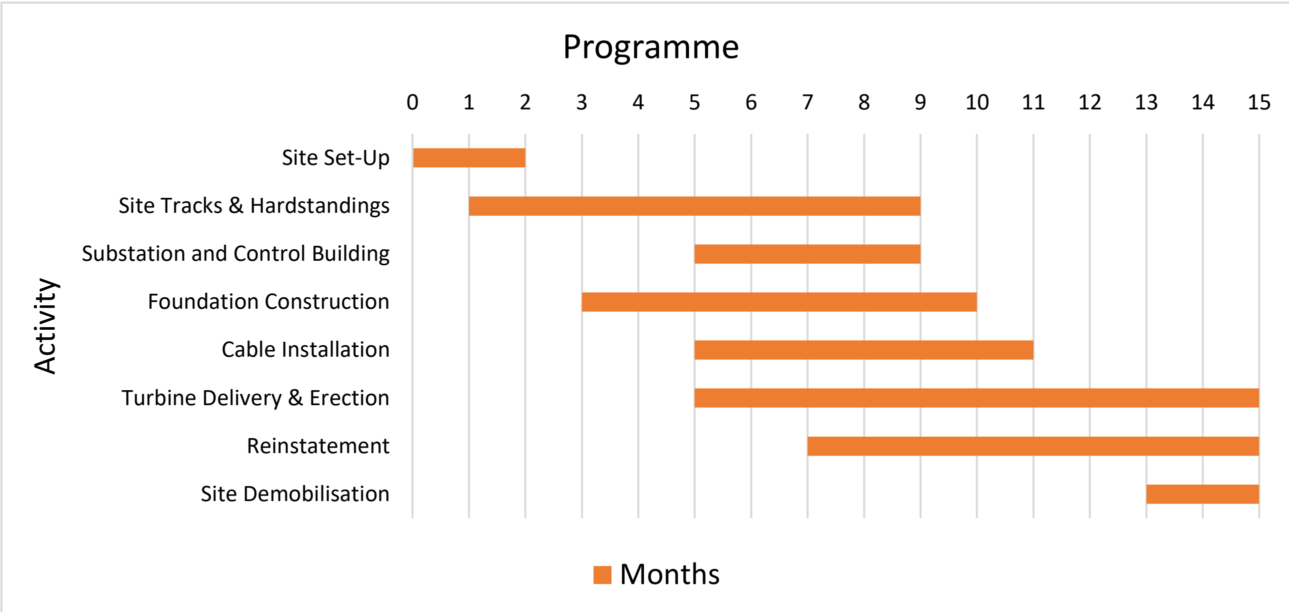
3.5.28 A programme of reinstatement would be implemented upon completion of construction. This would relate to the temporary areas of the crane hardstandings, cable trenches and track shoulders where appropriate. There remains a potential to use cranes during the operational phase of the Development, therefore the main crane hardstanding would remain uncovered.

3.5.29 It is essential that the access track width is retained during the operation of the Development to allow occasional access if required. Therefore, no works to reduce the track width, post turbine erection, are proposed.

Construction Programme

3.5.30 It is anticipated that construction of the Wind Farm would take up to approximately 15 months. The Wind Farm indicative construction programme is shown in Diagram 3.1.

Diagram 3.1 – Wind Farm Indicative Construction Programme



Hours of Work

3.5.31 Construction work would take place between the hours of 0700-1900 Monday to Friday and 0700 – 1300 on Saturdays. Outside these hours, work at the Site shall be limited to turbine erection, testing/commissioning works and emergency works. Deliveries may occur outside these times to minimise disruption to local residents.

Construction Traffic and Plant

3.5.32 In addition to staff transport movements, construction traffic would consist of heavy goods vehicles (HGVs) and abnormal load deliveries (AILs).

3.5.33 As outlined in Chapter 10: Traffic, Transport & Access, taking into account forecast vehicle numbers from construction activities (11075 trips) and forecast staff vehicle numbers (11310 private car, mini bus or land rover trips), the total number of two-way vehicle movements generated during the construction period would therefore be 22,385 journeys. However, figures in the more likely scenario, using site won stone from an on-site borrow pit(s), would equate to a forecast for the total number of two-way vehicle movements generated during the construction period of 11,596 journeys. Up to 10 abnormal load deliveries would be generated for the turbine erection stage per turbine, equating to approximately 130 AILs. However, the actual number would be determined in the development of the Construction Traffic Management Plan (CTMP) which would be written in consultation with the Local Authority post-consent.

3.5.34 Turbine components would be supervised during their transportation using appropriate steerable hydraulic and modular trailer equipment where required. Axle loads would be appropriate to the roads and access tracks to be used. The transportation of turbine components would be conducted in agreement with the relevant highways authorities and local police. RES would notify the police of the movement of abnormal length (e.g. turbine blade delivery) and any abnormal weight (e.g. crane) vehicles and obtain authorisation from the relevant overseeing highways authority prior to any abnormal vehicle movements.

3.5.35 Vehicle escorts would be used where necessary and the appropriate permits obtained for the transportation of AILs, to ensure that other traffic is aware of the presence of large, slow moving vehicles. Where long vehicles have to use the wrong side of the carriageway or have potential to block the movement of any vehicles travelling in the opposite direction, a lead warning vehicle would be used and escort vehicles would drive ahead to hold oncoming traffic. Vehicles would also be marked as long/abnormal loads. For return journeys, the extendible trailers used for wind turbine component delivery would be retracted to ensure they are no longer than that of a normal HGV.

3.6 Operation and Management

Life of the project

3.6.2 The expected operational life of the proposed wind farm is 35 years from the date of commissioning. At the end of this period, a decision is made whether to refurbish, remove or replace turbines. If refurbishment or replacement were to be chosen, relevant planning applications would be made. Alternatively, if a decision is taken to decommission the proposed wind farm, this would entail the removal of all of the turbine components, transformers, the substation and associated buildings. Specific sections of the access tracks may remain on-site to ensure the continued benefit of improved access for the landowners and commoners. The concrete foundations would normally remain in place to avoid unnecessary disturbance of the ground. The exposed concrete plinth may be removed to a specified depth, but the entire foundation would be graded over with topsoil and revegetated appropriately to restore the land to its original condition.

Maintenance Programme

3.6.3 Wind turbines and wind farms are designed to operate largely unattended. Each turbine at the proposed wind farm would be fitted with an automatic system designed to supervise and control a number of parameters to ensure proper performance (e.g. start-up, shut-down, rotor direction, blade angles etc.) and to monitor condition (e.g. generator temperature). The control system would automatically shut the turbine down should the need arise. Sometimes the turbines would re-start automatically (if the shut-down had been for high winds, or if the grid voltage had fluctuated out of range), but other shut-downs (e.g. generator over temperature) would require investigation and manual restart.

3.6.4 The Development itself would have a sophisticated overall Supervisory Control and Data Acquisition system (SCADA) that would continually interrogate each of the turbines and the high voltage (HV) connection. If a fault were to develop which required an operator to intervene then the SCADA system would make contact with duty staff via a mobile messaging system. The supervisory control system can be interrogated remotely. The SCADA system would have a feature to allow a remote operator to shut down one or all of the wind turbines. This is monitored 24 hours a day, 7 days a week.

3.6.5 An operator would be employed to operate and maintain the turbines, largely through remote routine interrogation of the SCADA system. The operator would also look after the day-to-day logistical supervision of the Development and would be on-site intermittently.

3.6.6 Routine maintenance of the turbines would be undertaken approximately twice yearly to ensure the turbines are maintained to Industry Standard. This would not involve any large vehicles or machinery.

3.6.7 If a fault should occur, the operator would diagnose the cause. If the repair warranted the Development being disconnected from the grid then the operator would make contact with NGED. However, this is a highly unlikely occurrence as most fault repairs can be rectified without reference to the network utility. If the fault was in the electrical system then the faulty part or the entire Development would be automatically disconnected until the fault is rectified.

3.6.8 Signs would be placed on the Development giving details of emergency contacts. This information would also be made available to the local emergency services and NGED.

3.7 Decommissioning

3.7.1 One of the main advantages of wind power generation over other forms of energy production is the ease of decommissioning and the simple removal of components from the site. The residual impact on the site is limited to the continued presence of the foundations and access tracks. All above ground structures can be removed from the site.

3.7.2 If the proposed wind farm obtains planning approval it is expected that a planning condition would be imposed to provide for the decommissioning and restoration of the site in accordance with a scheme to be agreed in writing with the Local Authority, which would consider the long term restoration of the site at the end of the lifetime of the Development.

3.7.3 The proposed wind farm would be decommissioned in accordance with best practice at that time and/or in compliance with any planning conditions. Current best practice includes the removal of all above ground structures (e.g. turbines, substation etc); the removal of certain underground structures where required (e.g. cables); and reinstatement of disturbed areas all of which would be subject to any necessary consents. Consideration would be given to the retention of the Wind Farm access tracks.

3.8 Construction and Decommissioning Management

3.8.1 This section details the environmental management controls that would be implemented by RES and its contractors during the construction of the proposed wind farm to ensure that potential significant adverse effects on the environment are, wherever practicable, prevented, reduced and where possible offset.

3.8.2 A CEMP would be agreed with the relevant statutory consultees prior to construction commencing. The purpose of the CEMP is to:

- Provide a mechanism for ensuring that measures to prevent, reduce and where possible offset potentially adverse environmental impacts identified in the ES are implemented;
- Ensure that good construction practices are adopted and maintained throughout the construction of the Development;
- Provide a framework for mitigating unexpected impacts during construction;
- Provide a mechanism for ensuring compliance with environmental legislation and statutory consents;
- Provide a framework against which to monitor and audit environmental performance.

3.8.3 The CEMP would, as a minimum, include details of the following:

- Pollution prevention measures
- Erosion and compaction management
- Control of contamination/pollution prevention
- Drainage management
- Spoil management
- Control of noise and vibration
- Control of dust and other emissions to air.

Site Induction

3.8.4 The principal contractor would ensure that all employees, sub-contractors, suppliers and other visitors to the site are made aware of the content of the CEMP and its applicability to them. Accordingly, environmental specific induction training would be prepared and presented to all categories of personnel working on and visiting the site.

3.8.5 As a minimum, the following information would be provided to all inductees:

- Identification of specific environmental risks associated with the work to be undertaken on-site by the inductee
- Summary of the main environmental aspects of concern at the site as identified in the CEMP
- Environmental Incident and Emergency Response Procedures (including specific Environmental Communication Plan requirements).

3.8.6 A conveniently sized copy of an Environmental Risk Map or equivalent would be provided to all inductees showing all of the sensitive areas, exclusion zones and designated washout areas. The map would be updated and reissued as required. Any updates to the map would be communicated to all inductees through a tool box talk given by specialist environmental personnel. Regular tool box talks would be provided during construction to provide ongoing reinforcement and awareness of environmental issues.

Pollution Prevention, Water Quality Monitoring and Emergency Response Plan

3.8.7 The CEMP would detail a number of measures to deal with pollution prevention, including RES' policies and procedures such as 'Environmental Requirements of Contractors' and 'Procedure in the Event of a Contaminant Spill'.

3.8.8 Contractors and sub-contractors would be required to follow all pertinent Pollution Prevention Guidance. The following pollution control measures would be incorporated into the CEMP:

- Equipment shall be provided to contain and clean up any spills in order to minimise the risk of pollutants entering watercourses, waterbodies or flush areas
- Trenching or excavation activities in open land shall be restricted during periods of intense rainfall and temporary landscaping shall be provided as required to reduce the risk of oil or chemical spills to the natural drainage system
- Sulphate-resistant concrete[2] shall be used for the construction of turbine bases to withstand sulphate attack and limit the resultant alkaline leaching into groundwater
- All refuelling will be undertaken at designated refuelling points. There will be no refuelling within catchments contributing to water supply points
- Equipment, materials and chemicals shall not be stored within or near a watercourse. At storage sites, fuels, lubricants and chemicals shall be contained within an area bunded to 110%. All filling points shall be within the bund or have secondary containment. Associated pipework shall be located above ground and protected from accidental damage
- Any on-site concrete wash-out shall occur in allocated bunded areas
- Drip trays shall be placed under machinery left standing for prolonged periods
- All solid and liquid waste materials shall be properly disposed of at appropriate off-site facilities
- Routine maintenance of vehicles shall be undertaken outwith the site
- There shall be no unapproved discharge of foul or contaminated drainage from the Development either to groundwater or any surface waters, whether direct or via soakaway
- Sanitary facilities shall be provided and methods of disposal of all waste shall be approved by regulatory bodies
- RES has a policy that no wind turbines, auxiliary and electrical equipment would contain askarels or Polychlorinated biphenyls (PCBs).

3.8.9 In the unlikely event of an environmental pollution incident, there would be an emergency response procedure to address any accidental pollution incident. For example, a procedure requiring the use of spill kits to contain the material and procedures to ensure that NRW is notified on their Pollution Hotline number (0300 065300) within 30 minutes of an incident (unless unsafe to do so), would be applied.

Potential Contamination Sources and Pathways

3.8.10 A series of reports were commissioned from Argyll Environmental to determine the potential impact relating to potential land contamination. Argyll Environmental Site Solutions Farm Report

[2] BS EN206:1 : 2000 Concrete Part 1: Specification, performance, production and conformity and BS 8500 – 1 : 2006 Concrete – Complementary British Standard to BS EN 206 – 1 Part 1

(Technical Appendix 3.2) covers the entire proposed wind farm and provides information relating to:

- Authorised industrial processes
- Incidents and enforcements
- Landfill and waste sites
- Current land use
- Historical land use
- Groundwater vulnerability
- Geology
- Environmental sensitivity

3.8.11 Relevant information contained in these reports is presented in drawing Figure 3.11: Potential Contamination Sources.

Authorised Industrial Processes, Incidents and Enforcements or Landfill and Waste Sites

3.8.12 The reports show no records of authorised industrial processes, incidents and enforcements or landfill and waste sites located within or immediately adjacent to the proposed wind farm. Current land use relating to contemporary trade directories and fuel stations also shows no records in the area of interest.

Potentially Contaminative Industrial Uses

3.8.13 Historical land uses include potentially contaminative industrial uses and potentially infilled land (water and non-water), mainly outside of the site. In all cases, these records are located a minimum of 250 m from any proposed wind farm infrastructure.

3.8.14 A number of areas are identified as potentially contaminative industrial uses are defined as "general quarrying" or "mining and quarrying general" dating from mapping between 1896 and 1922. Many of the locations identified as infilled land are associated with the same locations as these industrial uses though dated 1985 or 1990.

3.8.15 Particular areas located within the site or within 1 km of any proposed wind farm infrastructure include:

- General quarrying from 1886 and mining and quarrying general from 1922 located just outside the north-east site boundary, minimum 800 m from the proposed infrastructure associated with turbines 1 and 2. Two of these locations are also defined as unknown filled ground (pit, quarry etc) on 1985 mapping.
- Military land from 1886-1953, potentially a historic rifle range, located at the eastern site boundary, minimum 500 m from the proposed infrastructure associated with turbine 2. This location is also defined as unknown filled ground (pond, marsh, stream, dock etc.) on 1985 mapping.
- General quarrying from 1886 located just outside the eastern site boundary, minimum 250 m from the proposed infrastructure associated with turbine 9.
- General quarrying from 1886-1922 located outside the eastern site boundary, minimum 700 m from the proposed infrastructure associated with turbine 11.
- General quarrying from 1886 and mining and quarrying general from 1886-1902 located at the southern site boundary, minimum 1 km from the proposed infrastructure

associated with turbine 13. Two of these locations are also defined as unknown filled ground (pit, quarry etc) on 1985 mapping.

Groundwater Vulnerability, Geology and Environmental Sensitivity

3.8.16 The groundwater vulnerability section of the reports identifies primary and secondary aquifers across the site. These are described in more detail in Chapter 9: Hydrology and Hydrogeology.

3.8.17 The geology section of these reports identifies geological features which may be linked to potential contamination, primarily related to the South Wales Coal measures formation. The risks associated with coal mining are described in Technical Appendix 9.2: Coal Mining Risk Assessment and related studies presented elsewhere. Investigations have demonstrated that the presence of shallow coal across the site is not expected and will not impact the proposed wind farm.

3.8.18 No areas of nature reserves, national parks or sites of scientific interest, areas of conservation or special protection areas are identified near the proposed wind farm.

Conclusion

3.8.19 Based on the above, the only source of land contamination is linked to potentially contaminative industrial uses, all would seem to be benign in the context of impact on and impact by the proposed wind farm. In all cases, the construction and operation of the proposed wind farm will not require any activities in the vicinity of these locations.

General Drainage Design

3.8.20 As set out in Chapter 9: Hydrology and Hydrogeology, buffers to watercourses have taken account of and infrastructure designed in accordance with best practice guidance.

3.8.21 The potential impact of preferential routing of drainage and associated erosion and sediment wash-off within the sub-catchments draining the site would be mitigated through the following measures which would be incorporated into the SuDS Design:

- Site track construction materials would be free draining, strong, durable and well graded
- Attenuation ponds and silt fences would be provided adjacent to the drains to prevent pollution and sedimentation of watercourses
- Direct drainage into existing watercourses would also be avoided to ensure that sediment and runoff from disturbed ground is not routed directly to the watercourses
- Larger drains would be piped directly under the track through appropriately sized drainage pipes or culverts. Appropriate scour prevention and energy dissipation structures would be constructed at each culvert outlet. Where appropriate, a shallow, lateral drainage swale would be installed at the toe of site track cuttings to intercept the natural runoff. This lateral drain would be piped under the track at regular intervals through correctly sized cross drains away from watercourses. Again appropriate scour prevention and energy dissipation structures would be constructed at each culvert outlet
- Flow and sediment transport in any track drainage swales would be minimised by reducing concentrated flows, installing regular cross culverts and the use of check dams placed at regular intervals within the trackside drainage swales
- Track drainage swales, where required, would discharge into attenuation ponds excavated on the downslope side, or silt fences. A shallow drainage swale would be cut directly downhill as a fan and at minimum slope until the bottom of the swale reaches the natural surface level. The discharge point of track drains would be

constructed to minimise concentrated flows and ensure flows are dispersed over a large area with appropriate surface protection

- The depth of individual drainage swales would be kept to the minimum necessary to allow free drainage of the tracks and swale lengths would be minimised to avoid disruption of natural drainage paths. Direct drainage into existing watercourses would be avoided to ensure that sediment and runoff from disturbed ground is not routed directly to the watercourses.

Runoff and Sediment Control Measures

3.8.22 The following measures would be used to mitigate any potential impacts on the water quality of the sub-catchments through peat erosion, stream acidification and metals leaching during construction. These are incorporated into the Sustainable Drainage Management Plan (SDMP):

- Appropriate sediment control measures (silt fences, attenuation ponds, etc.) would be used in the vicinity of watercourses, springs or drains where natural features (e.g. hollows) do not provide adequate protection
- Sediment control measures (e.g. check dams, silt fences etc.) would be employed within the existing artificial drainage network during construction. These would be regularly checked and maintained during construction and for an appropriate period following completion
- The extent of all excavations would be kept to a minimum and during construction activities surface water flows shall be captured through a series of cut-off drains to prevent water entering excavations or eroding exposed surfaces. If dewatering of excavations is required, pumped discharges would be passed through attenuation ponds and silt fences to capture sediments before release to the surrounding land
- Where there is a permanent relocation of peat, the ground would be reinstated with vegetation as soon as practicable
- Where practicable, vegetation over the width of the cable trenches would be lifted as turfs and replaced after trenching operations to reduce disturbance
- The movement of construction traffic would be controlled to minimise soil compaction and disturbance. Vehicle movements outside the defined tracks and hardstandings would be avoided
- Trenching or excavation activities in open land would be restricted during periods of intense rainfall and temporary landscaping would be provided, as required, to reduce the risk of sediment transport to the natural drainage system
- Construction of the track and cable crossings will cease during periods of heavy rain (>25mm in 24 hours), significant snow event (>75mm lying) or extended period of freezing conditions (ground penetration>100mm). If necessary, upstream of the crossing would be dammed and water pumped around the construction zone. The construction period would be minimised as far as practicable.

Traffic Management Plan

3.8.23 As detailed in Chapter 10: Traffic, Transport & Access, a Construction Traffic Management Plan (CTMP) would be developed pre-construction to ensure road safety for all users during transit of AILs. The CTMP would outline measures for managing the AILs and would set out procedures for liaising with the emergency services to ensure that police, fire and ambulance vehicles are not impeded by the loads. The CTMP would be developed in consultation with the Local Authority, the police and the local community and agreed before deliveries to the Site commence.

Potential Construction and Decommissioning Phase Environmental Impacts

3.8.24 Construction is predominantly a civil engineering operation and would be phased over an approximate 15-month period for the proposed wind farm. Construction of tracks and foundations would be progressive, minimising the number of simultaneously active locations and ensuring that traffic density is kept low. Erection would span approximately 18 weeks toward the end of the work programme.

3.8.25 A programme of site reinstatement and enhancement would be put in place to minimise the visual and ecological impacts on the land.

3.8.26 The proposed wind farm would operate for approximately 35 years and would require only limited maintenance and inspection visits.

3.8.27 A detailed restoration plan / Decommissioning Method Statement would be prepared and agreed with the relevant authorities towards the end of the Development's operational life.

3.9 Carbon Balance Assessment

3.9.1 Volume 4, Technical Appendix 3.1: Carbon Balance Assessment contains an assessment of the carbon balance of the proposed wind farm. The assessment concludes that the proposed wind farm would effectively pay back its expected carbon debt from manufacture, construction, impact on habitat and decommissioning within 1.8 years, assuming it replaces electricity generated by fossil fuels.