3 PROJECT DESCRIPTION

3.1 INTRODUCTION

This chapter of the Environmental Statement (ES) outlines the site selection and iterative design processes and describes Spicer Hill Wind Farm ('the Development'), its components and any embedded mitigation measures. An indication of the proposed construction methods and timescales for both the construction and decommissioning phases is also provided.

3.2 PROJECT OVERVIEW

The proposal is to construct and operate a wind farm with an output of approximately 6.9 MW comprising the following:

- Three wind turbines and associated infrastructure including transformers and crane pads;
- Construction of site entrance;
- Construction of new access tracks;
- Construction of a control building;
- Laying of underground cabling between turbines and to the control building; and
- Erection of one permanent meteorological monitoring mast.

In addition, a temporary construction compound would be needed during the construction phase. The proposed layout of the wind turbines is shown in Figure 1.2. This also shows the location of the access tracks, permanent and temporary anemometer masts, control building and location of the site compound area.

Construction would take place over a period of approximately six months after which the Development would become operational and generate electricity for a 25 year period. After the 25 years it could either be decommissioned or a new planning application lodged to extend the operational life. For the purposes of the planning application and this ES it is assumed that the Development would be decommissioned.

The candidate turbine provisionally selected for this site, would have a maximum hub height of 60 metres (m) and a total height to blade tip of 95 m. The final selection of turbine depends upon the technology available at the time of construction, statutory requirements of tendering, project economics and the desired output from the proposed wind farm. For the purposes of the EIA, as presented in this ES, all assessments have evaluated the effects assuming a worst-case scenario that considers a turbine with the maximum dimesions specified above. An example turbine model that has these dimensions is the Enercon E70.

The Development would connect from the site control building (the location of which is illustrated in Figure 1.2) to the local or national electrical grid and the grid connection will form the subject of a separate application. A study has been carried out which has confirmed that there is capacity within the existing network and also indicates that there are several options available for connecting the proposed turbines to the grid. Should planning permission be granted, further studies will be undertaken to determine the most suitable method and route of connection and the relevant applications made.

The total area within the planning application boundary is 28.39 hectares (ha). It is estimated that the total land take of the wind farm comprising the turbine foundations, access tracks, control building, compound and hard-standings would be approximately 1.42 ha or 5% of the total application area which encompasses only part of the wider study area and landholding.

3.3 SITE SELECTION

Whilst the 2007 White Paper identifies that site selection and consideration of alternative sites is not a requirement this section of the document sets out the site selection process as an example of good practice.

A review of J.G. Pears Ltd ('the Developer') existing land holding was undertaken to ascertain the viability of proposed wind farm development based on the following criteria:

- Wind characteristics;
- Availability of suitable grid connection;
- Construction considerations, including access/ highway capacity and ground conditions;
- Planning policies;
- Landscape and visual considerations, including landscape designations and existing characteristics;
- Sensitivity to noise;
- Likely ecological and ornithological influences; and
- Existing land uses and infrastructure (*e.g.*, service pipes, air traffic issues).

The site at Spicer Hill was identified as the most suitable site within the available landholding based on the aforementioned criteria. The development planning policy framework relevant to the Development site was then reviewed. The review concluded that there were no policy presumptions against wind energy development in this location and that, through sensitive siting and design, a proposal could be developed which could meet the criteria for wind energy development set out in the development plan and make a contribution to the regional energy targets.

The site was then taken forward to the initial design stages when a range of studies were undertaken to identify any constraints to development and inform the iterative wind farm design.

3.4 DESIGN PROCESS

3.4.1 Iterative Design Process

The purpose of a wind farm is to harvest energy from the local wind resource. It is necessary to site a wind farm within an area with sufficient wind speeds and to try to locate individual turbines, within the wind farm, in the optimal position to maximise the wind yield whilst minimising environmental effects. Aesthetic considerations are also important with regard to the aspect of the wind farm from particular locations and viewpoints.

The most favourable layout of a wind farm depends upon a range of criteria. These vary depending on the type and size of turbine alongside the turbulence created by local ground conditions. Technical considerations prescribe that the turbines be spaced at approximately five rotor diameters in the prevailing wind direction and four rotor diameters across the prevailing wind direction. Such spacing, along with environmental constraints, limits the number of turbines which can be located on the site. The available capacity of the electricity grid into which a wind farm connects can also limit its size.

At the initial feasibility stage of the project, three different forms of wind farm development were considered:

- A smaller number of large scale turbines (125 m to tip);
- A larger number of smaller scale turbines (up to 85 m to tip); and
- A number of turbines at a height between the aforementioned tip heights (101 m to tip).

A previous planning application (Reference Number 2008/0804) for the site was submitted by the Developer in April 2008 for a five turbine wind farm. The application was withdrawn following concerns by BMBC over how the development scheme would integrate with consented and proposed wind farm sites after the decommissioning of the adjacent Royd Moor wind farm in 2018, and this resubmission has taken these concerns into cognisance.

Following the prior application to BMBC and taking other factors into consideration, a layout with three turbines with a height to tip of 95 m was decided as the best fit within the local landscape and environment. Whilst some individual responses were sought from consultees, a full scoping exercise for the revised submission was not issued; a scoping report was issued for the prior application with a layout of 5 turbines at a height of 85 m.

The combination of technical and environmental parameters has, through the iterative process of site design, allowed the development of the site layout shown in Figure 1.2. This represents the "best environmental fit" within those parameters. This process has included detailed consultation with officers from BMBC, together with other statutory and non-statutory bodies.

The effects reported in this ES are those relating to the final design of the Development. This layout has evolved from the earlier layout iteration by avoiding, where possible, sensitive areas and developing appropriate mitigation measures for those areas where avoidance was not possible. The main stages of the iteration process are outlined below, highlighting some of the main issues considered and resolved during the development of the final layout.

Table 3.1 Principle Layout Iterations

Iteration	Description	Comment
Pre-Scoping Layouts	3 x 125 m tip height turbines 6 x 80 m to tip height turbines	Used for initial consultation with BMBC prior to previous submission and to establish the capacity of the selected landholding for different forms of wind energy development
Previous Submission Layout	5 x 84 m to tip height turbines	Used to maximise the site generating capacity whilst respecting the Royd Moor Wind farm layout.
Layout Option	3 x 101 m to tip height turbines	Used to maximise the site generating capacity with similar turbine height to consented/ proposed wind farms.
Final Layout	3 x 95 m to tip height turbines	Final positions fixed taking account of landscape and visual, ecological, transport and geotechnical constraints and the hub height of other consented and proposed wind farms.

These layout iterations are shown on Figure 3.1.

For both the previous and current proposals, there were relatively few iterations as part of the EIA and wind farm design process. This was because the site selection process included detailed environmental surveys that highlighted few physical environmental constraints to development, and therefore the need for balancing environmental priorities in locating turbines was limited. As a consequence, the design has been driven largely by landscape and visual amenity considerations.

3.4.2 Embedded Mitigation

Measures proposed to reduce the overall environmental effects during the layout design iterations and other initial proposal decisions are termed 'Embedded Mitigation' measures. In respect of the Development, the measures include avoiding known constraints, including:

- Recorded archaeology;

- Residential property;
- Watercourses; and
- Public roads and rights of way.

These features will be discussed in greater detail within the appropriate technical assessments detailed in chapters 5-14 of this ES.

On-site borrow pits are not proposed as part of the Development. Stone required for the construction of the site will be imported from local quarries. Whilst importing stone for construction increases the volume of traffic for a short period, it prevents long term visual and ecological effects created by excavating borrow pits (small quarries) on-site.

The concrete required for the construction of the site will be imported ready mixed, in part due to the relatively small scale nature of the wind farm development. A concrete batching plant on site would introduce additional environmental effects in terms of visual effects as well as increasing risks to the hydrology and ecology of the area. A batching plant would also require the use of further hard-standing areas for storage of materials which may be extensive. The benefits in avoiding these effects were deemed to outweigh the additional traffic generated by importing the concrete ready mixed.

3.4.3 Micro-siting

The continual enhancement of the scheme will extend into the construction phase. It is therefore established good practice to seek agreement for the micro-siting of the turbines and other wind farm infrastructure within 50 m of the approved centre point.

The eventual turbine positions and all other new infrastructure would remain within the planning application boundary and would avoid blades over-sailing land outside the application boundary.

3.5 WIND TURBINES AND ASSOCIATED INFRASTRUCTURE

3.5.1 Wind Turbines

The scheme would consist of 3 three-bladed horizontal-axis machines and the maximum height to blade tip would be no greater than 95 m. Figure 3.2 illustrates a typical turbine of these dimensions. The blades would be manufactured from fibre-reinforced epoxy and the tower from steel. The nacelle houses the gearbox and generator. Subject to agreement with BMBC, the finish and colour of the turbines is likely to be semi-matt and pale grey.

The turbine would be of a variable speed type, so that the turbine rotor speed would vary according to the energy available in the wind. A typical turbine of this type would have a rotational speed of approximately 6 to 21.5 revolutions per minute generating power from all wind speeds between 3 metres per second (m/s) and approximately 28 m/s (9 and 62 miles per hour (mph) or force 3 to 9 (gale) on the Beaufort Scale). The turbines are computer controlled to ensure that the turbine faces directly into the wind and all times, ensuring optimum efficiency. Table 3.2 shows the proposed turbine specifications.

Table 3.2 Proposed Turbine Specifications

Number of turbines	3
Anticipated turbine rated capacity (MW)	2.3
Number of blades	3
Tower style	Tapered Cylindrical
Maximum hub height (m)	60
Maximum blade diameter (m)	71
Maximum height to blade tip (m)	95
Revolutions per minute	6- 21.5

The Enercon E70 has been selected as the candidate turbine for the Development, however, the final selection of the turbine will be based on an assessment of the most suitable turbine available at the time of procurement and will be subject to competitive tendering.

3.5.2 Wind Turbine Foundations

The form of the wind turbine foundations would depend on

- Site geology;
- Turbine location;
- Turbine manufacturer and type; and
- Turbine manufacturer's ground-stiffness foundation criteria.

Based on the candidate turbine and preliminary site survey work, the geology of sandstone and shale on site suggests that gravity turbine foundations would be achievable. These would take the form of reinforced circular concrete foundations with a diameter of 20 m and 2.5 m deep. Each foundation would contain approximately 350 m^3 of reinforced concrete. The foundation detail is shown on Figure 3.3.

Trial pits have been carried out at each of the proposed turbine locations to ascertain whether the geology will bear the foundations as proposed. The trial pits indicate that the turbines are likely to be viable in the current positions, subject to detailed Site Investigation which would be carried out prior to construction.

3.5.3 Turbine Crane Pads

Each turbine requires an area of hard-standing to be built adjacent to the turbine foundation. This provides a stable base on which to lay down the turbine components ready for assembly and erection and to site the two cranes necessary to lift the three tower sections, the nacelle and rotor components into place.

The turbine erection area would be left in place following construction in order to allow for use of similar plant should major components require to be replaced during the course of the wind farm's operational life. The hard-standing would be covered over with topsoil and allowed to naturally re-vegetate. The total area of hard-standing at each turbine location, including the turbine foundation and the turbine erection area would be approximately 990 m^2 (22 m by 45 m). A typical turbine erection area is illustrated in Figure 3.4.

3.5.4 Control Building, Substation and Grid Connection

The Development exports electricity via connection into the electrical grid and this connection is subject to a separate consenting process. Each of the turbines would be connected to the control building which would then be connected to the local electricity distribution system.

The control building, would comprise a single storey building with a pitched roof, would house switchgear and metering, and protection and control equipment. It would also house a welfare facility for visiting maintenance staff. Rainwater would be collected via a gutter and inlet pipe to fill a header tank and waste would be taken to a closed system and pumped out at regular intervals.

The control building would be finished in materials in-keeping with the local vernacular. Figure 3.5 provides an illustration of the control building.

Should planning permission be granted, a detailed electrical design will be undertaken to confirm the technical specification of the control building and associated switchgear, and the connection point to the existing electricity distribution network, as part of the application process for a grid connection.

3.5.5 Cabling

Underground cabling would link the turbines to one another and to the on-site control building. Detailed construction and trenching specifications would depend on ground conditions encountered. Typically cables would be laid in a trench approximately 1000 mm deep and 500 mm wide. To minimise ground disturbance cables would be along the side of the access tracks where practicable. Figure 3.6 illustrates a typical cable trench.

A Supervisory Control and Data Acquisition (SCADA) system would be installed to gather information from the individual wind turbines and provide the facility to control them from a central location. A fibre optic communications cable would run alongside the power cables to link the turbines to the SCADA system. The wind turbines could then be monitored remotely via a telephone link to the SCADA system.

3.5.6 Meteorological Mast

One permanent meteorological mast (NGR 420450, 404820) will be erected to aid performance monitoring of the wind turbines and to collect and store meteorological data. The mast would be of lattice design and would have a maximum height of 60 m. Figure 3.7 illustrates a typical meteorological mast.

3.5.7 Site Accommodation and Temporary Works

A temporary construction compound with approximate area of approximately 0.65 ha would be located at (NGR 420326, 404755) to provide the following facilities:

- Temporary portable buildings housing site offices and welfare facilities for contractors;
- Septic tank and soakaway;
- Containers used for tool and equipment storage;
- Parking for up to 20 vehicles; and
- Storage of components and materials.

An indicative site compound design is shown in Figure 3.8. The location has been selected to minimise environmental impacts, particularly areas of ecological, archaeological and hydrological interest, and on visibility grounds. It will also facilitate the contractor's on-site safety and security procedures.

The compound will be constructed using a geogrid base, or similar, in order to facilitate removal and reinstatement following the wind farm becoming operational. The compound would be designed so that any contaminated run-off would be directed to a central point and disposed of at an appropriate waste management facility. All portable buildings, machinery and equipment will be removed and the area fully restored in accordance with an approved method statement.

Other temporary fenced areas may be established for storage on the turbine crane pads as appropriate for security in remote parts of the site. These would not require any additional hard-standing areas.

Water for all construction activities would be supplied by a water bowser. Temporary effluent disposal facilities would be provided by 'portaloo' type facilities and emptied as required. There are no mains sewers or water pipes in the vicinity of the site.

3.6 ACCESS TRACKS AND TURNING AREAS

The main site access would be taken from Whitley Road as illustrated in Figure 3.9. The access would be secured by a gate as shown on Figure 3.10. Access tracks would be constructed typically as shown in Figures 3.11A and 3.11B to access individual turbine locations. An estimated 0.7 km of site access tracks would required for the wind farm.

The tracks would have a nominal width of 5 m and may have temporary passing places as required in order to facilitate traffic movement. At bends the track would be widened as appropriate depending on bend radius. Bends would be kept free from obstruction to allow a swept area for traversing by long loads

Access tracks will comprise a geotextile base with crushed stone on top, to a depth appropriate for the ground conditions. A running surface of higher quality finer graded stone will be applied. It is anticipated that tracks will have minimum thickness of 450 mm.

A turning area will be located at each turbine to allow the safe movement of vehicles in forward gear across the site. The turning areas will be constructed in the same way as tracks to an estimated depth of 600 mm.

Access tracks will be reduced in width following construction by laying topsoil on the shoulders of the tracks. The operational width of the tracks will be approximately 3 m which is adequate for routine maintenance.

Turning areas will also be covered with topsoil and allowed to regenerate naturally. In both cases, a geotextile separator would be used between the surface of the stone and the topsoil to minimise cross contamination between soil fines and stone which could weaken the strength of the compacted stone.

3.6.1 Track Layout Design

Various constraints have influenced the site track layout design some of which are generic and some of which are site specific:

- Track length is kept to a minimum;
- Gradients are to be kept to less than 10 degrees where possible to accommodate the requirements of delivery vehicles and to allow construction plant to move safely around the site;
- Track layout is designed to reflect contours, to avoid cross slopes and deep cut and fill sections into existing terrain; and
- Tracks are routed to avoid potentially valuable environmental features.

The final track design resulted from the optimisation of these constraints.

3.6.2 Earthworks and Track Alignment

Localised differences between required construction levels for tracks and existing ground levels will dictate that some earthworks are required in the site.

At each turbine location the turbine erection hard-standing would be constructed to cross falls not exceeding 1:100. Limitations placed on the relative heights of road, hard standing and foundation dictate that a wider area around the foundation and hard standing must be relatively level. On a sloping site such as this, some earthworks will therefore be required. The orientation of the hard-standing, roads and foundation will be adjusted where possible parallel to the contours, to minimise the need for significant earthworks.

It is anticipated that materials for use in cut and fill operations will be balanced on site. No additional material is expected to be imported or exported from site, as a result of these operations.

3.6.3 Drainage System

The drainage system along roads and hard-standings performs three main functions:

- To convey existing field drainage / ditches under or around the new roads / features;
- To convey water course (and large ditches) under the road; and
- To convey surface water across the road where ground slopes are significant or where ponding may otherwise occur as a result of road construction.

Adjacent to cross slope roads, a ditch will be placed on the up-slope side to intercept surface run-off. This will be conveyed under the road at regular intervals and disbursed back in into the ground by surface soakaways which will provide temporary storm storage and allow run-off to infiltrate the ground.

Cross pipes would be laid as required in areas where the position of the site track could lead to ponding on one side. It is currently anticipated that crosspipes will be laid in the vicinity of the site entrance which is currently a marshy area of ground.

The advice of the site ecologist would be sought to ensure that the location and outfall of cross pipes and soakaways minimise vegetation damage or change.

The anticipated track layout will accommodate existing infrastructure services, such as water pipes, by avoiding or bridging them where appropriate, and avoids water crossings.

Further details of measures which would be taken to manage run-off and avoid erosion are provided in Chapter 8: *Hydrology and Hydrogeology* of this ES.

3.6.4 Stone and Concrete Requirements and Sourcing

It is estimated that approximately 24,000 tonnes of stone would be required during the construction of the access track, turbine bases and other infrastructure. Stone would be sourced from local quarries. These quarries would be selected prior to construction following a competitive tendering process. Importing stone for construction, while increasing traffic for a short period, would prevent the additional visual and potentially polluting effects of digging borrow pits on site, and would provide benefits to the local community in terms of indirect economic benefits to the quarries selected.

An estimated 1,200 m^3 of concrete is required for construction of the turbine foundations and control building. Concrete will be imported ready mixed for use on site. The alternative, a

concrete batching plant on site, would introduce additional environmental effects in terms of visual effects and risks to hydrology and ecology. The batching plant would also require the use of further hard standing areas for storage of materials which may be extensive. Given these potentially harmful effects and relatively low volumes of concrete required, a batching plant has not been included in the project design.

3.7 DEVELOPMENT CONSTRUCTION

It is estimated that construction would take approximately six months, subject to the final details of the scheme, weather and ground conditions, with an additional final month for testing and commissioning. The construction process would comprise the following principal activities:

- Site survey and preparation;
- Construction of access tracks and passing places;
- Remedial works to lengths of the public highway to facilitate turbine delivery;
- Construction of the contractors compound including temporary site office facilities;
- Construction of the crane pads;
- Construction of the turbine foundations;
- Construction of the site control building;
- Excavation of the cable trenches and cable laying;
- Delivery and erection of wind turbines and permanent meteorological mast;
- Testing and commissioning of the wind farm; and
- Site restoration.

The majority of these operations would be carried out concurrently, albeit principally in the order identified, in order to minimise the overall length of the construction programme. In addition, development would be phased such that the civil engineering works would be continuing in some parts of the site whilst wind turbines are being erected in other areas. Site restoration would be programmed and carried out to allow restoration of disturbed areas as early as possible.

Table 3.3 shows an indicative schedule of construction activities. Should the project be granted planning consent, a more detailed programme of works would be produced jointly with the appointed construction contractors and would be agreed with the local authority and any other relevant bodies prior to commencement to ensure full compliance with planning conditions and health and safety considerations.

Prior to the main construction works commencing on-site, enabling works would be required. These would be phased into the pre-construction period, and include

- Off-site access consultation with regulatory authorities; and
- Detailed site investigation works.

Table 3.3 Indicative Construction Programme

Construction Activity	Months						
	1	2	3	4	5	6	7
Site Compound Set Up							
Site Tracks							
Erect Temporary Met Mast							
Turbine Crane Hard Standings							
Turbine Foundations							
Erect Control Building							
Erect Permanent Met Mast							
Install Site Cabling							
Install Switchgear/ Metering							
Install Transformers							
Turbine Erection							
Connection Commissioning							
Turbine and SCADA Commissioning							
Performance Testing							
Site Reinstatement							

In order to ensure that all the mitigation measured outlined in this ES are implemented, contractors would be provided with relevant documents pertaining to for example, pollution prevention measures, noise control measures and traffic management.

The contractor would maintain a clean and tidy site and manage the site area in accordance with best practice.

3.7.1 Waste Management

Wherever possible, excavated stone or soil will be reused on-site, primarily for restoration of disturbed ground.

Topsoil would be removed from the surface of proposed construction locations around the site and stored. It would then be used as necessary for land reinstatement following construction. Any excess would be used by the Developer or removed to a licensed waste disposal site. Other materials removed from site would also be disposed of in the same manner in accordance with relevant waste handling regulations at the time.

3.7.2 Site Specific Safety and Emergency Procedures

This would be addressed initially as part of the pre-tender process. A pre- Construction Information Pack will be prepared by the Construction and Design Management (CDM) Co-ordinator under the Construction (Design and Management) Regulations 2007. The Principal Contractor will be required to prepare a Construction Phase Health and Safety Plan and forward the information to the CDM Co-ordinator during the works to enable the Health and Safety File to be completed.

Access to the site may be temporarily restricted during construction for health and safety reasons.

An Operation and Maintenance Manual for the design life of the Development would also be prepared by the contractor which would cover all operational and decommissioning safety related procedures.

3.8 OPERATION

Wind farm operation would be overseen by suitably qualified local contractors who would visit the site regularly to carry out maintenance. The following turbine maintenance would be carried out along with any other maintenance required by the manufacturer's specifications:

- Initial service;
- Routine maintenance and servicing;
- Gearbox oil changes; and
- Blade inspections.

Routine servicing would take place twice per year, with a main service at once every year and a minor service at six months. Servicing would include the performance of tasks such as maintaining bolts to the required tension, adjustment of blades, inspection of blade tip brakes and inspection of welds in the tower. In addition oil sampling and testing from the main gearbox would be required and oil and components replaced at regular intervals. Other visits to the site would take place approximately once per month to ensure that the turbines are operating at their maximum efficiency. In the event of any unexpected events on site, such as the failure of a generator or gearbox, appropriate maintenance works would be carried out.

Ongoing track maintenance would generally be undertaken in the summer months when tracks are dry. Safe access would be maintained all year round.

3.8.1 Site Signage

The Development would have a series of directional and information based signs, which would include a sign at the site entrance showing the Developers' name and the name of the wind farm.

Each of the turbines will have a sign indicating turbine number, potential hazards and an emergency contact telephone number. Signage would be erected at the proposed control building with the operators' name, health and safety information and an emergency telephone number.

The final location and design of the proposed signage would be agreed prior to the wind farm becoming operational.

3.9 DECOMMISSIONING

The Development has been designed to have an operational life of 25 years. At the end of this period it would be decommissioned, under consent granted following this application. To extend the operational life of the wind farm, a further planning application would have to be made and approved in advance.

When dismantling and removing the turbines, the bases would be removed to a depth of approximately 1 m below ground level and all the cables cut and left in the ground. Typically decommissioning would involve the removal of the upstand plinth and the top surface of the foundation base. The area would then be reinstated with a final layer of topsoil over the foundation.

Demolition of the control building would involve the removal of the equipment followed by the demolition of the building and reinstatement of the area.

Roads would either be left for use by the landowner or covered with topsoil and no stone would be removed from the site. This approach is considered to be less environmentally damaging than seeking to remove all foundations, cables and roads entirely.

It is estimated that decommissioning a wind farm of this size would take approximately six to eight months.