This Environmental Statement has been prepared in support of a planning application for the development of a wind farm at Galawhistle near Douglas.

The Environmental statement comprises the following documents:

- Non-Technical Summary (NTS)
- Environmental Statement Volume 1
- Environmental Statement Volume 2
- Technical Appendices
- A Confidential Annex

The following technical appendices are included within the technical appendix volume:

- Carbon Balance
- Ornithology
- Peat Stability Assessment

A Planning Statement has been prepared and will be submitted in support of the application.

The Environmental Statement can be viewed, along with the other documents referred to in this section at the South Lanarkshire and East Ayrshire Council Offices, and selected deposit locations.

Further copies of the NTS are available free of charge and the Environmental Statement may be purchased for £300 per hard copy or £10 for CD-ROM from:

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Glossary

General

Access tracks: The hardstanding tracks within the site boundary which will be constructed (or upgraded for existing tracks) to allow access to construction and operational vehicles to the site infrastructure.

Baseline Studies: This is work done to determine and describe the environmental conditions against which any future changes can be measured or predicted and assessed.

Consultation: A formal request to a statutory or non-statutory organisation for information relevant to a proposed development site, which may influence the EIA of Planning Application.

Cumulative effects: These effects can be caused by a number of developments which, individually and in themselves, may have insignificant effects, but together combine to create a significant effect; for example, too many houses built in the countryside can change and diminish the character of an open landscape; cumulative effects can also be caused by the combination of several types of effects on the same feature or receptor, such as three developments near a housing area - one causing dust, the second causing smell and the third causing noise.

Effects: They are the results of the changes for specific environmental resources.

Environmental impact: A change brought about in the existing environment which results in an effect, adverse, beneficial or both.

Environmental Impact Assessment (EIA): The systematic, reproducible and interdisciplinary identification, prediction and evaluation, mitigation and management of impacts from a proposed development and its reasonable alternatives. The need for a planning application to be accompanied by an EIA can be established with reference to The Environmental Impact Assessment (Scotland) Regulations 1999 (EIA Regulations).

Environmental Management Plan: A structured plan that outlines monitoring and management requirements arising from an EIA.

Environmental Sensitive Areas: An area designated under the Agriculture Act 1986 designed to promote agricultural practices, distinctive landscapes and maintenance of wildlife habitats or historic features.

Environmental Statement (ES): This is the written record of the EIA. Information for inclusion within an ES is contained within Schedule 4 to the EIA Regulations.

Geographical Information Systems: Computer database of environmental information that can be easily updated and manipulated to assist in impact predictions and presentation.

Impacts: They are any changes attributable to the proposed development that have the potential to have environmental effects (i.e. they are the cause of the effects).

Installed Capacity: Maximum theoretical electricity generation capacity.

Iteration: A stage in the iterative process.

Iterative Process: The process by which proposals are refined through a cycle of development and assessment against environmental constraints identified during the EIA process.

Magnitude: Degree, extent and/or duration of effect.

Mitigation Measures: Methods employed to avoid, reduce, remedy or compensate for significant adverse impacts of development proposals.

Potential Effect: Effects that could occur in the absence of appropriate design measures.

Predicted Effect: Those effects which are predicted as a consequence of the development.

Residual Effect: The predicted effect following implementation of mitigation measures.

Scoping: The process of identifying the issues to be addressed by an EIA, it is a method of ensuring that an EIA focuses on the important issues and avoids those that are considered to be less significant.

Significance: The core of impact identification, prediction and evaluation.

Site Infrastructure: The physical elements of the wind farm such as buildings, turbines and compounds, which will be installed as defined in the project description.

Stages of Development: The three stages of development are construction, operation and decommissioning.

Wind Farm Site/the site: The area within the red line boundary including all land and infrastructure.

The Study Area: The area assessed during a technical assessment which may differ from the site red line boundary.

The Wind Farm: The Galawhistle wind farm site, all land and infrastructure.

Red line boundary: The site boundary as shown on the planning figures and all figures within the ES.

Landscape and Visual

Landscape Capacity: The degree to which a particular landscape character type (LCT) or area is able to accommodate change without unacceptable effects on its character. Capacity varies according to the type and nature of the change being imposed, and will reflect both the sensitivity of the landscape resource and its visual sensitivity.

Landscape Character: The distinct and recognisable pattern of elements that occurs consistently in a particular type of landscape, and how this is perceived by people.

Landscape Quality (or condition): Based upon judgements about the physical state of the landscape and about its intactness from visual, functional, and ecological perspectives. It also reflects the state of repair of individual features and elements which make up the character in any one place.

Landscape Sensitivity: A measure of how vulnerable landscape character is to change. Landscapes which are highly sensitive are at risk of having their key characteristics fundamentally altered, leading to a different landscape character. Sensitivity is assessed by considering the physical characteristics and the perceptual characteristics of landscapes in light of particular forms of development'.

Landscape Value: The relative value or importance attached to a landscape (often as a basis for designation or recognition), which expresses national or local consensus, because of its quality, special

features including perceptual aspects such as scenic beauty, tranquillity or wildness, cultural associations or other conservation issues.

Ecology terminology

Ancient woodland: Ancient woods in which the former tree cover has been replaced, often with non-native trees. For Scottish woods, the category Ancient' comprises woods recorded as being of semi-natural origin on either the 1750 Roy maps OR the 1st Edition Ordnance Survey maps of 1860. This is due a) to the likelihood of the latter having been omitted from the Roy maps and b) to render the Scottish classification compatible with that for England and Wales.

Appropriate Assessment: Assessment by a competent authority to assess the effects of the plans and projects that either alone or in combination with other plans and projects are likely to have a significant effect on a European designated site (part of the Natura 2000 network). It is a requirement of the European Habitats Directive.

Area of Outstanding Natural Beauty (AONB): An AONB is an area designated by the Countryside Commission under the National Parks and Access to the Countryside Act 1949 for its attractive landscape which is protected as part of national heritage.

Area of High Archaeological Potential (AHAPs): Areas identified as most likely to contain important archaeological features and artifacts.

Badger sett: Underground structure in which the badger social group lives and shelters during the day.

Bat roost: Any place where one or more bats rest.

Bat maternity roost: Where females gather to give birth to their young.

Bat hibernation roost (or hibernaculum): Place where bats hibernate (state of torpor) during winter.

Biodiversity: it is the variation of life forms within the variation of life forms within a given ecosystem, biome or entire earth.

Conservation Areas: Areas of special architectural or historic interest whose character or appearance is desirable to preserve or enhance.

Country: Land outside of the development boundaries of settlements designated in the development plan and shown on proposals maps in Local Plans.

Cultural Heritage: Important historic and cultural features including ancient monuments, archaeological sites, conservation area, and historic buildings.

Fauna: all members of the animal kingdom: vertebrates (e. g birds, mammals and fish) and invertebrates (eg insects).

Flora: all members of the plant kingdom: higher ferns, ferns and fern allies, mosses and liverworts, algae and phytoplankton, fungi and lichens.

Habitat: place where species live e. g plant communities or agglomerations of plant communities.

Historic parks and Gardens: Parks and Gardens before 1939 which still retain their special interest.

NVC - National Vegetation Classification: Is a 'phytosociological' classification, classifying vegetation solely on the basis of the plant species of which it is composed of. The resulting communities can usually be correlated to other factors, especially geology and soils, age and management; but the plant species alone are used to assign the vegetation to a community.

Otter couch: Above-ground resting places.

Otter holt: Below-ground resting places.

Ramsar Sites: These are designated under the Convention of wetlands of International Importance especially as Waterfowl Habitat or Ramsar Convention.

Semi-natural ancient woodland: Composed of native tree species that have not obviously been planted. The SNH's dataset contains information gathered by remote means using 1970s sources (maps, aerial photos) about the woodland cover present on Ancient & Long-Established Woodland Inventory sites. It does not contain information about woods not on the Inventory.

Sites of Special Scientific Interest (SSSI): Areas of land or water, statutorily notified by SNH, under the Wildlife and Countryside Act 1981 and the Nature Conservation (Scotland) Act 2004.

Special Area of Conservation (SAC): An area protected under the Natura 2000 Network which was established through the 1992 European Community Directive on the Conservation of natural habitats and of wild fauna and flora (92/43/EEC).

Special Landscape Features: Individual features which make a notable contribution to the character of the landscape.

Special Protection Area (SPA): Designated under the provision of the 1979 European Community Directive on the Conservation of Wild Birds (79/409/EEC), as being of international conservation importance to birds.

Spraint: Faeces used as territorial markers.

Wetlands: Low-lying and poorly drained land. These can sometimes provide valuable environmental conditions for the creation of important wildlife habitats.

Hydrology, hydrogeology and geology terminology

Alluvium: Deposits of clay, silt, sand, gravel or other particulate matter by erosional processes, usually by streams or other body of running water.

Aquifer: A geologic formation which contains sufficient saturated permeable material to yield significant quantities of water to wells and springs.

Attenuation: The process where the flood crest is reduced as it progresses downstream.

Drainage: An area having a common outlet for its surface runoff, also known as watershed, catchment area and drainage basin.

Erosion: Wearing way of the lands by running water, glaciers, winds, and waves. It is also subdivided into three process: corrosion, corrosion and transportation.

Geology: The study of the earth – materials of which it is made and the processes that act on these materials, products formed and history of life and the planet.

Groundwater: Water found beneath the ground surface.

Hydrology: The applied science which is concerned with the occurrences, distribution, and circulation of water and its relation to life on earth and earth itself.

Hydrogeology: the science of the occurrence, movement, abundance, distribution, and quality of water in the Earth's soils and rocks and related surface waters as well as interactions between water and geologic materials.

Impermeable: Material that does not permit fluids to pass through it.

Infiltration: Movement of water through the soil surface into the soil.

Interflow: The lateral motion of water through the upper layers of soil and into a stream channel.

Lithosphere: Part of the earth that is composed predominantly of rocks.

Percolation: The movement of water through the openings in rock or soil.

Reservoir: A manmade facility for the storage, regulation and controlled release of water.

Runoff: The part of precipitation that flows toward the streams on the surface of the ground or within the ground.

Noise terminology

Ambient Noise: The ambient noise level is the overall level of noise present at a particular location, including both the background noise and any specific noise sources.

Background Noise: The background noise level is the under lying level of noise present at a particular location for the majority (usually 90%) of a period of time. As such it excludes any short-duration noises, such as individual passing cars (but not continuous traffic), dogs barking or passers by. Sources of background noise typically include such things as wind noise, traffic and continuously operating machinery (e.g. air conditioning or generators).

Specific Noise: This term is used to refer to a particular noise source that is being discussed or investigated and that while it may form a component of the ambient noise, is distinct from the background noise. In the context of the preceding chapter, the noise from wind turbines could be considered as a specific noise source.

Decibel (dB): The decibel is the basic unit of noise measurement. It relates to the pressure created by the sound (Sound Pressure Level) and operates on a logarithmic scale, ranging upwards from 0 dB. 0dB is equivalent to the normal threshold of hearing at a frequency of 1000Hz. Each increase of 3 dB on the scale represents a doubling in the Sound Pressure Level, and is typically the minimum noticeable change in sound level under normal listening conditions. For example, while an increase in noise level from 32 dB to 35 dB represents a doubling in sound pressure level, this change would only just be noticeable to the majority of listeners.

dB(A): Environmental noise levels are usually discussed in terms of dB(A). This is known as the A-weighted sound pressure level, and indicates that a correction factor has been applied, which corresponds to the human ear's response to sound across the range of audible frequencies. The ear is most sensitive in the middle range of frequencies (around 1000-3000Hz), and less sensitive at lower and higher frequencies. The A-weighted noise level is derived by analysing the level of a sound at a range of frequencies and applying a specific correction factor for each frequency before calculating the overall level. In practice this is carried out automatically within noise measuring equipment by the use of electronic filters, which adjust the frequency response of the instrument to mimic that of the ear.

A scale of common noise sources compared to wind turbines is presented below (Source PAN45).

Source/Activity	Indicative Noise Level dB(A)
Threshold of Pain	140
Jet aircraft at 250 m	105
Pneumatic drill at 7 m	95
Truck at 30 mph at 100 m	65
Busy general office	60
Car at 40 mph at 100 m	55
Wind farm at 350 m	35-45
Quiet bedroom	20
Rural night-time background	20-40
Threshold of hearing 0	0

Free Field: This term refers to a location where the propagation (movement) of sound is not affected by the presence of obstacles or surfaces which would cause reflections (echoes).

Frequency: The frequency of a sound is equivalent to its pitch in musical terms. The units of frequency are Hertz (Hz), which represents the number of cycles (vibrations) per second.

$L_{A90,t}$: This term is used to represent the A-weighted sound pressure level that is exceed for 90% of a period of time, t. This is used as a measure of the background noise level.

$L_{Aeq,t}$: This term is known as the A-weighted equivalent, continuous sound pressure level for a period of time, t. It is similar to an average, and represents the sound pressure level of a sound of continuous intensity that would result in an equal quantity of sound energy as a sound which varies in intensity.

Low frequency noise: Noise at the lower end of the range of audible frequencies (20Hz – 20kHz). Usually refers to noise below 250Hz. Should not be confused with infrasound, which is sound below the lowest audible frequency, 20Hz.

Noise: Unwanted sound. May refer to both natural (e.g. wind, birdsong etc) and artificial sounds (e.g. traffic, noise from wind turbines, etc).

Noise contour plot: A diagram showing lines of equal sound levels in a similar manner to height contours on an Ordnance Survey map or isobars (lines of equal pressure) on a weather map.

Noise sensitive receptors: Locations that may potentially be adversely affected by the addition of a new source of noise. Can include residential properties, outdoor areas and sensitive species.

Sound power (W): The sound energy radiated per unit time by a sound source, measured in watts (W).

Sound power level (Lw): Sound power measured on the decibel scale, relative to a reference value (Wo) of 10^{-12}W.

Sound pressure (P): The fluctuations in atmospheric pressure relative to atmospheric pressure, measured in Pascals (Pa).

Sound pressure level (Lp): Sound pressure measured on the decibel scale, relative to a sound pressure of 2×10^{-5} Pa.

Tonal element: A characteristic of a sound where the sound pressure level in a particular frequency range is greater than in those frequency ranges immediately above higher or lower. This would be perceived as a humming or whining sound.

Vibration: In this context, refers to vibration carried in structures such as the ground or buildings, rather than airborne noise.

Chapter 1 - Introduction

1.1 In line with the requirements of the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 (the EIA Regulations) an application under Section 36 of the Electricity Act 1989 for Galawhistle Wind Farm will be submitted to the Scottish Ministers for determination. This Environmental Statement (ES) will accompany the Section 36 application.

1.2 Any proposal to construct or operate a power generation scheme with a capacity in excess of 50 megawatts requires Scottish Ministers' consent under Section 36 of the Electricity Act 1989. Schedule 9 of the Act places on the developer a duty to "have regard to the desirability of preserving the natural beauty of the countryside, of conserving flora, fauna and geological and physiological features of special interest and of protecting sites, buildings and objects of architectural, historic or archaeological interest".

1.3 Under the terms of the EIA Regulations, an Environmental Impact Assessment (EIA) has been carried out to identify and assess the likely environmental effects of the proposed development and recommend mitigation measures. This ES reports the findings of the EIA. Chapter 2 (EIA Approach) describes the EIA process in detail.

1.4 Galawhistle Wind Farm is approximately 7km east of Muirkirk in East Ayrshire and 4km west of Douglas in South Lanarkshire. The location of the Wind Farm and planning application boundary is shown in Figure 1.1. The majority of the Wind Farm site is located in South Lanarkshire but two turbines, one permanent anemometer mast and some of the access tracks lie within the administrative boundary of East Ayrshire (Figure 1.2). The proposal is for the construction and operation of a maximum of 22 wind turbines with a maximum installed capacity of 55 megawatts (MW) (2.5 MW per turbine) and other associated infrastructure including:

- One permanent anemometer mast;
- Wind Farm Substation;
- Scottish Power Substation (for proposed grid connection);
- Transformers and cables from the wind turbines to the Wind Farm substation;
- Four Borrow Pits;
- Upgrade of existing access tracks;
- Construction of new access tracks;
- Crane hardstanding areas adjacent to each wind turbine;
- Temporary construction compound; and
- Temporary laydown area.

1.5 The full details of the proposed Wind Farm project are provided in Chapter 3 (Project Description).

1.6 It is proposed that the Wind Farm would generate electricity for 25 years after which time it would be removed or an application made for further planning permission to extend the duration of operation at the site.

Structure of the Environmental Statement

1.7 This ES comprises the following stand alone documents:

- Non-Technical Summary (NTS) which summarises the key information presented in the ES in a non-technical manner;
- The ES which reports the findings of the EIA;
- Technical Appendices detailing technical information associated with the EIA assessments; and
- Confidential Annexes containing sensitive ecological information not made available to the public.

1.8 The ES is structured as follows:

- Chapters 1 – 4 contain background information on the project, EIA, methodology and planning policy.
- Chapters 5 -13 contain technical assessments of the potential environmental effects and mitigation measures proposed and/or adopted during the project to avoid or reduce such effects.

The Developer

1.9 Infinis is the UK's largest purely renewable energy company, and is focused exclusively on producing energy from a variety of renewable sources including wind, biomass, and landfill gas (http://www.infinis.com). The company operates approximately 260MW of installed generating capacity in the landfill gas sector, producing approximately 8% of the UK's renewable electricity. In addition to existing generation capacity from landfill gas, Infinis is currently developing further renewable energy projects in the landfill gas, wind and biomass sectors.

1.10 In the wind sector, Infinis has planning permission for a 27MW wind farm in North Lanarkshire and a further two sites proposed for development as follows:

- Burnhead Wind Farm, East Ayrshire: 47.5MW (Planning Application submitted for determination); and
- Westfield Wind Farm, Fife: 12.5 MW (Planning Application submitted for determination).

Project Team

1.11 RPS Planning and Development (RPS) has prepared the ES and managed the EIA process. In addition to RPS, specialist consultants selected by Infinis for their technical services and expertise in their field, have been consulted. The complete team of consultants involved in the EIA are listed in Table 1.1.

Table 1.1: The EIA Team

Specialist Input	Consultant
Planning and Renewable Energy Policy Context	RPS/ Jones Lang LaSalle
Landscape and Visual Assessment	Land Use Consultants
Ecology and Ornithology	RPS
Hydrology, Hydrogeology and Geology	RPS
Peat Slide	RPS
Cultural Heritage	RPS
Noise	RPS
Traffic, Transport and Access	RPS
Tourism, Socio-Economics and Land use	RPS
Shadow Flicker and Telecommunications	RPS

Specialist Input	Consultant
Aviation	Pager Power
Geotechnical	Donaldson Associates
Wind Resource	Sgurr Energy
Legal Review	Shepherd and Wedderburn LLP

1.12 Brief descriptions of the above named consultants are provided below.

RPS

1.13 RPS is one of the UK's largest environmental consultancies and has been responsible for management of the EIA, preparation of the ES and the technical assessments outlined in the table above. The RPS team has over 100 consultants, technicians and engineers with specific skills and experience relevant to wind development projects. RPS has been engaged on onshore wind projects totalling over 3,000 MW.

Jones Lang LaSalle

1.14 Jones Lang LaSalle is one of the worlds leading property and development advisors. The firm has been represented in Scotland since 1963 and is a leading planning consultancy, advising on numerous wind farm, grid reinforcement and other renewable energy developments throughout the UK. Advice is provided from feasibility stage, to project development and EIA, through to purification of conditions and to the implementation stage.

Land Use Consultants (LUC)

1.15 LUC was established in 1966 and is one of the country's leading environmental consultancies, with offices in Edinburgh, Glasgow, London and Bristol. LUC has a long and successful track record in undertaking Landscape and Visual Impact Assessments (LVIA) as part of the wider EIA process, particularly for major wind farm projects in recent years.

Pager Power

1.16 Pager Power is established as a leading authority within the field of aviation studies. The managing director has developed a range of specialist software that provides technical analysis on the impact of wind farms on radar and communications links. Pager Power works with leading energy companies and wind farm developers and provides aviation and communications assessments.

Donaldson Associates

1.17 Donaldson Associates employ a wide ranging experienced geotechnical and geological staff with a variety of backgrounds from specialist contractors (tunnelling, site investigation, piling) through traditional consultants (roads, rail, foundations) to highly specialist experts with an academic background (Finite Element and Numerical Modelling, Seismic Hazard Assessment). With this integrated specialist team Donaldson Associates can understand and deal with a project from its initial origin/perception, through detailed design to implementation, construction and supervision in the field.

SgurrEnergy

1.18 SgurrEnergy is a leading independent engineering consultancy delivering technical advisory services to utilities, renewable energy developers, manufacturers and finance houses. They offer services for the full project lifecycle including feasibility, design, technology specification and review, wind monitoring, resource assessment and energy yield prediction, right through to construction management, operations and maintenance support, performance assessment and post-investment appraisal.

Justification for Development

Climate Change and Finite Fuel Sources

1.19 Chapter 4 (Planning and Renewable Energy Policy Context) provides a detailed description of the planning and renewable energy policy context relevant to the application.

1.20 There is now unequivocal evidence of climate change, from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level[1]. The main human influence on global climate is emissions of key greenhouse gases, specifically: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O).

1.21 The Intergovernmental Panel on Climate Change (IPCC), a body of United Nations scientists which monitors studies examining the effects of climate change, reported an increase in atmospheric CO_2 concentration from a pre-industrial value of about 280 parts per million (ppm) to 379 ppm in 2005. About two-thirds of the observed increased atmospheric carbon concentration is due to the carbon emissions released from the burning of traditional fossil fuels (notably coal and oil).

1.22 This increase in the concentration of CO_2 and other greenhouse gases in the atmosphere in turn affect the way the earth retains heat and the world's leading environmental scientists have concluded this process is leading to an increase in the earth's average temperature, causing climate change.

1.23 In addition, concerns currently exist about the long-term viability of the use of fossil fuels to generate energy, due to the finite nature of the fuel. There are also concerns that too heavy a reliance on imported fuels could threaten the UK's security of supply even in the relatively short-term future, due to political instability.

The Advantages of Renewable Energy

1.24 There is now general consensus within the scientific community that the adoption of renewable energy (wind, solar, hydro, tidal, geothermal) is more likely to produce a more secure and long-term energy supply than the continuation of fossil fuel energy generation[2]. Unlike fossil fuel energy generation, renewable energy does not significantly contribute to climate change, and is infinite (effectively) by harnessing energy created by natural resources.

[1] IPCC, AR4 Synthesis Report 2007
[2] DEFRA, http://www.defra.gov.uk/sustainable/government/what/index.htm

Wind Power

1.25 The harnessing of wind energy is one of the best placed renewable technologies available in Scotland because it is one of the windiest countries in Europe[3] and improvements in technology have resulted in the cost of wind power falling close to those of conventional sources of electricity. Wind is therefore both the most abundant and one of the cheapest of the UK's renewable resources[4].

Galawhistle Wind Farm

Energy Generation

1.26 The proposed Galawhistle Wind Farm would have the capacity to produce a maximum of 469.9 gigawatt hours (GWh) of electricity per annum assuming all turbines are operating at full potential for 24 hours a day at optimum wind speed. Due to natural variations in wind speed it has been estimated that the output from a wind farm is on average 30% of the maximum output[5]. The energy output from the Galawhistle Wind Farm would therefore be approximately 140.9 GWh per annum.

1.27 Based on 2006 electricity sales data[6], the average Scottish household uses 4.5 MWh per annum, thus the Wind Farm would be able to provide electricity for approximately 31,311 households. In 2008, there were approximately 135,547 households in the South Lanarkshire Council area[7] and in 2001, approximately 50,346 households in the East Ayrshire Council area[8]. Therefore, the equivalent of approximately 17% of households across both South Lanarkshire and East Ayrshire councils could have their annual electricity consumption supplied by Galawhistle Wind Farm. This percentage may decrease slightly during the lifetime of the wind farm due to predicted population growth in Scotland as a whole[9]. However, there is also the strong possibility that domestic electricity consumption may reduce due to energy efficiency measures that are currently being proposed the Scottish Government[10] which would increase proportionately, the percentage of renewables.

Carbon displacement

1.28 It is widely recognised that wind farms save carbon emissions during operation when compared to fossil fuel energy generation. However, carbon losses and gains during the construction and operation of the wind farm need to be evaluated on a site specific basis.

1.29 Scottish Natural Heritage (SNH) produced a Technical Guidance Note in 2003 for calculating carbon 'payback' times for wind farms[11]. Nayak *et al.*[11] updated this guidance in 2008 and devised a carbon balance tool for wind farms being constructed on peatlands which considers the impacts of wind farms during construction and operation on soil stability and long-term greenhouse gas emissions[12]. This tool was used to calculate the carbon balance (sum of the carbon losses and gains) for Galawhistle Wind Farm and takes into account peat removal, drainage, habitat improvement and site restoration. Technical Appendix 3 (Peat Slide Risk Assessment) Chapter 8 (Hydrology, Hydrogeology and Geology) discuss peat on site in more detail.

1.30 Table 1.2 shows the calculated carbon 'payback' time associated with Galawhistle Wind Farm over a 25 year operating period. A breakdown of the input values and total carbon losses and gains associated with the Wind Farm are shown in Technical Appendix 1.

Table 1.2 Galawhistle Wind Farm Carbon Balance and Payback

Carbon Saving over Wind Farm Lifetime (t CO_2 eq/ yr $^{-1}$)*	Total Payback Time (yr)**
62152	2.4

*Saving compared to grid-mix electricity generation

**The carbon payback time is calculated by comparing carbon emissions from the site due to wind farm construction with the carbon savings achieved by the Wind Farm during a 25 year operating period.

1.31 The estimated total carbon payback time of the Wind Farm, based on carbon emissions and savings, is 2.4 years (Table 1.2). Galawhistle Wind Farm could save 62152 tonnes of CO_2 equivalent emissions per annum being released into the atmosphere over its lifetime (25 years), if using a fossil fuel mix of electricity generation as the counterfactual.

[3] BWEA, http://www.bwea.com/media/news/141105.html
[4] Sustainable Development Commission (2005): Wind Power in the UK - A guide to the key issues surrounding onshore wind power development in the UK
[5] BERR, http://www.berr.gov.uk/files/file43950.pdf (the average capacity factor varies between 27 and 34% for Scotland) ,
[6] BERR, http://stats.berr.gov.uk/energystats/dukes08_c5.pdf
[7] General Register Office for Scotland, http://www.gro-scotland.gov.uk/statistics/council-areas-map/south-lanarkshire.html
[8] East Ayrshire Council: http://www.east-ayrshire.gov.uk/corpres/admin/eabynos.pdf
[9] General Register Office for Scotland, http//:www.gro-scotland.gov.uk
[10] Scottish Government, http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Action/energy-efficiency-policy/ActionPlan
[11] SNH, http://www.snh.org.uk/pdfs/polstat/caf.pdf
[12] Nayak *et al* (2008) Calculating Carbon Calculations from Windfarms on Scottish Peatlands – A New Approach

Chapter 2 – Approach to EIA

Introduction

2.1 An Environmental Impact Assessment (EIA) is carried out by, or on behalf of, the developer of certain types of proposed developments in order to help refine the development design and ultimately to assist the determining authority in considering the planning application. EIA involves the identification, assessment and description of all the likely significant environmental effects of the proposed development. This process allows for negative impacts to be indentified and avoided wherever possible. This chapter sets out the broad method of approach taken to assess the proposed Galawhistle Wind Farm, which is in line with EIA best practice.

Legislative Context

2.2 Any proposal to construct or operate a power generation scheme with a capacity in excess of 50 megawatts (MW) requires Scottish Ministers' consent under Section 36 of the Electricity Act 1989. According to the Electricity Works (Environmental Impact Assessment) (Scotland) (EIA) Regulations 2000, any development that is subject to Section 36 application that is also considered likely to have significant effect on the environment must also be subject to an EIA. The proposed development has a maximum capacity of 55 MW and as such requires Scottish Ministers' consent under Section 36 of the Electricity Act 1989 and an EIA.

Guidance

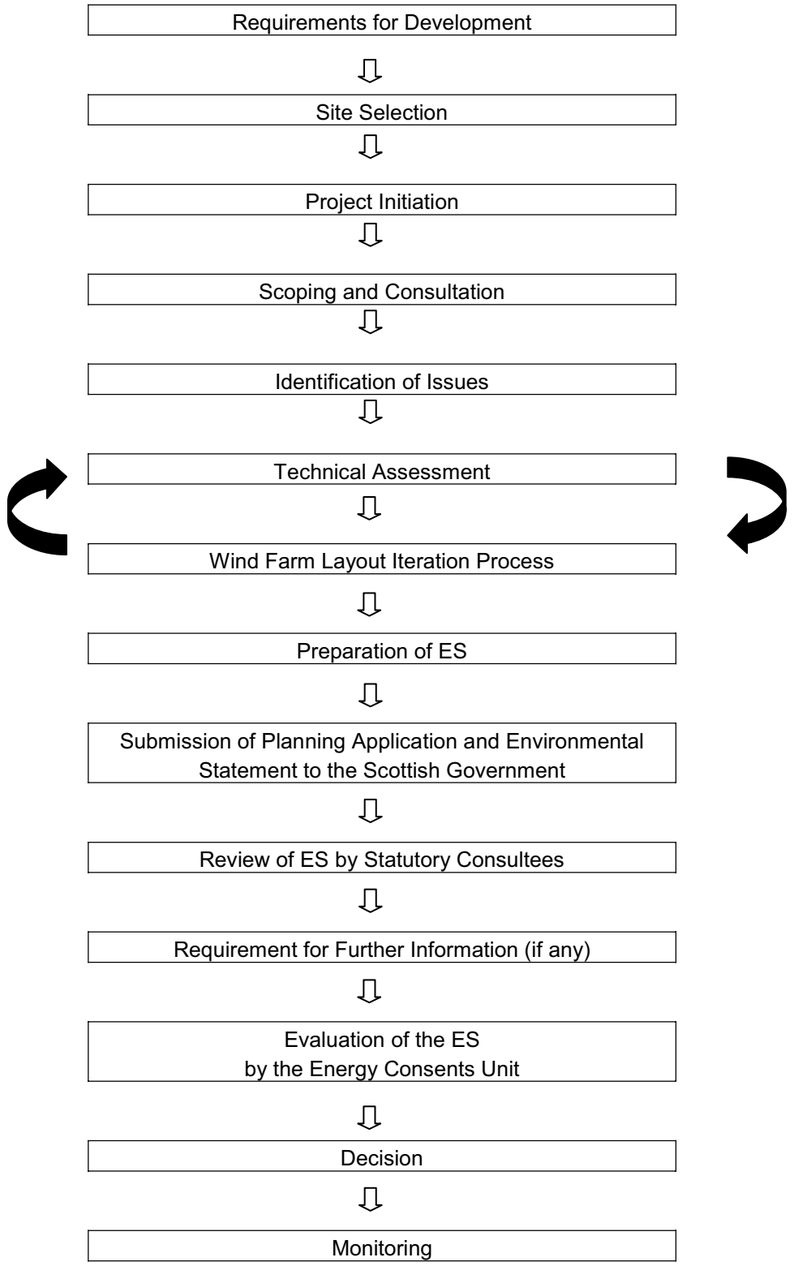
2.3 The preparation and production of this Environmental Statement (ES) has been conducted in accordance with the latest Government Regulations and good practice guidance, specifically

- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000;
- Electricity Works (Environmental Impact Assessment) (Scotland) Amendment Regulations 2008;
- Scottish Planning Series Planning Circular 8-2007: EIA regulations;
- National Planning Framework 2 for Scotland;
- Scottish Planning Policy (SPP) 6 Renewable Energy (2007);
- Planning Advice Note (PAN) 58 – Environmental Impact Assessment, September 1999;
- PAN 45 – Renewable Energy Technologies (revised 2002, 2006 and 2008);
- Preparation of ESs for Planning Projects that require Environmental Assessment, A Good Practice Guide (Department of the Environment, 1995);
- A Handbook on Environmental Impact Assessment, (Scottish Natural Heritage (SNH) 2005); and;
- Guidelines for Environmental Impact Assessment (Institute of Environmental Management and Assessment 2004, updated 2005 and 2006).

2.4 Other relevant guidance has been used to inform the various technical chapters and is referenced within those chapters.

Assessment and Design Approach

2.5 The assessment and design of Galawhistle Wind Farm has been carried out using the feedback approach. This approach allows the findings of the EIA to guide the evolution of the wind farm design and has allowed the development to be modified in order to avoid, reduce or mitigate effects as far as reasonably practicable. This approach is considered to be best practice and is preferable to carrying out a one-off post-design freeze environmental assessment. The following figure outlines the process adopted for the Galawhistle Wind Farm EIA.



2.6 The provision of environmental information through an ES involves the compilation, evaluation, and presentation of all likely significant environmental effects of a proposed development. This, together with the post-application consultation responses from statutory consultees and the public, assists the determining authority in considering and determining the application.

Requirements for Development

2.7 The requirements for the development are discussed in Chapter 1 (Introduction) and also from a regulatory and planning perspective in Chapter 4 (Planning Context) and the accompanying Planning Statement to this ES.

Approach to Site Selection

Planning Guidance

2.8 Scottish Planning Policy 6 (SPP6): Renewable Energy Development (adopted in 2007) states that support for renewable energy developments should be compatible with the need to protect and enhance Scotland's natural and historic environment. As a result, areas safeguarded through national or international legislation are less likely to be appropriate for development than those with no designation, or more local designated status.

Infinis Site Selection Process

2.9 Infinis operate a process by which it identifies available portfolios of land which have either undergone the initial stages of feasibility for development as a wind farm site or have been identified as having potential for wind development.

2.10 In respect of SNH's 'Strategic Locational Guidance for On-shore Windfarms[1]", Galawhistle Wind Farm lies within an area (Zone 2) of Medium Natural Heritage Sensitivity:

"(Zone 2) identifies areas with some sensitivities to wind farms. However, by careful choice of location within these areas there is often scope to accommodate development of an appropriate scale, siting and design (again having regard to cumulative effects) in a way which is acceptable in natural heritage terms".

2.11 This level of sensitivity is due to the proximity of the Muirkirk and North Lowther Uplands Special Protection Area (SPA) and the Muirkirk Uplands Site of Special Scientific Interest (SSSI). This sensitivity has been accounted for in the siting and design of Galawhistle Wind Farm and is discussed further in paragraphs 2.31-2.35 and also Chapter 6 (Ecology) and Chapter 7 (Ornithology).

Galawhistle Site History

2.12 In 2005, Scottish Coal carried out an EIA for Spireslack Wind Farm. The proposal was for a maximum of 42 turbines in three discrete locations but the application was withdrawn before a planning decision was determined. The Spireslack site was then acquired by Infinis as part of a portfolio of land from Scottish Coal in August 2007. As part of the acquisition process and following completion of the acquisition Infinis undertook due diligence and feasibility exercises to confirm if the Spireslack site should be taken forward for wind farm development. The following was investigated in the due diligence and feasibility exercises:

- Wind resource;
- Grid connection agreements;
- Proximity to international natural heritage designations (Ramsar sites, Special Protection Areas and Special Areas of Conservation);
- Proximity to national designations (National Scenic Areas, Sites of Special Scientific Interest (SSSIs), National Nature Reserves, National Parks and National Heritage Areas);
- Presence/absence of the historic environment including designated built and cultural heritage sites, areas or features (listed buildings, conservation areas, World Heritage Sites, Scheduled Ancient Monuments and sites listed in the Inventory of Gardens and Designed Landscapes);
- Planning policy (the location of the site in relation to the preferred areas in the structure and local plan); and
- Accessibility of site.

2.13 In addition to the above, the scoping responses from the Scottish Coal application process were considered as part of the feasibility exercise.

2.14 Following consideration of all the above, Infinis identified the Spireslack site as being suitable for a wind farm development. The Spireslack site was then renamed to Galawhistle in 2008 and Infinis engaged in a comprehensive consultation exercise prior to finalising the design proposals for the site, as discussed in paragraphs 2.15 -2.20.

Consultation and Scoping

Scoping Consultation

2.15 Scoping involves sending a scoping report illustrating the main details of the wind farm proposal, results of preliminary assessments and methodologies of further assessments to all relevant organisations - both statutory and non-statutory. These organisations are given five weeks to respond with comments they would like to see addressed during the EIA. The purpose of the scoping exercise is to inform all appropriate parties of the development and consider their comments and information when designing the EIA and the final site layout. This process ensures maximum congruity of the development with the surroundings.

2.16 The scoping for this development consisted of consulting and gaining feedback from over 50 organisations and stakeholders. A Scoping Report was prepared and submitted to Scottish Ministers and other statutory and non-statutory consultees in July 2008.

2.17 Table 2.2 details those consultees that were consulted during the EIA project period. A brief description of their response and the relevant ES chapters where these issues are addressed are detailed.

[1] Scottish Natural Heritage (SNH): http://www.snh.org.uk/pdfs/polstat/ar-ps01.pdf

Table 2.2 Summary of Scoping Consultee Responses and Infinis's Comments

Organisation	Response to date	Chapter in which Response is Addressed
Arqiva	Development unlikely to affect any of the UHF TV links. Requested that Ofcom should be contacted.	Chapter 13 - Other Considerations
Ayrshire Rivers Trust	Only three of the proposed turbine locations are located in the River Ayr catchment. As almost all the turbines are located within the Clyde catchment suggested that we should contact the Clyde River Foundation for their comments.	Chapter 8 – Hydrology, Hydrogeology and Geology
Association of Salmon Fishery Board	Project proposals should be conducted in full consultation with the River Ayr DSFB (which holds various relevant statutory powers), Ayrshire Rivers Trust (which provides scientific advice to the Ayr DSFB) and Clyde River Foundation. Construction contractors should consult the local fishery board on issues such as migration obstruction, spawning bed disturbance, silt and sediment increase, point source pollution drainage.	Chapter 8 – Hydrology, Hydrogeology and Geology Chapter 6 - Ecology
BAA (Glasgow Airport)	The project proposals will not have any adverse effect on the operations at the airport and if submitted for planning approval would not attract an objection.	Chapter 13 - Other Considerations
BBC	The BBC online wind farm tool identified that 1 household would be affected by the development for whom there is no alternative service. In addition, the following transmitters are likely to be affected: Black Hill CH5 Blackhill	Chapter 13 - Other Considerations
British Horse Society	No response to date	Chapter 12 - Socioeconomics, Tourism and Landuse
BT	Proposal should not result in any interference to BT's radio link and satellite.	Chapter 13 - Other Considerations
Civil Aviation Authority	May be a requirement to install aviation obstruction lighting if requested by other consultees. An anticipated amendment to international aviation regulatory documentation will require that the rotor blades, nacelle and upper 2/3 of the supporting mast of wind turbines that are deemed to be an aviation obstruction should be painted white, unless otherwise indicated by an aeronautical study. The requirement for painting wind turbines whites is likely to only be required if aviation obstruction lighting is required.	Chapter 13 - Other Considerations
Clyde River Foundation	Recommended we contact Douglas Angling Association and asked to be kept informed of the development.	Chapter 8 – Hydrology, Hydrogeology and Geology
CSS Spectrum Management	No objection	Chapter 13 - Other Considerations
Coalfield Environment Initiative	No response to date	Chapter 6 - Ecology
Crown Estate	Raised concerns over potentially harmful run-off introduced into the upper waters of Clyde and Ayr catchments, particularly with respect to Invertebrates. The Clyde River Foundation should be added to the list of consultees and culverts and watercourse crossings should be constructed with consideration of timing and the effects on quantity and quality of water. Regular monitoring after instalment should be undertaken to ensure continuing free passage of migrating fish. Evidence of this monitoring should be given to the River Ayr Salmon Fishery Board and the Clyde River Foundation.	Chapter 8 – Hydrology, Hydrogeology and Geology Chapter 6 - Ecology
Defence Estates	The turbine(s) will be within Low Flying Area 20T and will unacceptably affect military activities. These are areas made available for Military Operational Low Flying Training. Within Tactical Training Areas, military fast jets and Hercules aircraft may operate down to a height of 100ft separation distance from the ground and other obstacles. The proliferation of obstacles within this area, therefore, is not only a safety hazard but also severely impacts on the utilisation of the area for this essential Low Flying Training.	Chapter 13 - Other Considerations
East Ayrshire Council	Regarding Site Selection, 'Planning Policy' should include reference to Structure Plan and Local Plan policies. Regarding planning, the East Ayrshire Local Plan is finalised, specific reference should be made in the EIA to Strategic Development Policy SD 4, need to demonstrate under Policy CS 11 that the wind farm will not be unduly compromised by nearby wind farms, Policy CS12 - potential cumulative visual impacts, Policy ENV 10 - Muirkirk and Lowther Uplands SSSI (SPA) lies in the vicinity of the application site, Policy ENV 11 - proposal is within a Sensitive Landscape Character Area. Regarding LVIA, reference should be made here about the Sensitive Landscape Character Area. Regarding tourism, the EIA should recognise the A70 as the main tourist route into East Ayrshire, and the EIA should regard the Council's Supplementary Planning Guidance. Outlined their concerns for the impact on the approaches and navigation equipment at Glasgow Prestwick Airport. Prestwick Airport should be consulted.	Chapter 4 – Planning Chapter 5 – LVIA Chapter 6 –Ecology Chapter 7 – Ornithology Chapter 8 – Hydrology, Hydrogeology and Geology Chapter 9 – Cultural Heritage Chapter 10 – Noise Chapter 11 – Traffic and Transport Chapter 12 –Socioeconomics, Tourism and Landuse Chapter 13 – Other Considerations

Table 2.2 Summary of Scoping Consultee Responses and Infinis's Comments

Organisation	Response to date	Chapter in which Response is Addressed
Fisheries Research Services	Suggested that watercourses should be avoided where possible and river crossings should be minimised. The ES will need to establish the fish species present within the influence of the scheme, their distribution and abundance, and the temporal and spatial variability of water quality monitoring programmes. Furthermore consideration must be given to hydrochemistry, sediment transport and deposition, geomorphology and hydrology.	Chapter 6 - Ecology Chapter 8 – Hydrology, Hydrogeology and Geology
Five	Arquiva should be contacted with regards to all terrestrial transmissions on behalf of Channel Five Group Limited and they will respond to any issues.	Chapter 13 - Other Considerations
Forestry Commission Scotland	The main issue of concern is the potential effects of the proposals may have on woodlands and specifically the consequences that any tree felling may have on the ecology and landscape of the area and environment.	Chapter 5 - LVIA Chapter 6 - Ecology
Health and Safety Executive	HSE state that they have no useful information to add to the EIA.	Chapter 13 – Other Considerations
Historic Scotland	Discussed the need to revise the methodology slightly towards a more Scottish context of the historic environment. Suggested a review of archaeological periods stated in the scoping report as these may not be applicable in a Scottish context. The Neolithic period for example, is generally believed to begin in Scotland at *c.* 4000 BC, rather than 3500 BC. Referred to Historic Scotland document specifically produced for wind farms: http://www.historic-scotland.gov.uk/scoping_of_development_proposals_2009.pdf. The impact of the development on the setting of the scheduled monument termed Glenbuck Ironworks, W of Rowan Bank should be considered.	Chapter 9 - Cultural Heritage
JRC (Joint Radio Company)	Do not forsee any potential problems based on known interference scenarios and the data provided. Advised that there should be a re-coordination prior to submitting a planning application, as this will negate any links assigned between enquiry and the finalisation of the project.	Chapter 13 - Other Considerations
Muirkirk Angling Association	No issues but they would like to be kept updated on the progress of the development	Chapter 8 – Hydrology, Hydrologeology and Geology
National Air Traffic Authorities (NATS)	NATS stated that the radar safeguarding assessment reveals that the wind farm development is located within an area where there is insufficient terrain shielding from the Primary Radar Service at Lowther Hill. The proposed development has been examined from a technical and operational safeguarding aspect and conflicts with NATS (En Route) Pic's safeguarding criteria. Accordingly, NERL objects to the proposal.	Chapter 13 - Other Considerations
National Grid	No issues with the proposed development, the risk to existing networks is negligible.	Chapter 13 – Other Considerations
O2	No response to date.	Chapter 13 - Other Considerations
Ofcom	Requested site centre grid reference and radius to edge in order to provide a response. Grid reference sent out. Ofcom found one Orange fixed link and one BT fixed link and stated to contact Orange and BT directly. Stated that the Ofcom response is only for microwave links and does not include microwave fixed links and broadcast transmissions or scanning telemetry links but a copy of co-ordination request has been sent to CSS and JRC.	Chapter 13 - Other Considerations
Orange	Requested wind turbine location details. Proforma sent out with requested wind turbine coordinates. Response received stated that no fixed links will be affected by the proposal.	Chapter 13 - Other Considerations
Prestwick Airport - Infrantil	The proposed development appears to be entirely terrain shielded from Glasgow Prestwick Airport's surveillance radar. In light of this, they do not envisage any objections to the construction of the Wind Farm on radar or any other safeguarding grounds.	Chapter 13 - Other Considerations
RSPB, North Ayrshire	Are satisfied with the habitat survey methods proposed and suggest that 'ground truthing' of the previous Phase 1 survey should be carried out, alongside detailed NVC surveys of habitats of interest. All details of survey methods should comply with current SNH guidance. A thorough analysis of potential impacts on SPA species is required; analysis of habitat use must take into account any changes in land use resulting from construction of the wind farm and ongoing management of the neighbouring plantation forestry. Provided details of additional species of interest at the site for which appropriate surveys should be carried out, in line with standard methodology. RSPB also asserted that the ES must assess the cumulative impact of these activities in land use on birds of conservation of interest.	Chapter 6 – Ecology Chapter 7 - Ornithology
Scottish Ambulance Service	No response to date	Chapter 13 - Other Considerations
Scottish Environment Protection Agency (SEPA)	The types of work required for the construction and operation of the infrastructure listed in section 7.7 of the draft scoping opinion should be detailed in the ES together with an assessment of their likely environmental impacts and proposed mitigation measures/alternatives. ES should also have regard to the requirements of CAR and any required authorisations from SEPA. All proposed river engineering works, such as watercourse crossings or river bank modifications, should be identified and should be discussed with SEPA at an early stage. Recommend that the ES should also have regard to the relevant SPPs and PANs. SEPA's PPG Notes and the requirement for developers to comply with such guidance notes should also be noted.	Chapter 3 - Project Description Chapter 6 – Ecology Chapter 8 – Hydrology, Hydrogeology and Geology

Table 2.2 Summary of Scoping Consultee Responses and Infinis's Comments

Organisation	Response to date	Chapter in which Response is Addressed
Scottish Ministers	The following consultees responded- Association of Salmon Fishery Boards, Bt, CAA Airspace, The Crown Estate, Defence Estates, East Ayrshire Council, HSE, NATS, Ofcom, RSPB, SEPA, SNH and South Lanarkshire Council. The Scottish Government suggested that all ecological survey methods are agreed with SNH specialist advisers, and conform to the best available standard methods for each habitat and species. Also requested that all ecological survey data collected during ES survey work should be made available by the applicant to the Scottish Government and SNH, in a form which would enable them to make future analysis of the effects of the wind farms, if appropriate.	All Chapters
Scottish Natural Heritage (SNH)	According to SNH's Strategic locational Guidance, the proposed turbines fall within areas defined as Zone 2 - Medium natural heritage sensitivity. The level of sensitivity is due to the proximity of the Muirkirk and North Lowther Uplands Special Protection Areas (SPA) and the Muirkirk Uplands Site of Special Scientific Interest (SSSI). Regarding decommissioning, SNH stated that full site restoration and re-instatement details at both post-wind farm construction and decommissioning stages should be included. Regarding grid connection details, the effects of the proposed grid connection should be assessed in combination with the proposed wind farm. Regarding Design Landscape and the Built Environment, SNH stated that it is essential that the ES considers the cumulative impact of this proposal in conjunction with the range of other existing and proposed wind farms throughout this area. Regarding habitat management, SNH requests for National Vegetation Classification surveys on all the habitats within the footprint, locate any rare or nationally scarce higher and lower plant species, and avoid Priority Annex 1 habitats as part of the iterative design process. Regarding birds, SNH would expect the standard number of hours per vantage point to be greatly exceeded due to the sensitivity of the site and would expect data to be collected for two years, not one year as suggested. SNH also suggests surveys should be carried out for bats, otters, water voles, badgers, red squirrel, and lamprey. SNH suggests that the previous otter, badger and water vole surveys should be up-dated, contrary to the scoping report. Full surveys should also be undertaken of any other protected species if signs are found during habitat and other surveys. SNH strongly recommends survey methodologies are discussed and agreed with SNH. Regarding assessment of peat slide risk, SNH state that previous surveys indicate there is blanket bog on parts of the application area and there are likely to be underlying peat soils. Areas of peatlands should be mapped (depth, nature, hydrology and condition) as this should inform the location of tracks, siting of turbines, etc. It should include a detailed map of peat depth.	Chapter 5 – LVIA Chapter 6 – Ecology Chapter 7 – Ornithology Chapter 8 – Hydrology, Hydrogeology and Geology
ScottishPower - Energy Networks	Sent an indicative plan showing 11kV overhead lines in the surrounding development location	Chapter 13 – Other considerations
Scottish Rights of Way and Access Society (ScotWays)	There are no Rights of Way within the vicinity of the proposal.	Chapter 12 - Socioeconomics, Tourism and Landuse
Scottish Water	No pipelines have been found near or within the vicinity of the site so they have no comments.	Chapter 8 - Hydrology, Hydrogeology and Geology
Scottish Wildlife Trust	No response	Chapter 6 - Ecology
South Lanarkshire Council	They are unable to provide a scoping opinion for the wind farm due to workload pressure. However request that consideration is given to the cumulative visual impact of the proposal with other consented and proposed wind farms in the vicinity including the 152 turbine Clyde wind farm which was given approval on 21st July 2008 and the 14 turbine wind farm at Andershaw near Crawfordjohn which is currently at the application stage. Reference should be made in the EIA to development policies in the finalised South Lanarkshire Local Plan (as modified) as well as relevant government policy and guidance.	Chapter 4 –Planning Chapter 5 - LVIA
Strathclyde Police, South Lanarkshire Division	Sent a generic wind farm security report which discussed the number of crimes that have occurred at/near proposed wind farm (1 crime) and the increased risk of theft during construction.	Chapter 13 - Other Considerations
Sustrans Scotland	No comment to make on the proposal as the site is some distance from the existing and/or proposed National Cycle Network.	Chapter 12 - Socioeconomics, Tourism and Landuse
T-mobile	No response to date.	Chapter 13 - Other Considerations
Scotland Gas Networks	No response to date	Chapter 13 - Other Considerations
Transport Scotland	ES should state the work that has been undertaken e.g. transport/noise/air quality assessments etc.; what this has shown i.e. what impact if any has been identified; and why it is not significant.	Chapter 11 - Traffic and Transport
United Clyde Angling Protective Association (UCAPA) Ltd	Asked to be kept informed about development and recommended contact with the Clyde River Foundation and Douglas Angling Association.	Chapter 8 – Hydrology, Hydrogeology and Geology
Visit Scotland	No specific concerns on the proposed development except that the importance of landscape to tourism should be taken into consideration during the environmental assessment process.	Chapter 12 - Socioeconomics, Tourism and Landuse
Vodafone, Technology Operations	There are unlikely to be any adverse impacts on the existing or proposed network.	Chapter 13 - Other Considerations Chapter 9 – Cultural Heritage
West of Scotland Archaeological Service (WoSAS)	Happy with the methodology proposed for assessing the impacts of this wind farm proposal. Agree that there is a low potential for there being unknown archaeological remains within the areas proposed for turbine locations. These are all located at heights above 340m OD and in this area we would expect little archaeology in exposed locations at these sorts of heights, though there might be archaeology in more sheltered valleys. Archaeological mitigation works may be required with respect to the final location of the substation, due to the potential disturbance of a farmstead in this area.	Chapter 9 – Cultural Heritage

Consultation during the EIA process

2.18 The following consultees were also involved in discussions and meetings with regard to the proposal during 2008 and 2009:

- Members of Scottish Parliament;
- Local Councillors;
- Muirkirk Community Council;
- Lesmahagow Community Council;
- Douglas and Glespin Community Council;
- South Lanarkshire Council Planning;
- East Ayrshire Council Planning;
- Muirkirk Enterprise Group;
- Energy Consents Unit;
- Ministry of Defence; and
- Scottish Natural Heritage.

Public Consultation

2.19 Public exhibitions were held in the villages of Lesmahagow, Muirkirk and Douglas during September 2008. The exhibitions were advertised in local newspapers and were also publicised by letters of invitation to (councils and consultees etc.). The exhibitions included display boards and leaflets that described the proposed development and the EIA process, and gave illustrations of potential views of the site by means of photomontages. Over 24 members of the public attended the exhibitions. Written comments received during the public exhibitions were mostly positive:

- "*Renewable energy is an excellent idea. Hopefully it will benefit local people, i.e. trust fund for local community";*
- *"Wind energy is there to use";*
- *"I find no harm to the environment or landscape by this proposal. Funding within Douglas village would be an advantage";*
- *"Should get some use from land which would otherwise be little visited and not of any use if there is a resource"; and*
- *"Hope you (Infinis) get the go-ahead".*

2.20 Details of local community benefits are detailed in Chapter 12 (Socioeconomic, Tourism and Landuse). Infinis plan to host further exhibitions in the local community after this ES has been submitted in November 2009.

Identification of Issues

2.21 The issues (technical constraints) to be assessed are identified through consultation of:

- Relevant policy and guidance documents;
- Desk-based and site-based research;
- Scoping responses; and
- Further organisations identified in scoping responses.

2.22 These technical constraints comprise:

- Landscape and visual effects (Chapter 5);
- Ecology (designated sites, habitats, flora and fauna) (Chapter 6);
- Ornithology (Chapter 7);
- Hydrology, Hydrogeology and Geology (including pollution prevention) (Chapter 8);
- Cultural Heritage (Chapter 9);
- Noise (Chapter 10);
- Traffic and Transportation (Chapter 11);
- Socio-economics, Tourism and Landuse (Chapter 12); and
- Other Considerations (such as health and safety, shadow flicker, telecommunications, aviation and waste management) (Chapter 13).

Technical Assessments

2.23 The technical assessments of the topics in the EIA were carried out to predict the likely significant effects associated with the proposed development, inform the layout and design of the Wind Farm to minimise environmental effects and finally to propose further post-design mitigation measures. The findings of these assessments are presented within Chapters 5-13 of this ES. Within each assessment chapter, a systematic format has been followed, the principal stages of which are:

- Description of baseline conditions;
- Identification and assessment of potential environmental effects;
- Identification of mitigation measures;
- Description of residual effects; and
- Description of proposed monitoring.

Description of Baseline Conditions

2.24 The existing environmental character of the site is identified, with particular regard to the specific issue being assessed, through a combination of the following:

- Desk-based assessment, based on available data such as previous surveys, information derived from maps and aerial photographs, web searches etc;
- Information provided by consultees; and
- Specifically commissioned site surveys.

Identification and Assessment of Potential Environmental Effects

2.25 The identification of potential environmental effects is carried out in accordance with appropriate guidance, by considering the possible interactions between the proposed development and existing and future site conditions.

2.26 The potential effects identified are assessed in terms of their significance, and their beneficial or adverse character. Where available, published objective guidelines or assessment criteria are used to guide this process. In addition, professional judgements are also made where appropriate.

2.27 The significance of change is related to the duration, timing and extent of effects, the degree of certainty in the prediction of effects, and the likelihood of irreversible changes occurring. According to SNH guidance[2] the significance of an effect is derived from analysis of:

- The sensitivity of the environmental resource to change, including its capacity to accommodate changes associated with the project;
- The amount and type of change, i.e. the magnitude of change including timing, scale, size and duration of the effect; and
- The likelihood of the effect occurring.

2.28 It should be noted that an assessment of a significant effect does not imply that the effect would be unacceptable; rather it serves to provide an indication of the activities for which further consideration or mitigation of the effect would be required. This is in line with the Electricity Works, (Environmental Impact Assessment) (Scotland) Regulations 2000, which require that measures to prevent, reduce and where possible offset any significant effects are described within the ES.

Identification of Mitigation Measures

2.29 Generally two types of mitigation measures are considered during the EIA process:

- Measures identified and adopted during the design stage of the wind farm in order to avoid impacts wherever possible and ensure that the development achieves the best possible fit into its environment; and
- Measures identified during the EIA process and adopted during the construction, operation and decommissioning phases of the wind farm development in order to avoid or minimise possible significant adverse environmental effects of transportation, construction, operational and decommissioning activities.

Proposed Monitoring

2.30 Monitoring is a potentially useful tool to measure the actual environmental effects of a wind farm development in comparison to what was predicted by the EIA. Proposed monitoring procedures are specified where appropriate in each technical assessment chapter in this ES and are normally incorporated in the construction and post-construction phases of the development.

Wind Farm Layout Iteration Process

2.31 The final proposed Wind Farm layout comprising a maximum of 22 turbines and associated infrastructure (Figure 1.2) was established after an iterative process which lasted approximately 16 months. The results of the iteration process is shown in Figure 2.1. The iteration process started with the 42 turbine layout as proposed by Scottish Coal in the Spireslack Wind Farm ES (2005).

Scoping Layout

2.32 The scoping layout for Galawhistle Wind Farm was derived from the 42 turbine layout as proposed by Scottish Coal in the Spireslack Wind Farm ES in 2005. Due to the proximity of the adjacent Muirkirk and North Lowther Uplands Special Protected Area (SPA) and known bird flight activity, it was considered necessary to reduce the number of turbines to 29 as shown by Figure 2.1. In addition, the scoping layout was further refined from an appreciation of the physical characteristics of the site, as well as a need to ensure that appropriate wind capture and turbine spacing criteria were considered.

Constraints to Scoping Layout

2.33 The 29 turbine scoping layout was sent to statutory and non-statutory consultees for comment following which a number of major constraints were identified. These constraints resulted in a refining of the scoping layout design and required the number of turbines to be dropped by seven turbines from 29 to 22. The main reasons driving this reduction in turbines were:

- Landscape and Visual impacts (as discussed in Chapter 5);
- Annex 1 habitats (as discussed in Chapter 6);
- Aviation concerns (as discussed in Chapter 13);
- Protected mammals (as discussed in Chapter 6); and
- Cultural heritage features (as discussed in Chapter 9).

2.34 The above identified environmental constraints are discussed in more detail in their respective chapters.

2.35 In terms of reducing the landscape and visual impacts of the scoping layout, the design process aimed to: group turbines to create a balanced and coherent image which suggests a single wind farm; avoid situations where multiple turbines can be seen one behind the other; aim to make the Wind Farm and other adjacent operational developments read as one wind farm and aim to achieve consistent turbine heights and avoid creating geometric lines of turbines. The potential visual appearance of the proposed Wind Farm was tested from a number of key viewpoints also representative of a broad spectrum of views.

Final Layout

2.36 The design of the final layout comprising a maximum of 22 turbines reflects a layout that aims to merge with the surrounding wind farms and respect most of the constraints identified through the scoping exercise and also those identified by technical assessments. To further achieve consistent turbine heights, rather than having turbines be seen at a variety of different levels, two different maximum hub heights were proposed: 69m and 80m. Turbine dimensions are further discussed in Chapter 3 (Project Description).

2.37 In summary, the final layout was achieved over a 16 month iteration process and represents the best fit in terms of technical, environmental and landscape requirements.

2 A Handbook on Environmental Impact Assessment, SNH, 2005

Chapter 3 – Project Description

Introduction

3.1 This chapter provides a description of the proposed site location, the proposed Galawhistle Wind Farm components and associated infrastructure, details of construction methods and programme, and an overview of the operation and ultimate decommissioning of the site.

Site Description

3.2 The site is located on upland moorland approximately 7km east of Muirkirk in East Ayrshire and 4km West of Douglas in South Lanarkshire. The majority of the site boundary is located in South Lanarkshire but two turbines, one permanent anemometer mast and some of the access tracks lie within the administrative boundary of East Ayrshire (Figure 1.2). The total area of the site is approximately 594 hectares and its highest point is 463m Above Ordnance Datum (AOD). The area surrounding the site is characterised by Spireslack Open Cast Coal Site (OCCS) immediately to the west, the operational Hagshaw Hill Wind Farm and extension to the east, and forestry to the north. The nearest "A" road to the Wind Farm is the A70 which passes to the south of the site, approximately 900m south from the nearest turbine.

3.3 The settlements and small groups of residential properties within 10km of the site are listed in Table 3.1.

Table 3.1: Distance from Nearest Settlements

Settlement	Direction from site	Distance to nearest turbine (km)
Parish Holm*	South	1.3
Carmacoup	South	1.7
Glespin	South East	2.6
Bankend	North East	3.1
Douglas West	East	3.9
Coalburn*	North East	4.5
Douglas	East	5.1
Muirkirk*	South West	6.1
New Mains	East	6.4
Lesmahagow	North East	8.1

Note: Where a settlement contains a LVIA viewpoint, the distance has been calculated from the viewpoint to the nearest turbine (these are marked by an asterisk). For non-viewpoint locations, the distance has been calculated from the settlement boundary to the nearest turbine.

3.4 Individual residential receptors within 2km of the site are described in Chapter 10 (Noise).

Site Access

3.5 The access track to the site is shown in Figure 1.2. The site will be accessed directly from the A70 using the existing Scottish Coal access road from the Spireslack Distribution Point to a point approximately 900m west of the site. A new section of road will provide access from this point to the Wind Farm boundary. New internal access tracks will also be required to reach individual wind turbines on the site. Access track upgrades and the construction of new access tracks are discussed further in paragraphs 3.24 to 3.30.

Site Infrastructure

3.6 In addition to the assembly, erection and commissioning of the turbines, the following will be carried out during construction:

- Erection of one permanent meteorological mast;
- Construction of the Wind Farm substation and control building;
- Construction of the Scottish Power substation and control building (to connect to the National Grid);
- Transformers and cables from the wind turbines to the Wind Farm substation;
- Extraction of rock from four borrow pits;
- Upgrade of existing access tracks;
- Construction of new access tracks;
- Laying of turbine foundations and associated hardstandings;
- Construction of a temporary construction compound;
- Construction of a temporary laydown area;
- Signposts at site entrances and internal traffic control signage; and
- Post-construction restoration and reinstatement works.

3.7 Work will take place on a phased basis, commencing with the formation of the temporary construction compound, excavation of borrow pits and the upgrading and construction of the access tracks. Construction of turbine foundations, associated infrastructure and subsequent erection of the wind turbines will then be carried out.

3.8 All construction activities will be undertaken in adherence with pollution control measures which will be detailed in a Construction Method Statement (CMS) drawn up in consultation with SEPA, SNH, South Lanarkshire Council, East Ayrshire Council and other relevant parties before construction begins. Pollution prevention is detailed further in Chapter 8 (Hydrology, Hydrogeology and Geology).

3.9 Enabling works will be required prior to the commencement of the main construction works. These will be phased in the pre-construction period, and include:

- Detailed site investigation works; and
- Consultation with the appropriate authorities regarding turbine deliveries.

Wind Turbines

3.10 The proposal is for a maximum of 22 turbines and a maximum site rated capacity of 55MW. A plan of the proposed layout is shown in Figure 1.2.

3.11 The wind turbine comprises five main components: rotor blades (three), hub, nacelle (containing gearbox and generator), tower and foundation. Table 3.2 outlines the maximum key technical parameters of the candidate turbines and Figures 3.1a and 3.1b illustrate the dimensions of the turbines.

3.12 Two different hub heights are proposed for the site; 69m hub and 80m. The reasoning behind the different hub heights is discussed in Chapter 2 (EIA process). The turbines selected will not exceed a tip height of 121.2m for an 80m hub height.

Table 3.2 Maximum Key Technical Parameters

Maximum number of turbines	18	4
Maximum hub height (m)	69	80
Maximum blade length (m)	41.2	
Maximum height to blade tip (m)	110.2	121.2
Maximum turbine rated capacity (MW)	2.5	
Maximum site rated capacity (MW)	55	
Number of blades per turbine	3	
Tower style	Tapered tubular	

3.13 The turbine towers will be of tapering tubular steel construction and the blades of fibreglass with lightning protection, protecting the entire turbine. The finish of the turbines is proposed to be of a low-reflectivity semi-matt pale grey colour, subject to the agreement of the local authorities and other consultees.

3.14 The turbines will be computer controlled so that they face directly into the wind to ensure efficiency. At very high wind speeds the turbines will shut down.

3.15 The eventual choice of turbine and equipment supplier will be the subject of a tendering process and detailed technical and commercial appraisal (however, the physical dimensions of the turbines will not exceed the maximum figures set out in this ES).

Delivery to Site

3.16 Wind Turbine components are likely to be transported via the M74, exiting at junction 11 onto the A70 and are likely to then travel westbound past the settlement of Douglas (detailed in Chapter 11: Traffic and Transport and shown in Figure 1.2). From the A70 they would access the site as shown in Figure 1.2. Alternative delivery routes have also been identified.

Wind Turbine Foundations

3.17 Each turbine foundation will comprise a steel reinforced concrete base measuring approximately 16m x 16m x 1.5m (depth), subject to final turbine choice and ground conditions as shown in Figure 3.2. Blinding concrete will underlie the concrete base with a grid of steel reinforcement set into the outer layer of the concrete. Concrete for use in turbine foundations will be provided from an onsite batching plant located at the construction compound or from readymix imported to the site.

3.18 Typically the foundations will be constructed with a formation depth of approximately 3m (Figure 3.2), depending on the ground conditions. Some turbine foundations will need to be cut into the hillside due to the sloping nature of the site. Excavated material will be distributed on site and used for localised landscaping, for example around turbine locations, access tracks and borrow pits. The use of excavated peat on site is covered in detail in Chapter 6 (Ecology).

Crane and Laydown Hardstandings

3.19 The design of the crane hardstandings is dependent on the choice of turbine. Typically there will be two main areas of hardstanding; one for the cranes and one for a laydown area for components. The crane hardstanding will be triangular with dimensions of 56m x 32m and the laydown area will be trapezoidal with dimensions of 35/45 m x 5 m. Figure 3.3 illustrates a typical crane hardstanding area. All hardstandings will be formed with crushed rock and geotextile membranes.

Borrow Pits

3.20 Stone for access track and hardstandings will be won from four onsite borrow pits (Figure 1.2). It is estimated that approximately 220 000 m^3 of rock will be required. A summary of the preliminary borrow pit investigations, likely dimensions and volumes is provided in Technical Appendix 3A.

3.21 The potential borrow pit locations were selected according to the following industry standard:

- Likely depth of superficial deposits;
- Rock type;
- Proximity to proposed access tracks;
- Potential for adverse cultural heritage, visual and ecological effects;
- Steepness of topography.

3.22 Based on the above criteria, the likely dimensions of the potential borrow pit locations were identified. The potential rock yield from these borrow pits is estimated to be approximately 245,000 m^3. This maximum yield is higher than the estimated required volume to allow for potentially unsuitable stone, micrositing of borrow pit extents and removal of borrow pits from the scheme. It should be noted that the volume of suitable rock removed will not exceed that required to construct the Wind Farm and that the borrow extents shown may not be realised.

3.23 The rock will be extracted using recognised quarrying techniques (including blasting) and crushed to provide the required roadstone properties. Stone from the borrow pits will be tested to ensure it is inert for the purpose of where it will be used.

3.24 The actual number and extent of borrow pits required will be subject to a detailed site investigation however they will not exceed the maximum numbers or dimensions detailed in Appendix 3A. Final details of borrow pits will be confirmed with East Ayrshire and South Lanarkshire Councils prior to construction.

Access Tracks

Track Dimensions and Design

3.25 In order to reach the site and access the turbines and site infrastructure from the A70, a total of approximately 18km of access track will be required. Of this, approximately 6.3 km is existing colliery roads, 1.7km is upgraded former railway line and 10km is new access roads (all access track from the A70 to the site is private road). These figures include a 900m section of existing colliery road which will be reconstructed in order to make it suitable for abnormal loads. Figure 1.2 illustrates the on-site track layout.

3.26 During the design of the access tracks the following objectives were taken into account:

- Minimising ground disturbance by using the shortest route possible;
- Avoiding environmental constraints identified during the EIA process;
- Minimising the number of watercourse crossings required;
- Maximising the use of existing access tracks;
- Ensuring all gradients are suitable for vehicular access; and
- Turning radii.

3.27 The above design objectives have been achieved by:

- Utilising an existing access route through adjacent third party land;
- Construction of temporary construction compound and laydown area in an adjacent colliery area;

- Use of a former railway line;;
- Use of straight sections of road as much as possible, subject to terrain; and
- Accessing the western turbines from a main access track via the adjacent colliery.

3.28 The use of the former railway line has resulted in the requirement for only one substantial water crossing as discussed in Chapter 8 (Hydrology, Hydrogeology and Geology). Although two small areas of deeper peat (between 1.5 - 2.5 m in depth) occur under the proposed access track (see Figure 8.3 in Chapter 8 (Hydrology, Hydrogeology and Geology)), the track has not been redesigned to avoid these due to their very small size, the additional track length that would be required to divert around them and also because a detailed topographical survey is required to establish the final track design to this level of accuracy. However, where possible, the final track location will be microsited to avoid these small areas if the topography is acceptable.

3.29 New access tracks will comprise a 5m wide running surface with a 0.5m shoulder on either side, depending on local topography. They will be retained throughout the lifetime of the Wind Farm. Where possible, excavated peat and soils left over from road construction will be used to locally dress the verges and shoulders of the road and encouraged to revegetate. Further details on the use of excavated peat for habitat management purposes are detailed in Chapter 6 (Ecology).

3.30 A new track will be required to access the permanent anemometer mast during the lifetime of the Wind Farm. The meteorological mast track will be constructed to a similar specification as the other new tracks.

3.31 Existing access tracks will be upgraded where required by removing a layer of loose material from a 5m strip of track width or replacing with crushed rock compacted to tie in with the existing track level. The width of the upgraded track will be greater at junctions and bends.

3.32 At appropriate points, access tracks will be gated off with galvanised farm gates to discourage unauthorised vehicle access, and any signage will be discrete, co-ordinated and fixed to the gate or gateposts.

3.33 The access tracks will be used by construction vehicles and will be retained throughout the lifetime of the Wind Farm for use by maintenance vehicles and landowners. The majority of traffic will be generated during the construction and decommissioning phases of the Wind Farm development, as discussed in Chapter 11 (Traffic and Transport).

Overtaking / Passing Lanes

3.34 To allow safe passing of construction vehicles and to avoid the need to construct a loop track system, Onsite passing lanes will be constructed comprising a 5m wide by 10m long hardstanding area adjacent to the access tracks. These passing places will not be used for oversized turbine delivery vehicles which will be given priority over other vehicles on the access tracks.

Turning Areas

3.35 Subject to the final turbine selected, turning areas for turbine delivery vehicles on the Wind Farm site may be required. Where possible, turbine access track junctions will be used. Where not possible, T-junctions for turning will be constructed along the access track as shown in Figure 3.3.

Access Track Type

3.36 The track will be constructed of crushed rock won from onsite borrow pits. Two different track types will potentially be used on site depending on ground conditions such as slope and peat depth. The following track construction types are anticipated to be used at the site (Figure 3.4).

- **Cut Road Design (Typical):** Will be adopted where the ground has relatively thin peat or soil deposits present. This type of construction involves excavation and removal of peat and other superficial material, and placement of crushed rock.
- **Cut Road Design (Sloping Ground):** Will be adopted on sloping ground where it has relatively thin peat or soil deposits present. This type of construction involves excavation of removal of peat and deeper underlying Till or Rock, and placement of crushed rock.

3.37 Where areas of peat exceed 1.5m in depth it may be necessary to employ the following track design (Figure 3.4):

- **Floating Track Design**: Will be employed where the depths of peat are significant (typically greater than 1.5m over a significant length) and excavation of total depth of peat is not practical. Floating tracks consist of layers of geogrid overlain by compacted rock aggregate.

Drainage

3.38 The tracks will have an adequate crown or cross-slope to allow rainwater to be shed, and where gradients are present, lateral drains will intercept flow along the track.

3.39 Cross pipes will be laid as required to permit good track drainage. These will be located in areas where the position of the access track could lead to ponding to one side. As far as possible, these will coincide with naturally occurring drainage channels. Final track drainage will be determined prior to the commencement of construction of the relevant track section. Drainage is discussed further in Chapter 8 (Hydrology, Hydrogeology and Geology).

Temporary Construction Compound and Laydown Area

3.40 During the construction period a temporary construction compound and laydown area will be required. The compound will be located at NS 760 309 and the laydown area at NS 759 309 as shown in Figure 1.2. Both of these locations are within the existing open cast coal workings in order to minimise the disturbed area. Both the laydown area and compound will each comprise an area of hardstanding of approximately 100m x 50m. The compound will be used to provide space for:

- Temporary portacabins for site offices and welfare facilities for contractors;
- ISO Containers used for tool and equipment storage;
- Site toilets with a provision for contained waste storage and removal;
- Concrete batching, if required;
- Parking area; and
- Storage of components and materials including fuels, lubricants and oils.

3.41 Figure 3.5 illustrates an indicative layout of the construction compound. The hardstandings will be constructed using a geogrid base, or similar, to facilitate removal and reinstatement. Within six months of the Wind Farm becoming operational, all portacabins, machinery and equipment will be removed and the hardstandings covered over.

Meteorological Mast

3.42 There will be one meteorological mast within the site boundary at NS 76307 30130, as shown in Figure 1.2 which will be required for the operational life of the Wind Farm. Three anemometers and wind vanes will be mounted on the mast; the primary anemometer (uppermost anemometer) will be mounted at hub height (70 m). The mast dimensions are shown in Figure 3.6. The mast will be erected on a concrete base. A hardstanding will be provided adjacent to the mast to enable access for construction and maintenance of the mast. The dimension of the mast base and adjacent hardstanding will be subject to ground conditions. The following data will be recorded by the mast:

- Wind speed;
- Wind direction;
- Temperature;
- Pressure; and
- Humidity.

3.43 The data will be stored in a Supervisory Control and Data Acquisition (SCADA) system for each ten-minute period. The following data will be interpreted from the recorded data:

- Mean, maximum and minimum values;
- Standard deviation values; and
- Maximum 3-second gust.

Transformers

3.44 Each wind turbine has its own transformer. The turbine transformers, depending on the eventual model of turbine selected, could be located outside the turbine base. If located externally the transformer will be located within a small housing measuring a maximum of 6m x 4m x 3m.

3.45 The turbine transformers will be linked to the on-site substation by underground 33kV cables. The cables will run parallel to access tracks where practicable, and will be installed using the most appropriate solution available at the time of installation.

Substation and Control Buildings

Wind Farm Substation

3.46 The Wind Farm Substation will be located adjacent to the access track at grid reference NS 766 311 and the building will measure approximately 21m x 7m. Figure 1.2 shows the location of the substation and Figure 3.7 illustrates the indicative design of the substation. The building will be finished in a natural/stone coloured render which will match the colour of the existing buildings in the area with a pitched slate (or slate substitute) roof (see Chapter 5, LVIA for details). The substation building will be divided into rooms for SCADA, HV switchgear, LV switchgear, office, workshop and stores. A hardstanding will be included between the building and the access road for parking.

3.47 The building will also contain a single toilet and hand wash facility. The water for flushing the toilet will come from a rainwater collection tank located within the compound. It is likely the foul waste will be disposed into a septic tank and then soakaway. Percolation tests will be carried out prior to construction to obtain the appropriate CAR authorisation from SEPA. This is discussed further in Chapter 8 (Hydrology, Hydrogeology and Geology).

Scottish Power Substation

3.48 The Scottish Power substation compound will be located adjacent to the access track and Wind Farm substation at grid reference NS 765 310 and will measure approximately 86m x 33m. The compound will comprise a single storey building and an area for external switchgear. Figure 1.2 shows the location of the substation and Figure 3.8 illustrates the indicative design of the substation.

3.49 The final substation building design will be dependent on Scottish Power's detailed design and site investigations but the compound area is not expected to be larger than 86m x 33m. The substation compound will include a separate control building. The control building will house the control room, relay room, store room, telecoms room, LVAC room, battery room and meter room. A 2.74m high security fence will surround the substation and control room.

3.50 The control building will also contain a single toilet and hand wash facility. The water for flushing the toilet will come from a rainwater collection tank located within the compound. It is likely the foul waste will be disposed into a septic tank and then soakaway. Percolation tests will be carried out prior to construction to obtain the appropriate CAR authorisation from SEPA. This is discussed further in Chapter 8 (Hydrology, Hydrogeology and Geology).

Grid Connection

3.51 The Wind Farm substation will connect to the proposed adjacent Scottish Power substation, as shown in Figure 3.9 by underground 33kV cables. The Scottish Power substation will connect to the transmission network via a 132kV cable which will run via an underground cable from the substation through the site to the forestry on the eastern boundary. At this point, the connection will become an overhead line through the forest until it meets the Scottish Power Coalburn substation located at NS 825 375, approximately 3km north east of Coalburn.

3.52 This grid connection is likely to be subject of a Section 37 application under the Electricity Act 1989 and EIA by Scottish Power. It is therefore not covered in detail in this ES.

Wind Farm Construction Programme

3.53 It is estimated that construction of the Wind Farm will take approximately 14 months, including commissioning and site reinstatement. Table 3.3 provides an indicative schedule of construction activities. Following planning consent, a more detailed programme of works will be produced with the appointed construction contractors and agreed with South Lanarkshire Council and East Ayrshire Council.

Table 3.3 Indicative Construction Programme

Task		M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14
Construction compound		■													
Plant/Offices delivery & removal		■								■					■
Roads		■	■	■	■	■									
Water crossing				■											
WTG Foundations					■	■	■	■	■						
Hardstandings				■	■	■	■								
Substation & control room							■	■	■	■					
Grid sub station		■	■	■	■	■	■	■	■	■	■				
On site cabling			■	■	■	■				■	■				
Turbine erection												■	■		
Commissioning												■	■	■	
Final Works															■

Construction Vehicles

3.54 The numbers and type of construction vehicles and the potential impacts of vehicle movements are discussed in Chapter 11 (Traffic and Transport).

Construction Hours

3.55 Construction will likely be carried out between the hours of 0800 to 1800 during week days and 0900 to 1200 on Saturdays. In the event that construction will be required outwith these hours, e.g. for delivery of abnormal loads, both South Lanarkshire Council and East Ayrshire Council will be notified.

Maintenance

3.56 A full-time operations manager will oversee day-to-day Wind Farm operations. Employees from the turbine manufacturer and/or suitably qualified contractors will carry out maintenance at regular intervals. Turbine maintenance will be carried out, along with any other maintenance required by manufacturers' specifications and will likely include the following:

- Initial servicing;
- Scheduled routine maintenance and servicing;
- Unplanned maintenance or call outs; and
- Blade inspections.

3.57 Servicing will include the performance of tasks such as maintenance of bolts to the required torque, adjustment of blades, inspection of blade tip brakes, inspection of welds in the tower and re-lubrication of moving components. In addition, sampling and testing of oil from the main gearbox with replacement of oil as required. Oil filters will be replaced at regular intervals.

Site Signage and Fencing

3.58 A number of information signs will be required at the site during construction and operation of the proposed Wind Farm. The signage will include:

- Panel signs to indicate the site entrance;
- Signage on each turbine indicating the turbine number, potential hazards and an emergency contact telephone number;
- Control building signage with health and safety information and an emergency contact telephone number; and
- Other operational signage as required (Buried HV Cable Route, Turbine Locations etc.).

3.59 Fencing will be erected around the construction compound, laydown area, anemometer mast and Scottish Power substation. The fencing at the construction compound and laydown area will likely be temporary 2m Heras fencing and will be removed following completion of construction.

Decommissioning

3.60 The Wind Farm is expected to operate for a period of 25 years. At the end of this period, the Wind Farm will be decommissioned and the site reinstated as approved by the appropriate authority, and in agreement with the landowners. A decommissioning plan will be agreed with all parties before the cessation of operations. Decommissioning will involve:

- Dismantling and removal of the wind turbines and above ground electrical equipment;
- Reinstatement of ground above the wind turbine foundations;
- Demolition and removal of the control building and compound;
- Cutting off and de-energising electrical cables below ground level;
- Restoration of crane pads; and
- Leaving access tracks in-situ.

3.61 The turbines will be dismantled and removed from the site in a manner similar to that of their erection. Turbine foundations will be broken out below the final ground level. Typically this will involve the removal of the upstand plinth to the top surface of the main foundation base. Access tracks will be reinstated in accordance with best practice at the time of decommissioning. Information relating to decommissioning will be outlined within the decommissioning plan, which will be submitted to the appropriate authorities prior to cessation of operations.

Appendix 3A: Borrow Pit Analysis

Borrow Pit No.	Easting	Northing	New/existing	Dimensions (width x length x depth (m))	Potential Yield (m^3)
1	276226	631154	New	70 x 80 x 12	33,600
2	276414	630356	New	180 x 80 x 12	86,400
3	276541	629772	New	125x 60 x 15	56,250
4	277861	631301	New	160 x 72 x 12	69,120

Notes:

1. Coordinates – Easting and Northings taken from top left corner of borrow pit.
2. Borrow Pit Dimensions – these dimensions are estimated and subject to limitations imposed by archaeological, ecological, landscape factors etc.
3. Assumed Overburden Thickness (approximate depth of superficial materials that would be required to be removed prior to winning of rock materials may vary across slope) –assumes existing ground profile to be uniform slope, and have been averaged across any slope gradient. Slopes are likely to be convex so pits are likely to be smaller if rock is of sufficient quality.
4. Depth of Borrow Pit (approximate depth that material could practicably be won to including depth of overburden) –these dimensions are estimated.
5. Potential Yield (approximate volume of material that may be won) – derived from estimated values of borrow pit area and depth of borrow pit, with allowance made for overburden and other losses. Significantly more or less materials may be excavated.

Chapter 4 - Planning and Renewable Energy Policy Context

Introduction

4.1 This chapter describes the national and local planning policy framework for the proposed Galawhistle Wind Farm, setting out the policies of relevance to the determination of the application.

4.2 Furthermore, this chapter also includes a description of other relevant material considerations, which include emerging Development Plan policy, national planning policy and planning policy guidance. In addition the relevant wider policy context in relation to climate change and renewable energy is described at the European, UK and Scottish Government levels.

4.3 This chapter provides some background to the consideration of potential local environmental effects and implications of the proposed Wind Farm as set out in Chapters 5 to 13.

4.4 Due to the electricity capacity generation of the proposed development exceeding 50 MW, the application is submitted under the terms of Section 36 of the Electricity Act 1989 and Section 57 of the Town and Country Planning (Scotland) Act 1997.

4.5 In considering the application under Section 36 of the Electricity Act 1989 The Scottish Ministers must also fulfil the requirements of paragraph 3 to Schedule 9 of that Act. If Section 36 consent is granted then The Scottish Ministers may also direct that planning permission for the proposed development is deemed to be granted.

4.6 Relevant policies within the statutory Development Plan which provide the land use planning framework for the application site are described. The Structure and Local Plan policies provide the relevant policy context against which to assess the proposed development.

4.7 It is important to note that this chapter does not include an assessment of the proposed wind Farm's accordance with statutory Development Plan policy and other material considerations. This would inevitably involve a degree of subjective interpretation, which is contrary to advice on ES preparation, including good practice guidance on EIA, which states that discussions of planning policy in an ES should be objective. It should be noted that the applicant therefore intends to submit a separate Planning Statement. This will consider in detail, the relevant Development Plan policies, and national and renewable energy policy in the context of the proposed development and will reach conclusions on the acceptability of the proposed development in planning policy terms. The Planning Statement will not form part of the ES.

Development Plan Context

4.8 The Wind Farm site lies within the administrative area of both South Lanarkshire Council and East Ayrshire Council. There are 20 turbines within the South Lanarkshire Council boundary with 2 turbines and the entrance and the access track within East Ayrshire Council. The relevant Development Plan for the two areas are as follows:

South Lanarkshire Council

- Glasgow and the Clyde Valley Joint Structure Plan 2006 and;
- South Lanarkshire Local Plan - Volume 1: Development Strategy and Volume 2: Development Policies, Guidance and Appendices 2009

East Ayrshire Council

- Ayrshire Joint Structure Plan 2007 and;
- East Ayrshire Local Plan 2003

4.9 Both Development Plans contain renewable energy policies that are reasonably consistent with national advice, although the Glasgow and the Clyde Valley Joint Structure Plan and the East Ayrshire Local Plan both pre-date the prevailing national guidance on such matters (SPP6 Renewable Energy, published in 2007). SPP6 is further discussed in the section 'National Planning Policy'.

4.10 As the relevant policy currently in force, the East Ayrshire Local Plan 2003 has been reviewed for the purposes of this ES. Emerging policy under the East Ayrshire Local Plan Finalised Draft with Modifications will go through an Examination by a reporter from the Directorate of Planning and Environmental Appeals, appointed by Scottish Ministers which is anticipated to take place in Autumn/Winter 2009. The Council will then proceed to adopt the Alteration to the East Ayrshire Local Plan.

4.11 Sections 25 and 37 (2) of the Town and Country Planning (Scotland) Act 1997, require that planning decisions be made in accordance with the Development Plan, unless material considerations indicate otherwise.

Development Plan – South Lanarkshire Council

Glasgow and the Clyde Valley Joint Structure Plan 2006

4.12 At a strategic level, the most recent version of the Glasgow and the Clyde Valley Structure Plan is the Glasgow and the Clyde Valley Joint Structure Plan 2006, The Twenty Year Development Vision, Written Statement, Finalised Modifications, which became operative on 29 April 2008. It sets out a common strategy for the long term planning and development for an area which comprises eight local authorities, including South Lanarkshire Council.

Sustainability

4.13 Strategic Policy 8 'Sustainable Development of Natural Resources' is the key policy with regard to the location of windfarms. The policy states:

4.14 *'The Metropolitan Development Strategy supports developments which satisfy the following criteria:*

(b) Are in the Potential Areas of search for significant wind farm developments indicated on Diagram 22

(d) Safeguard and enhance the Strategic Environmental Resources, Schedule 7'

4.15 The term 'significant' is defined in Schedule 9 of the Structure Plan. In the instance of wind farms, developments of 20MW output capacity and above are regarded as significant. The

proposed capacity of the proposed Galawhistle Wind Farm is 55MW and therefore classed as a 'significant' wind farm proposal.

4.16 Diagram 22 identifies five potential areas of search for significant wind farms. The proposed development at Galawhistle is located within a potential area of search, therefore satisfies Criteria (b) of Strategic Policy 8. With regard to Criteria (d) of Strategic Policy 8, Schedule 7 Strategic Environmental Resources lists 7 resources to be safeguarded:

(a) 'Ecological resources: SACs, SPAs, SSSIs, NNRs, RSPB and SWT reserves, and species or habitats protected by national and international legislation or recognised in Local Plans;

(b) Landscapes: NSAs, RSAs, AGLVs and the landscape character of the Green Belt

(c) Existing and Potential Recreational Resources: National, Regional, Country and Major Urban Parks, the Green Belt and long distance walkways and cycling routes;

(d) Built Heritage: Scheduled Ancient Monuments and other archaeological sites and landscapes, Listed Buildings, World Heritage Sites, Conservation Areas, the locations identified in the Inventory of Historic Gardens and Designed Landscapes;

(e) Agricultural Land: ESAs, Grades 3.2 or higher (10ha+) as identified in Diagram 20;

(f) Minerals Reserves: Specialised mineral resources identified in Local Plans (e.g. brick making clays and barytes); and

(g) Undeveloped Functional Flood Plain Areas: As advised by SEPA and confirmed by the Local Planning Authority.

4.17 Strategic Policy 9 'Assessment of Development Proposals' is an overarching policy which is of relevance to all development proposals. The policy states:

'In order to accord with the Structure Plan, development proposals will require to satisfy the following criteria.

Any proposal which fails to meet these criteria will be regarded as a departure from the development plan and will be required to be justified against the criteria in Strategic Policy 10.'

4.18 The policy then goes on to list 3 categories (A, B & C), each with a number of criteria against which developments should be assessed. The criteria in Category A is not relevant in this instance.

4.19 The criteria within Category B of Strategic Policy 9 seek to ensure the location of development is appropriate in terms of the need to have regard to 10 criteria. The relevant criteria are stated as follows:

Criterion B

That the location of the development is appropriate in terms of the need to :

(i) Safeguard and avoid the diversion or displacement of investment from the development locations identified in Strategic Policies 1, 5, 6 and 8;

(iv) Safeguard the environmental resources listed in Schedule 7 or identified in local plans (including regard to landscape character and quality);

(v) Avoid isolated and sporadic development in the Green Belt and the wider countryside; and

(viii) Avoid the risk of flooding from all sources throughout the relevant water and drainage catchment area and safeguard the storage capacity of the functional flood plain.

Criterion C

That appropriate provision has been made by the developer for:

(i) The infrastructure or facilities required to make the development acceptable;

(ii) The implementation of appropriate transport measures for the minimisation and Management of the future levels of traffic generated, including Green Transport Plans; and

(vii) The excavation and recording of archaeological sites where preservation cannot be achieved.

4.20 Strategic Policy 7 'Strategic Environmental Resources' states:

'In addition to the Green belt, the sustainable development of the Glasgow and Clyde Valley metropolitan area requires that particular regard be had to safeguarding and managing the following International, National and Strategic Environmental Resources identified below and shown on Diagram 19; there shall be a presumption against any proposals which could have a significant adverse affect upon these resources informed where necessary by an Appropriate Assessment of the proposals on the conservation interests in the area. The Metropolitan Strategy also requires the protection and enhancement of the environmental resources listed in Schedule 7, in accordance with the guidance set out in NPPG 14 Natural Heritage.'

4.21 Strategic Policy 5 'Competitive Economic Framework' seeks to improve the economic competitiveness of Glasgow and the Clyde Valley metropolitan area. Although this policy focuses on business development, it is appropriate to note the investment into a rural area that will be generated by the Galawhistle wind farm scheme. The policy also specifies tourism development areas' and 'safeguarded high amenity locations'. The proposed Wind Farm is located outwith either of the designated areas, therefore complying with the aims of the policy.

South Lanarkshire Local Plan 2009

4.22 The Local Plan was approved by the Scottish Ministers March 2009 and provides a strategy at a local level for development in the South Lanarkshire area for a 5 year period from the date the plan was published.

Renewable Energy

4.23 The proposed site is zoned within the local plan as a potential wind farm area. Potential wind farm developments are assessed under Policy ENV14, which states:

4.24 *'In accordance with the Structure Plan and SPP6, the potential areas of search identified on the Strategy Plan should be the focus for investment in significant wind farm developments, pending*

the outcome of the policy review referred to in ENV 15 'Spatial Framework for Windfarm Proposal'. Proposals within the potential areas of search will be assessed against the criteria set out in ENV38 – Renewable Energy Site Assessment Policy. Outwith the broad areas of search, the criteria in policy ENV38 will be followed to consider applications on their merits, mindful of the overall policy of support for renewable energy developments.'

4.25 Paragraph 9.2 to 9.5 gives reasoned justification to renewable energy planning policies contained within the local plan. Whilst the Council do not want to unnecessarily inhibit the provision and growth of renewable energy resources, necessary justification must be provided to ensure the wellbeing of the surrounding environmental resources. The criteria against which wind farms should be assessed is outlined in Policy ENV 38 Renewable Energy Site Assessment Policy, which states:

'*All proposals for windfarms and other renewable energy developments will be assessed against the under noted criteria:*

A) International and National Natural Heritage Designations and the Green Belt;

1. *Developments affecting international and national natural heritage designations must accord with ENV4 - Protection of the Natural and Built Environment, and the specific environmental policies in Volume II as follows*
    - *ENV 20 – Natura 2000 Conservation Sites (Special Protection Areas and Special Areas of Conservation including sites outwith the South Lanarkshire boundary)*
    - *ENV 21 – European Protected Sites*
    - *ENV 26 – National Nature Reserves and Sites of Special Scientific Interest*
2. *In accordance with SPP 6, all renewable energy developments in the Green Belt must comply with the requirements of SPP21: Green Belts. Wind farm developments of over 20MW will only be permitted in exceptional circumstances, either as a national priority or to meet an established need, but only if no other suitable site is available.*

B) Other Natural and Built Heritage Resources

1. *The proposal can take place without unacceptable significant detrimental effects on landscape character and significant adverse visual impact, including the landscape quality of the Regional Scenic Area and the Areas of Great Landscape value. The findings of South Lanarkshire Landscape Capacity and Sensitivity Study 2005 will be reviewed by the Council as part of further work under ENV15 Spatial Framework for Windfarms Proposal, and its conclusions set out in Supplementary Planning Guidance, that will be subject to full stakeholder consultation and subsequently taken into account. Full assessment, demonstrating potential impact, to a radius of 35km unless otherwise agreed with the Council, will be required using a range of techniques including Zones of Visual Influence, wire line diagrams and photo montages where appropriate.*
2. *The cumulative visual and landscape impacts of wind farm developments, in accordance with paragraph 51 of SPP6, have been fully assessed and shown to be acceptable.*
3. *The development will have no unacceptable adverse impact on Local Nature Conservation Sites and priority species and habitats identified in the South Lanarkshire Local Biodiversity Action Plan. Where it is advised by SNH and RSPB at scoping stage that there may be significant cumulative impacts on ecological and/or ornithological interests, developers will be required to undertake a cumulative impact assessment.*
4. *Cumulative visual, landscape and ecological/ornithological impact assessments should include all operating and consented schemes and those that are the subject of valid but undetermined applications..*
5. *The development must comply with the Local Plan's built heritage policies as follows-*
    - ENV 22 – New Lanark World Heritage Site & its setting
    - ENV 23 – Ancient Monuments and Archaeology Policy
    - ENV 24 – Listed Buildings Policy
    - ENV 25 – Conservation Areas Policy
    - ENV 28 – Historic Gardens and Designed Landscapes Policy
6. *Developments should be designed to minimise soil disturbance when building and maintaining roads and tracks, turbine bases and other infrastructure to ensure that the carbon balance savings of the scheme are maximised. Where relevant, applicants will be expected to provide geotechnical and hydrological information in support of applications, identifying the presence of peat at each site, including the risk of landslide connected to any development work.*

C) Other Considerations

1. *The development will not unacceptably affect the amenity of residents of nearby towns, villages and other properties by means of noise, smell, visual dominance, shadow flicker, reflected light or other emission.*
2. *Views from key tourist routes and visitor attractions will not be adversely affected to an unacceptable degree.*
3. *The siting and external appearance of apparatus, including any locational or landscaping requirements, have been design to minimise the impact of such apparatus on amenity, while taking account of operational efficiency.*
4. *Access for construction traffic can be achieved without compromising highway safety, residential amenity or causing significant permanent damage to the environment. Applicants will be required to provide a transportation statement setting out the traffic impact for the construction an operational periods and demonstrating suitability of the transport routes for turbine components from their source. It is likely that pre and post construction road surveys will be required by the Council and that the developer may be required to enter a Section 96 Agreement with the Council. Any impacts of road construction, upgrading on Natura 2000 sites must comply with criteria A1 above.*
5. *Where there are clear landscape or other sensitivities that will have to be addressed, as agreed with the Council, the environmental effects of all new transmission lines between the development and the point of contact to the grid should have been assessed and shown to*

have no significant adverse environmental impact, or that such impacts can be suitably mitigated.

6. *No electromagnetic disturbance is likely to be caused by the proposal to any existing transmitting or receiving system or, where such disturbances may be caused, that measures will be taken to remedy or minimise any such disturbances. In relation to TV reception, pre-surveys should be carried out and agreed demonstrating the baseline position, and if required, appropriate mitigation measures and remedial procedures will be specified through a S75 Agreement with the Council.*

7. *The impact of the proposal on radar performance and other air safety considerations have been satisfactorily addressed and demonstrated to the satisfaction of the relevant technical authorities.*

8. *Where proposals are shown to have a significant adverse impact in respect of any of the above criteria, the developer will be required to demonstrate that appropriate mitigating measures will be applied.*

9. *For larger schemes, and for other schemes where specific species/habitats are affected, developers may be required to submit a Habitat Management Plan setting out the means of land management that will secure biodiversity objectives.*

10. *All wind farm should acknowledge the need for decommissioning, restoration and aftercare at the end of the permission or the life of the turbines, if earlier, and not renewed by the Council. Conditions, including a restoration bond where appropriate, will be imposed on any permission granted to this effect, requiring implementation measures to be agreed with the Council in accordance with best practice at the time..*

11. *The Council will require all applications for renewable energy developments which fall within the scope of the Environmental Assessment legislation to be accompanied by an Environmental Statement, and encourages these to be preceded by a pre-application scoping report.*

12. *Where appropriate, the Council will normally require an applicant to enter into a Section 75 Agreement to address community benefit payments, restoration bond requirements and others matters which cannot be controlled by the imposition of planning conditions.*

13. *Applications should include details of the environmental, social and economic benefits that will arise from the project, both locally and normally, including the overall number of jobs and economic activity associated with the procurement, construction and operation of the development.'*

4.30 With regards to point 12 above, there is a specific policy with regards to Community Benefit to ensure that local communities can benefit from the development which has the potential to have long term effects on the local environment. Policy ENV 17 Renewable Energy Community Benefit Policy states:-

'The Council encourages developers of renewable energy facilities in South Lanarkshire to contribute to the Renewable Energy Fund established for the benefit of communities affected by renewable energy development. The Council will consult affected communities on the use of the fund, which shall include:

- *Secure investment, create employment, implement training, promote or securing sustainable development;*
- *Relieving poverty, advancing education and other social purposes beneficial to a community;*
- *Preserving, protecting or enhancing the environment improvement or heritage interests, including any building;*
- *Promoting and encouraging environmental improvement or enhancement including the provision or upgrading of infrastructure; and*
- *Providing or assisting in the provision of facilities for recreation or other leisure time activities.*

In cases where a developer elects to make contributions to the Council fund, the Council will discuss with the developer ways in which the contributions will be managed, and any agreement necessary to secure this. This would normally be by means of a Section 75 Agreement to be concluded prior to the issue of planning consent.'

Built Environment

4.31 Policy ENV4 -Protection of the Natural and Built Environment Policy recognises the importance of the amenity of the natural and built environment and advises that development will only be permitted where it can be demonstrated that the integrity of the area will not be compromised. Further guidance is contained within local plan policies as follows:

ENV 23 – Ancient Monuments and Archaeology Policy

'Scheduled Ancient Monuments and other identified nationally important archaeological resources shall be preserved in situ and within an appropriate setting. Developments which have an adverse effect on scheduled monuments or the integrity of their setting shall not be permitted unless there are exceptional circumstances.

All other archaeological resources shall be preserved in situ wherever feasible. The Council will weigh the significance of any impacts on archaeological resources and their settings against other merits of the development proposals in the determination of planning applications.

The developer may be requested to supply a report of an archaeological evaluation prior to determination of the planning application. Where the case for preservation does not prevail, the developer shall be required to make appropriate and satisfactory provision for archaeological excavation, recording analysis and publication, in advance of development..'

4.32 Policies ENV 24 – Listed Buildings Policy, ENV 25– Conservation Area Policy and ENV 28 – Historic Gardens and Designed Landscapes Policy protect against development which effect the setting or character of any listed buildings, conservation areas or historic garden/designed landscape.

Ecology

4.33 Development which affects a Site of Special Scientific Interest/National Nature Reserves Policy is protected through Policy ENV 26 which states:

Development that affects a Site of Special Scientific Interest/National Nature Reserves will only be permitted where an appraisal has demonstrated:

a. The objectives of the designated area and the overall integrity of the area would not be compromised; or

b. Any significant adverse effects on the qualities for which the area has been designated are clearly outweighed by social or economic benefits of national importance.

4.34 There are two main policies with regards to protecting the natural habitats and the relevant legislation policies, which are, ENV 20 – Natura 2000 Sites Policy and ENV 21 – European Protected Species. The site is not identified as a Natural 2000 site, however ENV 21 is relevant to this proposal which states:

The Council will encourage the management and maintenance of areas supporting the following habitats and species, where these contribute to the coherence of the Natura network or are of major importance:-

a. Habitats and species listed in Annex I of the EC Habitats Directive;
b. Habitats and species of community interest listed in Annexes II, IV and V; and
c. Habitats of naturally occurring wild birds, particularly those in Annex I of the EC Birds Directive and migratory species

This policy will also apply to species listed in Schedules 1, 5 and 8 of the Wildlife and Countryside Act 1981 as amended.

Design

4.35 Local Plan policy ENV11 – Design Quality Guidance emphasises the importance of good design in order to make the most of the surrounding natural and built environment and states:

The quality of the design and layout of new developments must be such that they can demonstrate the application of the principles of sustainable development and make a positive contribution to the character and appearance of the urban or rural environment in which it is located.

Development Plan – East Ayrshire Council

Ayrshire Joint Structure Plan 2007

4.36 The Structure Plan was approved by the Scottish Ministers in November 2007 and is intended to provide a strategy to guide the location of development in Ayrshire until 2025. The Structure Plan sets out objectives relating to economic development, urban and rural regeneration and enhancing the environment.

4.37 Sustainability and renewable energy sources are highlighted as key indicators for the future of Ayrshire. Policy STRAT 1 Sustainable Development states:

'The three Councils shall, as appropriate, apply the Guiding Principles of Sustainable Development in Schedule 1 to the preparation of development plans, the consideration of masterplans and to planning applications.'

4.38 STRAT 1 and Schedule 1 will be prime considerations in framing planning policy and the preparation of future local plans. Schedule 1 sets out the guiding principles for sustainable development.

Renewable Energy

4.39 It is recognised in the Structure Plan that to reach Government targets for generation of electricity from renewable energy sources they will have to exploit the resources available, with Ayrshire being well placed to accomplish this goal. Ayrshire has above average mean wind speeds and as such is an attractive location for wind energy solutions. As such Policy ECON 6 Renewable Energy supports renewable energy proposals provided *'it can be demonstrated there will be no significant adverse impact, including adverse cumulative impact or infrastructure constraints, and where the design of the development is sensitive to landscape character, biodiversity and cultural heritage'*

4.40 There are two policies which are specific to renewable energy sources, with one of those addressing wind farms. The criteria against which wind farms should be assessed is outlined in Policy ECON 7 Wind Farms. It states:

'A) In the Areas of Search proposals for large and small scale wind farm development will be supported subject to specific proposals satisfactorily addressing all other material considerations.

B) Areas designated for their national or international heritage value, and green belts, will be afforded significant protection from large scale wind farms;

C) The integrity of national and international designations should not be compromised.

D) Cumulative impact will be assessed in all relevant cases, taking into account existing wind farms, those which have permission and those that are the subject of valid but undetermined applications. The weight to be accorded to undetermined applications will reflect their position in the application process. Where the limit of acceptable cumulative impact has been reached the area will be afforded significant protection.

E) Outside the Areas of Search: all wind farm proposals will be assessed against the following constraints, any positive or adverse effects on them and how the latter can be overcome or minimised:

1) Historic Environment;
2) Areas designated for their regional and local natural heritage features;
3) Tourism and recreational interests;
4) Communities;
5) Buffer zones;
6) Aviation and defence interests;
7) Broadcasting installations;

F) Proposals affecting Sensitive Landscape Character Areas shall satisfactorily address any impacts on the particular interest that the designation is intended to protect but the

designation shall not unreasonably restrict the overall ability of the plan area to contribute to national targets.

G) In all cases, applications for wind farms should be assessed in relation to criteria including, as appropriate, grid capacity, impacts on the landscape and historic environment, ecology (including birds), biodiversity and nature conservation, the water environment, communities, aviation, telecommunications, noise and shadow flicker.'

Landscape

4.41 Structure Plan Paragraph 91 recognises the significant contribution the Ayrshire landscape makes to the economic and, environmental and cultural life of the area. Policy ENV 1 Landscape Quality states:

'The quality of Ayrshire's landscape and its distinctive local characteristics shall be maintained and enhanced. In providing for new development, particular care shall be taken to conserve those features that contribute to local distinctiveness including:

A) Settings of communities and buildings within the landscape;

B) Patterns of woodland, fields, hedgerows and tree features;

C) Special qualities of rivers, estuaries and coasts;

D) Historic landscapes; and

E) Skylines and hill features, including prominent views.

Local plans shall seek to protect and enhance landscape character and establish criteria for the assessment of future development proposals in the context of the particular local landscape type within which the development is proposed.'

4.42 Paragraph 93 highlights the importance of providing protection for high quality landscapes and sensitive landscape character areas. Policy ENV 2 Landscape Protection sets out its aims as follows:

'A) Development that affects a National Scenic Area will only be permitted where it has been demonstrated:

(a) The overall objectives of the designated area and the overall integrity of the area would not be compromised; or
(b) any significant adverse effects on the qualities for which the area has been designated are clearly outweighed by social or economic benefits of national importance.

B) In Sensitive Landscape Character Areas the protection and enhancement of the landscape shall be given full consideration in the preparation of local plans and the determination of planning applications.'

Built Environment

4.43 The Structure Plan defines built heritage as '…*a wide range of conservation areas and historic settlements, historic and architecturally important buildings, scheduled ancient monuments, archaeological locations and landscapes, historic gardens and designed landscapes*.' Although much of these resources are protected by statutory legislation or government policy any proposed development which may have a detrimental effect on these resources will not be supported by Policy ENV 6 Protection of the Built Heritage which states:

'Development proposals considered to have an adverse effect on the following heritage resources shall not conform to the structure plan.

(a) listed buildings of architectural and historic interest;
(b) designated conservation areas;
(c) historic gardens and designed landscapes; and
(d) archaeological locations and landscapes…'

4.44 The Structure Plan highlights the change in agriculture and the rural economic base in general. It is recognised that during this changing process it is *'..essential that rural areas increase their capacity to adjust to and accommodate this change while protecting and enhancing environmental quality*.' This will play an important role in creating and sustaining rural employment and regeneration.

Other Considerations

4.45 The Structure Plan's aim is to sustain and enhance the Natural Environment through the promotion of Natural Heritage Designations. Policy ENV 7 Natural Heritage Designations states that the three Ayrshire Councils shall *'recognise international and national natural heritage designations and the statutory protection afforded by them'* and that Local Plans shall include policies based on the Scottish Executive Model Policy. The Local Biodiversity Action Plans Action Plan for Ayrshire identifies a series of actions for key species and seven broad habitat types requiring protection and enhancement.

4.46 Finally Policy ECON 14 Rural Diversification states that the Councils will '*Support the principle of rural diversification, particularly through proposals for small scale renewable energy*..' Whilst paragraph 61 recognises that rural diversification is necessary this will not, however, be at the expense of the environment and the rural character of Ayrshire which will be protected and essentially enhanced by future proposals. It is also noted in this paragraph that '*this does not mean that the appearance of rural areas will remain exactly as they are today*.'

East Ayrshire Local Plan 2003

4.47 The Local Plan was approved by the Scottish Ministers in April 2003 and provides a strategy at a local level for development in the East Ayrshire area for a 5 year period from the date the plan is published. The Development Plan contains renewable energy policies that are reasonably consistent with national advice, although the Local Plan pre-dates the prevailing national guidance on such matters (SPP6 Renewable Energy (published in 2006)). SPP6 is further discussed in the section 'National Planning Policy'.

Aims and Visions

4.47 East Ayrshire Council are keen to promote sustainable forms and patterns of development while conserving natural resources and protecting and enhancing the environment. Policy SD4 sets out the sustainability policy for developments within a Rural Diversification Area. Most relevant to this proposal is part (iii) which states the development maybe permitted where it *'...can be fully justified in terms of social and economic benefit to the community.'*

Renewable Energy

4.48 Local plan policy CS8 states that the Council will only be supportive of renewable energy developments within existing or proposed Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Sites of Special Scientific Interest (SSSIs) and Environmentally Sensitive Areas (ESAs) in exceptional circumstances. Development will only be permitted where it can be proven that it will not have an adverse effect on the environmental qualities of the area, there is an overriding national interest and when no reasonable alternative is available.

4.49 Proposals for renewable energy developments are assessed against local plan policy CS9 which states:

'The Council will require all applications for renewable energy developments which fall within the scope of the Environmental Assessment Regulations to be accompanied by an environmental assessment.

All wind farm, wind turbine and other renewable energy developments will be rigorously assessed against the following criteria:

(i) the extent to which the development may adversely affect any sites of nature conservation interest and, in particular, the natural habitat, territory and breeding areas of upland birds;

(ii) the extent to which the amenity of residents of nearby towns, villages and other residential properties may be adversely affected by reason of noise emission, visual dominance and other nuisance;

(iii) the extent to which the development may adversely affect any recognised heritage resources, including Listed Buildings, Conservation Areas, Scheduled Ancient Monuments, Archaeological Sites and Historic Gardens and Designed Landscapes and their individual settings;

(iv) the visual impact of the proposal and its setting within the immediate and wider natural landscape;

(v) the extent to which the proposal may conflict with the Councils strategy to promote tourism related developments in the Doon and Irvine Valleys, Glen Afton and the Muirkirk Uplands;

(vi) the extent to which the proposal may adversely affect or irreversibly damage prime quality agricultural land;

(vii) the cumulative impact of the proposal with other existing or authorised renewable energy developments within the vicinity of the development site;

(viii) the environmental impact of the connections linking the development site with the national grid and the provision of adequate access arrangements from the surrounding road network; and

(ix) the impact of the turbines on radar performance and other air safety considerations.

4.50 Policy CS12 advises that wind farm proposals may be looked at unfavourably if the development site is within close proximity to a wind farm development permitted by another local authority, if the visual intrusion was considered to be unacceptable.

Landscape

4.51 Policy ENV 11 which relates to Landscape and the Rural Environment states that:

'*Within the Sensitive Landscape Character Areas identified on the Local Plan maps, the Council will give priority and prime consideration to the protection and enhancement of the landscape in the consideration of rural development proposals. The Council will not be supportive of development which would create unacceptable visual intrusion or irreparable damage within these areas and will be supportive of development proposals only where these positively enhance or protect the natural landscape, wildlife and cultural heritage of the area or promote the social and economic well-being of communities.'*

4.52 Policy ENV12 recognises the importance of landscape in a rural setting and states that developers will be expected to protect and enhance the natural environment. Developers will also be expected to reinstate any loss to the *'..intrinsic landscape value*..' including existing:

'(i) existing setting of settlements and buildings within the landscape;

(ii) existing woodlands, shelter belts, hedgerows and trees;
(iii) existing burns, rivers, lochs and other water features;
(iv) existing field patterns and means of enclosure including dry stone dykes, hedging and fencing;
(v) existing Public Rights of Way, footpaths and bridleways; and
(vi) existing skylines, landform and contours.

4.53 This policy also states that the council will not support any development which '..*results in the permanent loss of landscape features which are not readily renewable and whose loss would be unacceptable in landscape terms…'.*

4.54 The landscape and visual impact of the proposed development is covered in more detail within Chapter 5 of the ES.

Built Environment

4.55 Policy ENV14 aims to protect the characteristics of the rural environment by ensuring that any future development has minimum impact on the existing character and value of the rural environment. This policy states that;

'In assessing development proposals relating to land within the rural area which has not been identified as specific development opportunity sites on the Local Plan maps, the Council shall

ensure that these have minimum impact on the rural environment. There will be a general presumption against any development which would:

(i) cause the permanent and irreversible loss of prime quality agricultural land (i.e. Classes 1, 2 and 3.1 in the Macaulay Land Classification System)(see Appendix 3);

(ii) have a permanent and irreversible impact or cause irreparable damage to built heritage resources requiring conservation or their settings including listed buildings, conservation areas, historic gardens and designed landscape, scheduled ancient monuments, archaeological and industrial archaeological sites;

(iii) have a permanent adverse impact or cause unacceptable, irreparable damage to natural heritage resources requiring conservation and to existing species and habitats;

(iv) adversely affect the quality of water resources, water catchment areas, land drainage or flood protection interests or create water pollution problems;

(v) result in the destruction of any areas of peat which are considered to be of significant ecological value.'

4.56 In addition to the aforementioned policies other relevant policies include Local Plan Policy ENV19 which has a presumption against any developments which will *'..have an adverse effect on water courses by increasing levels of pollution or detrimentally impact upon water quality, aquatic habitats for wildlife..'*

Built Heritage

4.57 With regards to built heritage and protecting the historic environment Local Plan Policy ENV1 seeks to '*protect, preserve and enhance all heritage resources requiring conservation including Listed Buildings and Conservation Areas, together with their respective settings, Scheduled Ancient Monuments and Archaeological and Industrial Archaeological sites and landscapes*.' Policy ENV4 seeks to protect Conservation Areas and Listed Buildings

Other Considerations

4.58 There are other policies as well as those referred to above such as transportation, economy and tourism which are relevant to the development which will be examined in more detail in the planning statement. Cultural Heritage, Hydrology and Ecology issues are discussed in other relevant chapters of the ES.

Other Relevant Material Considerations

Emerging Local Plan

Alteration to the East Ayrshire Local Plan Finalised Draft: December 2007

4.59 East Ayrshire Council anticipate that the Finalised Draft will be adopted late 2009. The emerging local plan has been written with the aim of achieving, in land use terms, the vision of the Council's Community Plan, which is to ensure that:

'East Ayrshire will be a place with strong, vibrant communities where everyone has a good quality of life and access to opportunities, choices and high quality services, which are sustainable, accessible and meet people's needs.'

4.60 A primary strategic approach has been taken by East Ayrshire Council with the objective:

'to promote sustainable development, to maximise the economic potential of East Ayrshire and to improve the quality of life of its residents.'

4.61 Other issues such as stabilising population levels, encouraging economic development, improving accessibility and transportation links, developing strong and vibrant communities, safeguarding and enhancing the quality of the built and natural environment have all been addressed within this alteration of the local plan.

4.62 The proposed site boundary is within an area zoned as 'Rural Area Outwith Settlement Protection Area' with the relevant policies being **RES10** and **RES12**. These have no relevance to wind farm proposals. A small area to the south of the site, within the proposed boundary, is zoned as a 'Sensitive Landscape Area' with policy **ENV3** being of relevance. This states:

'The Council will give priority and prime consideration to the protection and enhancement of the landscape in its consideration of development proposals within the Sensitive Landscape Character Areas identified on the local plan maps. The Council will ensure that all development proposals in these areas respect, in terms of their design, size, scale and location, the local landscape characteristics of the particular area within which they are proposed.'

Renewable Energy

4.63 The criteria against which wind farms should be assessed is outlined in **Policy CS13** under the Wind Energy policies. This states:

'The Council will assess all applications for wind farm developments against the provisions of Policy ECON7 of the approved Ayrshire Joint Structure Plan: Growing a Sustainable Ayrshire and any future supplementary planning guidance to be prepared relating to cumulative impact.'

4.64 The Council have identified a Preferred Wind Farm Area to the north east of Kilmarnock. The Preferred Wind Farm Area has been chosen as per the policies set out within the Structure Plan.

4.65 With the aim of minimising the environmental and visual impact of wind farm proposals the Council will prepare detailed supplementary design guidance. Once this guidance has been adopted by the Council it will be a material consideration in the assessment of all new wind farm proposals.

4.66 To compensate for any disturbance experienced by the local community during the construction, operational and decommissioning phases of the development **Policy CS14** states that:

'The Council will, if mindful to grant planning permission for a commercial wind farm development, require applicants to contribute to a dedicated Renewable Energy Fund which will be used to finance sustainable community environmental projects, particularly those designed to help reduce carbon emissions and counteract global warming. For a period of 10 years from the commencement of construction work on the wind farm, all contributions will be directed exclusively to local projects within 10 kilometres of the boundary of the wind farm. Thereafter, 50% of the contributions received will be directed towards local projects with 50% being reserved

for use in the wider East Ayrshire Area. Contributions will be payable annually and be set at a standard rate of £2500 per megawatt of energy produced per annum, index linked to 1 January 2008.'

4.67 To reduce the visual and environmental impact of wind farm developments **Policy CS15** states that:

'Where a wind turbine is not in operation producing electricity for a continuous period of six months, the operator will be required to provide evidence to the Council that the apparatus is in the process of being repaired or replaced. Otherwise, the Council will deem the turbine to be surplus to requirements and require its removal, with the land restored to its original condition within an appropriate period to be agreed with the Council.'

National Planning Policy

4.68 In addition to the above Development Plan considerations, national planning policy guidance and associated advice is a material consideration. Statements of Scottish Government policy and guidance on planning matters are provided in Scottish Planning Policy (SPP).

4.69 In addition Planning Advice Notes (PANs) are relevant. They are published by the Scottish Government and provide advice on good practice and information on technical planning matters.

4.70 The relevant planning policy guidance related to the proposed Development is listed in Tables 4.1 and 4.2. The aims and objectives of these policies are addressed throughout this ES in more detail within the relevant chapters. Addressed in this section are the relevant national planning policies and advice notes to this development and will be assessed in more detail within the accompanying planning statement.

National Planning Framework 2

4.71 The National Planning Framework 2 (NPF2) was approved by the Scottish Parliament in 2009 and sets out a framework for strategic development priorities in Scotland to 2030 to support sustainable economic growth. NPF2 continues on from the National Planning Framework by identifying key issues and building on the strengths in the different regions of Scotland and identifying the drivers of change, the NPF2 sets out a vision to continue the commitments of sustainable economic growth.

4.72 Paragraph 144 states 'in line with EU objectives, the Scottish Government is committed to working towards deriving 20% of total energy use for renewable sources by 2020'. Map 7 shows the Electricity Transmission System and Map 8 shows the Transmission System Reinforcements. National Development proposals are highlighted on Map 10.

SPP (Scottish Planning Policy)

4.73 On the 4 February 2010, the Scottish Ministers issued "Scottish Planning Policy" (SPP), following consultation on the proposed thematic policies during April 2009 and the publication of parts one and two of the SPP in October 2008. This consolidated SPP provides a shorter, clearer and more focused statement of the Scottish Government's planning policy on land use matters. The SPP supersedes the following statements of national planning policy, which are now revoked:

- SPP 2 – Economic Development,
- SPP 3 – Planning for Homes,
- SPP 4 – Planning for Minerals,
- SPP 6 – Renewable Energy,
- SPP 7 – Planning and Flooding,
- SPP 8 – Town Centres & Retailing,
- SPP 10 – Planning for Waste Management,
- SPP 11 – Open Space & Physical Activity,
- NPPG 12 – Skiing Developments,
- NPPG 13 – Coastal Planning,
- NPPG 14 – Natural Heritage,
- SPP 15 – Planning for Rural Development,
- SPP 16 – Opencast Coal,
- SPP 17 – Planning for Transport,
- NPPG 19 – Radio Telecommunications,
- SPP 20 – Role of Architecture and Design Scotland,
- SPP 21 – Green Belts,
- SPP 22 – Planning for Fish Farming,
- SPP 23 – Planning and the Historic Environment,
- Circular 12/1986 – Planning Control over Onshore Oil and Gas Operations, and
- PAN 53 – Classifying the Coast for Planning Purposes.

4.74 The SPP identifies that the Scottish Government's planning policy is now provided within the National Planning Framework, Designing Places, Designing Streets, various Circulars and the SPP. The SPP sets out:

- The Scottish Government's view of the purpose of planning,
- The 'core principles' for the operation of the system and the objectives for the key parts of the system,
- Statutory guidance on sustainable development and planning under Section 3E of the Planning etc. (Scotland) Act 2006,
- Concise subject planning policies, including the implications for development planning and development management, and
- The Scottish Government's expectations of the intended outcomes of the planning system.

4.75 The SPP provides an overview of the purpose of the planning system and states that the Scottish Government's view expressed in Paragraph 4, is that *"a properly functioning planning system is essential to achieving its central purpose of increasing sustainable economic growth."*

4.76 The Scottish Government advocates that the planning system should be structured and operated with the purpose of increasing sustainable economic growth and to support the Scottish Government's five strategic objectives and fifteen national outcomes.[1]

4.77 The SPP also recognises in Paragraph 8 that whilst the planning system should be genuinely "plan-led", Paragraph 6 states that the system "…*has a critical balancing role to play when competing interests emerge in the consideration of future development. It is essential to recognise that planning issues, by their very nature, will often bring differing interests into opposition and disagreement and the resolution of those issues will inevitably disappoint some parties*."

[1] The Scottish Governments strategic objectives and national outcomes can be viewed at www.scotland.gov.uk/About/scotPerforms

4.78 The SPP sets out in Paragraphs 7-9 the 'Core Principles' that should underpin the modernised planning system, which include the requirement for Development Plans to be kept up-to-date: the preparation of plans and handling of applications to be predictable and transparent; the constraints that the planning system imposes to be necessary and proportionate and there to be a clear focus on the quality of outcomes.

4.79 Development Management policy advice is set out at Paragraph 22 *et seq*. of the SPP. It is stated that Development Management is a key part of the planning system and "…*should operate in support of the Government's central purpose of increasing sustainable economic growth. This means providing greater certainty and speed of decision making*…"

4.80 The SPP states that increasing sustainable economic growth and sustainable development is an overarching principle of the Scottish Government and in Parahgraph 35 that the *"…planning system should promote development that supports the move towards a more economically, socially and environmentally sustainable society*". The planning system has an important role in supporting the Government's commitment towards Sustainable Development through its positive influence upon the location and design of new development. Paragraph 37 states that the decision making process within the planning system should, ***"….****contribute to the reduction of greenhouse gas emissions in line with the commitment to reduce emissions by 42% by 2020 and 80% by 2050, contribute to reducing energy consumption and to the development of renewable energy generation opportunities*."

4.81 In addition, it is also recommended that decision making should protect and enhance cultural heritage, the natural environment (including biodiversity and the landscape) and take into account implications for water, air and soil quality. These matters are addressed in the more detailed Subject Policies within the SPP.

4.82 Climate Change, and the need to reduce greenhouse gas emissions is prominent within the SPP. The SPP (para 41) reaffirms the position of Section 44 of the Climate Change (Scotland) Act 2009 which places a statutory duty on all public bodies to act:

- in the way best calculated to contribute to the delivery of the emissions targets in the Act,
- in the best way calculated to help deliver the Government's climate change adaptation programme, and
- in a way that it considers is most sustainable.

4.83 The 2020 and 2050 greenhouse gas reduction targets are noted and it is stated at Paragraph 42 of the SPP that *"…the causes of climate change and the need to adapt to its short and long terms impacts should be taken into account in all decisions throughout the planning system".*

4.84 In addition to the policy advice summarised above, the SPP provides more detailed planning policy advice with regard to specific subject areas which has replaced the series of SPPs and NPPGs referred to above. Specific policy advice is provided within the SPP under the following headings:

- economic development,
- town centres and retailing,
- housing,
- rural development,
- fish farming,
- coastal planning,
- historic environment,
- landscape and natural heritage,
- open space and recreation,
- green belts,
- transport,
- renewable energy,
- flooding,
- waste,
- minerals,
- open cast coal, and
- communications infrastructure.

4.85 The policy advice provided under these headings within the SPP does not restate policy advice expressed elsewhere. Instead, the policy focuses on key principles and considerations. As such, some policy provisions previously covered under the previous SPP and NPPG series has not been recovered.

SPP: Renewable Energy

4.86 The SPP outlines the Scottish Government's commitment to increase the amount of electricity generated from renewable sources to meet statutory obligations and states in Paragraph 182 that "…*the commitment to increase the amount of electricity generated from renewable sources is a vital part of the response to climate change".*

4.87 Scotland's 2020 target for 50% of electricity to be generated from renewable sources is referred to and it is noted that this target is not a cap. The SPP states in Paragraph 184 that Planning Authorities should *"…support the development of a diverse range of renewable energy technologies, guide development to appropriate locations..."* . It is also stated that onshore wind farms will continue to be the main source of renewable energy.

4.88 The SPP states that Planning Authorities should support the development of wind farm *"…in locations where the technology can operate efficiently and environmental and cumulative impacts can be satisfactorily addressed"* (paragraph 187). The SPP sets out the criteria that should be considered in deciding applications for all wind farm developments and requires that Development Plans or Supplementary Planning Guidance (SPG) set out those matters clearly at the local level. The SPP advises that the assessment criteria are likely to include:

- landscape and visual impact,
- effects on the natural heritage and historic environment,
- contribution to the development to renewable energy generation targets,
- effect on the local and national economy and tourism and recreational interests,
- benefits and disbenefits for communities,
- aviation and telecommunications,
- noise and shadow flicker, and
- cumulative impact.

4.89 The SPP also requires Planning Authorities to set out, within Development Plans a spatial framework for wind farms of over 20 mega watts (MW) and a spatial framework for wind farms under 20 MW if considered appropriate. It is advised I Paragraph 189 that *"Spatial frameworks should not be used to put in place a sequential approach to determining applications which requires applicants proposing developments outwith an area of search to show that there is no capacity within areas of search"* . It is also stated in Paragraph 190 that with regard to the development constraints that require to be considered in developing a spatial framework *"that the existence of these constraints does not impose a blanket restriction on development"*.

SPP: Historic Environment

4.90 The SPP sets out the Scottish Government's policy on the protection, conservation and enhancement of the historic environment and the role of the planning system.

4.91 The SPP states that the historic environment includes ancient monuments, archaeological sites and landscapes, historic buildings, townscapes, parks, gardens and designed landscapes and other features. Non-designated sites, as well as designated sites, are considered by the SPP as an important element of Scotland's heritage which contribute to national identity.

4.92 Paragraph 111 notes that *"In most cases, the historic environment (excluding archaeology) can accommodate change which is informed and sensitively managed, and can be adapted to accommodate new uses whilst retaining its special character"*.

4.93 The SPP makes reference to the need to take into account Historic Scotland policy in the determination of applications affecting the historic environment which includes Scottish Historic Environment Policy (SHEP) and the 'Managing Change in the Historic Environment' guidance note series.

SPP: Landscape and Natural Heritage

4.94 The SPP provides policy guidance for the conservation, enhancement and sustainable use of Scotland's landscape and natural heritage at paragraph 125 *et seq*. Natural heritage is identified as including flora, fauna, geological and physiographical features, its natural beauty and amenity (Natural Heritage (Scotland) Act 1991).

4.95 Planning Authorities are directed to take a broader approach to landscape and natural heritage than just conserving designated sites and species. The SPP also states in Paragraph 127 that the *"Landscape in both the countryside and urban areas is constantly changing and the aim is to facilitate positive change whilst maintaining and enhancing distinctive character."* It is also stated that *"Different landscapes will have a different capacity to accommodate new development, and the siting and design of development should be informed by the local landscape character"*.

4.96 Paragraph 131 of the SPP states that *"While the protection of the landscape and natural heritage may sometimes impose constraints on development, with careful planning and design the potential for conflict can be minimised and the potential for enhancement maximised"*.

4.97 On designated sites, the SPP provides guidance that *"Statutory natural heritage designations are important considerations where they are directly or indirectly affected by a development proposal. However, designation does not necessarily imply a prohibition on development"*, (Paragraph 131).

4.98 The SPP states that planning authorities should only apply the precautionary principle where the impacts of a proposed development are uncertain and where there is *"…sound evidence…"* that irreversible damage could occur. In line with this, Paragraph 132 is clear in that *"The precautionary principle should not be used to impede development unnecessarily. Where development is constrained on the grounds of uncertainty, the potential for research, surveys or assessments to remove or reduce uncertainty should be considered"*.

4.99 The SPP provides detailed guidance on natural heritage resources and classifies those under 5 key headings, namely:

- International Designations,
- National Designations,
- Local designations,
- Protected Species,
- Trees and Woodland.

4.100 Sites with international designations such as Natura 2000 sites, must be subject to appropriate assessment by Planning Authorities in the context of its conservation objectives where developments are likely to result in significant adverse effects on the designation. Development which could have a significant effect on a Natura site will only be permitted where:

- an appropriate assessment has demonstrated that it will not adversely affect the integrity of the site, or
- there is no alternative solutions, and
- there are imperative reasons of overriding public interest, including those of a social or economic nature.

4.101 Nationally designated sites, such as National Scenic Areas (NSA), Site of Special Scientific Interest (SSSI), National Parks and National Nature Reserves (NNR) are noted as important material planning considerations in the assessment of applications, and development proposals should only be permitted where:

- it will not adversely affect the integrity of the area or the qualities for which it has been designated, or
- any such adverse effects are clearly outweighed by social, environmental or economic benefits of national importance.

4.102 International and national natural heritage designations can be complemented by local designations which *"seek to protect, enhance and encourage the enjoyment and understanding of locally important landscapes and natural heritage"* (Paragraph 139). Local designations can be both statutory and non-statutory. Local Nature Reserves are statutory designations; for non-statutory designations the SPP seeks to limit local designations to two types; namely Local Landscape Areas and Local Nature Conservation Sites.

4.103 Although local designations should be taken into account in the assessment of development proposals, Paragraph 139 of the SPP states that *"The level of protection given to local designations through the development plan should not be as high as the level of protection given to international or national designations"*.

4.104 Paragraph 142 provides guidance on protected species and notes that the presence of legally protected species is an important material consideration in the assessment of planning applications. Although the presence of protected species rarely imposes an absolute block on development, a planning authority has to be clear that suitable mitigation measures have been adopted. Where a proposed development is likely to have an adverse effect on European Protected Species, planning permission can not be granted unless the Authority can be satisfied that:

- there is no satisfactory alternative, and
- the development is required for preserving public health or public safety or for other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance to the environment.

4.105 Paragraph 146 provides guidance on Trees and Woodland where they have natural heritage value or contribute to the amenity of a locality. Ancient and semi-natural woodland have the greatest value for nature conservation and are given the greatest protection.

SPP: Rural Development

4.106 The SPP provides the Scottish Government's planning guidance on rural development in Paragraphs 92 to 96. Significant emphasis is placed on supporting sustainable economic growth within rural areas and it is identified that the planning system has a large role to play in achieving this. It is recommended in Paragraph 93 that the Development Plan should reflect the *"…overarching aim of supporting diversification and growth in the rural economy".*

4.107 Good quality design and high environmental standards are required for rural development and Paragraph 95 states that *"All new development should respond to the specific local character of the location, fit in with the landscape and seek to achieve high design and environmental standards, particularly in relation to energy efficiency".*

4.108 The SPP also seeks to provide protection to 'Prime quality agricultural land' from inappropriate developments, but with regard to renewable energy developments notes that *"Renewable energy generation or minerals extraction may be acceptable where restoration proposals will return the land to its former status"* (Paragraph 97).

SPP: Transport

4.109 Reducing emissions from transportation sources is identified as providing a contribution to the Scottish Government's greenhouse gas reduction targets. Tackling emission levels and congestion will support economic growth and planning authorities need to give consideration to the relationship between transport and land use in order to achieve sustainable patterns of development.

4.110 Paragraph 167 notes that Planning Authorities should take into account existing transport, environmental and operational constraints, proposed or committed transport projects and demand management schemes, and that *"…development should be supported in locations that are accessible by walking, cycling and public transport, making best use of or adding to existing network and creating new networks".*

4.111 The SPP provides policy advice on the construction of new roads and advises that, where possible new routes should seek to follow the existing landscape character of an area by following existing gradients and working with the landform and landscape features inherent to a site. Where a route is permanent, Planning Advice Note (PAN) 57 provides that appropriate landscaping should be provided by way of the planting of native species where appropriate.

4.112 Development proposals that have potential to affect the strategic transport network should be appraised to determine their effects and the SPP requires planning authorities to consult Transport Scotland on such proposal, including any potential mitigation. Direct access to any strategic road should be avoided if possible, however Paragraph 175 of SPP provides guidance that the case for such junctions will be considered where *"…significant economic growth or regeneration benefits can be demonstrated…"* or no alternative exists.

SPP: Minerals

4.113 The policy advice provided within the SPP on minerals matters includes advice on borrow pits. The SPP supports borrow pit extraction for wind farms on the basis that there are associated environmental benefits with the borrow pits and that consents for extraction are time limited.

PAN 45: Renewable Energy Technologies

4.80 This supports the policies of SPP 6 by providing information and advice on the technologies for harnessing renewable energy for electricity generation. This PAN includes a substantial section on wind power, explaining the technology and the potential for environmental effects. Of particular note are the sections on 'Siting in the Landscape' and 'Visual Impact', which contain a number of statements that clarify the Scottish Ministers' policy.

4.81 PAN 45 recognises that the introduction of a windfarm development will introduce a significant feature into the landscape

Paragraph 71 *states that:*

> *There are no landscapes into which a wind farm will not introduce a new and distinctive feature.*
>
> *Given the Scottish Ministers' commitment to addressing the important issue of climate change and the contribution expected from renewable energy developments, particularly wind farms, it is important for society at large to accept them as a feature of many areas of Scotland for the foreseeable future.*

Paragraph 78 *provides guidance on the visual impact of wind farm development: -*

> *Turbines in wind farms are likely to be tall, frequently located in open land, and therefore likely to be highly visible…It will normally be unrealistic to seek to conceal them. Developers should seek to ensure that through good siting and design, landscape and visual impacts are limited and appropriate to the location.*

4.82 With regards to shadow flicker **Paragraph 64 states that:**

> *Under certain combinations of geographical position, time of day and time of year, the sun may pass behind the rotor and cast a shadow over neighbouring properties. When the blades rotate, the shadow flicks on and off; the effect is known as "shadow flicker". It occurs only within buildings where the flicker appears through a narrow window opening. The seasonal duration of this effect can be calculated from the geometry of the machine and the latitude of the potential site. Where this could be a problem,*

developers should provide calculations to quantify the effect. In most cases however, where separation is provided between wind turbines and nearby dwellings (as a general rule 10 rotor diameters), shadow flicker should not be a problem.

4.83 **PAN 45: Annex 2: Spatial Frameworks and Supplementary Planning Guidance for Wind Farms** was published in November 2008 and provides planning authorities with supplementary guidance for windfarms.

Renewable Energy Policy

Background & Global Targets

4.84 In Chapter 1 (Introduction) there is brief reference to the justification for the proposed development and reference is made to the issue of climate change. This part of Chapter 4 presents some detail on the climate change and renewable energy policy background for the proposed development by describing the renewable energy policy context at a European, UK and Scottish Government level.

4.85 The background to renewable energy policies in the UK and Scotland has its origins in international concern over the production of greenhouse gases, in particular carbon dioxide, and the effect that increases of these are having, or may have on climate. As noted above, key conventions such as the Earth Summit (Rio de Janiero, 1992) and the Kyoto Protocol (1997), to which the UK is a signatory, and to the requirements of which the Government has stated it will be bound, have resulted in targets being set for the reduction of greenhouse gases. Subsequently policies have been formulated in recognition of the fact that the burning of fossil fuels is having an adverse effect on world climate and that global measures are required to deal with it.

4.86 There have been a number of landmark reports published on the topic of the impacts of climate change in recent years. The International Energy Agency (IEA) the leading source of medium to long-term energy market projections and analysis has, in their World Energy Outlook report (November 2007), stated that immediate policy action is required to reduce greenhouse gas emissions and to curb growth in fossil energy demand. The challenge for all countries is to put in place a more secure lower carbon energy system without undermining social and economic development.

4.87 The Intergovernmental Panel on Climate Change (IPCC) published their Fourth Assessment Report in November 2007, which clearly states that warming of the climate system is unequivocal (page 1, section 1).

4.88 Climate change featured on the agenda at the G8 Gleneagles Summit in July 2005. Attention was focused on the importance of urgent action to tackle climate change. The Gleneagles Communiqué acknowledged that climate change was real and included commitments and an action plan to address it. Climate change was also high on the agenda of the G8 summit at Heiligendamm in June 2007.

Evolving European Policy

4.89 A draft Renewable Energy Directive from the European Commission was published in January 2008 which requires significant increases in renewable energy production. It is important to note that the Directive was adopted in March 2009 and is now legally binding. The UK Government has also publishing a strategy (July 2009) in order to implement the obligations contained within the Directive. The EU wishes to see 20% of all energy use to be generated by renewable sources. The 20% is split between member states – so called 'burden sharing'. The UK will have to provide 15% of all its primary energy use from renewable sources by 2020. This is a considerable challenge and would represent a 10-fold increase from the current level of some 1.5% of all energy used in the UK coming from renewable sources.

United Kingdom Policy

4.90 The UK Government retains control of the overall direction of energy policy. Since devolution in 1999, some energy policy issues have been devolved to Scotland such as energy efficiency and renewable energy (including planning consents for generating plants covered by the Electricity Act 1989). Encouraging more electricity generation from renewable sources is an important element of both the UK and Scottish Climate Change Programmes. The UK Government is working towards a target of renewable energy providing 10% of UK electricity supplies by 2010 and 20% by 2020, although as will be noted below, this target for 2020 has recently been increased.

4.91 In January 2008, the UK Government published the Government's plans for developing a strategy to increase renewable energy use in the UK. As noted above, the EU Renewables Directive provides the framework for achieving the EU's target of securing 20% of all its energy consumption from renewable sources by 2020. For the UK, the Commission's proposals include a requirement for a 16% reduction in UK greenhouse gas emissions by 2020 and for 15% of all energy consumed in the UK to be generated from renewable sources by 2020.

The UK Renewable Energy Strategy (July, 2009)

4.92 The UK Government retains control of the overall direction of energy policy. Since devolution in 1999, some energy policy. The UK Renewable Energy Strategy (UKRES) was issued by the Department of Energy and Climate Change (DECC) in July 2009.

4.93 The Strategy states that the UK needs to *"radically increase our use of renewable electricity…."* The document sets out the means by which the UK can meet the legally binding target of 15% of energy consumption from renewable sources by 2020. This will mean a 7-fold increase in the share of renewables in little more than a decade.

4.94 In the document, a 'lead scenario' is presented which suggests that more than 30% of electricity should be generated from renewables by 2020, which would be up from approximately 5.5% in 2009. The majority of this is expected to come from wind power, both on and offshore.

4.95 In terms of financial support, the Strategy sets out a framework of long term, comprehensive and targeted financial support. The Renewables Obligation (RO) is to remain the key mechanism for incentivising renewable electricity and Southern Energy plc is subject to the RO. The RO is to be expanded and extended to ensure it can deliver approximately 30% renewable electricity by 2020. The RO is to be extended beyond its current end date of 2027 until 2037 for new projects.

4.96 The strategy is expected to deliver significant environmental benefits, in particular by contributing to global action against climate change. It recognises that there will also be some pressures on the local environments and natural heritage from new infrastructure provision. The

document states that if the renewable energy target and longer term carbon reduction targets are to be met, then "*many communities will need to 'host' renewable energy projects such as wind farms*…." (UKRES, paragraph 6.3).

4.97 In terms of economic and employment opportunities, these are highlighted and the aspiration is for the UK to be at the forefront of global competition in the low carbon economy. The Government estimates that the Strategy will:-

- Put the UK on a path towards **decarbonising** the production of energy in the UK, alongside nuclear and carbon capture and storage.
- Contribute to the **security of energy supplies** in the UK through reducing demand for fossil fuels of around 10% and gas imports by between 20 – 30% against forecast use in 2020.
- Bring outstanding **business opportunities** and enable the UK to restructure into a low carbon economy, providing around £100Bn of investment opportunities and contribute to the creation of up to 0.5m more jobs in the UK renewable energy sector.

4.98 Paragraph 53 of the document makes it clear that the UKRES is an integral part of the Government's overall UK Low Carbon Transition Plan. Section 6 of the document states that the Devolved Administrations have a leadership role to undertake. The role of the Devolved Administrations is further set out in section 6 of the UKRES. The Strategy as a whole is published by the UK Government and that the policies to meet the 2020 targets will be taken forward in England, Scotland and Wales, Great Britain or on a UK – wide basis as appropriate and in accordance with each devolution arrangement. The UKRES makes it clear that there has been close engagement with the Devolved Administrations in developing the Strategy and that this close working will continue in implementing the policies set out in the UKRES. This will include in the development of the UK National Action Plan to facilitate meeting the 2020 targets. The document makes it clear that each of the Devolved Administrations is setting out its own plan to increase renewable energy use and that "*the UK Government and the Devolved Administrations are working together to ensure that our plans are aligned"* (UKRES, para 8.18).

The UK Low Carbon Transition Plan (White Paper)

4.99 Along with the UKRES, the UK Government published the UK Low Carbon Transition Plan, (LCTP) as a White Paper in July 2009.

4.100 The White Paper sets out the UK's first ever comprehensive low carbon transition plan to 2020. The plan seeks to deliver greenhouse gas emission (CO2) cuts of 18% on 2008 levels by 2020 (and over a third reduction on 1990 levels).

4.101 The document states that the UK will be calling for an ambitious global agreement at UN talks in Copenhagen in December 2009 (page 5). It adds that to encourage action, the EU promised to cut its emission to 20% below 1990 levels by 2020 and by 30% if other countries 'play their part'. The White Paper emphasises that the UK will need to drive major changes to the way energy is used and supplied (page 5).

4.102 It seeks to ensure that the UK will get 40% of electricity from low carbon sources by 2020, with policies to produce approximately 30% of UK electricity from renewables by 2020, by substantially increasing the requirement for electricity suppliers to sell renewable electricity.

4.103 The White Paper explains that the UK Government has put in place the worlds first legally binding target to cut emissions by 80% by 2050 and it has set five year "carbon budgets" to 2022 to 'keep the UK on track' and which provide a clear pathway for reducing emissions in the future (page 6). The White Paper for the first time sets out how these budgets will be met.

4.104 The White Paper explains that carbon budgets are a limit on the total quantity of greenhouse gas emissions over a five-year period. They are intended to reflect the fact that the UK's overall contribution to reducing global greenhouse gas emissions is determined by emissions into the atmosphere over time, not by meeting specific targets in specific years. The carbon budgets will provide an opportunity for scrutiny by reporting each year on progress and will ensure that an evidence base guides the policy framework for the UK.

4.105 In terms of carbon savings to 2020, the Government announced the first 3 budgets, covering the periods 2008 – 12, 2013 -17 and 2018 – 22 in April 2009. It notes that he carbon budgets will be challenging. The final budget period centred on 2020 requires a 34% cut on 1990 levels.

4.106 Overall the White Paper sets out the specific proposals and policies for meeting the UK's carbon budgets. The White Paper also makes the point (page 45) that the introduction of carbon budgets introduces a new imperative: they are legally binding and must be met.

4.107 The White Paper refers to 'transforming our power sector' and states that the Transition Plan, along with wider policies, will result in some 40% of electricity coming from low carbon sources by 2020 (Summary, page 4). Sources will be such as renewables, nuclear and fossil fuel coal generation fitted with carbon capture and storage technology.

Scottish Government Renewable Energy Generation Targets

4.108 In Scotland, policy and commitment generally reflects that of the UK Government. The Scottish Government set a target that 18% of electricity supplies in Scotland should be generated from renewable resources by 2010. SPP 6 confirms that the Scottish Government's 2010 target for renewable energy generation has been met.

4.109 The Government Spending Review in late 2007 confirmed that the Government's target is to achieve 50% of electricity consumption from renewable sources by 2020.

Framework for the Development and Deployment of Renewables in Scotland

4.110 The Scottish Government and the Forum for Renewable Energy Development in Scotland (FREDS) published a draft Framework for the Development and Deployment of Renewables in Scotland in late 2008. The Government consulted on this Framework in early 2009 and it complemented the proposals in the parallel consultation document on a Renewable Energy Strategy issued in June 2008 by the UK Department for Business, Enterprise and Regulatory Reform (BERR).

4.111 The Framework explained (page 24) that on the assumption that renewable sources will operate at 30% of theoretical potential, Scotland will require some 5GW of installed capacity to achieve the 2011 target and 8.3 – 8.4 GW to achieve 50% by 2020. The Framework makes reference to installed renewable capacities at December 2008 of approximately 2.8GW, and highlighted that 1.7GW of capacity is approved under the Electricity Act and under construction, and, approximately 2.5GW of capacity of section 36 applications is in the system, with more applications under the Town and Country Planning (Scotland) Act 1997 being approved and being considered by Councils. It is expected that further applications would feed into 2020

capacity. The Framework states that there remains a shortfall that requires to be addressed in order to achieve the 2020 target.

The Climate Change (Scotland) Act 2009

4.112 The Climate Change (Scotland) Act 2009 received Royal Assent on August 4 2009 following a comprehensive period of Parliamentary scrutiny where members of the Scottish Parliament passed the Bill unanimously.

4.113 Part 1 of the Act sets the statutory framework for greenhouse gas emission reductions in Scotland by setting an interim 42 per cent reduction target for 2020 and an 80 per cent reduction target for 2050, from the baseline, which for CO^2 is based on 1990 emission levels. Part 1 of the Act also requires The Scottish Ministers to set annual targets in secondary legislation, for Scottish emissions from 2010 to 2050 to ensure that the 2050 target is attained. Part 1 of the Act also requires the Scottish Government to publish a land use strategy by 31 March 2011 setting out land use objectives to aid the achievement of the 2020 and 2050 targets.

4.114 Part 2 of the Act contains provisions that will allow the Scottish Ministers to establish a Scottish Committee on Climate Change or to designate an existing body to exercise advisory functions should it be decided that this is appropriate. Part 3 places duties on the Scottish Ministers requiring them to report regularly to the Scottish Parliament on Scotland's emissions and on the progress being made towards meeting the emissions reduction targets as set out in the Act.

4.115 Reductions in greenhouse gas emissions for energy generation are a key component to achieve the above targets. The Act places a statutory requirement on the Scottish Ministers to set appropriate levels for energy generation to contribute to meeting the targets. Annual targets for the years 2010 – 2022 require to be set out by the Scottish Ministers no later than 1 June 2010.

The Climate Change Delivery Plan (2009)

4.116 The Scottish Government issued the Climate Change Delivery Plan, entitled 'Meeting Scotland's Statutory Climate Change Targets' in June 2009.

4.117 The Climate Change Delivery Plan highlights that The Scottish Government is already taking action to tackle climate change, but states that Scotland requires a co-ordinated approach – a national delivery plan for all the actions that can be delivered over the next decade and beyond, to achieve the targets that Parliament has laid down in the Climate Change (Scotland) Act.

4.118 The Delivery Plan identifies key sectors of the economy for abatement and identifies the high level measures required in each sector to deliver the interim 2020 targets: both the 34% (UK) and the 42% (Scottish) targets.

4.119 The Plan confirms that the key milestone is that by 2020, more than 50% of electricity should be generated from renewable sources. The Plan (paragraph 3.19) confirms that the 2020 target equates to an electricity generation level of some 8.4GW of installed renewables capacity.

4.120 Paragraph 3.20 notes that the requirement on the UK to meet EU renewable targets by 2020, equating to 15% of all energy use from renewable sources, which will lead to strong demand from elsewhere in the UK for Scottish renewable electricity. The Plan also notes that a new Scottish Renewables Action Plan will be published for consultation in summer 2009.

The Scottish Renewables Action Plan (2009)

4.121 The Scottish Government issued the Renewables Action Plan (RAP) in June 2009. This identifies what needs to happen in the renewables sector in order to achieve Government objectives and it focuses on actions needed over the immediate 24-month period.

4.122 The RAP refers to that the imperative for action to address climate change (demonstrated by Scotland's world leading carbon reduction target of 42% (see the reference to the Climate Change (Scotland) Act above) is driving development across a host of policy interests. It makes reference to the Scottish Government's commitment to achieve a headline target of 20% of total Scottish energy use coming from renewable sources by 2020. Specific targets include 50% of electricity demand and the RAP sets out the framework for action in the specific area of renewable energy.

4.123 Key objectives are summarised as follows:-

- To establish Scotland as a UK and EU leader in the field;
- To ensure maximum returns for the Scottish domestic economy; and
- To meet targets for energy from renewables, and for emissions reductions, to 2020 and beyond; (RAP, Executive Summary, page 5).

4.124 The RAP refers to Scottish and UK structures and makes it clear that the Scottish Government is continuing to engage very closely with the UK Government on the shape and scope of renewable energy legislation and the financial incentives that they create. There is reference to the Renewables Obligation (RO) mechanisms and the RAP states that Scottish Government is working with "*UK colleagues on the further changes to the RO required to align it with the demands of the EU 20% target….*" (page 17).

4.125 Section 4 of the RAP highlights that each of the technology sectors will have its own part to play in helping Scotland meet its energy targets "*and ministers are committed to a diverse renewables mix to maximise the scope to match supply with demand and to enhance security of supply*" (page 20).

4.126 In terms of energy consents and planning, this matter is addressed in section 8 of the RAP and regarding specific actions, there is reference to planning. Actions include the need to:

- Create a supportive planning landscape;
- Ensure the planning and consenting regimes better support investment in renewables in Scotland; and
- Continue to work with Local Planning Authorities to develop their strategic locational guidance in line with Planning Advice Note (PAN) 45 and to ensure that the planning system produces decisions that are efficient, transparent, consistent and timely (page 37).

4.127 Each renewable technology is referred in the Annex to the RAP and with regard to onshore wind the vision is expressed as: "*continued expansion of portfolio of onshore wind farms to help meet renewables targets, with robust planning frameworks supporting timely processing of consents applications and ensuring wind farms are consented where they are environmentally acceptable*" (RAP, page 77).

4.128 The document (page 77) explains that onshore wind is expected to provide the majority of capacity in the timeframe for the Government's interim and 2020 renewable electricity targets.

Table 4.1 National Planning Policy

Policy	Title	Summary	Relevant ES Chapter/s
NPF2	National Planning Framework 2 (2009)	Sets out a framework for strategic development priorities in Scotland to 2030 to support sustainable economic growth.	Chapter 4 (Planning and Renewable Energy Policy Context)
SPP	Scottish Planning Policy (Feb 2010)	Sets out the Government's key priorities for the planning system in Scotland. It provides detailed advice to local authorities regarding decision making through development management and refers to relevant policy topics including renewable energy, economic development, landscape and natural heritage, planning and flooding, rural development, transport, historic environment, minerals.	Chapter 4 (Planning and Renewable Energy Policy Context) Chapter 12 (Socioeconomics, Tourism and Land Use) Chapter 8 (Hydrology, Hydrogeology and Geology) Chapter 11 (Traffic and Transport) Chapter 11 (Traffic and Transport) Chapter 9 (Cultural Heritage) Chapter 6 (Ecology) Chapter 7 (Ornithology)

Table 4.2 Planning Advice Notes

Guidance	Title	Summary	Relevant ES Chapters
PAN42	Archaeology the Planning Process and Scheduled Ancient Monument Procedures (1994)	Provides best practice advice on addressing archaeological issues within the planning process, and on best practice separate controls over scheduled monuments. Also provides detailed advice on excavation, maintaining records, scheduling and legislation.	Chapter 9 (Cultural Heritage)
PAN45	Renewable Energy Technologies (2002); and Annex 2: Spatial Frameworks and Supplementary Planning Guidance for Wind Farms (2008)	Supports SPP by providing information and advice on the technologies for harnessing renewable energy for electricity generation. Provides planning authorities with supplementary guidance for wind farms.	Chapter 4 (Planning and Renewable Energy Policy Context)
PAN56	Planning and Noise (1996)	Demonstrates the role of the planning system in preventing and limiting the adverse effects of noise without prejudicing investment in enterprise, development and transport.	Chapter 10 (Noise)
PAN58	Environmental Impact Assessment (1999)		
PAN60	Planning for Natural Heritage (2000)	Gives basic advice in relation to development and natural heritage. It compliments SPP in relation to the subject policies of Natural Heritage. It reiterates the Governments Commitment to the protection and enhancement of the natural heritage.	Chapter 9 (Cultural Heritage)
PAN75	Planning for Transport (2005)	Provides advice on the requirement to link transport strategies and development plans and the need to take into account accessibility, location, modal split parking and design.	Chapter 10 (Traffic and Transport)
PAN81	Community Engagement – Planning with People (2007)	Advice to planning authorities and developers on how communities should be properly engaged in the planning process.	Chapter 2 (EIA Process)

Chapter 5 - Landscape and Visual Assessment

Introduction

5.1 This chapter assesses the potential landscape and visual effects of Galawhistle Wind Farm during the construction, operation and decommissioning of the development. Effects on the landscape include direct physical changes to the fabric of the landscape, as well as changes in character of the landscape as a result of perception of these changes. They include direct and indirect effects on the landscape and areas designated for their scenic or landscape qualities, at a national, regional or local level. Effects on visual amenity concern changes in views and the appearance of the Wind Farm in those views.

5.2 It is important to note that the baseline for the assessment includes the operational wind farm of Hagshaw Hill including its extension. Hagshaw Hill Wind Farm is located immediately adjacent to the Galawhistle site, on Hagshaw Hill, Common Hill and Broomerside Hill. Hagshaw Hill extension is located east of Hagshaw Hill Wind Farm on Henry's Hill and Burnt Rig. The proposed Galawhistle Wind Farm site is located immediately west of Hagshaw Hill Wind Farm on Hareshaw Hill, Arrarat Hill, Wedder Hill and Meikle Auchinstilloch. As described later in this chapter there are other operational wind farms across the study area include Black Law, Whitelee, Harehill, Windy Standard and Lochhead Wind Farms.

5.3 The key objectives of the assessment are to:

- Establish a baseline by identifying and evaluating the existing landscape and surrounding area and the site, the wider landscape character and existing landscape designations. Establishment of the baseline will also identify and evaluate the existing visual relationships between the site and its surrounding area;
- Identify the potential construction effects of the wind farm on the development site;
- Identify the potential operational effects of the wind farm on the landscape and visual resource;
- Identify the potential cumulative effects of the wind farm considering other additional wind farms in the landscape;
- Identify mitigation measures for avoiding and reducing the level of significance of potential effects;
- Determine any residual effects and their level of significance following mitigation;
- Determine the significance of the residual effects on the landscape resource and visual amenity;
- Identify any potential effects on decommissioning of the wind farm.

Study Area

5.4 The identification of the study area was based on the recommendations contained in publications including *Visual Representation of Wind Farms: Good Practice Guidance (2006)*[1] and *Visual Assessment of Wind Farms Best Practice (2002)*[2].

5.5 The study area has a radius of 35 kilometres (km) from the edge of the site, and is the maximum area across which the above guidance recommends that likely significant effects arising from the proposals may affect the landscape or visual amenity. The extent of the study area is shown in Figure 5.0. The shaded areas of the Zone of Theoretical Visibility (ZTV) (Figure 5.1) indicate the predicted maximum extent of the area from which the Wind Farm may be seen, and therefore enabled the study area to be focussed on those locations within the 35km radius ZTV which will potentially be affected.

The Proposed Development

5.6 The assessment is based upon the scheme described in detail in Chapter 3 (Project Description). The key information which was used to inform the assessment of landscape and visual effects includes the location of the construction compound, borrow pits and site access roads, the location, number and heights of the proposed turbines, the locations of the onsite substation, and operations and control room. The key components of Galawhistle Wind Farm are shown in Figure 1.2 in Chapter 1 (Introduction).

Key Issues

- Direct effects of construction of the wind farm on the landscape resource and direct and indirect effects on landscape character, including the perceptual qualities of the landscape, and on designated landscapes.
- Visibility and conspicuousness of the wind farm and potential effects on views and visual amenity during construction, including static and sequential views.
- Direct effects of the operational wind farm on the landscape resource and direct and indirect effects on landscape character, including the perceptual qualities of the landscape, and on designated landscapes.
- Visibility and conspicuousness of the operational wind farm and the potential effects on views and visual amenity, including static and sequential views.
- Cumulative effects of the wind farm in combination with other proposed wind farms on landscape character, views and visual amenity.
- Operational effects include associated activities and elements, such as vehicular and pedestrian activity, movement and lighting.

5.7 Potential mitigation measures and effects arising from decommissioning are also discussed.

Planning Policy Context

5.8 Chapter 4 (Planning and Renewable Energy Policy Context**)** provides a brief summary of the planning policies of relevance to landscape and visual amenity, including national through to local policies.

Assessment Methodology

Introduction

5.9 Landscape and visual assessment (LVA) considers effects on:

- Landscape resources and character, including effects on the aesthetic values of the landscape, caused by changes in the elements, characteristics and qualities of the landscape; and
- Visual amenity, including effects upon potential views caused by change in the appearance of the surrounding area as a result of the development.

5.10 Landscape resources and character are considered to be of importance in their own right and are valued for their intrinsic qualities regardless of whether they are seen by people. Effects on visual amenity as perceived by people are therefore clearly distinguished from, although closely linked to, effects on landscape resources and character. The assessment of landscape resource and visual amenity are therefore a separate, although linked processes.

[1] Scottish Natural Heritage. (SNH). Scottish Renewables Forum and the Scottish Society of Directors of Planning. (2006). *Visual Representation of Wind Farms Good Practice Guidance.*
[2] University of Newcastle. (2002). *Visual Assessment of Wind Farms Best Practice*, SNH Commissioned Report F01AA303A.

5.11 This section sets out the methodology used in the assessment. Work was undertaken in accordance with the methodology set out in the Scoping Report (July 2008), and any relevant comments made by statutory consultees, and follows current good practice guidance, including that contained in the Landscape Institute and the Institute of Environmental Management and Assessment's Second Edition Guidelines for Landscape and Visual Impact Assessment (2002)[3] (GLVIA).

Consultations

5.12 Prior to Land Use Consultants (LUC) involvement in the LVA of Galawhistle Wind Farm, a meeting was attended by representatives of RPS, SNH and East Ayrshire Council on 10th September 2008. Preliminary viewpoint selection, cumulative assessment and sequential views for inclusion in the Galawhistle LVA were discussed at this meeting.

5.13 Subsequently LUC have carried out further consultation with SNH, South Lanarkshire, East Ayrshire, Dumfries and Galloway, North Lanarkshire, East Renfrewshire, South Ayrshire, West Lothian, Scottish Borders, and Glasgow City Councils. Consultation has focussed on the selection of viewpoints and cumulative wind farms to be considered in this assessment. Responses from consultees are summarised in the Table 5.1.

Table 5.1 Consultation Responses

Consultee and dates of consultation	Discussion
SNH 20.02.09 - 23.07.09	• Suggested that the proposed viewpoint from Thirstane Hill is re-located to Lowther Hill and that the focus of the sequential assessment should be the A70 and M74 routes. Confirmed agreement of final list of viewpoints. • Advised on the list of additional wind farms for inclusion within the CLVA and their status, requesting the inclusion of Black Law, Black Law Bii, Black Law C, Muirhall, Harrow's Law, Whitelee, Whitelee 2i and Whitelee 2ii Wind Farms. • SNH also requested the inclusion of Calder Water Wind Farm (scoping) within the CLVA considering its proximity to Galawhistle Wind Farm. Subsequently the status of Calder Water Wind Farm changed from scoping to planning, prior to the cut off date for the CLVA.
South Lanarkshire Council 20.02.09 – 09.07.09	• Suggested the following viewpoints: •Views from Strathaven A723 •Views from Lowther Hill/East Mount Lowther •Coulter Fell • Assumed to be in agreement with final viewpoint list LUC letter dated 26th May 2009[4]. • Advised on the list of additional wind farms for inclusion within the CLIVA and their status.
East Ayrshire Council 20.02.09 – 09.07.09	• Advised on location of viewpoint at A76 south of Catrine. Confirmed agreement of final list of viewpoints. • Raised concerns regarding the proposed list of wind farms for inclusion within the CLVA. Subsequently LUC revised and increased the list of additional wind farms.
Dumfries and Galloway Council 20.02.09 – 18.06.09	• Suggested a viewpoint immediately west of Wanlockhead. • Assumed to be in agreement with final viewpoint list LUC letter dated 26th May 2009. • Provided updated information in relation to the status and details of additional wind farms for inclusion within the CLIVA.
North Lanarkshire Council 20.02.09 – 18.06.09	• Assumed to be in agreement with final viewpoint list LUC letter dated 26th May 2009.
East Renfrewshire Council 20.02.09 – 18.06.09	• Proposed no modifications to the viewpoint list or proposed list of wind farms for inclusion in the CLVA and therefore assumed to be in agreement.
South Ayrshire Council 20.02.09 – 18.06.09	• Assumed to be in agreement with final viewpoint list LUC letter dated 26th May 2009.
West Lothian Council 20.02.09 – 23.06.09	• Requested the re-inclusion of viewpoint located at Hartwood near Shotts to represent the surrounding hinterland of Fauldhouse. Requested the inclusion of a viewpoint from the Pentland Hills. Assumed to be in agreement with the final viewpoint list, LUC letter dated 26th May 2009, following the inclusion of these additional viewpoints. • Acknowledged that the proposed list of additional wind farms within the CLVA would be beneficial to the assessment process although noted that they considered the proposed list to be limited in the South Lanarkshire/Central Scotland region. Subsequently LUC revised and increased the list of additional wind farms to take account of SNHs comments summarised above.
Scottish Borders Council 20.02.09 – 30.06.09	• Proposed no modifications to the viewpoint list or proposed list of wind farms for inclusion in the CLVA and therefore assumed to be in agreement.
Glasgow City Council 09.04.09 – 24.06.09	• Proposed no modifications to the viewpoint list or proposed list of wind farms for inclusion in the CLVA and therefore assumed to be in agreement.

Guidance

5.14 The approach was informed by the following guidance documents:

- The Countryside Agency and Scottish Natural Heritage (SNH). (2002). *Landscape Character Assessment: Guidance for England and Scotland by University of Sheffield and Land Use Consultants* (LUC);
- The Countryside Agency and SNH. (2002). *Landscape Character Assessment: Guidance for England and Scotland. Topic Paper 6: Techniques and Criteria for Judging Capacity and Sensitivity*;

[3] Institute of Environmental Management and Assessment. (2002). *Guidelines for Landscape and Visual Impact Assessment,* Second Edition.
[4] The letter stated that if no comments relating to viewpoints were received by the 2nd June 2009 it was assumed consultees were in agreement with the final viewpoint list.

- Landscape Institute and the Institute of Environmental Management and Assessment. (2002). *Guidelines for Landscape and Visual Impact Assessment Second Edition*;
- The Landscape Institute. (1999). *The Use of the Guidelines for Landscape and Visual Assessment; Practical Advice Note*;
- SNH. (2001). *Guidelines on the Environmental Impacts of Wind Farms and Small Scale Hydro-electric Schemes*;
- SNH. (2009). *Policy Statement No 02/02: Strategic Locational Guidance for Onshore Wind Farms in Respect of the National Heritage;*
- University of Newcastle. (2002). *Visual Assessment of Wind Farms Best Practice. Scottish Natural Heritage Commissioned Report F01AA303A*;
- SNH. Scottish Renewables Forum and the Scottish Society of Directors of Planning. (2006). *Visual Representation of Wind Farms Good Practice Guidance*;
- SNH. (2008). *Designing Wind Farms in the Landscape (Consultation Draft).*

Data Sources

5.15 The assessment was informed by data gathered from the sources of baseline information listed below:

- Ordnance Survey (OS) Landranger (1:50,000) and Explorer (1:25,000) maps;
- Institute of Geological Sciences Geological Survey Ten Mile Map North Sheet (1:625,000);
- National, regional and local plans;
- SNH LCAs:
  - *LUC SNH commissioned report (1999), Glasgow and the Clyde Valley Landscape Assessment*;
  - *ASH Consulting Group SNH commissioned report (1998), The Borders Landscape Assessment*;
  - *LUC SNH commissioned report (1998), Ayrshire Landscape Assessment*; and
  - *LUC SNH commissioned report (1994), Dumfries and Galloway Landscape Assessment*;
- Field surveys;
- Aerial photography;
- Computer generated theoretical ZTVs;
- Computer modelled wire frame images and photomontages; and
- Consultation with local councils and statutory bodies.

Terms and Definitions

5.16 Key terms and definitions used in the assessment, as provided in the GLVIA[5], are provided in the Glossary in the Preface and Contents page iv-v.

Assessment of Landscape and Visual Effects

5.17 The assessment of landscape and visual effects is typically based on three stages:

- Classification of the sensitivity of the landscape and visual receptors to the development proposed;
- Prediction of the magnitude of change in the landscape or the view; and
- Evaluation of the significance of landscape and visual effects depending on the sensitivity of the receptor to change and the magnitude of change.

Assessment of Short Term Effects due to Construction

5.18 The potential effects on the landscape resulting from construction of the wind farm and associated infrastructure were predicted by combining observations and information collected from site visits, photographs and detailed plans with information regarding the construction process. A walkover survey of the development site was undertaken to identify those features contributing to the character of the site and those parts of the site where construction activities will take place.

5.19 Tall cranes and partially constructed turbines will be visible over approximately the same area as the turbines and the anemometer mast which comprise the completed project represented by the ZTV. Parts of the study area which will experience effects upon visual amenity during construction, will therefore be similar areas (as indicated by the ZTVs) as those described during operation of the development.

5.20 However, construction effects are by their nature, temporary, and are superseded by operational effects once the construction stage has been completed.

5.21 The sensitivity of the existing site landscape is considered in terms of the sensitivity of the site to the loss or change to features, or the change of character of the site landscape. Sensitivity is classified as either being low, medium or high.

5.22 Effects due to construction result from physical changes and perceived changes. Physical changes are assessed by considering: loss of landscape features and the introduction of new landscape features. Perceived changes to landscape are assessed by considering: changes to the character of the landscape, including the sense of openness or exposure, the duration of the effect, and the extent to which the effect is perceived to affect the landscape. The magnitude of change is classified as being either low, medium or high.

Assessment of Long Term Landscape Effects during Operation

5.23 The principal sources of information about the landscape character of the study area are:

- LUC SNH commissioned report. (1999). *Glasgow and the Clyde Valley Landscape Assessment*;
- ASH Consulting Group SNH commissioned report. (1998). *The Borders Landscape Assessment*;
- LUC SNH commissioned report. (1998). *Ayrshire Landscape Assessment*; and
- LUC SNH commissioned report. (1994). *Dumfries and Galloway Landscape Assessment.*

5.24 Landscape Character Assessments (LCAs) are systematic assessments of the landscape that were carried out at a regional or local scale. They include descriptions of the landscape, its key characteristics and sensitivities.

5.25 The landscape character types (LCTs) identified from the published LCAs within the study area were reviewed, including considering specific landscape features contributing to landscape character. The assessment of potential effects of Galawhistle Wind Farm included those LCTs covered by the ZTV. LCTs with very little or no area falling within the ZTV were omitted, as any effects were considered unlikely to be significant. The assessment identifies potential effects on the landscape of the wind farm site, LCTs covering the wind farm site and other LCTs across the study area covered by the ZTV.

Sensitivity and Magnitude of Change to the Landscape

5.26 Sensitivity of a LCT to the loss, or change, of key features or land cover and its susceptibility to landscape change is considered. Some LCAs provide information as to the sensitivity of the LCT to different types of development, including wind farms (i.e. judgements regarding the

[5] Ibid. Glossary. Page 119.

potential sensitivity of the LCT to the introduction of turbines into the landscape). Other LCAs do not discuss sensitivity to wind farms, but may offer guidance in relation to masts or other tall structures which can be considered relevant.

5.27 The assessment of landscape character sensitivity was based on evaluating the key characteristics of the landscape and landscape features, and their sensitivity to wind farm development.

5.28 The criteria for judging sensitivity to wind farm development were drawn from guidance contained in the Landscape *Character Assessment Guidance (2002)*[6] and *Topic Paper 6*[7]. *Topic Paper 6* states that *'Judging landscape character sensitivity requires professional judgement about the degree to which the landscape in question is robust, in that it is able to accommodate change without adverse impacts on character. This means making decisions about whether or not significant characteristic elements of the landscape will be liable to loss... and whether important aesthetic aspects of character will be liable to change'*[8].

5.29 Attributes of landscape character that may indicate sensitivity to wind farm development include:

- **Landform and scale** – steep, elevated and distinctive landforms such as prominent isolated hills or ridges are generally more sensitive to wind farms due to their visual prominence. Lower hills and more gentle topography are generally less sensitive because these landform features are not generally perceived as landmarks. Larger scale landscapes may be able to accommodate turbines more easily than smaller scale landscapes;
- **Landcover** – the existing landcover will influence which landscapes could accommodate turbines with least change. Although the presence of woods and trees may reduce visibility of turbines from local areas, continuous woodland or forestry may be interrupted by the introduction of turbines and access tracks due to the need for clearing of routes and open ground around the turbines. This is because trees can cause turbulence. However, commercial plantations are subject to felling and replanting and this may provide opportunity to accommodate wind development, including the provision of access along forest roads;
- **Land use** – areas used for recreation and residential areas are generally considered sensitive to wind farm development because of the effect on local visual amenity and the resultant effect on the perception of the landscape. Industrial, rural and upland areas may be considered less sensitive from this perspective;
- **Sense of enclosure** – open landscapes may be less sensitive to change by wind farm development as the scale of the development is more likely to relate to the scale of the landscape. Semi-enclosed landscapes (for example areas set back on a plateau, or within a gentle bowl or depression) are likely to have more restricted inter-visibility and are therefore considered to be less sensitive. In more intimate and enclosed landscapes, turbines are more likely to affect individual landscape features such as hedgerows and trees, and may be perceived as dominating views;
- **Perceptual aspects** (relative sense of remoteness and exposure) – areas with characteristics of relative remoteness[9] are considered to be more sensitive, in landscape terms, to wind farm development because the introduction of turbines and infrastructure may reduce the sense of wildness. Conversely, more exposed, and windswept areas may be considered more appropriate for the introduction of wind farm development, wind farms being associated with windswept places. Areas close to settlements are generally considered to be more appropriate in landscape terms (a connection is then created between the power source and the user), but sensitive visually, due to the greater number of people likely to perceive the development. Such variables need to be carefully considered for each landscape;
- **Inter-visibility** – some areas may be more sensitive because they are visible from sensitive landscapes such as valued and designated landscapes;
- **Landscape features** – landscapes with high density of characteristic landscape features (e.g. trees, 'native' woodland, hedgerows) which may be lost to development are more sensitive than landscapes with low density of characteristic landscape features.

5.30 The key characteristics under each of these topic headings were used to identify the sensitivity of each LCT, as described in the relevant LCA, to wind farm development. Sensitivity of LCTs are described as high, medium, or low according to **Table 5.2** below:

Table 5.2: Definitions of Sensitivity of the Landscape

Sensitivity Level	Definition
High	The landscape is unlikely to be able to accommodate change of this type without incurring significant adverse effects on existing landscape character – landscape attributes are liable to loss/change such that landscape character would be substantially changed.
Medium	The landscape is likely to be able to accommodate some change of this type – some landscape attributes are liable to loss/change such that landscape character may be changed to some degree.
Low	Wind farms could be absorbed into the landscape and would be unlikely to change the character of the landscape. The landscape is robust, in that it is able to accommodate wind farms of this type change without adverse effects on character or loss of/change to landscape attributes.

5.31 The magnitude of change to landscape character relates to both physical and perceptual changes in landscape character. The following factors all contribute to the magnitude of change (high, medium, low or negligible):

- Loss of specific landscape elements such as open moorland or forest;
- The scale of the wind farm in the landscape;
- The position of the wind farm relative to features characteristic of a LCT e.g. against a characteristic skyline;
- The presence of other existing vertical and man-made elements in the view;
- Changes to key characteristics of the landscape, including scale and relative remoteness;
- Whether the key characteristics of non-host LCTs specifically include views across the wider area;
- The spatial scale at which landscape character will be affected i.e. regional, local or site level.

5.32 Each LCT is considered as a whole, although effects on specific locations within an area will vary according to distance to, and visibility of, the site. Parts of one LCT may therefore experience a locally higher degree of effect from the wind farm as a result of its closer proximity to the wind farm site and/or larger extent of visibility of the wind farm than another location within the same LCT. Effects on the LCTs within the site are also described, along with effects on the landscape character areas of LCTs which cover the wind farm site.

[6] SNH and The Countryside Agency. (2002). *Landscape Character Assessment – Guidance for England and Scotland*. p 5-6.
[7] The Countryside Agency and SNH. (2002). *Landscape Character Assessment: Guidance for England and Scotland. Topic Paper 6: Techniques and Criteria for Judging Capacity and Sensitivity*
[8] The Countryside Agency and SNH. (2002). *Landscape Character Assessment: Guidance for England and Scotland. Topic Paper 6: Techniques and Criteria for Judging Capacity and Sensitivity*
[9] Relative sense of remoteness is informed, for the purposes of this study, by presence of semi-natural habitats, presence or absence of settlement, ease of access, and influence of human activity.

Assessment of Long Term Effects on Designated Landscapes during Operation

5.33 Some areas are recognised through the planning system for their scenic or landscape qualities and as such were designated in order to give them particular planning status or protection. The designated areas range from those of national importance to those of regional or local importance.

5.34 The assessment of effects on designated landscapes is primarily based on desk studies, although key sites were visited during the field work. LCTs covering the designated landscapes as described in the relevant LCA were referred to. Several viewpoints used in the visual assessment are also located within or selected to represent designated landscapes.

5.35 The ZTV was used to identify designated landscapes with potential views of the wind farm which could therefore potentially be affected by it.

Sensitivity and Magnitude of Change to Designated Landscapes

5.36 For the assessment of effects on designated landscapes, the following factors were considered to contribute to the sensitivity (high, medium or low) of the landscape to change:

- The policy importance of the designation;
- The physical extent of the designated area;
- The directions of principal views (from and to the designated area);
- The characteristics of the area (e.g. open hills or enclosed woodlands); and
- The reasons for the designation.

5.37 To determine the magnitude of change (high, medium, low or negligible), the following factors were considered:

- The distance from the site at its closest point;
- The ZTV coverage and potential changes to principal views or vistas from the designated area;
- The potential changes to the perceived character of the landscape as a result of the wind farm;
- The potential effects of the wind farm on the integrity of the designated landscape and the extent to which it could affect the reasons for designation.

Assessment of Long Term Effects on Visual Amenity during Operation

5.38 The assessment of visual effects considers the appearance of the wind farm during the operational phase, and how it will change existing views towards the site and around the surrounding area. Visual effects are assessed using views from static locations (represented by viewpoints) and consideration is also given to the visual experience from settlements, conservation areas (CAs) and when travelling through the area (sequential views).

5.39 The visual assessment is based largely upon field visits, and is aided by computer modelling used to produce the ZTV, wireframe diagrams and photomontages that represent the appearance of the wind farm in selected views.

5.40 The desk study relating to the visual characteristics of the study area made use of the ZTV, and Ordnance Survey maps. These were used to identify potentially important views and viewpoints for analysis during the field survey.

5.41 The field survey involved extensive travel across the study area to verify the extent of the computer generated ZTV. This provided a more accurate interpretation of the potential visibility of the development, based upon the realities of visual experiences, including factors such as screening, seasonality and weather which affect visibility. It also allowed consideration of the relationship between distance from the site and the relative prominence of the proposed turbines in the wider landscape.

Viewpoint Selection

5.42 A number of viewpoints were selected for detailed analysis. In consultation with SNH, South Lanarkshire, East Ayrshire, Dumfries and Galloway, North Lanarkshire, East Renfrewshire, South Ayrshire, West Lothian and Scottish Borders Councils, viewpoints were chosen according to the following criteria[10]:

- Being publicly accessible;
- Having a reasonably high potential number of viewers or being of particular significance to the viewer(s) affected;
- Providing a representative range of viewing distances (i.e. short, medium and long distance views) and elevations;
- Representing a range of viewing experiences (i.e. static views, for example from settlements, designated viewpoints or car parks, and points along sequential views, for example from public highways and walking and cycling routes);
- Representing a range of view types, (e.g. panoramas, vistas, glimpses);
- Representing locations with potential cumulative views of Galawhistle Wind Farm in conjunction with other wind farms.

5.43 The viewpoints chosen lie within the calculated ZTV. Viewpoints outside the ZTV and the 35km radius study area were excluded from detailed assessment on the grounds that the wind farm will not be visible, or will be too far for significant effects to occur.

Sensitivity and Magnitude of Change to Visual Amenity

5.44 Determining viewpoint sensitivity involves considering the existing character of each view, in the context of the following:

- Whether the viewpoint represents views from a tourist destination, advertised viewpoint, settlement or a designation;
- The scenic qualities of the view, including the presence of other existing vertical and manmade elements in the view to which the turbines would relate;
- The likely number of viewers.

5.45 The likely number of viewers was judged on the basis of other indicators, such as the size and the function of roads, the presence of a settlement, or tourist or visitor attractions since numerical data was not available. Generally, minor, local access or dead-end roads were judged to have relatively low numbers of viewers, A-grade roads, tourist routes or main settlements were judged to have relatively high numbers of viewers, and destination points such as castles or gardens open to the public were also judged to have relatively high numbers of viewers.

5.46 In the assessment of effects on visual amenity, the terms high, medium and low are used to describe the magnitude of change in the view (see Table 5.3). While this is influenced by the distance at which the proposal is seen, factors such as the role of the wind farm in the view, the proportion of the wind farm visible, and the prominence or dominance of other focal features within the view are also considered. There are therefore no distance-defined thresholds between the levels of magnitude.

[10] Please note that not all selection criteria apply to all viewpoints selected. The selection criteria are in accordance with SNH. (2006). Guidance: *Visual Representation of Windfarms, Good Practice Guidance*.

Table 5.3: Magnitude of Change to Visual Amenity

Magnitude of Change	Description
High	The wind farm has a defining influence on the view and may become a key visual focus in the view.
Medium	The wind farm is prominent in the view, and forms an important but not defining element of the view.
Low	The wind farm is present in the view, but does not constitute a defining or prominent part.
Negligible	The wind farm is visible, but may go unnoticed by some viewers or form a minimal element of the view.

5.47 The sensitivity of views from settlements is judged to be high because of the potential high numbers of residential and visitor viewers. Although settlements are not generally identified as locations for viewing the wider landscape on OS maps, they are places where people congregate and spend time. It is noted that the scenic quality of views from settlements varies.

5.48 The sensitivity of views from roads and railways is judged to be low as the purpose of using the route is for travel. For designated tourist routes, cycle paths, footpaths and long distance walking routes, the purpose of using the route is likely to include the attention of the user being on the landscape. These routes are therefore judged to be of high sensitivity.

Significance

5.49 The EIA regulations require that the significance of each potential effect is identified. In this assessment, four levels of significance of effect are used: major, moderate, minor and negligible. Moderate and major effects are considered to be significant for the purpose of the EIA Regulations. The assessment of level of effect is based upon professional judgement considering both the sensitivity of the receptor and the predicted magnitude of change resulting from the proposed development. A higher level of significance is generally attached to higher magnitude changes affecting higher sensitivity resources or receptors.

5.50 The preceding sections set out aspects of the methodology specific to the type of effect being considered, and describe how sensitivity of the receptor or resource and the magnitude of change are identified.

Computer Modelling

ZTV production

5.51 The term Zone of Theoretical Visibility (ZTV) is used to describe the area over which a development can theoretically be seen, and uses a digital terrain model (DTM) overlaid on a map base. This is also sometimes known as a Zone of Visual Influence (ZVI), or a Visual Envelope Map (VEM). A ZTV does not take account of localised landform (such as cuttings or embankments), buildings or vegetation and therefore shows only a theoretical situation. True visibility will therefore affect more restricted areas. The ZTV covers an area of 35km radius from the edge of the site.

5.52 The ZTV for this scheme was processed using a digital terrain model based on Ordnance Survey Landform Panorama data and produced using ESRI ArcView 9.1. The results of the ZTV were presented on a greyscale 1:50,000 Ordnance Survey map in accordance with `*Visual Representation of Wind Farms: Good Practice Guidance*' (2006) SNH[11]. ZTVs are based on 18 turbines with a tip height of 110m, and a hub height of 69m and 4 turbines with a tip height of 121m, and a hub height of 80m.

Photography and Visualisations

5.53 Visualisations are illustrations that aim to represent an observer's view of a proposed development. *Visual Representation of Wind Farms: Good Practice Guidance* (SNH, 2006) stresses that *'visualisations, whether they are hand drawn sketches, photographs or photomontages will never appear 'true to life'. Rather they are merely tools to inform an assessment of impacts, and like any tool, their application requires careful use'*.

Location of Viewpoint and Photography

5.54 The exact positioning of viewpoints and photography is in accordance with SNH's *Visual Representation of Wind Farms: Good Practice Guidance* (2006), paragraphs 107-108 Viewpoint Siting. Locations are chosen which are representative of the selected viewpoint avoiding local landscape elements such as isolated trees, structures or signage in photographs.

5.55 The location of the viewpoint was recorded in the field in accordance with page 63, paragraph 111, Table 8 of *Visual Representation of Wind Farms: Good Practice Guidance* (2006) SNH.

5.56 The camera used for the photography was a Nikon D70s digital SLR with a fixed at 35mm focal length lens (equivalent to a 52.5mm focal length lens on 35mm film camera). This focal length was in accordance with recommendations contained in the guidance.

5.57 A tripod with vertical and horizontal spirit levels was used to provide stability and to ensure a level set of adjoining images. A panoramic head was used to ensure the camera rotated about the no-parallax point of the lens in order to eliminate parallax[12] errors between the successive images and enable accurate stitching of the images. The camera was moved through increments of 20 degrees and rotated through a full 360 degrees at each viewpoint. 24 photographs were taken for each 360 degree view. This enabled a 90 degree angle, centred on the view towards the proposed wind turbines, to be cut from the overall 360 degrees in accordance with page 63, paragraph 121 of the guidance.

5.58 Weather conditions and visibility were considered an important aspect of the field visits for the photography. Where possible, visits were planned around clear sunny days with good visibility. Viewpoint locations were then, where possible, visited according to the time of day to ensure that the sun lit the view towards the wind farm from behind, or to one side as far as possible. South facing viewpoints can present problems particularly in winter when the sun is low in the sky. Photographs facing into the sun were avoided where possible to prevent the wind turbines appearing as silhouettes.

Photo-Stitching

5.59 Photograph stitching software (The Panorama Factory) was used to piece together the adjoining images.

Wirelines

5.60 The software package Resoft Windfarm version 4.1.1 was used to view the proposal from selected viewpoints in wireframe format[13]. Ordnance Survey Landform Panorama data (equivalent to 1:50,000 scale mapping with 10m contour intervals) was used to model the landform seen in the wireline view. Turbine locations, type and size, and viewpoint location coordinates were entered.

[11] p34. paragraph 61.

[12] The term parallax means the difference between what is seen through the viewfinder and what the camera records on film.

[13] A wireline model is a visual presentation of a three dimensional or physical object in 3D computer graphics. It is created using lines to reveal the structure of a 3D model and is therefore relatively simple and quick to produce.

5.61 A selection of visualisations from viewpoints were presented as fully rendered photomontages (see below). All views have been represented using wirelines, in accordance with guidance.

Producing Fully Rendered Photomontages

5.62 The presentation of fully rendered photomontages involved a number of additional stages as follows.

5.63 The Resoft software rendered the turbines based on sunlight conditions and the position of the sun in the sky at the time the photograph was taken. Blade angle and orientation adjustments were also made so as to represent a realistic situation before rendering the image. Fixed features on the ground, for example buildings and roads, were located in the wireline model and used as markers to help line up the wireline ground model with the photograph.

5.64 The final stage required the rendered turbines to be blended into the photograph. This was carried out using Adobe Photoshop software and allowed the turbines to be made to appear behind foreground elements in the photographs.

5.65 Photomontages have been constructed to show the largest likely rotor diameter for a turbine with this overall tip height (i.e. a rotor diameter of 82m). The Resoft software includes a default viewer height of 2m above ground level. The pre-prepared 90 degree photos were imported into the Resoft software and the wireframe views overlaid onto the photographs.

5.66 Adjustments to lighting were made in the rendering software to make the turbines appear realistic in the view under the particular lighting and atmospheric conditions present at the time of the photograph.

Presentation of Visualisations

5.67 Autodesk AutoCAD software was used to create the figures. For each view (Figures 5.9-5.33) the first page shows a location plan indicating the viewpoint and viewing angle. The second page presents the original photograph from the viewpoint, wireline image, and photomontage for the full 90 degree view to show the context. Although this arrangement is not able to meet recommended image height and viewing distances[14] set out by SNH guidance[15], it is included for context. The third page contains a 50 degree wireline and 50 degree photomontage (at image heights and viewing distances above the minimum recommended by SNH).

Assessment of Cumulative Effects on Landscape and Visual Amenity

5.68 The cumulative landscape and visual assessment (CLVA) considers the effects due to introducing Galawhistle Wind Farm into the area, with a baseline that includes existing, consented and other proposed wind farms (i.e. at the planning application stage or beyond), according to SNH guidance. One wind farm, Leadhills, at scoping stage is considered due to its proposed scale and proximity to Galawhistle.

5.69 SPP6 indicates that cumulative assessment should principally focus on large scale developments. It also states that projects which were built, those with permission and those the subject of valid but undetermined applications should be considered, emphasising that decisions should not be unreasonably delayed because other schemes in the area are at a less advanced stage.

5.70 The CLVA considers the effect of introducing the proposed wind farm in addition to other developments that do not yet exist in the current landscape but which may exist in the future. Although not all proposals will necessarily gain planning approval, it is assumed for the purposes of the assessment that all wind farms being proposed will be present in the landscape in future, as this represents the 'maximum development scenario'.

5.71 The GLVIA (2nd edition, 2002) define cumulative effects as: *'landscape and visual effects [that] result from additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated with or separate to it), or actions that occurred in the past, present or are likely to occur in the foreseeable future'*.

5.72 Further guidance on the assessment of cumulative effects is found in the following documents:

- ETSU. (2000). *Cumulative Effects of Wind Turbines: A Guide to Assessing the Cumulative Effects of Wind Energy Development*;
- SNH. (2005). *Cumulative Effect of Windfarms*;
- Landscape Institute and the Institute of Environmental Assessment. (2002). *GLVIA*;
- Department of Trade and Industry. (2000). *Cumulative Effects of Wind Turbines*.

Differences between CLVA and LVA

5.73 Although both CLVA and LVA look at the effects of the wind farm on views and on the landscape character of the surrounding area, there are differences in the condition of the baseline against which the assessments are carried out.

5.74 For LVA, the baseline is the existing landscape, which includes any existing wind farms. This is a fixed baseline that is clearly and easily defined. For CLVA, the baseline is to some extent uncertain, and is partially speculative. This is because wind farms considered may include not only those existing in the landscape, but also those which are consented but not yet built and also those in the process of being determined by the relevant planning authority. The baseline will therefore include (in addition to existing wind farms):

- Wind farms currently under construction;
- Wind farms with planning consent but are not yet constructed;
- Undetermined wind farm applications;
- Scoping stage sites of particular importance due to proximity and scale.

5.75 PAN 45[16] states that '*In assessing cumulative effects, it is unreasonable to expect this to extend beyond schemes in the vicinity that were built, those which have permissions and those that are currently the subject of undetermined applications'*. SNH guidance states that '*In some cases it may be thought desirable to include more speculative proposals in the assessment (e.g. where a formal scoping opinion has been provided and thus the principle of a proposal is within the public domain). Nonetheless inclusion of such projects would render the assessment less certain*'[17].

5.76 SPP6[18] states that *'In reaching decisions on individual applications, planning authorities should take account of those projects in the vicinity that have been built, those which have permissions and those that are currently the subject of valid but undetermined applications'*.

5.77 This assessment therefore considers those proposals that are firm applications, consented schemes, wind farms that are existing or in the process of being constructed and one site at scoping stage. The assessment was carried out with data available at the cumulative wind farm cut off date. It is important to note that the proposal for Leadhills Wind Farm may change considerably prior to an application being submitted for that site. The cut-off date for wind farms

[14] Viewing distance is the distance at which the image should be viewed to provide the best representation of the 'real life view'.
[15] SNH. (2006). Guidance: *Visual Representation of Windfarms, Good Practice Guidance*.
[16] Scottish Executive. (revised 2002). *PAN 45 Renewable Energy Technologies.*
[17] SNH. (2005). *Cumulative Effect of Windfarms.*
[18] Scottish Executive. (2007). *SPP6: Renewable Energy.*

within 60km was 24.02.09. The cut-off date for wind farms for detail consideration within the CLVA was 28.09.09.

Identification of the Study Area to be Considered in the CLVA

5.78 There were two stages to the identification of the study area to be considered in the CLVA. The initial search area was taken as 60km from the Galawhistle site. This allowed for the identification of wind farms across the study area and across the wider landscape, with potential views of wind farms 30km in opposite directions. Trends or patterns in wind farm development can be identified at this scale. However, given the number of developments identified within an area this large, it was not considered meaningful to assess the cumulative effects of Galawhistle at this scale. Instead, this information was used to narrow down the scope of the assessment to include those wind farms likely to have noticeable and significant cumulative relationships with Galawhistle Wind Farm. This process was carried out in consultation with SNH, South Lanarkshire Council and East Ayrshire Council.

5.79 To construct the cumulative ZTVs (CZTV), the ZTVs to tip height for each of the other wind farms were generated to 30km radius. These were then combined with the Galawhistle ZTV (30km radius) to create the CZTV. The CZTV was constructed to show the number of wind farms (rather than the number of turbines) visible.

5.80 The CZTVs are colour coded to distinguish between areas where Galawhistle Wind Farm is predicted to be visible (either on its own, or in conjunction with other wind farms), and areas where other wind farms are visible but Galawhistle Wind Farm is not. The CZTVs do not identify which other wind farms are visible.

5.81 Wireframes were generated for all viewpoints considered in the CLVA, in which all wind farms were modelled. The cumulative wireframes were set up in the same way as for the LVA, except that the included angle was increased to illustrate all of the wind farms in the panorama. Wind farms located outside the included angle of the LVA view (90° angle) are therefore shown on the cumulative wireframes, and considered in the assessment.

Sensitivity and Magnitude of Change

5.82 The assessment of significance of cumulative effects considered the sensitivity of the landscape or view (taken from the LVA), and the magnitude of change (high, medium or low). Magnitude of change was assessed considering:

- The arrangement of wind farms in the view, e.g. developments seen in one direction or part of the view, or seen in all directions;
- The relationship of scale of the wind farms, including turbine size and number of turbines;
- The position of the wind farms in the view, e.g. on the skyline, against the backdrop of land;
- The apparent distances, from the viewer, and between wind farms.

5.83 The level of significance of cumulative effect is judged on the basis of information from the CZTVs, wireframes and fieldwork. Overall, the cumulative effect is judged using a multifaceted assessment based on the magnitude of change and the relationships between the wind farms (illustrated by the computer modelling), consideration of potential sensitivity of the receptor, and professional judgement. Cumulative effects were assessed with respect to the site, LCTs, designated landscapes, viewpoints, settlements, and key routes across the study area.

5.84 It considers the potential effect arising from the introduction of Galawhistle Wind Farm into a landscape in which all other known, or a variety of combinations of wind farms, (existing, consented, or undetermined planning applications) are assumed to be present as required by SNH[19]. Not all proposals will necessarily gain consent and therefore the cumulative assessment is partly speculative, as a variety of combinations of developments may ultimately arise.

5.85 The LVA addresses the effects which will occur due to Galawhistle Wind Farm against an existing baseline which includes any operational wind farms across the study area. The EIA is also required to address the cumulative effects of a proposal together with other developments planned in the area. The Scottish Executive's statement *Securing a Renewable Future – Scotland's Renewable Energy* (2003) highlights the likelihood that cumulative effects may result in an eventual limit to the extent of onshore wind development, and points to the need for *'increased significance to be attached to the consideration of cumulative impact in specific areas'*[20]. Similarly PAN 45 states that *'the nature and character of the location and the landscape in which a development is located will in part determine the acceptability or otherwise of siting proposals in proximity to one another.*[21]*'*

Types of Cumulative Effect

5.86 Three types of cumulative effects on visual amenity were considered in the assessment: combined, successive and sequential[22]:

- **Combined** effects occur where a static receptor is able to view two or more developments from a viewpoint within the receptors arc of vision (assumed to be 120 degrees for the purpose of this assessment) at the same time.
- **Successive** effects occur where a receptor is able to view two or more developments from a viewpoint, but needs to turn their head to see them.

5.87 The locations from where combined and successive cumulative effects may be experienced are indicated by the areas of overlap between the zones of theoretical visibility (ZTVs), where one or more scheme will potentially be seen at the same time as Galawhistle Wind Farm.

- **Sequential** effects occur when a receptor is moving from one area to another, for instance when a person is travelling along a road or footpath, and is able to see two or more developments at the same, or at different times as they pass along the route. Frequent sequential effects occur when a development appears intermittently with short time lapses between points of visibility, depending on the speed and distance. Occasional sequential effects occur where long periods of time lapse between views of the developments, due to a lower speed of travel and/or longer distances between the points of visibility.

5.88 Sequential effects can potentially affect views from routes over a much wider area, but for the purposes of this assessment, we have described these within the study area as agreed with consultees.

5.89 The other important factor as noted above, is that not all proposals will necessarily gain planning approval or be built. However, for the purposes of CLVA, it is assumed that all wind farm proposals will be present in the landscape, representing the 'maximum development scenario'. The reality will be somewhere between the 'maximum development scenario' with all wind farms being built, and the 'minimum development scenario' with no other wind farms being built in addition to those already existing.

5.90 Each of the viewpoints used in the LVA was considered in the CLVA. Firstly, those viewpoints most likely to be affected by cumulative effects were identified, by superimposing the viewpoints on the CZTV, to identify whether or how many wind farms will be potentially visible from each of the locations. Secondly, judgements about the potential cumulative effects on these viewpoints

[19] SNH. (2005). *Cumulative Effect of Windfarms.*
[20] p17. Paragraph 29.
[21] Scottish Executive. (revised 2002). *PAN 45 Renewable Energy Technologies.* p32. Paragraph 89.
[22] SNH. (2005). *Cumulative Effect of Windfarms.*

were made. This assessment describes the potential cumulative effects on viewpoints judged to experience cumulative effects. Those viewpoints which will not experience views of wind farms, other than of Galawhistle Wind Farm alone, were not considered further in the cumulative assessment.

Existing Baseline Landscape and Visual Amenity

5.91 This section sets out the existing conditions in relation to the site and surrounding area. Below describes the baseline for the assessment of changes in landscape and views that would result from the introduction of the wind farm.

The Site

5.92 Galawhistle Wind Farm site comprises a series of rounded upland hills, Wedder Hill, Arrarat Hill, Hareshaw Hill and Meikle Auchinstilloch. These hills are dissected by the river valleys of Galawhistle Burn and Monks Water. The form and elevation of these hills, up to 491m Above Ordnance Datum (AOD), provide a relatively open and exposed character to the site. The narrow river valley bottoms are comparatively more enclosed due to the surrounding steep valley slopes.

5.93 A central river valley travels north to south through the site with Monks Water meandering along it. Smooth, steep slopes rise up either side of the river valley to form rounded hills. The smooth rounded upland hills of Arrarat Hill and Wedder Hill are located east of Monks Water, and Hareshaw Hill to the west. Galawhistle Burn flows west to east in the north of the site flowing into Monks Water. North of Galawhistle Burn, smooth slopes rise up to form the rounded upland hill of Meikle Auchinstilloch. A number of small tributary burns drain from the surrounding hills and flow into Galawhistle Burn and Monks Water forming small incised valleys.

5.94 The site is mainly covered by open moorland, the vegetation cover of the site is described in detail in Chapter 6 (Ecology). However the lower slopes of Meikle Auchinstilloch and Hareshaw Hill include isolated bound areas of grazed pasture. Monkshead Farm is unoccupied and located adjacent to the area of pasture on the east slope of Hareshaw Hill. These grazed areas have been subject to some cultivation and are bound by a combination of dry-stone walls and post and wire fences. A number of mature deciduous trees surround the cultivated pasture. The north and northeast boundary of the site is abutted by an area of commercial coniferous forest of sitka spruce species. The west boundary of the site is met by an active opencast coal site (OCCS) including some large elevated spoil heaps.

5.95 A track passes north to south through the site, to the east of Monks Water, until it reaches Monkshead Farm where it crosses the river and terminates. A dismantled railway track, now used as a track for vehicles passes east to west through the north of the site north of Galawhistle Burn on the lower slopes of Meikle Auchintilloch.

5.96 Although the wind farm site itself is relatively undeveloped, close views of Hagshaw Hill Wind Farm and extension, commercial forestry and active and restored areas of the OCCS when seen from the site limit the undeveloped nature of the landscape. The site enables elevated distant views of the surrounding landscape, including the rising hills of the Southern Uplands and Lowther Hills to the south and the low floodplain of the Clyde valley including the built development of Glasgow and its environs to the north.

The Study Area

Geology and Landform

5.97 The underlying geology of the area influences how the landform is structured and the resulting landscape and views around it.

5.98 The Southern Upland Fault line passes across Scotland from Rhinns of Galloway to Dunbar. This major fault line passes through the study area from Dalmellington to Biggar south of the wind farm site. The Southern Upland Fault defines the northern edge of the Southern Uplands which comprise ancient (Palaeozoic-Ordovician) sedimentary formations. North of this fault line is the Midland Valley of Scotland which extends to the Highland Boundary Fault encompassing Ayrshire, Forth of Clyde and Tay Firths and Basins. The Midland Valley area comprises largely sedimentary rock, but igneous intrusions create isolated hill ranges. The wind farm site is located on Silurian and Ardonian sedimentary rocks similar to the Southern Uplands underlying geology hence the upland landform.

Landscape Elements and Landcover

5.99 The landcover of much of the upland areas around the site and across the study area is open heather and grass moorland. Open heather and grass moorlands cover upland slopes and summits in central and southern parts of the study area. Farmland on lower elevations and slopes can be found in the north, northeast and west of the study area.

5.100 Commercial forestry plantations are located in the surrounding area, predominantly comprising sitka spruce. Plantations are relatively fragmented in appearance resulting from their variable size, form and age. The wider study area comprises some larger plantations to the southeast, southwest and northwest. The remainder of the study area comprises some small plantations interspersed by deciduous shelter belt woodlands and field boundary trees in lower areas.

5.101 The operational Hagshaw Hill Wind Farm and its extension are located immediately adjacent to Galawhistle Wind Farm site. In the wider study area Black Law Wind Farm is located in the northeast, Whitelee Wind Farm in the northwest and Harehill and Windy Standard Wind Farms are located in the southwest as shown in Figure 5.7.

Communications and Infrastructure

5.102 The site is accessed via the A70 which passes east to west south of the site. There are several existing tracks which pass through the wind farm site, passing adjacent to Monks Water and Galawhistle Burn. A network of tracks north, east and west of the site provide access to the forestry as well as the OCCS and the existing Hagshaw Hill Wind Farm and its extension.

5.103 The wider study area includes a considerable network of roads connecting settlements within the study area. The M74 and A76 pass northwest to southeast through the study area while the A702 passes north to south. The M74 is a major infrastructure connection between Scotland and England, connecting Glasgow and Carlisle. The A76 in the west of the study area passes northwest to southeast providing an important connection between Kilmarnock and Dumfries. Several infrastructure connections, including M8 in the north, A70 in the centre and A71 in the north, pass roughly east to west through the study area, connecting the east and west areas of Scotland.

5.104 There are no railways in close proximity to the site, however there are railway connections in the wider study area. A line travels southeast from Kilmarnock adjacent to the A76 whilst another passes to the east of the site, adjacent to the M74. A network of railway lines in the north of the study area connect Glasgow with its environs as well as with Edinburgh in the east of Scotland.

5.105 The Southern Upland Way (SUW) crosses the south of the study area, entering at Benbrack in the south and leaving the study area as it crosses the Lowther Hills in the southeast. National Cycling Routes 74 and 75 are located in the east and north of the study area respectively.

Settlement

5.106 No residential properties are located within the site boundary of Galawhistle Wind Farm. Residences to the south of the site include Parish Holm, Carmacoup and the small settlement of Glenbuck, to the east are Glespin and Hazelside, to the west is the settlement of Muirkirk and to

the north-east are the settlements of Coalburn and the residential properties of Stockhill, South Cumberhead, Broom Knowe and Blackhill.

5.107 Considering the wider study area, the city of Glasgow and its environs, including East Kilbride, Hamilton, Motherwell, Wishaw and Lanark are located in the north. Other settlements include Cumnock, Sanquhar, Biggar, Auchinleck, Mauchline, Kilmarnock and Strathaven. Within upland areas in the south and north-west of the study area, small settlements and scattered residential properties are limited to valley bottoms.

Climate and Weather Conditions

5.108 In addition to the physical features of the landscape, climate and weather conditions affect perception and experience of the landscape.

5.109 The main climatic influences are exposure, sunshine, precipitation and day length. Generally, Scotland is relatively cloudy due to the proximity of low-pressure systems from the Atlantic Ocean. In addition, day length varies with the seasons. Precipitation (rainfall and snowfall) in Scotland is very variable and is determined by topography and geographic location. The area with the highest precipitation is the Western Highlands, the driest area is the east coast. Galawhistle Wind Farm site is of average rainfall, with ground conditions often being wet, a factor of its upland location.

5.110 Scotland can also have periods of excellent visibility, as the greater part of the country is remote from the more industrial and populous areas of Great Britain and mainland Europe. These conditions are generally experienced for a limited time, due to the prevailing climatic influences.

Climate Change

5.111 Present-day Scottish landscapes have been formed by a wide range of influences, including climatic processes. Ice ages have had a major influence in sculpting today's landforms through glacial spread and retreat. Similarly, the warming of the planet and changing in patterns of rainfall have, over time, influenced the land's agricultural capacity and the flora of today.

5.112 Climate can be viewed as having been a highly influential factor in the development of today's landscapes; and it is widely accepted that due to anthropological activities, climates are changing. While there appears to be no certainty of what the effects of such climatic changes will be in the future, it is clear that these changes will affect the landscape. These concerns have been recognised in a number of papers in recent years.

5.113 The Countryside Agency and SNH (2000) *Topic Paper No 9: Climate Change and Natural Forces: the consequences for landscape character* explored some of these issues in 2000. The document states in Paragraph 31 that *"It is important to recognise that perceptual and aesthetic characteristics of landscapes may also be affected by climate change".*

5.114 *Natural England's Climate Change Policy states that "Climate change represents the most serious long-term threat to the natural environment"* (2008, Preface). The policy document states that *"climate change is already occurring", and stresses the "urgent need to develop strategies to enable the natural environment to adapt to the impacts of 'locked in' climate change"*, i.e. the effects of past activity that is yet to manifest in the climate system.

5.115 Wind farms, including the Galawhistle proposal, can play a part in helping to reduce anthropologically generated climate change, although wind farms themselves will contribute to on-going landscape change. Landscapes have always changed and will continue to change through time. Landscape character is not static, but is evolving. This suggests that we should move away from the 'point in time' approach to landscape assessment. Instead, we should look at how climate changes the landscape, and recognise that wind farms are a part of the potential package of measures to address the issue of climate change.

Forces for Landscape Change

5.116 Forces for change are those factors affecting the evolution of the landscape and which may, consequently, affect the perception of the wind farm in the near or distant future. Although prediction of these is necessarily speculative, some are discussed briefly below.

Wind Farms

5.117 Wind farm development is a clear force for change. In addition to existing wind farms there are a number of proposals at varying stages of the development process for further wind farms throughout the study area, which are discussed in the cumulative effect assessment section later in this chapter. Given the wind resource in this area, there are likely to be ongoing requests for wind farm development in the southwest area of Scotland, particularly across the uplands.

Industry

5.118 The development of opencast coal extraction is expected to continue in areas which have identified seams of coal as long as this remains economically viable. The predominant areas of coal extraction are likely to remain in the central, west, southwest and northeast parts of the study area. There are coal seams which are not currently economically viable which may become so in the future. Ground reinstatement typically follows extraction.

Residential and Tourism Development

5.119 There are pressures for the development or expansion of tourism facilities. Potential areas of tourism pressure include the south of the study area where the Southern Uplands provide outdoor recreation.

5.120 There is increasing pressure for urban expansion particularly in the north in areas adjacent to Glasgow and its environs as well as lowland areas and river valleys.

Agriculture

5.121 Agriculture within the region is likely to continue to be influenced by the provision of subsidies and grants through the Common Agricultural Policy (CAP) and the Scottish Countryside Premium Scheme (SCPS). It is not clear how these will affect future agricultural activity in the area. However, it is anticipated that changes to the landscape will result from changes in animal husbandary, arable techniques and policies towards rural protection.

Forestry and Woodland Cover

5.122 The present landcover by woodlands and forestry may change in the future as tree growth, felling and restocking occurs, and this has potential to affect the perception of a wind farm in views. From 1985 onwards, grant incentives have encouraged the planting of new native woodlands in the area.

5.123 At the same time, woodland, hedgerows and shelterbelt and riparian woodland are under pressure from neglect.

Baseline Landscape Character

Landscape Character of the Site

5.124 The majority of the site is located in the 'Western (Ayrshire) Plateau' Landscape Character Area of the *Plateau Moorlands* LCT (*Glasgow and the Clyde Valley* LCA). The remainder of the site is located within:

- *Plateau Moorlands* LCT (Ayrshire LCA);
- *Upland River Valleys* LCT (Ayrshire LCA) covers the access track of the wind farm site;

- 'Douglas Water' Landscape Character Area within *Upland River Valleys* LCT (Glasgow and the Clyde Valley LCA).

5.125 At a local level the site conforms with the descriptions of the LCTs being an area of upland character and exposed smooth plateau landform with small rivers draining from them forming river valleys.

Landscape Character of the Study Area

5.126 Numerous LCTs occur within 35km of the wind farm site. *Glasgow and the Clyde Valley*, *The Borders, Ayrshire, The Lothians* and *Dumfries and Galloway* LCAs provide a summary of the key characteristics of the landscape within the study area. LCTs are shown on Figure 5.3**.** It is important to recognise that there are local variations within the regional scale LCTs described, and that there have been changes to the landscape since the LCAs were published, including the construction of Hagshaw Hill, Hagshaw Hill extension, Black Law, Windy Standard, Hare Hill and Whitleee Wind Farms as shown in Figure 5.3. A proportion of the study area is occupied by urban areas, these areas are discussed in the assessment of visual effects on settlements. A number of LCTs within the study area have no theoretical visibility of the wind farm and therefore will not be affected by changes in views. In addition, LCTs where the ZTV indicates very little potential for change in views, at some distance away, are not assessed, as there is no likelihood of significant effects. LCTs which have the greatest potential to be affected by changes in views, and consequently their landscape character, as a result of the wind farm are listed below and described in Table 5.4:

- *Glasgow and the Clyde Valley LCA:*
  - *Rolling Farmlands;*
  - *Plateau Farmlands;*
  - *Fragmented Farmland;*
  - *Incised River Valley;*
  - *Broad Urban Valley;*
  - *Upland River Valley;*
  - *Broad Valley Upland;*
  - *Foothills;*
  - *Old Red Sandstone Hills;*
  - *Plateau Moorlands;*
  - *Southern Upland;*
- *Ayrshire LCA:*
  - *Ayrshire Lowlands;*
  - *Lowland River Valley;*
  - *Upper River Valley;*
  - *Lowland Hills;*
  - *Foothills with Forestry;*
  - *Plateau Moorlands;*
  - *Plateau Moorlands with Forestry;*
  - *Southern Uplands;*
  - *Southern Uplands with Forest;*
- *Dumfries and Galloway LCA:*
  - *Southern Uplands;*
  - *Southern Uplands with Forest;*
- *The Borders LCA:*
  - *Southern Uplands with Scattered Forest.*

Table 5.4: LCTs which lie within the ZTV and have potential to experience a change in Landscape or Visual Amenity[23]

LCT	Key Characteristics	Advise on sensitivity to wind farms
Glasgow and the Clyde Valley LCA 1998		
Rolling Farmlands	• *distinctive undulating landform created by fluvio-glacial action;* • *dominance of pastoral farming, varying in productivity according to elevation and exposure;* • *importance of woodland in structuring the landscape and providing shelter for agriculture and rural settlement.*	No advice given about wind farms.
Plateau Farmlands	• *extensive, gently undulating landform;* • *dominance of pastoral farming, but with some mosses surviving;* • *limited and declining treecover;* • *visually prominent settlements and activities such as mineral working;* • *the rural character of the Plateau Farmland has suffered as treecover has declined and the visual influence of settlements, transport infrastructure and mineral working has increased.*	No advice given about wind farms.
Fragmented Farmland	• *a landform which ranges from gently undulating topography associated with the plateau farmlands to more hummocky patterns where fluvioglacial action has created drumlins and eskers;* • *pockets of remnant pastoral farming, in some areas retaining a strong structure of hedges and trees, but in others suffering serious decline;* • *visual influence of the urban edge, of former and current industrial sites and transport infrastructure;* • *urban fringe issues including blight, management decline and anti-social behaviour such as flytipping.*	No advice given about wind farms.
Incised River Valley	• *narrow, steep sided valleys cut deeply into the plateau farmlands;* • *rich broadleaf woodlands on steep valley sides;* • *agriculture where valleys are wide enough with a mixture of pastures, arable, market gardens and orchards;* • *series of policy landscapes, castles and other historic sites;* • *linear villages and winding roads;* • *focal role of rivers and tributaries;*	No advice given about wind farms.

[23] Text quoted in i*talics* are direct quotes from the relevant LCA.

LCT	Key Characteristics	Advise on sensitivity to wind farms
	• *rich, sheltered and settled areas, often hidden within the wider landscape.*	
Broad Urban Valley	• *broad sections of main river valley with well defined floodplain;* • *past developments have resulted in significant modifications to landscape character;* • *between Bothwell and Motherwell, a large part of the valley is occupied by Strathclyde Country Park, comprising a large waterbody, woodland, grassland and a limited amount of recreation related development . However, neighbouring urban areas and the M74 have a significant visual influence also;* • *between Carmyle and Newton, the valley comprises a mosaic of derelict, contaminated, restored and active industrial sites. The M74 is also significant feature here.*	No advice given about wind farms.
Upland River Valley	• *a series of valleys formed along faultlines through the plateau moorlands and paired with valleys to the south and west in Ayrshire;* • *strong contrast between the wooded and settled character of the valleys and the exposed enclosing uplands;* • *transition from the exposed upper reaches to more sheltered lowland areas.*	No advice given about wind farms.
Broad Valley Upland	• *largescale landscape comprising a broad, flat bottomed valley enclosed by the rounded foothills to the north and the Southern Uplands to the south;* • *distinctive pattern of tree-cover comprising shelterbelts on lower hill slopes and lines of mature trees along field boundaries;* • *scattered pattern of rural settlement.*	*The landscape would be sensitive to the development of tall structures including masts, pylons and wind turbines, on areas of high ground visible from within the valley. Particular concerns would relate to situations where more than one windfarm, for example, is visible from within the valley. (p166)* *Discourage wind power development which would result in more than one wind farm being visible from any one point within a particular valley. (p166)*
Foothills	• *rounded, sometimes conical hills, forming a transition between the plateau moorlands and the southern uplands;* • *hillstops dominated by heather moorland, with a transition to rough grazing and enclosed pastures on lower slopes. Some areas of coniferous woodland;* • *the hills have little in the way of modern settlement in the hills.*	*This relatively remote and inhospitable landscape has few building development pressures. The large scale of topographic enclosure and potential for long views in this landscape, make the Foothills potentially sensitive to any development. A key sensitivity, however, is the potential development of tall structures including masts and wind turbines. This landscape type satisfies most of the technical requirements for wind power generation. These developments could weaken the apparently 'wild' character of the foothills landscape and could have extensive visual influence depending on location and the use of topography for visual containment. The relationship between the foothills and the Southern Uplands, for example, could provide opportunities for 'backclothing' such structures so that they are not always visible on the skyline. Particular concerns will apply, however, where more than one wind farm is visible from a given location, or where people travelling through the area view a number of such developments in close succession.* *Guidelines for this landscape type are as follows:* • *new development should generally be resisted. Where circumstances require buildings they should be located and designed so as to limit visual intrusion and landscape impact;* • *particular concerns relate to wind farm development on these hills. The limited extent of the hills, their remote and apparently 'natural' character, and the sensitivity of their hillslopes and skylines, mean that it is very likely that a windfarm development in any of the three areas would have a significant adverse effect on the wider landscape character.*

LCT	Key Characteristics	Advise on sensitivity to wind farms
Old Red Sandstone Hills	• *western tail of the Pentland Hills, comprising areas of moorland dropping steeply in places to the surrounding lowlands;* • *dominance of heather and peat moorland and rough grazing with small areas of coniferous plantation;* • *largely unsettled landscape though with areas of archaeological interest.*	*A key sensitivity, however, is the potential development of wind turbines and pylons. These developments may compromise the apparently 'wild' values of the landscape and may have extensive visual influence depending on location and the use of topography for visual containment or 'backclothing'. Particular concerns will apply where more than one wind farm is visible from a given location, or where people travelling through the area view a number of such developments in close succession. (p189)* *Guidelines for this landscape type are as follows:* • *an important part of these areas' character is derived from the lack of development of any sort. New development should generally be resisted, therefore;* • *discourage the erection of masts or other tall structures within the hills;* • *steer any new masts to sites where the landscape and visual impact is minimised;* • *minimise the requirement for ancillary developments such as roads or servicing buildings;* • *any wind energy developments in this area should be very carefully sited so as to minimise the visual and landscape impacts. Where possible developments should be located away from prominent ridgelines and summits and provided with a degree of backclothing. Potential cumulative and sequential effects should be taken into account.. (p189)*
Plateau Moorland	• *distinctive upland character created by the combination of elevation, exposure, smooth, plateau landform, moorland vegetation and the predominant lack of modern development;* • *these areas share a sense of apparent naturalness and remoteness which contrasts with the farmed and settled lowlands.*	*Parts of the moorlands between the Clyde Basin and the Ayrshire Basin fall into the Preferred and Intermediate Areas for wind farms identified in the Strathclyde Structure Plan 1995. Given the open, horizontal and apparently wild character of these areas, the landscape would be sensitive to the concentration of wind farm development in this area. This would be particularly the case where cumulative impacts occurred or where the intrinsic undeveloped upland character was weakened.* *Guidelines for this landscape type are as follows:* • *discourage the erection of additional masts or other tall structures within the hills;* • *encourage operators to share infrastructure with the aim of minimising the number of masts that are needed;* • *steer any new masts to sites where the landscape and visual impact is minimised;* • *minimise the requirement for ancillary developments such as service roads or servicing buildings;* • *wind energy developments in this area should be very carefully sited so as to minimise the visual and landscape impacts. Where possible developments should be located away from prominent ridgelines and skylines provided with a degree of backclothing. The open character of the landscape means that the potential to accommodate several wind power developments is likely to be limited. Potential cumulative and sequential effects should be taken into account. (p197)*
Southern Upland	• *large scale upland landscape with strong but smooth relief;* • *glacial carved and smoothed landforms, including "U"-shaped valleys, hanging valleys and corries;* • *extensive mosaics of heath and rough grassland;*	*A key sensitivity within the Southern Uplands is, however, the potential development of tall structures related to energy generation and transmission, namely wind turbines and pylons. This landscape type satisfies most of the technical requirements for wind power generation, indeed wind farms have already been established in neighbouring hill areas.*

LCT	Key Characteristics	Advise on sensitivity to wind farms
	• *significant archaeological sites, particularly from the Bronze and Iron Age periods;* • *prominent isolated conifers plantation and old stands of Scots Pine;* • *largely undeveloped, except for occasional upland farms and shielings.*	*These developments may compromise the 'wildland' values of the landscape and may have extensive visual influence depending on location and the use of topography for visual containment or 'backclothing'. The precedent of wind farm developments within this landscape type (some outside the study area) may cause the cumulative and sequential impact of wind farms to be an issue. (p214)* *Guidelines for this landscape type are as follows:* • *the main development pressures for this landscape relate to wind energy and telecommunications. This siting of such developments in this scenically valued landscape will require careful guidance and detailed assessment. This must address the potential cumulative impact of windfarms (and telecommunication masts) within South Lanarkshire and the neighbouring council area. As with forestry, it would be useful to define special "sensitive areas" which should be kept clear of such developments (regardless of their physical/technical ability to accommodate them). In addition, undeveloped areas which could significantly increase the cumulative visual impact of windfarms should be identified and special planning restrictions applied;* • *in general, areas of blander landforms, remote from settlements, main communication routes and popular recreation areas would be most suited to windfarm developments. Ideally, wind turbines should be located so as to avoid breaking the skyline from key viewpoints. Colls and hill shoulders may provide such sites and enable turbines to be kept below the general horizon level. The impact of new access roads should also be carefully assessed, as these can create intrusive scars in this landscape. Existing hill roads should be used whenever possible. (p214-215)*
Ayrshire LCA 1998		
Ayrshire Lowlands	• an extensive area of undulating lowland lying between 10m and 150m; • landform dissected by numerous burns and streams draining to the main river valleys; • landcover is mainly pastoral; • fields are often regular in shape and bound by beech or hawthorn hedges; • field boundaries are often marked by mature hedgerow trees giving the landscape a wooded character and often forms avenues along minor roads; • rich pasture gives way to wetter pasture and a stronger moorland influence; • extensive woodland is limited, concentrated along river valleys, shelterbelts or around large estates; • farms are often sited on low hilltops comprising a courtyard with a central farmhouse, with modern farm buildings rarely being intrusive; • a number of historic towns and villages with modern suburban settlement around their edges.	• *encourage the development of a regional strategy for renewable energy, including wind power, in order that the most appropriate types of development and areas come forward;* • *some limited potential for small scale wind power development associated with local consumption. (p118)*
Lowland River Valley	• covers two areas within the study area, River Ayr and River Irvine valleys; • narrow entrenched valleys, often just a few hundred metres wide, leaving the uplands and running towards the coast;	No advice given about wind farms.

LCT	Key Characteristics	Advise on sensitivity to wind farms
	• small scale landscapes, often hidden within the undulating lowlands; • bounded by steep slopes between 10m and 30m high on which are stands of beech and semi-natural woodland; • river meanders enclose semi-circles of rich pasture; • field boundaries are hedges; • settlement is limited; • mills are sited along river bridging points; • the rich river valley woodland has often been incorporated into designed landscapes.	
Upland River Valleys	• covers four areas within the study area, Upper Irvine, Upper Ayr, Upper Nithsdale and Glenmuir valley; • medium sized river valleys cut into the rim of hills, surrounding the Ayrshire Lowlands; • surrounding uplands provide a sense of enclosure; • Upper Irvine valley is a V-shaped valley with step valley slopes and narrow floodplain. Loudon Hill is a distinct volcanic plug within the valley; • Settled valley of linear settlements; • Wooded character associated with designed landscapes; • pasture on slopes are bound by treelined hedgerows; • Some sand and gravel opencast mining; • Upper Ayr valley varies in form along its length and includes the meandering River Ayr; • the Glenbuck area of the valley is broad and open with opencast exploitation resulting in associated settlement, infrastructure and a legacy of bings and mining relics. • the west of the valley is small in scale and incised with hanging birch and hazel woodland; • the Upper Nithsdale is part of a U-shaped valley with river meandering across its broad valley bottom; • the area is predominantly pastoral in character although giving way to rougher grazing and then open moorland; • field boundaries are mainly post and wire fences; • tree cover is limited to stretches of the river, tributary burns and transitional areas	No advice given about wind farms.

LCT	Key Characteristics	Advise on sensitivity to wind farms
	between enclosed and open land; • settlement is scarce, comprising farms on the lower slopes although the Nithsdale valley is important for communication; • the Glenmuir Valley (near Cumnock) is of smaller scale than the other upland valleys; • it has been a focus for industrial development and settlement resulting in small scale industrial remnants such as bings; • Cumnock, Auchinleck and Holmhead are prominent settlements in the open landscape.	
Lowland Hills	• within the Ayrshire Lowlands lie a series of hills just under 150m AOD, which culminate • in a series of bluffy, often gorse covered, summits; • a significant feature in the landscape, contrasting with the coastal lowlands; • pasture is dominant; • field boundaries are a mix of post and wire and hedges, often including gorse; • hard rock exploitation occurs in this area; • reservoirs and masts are present in the area.	• *some limited potential for small scale wind power development which would not compromise the rural character of the hills*
Foothills with Forestry	• a transitional landscape between the Ayrshire Lowlands and uplands; • cut by the River Doon and the Water of Girvan, creating a dissected landform; • rounded ridges and plateaux can rise to c. 300m between the valleys; • the eastern part of the Doon valley contains relicts of mineral extraction and existing opencast coal mining continues above Dalmellington and West of New Cumnock; • modern settlement, of industrial origin and now in decline, tends to be confined to the string of settlements along the B741. • forest plantation covers most of the lower slopes and rounded slopes, clearfell and design improvements are evident; • open ground is mainly used for rough or semi-improved pasture enclosed by drystone dykes; • unenclosed rougher pasture is found at higher elevation; • recreational activities are encouraged in the forest areas forests are integrated into the forest.	• *encourage wind power developments to locate away from skyline locations;* • *planning policies should indicate that medium scale wind power development may be suitable in areas where landform can minimise intrusion and cultural history provides an appropriate context;* • *potential siting of wind towers should attempt to use adjacent forested landscapes to aid screening and backclothing;* • *wind farms may be appropriate within open ground, ideally utilising existing roads, though individual schemes should be subject to thorough landscape and visual assessment at the design stage. (p179)*

LCT	Key Characteristics	Advise on sensitivity to wind farms
Plateau Moorlands	• the eastern Plateau Moorlands in Ayrshire are relevant to the study area; • extensive plateau basins rise to gentle ridges; • open, exposed and wild character; • landcover is blanket bog, heather and grass moorland; • isolated hill farms and sheep grazing.	*Wind Power: it is likely that large parts of the Plateau Moorlands have potential for wind power development, though this is likely to be constrained to some extent by the availability of connections into the power distribution system. Although this is a large scale landscape, development within the unforested parts of this landscape type could conflict with the untamed nature of the moorlands. It is a simple landscape dominated by horizontal elements. Modern wind infrastructure would contrast with this character, introducing vertical elements, movement and modern structures. It is likely that such a development would be visible over considerable distances, raising concerns about cumulative impacts. All other things being equal, it would be logical to steer wind farm development to those parts of the plateau moorlands already affected by mineral working, forestry and other developments. (p183-184)* • *encourage wind power developments to located away from skylines;* • *encourage the development of a regional strategy for renewable energy, including wind power, in order that the most appropriate types of development and areas come forward;* • *planning policies should indicate that medium scale wind power development may be suitable in areas where landform, landcover or land use can minimise intrusion;* • *wind energy developments should be discouraged in the more untamed parts of this landscape, and encouraged to locate in those areas already affected by development or large scale land use changes;* • *potential siting of wind towers should attempt to use adjacent forested landscapes to aid screening and backclothing;* • *the cumulative and sequential effects of wind farm developments in the Plateau Moorlands should be taken into account;* • *small scale wind developments, designed specifically to supply local needs, may be appropriate in more remote parts of the moorlands; (p186)*
Plateau Moorlands with Forestry	• as above but with afforestation; • extensive blanket cover of commercial Sitka forest; • uniform age, colour and texture; • little modified by redesign subsequent to felling; • surrounding open ground and moorland creates contrasting mosaics; • generally exposed and remote; • some enclosure within forests.	As above
Southern Uplands	• steep, smooth slopes rising to rounded summits up to 575m AOD; • glacial U-shaped valleys are cut into the uplands, with steep side slopes, hanging valleys,	*Wind power: it is likely that large parts of the southern uplands have potential for wind power development, though this is likely to be constrained to some extent by the availability of connections into the power distribution system. All other things being equal, it would be logical to steer wind farm development to those parts of the southern uplands already affected by forestry or other developments. More sensitive sites should be avoided. (p197)*

LCT	Key Characteristics	Advise on sensitivity to wind farms
	• crags and scree; • contrast with the lower moorlands and lowlands to the north; • generally assessable by foot; • a few minor roads; • landcover comprises coarse grassland, with heather moorland at the highest elevations; • semi-natural woodland is scarce, found in sheltered glens and gullies; • extensive areas of coniferous plantations exist around the edges of the higher hills; • modern settlement is confined to river valleys and glens.	• *Planning policies should indicate that medium scale wind power development may be suitable in areas where landform can minimise intrusion and cultural history provides an appropriate context;* • *Encourage any wind power developments to locate away from key skylines and valleys;* • *Potential siting of wind towers should attempt to use adjacent forested landscapes to aid screening and backclothing. (p199)*
Southern Uplands with Forest	• as above with dominant forestry landcover; • forests extend over the summits or are on higher slopes leaving the peaks exposed; • forest rotation provides textural and colour changes.	As above
Dumfries and Galloway LCA 1998		
Southern Uplands	• *large, smooth dome/conical shaped hills, predominantly grass covered;* • *open and exposed character except within incised valleys;* • *distinctive dark brown/purple colour of heather on some of the higher areas;* • *pockets of woodland in incised valleys;* • *stone dykes occasionally define the lower limit;* • *the legacy of lead and other mining activity.*	*The large scale topography of this landscape type should be able to accommodate the scale of wind turbines. This would, however, require siting below ridge and summit lines in positions which provide backclothing from main viewpoints. Locations within open ground in forest dominated areas should seek to utilise as far as possible any forestry and local access roads. The scale of the landscape might be able to accommodate large wind farms (approximately 20 no. turbines) but environmental assessment should seek to ensure these are not intervisible and do not dominate consecutive viewsheds.* *Planning policies should indicate that medium to large scale wind power development may be suitable in the less 'scenic', more remote parts of this landscape.*
Southern Uplands with Forest	• *large, smooth dome-shaped hills with large scale dark green plantations on slopes and over lower summits;* • *Sitka spruce dominated, interspersed with larch;* • *changing landscapes with large scale felling, ploughing and replanting.*	As above
The Borders LCA 1998		
Southern Uplands with Scattered Forest	• *Large-scale rolling landform with higher dome or cone-shaped summits* • *Significant areas of peatland and heather moorland* • *Mosaic of grassland, bracken and rushes on lower ground* • *Locally-prominent scattered large coniferous plantations.*	No advice given about wind farms.

Designated Landscapes

Designated Landscapes across the Site

5.127 There are no designated landscapes covering Galawhistle Wind Farm site.

5.128 SNH have issued guidance with regard to landscape designations and wind farms in SNH Policy Statement 02/02 *Strategic Locational Guidance for Onshore Windfarms in Respect of the Natural Heritage* (2009). This provides a composite map[24], of the natural heritage sensitivity of Scotland with respect to wind farms, which includes consideration of designated landscapes along with other natural heritage interests. It classifies Scotland into three zones, low, medium and high sensitivity. Galawhistle Wind Farm site is located within a zone of low sensitivity.

Designated Landscapes across the Wider Study Area

5.129 There are numerous designated landscapes across the wider 35km radius study area. Designated landscapes within the study area shown on Figure 5.5**.** Designated landscapes that lie within the study area but which will not be affected by views of the wind farm were identified, but not considered further in this assessment. Designated landscapes from where there will be very minimal extents with potential views of the wind farm were also not assessed further, as there will be little likelihood of significant effects. Designated landscapes from where there will be considerable extents with potential views of the wind farm were outlined and described in Table 5.5. The ZTV, as shown in Figure 5.6, indicates the potential visibility of the wind farm, highlighting the extents within designated areas which are most likely to be affected. Where ZTV coverage is discussed in the text that follows, it is specifically in relation to these potential views and the consequential effects that these could have on the character of the landscape and reasons for designation of the landscape.

5.130 There are numerous Sites of Special Landscape Importance in the Glasgow City Plan (Glasgow City Plan: Part 2, Development Policies, Section 9). However, no views of the site from these areas are predicted, therefore they have not been assessed further.

Table 5.5: Designated Landscapes within the Study Area from which Views of the Wind Farm may be Available

Designation	Distance to the Nearest Turbine	Physical Extent and Reason for Designation (where available)
National Scenic Area (NSA)		
Upper Tweeddale NSA	30.9km	The NSA is located in the east extent of the study area. It extends from Blakehope Head and Broughton to Peebles, including the River Tweed valley. As described in the Countryside Commission for Scotland 1978 report, the reasons for designation of this landscape include its enclosed narrow valley and meandering river providing a focus. The valley is wooded with shelterbelts, woodlands, hedgerows and plantations. Numerous historical features cover the landscape including castles and mansions.[25]
Areas of Great Landscape Value (AGLV)		
Douglas Valley AGLV	1.1 km	This AGLV is located east of the wind farm site in the central part of the study area. It covers the Douglas Water valley and surrounding slopes from east of Glespin to south of Rigside. No citation is available.
Clyde Valley AGLV	11.4 km	This AGLV is located in the north of the study area. It extends east and west of the River Clyde valley from Hamilton south-east to south of Lanark. No citation is available.
Tweedsmuir Hills/Upper Tweeddale AGLV	26.1 km	This AGLV is located in the east of the study area. It extends eastwards from Culter Fell and Clyde Law to include the valley surrounding the River Tweed. The AGLV extends beyond the study area boundary. No citation is available.
Regional Scenic Areas (RSA)		
South Clydesdale RSA	8.5 km	This RSA extends across the east of the study area and beyond the north-east study area boundary. The designated landscape extends from Gana Hill northwards covering the hills surrounding Abingdon and Biggar. No citation is available.
Thornhill Uplands RSA	13.5 km	The RSA extends from the southern extent of the study area. From Whether Hill the RSA covers an up area north-eastwards to Wanlock Head and east to Craighoar Hill. The reasons for designation of this landscape include its contrasting and variety of character and scenery. The RSA includes exposed remote summits, wooded gorges and wide and enclosed pastoral valleys.[26]
Sensitive Landscape Areas (SLA)		
Unnamed SLA (Afton)	1.4 km	This SLA covers from Maneight south-east to White Knowes and north towards New Cumnock. It includes areas east and north-east of New Cumnock, Muirkirk, Glenbuck and Glen Afton. It does not include the band of forestry on the eastern extreme of the county boundary. No citation is available.
Unnamed SLA (River Ayr-Lugar Water)	3.1 km	The SLA is located east of Ayr extending north-east along the course of the River Ayr to the east of Sorn and south to Ochiltree incorporating the River Lugar at its confluence with the River Ayr. No citation is available.
Scenic Area (SA)		
Unnamed SA (Lower River Ayr)	28.8 km	The SA lies east of Ayr and includes an area running westwards, covering the River Ayr as far as Failford. No citation is available.
Gardens and Designed Landscapes (GDL)[27]		
The Falls of Clyde	13.6 km	Located in the northeast of the study area south of Lanark, South Lanarkshire. The Falls of Clyde is valued for its outstanding historical, architectural, scenic and nature conservation interest. It is also valued for its high level of work of art and archaeological interest.
Lee Castle	15.4 km	This woodland, park and garden is located in the north of the study area west of Lanark, South Lanarkshire. Lee Castle is valued for its outstanding value of architectural and nature conservation interest as well as its high value of scenic interest.

[24] SNH. (2009). Strategic *Locational Guidance for Onshore Windfarms in Respect of the Natural Heritage*, Map 5 Zones of Natural Heritage Sensitivity, Policy Statement 02/02.
[25] Countryside Commission for Scotland. (1978). *Scotland's Scenic Heritage.*
[26] Dumfries and Galloway Council. (1999). *Dumfries and Galloway Structure Plan Technical Paper No. 6, Identification of Regional Scenic Areas.*
[27] GDLs as listed in Historic Scotland. (2007). *Inventory of Gardens and Design Landscapes* (Historic Scotland website).

Designation	Distance to the Nearest Turbine	Physical Extent and Reason for Designation (where available)
		The Castle also provides some historical interest.
Chatelherault (Wham)	19.8 km	Located in the north of the study area near Hamilton, South Lanarkshire it includes remnants of scenic parkland and historic trees. Chatelherault comprises a house with surrounding parkland and Wham reservoir area. Chatelherault (Wham) is valued for its outstanding work of art, historical, architectural, scenic and nature conservation interest.
Dumfries House	22.2 km	Located in the southwest of the study area in Old Cumnock, South Ayrshire. Dumfries House is valued for its outstanding historical, architectural and scenic interest as well as its high value of work of art and nature conservation interest.
Dalzell House	22.6 km	Located in the northeast of the study area in Dalzell, Lanarkshire Dalzell House includes a parkland and woodland. Dalzell House is valued for its outstanding value of historical, architectural, scenic and nature conservation interest. The house is also valued for its high value of work of art.
Allanton	25.4 km	Allanton includes a park, woodland and policy trees located in the north of the study area east of Newmains, North Lanarkshire. Allanton is valued for its outstanding work of art and historical interest as well as its high value of scenic interest. It also offers some value of nature conservation interest.
Little Sparta (Stonypath)	32.4 km	This garden and work of art is located in the northeast of the study area, west of Dunsyre. It is valued for its outstanding level of work of art, historical interest and high level of architectural interest.
Rowallan	34.2 km	Located in west of the study area north of Kilmarnock, East Ayrshire. Rowallan includes a parkland and woodland. Rowallan is valued for its outstanding historical and architectural interest. It also offers some value of work of art and nature conservation interest.

Other Designations

Recreational Designations

5.131 These areas are designated for the purposes of recreation and amenity. Three country parks have theoretical visibility: Calderglen Country Park; Strathclyde Country Park; and Drumpellier Country Park.

5.132 Calderglen Country Park is located east of East Kilbride and includes the area surrounding the River Calder. It has some theoretical visibility of its southern extent. Strathclyde Country Park is located west of Motherwell and occupies the valley surrounding the River Clyde. It has some ZTV coverage of its northern extent. Drumpellier Country Park is located east of Glasgow in the north of the study area. The majority of the Country Park has ZTV coverage.

Conservation Areas

5.133 CAs, introduced in 1967 under Section 61 of the Planning (Listed Building and Conservation Areas) (Scotland) Act 1967, are defined as 'areas of special architecture or historic interest, the character or appearance of which it is desirable to protect or enhance.' A total of three CAs fall within the ZTV of Galawhistle Wind Farm in the 35km study area:

- Ochiltree;
- Blairhill and Dunbeth, Coatbridge; and
- Hamilton Road, Motherwell.

Baseline Visual Amenity

5.134 On the basis of the criteria described in the methodology section above, and through consultation with statutory consultees, 25 viewpoints were selected for assessment. Views from many of the settlements within the study area will be limited because of screening by houses and seasonal filtering of views by trees. The viewpoints selected were therefore principally from the edges of settlements or elevated locations.

5.135 Following consultation, it was confirmed that a Scottish Power substation formed part of the project. The position of this substation within the site meant that there is limited theoretical visibility of the substation from the surrounding area and selected viewpoints. Viewpoint 26, located within the wind farm site, was therefore included in the assessment in order to illustrate the potential visual effect of the substation.

5.136 Viewpoint 7, A70 west of Ochiltree was discussed with Consultees however subsequently found to have no potential visibility of the wind farm. Field visits confirmed that an intervening local landform feature between the viewpoint and the wind farm will screen views of Galawhistle from this viewpoint. Viewpoint 7 was therefore not used further in the assessment.

5.137 Viewpoint 3 was relocated approximately 500m westwards following consultation. The viewpoint was re-positioned to the B7078 to provide an appropriate and safe location for viewpoint photography and assessment. The viewpoint is still representative of views from the adjacent stretch of M74.

5.138 The selected viewpoints are detailed in Table 5.6 and their location shown in Figure 5.8. Figures 5.9 to 5.33 provide photographs, wireframes and/or photomontages for each viewpoint.

Table 5.6: Selected Viewpoints

No.	Viewpoint	OS Grid Reference	Distance[28]
1	Minor road near Glespin	281303 627575	3.3km
2	Parish Holm	276272 628193	1.3km
3	B7078 near Lesmahagow	283427 636706	7.6km
4	Tinto Hill	295319 634368	17.5km
5	Cairn Table	272433 624223	6.7km
6	Lanark	289067 642844	15.9km
7	A70 west of Ochiltree	Not used in assessment	
8	Motherwell	275335 655265	23.5km
9	East Mount	287856 609991	21.5km
10	Hartwood near Shotts	285051 659292	28.5km
11	Carnwath	297855 646112	24.7km
12	Black Hill	283197 643543	13.2km
13	Douglas Castle	284330 631701	6.2km
14	A70 Rigside	287665 635137	10.3km
15	Crawfordjohn	288628624487	11.3km

[28] Distance from the viewpoint to the nearest turbine

No.	Viewpoint	OS Grid Reference	Distance[28]
16	Wedder Dod	282276 615414	14.4km
17	B743 near Nethershield	258722 626940	17.9km
18	Auchengilloch	270504 635497	7.2km
19	Loudon Hill near Drumclog	260871 637914	16.9km
20	A723 between Hamilton and Strathaven	270331 647424	17.1km
21	Muirkirk	270574 627876	6.1km
22	A76 south of Catrine	252689 624260	24.3km
23	Coalburn	281317 634511	4.5km
24	Lesmahagow	281553 638714	8.0km
25	Darlees Rig, Pentland Hills[29]	306513 653135	35.8km
26	Track north of Galawhistle Burn	276704 631103	142m

5.139 Visual effects on settlements and sequential experiences when travelling through the study area are considered. The settlements and routes considered are as follows:

Settlements

- Coalburn
- Muirkirk
- Douglas
- Lesmahagow
- Rigside
- Lanark
- Strathaven
- Larkhall
- Carluke
- Carstairs
- Carnwath
- Forth
- Glasgow and its environs[30]
- Shotts
- Stane
- Fauldhouse
- Ochiltree

Routes

- A70
- M74/A74(M)
- A721[31]
- A73
- A71
- A76
- M8/A8
- SUW
- National Cycle Route 74
- National Cycle Route 75

5.140 Other settlements across the study area including Kilmarnock, Galston, Newmilns, Darvel, Mauchline, Catrine, New Cumnock, Sanquhar, Abington and Biggar are not predicted to be affected by a change in views (as represented by the ZTV). Similarly, many routes such as M77, A702 and A72 are also not predicted to be affected by a change in views (as represented by the ZTV). These settlements and routes are shown to have no or minimal theoretical visibility of Galawhistle Wind Farm and are therefore are not assessed further.

5.141 Likely viewers or 'receptors' include:

- residents living in settlements or individual residential properties within the ZTV of the wind farm;
- people working in the countryside or any of the towns, villages or settlements within the ZTV of the wind farm;
- tourists visiting and staying in, or travelling through this part of Scotland;
- travellers (including tourists, workers or local people) using transport infrastructure passing through the study area; and
- recreational users of the landscape including those using golf courses, cycle routes and footpaths in the wider area.

Assessment of Potential Construction Effects

Potential Effects

5.142 This section describes the potential landscape and visual effects during the construction stage of the wind farm, on the site and the wider study area. It is important to note that these effects are likely to be only temporary. Construction effects will last for (part of) the duration of the construction period, 14 months, plus the time taken for restoration of the site and the vegetation that covers it, up to 5 years. Effects arising from construction will overlap to an extent with those arising from operation, as construction and erection of turbines will be progressive, with some being completed (and in that sense operational) ahead of others.

5.143 During construction, there will be short term effects on the landscape and upon visual amenity arising from plant and activities within the site including:

- Clearance of vegetation and topsoil stripping;
- Creation of new access tracks as well as upgrading of existing coal tracks and an existing disused railway line;
- The formation and operation of working compounds, offices and temporary fencing;
- Machinery (including concrete batching plant) and material storage;
- Plant and vehicle movements;
- Borrow pits;
- In-situ concrete works including formwork, shuttering and reinforcement;
- Excavations for foundations and cable trenches;
- The presence of tall cranes; and
- Construction related lighting in winter months;
- Partly constructed turbines.

Potential Landscape Effects of Construction on the Landscape and Visual Resource

5.144 The effects of construction of the wind farm upon landscape features and landcover of the site are set out in Table 5.7 below. The predicted changes to visual amenity across the site itself resulting from construction infrastructure and activities are also set out in Table 5.7. The potential visual effects due to tall crane activity and turbine construction across the wider study area are discussed in further detail for each viewpoint later in the chapter under the section on potential operational effects, as tall cranes will be seen across a similar area as fully constructed turbines.

5.145 As described in paragraphs 5.91 to 5.95, the landscape of the site is open in nature. Activity related to the adjacent OCCS and commercial forestry is visible in views from the site of the

[29] Although out side the 35km study area, this viewpoint was agreed with West Lothian Council during consultation.
[30] For the purposes of this assessment the environs of Glasgow are considered to include East Kilbride, Motherwell, Wishaw, Hamilton, Coatbridge and Airdrie.
[31] The section of road connecting Carnwath and Carstairs is considered to be A70 according to OS map, and is therefore not A721.

surrounding area. The sensitivity of the site itself to construction, which will add further tall vertical features beyond those perceptible in neighbouring landscapes, linear features (tracks) and vehicle and machinery activity is judged to be medium.

Table 5.7: Potential Landscape and Visual Effects on the Site Prior to Mitigation

Source of Potential Effect from Construction	Description of Effects on the Landscape Resource	Description of Effects on Visual Amenity
Ground disturbance: the disturbance of areas of land and vegetation at turbine base locations, and along access track routes	In the parts of the site where tracks and turbine foundations will be built, ground disturbance will change the character of the site from open, grass and heather plateau moorland to disturbed land with areas of exposed soil and altered landform. Although the vegetation around areas of disturbance will grow back over time, there will be a period when ground disturbance will affect the character of the landscape within the site.	Ground disturbance will be visible from most points around the site although the gentle topography means that few locations will have a view of the whole construction area.
Borrow Pits: ground disturbance of areas of land and vegetation and removal of excavated material	In the parts of the site where borrow pits will be excavated, ground disturbance will change the character of the site from open, grass and heather plateau moorland to disturbed land with areas of exposed peat, soil and rock and altered landform. Although the vegetation around areas of disturbance will grow back over time, the borrow pits themselves will remain exposed. Borrow pit excavation will affect the character of the site. The profile of smooth round uniform slopes will be altered where borrow pits are located.	The borrow pits will be potentially visible where they are cut into the slope profile, however they will be partially screened by landform around them. The wind farm site itself will have the greatest extent of visibility of the borrow pits, notably from the elevated slopes and summits within the site. The south facing slope of Meikle Auchinstilloch and the west facing slope of Wedder Hill within the site will face the borrow pits and therefore have the greatest extent of visibility. The borrow pits will locally alter the characteristic smooth round uniform profile of the slopes seen within the site.
Construction Activity: the introduction of construction activity and vehicular/personnel movements around the site and on local roads	The construction process will introduce construction activity, movement of personnel and machinery into a relatively 'still' site. This will change the character of the site although this effect will be intermittent and temporary.	Vehicle movements will be visible along the tracks during the construction period. Movements will change depending on the location of work.
Lighting on Site: the potential need for lighting on site during construction if work extends into hours of darkness	Lighting may be necessary during the construction of the wind farm, if work is undertaken during hours of darkness. Construction vehicles with lights may be seen moving around the site. There are existing sources of light around the site, with cars passing along the minor roads and lights at local farms and residences. However, during the hours of darkness, there is little impression of site character as little is visible.	If it is used, lighting will be visible across the site. There are a number of sources of light currently present in views surrounding the site.
Ground Level Elements: the introduction of tracks, crane pads at each turbine site and a substation	The introduction of tracks and crane pads as ground level structures will result in the introduction of new features in the site. The access tracks will introduce linear features into an open site therefore altering its pattern. The substation, which will be set into the hillside with dull coloured finishes, including a slate roof as described in Chapter 3, will introduce a new built structure on the moorland. Buildings are found on and around the site already, in the form of local farms. The new substation will not be located in association with these existing buildings. These infrastructure elements will alter the perceived character of the upland landscape.	Ground level structures will be visible from most points around the site, although few locations will have views of the whole network of tracks. The access tracks will introduce linear ground level elements into views of an open landscape. The increasing number of structures on site will introduce visual complexity as construction progresses.
Construction Compound: the construction and use of a works compound	The construction compound will be located in the north-west of the site on the lower north facing slope of Hareshaw Hill. The compound will be located in an area of open moorland and will alter this area from undisturbed land to a hardstanding area with works cabins and vehicles. The surrounding sloping topography of Hareshaw Hill, Meikle Auchinstilloch and the adjacent OCCS will screen this infrastructure element resulting in it having limited visibility both across the site and beyond.	There will be some visibility of the construction compound across the site, particularly from north-west, and south facing slopes of Meikle Auchinstilloch within the site.

Source of Potential Effect from Construction	Description of Effects on the Landscape Resource	Description of Effects on Visual Amenity
Tall Structures: the introduction of tall vertical structures (turbines and monitoring masts) with the use of cranes	The construction of the turbines and monitoring masts (both temporary and permanent) that extend above the site will introduce activity and tall cranes that will be perceptible from all parts of the site. As is the case with all wind farm construction projects, the site will be perceived as a potentially confusing array of partly constructed turbines adjacent to completed turbines for a period of time, but the duration of this stage of construction will be relatively short.	The cranes and partially constructed turbines will be visible from all parts of site given their height. Partly completed turbines may be visually confusing.
Construction Effects Overall	The magnitude of change on the site resulting from construction of the wind farm will be **high**. Although some elements of construction will result in temporary effects on the landscape and given time vegetation will regenerate reducing some effects, overall the effect on the landscape of the site itself is judged to be **major**.	The magnitude of change is judged to be **high**. Although some construction effects on visual amenity will be temporary, such as the construction of turbines, once completed the wind farm will form a less visually confusing image. Despite this, the overall visual effect of construction is judged to be **major**.

Potential Effects on the Study Area

5.146 The sensitivity of the wider landscape to construction effects is judged to be low. Forestry, opencast mining and construction activities can be found in various locations throughout the wider area.

5.147 The construction of the wind farm will potentially be perceptible from shaded areas indicated in the ZTV (Figures 5.1 and 5.2), specifically the cranes and partly constructed turbines which will be tall structures. This is described in detail in the assessment of operational effects on views, as the extent of theoretical visibility of cranes will be the same as for the turbines during operation.

5.148 Views of borrow pits will be possible from areas in close proximity, including from short sections of A70 south of Monksfoot and east of Muirkirk. The elevated summits of Little Cairn Table, Preisthill Height and north facing upper slopes of River Ayr and Douglas Water, in relative close proximity to the site will have views of tracks and borrow pits. Views from areas north and some south areas will be screened by existing commercial forestry. Other ground level aspects of construction will not be perceptible from beyond the local area around the site. For these areas with visibility of construction, the effect on the landscape and visual amenity of the wider study area, resulting from construction elements and activity, is judged to be **minor**. Construction of the wind farm will be seen from many of the areas within the shaded areas of the ZTV, but predominantly from the closer areas, which are near enough for activity to be seen clearly.

Residual Effects

5.149 As described above, the construction activities will give rise to significant but temporary effects on the landscape and visual amenity of the site over the duration of construction activity.

5.150 Once construction is complete, the wind farm substation, tracks and surfaces will progressively weather and become established parts of the landscape. The construction compound will be fully restored.

5.151 Following construction, restoration of disturbed areas will take time, particularly in areas of more sensitive vegetation, but with the implementation of a post-construction restoration plan, bare ground will soon become re-vegetated. The changes will affect landscapes and viewpoints close to the site, from where ground conditions will be discernible. These may last up to about five years (as heather and woody vegetation will take about this length of time to become re-established) but levels of effect will decline over this period. Over time, a species balance which is typical of less disturbed areas will become established.

5.152 There will be no significant landscape and visual effects of construction remaining after mitigation and restoration works are completed and vegetation has regenerated.

Assessment of Potential Operational Effects

Source of Effect

5.153 Turbines, anemometer masts, upgraded tracks, access tracks, the wind farm substation and the Scottish Power substation are considered to be potential sources of effect for the assessment of operational effects. Other features of the proposed wind farm (construction compound, access track working corridors, cable trenches, buried turbine foundations, and the grid connection) will be restored on completion of construction.

Movement

5.154 The wind turbines will rotate at speeds of 10-19 rpm when there is wind, except periodically when they are shut down for maintenance. This movement will be apparent in the landscape and in views. The smaller existing turbines of Hagshaw Hill Wind Farm will visibly rotate at faster speeds than Galawhistle turbines. Galawhistle turbines will rotate at similar speeds to the turbines of Hagshaw Hill extension.

Maintenance Activities

5.155 During the lifetime of the operational wind farm people and vehicles will be present within the site, typically 1-2 people and vehicles daily, giving rise to very low levels of activity associated with the presence of the wind farm.

5.156 In addition, there may be occasional infrequent requirements to repair or replace defective turbines or generators. This will result in large vehicles and cranes being present within the site for a number of days. Because of their short term nature, and the presence of existing wind turbines in the area, these changes are considered to be of low magnitude and not to constitute significant effects upon the landscape and upon visual amenity.

Landscape Effects during Operation

Potential Effects

5.157 This section contains the assessment of operational effects on the site itself, on LCTs and their sub-areas covering the site and LCTs across the wider ZTV.

Potential Effects on the Landscape of the Proposed Wind Farm Site

5.158 The upland plateau open moorland character and the presence of some scenic qualities to the site indicate some sensitivity to development. However, there are nearby man-made structures and development in views of the surrounding landscape. The landscape of the wind farm site is judged to be of **medium** sensitivity.

5.159 Although the turbines of Hagshaw Hill and its extension are visible in the neighbouring landscape, the site itself does not currently include any turbines. Galawhistle will introduce turbines, tracks, substations and other infrastructure elements into this upland site. The site will change from being relatively undisturbed and undeveloped open moorland of simple pattern, to one including turbines and tracks, and clearly perceptible as a wind farm. The turbines will form vertical manmade elements similar to those on Hagshaw Hill, Common Hill and Broomerside Hill. It is judged the magnitude of change to the landscape of the wind farm site as a result of operation of the wind farm will be **high**. The effect on the landscape of the site is judged to be **major**.

Potential Effects upon the Landscape Character Type covering the Site

5.160 The majority of the site is covered by Plateau Moorlands LCT of the Glasgow and Clyde Valley LCA. Three other LCTs cover the remaining parts of the site, Upland River Valleys (Glasgow and Clyde Valley LCA), Plateau Moorland (Ayrshire LCA) and Upland River Valleys (Ayrshire LCA). Upland River Valleys (Ayrshire LCA) covers the western end of the access track as shown on Figure 1.2 Chapter 1 Introduction. The assessment of effects arising from the wind farm on the landscape are set out below.

Glasgow and the Clyde Valley LCA

LCT	**Plateau Moorland**
Representative viewpoints	1, 2, 5, 18, 26
Extent within the study area: An area referred to in the LCA as 'The Western (Ayrshire) Plateau' area of this LCT covers the majority of the wind farm site including Meikle Auchinstilloch, Wedder Hill, Arrarat Hill and the east facing slopes of Hareshaw Hill. This area extends northwest beyond the site to the study area boundary north of Whitelees Forest. 'The Western (Ayrshire) Plateau' area also extends south from the wind farm site to include Middle Muir and the east slopes of Cairn Table. This LCT also occurs in the northeast of the wider study area, this area is referred to in the LCA as the 'Central Plateau' area which covers Hare Hill and land surrounding Auchter Water.	
Extent outside the study area: The Central Plateau area extends beyond the study area including land surrounding Hillend Reservoir and Fannyside Lochs, east of Glasgow.	
Sensitivity: Although the large scale, open and exposed character of this landscape indicates a tolerance to change, there is a relative sense of remoteness. Its upland and open nature enables extensive views of the surrounding area which are of some scenic quality. However the presence of several wind farms (Hagshaw Hill and extension, Black Law and Whitelees), masts and opencast mining within the LCT detract from its scenic qualities. There are limited distinctive landscape features within this LCT. This LCT is judged to be of **medium** sensitivity.	
Changes and effect on the landscape of the LCT within the wind farm site: The introduction of Galawhistle Wind Farm will have a direct effect on the extent of this LCT within the wind farm site. The development will reduce the characteristic relative sense of remoteness of this landscape. The introduction of additional large scale man made structures in the landscape will further detract from the scenic qualities of views. Galawhistle Wind Farm will be seen in context with the immediately adjacent Hagshaw Hill Wind Farm. Turbines will reduce the perceived scale of this upland landscape. The wind farm will result in a notable change in landscape character. It is judged the magnitude of change of this LCT covering the wind farm site will be **high**. The majority of the site itself is covered by this LCT and will therefore experience direct effects resulting from the wind farm. Therefore the effect on the landscape of this LCT within the wind farm site is judged to be locally **major**.	
Changes and effect on the landscape character area covering the wind farm site: Considering the 'The Western (Ayrshire) Plateau' area, from east of the Avon Water south-eastwards including the wind farm site, Middle Muir and the east slopes of Cairn Table, the landscape will experience a combination of direct and indirect effects from the wind farm. Commercial forestry will screen some views of turbines north and south of the wind farm site. However, when seen additional turbines will be introduced into the landscape which will be visible in near views. Galawhistle turbines will be visibly larger, of wider spacing and slower blade rotation speed than the existing turbines of Hagshaw Hill. Turbines will reduce the perceived scale of this upland landscape. The magnitude of change is judged to be **medium**. The effect on the landscape of the southern extent of 'The Western (Ayrshire) Plateau' area, from east of the Avon Water, is judged to be **moderate**.	

Changes and effect on the landscape of the LCT across the study area: The wind farm will result in indirect effects on surrounding areas of Plateau Moorland LCT. Turbines will be visible from slopes and summits of the LCT facing the site. Near views of these large scale structures will be possible from the southern extent of the Western (Ayrshire) Plateau area. Galawhistle Wind Farm will be seen as a distant feature in views from the Central Plateau area and the northern extent of the Western (Ayrshire) Plateau area. The presence of existing wind farms within views and in other parts of this LCT will temper the change caused by the introduction of Galawhistle. Galawhistle Wind Farm will be seen as an extension of Hagshaw Hill in distant views. It is judged the magnitude of change of this LCT across the wider study area will be **low**. Indirect effects on the wider parts of this LCT within the study area are limited due to the presence of existing man-made structures in the landscape and in views from it. The effect on the landscape of this LCT across the wider study area is judged to be **minor**.

LCT	**Upland River Valleys**
Representative viewpoints	13, 15
Extent within the study area: This 'Douglas Water' area of this LCT covers the south-east area of the wind farm site including the south slopes of Arrarat Hill. The Douglas Water and Duneaton Water areas of Upland River Valleys LCT are located in the east of the study area including the upland extents of the respective river valleys. The Avon Water is located in the northwest of the study area.	
Extent outside the study area: Beyond the study area Upland River Valleys LCT includes areas located west and southwest of Glasgow.	
Sensitivity: This medium scale landscape has a distinct settled and wooded character contrasting with neighbouring plateau and upland landscapes. The Douglas Valley AGLV covers part of the Douglas Water area within this LCT. The enclosed nature of this valley and the relative scenic qualities of views within and out from Upland River Valleys LCT indicates a sensitivity to change. However the presence of mineral workings, restored land and wind farms in neighbouring landscapes go some way to limit the quality of these views and also indicate a tolerance of the landscape to change. This LCT is judged to be of **medium** sensitivity.	
Changes and effect on the landscape of the LCT within the wind farm site: The introduction of Galawhistle Wind Farm will have a direct effect on the southerly extent of the wind farm site covered by this LCT. Two turbines will be located within the northwest extent of the 'Douglas Water area' of this LCT. The characteristic exposed nature of the upper reaches of this LCT will be reduced by the introduction of vertical manmade elements in the landscape. It is judged the magnitude of change of this corner of the LCT covering the wind farm site will be **medium**. Although the extent of direct effects on the site resulting from the wind farm is limited, the effect on the landscape of this LCT within the site is judged to be locally **moderate**.	
Changes and effect on the landscape character area covering the wind farm site: The 'Douglas Water' area of this LCT will experience a combination of direct and indirect effects from the wind farm. Two turbines will be located within this area and near views will be possible from west facing slopes and upper slopes north of the Douglas Water valley. However, Galawhistle will be seen behind the turbines of Hagshaw Hill in views. Some elevated locations within this area will enable views of the varying turbine sizes of Galawhistle and Hagshaw Hill. It is judged the magnitude of change on the landscape of the 'Douglas Water' area will be **low**. The existing presence of Hagshaw Hill Wind Farm in views from this area will temper the effect of introducing Galawhistle Wind Farm. Considering the limited extent of direct effects on this landscape and that Galawhistle will be seen in the context of Hagshaw Hill Wind Farm, the effect on the landscape of the 'Douglas Water' area of this LCT is judged to be **minor**.	
Changes and effect on the landscape of the LCT across the study area: The wider extents of this LCT beyond the site but within the study area, will experience indirect effects from the introduction of Galawhistle Wind Farm. Visibility of the wind farm will be limited due to screening by intervening upland landform and woodland. Turbines will be seen in close proximity from the Douglas Water area. Limited extents of south facing slopes of the Avon Water area and the valley floor, and north facing slopes of the Duneaton Water area will enable distant views of the wind farm. The increased presence of turbines in views of the surrounding uplands from this LCT will reduce the characteristic contrast between the settled nature of the valleys and exposed nature of the adjacent uplands. It is judged the magnitude of change of this LCT across the wider study area will be **low**. Indirect effects on the wider parts of this LCT within the study area are limited due to the presence of existing man-made structures in views and screening by intervening landform and woodland. The effect on the landscape of this LCT across the wider study area is judged to be **minor**.	

Ayrshire LCA

LCT	**Plateau Moorlands**
Representative viewpoints	5
Extent within the study area: The western extent of the wind farm site, including the west facing slope of Hareshaw Hill is located within Plateau Moorlands LCT of the Ayrshire LCA. This LCT extends beyond the site westwards within the study area to include Blackside and Sornhill, up to 25km from the wind farm site. South-west of the wind farm site, an area of Plateau Moorlands includes Wardlaw Hill and Airds Moss.	
Extent outside the study area: Beyond the study area, Plateau Moorlands LCT occurs in several locations within southwest Ayrshire.	
Sensitivity: The large scale open and exposed character of this landscape indicates a relative sense of remoteness in this LCT. This upland and open landscape enables extensive views of the surrounding area which are of some scenic quality. This landscape has inter-visibility with Southern Uplands LCT, judged to be of high sensitivity. However, the presence large scale manmade features in views of neighbouring areas of landscape, such as Hagshaw Hill and its extension, and the presence of opencast mining within the LCT detract from its scenic qualities. This LCT is judged to be of **medium** sensitivity.	
Changes and effect on the landscape of the LCT within the wind farm site: The introduction of Galawhistle Wind Farm will have a direct effect on the extent of this LCT covering the wind farm site. The development will reduce the characteristic relative sense of remoteness of this LCT. The introduction of large scale man made structures in the landscape will detract from the scenic qualities of views. Galawhistle Wind Farm will be seen in context with Hagshaw Hill Wind Farm. The turbines may reduce the perceived scale of this upland landscape. The wind farm will result in a notable change in landscape character. It is judged the magnitude of change of this LCT covering the wind farm site will be **high**.	

Considering the extent of direct effects on the site resulting from the wind farm, the effect on the landscape of this LCT covering the site is judged to be **major**.
Changes and effect on the landscape character area covering the wind farm site: The landscape character area which covers the west extent of the wind farm site extends westwards to include Blackside and Sornhill. This area will experience a combination of direct and indirect effects due to the introduction of the wind farm. Direct effects will be limited to the east extent of this LCT area. Across this area, slopes facing the wind farm will have views of Galawhistle turbines in front of existing Hagshaw Hill turbines. Near views of turbines will be possible from Middlefield Law. The varying turbine size of Galawhistle and Hagshaw Hill will be accentuated in views due to the closer proximity of Galawhistle wind farm to this landscape area. The turbines may reduce the perceived scale and relative sense of remoteness of this upland landscape. It is judged the magnitude of change on the landscape area of this LCT covering the wind farm site will be **medium**. Although direct effects on this landscape will be limited to the east extent, the visible difference of Galawhistle and Hagshaw Hill turbines is such that the perceived scale and relative sense of remoteness will be reduced. The effect on the landscape character area of this LCT which covers the wind farm site is judged to be **moderate**.
Changes and effect on the landscape of the LCT across the study area: The wind farm will result in indirect effects on surrounding areas of Plateau Moorlands LCT. Turbines will be visible from slopes and summits of the LCT facing the site. Close views of these large scale structures will be possible from the eastern extent of the LCT covering Middlefield Law and Wardlaw Hill. Galawhistle Wind Farm will be seen as a distant feature in views from further away areas of the LCT such as Airds Moss, approximately 15-22km away. The presence of existing wind farms within views from the LCT, such as Hagshaw Hill and its extension, will temper the change caused by the introduction of Galawhistle Wind Farm. It is judged the magnitude of change of this LCT covering the wider study area will be **low**. However, indirect effects on the wider parts of this LCT within the study area are limited due to the distance of areas of visibility from the wind farm and the presence of existing man-made structures in views. The effect on the landscape of this LCT within the wider study area is judged to be **minor**.

LCT	**Upper River Valleys**
Representative viewpoints	19, 21
Extent within the study area: This LCT covers a small part of the western part of the wind farm access track, west of Glenbuck.The landscape area covering the site extends beyond it to include the upper reaches of the River Ayr valley. This LCT is also found in the west of the study area covering the valleys of the River Nith, River Glenmuir and River Irvine.	
Extent outside the study area: Upper River Valleys LCT can also be found beyond the southwest boundary of the study area where it covers the River Doon valley.	
Sensitivity: The characteristics of this LCT and the extent of development within it varies slightly according to the valley. The presence of tree cover, including woodland pockets and tree lined hedgerows indicate a sensitivity to landscape change and provide semi-enclosed areas of landscape. The medium scale of the landscape and presence of opencast mining, mining remnants such as bings, and areas of restored land limit the sensitivity of this landscape. This LCT is judged to be of **medium** sensitivity.	
Changes and effect on the landscape of the LCT within the wind farm site:	

Although this LCT covers the western extent of the site, direct effects following upgrade construction of the access track will be limited to intermittent vehicle movement. It is judged the magnitude of change on the area of this LCT covering the wind farm site will be **low**. The limited extent of direct effects is such that the effect on the landscape of this LCT covering the site is judged to be **minor**.
Changes and effect on the landscape character area covering the wind farm site: The landscape character area which covers the west extent (access track) of the wind farm site extends westwards until North of Arids Moss including the River Ayr valley. This landscape area will experience direct effects, limited to intermittent vehicle movement on the site access track, and indirect effects, due to the introduction of the wind farm. Vegetation and built form will screen views from some parts of this landscape area. When seen Galawhistle turbines will introduce large man-made structures in views which will be visibly larger than the slightly further away Hagshaw Hill turbines existing in the view. It is judged the magnitude of change on the landscape of this LCT covering the wind farm site will be **medium**. Although direct effects will be limited, Galawhistle turbines will be seen as large man-made structures from this landscape area. The effect on the landscape area of this LCT covering the site is **moderate**.
Changes and effect on the landscape of the LCT across the study area: Close views of the turbines will be possible from the River Ayr valley. The wind farm will introduce additional large scale manmade structures into views. Turbines will be seen in front of the existing Hagshaw Hill and its extension. The northern extent of the Glenmuir area will have distant views of the wind farm. The Nith and Irvine areas will have no visibility of the wind. It is judged the magnitude of change on the landscape of this LCT across the study area will be **low**. The limited visibility of the wind farm from this LCT across the study area is such that the effect is judged to be **minor**.

Potential Effects on Landscape Character Types in the Wider Study Area

5.161 Beyond the wind farm site boundary, the ZTV extends to cover other LCTs. Effects on the landscape of LCTs in the wider study area covered by the ZTV are considered below:

Glasgow and the Clyde Valley LCA

LCT	**Rolling Farmlands**
Representative viewpoints	6, 11
Extent within the study area: Lanark and Blantyre areas are located in the northeast and north of the study area respectively. The Lanark area includes from Lanark west to Carnwath and north to the Mouse Water. The Blantyre area is a relatively small area including the neighbouring environs of Glasgow.	
Extent outside the study area: Beyond the study area Rolling Farmlands LCT occurs as Kirkintilloch and Gartocharn areas north of Glasgow.	
Sensitivity: Extensive agriculture within and expansion of neighbouring settlements into this landscape reduces the sensitivity of it to development. Mineral working within this LCT and limited inter-visibility with neighbouring landscapes also indicate its ability to tolerate a level of landscape	

change. However the small scale of landform and presence of historical landscape features including remnant policy woodlands within this landscape would be sensitive to change. This LCT is judged to be of **medium** sensitivity.
Changes: Visibility of the wind farm from this LCT will be limited by the built form of Lanark and presence of hedgerow trees within the landscape. The wind farm will be seen as a distant man-made feature within views from the LCT. Galawhistle Wind Farm will introduce turbines into the same part of the view as the existing Hagshaw Hill. Galawhistle will be seen as an extension of Hagshaw Hill Wind Farm. It is judged the magnitude of change will be **low**.
Effect on the landscape: The effect on the landscape of this LCT is judged to be **minor**.

LCT	**Plateau Farmlands**
Representative viewpoints	3, 10, 12, 20, 23, 24
Extent within the study area: A large extent of the study area is covered by Plateau Farmlands LCT. The Western Plateau and Central Plateau areas are located in the northeast and north of the study area. These two areas include areas either side of the Incised River Valley LCT surrounding the River Clyde. The Barrhead area is a comparatively smaller extent of Plateau Farmlands LCT in the northwest of the study area.	
Extent outside the study area: The Western Plateau area extends beyond the north of the study area to Cumbernauld and minimally west at Dunsyre and Tarbrax.	
Sensitivity: Plateau Farmlands LCT includes a number of man-made elements and activities, such as settlement, extensive pastoral farming and mineral working indicating a tolerance to change. Landform is large to medium scale indicating a tolerance to landscape change. The rural character of this landscape has declined due to the pressure of development. Scenic quality within this landscape is limited. This LCT is judged to be of **low** sensitivity.	
Changes: Indirect effects will occur to this LCT where the wind farm is present in views from this landscape. Large extents of this LCT will have views of Galawhistle Wind Farm, however the wind farm will be seen as a distant feature in views from the Central Plateau and Barrhead areas. The Western Plateau area will enable closer views of the wind farm. The wind farm will introduce additional manmade vertical elements in views and will be seen in the same part of the view as the existing Hagshaw Hill Wind Farm. Galawhistle will be seen as an extension of Hagshaw Hill in distant views. The varying turbine size, rotor diameter and spacing will be visible in close views. It is judged the magnitude of change will be **low**.	
Effect on the landscape: The effect on the landscape of this LCT is judged to be **minor**.	

LCT	**Fragmented Farmland**
Representative viewpoints	None
Extent within the study area: Fragmented Farmland LCT is located in the north of the study area and includes the South Calder, North Calder and the southern extent of the M73 areas.	
Extent outside the study area:	

The M73 area extends north beyond the study area including landscape east and west of the M73 until Mollinsburn.
Sensitivity: The scenic quality of views from and within this LCT are low due to visibility of urban edge industry, settlement and large scale transport infrastructure (M73). There are limited landscape features. Land cover and medium scale landform within this landscape provide a semi-enclosed landscape with opportunities for screening. The existing land use, visible manmade elements and low scenic quality of this landscape indicates it is tolerant of change. This LCT is judged to be of **low** sensitivity.
Changes: Galawhistle Wind Farm will be seen as a distant feature in views from this LCT. The wind farm will introduce an additional man-made feature into the same part of the view as Hagshaw Hill Wind Farm. Adjacent built form and vegetation will limit the extent of this LCT with views of the wind farm. Considering the distance of the wind farm from the LCT and the existing large scale man-made elements within and adjacent to this landscape, perceptibility of the wind farm in views will be minimal. It is judged the magnitude of change will be **negligible**.
Effect on the landscape: The effect on the landscape of this LCT is judged to be **negligible**.

LCT	**Incised River Valley**
Representative viewpoints	None
Extent within the study area: Incised River Valley LCT is located in the north of the study area and includes the following areas: Uddingston Clyde; Rotten Calder Water; Avon Water; Mid-Clyde Valley; River Nethan; North Calder Water; South Calder Water; and Mouse Water.	
Extent outside the study area: This LCT does not occur beyond the study area.	
Sensitivity: The distinct narrow steep valleys of this landscape and rich woodland cover provide views of scenic quality within this landscape. Incised River Valley LCT has a distinct landscape pattern which is self-contained and sheltered from the wider landscape. This small scale and enclosed landscape creates a LCT intimate in nature. There are limited opportunities for accommodating change within this landscape. This LCT is judged to be of **high** sensitivity.	
Changes: Visibility of the wind farm will be limited to the steep southwest facing slopes of the valley and the higher slopes south of the River Clyde. Vegetation and woodland within the landscape will considerably limit actual visibility of the wind farm by screening and filtering views. The wind farm will intermittently be seen as a distant man-made element in context with Hagshaw Hill Wind Farm from limited parts of this LCT. Galawhistle will not detract from the existing scenic qualities and focal elements of this LCT. It is judged the magnitude of change will be **low**.	
Effect on the landscape: The effect on the landscape of this LCT is judged to be **minor**.	

LCT	**Broad Urban Valley**
Representative viewpoints	14
Extent within the study area: Broad Urban Valley LCT is located in the north of the study area including Carmyle – Newton and Bothwell – Motherwell areas. These areas include the southern environs of Glasgow.	
Extent outside the study area: The area of Carmyle – Newton extends beyond the study area to include a small area of Rutherglen.	
Sensitivity: This landscape and neighbouring landscapes visible from it have been subject to considerable change and development. The transport infrastructure of M74 and a number of derelict, restored and active industrial sites characterise the landscape. Views of low scenic quality and infrastructure and industrial use indicate a tolerance to change. This landscape is medium to large in scale, relatively open with limited landscape features indicating a tolerance to change. This LCT is judged to be of **low** sensitivity.	
Changes: Galawhistle Wind Farm will be seen as a distant feature in views from this LCT. Where seen, the wind farm will introduce additional man-made feature into the same part of views as Hagshaw Hill Wind Farm. Bordering built form will considerably limit the extent of this LCT with views of the wind farm. The distance of the wind farm from the LCT and screening of views by bordering built form will result in minimal perceptibility of the wind farm. It is judged the magnitude of change will be **negligible**.	
Effect on the landscape: The effect on the landscape of this LCT is judged to be **negligible**.	

LCT	**Broad Valley Upland**
Representative viewpoints	None
Extent within the study area: Broad Valley Upland LCT is located in the west of the study area and is limited to one area, the Clyde Valley. This area covers upland valley landscape surrounding Douglas, Biggar and Abington.	
Extent outside the study area: This LCT does not occur beyond the study area within the Glasgow and Clyde Valley area. However, it can be found in the neighbouring Borders titled as Upland Valley LCT.	
Sensitivity: Although of large scale and rural character, surrounding enclosing hills and the distinct tree cover pattern of this LCT indicate the landscape has some sensitivity to change. The transport infrastructure of M74 and A70 are located along the valleys within this landscape indicating a tolerance to landscape change. Land use within this LCT indicates that there are some opportunities for accommodation of change. This LCT is judged to be of **medium** sensitivity.	
Changes: The extent of visibility of the wind farm is limited to the Clyde Valley south of Lanark. Views of Galawhistle will be screened and filtered by shelterbelts, tree lined field boundaries and scattered built form. Views of the wind farm will vary in proximity, ranging from near views from west of Rigside, and distant views east of Carstairs. Turbines will be seen as large scale man-made elements. The wind farm will be seen in context with Hagshaw Hill and will be visible within the same direction of view. It is judged the magnitude of change will be **low**.	
Effect on the landscape: The effect on the landscape of this LCT is judged to be **minor**.	

LCT	**Foothills**
Representative viewpoints	4
Extent within the study area: Foothills LCT is located in the east of the study area as the Tinto Hills and Biggar Hills areas.	
Extent outside the study area: The Biggar Hills area extends beyond the study area to include the landscape surrounding Dolphinton.	
Sensitivity: The limited and sparse development within this LCT and landmark summits such as Tinto Hill indicate there is limited potential for accommodation of change within this landscape. Summits provide extensive and elevated views of some scenic quality and allow inter-visibility with neighbouring landscapes. However, there are some large scale areas of commercial forestry within this landscape and several major and minor communication routes passing through it suggesting there are opportunities for change of successful mitigation. This LCT is judged to be of **medium** sensitivity.	
Changes: Parts of this landscape, including slopes and summits facing the site, will allow views of the wind farm. Shelter belts, field boundaries and forestry will screen and filter views of the wind farm from lower elevations of this landscape. The western extent of the Tinto Hills area will enable closer views of turbines in comparison to the Biggar Hills area, which will enable distant views. Where seen Galawhistle Wind Farm will be seen in the same part of the view as Hagshaw Hill Wind Farm. It is judged the magnitude of change will be **low**.	
Effect on the landscape: The effect on the landscape of this LCT is judged to be **minor**.	

LCT	**Old Red Sandstone Hills**
Representative viewpoints	25
Extent within the study area: Old Red Sandstone Hills LCT is located in the northeast of the study area as the Western Pentland Hills area. This area covers a small part of the study area including the west slopes of Bleak Law.	
Extent outside the study area: The Western Pentland Hills area extends beyond the northwest extent of the study area to include the summit of Bleak Law and White Craig.	
Sensitivity: This unsettled medium-large scale upland landscape includes a number of historical features indicating that this landscape has some sensitivity to the introduction of new development. The landscapes distinct character provides views of scenic quality. This LCT is judged to be of **high** sensitivity.	
Changes: Southwest facing slopes and summits will have distant views of Galawhistle Wind Farm, approximately 30-35km away. Galawhistle will introduce additional vertical man-made	

structures into the same direction of view as the existing Hagshaw Hill Wind Farm. Perception of the introduction of Galawhistle Wind Farm in views from this landscape will be minimal. It is judged the magnitude of change will be **negligible**.
Effect on the landscape: The effect on the landscape of this LCT is judged to be **negligible**.

LCT	**Southern Uplands**
Representative viewpoints	None
Extent within the study area: Southern Uplands LCT occurs once within the southeast of the study area as the Lowther Hills and Southern Uplands area. This area covers Gana Hill north to Drake Law and Snalp Hill including Dun Law, Clyde Law and Duncangill Head.	
Extent outside the study area: This LCT does not occur beyond the study area within the Glasgow and Clyde Valley area. However, it can be found in the neighbouring areas of Ayrshire and Dumfries and Galloway.	
Sensitivity: Although of large scale, the unsettled nature of this landscape and distinct glacial features indicate that this landscape has limited opportunities to accommodate change. The upland nature of this landscape provides extensive views within and out with the LCT of high scenic quality. This LCT is judged to be of **high** sensitivity.	
Changes: Visibility of the wind farm is limited to slopes facing the site and summits in the northern part of this landscape. Galawhistle Wind Farm will be seen in context with the existing Hagshaw Hill wind farm adjacent. Where seen in views, the wind farm may reduce the general undeveloped character of this LCT. However, Galawhistle Wind Farm will not introduce new man-made features within views from this landscape. It is judged the magnitude of change will be **low**.	
Effect on the landscape: The effect on the landscape of this LCT is judged to be **minor**.	

Ayrshire LCA

LCT	**Ayrshire Lowlands**
Representative viewpoints	22
Extent within the study area: Ayrshire Lowlands LCT covers relatively large extents of the west of the study area. The LCT extends north from Cumnock to Kilmarnock and is incised by Upper River Valleys LCT.	
Extent outside the study area: Ayrshire Lowlands LCT extends beyond the west study area boundary towards the coastal landscapes surrounding Ayr and Irvine Bay.	
Sensitivity: The undulating predominantly agricultural landscape provides some scenic qualities. Landform and cover create a semi-enclosed landscape with limited inter-visibility with neighbouring areas. However the presence of settlement and mineral workings temper the quality of these views. The medium scale and nature of the landscape offer some opportunities for the accommodation of change. This LCT is judged to be of **medium** sensitivity.	
Changes: Visibility of Galawhistle Wind Farm will be limited to intermittent areas north of Kilmarnock and south of Mauchline. Undulating landform, field boundaries and shelter belts will screen and filter views of the wind farm. The wind farm will introduce additional man-made elements in views from this landscape. Galawhistle Wind Farm will be seen as a distant feature in views and will be seen in the context of Hagshaw Hill Wind Farm. It is judged the magnitude of change will be **low**.	
Effect on the landscape: The effect on the landscape of this LCT is judged to be **minor**.	

LCT	**Lowland River Valleys**
Representative viewpoints	17
Extent within the study area: Lowland River Valleys LCT can be found in the west of the study area and includes landscape surrounding the River Irvine and River Ayr.	
Extent outside the study area: This LCT can also be found out with the study area including landscape surrounding the River Garnock, the River Annick and the River Doon.	
Sensitivity: Lowland River Valleys LCT is a relatively small scale landscape with a number of landscape features including field boundaries, semi-natural woodland and river. Views within this LCT are of some scenic quality and include limited manmade development. The distinctive character, pattern and scale of this landscape offer limited opportunities for change. This LCT is judged to be of **high** sensitivity.	
Changes: Views will be limited to intermittent areas of landscape surrounding the River Ayr in excess of 15km from the site. Turbines will be visible as distant vertical man-made elements in the context of Hagshaw Hill Wind Farm. Visibility will be limited by field boundaries and woodland screening views of the wind farm. It is judged the magnitude of change will be **low**.	
Effect on the landscape: The effect on the landscape of this LCT is judged to be **minor**.	

LCT	**Lowland Hills**
Representative viewpoints	None
Extent within the study area: Lowland Hills LCT covers the low hills west of Tarbolton in the west of the study area.	
Extent outside the study area: This landscape area extends beyond the west boundary of the study area, north-westwards to Dundonald.	
Sensitivity: Although semi-rural in nature, this predominantly agricultural landscape contains some vertical man-made structures. The medium scale and masts within this LCT indicates there are some opportunities for change in this landscape. This LCT is judged to be of **medium** sensitivity.	
Changes: Views of the wind farm from this landscape will be in excess of 30km from the site and limited to slopes facing the site. Turbines will be seen as distant man-made structures in views and in context with Hagshaw Hill Wind Farm. The introduction of Galawhistle will not be	

noticeable from this landscape. It is judged the magnitude of change will be **negligible**.
Effect on the landscape: The effect on the landscape of this CLT is judged to be **negligible**.

LCT	**Foothills with Forestry**
Representative viewpoints	None
Extent within the study area: Foothills with Forestry LCT covers Carsgailoch Hill, Stannery Knowe, Benbeoch and Kilmein Hill in the southwest of the study area.	
Extent outside the study area: Areas of landscape covered by Foothills with Forestry LCT can be found in south Ayrshire beyond the study area boundary.	
Sensitivity: This medium-large scale landscape has been subject to considerable change including large scale commercial forestry and mineral workings. Forestry within this landscape creates areas of enclosed landscape and limits inter-visibility. The land use and low scenic quality of this landscape indicates some tolerance to change. This LCT is judged to be of **low** sensitivity.	
Changes: The extent of commercial forestry within this LCT will considerably limit perceptibility of the wind farm. Views of Galawhistle will be limited to the unforested slope and summit of Benbeoch. The wind farm will be seen as a distant element in context with the existing Hagshaw Hill Wind Farm. Locations with views of Galawhistle Wind Farm will be minimal, and when seen will not be noticeable in the view. It is judged the magnitude of change will be **negligible**.	
Effect on the landscape: The effect on the landscape of this LCT is judged to be **negligible**.	

LCT	**Plateau Moorlands with Forest**
Representative viewpoints	None
Extent within the study area: Plateau Moorlands with Forest LCT can be found in the southwest of the study area covering Auchtitench Hill. In the northwest of the study area this LCT covers an area from Loudon Hill northwest to the boundary of the study area, including Whitelee Forest.	
Extent outside the study area: Plateau Moorlands with Forest LCT extends beyond the study boundary to include Gabroc Hill. This LCT can also be found outside the study area boundary in south Ayrshire covering Greensides, Sheil Hill and the north slopes of Mid Moile.	
Sensitivity: The presence of extensive commercial forestry, existing communication masts and mineral workings indicate that there is some tolerance to landscape change within this LCT. Although of large scale, forestry provides opportunities to screen development in the landscape. The land use and low scenic quality of this LCT indicates a degree of tolerance to landscape change. This LCT is judged to be of **low** sensitivity.	
Changes: The extent of commercial forestry within this LCT will screen views of Galawhistle Wind Farm. Minimal areas of this LCT around Whitelees Forest will enable views of the wind farm. Where perceptible the turbines of Galawhistle Wind Farm will be seen as distant features and in context with Hagshaw Hill, as well as Whitelees Wind Farm located within this LCT. It is judged the magnitude of change will be **negligible**.	
Effect on the landscape: The effect on the landscape of this LCT is judged to be **negligible**.	

LCT	**Southern Uplands**
Representative viewpoints	None
Extent within the study area: Southern Uplands LCT covers two locations in the southwest of the study area. One area includes Benty Cowan Hill, the other area includes Hare Hill, Blackcraig Hill, Blacklorg Hill and Whiteknowes which surround Glen Afton.	
Extent outside the study area: Beyond the study area this LCT can also be found in south and southwest Ayrshire covering Polmaddie Hill and Eldrick Hill, and Milljoan Hill and Beneraird. It can also be found in the neighbouring areas of Dumfries and Galloway and the Glasgow and Clyde Valley.	
Sensitivity: Although of large scale, the unsettled nature of this landscape and distinct glacial features indicate that this landscape has limited opportunities to accommodate change. The upland nature of this landscape provides extensive views within and out with the LCT of high scenic quality. This LCT is judged to be of **high** sensitivity.	
Changes: Visibility of the wind farm will be limited to the slopes and summits within this LCT facing the site. Galawhistle Wind Farm will be seen as a distant feature in context with Hagshaw Hill Wind Farm. Galawhistle Wind Farm will not be seen in contrast to Hare Hill Wind Farm located within this LCT. The distance of the wind farm from this LCT is such that views will not reduce the scenic quality of views from this landscape. It is judged the magnitude of change will be **negligible**.	
Effect on the landscape: The effect on the landscape of this LCT is judged to be **negligible**.	

LCT	**Southern Uplands with Forest**
Representative viewpoints	None
Extent within the study area: Southern Uplands with Forest LCT is located in the southwest of the study area covering Prickney Hill, Enoch Hill and Milray Hill.	
Extent outside the study area: Beyond the study area boundary Southern Uplands with Forest LCT extends to cover Windy Standard. This LCT can also be found in south Ayrshire and in the neighbouring areas of Dumfries and Galloway and Glasgow and Clyde Valley as Southern Uplands with Forest LCT and in the Borders as Southern Uplands Forest Covered LCT.	
Sensitivity: The large scale unsettled nature of this landscape and distinct glacial features indicate that this landscape has limited opportunities to accommodate change. Although of upland nature, extensive commercial forestry creates an enclosed landscape limiting inter-visibility and the scenic quality of views. Windy Standard Wind Farm is a near man-made element in close views from this landscape. This LCT is judged to be of **medium** sensitivity.	

Changes: The extent of commercial forestry within this LCT will considerably limit views of the wind farm. Minimal parts of this LCT, including isolated open summits will allow distant views of the wind farm. Where perceptible the wind farm will be seen in the context with Hagshaw Hill Wind Farm. Turbines will not be in contrast to the turbines of Wind Standard Wind Farm visible in close proximity from this landscape. It is judged the magnitude of change will be **negligible**.
Effect on the landscape: The effect on the landscape of this LCT is judged to be **negligible**.

Dumfries and Galloway LCA

LCT	**Southern Uplands**
Representative viewpoints	9, 16
Extent within the study area: Southern Uplands LCT is located in the south of the study area including the areas of Lowther and Nithsdale. Small extents of the areas of Carsphairy and North Moffat are also located in the study area.	
Extent outside the study area: Beyond the study area boundary the areas of Carsphairy and Nithsdale extend south. The North Moffat area extends east. Southern Uplands LCT is also located in north and east areas of Dumfries and Galloway and neighbouring areas of Ayrshire and the Glasgow and Clyde Valley.	
Sensitivity: Although of large scale, the unsettled nature of this landscape and distinct glacial features indicate that this landscape has limited opportunities to accommodate change. The upland nature of this landscape provides extensive views within and out with the LCT of high scenic quality. This LCT is judged to be of **high** sensitivity.	
Changes: Views of the wind farm will be distant and range from 10-35km from the wind farm. Perceptibility of the wind farm from this LCT will be limited to summits within this landscape including Cairnsmore of Carsphairn at 35km distance. When seen, the wind farm may reduce the perceived scale of the hills within the Southern Uplands LCT and limit the characteristic relative sense of remoteness experienced within this relatively undeveloped landscape. However the presence of Hagshaw Hill in the same direction and distance of views from this LCT will limit the perceptible change experienced by this landscape. It is judged the magnitude of change will be **low**.	
Effect on the landscape: The effect on the landscape of this LCT is judged to be **minor**.	

LCT	**Southern Uplands with Forest**
Representative viewpoints	None
Extent within the study area: Southern Uplands with Forest LCT is located in the south of the study area as the Ken and Carsphairn areas.	
Extent outside the study area: Beyond the study area the areas of Ken and Carsphairn extend southwards. This LCT can also be found in the neighbouring areas of Ayrshire and Glasgow and Clyde Valley as Southern Uplands with Forest LCT and in the Borders as Southern Uplands Forest Covered LCT.	
Sensitivity: The large scale unsettled nature of this landscape and distinct glacial features indicate that this landscape has limited opportunities to accommodate change. Although of upland nature, extensive commercial forestry creates an enclosed landscape limiting inter-visibility and the scenic quality of views. Manmade elements within this landscape include Windy Standard and Hare Hill Wind Farms. This LCT is judged to be of **medium** sensitivity.	
Changes: The extent of commercial forestry within this LCT will considerably limit views of the wind farm. Minimal parts of this LCT will allow distant views of the wind farm. Where perceptible the wind farm will be seen in context with Hagshaw Hill Wind Farm and will not be in contrast to the existing Windy Standard and Hare Hill Wind Farms located within this LCT. It is judged the magnitude of change will be **negligible**.	
Effect on the landscape: The effect on the landscape of this LCT is judged to be **negligible**.	

The Borders LCA

LCT	**Southern Uplands with Scattered Forest**
Representative viewpoints	None
Extent within the study area: Southern Uplands with Scattered Forest LCT is located in the east of the study area as the Broadlaw Group area including Common Law, Glenwhappen Rig and Craigmaid up to the study area boundary.	
Extent outside the study area: Beyond the study area the Broadlaw Group area extends westwards to Fastheugh Hill and Lingie Hill including a large area of the Scottish Borders. Southern Uplands with Scattered Forest LCT also covers large areas of the south Scottish Borders.	
Sensitivity: The large scale unsettled nature of this landscape and distinct glacial features indicate that this landscape has limited opportunities to accommodate change. Although of upland nature, areas of commercial forestry scattered throughout the landscape create semi-enclosed areas and intermittently limit the extent of views and their scenic quality. A small part of this LCT is covered by Upper Tweeddale NSA. This LCT is judged to be of **high** sensitivity.	
Changes: Minimal areas of this LCT will have distant views of the wind farm in excess of 25km from the site. Galawhistle Wind Farm will be seen in the same direction and at a similar distance in views as Hagshaw Hill. Scattered forest within this LCT will provide some screening of views. Considering the distance of Galawhistle from this landscape and the proximity of Hagshaw Hill Wind Farm to the development, perception of Galawhistle will be minimal. It is judged the magnitude of change will be **negligible**.	
Effect on the landscape: The effect on the landscape of this LCT is judged to be **negligible**.	

Potential Effects on Designated Landscapes

5.162 The assessment of effects on designated landscapes arising from the wind farm is set out in Table 5.8 below. Table 5.5 describes the physical extent of these designated landscapes and their reason for designation.

Table 5.8: Effects on Designated Landscapes

Landscape Designation	Distance to the nearest turbine	Sensitivity	ZTV Coverage	Discussion of Effects	Effect
NSA					
Upper Tweeddale	30.9	High	Limited to summits and upper slopes of Trahenna Hill and Whitslade Hill.	Views of the wind farm will be limited to distant views from isolated hill summits within the NSA. Galawhistle will be seen in excess of 30km from this NSA. When seen, Galawhistle Wind Farm will be seen in context with Hagshaw Hill Wind Farm and will be seen as an extension. Perceptibility of the introduction of Galawhistle will be minimal. The magnitude of change is judged to be **negligible**.	**Negligible**
AGLV					
Douglas Valley	1.1	Medium	The ZTV covers the west facing slopes of the Douglas Water valley including Pagie Hill. The north and southern extent of this landscape, including Common Law and Curly Brae, is also covered by the ZTV.	This landscape will allow near views of the wind farm, from 1.1km from the site up to 11km from the site. The turbines of Hagshaw Hill Wind Farm and extenstion are located within this AGLV. Galawhistle turbines will introduce additional man-made structures in views from the Douglas Water. Galawhistle will be seen behind existing turbines in views. Vegetation, including commercial forestry will screen some views of the wind farm. Variations in turbine size and blade rotor speed between Galawhistle and Hagshaw Hill Wind Farms are likely to be perceptible from elevated parts of this AGLV. Views from lower parts of this AGLV within the Douglas Water valley will be limited to turbine blade tips, and therefore varying turbine sizes will not be perceptible. The magnitude of change is judged to be **low**.	**Minor**
Clydesdale	11.4	Medium	Limited to upper south facing river valley slopes north of the River Clyde and upper slopes south of the River Clyde.	Views of the wind farm will be in excess of 10km from the site and will be limited to upper river valley slopes. Galawhistle Wind Farm will be seen in the same direction of views as the existing Hagshaw Hill Wind Farm. Perceptibility of the introduction of Galawhistle turbines will be as additional manmade elements. Built form and vegetation within this landscape will limit visibility of the wind farm. The magnitude of change is judged to be **low**.	**Minor**
Tweedsmuir Hills/Upper Tweeddale	26.1	Medium	Limited to isolated summits including Goseland Hill and Glenwhappen Rig.	Visibility of the wind farm is limited to isolated elevated locations scattered throughout this landscape. The wind farm will be seen as a distant man-made element, beyond 25km in views. Galawhistle turbines will be seen in context with Hagshaw Hill turbines in views. Perceptibility of the wind farm from this AGLV will be minimal and distant, and will not alter the experience of this landscape. The magnitude of change is judged to be **negligible**.	**Negligible**
RSA					
South Clydesdale	8.5	Medium	Limited to upper summits and west facing slopes towards the site including Tinto Hills, Dun Law, Black Mount and Bleak Law.	The introduction of Galawhistle Wind Farm will be as an additional man-made element in views of the surrounding landscape. The turbines of Galawhistle will be seen immediately behind the turbines of the existing Hagshaw Hill Wind Farm. Views of the wind farm will range from medium to distant. The presence and proximity of Hagshaw Hill turbines to Galawhistle is such, that Galawhistle turbines will be visible but not noticeable in views. The limited perception of Galawhistle will not alter the experience of the landscape within this RSA. The magnitude of change is judged to be **negligible**.	**Negligible**

Table 5.8: Effects on Designated Landscapes

Landscape Designation	Distance to the nearest turbine	Sensitivity	ZTV Coverage	Discussion of Effects	Effect
Thornhill Uplands	13.5	Medium	Limited to isolated summits and upper slopes facing the wind farm site including Lowther Hill and Cairnkinna Hill.	Visibility of the wind farm is limited to small areas of this landscape. The wind farm will be seen as a distant man-made element in views. Galawhistle Wind Farm will be seen adjacent to the existing Hagshaw Hill Wind Farm. Perceptibility of the introduction of Galawhistle Wind Farm will be minimal and will not alter the experience of this landscape. The magnitude of change is judged to be **negligible**.	**Negligible**
SLA					
Unnamed SLA (Afton)	1.4	Medium	Limited to the north facing slope of Wardlaw Hill and Cairn Table in the north of this landscape. Elevated summits and upper slopes in the south of this landscape also have ZTV coverage including Hare Hill, Blackcraig Hill and Enoch Hill.	Views of the wind farm will range from close (1.4km) to distant (up to 31km). Galawhistle will introduce additional vertical man-made elements in views from this landscape. The turbines of Galawhistle will be seen adjacent to Hagshaw Hill turbines. Differences in turbine size and blade rotor speed between these wind farms will be perceptible in near views from this SLA. Galawhistle Wind Farm will be seen as an extension to the existing Hagshaw Hill Wind Farm in distant views from this landscape. The magnitude of change is judged to be **low**.	**Minor**
Unnamed SLA (River Ayr-Lugar Water)	3.1	Medium	The ZTV covers the east facing slopes and hill summits including Middlefield Law, Little Hartmidden and Airds Moss.	Views of the wind farm will range from near (3.1km) to distant (up to 35km). The turbines of Galawhistle will be seen in front of the existing turbines of Hagshaw Hill. Close views will allow perceptibility of the different turbine sizes and blade rotor speeds of Galawhistle and Hagshaw Hill. Galawhistle Wind Farm will be seen as an extension to the existing Hagshaw Hill in medium and distant views. Galawhistle will introduce additional manmade elements into views from this designated landscape. The magnitude of change is judged to be **low**.	**Minor**
SA					
Unnamed SA (Lower River Ayr)	28.8	Medium	Limited to upper river valley slopes facing toward the wind farm site.	Views of the wind farm will be limited to distant views beyond 25km from the site. Vegetation within this landscape will screen some views of Galawhistle Wind Farm. When seen, Galawhistle turbines will be distant man-made vertical elements in views seen in context with Hagshaw Hill Wind Farm. Perceptibility of the wind farm will be minimal. The magnitude of change is judged to be **negligible**.	**Negligible**
GDL					
The Falls of Clyde	13.6	Medium	Limited to the upper valley slopes of this landscape.	Visibility of the wind farm from this landscape will be considerably limited by woodland and vegetation screening it from view. The enclosed nature of this valley landscape and internally focussed views is such that the wind farm will not be perceptible in views from this GDL. The magnitude of change is judged to be **negligible**.	**Negligible**
Lee Castle	15.4	Medium	Limited to elevated western extent of this landscape.	Visibility of the wind farm will be limited, the majority of the landscape will have no views of the wind farm. When seen Galawhistle will be seen at a distance in views in the context of Hagshaw Hill Wind Farm and its extension. Galawhistle Wind Farm will not be perceptible as a new development. The magnitude of change is judged to be **negligible**.	**Negligible**
Chatelherault (Wham)	19.8	Medium	Limited to the elevated southern extent of this landscape.	Actual visibility of Galawhistle Wind Farm will be limited by vegetation within the GDL screening views. When seen Galawhistle Wind Farm will be in the same part of the view and at a similar distance as the existing Hagshaw Hill Wind Farm. Perceptibility of Galawhistle Wind Farm will be minimal. The magnitude of change is judged to be **negligible**.	**Negligible**
Dumfries House	22.2	Medium	Limited to the south and west extent of this landscape.	Galawhistle Wind Farm will be north-east of this landscape. Woodland vegetation within this landscape will therefore screen any views of the wind farm. The magnitude of change is judged to be **negligible**.	**Negligible**

Table 5.8: Effects on Designated Landscapes

Landscape Designation	Distance to the nearest turbine	Sensitivity	ZTV Coverage	Discussion of Effects	Effect
Dalzell House	22.6	Medium	Limited to the northern extent of this landscape.	Vegetation within the GDL will screen views of Galawhistle Wind Farm. Locations where Galawhistle will be seen will be minimal. Where seen, Galawhistle will seen in context with Hagshaw Hill Wind Farm and will not be perceptible as new development. The magnitude of change is judged to be **negligible**.	**Negligible**
Allanton	25.4	Medium	Limited to the south, east and north-east extent of this landscape.	The wooded nature of this landscape and immediate areas to its south-west is such that views of the wind farm will be considerably screened. Where seen, the wind farm will be seen in distant views and in the context of the existing Hagshaw Hill Wind Farm and its extension. The magnitude of change is judged to be **negligible**.	**Negligible**
Little Sparta (Stonypath)	32.4	Medium	Limited to western extent of this landscape.	Visibility of the wind farm is limited and will be partly screened and filtered by vegetation. The distance of the wind farm from this landscape is such that it will not perceptible in views from this landscape. The magnitude of change is judged to be **negligible**.	**Negligible**
Rowallan	34.2	Medium	Limited to intermittent north and east areas of this landscape.	The screening of views by vegetation within this landscape and the far distance of the wind farm is such that Galawhistle Wind Farm will not be seen in views. The magnitude of change is judged to be **negligible**.	**Negligible**

Other Designations

Recreational Designations

5.163 Calderglen, Strathclyde and Drumpellier Country Parks are all located in excess of 29km north from Galawhistle Wind Farm. The wooded nature of these parks and the surrounding built form will considerably screen views of the wind farm. As described in Viewpoint 8, Motherwell located within Strathclyde Country Park (Figure 5.15), the wind farm will be seen as a distant element in views in the context of Hagshaw Hill Wind Farm and its extension. The limited area of these landscapes which will have visibility of Galawhistle and the distance of the wind farm in views is such that there will be no perceptible change. The magnitude of change will be **negligible**. Overall, the visual effect on these recreational designations resulting from the introduction of Galawhistle Wind Farm will be **negligible**.

Conservation Areas

5.164 Potential effects on CAs are limited to indirect effects resulting from visibility of the proposal. As all CAs within the study area are located within settlements assessed within the visual amenity section of this chapter, the effect on CAs are not discussed further here.

Summary of Landscape Effects

5.165 Significant direct effects are predicted on the landscape of the Wind Farm site (**major**) resulting from the introduction of the wind farm. Locally significant direct effects were predicted on Plateau Moorland (locally **major**), Plateau Moorlands (locally **major**) and Upper River Valleys (locally **moderate**) LCTs within the wind farm site.

5.166 When considering effects on the landscape character areas of LCTs covering the wind farm site, significant effects were identified on 'The Western (Ayrshire) Plateau' area of Plateau Moorland LCT (**moderate**), unnamed area (east Ayrshire) of Plateau Moorlands (**moderate**) and unnamed area (River Ayr valley) of Upper River Valleys (**moderate**) LCTs resulting from the direct and indirect effects of the wind farm.

5.167 Measures to reduce effects upon the landscape are predominantly addressed through the design of the wind farm. This was a consideration in the development of the design strategy and the wind farm layout. No screening planting is proposed or considered appropriate in this upland landscape.

5.168 The effects on LCTs as a whole across the study area, and designated landscapes were not found to be significant.

Visual Effects during Operation

Visual Amenity

5.169 The assessment of visual effects considers the appearance of Galawhistle Wind Farm from particular locations, and how it will change existing views. Visual effects are assessed using views from static locations (viewpoints) and also considering the visual experience from settlements, or when travelling through the area along routes (sequential views). It is important to note that visibility is considerably reduced by screening afforded by buildings and woodland, particularly from built up and lowland areas. Views from along roads and in rural areas are often limited by woodland and hedgerows. This filtering affect can be seasonal when trees are deciduous.

Analysis of the ZTV and Overall Visibility of the Wind Farm

5.170 The ZTV in Figure 5.1 shows the theoretical visibility of the wind farm to tip height across the study area. Field surveys were undertaken to verify potential views and visibility on the ground. This assessment considers close, mid-range and distant views of the wind farm from the surrounding area.

5.171 The splay of the ZTV across the study area is focused on the north-east and west-southwest parts of the surrounding landscape. This pattern of overall visibility results from surrounding landform screening views. Meikle Auchinstilloch in the north of the site, limits visibility of the wind farm from the north-west of the study area. The elevated nature of the landform in the south and south-east of the study area limits views of the wind farm to upper slopes and summits. The channelled nature and elevated valley slopes of the River Ayr valley, meandering east to west in the west of the study area, and surrounding summits, contain the wider visibility of the Galawhistle Wind Farm.

Comparison of ZTV to tip height and ZTV to hub height of the Wind Farm

5.172 Figure 5.1 shows parts of the study area which have ZTV coverage and therefore theoretical visibility of Galawhistle turbines to tip height (18 turbines at 110m and 4 turbines at 121m tip height). Figure 5.2 shows parts of the study area which has ZTV coverage and therefore theoretical visibility of Galawhistle turbines to hub height (18 turbines of 69m and 4 turbines of 80m hub height). Differences in ZTV coverage illustrate which parts of the study area which have theoretical visibility of turbine tips but not turbine hubs.

5.173 Overall the patterns of ZTV coverage to turbine tip height and to turbine hub height are similar. Areas which will have theoretical visibility of turbine tips but not turbine hubs are limited, and include lower slopes of the Southern Uplands and Lowther Hills across the south of the study area. The moorland plateau west of Strathaven has a larger area of ZTV coverage of turbines to tip height, although commercial forestry will screen actual views from this area. Other parts of the study area illustrating differences in extent of ZTV coverage between turbine tips and hubs are limited, and generally include lower valley bottoms and lower slopes.

5.174 Comparison of Figures 5.1 and 5.2 also illustrates that the extent of the wind farm theoretically visible will be greater for turbines to tip height than for turbines to hub height. These differences result from the difference in height of Galawhistle turbine tips and turbine hubs. The lower height of turbine hubs means there is greater opportunities for landform to screen views of turbines in comparison to the taller turbine tips. Overall the differences between visibility of Galawhistle turbine hubs and turbine tips across the study area will be limited.

5.175 The following section describes views at a range of distances, from within the site to distant views.

Views from within the Site (internal views)

- Turbines will be seen in close proximity on the upper slopes and summits of Hareshaw Hill, Wedder Hill and Arrarat Hill.
- Turbines will be seen at lower elevations on the lower valley slopes north and south of Galawhistle Burn on Meikle Auchinstilloch, Wedder Hill and Hareshaw Hill.
- The steep valley slopes east and west of Monks Water will limit the extent of the wind farm visible from the valley bottom in the south of the site.

- The elevated hills of Arrarat Hill and Hagshaw Hill will limit the extent of the wind farm seen in views from the southern part of the site.

Close Views (0-5km)

- Turbines will be seen in close proximity from the north-east and from the south.
- Elevated open slopes and summits to the south of the wind farm such as Little Cairn Table, Urit Hill, Earl Hill and Kennox Hill, will have views of a large extent of the wind farm.
- Existing commercial forestry across Law and Hagshaw Hill in the northeast and Parishholm Hill and Lees Hill in the south will screen and filter views of turbines.
- Views of the wind farm from the north will be limited by the landform of Nutberry Hill, Meikle Auchenstilloch and Preisthill Height.
- Lower valley slopes and the valley bottom of the Douglas Water valley will have views of a limited number of turbines.
- Galawhistle Wind Farm will be seen in the context of Hagshaw Hill Wind Farm and its extension from the north, east and south.

Middle-Range Views (5-15km)

- Views of turbines will mostly be from the west of the study area, along the River Ayr valley, and from northeast of the wind farm, from the lower undulating landscape.
- Views from the south and southeast will be limited to elevated open hill summits which will have clear views of a large extent of the wind farm such as Windy Dod, Hunt Law, Spango Hill and Polholm Rig.
- Commercial forestry will screen and filter views from some north and south areas.
- Landform will screen views from much of the northwest and southwest areas.
- Galawhistle Wind Farm will be seen in the context of the existing Hagshaw Hill Wind Farm and its extension.

Distant Views (15-35km)

- Views of the wind farm will mostly be from the River Clyde valley to the northeast and lower River Ayr valley to the west.
- Views of turbines from the south, east, southeast and northwest will be limited to isolated hill summits and upper slopes facing the proposed development.
- Forestry across distant slopes, vegetation and built form of settlement will considerably limit views of the wind farm.
- Galawhistle Wind Farm will be seen in the context of the immediately adjacent Hagshaw Hill Wind Farm and its extension in distant views, as well as other operational wind farms across the study area.

Discussion of CZTV of Galawhislte Wind Farm ZTV and Operational Wind Farms ZTVs within the study area

5.176 Figure 5.7 compares the ZTVs of Galawhistle against the ZTVs of existing operational wind farms within the study area. This CZTV therefore illustrates which parts of the study area will theoretically have views of Galawhistle in isolation, areas from which Galawhistle will theoretically be seen in conjunction with existing operational wind farms and areas from which existing operational wind farms are visible but Galawhistle will not be.

5.177 Analysis of Figure 5.7 illustrates that parts of the study area which will have theoretical views of Galawhistle which currently have no visibility of operational wind farms in the study area are limited. These green shaded areas on Figure 5.7 include the section of the River Ayr valley from the wind farm site to 5km westwards, isolated north facing upper slopes in the south-east of the study area and intermittent areas of the south facing slopes of the River Irvine valley between 15-35km away.

5.178 Galawhistle Wind Farm will theoretically be seen in conjunction with other operational wind farms from the north, east, west and central parts of the study area. The number of wind farms which will theoretically be visible from these areas in addition to Galawhistle varies. The north of the study area including Glasgow and its environs will theoretically have views of Galawhistle and up to five other wind farms. Upper slopes extending from Douglas to Rigside, between 5-13km from the wind farm site will also have theoretical views of Galawhistle and up to five other wind farms. From isolated parts of the west of the study area, Galawhistle will theoretically be seen in conjunction with up to five other wind farms.

5.179 The blue areas of the CZTV shown in Figure 5.7 illustrate that there are extensive parts of the study area which have theoretical visibility of existing operational wind farms but which Galawhistle will not be seen from. These areas include, large extents of the north-west, south and south-west of the study area.

Effects on Visual Amenity as Represented by Specific Viewpoints

5.180 Figures 5.9 to 5.33 illustrate the view from each viewpoint by means of a photograph of the existing view, a wire frame illustrating the wind farm and a photomontage. The photomontages are presented at two different sizes, to be viewed at 25cm and 45cm viewing distances (the optimum distance between the page and the eye calculated to best represent the actual view). Information about the viewpoint, photography and visualisation is included on each figure and is not repeated in the text.

5.181 The potential effects on visual amenity as represented by specific viewpoints are detailed below by provision of a full description of sensitivity, magnitude of change and effect significance.

Viewpoint 1: Minor road near Glespin

Grid reference	281303 627575	*Figure number*	5.9
LCT	Plateau Moorlands	*Landscape designation*	None
Direction of view	North-west	*Distance to nearest turbine*	3.3km
Number of hubs theoretically visible	5	*Number of blade tips theoretically visible*	9

Location, receptors and viewpoint sensitivity:

This viewpoint is located on an elevated section of the minor road to the northeast of opencast workings on Lees Hill. The viewpoint is approximately 1km southeast of the settlement of Glespin. The view is experienced by road users and representative of views experienced by workers in the surrounding fields and the adjacent OCCS. Considering this viewpoint will be experienced by a small number of viewers, is of limited scenic quality and includes a number of large scale man-made structures it is judged to be of **low** sensitivity.

Context:

The viewpoint is located on the south slope of the Douglas Water river valley. The surrounding landscape includes restored landform and grazed open fields.

Existing view:

The existing view comprises a complex combination of irregularly shaped restored landform and undulations sloping to the north in the foreground of the view. Landform in the middle distance of the view gradually descends. These gradual slopes are covered by grazed fields bound by drystone walls and post and wire fences and are scattered with pockets of deciduous woodland. Behind the linear built form of Glespin the elevated slopes of Longhouse Hill, Common Hill and Hareshaw Hill steeply rise to form smooth rounded hills. These middle to distant slopes and hills are covered by grazed and open moorland. Numerous turbines of Hagshaw Hill and its extension can be seen across the north-west of the view on the upper slopes and summit of Common Hill and Hagshaw Hill. The turbines form a focus of the view. The varying turbine sizes and blade rotation speeds of Hagshaw Hill and its extension are visible. Coniferous forest plantation is visible to the left (west) in the view covering Parishholm Hills upper slopes and summit.

Changes:

The turbines of Galawhistle Wind Farm will be seen to the left (west) of the existing Hagshaw Hill turbines in the north-west of the view. Galawhistle Wind Farm will increase the extent of turbines within the view. Turbines will be seen on the distant slopes of Hareshaw Hill and Arrarat Hill. Longhouse Hill will screen views of Galawhistle turbines in the centre of the view. Some turbines will be 'stacked' in the view. Galawhistle turbines will be of notable larger size, slower blade rotor speed and wider spacing than the smaller Hagshaw Hill turbines. However differences between Galawhistle and the Hagshaw Hill extension turbines will not be perceptible to some viewers. The magnitude of change will be **medium**.

Infrastructure other than turbines visible:

None.

Visual effects during operation:

The introduction of Galawhistle Wind Farm will be notable in the view. The development will introduce additional man-made structures into the view. The proximity of Galawhistle Wind Farm means it will be seen in conjunction with the existing Hagshaw Hill Wind Farm and its extension. Overall, the visual effect on this viewpoint resulting from the introduction of Galawhistle Wind Farm will be **moderate**.

Viewpoint 2: Parish Holm

Grid reference	276272 628193	*Figure number*	5.10
LCT	Plateau Moorlands	*Landscape designation*	None
Direction of view	North	*Distance to nearest turbine*	1.3km
Number of hubs theoretically visible	0	*Number of blade tips theoretically visible*	1

Location, receptors and viewpoint sensitivity:

This viewpoint is located adjacent to the residential property of Parish Holm on the busy A70. Parish Holm is one of the closest residential properties to the development. This view is experienced by the residents of Parish Holm and is representative of those experienced by road users on the adjacent stretch of A70. Although this view will be experienced by a medium number of viewers, it is of low scenic quality and is therefore judged to be of **low** sensitivity.

Context:

Parish Holm is east of Glenbuck Loch within the narrow valley of the River Ayr. Valley slopes north and south of Parish Holm steeply rise to form rounded upland hills.

Existing view:

The view comprises an undulating valley bottom framed by steep valley slopes north and south of the viewpoint. Valley slopes steeply rise to form the smooth round hills of Hareshaw Hill north of the viewer, and Belt Knowe south-west of the viewer. The eye is drawn up and down the valley, east and west. Rough grass fields grazed by sheep cover the valley bottom bound by drystone walls and post and wire fences. Pockets of mixed woodland can be seen scattered in the middle distance of the view at low elevations west of the viewpoint. Surrounding near steep slopes are covered by grazed rough grassland.

Changes:

One blade tip will be seen on the near horizon of Hareshaw Hill. Although the wind farm will be in close proximity to the viewpoint the extent of visibility is minimal. The wind farm will be virtually imperceptible. The magnitude of change will be **negligible**.

Infrastructure other than turbines visible:

None.

Visual effects during operation:

Overall, the visual effect on this viewpoint resulting from the introduction of Galawhistle Wind Farm will be **negligible**.

Viewpoint 3: B7078 near Lesmahagow

Grid reference	283427 636706	*Figure number*	5.11
LCT	Plateau Farmland	*Landscape designation*	None
Direction of view	South-west	*Distance to nearest turbine*	7.6km
Number of hubs theoretically visible	16	*Number of blade tips theoretically visible*	19

Location, receptors and viewpoint sensitivity:
This viewpoint is located adjacent to the B7078, south of Lesmahagow on the lower slopes of Broken Cross Muir. Receptors to the view include road users on the B7078. The view is also representative of those experienced by road users on M74 as the route passes over Broken Cross Muir until Nether Fieldhouse parallel to the B7078. Although there are large scale manmade structures in the view limiting its scenic quality, the number of receptors to the view are large. The sensitivity of this viewpoint is judged to be **medium**.

Context:
This viewpoint is located on the lower west facing slopes of Broken Cross Muir on the edge of a flat plateau.

Existing view:
The fore to middle ground of the view is across a flat plateau of rough grassland with scattered low trees and shrubs. Some distant low slopes are covered by cultivated pastoral fields with adjacent isolated farmsteads and surrounding deciduous trees. Distant slopes rise to form smooth round low hills covered by coniferous forestry. The turbines of Hagshaw Hill and its extension are visible across the horizon. Transmission lines and bings are visible across the width of the view.

Changes:
Galawhistle turbines will be seen across the horizon to the right (west) of Hagshaw Hill turbines. Existing commercial forestry will screen lower sections of turbines in views. Galawhistle turbines will be of notable larger size and wider spacing than adjacent existing turbines in the view. From this viewpoint there will be the potential to view three turbine blade rotor speeds. Hagshaw Hill Wind Farm Extension turbines are perceptibly of slower blade rotor speed than the original Hagshaw Hill Wind Farm turbines, immediately to the right in the view. Galawhistle turbines, immediately to the right of the original Hagshaw Hill turbines, will introduce a slower blade rotation speed. The larger scale turbines of Galawhistle may reduce the perceived scale of the hills in that part of the view. The wind farm will be notable in the view, but will be seen in the context of existing turbines at a similar distance and direction. Overall, the magnitude of change is judged to be **medium**.

Infrastructure other than turbines visible:
None.

Visual effects during operation:
Although there are existing developments in the view, Galawhistle will be a notable introduction of varying scale at this distance. Overall, the visual effect on this viewpoint resulting from the introduction of Galawhistle Wind Farm will be **moderate**.

Viewpoint 4: Tinto Hill

Grid reference	295319 634368	*Figure number*	5.12
LCT	Foothills	*Landscape designation*	South Clydesdale RSA
Direction of view	West	*Distance to nearest turbine*	17.5km
Number of hubs theoretically visible	17	*Number of blade tips theoretically visible*	22

Location, receptors and viewpoint sensitivity:
This viewpoint is located on the summit of Tinto Hill, an identified viewpoint on the Ordnance Survey map. This hill is popular with walkers and its summit provides a 360° panorama view of scenic quality across South Clydesdale RSA and the wider landscape. Receptors to the view include a medium number of hill walkers. The view is representative of views from neighbouring hill tops, albeit of lower elevation. This viewpoint is judged to be of **high** sensitivity.

Context:
Tinto Hill is an outlier hill of the Southern Uplands, separated from the main upland areas by the Upper Clyde Valley. Other surrounding landscape is contrastingly relatively flat upland moorland or lowlands.

Existing view:
This viewpoint provides a 360° panorama view. The view towards the wind farm site comprises the steeply descending rough grazed slope of Tinto Hill. Undulating low hills extend across the middle ground. Distant hills of increasing elevation to the south form a distant horizon. A flat plateau in the northwest of the view is covered by cultivated farmland, woodland pockets and interspersed with built form. Geometric tracts of commercial forestry can be seen across the view into the distance. Hagshaw Hill Wind Farm and extension is visible on the distant horizon west of the viewpoint. Black Law Wind Farm is visible north of the viewpoint.

Changes:
Galawhistle will introduce turbines west of the viewpoint. Some turbines will be seen against a backdrop of landform. Galawhistle turbines will be seen behind the turbines of Hagshaw Hill. Galawhistle will extend the spread of turbines slightly across this section of the view, either side of Hagshaw Hill turbines. Galawhistle turbines will be visibly larger and of slower blade rotation than the turbines of Hagshaw Hill Wind Farm. However, Galawhistle turbines will appear of similar scale to the existing Hagshaw Hill extension turbines. Galawhistle will be a notable introduction in the view but will not form a prominent feature. The magnitude of change is judged to be low.

Infrastructure other than turbines visible:
None.

Visual effects during operation:
Overall, the visual effect on this viewpoint resulting from the introduction of Galawhistle Wind Farm will be **minor**.

Viewpoint 5: Cairn Table

Grid reference	272433 624223	*Figure number*	5.13
LCT	Plateau Moorlands	*Landscape designation*	Unnamed SLA (Afton)
Direction of view	North-east	*Distance to nearest turbine*	6.7km
Number of hubs theoretically visible	19	*Number of blade tips theoretically visible*	22

Location, receptors and viewpoint sensitivity:

This viewpoint is located at the cairn summit of Cairn Table which is south-east of Muirkirk. Receptors to the view include walkers to the summit. There are a small number of potential viewers and a number of man-made detractors, including turbines and OCCS, in the view. However, the viewpoint is located within a SLA and the extensive nature of the 360˚ panorama provides scenic qualities to the view. This viewpoint is judged to be of **medium** sensitivity.

Context:

Cairn Table is a smooth rounded elevated hill to the south of River Ayr valley at the edge of a SLA.

Existing view:

The open moorland slope of Cairn Table descends in the foreground of the view. The smaller smooth round hill of Little Cairn Table is visible in the middle ground of the view covered by open moorland. The flat bottomed valley of Douglas Water is visible passing east to west across the view. The opposite slopes of the valley steeply rise to form the elevated hills of Common Hill, Hareshaw Hill, Meikle Auchinstilloch and Nutberry. Extensive coniferous forestry plantation covers lower slopes and summits. The eye is drawn along the far distant horizon which comprises the elevated slopes and summits of Tinto Hill, Pentland Hills and Lowther Hills. Man-made elements in the view include the OCCS and turbines of Hagshaw Hill Wind Farm and its extension, as well as Whitelee and Black Law Wind Farms. Hagshaw Hill Wind Farm and its extension form a near focus in the view.

Changes:

Galawhistle Wind Farm will introduce additional turbines north-east in the view. Galawhistle turbines will be seen in front of Hagshaw Hill turbines and will appear closer in the view. Galawhistle turbines will appear of perceptible larger size and of slower blade rotation speed than the existing turbines of Hagshaw Hill Wind Farm and its extension. However this difference may be perceived as an exaggerated depth of view/distance between the wind farms. The proportion of the view occupied by turbines will increase. Turbines will be visible on the lower slopes of Hareshaw Hill and Meikle Auchenstilloch against a distant backcloth. Galawhistle Wind Farm will be seen as a prominent new development in the view. The magnitude of change is judged to be **medium**.

Infrastructure other than turbines visible:

Access tracks and intermittent vehicular movement will be seen in the view. The substation and borrow pits will also be visible from this relatively close elevated viewpoint.

Visual effects during operation:

Although Galawhistle will be seen in the context of existing turbines, Galawhistle Wind Farm will form a prominent element in the view. Galawhistle turbines will be notably of different scale to existing turbines. Overall, the visual effect on this viewpoint resulting from the introduction of Galawhistle Wind Farm will be **moderate**.

Viewpoint 6: Lanark

Grid reference	289067 642844	*Figure number*	5.14
LCT	Rolling Farmland	*Landscape designation*	Clydesdale AGLV
Direction of view	South-west	*Distance to nearest turbine*	15.9km
Number of hubs theoretically visible	13	*Number of blade tips theoretically visible*	20

Location, receptors and viewpoint sensitivity:

This viewpoint is located on the south edge of Lanark at the end of The Beeches and adjacent to a new housing estate. Receptors to the view include road-users. The view is also representative of those experienced from the south and west edge of the settlement of Lanark, including the adjacent new residential properties although their view will be filtered by a line of mature beech trees. Although there are some man-made detractors in the view, the view represents a large number of potential viewers, is of some scenic quality and is located within an AGLV. The sensitivity of this viewpoint is therefore judged to be **high**.

Context:

The location of this viewpoint is at the top of the north slope of a tributary burn of the River Clyde, east of New Lanark World Heritage Site. The River Clyde and its narrow valley meanders south to north west of the viewpoint.

Existing view:

The existing view comprises gently rolling landform incised by river valleys. A combination of arable and pastoral fields cover slopes in the foreground and middle distance of the view. Fields are bound by lines of mature trees, post and wire fences and pockets of deciduous woodland. The far slopes of the River Clyde valley are visible in the middle distance covered by mixed woodland. Undulating landform gradually rises into the distance of the view to form distant hills. Far distant elevated slopes and summits form the horizon and include Hagshaw Hill and Nutberry Hill. The turbines of Hagshaw Hill Wind Farm are located on the slopes and summits in the centre of the view. The eye is drawn up the river valleys in the middle ground and along the horizon line.

Changes:

Galawhistle turbines will be seen to the right of the existing Hagshaw Hill turbines. The introduction of Galawhistle Wind Farm will extend the proportion of the view occupied by turbines. However, Galawhistle will be seen in the same direction of view as the existing Hagshaw Hill turbines. Mature trees on the near ridge line of Broken Cross Muir will screen views of lower turbine sections and some turbine blades located at lower elevations on the slopes surrounding Galawhistle Burn. The proximity of Galawhistle Wind Farm to Hagshaw Hill means that Galawhistle will be seen as an extension to the existing wind farm. Differences in turbine size and blade rotor diameter may be perceptible by some viewers, but will generally go unnoticed from this viewpoint. The magnitude of change will be **low**.

Infrastructure other than turbines visible:

None

Visual effects during operation:

Although perceptible, the wind farm will not form a prominent feature in the view and will be seen in the context of Hagshaw Hill Wind Farm and its extension. Overall, the visual effect on this viewpoint resulting from the introduction of Galawhistle Wind Farm will be **minor**.

Viewpoint 8: Motherwell

Grid reference	275335 655265	*Figure number*	5.15
LCT	Urban (outwith LCA)	*Landscape designation*	Clydesdale AGLV Dalzell House GDL
Direction of view	South	*Distance to nearest turbine*	23.5km
Number of hubs theoretically visible	7	*Number of blade tips theoretically visible*	15

Location, receptors and viewpoint sensitivity:

This viewpoint is located on an informal elevated section of footpath within Dalzell House GDL, which falls within Clydesdale AGLV, on the west edge of Motherwell. Receptors to the view include visitors and dog walkers in this area of the GDL. The view is also representative of views experienced from properties on the south edge of Motherwell. There are a number of man-made detractors in the view, including the M74, transmission lines and the townscape of Glasgow and its environs, limiting the scenic quality of the view. However there are a potentially large number of receptors to the view and it is covered by two designated landscapes, therefore the sensitivity of this viewpoint is judged to be **high**.

Context:

The viewpoint is located on the southwest facing slope of the Clyde valley and is surrounded by gently undulating landform. The built form of Motherwell extends to the east and north of the viewpoint.

Existing view:

The foreground of the view comprises the grassy slope which descends to the southwest of the viewpoint until out of view. Mature deciduous woodland pockets surround this grassy area of the park limiting distant views to the south-east. The viewpoint overlooks the wooded valley of the River Clyde to the west which includes the M74 passing along it surround by arable fields. The built form of Larkhall is visible to the southwest of the viewpoint in the middle distance. Gently undulating arable and pastoral fields extend into the distance. Scattered pockets of deciduous trees are found throughout the view and blocks of coniferous forestry. The far distant elevated round hills of Hagshaw Hill are visible including the turbines of Hagshaw Hill Wind Farm.

Changes:

Galawhistle Wind Farm will be perceptible in the far distance of the view to the right of the existing Hagshaw Hill turbines. Trees across the middle-distant horizon will screen some turbines in the view. Galawhistle will extend the proportion of the view including turbines. Turbines will be introduced to the same direction of view as existing turbines. Considering the distance of Galawhistle Wind Farm in the view and the presence and proximity of the existing Hagshaw Hill Wind Farm there will be minimal perceptible change to the view resulting from Galawhistle. The magnitude of change is judged to be **negligible**.

Infrastructure other than turbines visible:

None

Visual effects during operation:

Overall, the visual effect on this viewpoint resulting from the introduction of Galawhistle Wind Farm will be **negligible**.

Viewpoint 9: East Mount Lowther

Grid reference	287856 609991	*Figure number*	5.16
LCT	Southern Uplands	*Landscape designation*	Thornhill Uplands RSA
Direction of view	North-west	*Distance to nearest turbine*	21.5km
Number of hubs theoretically visible	19	*Number of blade tips theoretically visible*	22

Location, receptors and viewpoint sensitivity:

This viewpoint is located on the summit of East Mount Lowther, identified as a viewpoint on the OS map. Receptors to the include walkers. The view is representative of those possible from the adjacent SUW, a national walking route, which passes over Lowther Hill. The adjacent section of the SUW is also a maintenance access route to the masts on the summit of Lowther Hill. Although there are masts and a large radar station and builting in close proximity to the viewpoint, it is located within an RSA, is an identified OS viewpoint, representative of a national walking route and has a medium number of receptors. The sensitivity of this viewpoint is judged to be **high**.

Context:

East Mount Lowther and Lowther Hill form part of a range of hills named The Lowther Hills which extend across the southeast of the study area. The Lowther Hills form part of the Southern Uplands.

Existing view:

The viewpoint provides a 360˚ panorama view across the surrounding Southern Uplands. The foreground of the view comprises the descending open moorland slope of East Mount Lowther. The viewpoint overlooks the valley of Mennock Water. The valley is surrounded by smooth round slopes which extend to form upland hill slopes and summits covered by open moorland. Distant slopes and summits are covered by commercial forest plantations. The masts and radar station to the east of the view on Lowther Hill comprise prominent man-made structures in close proximity to the viewpoint. Other man-made elements in the view include the distant turbines of Hagshaw Hill Wind Farm and its extension to the north. The overlapping hill summits form the horizon and focus of the view.

Changes:

Galawhistle Wind Farm will be seen north-west of the viewpoint in the distance, immediately left (west) of Hagshaw Hill Wind Farm. Galawhistle will increase the extent of the view occupied by turbines. Considering that Galawhistle Wind Farm will be seen in the view at the same distance and direction as existing turbines, it will be perceived as an extension. Galawhistle Wind Farm will be noticeable in the view but will not form a prominent or defining element. The magnitude of change is judged to be **low**.

Infrastructure other than turbines visible:

None.

Visual effects during operation:

Overall, the visual effect on this viewpoint resulting from the introduction of Galawhistle Wind Farm will be **minor**.

Viewpoint 10: Hartwood near Shotts

Grid reference	285051 659292	*Figure number*	5.17
LCT	Plateau Farmland	*Landscape designation*	None
Direction of view	South	*Distance to nearest turbine*	28.5km
Number of hubs theoretically visible	17	*Number of blade tips theoretically visible*	21

Location, receptors and viewpoint sensitivity:
This viewpoint is located on the south edge of the settlement of Hartwood at the end of a residential street. Receptors to the view include residents and road-users. The view is representative of those possible from the south edge of Shotts, a settlement east of Hartwood. Although there are an average number of potential receptors to the view, the view is of low scenic quality and there are a number of man-made detractors. The sensitivity of this viewpoint is judged to be **low**.

Context:
The viewpoint is located on the south facing gentle slope of South Calder Water valley.

Existing view:
A grazed field bound by post and wire fences in the foreground of the view gently slopes away to the south. The far north facing slope of the South Calder Water is covered by pastoral fields intermittently bound by mature tree lines. Pockets of coniferous forestry and some deciduous woodland are visible across the width of the view in the middle ground. The eye is drawn along the South Calder Water valley which roughly passes east to west in the middle ground of the view. Transmission lines are notable in the view crossing the valley in front of a far distant horizon of low smooth hills. The built form of Allanton and Newmains can be seen extending up and across the far valley slopes south of the viewpoint. Coniferous commercial plantation is visible across the horizon to the southeast of the viewpoint with the turbines of Black Law Wind Farm behind in the middle distance. Hagshaw Hill Wind Farm forms a small element in the far distance.

Changes:
Galawhistle will be seen on the horizon across the distant low hills south of the viewpoint to the right (west) of Hagshaw Hill. The distance of the wind farm from the viewpoint is such that perception of the wind farm will be minimal. Galawhistle will be seen in the context of the existing Hagshaw Hill Wind Farm and its extension. The magnitude of change is judged to be **negligible**.

Infrastructure other than turbines visible:
None.

Visual effects during operation:
Overall, the visual effect on this viewpoint resulting from the introduction of Galawhistle Wind Farm will be **negligible**.

Viewpoint 11: Carnwath

Grid reference	297855 646112	*Figure number*	5.18
LCT	Rolling Farmland	*Landscape designation*	None
Direction of view	South-west	*Distance to nearest turbine*	24.7km
Number of hubs theoretically visible	16	*Number of blade tips theoretically visible*	21

Location, receptors and viewpoint sensitivity:
This viewpoint is located on the B7016 on south edge of the settlement of Carnwath. Receptors to the view include road-users and residents of Carnwath. The view is representative of views experienced from residential properties on the south and west edge of Carnwath and from A70 as it passes Carnwath. Considering there are an average number of potential receptors to the view and the view is of some scenic quality, this viewpoint is judged to be of **medium** sensitivity.

Context:
This viewpoint is located on the low south facing slope of Medwin Water valley.

Existing view:
The fore to middle-ground of the view comprises low undulating landform covered by arable fields bound by fences. Pockets of deciduous and coniferous woodland can be seen throughout these lowland areas intermittently filtering distant views beyond them. Isolated farmsteads are scattered throughout the view. Tinto Hill in the distance is visible south of the viewpoint, its smooth steep round form forms the focus of the view. Far distant low undulating hills form the horizon southwest of the viewpoint. The far distant turbines of Hagshaw Hill Wind Farm are visible in southwest views.

Changes:
Galawhistle Wind Farm will be seen in the southwest of the view at the same distance and direction as existing turbines in the view. The wind farm will extend the proportion of the view occupied by turbines to the right (west). An intermittent tree line in the middle ground will filter views of Galawhistle turbines. Although Galawhistle Wind Farm will be a perceptible introduction in the view, it will be seen in the far distance and will be perceived as an extension to the existing group of turbines. The change to the view will be perceptible although minimal. The magnitude of change is judged to be **negligible**.

Infrastructure other than turbines visible:
None.

Visual effects during operation:
Overall, the visual effect on this viewpoint resulting from the introduction of Galawhistle Wind Farm will be **negligible**.

Viewpoint 12: Black Hill

Grid reference	283197 643543	*Figure number*	5.19
LCT	Plateau Farmland	*Landscape designation*	Clydesdale AGLV
Direction of view	South-west	*Distance to nearest turbine*	13.2km
Number of hubs theoretically visible	20	*Number of blade tips theoretically visible*	21

Location, receptors and viewpoint sensitivity:

This viewpoint is located on the cairn summit of Black Hill approximately 4km west of Lanark. Receptors to the view include walkers to Black Hill summit. Although there are a low number of potential receptors to the view and there are a number of manmade detractors, it is a 360 degree viewpoint marked on OS maps. The viewpoint is located within an AGLV and the extensive nature of the view provides some scenic qualities. The sensitivity of this viewpoint is judged to be **medium**.

Context:

Black Hill is an elevated hill within flat agricultural plateau landform. The nature of the surrounding flat low landscape is such that Black Hill appears of larger scale than it actually is (290m Above Ordnance Datum (AOD)).

Existing view:

This view comprises an extensive 360 degree view which extends into the far distance. The southwest facing slope of Black Hill in the foreground of the view descends out of view. The broad River Nethan valley with gentle low slopes passes north to south southwest of the viewpoint. The valley is covered by pastoral and arable fields of medium size and regular pattern. Scattered farmsteads are located throughout the agricultural farmlands. The built form of Lesmahagow and its surrounding smaller settlements can be seen across the lower slopes and valley bottom. The eye is drawn along the wide valley bottom and to the distant elevated hills of Common Hill, Hagshaw Hill, Meikle Auchinstilloch and Nutberry Hill which form the horizon. These hills are covered by large tracts of coniferous commercial forestry. The turbines on Hagshaw Hill are visible across these hills to the southwest breaking the horizon. The different size and blade rotor speed of Hagshaw Hill Wind Farm and its extension are perceptible in the view. In other directions the other wind farms of Lochhead, Whitelee, Black Law and a number of masts are visible.

Changes:

Galawhistle Wind Farm will introduce additional turbines southwest in the view. Turbines will be seen to the right (west) of the existing Hagshaw Hill Wind Farm and its extension and at a similar distance from the viewpoint. Galawhistle will extend a small proportion of the view occupied by turbines down the slope of Wedder Hill and up the slope of Meikle Auchinstilloch. Some turbines at lower elevations within the Galawhistle Burn valley will be seen against a backdrop of forestry. Commercial forestry on Wedder Hill and Law will screen lower sections of the turbines. Galawhistle turbines will be of perceptible larger size, slower blade rotor speed and wider spacing than Hagshaw Hill. Although visible, Galawhistle Wind Farm will be seen in context with Hagshaw Hill Wind Farm and will not form a prominent element. Overall, the magnitude of change to the view will be **low**.

Infrastructure other than turbines visible:

None.

Visual effects during operation:

Overall, the visual effect on this viewpoint resulting from the introduction of Galawhistle Wind Farm will be **minor**.

Viewpoint 13: Douglas Castle

Grid reference	284330 631701	*Figure number*	5.20
LCT	Upland River Valleys	*Landscape designation*	Douglas Valley AGLV
Direction of view	West	*Distance to nearest turbine*	6.2km
Number of hubs theoretically visible	0	*Number of blade tips theoretically visible*	1

Location, receptors and viewpoint sensitivity:

This viewpoint is located on an elevated mound within the grounds of Douglas Castle, northeast of the settlement of Douglas. Receptors to the view include visitors to the castle ruins and its grounds. The view is also representative of those experienced by workers in the surrounding agricultural fields and locations on the north edge of Douglas. There are a low number of potential viewers for this viewpoint. Although there are some scenic qualities to this view and the viewpoint is located within an AGLV, there are a number of man-made detractors in the view. This viewpoint is judged to be of **medium** sensitivity.

Context:

Douglas Castle is located on the northwest facing slopes of the Douglas Water valley, a medium sized river valley meandering southwest to northeast.

Existing view:

The foreground of the view comprises a gently descending grassy slope. Groups and individual mature deciduous trees are located throughout the grassy parkland filtering distant views. A small water body is located on the valley bottom in the middle distance with mature deciduous trees intermittently grouped around it. The opposite slopes of Blackwood Hill gradually ascend covered by open grassland and a mix of deciduous woodland and coniferous forestry. The distant summit of Common Hill and Broomerside Hill forms the horizon. The existing turbines of Hagshaw Hill Wind Farm and its extension can be seen across the skyline west of the viewpoint. The eye is drawn down the valley bottom middle distance, although the existing turbines in the view detract from this.

Changes:

Galawhistle turbines will not be perceptible from this viewpoint. Visibility of one turbine blade tip is minimal and will be seen behind the existing turbines in the view. The introduction of Galawhistle Wind Farm will not be perceptible in the view. The magnitude of change is judged to be **negligible**.

Infrastructure other than turbines visible:

None.

Visual effects during operation:

Overall, the visual effect on this viewpoint resulting from the introduction of Galawhistle Wind Farm will be **negligible**.

Viewpoint 14: A70 Rigside

Grid reference	287665 635137	*Figure number*	5.21
LCT	Broad Valley Upland	*Landscape designation*	None
Direction of view	South-west	*Distance to nearest turbine*	10.3km
Number of hubs theoretically visible	8	*Number of blade tips theoretically visible*	16

Location, receptors and viewpoint sensitivity:

This viewpoint is located on an elevated section of the A70 as it passes the northeast edge of Rigside. Receptors to the view include road-users on the A70 and local residents. The view is representative of those experienced from residential properties on the northeast and east edge of Rigside. Although there area a large number of potential receptors, the view is of limited scenic quality and contains a number of man-made detractors. The sensitivity of this viewpoint is judged to be **medium**.

Context:

The viewpoint is located on the elevated east facing slope of the wide River Douglas valley.

Existing view:

The view comprises a broad undulating valley. Arable and grazed fields extend from the foreground of the view into the distance scattered with pockets of deciduous woodland. Large scale man-made features are notable on the valley bottom, including an opencast mine and a transmission line. The ascending far valley slopes are partly covered by commercial coniferous forestry and open moorland. The far slopes rise to the smooth elevated hills of Common Law, Broomerside Hill and Meikle Auchinstilloch forming a distant horizon. The turbines of Hagshaw Hill and its extension can be seen across the skyline east of the viewpoint and are notably of different size and blade rotation speed. The existing turbines provide some focus to the view, although the nature of the view is relatively busy.

Changes:

Galawhistle Wind Farm will be seen in the distance southwest of the viewpoint, to the right (north-west) of the existing turbines in the view. Galawhistle Wind Farm will be seen at the same distance and direction of view as existing turbines. Turbines will be introduced down the slope of Wedder Hill and on to the lower slopes of Meikle Auchinstilloch, extending the proportion of the view occupied by turbines. Galawhistle turbines will be of notable wider spacing, larger size and slower blade rotation speed than the existing turbines of Hagshaw Hill and its extension. Despite these perceptible differences, Galawhistle Wind Farm will be seen in the context of existing turbines in the view. The introduction of the wind farm will be notable in the view but will not constitute a defining feature. The magnitude of change will be **medium**.

Infrastructure other than turbines visible:

Existing commercial forestry will screen views of any further infrastructure relating to the wind farm.

Visual effects during operation:

A precautionary approach to the judgement of the effect on this viewpoint means the visual effect resulting from the introduction of Galawhistle Wind Farm will be **moderate**.

Viewpoint 15: Crawfordjohn

Grid reference	288628 624487	*Figure number*	5.22
LCT	Upland River Valleys	*Landscape designation*	South Clydesdale RSA
Direction of view	North-west	*Distance to nearest turbine*	11.3km
Number of hubs theoretically visible	12	*Number of blade tips theoretically visible*	16

Location, receptors and viewpoint sensitivity:

The view is located on the B740 road east of Crawfordjohn as it crosses the lower slopes of Greenfield Law. Receptors of the view include road-users. This viewpoint is not representative of views experienced from the settlement of Crawfordjohn as landform will screen visibility of the development from the settlement. Although there are some scenic qualities in the view and it is located within a RSA, the small number of potential viewers is such that this viewpoint is judged to be of **medium** sensitivity.

Context:

This viewpoint is located on the north slope of the Duneaton Water valley.

Existing view:

The view is of simple composition, with low undulating arable and pastoral farmland from the foreground into the middle distance. Fields are bound by a combination of dry-stone walls, hedges and post and wire fences. Blocks of deciduous and coniferous trees can be seen on near lower slopes in the view. Geometric blocks of coniferous forestry plantations cover lower summits and slopes into the distance. Distant elevated hills covered by open moorland are smooth and round in form, comprising a distant horizon. This distant horizon is glimpsed beyond the forestry of Middle Muir and Braid Knowe. The turbines of Hagshaw Hill Wind Farm are visible on the distant horizon. The built form of Crawfordjohn is visible to the east of the viewpoint.

Changes:

Galawhistle Wind Farm will extend the spread of turbines across the horizon in the view. Galawhistle turbines will appear larger and of wider spacing than the existing turbines of Hagshaw Hill in the view. However this difference may be perceived as an exaggerated depth of view/distance between the wind farms and the viewpoint. Although the wind farm will be seen in the context of Hagshaw Hill and extension they will not appear as one development. Galawhistle will be a perceptible development in the view but will not become a defining element. The magnitude of change is judged to be **medium**.

Infrastructure other than turbines visible:

None.

Visual effects during operation:

The predicted perceptible change in the view means the wind farm will have a significant effect on the viewpoint. Overall, the visual effect on this viewpoint resulting from the introduction of Galawhistle Wind Farm will be **moderate**.

Viewpoint 16: Wedder Dod

Grid reference	282276 615414	*Figure number*	5.23
LCT	Southern Uplands	*Landscape designation*	None
Direction of view	North	*Distance to nearest turbine*	14.4km
Number of hubs theoretically visible	18	*Number of blade tips theoretically visible*	22

Location, receptors and viewpoint sensitivity:

This viewpoint is located on the summit of Wedder Dod within a rough grazed field. Receptors to the view include farm workers and walkers. This viewpoint has a small number of potential receptors. This viewpoint is not representative of views experienced from the SUW (approximately 0.5km southeast), as views from this stretch of the route are screened by surrounding commercial forestry. Although there are scenic qualities to this view, there are a small number of receptors and the viewpoint is not covered by a designated landscape. The viewpoint is judged to be of **medium** sensitivity.

Context:

Wedder Dod is one of the hills which comprise the Southern Uplands and is located approximately 1.7km east of Crawick Water valley.

Existing view:

This viewpoint provides a 360˚ panoramic view. The foreground of the view comprises the smooth steeply descending slope of Wedder Dod covered by rough grazed grass. The U-shaped valley of Crawick Water can be seen north of the viewpoint extending from the middle to distant part of the view. Several isolated farmsteads and pockets of forestry are located within the valley to the north. Round smooth upland hills overlap in the distance of the view. Tinto Hill to the right (northeast) of the view is the most prominent landmark hill in the view towards the wind farm site. Hagshaw Hill Wind Farm and extension and distant hill summits provide foci in the view. The distant 360˚ horizon forms holds no single focus to the panorama.

Changes:

Galawhistle Wind Farm will be seen north of the viewpoint, to the left (west) of the existing turbines of Hagshaw Hill Wind Farm and its extension. Galawhistle will extend the proportion of the view occupied by turbines. Turbines will be introduced at a similar distance and direction of view to existing turbines in the view. Galawhistle turbines will be perceptibly larger and of wider spacing in the view than the existing turbines of Hagshaw Hill, and may slightly reduce the perceived scale of upland hills in that part of the view. Although noticeable, Galawhistle Wind Farm will not form a prominent feature in the view and will be seen in the context of existing turbines. The magnitude of change is judged to be **low**.

Infrastructure other than turbines visible:

None.

Visual effects during operation:

The wind farm will not introduce a new type of man-made feature in the view and although it will be noticeable the wind farm will not form a prominent element in the view. Overall, the visual effect on this viewpoint resulting from the introduction of Galawhistle Wind Farm will be **minor**.

Viewpoint 17: B743 near Nethershield

Grid reference	258722 626940	*Figure number*	5.24
LCT	Lowland River Valleys	*Landscape designation*	Unnamed SLA (River Ayr-Lugar Water)
Direction of view	East	*Distance to nearest turbine*	17.9km
Number of hubs theoretically visible	11	*Number of blade tips theoretically visible*	20

Location, receptors and viewpoint sensitivity:

This viewpoint is located on an elevated section of the B743 as it passes over the lower south facing slope of Tincorn Hill. The viewpoint is located approximately 0.5km east of Nethersheild. Receptors to the view include road-users along B743. The view is representative of those experienced from the properties of Nethershield and Bruntshield and by workers in the adjacent fields. Although there are a low number of receptors to the view, the viewpoint is located within a SLA and the expansive nature of the view provides some scenic qualities. The viewpoint is judged to be of **medium** sensitivity.

Context:

The viewpoint is located north of the River Ayr.

Existing view:

The view comprises gently undulating open rough grazed fields which extend from the foreground into the middle distance. The farmstead of Bruntshield and surrounding trees are visible to the southeast in the view. The eye is drawn along the B743 extending into the distance until it is screened by landform and vegetation. A large plantation of commercial coniferous forestry can be seen to the northeast of the viewpoint. Distant elevated rounded hills covered by open moorland include Nutberry Hill, Middlefield law and Cairn Table. These distant hills form the horizon and the focus of the view, although partially filtered by near vegetation. The turbines of Hagshaw Hill Wind Farm and its extension are visible on Common Law, east of the viewpoint, breaking the horizon.

Changes:

Galawhistle Wind Farm will introduce additional turbines in the distance of the view on the elevated rounded hills. New turbines will be seen in front and to the right (south) of the existing Hagshaw Hill turbines. The proportion of the view occupied by turbines will slightly increase. Some of the Galawhistle turbines will appear closer in the view than the existing turbines and will be of visibly larger size than the existing turbines. Although the development will be perceptible from this viewpoint, it will be seen in context with existing wind farms in the view. The magnitude of change is judged to be **low**.

Infrastructure other than turbines visible:

None.

Visual effects during operation:

Although Galawhistle Wind Farm will be noticeable in the view, turbines will be introduced in the same direction and at a similar distance as existing turbines. This will limit the impact of introducing Galawhistle Wind Farm into the view. Overall, the visual effect on this viewpoint resulting from the introduction of Galawhistle Wind Farm will be **minor**.

Viewpoint 18: Auchengilloch

Grid reference	270504 635497	*Figure number*	5.25
LCT	Plateau Moorlands	*Landscape designation*	None
Direction of view	South-east	*Distance to nearest turbine*	7.2km
Number of hubs theoretically visible	1	*Number of blade tips theoretically visible*	8

Location, receptors and viewpoint sensitivity:
This viewpoint is located at the summit of Auchengilloch. East of the viewpoint is Auchengilloch Convectile Monument. Receptors to the view include walkers. The view is not representative of those experienced from Auchengilloch Convectile Monument as this area has no theoretical visibility. Although the view is expansive in nature, it is not of notable scenic quality and there are a low number of receptors. The sensitivity of this viewpoint is judged to be **low**.

Context:
This viewpoint is located on an open summit within Kype Muir forest.

Existing view:
The view comprises the descending slopes of Auchengilloch covered by rough heather moorland in the foreground of the view. The upper slopes and summit of Goodbush Hill extends across the width of the view covered by rough heather moorland and large tracts of commercial coniferous forestry. Distant summits can be seen behind the nearer slopes of Goodbush Hill and are partly covered by open moorland and forestry. Far distant upland hills are visible south of the viewpoint. Whitelee Wind Farm is visible to the north-west of the viewpoint, in the opposite direction of Galawhistle Wind Farm site.

Changes:
The tips of Galawhistle turbines and one turbine hub will be seen breaking the horizon. Existing forestry on the intermediate horizon of Gordonbush Hill will further screen views of the turbines. A limited extent of the wind farm will therefore be perceptible in the view. The introduction of Galawhistle will result in minimal change to the view. The magnitude of change is judged to be **negligible**.

Infrastructure other than turbines visible:
None.

Visual effects during operation:
Overall, the visual effect on this viewpoint resulting from the introduction of Galawhistle Wind Farm will be **negligible**.

Viewpoint 19: Loudon Hill near Drumclog

Grid reference	260871 637914	*Figure number*	5.26
LCT	Upper River Valleys	*Landscape designation*	None
Direction of view	South-east	*Distance to nearest turbine*	16.9km
Number of hubs theoretically visible	1	*Number of blade tips theoretically visible*	3

Location, receptors and viewpoint sensitivity:
This viewpoint is located on the summit of Loudon Hill adjacent to the cairn. A footpath leads to the summit of the hill. Receptors to the view include walkers. The rock face of the hill is used by climbers, and therefore the viewpoint is representative of views experienced by climbers on Loudon Hill. Although the view is extensive and panoramic in nature, there are a number of man-made detractors. There are a small number of potential receptors to this view. The sensitivity of this viewpoint is judged to be **low**.

Context:
Loudon Hill is a large resistant rocky outcrop within the valley of the River Avon. Loudon Hill is approximately 3.5km east of Darvel.

Existing view:
This location provides a 360˚ panorama view overlooking the gently undulating River Avon valley. The foreground slope of Loudon Hill steeply descends out of view. The gently undulating valley bottom extends from the middle ground into the distance. Areas of irregular restored landform are notable in the middle ground of the view. Arable and pastoral medium sized fields cover the valley bottom bound by intermittent hedgerows and post and wire fences. Scattered farmsteads can be seen throughout the low agricultural land. Distant landform rises to form elevated smooth hills, with slopes and lower summits are covered by large commercial coniferous forest plantations. These hills form the horizon in the view. Numerous turbines of Whitelee Wind Farm are visible to the north of the viewpoint in the middle distance and introduce large scale man-made structures into the view.

Changes:
Galawhistle Wind Farm will introduce three blade tips and one turbine hub into the view. These turbines will be seen on the horizon behind the slope of Regal Hill in the distance. Existing commercial forestry on the north and west slopes of Regal Hill will screen lower sections of turbines in the view. The wind farm will introduce additional man-made structures into the view, although into a new direction of view from this viewpoint. Although perceptible, the extent of visibility of the wind farm will be small and turbines will not introduce a notable feature into the view. The magnitude of change is judged to be **negligible**.

Infrastructure other than turbines visible:
None

Visual effects during operation:
Overall, the visual effect on this viewpoint resulting from the introduction of Galawhistle Wind Farm will be **negligible**.

Viewpoint 20: A723 between Hamilton and Strathaven

Grid reference	270331 647424	*Figure number*	5.27
LCT	Plateau Farmland	*Landscape designation*	None
Direction of view	South	*Distance to nearest turbine*	17.1km
Number of hubs theoretically visible	5	*Number of blade tips theoretically visible*	15

Location, receptors and viewpoint sensitivity:

This viewpoint is located on an elevated section of the relatively busy A723 road as it passes over plateau landscape north of Udstonhead south of Hamilton. Receptors to the view include road-users on A723. The view is representative of those experienced local residents and workersz. Although there are an average number receptors to the view, the view is of limited scenic quality. The sensitivity of this viewpoint is judged to be **low**.

Context:

This viewpoint is located on the Strathaven Road (A723) which connecting Strathaven and Hamilton. The road passes over lowland plateau landscape covered by farmland.

Existing view:

The view comprises low gently undulating landform which extends into the distance. Grazed fields bound by post and wire fences cover foreground slopes. Groups of deciduous trees often relating to farmsteads and tree line field boundaries can be seen across the view. A transmission line southeast of the viewpoint provides a man-made detractor in the view. Elevated hills and slopes form a far distant horizon, with Tinto Hill a recognisable landmark southeast in the view. Commercial plantation covers lower distant slopes with the turbines of Hagshaw Hill Wind Farm visible on the skyline behind it. Isolated farmsteads and properties are scattered throughout the view.

Changes:

Galawhistle turbines will be seen south of the viewpoint in the distance. The turbines will be seen to the right (west) of the existing turbines of Hagshaw Hill and at a similar distance in the view. Landform and existing coniferous forestry will screen lower sections of the turbines. Galawhistle turbines will be seen as an extension of Hagshaw Hill Wind Farm in the view. Perception of the introduction of Galawhistle Wind Farm in the view will be limited considering the distance of the development from the viewpoint and its proximity to existing turbines in the view. The magnitude of change is judged to be **low**.

Infrastructure other than turbines visible:

None.

Visual effects during operation:

Overall, the visual effect on this viewpoint resulting from the introduction of Galawhistle Wind Farm will be **minor**.

Viewpoint 21: Muirkirk

Grid reference	270574 627876	*Figure number*	5.28
LCT	Upper River Valleys	*Landscape designation*	None
Direction of view	East	*Distance to nearest turbine*	6.1km
Number of hubs theoretically visible	9	*Number of blade tips theoretically visible*	15

Location, receptors and viewpoint sensitivity:

This viewpoint is located on the A70 on the east edge of Muirkirk, one of the closest settlements to Galawhistle Wind Farm. Receptors to the view include road-users along the A70. The view is also representative of views experienced from residential properties on the east edge of Muirkirk and from elevated locations within the settlement. Although the view is of limited scenic quality and contains man-made detractors, there are a potential medium number of receptors to the view. The sensitivity of this viewpoint is judged to be **medium**.

Context:

The viewpoint is located within the upper stretches of the River Ayr valley, however immediately surrounding the viewpoint comprises undulating restored landform.

Existing view:

The A70 passes along the centre of the view into the middle distance before being screened by landform. Undulating restored land covered by grazed fields is located either side of the A70 extending into the middle distance. Fields are bound by post and wire fences with some dry-stone walls. Isolated residential properties are located along the road and are surrounded by pockets of mature mixed woodland. Opencast mining works are visible in the left and centre of the view in the distance. The elevated smooth round landform of Hareshaw Hill covered by open moorland is visible in the distant centre of the view and forms the horizon. Approximately six turbine hubs of Hagshaw Hill Wind Farm and two blades can be seen behind Hareshaw Hill breaking the horizon. The eye of the viewer is drawn along the road and towards the distant horizon of hills, with Hareshaw Hill forming a focus of the view.

Changes:

The turbines of Galawhistle will be seen across Hareshaw Hill on the horizon. The wind farm will increase the proportion of the view comprising turbines, extending development to the centre (east) of the view. Galawhistle turbines will be notably larger in size than the Hagshaw Hill turbines, accentuated by their closer proximity to the viewer and location on the ridge of Hareshaw Hill. The variation in blade rotation speed and spacing of the Galawhistle turbines will be notably different in the view from the existing turbines. The turbines of Galawhistle Wind Farm will have a defining influence on the view as they are located on the current focal hill. The magnitude of change is judged to be **high**.

Infrastructure other than turbines visible:

Intermittent vehicular movement along access tracks will be perceptible in the view.

Visual effects during operation:

Although there are existing turbines within the view, the proximity of Galawhistle and location across the horizon in the centre of the view will result in a substantial change to the view. Overall, the visual effect on this viewpoint resulting from the introduction of Galawhistle Wind Farm will be **major**.

Viewpoint 22: A76 south of Catrine

Grid reference	252689 624260	*Figure number*	5.29
LCT	Ayrshire Lowlands	*Landscape designation*	None
Direction of view	East	*Distance to nearest turbine*	24.3km
Number of hubs theoretically visible	11	*Number of blade tips theoretically visible*	20

Location, receptors and viewpoint sensitivity:

This viewpoint is located at the junction of A76 and the minor road leading to Ochiltree, approximately 1.5km south of Catrine. Receptors to the view include road-users. The view is also representative of those experienced by workers in the adjacent fields. Although there are a high number of potential viewers from the busy A76, the view is of limited scenic quality, is not an identified OS viewpoint or located within a designated landscape. The sensitivity of this viewpoint is judged to be **low**.

Context:

This viewpoint is located within agricultural lowland landscape with views of surrounding upland hills.

Existing view:

The foreground of the view comprises undulating arable fields bound by hedgerows and trees. Pastoral and arable fields extend into the middle-ground of the view. Blocks of deciduous trees and commercial coniferous plantations are visible in the distance scattered across the width of the view. Isolated farmsteads are scattered throughout the lowland landscape of the view. Built form of Catrine is visible to the north of the viewpoint. Distant landform rises to form elevated upland hills extending into the far distance. These smooth rounded hills are covered by open moorland and form a staggered horizon to the view, including Blackside to the north-east and Cairn Table to the east through hedgerow trees. Man-made detractors in the view include masts.

Changes:

Galawhistle turbines, although theoretically visible, will not be perceptible from this viewpoint. This is because existing coniferous and deciduous woodland will screen visibility of the turbines. The magnitude of change is judged to be **negligible**.

Infrastructure other than turbines visible:

None.

Visual effects during operation:

Overall, the visual effect on this viewpoint resulting from the introduction of Galawhistle Wind Farm will be **negligible**.

Viewpoint 23: Coalburn

Grid reference	281317 634511	*Figure number*	5.30
LCT	Plateau Farmland	*Landscape designation*	None
Direction of view	South-west	*Distance to nearest turbine*	4.5km
Number of hubs theoretically visible	13	*Number of blade tips theoretically visible*	18

Location, receptors and viewpoint sensitivity:

This viewpoint is located on the south edge of Coalburn, next to one of the main roads which passes through the settlement. Receptors to the view include local residents and road-users. The view is representative of those experienced from the adjacent residential properties and ones on the south edge of Coalburn. Although there are a number of man-made detractors resulting in limited scenic quality of the view, there are an average number of receptors to the view. The sensitivity of the viewpoint is judged to be **medium**.

Context:

Coalburn is one the closest settlements to the development.

Existing view:

The view comprises an expansive area of undulating restored land covered by rough grassland which gradually rises into the middle-ground. The built form of Coalburn within a dip in the foreground of the view. Distant rising slopes and summits of Henry's Hill, Common Hill, Wedder Hill and Meikle Auchinstilloch form the horizon. Commercial coniferous forest plantation covers these slopes, leaving the higher summits as open moorland. The turbines of Hagshaw Hill and its extension are visible behind the forest plantation and form the focus of the view. The turbines are visible across Common Hill and Henry's Hill and are of notable varying size and blade rotor speed.

Changes:

Additional turbines will be seen in close proximity on the northwest facing slope of Wedder Hill and southeast facing slope of Meikle Auchinstilloch. The introduction of Galawhistle Wind Farm will extend the proportion of the view occupied by turbines. Galawhistle turbines will be of notable larger size and slower blade rotation speed than the existing turbines of Hagshaw Hill and its extension. This difference may be perceived as an exaggerated depth of view/distance between the wind farms making Galawhistle appear closer to the viewer than it actually will be. The built form of Coalburn in the foreground will screen lower sections of turbines at lower elevations. Although Galawhistle Wind Farm will be seen in the context of Hagshaw Hill, the close proximity of the Galawhistle to the viewer means the wind farm will have a defining influence on the view. The magnitude of change is judged to be **high**.

Infrastructure other than turbines visible:

None.

Visual effects during operation:

Overall, the visual effect on this viewpoint resulting from the introduction of Galawhistle Wind Farm will be **major**.

Viewpoint 24: Lesmahagow

Grid reference	281553 638714	*Figure number*	5.31
LCT	Plateau Farmland	*Landscape designation*	None
Direction of view	South-west	*Distance to nearest turbine*	8.0km
Number of hubs theoretically visible	18	*Number of blade tips theoretically visible*	20

Location, receptors and viewpoint sensitivity:

This viewpoint is located on the southwest edge of Lesmahagow within a open amenity grass area adjacent to residential properties. Receptors to the view include local residents and roadusers on the adjacent residential road. The view is representative of those experienced from residential properties on the south and southwest edge of Lesmahagow. Although man-made detractors limit the scenic qualities to the view, and it is not a designated or OS viewpoint, there are a potentially large number of receptors. The viewpoint is judged to be of **medium** sensitivity.

Context:

The viewpoint is located on the upper west facing slope of the River Nethan valley.

Existing view:

The viewpoint overlooks the medium sized wooded valley of River Nethan which meanders through the middle-distance. Deciduous and coniferous woodland cover the valley slopes and the width of the view. Woodland in the foreground limits distant views southeast of the viewpoint. Distant landform rises to form elevated smooth rounded hills of Common Hill, Wedder Hill, Meikle Auchinstilloch and Nutberry Hill covered by commercial coniferous forestry. Man-made detractors in the view include a transmission line crossing the River Nethan valley and the distant turbines of Hagshaw Hill on the horizon. The eye is drawn along the river valley to the distant hills and across the horizon.

Changes:

Galawhistle turbines will be seen on the distant elevated slopes of Meikle Auchinstilloch and Wedder Hill to the right (west) of existing turbines in the view. Commercial forestry will screen lower sections of turbines in the view. Galawhistle Wind Farm will be seen at a similar distance and direction of view as Hagshaw Hill Wind Farm. However Galawhistle turbines will be of perceptible larger size and slower blade rotation speed than existing turbines in the view. The proportion of the horizon in the view occupied by turbines will increase. Galawhistle Wind Farm will form a prominent man-made element in the view. The magnitude of change is judged to be **medium**.

Infrastructure other than turbines visible:

Existing commercial forestry will screen infrastructure in the view.

Visual effects during operation:

Overall, the visual effect on this viewpoint resulting from the introduction of Galawhistle Wind Farm will be **moderate**.

Viewpoint 25: Darlees Rig, Pentland Hills

Grid reference	306513 653135	*Figure number*	5.32
LCT	Old Red Sandstone Hills	*Landscape designation*	South Clydesdale RSA
Direction of view	South-west	*Distance to nearest turbine*	35.8km
Number of hubs theoretically visible	18	*Number of blade tips theoretically visible*	22

Location, receptors and viewpoint sensitivity:

This viewpoint is located at the Triangulation pillar on the summit of Darlees Rig on the edge of the Pentland Hills. Receptors to the view include walkers to this summit. The view is representative of those experienced from the adjacent ScotWays footpath. Although the viewpoint located within a RSA, the number of receptors is small and there are a number of man-made detractors in the view. The viewpoint is judged to be of **low** sensitivity.

Context:

The viewpoint is located within the low hills on the west extent of Pentland Hills.

Existing view:

The view comprises descending heather slope in the foreground. Gently rolling heather and open moorland covered low hills extend across the width of the view in the middle ground. The distant cultivated River Clyde valley is visible in the distance covered by agricultural fields and scattered pockets of forestry. Round smooth hills are visible in the far distance partially covered by coniferous forestry. The higher hills of the Southern Uplands and Lowther Hills including masts and radar on their summits are visible to the south and south-east. Black Law Wind Farm is visible in the right (west) of the view in the middle distance. Perception of Hagshaw Hill Wind Farm in the far distance is minimal.

Changes:

Considering the distance of the wind farm in the view, perception of turbines will be minimal. When seen during periods of good visibility, Galawhistle will be seen as an extension of Hagshaw Hill Wind Farm and will not be easily distinguishable as a distinct new development. The magnitude of change is judged to be **negligible**.

Infrastructure other than turbines visible:

None.

Visual effects during operation:

Overall, the visual effect on this viewpoint resulting from the introduction of Galawhistle Wind Farm will be **negligible**.

Viewpoint 26: Track, north of Galawhistle Burn

Grid reference	276704 631103	*Figure number*	5.33
LCT	Plateau Moorlands	*Landscape designation*	None
Direction of view	All directions	*Distance to nearest turbine*	142m
Number of hubs theoretically visible	22	*Number of blade tips theoretically visible*	22
Location, receptors and viewpoint sensitivity: This viewpoint is located on an existing track on the lower slopes of Meikle Auchinstilloch within the wind farm site. Receptors to the view include a small number of walkers. During operation of the wind farm receptors to the view would also include a small number of maintenance personnel for the wind farm. The view is representative of those across the north extent of the wind farm site. There are limited scenic qualities to the view and manmade detractors in the view. The viewpoint is judged to be of **low** sensitivity.			
Context: This viewpoint is located on track within the site which is currently used infrequently. However during operation of the wind farm, this track will be upgraded, although frequency of use will increase, it will still amount to a small number of receptors.			
Existing view: The eye is drawn along the valley of Galawhistle Burn as it meanders south-west of the viewpoint. Smooth round slopes north and south of the burn ascend covered by open moorland. The opposite slope in the view (south) ascends to form the elevated hill of Hareshaw Hill. Beyond the slopes of Hareshaw Hill, a large mining spoil heap is visible (south-west) with a stepped profile in contrast to the adjacent smooth slopes. The turbines of Hagshaw Hill Wind Farm can be seen in close proximity (approximately 1.5km away) south-east of the viewpoint.			
Changes: The turbines of Galawhistle will be seen in close proximity and surrounding the viewpoint. Turbines will appear as large scale man-made structures of larger size and slower blade rotation than the existing Hagshaw Hill turbines. The perceptible varying turbine size of the wind farms may result in there being an increased perception of depth/distance between them. The proximity of the turbines and other infrastructure elements in the view are such that they will alter the fundamental nature of the view. The magnitude of change is judged to be **high**.			
Infrastructure other than turbines visible: The substations will be visible on the valley of Galawhistle Burn in close proximity to the west of viewpoint. Substations will introduce a new type of man-made structure into the view. Upgraded and new access tracks will be visible across the slopes of Meikle Auchinstilloch and Hareshaw Hill connecting turbines and substations. The viewpoint is located on a stretch of disused railway that will also be upgraded to form a track.			
Visual effects during operation: Although of low sensitivity, the degree of change and proximity of the development is such that the visual effect on the viewpoint resulting from the introduction of Galawhistle Wind Farm will be **major**.			

Visual Effects on Settlements

5.182 As settlements are generally located on lower ground and in valleys, views to the hill tops of the wind farm site are often limited by high ground between the settlement and the site. The theoretical visibility of the wind farm from settlements in the study area is illustrated in Figures 5.1 and 5.2 and discussed in Table 5.9 below. Several settlements are represented by the selection of viewpoints.

5.183 Visibility from a settlement is not uniform across the settlement. This is because views of the surrounding landscape from within the settlement are inevitably obscured by the buildings, structures, trees and vegetation of the settlement itself. Where the ZTV indicates theoretical visibility within settlements, upper storey windows of buildings are more likely to have views than locations at ground level.

Table 5.9: Visual Effects on Settlements

Settlement (Representative Viewpoint and distance[32])	**Discussion of Potential Effects on Views from Settlements**
Coalburn (Viewpoint 23) (4.0km)	Views of the wind farm will be possible from the south and south-west edge of the settlement. Built form, vegetation and landform will considerably limit views of the wind farm from the north, east and west areas of the settlement to upper floors and elevated locations. Galawhistle turbines will be seen in relative close proximity and as described in Viewpoint 23, will be seen in the context of existing turbines in views. Although the wind farm will form a prominent part of the view when seen, the limited extent of the settlement with visibility means the magnitude of change to views is judged to be low. The visual effect on this settlement overall resulting from the introduction of Galawhistle Wind Farm is judged to be **minor**.
Douglas (Viewpoint 13) 5.0km	Visibility of the wind farm from Douglas will be limited to the south-east edge of the settlement. Galawhistle turbines tips will be seen behind the closer Hagshaw Hill turbines existing in views. The ZTV shows this area will have views of a limited extent of the wind farm. Built form and vegetation will considerably screen views of turbines, limiting visibility of turbines to upper floors and the few locations with clear elevated views to the west. Views of the wind farm will be limited to a relatively small number of turbine tips and upper sections. The magnitude of change to views is judged to be negligible. The visual effect on this settlement overall resulting from the introduction of Galawhistle Wind Farm is judged to be **negligible**.
Muirkirk (Viewpoint 21) (6.1km)	The ZTV shows coverage over the whole of Muirkirk, however actual visibility of the wind farm will be limited by built form and vegetation screening outward views from the settlement. The linear nature of the settlement means the majority of properties have a northwest to southeast orientation away from the wind farm site located to the east-northeast. However, when seen the wind farm will be prominent in views from the east edge of the settlement, upper floors and elevated locations within Muirkirk including its northern area as it ascends the valley slope. The magnitude of change to views is judged to be

[32] Distance of nearest part of the settlement from the nearest turbine

Settlement (Representative Viewpoint and distance[32])	**Discussion of Potential Effects on Views from Settlements**
	medium. The visual effect on this settlement overall resulting from the introduction of Galawhistle Wind Farm is judged to be **moderate**.
Lesmahagow (Viewpoint 24) 8.2km	ZTV coverage includes the areas of Lesmahagow on the west facing slope of River Nethan valley and the top of the east facing slope. The screening of views by built form and vegetation will limit actual visibility of the wind farm to the south-west edge of the settlement. As described in Viewpoint 24, Galawhistle Wind Farm will be seen in the same direction and at similar distance as existing turbines in views. The magnitude of change to views is judged to be low. The visual effect on this settlement overall resulting from the introduction of Galawhistle Wind Farm is judged to be **minor**.
Rigside (Viewpoint 14) 9.9km	ZTV coverage indicates visibility across the settlement of a large extent of the wind farm. However, actual visibility from the settlement will be limited to the north-west and west edge as built form will screen views of the wind farm from other areas. When visible, the wind farm will be seen in the same direction and at a similar distance to existing Hagshaw Hill turbines in views as described in Viewpoint 14. Although the wind farm will form a notable feature in the view when seen, the limited areas with visibility of the wind farm is such that the magnitude of change to views is judged to be low. The visual effect on this settlement overall resulting from the introduction of Galawhistle Wind Farm is judged to be **minor**.
Strathaven 13.7km	ZTV coverage of this settlement is limited to the north and northeast areas. Built form and vegetation within the settlement will screen views of the wind farm so that locations with visibility will be minimal. Therefore the magnitude of change is judged to be low and the visual effect on this settlement overall resulting from the introduction of Galawhistle Wind Farm is judged to be **negligible**.
Lanark (Viewpoint 6) 15.6km	The wind farm will be visible in the distance from the south-west edge of the settlement located at the top of the south-west facing River Clyde valley slopes. The wooded River Clyde valley will further screen and filter views from the south-west edge of Lanark. Built form and vegetation will screen views from the north and east of the settlement. The wind farm will be seen at a distance in views, and in the same direction and at a similar distance to existing Hagshaw Hill turbines in views. The magnitude of change to views is judged to be low. The visual effect on this settlement overall resulting from the introduction of Galawhistle Wind Farm is judged to be **minor**.
Larkhall 17.8km	ZTV coverage of Larkhall is limited to its southern area. Built form will screen views of the wind farm from internal areas, limiting views of Galawhistle to the south edge of the settlement. The wind farm will be seen in the distance in views and in same direction and at a similar distance as the existing Hagshaw Hill Wind Farm and its extension. The change to views from this settlement will be minimal, and therefore the magnitude of change is judged to be negligible. The visual effect on this settlement overall resulting from the introduction of Galawhistle Wind Farm is judged to be **negligible**.
Carluke	Galawhistle Wind Farm will be visible in distant views from the south-west edge of Carluke. Views towards the wind farm from the north, east and internal areas of the settlement will be screened by built form and vegetation. Considering the presence of existing turbines in the same direction and at a similar distance in views, the introduction of Galawhistle will have a minimal change on views from this settlement. The magnitude of change is judged to be negligible. The visual effect on this settlement overall resulting from the introduction of Galawhistle Wind Farm is judged to be **negligible**.
19.1km	
Glasgow and its environs (Viewpoint 8) 20.9km	The south of Glasgow will have minimal visibility of Galawhistle Wind Farm as illustrated by the ZTV. Isolated edges of East Kilbride and the south edge of Wishaw will have views of distant turbines. Views from the east of Glasgow will be screened by built form and vegetation. Elevated locations with clear south views, such as Viewpoint 8, Motherwell, and upper storey floors will have views of the wind farm as a distant element in views. Galawhistle will be at such a distance from this settlement (in excess of 20km) and in the same view as Hagshaw Hill Wind Farm that changes to views will be minimal. The magnitude of change is judged to be negligible. The visual effect on this settlement overall resulting from the introduction of Galawhistle Wind Farm is judged to be **negligible**.
Carstairs 21.2km	Views from the south-west edge of the settlement will be screened and filtered by existing coniferous and deciduous woodland to the south and west of the settlement. Views towards the wind farm from the north and east of Carstairs will be screened by built form. Views from Carstairs Junction will be screened by landform, with the exception of minimal parts of the west edge of the settlement. The magnitude of change is judged to be negligible. The visual effect on this settlement overall resulting from the introduction of Galawhistle Wind Farm is judged to be **negligible**.
Carnwath (Viewpoint 11) 24.3km	Galawhistle Wind Farm will be seen at a distance in views from the south edge of the settlement, however coniferous woodland west of Carnwath will screen and filter views. View of turbines from the north and east areas of the settlement will be screened by built form. As described in Viewpoint 11, Galawhistle turbines will be seen in the same direction of view and at a similar distance as existing turbines in views. There will be a minimal change in views and therefore the magnitude of change is judged to be negligible. The visual effect on this settlement overall resulting from the introduction of Galawhistle Wind Farm is judged to be **negligible**.
Ochiltree 26.7km	The ZTV shows coverage of the elevated central and west area of Ochiltree. Elevated locations with clear views and upper floors will enable distant views of the wind farm. The built form of the settlement will screen views of the wind farm from lower floors and ground level areas within the settlement. The limited visibility of Galawhistle and distance of the wind farm in views (in excess of 27km) is such that there will be a negligible magnitude of change on views from this settlement. The visual effect on this settlement overall resulting from the introduction of Galawhistle Wind Farm is judged to be **negligible**.

Settlement (Representative Viewpoint and distance[32])	**Discussion of Potential Effects on Views from Settlements**
Forth 27.1km	The wind farm will be seen in the distance from the south-west edge of Forth. Existing coniferous forestry will screen and filter some views from lower elevations of the settlement. North and east areas of Forth will have no visibility of the wind farm as built form will screen views towards the site. The limited wind farm visibility, distance of the wind farm from the settlement and presence of the existing Hagshaw Hill in views is such that Galawhistle will result in minimal change in views from Forth. The magnitude of change is judged to be negligible. The visual effect on this settlement overall resulting from the introduction of Galawhistle Wind Farm is judged to be **negligible**.
Shotts 29.4km	The ZTV indicates that Shotts has theoretical visibility of a large extent of Galawhistle Wind Farm. However, vegetation and built form will screen actual views of the wind farm from the settlement to the extent that it will not be seen. The magnitude of change is judged to be negligible. The visual effect on this settlement overall resulting from the introduction of Galawhistle Wind Farm is judged to be **negligible**.
Stane 29.5km	The ZTV indicates that the south and north edge of Stane has theoretical visibility of a large extent of Galawhistle Wind Farm. However, vegetation and built form will screen actual views of the wind farm from these areas to the extent that it will not be seen. The magnitude of change is judged to be negligible. The visual effect on this settlement overall resulting from the introduction of Galawhistle Wind Farm is judged to be **negligible**.
Fauldhouse 32.0km	The ZTV shows coverage of the north and north-west edge of Fauldhouse. However, the built form of the settlement will screen any views of the wind farm to the extent that it will not be seen. The magnitude of change is judged to be negligible. The visual effect on this settlement overall resulting from the introduction of Galawhistle Wind Farm is judged to be **negligible**.

Visual Effects Experienced when Travelling on Roads through the Surrounding Area

5.184 The effects on sequential experiences when travelling around the study area set out in Table 5.10 below.

Table 5.10: Visual Effects along Selected Routes (sequential views)

Route (Representative Viewpoint and distance[33])	**Discussion about Potential Effects on Views from Routes**
A70 (Viewpoints 2, 7, 14 and 21) 723m	The A70 passes through the centre of the study area, roughly north-eastwards from north of Drongan to east of Trabrax. When travelling east along the A70, from Tarelgin to Cumnock, Galawhistle Wind Farm will be seen in intermittent glimpses as a very distant element in an east-northeast direction. Landform and roadside vegetation will intermittently screen views along this distant stretch of road. The wind farm will not be seen in views from Cumnock to Carbellow. At Carbellow glimpses of distant turbines will be possible. The elevated section of the A70 as it passes over the north slope of Cairn Hill will allow clear views of a large extent of the wind farm. Galawhistle turbines will be seen across the east horizon until Nether Wellwood at which point the A70 descends and landform will screen turbine visibility. When passing along River Ayr valley from Mid Wellwood east through Smallburn and Muirkirk the wind farm will be seen in glimpses as woodland blocks and built form will intermittently screen views. From the east edge of Muirkirk to Newmains, Galawhistle turbines will be seen as prominent vertical man-made elements on the near horizon. Although roadside vegetation will intermittently screen and filter views of the wind farm, it will become the focus of the view at this stretch of the A70. The wind farm will be screened from view by vegetation and landform as it passes Glenbuck Loch and Parish Holm. Blade tips of a small number of turbines will be visible in north views as the A70 passes over lower slopes of Sheil Hill. East of Monksfoot the wind farm will be behind the viewer and no longer visible. When travelling west along the A70 Galawhistle turbines will be seen at similar distances and direction of view as the existing turbines of Hagshaw Hill and extension. As the A70 passes over the Pentland Hills Galawhistle turbines will be seen intermittently in the far distance although its introduction is not expected to be perceptible from this distance (in excess of 25km). From Windygates to Howford the built form of Carnwath, West End, Carstairs and Hyndford Bridge and woodland and forest blocks will intermittently screen distant views of the wind farm. South of Howford, Galawhistle turbines will be seen in distant west views until west of Stone Hill. As the A70 passes over elevated north slopes of Robert Law and through Rigside road-users will have elevated clear views of a large extent of the wind farm on the horizon. Galawhistle turbines will be perceptibly of different size and blade rotation as the existing turbines of Hagshaw Hill. Limited views will be possible as the A70 descends through Uddington and crosses the M74 as built form, roadside vegetation and the motorway embankment will screen visibility. Whilst passing south of Douglas Castle and through Douglas, roadside walls, mature woodland and built form will limit views of turbines to blade tips behind the existing turbines of Hagshaw Hill and its extension. West of Glespin near blade tips will be seen in north views until Debog. West of Debog, the wind farm will be behind the road-user and no longer visible. The magnitude of change is judged to be medium overall due to almost continuous visibility along this route. However the magnitude of change is judged to be high for the stretch of the A70 between Muirkirk to

[33] Distance of the closest part of the route to the nearest turbine

Route (Representative Viewpoint and distance[33])	Discussion about Potential Effects on Views from Routes
	Newmains. The visual effect resulting from the introduction of Galawhistle Wind Farm on this route overall is judged to be **moderate**, and judged to be locally **major** between Muirkirk and Newmains.
M74/A74(M) (Viewpoint 3) 7.2km	The M74/A74(M) crosses the study area north to southeast passing east of the wind farm site. The B7078 and National Cycle Route 74 Pass roughly parallel to the M74/A74(M). When travelling north along the M74 a relatively small extent of the wind farm will be visible from a limited section of the motorway. The Wind Farm will be seen in west views as the M74 passes over the elevated slopes of Wedder Law, Knock Leven and Jacks Law. The remainder of views from the M74 will be screened by the surrounding elevated slopes and summits. Galawhistle Wind Farm will be seen in the context of the existing Hagshaw Hill Wind Farm and its extension in views. When travelling south along the M74, the wind farm will be screened from view by built form, vegetation and roadside embankments as it passes through Glasgow and surrounding environs. Distant glimpses of Galawhistle turbines will be possible from south of Struther Hill to Blackwood although intermittently screened in views. However, the close proximity of Lochhead Wind Farm along this stretch of the route provides a near focus to the view. Built form and motorway embankment will screen views as road-users pass east of Lesmahagow. As the M74 gradually ascends the elevated west facing slopes of Broken Cross Muir the wind farm will be visible on the west horizon. Galawhistle turbines will be seen adjacent to existing Hagshaw Hill turbines in views. However, roadside embankments and woodland blocks will momentarily screen views until Nether Fieldhouse. South of Nether Fieldhouse, existing forest blocks will screen any views of the wind farm, until the wind farm is behind the viewer and no longer visible. The magnitude of change is judged to be negligible overall, however is judged to be low for the stretch of the M74 between Lesmahagow and Nether Fieldhouse. The visual effect resulting from the introduction of Galawhistle Wind Farm on this route overall is judged to be **negligible**, and judged to be locally **minor** between Lesmahagow and Nether Fieldhouse.
National Cycle Route 74 7.3km	National Cycle Route 74 crosses the study area north to southeast passing east of the wind farm site, following a similar route to the B7078 and M74/A74(M). When travelling north along this route a relatively small extent of the wind farm will be visible from a limited section. The Wind Farm will be seen in west views as the route descends the north slope of Black Hill. The remainder of views from the route will be screened by the surrounding elevated slopes and summits. When travelling south along this route, the wind farm will be screened from view by built form, vegetation and roadside embankments as it passes through Glasgow and surrounding environs. Distant glimpses of turbines will be possible west and south-west of Larkhill although intermittently screened in views by roadside vegetation. Built form of Blackwood and Lesmahagow will screen views from the route as it passes through these settlements. South of Lesmahagow as the route gradually ascends the elevated west facing slopes of Brocken Cross Muir the wind farm will be visible on the west horizon until Nether Fieldhouse, although intermittently screened by roadside vegetation. Galawhistle turbines will be seen adjacent to existing Hagshaw Hill turbines in views. South of Nether Fieldhouse, existing forest blocks will screen any views of the wind farm, until the wind farm is behind the viewer and no longer visible. The magnitude of change is judged to be negligible overall, however is judged to be low for the stretch of the route between Lesmahagow and Nether Fieldhouse. The visual effect resulting from the introduction of Galawhistle Wind Farm on this route overall is judged to be **negligible**, and judged to be **minor** between Lesmahagow and Nether Fieldhouse.
SUW (Viewpoints 9 and 16) 14.1km	The SUW passes eastwards through the south of the study area from Manquhill Hill to west of Moffat. Parts of the SUW which will have visibility of the wind farm are limited to relatively short sections. As the route passes over Glengaber Hill and Stood Hill, in excess of 15km from the wind farm site, viewers will have north views of Galawhistle turbines. When descending Lowther Hill viewers will have distant visibility of the wind farm, in excess of 20km away in views. Existing commercial forestry will screen views of the wind farm from the route as it passes over Black Hill, Benbrack and Well Hill. The limited parts of the route with visibility of the wind farm as a distant element in views is such that overall it is judged the magnitude of change will be negligible. The visual effect resulting from the introduction of Galawhistle Wind Farm on this route overall is judged to be **negligible**.
A71 14.1km	The A71 passes the north part of the study area from Fauldhouse to Kilmarnock. When travelling west along the A71 the wind farm will be momentarily visible in the far distance of the view south of Springhill and Stane. As the A71 passes through Allanbank, Newmains and Wishaw built form will screen views of turbines so Galawhistle Wind Farm will not be seen. Galawhistle turbines will appear in south views at 15-20km distance from the wind farm east and south of Larkhall. However, the M74 embankment, roadside vegetation and built form of Stonehouse will limit visibility from this section of the A71. When travelling east along the A71 the wind farm will only be visible for a short section south-east of Loudon Hill. This stretch of road will have visibility of a small number of distant blade tips.

Route (Representative Viewpoint and distance[33])	Discussion about Potential Effects on Views from Routes
	Considering the limited visibility of the wind farm and its appearance as distant and far distant element in views, it is judged that the magnitude of change will be negligible. The visual effect resulting from the introduction of Galawhistle Wind Farm on this route overall is judged to be **negligible**.
A73 15.0km	The A73 is located north-west of the study area, north of Abington. When travelling south the wind farm will be screened from views by built form as the A73 passes through Airdrie. From Newhouse to Newmains the perception of Galawhistle turbines in views will be minimal considering the far distance of the wind farm from this area (approximately 30-35km). Intervening vegetation and built form will also limit views along this stretch of the A73. South of Newmains the wind farm will be intermittently seen as a distant element in south views until Carluke. Road-users will have no visibility of the wind farm as the A73 passes through Carluke, Braidwood and Lanark as built form and mature vegetation surrounding Lee Castle will screen views. South of Lanark Galawhistle turbines will be seen in intermittent glimpses as roadside vegetation will limit visibility. Galawhistle Wind Farm is not seen in views when travelling north on the A73. Visibility of the wind farm will be minimal and limited to glimpses when travelling south on the A73. Therefore the magnitude of change is judged to be negligible. The visual effect resulting from the introduction of Galawhistle Wind Farm on this route overall is judged to be **negligible**.
A721 20.3km	The A721 passes through the study area to the north-east of the site, approximately 20km from the wind farm site at its closest point. This route is included in the assessment due to its extensive theoretical visibility of the wind farm. When travelling west from east of Melbourne to Elsrickle the wind farm will not be visible as existing forestry will screen it from view. From Kaimend west to the edge of Carnwath far distant glimpses of the wind farm may be possible although built form and existing forest blocks will considerably limit views. From Carstairs to Carluke the wind farm will be seen in distant south-west views, although roadside vegetation and built form will intermittently limit visibility. The wind farm will be behind the viewer and not seen in views when travelling east along the A721.

Route (Representative Viewpoint and distance[33])	Discussion about Potential Effects on Views from Routes
	The actual visibility of the wind farm will be limited by screening to distant intermittent views, and therefore the magnitude of change is judged to be negligible. The visual effect resulting from the introduction of Galawhistle Wind Farm on this route overall is judged to be **negligible**.
A76 (Viewpoint 22) 22.5km	The passes from the through the study area from Kilmarnock in the west, south-eastwards, leaving the study area at Thornhill south of the study area. When travelling south on the A76, turbines will be intermittently visible in the distance in east views between Mauchline and Auchinleck. Roadside vegetation including mature hedge-lines as well as undulating landform will limit views of Galawhistle from this section of the A76. When travelling north on the A76 east views, west of Cumnock will be screened by the built form of the settlement resulting in no views of the wind farm. The minimal and limited extent of visibility Galawhistle is such that it is judged that the magnitude of change will be negligible. The visual effect resulting from the introduction of Galawhistle Wind Farm on this route overall is judged to be **negligible**.
M8/A8 29.7km	The M8/A8 passes through the north of the study area between 30-35km from the wind farm site. Built form, vegetation and roadside embankments will screen south views from the M8/A8 to the extent that road-users will have no visibility of Galawhistle Wind Farm. It is judged the magnitude of change will be negligible. The visual effect resulting from the introduction of Galawhistle Wind Farm on this route overall is judged to be **negligible**.
National Cycle Route 75 33.0km	National Cycle Route 75 pass through the north of the study area. The built form of Airdrie, Coatbridge, Uddingston which the route passes through will screen any views of the wind farm. No visibility of the wind farm means it is judged the magnitude of change will be negligible. The visual effect resulting from the introduction of Galawhistle Wind Farm on this route overall is judged to be **negligible**.

Summary of Visual Effects

5.185 Significant effects are predicted on the following views resulting from the introduction of the wind farm:

- Viewpoint 21 Muirkirk (**major**);

- Viewpoint 23 Coalburn (**major**);
- Viewpoint 26 Track, north of Galawhistle Burn (**major**);
- Viewpoint 1 Minor road near Glespin (**moderate**);
- Viewpoint 3 M74 near Lesmahagow (**moderate**);
- Viewpoint 5 Cairn Table (**moderate**);
- Viewpoint 14 A70 Rigside (**moderate**);
- Viewpoint 15 Crawfordjohn (**moderate)**;
- Viewpoint 24 Lesmahagow (**moderate**);
- Settlement of Muirkirk (**moderate**);
- Views from A70 (**moderate** and **locally major**).

5.186 The effects on other views from static viewpoints, settlements and views from routes were not found to be significant.

5.187 Measures to reduce effects upon visual amenity are predominantly addressed through the design of the wind farm. This was a key consideration in the development of the design strategy and the wind farm layout. No screening planting is proposed or considered appropriate in this upland landscape.

Assessment of Cumulative Landscape and Visual Effects

5.188 The cumulative assessment considers the additional effect of introducing the Galawhistle Wind Farm into the landscape, assuming that all other developments (consented or subject to a valid planning application[34]) are present. Wind farms considered in the cumulative assessment include those set out in Table 5.11 below and shown in Figure 5.35. These wind farms were identified following the cumulative methodology set out above.

5.189 Cumulative effects upon the landscape and on views were assessed by examining effects upon LCTs, designated landscapes, viewpoints, settlements and key routes across the study area. The assessment focused upon highlighting significant effects which will result from the addition of Galawhistle Wind Farm to a landscape in which other proposed developments are assumed to be present. Black Law Phase 1-2, Hagshaw Hill and its extension, Lochhead and Whitelee Wind Farms have already been considered in the LVA, as they are existing developments within the landscape.

Development Patterns across the Wider Area

5.190 When considering wind farm developments up to 60km away from the proposed Galawhistle Wind Farm (illustrated in Figure 5.34), clear trends in wind farm development can be seen. Developments (existing and proposed) can be grouped into broad regional groups, corresponding with the hill ranges in the area. These groups of wind farms, and wind farm proposals are located on each group of the hills across the Southern Uplands, Lowther Hills, coastal areas of North Ayrshire and within the Clyde valley.

5.191 The wind farms considered within this assessment are shown in Figure 5.35 and include seven within and adjacent to the northern extent of the Southern Uplands (Hagshaw Hill and its extension, Nutberry, Bankend Rig, Dungavel, Penbreck, Andershaw and Limmer Hill), two across the Lowther Hills (Leadhills and Clyde) and ten across the River Clyde valley (Whitelee and its Phase 1 and 2 extension, Calder Water, Lochhead and its extension, Black Law Phases 1-3, Harrows Law and Muirhall). Although the proposed wind farms of Harrows Law and Muirhall will be in excess of 30km form Galawhistle Wind Farm, they were included in the cumulative assessment following consultation with SNH.

[34] With the exception of Leadhills Wind Farm which is at scoping stage

Cumulative Baseline Information

Table 5.11: Additional Wind Farms Considered in the Cumulative Assessment[35]

Development Name	Distance from Galawhistle (km)	Turbine Tip Height (m)	Number of Turbines	Grid Reference	Status	LCT
Black Law - Phase1-2	23.5	110	55	289635 654117	Operational	Plateau Moorlands, Upland Fringes
Hagshaw Hill	0.3	55.5	26	279259 630733	Operational	Plateau Moorlands
Hagshaw Hill Extension	1.4	80	20	279259 630733	Operational	Plateau Moorlands
Lochhead	15.1	100	3	277925 647133	Operational	Plateau Farmland
Whitelee	19.8	110	140	257538 646313	Operational	Plateau Moorlands, Plateau Moorlands with Forest
Clyde	19.0	125	152	299492 617321	Consented	Southern Uplands, Southern Uplands with Scattered Forest
Whitelee Extension Phase 1	22.3	140	36	254797 644171	Consented	Plateau Moorlands with Forest
Andershaw	6.8	125	14	284542 625320	Planning	Plateau Moorlands
Bankend Rig	10.8	76	11	265319 633469	Planning	Plateau Moorlands
Black Law - Phase 3	26.4	127	23	291128 656467	Planning	Plateau Moorlands, Upland Fringe
Calder Water	18.0	147	14	261111 641488	Planning	Plateau Moorlands
Dungeval	8.6	120	13	267962 636454	Planning	Plateau Moorlands
Harrows Law	33.7	110	17	305148 653646	Planning	Old Red Sandstone Hills
Limmer Hill	9.3	125	33	289267 629862	Planning	Foothills
Lochhead Extension	14.6	100	2	278186 646526	Planning	Plateau Farmland
Muirhall	31.2	125	6	300838 653104	Planning	Plateau Farmland
Nutberry	0.4	115	6	277297 632757	Planning	Plateau Moorlands

[35] As explained in the methodology above, the cumulative assessment included those wind farms likely to have noticeable and significant cumulative relationships with Galawhistle Wind Farm. This process was carried out in consultation with SNH, South Lanarkshire Council and East Ayrshire Council and led to Dersalloch and Hare Hill Extension Wind Farms not being included in the baseline of the CLVA.

Development Name	Distance from Galawhistle (km)	Turbine Tip Height (m)	Number of Turbines	Grid Reference	Status	LCT
Penbreck	7.1	125	9	272983 622151	Planning	Plateau Moorlands, Plateau Moorlands with Forest
Whitelee Extension Phase 2	22.8	140	39	254404 642756	Planning	Plateau Moorlands with Forest
Leadhills	11.1	125	36	286420 619110	Scoping	Upland River Valleys, Southern Uplands

Cumulative Zones of Theoretical Visibility

5.192 Figure 5.35 shows the cumulative ZTV (CZTV) to tip height, indicating the number of wind farms (not the number of turbines) theoretically visible from any given point on the map. The figure illustrates that:

- At least one wind farm will be visible from almost all parts of the study area with the exception of isolated areas of the Southern Uplands and Lowther Hills in the south of the study area, Tweeddale in the east, valley bottom of the Clyde Valley in the north and areas of Ayrshire Lowlands in the west of the study area. The bottom and lower slopes of the Nithsdale Valley in the south of the study area will have no visibility of wind farms;
- Multiple wind farms will be visible across the Clyde Valley in the northern extent of the study area;
- Multiple wind farms will be visible from elevated hill summits and upper slopes. Narrow valleys and glens show to have one or no wind farms visible.

5.193 These observations show that, from locations such as settlements and roads which are located in valleys, views of multiple wind farms are less likely. Such views are more likely when walking over the hill tops.

Cumulative Effects on the Landscape (as represented by LCTs)

5.194 Potential cumulative effects on the site during operation of the wind farm were considered. Galawhistle will be located immediately west of Hagshaw Hill Wind Farm and its extension, and immediately south of Nutberry Wind Farm, which will therefore be open moorland plateau adjacent to wind farms. The change to the site with addition of Galawhistle turbines, to become open moorland plateau site with turbines is judged to be of low magnitude of change. The effect will be **minor**.

5.195 Potential cumulative effects on LCTs were considered. The majority of the proposed development will be located within Plateau Moorland (Glasgow and Clyde Valley LCA). The rest of the site comprises Upland River Valleys LCT (Glasgow and Clyde Valley LCA), as well as Plateau Moorlands and Upper River Valleys LCTs (Ayrshire LCA). Hagshaw Hill Wind Farm and its extension and Nutberry Wind Farm are also located within Plateau Moorlands LCT (Glasgow and Clyde Valley LCA), as well as a further eight wind farms across the study area. The addition of 17 turbines within Plateau Moorlands LCT will have **negligible** cumulative effects. Two Galawhistle turbines will be located within Upland River Valleys LCT and three within Plateau Moorlands LCT. The addition of two to three turbines within these LCTs and the indirect effects of turbines on Upper River Valleys LCT will have **negligible** cumulative effects.

5.196 Indirect effects on other LCTs will be minimal, as Galawhistle will be seen in the context of Nutberry and Hagshaw Hill and its extension. No significant effects are predicted.

Cumulative Effects on Designated Landscapes

5.197 **Table 5.8** sets out the landscape effects of the proposed Galawhistle Wind Farm on designated landscapes, and concludes that there will be no significant effects.

5.198 From each of the designated landscapes, Galawhistle will be seen in the context of the other wind farms on the hills around the site, including Hagshaw Hill and its extension and Nutberry. Although differences in turbine size between Galawhistle and Hagshaw Hill Wind Farms will be perceptible from close views, this will not alter the perception of the surrounding landscape from these designated landscapes. It is therefore judged that there will be no significant cumulative effects on designated landscapes arising from the addition of Galawhistle Wind Farm in the context of the cumulative wind farms considered.

Cumulative Effects on Visual Amenity (as represented by selected viewpoints)

5.199 The potential cumulative effects of Galawhistle Wind Farm on viewpoints were considered for all viewpoints in the LVA (viewpoint locations are shown on Figure 5.35). Cumulative wireframes are provided in Figures 5.36 to 5.59, and the assessment is presented in Table 5.13 below.

Table 5.12: Cumulative Assessment of Changes in Visual Amenity at Viewpoints

Cumulative Viewpoint		Additional Wind Farms[36]	Discussion of Magnitude of Change and Cumulative Effect
1	Minor road near Glespin	Hagshaw Hill and Extension; Muirhall; Andershaw; Leadhills.	Wind Farms will primarily be seen north-west, south-east and west of the viewpoint in the middle distance, far distant turbines of Muirhall will be seen to the north-east. Galawhistle Wind Farm will introduce additional turbines north of the viewpoint at a similar distance in the view to Hagshaw Hill and Andershaw turbines. Galawhistle will extend the spread of turbines in the view. Differing turbine size and spacing will be notable between Hagshaw Hill Wind Farm and Galawhistle Wind Farm. Differing turbine size will be tempered by landform screening lower sections of some Galawhistle turbines in the view. The magnitude of change will be low and the cumulative effect will be **minor**.
3	B7078 near Lesmahagow	Limmer Hill; Leadhills; Andershaw; Hagshaw Hill, and Extension; Nutberry; Dungeval.	Wind Farms will be seen in the distance of the view west, south-west and south of the viewpoint. Views of south and south-west turbines will be limited to tips and occasional turbine hubs. Galawhistle Wind Farm will be seen between Hagshaw Hill and Nutberry Wind Farms at a similar distance in the view. Galawhistle,

[36] Additional wind farms considered (excluding Galawhistle Wind Farm) that are visible within 30km of the viewpoint (data from CZTV and modelling).

Cumulative Viewpoint		Additional Wind Farms[36]	Discussion of Magnitude of Change and Cumulative Effect
			Hagshaw Hill and Nutberry Wind Farms will be seen as a continuous spread of turbines across the distant horizon. Differences between Galawhistle and Hagshaw Hill turbine sizes will be perceptible. Galawhistle will contribute to the formation of a group of wind farms southwest of the viewpoint by closing the 'gap' between Hagshaw Hill and Nutberry Wind Farms. The magnitude of change will be medium and the cumulative effect will be **moderate**. Although there will be a significant cumulative effect on this viewpoint, the continuous spread of development formed by introducing Galawhistle may improve the visual balance of developments in the view.
4	Tinto Hill	Clyde; Leadhills; Limmer Hill; Andershaw; Penbreck; Hagshaw Hill and Extension; Nutberry; Dungeval; Whitelee and Extension Phase 1 and 2; Calder Water; Lochhead and Extension; Black Law Phase 1, 2 and 3; Muirhall; Harrows Law.	An extensive array of turbines will be seen at varying distances across the length of the view. Wind Farms will be seen A large number of wind farm schemes will be visible from this elevated viewpoint. Galawhistle Wind Farm will be seen as an additional development in the view, in the same direction and similar distance as other wind farm schemes. Galawhistle Wind Farm will be seen immediately behind Hagshaw Hill Wind Farm. Galawhistle, Hagshaw Hill and Nutberry Wind Farms will be seen as a continuous spread of turbines in that part of the view. The magnitude of change will be negligible and the cumulative effect will be **negligible**.
5	Cairn Table	Black Law Phase 1, 2 and 3; Nutberry; Muirhall; Harrows Law; Hagshaw Hill and Extension; Limmer Hill; Andershaw; Clyde; Leadhills; Penbreck; Whitelee and Extension Phase 1 and 2; Bankend Rig; Calder Water; Dungeval.	Penbreck Wind Farm will be seen immediately south of the viewpoint, other wind farms will be seen across the 360 degree view at varying distances from the viewpoint. Galawhistle turbines will be seen in front of Hagshaw Hill and Nutberry turbines in the same direction of view. The larger Galawhistle turbine size and closer proximity of Galawhistle may result in it appearing closer than is actual. Differences between Nutberry and Galawhistle turbines will not be perceptible in the view. Galawhistle Wind Farm will contribute to the formation of a group of turbines northeast of the viewpoint in relative close proximity. The magnitude of change will be low and the cumulative effect will be **minor**.
6	Lanark	Limmer Hill; Leadhills; Andershaw; Hagshaw Hill, and Extension; Nutberry; Lochhead and Extension.	Distant wind Farms will be concentrated in the south-west and west part of the view from this viewpoint. Galawhistle Wind Farm will be seen between Hagshaw Hill and Nutberry Wind Farms at a similar distance in the view. Galawhistle, Hagshaw Hill and Nutberry Wind Farms will be seen as a continuous spread of turbines across the distant horizon. Differences in Galawhistle and Hagshaw Hill turbine sizes will be perceptible. Differences in turbine size with Nutberry will not be perceptible. The magnitude of change will be low and the cumulative effect will be **minor**.
8	Motherwell	Black Law Phase 1, 2 and 3; Clyde; Limmer Hill; Lochhead and Extension; Hagshaw Hill and Extension; Nutberry; Whitelee.	A group of distant wind farms will be visible south-west of this viewpoint. Lochhead Wind Farm and extension will be the closest in the view. Galawhistle Wind Farm will be seen between Hagshaw Hill and Nutberry Wind Farms at a similar distance in the view. Galawhistle, Hagshaw Hill and Nutberry Wind Farms will be seen as a continuous spread of turbines across the far distant horizon. Differences in turbine sizes will not be perceptible from this viewpoint. The magnitude of change will be negligible and the cumulative effect will be **negligible**.
9	East Mount Lowther	Penbreck; Whitelee and Extension Phase 1 and 2; Calder Water; Dungeval; Nutberry; Hagshaw Hill and Extension; Lochhead and Extension; Andershaw; Leadhills; Black Law Phase 1, 2 and 3; Limmer Hill; Harrows Law.	An extensive array of turbines will extend 90 degrees across the length of the view, north of this viewpoint. Turbines will be seen in the middle-ground and distance. Galawhistle Wind Farm will be seen to the left (west) of Hagshaw Hill Wind Farm in the view, at a similar distance. Nutberry turbines will be seen behind Galawhistle turbines. Galawhistle will extend the proportion of the view occupied by turbines. Perception of differing turbine size will be minimal from this viewpoint. The magnitude of change will be negligible and the cumulative effect will be **negligible**.
10	Hartwood near Shotts	Black Law Phase 1, 2 and 3; Limmer Hill; Leadhills; Andershaw; Hagshaw Hill and Extension; Nutberry; Lochhead and Extension; Dungeval; Calder Water; Whitelee and Extension Phase 1.	Wind farms will be seen south, south-west and south-east from this viewpoint. Black Law Phase 1, 2 and 3 turbines will be the closest in the view extending across the near horizon. Galawhistle Wind Farm will be seen between Hagshaw Hill and Nutberry Wind Farms at a similar distance in the view. Galawhistle, Hagshaw Hill and Nutberry Wind Farms will be seen as a continuous spread of turbines across the far distant horizon. Differences in turbine sizes will not be perceptible from this viewpoint. The magnitude of change will be negligible and the cumulative effect will be **negligible**.
11	Carnwath	Clyde; Limmer Hill; Penbreck; Hagshaw Hill and Extension; Nutberry; Dungeval; Black Law Phase 1, 2 and 3; Muirhall;	Turbines will be seen south and south-west from this viewpoint in the distance. Wind farms north of the viewpoint will be screened by the near built form of Carnwath. Galawhistle Wind Farm will be seen adjacent to Hagshaw Hill and behind Nutberry Wind Farms at a similar distance in the

Cumulative Viewpoint		Additional Wind Farms[36]	Discussion of Magnitude of Change and Cumulative Effect
		Harrows Law.	view. Galawhistle, Hagshaw Hill and Nutberry Wind Farms will be seen as a continuous spread of turbines across the far distant horizon. Differences in turbine size will not be perceptible from this viewpoint. The magnitude of change will be negligible and the cumulative effect will be **negligible**.
12	Black Hill	Leadhills; Andershaw; Hagshaw Hill and Extension; Penbreck; Nutberry; Dungeval; Whitelee and Extension Phase 1 and 2; Calder Water; Lochhead and Extension; Black Law Phase 1, 2 and 3; Muirhall; Harrows Law; Clyde; Limmer Hill.	Wind Farms will be seen across the 360 degree view at varying distances. Clusters of turbines will be visible north-east, south and west of the viewpoint. Galawhistle will be seen at a similar distance and the same direction of view as Hagshaw Hill and Nutberry Wind Farms. Galawhistle turbines will be seen behind and left (east) of Nutberry turbines. Galawhistle turbines will be seen in front of the distant Penbreck turbines. Galawhistle, Hagshaw Hill and Nutberry Wind Farms will be seen as a continuous spread of turbines across the distant upland hills. Differences in Galawhistle and Hagshaw Hill turbine sizes will be perceptible. Differences in turbine size with Nutberry will not be perceptible. Galawhistle Wind Farm will contribute to the formation of a group of turbines southwest of the viewpoint. The magnitude of change will be low and the cumulative effect will be **minor**.
13	Douglas Castle	Muirhall; Limmer Hill; Andershaw; Hagshaw Hill and Extension; Nutberry.	Near turbines will be visible east and west of the viewpoint, as well as the distant turbines of Andershaw Wind Farm to the south-west. One Galawhistle blade tip will be visible behind the closer turbines of Hagshaw Hill and its extension. Differences in turbine size will not be perceptible in the view. The magnitude of change will be negligible and the cumulative effect will be **negligible**.
14	A70 Rigside	Limmer Hill; Andershaw; Hagshaw Hill and Extension; Nutberry; Dungeval; Black Law Phase 1, 2 and 3.	Clusters of turbines will be visible south-west and north of the viewpoint. Galawhistle Wind Farm will be seen between Hagshaw Hill and Nutberry Wind Farms at a similar distance in the view. Galawhistle, Hagshaw Hill and Nutberry Wind Farms will be seen as a continuous spread of turbines across the horizon. Differences in Galawhistle and Hagshaw Hill turbine sizes will be perceptible. Differences in turbine size with Nutberry will not be perceptible. Nutberry and Galawhistle Wind Farms will be perceived as one development in the view. The magnitude of change will be low and the cumulative effect will be **minor**.

Cumulative Viewpoint		Additional Wind Farms[36]	Discussion of Magnitude of Change and Cumulative Effect
15	Crawfordjohn	Limmer Hill; Clyde; Leadhills; Penbreck; Andershaw; Hagshaw Hill and Extension; Nutberry.	Near turbines will be seen north, south and west from this viewpoint across the near horizon. A distant group of turbines will be visible north-west in the view. Galawhistle Wind Farm will be seen behind and adjacent to Hagshaw Hill turbines at a similar distance in the view. Galawhistle will be seen behind the closer turbines of Andershaw Wind Farm. The differing size of Galawhislte and Hagshaw Hill turbines will be perceptible which may result in Galawhistle appearing closer in the view. Galawhistle will extend turbines across a small proportion of the view. The magnitude of change will be low and the cumulative effect will be **minor**.
16	Wedder Dod	Penbreck; Nutberry; Hagshaw Hill and Extension; Black Law Phase 1, 2 and 3; Andershaw; Limmer Hill; Leadhills; Clyde.	Clusters of turbines will be visible north-east and north of this viewpoint at varying distances. Leadhills Wind Farm will be the closest in the view. Galawhistle Wind Farm will be seen adjacent to Hagshaw Hill Wind Farm, at a similar distance in the view. Differences in Galawhistle and Hagshaw Hill turbine size and spacing will be noticeable in the view. Andershaw and Penbreck Wind Farms will be seen in different directions but similar distances in the view. Galawhistle will contribute to the formation of a group of turbines northwest of the viewpoint. The magnitude of change will be low and the cumulative effect will be **minor**.
17	B743 near Nethershield	Dungeval; Bankend Rig; Hagshaw Hill and Extension; Penbreck.	Three groups of turbines will be visible south and south-west of the viewpoint in the distance. Galawhistle Wind Farm will be seen adjacent to Hagshaw Hill Wind Farm at a similar distance in the view. Galawhistle, Hagshaw Hill and Nutberry Wind Farms will be seen as a continuous spread of turbines across the far distant horizon. Galawhistle will contribute to the formation of a group of turbines in the distant south of the view. Differences in turbine size will not be perceptible from this viewpoint. The magnitude of change will be negligible and the cumulative effect will be **negligible**.
18	Auchengilloch	Penbreck; Bankend Rig; Dungeval; Whitelee and Extension Phase 1 and 2; Calder Water.	An extensive array of turbines will be visible north-west of the viewpoint, with Dungeval wind farm located in near proximity. Galawhistle will introduce three turbine tips into a new part of the view, extending the proportion of the view occupied by man-made development. The limited visibility of Galawhistle turbines means they will not be of perceptible different specification to other turbines in the view.

Cumulative Viewpoint		Additional Wind Farms[36]	Discussion of Magnitude of Change and Cumulative Effect
			Considering the extensive array of turbines northwest of the viewpoint Galawhistle will have minimal cumulative change to the view. The magnitude of change will be negligible and the cumulative effect will be **negligible**.
19	Loudon Hill near Drumclog	Whitelee and Extension Phase 1 and 2; Calder Water; Black Law Phase1, 2 and 3; Lochhead and Extension; Muirhall; Harrows Law; Dungeval; Leadhills; Bankend Rig; Penbreck.	Turbines will be visible across the 360 degree panorama view. Whitelee Wind Farm and Extension Phase 1 and 2 will form a focus of the view given its extensive array of turbines in near proximity north of the viewpoint. Galawhistle turbines will be seen southeast of the viewpoint between the closer wind farms of Dungeval and Bankend Rig. Galawhistle wind farm will be seen at a similar distance in the view to Penbreck wind farm. Galawhistle will contribute to the forming cluster of turbines southeast in the view, but will not detract from the extensive array of turbines to the northwest. The magnitude of change will be low and the cumulative effect will be **minor**.
20	A723 between Hamilton and Strathaven	Black Law Phase 1, 2 and 3; Harrows Law; Muirhall; Lochhead and Extension; Clyde; Limmer Hill; Hagshaw Hill and Extension; Nutberry; Dungeval; Bankend Rig; Calder Water; Whitelee and Extension Phase 1 and 2.	Several groups of turbines will be visible in the distance east, west and south of the viewpoint. Galawhistle Wind Farm will be seen in the same direction and similar distance in the view as other developments. Galawhistle, Hagshaw Hill and Nutberry Wind Farms will be seen as a continuous spread of turbines across the distant horizon. The magnitude of change will be negligible and the cumulative effect will be **negligible**.
21	Muirkirk	Hagshaw Hill and Extension.	Galawhistle turbines will be seen in front of Hagshaw Hill turbines in the same direction of view. The larger Galawhistle turbine size and closer proximity in the view may accentuate the depth of view between Galawhistle and Hagshaw Hill Wind Farms. Galawhistle will contribute to the formation of a group of turbines in this direction of the view. The magnitude of change will be low and the cumulative effect will be **minor**.
22	A76 south of Catrine	Whitelee and Extension Phase 1 and 2; Nutberry; Hagshaw Hill and Extension; Penbreck.	Distant turbines will be seen east and north of the viewpoint. Considering Galawhistle Wind Farm will not be perceptible from this viewpoint the magnitude of change will be negligible and the cumulative effect will be **negligible**.
23	Coalburn	Black Law Phase 1 and 2; Muirhall; Harrows Law; Limmer Hill; Clyde; Leadhills; Hagshaw Hill and Extension; Nutberry.	Turbines will be visible south-west and south-east of the viewpoint. Galawhistle Wind Farm will be seen between Hagshaw Hill and Nutberry Wind Farms at a similar distance in the view. Galawhistle, Hagshaw Hill and Nutberry Wind Farms will be seen as a continuous spread of turbines across the near upland hill horizon. Differences between Galawhistle and Hagshaw Hill turbine sizes will be perceptible. Galawhistle will contribute to the formation of a group of wind farms in close proximity southwest of the viewpoint by closing the 'gap' between Hagshaw Hill and Nutberry Wind Farms. The magnitude of change will be medium and the cumulative effect will be **moderate**. Although there will be a significant cumulative effect on this viewpoint, the continuous spread of turbines formed by introducing Galawhistle would improve the visual balance of development in the view.
24	Lesmahagow	Lochhead and Extension; Black Law Phase 1 and 2; Andershaw; Leadhills; Hagshaw Hill and Extension; Nutberry.	Galawhistle Wind Farm will be seen between Hagshaw Hill and Nutberry Wind Farms at a similar distance in the view. Some Galawhistle turbines will be behind Nutberry turbines in the view. Galawhistle, Hagshaw Hill and Nutberry Wind Farms will be seen as a continuous spread of turbines across the distant horizon. Differences in Galawhistle and Hagshaw Hill turbine sizes will be perceptible. Galawhistle will contribute to the formation of a group of wind farms southwest of the viewpoint by closing the 'gap' between Hagshaw Hill and Nutberry Wind Farms. Assuming Galawhistle will be introduced of a baseline including Nutberry Wind Farm, the magnitude of change will be low and the cumulative effect will be **minor**.
25	Darlees Rig, Pentland Hills	Clyde; Andershaw; Limmer Hill; Penbreck; Hagshaw Hill and Extesion; Nutberry; Dungeval; Harrows Law; Whitelee and Extension Phase 1 and 2; Calder Water; Black Law Phase 1, 2 and 3; Muirhall.	Wind farms will be visible south-west of the viewpoint. Harrows Law turbines will be immediately adjacent the viewpoint and therefore will provide a near focus in the view. Galawhistle Wind Farm will be seen between Hagshaw Hill and Nutberry Wind Farms at a similar distance in the view. Galawhistle, Hagshaw Hill and Nutberry Wind Farms will be seen as a continuous spread of turbines across the far distant horizon. Differences in turbine sizes will not be perceptible from this viewpoint. The magnitude of change will be negligible and the cumulative effect will be **negligible**.
26	Track north of Galawhistle Burn	Nutberry; Hagshaw Hill and Extension.	Near turbines will surround the viewpoint. Galawhistle Wind Farm will be seen in close proximity surrounding the viewer. Differences in turbine size between Nutberry and Galawhistle will not be perceptible. Galawhistle turbines will appear larger than Hagshaw Hill turbines, accentuated by their closer proximity to the

Cumulative Viewpoint		Additional Wind Farms[36]	Discussion of Magnitude of Change and Cumulative Effect
			viewpoint. The different turbine size of Galawhistle and Hagshaw Hill turbines will accentuate the depth of view and therefore the distance between the wind farms in the view. The extent of turbines surrounding the viewpoint is such that there will be a medium magnitude of change. The cumulative effect will be **moderate**.

Cumulative Effects on Views from Settlements

5.200 No significant cumulative effects were predicted on settlements, largely resulting from the limited visibility and perceptibility of the wind farm from them (as described in Table 5.9 above).

5.201 When the wind farm will be visible from other settlement across the study area it will be seen in the context of the neighbouring Hagshaw Hill, its extension and Nutberry Wind Farms. Differing turbine size will be perceptible between Hagshaw Hill and Galawhistle from closer settlements although will not result in any significant cumulative effects. Numerous wind farms will be visible in the surrounding landscape from settlements in the northeast of the study area, to the extent that the perception of introducing Galawhistle Wind Farm will be minimal.

Cumulative Effects on the Visual Amenity of Routes

5.202 The potential cumulative effects of the proposed Galawhistle Wind Farm on the visual amenity as experienced when travelling along routes through the study area were examined for all routes LVA. No cumulative effects on routes were found to be significant, as the proposed Galawhistle wind farm will be seen in the context of the immediately adjacent wind farms of Hagshaw Hill and extension and Nutberry. Galawhistle will also be seen as part of the wider group of wind farms including Bankend Rig, Dungavel, Penbreck, Andershaw, Limmer Hill and Leadhills. The wind farm will be visible form the A70, in the context of Hagshaw Hill and extension and Nutberry Wind Farms as well as other wind farms in the wider landscape. Although differences in turbine size will be perceptible from closer sections of the A70 to the site, this cumulative effect will not be significant.

Summary of Cumulative Effects

5.203 No cumulative effects were predicted on the landscape, landscape designations or views from static viewpoints, settlements or routes across the study area. This is largely due to the immediate proximity of Galawhistle to the wind farms of Nutberry and Hagshaw Hill and its extension. This cluster of wind farms is located within a group of local wind farms across the surrounding hills.

Mitigation

5.204 There is limited scope for mitigation of operational effects as visual effects of the turbines are unavoidable given their size and location. However, the best way of mitigating potential adverse landscape and visual effects is with careful design, modifying the scheme where necessary, so that it ties into and matches, in so far as possible, the approach taken at nearby developments. The design process is discussed in Chapter 2 (EIA Process). The landscape and visual design process of the wind farm layout is summarised below.

5.205 The landscape and visual objectives of the wind farm site layout aimed to:

- Create a balanced and rhythmic composition where appropriate, and avoid/minimise effects on landscape character, landscape designations and minimise visual effects;
- Limit and/or avoid adverse impacts on natural heritage features on the ground;
- Balance the energy yield aspirations as defined by the developer, with creating a development that reads as an extension to Hagshaw Hill Wind Farm.

5.206 To achieve these aims the wind farm layout sought:

- To group turbines to create a balanced and coherent image that reads as a single wind farm with other adjacent operational developments;
- To avoid turbines that are perceived as being remote from the rest of the group;
- To avoid ‘tangles’ of turbines from key viewpoints, i.e. situations where multiple turbines can be seen one behind the other;
- To achieve consistent heights, rather than having turbines seen at a variety of levels or having selected prominent turbines located at high points above the rest;
- To avoid creating geometric lines of turbines, favouring a loose cluster, responding to the local landscape form.

5.207 The potential visual appearance of the proposed wind farm was tested from a number of key viewpoints also representative of a broad spectrum of views. These were:

- Viewpoint 21, Muirkirk is located in near proximity (6.1km) west of the development area and is representative of views from a close settlement and centre of population. Testing of wind farm layouts identified that turbines should be limited to the lower slopes of Meikle Auchinstilloch in order to prevent the creation of an outlying group of turbines northeast in the view. Tested wind farm layouts also identified that the ‘stacking’ of turbines positioned on Hareshaw Hill and Wedder Hill should be avoided.
- Viewpoint 23, Coalburn is located in near proximity (4.5km) northeast of the development area and is representative of views from a close settlement and centre of population. Testing of wind farms layouts identified that Galawhistle Wind Farm should create a continuous spread of turbines in the view, avoiding a gap appearing at the lower section of Galawhistle Burn valley. The wind farm layouts also identified that the appearance of a gap between Galawhistle Wind Farm and the immediately adjacent Hagshaw Hill Wind Farm in the view should be avoided.
- Viewpoint 5, Cairn Table is located in close proximity (0.6km) southwest of the development area and represents views from a close hill summit along a popular local walking route. Testing of wind farm layouts identified that Galawhistle should limit the extent of turbines back dropped by near landform in order to reflect the layout of Hagshaw Hill turbines which are mostly back dropped by sky or distant landform. This therefore constrained the positioning of turbines on Meikle Auchinstilloch.
- Viewpoint 12, Black Hill is located (13.2km) northeast of the development area and represents a hill summit on a local walking route. The hill summit is identified as viewpoint on OS maps. Testing of wind farm layouts identified that the number of Galawhistle turbines with increased hub height should be limited to those positioned on the lower slopes of Meikle Auchinstilloch and Wedder Hill ensuring minimal perception of the hub height difference from this viewpoint.

5.208 With reference to these viewpoints and informed by wireframe analysis, alternative layouts were tested and developed aiming to provide a balanced composition of views of the wind farm from these viewpoints. The proposed layout is the product of these processes of iterative design.

5.209 No further design modifications are proposed.

5.210 The turbines will be matt off white/light grey colour which is considered to be the most effective colour to reduce visibility, appearing pale against the sky. This colour is typical of that proposed for all wind farms in Scotland.

Mitigation of Construction Effects

5.211 Mitigation measures that will be undertaken where practicable to minimise the potential landscape and visual effects resulting from the construction of the proposed Galawhistle Wind Farm are addressed in this section.

5.212 To keep construction effects to a minimum, contractors will work within a marked wayleave. Careful control of construction activities is proposed for the proposed development. The area of works will be written into the contract and will be clearly pegged out. Site design, track design and reinstatement of the ground surrounding the works will also be under strict guidance. In addition, construction work will be scheduled to require minimal after-dark work, to reduce the likelihood of effects arising from lighting on the site.

5.213 Tracks will be designed to follow the landform and avoid ecological constraints (see Chapter 6: Ecology), which will be fenced off during the works. The tracks will be constructed in the initial stages and vehicle activity will be limited to the tracks. Where tracks pass through field boundaries, gates or cattle grids will be provided. Where drystone dykes are breached, the dykes either side of the crossing will be reconstructed up to the edge of the track utilising the skills of a suitable craftsman and materials.

5.214 Exposed surfaces will be covered with a suitable material to reduce the potential for erosion. Erosion and run off control measures will be installed. These may include cut off drains and embankments in areas of erosion risk (See Chapter 8: Hydrology, Hydrogeology and Geology).

5.215 As part of the construction works it is proposed that all verges, cable tracks and other disturbed ground is reinstated subject to best practice methods. This will include stripping and storing of the peat, with vegetation intact, for use in on site restoration. It will also include reseeding, where necessary, with a suitable seed mix for moorland.

Residual Effects

5.216 Given the limited opportunities for mitigation, the residual cumulative effects are the same as those identify in the discussion of operational effects. Modifications to the size, siting and layout of the wind farm, were integrated into the design of the scheme.

Summary of Effects

5.217 **Table 5.13** below sets out all effects considered to be significant in terms of the EIA Regulations (major and moderate effects). Those effects that are judged to be minor or negligible are not listed in this table. Table 5.13 therefore summarises the maximum effect resulting from the introduction of Galawhistle Wind Farm.

Table 5.13: Summary of Significant Effects

Potential Effects	Pre-Mitigation Effect	Mitigation	Residual Effects
Effects during construction			
Landscape:			
Effects on the landscape of the Wind Farm site	Major direct	Post – construction restoration and regeneration of vegetation	Minor
Visual Amenity:			
Effects on the visual amenity of the Wind Farm site	Major	Post – construction restoration and regeneration of vegetation	Minor
Effects during operation			
Landscape:			
Effects on the landscape of the Wind Farm site	Major	Landscape and habitat management of the site during operation. Ultimate restoration upon decommissioning.	Major
Effects on the landscape of LCTs within the wind farm site:			
Plateau Moorland LCT Plateau Moorlands LCT	Locally major direct	Incorporated into design of wind farm. Ultimate restoration upon decommissioning.	Locally major
Upland River Valleys LCT	Locally moderate direct	Incorporated into design of wind farm. Ultimate restoration upon decommissioning.	Locally moderate
Effects on the Landscape Character Areas of LCTs covering the wind farm site			
The Western (Ayrshire) Plateau' area of Plateau Moorland LCT unnamed area (east Ayrshire) of Plateau Moorlands LCT unnamed area (River Ayr valley) Upper River Valleys LCT	Moderate direct and indirect	Incorporated into design of wind farm. Ultimate restoration upon decommissioning.	Moderate
Visual amenity:			
Effects on viewpoints:			
Viewpoint 21 Muirkirk Viewpoint 23 Coalburn Viewpoint 26 Track, north of Galawhistle Burn	Major	Incorporated into design of wind farm. Ultimate restoration upon decommissioning.	Major
Viewpoint 1 Minor road near Glespin Viewpoint 3 M74 near Lesmahagow Viewpoint 5 Cairn Table	Moderate		Moderate

Potential Effects	Pre-Mitigation Effect	Mitigation	Residual Effects
Viewpoint 14 A70 Rigside Viewpoint 15 Crawfordjohn Viewpoint 24 Lesmahagow			
Effects on settlements:			
Muirkirk	Moderate	Incorporated into design of wind farm. Ultimate restoration upon decommissioning.	Moderate
Effects on views from routes:			
A70	Moderate and Locally major	Incorporated into design of wind farm. Ultimate restoration upon decommissioning.	Moderate and Locally major
Cumulative Effects			
Visual amenity:			
Viewpoint 3 B7078 near Lesmahagow Viewpoint 23 Coalburn Viewpoint 26 Track north of Galawhistle Burn	Moderate	Incorporated into design of wind farm. Ultimate restoration upon decommissioning.	Moderate

Proposed Monitoring

5.218 No ongoing monitoring is proposed in respect of long term landscape and visual effects.

Statement of Significance

5.219 The landscape and visual assessment considered the effect that the wind farm development will have upon the landscape and views from that landscape. Based on consultations with statutory consultees, 26 viewpoints were selected. The assessment involved a desk study, field survey and computer modelling. The assessment took account of the presence of existing wind farms in the study area including the immediately adjacent Hagshaw Hill and its extension.

5.220 In this assessment, four levels of significance of effect were used: major, moderate, minor and negligible. Moderate and major effects were considered to be significant for the purpose of the EIA Regulations (Environmental Impact Assessment (Scotland) Regulations 1999).

5.221 The site is not covered by any national, regional or local landscape policy designations. **No significant** residual effects were identified for construction activities in respect to the landscape character of the site. In terms of operational effects on landscape character, the assessment identified that there will be a **major effect** on the landscape character of the immediate site itself. This significant effect results from the site changing from a relatively still undeveloped site to one comprising wind turbines, access tracks and two substations which are not characteristic of the existing landscape. Within the wind farm site, locally **major effects** were identified on the Plateau Moorland and Plateau Moorlands LCTs, and locally **moderate effects** on Upland River Valleys LCT as a result of the direct effects these landscapes will experience. The wind farm will introduce large scale man-made structures into the parts of these LCTs which are within the wind farm site.

5.222 The assessment also considered effects on the wider LCTs as identified in the Glasgow and the Clyde Valley, Ayrshire, Dumfries and Galloway and The Borders LCAs. The assessment identified **moderate effects** on the landscape character areas which cover the wind farm site of Upper River Valleys, Plateau Moorland and Plateau Moorlands LCTs. However the effect on these LCTs as whole, given they are much more extensive in the wider landscape was identified as **not significant**. The overall change to the landscape on the surrounding LCTs was judged also to be **not significant.**

5.223 The wind farm will be visible from several designated landscapes across the 35km study area. These include Douglas Valley AGLV (1.1km from the wind farm site), and the Unnamed SLA (Afton) and Unnamed SLA (River Ayr - Lugar Water) 1.4km and 3.1km respectively from the wind farm site. Other regional designations, Gardens and Designed Landscapes across the study area will also have visibility of the wind farm. The assessment concluded that there would be **no significant effects** on these designated landscapes.

5.224 The visual effect of Galawhistle Wind Farm was assessed from 26 viewpoints. Three viewpoints were predicted to experience a **major effect** resulting from the introduction of Galawhistle (Viewpoints 21 Muirkirk, 23 Coalburn and 26 Track, north of Galawhistle Burn). Six viewpoints were predicted to experience a **moderate effect** (Viewpoints 1 Minor road near Glespin, 3 M74 near Lesmahagow, 5 Cairn Table, 14 A70 Rigside, 15 Crawfordjohn and 24 Lesmahagow). The remaining viewpoints were judged to have minor or negligible effects. One settlement, Muirkirk, was predicted to experience a **moderate effect** resulting from the introduction of Galawhistle. No significant effects were identified for any other settlements across the study area. A **significant effect** (moderate and locally major) was identified for one route, the A70.

5.225 The cumulative assessment considered the additional effect of introducing Galawhistle into a baseline of existing and proposed developments. Significant **moderate cumulative effects** were predicted on three viewpoints (Viewpoints 3 B7078 near Lesmahagow, 23 Coalburn and 26 Track north of Galawhistle Burn). The significant cumulative effects predicted on Viewpoints 3, 23 and 24 result from closing of the 'gap' in views between Hagshaw Hill and Nutberry Wind Farms which will improve the visual balance of development in the view. **No cumulative effects** were predicted on the landscape, landscape designations, or views from settlements or routes across the study area.

Abbreviations

AGLV	Area of Great Landscape Value
AOD	Above Ordnance Datum
CLVA	Cumulative Landscape and Visual Assessment
CA	Conservation Area
CZTV	Cumulative Zone of Theoretical Visibility
GLVIA	Guidelines for Landscape and Visual Impact Assessment
GDL	Garden and Designed Landscape
km	Kilometre
LCA	Landscape Character Assessment
LCT	Landscape Character Type
LUC	Land Use Consultants
LVA	Landscape and Visual Assessment
m	Metre
NPPG	National Planning Policy Guideline
NSA	National Scenic Area
OCCS	Opencast Coal Site
PAN	Planning Advice Note
RSA	Regional Scenic Area
SA	Scenic Area
SLA	Sensitive Landscape Area
SLCA	Sensitive Landscape Character Area
SNH	Scottish Natural Heritage
SPG	Supplementary Planning Guidance
SPP	Scottish Planning Policy
SUW	Southern Upland Way
ZTV	Zone of Theoretical Visibility

Chapter 6 - Ecology

Introduction

6.1 This Chapter assesses the effects of the Galawhistle Wind Farm on important habitats and species. Where adverse effects are predicted, the chapter sets out the mitigation that will avoid or reduce these effects. Measures to secure habitat enhancement over the lifetime of the proposed Wind Farm are also given, in accordance with best practice. The location of the Wind Farm shown in Figure 6.1 and 6.2a-b.

6.2 The assessment uses data collated from a combination of desk studies, consultations and field surveys.

6.3 Consideration has also been given to underlying geology, landform and hydrology, details of which are provided in Chapter 8 (Hydrology, Geology and Hydrogeology). This was particularly important in relation to drainage and water quality, which both influence the site's riparian and aquatic wildlife (notably otter, water vole and brown trout).

6.4 In accordance with planning guidelines this chapter fully assesses potential impacts on European protected species (EPS).

6.5 Bird interests at the proposed Wind Farm are covered separately in Chapter 7 (Ornithology).

Key Issues

6.6 The key potential ecological issues relating to the Wind Farm are:

- The potential effects on designated sites;
- The potential effects on habitats, including Annex 1 and UK priority habitats;
- The potential effects on European and UK protected species (other than birds);
- Other priority habitats and species.

Methodology

6.7 This assessment has involved the following:

- Reference to relevant legislation, policy and guidance;
- Consultation with relevant statutory and non-statutory bodies;
- Detailed desk studies and site surveys to establish the existing important wildlife interests on site, and in its immediate surroundings;
- Evaluation of the potential effects of the proposed Wind Farm and the effects these could have on important wildlife interests;
- Evaluation of the significance of these effects by consideration of the sensitivity of these interests, the potential magnitude of these effects and the probability of these effects occurring;
- Identification of appropriate measures to avoid and mitigate against any potential adverse effects resulting from the development; and
- The residual significance of the predicted effects following mitigation.

Legislation and Guidance

6.8 This assessment takes into account the requirements of the following legislation, regulations and other guidance:

- Council Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Flora and Fauna (the "Habitats Directive");
- Conservation (Natural Habitats &c.) Regulations 1994 (the "Habitats Regulations");
- Conservation (Natural Habitats &c.) Amendment (Scotland) Regulations 2007
- Scottish Executive Interim Guidance on European Protected Species Development Sites and the Planning System;
- Wildlife and Countryside Act 1981;
- Nature Conservation (Scotland) Act 2004;
- Electricity Works (Environmental Impact Assessment (Scotland) Regulations) 2000 (EIA Regulations);
- Protection of Badgers Act 1992;
- National Planning Policy Guideline 14: Natural Heritage 1999;
- Planning Advice Note 60 Planning for Natural Heritage 2000;
- Guidelines on the Environmental Impacts of Wind farms and Small Scale Hydroelectric Schemes[1] ;
- Guidelines for Ecological Impact Assessment in the United Kingdom[2] ;
- Eurobats Guidelines for Consideration of Bats in Wind Farm Projects[3];
- Natural England Guidance on Bats and onshore wind turbines[4];
- UK Biodiversity Action Plan (UKBAP);
- Scottish Biodiversity List;
- South Lanarkshire Local Biodiversity Action Plan; and
- Ayrshire Local Biodiversity Action Plan.

European Protected Species Legislation

6.9 European protected species are those that are protected by the EC Habitats and Species Directive 92/43/EEC. The Conservation (Natural Habitats, &c.) Regulations 1994 translates this European legislation into UK law. The Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2007 amended the offences in regard of disturbance to a European Protected Species.

6.10 This legislation makes it an offence to deliberately or recklessly disturb European protected species. Their places of shelter are fully protected, and it is an offence to damage, destroy or obstruct access to or otherwise deny the animal use of a breeding site or resting site, whether deliberately or not. It is also an offence disturb in a manner that is, or in circumstances which are, likely to significantly affect the local distribution or abundance of the species, disturb in a manner

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[1] Scottish Natural Heritage (2001) *Guidelines on the Environmental Impacts of Wind Farms and Small Scale Hydroelectric Schemes*. SNH Natural Heritage Management Series, Perth.
[2] Institute of Ecology and Environmental Management (2006). *Guidelines for Ecological Impact Assessment in the UK*. IEEM, Winchester
[3] Rodrigues L., Bach L., Doubourg-Savage M.-J., Goodwin J., and Harbush C. (2008). *Guidelines for Consideration of Bats in Wind Farm Projects*. Eurobats Publication Series no. 3 (English version).
[4] Natural England (2009) *Bats and Onshore Wind Turbines*, Interim Guidance.

or circumstances which are likely to impair its ability to survive, breed or reproduce, or rear or otherwise care for its young. Species which are covered by this legislation include all bat species, otter and great crested newt. Any activity which is likely to affect these species requires prior consultation with the relevant statutory nature conservation organisation. In Scotland, this means that Scottish Natural Heritage (SNH) should be consulted.

6.11 A licence from the Scottish Government is required in case of potential disturbance of European Protected Species or damage or destruction of a resting site as a result of work activities. Under Regulation 44 2(e) of the Conservation (Natural Habitats etc) Regulations 1994 licences may be granted for:

- Preserving public health or safety, or other imperative reasons of overriding public interest, including those of a social or economic nature and beneficial consequences of primary importance for the environment.

6.12 Importantly, under section 3 of Regulation 44, in order for a licence to be successful, two tests must be satisfied:

- There is no satisfactory alternative (including retaining the status quo); and
- The action authorised will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in its natural range.

The Wildlife and Countryside Act 1981

6.13 The Wildlife and Countryside Act 1981 provides protection to species and habitats. The Nature Conservation (Scotland) Act 2004 amends the Wildlife and Countryside Act in Scotland.

6.14 Section 9 provides protection to certain animal species. Enhanced protection is provided for species listed in Schedule 5. Those potentially present in close proximity to the proposed Galawhistle Wind Farm were water vole.

6.15 It is an offence to recklessly kill, injure or take animals listed in Schedule 5, with the exception of water vole. Water voles are protected in respect of section 9(4) only, meaning that water vole habitat is protected, although the animals themselves are not.

6.16 It is also an offence to recklessly damage, destroy or obstruct access to any place used for shelter or breeding. Any works which may potentially cause disturbance to these species requires prior consultation with SNH.

6.17 Section 13 provides protection to wild plants. It is an offence to uproot or posses or offer for sale certain species listed in Schedule 8. It is also an offence to allow certain species such as Japanese knotweed and giant hogweed to grow in the wild.

6.18 Part two of the Wildlife and Countryside Act provides protection for certain areas which are considered to be of special interest for their flora, fauna, geology or physiographical features. It is an offence to damage any sites designated as Sites of Special Scientific Interest (SSSI). Any works which may potentially cause disturbance to these sites requires prior consultation with SNH.

The Protection of Badgers Act 1992

6.19 The Protection of Badgers Act 1992 provides full legal protection to badgers. In Scotland, this legislation was up-dated by the Nature Conservation (Scotland) Act 2004.

6.20 It is an offence to recklessly take, injure or kill a badger, or destroy or cause disturbance to their setts. SNH interprets the legislation in such a way that any sett within an active badger territory is afforded legal protection, whether it shows signs of recent use or not. In addition, badgers are afforded protection from ill-treatment. This has been defined to include preventing badgers access to their setts as well as causing the loss of significant foraging resources within a badger territory.

6.21 Licences are available for the disturbance or destruction of setts. SNH must be consulted prior to any works which could cause disturbance to badgers.

Consultations

6.22 To ensure comprehensive coverage of ecological issues, key conservation organisations were consulted during the preparation of this Chapter. The purpose of the consultations was to identify and obtain relevant existing ecological data, determine any notable information gaps, establish requirements for new ecological surveys, identify potential development design modifications that might address ecological sensitivities and identify preferred mitigation and enhancement. The summary of the key points raised by consultees relevant to this Chapter is given in Table 6.1. A full description of the scoping process is described in Chapter 2 (EIA Process).

Table 6.1 Summary of Consultations and Responses

Consultee	Date of Consultation	Summary of Response
Scottish Natural Heritage (SNH)	*8th October 2008 (Scoping response)*	SNH stated that the turbines fall within Zone 2 - Medium natural heritage sensitivity of their Strategic Locational Guidance, due to the proximity of the Muirkirk and North Lowther Uplands Special Protection Areas (SPA) and the Muirkirk Uplands Site of Special Scientific Interest (SSSI). SNH requested the effects of the proposed grid connection be assessed in combination with the proposed Wind Farm. SNH requests National Vegetation Classification surveys be carried out on habitats within the proposed Wind Farm footprint, and that efforts be made to locate any rare or nationally scarce higher and lower plant species, and avoid Priority Annex 1 habitats as part of the iterative design process. SNH also suggests surveys for bats, otters, water voles, badgers, red squirrel, and lamprey to up-date previous work on these species. Surveys should also be undertaken of any other protected species if signs are found during habitat and other surveys. SNH strongly recommends survey methods be discussed and agreed with SNH. SNH stated that full site restoration and re-instatement details at both post-Wind Farm construction and decommissioning stages should be included.
	23rd April 2009 (Consultation regarding bat survey methodology)	SNH confirmed that they would be adopting the most recent Natural England guidance for bats at this proposed Wind Farm site.

Consultee	Date of Consultation	Summary of Response
South Lanarkshire Council	*27th July 2008 (Scoping response)*	No response relating to ecological issues received.
East Ayrshire Council	*8th October 2008 (Scoping response)*	No response relating to ecological issues received, other than the need to consider Policy ENV10 of the Finalised East Ayrshire Local Plan.
Ayrshire Rivers Trust	*15th July 2008 (Scoping response)*	Responded that as all but 3 of the turbines are in the River Clyde, rather than the River Ayr catchment, they recommended contact was made with the Clyde Foundation.
Association of Salmon Fisheries Board (ASFB)	*6th April 2009 (Scoping response)*	ASFB stated that the project proposals should be conducted in full consultation with the River Ayr District Salmon Fishery Board (which holds various relevant statutory powers), Ayrshire Rivers Trust (which provides scientific advice to the Ayr DSFB) and Clyde River Foundation. ASFB is concerned that if the construction contractors do not consult the local fishery board issues such as migration obstruction, spawning bed disturbance, silt and sediment increase, point source pollution and drainage will be adversely affected.
Clyde River Foundation	*17th March 2009 (Scoping response)*	The Clyde River Foundation requested no damage is done to the watercourses within and adjacent to the proposed development site, and noted the Douglas Water is a productive salmonid fishery, with the Monks Water providing suitable spawning grounds. It requested a full baseline assessment of all watercourses likely to be affected by the construction and operation of the wind farm and made recommendations regarding pollution prevention. They also provided historical electro-fishing results for the area and were commissioned to complete 2009 surveys on site.
The Crown Estate	*6th April 2009 (Scoping response)*	Regarding invertebrates, they raised concerns over potentially harmful run-off introduced into the upper waters of Clyde and Ayr catchments. They requested culverts and watercourse crossings be constructed with consideration of timing and the effects on quantity and quality of water, and regular monitoring after installment should be undertaken to ensure continuing free passage of migrating fish. Evidence of this monitoring should also be given to the River Ayr Salmon Fishery Board and the Clyde River Foundation.
Fisheries Research Services	*8th October 2009 (Scoping response)*	Suggested that watercourses should be avoided where possible and river crossings should be minimized. The ES will need to establish the fish species present within the influence of the scheme, their distribution and abundance, and the temporal and spatial variability of water quality monitoring programmes. Furthermore consideration must be given to hydrochemistry, sediment transport and deposition, geomorphology and hydrology. They also suggested contacting Muirkirk Angling Association, who operate a fishery at Glenbuck Loch

Consultee	Date of Consultation	Summary of Response
Muirkirk Angling Association	*15th March 2009 (Scoping response)*	They did not raise any issues but requested they be kept informed of the development.
United Clyde Angling Protective Association	*27th March 2009 (Scoping response)*	They did not raise any issues but requested they be kept informed of the development.
Scottish Wildlife Trust (SWT)	*October 2008 (Scoping response)*	No response received.
SEPA	*10th September 2008 (Scoping response)*	Consideration should be made to flood risk when culverting or re-aligning watercourses, and the management of waste generated on site.
Forestry Commission Scotland (FCS)	*18th August 2008 (Scoping response)*	Stated that the main issue of concern to FCS is the potential effects the proposal may have on woodlands and specifically the consequences that any tree felling may have on the ecology and landscape of the area and environs.
Clyde Bat Group (CBG)	*18th April 2009 (Response to data request)*	The CBG holds minimal information for the Douglas area and does not hold any record of bats within 1km of the site boundary. The CBG suggested the features, forest area and open water could support bats and a presence /absence survey of these areas would be of value. The recent research on bats and turbines should be taken into account (including the Natural England guidance).
Scottish Badgers	*7th September 2009*	The group has no records of badgers within the survey area.

Baseline Studies – Establishing the Site's Existing Wildlife Interest

Data Sources

6.23 Data on the important wildlife within the study area were obtained from a combination of scoping/consultation, desk studies, and newly commissioned field surveys conducted over 2008-2009.

6.24 A variety of previous wildlife studies had been carried out on the site and adjacent to it, so the assessment has been able to benefit from this (where data are reliable and collected using appropriate survey methods). As one-off surveys can only provide a snap shot of species' presence, the value of combining reliable data from all such sources is that it provides a more robust longer-term indication of species distribution and abundance. It can also give an insight into local population changes and provide the wider context of the site, enabling its relative local importance to be more comprehensively assessed. The main additional sources used were Environmental Statements (ES) for the Spireslack, Nutberry and Hagshaw Hill Extension Wind Farms, the draft Cumberhead Long Term Forest Plan, and various open cast coal sites (OCCS) (see Figure 6.3). The resulting information is considered comprehensive, with no notable shortfalls or information gaps.

Designated Sites in the Area

6.25 Table 6.2 gives details of all the designated areas within 10km of the site boundary and the locations are shown in Figure 6.1.

6.26 Further information on their designated interests, citations and management statements are available on the SNH SiteLink website (http://www.snh.org.uk/snhi/).

6.27 Shiel Burn geological Site of Special Scientific Interest (SSSI) falls partially within the site (although no Wind Farm infrastructure lies on or near it). There are no other designated sites within or adjacent to the development.

6.28 There are twelve other SSSIs, plus three Special Areas of Conservation (SAC), Airds Moss, Coalburn Moss and Red Moss (all protected bog habitats) and one Special Protection Area (SPA), the Muirkirk and North Lowther Uplands SPA within this 10km buffer of the site boundary (as the SPA designation relates only to birds, it is dealt with in detail in Chapter 7).

6.29 Consideration has been given to the potential development effects on all these sites. By virtue of either the designated features, or the distance separating the proposed Wind Farm from these 12 SSSIs and three SACs, no effects are predicted on any of them because there are no hydrological or other pathways or vectors through which an effect could result.

Table 6.2 Designated sites within 10km

Site Name and Qualifying Feature	Distance from Site	Reason for its Designation
Shiel Burn SSSI Geological	*Partially within the site (south). 6.7ha (0.08% of the total SSSI) is within the site boundary.*	Shiel Burn (NS 777 290) lies within the application boundary west of Strawberry Hill and extends from the Monks Water valley southwest towards Shiel Hill. The site was notified for its geological interest.
Muirkirk and North Lowther Uplands SPA (26,330ha) Birds	*1.1km (northwest, west and southwest)*	The Wind Farm is near the northern part of the Muirkirk and North Lowther Uplands SPA, (classified in 2003). The SPA qualifies under Article 4.1 of the EU Birds Directive by regularly supporting breeding populations of European importance of golden plover, short-eared owl, merlin, peregrine and hen harrier, plus wintering hen harriers.
Muirkirk Uplands SSSI (19,350ha) Biological	*1.1km (northwest and southwest)*	Upland habitats within the SSSI consist of high quality *Calluna vulgaris- Erica cinerea* heather-dominated moorland, *C. vulgaris- Vaccinium myrtillus* dry heath, *Nardus stricta- Galium saxatile* acid grassland and blanket bog comprising of *C. vulgaris- Eriophorum vaginatum* wet heath and *Sphagnum* moss *Erica tetralix- Sphagnum papillosum* wet heath.
Ree Burn and Glenbuck Loch SSSI Geological	*0.7km(south)*	Ree Burn and Glenbuck Loch is of special palaeoenvironmental and palaeontological significance demonstrating changes which occurred at the time of the closure of the lapetus ocean.
Millers Wood SSSI	*3.1km (southeast)*	An area of birch and rowan woodland of a type which is rare and unusual in the District. The ground flora comprises bracken-dominated communities on the drier slopes and floristically-rich wet flushes and roadside verges. An interesting insect fauna is associated with a relict stand of Scots pine and an abundance of dead wood.
Kennox Water SSSI Geological	*3.2km (south)*	The site comprises rock exposures along a 2km stretch of Kennox Water and its associated riverbanks and cliffs.
Birk Knowes SSSI Geological	*3.87km (north)*	Birk Knowes located on the Logan Water, is one of a network of Silurian sites in the Midland Valley of Scotland.
Birkenhead Burn SSSI Geological	*4.0km (north)*	Several exposures on the south side of the Birkenhead Burn yield Vertebrate fossils.
Garpel Water SSSI Geological	*4.43km (southwest)*	Garpel Water is an important site showing a section through the Carboniferous Limestone, including marine bands in the Lower and Upper Limestone Groups.
North Lowther Uplands SSSI Biological	*4.7km (south)*	The North Lowther Uplands SSSI, an extension of the existing Rough Flow Moss SSSI, is situated to the south of the Muirkirk Uplands SSSI. The North Lowther Uplands SSSI supports a range of habitats and associated species. The dominant habitats include blanket bog, wet and dry heaths and acid grassland. The North Lowther Uplands SSSI also has a mosaic of upland grassland habitats, including localised areas of *Nardus stricta-Galium saxatile* (mat grass-heath bedstraw) acid grassland.
Blood Moss and Slot Burn SSSI Geological and Biological	*5.1km (northwest)*	Blood Moss and Slot Burn SSSI is an area of upland moorland dissected by the Slot Burn and several tributaries. The protected natural features include fossil-bearing rocks (yielding fossil fish and water scorpions) alongside the Slot Burn, and blanket bog. Blood Moss is an excellent example of blanket bog vegetation and one of the best of its type in south-west Scotland. The bog surface is gently undulating and has numerous pools and runnels providing a variety of different hydrological conditions which is reflected in the vegetation. A number of species rare or uncommon in southern Scotland occur, including tall bog-sedge *Carex magellanica*, few-flowered sedge *Carex pauciflora* and two species of bog moss, *Sphagnum imbricatum* and *Sphagnum fuscum*.

Site Name and Qualifying Feature	Distance from Site	Reason for its Designation
Dunside SSSI Geological	*5.2km (west)*	This is a locality of importance for studies of ancient arthropod faunas. Rocks of the Priesthill Group of Silurian age here yield a number of eurypterids, xiphosurans and crustaceans in association with a 'fish' fauna, and this is the type locality for eight eurypterid species. These species make up the typical and distinct fauna of the Lesmahagow area, and include specimens of large species only found elsewhere as fragments. A key site for studies of arthropod history and palaeobiology.
Coalburn Moss SAC and SSSI Botanical	*5.6km (southwest)*	Coalburn Moss is one of the best examples of lowland raised bog in the United Kingdom for its actively-growing *Sphagnum*-rich vegetation. The raised bog habitat is extensive and subtle variations in nutrient conditions within the bog affects the distribution of the individual species and gives rise to the distinctive undulating, and often colourful, surface pattern characteristic of raised bogs, with birch woodland in places.
Airds Moss SAC Botanical	*7.8km (southwest)*	Airds Moss represents one of the few remaining areas of relatively low-altitude blanket bog in south-west Scotland.
Red Moss SAC and SSSI	*8.0km (southeast)*	Red Moss is a complex area of mire vegetation situated in the broad valley of the Black Burn north of Crawfordjohn. It consists of three raised bogs with associated fen and lagg vegetation along the Black Burn and its tributaries. There is a narrow band of lagg vegetation around the outside of parts of the raised bogs. This flood plain complex of raised bogs lies in the upland margins at 260m above sea level. The raised bog expanses appear slightly domed relative to the adjacent fen and lagg vegetation. The southern most area is distinctly raised with a definite rise to the edge of the bog, marked by deep hagging and gully erosion. The fen found in the alluvial flood plain of the Black Burn complements the raised bogs and adds to the diversity of the site.
Greenock Mains SSSI Geological	*8.7km (west)*	Greenock Mains, lying 8km west of Sorn, demonstrates some of the best representative exposures in the glacial deposits of north Ayrshire dating from the last ice age, which ended 11,500 years ago.

Existing Land Use and Local Land Use Context

6.30 The site is about 2km wide and 3km long, within the western Central Southern Uplands. It comprises 2 main glens (Galawhistle and Monks Water) bounded by smooth sided, moderately steep to steep slopes. These form the flanks of 2 broad ridges, both of which have generally flattish ridge tops. Post-glaciation, the area has been covered with glacial drift (boulder clay), although there are some rock outcrops and generally shallow peat (<1.0m) overlying the boulder clay on the hill tops and saddles between hills.

6.31 The site is used for sheep rearing and has a long history of agricultural use and improvement, with the land originally comprising Monkshead Farm[5]. The resulting effects on vegetation on site are covered in more detail below.

6.32 Immediately to the west, coal mining has been carried out in various forms for over a century, with deep mines giving way to a sequence of open cast coal sites (OCCS). The latest of these, at Spireslack and Grasshill are generally being worked or awaiting restoration. The relevance of this, apart from hosting the access track to the proposed Wind Farm, is that part of the formerly mined area may eventually become available for habitat enhancement, once restoration has been completed. This partially encompasses a sequence of Scottish Coal OCCS, from Airdsgreen (restored), Ponesk (restored), Spireslack (on-going), for which the Environmental Statement (ES) was completed in 1997), the Grasshill Extension (on-going) and the proposed Ponesk Remainder (Figure 6.3)[6 7 8]. The western boundary of the Wind Farm site is therefore formed partly by the large over-burden mound of the Spireslack OCCS, along which runs a large drainage ditch dividing the mined and un-mined parts of Hareshaw Hill.

6.33 The access track for the proposed Wind Farm leads south west through the Spireslack OCCS, across ground that has mainly been open cast and is therefore heavily modified in its hydrology and habitats, with little remaining vegetation cover. The extraction has been made in stages, with operational areas still largely to undergo restoration, but with some small areas being colonised by early successional habitats. There is currently no detailed restoration plan for the Spireslack opencast coal areas, with only an indicative plan (see 1997 Spireslack OCCS ES).

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[5] The farm is shown on the 1st Edition OS 6" map, dating it to 1864 or earlier. The nature of the agricultural improvement in this area is illustrated by local historical accounts of agricultural development on the Glenbuck Estate, in the second half of the 19th century. Recounted in 'Glenbuck Memories, Extracts from James Taylor's book, Cairntable Echoes' (see http://www.ayrshirehistory.com/pdf/glenbuckmemories.pdf) it explains 'Draining and liming were carried on upon the land, replacing most of the old bleak heath with a sweet greensward of natural grasses'. This was the evolving practice on better managed hill ground, in response to the profitability of sheep farming at the time. The widespread drainage ditches were regularly maintained well into recent decades, but this has generally declined over the recent 20 years. Burning was also used as a management tool to encourage grasses to replace heathland vegetation. The date of drain cutting for the area can potentially also be inferred from an archaeological find, uncovered 'whilst drain cutting in 1864' reported in the Spireslack WFES (Scottish Coal 1997, p. 663 of Vol. 2)

[6] Environmental Statement: Extraction of Coal by Opencast Methods, Removal of Dereliction, and Enhancement of Landscape and Nature Conservation Interests at Spireslack, Glenbuck, Muirkirk, Ayrshire. Scottish Coal Ltd. February (1997).

[7] Scottish Coal Ltd. (2005) *Spireslack Wind Farm Environmental Statement*, Scottish Coal.

[8] RPS (2005) Hagshaw Hill Wind Farm Extension Environmental Statement. CRE Energy and Scottish Power Company.

6.34 To the north and northeast of the proposed Galawhistle Wind Farm there is the Cumberhead UKWAS certified private commercial conifer forest (managed by Tilhill). This 2,029ha holding, consisting mainly of sitka spruce (approximately 78%) and mainly planted in the 1970s, on deep peats, is subject of a draft Long Term Forest Plan.[9] The first felling to take place was in 2004, and is scheduled for completion in 2026. This plantation is also the location of the proposed six turbine Nutberry Wind Farm development.

6.35 To the east of Galawhistle is the Hagshaw Hill (formerly known as Common Hill) Wind Farm, operational since 1995, with its the subsequent Hagshaw Hill Extension, commissioned in 2008/09 and comprising 26 turbines. As part of the impact mitigation for the Extension, habitat enhancement in the form of native woodland planting has been completed, aimed at benefitting Hagshaw's black grouse population. The remaining open ground is used for sheep farming.

Surveys

6.36 The surveys undertaken to inform the Galawhistle Wind Farm assessment were the following:

- Extended Phase 1 Habitat Survey
- National Vegetation Classification (NVC) quadrat surveys;
- Bat surveys (scoping, roost activity and foraging activity);
- Otter survey;
- Water vole survey;
- Badger survey; and
- Salmon and trout fishery survey.

6.37 In combination with desk study results, this combination of surveys ensured the necessary level of information was available to establish a full understanding of the site and its important wildlife and habitats.

Extended Phase 1 Habitat Mapping and NVC Quadrat Surveys

Methodology

6.38 Comprehensive Phase 1 Habitat surveys were carried out over an extended period for this ES, on 17th and 18th of September 2008 and 16th July and 10th, 11th and 17th August 2009. NVC quadrat surveys were undertaken during the 2009 surveys (including a supplementary visit on 6th October 2009) and focused on potential Annex 1 habitats in proximity to the Wind Farm infrastructure. To provide added context, reference was also made to 2003 and 2004 Phase 1 and NVC work carried out by JDC Ecology (for Scottish Coal Ltd's Spireslack Wind Farm application) and to Phase 1 Habitat Surveys on the adjacent Ponesk Remainder Surface Mine (Scottish Coal Ltd. 2009), Nutberyy Hill Wind Farm (RDC 2007)[10] and Hagshaw Hill Wind Farm Extension site (RPS 2005)[8].

6.39 In all cases, the Phase 1 Habitat Survey followed the methodology described in JNCC (2003)[11] and the NVC survey methodology included in Rodwell, J.S.[12].

Results

6.40 The 2008/2009 Phase 1 Habitat map and NVC quadrat locations are shown on Figure 6.4a-d.

6.41 Phase 1 Target notes are given in Appendix 6A, together with NVC quadrat survey results and photographs of the site to give an impression of the area and its vegetation communities.

6.42 Given that the site has previously been subject to a Phase 1 Habitat Survey for the Spireslack Wind Farm, Target Notes from this work (carried out over 7.5 days in October 2003) are also provided in Appendix 6A, to give added insight into the area's vegetation. The location of Target Notes and NVC quadrats are shown in Figure 6.4a-d.

6.43 From the breakdown of habitat results, the site can be broadly divided into the:-

- Access track, across the current open cast coal areas;
- Lower ground, associated with the valley bottoms and in-bye; and
- Hill slopes and tops, which support a range of upland habitats.

6.44 All habitats encountered are characteristic and common in this part of southern Scotland.

Habitats Adjacent to the Access Track

6.45 The Wind Farm's access track runs through the Spireslack OCCS (Figures 6.4c-d). Habitats consist mainly of bare spoil with ephemeral vegetation and grassland including *Agrostis/Festuca* dominant with other grasses and *Euphrasia officinalis* and *Ranunculus repens, Leontodon* spp, *Epilobium brunnescens* and dog lichens *Peltigera canina*. The track also crosses areas of neutral grassland dominated by tufted hair grass *Deschampsia cespitosa* with soft rush *Juncus effuses,* and smaller sections flanked by wet modified bog. There are also limited sections flanked by marshy grassland, comprising a mosaic of rush communities dominated by *Deschampsia cespitosa, Juncus acutiflorus* and other rushes *Juncus* spp with *Angelica sylvestris*, *Agrostis stolonifera* and *Cirsium palustre* occasional *Filipendula ulmaria, Lathyrus pratensis* and a wide variety of sedges including *Carex flacca*.

6.46 Areas of open water, mainly artificial lagoons, are located at various points around the mine site. Some have partially re-vegetated and support open water plants, emergent and swamp communities, with *Typha latifolia*, *Carex rostrata* and some pond weeds over large areas of the open water *Potamageton* spp with emergent *Typha latifolia,* and marginal water forget-me-not *Myosotis scopioides*.

Habitats Within the Wind Farm Area Associated with Valley Bottoms and In-bye

[9] Tillhill Forestry (2005) Cumberhead Forest Plan Complex Forest Plan. Prepared by Tillhill Forestry on Behalf of Electricity Supply Nominees Ltd. According to Long Term Forest Plan Map 3: Design Concept of the Forest Plan, the majority of the plantation is on deep peat (>1m), as mapped and defined by the British Geological Survey. In terms of forest cover,, as of 2005, 1,800ha of the 2,029ha had conifer plantation, 5.5ha had native broadleaves, 46.3ha were felled and due for replanting, and 177.4ha were open ground.

[10] RDC (2007) Nutberry Supplementary Additional Information.

[11] JNCC (2003). *Handbook for Phase 1 Habitat Survey*. Joint Nature Conservation Committee, Peterborough.

[12] Rodwell, J.S. (1991) *British Plant Communities, Volume 1 Woodland and scrub.* Cambridge University Press, Cambridge; Rodwell, J.S. (1991) *British Plant Communities, Volume 2 Mires and heath.* Cambridge University Press, Cambridge; Rodwell, J.S. (1992) *British Plant Communities, Volume 3 Grassland and Montane Communities.* Cambridge University Press, Cambridge; Rodwell, J.S. (2006) *National Vegetation Classification: Users' handbook*. Joint Nature Conservation Committee: Peterborough.

6.47 The lower ground on site consists of the valleys of the Monks Water and Galawhistle Burn. The main communities are *Festuca-Agrostis* with some *Holcus* and *Cynosurus cristatus* with *Anthoxantum odoratum.* These are neutral grasslands and some more base-rich, localised flushes.

6.48 Whilst sheep grazing occurs over much of the site, notably over the hill areas Hareshaw, Arrarat and Wedder Hill, it is generally concentrated on the margins of the Monks Water and the in-bye at Monkshead Farm.

Habitats on Upper Slopes and Hill Tops

6.49 The hill areas support a combination of wet modified bog, wet heath and acid grassland, and acid flushes with areas of neutral grassland and dry heath and bracken on steeper slopes. Peatland and acidic habitats dominate the site but there are some water seepage areas and wetlands with the steeper slopes supporting dry heath and acid grasslands.

6.50 Acid grassland was found on areas on the south west of the site on thinner more drained soil, which corresponds with NVC type U4 *Festuca ovina-Agrostis capillaries-Galium saxitile* grassland. There are also areas with frequent *Juncus squarrosus* (U6 *Juncus squarrosus – Festuca ovina* grassland) *and Nardus stricta* (U5 *Nardus stricta – Galium saxatile* grassland) especially grading to more heathy areas or in mosaic with wet and dry heath. These covered the hill areas and were mainly associated with the grassland communities on the steep slopes on the west side of Arrarat Hill. In the lower lying areas often associated with the margins on the opencast areas there was frequent *Deschampsia cespitosa* and potentially *representative of* U13 *Deschampsia cespitosa – Galium saxatile* grassland.

6.51 Extensive areas of bracken (*Pteridium aquilinum*) occur at various locations around the site, particularly at mid-altitudes, and on steep stream-side valleys, with the greatest extent on the western flanks of Arrarat Hill. These equate to the NVC community U20.

6.52 There are small areas of dry heath on site, some areas with *Calluna* dominant and some with *Vaccinium myrtillus* (possible NVC type H18 *Vaccinium myrtillus – Deschampsia flexuosa* the most prominent on the west side of Arrarat Hill). These dry heath areas were generally too small to map, often being in mosaic with acid grassland. These are away from the development infrastructure and are therefore not likely to be affected.

6.53 Assigning the most appropriate Phase 1 Habitat community to the hill top bog and heath vegetation is complex, and is in large part, a matter of the relative weight given to different criteria used in Phase 1 and NVC definitions. To assist in the interpretation of habitats, therefore, information from peat probing was used.

6.54 The results of the peat mapping (which are discussed in more detail in relation to Hydrology, in Chapter 8, and peat slide risk in Technical Appendix 3), show in general that peat depths on site are relatively shallow (primarily less than 1m), and that on the eastern side of the Wind Farm in particular, extensive areas are shallow peat (less than 0.5m) (see Figure 6A.1 in Appendix 6A).

6.55 Artificial drains were also mapped (from the aerial photo), helping to reveal hydrological modification and agricultural improvement carried out (Figure 6A.2 in Appendix 6A). The characteristics of these drains was examined in the field, notably whether they continued to drain the surrounding habitat, their depth and degree of incision through peat layers (many cut through the peat and exposed the under-lying til), and any signs of vertical or lateral erosion taking place.

6.56 The majority of peatland habitats have been subjected to historical drainage, with many a number of these drainage ditches still active. A smaller proportion, estimated to be approximately 5-10% (based on a sub-sample visited during a one-day assessment in September 2009) were showing active lateral erosion. The majority drain to the north and west into the Monks Water from the slopes of Wedder Hill and the western and northern slopes of Hareshaw Hill. Many hillside drains have widened and deepened over time, in some places reaching approximately 1.3m-1.6m deep and over 1m wide. The lower and flatter wet modified bog and wet heath areas are also partly drained in places but many of these drains are not as functional (but probably have a small localised negative effect on water run-off).

6.57 The NVC communities which comprise the wet modified bog and dominate the hill tops are M20 *Eriophorum vaginatum* blanket mire and M19a mire *Calluna vulgaris – Eriophorum vaginatum, Erica tetralix* sub-community. Peat depth is predominantly shallow, generally <1m but frequently <0.5m deep. *Sphagnum capillifolium* is the dominant moss species although small patches of other *Sphagnaceae* were noted. The characteristic feature of these areas, is the overwhelming dominance of *Eriophorum vaginatum* which forms the bulk of the structural component of the vegetation in tussocks. Averis *et al* (2004)[13] describes this vegetation and its associated variation more clearly than Rodwell 1991[14], noting additional sub-communities, which accurately describe the variation in the vegetation here. This vegetation is a modified and impoverished form of bog vegetation. Rodwell (1991) notes that variation between M20 and M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire is continuous, and that transitions from one to the other are common. However, *Calluna vulgaris* and *Vaccinium myrtillus* do not form a conspicuous part of the vegetation here, being heavily suppressed by grazing. Reduced grazing pressure would be likely to favour the ericoid sub-shrub component of the vegetation and may over long time periods lead to a shift away from M20 and towards M19[14], where *Calluna vulgaris* would increase its cover relative to *Eriophorum vaginatum*.

6.58 Areas of purple moor-grass M25 *Molinia caerulea – Potentilla erecta* mire are also found. However, it was sometimes difficult to distinguish between M25 mire and *Molinia* dominated wet heath as the peat depth varied but generally the bog moss content and species diversity was more variable in the wet heath areas with some other heath component.

6.59 On the western slopes of Hareshaw Hill, extensive drainage has occurred. This has modified habitats creating complex mosaics of wet heath, acid grassland, patches of wet modified bog and with frequent acid flushes of *Juncus*. The complex mosaic has large old field drains which have disrupted the normal hydrology and therefore altered the natural drainage pattern, contributing to the difficulty in mapping these habitats.

6.60 There are localised occurrences of other types of mire community including M17 *Scirpus cespitosus- Eriophorum vaginatum* blanket mire and M15 *Scirpus cepitosus-Erica tetralix* wet heath, located on the northern lower slopes of Hareshaw Hill. Much of this area is also drained and this has had some negative effect on the mire communities. This community of *E.tetralix* and *Calluna* are typically accompanied by abundant deergrass *Trichophorum cespitosum* and purple moor-grass *Molinia caerulea* which graded into flushed vegetation.

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[13] Averis, A.M., Averis, A.B.G., Birks, H.J.B., Horsfield, D., Thompson, D.B.A and Yeo, M.J.M. (2004) *An Illustrated Guide to British Upland Vegetation* Joint Nature Conservation Committee, Peterborough

[14] Rawes (1983) Changes in two high altitude blanket bogs after the cessation of sheep grazing *Journal of Ecology* **71** 219-235, summarised in Rodwell 1991.

6.61 Acid flush occurs throughout the site and is particularly frequent on the hills running off the peatland margins. These flushes are quite complex and generally include rush species and some *Sphagnum*.

Notable Flora

6.62 Previous surveys by JDC Ecology in 2003 and 2004 found cloudberry *Rubus chamaeamorus* on Wedder Hill, with cranberry *Vaccinum oxycoccus* and round-leaved sundew *Drosera rotundiflora* on the lower lying bog and wet heath. Cloudberry was also reported from the ecological audit of the adjacent Cumberhead Forest (Tilhill 2005), These three species are all listed as priority species in the South Lanarkshire LBAP. There were no additional notable plants located during the ecological surveys carried out for this ES.

European Protected Species

6.63 This section of the chapter describes the evidence of European protected species (for which the UK and Scottish governments have a responsibility to maintain in favourable conservation status).

Bat Scoping Survey

Methodology

6.64 An initial desk study was undertaken prior to surveys, using basemaps and aerial photographs to assess the potential value of the site and its surroundings for bats. This also involved identifying bat species known to have occurred locally, using Environmental Statements from nearby developments, consultee data, the National Biodiversity Network and Haddow and Herman[15] .

6.65 The Hagshaw Hill Extension ES (RPS 2005) included a bat roost risk assessment which concluded there was only a low likelihood of bats roosts within its boundary. On this basis, and the assumption that bats would not use the hilltops as significant foraging habitat, no further bat surveys were undertaken for that development.

6.66 A combined Extended Phase 1 Habitat Survey and protected species survey was carried out for the Ponesk Remainder ES on 28th and 29th August 2008 (Scottish Coal 2009). However, it did not include a bat roost risk assessment, bat survey work or consideration of the development's impacts on these European Protected Species, so this ES provides no contextual insights into bat activity to the west of Galawhistle.

6.67 No consideration of bat roosts or bat surveys was given either for Scottish Coal Ltd.'s proposed Spireslack Wind Farm (in their 2005 ES) or through the original ES for the Spireslack OCCS (Scottish Coal 1997). Both these developments do, however, pre-date the more recent emphasis on the need to assess possible development effects on bats.

6.68 Informed by this background data, a scoping survey was undertaken for the Galawhistle Wind Farm on site on 29th August 2008 to check the habitats present and any structures of value or potential value to bats. This assessment of bat roost potential was undertaken following the standard guidelines published by English Nature[16] and the Bat Surveys Good Practice Guidelines[17]. A detailed inspection of potential bat roosts was not undertaken at this stage of the assessment.

Results

6.69 Consultees did not highlight any bat roosts within 1km of the site. Records indicated that the species previously known to occur in the area were:

- Soprano pipistrelle (*Pipistrellus pygmaeus*) – common and widespread;
- Common pipistrelle (*Pipistrellus pipistellus*) – common and widespread;
- Brown long-eared bat (*Plecotus auritus*) – scarce and widespread;
- Daubenton's bat (*Myotis daubentonii*) – scarce and widespread; and
- Natterer's bat (*Myotis nattereri*) – scarce and widespread.

6.70 Two sites were identified with bat roost potential within the site boundary, one with high potential and very likely to hold a roost/s and the other with low potential, being of only limited suitability and a relatively small structure.

6.71 The high potential bat roost was located at a derelict farmhouse and outbuildings at Monkshead (NS 770300) (Photographs 1-3). This farmstead comprises three roofed and one unroofed buildings, and from inspections there is access for bats to the loft and wall cavities.

6.72 Low potential for bat roost was found at an old brick built railway bridge (NS 772313) over a small burn (Photograph 4). There are gaps in the stonework, which might provide roost locations for bats at some time of the year but none were found during the survey period. The majority of these crevices were shallow although of slightly higher quality at the south side.

6.73 Elsewhere on site, there were no other structures or features considered likely to be used for roosts. The edges of plantations and treetops provide valuable foraging bat habitat because they harbour invertebrate populations. However, most coniferous and young broadleaved trees due to their young age have little potential to contain cavities and therefore are not regarded as having any potential for bat roosts.

[15] Haddow , J.F.and Herman, J.S. (2000). *Recorded Distribution of Bats in Scotland*. Scottish Bats 5.
[16] Mitchell-Jones, A.J. (2004). *Bat Mitigation Guidelines*. English Nature. Peterborough.

[17] Bat Conservation Trust (2007). *Bat Surveys – Good Practice Guidelines*. Bat Conservation Trust, London.

Photograph 1 Derelict building (back)

Photograph 2 Derelict building and adjacent buildings

Photograph 3 Derelict building (front)

Photograph 4 Old railway bridge

Bat Roost Activity Survey

Methodology

6.74 Having established the distribution and nature of potential bat roosts on site, an activity survey and detailed inspection of the two potential roosts found during the bat scoping survey were carried out. The buildings were surveyed on 3rd and 12th of September and the bridge on 8th and 21st of September 2008.

6.75 Two dusk surveys were undertaken at each potential roost by two experienced surveyors, following standard guidelines[18]. Surveyors were positioned at different vantage points around the building and railway bridge.

Results

Monkshead Derelict Farmhouse and Outer Buildings

6.76 The derelict building at Monkshead contained one roost entered by a common pipistrelle at the north-western corner. A second common pipistrelle appeared to have left the building at the north-eastern corner.

6.77 The species recorded passing during the Monkshead roost activity survey were common pipistrelle, soprano pipistrelle, Natterer's bat and brown long-eared bat (all consistent with the species identified during the desk study as present in the wider area).

Old Railway Bridge

6.78 During the activity survey no bats entered or left the railway bridge so evidently it was not being used as a bat roost at the time of the survey. Given that roosting crevices are limited and wet, it is considered therefore that this location is not likely to be used for roosting at any time.

6.79 Bats were recorded passing (but not in or out of the structure) during this Railway Bridge roost activity survey. These were small numbers of soprano pipistrelle and common pipistrelle, and the few feeding buzzes recorded indicated that these bats were commuting between roosts and feeding sites.

Bat Activity Survey

Methodology

6.80 To assess bat use of the wider site, not associated with actual or possible roost locations, bat foraging surveys were undertaken in three visits in 2008, on the 29th August, 3rd and the 12th September. Three additional visits were undertaken in 2009, on 1st June, 29th June and 6th August, following the publication of new Interim English Nature Guidance (as requested by SNH- see Table 6.1). No surveys were undertaken in April/early May due to the bad weather conditions recorded during this period (not suitable for bat surveys).

6.81 The habitats given particular consideration during these surveys because of their known potential for foraging usage were:

- Woods, particularly sheltered edges and areas on wet soils where insect productivity can be high and edges provide shelter from wind exposure;
- Unimproved grasslands, mashes and wetlands;
- Heathlands and peatlands; and
- Hedgerows and small dens (gullies) provide easy connectivity up onto higher land.

[18] Bat Surveys (2007) Bat Conservation Trust; Bat Mitigation Guidelines (2004) A J Mitchell-Jones, English Nature; Bat Surveys For Development Proposals In North-East England (2004). English Nature.

6.82 A survey route was therefore drawn up based on a combination of the location of potential foraging habitat and the proposed locations of Wind Farm infrastructure. Point count survey locations were set up to cover the proposed turbine locations and any structures which provide bat foraging habitat. The 2008 survey covered a wider area reflecting an early turbine layout.

6.83 The survey routes covered the Wind Farm site, but health and safety restrictions meant that the access route could not be surveyed because no access to the site was allowed outside normal working hours (with the bat work having to be done generally in hours of darkness).

6.84 The survey was undertaken with an Anabat bat detector and hand held detectors (Duet Bat box and Petterson recording device, which allows analysis of recordings with specialised software).

Results

6.85 The following species of bat were recorded during the 2008 and 2009 foraging activity surveys, as shown in Figure 6.5a and 6.5b respectively

- Common pipistrelle;
- Soprano pipistrelle;
- Brown long-eared;
- Daubenton's; and
- Unidentified *Myotis* species (either Natterer's or Daubenton's).

6.86 Again, this is consistent with the previous knowledge of bats from the wider area. The more varied and sheltered woodland edges, rides and glades outside the site provide a greater abundance of invertebrate prey than on the top of the open moor. The site is not therefore likely to constitute a significant foraging resource for bats locally.

6.87 The results of the comprehensive bat survey work on site over two years give evidence that small numbers of common bat species range over most of the site, including the upland areas where they appear to be commuting between roosts and feeding areas. The extent of foraging activity detected across the site is low. The species present on site are those already known from the wider area. There is only one roost location on site, at Monkshead Farm. This is an abandoned structure that can support small numbers of roosting bats at any time of year but is not suitable for maternity roosts with large numbers of bats. Apart from this abandoned farm, the risk of other roosts occurring elsewhere on site is concluded to be low. Given the similarity in their location and habitats, the level of bat activity is likely to be very similar to that at the operational Hagshaw Hill Extension Wind Farm.

Otter Survey

Methodology

6.88 A combination of desk study and fieldwork was undertaken to determine the nature and extent of otter activity at the proposed Galawhistle Wind Farm. This involved using basemaps and aerial photographs to assess the potential value of the site and environs for otters. Other sources of existing information were also collated, notably from Environmental Statements from other recent development proposals in the area, plus consultee records and the National Biodiversity Network.

6.89 It was evident from this desk study that a sequence of otter survey work had previously been undertaken in the area. This was used where data were considered robust and collected by suitably experienced ecologists using the correct methodologies, at appropriate survey times.

6.90 A protected mammal survey was carried out in November and December 1998, and again on 8th April 2004 by Scottish Coal's ecologist. The first was completed for their Spireslack OCCS and the latter with their Wind Farm (the latter based on survey methods set out in Chanin 2003[19]). Consequently, the 1998 survey covered the Stottencleugh and Galawhistle Burns (prior to the latters' diversion), and the 2004 survey extended to include all burns and main ditches within their proposed Wind Farm site. By 2004, the upper reaches of the Galawhistle Burn had been diverted as part of the Spireslack OCCS (see Figure 6.2b), so the Burn was checked from its Monks Water confluence up to NS765310. Beyond this point, the survey moved uphill to cover the un-named tributaries that drain the slopes of Little Auchinstilloch into the interception/cut-of ditches that Scottish Coal dug across slope, above the northern boundary of the OCCS (see Figure 6A.2 in Appendix 6A). All watercourses and major ditches were walked, noting any signs of otters and potential otter resting up sites within 10m of the bank top.

6.91 A combined Extended Phase 1 Habitat Survey and protected species survey were carried out for the Ponesk Remainder ES on 28th and 29th August 2008 (Scottish Coal 2009). It covered the Ponesk Burn (the proposed diversion plus 100m upstream) and adjoining stretch of the River Ayr, and followed SNH guidance for otter surveying. However, it was acknowledged that the wet weather prior to the survey had raised the water levels and therefore reduced the likelihood of observing otter signs (p. 11.9 of the Ponesk Remainder ES).

6.92 The Hagshaw Hill Extension ES (RPS 2005) included an otter survey by a mammal survey specialist over two days in September 2004. All watercourses mapped on the 1:50,000 OS map were checked, including the Podowrin Burn, which forms part of the eastern edge of the Galawhistle Wind Farm site.

6.93 RPS undertook protected species surveys (two surveyors over four days in April 2005) for the Nutberry ES. This work used the survey methods set out in Chanin 2003[19]) and covered 50m up and downstream where watercourses were crossed by the proposed access track or adjacent to turbine sites. Signs being searched for were spraints, footprints, lying up sites, potential holts or couches, and meal remains. This was supplemented by further work in September 2007 (following Strachan 2006 [20], and Green, R. and Green, J. 1997 [21]), which covered water courses 600m up and downstream from proposed Wind Farm infrastructure.

6.94 There were no further records from consultees within 1km of the site.

6.95 The otter survey carried out for the Galawhistle ES took place throughout several days in 2008 and 2009. Surveys were undertaken on 28th of April, 27th of May, 15th August 2008 and 14th July 2009 searching for field signs along Monks Water, Galawhistle Burn and Podowrin Burn. A further otter survey was carried out along the proposed access track (within the opencast area) on 10th and 11th August 2009 on all watercourses and open water. The otter survey involved systematically searching for field signs along water bodies and adjacent areas located within 250m of development infrastructures. Otter field signs are described in Bang & Dahlstrøm[22] and Sargent & Morris[23] , and are:

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[19] Chanin, P. (2003). Monitoring the Otter *Lutra lutra*. Conserving Natura 2000 Rivers Ecology Series No 10. Peterborough, English Nature

[20] Strachan, R. (2006). *The Water Vole Conservation Handbook*. Second Edition. Wildlife Conservation Research Unit, Department of Zoology, University of Oxford.

[21] Green, R & Green, J (1997) *Otter Survey of Scotland 1991-1994*. Vincent Wildlife Trust, London

[22] Bang, P & Dahlstrøm, P. (2001) *Animal Tracks and Signs*. Oxford University Press, Oxford.

[23] Sargent G. & Morris, P. (2003). *How to Find & Identify Mammals.* The Mammal Society, London.

- Holts;
- Couches;
- Prints; and
- Spraints.

6.96 Any of the above signs are diagnostic of the presence of otter; however, it is often not possible to identify couches and holts with confidence unless other field signs are also present. Spraint is the most reliably identifiable evidence of the presence of this species.

6.97 Visits were limited to periods of low rainfall to ensure signs would not have been washed away.

Results

6.98 The compilation of results from the various recent otter surveys is shown in Figure 6.6

6.99 The 1998 otter survey by Scottish Coal found no otter signs along the Galawhistle Burn but the lower reaches of the Stottencleugh Burn were considered important otter habitat and otters were also present at Glenbuck Loch.

6.100 As of 2004, Scottish Coal's survey found no otter signs along the Galawhistle Burn or its tributaries on the slopes of Little Auchinstilloch. Along the Stottencleugh Burn, signs were absent from its upper reaches but two spraints were found in it's mid-reaches (plus one spraint was found in 2003 during Phase 1 Habitat Surveys). The 2004 survey found signs at four locations along the Monks Water (three spraint and a footprint).

6.101 The Scottish Coal two day riparian survey, along the Ponesk, for the Ponesk Remainder ES was completed in sub-optimal weather and water level conditions. This may have accounted for the fact that only one spraint was located along the Ponesk and River Ayr sections covered.

6.102 To the east of Galawhistle, the RPS 2004 surveys for the Hagshaw Hill Wind Farm Extension found no signs of otter using the site. To the north, the RPS Nutberry ES surveys in the Cumberhead Forest recorded no signs of otter being present in 2005 or 2007.

6.103 From the more recent Galawhistle 2008 and 2009 RPS data, the results were consistent with the above, the evidence showing distribution limited to the Monks Water and the River Ayr corridor, Three spraint locations were found, plus one otter holt adjacent to the Monks Water. This was judged to be a non-breeding shelter (holt), and therefore a temporary rest up site probably used on occasions while hunting along the burn.

6.104 Drawn from specialist surveys in 1998, 2004, 2005, 2007, 2008 and 2009, the above results provide consistent site-specific and contextual data from which to assess the predicted effect on otters of the proposed Galawhistle Wind Farm.

6.105 All the evidence indicate the site and its surroundings are of relatively low importance for this species, with use of the Wind Farm area limited to infrequent foraging along burns, and potentially occasional movements between catchments across open ground.

UK Protected Species

Water Vole Survey

Methodology

6.106 Water vole surveys were undertaken within all areas of suitable habitat within 100m of proposed development structures during 28th April, 27th May and 15th August 2008, and 14th July, 10th and 11th August 2009. Water vole signs were searched for in water courses and open water within the site boundary. Water vole field signs are described below from Strachan :

- Faeces – recognisable by their size, shape, and content, and (if fresh) also distinguishable from rat droppings by their smell;
- Latrines – faeces are often deposited at discrete locations known as latrines;
- Feeding stations – food items are often brought to feeding stations along pathways and at haul out platforms, recognisable by neat piles of chewed vegetation up to 10cm long;
- Burrows – appear as a series of holes along the water's edge distinguishable from rat burrows by size and position;
- Lawns – may appear as closely grazed areas around burrow entrances;
- Nests – where the water table is high above ground, woven nests may be found;
- Footprints – tracks may occur at the water's edge and lead into vegetation cover, may be distinguishable from rat footprints by size; and
- Runways in vegetation – low tunnels pushed through vegetation near the water's edge, less obvious than rat runs.

6.107 As with many species, droppings are the best and most reliable evidence for the presence of this species. Feeding remains cannot always be reliably distinguished from field vole feeding remains, and footprints are rarely clear enough to be relied solely on as diagnostic evidence.

6.108 The survey areas in the previous ES studies (referred to in paragraphs. 6.99 to 6.102) were covered for water voles.

Results

6.109 No consultees had records to indicate water vole were present within the site.

6.110 No signs of water voles were recorded from the surveys for Nutberry or Hagshaw Extension Wind Farm developments, the Ponesk Remainder ES or the Spireslack OCCS ES. The 2004 Scottish Coal Wind Farm ES surveys did, however, find numerous signs of water vole (burrows, droppings and cuttings of grasses and rushes) all the way along Monks Water (from NS784287 to NS775315). Burrows and droppings were also found along the tributaries of the Galawhistle Burn as far up as NS766310. In addition, droppings and runs were noted during the Oct. 2003 Phase 1 survey in the grassland at NS741314 (Figure 6.7).

6.111 No water voles signs were found along the watercourses that cross the access tracks and within the current opencast site.

6.112 The 2008 and 2009 Galawhistle surveys located old signs of water vole activity (mainly in the form of old burrows) along the edge of Monks Water, but these burrows showed no recent signs of activity. It therefore appears water vole are no longer present on site.

6.113 A possible explanation for the decline of water voles in the Monks Water catchment since 2004 is the spread of mink. From signs found during the recent surveys, mink are now present along

Monks Water, whereas in 2004, the Spireslack ES (p. 295 Volume 2) states that, although present at Glenbuck, there were no sign of mink along Monks Water.

Badger Survey

Methodology

6.114 A badger survey was carried out on 9th July 2009. All ground within 100m of development infrastructures was searched for field signs of badger as shown in Figure 6.8. Additional notes were taken during the other species surveys. Field signs of badger are described in Neal & Cheeseman[24], Bang & Dahlstrøm and SNH[25]. Field evidence searched for included:

- Setts;
- Prints;
- Latrines (and dung pits used as territorial markers);
- Hairs;
- Feeding signs (snuffle holes); and
- Paths.

6.115 Any of the above signs can be taken as diagnostic evidence of the presence of badger.

6.116 Surveys for badgers were carried out as part of the ES studies referred to above, and used the same method.

Results

6.117 There were no existing data from consultees on the occurrence of badgers on site or from within the locality. Badgers were not recorded within the Scottish Coal Spireslack Wind Farm area or in the Grasshill/Stottencleugh conifer plantation to the west of the site, when they were surveyed in 2002. During the Phase 1 survey of October 2003 three badger setts were recorded (considered to have established during the 2002-2003 period). In 2004 (during a June breeding bird visit), evidence of foraging activity was located in the plantation north of Wedder Hill. Overall, the badger specialist (John Darbyshire) who carried out these surveys considered that whilst it was possible that badgers used the site for foraging at least on an occasional basis, there was a lack of suitable locations on site for establishing a sett in the vicinity of the proposed wind farm.

6.118 The Hagshaw Hill Extension area was considered to offer limited suitable foraging habitat, other than the improved grassland to the south of the site, and as a reflection of this, no evidence of badgers were found on site (or in the plantation to the north, which was also checked). This is consistent with information contained in the Cumberhead draft Long Term Forest Pan, which makes no reference to any badger signs or setts having been recorded. The surveys undertaken for the Nutberry Wind Farm (RPS 2005) recorded two tracks at one location on an existing track (NS774334) and one possible spraint (NS755326). One further record of foraging activity on a forest track was recorded in September 2007 in follow-up otter/water surveys, located at NS759335). The plantation was judged not suitable habitat for badger setts, and it was concluded that whilst badgers may use the site for foraging and travelling, they were not resident.

6.119 The Ponesk Remainder area was searched for badger signs in 2008 but no evidence of activity was found.

6.120 The 2008 and 2009 badger survey work for the Galawhistle ES only recorded use of the site for foraging around the small semi-natural mixed woodland to the south (Figure 6.8). Additional field signs (droppings and tracks) of badger were found near the site's southern boundary during the Bat Scoping Survey on the 29th of August 2008.

6.121 The evidence from this sequence of surveys on site and in adjacent areas all support the conclusion that the Wind Farm infrastructure area does not contain any badgers setts, and that there is limited suitable habitat in which setts are likely to occur. There is some use of the wider site, as evidenced by sings of foraging and travelling.

Red Squirrel Assessment

6.122 SNH in their response highlighted the desirability of surveying for red squirrels. Having reviewed existing information, this was not considered necessary, given the consistent local evidence that they are not present in the area, and the fact that the Galawhistle site does not contain suitable habitat for this species. The forests off-site but adjacent have been checked for red squirrel in 2005 (Nutberry ES RPS 2006), Hagshaw Hill Extension (RPS 2005), and for the Spireslack proposed Wind Farm (which used hair tubes) or the Ponesk Remainder ES (Scottish Coal 2009). Consultation with the shooting tenant of Cumberhead Forest (carried out in 2005 for the Long Term Forest Plan) also did not reveal any records of this species, On the basis of the above, this species is not considered further in the assessment, as it is not present on site or adjacent to it.

Fish Survey

Methodology

6.123 A desk study of salmon and trout populations was undertaken for the Monks Water and the Douglas Water (including Podowrin Burn) but limited information was available on these areas.

6.124 An electrofishing survey was also completed by the Clyde River Foundation (CRF) on 12 sites between 13th July and 12th August 2009 and data used for the assessment of effects of this development. The study area and sample locations are shown in Figure 6.9.

6.125 The electrofishing method uses electricity to attract and stun fish, which allows operators to remove them from the water. The fish are transferred to a holding container until they have recovered and then anaesthetised using a mild alcohol solution. Each individual is then identified, weighed, measured and returned unharmed to the area from which they were captured.

6.126 Fish densities were calculated for different age classes, with fry referring to fish less than one year old resulting from spawning at the end of the previous year and parr to older fish.

6.127 The full CRF report, including detailed description of the methodology used for this survey, is provided in Annex 6B.

Results

6.128 In terms of habitat and drainage features of the site's water courses, details from the desk study and hydrological fieldwork are provided in Chapter 8 (Geology, Hydrogeology and Hydrology). Existing data on the site's fish populations were limited because surveys had not generally been undertaken for the ES studies for surrounding developments. For the Hagshaw Hill Extension, for example, the Clyde River Foundation supplied data from one end of the site (Podowrin Burn) as

[24] Neal, E. & Cheeseman, C. (1996). *Badgers*. Poyser Natural History, London.
[25] Scottish Natural Heritage (2001). *Scotland's Wildlife: Badgers and Development.* SNH, Battleby.

work at this location was already underway as part of on-going electrofishing surveys for the Clyde catchment. No further fishery surveys were carried out for the rest of the Hagshaw Hill Extension watercourses (which feed into the Douglas Water), or for the Spireslack Wind Farm or Nutberry Wind Farm proposals.

6.129 Surveys were therefore specifically commissioned for the Galawhistle Wind Farm and recorded a total of four fish species on site. All were considered typical of those found in watercourses in the River Clyde Catchment without free access from the sea (due to obstacles preventing migratory species gaining access). As shown in Table 6.3, brown trout were ubiquitous, stone loach were almost the same (recorded at 11 out of the 12 survey stations), minnow present at 4 and three-spined stickleback at one. Minnows were found at a cluster of 4 stations around the lower ends of the Monks Water and Podowrin Burn. Elsewhere the fish communities were composed of brown trout and stone loach.

Table 6.3 Site-specific Fish Communities

Site Ref	Site Name	Fish Species					
		Brown Trout		Stone Loach	Minnow	3-spine Stickle-back	Brook Lamprey
		0+	1++				
1	Douglas Water u/s Monks water	*	*	*	*	*	*
2	Douglas Water u/s Podowin Burn	*	*	*	*		
3	Douglas Water u/s Carmacoup Burn	*	*	*			
4	Monks Water u/s Galawhistle Burn	*	*	*			
5	Monks Water d/s Galawhistle Burn	*	*	*			
6	Monks Water @ Monks Head	*	*	*			
7	Monks Water 1km u/s Monksfoot	*	*	*	*	*	
8	Monks Water @ Monksfoot	*	*	*	*	*	
9	Galawhistle Burn 600m u/s Monks Water	*		*			
10	Galawhistle Burn 250m u/s Monks Water	*	*	*			
11	Podowrin Burn @ Low Broomerside Farm	*	*	*			
12	Podowrin Burn u/s Douglas Water	*	*	*			

6.130 Multiple year classes of trout were present at all stations, except Station 9, on the upper reach of Galawhistle Burn, nearest to the Spireslack OCCS (Diagram 1).

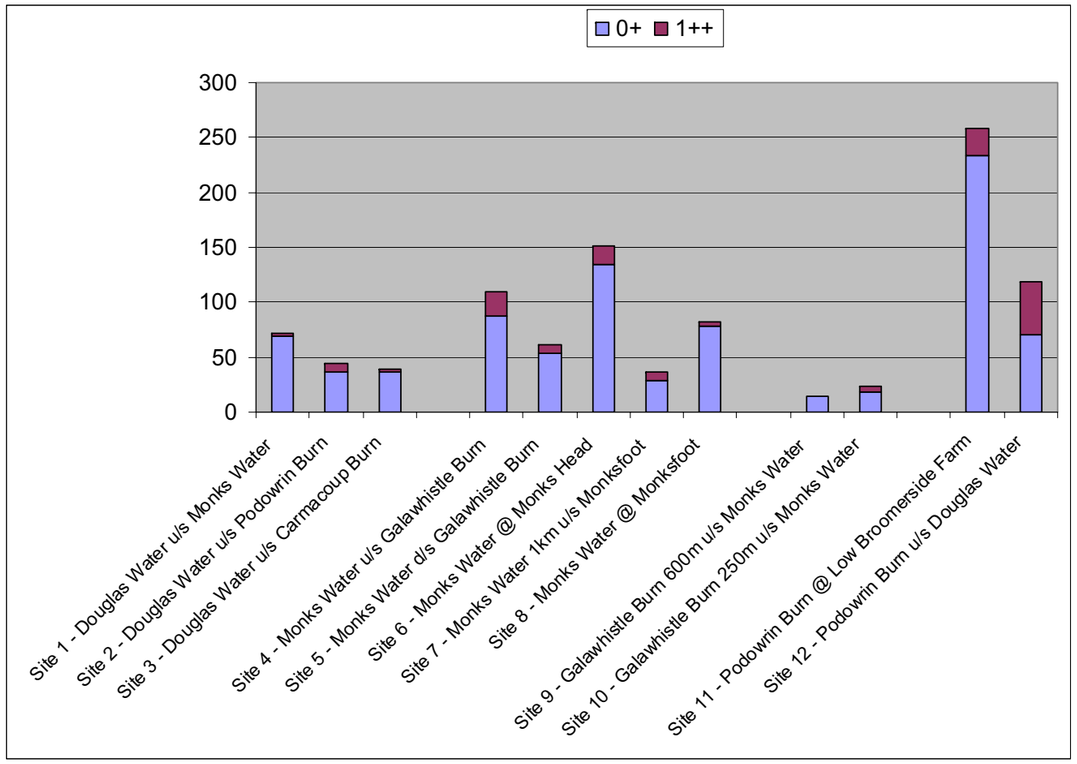
6.131 The CRF monitoring of the Clyde catchment since 2003 indicates that Monks Water (at Station 6) and Podowrin Burn (Station 11) can, on occasion, be considered as having high numbers of brown trout in the context of the Clyde.

6.132 Off site, there was one record of a brook lamprey, approximately 950m downstream, on the Douglas Water.

6.133 Brown trout are a UK BAP species brook lamprey are on Annex 2 of the EC Habitats Directive.

6.134 The fish communities present at Galawhistle are therefore typical of those found in the River Clyde catchment.

Diagram 1 Densities of Brown Trout among the Sampling Sites



6.135 Given that electrofishing has been carried out at Station 6 (Monkshead Farm) and Station 11 (Low Broomerside Farm) since 2003, there is data from which to assess the effects of both the Spireslack OCCS (which involved the truncation of the upper reaches of the Galawhistle Burn) and the Hagshaw Hill Wind Farm Extension. Of note is that the trout have survived (albeit in small numbers) along Galawhistle Burn despite the substantial modification to its upper tributaries and in-channel effects from the Spireslack OCCS. In addition the presence of high diversity of brown trout along Podowrin Burn is also informative, given that it is down stream of the Hagshaw Hill Wind Farm Extension. This provides evidence that fisheries can be protected during Wind Farm construction providing appropriate measures such as pollution control and ECOW presence are implemented.

The Assessment Process

6.136 The work above explained the scope, survey methods and results used to identify the important nature conservation interests on site (i.e. the baseline). This following section explains how the significance of effects on these wildlife interests is assessed.

6.137 Assessing the significance of impacts on ecological interests is a staged process, using the 2006 IEEM guidelines[2]. A significance matrix is also included for this Chapter (although not part of this Guidance) because is considered useful, adding clarity and consistency, which compliments professional judgement used to assign significance of effects through reasoned argument.

Assigning the Importance of Wildlife Interests

6.138 Determining the conservation importance of wildlife interests within the study area is the first step in the assessment process, and is undertaken in a systematic way using criteria that determine whether it is of international, national, regional, local or negligible significance.

6.139 The term for the ecological receptors affected at the site is 'Valued Ecological Receptors' (or VERs). The criteria for valuing the nature conservation level of each ecological receptor is outlined in Table 6.4.

Magnitude of Effect

6.140 The potential effects on each VER are determined through understanding how each of these responds to the proposed development (Table 6.5). The elements used to define the scale of the effect of a development include determining:

- The potential duration, whether short-term (< 5 years), medium-term (5 - 15 years) or long-term (15 – 25 years or longer);
- Timing and frequency, whether the effects will be timed at a sensitive period, or the frequency will alter the effects;
- Reversibility, whether the effects will be reversible in the short to medium term;
- Confidence in predictions, whether the predicted effect is certain/ near certain (>95%), probable (50% - 95%), unlikely (5% - 50%), or extremely unlikely (<5%) to occur;
- Potentially whether the effect will affect the long-term viability of a habitat or population of species; and
- Whether there are any cumulative effects that may affect the long-term integrity of the ecosystem(s) at the site.

6.141 Any potential cumulative impacts arising from other development proposals within a distance that may affect the ecological resource or multi-faceted impacts on any single ecological receptor are also considered.

Significance of Effect

6.142 The significance of the potential effects on each VER is determined by considering the value of each nature conservation interest and the degree to which it may be affected (the effect magnitude) by the proposed development, i.e. by using the Tables 6.4 and 6.5 above. These are described as Major, Moderate, Minor and Negligible. This is presented as a matrix (Table 6.6).

Table 6.4 Criteria for Valuing the Conservation Importance of Ecological Receptors on Site

Conservation Value	Examples
International	Habitats or species that form part of the cited interest within an internationally protected site, such as those designated under the Habitats Directive (Special Areas of Conservation - SACs), the Birds Directive (Special Protection Areas - SPAs) or other international convention (e.g. Ramsar site). A feature (e.g. habitat or population) which is either unique or sufficiently unusual to be considered as being one of the highest quality examples in an international/ national context such that the site is likely to be designated as an SAC/ SPA.
National	Habitats or species that form part of the cited interest within a nationally designated site, such as a Special Site of Scientific Interest (SSSI), or a National Nature Reserve (NNR). A feature (e.g. habitat or population) which is either unique or sufficiently unusual to be considered as being one of the highest quality examples in a national/ regional context for which the site could potentially be designated as an SSSI. Presence of UK Biodiversity Action Plan habitats or species, where that action plan states that all areas of representative habitat, or individuals of the species should be protected.
Regional	Habitats or species that form part of the cited interest of a Local Nature Reserve, or some local-level designated sites depending on specific site conditions. A feature (e.g. habitat or population) which is either unique or sufficiently unusual to be considered as being of nature conservation value up to a district or county context. Presence of Local Biodiversity Action Plan habitats or species, where that action plan states that all areas of representative habitat, or individuals the species should be protected.
Local	Habitats or species that form part of the cited interest of a local-level designated site and may be designated as a non-statutory Site of Importance for Nature Conservation (SINC) or the equivalent, e.g. Local Wildlife Site, Ancient Woodland designation. A feature (e.g. habitat or population) that is of nature conservation value in a local context only, with insufficient value to merit a formal nature conservation designation.
Negligible	Common place feature of little or no habitat/ historical significance. Loss of such a feature would not be seen as detrimental to the ecology of the area.

Table 6.5 Defining the Magnitude of Effect on Valued Ecological Receptors

Magnitude	Definition
Total / Near Total	Would cause the loss of all or a major proportion of a habitat or numbers of a species' population, or cause sufficient damage to immediately affect long-term viability.
High	Major effects on the feature/ population which would have a sufficient effect to alter the nature of the feature in the short-long term and affect its long-term viability. For example, more than 20% habitat loss or long-term damage, or more than 20% loss of a species' population.
Medium	Effects that are detectable in short and medium-term but which should not alter the long-term viability of the feature/ population. For example, between 10-20% habitat loss or 10-20% reduction of a species' population.
Low	Minor effects, either of sufficiently small-scale or of short duration to cause no long-term harm to the habitat/ population. For example, less than 10% loss or damage.
Neutral	A potential impact that is not expected to affect the habitat/population in any way.

Table 6.6 Significance of the Effects Defined by the Relationship between the Nature Conservation Value and Effect Magnitude

Effect Magnitude	Nature Conservation Value				
	International	National	Regional	Local	Negligible
Total / near total	Major	Major	Major	Moderate	Slight
High	Major	Major	Major-Moderate	Moderate	Slight
Medium	Major	Major or Moderate	Moderate	Moderate or Minor	Minor
Low	Moderate or Minor	Moderate or Minor	Moderate or Minor	Minor	Minor
Neutral	No/ Negligible Effect				

6.143 The significance of impacts can be two-way: either adverse or beneficial. The two extremes are:

- Major adverse impacts on a feature of at least national nature conservation value. In this case, mitigation measures to offset the impact would be required.
- Major benefits for a feature/population.

6.144 Effects or residual effects are considered to be significant under the Environmental Impact Assessment (Scotland) Regulations 1999 (EIA Regulations) if they are at a level of Moderate or Major (i.e. “a likely significant effect”). These are coloured in red and orange in Table 6.6. Some categories of nature conservation value and effect magnitude may vary in the level of significance effects depending on the circumstances which is why some of the cells in Table 6.6 have two levels within them. This allows for professional judgement to be applied when identifying the level of significance. Effects that are neutral or minor are not considered significant with respect to the EIA Regulations.

Baseline Description

6.145 A summary of the habitats and species identified as Valued Ecological Receptors (VERs) at the site is given in Table 6.7, together with the legislation and guidance defining their value.

Table 6.7 Summary of the Confirmed Valued Ecological Receptors within the Study Area

Valued Ecological Receptors	Covering Legislation and Guidance	Conservation Value[26]
Wet Modified Bog	Drainage and grazing mean that these areas are degraded forms of bog vegetation, overwhelmingly dominated by *Eriophorum*. As a result, in general, the bog habitats within the site are very unlikely to be actively peat-forming, have relatively low floristic diversity, and are also frequently on shallow (<0.5m) peat. Given these combined characteristics, the bogs fall short of Annex 1 status of the Habitats Directive 92/43/EEC and SSSI quality[27]. They do, however, have conservation value because of the potential for restoration and enhancement. Modified bog is a widespread habitat resource in the context of the Scottish uplands[28]. Restoration of modified bog is included as a target within UK and Ayrshire Biodiversity Action Plans.	Regional
Wet Heath	Wet heath is listed in Annex I of the Habitats Directive. On most of the site the habitat quality is moderate because modification has taken place by drainage and prolonged grazing impacts. The area of wet heath often forms part of a mosaic with acid grassland, and therefore of higher botanical diversity. Wet heath is a relatively common and widespread habitat in the context of the Scottish uplands.	Regional
Dry Heath	Dry heath is listed on Annex I of the Habitats Directive. It is a relatively common and widespread habitat in the context of the Scottish uplands and the small extents within the site are of relatively widespread forms.	Regional

[26] Defined in Table 6.4
[27] Nature Conservancy Council. 1989 (revised 1998). Guidelines for Selection of Biological SSSIs. Nature Conservancy Council, Peterborough
[28] Although there is no agreed figure for the total extent of blanket bog vegetation in Scotland, there are over one million hectares of blanket peat. See for example http://www.ukbap.org.uk/UKPlans.aspx?ID=21

Valued Ecological Receptors	Covering Legislation and Guidance	Conservation Value[26]
Flushes	'Upland Flushes, Fens and Swamps' are classified as UK Biodiversity Action Plan (BAP) priority habitat. Extensive acid flushes occur throughout the site, predominantly from peatland areas but on lower ground this is influenced by the banks of the water courses. Other water seepage areas tend to be more neutral or even tend toward base rich adjacent to the Galawhistle and Monks Water but these are much less frequent.	Local
Acid grassland	Acid grassland was found on many areas of the site often in mosaic with other habitats. This is a common and widespread habitat in the context of the Scottish uplands.	Local
Running water	The Ayrshire LBAP has a Habitat Action plan for Rivers and Streams. Rivers and streams are also 'broad habitats' within the UK BAP. The potential effects on the running water habitat are directly linked to effects on its catchment area, and will also have implications for important species, notably otters and brown trout.	Local
Bats	All species of bats are listed in Annexes II and IV of the Habitats Directive and therefore protected in the UK under the Conservation (Natural Habitats, &c.) Regulations 1994, as up-dated by the Conservation (Natural Habitats, &c.) Amendments (Scotland) Regulations 2007. Pipistrelle bats also have an Action Plan within the UKBAP and are listed on the Ayrshire LBAP. Brown long-eared bats are a UK Priority Species within the UK BAP. Brown long-eared bats, Natterer's bats and Daubenton's bats are all included in the Scottish Biodiversity List. One roost site was confirmed supporting small numbers of common species. Bat activity at the site is low. Bats are therefore classified as Locally Important on site.	Local
Otter	The otter is listed on Annexes II and IV of the Habitats Directive. A species Action Plan is included in the UKBAP. It is protected under Schedule 5 of the WCA 1981 and Schedule 2 of the Conservation (Natural Habitats, etc.) Regulations, 1994. Otter was recorded using the Monks Water, the Galawhistle Burn and an unnamed burn (tributary of Douglas Water) by the site entrance. Only one holt (non-breeding) was identified approximately 200m from the nearest Wind Farm infrastructure. Otter is classified as Locally Important on the site.	Local

Valued Ecological Receptors	Covering Legislation and Guidance	Conservation Value[26]
Badger	Badger is protected under the Protection of Badgers Act 1992 and it is also listed on the Scottish biodiversity List. The badger activity recorded on site is very low and confined to the south of the site. Badger is therefore classified as Locally Important on site.	Local
Brown trout	Brown trout is a UKBAP priority species. The Douglas Water and Monks Water are considered important for brown trout. Significant numbers were recorded within the Monks Water and Podowrin Burn. Brown trout was also recorded within the Galawhistle Burn. Brown trout is classified as Regionally important on site.	Regional

Assessment of Effects on the Valued Ecological Receptors

6.146 This section provides an assessment of the likely effects of the development on the Valued Ecological Receptors (VERs). For each VER, the potential effect is assessed for each of the construction, operation and decommissioning phases of the development.

6.147 The construction programme is estimated to take approximately 14 months, as detailed in Chapter 3. This includes site re-instatement.

Predicted Effects

Construction Effects

6.148 Construction of access tracks, turbine bases, other associated infrastructure and the excavation of borrow pits will result in the loss of 23.5 ha (just under 4%) of habitats, out of the 593ha site, over approximately 13 months.

6.149 A proportion of habitats (in the region of approximately 2.4ha to 5.6ha), will be restored at the end of the construction period, the precise figure depending on the extent of borrow pits used. As explained in Chapter 3, (paragraphs 3.20-3.24), the current borrow pit dimensions allow for a maximum requirement and therefore the eventual direct habitat loss could be lower than 23.5ha.

6.150 The breakdown of habitat loss is given in Table 6.8. Wet modified bog is the main habitat effected, followed by unimproved acid grassland.

6.151 It is not possible at present to specify exact timings, but it is worth noting that the extent of certain additional habitats, will increase in the wider area as a result of restoration of the Spireslack/Grasshill OCCS. Although comparisons between (a) the timings and (b) the nature and extent of OCCS restoration cannot be made (because the OCCS restoration programme has not been finalised at this stage), it is relatively likely that there will be an increase, either before wind farm construction, or during the early part of it, where the local extent of semi-improved acid grassland and marshy grassland in particular, will increase as the extensive areas of mining spoil are restored.

Table 6.8 Estimated Extent of Loss of VER Habitat From Wind Farm Construction

Habitat	Extent on Site (ha)	Area Lost (ha)	% of Habitat's Extent
Mixed semi-natural woodland	0.98	0.000	0.00
Scattered scrub	0.23	0.000	0.00
Unimproved acid grassland	57.96	1.110	1.91
Unimproved neutral grassland	18.34	0.015	0.08
Semi-improved neutral grassland	1.61	0.018	1.13
Improved grassland	12.18	0.000	0.00
Marshy grassland	5.51	0.099	1.81
Poor semi-improved grassland	2.39	0.560	23.42
Continuous bracken	25.16	0.031	0.12
Acid dry dwarf shrub heath	3.06	0.061	1.98
Wet dwarf shrub heath	32.19	0.019	0.06
Dry heath/acid grassland mosaic	50.88	0.218	0.43
Wet heath/acid grassland mosaic	48.65	0.820	1.69
Wet modified bog	280.49	11.498	4.10
Dry modified bog	0.01	0.000	0.00
Acid/neutral flush	19.60	0.163	0.83
Mine	16.51	1.892	11.46
Ephemeral/short perennial	0.14	0.000	0.00
Bare ground	16.63	0.000	0.00

Wet Modified Bog

6.152 Of the 280.49ha of wet modified bog on site, approximately 11.5 ha (4.10%) will be permanently lost due to turbines, tracks and 3 of the 4 borrow pit locations.

6.153 In addition to this direct loss, consideration has also been given to the potential for indirect habitat loss from changes to drainage as a result of turbine track construction. However, the orientation of tracks, and the frequently shallow nature (<0.5m deep) of the peat they cross, will minimise lateral drainage effects. Evidence of this comes from, inspection of vegetation up and down slope of the numerous existing artificial drains, which reveals comparable vegetation either side. This suggests that lateral impacts from drainage will be limited. Although conjectural, the reasoning for this apparent lack of drainage effects on vegetation could be the relatively intensively drained nature of the habitat at present. It is therefore considered track construction will have minimal indirect effects on the extent of wet modified bog.

6.154 The effect magnitude on wet modified bog is therefore low, and in combination with its regional conservation value on site, produces an effect of **moderate or minor** significance, prior to any mitigation.

Wet heath

6.155 Of the 32.19ha on site, approximately 0.019ha (0.06%) will be permanently lost.

6.156 On this basis the effect magnitude is low, which, in combination with its regional conservation value on site, produces an effect that is of **moderate-minor** significance, prior to any mitigation.

Dry heath

6.157 Of the 3.06ha on site, approximately 0.061ha (1.98%) will be permanently lost due to access track construction.

6.158 On this basis the effect magnitude is low, which, in combination with its regional conservation value on site, produces an effect that is of **moderate-minor** significance, prior to any mitigation.

Acid Flush

6.159 Of the 19.6ha on site, approximately 0.16ha (0.83%) will be permanently lost due to turbine and track construction, primarily for turbine 12 and access to the permanent met mast.

6.160 On this basis the effect magnitude is low, which, in combination with its local conservation value on site, produces an effect that is of **minor** significance, prior to any mitigation.

Acid Grassland

6.161 Of the 57.96ha on site, approximately 1.11ha (1.91%) will be permanently lost due to turbine and track construction. On this basis the effect magnitude is low, which, in combination with its local conservation value on site, produces an effect that is of **minor** significance, prior to any mitigation.

Running Water

6.162 Construction will disturb soils and, without appropriate precautions in place, has the potential to cause runoff of oil and other chemicals into the freshwater on the site which feeds into the tributaries of the Douglas Water and River Ayr.

6.163 Effects on construction on the watercourses are further discussed in Chapter 8 (Hydrology, Hydrogeology and Geology).

6.164 The ecological effects of potential pollution events vary with the severity of the pollution incident and in the most extreme would result in fish kills downstream from construction operations and long-term damage to spawning-habitat. Any unmitigated effect would be of high magnitude.

6.165 Any effects on burns and tributaries could therefore be of **moderate** significance, prior to any mitigation.

Bats

6.166 No potential bat roosts will be directly affected by the construction of the proposed Wind Farm.

6.167 The more varied and sheltered woodland edges around Monkshead, provide a greater abundance of invertebrate prey than on the top of the moor where the majority of the Wind Farm infrastructure will be sited. This low bat activity on the open moor has been confirmed by bat activity surveys.

6.168 The construction of the Wind Farm will therefore have **negligible** significance on bat interests.

Otter

6.169 Evidence shows that the area is generally not heavily used by otters. It is occasionally occupied for foraging, primarily along the Monks Water.

6.170 No natal dens were found on site or in adjacent areas. A temporary otter shelter was found on the Monks Water but it is likely that this is used only occasionally. There will therefore be no physical damage or disturbance to resting up sites during Wind Farm construction.

6.171 The species is dependent on clean watercourses and therefore the main risk to otters from Wind Farm construction is potential loss of prey abundance if there is a water pollution incident. Given that alternative feeding locations would be available, and that any incident is unlikely to be long lasting, this would be unlikely to cause a sustained effect.

6.172 There is also a small risk of incidental injury or mortality during the construction phase, caused by entrapment in open trenches, holes and pipes. Adult otters will cross open land or move between catchments, foraging or looking for a mate, and young otters disperse from their natal territory. These are all circumstances during which otters would be potentially vulnerable to these kinds of accidents (albeit the risk being extremely small).

6.173 The effect on otters is therefore predicted to be of low magnitude and therefore of **minor** significance, prior to mitigation.

Badger

6.174 There were signs of badger activity recorded in the southern part of the site but not in proximity to the Wind Farm infrastructure. Potential disturbance to foraging badgers can occur as a result of construction activities but this is considered not to be significant given the distance of badger activity from construction activities.

6.175 The predicted effect is of low magnitude.

6.176 The effects on badger are therefore predicted to be of **minor** significance.

Brown Trout

6.177 The potential effects on brown trout are directly linked with potential effects on Running Water.

6.178 Effects on construction on the watercourses are discussed in detail in the Chapter 8 (Hydrology, Hydrogeology and Geology) but brown trout will be adversely affected by increased silt loading or chemical contamination. Any unmitigated effect would be of high magnitude.

6.179 Any effects on burns and tributaries in such circumstances would therefore be of **moderate** significance, prior to any mitigation.

Operational Effects

Wet modified bog

6.180 Operation will not cause additional habitat loss of this habitat. The effect is assessed to be neutral with **no significance**.

Wet heath

6.181 Operation will not cause additional habitat loss of this habitat. The effect is assessed to be neutral with **no significance**.

Dry Heath

6.182 Operation will not cause additional habitat loss of this habitat. The effect is assessed to be neutral with **no significance**.

Acid Flush

6.183 Operation will not cause additional habitat loss of this habitat. The effect is assessed to be neutral with **no significance**.

Acid Grassland

6.184 Operation will not cause additional habitat loss of this habitat. The effect is assessed to be neutral with **no significance**.

Running Water

6.185 Operation will not further disturb soils and cause contamination of the freshwater on the site. However, there may still be a risk of run-off of oil and other chemicals from turbine machinery or maintenance operations and vehicles. These effects are further discussed in the Chapter 8 (Hydrology, Hydrogeology and Geology).

6.186 Any effect would be of low magnitude.

6.187 Effects on freshwater and the potential knock-on effect to other watercourses categorises this unmitigated risk as of **minor** significance.

Bats

6.188 The potential for any effects on bats is limited to foraging activity, as there are no roosts in proximity to Wind Farm infrastructure. The species identified on the site are known to fly in excess of 40m height and therefore may be at risk of collision with turbines. However, they typically forage and commute along the edges of woodland and over water bodies (e.g. Daubenton's bats). Daubenton's bats, Natterer's bats and brown long-eared bats are considered to be at low risk from wind turbine collision[29], although common and soprano pipistrelle are in the medium risk category. However, a separation distance between turbine blade tips and woodland edge and tree lines of approximately 140m, plus constructing turbines away from water courses, will both minimize the risk of collision[27]. Therefore, whilst surveys showed some foraging bats are present, and therefore may be affected, numbers are evidently low in local population context.

6.189 The effect is of low magnitude and therefore of **minor** significance.

Otter

6.190 Otters are extremely unlikely to be disturbed during operation on the open hill part of the site, because of a combination of their limited presence on site and the fact that they are generally nocturnal, whilst operational maintenance is carried out during the day. However, otters and their prey use watercourses so there remains a potential risk of contamination of the watercourses from oil or other leaks from turbine machinery, spills during maintenance, or leaks from maintenance vehicles. Prevention and consideration of these effects are further discussed in the Chapter 8 (Geology, Hydrogeology and Hydrology).

6.191 On the basis of the experience gained from wind farm operations in Scotland to date, the risk, frequency and nature of operational maintenance indicates that any unmitigated effect would however be of low magnitude with **minor** significance.

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[29] Natural England (2009) *Bats and Onshore Wind Turbines*, Interim Guidance

Badger

6.192 Badger are not likely to be disturbed during operation. The fact that they are generally nocturnal and maintenance operations are carried out during the day also means potential for any disturbance (e.g. access track repairs, maintaining turbines) is minimal. The effect is assessed to be neutral with **no significance**.

Brown Trout

6.193 The potential effect on this species is directly linked with potential effects on "Running Water" so there remains a potential risk of contamination of the watercourses from oil or other leaks from turbine machinery, spills during maintenance, or leaks from maintenance vehicles. These effects are examined in detail in Chapter 8 (Hydrology, Hydrogeology and Geology).

6.194 The potential effects on brown trout would be of low magnitude and therefore of **minor** significance.

Decommissioning Effects

6.195 Decommissioning effects would be of similar or of lower magnitude to the construction phase effects with an overall positive effect resulting from restoration.

Mitigation

6.196 Six VER habitats and four VER species (species group, in the case of bats), have been assessed as potentially affected by the construction/operation/decommissioning of the Wind Farm. Appropriate mitigation measures have already been designed into the development to avoid or minimise the potential effects on these VERs. However, additional mitigation measures will be implemented to avoid or reduce impacts further, notably on wet modified bog and heathland.

Prior to Commencement Mitigation Measures

6.197 As previously highlighted, because this assessment has been based on data spanning more that one year for most VERs, the knowledge of baseline conditions is extremely robust and less of a 'snapshot' than would have been obtained from a single year's survey. Nonetheless, the distribution or abundance of species can change and therefore pre-construction surveys for protected species will be carried out to up-date information ahead of pre-commencement and prior to commencement work. This will enable any refinements to be made (if necessary), to micro-siting and/or the construction programme to take into account any up-dated sensitivity. It is proposed that the species covered are otter, water vole, and fish and important plants (notably South Lanarkshire LBAP species crowberry, cloudberry and round-leaved sundew).

6.198 Wherever possible, prior to commencement surveys will also be used to identify locations where bog and heath habitats are in better condition, where bog pools are present, where there is a mover diverse flora, or they overlie deeper peats. Any such locations will be avoided wherever possible during construction, through micro-siting.

6.199 For locations where turbine tracks cross burns, drains and acid flush habitats, the most appropriate method of crossings will be identified at the prior to commencement stage, in order to minimise impacts in these areas or effects downstream.

6.200 Where appropriate, relevant mitigation measures will be implemented through Construction Method Statements. These will be prepared in consultation with, and to the satisfaction of South Lanarkshire and East Ayrshire Councils, SEPA and SNH, and submitted for their approval. Further proposals for Method Statements relating to pollution prevention are given in Chapter 8 (Geology, Hydrogeology and Hydrology).

6.201 A detailed Habitat Management Plan (HMP) will also be completed prior to commencement, to the satisfaction of SNH, SEPA, RSPB Scotland and the Planning Authorities (see below). This will set out the habitat enhancement measures to be carried out on site, the aims, objectives and targets of these measures, monitoring requirements, responsibility for implementing habitat works and on reporting and reviewing HMP activities over the 25 year lifetime of the Wind Farm.

6.202 The main objective of the HMP will be to off-set the loss of 11.6ha of modified wet bog, wet heath and dry heath, with the enhancement of the remaining areas of these habitats. Through a combination of improved grazing and drain blocking the mitigation will cover the large majority of the site.

Construction Mitigation Measures

6.203 In order to prevent contamination of running water, and subsequent effects on brown trout or otters, a series of measures will be taken to minimise risk of water pollution during construction.

6.204 The details for protecting the water courses are outlined in Chapter 8 (Geology, Hydrogeology and Hydrology). They combine a 50m buffer between development infrastructures and water courses, the avoidance of water crossings wherever possible and the design and enforcement of procedural mechanisms to absorb any silt or other particulate runoff into the freshwater systems. This will ensure that the running freshwater is maintained at a high quality and that brown trout, otters and water vole, as well as other non-VER aquatic wildlife, are protected.

6.205 All agreed mitigation measures will be implemented through one or more of the following:- Construction Method Statements, HMP or Environmental Management Plan (referred to in Chapter 8 Geology, Hydrogeology and Hydrology).

6.206 An Ecological Clerk of Works (ECoW) will be retained on site to oversee prior to commencement works and construction,. The ECoW will be a suitably experienced individual, approved by SNH, South Lanarkshire and East Ayrshire Councils, whose role will be to work on site providing ecological and pollution control advice and supervision for all relevant mitigation measures. They will also ensure works are carried out in accordance with all relevant Construction Method Statements, the HMP, the Environmental Protection Plan and wildlife legislation.

Peat

6.207 In order to minimise the volume of peat generated, and to ensure its beneficial use for biodiversity enhancement, a Construction Method Statement will be produced specifically for peat handling, storage and after-use. This will include the lifting and storage of bog vegetation and remaining underlying peat, and detail how both shall be stored and re-laid to benefit site restoration and peat habitat enhancement (one of the aims of the proposed HMP).

6.208 The volume of peat generated from construction are relatively low in comparison to several recently constructed Scottish wind farms (for example Whitelee and the Braes of Doune). Peat that is produced from each borrow pit is sufficiently low volume to be replaced in situ, at depths of no greater than originally present, and peat from track construction and turbines bases and crane pads will be replaced, under ECoW supervision, on track shoulders and for restoring eroding peat drains, as part of HMP drain blocking for peatland restoration and enhancement.

Otter

6.209 Best practice measures as described by SNH[30] for minimising potential effects on otters will be implemented.

6.210 "Otter friendly" watercourse crossing designs incorporating the features to ensure otters can pass unhindered will be used.

6.211 The ECoW will carry out on-going protected species checks for otters (and all other protected species), as part of their regular monitoring duties.

Badger

6.212 It is unlikely that badgers will be affected by construction operations and no mitigation is proposed.

Operation

6.213 Vehicles coming on site will be maintained in good condition and inspected to prevent oil leaks on the site, to avoid risk of pollution. Spill kits will also be kept available, to help control pollution in the event of a leak or spillage.

6.214 On site tracks will have a speed limit of 15 miles per hour to reduce the risk of collision with otters and badgers.

Decommissioning

6.215 Best practice measures as described in the construction stage will be followed. New guidance available at the decommissioning phase would be adopted if appropriate.

Restoration

6.216 The restoration of habitats will be achieved in two phases. The first will follow construction and covers the reinstatement of track edges, crane pads, borrow pits etc. The second phase will take place after Wind Farm decommissioning.

6.217 The objectives of restoration will be agreed with the appropriate authorities but will be closely allied to the objectives of the HMP.

Habitat Management Plan

6.218 The ES includes a range of mitigation measures to protect natural heritage interests (both ecological and ornithological). To ensure these can be readily secured through the planning system, and for ease of future monitoring and enforcement, the recommendation is that these measures are incorporated into a HMP.

6.219 Enhancement of modified bog and wet and dry heath is the key aim of the HMP. Prescriptions will be implemented on site through blocking of drainage channels, fencing to allow improved stock control, reduced levels of grazing, re-wetting and where appropriate, creation of pools. These activities will be applied across all modified bog and heath, to off-set the direct loss that will result from construction of the Wind Farm.

6.220 The establishment of new native woodland is also proposed along the Monks Water and adjacent lower slopes. This is partly to benefit wider biodiversity, but also to improve riparian conditions for otters and fish. It will also create additional habitat for black grouse, and increase prey availability for bats, merlin, hen harriers and peregrine (see Chapter 7 – Ornithology). The extent of this planting will be limited to avoid encouraging these species into proximity of turbines. The exact nature of the planting mix will be determined through Ecological Site Classification but likely species include ash (*Fraxinus excelsior*), alder (*Alnus glutinosa*), elm (*Ulmus glabra*), downy birch (*Betula pubescens*), bird cherry (*Prunus avium*) and sessile oak (*Quercus petraea*) with an associated shrub layer of species such as hazel (*Corylus avellana*), hawthorn (*Crataegus monogyna*), willow species (*Salix* sp) and blackthorn (*Prunus spinosa*).

6.221 To ensure mitigation measures are implemented, it is proposed a combination of planning conditions and Section 75 agreements are used, or some similar legally binding mechanism. The precise details of any habitat management enhancement would be subject to agreement with SNH, RSPB Scotland and the Planning Authorities.

Additional Enhancement

6.222 In accordance with best practice, additional opportunities have also been sought to secure off-site enhancement of peatland habitats, to help ensure that important biodiversity interests are conserved. In identifying appropriate locations for off-site enhancement, the search criteria used have been (a) peatlands that are of conservation importance, (b) peatlands that are in proximity to the site, (c) peatlands where land ownership and management enable implementation of enhancement measures to be guaranteed, and (d) where implementation of enhanced management can be assured over at least the lifetime of the proposed Wind Farm.

Summary of Effects

Table 6.9 Summary of the Potential Effects on VERs and Residual Effects Following Mitigation

Potential Effects	Pre-Mitigation Effect	Mitigation	Residual Effects
Construction			
Effects on Wet modified bog	Moderate - minor	• Design measures • Restoration and enhancement of wet modified bog through HMP • ECoW on site during construction	Minor negative
Effects on Wet heath	Moderate - minor	• Design measures • Restoration and enhancement of wet heath through HMP • ECoW on site during construction	Minor negative

[30] SNH 2008 Otters and Development online publication, http://www.snh.org.uk/publications/on-line/wildlife/otters/default.asp

Potential Effects	Pre-Mitigation Effect	Mitigation	Residual Effects
Effects on Dry heath	Moderate – minor	• Design measures • Restoration and enhancement of dry heath through HMP • ECoW on site during construction	Minor negative
Effects on Acid grassland	Minor	• Design measures • Restoration of acid grassland • ECoW on site during construction	Minor negative
Effects on Acid flush	Minor	• Design measures • ECoW on site during construction	Minor negative
Adverse effects on the freshwater interests within the watercourses arising from loading of the freshwater courses of silt oils or other chemicals from construction activities on-site	Moderate	• Design measures • Protection of watercourses (see Chapter 8 Hydrology, Hydrogeology and Geology) • ECoW on site during construction	Minor negative
Effects on otter and otter habitat	Minor	• Best practice measures during construction, including protection of watercourses and use "otter friendly" crossings • Pre-construction surveys (areas with breeding otter will remain undisturbed and SNH will be consulted regarding possible need of license). • ECoW on site during construction	Minor negative
Effects on Badger	Minor	• Best practice measures during construction. • Pre-construction surveys • ECoW on site during construction.	Negligible

Potential Effects	Pre-Mitigation Effect	Mitigation	Residual Effects
Brown Trout	Moderate	• Design measures • Protection of watercourses (see Chapter 8 Hydrology, Hydrogeology and Geology) • ECoW on site during construction	Minor negative
Operation			
Effects on Wet modified bog	Neutral	• HMP	Minor positive after enhancement
Effects on Wet heath	Neutral	• HMP	Minor positive after enhancement
Effects on Dry heath	Neutral	• HMP	Minor positive after enhancement
Effects on Acid Grassland	Neutral	• HMP	Minor positive after enhancement
Effects on Acid flush	Neutral	• HMP	Minor positive after enhancement
Adverse effects on the freshwater interests on site, notably brown trout	Minor	• Protection of watercourses (see Chapter 8 Hydrology, Hydrogeology and Geology) • Vehicle checks to prevent oil spillage • HMP	Minor positive after enhancement
Effects on bats	Minor	• Design measures	Minor negative
Effects on otter	Minor	• Protection of watercourses (see Chapter 8 Hydrology, Hydrogeology and Geology) • HMP	Minor negative before enhancement Minor positive after enhancement
Decommissioning			
Similar range of effects as construction phase.			

Residual Effects

6.223 The mitigation measures are expected to reduce residual effects to minor or negligible significance.

6.224 Wet modified bog will be restored and enhanced by blocking drains and management of grazing. Wet and dry heath will be treated using the same methods. The overall residual effect will be minor negative in the short term, progressing over the lifetime of the Wind Farm to minor positive, as vegetation and hydro-ecology recover and bog and heath enhancement are achieved.

6.225 Providing the mitigation measures proposed are fully implemented, it is predicted there will be no long-term negative effects on any species or habitat of importance.

Proposed Monitoring

6.226 Full details of monitoring requirements will be agreed in consultation with SNH, but are likely to include periodic survey to assess the recovery of wet modified bog, wet heath and dry heath, and fisheries surveys (in liaison with the Clyde River Foundation).

Statement of Significance

6.227 This chapter has assessed the likely significance of effects of the development with regard to important habitats and species at the site. By applying effective mitigation measures, and implementation of a 25 year HMP, the residual effects of this development are assessed as being minor and therefore not significant in terms of the EIA Regulations.

Chapter 7 - Ornithology

Introduction

7.1 This Chapter assesses the effects of the Galawhistle Wind Farm on birds. Together with Chapter 6 (Ecology), it completes the assessment of the Wind Farm's effects on natural heritage.

7.2 The assessment uses a comprehensive combination of data. This comprises specifically commissioned surveys covering 2007-2009, completed in accordance with SNH Guidelines. It also draws on pre-existing information, where appropriately collected, from other studies on site and adjacent areas, most of which has been gathered for other Environmental Statements. The assessment also draws on local knowledge from the RPS ornithology team and from the South Strathclyde Raptor Study Group.

7.3 The location of the Wind Farm is shown in Figure 7.1.

Key Issues

7.4 The potential key ornithological issues relating to the Wind Farm development are its potential to adversely affect the:

- Integrity of the Muirkirk and North Lowther Uplands Special Protection Area (SPA), designated for its ornithological features of European importance (breeding and wintering hen harrier, and breeding peregrine, short-eared owl, merlin and golden plover);
- Conservation status of bird species given the highest level of statutory protection through inclusion in Annex I of the EU Birds Directive (through habitat loss, disturbance, displacement and collisions with the turbines);
- Designated features of the Muirkirk Uplands Site if Special Scientific Interest (SSSI);
- Potential for the Wind Farm to adversely affect the conservation status of geese and other wildfowl due to the risk of turbine collisions as they fly through the area on migration or while commuting locally;
- Conservation status of breeding waders, through habitat loss, disturbance, displacement and collisions with the turbines;
- Conservation status of rare or vulnerable breeding passerines, primarily through habitat loss, disturbance and displacement; and
- Ornithological interests of local sites designated for their ornithological features.

Methodology

7.5 To ensure the above potential effects were thoroughly examined, this assessment has therefore involved the following:

- Reference to relevant legislation, policy and guidance;
- Consultation with relevant statutory and non-statutory bodies;
- Detailed desk studies and collation of existing material;
- Site surveys to establish the important wildlife interests on site, and in its immediate surroundings;
- Evaluation of the potential effects of the proposed Wind Farm and the effects these could have on current important wildlife interests;
- Evaluation of the significance of these effects by consideration of the sensitivity of these interests, the potential magnitude of these effects and the probability of these effects occurring;
- Identification of appropriate measures to avoid and mitigate against any potential adverse effects resulting from the development; and
- The residual significance of the predicted effects following mitigation.

Legislation and Guidance

7.6 This assessment takes into account the requirements of the following legislation, regulations and other guidance :

- Council Directive 79/409/EEC on the conservation of wild birds (EU Birds Directive)[1] as amended as amended by Directive 94/24/EC;
- Council Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Flora and Fauna (the "Habitats Directive");
- Conservation (Natural Habitats &c.) Regulations 1994 (the "Habitats Regulations");
- Conservation (Natural Habitats &c.) Amendment (Scotland) Regulations 2007;
- Wildlife and Countryside Act 1981;
- Nature Conservation (Scotland) Act 2004;
- Electricity Works (Environmental Impact Assessment (Scotland) Regulations 2000 (EIA Regulations);
- Scottish Executive Ecological Advisers Unit Guidance (ref EJ K1-3);
- National Planning Policy Guideline 14: Natural Heritage 1999;
- Planning Advice Note 60 Planning for Natural Heritage 2000;
- Guidelines on the Environmental Impacts of Wind Farms and Small Scale Hydroelectric Schemes[2] ;
- Guidelines for Ecological Impact Assessment in the United Kingdom[3] ;
- Band, W., Madders, M. and Whitfield, D.P. (2007). Developing field and analytical methods to assess avian collision risk at wind farms;
- UK Biodiversity Action Plan (UKBAP);
- Scottish Biodiversity List;
- South Lanarkshire Local Biodiversity Action Plan; and
- Ayrshire Local Biodiversity Action Plan.

Consultations

7.7 To ensure comprehensive coverage of ornithological issues, key conservation organisations were consulted during the preparation of this Chapter. In July 2008, Scottish Natural Heritage (SNH) and the Royal Society for the Protection of Birds (RSPB Scotland) were each sent a scoping report prepared by RPS and asked to comment on the:

- Ornithological issues surrounding the proposed Galawhistle Wind Farm; and
- Suitability of the baseline survey, analysis and assessment methods proposed by RPS.

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[1] http://eur-lex.europa.eu/LexUriServ/site/en/consleg/1979/L/01979L0409-20070101-en.pdf
[2] Scottish Natural Heritage (2001) *Guidelines on the Environmental Impacts of Windfarms and Small Scale Hydroelectric Schemes*. SNH Natural Heritage Management Series, Perth.
[3] Institute of Ecology and Environmental Management (2006). *Guidelines for Ecological Impact Assessment in the UK*. IEEM, Winchester

7.8 Details of the scoping responses received are given in Table 7.1.

Table 7.1 Scoping Responses

Consultee	Response
Scottish Natural Heritage	Regarding bird issues, SNH would expect the standard number of hours per vantage point to be exceeded due to the sensitivity of the site. Furthermore, because of the potential sensitivity to SPA breeding species, SNH would expect data to be collected for two years.
Royal Society for the Protection of Birds, Scotland	RSPB Scotland stated that a thorough analysis of potential impacts on SPA species was required. Analysis of habitat use would need to take into account any changes in land use resulting from construction of the Wind Farm and ongoing management of the neighbouring plantation forestry. As well as the SPA's qualifying species, other birds of interest at the site were black grouse and breeding waders. Therefore they requested appropriate surveys for these should be carried our, in line with standard methodologies. RSPB Scotland also requested that the ES assess the cumulative impact of the Wind Farm development and that all survey methods should comply with current SNH guidance.
South Strathclyde Raptor Study Group	Provided historical data on nesting raptors in the area.

7.9 Following on from formal scoping, further discussions during 2007-2009 were held with SNH, RSPB Scotland and South Strathclyde Raptor Study Group (SSRSG) members, to ensure information on survey findings, survey methods and site access issues were notified to these key consultees.

Baseline Studies

Target Species

7.10 The desk study, baseline surveys and impact assessment all focused on a defined group of target species, specifically those with a moderate to high conservation value. The target species at Galawhistle were therefore:

- Swans, geese and ducks (all species except mallard);
- Raptors listed in Annex 1 of the EU Birds Directive and/or Schedule I of the Wildlife and Countryside Act 1981 (as amended);
- Breeding waders (all species); and
- Other species included in the Red List of Birds of Conservation Concern (BoCC)[4].

[4] Eaton, M.A., Brown, A.F., Noble, D.G., Musgrove, A.J., Hearn, R., Aebischer, N.J., Gibbons, D.W., Evans, A. and Gregory, R.D. (2009). Birds of Conservation Concern 3: the population status of birds in the United Kingdom, Channel Islands and the Isle of Man. British Birds 102, pp296-341.

Desk Study

7.11 A search was made for all sites with a European, national or local authority designation for an ornithological interest (including SPAs, Sites of Special Scientific Interest (SSSIs) and Sites of Importance for Nature Conservation (SINCs) that could be affected by the proposed Wind Farm.

7.12 This information was obtained from the SNH Sitelink website[5], the JNCC website[6] and the Scottish Wildlife Trust.

7.13 Ornithological data on the site and its surroundings was collated from a range of existing sources. Notably, the assessment draws on longer term data from the South Strathclyde Raptor Study Group, plus survey results from Environmental Statements (ES) completed for adjacent developments, specifically Nutberry Wind Farm (RPS 2005, RDC Scotland 2007) and the Hagshaw Hill Wind Farm Extension (RPS 2005)[7].

7.14 The site itself forms part of a previous wind farm application by Scottish Coal Ltd., for which an ES was issued by Sinclair Knight Mertz in 2005, on behalf of Scottish Coal Ltd. Their ES included a scoping survey of the breeding birds in 2002, and surveys over winter 2003/4 and spring/ summer 2004. Not all of this work was undertaken in accordance with the up-to-date SNH guidelines. Therefore, only information gathered in compliance with recognised survey methodologies has been referred to in this Chapter.

Survey Coverage

7.15 During all fieldwork, disturbed ground and areas of ancillary activity associated with the Spireslack Open Cast Coal Site (OCCS) were inaccessible for health and safety reasons. No access to these areas was possible for upland breeding bird, black grouse, breeding raptor and winter walkover surveys. This included parts of the proposed access track route. Due to the bare ground predominant in these areas, ornithological interest is limited and therefore the validity of the ornithological assessment is not considered to have been reduced to any degree by these access restrictions.

7.16 It was also not possible to conduct upland breeding bird surveys in 2009 in an area of open moorland in the southeast of the application site (due to landowner restrictions). This area was, however, covered by 2008 surveys. The one year's results provided sufficient insight into its bird assemblage, and given this part of the site was characteristic of adjacent habitats, it is safe to conclude there were no species likely to have been missed by only having one year's data. It is not therefore anticipated that any significant species or populations were unrecorded because of this survey constraint.

7.17 The locations of areas where these survey restrictions operated are shown in Figure 7.2a and 7.2b.

7.18 It is important to note that the above access restrictions did not affect results of flight activity surveys, as all parts of the survey area were visible from selected Vantage Points (VPs).

[5] http://gateway.snh.gov.uk/portal/page?_pageid=53,854538&_dad=portal&_schema=portal
[6] http://www.jncc.gov.uk
[7] RPS (2005) Hagshaw Hill Windfarm Extension Environmental Statement. CRE Energy and Scottish Power Company.

Upland Breeding Birds Survey

7.19 Breeding bird surveys covered the initial Wind Farm boundary (as of April 2008) plus a buffer of 500m (Figure 7.2a and 7.2b) in both 2008 and 2009. Although the application site boundary has since been modified, the same survey area was retained in 2009 to allow direct comparison of breeding densities between both years.

7.20 The only exception to the 500m survey buffer was where it overlapped with the Cumberhead Forest Plantation. Given that the survey was to primarily determine open habitat birds, the internal forest area was not covered other than by the breeding raptor survey[8].

7.21 The upland breeding bird survey methodology followed the methods set out by Brown and Shepherd (1993)[9], as this was judged most appropriate and is the industry standard for wind farm surveys in comparable habitats.

7.22 Three survey visits were made in April, May and June 2008 and 2009, following SNH guidance[10] in order to ensure that key phases of the breeding cycle were not missed.

<u>2008 Breeding Bird Survey Dates:</u>

- Visit 1 - 8, 9 April
- Visit 2 - 13, 30 May
- Visit 3 - 20 June

<u>2009 Breeding Bird Survey Dates:</u>

- Visit 1 - 24, 28, 29 April and 10, 11 May
- Visit 2 - 25, 28, 29, 30 May
- Visit 3 - 18, 19, 20, 23, 24 June

7.23 A single surveyor walked a pre-determined route ensuring that all parts of the survey area were approached to within 100m. The location and behaviour of all birds (not just waders) encountered during the survey visits were recorded, with the exception of meadow pipit. For meadow pipit, an estimate of abundance was determined by recording the number of birds observed within each km².

7.24 The location and behaviour of the birds were recorded in the field on 1:10,000 scale maps. Records from all 3 visits were combined into a final visit map, to allow an estimate of territory numbers for each species.

7.25 Full details of the methods used are given in the Ornithology Technical Appendix.

[8] Point count breeding (and winter) surveys previously completed by RPS in 2005 for the Nutberry Wind Farm ES had shown that the conifer plantation did not support any target species. Turbines for the Galawhistle wind farm had also been located away from the forest edge, as part of the design process to avoid potential effects on forest and forest edge species (see Chapter 2, Figure 2.1). For these reasons, it is not considered that limiting the breeding survey coverage to the forest edge and open ground inhibits the assessment.

[9] Brown, A.F. & Shepherd, K.B. (1993) A Method for Censusing Upland Breeding Waders. Bird Study 40: 189-195.

[10] Scottish Natural Heritage (2005) Guidance: Survey Methods for Use in Assessing the Impacts of Onshore Wind Farms on Bird Communities.

Black Grouse Surveys

7.26 Breeding black grouse surveys were undertaken in 2008 and 2009, following the method of Etheridge and Baines (1995)[11], as summarised in Gilbert et al. (1998)[12]. The application site and a buffer of up to 1.5km were surveyed for all signs of black grouse activity in 2008, in areas of suitable habitat (e.g. mosaics of moorland, woodland, plantations, rough grazing, in-bye land and meadows). Surveys were undertaken during the period one hour before and two hours after sunrise.

7.27 By spring 2009, a range of evidence led to the conclusion that black grouse do not lek within 1.5km of the Wind Farm site. This was on the basis of the 2008 Galawhistle results, Hagshaw Hill Extension pre and post-construction surveys, and results from extensive black grouse surveys carried out in East Ayrshire by RPS for SNH in 2007[13], including part of the application site. In light of this, the nearest lek sites within the wider area were therefore visited in April 2009, to get an up-to-date picture on the status of the leks nearest to the Wind Farm.

7.28 Surveys were conducted on the following dates:

- 7, 11, 15 and 19 April 2008
- 7, 15 and 19 April 2009

Breeding Raptor Surveys

7.29 Breeding raptor surveys were conducted in areas of suitable habitat within at least 2km of the application boundary (Figure 7.2a and 7.2b), following standard methodologies [14]. Target species were hen harrier, merlin, peregrine, barn owl and short-eared owl, although observations of buzzard, sparrowhawk, kestrel and raven were also noted. Areas of suitable habitat included heathland and other areas of open habitat, craggy rock faces and cliffs, steep sided burns, trees along the forest edge, older stands of trees within the forest, farm outhouses and derelict buildings.

7.30 Surveys were conducted between February and June 2008, on the following dates:

- 19 February (barn owl)
- 3, 4, 9, 10, 11, 21 April
- 12 and 27 May
- 16 and 27 June

7.31 Surveys were conducted between April and August 2009, on the following dates:

- 24, 26, 29 April
- 2, 11, 20, 21, 28, 31 May
- 4, 6, 13, 22, 24, 28 June
- 6, 12, 19, 25 July
- 2, 9 August

[11] Etheridge, B and Baines, D (1995) Instructions for the Black Grouse Survey 1995/6: a Joint RSPB/GCT/JNCC/SNH Project. Unpublished.

[12] Gilbert, G, Gibbons, D.W and Evans, J (1998). Bird Monitoring Methods. RSPB, Sandy.

[13] RPS (2007). East Ayrshire Black Grouse Lek Distribution 2007: An Analysis of Current Status and Trends. Commissioned Report to SNH.

[14] Hardey, J., Crick, H., Riley, H., Wernham, C., Etheridge, B. and Thompson, D. (2006). Raptors: A Field Guide to Survey and Monitoring. The Stationery Office, Edinburgh.

7.32 Surveys in 2009 included a set of raptor monitoring surveys undertaken within the SPA with the aim of establishing where the closest breeding locations of qualifying species were to the Wind Farm. Specific hen harrier and peregrine surveys from Vantage Point (VP) 6 (see below) were conducted in summer 2009 (total of 15 hrs 5 min) to assess connectivity between the SPA and the application site. This was in addition to the standard VP watches from VP6, and was part of the raptor breeding survey work, rather than flight activity surveys. These were conducted on the following dates:

- 20, 28 May
- 4, 8, 15, 24 June
- 5, 12, 19, 23, 28 July
- 5, 20, 24, 28 August

7.33 Information on raptor breeding was also obtained from South Strathclyde Raptor Study Group.

Winter Walkover Surveys

7.34 Winter walkover surveys were carried out at the site in order to assess the bird interest of the area throughout the winter. These were conducted within the application site and a buffer of 500m (the same as the breeding bird survey area) at least once a month from September 2007 to March 2008 inclusive and September 2008 to March 2009 inclusive.

7.35 Following examination of topographical data on GIS, colour aerial photography and a preliminary site visit, a winter walkover survey route was selected. The survey area included the whole application site with the exception of the Spireslack OCCS for health and safety reasons, and areas of open ground buffering the site. Surveyors combined shortened VP watches with a walk route between VP locations, approaching landscape features of potential ornithological importance (e.g. lagoons, burns, valleys, plantations etc.).

7.36 The location and activity of target species was recorded on 1:10,000 OS maps, using standard BTO notation. Data was then digitised for analysis and presentation.

Flight Activity Surveys

7.37 Flight activity surveys were undertaken using the vantage point methodology advocated by SNH. The Wind Farm site is relatively difficult to get VP coverage across because of the depth and orientation of the glens that run through it. Therefore 9 VPs were used over the 24 month survey, generally covering the site plus a buffer area of 500m and including areas to the south and west to assess possible connectivity with the Muirkirk and North Lowther Uplands SPA (see below). The position of each VP is given in Table 7.2.

7.38 The viewsheds from each VP are shown in Figure 7.3a and the combined viewshed in 7.3b.

7.39 In order to achieve full coverage, it was necessary to have one VP (VP8) within the Wind Farm. This was located at significantly lower altitude than the area being covered, and surveyors were inconspicuously positioned and were at least approximately 750m from nearest turbine location being watched. For all these reasons, their presence was not considered to risk modifying flight behaviour of birds in their viewshed.

7.40 VP3 was discontinued after 12 hours in September 2007 as it was concluded that coverage of the survey area was more comprehensive from VPs 7 and 8 instead.

Table 7.2: Position of VPs Used

VP	VP name	Grid Reference
1	Sclanor Hill	NS 74142 30937
2	Meikle Auchinstilloch (west)	NS 75700 31937
4	Avermarks Hill	NS 78457 30142
5	Shiel Hill	NS 77655 28594
6	Belt Knowe	NS 75443 28243
7	Meikle Auchinstilloch (east)	NS 76403 32153
8	Monkshead	NS 76978 30186
9	Cartcraig Quarry	NS 74825 28976

Vantage point 3 was discontinued after 12 hours in September 2007

7.41 A total of 1,080 hours and 11 minutes of vantage point surveys were undertaken from the 8 VPs (plus 12 hours at VP 3). Time per VP and per season are shown in Table 7.3.

Table 7.3: Survey Effort per Vantage Point

VP	Season	Hours Surveyed	VP	Season	Hours Surveyed
1	Winter 2007-08	42:00	6	Winter 2007-08	40:00
	Summer 2008	35:02		Summer 2008	30:30
	Winter 2008-09	39:00		Winter 2008-09	--:--
	Summer 2009	42:00		Summer 2009	--:--
	Total	**158:02**		**Total**	**70:30**
2	Winter 2007-08	42:00	7	Winter 2007-08	34:30
	Summer 2008	31:00		Summer 2008	34:00
	Winter 2008-09	42:00		Winter 2008-09	39:00
	Summer 2009	33:00		Summer 2009	39:00
	Total	**148:00**		**Total**	**146:30**
3	Winter 2007-08	12:00	8	Winter 2007-08	34:00
	Summer 2008	--:--		Summer 2008	38:00
	Winter 2008-09	--:--		Winter 2008-09	42:00
	Summer 2009	--:--		Summer 2009	41:50
	Total	**12:00**		**Total**	**155:50**
4	Winter 2007-08	41:00	9	Winter 2007-08	--:--
	Summer 2008	39:03		Summer 2008	--:--
	Winter 2008-09	36:00		Winter 2008-09	38:00
	Summer 2009	41:05		Summer 2009	44:01
	Total	**157:08**		**Total**	**82:01**
5	Winter 2007-08	39:30			
	Summer 2008	37:00			
	Winter 2008-09	32:45			
	Summer 2009	40:55			
	Total	**150:10**			

7.42 VP 1 and 6 were created primarily for the purpose of investigating any possible connectivity between birds breeding in the SPA and foraging in the application site. Access was not permitted to VP6 from winter 2008 onwards and so VP9 was used as a replacement.

7.43 To assist the reader visualise flights in relation to turbine locations on part of the site, reference can be made to Figures 5.33.1 to 5.33.4 in Chapter 5 (Landscape and Visual Assessment).

7.44 Each VP survey was undertaken by a single observer in conditions of good visibility. VP watches were generally limited to 3 hours duration by any single observer. Occasionally watches were extended to make up for lost time due to poor weather conditions during previous visits.

7.45 During each watch, the landscape was scanned continuously until a target species[15] was detected. Once detected, the bird was observed until it landed or flew out of sight. The time of first detection was noted, and the flight height was recorded for each 15 second period that the bird was in view, as one of five height bands: <20m, 20-40m, 40-100m, 100-150m and >150m. The height bands 20-20m and 40-100m together span the potential collision height (PCH) associated with the proposed turbines at Galawhistle (a maximum span of 27.8m to 121.2m was used for calculations, based on maximum blade length of 41.2m and maximum hub height of 80m, as the turbine tip is anticipated not to exceed 121.2m height). The paths of all observed flights (flight lines) were drawn onto 1:10,000 scale maps in the field.

7.46 It was assumed that the vertical distribution of flight activity was similar between 27.8-121.2m and between the 20-100m height bands. On this basis the figures for birds in flight and occupancy at 20-100m were adjusted to the slightly increased actual PCH (27.8m to 121.2m) by simple direct proportion (number of birds in flight x 27.8-121.2m / 20-100m).

7.47 As the key target species (notably the SPA qualifying raptors) tend to fly relatively close to the ground, the lower 20m threshold compared to the actual 27.8m lowest blade level will increase the number of flights for these species that are categorised as being at PCH. This adds an extra degree of precaution to the collision risk modelling.

7.48 A map showing the flight lines for each target species was compiled in a Geographic Information System (ArcView v.9.3 GIS), with each flight line linked to its associated flight duration and height information held in a Microsoft Access database.

7.49 The information collected on key target species flying over theWind Farm site and the adjacent airspace was used to estimate the number of individuals per species predicted to collide with the turbine rotors. These estimates were obtained by estimating the annual number of flights of each of these species from the survey data and entering these estimates into an appropriate collision risk model. The collision risk modelling methods used were in accordance with the Band Model recommended by SNH.

Collision Risk Modelling and Defining the Risk Area/Volume

7.50 For each target species, an annual collision rate was predicted using either a directional or non-directional (random) collision risk model. The choice of model for each target species was based on its pattern of flight behaviour within the survey area. The directional model is appropriate when a species tends to move across the wind farm area in a particular direction. This type of flight behaviour is characteristic of species on migration or making regular movements between feeding and roosting sites and SNH advocates using it for groups such as divers, geese, swans and ducks. A non-directional model is more appropriate where the flights of a particular species are not predominantly in any direction. This is usually the case for birds moving around within a breeding or hunting territory that is wholly or partly within the site of interest. This approach, which assumes that the direction of flights is random, is usually appropriate for breeding and non-breeding raptors and waders. An important difference between the directional and non-directional methods concerns the most appropriate unit of "exposure" to collision risk.

7.51 For "directional" species, the appropriate unit of exposure is the two-dimensional Risk Area: the area of the turbines facing a bird as it flies towards the wind farm area with the intention of continuing on in the same direction. The size of the Risk Area is given by the horizontal width of the proposed turbine array facing the species on its normal flight orientation, multiplied by the vertical span of the proposed rotors.

7.52 For "non-directional" species (no consistent flight direction) a three-dimensional Risk Volume is a more appropriate unit of exposure to collision risk. Risk Volume is calculated as the horizontal area of ground (i.e. the 'footprint') of the turbine array, the Risk Zone, multiplied by the vertical span of the rotors.

7.53 The Risk Zone within which birds were considered to be at risk of collision was taken to be the area enclosed by the tips of the outermost turbine rotors, plus a precautionary 200m buffer to allow for a degree of surveyor error when mapping flightlines. This definition in line with SNH guidance. This definition of the Risk Zone is commonly referred to as the Wind Farm Polygon (abbreviated to WP throughout this chapter).

7.54 Full details of the collision risk modelling process are given in Technical Appendix 2, together with all VP flight survey data.

Assessment of Significance

7.55 Assessment of the significance of impacts on ornithological interests was broadly based on the staged process outlined in the 2005 version of the IEEM guidelines. In the most recent 2006 version of these guidelines, a more flexible system is advocated that allows for a greater degree of professional judgement by the ecologist when assessing the significance of effects. In the present assessment, the 2005 IEEM method was followed as outlined below, except where this formal approach led to an assessment result that seemed inappropriate in the professional judgement of RPS.

7.56 The stages in the 2005 IEEM process are as follows:

- Determine the nature conservation value of the ornithological interests present within the study area;
- Identify the potential impacts based on the nature of the proposed development;
- Determine the scale and magnitude of those effects;
- Determine the significance of those effects based on the magnitude and duration of the effects on the nature conservation value of the bird populations affected;
- Identify and assess mitigation measures required to address significant adverse effects; and
- Determine the significance of any residual effect once the benefits of the prescribed mitigation measures have been assessed.

[15] Target species included swans, geese, Annex 1 (European Birds Directive) raptors, black grouse, Annex 1 waders, barn owl and short-eared owl.

7.57 Evaluation of the ornithological resources identified by the baseline studies as valued ornithological receptors (VORs) has been guided by the 2006 revision of the IEEM Guidelines. In accordance with these Guidelines, the importance of each VOR has been assessed in relation to the conservation status of the species over the full range of geographical scales as listed below (Table 7.4). Evaluating the VORs of the site was also informed by the following guidelines:

- Assessing Significance of Impacts from Onshore Wind farms on Birds Outwith Designated Areas. Scottish Natural Heritage, July 2006[16].
- Guidelines for the Selection of Biological SSSIs. Joint Nature Conservation, Committee, 1995.[17]
- The qualifying species of the Muirkirk and North Lowther Uplands SPA and the birds included in the designated features of the Muirkirk Uplands SSSI.

Table 7.4: Approach to Classifying Nature Conservation Value of the Ornithological Receptors at the Site

Value	Examples
International	Bird species that form part of the cited interest within an internationally protected site, or candidate site, such as those designated under the EU Birds Directive 1994. SPAs or other international convention (e.g. Ramsar site). This also includes species listed in the Birds Directive when outside of areas designated for their protection, i.e. within the wider countryside.
National	Bird species that form part of the cited interest within a nationally designated site, or candidate site, such as a SSSI, or a National Nature Reserve (NNR).
Regional	Bird species that form part of the cited interest of a Local Nature Reserve, or some local-level designated sites depending on specific site conditions. Birds that are the subject of a specific action plan within the UK and / or Local Biodiversity Action Plan. A bird species for which a significant proportion (more than 1%) of the regional/Natural Heritage Zone population breeds within the site. A bird species which is either unique or sufficiently unusual to be considered as being of nature conservation value at up to a district or county context.
District	A category added within the 2006 version of the IEEM guidelines, which is not defined but is taken here to be bird species for which a significant proportion (more than 1%) of the sub-regional/district population breeds within the site.
Local	Bird species that form part of the cited interest of a local-level designated site, i.e. Site of Importance for Nature Conservation (SINC) or others, such as those designated as ancient woodland. A bird species that is of nature conservation value in a local context only, with insufficient value to merit a formal nature conservation designation.
Negligible	Commonplace species of little or no conservation significance. Loss of such a species from the site would not be seen as detrimental to the ecology of the area.

7.58 The potential effects are determined through understanding how each VOR is affected by a development. The elements used to define the scale of the effect of a development include determining:

- The potential duration, whether short-term (< 5 years), medium-term (5 - 15 years) or long-term (15 - 25 years or longer);
- The scale / magnitude of the effect (Table 7.5);
- Whether there are any cumulative impacts that may affect the long-term integrity of the ecosystem(s) at the site.

7.59 It has also been established whether the identified effects are:

- Direct, indirect, and/or cumulative;
- Positive or negative;
- Short, medium or long-term;
- Permanent or temporary.

Table 7.5: Defining the Magnitude of Effect on Valued Ornithological Receptors

Magnitude	Description
Total / near-total	Would cause the loss of a major proportion or whole feature / population, or cause sufficient damage to a feature to immediately affect its viability. Irreversible.
High	Major effects on the feature / population, which would have a sufficient effect to irreversibly alter the nature of the feature in the short-to-long term and affect its long-term viability, for example more than 20% habitat loss or damage.
Medium	Effects that are detectable in short and long-term, but which should not alter the long-term viability of the feature/ population, for example between 10 - 20% habitat loss or damage.
Low	Minor effects, either of sufficiently small-scale or of short duration to cause no long-term harm to the feature / population, for example less than 10% habitat loss or damage.
Neutral	A potential impact that is not expected to affect the feature / population in any way; therefore no effects are predicted.

7.60 The significance of a potential effect on each VOR was determined by considering the magnitude and duration of the effect (Table 7.5) in relation to the conservation importance of the VOR (Table 7.4). Significance is described as Major, Moderate, Minor or Negligible, or within a range e.g. Major – Moderate as given in Table 7.6.

7.61 Effects or residual effects are considered to be significant under the relevant Environmental Impact Assessment Regulations if they are at a level of Moderate or Major as described in Table 7.6. Impacts of minor, neutral or slight conservation value are not considered to be significant in the sense used in the Regulations.

[16] http://213.121.208.4/pdfs/strategy/renewable/Significance%20of%20bird%20impacts%20July%2006.pdf
[17] http://www.jncc.gov.uk/page-2303

Table 7.6: Significance of the Effects as Defined by the Relationship Between the Nature Conservation Value and Effect Magnitude

Effect Magnitude	Nature Conservation Value				
	International	National	Regional	Local	Negligible
Total / near total	Major	Major	Major	Moderate	Slight
High	Major	Major	Major or Moderate	Moderate	Slight
Medium	Major	Major or Moderate	Moderate	Moderate - Minor	Minor
Low	Moderate - Minor	Moderate - Minor	Moderate - Minor	Minor	Minor
Neutral	No/ Negligible Effect				

7.62 Following the application of mitigation and enhancement measures, the magnitude of change needs to be re-established and the significance values reassessed. The significance criteria listed in Table 7.6 have been used to predict the residual significance of each potential effect following mitigation and enhancement.

Baseline Description

Desk Study

Designated Sites

7.63 There are 4 sites with a recognised ornithological interest within 10km of the Galawhistle Site (Figure 7.1).

Muirkirk and North Lowther Uplands SPA

7.64 The Muirkirk and North Lowther Uplands SPA is of European importance for its breeding and non-breeding birds, specifically breeding golden plover, hen harrier, merlin, short-eared owl and peregrine, and wintering hen harriers. It comprises 3 adjacent upland blocks (situated to the north and south of Muirkirk, and in the northern Lowther Hills), together with Airds Moss, a lower-lying intermediate bog situated between the 2 upland areas of north and south Muirkirk. The predominant habitats are semi-natural areas of blanket bog, acid grassland and heath. The nearest boundary of the SPA is approximately 1.1km from the application boundary at its closest point (to the south, at Paris Holm). The nearest proposed turbine location is approximately 1.3km from the SPA boundary (Figures 7.1 and 7.2). Distances from turbines to the nearest known nest sites for qualifying species exceed 2km and are given in more detail in the Ornithology Confidential Annex.

7.65 A range of blanket bog and wet heath types are found within the SPA. Stock grazing and moorland management for red grouse are the 2 main current land uses. Large areas of the uplands are managed for grouse shooting, but the type and frequency of moorland management is variable in different areas. This, and patterns of agricultural management, create a diverse mix of upland habitats.

7.66 This site qualifies under Article 4.1 of the EU Birds Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive:

7.67 During the breeding season;

- Golden plover, 175 pairs representing at least 0.8% of the breeding population in Great Britain (mid-1990s);
- Hen harrier, 30 pairs representing at least 6.0% of the breeding population in Great Britain (1998 national survey);
- Merlin, 12 pairs representing at least 0.9% of the breeding population in Great Britain;
- Peregrine, 9 pairs representing at least 0.8% of the breeding population in Great Britain (Mid-1990s);
- Short-eared owl, 30 pairs representing at least 3.0% of the breeding population in Great Britain (Mid-1990s).

7.68 Over winter;

- Hen harrier, 10 individuals representing at least 1.3% of the wintering population in Great Britain (RSPB survey, mid-1990s).

Muirkirk Uplands SSSI

7.69 The Muirkirk Uplands SSSI Is designated as part of the Muirkirk and North Lowther Uplands SPA for its important upland moorland bird assemblage. The site is of importance, both nationally and internationally, for breeding hen harrier and short-eared owl.

7.70 The site is composed of 2 adjacent upland areas to the north and south of Muirkirk. This SSSI is 1.1km from the application boundary and is approximately 1.3km from the nearest turbine location. Upland habitat within the site includes heather dominated moorland, acid grassland and blanket bog. The large expanses of heather moorland are of particularly good quality. The SSSI also encompasses Airds Moss, an area of low-lying blanket bog located between the 2 upland areas (Figures 7.1 and 7.2a and 7.2b).

North Lowther Uplands SSSI

7.71 The North Lowther Uplands SSSI, an extension of the existing Rough Flow Moss SSSI, is situated to the south of the Muirkirk Uplands SSSI, and is coincidental in range with this part of the Muirkirk and North Lowther Uplands SPA.

7.72 The dominant habitats include blanket bog, wet and dry heaths and acid grassland. The range of habitats provides a mosaic of breeding and foraging habitats for the diverse upland bird community which is of national importance. Amongst the species present are hen harrier, short-eared owl, merlin, peregrine, golden plover, red grouse, raven, dunlin, snipe, teal, curlew, redshank, whinchat and wheatear.

7.73 The breeding population of hen harriers is of both national and European importance (1.5% of GB population).

Glenbuck Loch, Woodland and Floodplain provisional Wildlife Site

7.74 Glenbuck Loch and surrounding habitat (NS750286, approximately 900m south of turbine 10) has been listed as a provisional Wildlife Site by East Ayrshire Council. The site is listed because it supports a variety of habitat types such as open water, scrub, swamp, and mature woodland. It provides an important local habitat for birds on and around the loch.

7.75 A summary of included sites is provided below (Table 7.7).

Table 7.7: Designated sites with an ornithological interest within 10km of Galawhistle

Site Name	Distance from Site	Reason for Designation
Muirkirk and North Lowther Uplands SPA	1.1km	Upland bird assemblage in breeding and non-breeding season.
Muirkirk Uplands SSSI	1.1km	Upland habitat including heather dominated moorland, acid grassland and blanket bog. Upland breeding bird assemblage.
North Lowther Uplands SSSI	4.7km	Blanket bog, wet and dry heaths and acid grassland habitat, upland breeding bird assemblage.
Glenbuck Loch, Woodland and Floodplain pWS	900m	Open water, scrub, swamp, and mature woodland habitats and associated birds.

7.76 Given the existence of these designated sites, particular attention was paid in the assessment to examining if there was any connectivity between the birds using the SPA and the application site. This was examined using the results of breeding bird surveys and flight activity surveys, plus liaison with the South Strathclyde Raptor Study Group, and reference to nest location data for qualifying SPA species, and winter roost data for hen harriers.

7.77 Details of all non-ornithological designated sites are given in Chapter 6 (Ecology) and Chapter 8 (Hydrology, Hydrogeology and Geology).

Breeding Bird Results

7.78 A total 59 species including 7 wader species were recorded in the study area in 2008 and 79 species were recorded, including 8 wader species, were recorded in 2009.

7.79 The estimated number of breeding wader territories (applying the method for determining territory numbers described by Brown and Shepherd) is shown in Table 7.8. The approximate central locations of these territories are shown in Figures 7.4 and 7.5.

7.80 Other than waders, there were 15 species present on the Red List[18] and 35 on the Amber List[19] of Birds of Conservation Concern. The estimated number of breeding bird territories of each Red and Amber-listed species is shown in Table 7.9. The approximate central locations of the territories of Red-listed species are shown in Figures 7.6 to 7.9.

[18] Red-listed species have either undergone a population decline of at least 50% or a range contraction of at least 50%, during the last 25 years.
[19] Amber-listed species have undergone a population decline or a range contraction of 25-49% during the last 25 years.

7.81 Details of the number of territories of all other species recorded are provided in the Ornithology Technical Appendix 2.

Table 7.8: Breeding Waders Recorded During Breeding Bird Survey in 2008 and 2009

Species	Conservation status	Number of territories							
		Within survey area		Within application site		Within Wind Farm Polygon		Within 250m of access track	
		2008	2009	2008	2009	2008	2009	2008	2009
Curlew	Amber-listed UK BAP; LBAP(h); SBL	14	10	3	2	3	2	0	0
Common sandpiper	Amber-listed	4	7	2	2	2	2	0	3
Golden plover	Annex I, Amber-listed LBAP(h); SBL	P	P	P	0	P	0	0	0
Lapwing	Red-listed UKBAP; SBL	2	2	P	P	P	P	0	0
Oystercatcher	Amber-listed	5	11	P	1	P	0	2	4
Ringed plover	Amber-listed	3	4	0	0	0	0	1	2
Snipe	Amber-listed LBAP(h)	6	6	2	2	2	2	0	1
Woodcock	Amber-listed	0	1	0	0	0	0	0	0

LBAP(h) = species is listed within a Habitat Action Plan of the LBAP
SBL = Scottish Biodiversity List

Table 7.9: Red- and Amber-listed Birds of Conservation Concern Recorded During the 2008 and 2009 Breeding Bird Surveys

Species	Conservation status	Number of pairs or territories 2008 and 2009							
		Within survey area		Within application site		Within Wind Farm polygon		Within 250m of access track	
		2008	2009	2008	2009	2008	2009	2008	2009
Barn owl	Schedule 1; Amber-listed; SBL	1	P	1	P	1	P	0	0
Bullfinch	Amber-listed; UKBAP; SBL	0	1	0	0	0	0	0	0
Black-headed gull*	Amber-listed; SBL	3	58	3	0	0	0	3	58
Black grouse	Red-listed; UKBAP; LBAP; SBL	0	1	0	0	0	0	0	0
Cuckoo	Red-listed UKBAP	1	0	0	0	0	0	0	0
Common gull	Amber-listed	0	P	0	0	0	0	0	P
Curlew	Amber-listed UK BAP; LBAP(h); SBL	14	10	3	2	3	2	0	0
Crossbill	Schedule 1	1	P	1	0	1	0	0	0
Common sandpiper	Amber-listed	4	7	2	2	2	2	0	3
Dunnock	Amber-listed UKBAP	P	3	P	1	P	1	0	0
Fieldfare	Schedule 1 Red-listed	P	0	P	0	P	0	0	0
Greater black-backed gull	Amber-listed	P	0	P	0	P	0	0	0
Greylag goose	Amber-listed	P	P	0	0	0	0	0	0
Grey wagtail	Amber-listed	1	2	1	2	1	2	0	0
Golden plover	Annex I, Amber-listed LBAP(h); SBL	P	P	P	0	P	0	0	0
Grasshopper warbler	Red-listed UKBAP	1	1	0	0	0	0	0	1
House martin	Amber-listed	0	P	0	P	0	P	0	0
House sparrow	Red-listed UKBAP	P	P	P	0	0	0	P	0
Herring gull	Red-listed; UKBAP; SBL	0	P	0	0	0	0	0	0
Kestrel	Amber-listed	P	P	P	0	P	0	P	0
Lapwing	Red-listed UKBAP; SBL	2	2	P	P	P	P	0	0
Lesser black-backed gull	Amber-listed	P	0	0	0	0	0	0	0
Lesser redpoll	Red-listed UKBAP	3	3	P	P	P	P	0	2
Linnet	Red-listed; UKBAP; SBL	0	P	0	0	0	0	0	P
Little grebe	Amber-listed	0	1	0	0	0	0	0	0
Mistle thrush	Amber-listed	1	2	P	0	P	1	0	0
Mallard	Amber-listed	P	1	P	P	P	P	P	P
Meadow pipit**	Amber-listed	P	P	P	P	P	P	P	P
Oystercatcher	Amber-listed	5	11	P	1	P	0	2	4

Species	Conservation status	Number of pairs or territories 2008 and 2009							
		Within survey area		Within application site		Within Wind Farm polygon		Within 250m of access track	
		2008	2009	2008	2009	2008	2009	2008	2009
Peregrine ***	Annex I; Schedule 1; LBAP(h); SBL								
Reed bunting	Amber-listed UKBAP; SBL	15	22	1	6	1	7	3	4
Red grouse	Amber-listed	0	4	0	2	0	2	0	0
Redstart	Amber-listed	0	1	0	0	0	0	0	0
Ringed plover	Amber-listed	3	4	0	0	0	0	1	2
Skylark	Red-listed UK & LBAP(h)	67	148	25	58	30	59	3	7
Stonechat	LBAP(h)	14	13	3	2	4	2	1	2
Stock dove	Amber-listed	0	1	0	0	0	0	0	1
Sand martin*	Amber-listed	4	22	4	15	4	15	0	0
Snipe	Amber-listed LBAP(h)	6	6	2	2	2	2	0	1
Spotted flycatcher	Red-listed; UKBAP; SBL	0	P	0	0	0	0	0	0
Song thrush	Red-listed: UK & LBAP; SBL	1	8	0	0	0	5	0	0
Starling*	Red-listed; UKBAP	0	1	0	0	0	0	0	0
Swallow	Amber-listed	0	3	0	3	0	3	0	0
Swift	Amber-listed	0	P	0	0	0	0	0	0
Tree pipit	Red-listed; UKBAP	0	1	0	0	0	0	0	0
Tufted duck	Amber-listed	0	P	0	0	0	0	0	P
Wheatear	Amber-listed	17	22	3	8	3	7	4	6
Woodcock	Amber-listed	0	1	0	0	0	0	0	0
Whinchat	Amber-listed	2	4	2	3	2	3	0	0
Whitethroat	Amber-listed	1	0	0	0	0	0	0	0
Willow warbler	Amber-listed	9	36	0	3	1	7	0	7
Yellowhammer	Red-listed; UKBAP; SBL	0	1	0	0	0	0	0	0

** Colony count; **Meadow pipit present breeding, but not included in survey.*
**** See Confidential Annex*

7.82 In 1996, surveys for the Spireslack OCCS ES recorded a total of 19 species, including a grey partridge at Stottencleuch Burn (NS747296) and 1 short-eared owl territory northwest of Glenbuck (NS742302).

7.83 In 2002, breeding bird surveys for the Spireslack Wind Farm ES recorded 35 species including:

- 2 black grouse recorded on 2 occasions at Hagshaw Hill;
- Short-eared owl singles at 3 sites. Recorded foraging in Galawhistle corridor – assumed breeding;
- 5 wader species – curlew, lapwing, oystercatcher, common sandpiper and snipe.

7.84 In 2004, Moorland Bird Surveys recorded 44 species, with 17 thought to be breeding. This included:

- 4 waders: curlew (9 pairs), common sandpiper (2 pairs), lapwing (3 pairs) plus a single snipe;
- Nesting barn owl;
- Possible short-eared owl breeding;
- Skylark – 75 breeding pairs, at 6.29 territories per km^2.

7.85 Meadow pipit surveys were also carried out. Densities ranged from Hare Craig in west (13.19 territories per km^2) to Wedder/Arrarat in east (6.86 territories per km^2). The highest density recorded was at Galawhistle, in the central section north of disused railway line (18.56 territories per km^2).

7.86 In 2003, a total of 22 species were recorded during the survey of moorland breeding birds for the Hagshaw Hill Wind Farm Extension[20], including 18 species that bred. This included 3 black grouse leks and 3 wader species (lapwing, 1 territory; snipe, 8 territories; curlew 14 territories).

Black Grouse Surveys

7.87 Results from black grouse surveys for Galawhistle in 2008 and 2009, and historic data show that black grouse do not lek within at least 1.5km of the site, although are active in at least 3 locations the wider area. Exact locations of these sites are detailed in the Confidential Annex. The sites are 2.1km, 3km and approximately 20km west of the closest part of the site. These findings correlate with results in the 2007 RPS East Ayrshire black grouse survey report, carried out for SNH, which recorded a total of 17 leks in the district, with a maximum of 38 lekking males.

7.88 Results of black grouse surveys compiled for the Spireslack OCCS ES in 2002 and the Spireslack Wind Farm ES in 2004 showed that black grouse were present in the area in these years (see Confidential Annex for more details). In 2002, 2 black grouse were recorded on 2 occasions at Hagshaw Hill during breeding bird surveys. During the 2003 Phase 1 survey, a female black grouse was seen in flight over Shiel Hill and another near Wedder Hill. In 2004, no lek sites were recorded within survey area plus 1km buffer, although 2 leks were identified in the wider area (beyond 2km). It was considered that a total of 7 males were present at these sites, with mixing between them. No females were observed. During the Spireslack Wind Farm flight activity surveys, all sightings were to the west of the application site boundary.

[20] RPS (2005) Hagshaw Hill Wind Farm Extension Environmental Statement. CRE Energy and Scottish Power Company

7.89 The species was also present during the surveys conducted for the adjacent Hagshaw Hill Wind Farm extension in 2003/04 (3 leks), although by 2007 only 2 leks remained, each consisting of a single male. During Wind Farm construction in late April 2008, a black grouse survey found no signs of presence on site (M. Austin pers. comm.). Closest observations were some 1.5km from the nearest proposed turbine at Galawhistle, although evidence of lekking and roosting was beyond 2km (see Confidential Annex for details).

7.90 Surveys in preparation for the proposed Nutberry Hill Wind Farm in 2004-05 recorded 1 male lekking in an area of open moorland approximately 2km to the west and a group of four lekking males another 2km further west in 2004[21]. It was reported in the ES that stalkers and local landowners have commented that previously strong populations have declined at the site.

Breeding Raptor Surveys

7.91 Annex 1 or Schedule I raptors recorded as breeding within 2km of the application site in 2008 and/or 2009 were **peregrine** and **barn owl**. The exact locations of these records are given in the Confidential Annex.

Hen Harrier

7.92 No hen harrier breeding attempts were recorded within 2km of the application site in 2008 or 2009. In addition, turbines are all over 2km from the nearest known historical nest site within the SPA, and there are no SPA-associated nesting locations between the Wind Farm and SPA.

7.93 As highlighted above, surveys were carried out to monitor the direction from which connectivity with the SPA was considered possible. Male adult hen harriers were recorded foraging within the Muirkirk and North Lowther Uplands SPA to the south of Galawhistle, between April and July 2009. Activity was often recorded in the region of Cairn Table along the slopes of the Douglas Water – possibly from a hen harrier pair known to breed in the Cairn Table area. There was no significant linkage evident, however, between the SPA and site for this species during the breeding or winter season.

7.94 No evidence indicative of breeding hen harrier was observed within areas of suitable habitat up to 2km during surveys for the planned Hagshaw Hill Extension in 2003-04, or the planned Nutberry Hill Wind Farm in 2004-05. During the 2006 breeding season, Colin Crooke, with assistance from Brian Etheridge, carried out raptor surveys on behalf of Scottish Coal of the Spireslack wind farm area (8 field days on 11 and 12 May and 18 and 19 June 2006). No evidence of breeding harriers was found and they reported the wind farm site was 'largely unsuitable due to the virtual absence of tall heather' and that 'overall the habitat present (and the forestry to the north) was not suitable to support nesting harrier. In reaching this conclusion, they also took into account the potential for harriers to use rushes for nesting, but this was ruled out having checked most suitable rush patches.

Merlin

7.95 No merlin breeding attempts were recorded within 2km of the application site in 2008 or 2009. Details of nesting locations outwith this distance are provided in the Confidential Annex.

7.96 Signs of merlin were recorded on site, specifically merlin droppings on a cairn, and prey remains on fence posts. Occasional merlin activity was recorded along the plantation edge within 1km

[21] RPS (2005) Nutberry Hill Wind Farm Environmental Statement.

north of the application site boundary, and within the SPA over 1.5km to the south, in particular along the Douglas Water.

7.97 No evidence of breeding merlin was observed within areas of suitable habitat up to 2km during surveys for the planned Hagshaw Hill Extension in 2003-04 or the Nutberry Hill Wind Farm in 2003-05. From his 2006 raptor survey work at the Spireslack wind farm site, Colin Crooke found no evidence of breeding merlin, and considered the area to be of relatively low importance for this species, given the combined absence of tall heather for nesting, and the lack of old crow nests present.

Peregrine

7.98 Peregrine were recorded in 2008 and 2009, details of which are in the Confidential Annex.

Short-eared Owl

7.99 No short-eared owl breeding attempts were recorded within 2km of the application site in 2008 or 2009.

7.100 During 2008 raptor surveys 1 short-eared owl was recorded in suitable breeding habitat on 7 July on Priesthill Heights. A possible short-eared owl was also seen briefly 2km to the east/ southeast of Priesthill Heights, to the west of Little Auchinstilloch, on 28 May. On the 29 July 2008, a short-eared owl was flushed by a person on quad bike to the south of Glenbuck Loch.

7.101 Only 1 flight of a short-eared owl was recorded in 2009, in the SPA along the upper slopes of the Douglas Water, some 4.2km southwest of the application site. This was in potential nesting habitat, and so breeding is considered possible in the wider area.

7.102 According to the Spireslack Wind Farm ES, 2 pairs of short-eared owl were recorded at Kennox Water in May 1998. In 1996, 1 short-eared owl territory was recorded near Glenbuck. In 2002 the species was recorded foraging in Galawhistle corridor and assumed breeding in the area. Breeding was also rated as possible in 2004.

7.103 No evidence indicative of breeding short-eared owl was observed within areas of suitable habitat up to 2km during surveys for the planned Hagshaw Hill Extension in 2003-04.

7.104 Raptor surveys for the Nutberry Hill Wind Farm ES concluded that it was possible that 1 pair bred in suitable habitat within 2km of the site boundary in 2004.

7.105 Full details of these records are given in the Confidential Annex.

Barn Owl

7.106 Barn owl breeding was confirmed at 1 location within the application site in 2008 and 2009, and a second pair bred close to the access track in 2009, and probably in 2008.

7.107 Other barn owl signs were recorded to the south and north of the application site.

7.108 In 2002 a single barn owl recorded roosting on site, and nesting was confirmed (exact locations not known). A bird was recorded at Monkshead during flight activity surveys for the Spireslack Wind Farm ES.

7.109 Evidence suggested that breeding barn owl were observed at 2 locations within the area during surveys for the Hagshaw Hill Extension in 2003-04 (see Confidential Annex for details).

Other Raptors

7.110 No breeding evidence was recorded within the application site for any other raptor species in 2008 or 2009.

7.111 One **osprey** flight was recorded in May 2009 some 4km to the southwest of the application site. According to reports in the Spireslack Wind Farm ES, an osprey was seen regularly roosting at Glenbuck Loch in 2004, but not fishing there.

7.112 One short **golden eagle** flight was recorded within the WP in June 2008, when this roaming individual was mobbed by 2 buzzards.

7.113 **Buzzards** were regularly recorded in flight, both above the application site, and in particular within the SPA to the south. The observation of a pair suggests that breeding may have been attempted in the wider area.

7.114 **Kestrels** were observed hunting throughout the surveys, and a nest was located near Parish Holm, 1.6km south of the nearest turbine in 2008. A second nest was located 1.3km south of the nearest turbine at Carmacoup in 2008. A kestrel family was recorded on 3 occasions along the headwater of Douglas Water in August 2009.

7.115 A **tawny owl** was recorded roosting in June 2008, within a derelict building in the centre of the application site.

7.116 A **long-eared owl** was flushed from the plantation edge to the north of the application site in May 2008, over 3km from the closest turbine. Although in possible suitable breeding habitat, no nest was located.

7.117 A single **sparrowhawk** flight was recorded at the plantation edge to the north of the application site in May 2008.

Winter Walkover Surveys 2007/08 and 2008/09

7.118 A total of 66 species were recorded during the winter walkover surveys, between September 2007 and March 2008, and September 2008 and March 2009.

7.119 A full list of these species can be found in the Technical Appendix 2. The observations for target species are listed in Table 7.10 and shown in Figures 7.10 and 7.11

Table 7.10: Target Species Observed on Winter Walkover Surveys 2007/08 and 2008/09

Species	Observation
Barn owl	Signs in sheds in centre of application site (Sep 07); fresh droppings and pellets in building north of Glenbuck Loch (Feb 08)
Black grouse	1 bird present 1.7km west of application site (Oct 07)
Bullfinch	12 at plantation edge (Dec 08)
Common sandpiper	4 birds flying and calling north of application site (Sep 08)
Crossbill	Up to 10 birds recorded throughout, mainly near plantation to north of site, occasional flight within WP
Curlew	2 birds calling and flying inside WP in Mar 08, Oct 08, Mar 09
Dunnock	2 birds present within WP most months
Fieldfare	Up to 27 birds flying within WP (Oct 07); 5 in Nov 07; 29 birds, 25 within WP (Oct 08); 5 in Feb 08; 20 birds inside WP (Mar 08); 25 (Feb 09), 44 to south of WP (Feb 09)
Golden plover	1 on Avermarks Hill to east of site in Feb 08; 4 present near Glenbuck Loch, 1 in WP, 1 calling 500m north of WP (Feb 09)
Greylag goose	Skein of 12 recorded flying south of site (Sep 08); 2 on Loch in Feb 08
Hen harrier	2 ringtails (juveniles) calling at northwest section of WP in Oct 08
Kestrel	Hunting regularly inside and outside of WP; possible nest in plantation edge 2km NW of WP (Mar 08); 1 bird calling in centre of WP (Oct 08)
Lesser redpoll	Up to 7 flying within application site (Oct 07). Regular use of plantation edge
Mute swan	Up to 7 birds on Glenbuck Loch (Oct 07). Regular use throughout
Oystercatcher	3 present at Glenbuck Loch Feb 08; 2 in flight in WP (Mar 09)
Peregrine	1 flushed from track west of WP in Feb 08; 2 flights to west near access track in Mar 09
Pochard	Up to 26 present on Glenbuck Loch (Feb 08)
Raven	Small numbers regularly flying within WP
Redshank	2 birds near Glenbuck Loch (Oct 08)
Redwing	2 birds within WP (Nov 08); 10 in WP (Feb 09)
Reed bunting	Small numbers within WP throughout
Skylark	Small numbers using WP throughout surveys
Snipe	Up to 15 present in WP, including flock of 13 (Nov 07); regular use throughout including 2 birds within application site (Oct 07); 3 in WP (Nov 08)
Song thrush	2 flying in WP (Feb 08); 2 at plantation edge (Mar 08); 3 in WP in Nov 08
Starling	2 present in WP Mar 08 and Nov 08; 25 south of WP in Feb 09
Tufted duck	Up to 12 birds on Glenbuck Loch (Feb 09). Regular use throughout
Woodcock	1 present north of Glenbuck Loch (Feb 08 and Nov 08)

7.120 In 2003/04, the winter bird survey for Spireslack wind farm recorded 11 species including a single immature golden eagle flight.

7.121 At Hagshaw Hll Extension, 24 species were recorded, including 2 hen harriers and single merlin and peregrine.

Flight Activity Survey Results

7.122 Twenty-one target species were recorded during the flight activity surveys between September 2007 and August 2009 (see Figures 7.12 to 7.22). Total numbers of each target species observed during flight surveys are shown in Table 7.11, and each species is discussed below in relation to its pattern of flight activity and susceptibility to turbine collisions. Species for which collision risk modelling was undertaken are shown in Table 7.11 in bold

7.123 Collision risk modelling was generally only undertaken for those species for which more than 3 independent flight events occurred throughout the entire survey period, as it was considered that reliable predictions of collision risk were not likely for fewer events. A bird was considered to be “at risk” if flying over the Wind Farm polygon at Potential Collision Height (PCH) (20-100m above ground).

7.124 Flight events are split between breeding and non-breeding periods, which for raptors is mid-March (nominally March 15) to the end of August inclusive, and for waders and wildfowl is April to July inclusive.

Table 7.11: The Total Number of Each Target Species Observed During the Flight Activity Surveys, Along with the Number Considered to be Potentially at Risk of Turbine Collision

Species (and season)	Total number of birds in flight recorded	- of which over WP risk zone	- of which at PCH	
			Birds	Flight events (i.e. number of flights)
Black grouse: all year	3	0	0	0
Cormorant: non breeding	3	2	2	1
Curlew: **non breeding** **breeding**	 **51** **268**	 **36** **151**	 **22** **54**	 **12** **41**
Dunlin: Breeding	4	3	0	0
Green sandpiper: Breeding	1	0	0	0
Golden plover: **non breeding** **breeding**	 **112** **115**	 **55** **115**	 **45** **31**	 **6** **1**
Goosander: non breeding	11	5	5	2
Greylag goose, plus unidentified grey goose: **non breeding**	**289**	**200**	**122**	**4**
Hen harrier: **non breeding** **breeding**	 **18** **15**	 **7** **6**	 **2** **5**	 **1** **5**
Lapwing: non breeding **breeding**	 38 **36**	 18 **17**	 0 **8**	 0 **5**
Merlin: non breeding Breeding	 13 2	 8 1	 1 0	 1 0
Mute swan: non breeding	6	4	0	0
Oystercatcher: non breeding Breeding	 12 26	 3 11	 0 0	 0 0
Peregrine: **non breeding** **breeding**	 **29** **53**	 **24** **42**	 **13** **11**	 **12** **11**
Pink-footed goose plus unidentified grey goose: **non breeding**	**507**	**324**	**189**	**4**

			- of which at PCH	
Red kite:				
non breeding	**3**	**3**	**1**	**1**
breeding	**3**	**3**	**2**	**2**
Ringed plover:				
Breeding	1	0	0	0
Short-eared owl:				
Breeding	1	1	0	0
Snipe:				
non breeding	**5**	**1**	**1**	**1**
breeding	**27**	**23**	**3**	**3**
Unidentified grey goose:				
non breeding	83	50	50	1
Whooper swan:	13	8	0	0
non breeding				

Grouse

Black Grouse

7.125 Two short black grouse flight events were recorded during flight activity surveys between September 2007 and August 2009 - 1 in October 2007 (2 birds) and 1 in April 2009 (1 bird) (Table 7.11). Both were recorded west of Little Auchenstilloch, 2km west of the WP (Figure 7.12). Neither flight was at PCH. The lack of “at risk” flights therefore suggests collision risk to be very low for this species.

Wildfowl

Cormorant

7.126 Two flight events, totalling 3 birds were recorded near Glenbuck Loch in April 2008. Only 2 of these birds flew through the WP at PCH (Table 7.10).

7.127 With only 1 independent “at risk” flight event during the surveys, there was considered to be insufficient data to generate robust predictions of collision risk. It follows however, that the infrequency of “at risk” flights indicates collision risk is very low for this species.

Goosander

7.128 In total, 6 goosander flight events, totalling 11 birds were recorded over the 2 years at Galawhistle. Two of these flights (5 birds) were 'at-risk', and took a north-south direction through the centre of the application site. With only 2 independent “at risk” flight events during the surveys, there was considered to be insufficient data to generate robust predictions of collision risk. It follows however, that the infrequency of “at risk” flights is evidence that the collision risk is very low for this species.

Greylag goose

7.129 Including 2 unidentified grey geese flocks, a total of 289 birds were recorded during flight activity surveys, from 14 flight events. The majority of flights took place during the spring migration, with only 3 flight events during the autumn (Figure 7.13). Maximum flock size recorded was 70 birds in April 2008.

7.130 Four flocks, totalling 122 birds were recorded flying 'at-risk' over the survey area during the surveys, all during the period December to April. These flocks were considered to represent four independent “at risk” flight events and this information was used to generate collision risk predictions using collision risk modelling. These predictions are given in the next section. Background calculations are detailed in the Technical Appendix 2.

Mute swan

7.131 Three pairs of mute swans were recorded flying at Galawhistle, all in the vicinity of Glenbuck Loch in October 2007 (Figure 7.14). All of these birds flew outside of the WP, and hence there were no 'at-risk' flights. It follows that collision risk would be very low for this species.

Pink-footed goose

7.132 Pink-footed goose flights recorded at Galawhistle during the winter months are shown in Figure 7.13. The peak count recorded was 150 birds in December 2008. Including 1 unidentified goose flock, 4 flocks, totalling 189 birds crossed the WP at PCH, which was considered sufficient to conduct collision risk modelling for this species. These predictions are given in the next section. Background calculations are detailed in the Technical Appendix 2.

Whooper swan

7.133 Two flights of 8 and 5 birds were recorded flying westwards from Glenbuck Loch during the flight activity surveys in October and November 2007 (Figure 7.14). As they were at least 800m from the WP, no 'at-risk' flights were recorded. It follows therefore that collision risk will be very low for this species.

Waders

Curlew

7.134 During the 2008 and 2009 breeding seasons, (April to July inclusive), a total of 268 curlews were recorded in flight (Figure 7.16). In addition, 51 birds were recorded outside of the breeding season in March 2008 and 2009 (Figure 7.18). Flights were widespread across the site, although were particularly concentrated in an area around Shiel Hill, generally beyond 500m from the turbines.

7.135 There were a total of 54 'at-risk' flights during the breeding season (41 flight events), and 22 during the non-breeding season (12 flight events) (Table 7.11). In both cases, these flocks were considered to represent sufficient independent “at risk” flight events to generate collision risk predictions using collision risk modelling. These predictions are given in the next section. Background calculations are detailed in the Technical Appendix 2.

Dunlin

7.136 Two dunlin flight events were recorded throughout the surveys - all 4 birds flew outside of the WP (3 at PCH), and hence there were no 'at-risk' flights (Figure 7.16). It follows that collision risk would be very low for this species.

Golden plover

7.137 Golden plovers were recorded at Galawhistle on 15 occasions - a total of 227 birds, with a maximum count of 80 individuals in 1 flock in May 2009 (Figure 7.15). This was the only record of the species during the breeding season. There was a small concentration of flights in the southeast sector of the application site. Of the 14 flight events throughout the non-breeding periods, 45 individuals were 'at-risk' during 6 flight events and this information was used to generate collision risk predictions using collision risk modelling. These predictions are given in the next section. Background calculations are detailed in the Technical Appendix 2.

Green sandpiper

7.138 A single green sandpiper flight, thought likely to be a roaming non-breeder was recorded to the west of Glenbuck Loch in June 2009, some 1.4km from the WP (Figure 7.16). With such a low activity rate, it follows that collision risk would be negligible for this species.

Lapwing

7.139 Lapwing is predominantly a breeding species at Galawhistle, with early arrivals in March being included in the non-breeding flight events. A total of 34 flight events were recorded, with 10 occurring in March (38 birds) and 24 between April and the end of July (36 birds) (Figures 7.17 and 7.18). A maximum flock size of 18 birds was recorded above Glenbuck Loch in March 2008.

7.140 Most lapwing activity was concentrated within enclosed fields generally over 500m south of the nearest turbine. This is reflected in the fact that only 5 flight events (8 birds) were 'at-risk' during the breeding season, with none in the non-breeding season. These 5 independent “at risk” flight events during the breeding season were used to generate collision risk predictions using collision risk modelling. These predictions are given in the next section. Background calculations are detailed in Technical Appendix 2.

Oystercatcher

7.141 Oystercatchers are predominantly a breeding bird at Galawhistle, although early arrivals were observed on 28 February 2009 onwards. A total of 26 flight events were recorded (38 birds), with 12 birds in the non-breeding season, and 26 birds in the breeding season (Figure 7.15). Survey results showed that the majority of flights were well outside of the WP near Glenbuck Loch, with a smaller number in enclosed land in the centre of the WP. Of these flights, none were at PCH and considered to be 'at-risk'. It therefore follows that collision risk would be very low for this species.

Ringed plover

7.142 A solitary ringed plover flight was recorded over 400m to the west of the WP in June 2009 (Figure 7.17). This flight was also below PCH and it therefore follows that collision risk for this species at Galawhistle will be negligible.

Snipe

7.143 Snipe flights were recorded on 24 occasions (32 birds), mainly during June and July (Figures 7.16 and 7.18). A peak flock size of 5 was recorded in June 2008. Most flights were concentrated near enclosed fields up to 500m south of the WP, but a total of 4 individual flights were within the WP and perceived to be 'at-risk' - 3 in the breeding season and 1 in the non-breeding season. These observations were considered to represent 4 independent “at risk” flight events and this information was used to generate collision risk predictions using collision risk modelling. These predictions are given in the next section. Background calculations are detailed in Technical Appendix 2.

Raptors

Hen harrier

7.144 Hen harrier flights were recorded evenly throughout the year between 2007 and 2009 at Galawhistle. All but 1 of these was of single birds, with a total of 33 individuals (15 during the breeding season, and 18 during the non-breeding season) (Figures 7.19 and 7.20). Of these flights, only 1 'at-risk' event with 2 birds was recorded in the non-breeding season, which has been modelled for completeness. During the breeding season, 6 individual flights were 'at-risk', and this information was used to generate collision risk predictions using collision risk modelling. These predictions are given in the next section. Background calculations are detailed in Technical Appendix 2.

Merlin

7.145 A total of 15 individual merlin flights were recorded at Galawhistle, mainly during the breeding periods (Figures 7.21 and 7.22). Observations were widely spread throughout the survey area. Of the 13 flights during the breeding season, only 1 was 'at-risk'. This was considered to be insufficient data to generate robust predictions of collision risk. It follows however, that the infrequency of “at risk” flights suggests collision risk to be very low for this species.

Peregrine

7.146 Peregrine is a resident species in the wider area, and as such flights were recorded throughout the year, although as expected there was increased activity during the breeding season. A total of 78 flight events (83 birds) were recorded between 2007 and 2009, spread throughout the survey area (See Confidential Annex). During the non-breeding season 12 flight events (13 birds) were 'at-risk', and in the breeding season, 11 individual birds flew 'at-risk'. For both

breeding and non-breeding seasons, the flight information was considered sufficient to generate robust collision risk predictions using collision risk modelling. These predictions are given in the next section. Background calculations are detailed in Technical Appendix 2.

Red kite

7.147 Red kite was an infrequent visitor to the Galawhistle site, with 6 individual flight events occurring evenly throughout the year (Figures 7.21 and 7.22). Of these fights, only 2 birds were 'at-risk' in the breeding seasons, with only 2 during the non-breeding seasons. There was however considered to be sufficient data to generate predictions of collision risk. These predictions are given in the next section. Background calculations are detailed in Technical Appendix 2.

Short-eared owl

7.148 A single short-eared owl flight was recorded 1.7km to the west of the WP in July 2008 (Figure 7.21). With no 'at-risk' flights recorded during 2 years of surveying (and given the absence of any historical breeding records on site), it follows that collision risk for this species is negligible.

Collision Risk Modelling Results

7.149 Of the target species recorded during the flight activity surveys, 9 species were responsible for at least 3 statistically independent flight events that might be at risk of a turbine collision within the Wind Farm per season (Table 7.11). There was considered be to sufficient information to enable robust collision risk predictions for these species, and it follows that the infrequency of “at risk” flight activity for the other target species means that their risk of turbine collisions is very low.

7.150 The flight activity data for the 9 species were extrapolated to estimates of their total annual flights through the Risk Area or Risk Volume, respectively[22]. These annual totals were then entered into the collision risk model to generate estimates of the annual frequency of turbine collisions for each species. Tables 7.a.4 to 7.a.18 in Technical Appendix 2 detail each stage of the collision modelling process.

Greylag goose plus unidentified grey goose (mid-September to mid-May)

7.151 A total of 122 birds were observed flying through the Risk Area during the surveys. This extrapolates to an annual total of 852 birds through the Risk Area (step 4). The 22 turbines of the Wind Farm would together sweep 55% of the Risk Area, leading to an estimate of 466 birds flying through the Rotor-swept Area each year (step 8). After accounting for the probability that a given rotor transit will result in a collision (step 9), plus the likely operation rate of the turbines (step 11), the modelling process leads to a range of estimates for different levels of avoidance by the geese (step 12).

7.152 The survey data generate a predicted collision rate **of 1 every 29 months (99% avoidance)** (Table 7.12).

Pink-footed goose plus unidentified grey goose (mid-September to mid-May)

7.153 A total of 189 birds were observed flying through the Risk Area during the surveys. This extrapolates to an annual total of 1,831 birds through the Risk Area and an estimated 1,002 birds would fly through the Rotor-swept Area each year. The survey data lead to predicted collision rate **of 1 every 14 months (99% avoidance)**.

Hen Harrier (breeding and non-breeding seasons)

Breeding season

7.154 Occupancy of the Risk Volume totalled 515 seconds during the surveys. This extrapolates to a total of 4,447 seconds during the breeding seasons. The 22 turbines of the Wind Farm would together sweep 0.09% of the Risk Volume, leading to an estimate of 4.14 seconds occupancy of the Rotor-swept Volume each year. After accounting for the probability of a given rotor transit leading to a collision, plus the likely operation rate of the turbines, the modelling process generates a range of estimates for different levels of avoidance by the birds.

7.155 The survey data lead to predicted collision rates ranging from **1 every 25 years (95% avoidance) to 1 every 125 years (99% avoidance)**.

Non-breeding season

7.156 Occupancy of the Risk Volume totalled 300 seconds during the surveys. This extrapolates to a total of 1,769 seconds during the non-breeding seasons (1.65 seconds occupancy of the Rotor-swept Volume each year). The survey data lead to predicted collision rates ranging from **1 every 63 years (95% avoidance) to 1 every 314 years (99% avoidance)**.

Curlew (non-breeding and breeding)

Non-breeding season

7.157 Occupancy of the Risk Volume totalled 4,366 seconds during the surveys. This extrapolates to a total of 29,217 seconds during the 2 non-breeding seasons (27.76 seconds occupancy of the Rotor-swept Volume each year)

7.158 The survey data lead to predicted collision rates ranging from **1 every 2.4 years (95% avoidance) to 1 every 12.2 years (99% avoidance)**.

Breeding Season

7.159 Occupancy of the Risk Volume totalled 2,195 seconds during the surveys. This extrapolates to a total of 22,726 seconds during the 2 breeding seasons (21.59 seconds occupancy of the Rotor-swept Volume each year).

7.160 The survey data lead to predicted collision rates ranging from **1 every 3.1 years (95% avoidance) to 1 every 15.7 years (99% avoidance)**.

Golden Plover (non-breeding and breeding seasons)

Non-breeding season

7.161 Occupancy of the Risk Volume totalled 1,001 seconds during the surveys. This extrapolates to a total of 9,191 seconds during the 2 non-breeding seasons (8.07 seconds occupancy of the Rotor-swept Volume each year)

7.162 The survey data lead to predicted collision rates ranging from **1 every 14.2 years (95% avoidance) to 1 every 70.8 years (99% avoidance)**.

[22] The Risk Area is the appropriate concept for a species like greylag goose where collision risk is modelled using the directional approach, while Risk Volume is the correct concept for golden plover for which the non-directional (or random) approach is used.

Breeding season

7.163 Occupancy of the Risk Volume totalled 465 seconds during the surveys. This extrapolates to a total of 7,030 seconds during the 2 breeding seasons (6.18 seconds occupancy of the Rotor-swept Volume each year)

7.164 The survey data lead to predicted collision rates ranging from **1 every 19 years (95% avoidance) to 1 every 96 years (99% avoidance)**.

Lapwing (breeding season)

7.165 Occupancy of the Risk Volume totalled 543 seconds during the surveys. This extrapolates to a total of 4,372 seconds during the 2 breeding seasons (3.86 seconds occupancy of the Rotor-swept Volume each year).

7.166 The survey data lead to predicted collision rates ranging from **1 every 23 years (95% avoidance) to 1 every 117 years (99% avoidance)**.

Peregrine (non-breeding and breeding season)

Non-breeding season

7.167 Occupancy of the Risk Volume totalled 1,104 seconds during the surveys. This extrapolates to a total of 6,900 seconds during the non-breeding seasons (6.4 seconds occupancy of the Rotor-swept Volume each year).

7.168 The survey data lead to predicted collision rates ranging from **1 every 12 years (95% avoidance) to 1 every 62 years (99% avoidance)**.

Breeding season

7.169 Occupancy of the Risk Volume totalled 838 seconds during the surveys. This extrapolates to a total of 6,237 seconds during the breeding seasons (5.75 seconds occupancy of the Rotor-swept Volume each year).

7.170 The survey data lead to predicted collision rates ranging from **1 every 13 years (95% avoidance) to 1 every 68 years (99% avoidance)**.

Red kite (non-breeding and breeding season)

Non-breeding season

7.171 Occupancy of the Risk Volume totalled 47 seconds during the surveys. This extrapolates to a total of 217 seconds during the non-breeding seasons (0.21 seconds occupancy of the Rotor-swept Volume each year).

7.172 The survey data lead to predicted collision rates ranging from **1 every 354 years (95% avoidance) to less than 1 every 1,000 years (99% avoidance)**.

Breeding season

7.173 Occupancy of the Risk Volume totalled 482 seconds during the surveys. This extrapolates to a total of 2,863 seconds during the breeding seasons (2.76 seconds occupancy of the Rotor-swept Volume each year).

7.174 The survey data lead to predicted collision rates ranging from **1 every 26 years (95% avoidance) to 1 every 133 years (99% avoidance)**.

Snipe (breeding and non-breeding seasons)

Breeding season

7.175 Occupancy of the Risk Volume totalled 167 seconds during the surveys. This extrapolates to a total of 2,525 seconds during the breeding seasons (2.2 seconds occupancy of the Rotor-swept Volume each year).

7.176 The survey data lead to predicted collision rates ranging from **1 every 35 years (95% avoidance) to 1 every 175 years (99% avoidance)**.

Non-breeding season

7.177 Occupancy of the Risk Volume totalled 120 seconds during the surveys. This extrapolates to a total of 560 seconds during the non-breeding seasons (0.49 seconds occupancy of the Rotor-swept Volume each year).

7.178 The survey data lead to predicted collision rates ranging from **1 every 157 years (95% avoidance) to 1 every 787 years (99% avoidance)**.

Assessment of Effects

Evaluation of Ornithological Receptors

7.179 Each bird species recorded within 500m of the proposed Wind Farm site was considered to be a Valued Ornithological Receptor (VOR) of the site if it met any of the following criteria:

- The species is listed in Annex I of the EU Birds Directive.
- The qualifying species of the Muirkirk and North Lowther Uplands SPA.
- The species is listed in Schedule 1 of the Wildlife and Countryside Act 1981, as amended (e.g. by The Conservation (Scotland) Act 2004[23].)
- The UK supports an internationally important population of the species;
- The species is a Priority Species within the UK Biodiversity Action Plan;
- The species is the subject of a species action plan within the Ayrshire or South Lanarkshire Local Biodiversity Action Plan;
- The species is included in the Birds of Conservation Concern (BoCC) Red List;[24]
- There is a population of an Amber or a Green-listed species within the survey area deemed sufficiently large as to be of national importance.

7.180 A total of 28 species met at least 1 of these criteria and therefore constitute the VORs at Galawhistle. A summary of their presence, conservation status and legislative protection is given in Table 7.12.

7.181 The importance of the application site for each VOR is discussed below.

[23] http://www.jncc.gov.uk/page-3148

[24] http://www.bto.org/birdtrack/bird_recording/red_list.htm. Note that an Amber-listed species does not in itself merit qualification as a VOR - at least one other criterion must be met to qualify. This list comprises species with populations that in the last 25 years have either undergone a rapid decline (by 50% or more) or have undergone a large range contraction (again by 50% or more).

Table 7.12: The Valued Ornithological Receptors (VORs) of the Survey Area

Receptor	Recorded Presence	Conservation Status and Level of Protection	Species conservation value[25] (Sp) and level of site importance for the species (Site)
BREEDING BIRDS:			
Peregrine	See Confidential Annex 78 flight events between September 2007 and August 2009	Conservation status: SPEC[26] - Non-SPEC (secure); Muirkirk & North Lowther Uplands SPA qualifying species; LBAP action plan for Upland Heath Legal protection: Annex I, Schedule 1	Sp: International Site: International
Merlin	No evidence of breeding within 2km Signs of hunting to north of site 15 flight events between September 2007 and August 2009. Breeding in SPA to south	Conservation status: Non-SPEC (secure); BoCC Amber List; Muirkirk & North Lowther Uplands SPA qualifying species; LBAP action plan for Upland Heath and Blanket Bog Legal protection: Annex I, Schedule 1	Sp: International Site: International
Hen harrier	No breeding evidence within 2km 32 flight events between September 2007 and August 2009. Mainly during spring/autumn migratory periods. Closest breeding likely to be in SPA	Conservation status: SPEC 3 (depleted, large historical decline); BoCC Red List; Muirkirk & North Lowther Uplands SPA qualifying species (winter); Ayrshire LBAP action plan species; LBAP Species Action Plan for Upland Heath and Blanket Bog; Legal protection: Annex 1, Schedule 1	Sp: International Site: International
Short-eared owl	No evidence of breeding within 2km Occasional visitor - small number of recorded flights	Conservation status: SPEC 3 (depleted - large historical decline, not concentrated in Europe); BoCC Amber List; Muirkirk & North Lowther Uplands SPA qualifying species; LBAP action plan for Upland Heath and Blanket Bog Legal protection: Annex I	Sp: International Site: International

[25] Species conservation value is within a UK context as outlined in Table 7.3.
[26] The SPEC (Species of European Conservation Concern) classification summarises the conservation status of species with an unfavourable conservation status in Europe.

Receptor	Recorded Presence	Conservation Status and Level of Protection	Species conservation value[25] (Sp) and level of site importance for the species (Site)
Barn owl	Resident breeder 1 breeding pair within WP, and 1 adjacent in 2008 and 2009. Signs of roosting within WP in winter 2007/08, and south of site in 2008/09	Conservation status: SPEC 3 – (declining, not concentrated in Europe); BoCC Amber List Legal protection: Schedule 1	Sp: National Site: District
Black grouse	No leks or indication of breeding on site 3 leks within wider area but not within 1.5km of the WP	Conservation status: SPEC 3 (Depleted - large historical decline); BoCC Red List; UK BAP Priority Species; Ayrshire LBAP action plan species; LBAP Species Action Plan for Upland Heath and Blanket Bog Legal protection: Annex II/2 [27]	Sp: Regional Site: District
Lapwing	Breeding species present March to July 2 territories outwith WP in 2008 and 2009. 34 flight events. Peak count of 18 birds.	Conservation status: SPEC 2 (vulnerable, concentrated in Europe); BoCC Red List; UK BAP Priority Species; forms part of the Ayrshire LBAP action plan for farmland birds. Legal protection: general, under WCA	Sp: Regional Site: Local
Curlew	Breeding species between March and July 3 territories within WP in 2008 (total 14 territories); 2 within WP in 2009 (10 territories). 245 flight events between March and July periods. Max count of 10 birds. 2 birds recorded flying within WP in October 2008	Conservation status: SPEC 2 – declining (concentrated in Europe); BoCC Amber List; UK BAP Priority Species; forms part of the Ayrshire LBAP action plans for upland heath, blanket bog and farmland birds. Legal protection: general under WCA, Annex II/2	Sp: Regional Site: District
Dunlin	Rare visitor 2 flight events in April 2008. Peak count of 3 birds.	Conservation status: SPEC 3 – depleted (not concentrated in Europe); BoCC Red List; forms part of the Ayrshire LBAP action plans for upland heath and blanket bog birds. Legal protection: general under WCA	Sp: Regional Site: Negligible

[27] Annex II/2 of the EU Birds Directive. The species listed here may be legally killed or sold.

Receptor	Recorded Presence	Conservation Status and Level of Protection	Species conservation value[25] (Sp) and level of site importance for the species (Site)
Skylark	Common breeding species 167 territories in 2008 (30 within WP). 148 territories in 2009 (59 within WP). Low numbers throughout winter periods	Conservation status: SPEC 3 (depleted - not concentrated in Europe); BoCC Red List: UK BAP Priority Species; forms part of the Ayrshire LBAP action plan for farmland birds and Blanket Bog. Legal protection: general, under WCA	Sp: Regional Site: District
Song thrush	Breeding species 1 singing male outside of site in 2008. 5 territories along plantation edge and within WP in 2009. Up to 3 birds recorded using site throughout winter 2007/08 and 2008/09	Conservation status: Non-SPEC (secure - concentrated in Europe); BoCC Red List: UK BAP Priority Species; LBAP Species Action Plan; forms part of the Ayrshire LBAP action plan for farmland birds. Legal protection: general, under WCA	Sp: Regional Site: Local
Starling	Occasional visitor 1 territory outwith WP in 2009. 2 birds present in WP in March and November 2008; 25 south of WP in February 2009	Conservation status: Non-SPEC (secure - not concentrated in Europe); BoCC Red List: UK BAP Priority Species; forms part of the Ayrshire LBAP action plan for farmland birds. Legal protection: general, under WCA	Sp: Regional Site: Local
House sparrow	Probable resident Present but not confirmed breeding in 2008 and 2009. Peak count of 5 birds.	Conservation status: SPEC 3 (declining - not concentrated in Europe); BoCC Red List: UK BAP Priority Species; forms part of the Ayrshire LBAP action plan for farmland birds. Legal protection: general, under WCA	Sp: Regional Site: Local
Dunnock	Resident 1 pair breeding within WP in 2009. 2 birds in WP throughout winter	Conservation status: Non-SPEC (secure - concentrated in Europe); BoCC Amber List: UK BAP Priority Species; forms part of the Ayrshire LBAP action plan for farmland birds. Legal protection: general, under WCA	Sp: Regional Site: Local

Receptor	Recorded Presence	Conservation Status and Level of Protection	Species conservation value[25] (Sp) and level of site importance for the species (Site)
Grasshopper warbler	Rare breeder 1 territory in 2008 and 2009.	Conservation status: Non-SPEC (secure, concentrated in Europe); BoCC Red List: UK BAP Priority Species. Legal protection: general, under WCA	Sp: Regional Site: Local
Crossbill	Resident in wider area 1 territory within WP in 2008. Very occasional site usage in summer Up to 10 birds in winter, mainly near plantation to north of site, occasional flight within WP.	Conservation status: Non-SPEC (secure, not concentrated in Europe) Legal protection: Schedule 1	Sp: National Site: Local
Linnet	Breeding in wider area Present within WP in 2009 but not confirmed breeding.	Conservation status: BoCC Red List: UK BAP Priority Species; forms part of the Ayrshire LBAP action plan for farmland birds. Legal protection: general, under WCA	Sp: Regional Site: Local
Lesser redpoll	Resident in wider area Present, but not confirmed breeding within WP. 3 territories outwith site in 2008 and 2009, with 2 near access track. Up to 7 flying within application site (Oct 07). Regular use of plantation edge in winter.	Conservation status: BoCC Red List: UK BAP Priority Species; forms part of the Ayrshire LBAP action plan for farmland birds. Legal protection: general, under WCA	Sp: Regional Site: Local
Reed bunting	Breeder/resident 22 territories, with 7 inside WP in 2009. Small numbers within WP throughout winter.	Conservation status: Non-SPEC (secure, not concentrated in Europe); BoCC Amber List; UK BAP Priority Species; forms part of the Ayrshire LBAP action plan for farmland birds. Legal protection: general, under WCA	Sp: Regional Site: District

Receptor	Recorded Presence	Conservation Status and Level of Protection	Species conservation value[25] (Sp) and level of site importance for the species (Site)
WINTERING & MIGRATING BIRDS:			
Whooper swan	Winter visitor to Glenbuck Loch 2 flights in October and November 2007. Peak count of 8 birds.	Conservation status: Non-SPEC (Secure, concentrated in Europe); BoCC Amber List; UK population is internationally important UK Species of Conservation Importance. Legal protection: Annex 1 (migratory)	Sp: International Site: Negligible
Pink-footed goose	Occasional winter migratory flights 6 flight events in autumn and winter periods. Peak count of 150 birds.	Conservation status: Non-SPEC (secure, concentrated in Europe); BoCC Amber List; UK population is internationally important Legal protection: Annex II/2, Schedule 2[28].	Sp: International Site: Negligible
Greylag goose (Icelandic population)	14 flight events, mainly spring migration. Peak count of 70 birds.	Conservation status: Non-SPEC (secure, not concentrated in Europe); BoCC Amber List; Species of European Conservation Concern, UK Species of Conservation Importance Legal protection: Annex II/2, Schedule 2.	Sp: International Site: Negligible
Red kite	Infrequent wandering individual 6 flights, mainly late summer and autumn periods.	Conservation status: SPEC 2 (declining, concentrated in Europe); BoCC Amber List Legal protection: Annex 1, Schedule 1	Sp: International Site: Negligible
Green sandpiper	Rare passage 1 flight in June 2009	Conservation status: Non-SPEC (secure - not concentrated in Europe); BoCC Amber List Legal protection: Schedule 1	Sp: National Site: Negligible

[28] Schedule 2 of the WCA. Species listed here may be killed or taken outside the close season.

Receptor	Recorded Presence	Conservation Status and Level of Protection	Species conservation value[25] (Sp) and level of site importance for the species (Site)
Golden plover	Present but likely non-breeder in 2008 and 2009 15 flight events mainly during spring/autumn migratory periods. Peak count of 80 birds in May 2009.	Conservation status: Non-SPEC (secure, concentrated in Europe); BoCC Amber List; Muirkirk & North Lowther Uplands SPA qualifying species; forms part of the Ayrshire LBAP action plan for Upland Heath and Blanket Bog. Legal protection: Annex I	Sp: National Site: District
Fieldfare	Predominantly winter visitor Flocks throughout winter 2007/08 and 2008/09. Up to 27 birds flying within WP (October 07) 55 birds present on 9 April 2008	Conservation status: Non-SPEC (secure - concentrated in Europe); BoCC Red List. Legal protection: Schedule 1	Sp: National Site: District
Redwing	Occasional winter visitor 2 birds (Nov 08); 10 birds (Feb 09)	Conservation status: Non-SPEC (secure - concentrated in Europe); BoCC Red List. Legal protection: Schedule 1	Sp: National Site: Local
Bullfinch	Occasional winter usage - 12 birds at plantation edge (December 2008)	Conservation status: Non-SPEC (secure - not concentrated in Europe); BoCC Amber list: UK BAP Priority Species; forms part of the Ayrshire LBAP action plan for farmland birds. Legal protection: general, under WCA	Sp: Regional Site: Negligible

7.182 Although **song thrush, starling, house sparrow, dunnock, linnet, bullfinch and lesser redpoll** are priority species within the UKBAP, and/or are Red-listed species of BoCC, their presence reflects a decline in numbers rather than rareness; they are still relatively common and widespread in the UK. Although these species have been identified as breeding or at least present within the survey boundary at Galawhistle, they occur in very low numbers (absolutely and/or relative to national populations) in an area of limited habitat suitability. As a consequence the importance of the site to these species is no more than Local level. Therefore there are **no significant impacts predicted on any of these species, and they will not be considered further**. The remaining species are discussed in turn below.

Whooper Swan

7.183 Whooper swan is listed in Annex 1 of the Birds Directive (migratory), and is on the UK Amber list of BoCC. As a result, it is considered to be a VOR of **international** importance (importance criteria defined in Table 7.4).

7.184 Only a small number of pairs breed sporadically in Britain, but wintering numbers of whooper swan in Britain have been estimated at 5,720 individuals[29]. In Scotland, 4,142 individuals were counted in 2005[30]. The 2005/06 Wetland Bird Survey (WeBS), revealed a slight fall in the British wintering whooper swan population (GB maximum = 7,439 individuals) from its peak in 2003/04 but this follows a notable rise in the previous years, remaining high in historical terms[31].

7.185 No complete population data are available for the Western Southern Uplands and Inner Solway Natural Heritage Zone (NHZ 19)[32]. There is however, information for the most important sites within the NHZ. During the period 1998-2003, Caerlaverock on the North Solway consistently held an internationally important concentration of over 300 birds, while a further 4 sites held nationally important numbers over the same period (each with over 70 birds)30. The Solway Estuary held a 5-year mean WeBS peak count of 424 birds (2003/04-2006/07), and Wigtown Bay held 230 birds over the same period . Together these data indicate a NHZ population in excess of 800 birds, approximately 10% of the British wintering population.

7.186 The presence of the species at Galawhistle was very low throughout the survey period (September 2007 to August 2009): 2 flights with a peak count of 8 birds were observed at Glenbuck Loch during the flight activity surveys in October and November 2007 (Table 7.11). In the context of a regional population of over 800 birds, the loch is clearly relatively unimportant migration stage for wintering or migrating whooper swans. The site is considered to be of **negligible** importance for this species.

Pink-footed Goose

7.187 Due to the localised and vulnerable nature of the global population in winter, the pink-footed goose population in the UK is considered to be of international importance. It is considered that at least 50% of the world population winters in Scotland, with over 50% of UK wintering birds being concentrated into 10 or fewer sites. Despite this localisation, numbers are high and pink-footed goose is a legitimate quarry species that can be hunted outside the close season. Given that the species qualifies under Article 4.2 of the EU Birds Directive and is found in internationally-important numbers in the UK, pink-footed goose is considered to be a VOR of **International** level importance (Table 7.4).

7.188 Winter numbers of pink-footed goose in Scotland have been estimated at 100,000-150,000 birds 30. The total British population was estimated at 287,563 in November 2007[33]. There has been a large increase in the wintering population since the mid-1980s due to a combination of factors, including increased acreages of winter cereal and permanent grass leys, combined with a decline in shooting pressure and the better protection of many major roosts.

7.189 No population data are available at the NHZ 19 level, but the latest Icelandic-breeding Goose Census in 2007 showed that the majority of pink-footed geese in Scotland were recorded in the eastern half of the country (just under 200,000), compared to a peak of 6,045 birds recorded in Southwest Scotland in October 200733. A total of 5,793 birds (2% of the total population estimate) were recorded in the Solway Firth during this month. Thus, Southwest Scotland is not an important region for wintering pink-footed geese, with only 2% of the wintering population.

7.190 The 6 flocks recorded over the 2 years' study with a peak count of 150 birds within the Wind Farm site throughout the period of flight activity surveys (Table 7.11) indicates that the site is not important within NHZ 19. No birds were recorded on the ground during any of the baseline surveys, and the site is therefore considered to be of **negligible** importance for pink-footed goose.

Greylag Goose (Icelandic population)

7.191 Greylag goose is on the UK Amber List of BoCC, due to the localised and vulnerable nature of the northwest European population. Of the 3 greylag goose populations found in Britain, the birds seen at Galawhistle are likely to belong to the migratory population that breeds in Iceland, 95% of which winter in Scotland.

7.192 At least 20% of the entire greylag goose population winters in the UK, with over 95% of UK wintering birds regularly being concentrated into 10 or fewer sites (including Orkney as 1 site)[31]. Despite this localisation, numbers are high and the species is a legitimate quarry species that can be hunted outside the close season. Given that the species qualifies under Article 4.2 of the EU Birds Directive and is found in internationally-important numbers in the UK, greylag goose is considered to be a VOR of **International** level importance (Table 7.4).

7.193 The winter Icelandic population of greylag goose increased up to 1990 but has since declined slightly. However, the species remains relatively abundant in Britain with wintering numbers estimated at 107,137 in 2007, an increase of 30% on the 2006 figures. Scottish numbers were considered to be approximately 83,500 birds in November 2004. Within Scotland there has been a northwards range shift since the 1980s[30]. Currently, the majority of the population winters in north Scotland, with only 2.4% of the Icelandic population wintering in Southwest Scotland33 equating to approximately 2,000 birds.

7.194 The 14 flocks (with a peak count of 70 birds) observed during the flight activity surveys (Table 7.11) indicate that the Galawhistle site is not important for the species at the Southwest

[29] Baker, H., Stroud, D. A., Aebischer, N. J., Cranswick, P. A., Gregory,R. D., McSorley, C. A., Noble, D.G & Rehfisch, M. M. (2006) Population Estimates of Birds in Great Britain and the United Kingdom. *British Birds* 99: 25-44.

[30] Forrester, R. W., Andrews, I. J., McInerny. C. J., Murray, R. D., McGowan, R. Y., Zonfrillo, B., Betts, M.W., Jardine, D.C. & Grundy, D.S. (eds) (2007). The Birds of Scotland. The Scottish Ornithologists' Club, Aberlady

[31] Austin, A.N., Collier, M.P, Calbrade, N.A., Hall, C. and Musgrove, A.J. 2008. *Waterbirds in the UK 2006/07: The Wetland Bird Survey*. BTO/WWT/RSPB/JNCC, Thetford.

[32] Natural Heritage Zones have been defined throughout Scotland by SNH, as areas with shared natural heritage characteristics including species, habitats and landscapes in addition to a range of other geographical and geological features. Scottish Natural Heritage encourages the assessment of ecological impacts at the Natural heritage Zone level. Galawhistle lies within NHZ 19.

[33] Mitchell, C. 2008. *Status and Distribution of Icelandic-breeding Geese: Results of the 2007 International Census*. Wildfowl & Wetlands Trust Report, Slimbridge.

Scotland or NHZ level. No birds were recorded on the ground during any of the baseline surveys. Consequently, the site is considered to be of **negligible** importance for greylag goose.

Hen Harrier

7.195 Hen Harrier is listed in Annex 1 of the EU Birds Directive and, as such constitutes a VOR of **international** importance in a UK context (Table 7.4). It is also a breeding and wintering qualifying interest of the Muirkirk and North Lowther Uplands SPA.

7.196 National surveys show the UK population to have remained fairly stable at 578-700 breeding pairs over the last twenty years[34]. There are however, large regional differences in the population trend. The most recent national survey reported 64 breeding pairs in the Southern Uplands in 2004, a 45% decrease since 1998[35]. This decline was largely attributed to a combination of factors including predation and human disturbance in areas where they are perceived to threaten grouse shooting interests.

7.197 This trend is reflected in the reduction in numbers in the Muirkirk and North Lowther Uplands SPA. The original citation estimated that the SPA held 29 breeding pairs (1994-1998 5 year average). However, by 2004 the number of breeding pairs had reduced to 21 pairs and by 2008 there were no more than 14 pairs[36].

7.198 During the survey period (September 2007 to August 2009) a total of 32 hen harrier flight events were observed (33 birds) throughout the year (Figure 7.11). Although no breeding was recorded within the survey area, and turbines are greater than 2km from any SPA or SPA-associated nesting location, a precautionary approach was taken to ranking the site's status. The application site is considered to be of **International** importance for hen harrier.

Peregrine

7.199 Peregrine is listed in Annex 1 of the EU Birds Directive (1994) and, as such constitutes a VOR of **International** importance in a UK context (Table 7.4). It is also a qualifying breeding species for the Muirkirk and North Lowther Uplands SPA.

7.200 The last national survey of breeding peregrines in 2002, located 1,402 breeding pairs in the UK, a 9% increase over the population found by the previous survey in 1991[37].

7.201 NHZ 19 and the Southern Uplands in general are quite important areas for breeding peregrines in a national context. The Scottish Raptor Monitoring Scheme Report for 2006 gives a population estimate for South West Scotland of 43 pairs, including 38 pairs in the South Strathclyde Raptor Study Group area (approximating to the Western Southern Uplands and Inner Solway NHZ). Six pairs breed within the Muirkirk and North Lowther Uplands SPA.

7.202 A total of 78 peregrine observations were made from the Galawhistle vantage points during September 2007 to August 2009. The breeding attempts reported in the Confidential Annex from 2008 and 2009 are not considered to be SPA birds (being allied to breeding sites outside the SPA, and with foraging concentrated outside the SPA boundary). Nonetheless, taking a precautionary view, the application site is considered to be of **International** importance for peregrine.

Merlin

7.203 Merlin is listed in Annex 1 of the Birds Directive (1994), and Schedule I of the Wildlife and Countryside Act (1981, as amended). It is also a qualifying breeding species for the Muirkirk and North Lowther Uplands SPA. As a result, it is considered to be a VOR of **International** importance.

7.204 The merlin breeding range extends across northern Eurasia, from Iceland, Britain and the Faroe Islands to east central Siberia, wintering as far south as North Africa. In Britain, the species breeds on moorland notably in the Scottish Highlands and Islands, the Welsh mountains, the English Pennines and the Scottish Southern Uplands. There are an estimated 1,330 breeding pairs of merlin in the UK.

7.205 The Scottish breeding population is estimated at approximately 800 pairs. A larger winter population of 3000+ birds includes Icelandic birds overwintering in Scotland.

7.206 According to the SPA citation, the SPA held 12 pairs, representing at least 0.9% of the breeding population in Great Britain. There is no specific information on the breeding population of NHZ 19, but data are available for the South Strathclyde (SS) and Dumfries and Galloway (D&G) Raptor Study Group areas, which together cover most of Southwest Scotland. In 2006, 10 and 8 occupied home ranges were monitored in the SS and D&G areas, respectively[38]. The corresponding figures in 2005 were 16 and 6 occupied home ranges. This suggests a NHZ population in the region of at least 25 pairs, of which the SPA is host to perhaps just under half.

7.207 Baseline surveys recorded low levels of activity (15 flights) from September 2007- August 2009, with no evidence of breeding taking place within the survey area. Although all turbines are greater than 2km from any SPA or SPA-associated nesting location, a precautionary view was still taken. Recorded birds are therefore classified as SPA birds, suggesting that Galawhistle is of **International** importance for merlin.

Red kite

7.208 Red kite is listed in Annex I of the EU Birds Directive and Schedule 1 of the Wildlife and Countryside Act (1981, as amended). As a result, it is considered to be a VOR of **International** importance.

7.209 There were estimated between 1,463 and 1,713 pairs of red kites breeding in Britain in 2007, with 32 pairs in the Dumfries and Galloway, and 45 pairs in the Central Scotland re-introduction programme areas[39]. The Scottish population in winter is estimated at between 300-350 birds[30].

7.210 Only 6 flights were recorded, mainly during the late summer and autumn periods, suggesting that birds were either roaming non-breeders or failed breeders crossing the site. No breeding evidence was recorded in either survey year, and as such the application site is considered to be of **negligible** importance for this species.

[34] Bright, J., Langston, R., Bullman, R., Evans, R., Gardner, S., and Pearce-Higgins, J. 2006. Map of bird sensitivities to wind farms in Scotland: A tool to aid planning and conservation. *Biological Conservation* 141: 2342-2356 .

[35] Sim, I.M.W., Dillon, I.A., Eaton, M.A., Etheridge, B., Lindley, P., Riley, H., Saunders, R., Sharpe, C., Tickner, M. (2007). Status of the Hen Harrier *Circus cyaneus* in the UK and Isle of Man in 2004, and a comparison with the 1988/89 and 1998 surveys. *Bird Study*, 54(2): 256-267.

[36] Scottish Raptor Study Group News. http://www.scottishraptorgroups.org/news.php?month=11&year=2008

[37] 2002 National Peregrine Survey described at: http://www.bto.org/survey/complete/peregrine.htm

[38] The Scottish Raptor Monitoring Scheme reports for 2006 and 2005: http://www.scottishraptorgroups.org/srmscheme.php

[39] http://www.gigrin.co.uk/red_kites_in_the_united_kingdom_breeding_pairs_1989-2007.html

Short-eared Owl

7.211 Short-eared owl is listed in Annex 1 of the EU Birds Directive and as a result, it is considered to be a VOR of **International** importance. It is also a qualifying breeding species of the SPA.

7.212 The short-eared owl is found across much of the Holarctic and Neotropic regions. The Scottish population is estimated as being no more than 1,250 pairs, representing 77% of the British breeding population. The Scottish wintering population is thought to number no more than 3,000 birds.

7.213 There is currently no estimate of the NHZ 19 population of this species, or its importance for short-eared owl. Birds are nomadic between breeding seasons in response to changes in prey abundance, which can result in breeding pairs being widespread in a region but absent in another, making regional populations variable and difficult to estimate. The species is a qualifying breeding bird for the Muirkirk and North Lowther Uplands SPA, with up to 30 pairs representing at least 3.0% of the breeding population in Great Britain (based on mid-1990s data).

7.214 With only a very small number of observations recorded, and no breeding signs, the evidence shows Galawhistle was of minimal importance for this species over 2008 and 2009. However, as the application site is potentially within the range of the Muirkirk and North Lowther Uplands SPA population, it is considered to be of **International** importance for short-eared owl.

Barn owl

7.215 Barn owl is listed in Schedule 1 of the Wildlife and Countryside Act 1981 (as amended), and is Amber-listed. It is considered to be a VOR of **National** importance.

7.216 The barn owl has a cosmopolitan world distribution and is not threatened over most of its range. The British and Scottish breeding populations remain strong in many areas, but the species is Amber-listed due to a moderate range decline (25-49%) in the UK over the last 25 years. The Scottish breeding population has been estimated as 500-1,000 pairs and 1,000-2,000 individuals (winter).

7.217 The Western Southern Uplands and North Solway NHZ is one of the main strongholds of the species in Scotland with an estimated 400 pairs in the Dumfries and Galloway part of the NHZ alone (40% to 80% of the Scottish total). Within this context, the 2 pairs nesting within 1km of the application site is considered to be of **District** level importance.

Black Grouse

7.218 Black grouse is on the UK Red List of BoCC on account of a population decline exceeding 50% in the last 25 years. In recognition of this rapid decline it is a Priority Species within the UK Biodiversity Action Plan. Consequently, the species is considered to be a VOR of **Regional** importance.

7.219 The black grouse is the one of the fastest declining bird species in the UK. Its population has declined in many parts of the UK over the last century, and in the last 2 to 3 decades this has accelerated, leading to considerable range contraction and concerns about further localised extinctions[40]. As a result, black grouse has been set as a priority for conservation action, featuring in SNH's Species Framework, the Scottish Biodiversity List, and the Birds of Conservation Concern Red List. Black grouse are also the subject of UK, South Lanarkshire and Ayrshire Biodiversity Action Plans.

7.220 Estimates of numbers in the UK have been derived from 2 national surveys. A 2005 survey[41] estimated 5,078 displaying males in the UK, and revealed a 29% decline in Scotland since the previous survey completed in 1995-9640: from 4,719 to 3,344 lekking males. Regionally, the decline was much steeper in south-eastern and south-western Scotland (by 69% and 49% respectively), although Scotland is still the species' stronghold in the UK with 66% of the population.

7.221 In 2007, a survey of lekking black grouse was undertaken over most of the suitable habitat in East Ayrshire by RPS for SNH. A total of 38 lekking males were located, suggesting a total population of 100-200 birds. Galawhistle was at the eastern edge of the survey area, although the majority of the site was covered. Records from this report reveal that 2 active leks were found within 5km of the site (see Confidential Annex for details).

7.222 With the closest record of black grouse 1.7km west of the WP, along with the desk study revealing a lack of recent records on site, Galawhistle is currently only of local importance to the species. However, in recognition of the possibility that black grouse may recolonise the site in response to ongoing conservation efforts in the wider area, the Galawhistle application site is considered to be of **District** level importance for the species.

Lapwing

7.223 Lapwing is a Red-listed BoCC species on account of a high population decline over the last 25 years, is a UK BAP species, and is the subject of an action plan for farmland birds within the Ayrshire Biodiversity Action Plan. On the basis of this level of conservation value (Table 7.3), lapwing is considered to be a VOR of **Regional** importance.

7.224 There has been a sharp and sustained decline in lapwing numbers in the UK since the mid-1980s, with range contractions in south-west England and in parts of Wales, associated with agricultural intensification. Lapwing numbers dropped by 49% in England and Wales between 1987 and 1998. The species has fared better in Scotland where crucial changes to farming were introduced later than in England and Wales; however, even here the breeding numbers have dropped by 29% since 198742. Lapwing was recently added to the BoCC Red list, signifying an overall decrease of at least 50% over the last 25 years[4].

7.225 The Scottish breeding population has been estimated at between 71,500-105,600 pairs30. There seems to be no information on the lapwing population of the Western Southern Uplands & Inner Solway NHZ. Considering the total national figures however, the breeding lapwing population of the NHZ is likely to be over 10,000 pairs.

7.226 From this, the 2 pairs of lapwing recorded outwith the application site in 2008 and 2009 are not considered to be important at the NHZ level. As most of the 34 recorded flight events were associated with these pairs, the application site is considered to be of no more than **Local** importance for lapwing.

[40] Hancock, M., Baines, D., Gibbons, D., Etheridge, B. & Shepherd, M. 1999. Status of Male Black Grouse Tetrao tetrix in Britain in 1995-96. *Bird Study* 46: 1-15.

[41] Sim, I.M.W., Eaton, M.A., Setchfield, R.P., Warren, P.K., Lindley, P. (2008). Abundance of Male Black Grouse Tetrao tetrix in Britain in 2005, and Change Since 1995-96. Bird Study, Nov 2008

[42] RSPB website. http://www.rspb.org.uk/wildlife/birdguide/name/l/lapwing/decline_and_conservation.asp

Golden Plover

7.227 Golden plover is listed in Annex 1 of the Birds Directive (migratory). As a result, it is considered to be a VOR of **International** importance. It is also a qualifying breeding species of the SPA.

7.228 Golden plover breed in northern latitudes across the Western Palaearctic from Iceland to western Siberia. Breeding habitats include heather moorland, blanket bog, acid grasslands, forest edge tundra and montane plateau. The European population is believed to number 440,000-785,000 pairs43. The race *apricaria* breeds in the British Isles, at the southern limit of the species' distribution. In Britain, the species favours moorland and boggy habitats in the uplands of northern and western Scotland (including the Outer Hebrides).

7.229 Whilst the core population in northern Europe is believed to be stable, the southern populations including those of *P. a. apricaria* in Britain and Ireland are believed to have been declining since the 19th century. A comparison of the species distribution between the 2 national breeding bird atlases in 1968-71 and 1988-91 reveals a 7% range contraction in Britain, with this being most pronounced in the southern populations including those of Wales, the Pennines, south-west Scotland and the eastern Highlands44.

7.230 The most recent breeding population estimate of 22,600 pairs in Britain suggests that the core British populations in upland Scotland remain strong, albeit at a lower level than in the 19th century. The BTO's breeding bird survey records between 1994 and 2007 showed a decrease in Scotland of 5%[45], although breeding densities in Scotland of 2-7 pairs per km^2 are among the highest anywhere in the species' range.

7.231 There are no data available on the breeding golden plover population of NHZ 19. The nearest significant population to Galawhistle is that of the Muirkirk and North Lowther Uplands SPA. Breeding golden plover is a qualifying species for this SPA, which holds an estimated 175 pairs, representing at least 0.8% of the breeding population of Great Britain[46].

7.232 The wintering population of the British mainland has recently been estimated at approximately 580,000 birds[47]. WeBS48 data suggest the Scottish wintering population using estuarine habitats is between 11,064 (1993) and 16,376 (1997) with an additional 15,000-20,000 wintering on rocky shores or inland.

7.233 Although present in small numbers at Galawhistle during the early part of the breeding season, there was no evidence of breeding golden plover within the survey area in 2008 or 2009. A peak count of 42 birds was recorded flying over the eastern edge of the site in May 2008.

7.234 During the flight activity surveys at Galawhistle, 15 flocks totalling 227 birds were recorded, with a peak count of 80 birds (Table 7.11). Consequently, the application site and surrounding area appear to periodically support up to a maximum of 80 golden plovers at any one time throughout the year, although mainly during spring and autumn migration periods. Taken in the context of the species high conservation status, the baseline information suggests that the site is important for this species at a **Regional** level.

Curlew

7.235 Curlew is an Amber-listed BoCC species, a UK BAP priority species, and is the subject of an action plan for farmland birds within the Ayrshire Biodiversity Action Plan. On the basis of this level of conservation value, is considered to be a VOR of **Regional** importance.

7.236 Despite a recent expansion into lowland agricultural habitats, the species is still more abundant in uplands and northern regions where there are extensive areas of its favoured moorland and unimproved grassland breeding habitat.

7.237 In the UK, there has been a considerable contraction of breeding range in south and east Ireland, as well as more localised contractions in west Scotland, the Midlands and south west of England and Pembrokeshire. These declines are likely to be associated with recent agricultural improvements to upland grasslands as well as increased afforestation, though increases in nest and chick predation rates have also been implicated[49].

7.238 The breeding population of the UK has been estimated as 107,000 pairs[50], of which approximately 58,800 pairs breed in Scotland30. Breeding numbers in the Western Southern Uplands & Inner Solway NHZ are unknown; however, The Muirkirk Uplands SSSI was considered to be of international importance for curlew (1.09% of GB population, as of Notification of Designation date in April 2000 [51], although the species appears to have been dropped from qualification since). This suggests that SSSI numbers would be approximately 1,167 pairs. Ayrshire Bird Reports have reported small numbers breeding at numerous sites, and winter-spring counts at main regional sites included 500 birds at Bogside on 19 April 2002 [52], suggesting that the NHZ population is likely to be over 2,000 pairs.

7.239 It is believed likely that the 14 pairs at Galawhistle survey area in 2008 form at least 1% of the District (East Ayrshire) population, and with 245 flight events recorded during the May-June periods of 2008 and 2009, the application site is considered to be important to the conservation status of the curlew at a **District** level.

Dunlin

7.240 Dunlin has recently been added to the BoCC Red-list and is also the subject of an action plan for upland heath and blanket bog birds within the Ayrshire Biodiversity Action Plan. As a result, it is considered to be a VOR of **Regional** importance.

7.241 The Scottish breeding population for the race *Calidris alpina schinzii* is believed to be 8,000-10,000 pairs, which is around 85% of the British breeding population. Breeding is widespread but in low numbers in Ayrshire, with local declines in the 1970s and 1980s likely to be linked to afforestation[57]. It is reported as an uncommon breeder in the Ayrshire Bird Report[58].

[43] Hagemeijer, W.J.M., Blair, M. (Eds.), 1997. The EBCC Atlas of European Breeding Birds: Their Distribution and Abundance. T. & A.D. Poyser, London
[44] Byrkjedal & Thompson. 1998. Tundra Plovers. T & A.D. Poyser, London.
[45] Risely, K., Noble, D.G. & Baillie, S.R. (2008). *The Breeding Bird Survey 2007*. BTO Research Report 508. British Trust for Ornithology, Thetford.
[46] SPA information at: http://www.jncc.gov.uk/pdf/SPA/9003261.pdf
[47] Jackson *et al*. 2006. Surveying Waterbirds Away from Major Waterbodies: Implications for Waterbird Population Estimates in Great Britain. *Bird Study* **53**, 105-111.
[48] Waterbirds in the UK, The Wetland Bird Survey. Annual surveys. BTO, WWT, RSPB, JNCC.

[49] Grant, M.C. et al. (1999). Breeding Success and Causes of Breeding Failure of Curlew *Numenius arquata* in Northern Ireland. *Journal of Applied Ecology*, 36: 59-74
[50] RSPB website: http://www.rspb.org.uk/wildlife/birdguide/name/c/curlew/index.asp
[51] http://www.east-ayrshire.gov.uk/content.asp?URL=/crpadmmin/agendas/dev%20serv/may%202000/muirkirk%20uplands%20and%20muirkirk%20and%20north%20lowther%20uplands.pdf
[52] http://www.ayrshire-birding.org.uk/ABR/bird_report.htm

7.242 Although relatively uncommon within the NHZ, the rarity of dunlin at Galawhistle (2 flight events with a peak count of 3 birds over 2 years) and lack of breeding evidence suggests that the application site is considered to be of **negligible** importance for dunlin.

Green sandpiper

7.243 Green sandpiper is listed in Schedule I of the Wildlife and Countryside Act (1981, as amended), and is an Amber-listed BoCC. As a result, it is considered to be a VOR of **National** importance.

7.244 The European breeding population is large (>330,00 pairs)[53], but the species breeds in Scotland in very small numbers, at most 1-5 pairs each year, with numbers increasing to 110-230 birds during autumn passage[30]. The total for Britain during this period is an estimated 1,000 birds[29]. No figures are available for NHZ levels, but in southwest Scotland, the numbers have been estimated as 30-39 individuals during the autumn passage[30].

7.245 Only 1 flight was recorded at Galawhistle, in June 2009, and no breeding evidence was recorded in either year. It is therefore likely that this individual was either a wandering non-breeder, or a very early-returning failed breeder passing through. As such the application site is considered to be of **negligible** importance for this species.

Skylark

7.246 The skylark is BoCC Red-listed, is a Priority Species within the UK Biodiversity Action Plan and is also the subject of an action plan for farmland birds within the South Lanarkshire and Ayrshire Biodiversity Action Plans. As a result, it is considered to be a VOR of **Regional** importance.

7.247 The estimated 58 breeding territories within the application site boundary in 2009 (Figures 7.6 and 7.7) represents an average density of 9.78 pairs per km^2. This density is higher than the average of 3.6 pairs per km^2 in marginal upland within Britain[54], 6.3 pairs per km^2 recorded at Hagshaw Hill adjacent, and 3.2 pairs per km^2 recorded at Burnhead, approximately 30km to the southwest of the site[55], but similar to the 9.47 pairs per km^2 recorded at Dunstonhill, just over 35km southwest of the site[56]. Of the total 148 territories recorded in 2009, the 59 that lie within the WP and the 7 within 250m of the access track (Table 7.8) are the most likely to be affected by the proposed Wind Farm. The numbers involved however, do not approach significance in a British or Scottish context (population approx. 1 million pairs and approx. 280,000 pairs, respectively). To represent even 1% of the NHZ or regional populations, these populations would need to number around 1,600 pairs or more. It is judged likely that the skylark population of the Western Southern Uplands and Inner Solway NHZ is considerably greater than 1,600 pairs. The breeding population of South Lanarkshire may be of this order of magnitude however, and it is considered likely that the skylark population of the application site is important at the **District** level.

Fieldfare

7.248 Fieldfare is listed in Schedule I of the Wildlife and Countryside Act (1981, as amended), and is a Red-listed BoCC. As a result, it is considered to be a VOR of **National** importance.

7.249 The species is a rare breeder in Britain (with up to 5 pairs per year), although is a widespread visitor in winter from northern latitudes. Most recent estimates have indicated that the population may reach 680,000 individuals. In Scotland, the winter population is an estimated 40,000-100,000 birds, although numbers can be significantly higher during autumn passage (1-1.5 million) and spring passage (100,000-150,000). Autumn numbers can however vary greatly, depending on the food supplies in Fennoscandia and wind direction during passage.

7.250 Because of such unpredictability, passage and wintering numbers for the NHZ are difficult to accurately predict. In the Ayrshire Bird Reports, fieldfare is considered to be a common winter visitor and passage migrant. A flock of over 500 birds was recorded at Fail Loch in autumn 2002, and over 10 other locations recorded flocks of more than 100 birds58.

7.251 At Galawhistle, fieldfares were present, but non-breeding in April 2008, and recorded in flocks of up to 27 birds during the autumn migration in October 2007. This peak count is not considered to be significant at a national level, and from the number of sightings recorded in Ayrshire alone, is not considered significant at a NHZ level. It is however likely that the application site is of some value to wintering fieldfare in the wider area and is therefore considered as being important for the species at a **District** level.

Redwing

7.252 The redwing is included in Schedule 1 of the Wildlife and Countryside Act (1981, as amended), and is a Red-listed species of BoCC. As a result, it is considered to be a VOR of **National** importance.

7.253 Although a rare breeder in Scotland, passage and wintering numbers can reach 30,000-300,000 birds, with totals being extremely variable between years30. In Ayrshire the species is considered a regular winter visitor from October onwards, and numbers of 600 were reported at Warwickdale in January 2002[58]. Although spring migration is often more easterly, flocks of over 300 birds have been recorded throughout Scotland[30]. As such, the infrequent usage at Galawhistle, with a peak count of 10 birds, suggests that the application site is important for this species at most at a **Local** level.

Grasshopper Warbler

7.254 The grasshopper warbler is Red-listed, is a Priority Species within the UK Biodiversity Action Plan and, as a result, is considered to be a VOR of **Regional** importance.

7.255 The national breeding population of grasshopper warbler has fallen by more than 50% in the last 25 years and there are now thought to be less than 10,000 pairs in the UK, with between 900 and 3,700 pairs estimated in Scotland.

7.256 There are no known population data available at the regional or NHZ levels, although Ayrshire was recognised as a core population area in the late 20th century[57]. Up to 23 territories were reported in the Ayrshire Bird Report 2002[58], but this secretive species is likely to be under-recorded. The single pair located outside of the WP (Figures 7.6 and 7.7) is not thought likely to form over 1% of the breeding population in the context of East Ayrshire and so the site is considered important at the **Local** level for this species.

[53] http://www.birdlife.org/datazone/species/BirdsInEuropeII/BiE2004Sp3024.pdf
[54] Browne, S., Vickery, J., and Chamberlain, D. (2000). Densities and Population Estimates of Breeding Skylarks *Alauda arvensis* in Britain in 1997. *Bird Study* 47: 52-65.
[55] Burnhead Wind Farm Environmental Statement (2009).
[56] Dunstonhill OCCS Environmental Statement (2008).
[57] Gibbons, D.W., Chapman, R. & Reid, J. (1993). *The New Atlas of Breeding Birds in Britain and Ireland: 1988-91*. T. & A.D. Poyser, London.
[58] Hogg, A. and Waite, K. (2003). *Ayrshire Bird Report 2002*. Scottish Ornithologists Club,

Crossbill

7.257 All crossbill species are included in Schedule 1 of the Wildlife and Countryside Act (1981, as amended). As a result, it is considered to be a VOR of **National** importance.

7.258 The 3 crossbill species found in Scotland are usually extremely difficult to differentiate in the field, although known species ranges suggest that the birds found at Galawhistle will be the common crossbill *Loxia curvirostra*.

7.259 Population totals are very variable for common crossbill, with a best estimate of 1,000-20,000 pairs in Britain[29], and a figure of 11,000 pairs has been quoted by the BTO[59]. In Scotland between 5,000 and 50,000 breeding pairs are estimated to breed, although in 1991 the figure rose substantially to over 250,000 pairs[30]. In winter the Scottish figures are estimated at 10,000-100,000 but in 1990/1991 500,000+ were thought to be present.

7.260 Due to periodic irruptions from the continent, population trends across Britain are unclear, although the crossbill's range appears to have substantially increased between the 2 national breeding atlases[60], reflecting the expansion of cone-bearing conifer plantations. No NHZ-level figures are available for this species, although the small numbers of breeding pairs along the plantation edge are unlikely to form a significant proportion of the regional population.

7.261 The common crossbill is highly mobile due to variations in conifer seed production, and as there is an abundance of suitable plantation habitat particularly to the north of the site, and none within, the site itself is considered to be important at most at a **Local** scale for this species.

Reed Bunting

7.262 The reed bunting is a Priority Species within the UK Biodiversity Action Plan and is also the subject of an action plan for farmland birds within the Ayrshire Biodiversity Action Plan. As a result, it is considered to be a VOR of **Regional** importance.

7.263 Concern over the conservation status of this species is reflected in specific action plans targeting their conservation within the UK BAP and many LBAPs. This may be reflected in the fact that although reed bunting has shown a 19% decline over the last 39 years, there has been a significant upturn recorded over the past ten years[61]. As such the species has been recently downgraded from Red-listed to Amber-listed. While declining, reed buntings are not seriously threatened and they remain widespread and relatively common in many areas. The most recent Scottish estimates are for 15,000-30,000 pairs[30].

7.264 No population data are available at the regional or NHZ levels but the maximum of 7 pairs located within the WP in 2009, and 4 within 250m of the access track (Figures 7.6 and 7.7) are considered unlikely to form a significant proportion of the population of the NHZ. These 11 pairs are however, considered to represent a population of **District** level importance for reed bunting.

Potential Effects

7.265 The nature of the potential effects of the Wind Farm on each VOR is considered in this section, along with the impact these may have on the conservation status of each species. The potential effects and impacts are discussed in relation to the 3 main phases of the proposed development: construction, operation and decommissioning.

Land-take Effects

7.266 Direct land take for the installation of the Wind Farm infrastructure (turbine bases, sub-stations, access tracks etc.) would result in the loss only 0.17km^2 of land within the 5.93km^2 application site (2.8% of the total area). For the target species, the potential for a direct effect resulting from such limited land take is considered to be negligible, with impacts that are not significant under the terms of the EIA Regulations.

Construction Effects

7.267 Disturbance caused by construction operations may directly displace birds from breeding sites, directly affecting breeding success, or may temporarily displace birds from foraging areas, affecting their breeding success and winter survival.

7.268 In addition to these possible effects on individuals and populations, any wind farm construction work undertaken during the bird breeding season (March to July, inclusive) carries a risk of illegal destruction, damage or disturbance to occupied bird nests. The nests of nearly all bird species are protected by the law and it is necessary to take measures to ensure compliance with the appropriate legislation.

7.269 Details of the law protecting nesting birds and the best practice measures to be adopted to ensure compliance are given later (under Mitigation).

Operational Effects

<u>Disturbance/displacement and barrier effects</u>

7.270 The operation of turbines and the associated human maintenance activity has the potential to cause disturbance and displace birds from the Wind Farm area. However, disturbance effects will be far less intensive than during the construction phase, .

7.271 Review studies have shown that in general, species are not disturbed beyond 800m from turbines and in some cases, birds have not been disturbed at all [62 34 63]. Individual turbines, or the Wind Farm as a whole however, may present a barrier to the movement of birds, restricting or displacing birds from much larger areas. The effect this would have on a population is subtle, and difficult to predict with any certainty. If birds regularly have to fly over or around obstacles or are forced into suboptimal habitats, this may result in greater energy expenditure. By implication, this will reduce the efficiency with which they accumulate reserves, potentially affecting their survival or breeding success.

7.272 During the lifetime of the Wind Farm birds may habituate to the presence of turbines however, and so this effect is likely to be greatest in the short-term.

[59] http://blx1.bto.org/birdfacts/results/bob16660.htm
[60] http://blx1.bto.org/atlases/CR-atlas.html
[61] http://www.bto.org/birdtrends2008/key_findings.htm

[62] Langston, R.H.W. & Pullan, J.D. 2003 Wind Farms and Birds: An Analysis of the Effects of Wind Farms on Birds, and Guidance on Environmental Assessment Criteria and Site Selection Issues. Report by Birdlife International on Behalf of the Bern Convention. RSPB, Sandy.
[63] Pearce-Higgins, J.W., Stephen, L.H., Langston, R.H.W., Bainbridge, I.P., & Bullman, R. (in press). The Distribution of Breeding Birds Around Upland Wind Farms. Journal of Applied Ecology.

Collision

7.273 Collision of a bird with the turbine rotors is almost certain to result in the death of the bird. The impact of an individual loss on a population is influenced by several characteristics of the affected population, notably its size, density, recruitment rate (additions to the population through reproduction and immigration) and mortality rate (the natural rate of losses due to death and emigration).

7.274 In general, the impact of an individual lost from the population will be greater for species that occur at low density, are relatively long-lived and reproduce at a low rate. Such species include wildfowl and the larger raptors. Conversely, the impact will often be insignificant for short-lived species with high reproductive rates found at high densities, including most passerines (e.g. skylark).

7.275 In broad terms, the number of collisions during a given period (e.g. a year) is the product of 2 factors:

- The number of birds flying through the rotor swept-area during the period (the number of rotor transits). The number of rotor transits is influenced by the frequency with which a species flies through the wind farm area and, crucially, the probability that any bird on a collision course will take avoiding action (the avoidance rate);
- The probability that a bird will be struck by the rotors on any given transit. The probability of collision for a bird passing through the rotors is mainly determined by the size of the bird, its mode of flight (flapping or gliding) and its flight speed, along with the dimensions of the rotors and the speed at which they rotate.

7.276 Collision risk is perceived to be higher in birds that spend much of the time in the air, such as foraging raptors and those that have regular flight paths between feeding and breeding/roosting grounds (e.g. divers and geese). Vulnerability to collision is also influenced by factors such as the flight manoeuvrability of a species and its tendency to fly in conditions of reduced visibility (e.g. at night or in fog).

7.277 The size and location of the turbine array in relation to local topography can also influence collision rate greatly. The application site at Galawhistle contains no topographical factors that are likely to increase the risk of bird collision.

7.278 It should be noted that operational disturbance and collision risk effects are mutually exclusive in a spatial sense i.e. a bird that avoids the wind farm area cannot be at risk of collision with the turbine rotors at the same time. However, they are not mutually exclusive in a temporal sense; a bird may initially avoid the wind farm, but habituate to it, and would then be at risk of collision. The estimated collision risk figures below were calculated under the assumption that flight activity during the operational phase will be similar to pre-development levels.

7.279 Full details of the methodology used in the collision risk calculations are given in the Ornithology Technical Appendix 2.

Decommissioning Effects

7.280 Potential disturbance effects associated with decommissioning are assumed to be the same as those identified for construction. This assumes that there is no permanent displacement of birds from the Wind Farm due to disturbance effects. Decommissioning effects are not considered separately for each species.

Factoring In Future Land Use Change over the Lifetime of the Wind Farm

7.281 Consideration has been given to predicted land use changes on site and in adjacent areas during the lifetime of the Wind Farm. Specifically, this has examined whether or not these changes are likely to affect the breeding distribution, abundance and flight activity of VORs.

7.282 Within the site, peatland habitat mitigation and enhancement is proposed through drain blocking and reduced grazing. It is also proposed to carry out native woodland planting along part of the Monk's Water glen (further details of proposed habitat mitigation and enhancement are given in Chapter 6 - Ecology). The likely effects on these changes on site for bird activity are judged to be relatively minor; a number of sheep carcasses were present on site in 2008 and this may have accounted for the occasional presence of red kite. With changes to grazing it is less likely carcasses will be on site and consequently less likely to draw in kites or other carrion eaters. The peatland enhancement is intended to improve conditions for moorland breeding birds (as well as the habitat itself) but whether or not this increases their abundance and exposure to collision risk will depend on their distribution around the site, possible reflecting localised displacement. Finally, the planting of native woodland will increase passerine abundance and may therefore provide more prey for short-eared owl, merlin and harriers, especially during its pre-thicket stage. However, the planting is proposed at lower altitudes to be well separated from turbines, so there is very limited risk of any increased collision risk resulting from this enhancement work.

7.283 Off-site, the Cumberhead Forest will be progressively felled and replanted (in accordance with a proposed Long Term Forest Plan). There is the possibility that hen harriers and black grouse, in particular, may move in to breed and/or forage in felled or re-stocked coupes, but given the distance from the nearest turbines would be a minimum of approximately 100m (turbines 18, 8, 7 and 22), the risk of additional exposure to collision risk is considered minimal (particularly given their characteristic flight heights, generally below PCH).

7.284 The most transformational off-site change in land use that will occur over the lifetime of the Wind Farm is the restoration of the adjacent Spireslack and Grasshill OCCS, and potentially the working and restoration of the Ponesk Remainder OCCS (if consented). The outcome of restoration of these sites is guided by the 3 respective restoration plans in their ES, plus any subsequent variation approved by East Ayrshire Council. Spireslack and Grasshill, being of an earlier generation of such plans, are less detailed and more 'conceptual', which makes it more difficult to predict the habitats that will ultimately develop. Based on previous experience of RPS staff who have worked on OCCS restoration in the area[64], it is likely, however, that they will return to a combination of acid grassland, with pockets of rushes and scrub, and in the latter 2 cases, conifer plantation. This combination of habitats is not likely to be optimal for the SPA's qualifying species, either for nesting or foraging[65]. It is therefore not predicted that post-restoration there would be a significant increase in their activity in these adjacent areas, that would risk significant increased exposure to collisions with turbines. It is possible that the restoration of current voids, over-burden stores, site facilities and settlement ponds will, in fact, be colonised to a degree by a proportion of any breeding birds displaced by the Wind Farm, either during construction or operation.

[64] Zisman, S. (2000) Open Cast and Biodiversity: A Good Practice Guide. Published by RSPB and SNH. Edinburgh.
[65] Forrester, R. and I. Andrews (2007) Birds of Scotland. SOC, Edinburgh.

Potential Impacts on Designated Sites

Muirkirk and North Lowther Uplands SPA, Muirkirk Uplands SSSI and North Lowther Uplands SSSI

7.285 For an assessment of the SPA, and by default the 2 component SSSIs, please refer to the section 'Impacts on the Muirkirk and North Lowther Uplands SPA' later in this Chapter.

Glenbuck Loch, Woodland and Floodplain provisional Wildlife Site (pWS)

7.286 The majority of species recorded using the loch and surrounding woodland in 2008 and 2009 were confined to these particular habitats. These were either common passerines such as blue tit, willow warbler and blackbird, or common waterfowl species such as mallard and tufted duck that preferentially use open water habitats. Wider-ranging geese and swans were recorded only very occasionally in the vicinity of the loch, suggesting that it is not an important staging or wintering location for any such species. Glenbuck Loch pWS is situated some 700m from the nearest turbine, and a similar distance from the proposed access track, and therefore beyond the likely distance of any disturbance effects. There are **no impacts** predicted on this site.

Potential Impacts on Valued Ornithological Receptors

Whooper Swan

Disturbance and Displacement

7.287 The desk study and baseline surveys indicate that whooper swan does not use the application site for foraging, roosting or breeding. The closest location is likely to be Glenbuck Loch approximately 700m away, which evidence from flight activity surveys suggests is used only rarely by this species. Galawhistle is not therefore an important site for the species and it is considered that there will be a **negligible** impact on the conservation status of whooper swan at any level (**not significant**).

Collision Risk

7.288 The species was only recorded flying on two occasions, both near Glenbuck Loch, with a peak count of eight birds over the total hours of survey effort (Table 7.11). These eight birds did fly over the Wind Farm polygon but not at PCH, and so no 'at-risk' flights were recorded.

7.289 Given these findings it is concluded that the collision risk to whooper swan must be very low or negligible and there will be **negligible** impact on the conservation status of the species at any level (**not significant**).

Greylag Goose

Disturbance and Displacement

7.290 The desk study and baseline surveys indicate that greylag goose does not breed, roost or forage on the application site. The nearest recorded location was adjacent to Glenbuck Loch where 2 birds were on the water in February 2008, 4 birds were recorded in April 2008, and 5 in April 2009. As this is over 700m from the closest turbine, it is considered that disturbance or displacement is unlikely at this distance. Consequently, there is no potential for the Wind Farm to disturb or displace significant numbers of breeding, feeding or roosting greylag geese (**not significant**).

Collision Risk

7.291 The species was recorded flying over the greater survey area in flocks of up to 70 birds, mainly during spring migration periods. This included a total of four independent “at risk” flight events. The collision risk modelling resulted in collision estimates of 1 every 29 months at a 99% avoidance rate (Table 7.11). This suggests that 10-11 greylag geese might be lost over the 25 year lifespan of the proposed Wind Farm.

7.292 The greylag geese seen at Galawhistle were assumed to belong to the Icelandic breeding population which forms approximately 95% of the Scottish wintering population. Over 100,000 Icelandic greylag geese winter in Great Britain and this population currently has a favourable conservation status in Europe[66]. Ayrshire currently does not support any nationally important feeding concentrations (population is at least 6,045 birds).

7.293 Bearing in mind the species’ population size, and its favourable conservation status[67], it is considered that the loss of 1 greylag goose every 2.4 years will have a **negligible** impact on the conservation status of the Icelandic greylag goose (**not significant**).

Pink-footed Goose

Disturbance and Displacement

7.294 The desk study and baseline surveys indicate that pink-footed goose does not use the application site or general vicinity for foraging, roosting or breeding. This is expected given the lack of suitable arable farmland foraging habitat within at least 2km of the site. The species breeds no closer than Iceland. No birds were recorded using Glenbuck Loch. Consequently, there is considered to be no potential for the proposed Wind Farm to disturb or displace breeding, roosting or feeding pink-footed geese (**not significant**).

Collision Risk

7.295 The flight activity surveys indicate that the species does occasionally fly over the site, with 6 flocks during autumn and winter and a peak count of 150 birds during the 1,080 hours of survey effort.

7.296 Of these flights, 4 were 'at-risk' (189 birds), and collision risk modelling resulted in a collision estimate of 1 every 14 months at a 99% avoidance rate (Table 7.11). This suggests that 21 pink-footed geese might be lost over the 25 year lifespan of the proposed Wind Farm, equating to less than 1 per year.

7.297 The British wintering population is currently in excess of 250,000 birds and also has favourable conservation status. In this context, it is considered that the loss of one pink-footed goose each winter will have a negligible effect on the British and regional (c. 2,000 birds) level wintering populations. Consequently, it is predicted that the collision risk associated with the proposed Wind Farm will have a **negligible** impact on the conservation status of the species (**not significant**).

[66] BirdLife International/European Bird Census Council (2000). *European Bird Populations: Estimates and Trends.* BirdLife Conservation Series No. 10,. BirdLife International, Cambridge.
[67] http://www.independent.co.uk/environment/revealed-22-million-birds-shot-each-year-411917.html

Hen Harrier

Disturbance and Displacement

7.298 The desk study and baseline surveys indicate that hen harriers have not bred on the application site or within at least 2km of it during recent years. Evidence suggests that the closest current breeding site is likely to be within the Muirkirk and North Lowther Uplands SPA at Garpel Water, some 8km to the southwest or over 4km to the west. Disturbance-displacement effects on breeding harriers are therefore considered to be **negligible** (**not significant**).

7.299 During the construction and operational phases of the project there is potential for disturbance-displacement from foraging areas for SPA or SPA-associate birds throughout the year. However, since the site is not within the core foraging range of a breeding hen harrier pair (2km, according to SNH guidelines), and therefore does not represent an important breeding or feeding resource for hen harriers, any such effects (of low magnitude) would have no more than a **minor** impact on the conservation status of the species at any level (**not significant**). The same applies for wintering harriers, since there is no known SPA roost location within 2km of the site. Any winter displacement is therefore not predicted to be detrimental to SPA or SPA-associated wintering harriers.

Collision Risk

7.300 Of the 33 foraging hen harrier flights from 2007-09, only 12 were at PCH, and only 6 were 'at-risk', demonstrating that the species flies predominantly below normal risk heights[68]. In the breeding season this resulted in collision estimates ranging from 1 strike every 25 years at a 95% avoidance rate to 1 every 125 years at a 99% avoidance rate (Table 7.12). Collision rates during non-breeding seasons are likely to be of negligible influence during the lifetime of the Wind Farm when added to breeding season rates.

7.301 The accepted collision risk avoidance rate for hen harrier is 99%, and so collision risk to hen harrier is assessed as very low. With an NHZ population of 64 breeding pairs, the unlikely loss of 0.008 individuals a year breeding during the lifespan of the Wind Farm equates to a **negligible** impact (**not significant**).

7.302 The risks to the SPA population will be considered separately in the section 'Impacts on the Muirkirk and North Lowther Uplands SPA'.

Red kite

Disturbance and Displacement

7.303 There is a theoretical potential for some disturbance-displacement of wandering red kites during the construction and operational phases of the project. However, the site is used very infrequently by this species suggesting it is not important to this species for foraging, breeding or roosting. As such any effect will have a **negligible** impact on the conservation status of the species at all levels (**not significant**).

Collision Risk

7.304 A total of three flight events were observed over the Wind Farm polygon at PCH, during breeding and non-breeding periods. This resulted in a range of predictions from 1 collision every 26 years at 95% avoidance to 1 collision every 133 years at 99% avoidance during the breeding season. The results suggest that during the non-breeding season, collision risk rates would be negligible, at 1 every 354 years at a 95% avoidance rate..

7.305 With the Scottish population estimated as being 300-350 birds, and the regional (Central and Dumfries and Galloway populations being 77 pairs, it is considered that that the impact of the proposed Wind Farm on the conservation status of red kite is **negligible** and will be not significant at any level (**not significant**).

Merlin

7.306 The desk study and baseline surveys indicate that merlin has not bred on the application site or within at least 2km of the nearest turbine during recent years. The closest confirmed attempt was over 3km south within the Muirkirk and North Lowther Uplands SPA in 2009. The survey area is periodically used by merlin, with some evidence of hunting (prey remains, droppings) to the north of the site near the plantation edge. A total of 9 flights were recorded within the WP over the 2 years of survey.

Disturbance and Displacement

7.307 No merlin breeding has been recorded within 2km of the application site. On this basis, there is considered to be **negligible** risk to breeding merlin from disturbance-displacement effects during construction and operation (**not significant**).

7.308 There is a theoretical potential for disturbance-displacement of merlin from foraging areas during the construction and operational phases of the project. However, the application site is evidently not an important feeding area for this species. Although hunting does apparently take place near the plantation edge to the north of the site, activity is restricted to approximately 500m from the closest turbine, and as such disturbance-displacement effects will have no more than a **minor** impact on the conservation status of the species (**not significant**).

7.309 In further support of this conclusion is increasing evidence from bird monitoring during and post-construction at a number of wind farms in central Scotland, that merlin do successfully breed in relative proximity to wind farm activity (Whitelee, Black Law, and Dun Law Wind Farms, for example).

Collision Risk

7.310 A total of 15 flights were recorded during the flight activity surveys, with only 1 considered to be 'at-risk'. As such, no collision risk modelling was carried out for this species. It is therefore concluded that the collision risk to merlin must be **negligible** and its impact on the conservation status of the species is predicted to be **not significant** at any level.

7.311 The risks to the SPA population will be considered separately in the section "Impacts on the Muirkirk and North Lowther Uplands SPA".

Peregrine

7.312 Details of peregrine activity are given in the Confidential Annex.

Land-Take

7.313 The areas used for turbine placement, borrow pits and access track construction do not coincide with those used for peregrine nesting and are sufficiently small scale that the effects of land-take on breeding peregrine are considered **negligible** (**not significant**).

[68] Whitfield, D.P. & Madders, M. 2006. Flight Height in the Hen Harrier Circus cyaneus and its Incorporation in Wind Turbine Collision Risk Modelling. Natural Research Information Note 2. Natural Research Ltd, Banchory, UK.

Disturbance and Displacement

7.314 Full consideration of the possible effects of disturbance and displacement are provided in the Confidential Annex. It is not likely that the breeding success of local peregrines would be significantly reduced due to direct disturbance associated with the construction or operation of the Wind Farm. It is therefore concluded that displacement will have a negligible impact, while any small disturbance effect will have no more than a (low magnitude) **Minor** impact on the conservation status of peregrine (**not significant**).

7.315 The potential for displacement from foraging areas due to disturbance would also be limited to the site during the construction and operational phases of the project. This represents an impact magnitude of low magnitude and therefore a **Minor** impact on the conservation status of peregrine (**not significant**).

Collision Risk

7.316 During the 2 non-breeding seasons 12 flight events (13 birds) were 'at-risk'. This produced a range of collision risk estimates of 1 collision every 12 years (95% avoidance rate) to 1 collision every 60 years (99% avoidance). Over the 2 breeding seasons, 11 individual birds flew 'at-risk', producing a range of estimates of 1 collision every 13 years (95% avoidance rate) to 1 collision every 68 years (at 99% avoidance).

7.317 This shows that over the entire lifespan of the Wind Farm, at most 4 birds may collide with turbines (at a 95% avoidance rate) - 2 during breeding seasons and 2 during non-breeding seasons. In an NHZ context, the loss of 2 birds would equate to the loss of approximately 2.3% of the breeding population. Regional wintering numbers are not known, although in a Scottish context, numbers increase two-fold from the breeding season. If this trend is followed in a regional context, the NHZ population would rise to approximately 172 birds. The loss of 2 birds would therefore equate to a loss of 1.2% of the wintering NHZ population, although the actual percentage is likely to be lower due to the presence of non-breeders during the summer.

7.318 In general, results from operational wind farm monitoring studies suggest that there appears to be a low risk of collision for peregrine, although 2 fatalities have been reported in Belgium[69], and Meek et al.[70] reported 1 casualty in the Orkney Islands over an 8 year study. Most recently, post-construction monitoring at 2 central Scotland wind farms over 2 years has demonstrated that successful breeding can take place approximately 1-1.5km from operational sites. In addition, the fact that peregrine's range coincides with large numbers of wind farms, yet few collisions are reported, tends to support the view that there is a low risk of collision for this species. On this combination of evidence and experience to date, it is concluded that collision risk poses a **Minor** impact to the conservation status of the species (**not significant**).

7.319 The risks to the SPA population are considered separately in the Confidential Annex.

Short-eared Owl

7.320 The desk study and baseline surveys indicate that short-eared owls have not bred on the application site or within at least 2km of it during recent years, and are rare visitors to the site.

[69] Hötker, H., Thomsen, K.-M. & H. Jeromin (2006): Impacts on Biodiversity of Exploitation of Renewable Energy Sources: the Example of Birds and Bats - Facts, Gaps in Knowledge, Demands for Further Research, and Ornithological Guidelines for the Development of Renewable Energy Exploitation. Michael-Otto-Institut im NABU, Bergenhusen.

[70] Meek, E.R., Ribbands, J.B., Christopher, W.B., Davy, P.R., Higginson, I. (1993). The Effects of Aero-generators on Moorland Bird Populations in the Orkney Islands, Scotland. Bird Study 40: 140-143

Disturbance and Displacement

7.321 Whilst there is a theoretical potential for disturbance-displacement of short-eared owls from foraging areas during the construction and operational phases of the project, the site is not used for breeding and is evidently not an important feeding area for the species. It is therefore concluded that disturbance-displacement effects are **negligible** and their impact on the conservation status of the species is predicted to be **not significant** at any level.

Collision Risk

7.322 Only 1 short-eared owl was recorded during the flight activity surveys, and although this bird was inside the WP, it was below PCH. Consequently, with no 'at-risk' flights recorded over 2 years, the collision risk to short-eared owl must be **negligible** and its impact on the conservation status of the species is predicted to be **not significant** at any level.

7.323 The risks to the SPA population will be considered separately in the section "Impacts on the Muirkirk and North Lowther Uplands SPA".

Barn Owl

7.324 Information recorded during specific barn owl, raptor and breeding bird surveys over 2 years, indicates the presence of 2 breeding pairs within 1km of the Wind Farm and access track, including 1 pair within the Wind Farm polygon.

Land-Take

7.325 Barn owl nesting and roosting within the survey area was restricted to buildings. The probable nest site found within a derelict building at Spireslack, north of Glenbuck would be lost if the proposed access track route requires demolition of this building. In this case, the loss of 1 barn owl pair would represent a medium-high impact magnitude on the district population (**Moderate** impact), but would be **not significant** at a regional level. No other nest or roost sites are threatened by the proposals.

Disturbance and Displacement

7.326 Whilst there is a theoretical potential for disturbance-displacement of barn owls from foraging areas during the construction phase of the project, this is considered unlikely due to the predominantly nocturnal/crepuscular hunting behaviour of the species. All construction operations within the barn owl breeding season would take place during full daylight while the birds are usually roosting at/near their nests. It is considered a **negligible** impact on the pair nesting adjacent to the access track (**not significant**).

7.327 The closest turbine to the pair nesting within the application site would be 500m away. Therefore, on the basis of distance from the disturbance source and the nocturnal/crepuscular activity pattern of the species, it is considered that both direct disturbance and displacement from nesting areas will be minimal. In support of this, there is abundant evidence of barn owls successfully nesting in close proximity to various sources of disturbance. From RPS post-construction monitoring of one wind farm in south Scotland, there is also evidence of successful breeding within 150m of the closest turbine. Consequently, it is considered that disturbance-displacement impacts on the conservation status of breeding barn owl are unlikely and therefore **not significant** at any level.

Collision Risk

7.328 No barn owls were recorded during the flight activity surveys.

7.329 The hunting range of breeding barn owls varies with food abundance but typically ranges between 800m and 1.5km from the nest. Hunting flights of the species are typically below 20m height (risk height)[71].

7.330 Therefore the proposed Wind Farm would be at the limits of a typical barn owl hunting range for the pair breeding adjacent to the access track and, in combination with predominant flight heights, the risk to this pair would be very low or negligible. Although the hunting range of the pair breeding within the application site would overlap with the nearest turbine, it is not considered that there will be more than a low risk of collision because of the barn owl's propensity for low flights.

7.331 Within the context of a dense, healthy population at the local, district and regional levels, the impact of turbine collisions on the conservation status of barn owl is predicted to be not significant at any level (**no impact**).

Black Grouse

7.332 There is no evidence for breeding black grouse within at least 1.5km of the application site in recent years. The closest records of 1 male (October 2007) and 2 short black grouse flight events were recorded during flight activity surveys between September 2007 and August 2009 - 1 in October 2007 (2 birds) and 1 in April 2009 (1 bird). Both were recorded west of Little Auchenstilloch, 1.7-2km west of the WP. Thus, there was there was at least 1 black grouse within the survey area during the 2009 breeding season, although no females were seen and there was no evidence for breeding.

Disturbance and Displacement

7.333 Black grouse leks are relatively conspicuous, and so the lack of further black grouse observations in this area during targeted surveys in 2008 and 2009 indicates there to have been no leks. Consequently, it is believed that no lekking behaviour would be disrupted by disturbance during the construction and subsequent operation of the proposed Wind Farm.

7.334 With there being almost no evidence for black grouse on the application site or within at least 1.7km, it is considered that the construction and operation of the proposed Wind Farm would not significantly disturb or displace displaying or breeding black grouse. The recommended sensitivity range to use for black grouse and Wind Farms is 1.5km.

7.335 Although results from Hagshaw Hill Wind Farm ES suggest that black grouse may breed in an area around 2km to the east of the Galawhistle site, results from flight activity surveys suggest that there is no clear linkage between grouse at this location and those birds located to the west of Galawhistle.

7.336 Consequently, the impact of disturbance-displacement on the conservation status of black grouse is **negligible** and considered to be **not significant** at any level.

Collision Risk

7.337 Two black grouse flights were recorded by flight activity surveys from 2007-09, both below PCH. This is unsurprising, given the apparent scarcity of the species in the survey area coupled with this being a species that very rarely flies at PCH. It is considered that the proposed Wind Farm will represent no significant collision risk to black grouse and that consequently, the impact on the conservation status of the species will be **not significant** at any level.

[71] Cramp, S. The Complete Birds of the Western Palearctic. Optimedia, 1998 (CD-ROM)

Golden Plover

Land-Take

7.338 The desk study and baseline surveys indicate that although golden plover was occasionally present during the breeding season (a flock of 42 birds in April 2008 and a single bird in June 2008; a flock of 80 birds and a single bird in May 2009), it does not breed within the application site or within at least 500m of it. Consequently, the development will result in no significant loss or fragmentation of potential breeding habitat and there will be no significant impact on the golden plover breeding population at any level above Local (**not significant**).

7.339 Outside of the breeding season, the species does use the application site in relatively small numbers, mainly while passing through on spring and autumn migration (maximum count of 14 birds on site in November 2008). The scale of the proposed land take within the application site is considered to be too small compared with the local area however to result in any significant impact on the golden plover population, even at a local scale (**not significant**)

Disturbance and Displacement

7.340 Although no breeding evidence was recorded, the surveys produced some evidence that golden plovers occasionally forage within the survey area. Between September 2007 and August 2009, golden plovers were recorded flying within the Wind Farm polygon and occasionally heard calling 500m north of the site during the flight activity surveys (although the exact location of these birds could not be established). A peak count of 80 birds was recorded in May 2009. Consequently, there is considered to be some potential for disturbance-displacement to foraging golden plovers during the non-breeding season. Hötker et al. (2006) identified negative effects on golden plover density in 21 out of 29 studies at wind farms during the non-breeding season across Europe. A recent review of wind farm monitoring studies however, indicated that avoidance by golden plover was largely restricted to 200m beyond turbines.

7.341 The magnitude of any effect on the District golden plover population is therefore considered likely to be low for a number of reasons:

- Most disturbance would be short-term and limited to the construction phase.
- The relative infrequency by which the species was seen on the ground, along with the mostly small numbers observed during the flight activity surveys (average size flock of 15 birds), indicates that the application site is not an important foraging area for the species in a national, regional or district context.
- Monitoring of golden plover by RPS at a south Scotland operational wind farm demonstrates continued use of that site by golden plover flocks[72].
- There is a high availability of alternative suitable acid grassland and bog foraging habitat close to the site.

7.342 It is considered that while the wind farm has a low risk of displacing the small numbers of foraging golden plovers from the site, this would only affect the species at the local level. It is not expected to be large enough to affect the size of the population in the wider area (magnitude low). This potential impact is considered to be **Minor** in terms of the conservation status of golden plover (this is considered to be **not significant** under the terms of the EIA Regulations).

[72] RPS (in prep.) Golden Plovers and Windfarms Joint Study Project Report 3. Review of Post-Construction Monitoring Programs.

Collision Risk

7.343 Collision risk modelling of the data collected during the flight activity surveys in the non-breeding season leads to a range of predicted collision rates, from 1 every 15 years assuming that birds on a collision course take avoiding action in 95% of cases, to 1 every 74 years assuming 99% avoidance. Golden plover was primarily found outside of the main breeding season at Galawhistle, although non-breeders on migration were recorded. It was considered that based on results of collision modelling during the breeding season, no more than 1 individual would be at additional risk (1 every 19 years at 95% avoidance) during the lifetime of the Wind Farm.

7.344 Whitfield (2007)[73] estimated avoidance rates for a range of North American waders, including the closely related American golden plover, concluding that species was able to take avoiding action in over 99% of potential collision events. It is reasonable to assume on the basis of this research that golden plover will also have an avoidance rate in excess of 99% and therefore that the collision rate of this species at Galawhistle will be no greater than 1 bird during the lifetime of the Wind Farm. Such a high avoidance rate is in line with the fact that only 7 golden plover fatalities have ever been attributed to turbine collisions (England: 1; Norway: 2; Germany: 2; Netherlands: 1; and Sweden: 1), despite large numbers of golden plovers occurring at wind farm sites throughout Europe[74].

7.345 The Scottish breeding population has recently been estimated as 15,000 pairs, while 25,000-35,000 birds are believed to winter in Scotland. In this context, the possible loss of one bird at the very most during the lifetime of the Wind Farm is considered to be of sufficiently small-scale that there is a **negligible** risk of long-term population reduction at any level (**not significant**).

7.346 The risks to the SPA population will be considered separately in the section 'Impacts on the Muirkirk and North Lowther Uplands SPA'.

Dunlin

Land-Take

7.347 No breeding occurred within the breeding bird survey area in 2008 and 2009, and birds were not observed using the site for feeding or roosting. There will be **negligible** loss of habitat important to this species at any level (**not significant**).

Disturbance and Displacement

7.348 Dunlin was a rare visitor at Galawhistle, and there was no evidence of any breeding, roosting or foraging within at least 500m of the site. There is therefore predicted to be no impacts on the species due to disturbance-displacement at any level (**not significant**).

Collision Risk

7.349 Two flight events were observed over the Wind Farm polygon, although neither was at PCH. This meant that collision risk modelling was not possible, and suggests that dunlin collision risk is **negligible.** It is therefore considered that that the impact of the proposed Wind Farm on the conservation status of dunlin will be not significant at any level (**not significant**).

[73] Whitfield, D.P. (2007). The Effects of Wind Farms on Shorebirds (waders: Charadrii), Especially with Regard to Wintering Golden Plovers. Natural Research Ltd. report to Your Energy.
[74] RPS (2008) Golden Plovers and Wind farms Joint Study Report 3.

Lapwing

Land-Take

7.350 Two pairs of lapwing bred within the breeding bird survey area in 2008 and 2009. In both years the closest nest site was located in an enclosed area to the south, centred over 500m from the application site boundary. There is to be no land take at these particular areas and so there will be no direct loss or fragmentation of breeding habitat (**not significant**).

Disturbance and Displacement

7.351 The closest breeding lapwing site was no closer than approximately 900m metres to any turbine (Figure 7.4). Several studies have looked at the effect of wind turbines on breeding lapwings but have found no consistent displacement or effect on numbers [63 75], whereas other wader species have shown a range of reduced occurrence from 200m (golden plover) up to 800m (curlew). Therefore, on the basis that the species seems to be relatively tolerant of turbine presence compared to other waders, and breeding only occurring beyond the maximum possible displacement distance, it is considered that the Wind Farm will have a **negligible** displacement effect on breeding or foraging lapwings. Consequently, the impact of disturbance and displacement on the conservation status of lapwing is expected to be **not significant** at any level.

Collision Risk

7.352 Lapwing occurs at Galawhistle almost exclusively during the breeding season, and on this basis, collision risk modelling was only possible for these periods. Results showed a range of avoidance estimates from 1 collision every 23 years (at a 95% avoidance rate) to 1 collision every 117 years (at a 99% avoidance rate). Even using the precautionary 95% avoidance rate, at most 1 bird is expected to collide with a turbine during the lifetime of the Wind Farm.

7.353 With a regional population likely to be in excess of 10,000 pairs, it is concluded that the impact of collision risk on the conservation status of the species is **negligible** and is predicted to be **not significant** at any level above site level.

Green sandpiper

Land-Take

7.354 Only 1 observation of a single green sandpiper was recorded at Galawhistle, and there was no evidence of breeding, feeding or roosting. There will be no loss of habitat important to this species at any level (**not significant**).

Disturbance and Displacement

7.355 There was no evidence of any green sandpipers breeding, roosting or foraging within at least 500m of the site. There is therefore predicted to be no impacts on the species due to disturbance-displacement at any level (**not significant**).

Collision Risk

7.356 One flight of a bird on passage was observed in June 2009. This meant that reliable collision risk modelling was not possible, and suggests that green sandpiper collision risk is very low or

[75] Langston, R.H.W. & Pullan, J.D. 2003 Wind Farms and Birds: An Analysis of the Effects of Wind Farms on Birds, and Guidance on Environmental Assessment Criteria and Site Selection Issues. Report by Birdlife International on Behalf of the Bern Convention. RSPB, Sandy.

negligible and it is considered that that the impact of the proposed Wind Farm on the conservation status of the species will be **not significant** at any level.

Curlew

Land Take

7.357 Three pairs of curlew bred within the turbine area in 2008, with 2 pairs in 2009. No pairs bred within 250m of the proposed access track. Although the proportion of land take of turbines compared with the overall application site is small, the effects of fragmentation may be felt due to for example, physical barriers such as drainage channels along access tracks preventing chicks from accessing large areas of the site.

7.358 Analysis of breeding bird surveys in 2008 and 2009 suggests that the locations of the territories are of sufficient distance from associated infrastructure as to preclude any fragmentation effects and that land-take is **not significant** at any level.

Disturbance and Displacement

7.359 A recent review of disturbance to birds by wind turbines suggested that curlews are particularly vulnerable to displacement, showing reduced occurrences up to 800m. However, a separate study at Dun Law Wind Farm (Scottish Borders) suggested that breeding waders, including curlew, are not displaced by the presence of turbines (although this study suffered from inconsistent methodology between the pre- and post-Wind Farm phases). On the basis of this information, a precautionary displacement range of 800m is however considered. In this case, a total of 9 pairs of curlew were within 800m of the application site in 2008, with 5 pairs in 2009.

7.360 It is likely that some pairs close to the Wind Farm polygon would be displaced onto the surrounding area during the construction operations (if construction work is unavoidable during the breeding season), but it is not known whether these pairs would reoccupy all of their former territories after construction has ended. It is therefore considered that the development is likely to lead to a detectable effect on breeding curlews. The effect may be of sufficient magnitude to reduce the curlew population around the site by up to nine pairs for the lifetime of the Wind Farm and may reduce the population of the NHZ by up to 0.45% (low magnitude; Table 7.4).

7.361 With breeding curlew being a regional VOR and the effect of displacement expected to be of low magnitude, the impact on the conservation of curlew is rated as **Minor** in a District to Regional context, but **not significant** under the terms of the EIA regulations.

Collision Risk

7.362 The locally breeding pairs were responsible for all or most of the curlew flight activity observed during the flight activity surveys, with most occurring outside the Wind Farm polygon, near enclosed fields to the south (Figure 7.4). Forty-one flight events were observed over the Wind Farm polygon at PCH during the breeding seasons, the majority either involving individuals or a pair together. In the non-breeding seasons, the total number of 'at-risk' flights reduced to 12, although flock sizes were often larger.

7.363 These flight counts resulted in a range of estimates of collision risk from 1 collision every 3.1 years (95% avoidance) to 1 collision every 15.7 years (99% avoidance) in the breeding season; and 1 collision every 2.4 years (95% avoidance) to 1 collision every 12.2 years (99% avoidance) in the non-breeding season.

7.364 At a worst-case scenario (95% avoidance), this would result in a total of 18-19 curlew collisions during the lifetime of the Wind Farm. In a regional context, this equates to 0.5% of the breeding population (c. 4,000 birds). Even taking into consideration the likelihood of the curlew's national population continuing to decline during the lifetime of the Wind Farm, the impact on the conservation of curlew is likely to be no more than **Minor** significance in a regional context, and **not significant** under the terms of the EIA regulations.

Skylark

Land Take

7.365 Land take for the proposed Wind Farm will result in the loss of up to 0.17km^2 of skylark breeding habitat representing approximately 2.8% of the application site. Skylark territories were relatively evenly spread across suitable open habitat within the survey area (where surveyed) and so this land take implies there will be 2.8% less space for skylarks and other breeding birds. This in turn implies the loss of approximately 2.8% of the population of the survey area (58 territories in 2009), or 2 pairs. As a small bird, any effects of fragmentation on breeding are not considered significant.

7.366 The loss of 2 pairs represents an effect of low magnitude, which for skylark, a VOR of regional importance, represents an impact of moderate-minor significance. Given the large expanse of similar habitat in upland South West Scotland and that this is likely to support a breeding skylark population numbering thousands of pairs. It is considered that the loss of 2 breeding pairs through land take represents a negligible impact at anything beyond a site level (**not significant**).

Disturbance and Displacement

7.367 There is evidence that skylarks are relatively unaffected by the disturbance associated with wind farms: a German study reviewing the effects of turbine installation at 4 coastal sites in Germany found no effect on numbers and distribution of skylarks. A review by Pearce-Higgins *et al*. (in press) showed only marginal effects up to 200m for breeding skylarks.

7.368 Potentially as a worst-case scenario, the 59 pairs breeding within the WP (i.e. up to 200m from turbines) may be temporarily disturbed or displaced during the construction phase of the proposed Wind Farm. This disturbance would be limited to 1 breeding season and the birds would be able to recolonise these breeding sites the following year. Therefore, the long-term loss of any significant proportion of the local skylark population is considered highly unlikely.

7.369 During the operational phase, disturbance effects are likely to be of low magnitude and it is considered that the impact of operational disturbance on the conservation status of skylark will be **Minor** at no more than a District level and therefore considered to be **not significant** under the terms of the EIA Regulations.

Collision Risk

7.370 Conventionally, collision risk is not assessed for passerine birds due to high abundance in comparison to other birds of conservation importance, their small size, agility and the fact that during the breeding season their flight behaviour is highly localised. On this basis there is considered to be very little risk of turbine collisions for this species, and therefore that there will be no significant impact on the conservation status of skylark (**not significant**).

Grasshopper Warbler

Land Take

7.371 The survey area held 1 pair of grasshopper warblers in both 2008 and 2009, with the territory in 2009 within 100m of the proposed access track. No singing males were recorded within the WP (Figure 7.5).

7.372 The amount of land that would be lost as a result of widening the existing track to support the development would be relatively small, although may be sufficient for territory loss of 1 pair. Similar habitat is available nearby and consequently, it is considered that the land take necessary for the proposed development can have no more than a very small effect on the breeding and feeding habitat available to grasshopper warbler. It is considered that land take will have at most a **Minor** impact on the conservation status of the species at Local level (**not significant**).

Disturbance and Displacement

7.373 Grasshopper warbler breeds on or near the ground in rank grassland and scrub habitats and stays almost exclusively in dense cover within 1-2 metres of the ground. There may be temporary displacement of the breeding pair close to the access track during the track construction. However, it is believed that this displacement will be slight and for the duration of just 1 breeding season. The other territory is located beyond 200m from any proposed construction site or installed Wind Farm infrastructure. It is therefore considered that there will be no more than a slight, short-term displacement effect on one pair breeding close to the access track and that the impact on the conservation status of grasshopper warbler will be **negligible** (**not significant**) at any level.

Reed Bunting

7.374 The survey area held an estimated maximum of 22 pairs of reed buntings in 2009: 7 nesting within the WP plus 4 within 250m of the access track.

Land Take

7.375 Some reed bunting breeding habitat will be lost due to land take. However, reed buntings forage extensively outside their territories when feeding their young. Consequently, it is considered that the limited amount of land lost within the territories of some pairs would not be crucial to breeding success given the extensive areas of similar habitat in the area (magnitude low). Land take is considered to have the potential for, at most, a small effect on a few pairs, with only a **negligible** impact on the reed bunting population at a Local level (**not significant**).

Disturbance and Displacement

7.376 The construction of the proposed Wind Farm has the potential to cause some displacement of reed buntings from some breeding and feeding sites. This will be completely avoided during the breeding season by re-scheduling the work and/or by cordoning off any occupied nests located within 20m of any construction work on the access track (see Mitigation section). The species is not territorial outside the breeding season and so any locally displaced birds are free to use the large extent of suitable feeding habitat surrounding the proposed development site. Consequently, there is expected to be no impact on reed buntings resulting from disturbance or displacement during the construction of the proposed Wind Farm.

7.377 As for most passerines, there is no evidence that this species is unduly disturbed or displaced by the operation of wind turbines. Consequently, it is considered that wind farm operation will have no displacement effects on breeding or wintering reed buntings and that the impact on the conservation status of the species will be **not significant** at any level.

Crossbill

7.378 Crossbills were recorded infrequently flying across the site and are probably fairly common in conifer plantations across the wider area.

Land Take

7.379 As crossbills are tree-nesting, no breeding habitat will be lost due to Wind Farm construction. Consequently, the impact will be **negligible** on crossbills resulting from land take required for the construction of the proposed Wind Farm at any level (**not significant**).

Disturbance and Displacement

7.380 Crossbills are equally at home in deep dense forest and on edges or in open or detached stands[76]. The construction of the proposed Wind Farm therefore has the potential to cause some displacement of crossbills from a small number of breeding and feeding sites.

7.381 The time of breeding is determined by the availability of conifer seeds. In Scotland the species has an extended breeding season due to the ability to exploit a variety of tree species, with laying in Scotland occurring between August–April in spruce. FSC guidance suggests that the main nesting period to avoid disturbance is between mid-February and mid-May[77].

7.382 Effects will be minimised by scheduling turbine installation within 50-150 m of the plantation edge[77] outside of the main breeding season. The species is not territorial outside the breeding season and so any locally displaced birds are free to use the large extent of suitable feeding habitat surrounding the proposed development site. Consequently, there is expected to be a **negligible** impact at Local level on crossbills resulting from disturbance or displacement during the construction of the proposed Wind Farm (**not significant**).

Fieldfare and Redwing

Land Take

7.383 Fieldfares and redwings are winter visitors to the region and were recorded at Galawhistle predominantly in the non-breeding season, probably while passing through on spring and autumn migration (maximum count of 55 fieldfares in early April 2008; 10 redwings in February 2009). The scale of the proposed land take within the application site is considered to be too small however to result in any significant impact on the populations of these species at anything beyond a site level (**not significant**).

Disturbance and Displacement

7.384 There is a lack of published information on the distances at which most passerines, including fieldfares and redwings are likely to be disturbed by wind farms and so it is difficult to quantify the magnitude of any disturbance effect on these birds.

[76] Cramp, S. et al. (1998). The Complete Birds of the Western Palearctic. Optimedia, (CD-ROM)
[77] FCS (2006) FCS Guidance Note 32: Forest Operations and Birds in Scottish forests: Nov. 2006. http://www.forestry.gov.uk/pdf/Guidancenote32Birddisturbance.pdf/$FILE/Guidancenote32Birddisturbance.pdf

7.385 Disturbance may take place during the construction phase if work is carried out during the non-breeding season. This would result in a short-term displacement of flocks from the application site as they pass through on migration. It is thought however that alternative suitable ecological resources are available in the area, and as such the populations of neither species would be significantly affected at any scale above Local level. The infrequent occurrence of these species at Galawhistle suggests the site is not an important migratory site for either, and so any long-term impacts on the regional or national populations are unlikely to occur (**not significant**).

Impacts on the Muirkirk and North Lowther Uplands SPA

7.386 The Conservation (Natural Habitats, &c.) Regulations 1994, as amended (the Habitats Regulations) require an Appropriate Assessment to be carried out by the competent authority, to determine whether or not a development, either alone or in combination with other plans and projects, risks having an adverse impact on the integrity of the Muirkirk and North Lowther Uplands SPA. This section provides information to help inform the Appropriate Assessment.

7.387 The initial requirement for this assessment stems from the fact that the Wind Farm is not directly connected with, or necessary to, the nature conservation management of the SPA. Secondly, whilst the evidence indicates that the Wind Farm is unlikely to have a significant impact on the qualifying interests of the SPA, there is some risk and therefore a detailed appraisal of the development's implications for the qualifying interests' conservation objectives is required.

SPA Conservation Objectives

7.388 The purpose of this examination is to determine, beyond reasonable scientific doubt, whether or not the Wind Farm will compromise the conservation objectives of the SPA's qualifying interests, thereby having an adverse effect on site integrity.

7.389 The assessment covers the implications for each objective from just the Wind Farm. Once this process is complete then the 'in combination' review is presented, taking into account the potential implications of other plans and projects on the qualifying species and their conservation objectives. The range of plans and projects taken into account has been informed by feedback from SNH and RSPB Scotland).

7.390 The conservation objectives of the Muirkirk and North Lowther Uplands SPA are:

- 1. To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and
- 2. To ensure for the qualifying species that the following are maintained in the long term:
    - a. population of the species as a viable[78] component of the site;
    - b. distribution of the species within site;
    - c. distribution and extent of habitats supporting the species;
    - d. structure, function and supporting processes of habitats supporting the species;
    - e. no significant disturbance of the species.

[78] 'Viability' is understood as a wider concept than simply avoiding a local extinction. Although not explicitly defined in the Habitats Directive Regulations, it is clear from their context that to form a viable part of the Natura 2000 network of sites involves more than simply maintaining a presence on the sites. The Natura network of sites is intended to protect the best examples of populations of birds of conservation concern. It is clearly outwith the spirit of the legislation if even the best examples are reduced to the threshold of viability.

Conservation Objective 1 – Habitat Deterioration and Disturbance

7.391 Deriving a definitive assessment on this objective is relatively straight forward. The Wind Farm is separated by a minimum of 1.1km from the SPA and there are no direct or indirect vectors or pathways that could cause habitat deterioration within the SPA.

7.392 Again on account of the distance between the Wind Farm and SPA (and the even greater distance between the Wind Farm and the nests of qualifying species, and, in the case hen harrier, the distance from winter roosts), there is no risk of 'significant disturbance' to qualifying species. Further elaboration on this in relation to peregrine is provided in the Confidential Annex, but it is evident that significant disturbance will not arise.

7.393 It can be concluded therefore that the Wind Farm can be developed without prejudicing the first conservation objective of the SPA, i.e. without causing habitat deterioration or significant disturbance.

Conservation Objective 2 – Long-term Maintenance of Qualifying Species.

7.394 Using the same reasoning, it is possible to firmly establish that the development will not have an a prejudicial impact on objectives 2c, 2d and 2e. The sections below therefore aim to provide the evidence to demonstrate that there will also be no impact on objectives 2a or 2b.

Implications of the Wind Farm on the SPA Population of Hen Harrier

7.395 Disturbance and predation are factors reportedly reducing the SPA hen harrier breeding population to a recently-estimated 14 pairs. The result of this is that the viability of the SPA population is not in favourable conservation status. This makes it particularly important that land adjacent to the SPA is not altered in a way that may significantly impact SPA or SPA associated harriers (i.e. those nesting within 2km of the SPA boundary).

7.396 Survey data from work for this ES (2007 and 2009) plus longer term monitoring by the South Strathclyde Raptor Study Group (going back to the early 1990s) show that there are no SPA or SPA associated hen harriers nest within at least 2km of any turbines. This distance was considered to be the outermost range of 'high sensitivity' by Bright et al (2006), given that estimates of hunting range radii range from around 1km to 2km.

7.397 Due to the current local habitat at Galawhistle, the risk of harriers becoming established within the Wind Farm, or between the Wind Farm and the SPA are remote. Hen harriers generally build their nests amongst medium height vegetation, with a preference for nesting amongst leggy heather[79 80]. Results from the Phase 1 Survey (Chapter 6 - Ecology) shows that there are minimal areas of such vegetation on site and as highlighted earlier in this Chapter, Colin Crooke and Brian Etheridge reported the site as being of low suitability for harrier nesting following their raptor survey work in 2006.

7.398 Even in the unlikely event that SPA hen harriers do nest at the edge of the SPA (approximately 1.3 km from the nearest turbine) or SPA-associated nests are laid within or adjacent to the application site in the future, there is an increasing body of evidence that hen harriers can successfully breed within close proximity to wind farms. A recent review on levels of turbine avoidance at various wind farms suggest breeding hen harrier densities may be reduced only within a 250m buffer of the turbines, and no effects over 800m have been shown for any

[79] Watson, D. (1977). The Hen Harrier. T & A.D. Poyser, London.
[80] Redpath, S.M., Madders, M., Donnelly, E., Anderson, B., Thirgood, S., Martin, A., McLeod, D. (1998). Nest Site Selection by Hen Harriers in Scotland. Bird Study 45, 51–61.

species studied. Although not fully in the public domain, reliable verbal accounts confirm that at Paul's Hill wind farm (24 turbines operational since 2006) and Lendrum Hill wind farm (24 turbines), successful harrier nesting has taken place in successive years within approximately 300m of these operational wind farms.

7.399 In terms of foraging, flight activity surveys from VPs 6 and 9 in 2007-09 were designed to record any hen harrier movements between the SPA to the south and the application site, specifically to assess connectivity. Results showed that activity levels were very low. From a total of 152 hrs 31 min, plus 15 hour-long surveys in summer 2009, only 5 individual flights were recorded. Four of these flights were on 28 September 2007, 3 to the southwest of the application site, and 1 to the south of the A70 along the Smithy Burn, and occurred within the space of just over 1 hr, quite possibly from the same bird during the post-breeding phase. A single flight was recorded on 28 February 2009 near Glenbuck Loch.

7.400 Such a small number of flights to or from the SPA shows that there is no significant linkage between breeding SPA birds and their use of the application site for foraging over this period. This is what would be expected, given the distances from nests to the Wind Farm. It is apparent therefore, that the site is not important for foraging hen harriers, with only 13 flights recorded over the WP throughout the 2 years of survey.

7.401 Low activity levels are reflected in collision modelling estimates that showed negligible risks to harriers (1 collision every 125 years during the breeding season and 1 every 314 years in the non-breeding season, using the 99% avoidance rate). In support of this, Madden & Porter (2007)[81] showed that hen harriers managed to avoid turbines even when erected in their nesting or foraging areas. This finding was also observed for foraging birds by Scott & McHaffie (2008)[82]. Furthermore, no harrier collisions have been recorded at the two operational wind farms mentioned above, and only 2 collisions have been recorded at any wind farms in the UK, Europe or North America. The recorded UK collision was at a wind farm in County Antrim in 2007, and was believed to be as a result of a wintering bird not familiar with its surroundings colliding during a period of poor visibility. This suggests that flight behaviours of hen harriers are such that collision-risk with turbines is minimal, particularly for breeding birds.

7.402 For this SPA, hen harriers are a qualifying interest for their winter population, as well as their breeding. It is therefore appropriate to also examine the location of the Wind Farm in relation to winter activity of this species, notably its trait of communal roosting during the winter months. However, none of the survey results indicated the presence of a roost on site, and no evidence of roosts is reported at the Cumberhead Plantation or the adjacent Spireslack OCCS or the Nutberry Wind Farm or Hagshaw Hill Wind Farm Extension. Furthermore, there are no records of roosting harriers from these areas from the South Strathclyde Raptor Study Group.

7.403 There are no known roosts between the Wind Farm and SPA, with none of the 2007-2009 survey results suggesting roosts were present to the south or west in the direction of the SPA.

7.404 There is only one known roost within the SPA, and that is well over 14km to the west of any turbines. Given the extensive suitable foraging habitat that exists between this location and the Wind Farm, in combination with the low level of flight activity recorded over the winter period, it is evident that the Wind Farm will pose negligible additional collision risk to these SPA roosting birds, given harriers make negligible use of the Wind Farm.

7.405 On the basis of this site-specific, SPA, and generic information on harrier distribution, behaviour, foraging and nesting habitat preferences, the conclusion can be reached beyond reasonable scientific doubt that on its own, the Wind Farm will not have an adverse impact on the integrity of the SPA. This is because it can be shown no long term prejudicial effects on the harrier population as a viable component of the site or the distribution of harriers within it, either for breeding or wintering.

Implications of the Wind Farm on the SPA Population of Peregrine

7.406 The implications of the development for peregrine are examined in detail in the Confidential Annex.

Implications of the Wind Farm on the SPA Population of Merlin

7.407 The desk study and baseline surveys indicate that merlin has not bred on the application site or within at least 2km of the nearest turbine during recent years. The closest confirmed attempt was over 3km south within the Muirkirk and North Lowther Uplands SPA in 2009. A total of 5 flights were recorded from VPs 6 and 9 between 2007 and 2009 - 2 flights near Parishholm Hill, 2 flights near Glenbuck Loch and 1 flight which was north-south, crossing the A70 road.

7.408 This suggests that that the survey area may periodically be used by merlin from the SPA. However, the only evidence of hunting within the site was to the north near the plantation edge, indicating that site usage by SPA birds from the south is rare.

7.409 Merlin do not hold exclusive territories for hunting during the breeding season, but instead only defend the territory immediately around the nest site. Studies of merlin in the UK, in south-east Grampian and Wales, have found maximum foraging ranges from the nest of 3.4km and 4km, respectively[83]. This suggests that the application site is at the edge of a foraging range for the closest SPA pair, and is unimportant habitat for the SPA population of merlin.

7.410 In addition, collision risk to this species is considered to be negligible, with only 1 'at-risk' flight recorded during 2 years' surveys. Although this species may be under-recorded due to its size, merlin is generally considered to be of low risk from wind turbines as it is a small and agile species which predominantly flies below rotor heights.

7.411 On the basis of this information, it is therefore concluded that there will be no impact on merlin, and no adverse effects on the integrity of the SPA as a consequence of the proposed development.

Implications of the Wind Farm on the SPA Population of Short-eared Owl

7.412 The desk study and baseline surveys indicate that short-eared owls have not bred on the application site or within 2km of it during recent years, and are rare visitors to the site. The nearest possible SPA pair in 2009 was some 4.2km southwest of the application site. It is possible that the species bred within the wider survey area in 2004 and near the application site in 2002 (from Spireslack Wind Farm ES). Short-eared owls feed almost exclusively on voles, and their breeding locations strongly reflect changes in vole density, with pairs often moving

[81] Madden, B. and Porter, B. (2007). Do Wind Turbines Displace Hen Harriers Circus cyaneus from Foraging Habitat? Preliminary Results of a Case Study at the Derrybrien Wind Farm, County Galway. Irish Birds 8: 231-236.

[82] Scott, D. and McHaffie, P. (2008). Hen Harrier Circus cyaneus Killed at Windfarm Site in County Antrim. Irish Birds 8: 436-437

[83] Rebecca, G.W. Cosnette, B. L., Duncan, A., Picozzi, N. and Catt, D.C. (1990). Hunting Distance of Breeding Merlins in Grampian Indicated by Ringed Wader Chicks Taken as Prey. Scottish Birds, 16, 38-39.

considerable distances between breeding seasons[84] [85]. The presence of breeding birds suggests that vole density in the wider area can be sufficiently high in some years for breeding to be attempted.

7.413 Due to their nomadic nature, there is minimal information on the extent to which short-eared owls are affected by the presence of wind turbines. However, there are no known instances of short-eared owl collisions with turbines in the UK. The species generally flies below collision risk height, which is likely to account for this. They specialise in quartering moorland, hunting small mammals on or close to ground level, and flights are usually made between 0.3m and 2m above the vegetation, rarely exceeding 3m. Display flights may take place between 50m and 200m, and generally occur within 300 to 400m from the nest site[86].

7.414 Only 1 short-eared owl flight was recorded from VPs 6 and 9 during surveys from 2007 to 2009. The species is relatively conspicuous in flight and would unlikely be overlooked, which shows that connectivity between the SPA and the application site is negligible for this species.

7.415 The information available suggests that there is no risk to the SPA population of short-eared owls and that there will be no resultant adverse effects on the integrity of the SPA as a consequence of the proposed development.

Implications of the Wind Farm on the SPA Population of Golden Plover

7.416 The desk study and baseline surveys indicate that although golden plover was occasionally present during the breeding season (a flock of 42 birds in April 2008 and a single bird in June 2008; a flock of 80 birds and a single bird in May 2009), it does not breed within the application site or within at least 500m of it.

7.417 The site was mainly used mainly during the post-breeding period by migrating flocks, with no birds recorded after early November until the following late February. No flights were recorded from VPs 6 and 9 during the entire survey period 2007-09, and results from the desk study showed that the wider area was not historically used by the species for breeding.

7.418 Golden plovers often forage in nearby enclosed fields throughout the breeding season. Whittingham et al., (2000)[87] found that during incubation birds spent only 5% of their time on moorland, but this rose to 85% with broods. They suggested that fields are only used when moorland breeding territories are insufficient to provide all of the parents' food requirements. Due to this behaviour, the risk to golden plover from collision due to their regular commuting flights from breeding territories to enclosed farmland for foraging during both day and night has been considered [88]. A study of golden plover in the South Pennines determined most daytime flights of adults (off-duty females) to be 6.6 to 7.2km (maximum: 8.2km) from the nest. Nocturnal off-duty flights (by males) in this study were recorded foraging much closer to the nest site (2.4 – 2.7km; maximum: 4.2km). A study in Durham found that during the incubation period adults flew to enclosed fields 1.1 – 3.7km from the nest site.

[84] Village, A. (1987). Territory-size and Turnover of Short-eared Owls Asio flammeus in Relation to Vole Abundance. Ornis Scandinavica, Vol. 18, No. 3 (Sep., 1987), pp. 198-204

[85] Petty, S.J., Lambin, X., Sherratt, T.N., Thomas, C.J., Mackinnon, J.L., Coles, C.F., Davison, M. and Little, B. (2000). Spatial Synchrony in Field Vole Microtus agrestis Abundance in a Coniferous Forest in Northern England: the Role of Vole-eating Raptors. Journal of Applied Ecology, Vol. 37, Supplement 1, pp 136-147

[86] RPS (2008). Literature Review to Assess Bird Species Connectivity to Special Protection Areas.

[87] Whittingham, M.J., Percival, S.M. & Brown, A.F. (2000). Time Budgets and Foraging of Breeding Golden Plover Pluvialis apricaria. Journal of Applied Ecology, 37, 632-646.

[88] Pearce-Higgins, J.W. & Yalden, D.W. 2003. Variation in the Use of Pasture by Breeding European Golden Plovers Pluvialis apricaria in Relation to Prey Availability. Ibis, 145, 365-381.

7.419 It is not clear how many pairs of golden plover from the SPA breed within 7-8km of the application site, although territories were recorded during surveys for the proposed Penbreck/Carmacoup Wind Farm[89], some 7.0km to the southwest, on the fringe of the SPA. Results from breeding bird surveys showed no signs of golden plover using the enclosed fields around Monkshead or Glenbuck for foraging. A desk study using aerial photography shows that although there is apparently suitable feeding habitat around 2km north of the application site, the low numbers of flights overhead and their apparent random direction suggests that there is no evidence to suggest that the application site constitutes an important part of a commuting route for golden plover from the SPA.

7.420 This conclusion fully supports the findings of more detailed fieldwork carried out in the Galawhistle area, to survey for commuting flights for the Nutberry Wind Farm. The evidence of flight activity through the area was that it was negligible (RDC 2007, Appendix 5).

7.421 On the basis of this information, it is therefore concluded that there will be no impact on golden plover, and no adverse effects on the integrity of the SPA as a consequence of the proposed development.

Conclusions in Relation to the SPA

7.422 Having given full consideration to all available evidence the final conclusion reached, as summarised in Table 7.13, is that the Wind Farm will not prejudice the SPA's conservation objectives. It will therefore have no adverse impact on the integrity of the SPA.

[89] http://arsu.de/gb/media/Non_Technical_Summary.pdf

Table 7.13: Summary of the Appraisal of the Wind Farm's Impact on the SPA

Conservation Objective	Expected Impact
1. To avoid deterioration of the habitats of, or significant disturbance to SPA species, thus ensuring that the integrity of the site is maintained.	None. The proposed development site is sufficiently distant from the SPA to avoid habitat deterioration or disturbance.
2.a To ensure that populations are maintained as a viable component of the SPA.	None. The evidence shows collision risk is negligible for all species and is too small to affect the SPA's populations.
2.b To ensure that the distribution of populations is maintained within the SPA.	None. The proposed development site is of sufficient distance from the SPA to avoid influencing population distribution.
2.c To ensure that the distribution and extent of supporting habitats is maintained within the SPA.	None. The habitats of the SPA will not be affected as the proposed development site is outside the SPA.
2.d To ensure that the structure, function and supporting processes of habitats supporting SPA species are maintained within the SPA.	None. The development will not affect any physical features or processes linking the SPA.
2.e To ensure that there is no significant disturbance to the SPA species populations.	None. Distance from Wind Farm to breeding locations is sufficient to exclude disturbance effects. Construction activities can be alleviated, if considered necessary, by taking place outside of the breeding period, i.e. between mid-March and August. Disturbance from operational and decommissioning activities will not be significant due to distance from breeding locations.
Overall effects	None.

Cumulative Effects

7.423 The above sections have considered the implications of the Wind Farm on the SPA in isolation from potential effects of other plans and projects. The Habitats Regulations also require that the proposed development be assessed cumulatively, so any combined implications can be identified.

7.424 Galawhistle Wind Farm should be considered in combination with other developments that are likely to occur in the local area, which after a desk study was considered to include wind farms, opencast coal sites and forestry activities. This includes both operational projects and projects in the planning process.

7.425 Currently there is no agreed method for determining significant adverse cumulative impacts. SNH guidance[90] on cumulative effects on wind farms recommends a 5-stage process to aid in the ornithological assessment:

- Define the species to be considered
- Consider the limits or 'search area' of the study
- Decide the methods to be employed
- Review the findings of existing studies
- Draw conclusions of cumulative effects within the study area.

7.426 The main focus of considering cumulative effects should be an attempt to identify any situation where effects that are minor in isolation have a greater additive effect, so as to be significant according to the EIA Regulations. This could occur in a situation where there is more than 1 development proposal that in isolation affects either a single pair of birds, or a population of birds of high conservation value at a minor level.

7.427 In line with SNH guidance, target species considered in this assessment are:

- Species found at Galawhistle that are considered of high conservation importance; and/or
- Species found at Galawhistle that are considered to be vulnerable to wind farms by virtue of their behaviour or ecology.

7.428 Species therefore considered are raptors, waders and wildfowl which may have extensive ranges that may potentially include more than 1 development. Although some passerine species found at Galawhistle are considered to be of high conservation value, due to their small territory ranges and/or low numbers recorded, no cumulative effects on these species are predicted.

7.429 From the Assessment of Effects section, those target species predicted to be affected at any level due to Wind Farm construction and operations were peregrine, hen harrier, merlin, golden plover and curlew.

7.430 Existing developments and developments in planning were considered within 10km of the proposed Galawhistle Wind Farm site, and advice sought from SNH (Lanark Office). Available ES and non-technical summaries from relevant projects were consulted, as was the latest available Wind Farm Footprint map of Scotland on the SNH website[91].

7.431 There is currently one existing wind farm within 10km of the edge of the Galawhistle site - Hagshaw Hill and its associated extension (Figure 7.23). In the cumulative assessment, SNH have requested that this been included, together with other wind farms within 10km currently in the application stage. These are Andershaw Wind Farm, Dungavel Wind Farm, Bankend Rig Wind Farm, Nutberry Hill Wind Farm and Penbreck/Carmacoup Wind Farm.

7.432 The Spireslack and Grasshill OCCS are the largest other projects in the area. These have converted rough grassland, mature conifer plantation and modified bog into opencast workings.

[90] SNH (2005). Cumulative Effects on Wind Farms: Version 2. Scottish Natural Heritage.
[91] http://www.snh.org.uk/strategy/renewable/sr-rt01.asp (September 2009 version)

7.433 A summary of the projects is given in Tables 7.14 to 7.19.

Table 7.14: Hagshaw Hill Wind Farm and Extension

Site	Hagshaw Hill Wind Farm including Extension [92]
Stage	Operational
Number of turbines	46
Area	4.5km^2
Distance from Galawhistle	Adjacent to east boundary
Main habitats affected	Acid grassland and modified bog, with small areas of wet and dry heath, mature conifer plantation
Significant impacts	Principal sensitive receptors are black grouse and skylark. Moderate magnitude adverse effects on the local breeding population of black grouse predicted as a result of construction activities. Effects are anticipated to persist into the long-term. Habitat management proposals will reduce significance of the likely effects to low. High magnitude, short term, adverse effects on the site's population of breeding skylark is predicted due to construction. No long term effects are anticipated. Significance of the likely effects is judged to be low. All other impacts on the local bird population are assessed as being of low or negligible significance.
Potential cumulative impacts	Cumulative collision risk for hen harrier and peregrine; habitat fragmentation for black grouse
Impact significance	Not significant - negligible increase in collision risk as baseline activity levels were very low; no apparent linkage between black grouse leks at Hagshaw Hill and to west of Galawhistle

Table 7.15: Andershaw Wind Farm and Transmission Line

Site	Andershaw Wind Farm and Transmission Line[93]
Stage	Application submitted
Number of turbines	14
Area	3.3km^2
Distance from Galawhistle	5.5km to the southeast
Main habitats affected	Mature conifer plantation for Wind Farm. Transmission line passes semi-natural woodlands, unimproved acid and base rich grassland, mires and bryophyte dominated springs and flushes
Significant impacts	Impacts from Wind Farm unknown. No significant effects for transmission line predicted.
Potential cumulative impacts	None anticipated for Wind Farm - target species unlikely to be currently found within plantation and should be unaffected by tree removal and Wind Farm construction. Magnitude and duration of transmission line construction unlikely to be significant impact on target species.
Impact significance	Not significant

[92] http://www.scottishpowerrenewables.com/pages/under_construction.asp
[93] http://www.sppowersystems.co.uk/publicinformation/performance.asp

Table 7.16: Dungavel Wind Farm

Site	Dungavel Wind Farm[94]
Stage	Application submitted
Number of turbines	13
Area	13.4km^2
Distance from Galawhistle	5.7km to the northwest
Main habitats affected	Mature conifer plantation, with grass and heather moorland surrounding
Significant impacts	Minor disturbance impact on black grouse during construction and operation; Minor significance of collision risk for hen harrier, goshawk, merlin, golden plover and short-eared owl. No significant impacts predicted after mitigation measures are considered. Habitat management plan would provide overall net gain in habitat.
Potential cumulative impacts	Cumulative collision risk for hen harrier, merlin, golden plover and short-eared owl. Cumulative loss of habitat for above species
Impact significance	Not significant when mitigation measures and habitat enhancement is considered. Negligible increased collision risk.

Table 7.17: Penbreck/Carmcoup Wind Farm

Site	Penbreck/Carmacoup Wind Farm
Stage	Application submitted
Number of turbines	9
Area	1.6km^2
Distance from Galawhistle	7.0km to the southwest
Main habitats affected	Mostly open plateau moorland, with coniferous forest adjacent. Small amount of blanket bog and dry heath
Significant impacts	Surveys in 2005/06 showed that the area is not, or is very rarely used by SPA qualifying species. The centre of activities of hen harrier, peregrine and merlin are 1.3-2.0km from the turbines. Turbines are at least 250 m away from identified golden plover territories. Low flight activity recorded. No significant impacts predicted. Integrity of SPA not adversely affected. Planned restoration of 100-200 ha of heathland
Potential cumulative impacts	Increased collision risk to hen harrier, peregrine and merlin. Cumulative habitat loss to SPA species.
Impact significance	Not significant - no more than a negligible cumulative increase in collision risk to peregrine, harrier and merlin. No significant habitat loss if restoration plan is implemented.

[94] http://www.eon-uk.com/downloads/Dungavel.pdf

Table 7.18: Bankend Rig Wind Farm

Site	Bankend Rig Wind Farm[95]
Stage	Application submitted
Number of turbines	11
Area	7.5km2
Distance from Galawhistle	9.0km to the northwest
Main habitats affected	Mature conifer plantation
Significant impacts	No significant impacts predicted - no target species found breeding or regularly foraging within potential impact zone of Wind Farm. Cumulative effects with Dungavel Wind Farm not considered significant. Proposed habitat enhancement area.
Potential cumulative impacts	Any increase in collision risk to target species not considered significant. Cumulative habitat loss minimised by planned habitat enhancement area
Impact significance	Not significant when habitat enhancement area is considered.

Table 7.19: Nutberry Hill Wind Farm

Site	Nutberry Hill Wind Farm[96]
Stage	Application re-submitted with amended ES
Number of turbines	6
Area	Approx. 5km^2
Distance from Galawhistle	Adjacent to northeast site boundary
Main habitats affected	Mature conifer plantation, rough grazing along some of access track
Significant impacts	None. Site was rated of low importance to SPA species. With the revised layout, there are no significant potential impacts predicted on any species - no target species found breeding or regularly foraging within potential impact zone of Wind Farm. Cumulative effects not considered significant.
Potential cumulative impacts	Cumulative collision risk to hen harrier, merlin and golden plover not considered significant. No significant habitat loss or displacement for key breeding species.
Impact significance	Not significant - negligible increase in collision risk as baseline activity levels were very low; no breeding of key species recorded within survey area for original ES or addendum

Table 7.20: Spireslack OCCS

Site	Spireslack OCCS
Stage	Operational
Number of turbines	n/a
Area	Approx. 6km^2
Distance from Galawhistle	adjacent to the west
Main habitats affected	Acidic upland grassland, modified bog, patches of wet and dry heath
Significant impacts	No formal assessment available
Potential cumulative impacts	Cumulative habitat loss and disturbance-displacement to hen harrier, merlin, peregrine, golden plover and curlew
Impact significance	Not significant. Habitat Restoration Plan would avoid long-term cumulative impacts. Peregrine already breeds within OCCS. Hen harrier, merlin and golden plover do not breed near site which would negate disturbance-displacement impacts. Increased disturbance-displacement to curlew but not considered significant at a regional level.

7.434 In order to assess the potential cumulative collision risk effects on target species from these proposed/operational wind farms, an assessment was made based on combined predicted annual mortality rates from collision risk modelling in support of the Galawhistle, Dungavel, Bankend Rig, Nutberry Hill and Penbreck/Carmacoup Wind Farms. Results from collision risk modelling of hen harrier, peregrine and golden plover were assessed.

7.435 No collision risk modelling was carried out for Andershaw Wind Farm as from all SPA species only one golden plover flight was recorded 'at-risk'. It follows however that the collision risk would be negligible for all SPA species. No collision risk modelling was carried out for the Hagshaw Hill Extension Wind Farm ES, and this reflects the premise that flight activity was very low (RPS 2005). As such, Hagshaw Hill has not been included in this assessment.

7.436 As flight activity levels were very low for merlin and short-eared owl at Galawhistle, no collision risk modelling was carried out for either species. It follows however that the proposed Wind Farm will have a negligible cumulative collision risk impact on these species.

7.437 The combined collision risk was based on calculations using a 99% avoidance rate for hen harrier and peregrine, with a 95% avoidance rate for golden plover.

7.438 Results from the cumulative collision risk assessment are shown below in Table 7.21:

Table 7.21: Cumulative Collision Risk Assessment

Site	Galawhistle	Dungavel	Bankend Rig	Nutberry Hill	Penbreck/ Carmacoup	Max. Total (collisions per annum)	% of SPA breeding popn.
Hen Harrier	0.011	0.010-0.018	0.14	0.004-0.005	0.004	0.169-0.178	0.6%
Peregrine	0.031	0.004	0.01	-	0.001-0.003	0.046-0.048	0.3%
Golden Plover	0.12	0.05	0.00	0.162	-	0.332	0.09%

95-97.5% avoidance rate based collision risk results from other wind farms have been converted to 99% avoidance for hen harrier and peregrine

7.439 For hen harrier, there will be no significant cumulative impacts at an NHZ level (with 64 breeding pairs in the Southern Uplands, roughly equivalent to the NHZ), resulting in a loss of 0.13% of the population per annum. The in-combination effects for hen harrier at an SPA level are not likely to be materially different when Galawhistle is included. Hen harrier activity levels were

[95] Bankend Rig Environmental Statement (2006).
[96] Nutberry Wind Energy Ltd. (2006). Nutberry Wind Farm Environmental Statement and Addendum

considerably higher at Bankend Rig due to the fact that 3 pairs were breeding within 2km of the study area. This means that it is likely that courtship and territorial flights were recorded at these sites. In contrast, Galawhistle has been used by hen harriers infrequently, and only for foraging, and when considered in addition to the other sites, adds a negligible increase in collision risk to the SPA hen harrier population.

7.440 Even with a precautionary 95% avoidance rate, the NHZ and SPA golden plover populations will not be affected by in-combination effects, with additional mortality likely to be less than 1% over the entire lifespan of the wind farm.

7.441 Results suggest that the viability of the NHZ and SPA peregrine populations would not be compromised due to in-combination effects. In addition, consideration of all these developments is a worst case scenario, as it is very unlikely that all projects will be consented and be operational at the same time.

7.442 From the evidence available and comparing the predicted impacts of Galawhistle Wind Farm with those considered to be significant at other proposed developments, it is concluded that there will be **no significant cumulative impacts** as a result of the construction and operation of the proposed Galawhistle Wind Farm.

Mitigation

7.443 There is no formal requirement to mitigate any of the potential effects of the development on any VORs, given the are all Minor or less. There is however, a need to follow best practice during the construction of the Wind Farm to ensure compliance with the legislation concerning disturbance to breeding birds.

Best Practice Regarding Breeding Birds

7.444 Under the Wildlife and Countryside Act 1981 as amended by the Nature Conservation (Scotland) Act 2004, it is an offence with only limited exceptions, to:

- Intentionally or recklessly take, interfere with, damage or destroy the nest of any wild bird whilst it is in use or being built
- Intentionally or recklessly take, interfere with or destroy the egg of any wild bird
- Intentionally or recklessly disturb any wild bird listed on Schedule 1 while it is nest building, or at (or near) a nest containing eggs or young, or disturb the dependent young of such a bird.

7.445 Best practice will be necessary to reduce the possibility of illegal, damage, destruction or disturbance to occupied bird nests during the construction phase. Three best practice measures will be adopted: timing, pre-construction surveys and the use of an Ecological Clerk of Works (ECoW).

Timing of construction activities

7.446 If feasible, site clearance and construction activities will be timed to take place outside of the main breeding bird season from mid-March to July inclusive, so as to avoid nest destruction and disturbance to breeding. If work during the breeding season is unavoidable, activities will aim to commence before mid-March. By timing construction activities to start before the breeding season, birds will have an opportunity to take potential disturbance into account in the process of selecting a nest site, and those birds with a choice of nest sites may select an alternative nest site for that season.

Pre-construction surveys

7.447 Surveys will be taken to locate nesting birds in the vicinity of construction works to ensure nesting birds are not disturbed. If species are found nesting, the work will either be re-scheduled or the nest site cordoned-off and disturbance prevented.

Ecological Clerk of Works

7.448 Compliance with the law will be achieved by the appointment of a suitably experienced ornithologist as Ecological Clerk of Works to locate any active nests close to construction works shortly before these commence. Any active nests found will be cordoned off to a suitable distance for the species concerned (as highlighted).

7.449 There will be a clear line of responsibility for ensuring these measures are adhered to.

Peregrine mitigation

7.450 The only Annex I species likely to breed within 2km of the application site is peregrine. Annex I species are the subject of special conservation measures concerning their habitat and so particular measures are likely to be required for peregrine.

7.451 Details of mitigation options, if necessary, are provided in the Confidential Annex. If work during the breeding season is unavoidable, activities should commence before March. By timing construction activities to start before the breeding season, birds will have an opportunity to take potential disturbance into account in the process of selecting a nest site, and may select an alternative nest site for that season.

7.452 To help contribute to evolving understanding of peregrine interactions with wind farms, it is also proposed to carry out over the development's lifetime a monitoring programme to investigate territory occupancy, breeding success and turn-over rates in the area. This will use PIT technology, and cover a minimum of 3 territories in the wider area. It is also proposed that this work be carried out in association with the South Strathclyde Raptor Study Group, and is also subject to the approval of SNH and RSPB Scotland.

Habitat Enhancement

7.453 In accordance with good practice, the Wind Farm development will seek opportunities to contribute to habitat enhancement, through a Habitat Management Plan. Details will be agreed in consultation with SNH and RSPB Scotland, and are elaborated on in more detail in Chapter 6 – Ecology. The conservation objectives of this enhancement for birds will be to combine peatland restoration with appropriate measures for breeding waders and black grouse. Nest box provision for barn owl and kestrels will also be carried out, if this is seen as beneficial by consultees and appropriate sites can be identified.

7.454 There may also be scope to implement off-site enhancement, if suitable locations can be secured.

Residual Effects

7.455 Residual effects, after taking into account the mitigation and best practice measures proposed are summarised in Table 7.21. The effective implementation of these measures will ensure compliance with the law and reduce any impact to a level that is not significant.

Summary of Effects

Table 7.21: Summary of Effects

Potential Impacts	Pre-mitigation Significance	Mitigation Required	Residual Effects
Muirkirk and North Lowther Uplands SPA and component SSSIs			
Disturbance/displacement from breeding or foraging sites	No impact	None	None
Collision risk	Minor	None	None
Glenbuck Loch, Woodland and Floodplain pWS			
Disturbance/displacement from breeding or foraging sites	No impact	None	None
Collision risk	Minor	None	None
Whooper Swan			
Loss of habitat	Not impact	None	None
Disturbance/displacement from foraging/roosting sites	Not significant	None	None
Collision risk	Not significant	None	None
Greylag goose			
Loss of habitat	No impact	None	None
Disturbance/displacement from foraging/roosting sites	Not significant	None	None
Collision risk	Not significant	None	None
Pink-footed goose			
Loss of habitat	No impact	None	None
Disturbance/displacement from foraging/roosting sites	Not significant	None	None
Collision risk	Not significant	None	None
Hen Harrier			
Loss of habitat	No impact	None	None
Disturbance/displacement from breeding sites	Not significant	None	None
Disturbance/displacement from foraging sites	**Minor**	Habitat enhancement	Not significant
Collision risk	Not significant	None	None

Potential Impacts	Pre-mitigation Significance	Mitigation Required	Residual Effects
Merlin			
Loss of habitat	No impact	None	None
Disturbance/displacement from breeding sites	Not significant	None	None
Disturbance/displacement from foraging sites	**Minor**	Habitat enhancement	Not significant
Collision risk	Not significant	None	None
Peregrine			
Loss of habitat	Not significant	None	None
Disturbance/displacement from breeding sites	**Minor**	Habitat enhancement Construction outwith breeding season if possible, or started ahead of breeding season;	None
Disturbance/displacement from foraging sites	**Minor**	None	Not significant
Collision risk	**Minor**	Habitat enhancement	Not significant
Red Kite			
Loss of habitat	No impact	None	None
Disturbance/displacement from breeding sites	Not significant	None	None
Disturbance/displacement from foraging sites	Not significant	None	None
Collision risk	Not significant	None	None
Short-eared owl			
Loss of habitat	No impact	None	None
Disturbance/displacement from breeding sites	Not significant	None	None
Disturbance/displacement from foraging sites	Not significant	None	None
Collision risk	Not significant	None	None
Barn owl			
Loss of habitat	Not significant	None	None

Potential Impacts	Pre-mitigation Significance	Mitigation Required	Residual Effects
Disturbance/displacement from breeding sites	Not significant	None	None
Disturbance/displacement from foraging sites	Not significant	None	None
Collision risk	Not significant	None	None
Black Grouse			
Loss of habitat	No impact	None	None
Disturbance/displacement from breeding sites	Not significant	None	None
Disturbance/displacement from foraging sites	Not significant	None	None
Collision risk	Not significant	None	None
Golden Plover			
Loss of habitat	Not significant	None	None
Disturbance/displacement from breeding sites	Not significant	None	None
Disturbance/displacement from foraging sites	**Minor**	None	Not significant
Collision risk	Not significant	None	None
Lapwing			
Loss of habitat	Not significant	None	None
Disturbance/displacement from breeding/foraging sites	Not significant	None	None
Collision risk	Not significant	None	None
Curlew			
Loss of habitat	Not significant	None	None
Disturbance/displacement from breeding/foraging sites	**Minor**	Habitat enhancement	Not significant
Collision risk	**Minor**	Habitat enhancement	Not significant
Dunlin			
Loss of habitat	Not significant	None	None
Disturbance/displacement from breeding sites	Not significant	None	None
Disturbance/displacement from foraging sites	Not significant	None	None

Potential Impacts	Pre-mitigation Significance	Mitigation Required	Residual Effects
Collision risk	Not significant	None	None
Green sandpiper			
Loss of habitat	Not significant	None	None
Disturbance/displacement from breeding sites	Not significant	None	None
Disturbance/displacement from foraging sites	Not significant	None	None
Collision risk	Not significant	None	None
Skylark			
Loss of habitat	Not significant	None	None
Disturbance/displacement from breeding/foraging sites	**Minor**	Habitat enhancement	Not significant
Fieldfare			
Loss of habitat	Not significant	None	None
Disturbance/displacement from foraging sites	Not significant	None	None
Redwing			
Loss of habitat	Not significant	None	None
Disturbance/displacement from foraging sites	Not significant	None	None
Grasshopper warbler			
Loss of habitat	**Minor**	Habitat enhancement	Not significant
Disturbance/displacement from breeding/foraging sites	Not significant	None	None
Crossbill			
Loss of habitat	Not significant	None	None
Disturbance/displacement from breeding/foraging sites	Not significant	None	None
Reed bunting			
Loss of habitat	Not significant	None	None
Disturbance/displacement from breeding/foraging sites	Not significant	None	None

Statement of Significance

7.456 An assessment has been made of the likely effects of the proposed Wind Farm during the construction, operation and decommissioning stages. It is concluded that, provided best practice is followed to avoid disturbance to breeding birds, including damage or destruction to their occupied nests, there will be no major or moderate impacts on any VOR. The possible displacement of breeding curlew and other birds is considered to be **not significant** when mitigation measures are considered. It is considered that the impacts on peregrine, hen harrier, merlin, short-eared owl and golden plover will be **not significant**. Following detailed considerations of the implications of the Wind Farm for the conservation objectives these qualifying of the Muirkirk and North Lowther Uplands SPA, alone and in combination with other plans and projects, it is also concluded beyond reasonable scientific doubt that there will be no adverse impact on the integrity of this Natura 2000 site.

Chapter 8 – Hydrology, Geology and Hydrogeology

Introduction

8.1 The purpose of this chapter is to provide an assessment of the potential hydrological, hydrogeological and geological effects associated with the proposed Galawhistle Wind Farm.

8.2 This chapter details the existing baseline situation in terms of the hydrological, hydrogeological and geological conditions present within the proposed Galawhistle Wind Farm site boundary and extended study area. The effects assessment covers the construction, operation and decommissioning phases of the proposed Wind Farm and identifies aspects of the proposed development which have the potential to influence the existing baseline situation.

8.3 Effects on hydrology, hydrogeology and geology may result in secondary ecological effects on habitats. Any such effects are considered in greater detail in Chapter 6, (Ecology) and Technical Appendix 3 (Peat Stability Risk Assessment).

Key Issues

8.4 The following key issues have been addressed in this chapter:

- The existing baseline situation;
- Changes to existing drainage patterns;
- Effects on baseflow;
- Effects on run-off rates and volumes;
- Effects on erosion and sedimentation;
- Effects on groundwater and surface water quality;
- Effects on groundwater levels;
- Effects on water resources (private and public water supplies, and fisheries);
- Effects on impediments to flow;
- Flood risk;
- Pollution risk; and
- Effects on local geology.

8.5 A number of features of the wind farm site hydrology and hydrogeology were identified as being particularly sensitive. The site infrastructure will be located within the catchments of important salmonid fisheries, as well as the catchment area of watercourses classed as 'Good' under the Scottish Environment Protection Agency (SEPA) water quality classification scheme (Douglas Water)[1]. Hydrological features within and downstream of the site are also vulnerable to flooding. Consequently, a suite of measures have been identified and will be implemented to ensure these sensitivities are appropriately protected.

Study and Site Areas

8.6 The site area for this assessment lies in the watershed of two catchments; Douglas Water to the north and south east and River Ayr to the south west. The majority of the site watercourses discharge into the Douglas Water via the Galawhistle Burn, Monks Water and the Powdowrin Burn (Figure 8.1a).

[1] SEPA Draft River Basin Management Plans (RBMP), Interactive Map, gis.sepa.org.uk, accessed 12/08/09

8.7 The study area is larger in extent than the red line planning boundary and includes the lower reaches of watercourses that have their headwaters within the site boundary. Other specific waterbodies and wind farm developments are considered from the perspective of assessing any potential hydrological linkages or cumulative effects.

Methodology

8.8 This assessment has involved the following:

- Reference to relevant legislation and regulations;
- Consultation with relevant statutory and non-statutory bodies;
- Detailed desk studies and site visits by a hydrologist to establish the baseline conditions of the proposed Wind Farm site;
- Evaluation of the potential effects of the proposed Wind Farm and the effect these could have on current site conditions;
- Evaluation of the significance of these effects by consideration of the sensitivity of the baseline features of the Wind Farm site, the potential magnitude of these effects and the probability of these effects occurring;
- Identification of possible measures to avoid and mitigate against any potential adverse effects resulting from this development; and
- The residual significance of the potential effects following mitigation.

Legislation and Guidance

8.9 This assessment takes into account the requirements of the following key legislation: the Water Environment and Water Services (Scotland) Act 2003, the Water Framework Directive (WFD) 2000/60/EC and the Water Environment (Controlled Activities) (Scotland) Regulations 2005 (CAR). The key objectives of the WFD relevant to this assessment are:

- To prevent deterioration and enhance the status of aquatic ecosystems; and
- To establish a framework for the protection of surface freshwater and groundwater.

8.10 Table 8.1 below lists the legislation, policies and guidance which have been taken into consideration during this assessment:

Table 8.1 Legislation, Policies, Guidance and Best Practice

Topic	Sources of Information
Legislation	The Water Framework Directive (2000/60/EC) (WFD) Dangerous Substances Directive (2006/11/EC) The Water Environment and Water Services (Scotland) Act 2003 Freshwater Fish Directive (2006/44/EC)
Statutory Instruments	The Water Environment (Controlled Activities) (Scotland) Regulations 2005 The Water Environment (Controlled Activities) (Scotland) Amendment Regulations 2007 (CAR) The Water Environment (Oil Storage) (Scotland) Regulations 2006 The Groundwater Regulations 1998 The Private Water Supplies (Scotland) Regulations 2006 Surface Waters (Fishlife) (Scotland) Directions 2007

Topic	Sources of Information
Scottish Planning Policies (SPP's)	SPP7 Planning and Flooding
SEPA Policies	No. 3 Consenting Policy for Discharges to Controlled Waters No. 19 Groundwater Protection Policy for Scotland No. 26 Policy on the Culverting of Watercourses No. 54 Land Protection Policy
Scottish Government Planning Advice Notes (PAN's)	PAN 51 Planning, Environmental Protection and Regulation PAN 58 Environmental Impact Assessment PAN 61 Planning and Sustainable Urban Drainage Systems PAN 79 Water and Drainage
SEPA Pollution Prevention Guidelines (PPG's)	PPG1 General Guide to the Prevention of Water Pollution PPG2 Above Ground Oil Storage Tanks PPG4 The Disposal of Sewage where no Mains Drainage is Available PPG5 Works in, Near or Liable to Affect Watercourses PPG6 Working at Construction and Demolition Sites PPG8 Safe Storage and Disposal of Used Oil PPG21 Polluting Incident Response Planning
SEPA Position Statements (Published)	PS-06-02 Culverting of Watercourses
Other Guidelines	Forestry Commission, Forest and Water Guidelines 2003 CIRIA C502 Environmental Good Practice on Site CIRIA C515 Groundwater Control - Design and Practice CIRIA C521 Sustainable Urban Drainage Systems Design Manual for Scotland and England CIRIA C532 Control of Water Pollution from Construction Sites CIRIA C648 Control of Water Pollution from Linear Construction Projects CIRIA C650 Environmental Good Practice on Site (Expansion of C502) CIRIA R168 Culvert Design Manual SEPA, The Water Environment (Controlled Activities) (Scotland) Regulations 2005, A Practical Guide, Version 5, June 2008 A Handbook of Environmental Impact Assessment, SNH, 2005 River Crossings and Migratory Fish: Design Guidance, A Consultation Paper, The Scottish Executive, April 2000 Code of Practice for the owners and operators of quarries and other Mineral Extraction Sites, Groundwater Regulations 1998, Scottish Executive, March 2003 Special Requirements for Civil Engineering Contracts for the Prevention of Pollution, Version 2, SEPA, 2006 Managing River Habitats for Fisheries, SEPA, 2002 A, M, MacDonald, D, F, Ball and B, É, O, Dochartaigh (2004), A GIS of aquifer productivity in Scotland: explanatory notes, Groundwater Systems and Water Quality Programme Commissioned Report CR/04/04/047N SEPA, Engineering in the Water Environment, Good Practice Guide: Temporary Construction Methods, 1st edition, March 2009 SEPA, Engineering in the Water Environment, Good Practice Guide: Construction of River Crossings, 1st edition, April 2008

Consultations

8.11 A scoping report was submitted to South Lanarkshire Council, East Ayrshire Council and all statutory and non-statutory consultees in June 2008. Consultees were also contacted again post scoping. The comments relevant to this chapter are provided below and a full description of the scoping process provided in Chapter 2 (EIA process).

8.12 The **Ayrshire Rivers Trust** highlighted the possible impact of the development on the River Ayr, but due to the majority of the site being situated within the River Clyde catchment, it was suggested that RPS should contact the River Clyde Foundation for further comments.

8.13 The **Association of Salmon Fishery Board** indicated that project proposals should be conducted in full consultation with the River Ayr District Salmon Fishery Board, Ayrshire Rivers and Clyde River Foundation. It was suggested that construction contractors should consult the local fishery board on issues such as migration obstruction, spawning bed disturbance, silt and sediment increase, point source pollution drainage.

8.14 The **Clyde River Foundation** (CRF) indicated that the Douglas Water is a productive salmonid fishery with the Monks Water providing suitable spawning grounds. The CRF have also provided electro-fishing data for fish populations in the upper catchment areas in the vicinity of the site.

8.15 The **Crown Estate** indicated that all culverts and watercrossings are constructed with consideration of the potential effects on the quality and quantity of the surface water environment. Regular monitoring should also be carried out to ensure that watercrossings do not hinder the passage of aquatic fauna.

8.16 The **Fisheries Research Service** suggested that the ES should establish the distribution and abundance of fish present within the watercourses. Furthermore, consideration must also be given to hydrochemistry, sediment transport and deposition, geomorphology and hydrology of the site.

8.17 The **Muirkirk Angling Association** did not raise any issues but stated that they should be kept informed of developments.

8.18 The **Scottish Environment Protection Agency (SEPA)** stated that the types of work required for the construction and operation of the proposed infrastructure should be detailed in the ES together with an assessment of their likely environmental impacts and proposed mitigation measures. The ES should also have regard to the requirements of CAR and any required authorisations. All proposed river engineering works, such as watercourse crossings or river bank modifications, should be identified and should be discussed with SEPA at an early stage. SEPA also recommended that the ES should have regard to the relevant SPPs, PANs and PPGs.

8.19 **Scottish Natural Heritage (SNH)** raised concerns regarding the direct and indirect impacts upon protected species and habitats. In particular the following issues should be addressed for the proposed Wind Farm site:

- Full details of the effects of construction activities should be identified and the potential impacts addressed; and

- Areas of peatlands should be mapped as this should inform the location of the site infrastructure. A detailed map of peat depth should also be included in the ES.

8.20 The **United Clyde Angling Protective Association (UCAPA) Ltd** did not raise any issues but asked to be kept informed on the Wind Farm development proposals.

8.21 **Scottish Water** indicated that they have no assets or infrastructure in the immediate area that is likely to be affected by the proposed development.

Baseline Studies

Desk Study

8.22 A desktop survey to establish the baseline was undertaken in order to:

- Describe surface water hydrology, including watercourses, springs and ponds;
- Identify and confirm the location and extent of old mines and opencast workings;
- Identify existing catchment pressures (e.g. point source and diffuse pollution issues);
- Identify all private drinking water abstractions and public water supplies within 5km of the site;
- Identify all flooding risks;
- Describe the hydromorphological conditions of watercourses;
- Collect information relating to recreational and fisheries resources;
- Collate historic hydrological flow and flooding data for the immediate area and main downstream watercourses;
- Collect soil, geological and hydrogeological information; and
- Confirm surface water catchment areas and watersheds.

8.23 Published information consulted for the baseline survey is outlined in Table 8.2 below.

Table 8.2 Baseline Information Sources

Topic	Sources of Information
Geology	
Solid Geology	British Geological Survey (BGS) Digital Data provided at www.emapsite.com BGS, British Regional Geology, The Midland Valley of Scotland, 3rd Edition, 1985
Drift Geology	BGS Digital Data provided at www.emapsite.com
Borehole Records	The British Geological Society, GEOINDEX, www.bgs.ac.uk
Soils and Peat	Macaulay Land Use Research Institute and Digital Soil Data – 1:25 000 BGS Superficial Geology Data provided at www.emapsite.com
Climate	British Geological Survey, Hydrogeological Map of Scotland, 1:625,000, 1988 MetOffice – Rainfall data from Auchincruive and Eskdalemuir gauging station from 1971 – 2000 Flood Estimation Handbook (FEH) CD-ROM
Topography	Aerial Photography 1:25,000 Raster Data provided by emapsite, www.emapsite.com 1:50,000 Raster Data provided by emapsite, www.emapsite.com
Surface Hydrology	
Surface Hydrology	1:10,000 Raster Data provided by emapsite, www.emapsite.com 1:25,000 Raster Data provided by emapsite, www.emapsite.com Flood Estimation Handbook (FEH) CD-ROM
Flooding	Indicative River and Coastal Flood Map (SEPA) www.sepa.org.uk
Water Quality and Catchment Assessment	SEPA, Draft River Basin Management Plans, Web Mapping Application, http://gis.sepa.org.uk/rbmp/MapViewer.aspx
Groundwater	Vulnerability of the Groundwater in the Uppermost Aquifer, SEPA Bedrock Aquifer Map, SEPA Superficial Aquifer Map, SEPA SEPA, Draft River Basin Management Plans, Web Mapping Application, http://gis.sepa.org.uk/rbmp/MapViewer.aspx

Field Survey Techniques

8.24 An initial site investigation was undertaken on the 28th May 2008 to help determine the hydrological characteristics of the development area. The purpose of the site inspection was to visually assess the surface water features, land use, hydrological regime and gain an understanding of site topography, geology and soils. The weather conditions during the site visit were wet and windy, with very poor visibility of the surrounding hills.

8.25 Following the finalisation of the site layout an additional site investigation was carried out on the 13th June 2009 to assess watercourse crossing locations.

Assessment of Significance

8.26 The significance of the potential effects of the development has been defined taking into account the sensitivity of the receiving environment, and the potential magnitude of the effect. There is currently limited guidance available in the UK for predicting the significance of the effects of developments on the water environment. However this assessment methodology is based on SNH guidance (2006)[2] and has been developed by RPS based on their experience of carrying out assessments for a range of developments, and also draws on guidance from the Water Environment Sub-Objective from Transport Analysis Guidance published by the Department of Transport[3] and by Mustow, Burgess and Walker (2005)[4].

8.27 The sensitivity of the receiving environment, i.e. its ability to absorb the effect without perceptible change, is defined in Table 8.3. Table 8.3 also provides examples of the characteristics that define receptor sensitivity.

[2] Scottish Natural Heritage, 2006, A Handbook on Environmental Impact Assessment
[3] www.webtag.org.uk
[4] Mustow, S.E, Burgess, P.F, Walker, N (2005) Practical Methodology for Determining the Significance of Effects on the Water Environment, WEJ, Journal of the Chartered Institution of Water and Environmental Management, Volume June 2005 No.2, 100-108

Table 8.3 Definition of Sensitivity of the Receiving Environment

Sensitivity	Definition
Very High	*Receptor with a high quality and rarity, regional or national scale and limited potential for substitution/replacement:* • Site of Special Scientific Interest (SSSI) or Special Area of Conservation (SAC) • SEPA Water Quality High[5] • Surface Water - large scale industrial abstractions >1000m3/day within 2km downstream • Abstractions for public drinking water supply • Private Water Supplies – Surface water abstractions within 0 – 200m and groundwater spring abstractions from 0-100m from construction activities • Designated salmonid fishery and/or salmonid spawning grounds present • Watercourse widely used for recreation, directly related to watercourse quality (e.g. swimming, salmon fishery etc.) within 2km downstream • Conveyance of flow and material, main river >10m wide • Flood zone 3b • Active floodplain area (important in relation to flood defence) • Groundwater abstractions >1000m3/day (within zone of influence from development) • Groundwater - public drinking water supply • Groundwater aquifer vulnerability classed between 4d, 4c, 4b, 4a and 5 in the SEPA vulnerability classification scheme • Geology rare or of national importance.
High	*Receptor with a high quality and rarity, local scale and limited potential for substitution/replacement or receptor with a medium quality and rarity, regional or national scale and limited potential for substitution/replacement:* • SEPA Water Quality Good[5] • Large scale industrial agricultural abstractions 500-1000m3/day within 2km downstream • Surface water abstractions for private water supply for more than 15 people • Private Water Supplies – Surface water abstractions within 200m – 600m, groundwater spring abstractions from 100 – 400m, and groundwater borehole abstractions from 0 – 200m from construction activities • Designated salmonid fishery and/or cyprinid[6] fishery • Watercourse used for recreation, directly related to watercourse quality (e.g. swimming, salmon fishery etc) • Conveyance of flow and material, main river >10m wide • Flood zone 3a • Active floodplain area (important in relation to flood defence) • Groundwater abstractions 500-1000m3/day (within zone of influence from development) • Groundwater abstraction for private water supply >10m3/day or serves >50 people • Groundwater aquifer vulnerability classed as 3 in the SEPA vulnerability classification scheme
Medium	*Receptor with a medium quality and rarity, local scale and limited potential for substitution/replacement or receptor with a low quality and rarity, regional or national scale and limited potential for substitution/replacement:* • SEPA Water Quality Moderate[5] • Industrial/agricultural abstractions 50-499m3/day within 2km downstream • Designated cyprinid fishery or undesignated for fisheries • Occasional or local recreation (e.g. local angling clubs) • Conveyance of flow and material, main river <10m wide or ordinary watercourse >5m wide • Flood zone 2 • Existing flood defences • Groundwater abstractions 50-499m3/day • Private Water Supplies – Surface water abstractions from 600 – >800m, groundwater spring abstractions from 400m – 800m and groundwater borehole abstractions from 200m – 600m from construction • May be subject to improvement plans by SEPA • Designated cyprinid fishery, salmonid species may be present and catchment locally important for fisheries • Watercourse not widely used for recreation, or recreation use not directly related to watercourse quality • Groundwater aquifer vulnerability classed as 2 in the SEPA vulnerability classification scheme
Low	*Receptor with a low quality and rarity, local scale and limited potential for substitution/replacement. Environmental equilibrium is stable and is resilient to changes that are greater than natural fluctuations, without detriment to its present character:* • SEPA water quality is Poor or Bad[5] • Industrial/agricultural abstractions <50m3/day within 2km downstream • Fish sporadically present or restricted, no designated features; • Receptors not used for recreation • Watercourse <5m wide • Flood zone 1 • Groundwater abstractions <50m3/day

[5] SEPA Draft River Basin Management Plan for the Scotland River Basin District, http://www.sepa.org.uk/water/river_basin_planning.aspx
[6] 'Coarse' Fish, including roach, carp, chubb, bream etc.

Sensitivity	Definition
	• Private Water Supplies – groundwater spring abstraction >800m and groundwater borehole abstractions from 600 - >800m from construction activities • No public drinking water supplies • Groundwater aquifer vulnerability classed as 1 in the SEPA vulnerability classification scheme • Receptor heavily engineered or artificially modified and may dry up during summer months • Geology typical of wider area and no rare or vulnerable formations present

Magnitude of Effect

8.28 The magnitude of effect includes the timing, scale, size and duration of the potential effect. For the purposes of this assessment the magnitude criteria are defined as follows in Table 8.4.

Table 8.4 Magnitude of Effect

Magnitude	Criteria	Description and Example
Major	Results in loss of attribute	*Fundamental (long term or permanent) changes to geology, hydrology, water quality and hydrogeology:* • Loss of EC designated Salmonid Fishery • Loss of designated species/ habitats • Changes in water quality status of river reach • Compromise employment source • Loss flood storage/ increased flood risk • Pollution of potable source of abstraction
Moderate	Results in effect on integrity of attribute or loss of part of attribute	*Material but non-fundamental and short to medium term changes to the geology, hydrology, water quality and hydrogeology:* • Loss in productivity of a fishery; • Contribution of a significant proportion of the effluent in the receiving water, but insignificant enough to change its water quality status; and • Reduction in the economic value of the feature
Minor	Results in minor effect on attribute	*Detectable but non-material and transitory changes to the geology, hydrology, water quality and hydrogeology:* • Measurable change in attribute, but of limited size and/ or proportion
Negligible	Results in an effect on attribute but of insufficient magnitude to affect the use/ integrity	*No perceptible changes to the geology, hydrology, water quality and hydrogeology:* • Discharges to watercourse but no loss in quality, fishery productivity or biodiversity • No significant effect on the economic value of the receptor • No increase in flood risk

Significance Criteria

8.29 The sensitivity of the receiving environment together with the magnitude of the effect defines the significance of the effect prior to application of mitigation measures as outlined in Table 8.5.

Table 8.5 Significance Criteria

	Sensitivity			
Magnitude	**Very High**	**High**	**Medium**	**Low**
Major	Major	Major	Moderate	Minor
Moderate	Moderate	Moderate	Moderate	Minor
Minor	Minor	Minor	Minor	Not Significant
Negligible	Not Significant	Not Significant	Not Significant	Not Significant

8.30 Potential effects are therefore concluded to be of major, moderate, minor or of no significance. The shaded boxes in Table 8.5 represent effects considered to be significant in terms of the EIA regulations.

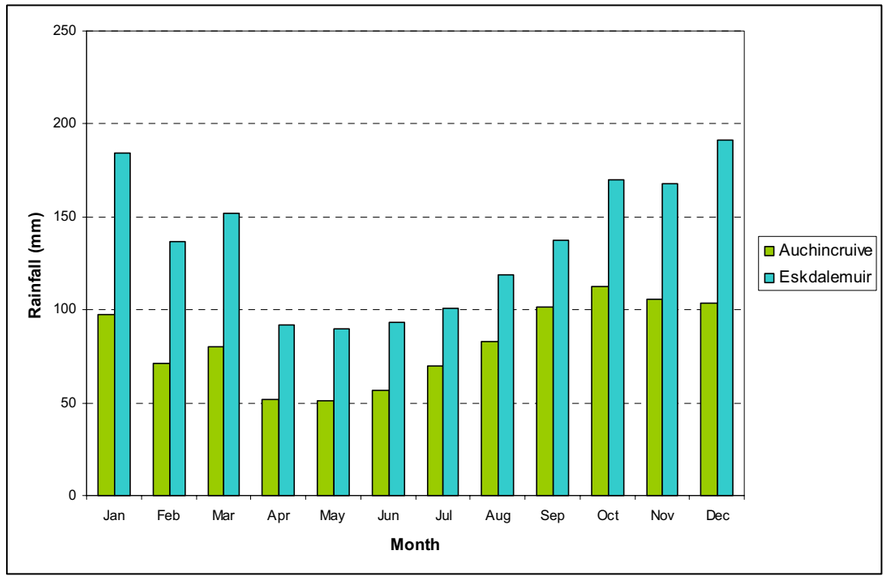
Baseline Description

8.31 This section presents the information gathered on the existing topographical, hydrological geological and hydrogeological conditions at the proposed site and its immediate surroundings.

Climate

8.32 The standard average annual rainfall (SAAR) for the site has been estimated from the Flood Estimation Handbook (FEH) CD-ROM as ranging from 1325mm - 1379mm. To put this into context, rainfall in Scotland varies from over 3000mm per year in the western Highlands to under 600mm per year in some eastern coastal areas.

8.33 Long term, average rainfall data from 1971 - 2000 is available from the MetOffice rainfall gauging stations at Auchincruive and Eskdalemuir. The Auchnicruive station is located north west of the site and the Eskdalemuir station is located south east. Based on the data collected the long term annual average annual rainfall for Auchnicruive is 984.4mm and 1634.6mm for Eskadlemuir. The monthly average rainfall for both stations is shown on Graph 8.1.



Graph 8.1 Average Monthly Rainfall Data

Designated Sites

8.34 This section highlights the designated sites that are in the immediate vicinity of the Galawhistle Wind Farm site. Information specific to each site has been retrieved from the SNHi, SiteLink website (http://www.snh.org.uk/snhi/) and are presented in the Chapter 6 (Ecology). Figure 6.1 of Chapter 6 (Ecology) illustrates that there is one designated site within the proposed Wind Farm site boundary and 13 Site of Special Scientific Interest (SSSIs) lie within 10km of the site boundary. Of these, the ones relevant to hydrological and geological issues are limited to:

- **Shiel Burn (SSSI)** straddles the site boundary and is located approximately 570m south west of Turbine 1. The site is designated for its geological features with exposures along a 325m stretch of stream that flows into the Monks Water. The features illustrate a sequence of sedimentary rocks which were formed around 430 million years ago during the Silurian geological period. The site is important for the fossils found in the rock exposures, which have yielded rare and very important early fish;

- **Ree Burn and Glenbuck Loch SSSI** is located approximately 900m south west of Turbine 10, and the areas represent, respectively, an 800m section of the Ree Burn and a 400m length of the eastern bank of Glenbuck Loch. Together they illustrate a sequence of sedimentary rocks demonstrating the transition from marine to terrestrial conditions. This transition occurred across the southern Midland Valley during the Wenlock epoch (part of the Silurian geological period), around 428-421 million years ago;

- **The Muirkirk Uplands SSSI** is located approximately 1.1km north west and south west from the Wind Farm site boundary and is largely comprised of two upland areas to the north and south respectively of the Ayrshire town of Muirkirk. Upland habitats within the site consist of heather dominated moorland, acid grassland and blanket bog. Dry heath dominated by heather typifies the moorland on steeper, well-drained slopes, while blanket bog of various types predominates on flatter, wetter ground where peat soils have developed. Acid grassland types are best represented on lower ground around the periphery of the SSSI, where peat shallows and gives way to mineral soils. Both areas are located within the River Ayr catchment, and due to the significant variations in topography it is unlikely that the SSSI will be affected by the activities associated with the wind farm;

- **The Kennox Water SSSI** is located approximately 3.2km south of the proposed Wind Farm. It is designated for geological purposes and encompasses a sequence of sedimentary rocks that were formed during the Carboniferous, a geological time period spanning approximately 359 to 299 million years ago, when the geography of northern Britain was very different from the distribution of land and sea which exists today. The site is located within the Kennox Water catchment, which is a tributary of the Douglas Water. The site is hydrologically distinct from the watercourses draining the proposed Wind Farm and will not be affected by the development;

- **The North Lowther Uplands SSSI** is located approximately 4.7km south of the proposed Wind Farm. The site supports a range of habitats and associated species. The dominant habitats include blanket bog, wet and dry heaths and acid grassland. The site is hydrologically distinct from the watercourses draining the proposed wind farm and is unlikely to be affected by the development; and

- **Miller's Wood SSSI** is a small upland birch and rowan woodland on acid soils, of a type which are rare in southern Scotland. The site is located approximately 3.1km south east of the proposed Wind Farm. Miller's Wood is located on the right hand bank of the Douglas Water, with wind farm activities located on the left bank and due to this topographical separation and the distance between wind farm activities it is highly unlikely that the designated site will be affected by the proposed development.

Surface Water Hydrology

8.35 The proposed Wind Farm site lies in the watershed of two catchments; the Douglas Water to the north and south east and the River Ayr to the south west. The numerous watercourses within the site and immediately downstream have been divided into their respective sub-catchments, based on the topography and the Flood Estimation Handbook (FEH) CD-ROM. The site catchments are displayed in Figures 8.1a and 8.1b, and their characteristics are described in the following paragraphs. Figure 8.1a provides the surface water hydrology using the OS 1:25,000 basemap and Figure 8.1b utilises aerial photography.

8.36 The following sections on surface water hydrology also discuss the hydromorphology of the on-site watercourses. The hydromorphology has been qualitatively assessed in line with Annex V of the Water Framework Directive for river continuity, morphological conditions and structure of the riparian zone.

Douglas Water Catchment

8.37 The majority of the on-site watercourses discharge into the Douglas Water via the Galawhistle Burn, Monks Water and the Podowrin Burn.

Galawhistle Burn

8.38 The Galawhistle Burn has its headwaters rising from Little Auchinstilloch and Meikle Auchinstilloch and is characteristic of upland, moorland/heath watercourses, situated in shallow v-shaped valleys. Due to the presence of the Spireslack Open Cast Coal Site (OCCS), the majority of these headwaters and tributaries have had their courses altered by man-made diversion channels,

implemented as part of OCCS operations. These channels are designed to significantly reduce the volume of water flowing into the OCCS. As a result of these artificial channels, a large number of headwaters had no flow at the time of the initial site visit.

8.39 Due to the mine workings, the flow of the main channel has also been altered. The natural flow would be from the south west to north east. As shown Photograph 8.1 however, the mine workings have altered the flow approximately between NGR NS 76003 30840 to NGR NS 76067 30974. The channel between these two points is lined with rubber sheeting and is diverted into a series of lagoons that were constructed as part of the mine workings.

Photograph 8.1 Modification to Galawhistle Burn as a result of the existing open cast mine workings

8.40 From NGR NS 76067 30974 onwards, the Galawhistle Burn reverts back to its natural state and continues to flow east in a well established v-shaped valley, with distinct natural terraces between Meikle Auchinstilloch and Hareshaw Hill. The channel ranges from approximately 0.5m – 1.0m in width with much of the channel having little or no in-stream vegetation. Meanders are also an important feature of the Galawhistle Burn, with extensive evidence of the erosive and depositional features that occur as a result. Pool and riffle sequences are also a dominant characteristic of the Galawhistle Burn.

8.41 The Galawhistle Burn continues to flow east until its confluence with the Monks Water at NGR NS 77193 31041.

8.42 The riparian zone is dominated by grasses and appears to be stable for much of its length. No in-stream, artificial or natural obstructions compromising river continuity of the Galawhistle Burn were observed during the initial site visit. Photograph 8.2 illustrates the hydromorphology of the Galawhistle Burn.

Photograph 8.2 Hydromorphology of the Galawhistle Burn

Monks Water

8.43 The Monks Water has headwaters that rise from Meikle Auchinstilloch and Wedder Hill in the vicinity of the Cumberhead forestry plantation. The headwaters are characteristic of upland, moorland/heath watercourses.

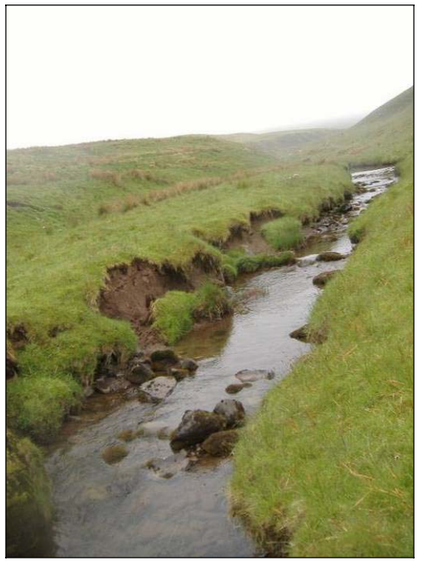
8.44 The Monks Water continues to flow in a south west direction before its confluence with the Galawhistle Burn. Upstream of this confluence the channel width ranges between 0.5m – 1.5m, with much of the channel having little or no in-stream vegetation. Pool and riffle sequences are characteristic of the Monks Water. The development of pool and riffle sequences is usually through a combination of scour and deposition, organised spatially to give a more or less regular spacing between each sequence. Meanders are also an important feature of the watercourse, with evidence of the initial stages of meander formation and cut-offs present.

8.45 After its confluence with the Galawhistle Burn at NGR NS 77193 31041 the Monks Water flows in a south, south east direction through open rough grassland used for livestock grazing. The channel increases in width, ranging between 1.5m – 3.0m with very little in-stream vegetation. As shown in Photograph 8.3 the bed material ranges from gravels to boulders.

Photograph 8.3 Example of bed material of the Monks Water

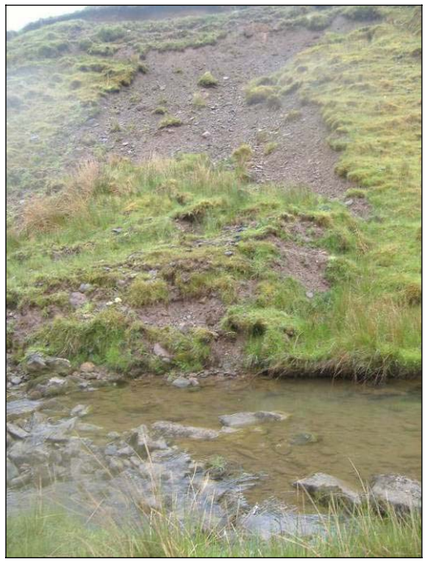
8.46 The Monks Water continues to flow in a south, south east direction through a deeply incised v-shaped valley between Ararat Hill/Strawberry Hill and Hareshaw Hill/Shiel Hill before discharging into the Douglas Water at NGR NS 78715 28317.

8.47 The riparian zone of the Monks Water is dominated by mosses and grasses with evidence of slumping and poaching by livestock along various stretches of its course. Photographs 8.4 and 8.5 give examples of channel instability along different reaches of the Monks Water. Photograph 8.4 was taken at NGR NS 77279 30465 and indicates minor slumping possibly due to undercutting of the channel bank by the watercourse.



Photograph 8.4 Evidence of minor slumping

8.48 Photograph 8.5 was taken at NGR NS 77184 30611 and indicates significant failure possibly due to the incised nature of the valley increasing instability of the channel slope. It is worth noting that the scar area of the mass movement is comprised mainly of mineral soil and possibly till.



Photograph 8.5 Evidence of significant slope failure

8.49 The Podowrin Burn is situated along the eastern periphery of the site and rises between Wedder Hill and Hagshaw Hill. The burn flows in a general south west direction at the base of the aforementioned hills. The burn begins to flow in a south east direction between Avermarks Hill and Arrarat Hill and continues to do so until it reaches Low Broomerside Hill (NGR NS 79661 29144). From this point the watercourse abruptly changes direction and starts to flow in a south west direction until it discharges into the Douglas Water at NGR NS 78962 28156.

River Ayr Catchment

8.50 The remainder of the on-site watercourses discharge into the River Ayr via the Hareshaw Burn and Glenbuck Loch.

8.51 The headwaters of the Hareshaw Burn rise between the two summits of Hareshaw Hill and flow in a general south to south west direction until the watercourse reaches the extents of the mine workings. From approximately NGR NS 758 296 the watercourse changes direction and flows in a south west direction for approximately 600m before its confluence with the Stottencleugh Burn at NGR NS 75313 29056.

8.52 The headwaters of the Hareshaw Burn are characteristic of upland, mainly surface-water fed moorland/heath watercourses. The riparian zone of the lower reaches is dominated by small corridors of mixed forestry. From studying the 1:25,000 ordnance survey basemaps, a number of crossings and a waterfall are located along the lower reaches of the watercourse.

8.53 Glenbuck Loch is a man-made loch created in 1802 to secure water supplies for the cotton mills that once existed at Catrine. The loch is fed by the Stottencleugh Burn whose headwaters rise in the vicinity of Sclanor Hill. As shown in Photograph 8.6, the northern extents of the loch are surrounded by the steep slopes of Hareshaw Hill with some of the banks dominated by small forestry plantations. The loch discharges into the River Ayr at NGR NS 75393 28757.

Photograph 8.6 View of Glenbuck Loch in the vicinity of Turbine 10 (view: south west)

8.54 Further detail regarding any fisheries and recreational activities associated with the loch are provided in paragraphs 8.118-8.123.

8.55 The site access is located within the catchment of the Ponesk Burn. The Ponesk Burn flows into the River Ayr, immediately south of the A70. The route of the Ponesk Burn is the result of a diversion approximately 25 years ago for the mining of the Ponesk OCCS. In its lower reaches, the burn flows in a straight channel with hard engineered banks.

Hydrological Regime

8.56 The hydrological regime of the on-site watercourses are dependant upon the topography, geology and soils of the surrounding landscape.

8.57 As discussed in paragraph 8.35, the site lies within the catchments of the Douglas Water and River Ayr. Peak flows have been estimated for a number of the tributaries of the watercourses mentioned above using the Flood Estimation Handbook (FEH) Rainfall - Runoff Method for a range of return periods, with the results presented in Table 8.6. Catchment descriptors derived from the FEH CD-ROM and FEH Handbook are inserted into the ISIS program and this automatically calculates the peak flow for the specified return period.

Table 8.6 Estimated Q95 and Peak Flows for site catchments

Catchment	Area (km^2)	Q95[7]	Estimated Peak Runoff (m^3/s) for each Return Period (years)					
			2.33 (QMED)[8]	10	30	50	100	200
Douglas Water								
Galawhistle Burn	4.21	0.00201	3.389	5.745	7.527	8.475	9.695	10.584
Monks Water	9.79	0.00459	6.662	11.237	14.586	16.369	18.658	20.325
Podowrin Burn	3.91	0.00174	2.773	4.602	6.057	6.819	7.796	8.508
River Ayr								
Hareshaw Burn	0.77	0.00037	0.704	1.187	1.570	1.774	2.037	2.229
Stottencleugh Burn	3.59	0.00170	3.043	5.199	6.830	7.700	8.821	9.640
Ponesk Burn	7.54	0.00367	5.212	8.911	11.513	12.904	14.690	15.991
Unnamed Tributary	0.88	0.00040	0.776	1.320	1.762	1.996	2.298	2.519

8.58 The FEH CD-ROM also provided data relating to the Base Flow Index (BFI) and Standard Percentage Runoff (SPR) for the site catchments. The BFI is a measure of the proportion of a catchment's long-term runoff that derives from stored sources, with the BFI ranging from 0.1 in relatively impermeable clay catchments to 0.99 in highly permeable catchments. The SPR values represent the percentage of rainfall that is likely to contribute to runoff.

8.59 The BFI for the site catchments range from 0.32 to 0.396 indicating that less than half of the catchment's long-term runoff is derived from stored sources. The SPR for the site catchments range from 45% to 48.91%, indicating that approximately half of the rainfall during an event will contribute

[7] Q_{95} – flow (m^3/s) that is exceeded 95% of the time
[8] Robson, A. J. and Reed, D. W. (1999) Statistical procedures for flood frequency estimation. Volume 3 of the Flood Estimation Handbook. Centre for Ecology and Hydrology - *"QMED is the median annual maximum flood. It is described as the flood that is exceeded on average 'every other year'. QMED is formally defined as the middle-ranking value in the series of annual maximum floods, where the annual series comprises the largest flow observed in each year".*

to runoff. The BFI and SPR values show that the site is located on a slowly permeable catchment and is likely to have a rapid response to rainfall events.

Flood Risk

8.60 A review of SEPA's flood map[9] indicates that minor areas of the Galawhistle Burn and Monks Water within the site boundary are at risk from the 200 year inundation envelope. The flood map also shows that areas of the Douglas Water and River Ayr are also at risk from flooding.

8.61 The construction compound is the only site infrastructure to be at risk from the 200 year event, and therefore falls within Flood Zone 3a or 3b. However, it is worth noting that the historic mine workings have significantly altered the hydrological regime of the Galawhistle Burn and the actual extent of flooding within the catchment is not known. The SEPA Flood Zones and acceptable development types are explained in Table 8.7.

Table 8.7 Flood Zones in SPP7 (Table 10 in SPP7) Land in Scotland is divided into three flood risk zones

Flood Zone	Probability	Explanation	Appropriate Land use
Zone 1	Low	Annual probability of watercourse, tidal or coastal flooding: less than 0.1% (1:1000)	All development types generally acceptable
Zone 2	Low – Medium	Annual probability of watercourse, tidal or coastal flooding: in the range 0.1% – 0.5% (1:1000 – 1:200)	Most development types are generally acceptable unless site specific conditions indicate otherwise. A flood risk assessment may be required at the upper end of the probability range (i.e. close to 0.5%) or where the nature of the development or local circumstances indicate heightened risk.
Zone 3a	Medium-High	Annual probability of watercourse, tidal or coastal flooding: greater than 0.5% (1:200)	Areas already built up may be suitable for residential, institutional, commercial and industrial development provided flood prevention measures to the appropriate standard already exist, are under construction or are planned as part of a long term development strategy in a structure plan context. Land raising may be acceptable.
Zone 3b	Medium-High	Annual probability of watercourse, tidal or coastal flooding: greater than 0.5% (1:200)	Undeveloped and sparsely developed areas are generally not suitable for additional development, including residential, institutional, commercial and industrial development. Exceptions may arise if a location is essential for operational reasons, e.g. for navigation and water-based recreation uses, agriculture, transport or some utilities infrastructure, and an alternative lower risk location is not achievable. Land raising may be acceptable

8.62 From the information provided in Table 8.7 a more detailed topographic survey and Flood Risk Assessment (FRA) will be required to accurately assess the flooding issues relating to development of Galawhistle Wind Farm.

[9] http://www.sepa.org.uk/flooding/flood_map.aspx , accessed 18th July 2009

8.63 Despite the majority of the site infrastructure being located outwith the inundation envelope, the assessment needs to focus on the management of surface water runoff as developments can increase the area of impermeable surface that may increase surface water run-off, which in turn can result in an increase in flood risk both on site and downstream of the development. It is imperative that the construction, operation and decommissioning of the proposed development does not exacerbate this situation. By implementing the appropriate construction management practices these issues can be mitigated.

8.64 Modification of the surface runoff of the site will occur as a result of the construction of the following wind farm infrastructure. Site tracks and associated drains will intercept diffuse overland flow, interrupting the natural and existing artificial drainage regime by concentrating flows and potentially diverting them from one catchment to another. The total landtake for the proposed development site will be 168,888m^2. The percentage of the main hydrological catchments that this constitutes is given in Table 8.8.

Table 8.8 Proposed landtake as a percentage of catchment area

Catchment	Catchment Area (km^2)*	Infrastructure landtake per catchment (km^2)	% of Catchment Area
Douglas Water Catchment			
Galawhistle Burn	4.21	0.07826km^2	1.9
Monks Water	9.79	0.1462km^2	1.5
Podowrin Burn	3.91	0.01851km^2	0.5
River Ayr Catchment			
Hareshaw Burn	0.77	0.002048km^2	0.26
Stottencleugh Burn	3.59	0.008234km^2	0.23
Ponesk Burn	7.54	0.002135km^2	0.03
Unnamed Tributary	0.88	0.003511km^2	0.4
* Catchment areas are derived from FEH CD-ROM			

8.65 Given the small percentage of each catchment that will be modified and the slowly permeable nature of the site soils, the increase in runoff volume as a result of the proposed development is expected to be negligible[10].

8.66 Table 8.14 details the mitigation measures that can be incorporated into the construction of the proposed development.

Water Quality

8.67 No watercourses within the site boundary have been classified under SEPA's draft River Basin Management Plans (RBMP). However, a number of watercourses within the vicinity of the site have been classified under the draft RBMP. The Douglas Water has been classed as 'Good', with no evidence of pressures that are likely to have an impact on the water quality of the catchment.

8.68 The Stottencleugh Burn is a tributary of the River Ayr and has been classified as 'Poor' for a number of reasons. This includes the presence of opencast mine workings that has had a significant impact on the quality of the water.

[10] SUDS; promoting good practice – A CIRIA Initiative – "If less than 5% of a site is paved or compacted, the impact on the quantity if the surface runoff will be negligible", http://www.ciria.com/suds/prevention.htm, accessed 18th July 2009

8.69 The plans have been put into place as one of the requirements of the EU WFD. The draft plans cover all types of water body (such as rivers, lochs, lakes, estuaries, coastal waters and groundwater) and:

- Describe the current condition of the water environment and identify areas for protection and improvement;
- Identify where current or historic activities are constraining the quality of the water environment and the biodiversity it supports;
- Detail the actions required to ensure that the quality of the water environment is up to standard and maintain the quality where they already meet those standards; and
- Set out the actions needed to deliver environmental improvements in line with the WFD[11].

8.70 The watercourses in the vicinity of the site that have been classified under SEPA's classification scheme are shown in Figure 8.2.

Soils and Peat

8.71 The distribution of the soils across the site is dependant upon the geology, topography and drainage regime of the area. The site soils consist predominantly of blanket peat, peaty gley soils of the Glenalmond and Rowanhill Associations and peaty podzols of the Ettrick, and Glenalmond Associations. Areas of brown forest soils of the Ettrick and Glenalmond Associations are found within the valleys of some of the watercourses. A minor area of non-calcerous gley soils belonging to the Ettrick Association is also located to the south of the site. The main soil types are listed below in relation to their dominance on site:

- **Blanket Peat** – organic material that has remained wet to the surface. They also constitute a carbon store;

- **Peaty Gleys** – slowly permeable, seasonally waterlogged clay-like soils with a peaty surface horizon;

- **Peaty Podzols** – leached soils with a peaty surface layer. The drainage of these soils is dependant on the level of leaching. Peaty podzols are normally free draining however where strong leaching has occurred sufficient deposition of iron and aluminium in the lower soil horizons may cement the material into a hard impermeable later, or ironpan, resulting in waterlogging of the profile above. The product of this is a soil intermediate between podzol and gley;

- **Brown Forest Soils** – are well drained with brownish subsoils where iron oxides created through weathering processes are bonded to silicate clays. The texture and fertility of the soil is dependant upon the nature of the parent material and the degree of alteration it has undergone. Under natural conditions the soils would form under broadleaf forest which promotes rapid decomposition of plant residue and subsequent recycling of plant nutrients; and

- **Non-calcerous Gleys** – are developed under conditions of intermittent or permanent waterlogging. These soils are naturally poorly drained and support grassland based agriculture.

8.72 Comparisons between the 1:25,000 digital soils data and the 1:50,000 digital superficial geology data shows much of the site is covered in moderately deep blanket peat or peaty soils. Peat is a soft to very soft, highly compressible, highly porous organic material that can consist of up to 90 – 95% water, with 5 – 10% solid material[12]. Unmodified peat consists of two layers; a surface layer or acrotelm[13] which is usually 10 – 30cm thick, highly permeable and receptive to rainfall. Decomposition of organic matter within the acrotelm occurs aerobically and rapidly. The acrotelm generally has a high proportion of fibrous material and often forms a crust in dry conditions.

8.73 A second layer, or catotelm, lies beneath the acrotelm and forms a stable colloidal substance which is generally impermeable. As a result the catotelm usually remain saturated with little groundwater flow. Peat is thixotropic, meaning that the viscosity of the material decreases when stress is applied. The thixotropic nature of peat may be considered less important where the peat has been modified through artificial drainage and is drier, but will be significant when the peat body is saturated.

8.74 Due to the distribution of blanket peat and peaty soils across the site, a peat depth and peat stability risk assessment has been carried out. As part of the assessment a peat probing exercise was carried out on the 28th May 2009 to help inform the site layout. Following the finalisation of the site layout, additional peat probing was carried out on the 18th and 19th of August 2009 in areas of proposed infrastructure. An indicative peat depth map is provided in Figure 8.3 and also shows the distribution of all peat depths recorded during the site investigations.

8.75 Table 8.9 provides a summary of the peat depths that were recorded during all the site investigations and Technical Appendix 3 (Peat Stability Assessment) provides more detail.

Table 8.9 Summary of recorded peat depths

Peat Depth Range (m)	Peat depth categorisation	Results	% of Points
<0.25	Shallow	34	12.9
0.25-0.75	Moderate	139	52.3
0.75-1.5	Deep	81	30.8
>1.5	Very Deep	9	3.4
	TOTAL	263	100

8.76 The results of the peat probing illustrate that the site is dominated by a moderate (0.25-0.75m) peat depth. 139 recorded depths fall within the moderate peat depth category, while 81 recorded depths were recorded to fall within the deep peat depth category. The table also shows that only 9 peat depths were recorded in the very deep (>1.5m) category.

8.77 Due to the distribution of blanket peat and peaty soils across the site a peat depth and peat risk assessment has been carried out. The results of the peat stability assessment are presented in Technical Appendix 3.

Superficial Geology

8.78 The BGS 1:50 000 digital superficial geology data for the site (shown in Figure 8.4) indicates that the majority of the site is underlain by deposits of Devensian Till called Diamicton. Diamicton is characterised by being very poorly sorted with larger sedimentary grains set in a matrix of fine grains.

8.79 There are also isolated areas of peat overlying the till deposits that are situated on the tops and slopes of the surrounding hills, such as Meikle Auchinstilloch, Wedder Hill and Hareshaw Hill.

[11] SEPA, River Basin Planning, http://www.sepa.org.uk/water/river_basin_planning.aspx , accessed 14th August 2009

[12] Warburton, J., Holden, J., Mills, A.M., 2004. *Hydrological Controls of Surficial Mass Movements in Peat*. Earth-Science Reviews 67, 139-156

[13] Is the upper layer of the peat bog, in which organic matter decomposes aerobically and rapidly.

8.80 Areas of alluvium and alluvial fan deposits (comprised of clay, silt, sand and gravel) are found within the valleys of some of the watercourses.

Solid Geology

8.81 As shown in Figure 8.5, the BGS 1:50 000 data indicates that the solid geology underlying the site mainly comprises sandstones from the Lanark Group, Inverclyde Group, Dungavel Group and Monks Water Group. The Lanark Group sandstones form the Swanshaw Sandstone Formation, part of the Old Red Sandstone Supergroup, and are described as medium grained and moderately well sorted. The Inverclyde group sandstones form the Kinneswood Formation and are described as fine to medium-grained, weakly cemented, and are variously coloured red, brown, yellow or white. The Dungavel group sandstones form the Plewlands Sandstone Formation, which are described as greyish brown, micaceous and cross-bedded fluviatile sandstones. Finally the Monks Water Group forms the Quarry Arenite Formation which is described as medium- and coarse-grained sandstone often containing intraclast fragments of red shale.

8.82 To the northern and southern edges of the site there are outcrops of Greywacke Conglomerate belonging to the Lanark Group and the Greywacke Conglomerate Formation. In addition to greywacke it contains pebbles of quartz, jasper and chert.

8.83 In the area of the existing colliery road associated with the Spireslack OCCS, the construction compound and laydown area the site is dominated by undivided cyclic sedimentary rocks with areas of limestone. The undivided cyclic sedimentary rocks are part of the Limestone Coal Formation which comprises sandstone, siltstone and mudstone in repeated cycles. The siltstone and mudstone are usually grey to black while the sandstone is usually fine- to medium- grained and off-white to grey. Coal seams are common and may exceed 0.3m in thickness. The limestone rocks are part of the Lower Limestone formation. The limestones are nearly all marine and fossiliferous and are pale to dark grey in colour.

8.84 The site is also heavily faulted with a number of faults traversing the site.

Hydrogeology

Hydrogeological Units

8.85 The Hydrogeological Map of Scotland[14] indicates that the site is dominantly underlain by Carboniferous Westphalian rocks in which groundwater flow is dominantly in fissures and other discontinuities. These aquifers are comprised of cyclical deposits of mudstones, siltstones, fine-grained sandstones, seatclays and coals. To enable open cast operations to proceed, large volumes of water have been pumped from mine workings. Water supply boreholes have not been developed because yields are low and water quality poor.

8.86 Areas in the vicinity of the main access track and north east of the site are underlain by highly productive aquifers of the Carboniferous rocks of the Dinantian and Namurian. Groundwater is dominantly in fissures and other discontinuities. The oldest strata of Dinantian age consist of medium grained sandstones, with subordinate mudstones, siltstones and limestones. Borehole yields in the oldest strata are generally moderate and not greater than 10l/s. The highest strata consists of sandstones, mudstones and occasional thin coals with borehole yields generally less than 10l/s and exceptionally 20l/s.

8.87 A minor area to the south east of the site is underlain by Silurian and Ordovician rocks that are generally impermeable and without groundwater except at shallow depths. Any groundwater is confined to near surface cracks and joints.

[14] BGS (1988), Hydrogeological Map of Scotland, 1:625,000

Groundwater Flow in the Superficial Deposits

8.88 In 2004, SEPA in conjunction with the BGS produced a series of maps to gain a better understanding of the hydrogeological properties of superficial and bedrock aquifers in Scotland. The superficial aquifer map indicates that the superficial aquifers underlying the site are dominated by intergranular flow with low productivity (0.1 - 1l/s)[15]. In the western extent of the site there are areas where groundwater flow in the superficial deposits is dominated by intergranular flow with high productivity (>10l/s)[15].

8.89 In areas dominated by Till, groundwater movement is likely to be restricted due to the mixture of clay through cobbles generally having a low permeability. However, weathered horizons or thick lenses of sand and gravel are likely to have slightly higher permeability and support small groundwater flows.

8.90 The groundwater regime that operates in peat is complex and very variable over short distances. Groundwater flow is considered to be more active within the acrotelm layer and to be more static within the deeper lower permeability catotelm layer. However, the presence of naturally occurring "peat-pipes" and desiccation cracks within peat facilitates the rapid movement of water, similar to the presence of major fractures in bedrock formations. Minor groundwater flow is also likely to occur at the boundary between the peat and superficial deposits. As shown in Figure 6.3a of Chapter 6 (Ecology), there have been considerable drainage ditches dug across the site, often cutting through the peat layer to underlying Till, and these features influence groundwater flows within the peat body, tending to intercept and channel such sub-surface drainage.

8.91 It is worth noting that naturally occurring features such as "peat-pipes" and desiccation cracks, as well as the flow of groundwater between the peat and low permeability superficial and bedrock geology can facilitate peat failure. Full details regarding the peat stability on site are considered in Technical Appendix 3 – Peat stability risk assessment.

8.92 Due to the nature of the constituents that make up Alluvium, groundwater movement is likely to be less restricted within the river valleys.

Groundwater Flow in the Bedrock

8.93 The Bedrock Aquifer map produced by SEPA indicates that the bedrock aquifers underlying the site are dominated by intergranular-fracture flow with moderate productivity (1-10l/s)[15] .

Groundwater Vulnerability

8.94 The WFD policed by SEPA through the Water Environment and Water Services (Scotland) Act 2003, is intended to protect all groundwater, including that which is not exploited for supply and providing baseflow to surface watercourses. Part of the implementation of the WFD has involved assessing the vulnerability of groundwater to pollution and SEPA has published an assessment of groundwater vulnerability in Scotland[16]. The methodology for the assessment determines the vulnerability of the groundwater based upon the permeability of the bedrock, type of groundwater flow (intergranular flow or fracture flow) and the type and thickness of the superficial deposits. The underlying superficial aquifers are dominated by intergranular flow with low productivity, whilst the bedrock aquifers are dominated by fracture flow with low productivity. The Groundwater Vulnerability Map of Scotland classes the site as 'Vulnerable' (4a) and (4b). The vulnerability classification can be attributed to the transmission of rainfall and runoff from the surface to groundwater and the subsequent ease of movement of pollutants through the fracture dominated rocks. This assessment

[15] A, M, MacDonald, D, F, Ball and B, É, O, Dochartaigh (2004), A GIS of aquifer productivity in Scotland: explanatory notes, Groundwater Systems and Water Quality Programme Commissioned Report CR/04/04/047N
[16] Development of a Groundwater Vulnerability Screening Methodology for the Water Framework Directive, Scotland and Northern Ireland Forum For Environmental Research, Project WFD 28 Final Report 2004

is based on the generic consideration of soil and rock types and does not indicate that the risks to individual groundwater sources are high.

Water Resources

Public Water Supplies

8.95 Following consultation with Scottish Water, it was confirmed that no sensitive public water supply infrastructure was located within or in the vicinity of the site boundary. As such, public water supplies are not considered further in this assessment.

Private Water Supplies

8.96 Easy Ayrshire Council (EAC) and South Lanarkshire Council (SLC) were contacted with regards to the presence of private water supplies (PWS) in the vicinity of the site. EAC confirmed that they do not have any PWS in the vicinity of the site, while SLC confirmed that they have a number of supplies in the vicinity of the site.

8.97 The details of the PWS provided by SLC are detailed in Table 8.10 and the location of the supplies is also provided in Figure 8.6. The table provides details of the type of supply and the properties served but the sources of supplies were not provided.

Table 8.10 Summary of PWS in the vicinity of Galawhistle Wind Farm

ID	Supply Name	Properties on Supply	Use	Type of Supply	Volume (m^3/day)
1	Cumberhead	• North Cumberhead Farm • Broomknowe Cumberhead • Cumberhead Cottage	Domestic/ Agricultural	Spring	Not Known
2	Parisholm	• Parisholm Farmhouse • Parisholm Farm Cottage	Domestic	Spring	<10m^3/ day
3	Broomerside	• Broomerside	Domestic	Spring	<10m^3/ day
4	Carmacoup	• Carmacoup Farmhouse • Carmacoup Cottage	Domestic	Spring	<10m^3/ day
5	Carmacoup Bridge	• The Bungalow Carmacoup	Domestic	Spring	<10m^3/ day
6	Hazelside	• Hazelside Lodge • Hazelside Farm	Domestic	Spring	<10m^3/ day

8.98 PWS have the potential to be affected by activities associated with the proposed Wind Farm where the source of the supply is located downstream or downgradient from the Wind Farm. The following provides information relating to the PWS and their likelihood of being affected by the activities associated with the Wind Farm:

- The source of the Cumberhead (1) supply was retrieved from reviewing the Nutberry Hill Wind Farm ES. This stated that the supply source is located on the slopes of the Law Hill and is approximately 2km north from the nearest construction activity (Turbine 18). The topographical separation between the supply source and Galawhistle Wind Farm, and the associated distances means that wind farm activities are unlikely to significantly alter the quality and quantity of water serving the supply;
- The properties of the Parisholm supply (2) are located approximately 1.3km south of the nearest wind farm infrastructure (Turbine 10). The properties are also located on the opposing valley side of the Douglas Water to the development. Given this information, along with the location of the A70 road, it is possible to deduce that the supply source is likely to be located on the slopes of Parisholm Hill, Urit Hill, Black Hill or Belt Knowe. This topographical and hydrological separation means that the supplies will not to be affected by the proposed Wind Farm;
- The exact source location of the Broomerside supply (3) is unknown. However, it is likely that the supply source to be located on the slopes of Strawberry Hill. If this is the case, it is likely that the quality and quantity of water serving the supply could be affected by the proposed Wind Farm;
- Carmacoup (4) and Carmacoup Bridge (5) are located approximately 1.8km south east from the nearest wind farm infrastructure (Turbine 1). The supplies are also located on the opposing valley side of the Douglas Water to the development. The position of the properties and the topographical separation means that the quality and quantity of water serving the supply is unlikely to be affected by the proposed Wind Farm; and
- The Hazelside supply (6) is located approximately 3km east from the nearest infrastructure (Turbine 1). Taking into account the distances between the proposed Wind Farm and the supply and the shallow nature of Wind Farm construction activities, it is considered that the quality and quantity of water serving the supply will not be affected.

8.99 The information provided by SLC has determined that one PWS within the vicinity may be at risk from the proposed Wind Farm. The exact location of the supply source is unknown but the assessment has assumed that the source is located on the slopes of Strawberry Hill. The mitigation measures presented in Table 8.14 will also help to ensure that the risk to the supply is avoided altogether.

8.100 The remaining supplies are situated within hydrological catchments with no Wind Farm infrastructure and have a physical separation of 1.3km to 3km from the nearest proposed infrastructure. This hydrological and potentially hydrogeological separation indicates that these supplies will not be affected by activities associated with the proposed Wind Farm.

Fisheries and Recreation

8.101 As discussed in paragraphs 8.38 - 8.53 the watercourses within the site drain into the River Ayr and Douglas Water. The Douglas Water is a tributary of the River Clyde and both the River Ayr and River Clyde are designated salmonid fisheries under the Freshwater for Fish Directive 78/659/EEC).

8.102 Glenbuck Loch is the source of the River Ayr and is a managed trout fishery. The River Ayr is a productive fishery with species including salmon, sea trout, brown trout, grayling, eel, stickleback, minnow and stone loach. Several old mill structures are present along the stretch of the river, potentially hindering fish migration. The River Ayr is also under constant threat of pollution from operational and disused coal mines.

8.103 The Douglas Water is also a highly productive salmonid fishery with the Monks Water and a number of tributaries in the vicinity of the site providing spawning grounds.

8.104 Further details of fish species present in the site boundary are provided in Chapter 6 (Ecology) including additional consideration of existing habitat characteristics.

Sensitivity of Receptors

8.105 On the basis of the baseline surveys and available information, Table 8.11 below identifies the sensitivity of hydrological receptors as outlined in Table 8.3 with justification for their categorisation.

Table 8.11 Sensitivity of Receptors

Receptor	Sensitivity	Comment
Surface Water		
Douglas Water Catchment Galawhistle Burn Monks Water Podowrin Burn	High	Watercourses support salmonid fisheries that are likely to be influenced by water quality. Douglas Water is also classed as 'Good' under the SEPA RBMP classification scheme.
River Ayr Catchment Hareshaw Burn Stottencleugh Burn Ponesk Burn Unnamed tributary	High	'Poor' water quality but watercourses support salmonid fisheries that are likely to be influenced by water quality. Under the objectives of the WFD, watercourse must not be allowed to deteriorate.
Fisheries and Recreation		
Douglas Water Catchment Galawhistle Burn Monks Water Podowrin Burn	Very High	Catchment is part of the River Clyde, which is a designated salmonid fishery. Watercourses used for recreation are directly related to watercourse quality. Pollution incidents have the potential to cause damage to fish populations and habitats.
River Ayr Catchment Glenbuck Loch Hareshaw Burn Stottencleugh Burn Ponesk Burn Unnamed tributary	Very High	Designated salmonid fishery. Watercourses used for recreation are directly related to watercourse quality. Pollution incidents have the potential to cause damage to fish populations and habitats.
Flooding	High	Construction Compound is situated in the flood inundation envelope provided in the SEPA flood risk map. No other areas of infrastructure appear to be at risk. Hydrological features downstream of the site are also at risk from 200 year flood event.
Soils, Geology and Hydrogeology		
Soils and Peat On-site soils and peat	Very High	Blanket bog is listed as an Annex 1 habitat under the Habitats Directive. Potential loss of habitat as a result of proposed Wind Farm. Peat stability issues as a result of construction activities.
Geology Shiel Burn SSSI	Very High	The site is important for the fossils found in the rock exposures, which have yielded rare and very important early fish.
Ree Burn and Glenbuck Loch SSSI	Very High	Designated site illustrates the sequence of sedimentary rocks demonstrating the transition from marine to terrestrial conditions.
Underlying Bedrock	Low	Geology is typical of wider area.
Hydrogeology Underlying Aquifers	Very High	Groundwater is dominated by intergranular fracture flow, which offers little protection from pollutants. Aquifers are classed as vulnerable to pollution (4a and 4b) in SEPA vulnerability classification scheme.
Water Resources		
Private Water Supplies Brommerside (3)	Medium	Groundwater spring source is potentially located downgradient of Wind Farm activities. It is possible activities could cause contamination of groundwater and disrupt the hydrogeological regime.

Assessment of Effects

8.106 This section describes the potential effects on hydrology, geology and hydrogeology that could arise in the absence of mitigation during the following phases of development:

- Construction;
- Operation; and
- Decommissioning.

8.107 The assessment of effects has been carried out in a number of stages. Due to the nature of the site and the work to be undertaken, a number of effects will be similar for each phase of development.

8.108 The first stage of the assessment details the various potential effects on the hydrological, geological and hydrogeological environment that may arise as a result of the Wind Farm but does not consider their significance.

8.109 The second stage assesses the significance of the potential effects on the specific receptors identified in Table 8.11 for each stage of the development but does not take into account the implementation of mitigation measures.

8.110 The final stage reassesses the significance of the potential effects following the implementation of mitigation measures.

Potential Construction Effects

8.111 The most significant phase in terms of the potential effects is the construction period. This section identifies the effects for all sensitivities that are likely to occur on the hydrological, hydrogeological and geological environment during wind farm construction.

8.112 The consideration of potential effects takes into account the site conditions, baseline sensitivities, and construction activities anticipated.

Potential Risks to Surface Water Quality

Chemical Pollution

8.113 A number of chemicals will be stored and used on-site during construction of the proposed Wind Farm. These include unset concrete, concrete additives, fuel and oil. These pollutants have the potential to adversely affect water quality of the receiving surface water environment if not handled correctly.

8.114 Spillages of concrete may occur during concrete pumping operations into turbine bases, which may runoff into surface watercourses. Concrete is highly corrosive and can cause pH changes in watercourses.

8.115 Contamination of surface water may also occur as a result of spillages from routine plant maintenance, improper storage and accidental spillages.

8.116 Periods of heavy rain can also dramatically increase the volume of surface water runoff with very high pollutant loads such as oils and fuels from hardstandings and unset concrete from turbine foundations.

Modification to surface runoff

8.117 Increases in the rate and volume of runoff can be caused by excavations, exposure of bare ground, compaction of soils and peat and poor design of site drainage. As well as increasing the risk of downstream flooding it is also likely that increases in the volume of runoff entering watercourses can alter the water quality and hydrological regime of the site.

Erosion and sedimentation

8.118 Changes in natural drainage patterns due to runoff from exposed soil, dewatering, stripping of vegetation and topsoils may lead to the erosion and transport of sediment into watercourses. Sedimentation of watercourses can have a detrimental effect on flood storage capacity and water quality.

Impediments to flow

8.119 The improper crossing of watercourses on site could restrict flow in the stream channels and reduce hydraulic capacity. The results of this could be increased the promotion of erosion and sedimentation of watercourses, ultimately having a detrimental impact on water quality.

Potential Risks to Fisheries and Recreation

Chemical Pollution

8.120 A number of chemicals will be stored and used on-site during construction of the proposed Wind Farm. These chemicals have the potential to significantly reduce the quality of the surface water environment and significantly impact upon the freshwater ecology.

8.121 The impact of concrete on the pH of watercourses can have severe or fatal consequences on freshwater ecology.

Erosion and sedimentation

8.122 Changes in natural drainage patterns due to runoff from exposed soil, dewatering, stripping of vegetation and topsoils may lead to erosion and transport of sediment into watercourses.

8.123 Sedimentation of watercourses can have a detrimental effect on the ecology of aquatic plants, fish, and invertebrates. Sediment can settle out in slower moving stretches of a watercourse, with the potential to smother gravels used for salmonid spawning and hatching, whilst deposits of significant quantities of sediment can alter river morphology.

8.124 Sediment can also have impacts on the health of aquatic fauna by interfering with respiration and increasing stress levels.

Impediments to flow

8.125 The improper crossing of watercourses on site could restrict flow in the stream channels and reduce hydraulic capacity. Poorly constructed crossings can also cause a drop in hydraulic head on the downstream side of the crossing. The results of impediments to flow can be the impediment of fish migration.

Potential Risks to Flood Risk

Modification to surface runoff

8.126 Increases in the rate and volume of runoff can be caused by excavations, exposure of bare ground and poor design of drainage ditches. An increase in the area of hardstanding may also contribute to a rapid runoff response to rainfall events and an increase in the rate of runoff to the network of watercourses on site. Due to the steep topography and poorly draining soils there is limited infiltration at the site, and potentially high rates of runoff. In addition, movement of construction traffic may lead to compaction of the soil, reducing soil permeability and rainfall infiltration, which could lead to changes in the runoff. Significant increases in runoff may lead to changes in the flow pattern within a receiving watercourse, which could potentially lead to a change in watercourse morphology and effects on ecology. Runoff can also arise from track dust suppression during dry periods.

Impediments to flow

8.127 The improper crossing of watercourses on site could restrict flow in the stream channels and reduce hydraulic capacity. The construction of access tracks and their associated watercrossing can cause impediments to flows in the watercourses leading to elevated water levels upstream and increased flood risk. Watercrossings associated with access tracks can also impede flows and tracks can alter drainage to the upper reaches of the watercourses if inadequately designed and installed. This can lead to higher water levels upstream, increasing flood risk.

Potential Risks to Soils and Peat

Chemical Pollution

8.128 A pollution event e.g. oil spillage, could impact on the soils and peat in the vicinity of the incident. Because of the low infiltration potential of the peat, contaminants are unlikely to penetrate into deep peat. However, high surface runoff coefficients mean a large area of the surface of the peat could be affected. Contaminants will be likely to damage irrevocably the water quality and ecology of the peat and reduce its ecological status.

Changes to soil interflow patterns

8.129 During wind farm construction some excavations may require temporary sub-surface water controls, such as physical cut-offs or dewatering. Cut-offs divert flows away from construction activities, while dewatering temporarily lowers the water table in the vicinity of the excavation.

8.130 Prolonged or permanent alteration to drainage and soil interflow patterns may lead to the drying out of peat, which can ultimately lead to erosion and shrinkage. Changes to soil interflow patterns can also be caused by the movement of construction traffic that may lead to compaction of the soil, reducing soil permeability and rainfall infiltration.

Compaction and erosion

8.131 The movement of construction traffic throughout the site could cause compaction in the peat and peaty soils affecting both hydrology and hydrogeology. The effects of compaction are likely to be highly localised but will damage the vegetation and result in a reduction in soil permeability and rainfall infiltration, thereby increasing the potential for erosion. Stockpiled and exposed areas of peat and soils could be at risk of desiccation and erosion.

Destabilisation of peat

8.132 In recent years, with an increase in developments on sites with a cover of peat, the significance of impacts on peatlands has been acknowledged. This relates in particular to the impact on peat stability and the associated increased risk of peatslides or bog bursts. Although peatslides do occur naturally they are thought to be relatively uncommon. However, because of the remote nature of most peatlands the frequency of natural peatslides may be under reported. As a result, peatslides and their causes are poorly understood, although it is recognised that they are the result of multiple causes.

8.133 A peatslide occurs when a portion of the peat mass becomes detached and flows downhill, usually as blocks of solid peat rafted upon a slurry of semi-liquid peat. Peat failures may have a significant effect on river water quality and ecology, particularly fish stocks. The land affected by peatslides usually re-vegetates quite rapidly, although the original balance of vegetation species is unlikely to be re-established as a consequence of the changes in local topography and drainage patterns.

8.134 A peat stability risk assessment has been carried out and the results are provided in the technical Appendix 2 (Peat Stability Risk Assessment).

Potential Risks to Geology

8.135 The utilisation of borrow pits and excavation of foundations can have significant impacts on potentially sensitive geological resources. No designated sites have been identified underlying the site infrastructure but any fossils present could potentially be damaged by the construction activities.

8.136 Exposure can also have long term consequences with regards to the weathering and erosion of the bedrock.

Potential Risks to Hydrogeology

Chemical Pollution

8.137 As with surface water, there will be a number of activities undertaken during construction that could influence groundwater. The presence of potential pollutants on site, including oil, fuel and concrete, combined with work near or below the water table provides the necessary links in the chain source–pathway–receptor. In particular, pouring concrete for turbine foundations will introduce a pollutant into close proximity to the groundwater regime.

Modifications to Hydrogeological Regime

8.138 Potential dewatering from turbine excavations presents a significant risk to groundwater for a number of reasons including: it may draw contaminated groundwater onto the site from contaminated areas off site and thereby generate a contaminated discharge and it has the potential to compromise the yield of nearby water abstractions. Following dewatering activities the artificial addition of water into the groundwater may cause natural groundwater levels to rise. This can cause the remobilisation of contaminants within the unsaturated zone.

8.139 Deep excavations such as those needed for the turbine bases and borrow pits are likely to disrupt any shallow groundwater systems within the peat, drift and upper bedrock. Temporary groundwater controls such as dewatering or physical cut-offs may be required to prevent the excavations filling with water, which would be likely to result in the lowering of groundwater levels in the immediate vicinity of the excavation. Cable trenches could provide preferential flow pathways for groundwater, especially if cut to the soil/drift–bedrock interface.

Potential Risks to Private Water Supplies

Chemical Pollution

8.140 As with surface water and hydrogeology, a number of chemicals will be stored and used on-site during construction of the proposed Wind Farm. Potential effects on the identified supply include the infiltration or runoff of potentially toxic contaminants as well as effects on aesthetic aspects such as taste and appearance.

Modifications to Hydrogeological Regime

8.141 Potential dewatering from turbine excavations also presents a risk to private water supplies. Dewatering can disrupt the hydrogeological regime and ultimately have impacts upon the quality and quantity of water serving the supply.

Assessment of Potential Construction Effects

8.142 Table 8.12 identifies the likely construction effects and their significance before mitigation on the receptors identified in Table 8.11. The assessment is based on the significance criteria outlined in Table 8.1.

Table 8.12 Assessment of Potential Construction Effects

Description of Potential Effect	Feature (s) (Receptor(s))	Sensitivity	Magnitude of Effect	Significance before Mitigation
Surface Water Quality				
• Sediment entrained runoff from excavations and infrastructure construction reaching upper reaches of watercourse. • Poor sediment management. • Poor management of soil/peat stockpiles. • Compromised peat stability as a result of construction. • Poor storage resulting in oils and chemicals entering watercourses. • Concrete from excavations entering watercourses.	*Douglas Water Catchment*			
	Galawhistle Burn	High	Major	**Major**
	Monks Water	High	Major	**Major**
	Podowrin Burn	High	Moderate	**Moderate**
	River Ayr Catchment			
	Glenbuck Loch	High	Moderate	**Moderate**
	Hareshaw Burn	High	Moderate	**Moderate**
	Stottencleugh Burn	High	Minor	**Minor**
	Ponesk Burn	High	Minor	**Minor**
	Unnamed Tributary	High	Minor	**Minor**

Description of Potential Effect	Feature (s) (Receptor(s))	Sensitivity	Magnitude of Effect	Significance before Mitigation
• Restriction of flow in channels leading to the promotion of erosion and sedimentation.				
Fisheries and Recreation				
• Sediment entrained runoff from excavations and infrastructure construction reaching upper reaches of watercourse. • Poor sediment management. • Poor management of soil/peat stockpiles. • Compromised peat stability as a result of construction. • Poor storage resulting in oils and chemicals entering watercourses • Concrete from excavations entering watercourses. • Restriction of flow in channels leading to the promotion of erosion and sedimentation, and impeding fish migration.	*Douglas Water Catchment*			
	Galawhistle Burn	Very High	Major	**Major**
	Monks Water	Very High	Major	**Major**
	Podowrin Burn	Very High	Moderate	**Moderate**
	River Ayr Catchment			
	Glenbuck Loch	Very High	Moderate	**Moderate**
	Hareshaw Burn	Very High	Moderate	**Moderate**
	Stottencleugh Burn	Very High	Minor	**Minor**
	Ponesk Burn	Very High	Minor	**Minor**
	Unnamed Tributary	Very High	Minor	**Minor**
Flooding				
• Development (landtake) on upper catchments may exacerbate flooding in downstream areas.	Surface water hydrology	High	Minor	**Minor**
Soils and Peat				
• Poor management of soil/peat stockpiles. • Compromised peat stability as a result of construction. • Compaction of soils through vehicle movements, desiccation & erosion of stockpiled materials.	Site soils and peat	Very High	Moderate	**Moderate**
Geology				
• Disruption to local geological features from deep turbine excavations and other excavations required for construction.	Shiel Burn SSSI	Very High	Negligible	**Not Significant**
	Ree Burn and Glenbuck Loch SSSI	Very High	Negligible	**Not Significant**
	Underlying Bedrock	Low	Negligible	**Not Significant**
Hydrogeology				
• Leaching of hydrocarbons, chemicals and concrete to groundwater via excavations and groundwater flow dominated by intergranular fracture flow. • Modifications of groundwater flow caused by deep excavations, dewatering of excavations; development of preferential flow pathways.	Underlying aquifers	Very High	Moderate	**Moderate**
Private Water Supplies				
• Leaching of hydrocarbons, chemicals and concrete to groundwater via excavations and groundwater flow dominated by intergranular fracture flow. • Poor management of soil/peat stockpiles. • Compromised peat stability as a result of construction. • Compaction of soils through vehicle movements, desiccation & erosion of stockpiled materials.	Broomerside (3)	Medium	Moderate	**Moderate**

Potential Operational Effects

8.143 The following infrastructure will be retained on site during operations:

- Turbines;
- Access tracks and watercourse crossing points;
- Turning areas;
- Turbine bases;
- Substation (along with site office and welfare facilities);
- Cane and met mast hardstandings; and
- Cabling.

8.144 The following section identifies the potential effects that are likely to occur on the hydrological, geological and hydrogeological environment during the operation of the proposed Wind Farm.

Potential Risks to Surface Water Quality

Chemical Pollution

8.145 The potential risk of pollution is substantially lower during the operational phase because of the decreased levels of activity. The majority of potential pollutants will have been removed when construction is complete. However, lubricants for turbine gearboxes, transformer oils and possible fuel leaks from maintenance vehicles will continue to be present.

Erosion and Sedimentation

8.146 Levels of erosion and sedimentation will also be much lower than during construction as there will be no excavations or bare exposed ground. Some erosion and sedimentation is still possible on the site tracks, hardstandings and drainage ditches as a result of scouring during extreme rainfall events. Similarly there could be some minor erosion and sedimentation around new and upgraded stream crossings as watercourses find a new equilibrium.

Impediments to Flows

8.147 During the operational phase, impediments to flows generally only arise from blockages to ditches and watercourses resulting from vegetation and erosion debris.

Modification of Surface Runoff

8.148 Modification of the surface hydrological regime of the site will occur as a result of the presence of the wind farm infrastructure. There are potentially two aspects to this, changes to the volume and changes to runoff rate. However, as discussed in paragraph 8.63 it is unlikely that surface water runoff rates will be significantly greater than the natural runoff rates.

Potential Risks to Fisheries and Recreation

Chemical Pollution

8.149 As with surface water quality the majority of potential pollutants will have been removed when construction is complete; however, lubricants for turbine gearboxes, transformer oils and possible fuel leaks from maintenance vehicles will remain.

Erosion and Sedimentation

8.150 The levels of erosion and sedimentation will significantly reduce during the operational phase of the wind farm. However, as mentioned in paragraphs 8.120-8.122, erosion and sedimentation is still possible on site access tracks and drainage ditches. Sedimentation of watercourses can have a detrimental effect on the ecology of aquatic plants, fish, and invertebrates.

Potential Risks to Flood Risk

Modification to Surface Runoff

8.151 Increases in the rate and volume of runoff are significantly reduced during the operational phase of the wind farm. The landuse will largely remain rural, and as discussed in paragraph 3.63 the increase in compacted and/or impermeable ground is unlikely to significantly increase the volume of runoff draining the site catchments.

Potential Risks to Soils and Peat

Chemical Pollution

8.152 The potential risk of pollution during the operational phase is substantially lower than during construction because of the decreased levels of activity. The majority of potential pollutants will have been removed upon completion of construction; however, leaks of turbine gearbox lubricants, transformer oils and fuel from maintenance vehicles remain possible.

Changes to Soil Interflow Patterns

8.153 The interception of diffuse overland flow by the tracks and their drainage will disrupt the natural drainage regime of the site, concentrating flows and potentially diverting flows from one catchment to another. This prolonged or permanent alteration to the drainage and soil interflow patterns may lead to the drying out of peat, which can ultimately lead to erosion and shrinkage.

Destabilisation of Peat

8.154 The permanent alteration to the site drainage which can led to the shrinking and drying out of peat can also increase the susceptibility of the peat to failure. Dessication is an important factor in peat mass movements because periods of dry weather often precede a large rainfall event which triggered a failure in the peat mass.

Potential Risks to Hydrogeology

Chemical Pollution

8.155 During the operational phase of the Wind Farm there will be considerably less on-site activity than during construction. As the underlying bedrock aquifers are dominated by intergranular fracture flow, the leaching of hydrocarbons, chemicals, transformer oils and fuel leaks from maintenance still present a potential source of contamination to the site.

Modification to Hydrogeological Regime

8.156 Cut tracks and their drainage and borrow pits will alter the water table within the adjacent peat and upper bedrock aquifers. Backfilled cable trenches may provide preferential flow pathways for groundwater.

Potential Risks to Private Water Supplies

Chemical Pollution

8.157 During the operational phase of the Wind Farm there will be considerably less on-site activity than during construction. As the underlying bedrock aquifers are dominated by intergranular fracture flow, the leaching of hydrocarbons, chemicals, transformer oils and fuel leaks from maintenance still present a potential source of contamination to the site.

Assessment of Potential Operational Effects

8.158 Table 8.13 highlights the potential operational effects and their significance prior to mitigation on the receptors identified in Table 8.11.

Table 8.13 Assessment of Potential Operational Effects

Description of Potential Effect	Feature (s) (Receptor(s))	Sensitivity	Magnitude of Effect	Significance before Mitigation
Surface Water Quality				
• Spillages and leakages during storage and routine maintenance. Including oils from wind turbine transformers. • Erosion & sedimentation from tracks and drainage ditches, and scouring around new stream crossings. • Restriction of flow in channels leading to the promotion of erosion and sedimentation.	*Douglas Water Catchment*			
	Galawhistle Burn	High	Minor	**Minor**
	Monks Water	High	Minor	**Minor**
	Podowrin Burn	High	Negligible	**Not Significant**
	River Ayr Catchment			
	Glenbuck Loch	High	Minor	**Minor**
	Hareshaw Burn	High	Minor	**Minor**
	Stottencleugh Burn	High	Minor	**Minor**
	Ponesk Burn	High	Negligible	**Not Significant**
	Unnamed Tributary	High	Negligible	**Not Significant**
Fisheries and Recreation				
• Spillages and leakages during storage and routine maintenance. Including oils from wind turbine transformers. • Erosion & sedimentation from tracks and drainage ditches, and scouring around new stream crossings. • Restriction of flow in channels leading to the promotion of erosion and sedimentation.	*Douglas Water Catchment*			
	Galawhistle Burn	Very High	Minor	**Minor**
	Monks Water	Very High	Minor	**Minor**
	Podowrin Burn	Very High	Negligible	**Not Significant**
	River Ayr Catchment			
	Glenbuck Loch	Very High	Minor	**Minor**
	Hareshaw Burn	Very High	Minor	**Minor**
	Stottencleugh Burn	Very High	Minor	**Minor**
	Ponesk Burn	Very High	Negligible	**Not Significant**
	Unnamed Tributary	Very High	Negligible	**Not Significant**
Flooding				
• Development (landtake) on upper catchments may exacerbate flooding in downstream areas.	Surface water hydrology	High	Minor	**Minor**
Soils and Peat				
• Maintenance of site infrastructure resulting in contamination of soils and peat. • Maintenance could reduce the stability of the peat. • Prolonged or permanent alteration to the drainage and soil interflow patterns leading to the drying out of soils and peat, ultimately leading to erosion and shrinkage. • Modification of surface and groundwater flows.	Site soils and peat	Very High	Minor	**Minor**
Hydrogeology				
• Leaching of hydrocarbons, chemicals and concrete to groundwater via excavations and groundwater flow dominated by intergranular fracture flow.	Underlying aquifers	Very High	Minor	**Minor**
Private Water Supplies				
• Spillages and leakages during storage and routine maintenance. Including oils from wind turbine transformers. • Leaching of hydrocarbons, chemicals and concrete to groundwater via excavations and groundwater flow dominated by fracture flow.	Broomerside (3)	Medium	Negligible	**Not Significant**

Potential Decommissioning Effects

8.159 The potential Wind Farm is expected to be operational for 25 years. Following this period, if the operational period is not extended, the wind farm will be decommissioned and the site reinstated as approved by the appropriate authority.

8.160 During decommissioning it is preferable to leave buried structures and equipment such as foundations in situ as it minimises ground disturbance. Attempting to remove and reinstate the tracks is likely to result in a footprint of altered vegetation which is unlikely to revert to pre-wind farm conditions in the long term. It is felt that the minimal benefit gained from this will be outweighed by the ground disturbance involved in removing the tracks. With this in mind it is proposed that the access tracks, cables and water crossings would also be left in situ.

8.161 Potential effects of the decommissioning phase are expected to be similar or not as significant to those of the construction phase, and have not been assessed further.

Cumulative Effects

8.162 There are three potential sites in the vicinity of the proposed Galawhistle Wind Farm that could have a cumulative effect on the hydrological and hydrogeological environment.

8.163 Hagshaw Hill and its Extension is an operational wind farm and is located immediately to the east of the proposed Galawhistle Wind Farm. This site is located within the catchment of the Douglas Water. Assuming that the proposed Wind Farm is given consent and adheres to best practice, the cumulative effects on the hydrological and hydrogeological environment are expected to be not significant. Review of the Hagshaw Extension Environmental Statement (2005) and liaison with the Ecological Clerk of Works (ECoW) for Hagshaw Extension development confirmed that there were no significant hydrological effects during construction. More recent consultation with SEPA shows that there have been no significant hydrological effects from the operation of Hagshaw Extension.

8.164 The proposed Nutberry Hill Wind Farm, which is still in planning, is located immediately to the north of the site, within the forestry plantation. Various aspects of the infrastructure associated with the Nutberry Hill site are located near the summits of Meikle Auchinstilloch and Little Auchinstilloch and it is possible for aspects of this development to be on the boundary of the catchments of the watercourses draining the proposed Galawhistle Wind Farm. Assuming both sites are given consent and adhere to best practice throughout construction, operation and decommissioning, any cumulative impacts on the surface and groundwater environment are expected to be not significant.

8.165 Scottish Coal are also progressing plans to continue coal mining by surface mining methods at the Ponesk Remainder OCCS, Muirkirk. As part of the original Spireslack OCCS, the Ponesk Burn was diverted, which resulted in a change to its discharge location into the River Ayr. As part of the proposed works, the Ponesk Burn will be subject to further alteration. The work will include the improvement of associated riparian habitats and restoration to forestry, farmland and nature conservation interests. The route of the Ponesk Burn will be also diverted to flow west, to confluence with the River Ayr at its original, natural location.

8.166 The activities associated with the proposed Ponesk Remainder OCCS and Galawhistle Wind Farm could potentially have an impact on the quality and quantity of the surface and groundwater environment. This may also have secondary affects on freshwater ecology and private water supplies. However, assuming both sites are given consent and adhere to best practice throughout construction, operation and decommissioning, any cumulative impacts on the surface and groundwater environment are expected to be minor.

Design, Management and Mitigation Measures

8.167 A number of planning, design and construction proposals have been identified during the conducting of the assessment. Full design considerations are described in Chapter 2 (EIA process).

8.168 In terms of hydrology, wherever possible, Wind Farm infrastructure has been sited at least 50m from on-site hydrological features, with the exception of the substations which have been sited 20m away.

8.169 In addition, examples of mitigation that can be implemented in hydrologically sensitive locations include, but are not limited to:

- Silt traps located downstream of construction activities;
- Bunding of the watercourses to provide protection from potentially contaminated runoff;
- Appropriate storage of oils and chemicals to prevent pollution;
- Closely monitored use of concrete to make sure that no spillages occur that could potentially impact on the surface and groundwater environment;
- Appropriate storage of emergency mitigation measures to provide a rapid response to potential pollution incidents; and
- Fencing of areas close to water to prevent accidental vehicular access.

8.170 Due to the nature of the development, surface water runoff from the site must be drained by Sustainable Urban Drainage Systems (SUDS)[17]. SUDS are used to attenuate rates of runoff from development sites and can also have water purification benefits[18].

8.171 The implementation of SUDS as opposed to conventional drainage systems provides several benefits by:

- Reducing peak flows to watercourses and potentially reducing risk of flooding downstream;
- Reducing the volumes and frequency of water flowing directly to watercourses;
- Improving water quality by removing pollutants;
- Reducing potable water demand through rainwater harvesting; and
- Replicating natural drainage patterns, including the recharge of groundwater so that base Flows are maintained.

8.172 Where appropriate, SUDS measures have been incorporated into the water management methods discussed in the following sections.

General Site Pollution Control

8.173 An Environmental Management Plan (EMP) will be prepared and agreed with all relevant bodies prior to commencement of construction at the site. The EMP will ensure that mitigation measures are put in place and activities carried out in such a manner as to prevent or minimise effects on the surface and groundwater environment. The implementation of this plan will be overseen by an ECoW who will be employed on site during the construction period.

8.174 The EMP will apply to all phases of the Wind Farm, from construction through to operation and decommissioning. The EMP will be prepared prior to commencement of construction at the site, and will include, but will not be limited to, guidance as follows:

- *Storage* – all equipment, materials and chemicals will be stored well away from any watercourses. Chemical, fuel and oil stores will be sited on impervious bases within a secured bund;
- *Vehicles and Refuelling* – standing machinery will have drip trays placed underneath to prevent oil and fuel leaks causing pollution. Where practicable, refuelling of vehicles and machinery will be carried out in one designated area, on an impermeable surface, and well away from any watercourse;
- *Maintenance* – only emergency maintenance to construction plant will be carried out on-site, in one designated area, on an impermeable surface well away from any watercourse or drainage, unless vehicles have broken down necessitating maintenance at the point of breakdown, where special precautions will be taken;
- *Welfare Facilities* – on-site welfare facilities will be adequately designed and maintained to ensure all sewage is disposed of appropriately. This may take the form of an on-site septic tank

[17] SEPA, The Water Environment (Controlled Activities)(Scotland) Regulations 2005, A Practical Guide, Version 4, March 2008 – "If the surface water run-off is from areas constructed after 1 April 2007, the site must be drained by Sustainable Urban Drainage Systems (SUDS) or if the surface water runoff is from a construction site operated after 1 April 2007, the site must be drained by a SUDS or equivalent. The only exceptions are if the runoff is from a single dwelling and its curtailage, or if the discharge is to coastal water".
[18] CIRIA C648 – Control of Water Pollution from Linear Construction Projects

with soakaway, or tankering and offsite disposal depending on the suitability of the site for a soakaway and prior agreement with SEPA;

- *Cement and Concrete* – fresh concrete and cement are very alkaline and corrosive and can be lethal to aquatic life. The use of wet concrete in and around watercourses will be minimised and carefully controlled;
- *Contingency Plans* – plans will ensure that emergency equipment is available on site i.e. spill kits and absorbent materials, advice is available on action to be taken and who should be informed in the event of a pollution incident; and
- *Training* – All relevant staff personnel will be trained in both normal operating and emergency procedures, and be made aware of highly sensitive areas on-site. The staff training and implementation of site procedures will be overseen by an Environmental Manager to ensure that these measures are carried out effectively to minimise the risk of a pollution incident.

8.175 Further details regarding the specific management and mitigation measures that can be adopted during the construction, operation and decommissioning of the Wind Farm are detailed in the following sections.

Turbine Foundations

8.176 Excess runoff draining downstream of the excavations could be drained into an infiltration trench or swale. Infiltration trenches create an underground reservoir due to the excavated trench being backfilled with clean stone. Runoff directed into the trench will gradually infiltrate back into the peat/soil. If infiltration trenches are properly maintained they can significantly reduce the volume of suspended solids and pollutants in the runoff. If the volume of runoff exceeds the capacity of the infiltration trench, swales could be constructed to attenuate and convey the runoff away from the excavation.

8.177 If dewatering activities are required it is essential that the infrastructure contractor is aware of any historical land uses before pumping is carried out. If the groundwater is already polluted, dewatering could mobilise pollutants.

8.178 Water derived from dewatering activities can be treated via settlement lagoons, retention ponds or siltbusters. The settlement lagoons or retention ponds will allow the settlement of suspended solids.

8.179 Treated water can also be discharged onto vegetated surfaces and directed away from watercourses and drainage ditches to avoid direct entry into watercourses. Any sediment still within the treated water will be deposited amongst the rough surface vegetation. For discharge onto rough grasslands to be effective the discharge must be spread efficiently. This is normally achieved by using a number of discharge points, silt fences to spread and attenuate flow and the use of spray irrigation 'Rain Guns'. The latter provides a means of rapid and flexible deployment of discharge points.

8.180 If the excavations are below the water table, physical barriers such as sheet-piling can also be used to prevent groundwater ingress. The choice of the exclusion technique would depend upon the requirements of the site. The infrastructure contractor will need to take into account the level of groundwater relative to the excavation, superficial and solid geology characteristic and the sensitivity of the receiving site hydrology.

8.181 Peat removed during the excavation of the turbine foundations will be stored nearby in such a manner that it will not dry out or degrade. Consideration will also be given to storage locations to avoid slippage and damage to underlying material. The gradient at storage locations will be considered to avoid further erosion or potential sediment transport into watercourses. This material will be used to reinstate the excavation area and to assist with blocking of artificial drains across peat habitats, where this will enhance peatland restoration and enhancement. Any excess peat will be used in re-contouring and restoration as well as the dressing of the shoulders of floating roads. Excess peat is not anticipated to be of sum quantity that other means of disposal will be necessary.

Site Tracks

8.182 The construction of new tracks will vary depending on the ground conditions. Cut tracks will be constructed on harder ground, where peat depths are typically less than 1.5m, and on steeper gradients. Floating tracks could be constructed on softer areas, where peat is typically greater than 1.5m. However, as the site investigation determined that peat on site is dominated by depths between 0.5m - 1.5m it is likely that the access tracks will be predominately by a cut construction method.

8.183 The tracks will be constructed with sufficient camber or crossfall to minimise ponding of surface water on the track surface. Tracks constructed on steep gradients will have waterbars installed at regular intervals to divert longitudinal runoff from the track surface and into the drainage network. Where necessary, surface water runoff can be directed into infiltration trenches and/or swales. These SUDS measures will treat and attenuate the runoff before discharging back into the natural drainage network. If permanent infiltration trenches, swales and drainage ditches are to be constructed, they would require outlets at frequent intervals to reduce the volume of water collected in a single channel, thus reducing the erosive potential. These measures will minimise the risk of erosion of the track surface and the subsequent risk of sedimentation.

8.184 Runoff may require further treatment, the use of silt traps, lagoons and retention ponds can fulfil this function. These measures should be sited to avoid steep slopes. Silt traps will be utilised to trap and filtrate sediment laden runoff. Lagoons and retention ponds are a form of SUDS used to allow the settlement of suspended solids.

8.185 Extended detention basins can be designed into the sustainable drainage network from the access tracks. Extended detention basins are normally dry and store runoff beyond the time normally required for flow attenuation. This provides extra time for natural processes to remove some of the pollutants in the water.

Water Crossings

8.186 During the optimisation of the site layout, desk top studies were carried out to identify watercourses marked on the OS 1:25,000 mapping that will require the construction of crossings. Following the finalisation of the site layout a total of 7 watercourse crossings were identified.

8.187 The type and design of stream crossing is dependent on the stream morphology, peak flows, local topography and ecological importance and will be finalised at the detailed design stage. Discussions will be held with SEPA and SNH to agree designs and construction methodologies for each water crossing.

8.188 Access to turbines to the east of the site would require the construction of an arch culvert watercrossing over Monks Water (see Figure 8.7) at NS 7755 3171. This arch culvert has been designed following SEPA's best practice guidance.

8.189 All water crossings on site were visited during the site investigation and details of the locations were recorded, including a series of photographs of the crossing site. In all cases an evaluation has been made of the type of crossing required. Full details, including details of CAR authorisations are provided in Appendix 8.1.

8.190 All structures will be designed and constructed using best practice techniques and will be of sufficient capacity to accommodate storm flows, with an allowance for increased flows that may

occur as a result of climate change. By ensuring that structures have sufficient capacity the risk of upstream flooding and increased erosion and sedimentation will be reduced.

8.191 Crossing structures will not form a barrier to aquatic fauna, and will be designed and constructed following design guidance given by the Scottish Executive (2000) relating to river crossings and migratory fish. Where the structure has an invert within the stream channel, e.g. a precast concrete box section, this will be set low enough to enable the same level and gradient as in the original stream bed to be maintained, and will carry similar bed material and flow to the original stream bed. Crossings will not have a hanging outflow and erosion protection measures will not prohibit fish passage during low flows (the use of gabion baskets for erosion protection can result in the stream passing through the baskets, rather than over them, during low flows, preventing fish migration). Similarly crossings will be constructed with a mammal ledge or similar to ensure the unobstructed movement of mammals (specifically, otter and watervole, see Chapter 6 (Ecology)) in the riparian corridor.

Crane Hardstandings and Temporary Construction Compound/Laydown Areas

8.192 The following measures will be implemented to ensure that activities carried out on the construction compound and laydown areas do not adversely impact on the quality of surface and groundwater hydrology.

8.193 All equipment, materials and chemicals to be stored away from any watercourses. Chemicals, fuel and oil should be stored in tanks of sufficient strength and structural integrity to ensure that it is unlikely to burst or leak in ordinary use. They should also be sited on impervious bases within a secured bund of 110% of the storage capacity[19].

8.194 Where oil is stored in a bunded area, oil residue can build up. This residue build up will reduce the storage capacity of the bund and should be removed at regular intervals. The residue should be disposed as special waste of by a specialist waste contractor[20].

8.195 Standing machinery to have drip trays placed underneath to prevent oil and fuel leaks causing pollution. Where practicable refuelling of vehicles and machinery will be carried out at a central designated area, on an impermeable surface, which will be located away from any watercourses.

8.196 Maintenance of construction plant to be carried out in designated areas, on an impermeable surface away from any watercourse or drainage. Only if vehicles have broken down will maintenance be permitted outwith a designated area, and this would only be carried out after implementing special precautions. Such precautions include, but are not limited to:

- Ensure that drip trays are placed underneath vehicle during maintenance; and
- As a precautionary measure, ensure that straw bales or entrapment matting are placed downstream of the maintenance area.

8.197 Turbine hardstandings can be designed in a way to direct flow into infiltration trenches. The infiltration trenches will allow the treatment of runoff before gradually discharging back into the natural drainage network.

8.198 Due to the negligible/low permeable nature of the surrounding peat, excess runoff from the temporary hardstandings can also be directed into detention basins. The detention basins would attenuate flows before discharging back into the natural drainage network.

8.199 Drainage within the site compounds and laydown areas may also be directed to an oil interceptor to prevent pollution if any spillage occurs. The type of interceptor used will be dependant upon the local circumstances and risk factors such as the:

- Discharge point of the proposed separator;
- Environmental sensitivity of the location; and
- Activities being carried out at that site[21].

8.200 Where there is a high risk of oil contamination identified by the infrastructure contractor, it may be appropriate to integrate an oil separator into the SUDS measure. For low risk areas, permeable surfaces and infiltration trenches could be used to filter out pollutants. The closer these methods are to the source of the runoff the more effective they will be. In higher risk areas the construction of swales or ponds could be used to treat the runoff. The implementation of the type of SUDS measures will be dependant upon detailed site and hydrological investigations.

8.201 Following construction of the wind farm the construction compound and other temporary structures will be removed using best practice techniques. The laydown areas will not be restored as it is located on an area of made ground previously used for site offices which is predominantly surfaced with hardstanding.

On-site Buildings and Permanent Hardstandings

8.202 On-site welfare facilities need to be adequately designed and maintained to ensure all sewage is disposed of appropriately. This disposal may take the form of an on-site septic tank with soakaway, or tankering and offsite disposal depending on the suitability of the site for a soakaway and agreement with SEPA.

8.203 Buildings can be designed with SUDS measures to reduce the impact on the surrounding hydrology. The majority of the runoff would be directed onto the hardstanding areas that could be designed with permeable surfaces that would allow the infiltration to a sub-surface permeable fill. This would allow the storage, treatment and infiltration of the water. The permeable surfaces would encompass the entire area occupied by the building compound.

8.204 As a precautionary measure, the permanent hardstandings could be designed to direct runoff into infiltration trenches. The runoff directed into the trenches will be subject to treatment before gradually infiltrating back into the natural drainage network.

8.205 Due to the negligible/low permeability of the surrounding peat, excess runoff from the permanent hardstandings can also be directed into detention basins. The detention basins would attenuate flows before discharging back into the natural drainage network.

8.206 As the runoff from these areas is more likely to be contaminated and therefore to require treatment, appropriate treatment, such as oil interceptors and treatment for high alkalinity, can be installed.

8.207 The sizing and location of the various elements of the drainage system will be influenced by the topography, gradient and catchment runoff characteristics and the volumes of runoff intercepted by each drain. These factors will be determined at the detailed design stage.

Concrete Transportation and Pouring

8.208 Concrete for use in foundations will be batched on site within the construction compound. Wet concrete operations will not be carried out within watercourses or adjacent to watercourses.

[19] SEPA Pollution Prevention Guidelines, PPG2: Above ground oil storage tanks
[20] SEPA Pollution Prevention Guidelines, PPG8: Safe storage and disposal of used oils
[21] SEPA Pollution Prevention Guidelines, PPG3: Use and design of oil separators in surface water drainage systems

Measures to prevent discharge of alkaline wastewaters will be outlined in a method statement to be approved by SEPA before commencement of works. Wastewater spillage will be minimised by using settling tanks and recycling water. Potential requirement for CAR authorisation of the concrete batching process and any water abstractions or associated impoundments or discharges will be discussed and agreed with SEPA prior to commencement of the proposed development.

Borrow Pits

8.209 Prior to excavation, ground investigations including trial pits will be carried out to assess the suitability of the rock as an aggregate, slope stability and the potential for groundwater ingress. The latter investigations will inform the final design of the borrow pits. At present it has been stated that up to four borrow pits will be used. It is intended that the number of borrow pits opened will be minimised. However, this will depend on a number of factors including the volume and quality of rock available at each location, and the balance between minimising the visual impact at any one location and minimising haulage distances.

8.210 Prior to excavation the surface soils and peat will be removed and stockpiled for use in the reinstatement of the borrow pits. The stockpiles will be located and battered so as to limit instability and erosion. Silt fences and mats will be used to minimise sediment levels in runoff from the stockpiles.

8.211 Temporary stockpiles can also be reseeded with seed species of local provenance to help maintain stability. Binders can also be used to help maintain the stockpiles. Binders are biodegradable adhesives that can be applied directly to the peat/soil. They are usually mixed with water and sprayed on. They are also used to reduce dust generation from the stockpiles. It is worth noting that advice should be sought from suppliers to select the appropriate binder and application method[22].

8.212 To assist with peatland and heath restoration and enhancement, it is intended to remove the vegetation and topsoil and store it separately from deeper soils. This top soil will, being richest in seed banks, will assist with rapid recolonisation of borrow pit areas.

8.213 Temporary interception bunds and drainage ditches will be constructed upslope of the borrow pits to prevent surface runoff ingress. As with the trackside drainage these ditches will be of minimal length, depth and gradient, and silt traps and buffer strips will be used to minimise erosion, sedimentation and peak flows.

8.214 Given the low permeability of the overlying peat deposits it is not anticipated that groundwater ingress from the peat will be significant. However, the borrow pit floors will be designed such that they gravity drain, with all floor water draining to an adequately sized settling sump before being pumped into a drainage system similar to that described above for the turbine excavations.

Cable Trenches

8.215 Wherever possible, cable trenches will be laid in the disturbed material adjacent to tracks. Cable trenches may form groundwater conduits as a consequence of their greater permeability compared with the surrounding materials. To minimise this, two methods of cable trenching will be used as appropriate.

8.216 Where conditions are suitable, on deeper subsoil and peat, cables will be laid using a plough “lift and turn” process which lifts the required depth of material and turns it over, exposing the trench. The cable is immediately laid and the overlying material is turned back to its original position burying the cable. This method is effective, swift and produces very little damage to the surface. However, it is not possible to use this method where the subsoil is uneven or rocky.

8.217 Where cables cannot be installed using the “lift and turn” process, conventional trenches will have to be dug and then backfilled with the excavated material. In some locations where the underlying surface may be detrimental to the cable, a bed of support material (typically sand) will have to be laid to protect the cable. Such material has the potential to act as a drainage conduit, particularly in areas where cable trenches are on steep slopes. In these areas clay bunds will be installed for every 50cm change in altitude along the length of the cable trench to minimise down-slope groundwater flow.

Construction Management

8.218 Construction traffic access will be restricted wherever possible, and the number of vehicle movements limited as much as practicable. Land surrounding the immediate construction area will be fenced off or otherwise demarcated to prevent inadvertent intrusion by construction plant. This will help to limit soil disturbance and subsequently reduce the potential of erosion.

8.219 Watercourses, culverts and drainage ditches will be inspected and cleared regularly to prevent blockages and remove the risk of flooding.

8.220 Silt traps and sediment settlement tanks will be inspected and cleared regularly to ensure they remain fully operational and effective.

8.221 Silt fences and mats will be used to ensure minimum sediment runoff from stockpiles.

8.222 Spill kits will also be utilised during the construction and operation of Galawhistle Wind Farm. Spill kits should be available for dealing with spillages on both land and water and should be obtained from a reputable supplier[23]. Spill kits will be ideally situated near to discharge points or oil storage areas and should be carried by all site plant machinery[24].

Mitigation and Residual Effects

8.223 Tables 8.14 and 8.15 summarise the residual significance of the identified effects following the implementation of the mitigation and construction management measures discussed in paragraphs 8.165-8.220. The recommended mitigation measures for each potential effect are also provided in the tables.

[22] CIRIA C648 Control of Water Pollution from Linear Construction Projects

[23] CIRIA C648 Control of water pollution from linear construction projects, Technical Guidance, 2006.

[24] CIRIA C532 Control of water pollution from construction sites, Guidance for consultants and contractors, 2001

Table 8.14 Residual Construction Effects

Potential Effect	Feature (s) (Receptors (s))	Significance before Mitigation	Mitigation	Residual Significance
Surface Water Quality				
• Sediment entrained runoff from excavations and infrastructure construction reaching upper reaches of watercourse. • Poor sediment management. • Poor management of soil/peat stockpiles. • Compromised peat stability as a result of construction. • Poor storage resulting in oils and chemicals entering watercourses. • Concrete from excavations entering watercourses. • Restriction of flow in channels leading to the promotion of erosion and sedimentation.	*Douglas Water Catchment*		• Infrastructure placement outwith 20m buffer around existing watercourses where possible. • EMP and PPP will detail appropriate mitigation measures to prevent deterioration of surface and groundwater environment. • Use of SUDS measures including swales, infiltration trenches and detention ponds to treat and attenuate runoff • Use of silt traps, natural soakaways and/or use of mobile siltbuster units. • Use of silt fences, mats and/or geotextiles around construction activities. • Oils/Chemicals stored in 110% bund, drip trays, refuelling within designated areas. Provision of spill kits on site and trained staff. Temporary sanitation facilities. • Careful use of flocculants to treat sediment entrained runoff • Regular maintenance of mitigation structures to ensure efficient operation.	
	Galawhistle Burn	Major		**Minor**
	Monks Water	Major		**Minor**
	Podowrin Burn	Moderate		**Not Significant**
	River Ayr Catchment			
	Glenbuck Loch	Moderate		**Minor**
	Hareshaw Burn	Moderate		**Minor**
	Stottencleugh Burn	Minor		**Not Significant**
	Ponesk Burn	Minor		**Not Significant**
	Unnamed Tributary	Minor		**Not Significant**
Fisheries and Recreation				
As Surface Water Quality Above.	*Douglas Water Catchment*		As Water Quality Above. Appropriate placement of crossings to ensure passage of aquatic fauna	
	Galawhistle Burn	Major		**Minor**
	Monks Water	Major		**Minor**
	Podowrin Burn	Moderate		**Not Significant**
	River Ayr Catchment			
	Glenbuck Loch	Moderate		**Minor**
	Hareshaw Burn	Moderate		**Minor**

Potential Effect	Feature (s) (Receptors (s))	Significance before Mitigation	Mitigation	Residual Significance
	Stottencleugh Burn	Minor		**Not Significant**
	Ponesk Burn	Minor		**Not Significant**
	Unnamed Tributary	Minor		**Not Significant**
Flooding				
Development (landtake) on upper catchments may exacerbate flooding in downstream areas.	Surface water hydrology	Minor	• Use of an extensive suite of mitigation techniques including silt traps, settlement/balancing ponds and pumping water to natural soakaways high in the catchment to encourage attenuation of flow via soil infiltration. • SUDS measures incorporated into drainage design. SUDS encourage attenuation of runoff while maintaining natural drainage patterns. • Appropriate maintenance of site drainage and watercrossings to ensure that flow of water is uninterrupted.	**Not Significant**
• **Soils and Peat**				
• Poor management of soil/peat stockpiles • Compromised peat stability as a result of construction. • Compaction of soils through vehicle movements, desiccation & erosion of stockpiled materials.	Site soils and peat	Moderate	• Identification of areas of deep peat within areas of proposed development by physical demarcation with instruction to site personnel to avoid the identified areas or minimise the requirement for construction activities in these locations where practical • Appropriate micrositing of the construction compound, substation, laydown area and turbines and track to avoid deep peat or areas sensitive to surface drainage • Design and construction of a suitable drainage system for the development • Identification of approved areas for stockpiling of any excavated soils and peat	**Minor**
Geology				
• Disruption to local geological features from deep turbine excavations and other excavations required for construction.	Shiel Burn SSSI	Not Significant	• If required, appropriate micrositing of site infrastructure to increase the distance between the development and potential important geological features • If required, ensure that site staff are made aware of the importance of the geology to ensure that no unnecessary works occur in and around the features	**Not Significant**
	Ree Burn and Glenbuck Loch SSSI	Not Significant		**Not Significant**
	Underlying Bedrock	Minor		**Not Significant**
Hydrogeology				
• Leaching of hydrocarbons, chemicals and concrete to groundwater via excavations and groundwater flow dominated by fracture flow. • Modifications of groundwater flow caused by deep excavations, dewatering of excavations; development of preferential flow pathways.	Underlying aquifers	Moderate	• EMP and PPP will detail appropriate mitigation measures to prevent deterioration of surface and groundwater environment. • Oils/Chemicals stored in 110% bund, drip trays, refuelling within designated areas. Provision of spill kits on site and trained staff. Temporary sanitation facilities. • Appropriate design of SUDS measures to allow contaminated runoff to be adequately treated before discharge back into the hydrogeological environment • Removal of construction compound at end of construction period	**Minor**

Potential Effect	Feature (s) (Receptors (s))	Significance before Mitigation	Mitigation	Residual Significance
Private Water Supplies				
• Leaching of hydrocarbons, chemicals and concrete to groundwater via excavations and groundwater flow dominated by intergranular fracture flow. • Poor management of soil/peat stockpiles. • Compromised peat stability as a result of construction. • Compaction of soils through vehicle movements, desiccation & erosion of stockpiled materials.	Broomerside (3)	Moderate	• EMP and PPP will detail appropriate mitigation measures to prevent deterioration of surface and groundwater environment. • Use of SUDS measures including swales, infiltration trenches and detention ponds to treat and attenuate runoff • Oils/Chemicals stored in 110% bund, drip trays, • refuelling within designated areas. Provision of spill kits on site and trained staff. Temporary sanitation facilities. • Regular maintenance of mitigation structures to ensure efficient operation.	**Not Significant**

Table 8.15 Residual Operational Effects

Potential Effect	Feature (s) (Receptors (s))	Significance before Mitigation	Mitigation	Residual Significance
Surface Water Quality				
• Sediment entrained runoff from excavations and infrastructure construction reaching upper reaches of watercourse. • Poor sediment management. • Compromised peat stability as a result of infrastructure maintenance. • Spillages and leakages during storage and routine maintenance. Including oils from wind turbine transformers. • Erosion & sedimentation from tracks and drainage ditches, and scouring around new stream crossings. • Restriction of flow in channels leading to the promotion of erosion and sedimentation.	*Douglas Water Catchment*		• EMP and PPP and consultation with relevant water users to inform them of contingency measures. • Chemicals, fuels and maintenance bay stored within substation compound within bunded and signed areas. • Appropriate maintenance of SUDS measures to ensure maximum efficiency • Appropriate design, construction and maintenance of septic tank or contained system	
	Galawhistle Burn	Minor		**Not Significant**
	Monks Water	Minor		**Not Significant**
	Podowrin Burn	Not Significant		**Not Significant**
	River Ayr Catchment			
	Glenbuck Loch	Minor		**Not Significant**
	Hareshaw Burn	Minor		**Not Significant**
	Stottencleugh Burn	Not Significant		**Not Significant**
	Ponesk Burn	Not Significant		**Not Significant**
	Unnamed Tributary	Not Significant		**Not Significant**
Fisheries and Recreation				
• Sediment entrained runoff from excavations and infrastructure construction reaching upper reaches of watercourse. • Poor sediment management. • Compromised peat stability as a result of infrastructure maintenance. • Spillages and leakages during storage and routine maintenance. Including oils from wind turbine transformers. • Erosion & sedimentation from tracks and drainage ditches, and scouring around new stream crossings. • Restriction of flow in channels leading to the promotion of erosion and sedimentation.	*Douglas Water Catchment*		• EMP and PPP and consultation with relevant water users to inform them of contingency measures. • Chemicals, fuels and maintenance bay stored within substation compound within bunded and signed areas. • Appropriate maintenance of SUDS measures to ensure maximum efficiency • Appropriate design, construction and maintenance of septic tank or contained system	
	Galawhistle Burn	Minor		**Not Significant**
	Monks Water	Minor		**Not Significant**
	Podowrin Burn	Not Significant		**Not Significant**
	River Ayr Catchment			
	Glenbuck Loch	Minor		**Not Significant**
	Hareshaw Burn	Minor		**Not Significant**
	Stottencleugh Burn	Not Significant		**Not Significant**
	Ponesk Burn	Not Significant		**Not Significant**

Potential Effect	Feature (s) (Receptors (s))	Significance before Mitigation	Mitigation	Residual Significance
	Unnamed Tributary	Not Significant		**Not Significant**
Flooding				
• Development (landtake) on upper catchments may exacerbate flooding in downstream areas.	Surface water hydrology	Minor	• Landuse will remain largely rural. Use of sustainable urban drainage systems (SUDS) where appropriate. • Appropriate maintenance of site drainage and watercrossings to ensure that flow of water is uninterrupted.	**Not Significant**
Soils and Peat				
• Maintenance of site infrastructure resulting in contamination of soils and peat. • Maintenance site infrastructure could result in reduced stability of peat. • Compaction of soils/peat could have an impact on surface and groundwater flows.	Site soils and peat	Minor	• Design, construction and maintenance of a suitable drainage system for the development • Identification of approved areas for stockpiling of any excavated soils and peat	**Not Significant**
Hydrogeology				
• Leaching of hydrocarbons, chemicals and concrete to groundwater via excavations and groundwater flow dominated by intergranular fracture flow.	Underlying aquifers	Minor	• EMP and PPP and consultation with relevant water users to inform them of contingency measures. • Chemicals, fuels and maintenance bay stored within substation compound within bunded and signed areas. Appropriate design, construction and maintenance of septic tank or contained system • Oils/Chemicals stored in 110% bund, drip trays, refuelling within designated areas. • Provision of spill kits on site and trained staff. • Design, construction and maintenance of a suitable drainage system for the development	**Not Significant**
Private Water Supplies				
Spillages and leakages during storage and routine maintenance. Including oils from wind turbine transformers • Leaching of hydrocarbons, chemicals and concrete to groundwater via excavations and groundwater flow dominated by intergranular fracture flow.	Broomerside (3)	Not Significant	• EMP and PPP and consultation with relevant water users to inform them of contingency measures. • Chemicals, fuels and maintenance bay stored within substation compound within bunded and signed areas. Appropriate design, construction and maintenance of septic tank or contained system • Oils/Chemicals stored in 110% bund, drip trays, refuelling within designated areas. • Provision of spill kits on site and trained staff. • Design, construction and maintenance of a suitable drainage system for the development	**Not Significant**

Summary of Effects

Surface Water Quality

8.224 The proposed Wind Farm is located within the catchments of the Douglas Water and River Ayr and a number of risks identified included the effects of the proposed Wind Farm on water quality. The Douglas Water (tributary of the River Clyde) has been classed as having 'Good' water quality, and the River Ayr has been classed as having 'Poor' water quality.

8.225 The impact assessment has taken into account the site's hydrological regime, highlighting that the principal effects on site hydrology will occur during wind farm construction. With the implementation of the site specific EMP and the successful implementation of mitigation measures the significance of construction effects on the water quality of the Douglas Water and River Ayr catchments are considered to be of **minor significance** or less.

8.226 Following the successful implementation of the EMP the operation effects on the quality of the surface water environment is considered to be of **no significance**.

Fisheries and Recreation

8.227 The Douglas Water is a tributary of the River Clyde and both the River Ayr and River Clyde are designated salmonid fisheries under the Freshwater for Fish Directive 78/659/EEC). Glenbuck Loch is a tributary of the River Ayr and is a managed trout fishery.

8.228 The assessment has taken into account the effects of the construction, operation and decommissioning phases of the proposed Development on fisheries and recreation. With the implementation of the site specific EMP and the successful implementation of mitigation measures the significance of construction on the fisheries is considered to be of **minor significance** or less

8.229 Following the successful implementation of the EMP the operation effects on fisheries and recreation is considered to be of **no significance**.

Flood Risk

8.230 The impact assessment has taken into account the site's hydrological regime, highlighting that the principal effects on site hydrology will occur during wind farm construction. The assessment has also determined that the increased landtake as a result of the proposed development will have an insignificant effect on the pre-construction runoff rates.

8.231 With the implementation of mitigation measures the effects on flooding are also considered to be of **no significance**.

Soils and Peat

8.232 An assessment was also carried out on the potential impacts of soils and peat within the site. Following the implementation of mitigation measures the impacts of the proposed development on the site soils and peat are considered to be of **minor significance** or less. It was also established that the proposed Wind Farm may have an impact on the stability of peat on site. Further details of the peat conditions on site are provided in Technical Appendix 2.

Geology

8.233 The assessment has determined that there is one designated site of geological interest within the site boundary. However, the designated site is situated away from wind farm infrastructure. The construction of the wind farm will result in permanent alterations to the site geology. Following the implementation of mitigation measures it has been concluded that the effects of the proposed Wind Farm on the site geology will be of **no significance**.

Hydrogeology

8.234 Despite the low productivity of the underlying aquifer units, the hydrogeology was also considered to be particularly sensitive due to the bedrock aquifers being dominated by intergranular-fracture flow. Fracture flow dominated aquifers are more susceptible to pollution as they offer very little attenuation of pollutants.

8.235 Following the identification and assessment of the sensitivity of the hydrogeology a comprehensive suite of mitigation measures has been incorporated into the design of the proposed wind farm. In addition, the EMP and specific mitigation techniques for the construction, operation and decommissioning phases will be implemented to protect the groundwater from pollution.

8.236 Following the implementation of mitigation measures the assessment has determined that the effects on the site hydrogeology are considered to be of **minor significance** or less.

Private Water Supplies

8.237 The information provided by SLC has determined that one PWS within the vicinity may be at risk from the proposed Wind Farm. The exact location of the supply source is likely to be located on the slopes of Strawberry Hill. It was concluded that the construction phase of the wind farm has the most potential to significantly impact upon the quality and quantity of water serving the supply. Following the implementation of mitigation measures the potential effects of wind farm construction and operation on the PWS are considered to be **no significance**.

8.238 The remaining supplies are situated within hydrological catchments with no wind farm infrastructure and have a physical separation of 1.3km to 3km from the nearest proposed infrastructure. This hydrological and potentially hydrogeological separation indicates that these supplies are unlikely to be affected by activities associated with the proposed Wind Farm.

Proposed Monitoring

8.239 It is proposed that a programme of surface and groundwater monitoring be established and carried out throughout the construction, operation and decommissioning of the site. The details should be discussed and agreed with SEPA prior to the commencement of monitoring. The extent and frequency of the monitoring will be proportionate to the level of activity current on the site during the different phases of the development. Appropriate monitoring is important to:

- Provide reassurance that established in-place mitigation measures are effective and that the development is not having an significant adverse impact upon the environment; and
- Indicate whether further investigation is required and, where pollution is identified the need for additional mitigation measures to prevent, reduce or remove any impacts on the water environment.

8.240 A supplementary baseline monitoring programme will be undertaken prior to the commencement of construction works. This will be based upon surface and groundwater chemistry sampling, groundwater level measurement and an electrofishing and macroinvertebrate survey of previously established fish sample sites. The establishment of a baseline is very important as it provides a suite of parameters against which to compare samples taken during the development's lifetime and with which to assess any impacts and the requirement for any appropriate remedial measures.

Control sites, situated outwith the area affected by proposed infrastructure, will also be established at this time.

8.241 The monitoring programme will be site-specific and tailored so as to provide a meaningful and pragmatic indication of the state of the water environment. The following elements will be included within the established water monitoring programme:

- Regular visual inspection of surface water management features such as culverts and receiving watercourses in order to establish whether there are increased levels of suspended sediment, erosion or deposition. It is likely that there will be an ongoing need to maintain these structures, for example by the removal of debris, to ensure they continue to function as designed.
- Regular visual inspection of watercourses during construction and decommissioning stages, particularly during periods of high rainfall, in order to establish that levels of suspended solids have not been increased by on-site activities.
- Periodic and ad-hoc sampling and analysis of surface water, groundwater and private water supplies in order to complement the programme of visual inspection. Periodic analysis enables monitoring of trends in levels of critical parameters (e.g. turbidity, pH) so that deviations from the norm can be identified and actioned.
- Additional monitoring as required as a condition of discharge consents, abstraction licences or other environmental regulation.

8.242 It is recognised that the impacts of the proposed Wind Farm will be deemed 'acceptable' if there is no significant net deviation from the baseline monitoring results.

Statement of Significance

8.243 Overall, the effects on the site hydrological, hydrogeological and geological regime are **not significant** under the terms of the Environmental Impact Assessment (Scotland) Regulations and other applicable legislation.

Appendix 8.A – Watercrossing Survey

RPS carried out a survey of the 8 watercourse crossings that will be constructed or upgraded as part of the construction works for Galawhistle Wind Farm.

Hydrologically the proposed Wind Farm site lies within the watershed of the Douglas Water and River Ayr. 5 of the watercrossings on site are situated in the Douglas Water catchment area, with the remaining three crossings situated in the River Ayr catchment.

The watercourse crossings on site vary from small headwater crossings to large river crossings.

Table 1 provides a summary of the watercourse crossings required at Galawhistle. More detailed information on the watercourse crossings is provided in Table 2, which includes the following:

- Watercourse Crossing ID;
- Grid reference;
- New/Existing;
- Hydromorphological information at watercrossing location; NS 73396 28708
- Type of crossing required; and
- The level of CAR authorisation required[25, 26,]

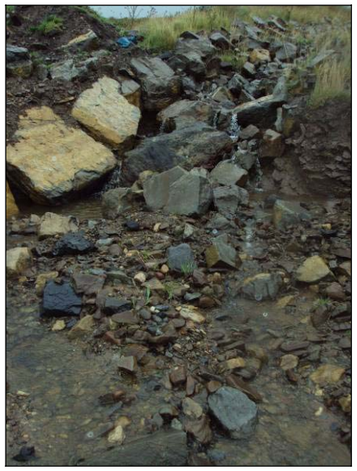
Table 1 – Summary of watercrossings

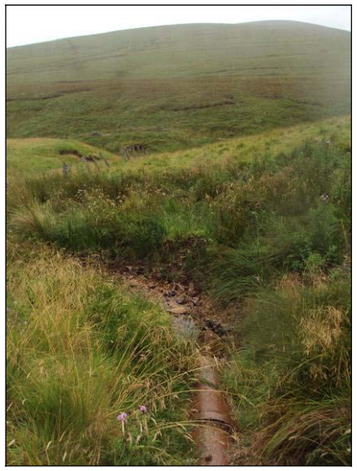
Crossing ID	Easting	Northing	New/Existing
WX1	274697	629472	Existing
WX2	273396	628708	Existing
WX3	276152	631056	New
WX4	276402	631080	Existing
WX5	277017	631175	Existing
WX6	277335	631535	Existing
WX7	277564	631682	Existing
WX8	277602	631709	New

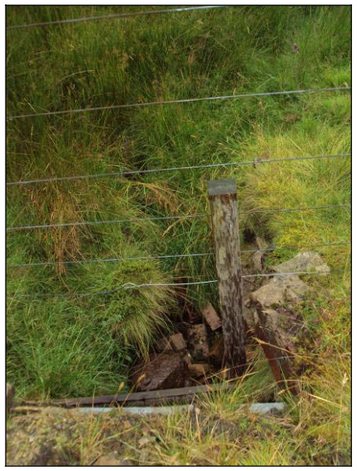
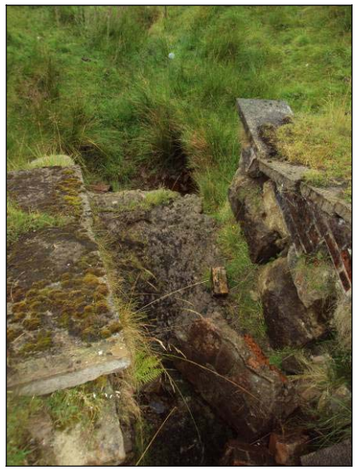
[25] The engineering levels of authorisation can be found in Table 6 (page 25) *The Water Environment (Controlled Activities) (Scotland) Regulations 2005, A Practical Guide, SEPA, v4, March 2008.*
[26] SEPA will only require authorisation for watercourse crossings shown on the 1: 50,000 scale Ordnance Survey maps (Landranger series). All other watercourse crossings are exempt under *The Water Environment (Controlled Activities) (Scotland) Regulations 2005, A Practical Guide, SEPA, v4, March 2008*.

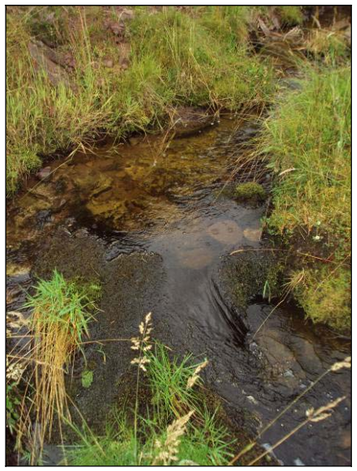
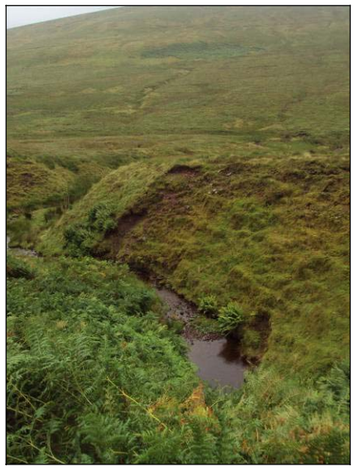
WX1 (NS 74697 29472)			
Watercrossing Description	Crossing Location	Upstream	Downstream
Crossing Information: Existing crossing with water running through a plastic pipe culvert. Vegetated banks with rock *CAR Authorisation:* General Binding Rule 6			
	Flow: Low Speed: Low Gradient: Gentle Substrate: Coarse	Watercourse Width: 0.1m Watercourse Depth: 0.4m Channel Width:3m/2m Channel Depth:2.5m	Watercourse Width: 0.4m Watercourse Depth: 0.7m Channel Width:2m Channel Depth:2m

WX2 (NS 73396 28708)			
Watercrossing Description	Crossing Location	Upstream	Downstream
Crossing Information: Existing crossing with two large pipes going through arch culvert. Vegetated banks with rock, downstream some erosion. *CAR Authorisation:* General Binding Rule 6			
	Flow: Medium Speed: Medium Gradient: Gentle Substrate: Coarse	Watercourse Width: 1.7m Watercourse Depth: 0.2m Channel Width: 2m Channel Depth: 0.4m	Watercourse Width: 4m Watercourse Depth: 0.4m Channel Width: 6m Channel Depth: 3m

WX3 (NS 76152 31056)			
Watercrossing Description	Crossing Location	Upstream	Downstream
Crossing Information: New crossing required as part of the proposed access tracks. The watercourse appears to have been part of the Coal Burn that was diverted as part of the historic open cast workings Banks of the watercourse are dominated by strata ranging in size from silts to boulders. Very little evidence of vegetation. *Proposed Crossing Type:* Circular Culvert *CAR Authorisation:* N/A – Watercourse is not displayed on the 1:50,000 Ordnance Survey Basemap.			
	Flow: Medium Speed: Low Gradient: Gentle Substrate: Coarse	Watercourse Width: 0.75m Watercourse Depth: 0.1m Channel Width: 2m	Watercourse Width: 0.75m Watercourse Depth: 0.1m Channel Width: 2m

WX4 (NS 76402 31080)			
Watercrossing Description	Crossing Location	Upstream	Downstream
Crossing Information: Existing crossing on minor watercourse that drains into the Galawhistle Burn. It is likely that this watercourse was modified as part of the open cast workings Heavily vegetated banks with no indication of bank instability. *CAR Authorisation:* N/A – Watercourse is not displayed on the 1:50,000 Ordnance Survey Basemap			
	Flow: Low Speed: Low Gradient: Moderate Substrate: Coarse	Watercourse Width: 0.6m Watercourse Depth: 0.1m Channel Width: 1m Channel Depth: 0.8m	Watercourse Width: 0.6m Watercourse Depth: 0.1m Channel Width: 1m Channel Depth: 0.8m

WX5 (NS 77017 31175)			
Watercrossing Description	Crossing Location	Upstream	Downstream
Crossing Information: Existing crossing situated on a tributary of the Galawhistle Burn. The crossing on the downstream side has created a significant drop in hydraulic head that will pose a significant barrier to the passage of aquatic fauna Heavily vegetated banks with no indication of bank instability. *CAR Authorisation:* General Binding Rule 6			
	Flow: N/A Speed: N/A Gradient: Gentle Substrate: Coarse	Watercourse Width: 0.3m Watercourse Depth: N/A Channel Width: 0.6m Channel Depth: 0.6m	Watercourse Width: 0.3m Watercourse Depth: N/A Channel Width: 0.6m Channel Depth: 0.6m

WX6 (NS 77180 31278)			
Watercrossing Description	Crossing Location	Upstream	Downstream
Crossing Information: Existing arched bridge crossing over a tributary of the Galawhistle Burn. The existing bridge is in disrepair and is likely to require upgrading as part of the construction work. Heavily vegetated banks with minor evidence of bank instability *CAR Authorisation:* General Binding Rule 6			
	Flow: Medium Speed: Medium Gradient: Moderate Substrate: Coarse	Watercourse Width: 1m Watercourse Depth: 0.2m Channel Width: 2m Channel Depth: 2m	Watercourse Width: 1m Watercourse Depth: 0.2m Channel Width: 2m Channel Depth: 2m

WX7 (NS 77335 31535)			
Watercrossing Description	Crossing Location	Upstream	Downstream
Crossing Information: Existing crossing situated on a tributary of the Galawhistle Burn. The crossing on the downstream side has created a significant drop in hydraulic head that will pose a significant barrier to the passage of aquatic fauna Heavily vegetated banks with evidence of bank instability. *CAR Authorisation:* N/A – Watercourse is not displayed on the 1:50,000 Ordnance Survey Basemap			
	Flow: Low Speed: Low Gradient: Gentle Substrate: Coarse	Watercourse Width:0.3m Watercourse Depth: 0.1m Channel Width: 3m Channel Depth: 1m	Watercourse Width: 3m Watercourse Depth: 0.2m Channel Width: 6m Channel Depth: 4m

WX8 (NS 77602 31709)			
Watercrossing Description	Crossing Location	Upstream	Downstream
Crossing Information: New crossing required over the Monks Water to access turbines on the east of the site. Heavily vegetated watercourse and riparian corridor with no indication of bank instability. *Proposed Crossing Type:* Bottomless Arch Culvert – See Figure 8.7 *CAR Authorisation:* Simple License			
	Flow: Medium Speed: Medium Gradient: Gentle Substrate: Coarse	Watercourse Width:0.3m Watercourse Depth: 0.2m Channel Width: 1m Channel Depth: 1m	Watercourse Width:0.3m Watercourse Depth: 0.2m Channel Width: 1m Channel Depth: 1m

Chapter 9 – Cultural Heritage

Introduction

9.1 This chapter provides an overview of the extent of known archaeological features and the wider cultural heritage present within and surrounding the proposed Wind Farm area based on currently available data. Furthermore, it aims to assess the significance of the effect of the proposal on the cultural heritage resource. Cultural Heritage resources include:

- Scheduled Ancient Monuments;
- Other archaeological sites;
- Listed Buildings;
- Other buildings of historic or architectural importance and recorded on the Sites and Monuments
- Record (SMR) maintained by the West of Scotland Archaeology Service (WoSAS) and
- Conservation Areas and Designed Landscapes.

9.2 More specifically, the assessment seeks to:

- Identify the cultural heritage baseline within the proposed development area and any sensitive receptors which may be affected by the proposed wind farm;
- Assess the proposed development in terms of its potential effects on the archaeological and historic environment;
- Consider the potential and predicted effects of the construction, operation and decommissioning of the development on the baseline cultural heritage resource, within the context of relevant legislation and planning policy; and
- Propose measures, where appropriate, to mitigate any predicted adverse effects.

9.3 The cultural heritage core study area is defined by the boundary shown on Figure 9.1, which encompasses an area of 1.5 kilometres around the boundary of the proposed Wind Farm. The assessment of predicted effects has been undertaken with reference to the development layout, also shown on Figure 9.1, which shows the proposed positions of 22 turbines and 1 permanent meteorological mast, routes of connecting access roads, a construction compound and laydown area, substation sites and borrow pits (as described in more detail in Chapter 3, Project Description).

Key Issues

9.4 Any ground-breaking activities associated with the construction of proposed Wind Farm features (such as turbines, access tracks, cable routes, substations, or storage compounds) have the potential to disturb or destroy features of cultural heritage interest. The creation of borrow pits to extract building materials could have similar direct effects. In addition, other construction activities, such as vehicle movements, soil and overburden storage and landscaping, have the potential to cause adverse direct effects on the cultural heritage. The presence of development features may also have indirect effects on the setting of sites of cultural heritage interest. Most development features have only relatively low surface relief and potentially only localised indirect effects are likely to occur. However, given their height wind turbines and meteorological masts have the potential to cause indirect (i.e. setting) effects over a wider area.

Methodology

Consultations

9.5 Information was obtained from Historic Scotland on the locations and extents of sites with statutory designations either within or close to the proposed Wind Farm. Data was collected on SAMs, listed buildings and Inventory Gardens and Designed Landscapes. Historic Scotland was contacted to comment on any other key issues within their remit likely to be raised by the study. All Scheduled Ancient Monument, listed building, Inventory Gardens and Designed Landscapes data is taken directly from current digital GIS mapping supplied by Historic Scotland.

9.6 Scoping responses regarding cultural heritage were received from the Scottish Government and East Ayrshire and South Lanarkshire Councils, as statutory consultees. South Lanarkshire noted that the possible cumulative visual impact of the proposal in conjunction with other consented and approved wind farms in the vicinity should be assessed. East Ayrshire recommended further consultation with West of Scotland Archaeological Service (WoSAS).

9.7 Following the scoping responses, Historic Scotland provided comments on the proposed methodology for the assessment of cultural heritage affected by the development in a letter dated 27th July 2009. As well as drawing attention to general issues and recently published guidelines involving the settings of cultural heritage receptors, Historic Scotland noted the proximity of the Scheduled Monument of Glenbuck Ironworks (Index No. 2391) and requested that the assessment address potential impacts from the proposed developments on viewpoints to and from this site.

9.8 WoSAS considered that the proposed methodology for the assessment of the effect of the proposed development on cultural heritage remains was appropriate in a letter dated 30th July 2009. While commenting on the overall low potential for the proposed development area to contain unidentified archaeological remains, particularly at higher elevations, it was noted that prehistoric archaeological sites have been identified at similar elevations in the vicinity. WoSAS noted the potential medieval origin of the two farmsteads within the core study area and that any disturbance of features associated with these sites would require archaeological mitigation, with mitigation proposals to be included in the Environmental Statement.

9.9 In providing both relevant SMR data and previous reports of archaeological assessments and investigations conducted in the locality, WoSAS indicated that consideration should be given to visual impacts on the settings of Scheduled Ancient Monuments and sites of schedulable quality outwith the proposed development area. In particular the Glenbuck Ironworks (Index No. 2391) and the Covenanter's Memorial. The comments and advice received has been considered and addressed during the design of the proposed Wind Farm and in this chapter.

9.10 The following section identifies the guidance used in the preparation of this assessment.

Legislation and Planning

9.11 The following have been referenced during the preparation of this chapter:

Legislation

- Ancient Monuments and Archaeological Areas Act 1979[1] provides Scheduled Ancient Monuments (SAMs) with protection. Scheduling is administered by Historic Scotland, who

[1] http://www.opsi.gov.uk/RevisedStatutes/Acts/ukpga/1979/cukpga_19790046_en_1

maintain a list of all SAMs and enforce the protection. Scheduled Monument Consent is required for works that affect or alter SAMs, with the exception of some agricultural activities.

- Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997[2]. A list of buildings of special architectural or historic interest is maintained by Historic Scotland. Development affecting the character of such designated features is subject to listed building consent via the Planning Authority under the Act.

- The Inventory of Gardens and Designed Landscapes in Scotland[3] is compiled by Historic Scotland. The purpose of the Inventory is to identify sites of national importance at the time of designation. Such designation is not the same as affording statutory protection. Under Article 15 of the Town and Country Planning (General Development Procedure) (Scotland) Order 1992, [as amended April 2007][4], planning authorities must consult with Historic Scotland on any proposed development that may affect a site contained in the Inventory.

Planning Guidance and Policies

9.12 Planning guidance and policies relevant to cultural heritage are set out in Chapter 4 (Planning and Renewable Energy Context). In addition to those described in Chapter 4 (Planning and Renewable Energy Context), the following planning guidance documents are relevant to this assessment:

- *Scottish Planning Policy 23 Planning and the Historic Environment* (October 2008)[5]. SPP 23 has superseded and consolidated NPPG18 Planning and Historic Environment and NPPG5 Archaeology and Planning. The policy sets out that the planning authorities have to ensure that the special qualities of historic environments are safeguarded. Statutory and Non-Statutory designations are material considerations when determining planning applications: The policy recognises that the historic environment can be adapted to accommodate new uses, offering opportunities for new and creative design, whilst retaining its special character. Historic Scotland has to be consulted at the early stages of a proposal. Overall, SPP 23 aims to encourage a positive and proactive approach by Planning Authorities to managing change in the historic environment.

- *The Scottish Historic Environment Policy* (SHEP) 2009[6] complements and has the same authority as the Scottish Planning Policy series and other Ministerial policy documents. The SHEP is a relevant document in the statutory planning, Environmental Impacts Assessments (EIA) and Strategic Environmental Assessment (SEA) processes. It has been prepared and is published in parallel with Scottish Planning Policy 23 on the Historic Environment.

- *Planning Advice Note (PAN) 42: Archaeology The Planning Process and Scheduled Monument Procedures* (1994)[7] provides advice on the handling of archaeological matters within the planning process.

- *Planning Advice Note (PAN) 45: Renewable Energy Technologies* (rev. 2002)[8] provides advice and information on onshore wind power and contains guidance on the visual effects of wind turbines.

- *Scoping of Development Proposals: Assessment of Impact on the Setting of the Historic Environment Resource – Some General Considerations,* Historic Scotland 2009[9], provides advice on the assessment of adverse impacts on historic environment assets and proposed mitigation measures to be addressed in Environmental Statements.

General Guidance

- *The Burra Charter (The Australia International Council on Monuments and Sites charter for places of cultural significance),* ICOMOS (1999)[10] is widely regarded as the benchmark for cultural heritage conservation, and outlines best practice for the conservation and management of sites of cultural significance. It outlines the principles for assessment of cultural significance and continued conservation of that significance by a process of information gathering and subsequent precautionary and sympathetic decision-making.

- *Standard and Guidance for Archaeological Desk Based Assessments,* Institute of Field Archaeologists (rev. 2008)[11] outlines the requirements for carrying out desk-based assessments to nationally recognised standards. It outlines the recommended sources of information for such assessments, analysis required and the standards of reporting.

- *Visual Assessment of Windfarms: Best Practice,* Scottish Natural Heritage (2006)[12] details setting issues.

Baseline Studies

General

9.13 This assessment has been undertaken using the available data sources and guidance as set out in this chapter. The assessment aims not only to analyse the value of individual sites, but also to consider their place within a wider landscape that is continuing to evolve, of which the proposed development may be merely the latest in a series of changes that constitutes the historic environment as we consider it.

9.14 Sites are generally numbered either according to their National Monuments Record (NMRS) identifier or by the Historic Scotland identifier for Listed Buildings (HBNUM). Undesignated sites recorded by local SMR's have included the identifying index number.

Desk-Based Study

9.15 The following sources of information were consulted as part of this process:

- The Schedule of Ancient Monuments, and the Statutory List of Buildings of Special Architectural or Historical Interest, maintained by Historic Scotland;
- The West of Scotland (WoSAS) Sites and Monuments Record (SMR);
- The National Monuments Record for Scotland (NMRS) held by the Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS);

[2] http://www.england-legislation.hmso.gov.uk/acts/acts1997/ukpga_19970009_en_1
[3] An Inventory of Gardens and Designed Landscapes Historic Scotland 2007
[4] http://www.opsi.gov.uk/legislation/scotland/ssi2007/ssi_20070177_en_1
[5] http://www.scotland.gov.uk/Publications/2008/10/28135841/0
[6] http://www.historic-scotland.gov.uk/shep-july-2009.pdf
[7] http://www.scotland.gov.uk/Resource/Doc/109640/0026470.pdf
[8] http://www.scotland.gov.uk/Publications/2002/02/pan45/pan-45
[9] http://www.historic-scotland.gov.uk/scoping_of_development_proposals_2009.pdf
[10] http://www.icomos.org/australia/charter.html
[11] http://www.archaeologists.net/modules/icontent/inPages/docs/codes/dba2.pdf
[12] University of Newcastle (2006) Visual Assessment of Windfarms Best Practice. *Scottish Natural Heritage Commissioned Report* F01AA303A.

- Historic Maps, held by the National Map Library of Scotland (NLS); and
- Data on Historic Gardens and Designed Landscapes held on the Inventory maintained by Scottish Natural Heritage and Historic Scotland.

9.16 A review of previous work carried out in the vicinity was undertaken and local libraries and archives were examined as appropriate.

9.17 All known cultural heritage resources were identified within a 1.5km radius of the proposed development area as defined by the red line boundary on Figure 9.1. An assessment of the records provided by the West of Scotland Archaeological service Sites and Monuments Record (SMR) was undertaken. Digital GIS mapping of a range of designated and undesignated sites within a 10km radius of the proposed development area was provided.

9.18 An assessment of the records held by the National Monuments Record of Scotland (NMRS) was undertaken. These records consist of computer database of all the known archaeological sites and monuments in Scotland, with associated oblique aerial photographs where appropriate. This assessment provided information on the range of known monuments within 10km of the proposed development area.

9.19 An assessment of digital GIS mapping data provided by Historic Scotland for Scheduled Ancient Monuments, listed buildings and Gardens and Designed Landscapes up to 10km from the proposed development was carried out.

9.20 An examination of early cartographic sources and Ordnance Survey editions was conducted to identify potential cultural heritage features within and outwith the proposed development area. Relevant aerial photographic coverage of the core study area held by the Royal Commission on the Ancient and Historic Monuments of Scotland (RCAHMS) were also examined.

Core Study Area

9.21 The Core Study Area was defined as a 1.5km radius of the boundary of the proposed wind farm as defined by the red line boundary on Figure 9.1. Available areas within the proposed development site were subject to a site inspection to identify, or assess the potential for, the presence of previously unrecorded cultural heritage receptors.

Wider Study Area

9.22 Cultural heritage receptors within a Zone of Theoretical Visibility (ZTV) at appropriate ranges from the Core Study Area were identified and assessed, in order to address issues of setting. A number of sensitive receptors within the wider study area were visited, site notes were made and digital photographs taken of the features visited. Data studied included:

- For designated cultural heritage resources of international and national significance (World Heritage Sites, Scheduled Monuments, Category A Listed Buildings, Inventoried Historic Gardens and Designed Landscapes) the study area is a circle of 10 kilometre radius centred on the proposed development. Only those receptors that fall within the Zone of Theoretical Visibility (ZTV) have been identified and described where appropriate.

- For designated historic environment resources of regional and local significance (Conservation Areas, Category B Listed Buildings, locally identified historic landscape areas), the study area is a circle of 5 kilometre radius centred on the proposed development. Only those receptors that fall within the Zone of Theoretical Visibility (ZTV) have been identified and described where appropriate.

- For Category C(S) Listed Buildings and cultural heritage receptors recorded on the Sites and Monuments Record (SMR) but not otherwise designated, the study area is a circle of 1.5 km radius centred on the proposal site.

Assessment of Resource Importance (Value) – Archaeological Remains

9.23 There are no national government guidelines for evaluating the importance or significance and hence the 'value' of cultural heritage resources. Clearly a high degree of professional judgement is necessary, guided by acknowledged standards, designations and priorities. It is also important to understand that buried archaeological remains may not be well-understood at the time of assessment, and can therefore be of uncertain value.

9.24 The most recent guidance from any national agency regarding cultural heritage and Environmental Impact Assessment is from Transport Scotland and the Highways Agency, and is expressed in Guidance Note 208/07 (August 2007) that now forms part of the Design Manual for Roads and Bridges (DMRB, Volume 11, section 3, part 2)[13]. Guidance Note 208/07 provides the following table as a guide for assessing the value of archaeological resources:

Table 9.1: Factors for assessing the value of archaeological assets

Very High	World Heritage Sites Assets of acknowledged international importance Assets that can contribute significantly to acknowledged international research objectives
High	Scheduled Monuments Undesignated assets of schedulable quality and importance Assets that can contribute significantly to acknowledged national research objectives
Medium	Designated or undesignated assets that contribute to regional research objectives
Low	Undesignated assets of local importance Assets compromised by poor preservation and/or poor survival of contextual associations Assets of limited value, but with potential to contribute to local research objectives
Negligible	Assets with very little or no surviving archaeological interest
Unknown	The importance of the resource cannot be ascertained

Assessment of Resource Importance (Value) - Historic Buildings

9.25 For historic buildings, assessment of importance is usually based on the designations used in the Listed Building process. However where historic buildings are not listed, or where the listing grade may be in need of updating, professional judgement will be required.

9.26 The criteria used in establishing the value of historic buildings within the listing procedure include architectural interest, historic interest, close historic association (with nationally important people or events), and group value. Age and rarity are also taken into account; in general (where surviving in original or near-original condition) all buildings of pre-1700 date are listed, most of 1700-1840 date are listed, those of 1840-1914 date are more selectively listed, and thereafter even more selectively. Specific criteria have been developed for buildings of 20th century date.

[13] http://www.standardsforhighways.co.uk/dmrb/vol11/section3/ha20807.pdf

9.27 At a local level, buildings may be valued for their association with local events and people or for their role in the community.

9.28 Guidance Note 208/07 provides the following table as a guide for evaluating the value of historic buildings:

Table 9.2: Guide for establishing the value of historic buildings

Very High	Standing buildings inscribed as of universal importance as World Heritage Sites Other buildings of recognised international importance
High	Scheduled Monuments with standing remains Category A Listed buildings Other listed buildings that can be shown to have exceptional qualities in their fabric or historical association not adequately reflected in the listing grade Conservation Areas containing very important buildings Undesignated structures of clear national importance
Medium	Category B Listed Buildings Historic (unlisted) buildings that can be shown to have exceptional qualities in their fabric or historical association Conservation Areas containing important buildings Historic Townscape or built-up areas with historic integrity in their buildings, or built settings (e.g. including street furniture and other structures)
Low	Category C (S) Listed buildings Historic (unlisted) buildings of modest quality in their fabric or historical association Historic Townscape or built-up areas of limited historic integrity in their buildings, or built settings (e.g. including street furniture and other structures)
Negligible	Buildings of no architectural or historic note; buildings of an intrusive character
Unknown	Buildings with some hidden (i.e. inaccessible) potential for historic significance

Assessment of Resource Importance (Value) - Historic Landscape

9.29 The sub-topic of Historic Landscape is recognised as having significant overlaps with other topics such as Landscape and Townscape, and a multi-disciplinary approach to assessment is required. This is partially to avoid double-counting, and also to avoid duplication of effort. There are also significant overlaps with the other Cultural Heritage sub-topics; Archaeological Remains and Historic Buildings. The elements that are considered within those two sub-topics can make significant contributions to the historic landscape, and this latter subtopic should concentrate on the overall historic landscape character and its value rather than the individual elements within it.

9.30 All landscapes have some level of historic significance, as all of the present appearance of the urban and rural parts of Scotland is the result of human or human-influenced activities overlain on the physical parameters of climate, geography and geology.

9.31 There are number of designations that can apply to historic landscapes, including World Heritage Sites (inscribed for their historic landscape value), Inventoried Gardens and Designed Landscapes, and Conservation Areas. Some local plans include locally designated Historic Landscape Areas, and Historic Parks and Gardens (or similar).

9.32 A model has been produced by the Council for British Archaeology whereby the historic landscape can be divided up into units that are scaled, from smallest to largest, as follows:

- **Elements** - individual features such as earthworks, structures, hedges, woods etc
- **Parcels** - elements combined to produce, for example farmsteads or fields
- **Components** - larger agglomerations of parcels, such as dispersed settlements or straight-sided field systems
- **Types** - distinctive and repeated combinations of components defining generic historic landscapes such as ancient woodlands or parliamentary enclosure
- **Zones** - characteristic combinations of types, such as Anciently Enclosed Land or Moorland and Rough Grazing
- **Sub-regions** - distinguished on the basis of their unique combination of interrelated components, types and zones
- **Regions** - areas sharing an overall consistency over large geographical tracts
- The model described above can be used as the principal part of the overall assessment usually known as Historic Landscape Characterisation (HLC). However, there is no significant guidance or advice regarding the attribution of significance or value to identified historic landscape units.

9.33 Guidance Note 208/07 provides the following table as a guide for evaluating the value of historic landscape units (not all of which are directly applicable to Scotland, but the table is repeated below in its entirety):

Table 9.3: Guide for evaluating Historic Landscape Character units

Very High	• World Heritage Sites inscribed for their historic landscape qualities • Historic landscape of international sensitivity, whether designated or not • Extremely well-preserved historic landscapes with exceptional coherence, time-depth, or other critical factor(s)
High	• Designated historic landscapes of outstanding interest • Undesignated landscapes of outstanding interest • Undesignated landscapes of high quality and importance, and of demonstrable national sensitivity • Well-preserved historic landscapes exhibiting exceptional coherence, time-depth, or other critical factor(s)
Medium	• Designated special historic landscapes • Undesignated historic landscapes that would justify special historic landscape designation, landscapes of regional sensitivity • Averagely well-preserved historic landscapes with reasonable coherence, time-depth, or other critical factor(s)
Low	• Robust undesignated historic landscapes • Historic landscapes with specific and substantial importance to local interest groups, but with limited sensitivity • Historic landscapes whose sensitivity is limited by poor preservation and/or poor survival of contextual associations • Robust historic landscapes

Negligible	• Landscapes with little or no significant historical interest

Assessment of Impact Magnitude - Archaeological Remains

9.34 The magnitude of impact is assessed without regard to the value of the resource. In terms of the judgement of the magnitude of impact, this is based on the principle (established in SPP23) that preservation of the resource is preferred, and that total physical loss of the resource is the least preferred.

9.35 It is not always possible to assess the physical impact in terms of percentage loss, and therefore it can be important in such cases to try to assess the capacity of the resource to retain its character following any impact. Similarly, impacts on the setting of archaeological remains may also be more difficult to assess as they do not involve physical loss of the resource and may actually be reversible.

9.36 Additional methodology regarding the assessment of effects on settings is provided below.

9.37 Impact scales are defined (as in DMRB Volume 11, Section 3, Annex 5)[14] thus:

Major Change to most or all key archaeological elements, such that the resource is totally altered.
Comprehensive changes to setting.
Moderate Changes to many key archaeological elements, such that the resource is clearly modified.
Considerable changes to setting.
Minor Changes to key archaeological elements, such that the asset is slightly altered.
Slight changes to setting.
Negligible Very minor changes to elements or setting.
No change No change.

Assessment of Impact Magnitude - Historic Buildings

9.38 The magnitude of impact is assessed without regard to the value of the resource, so the total destruction of an insignificant building has the same degree of impact as the total loss of a high value building. In terms of the judgement of the magnitude of impact, this is based on the principle that preservation of the resource and its setting is preferred, and that total physical loss of the resource is the least preferred.

9.39 Impacts on the setting of historic buildings may include vibration, noise and lighting issues as well as visual impacts, and may be reversible. Additional methodology regarding the assessment of effects on settings is provided below.

9.40 Impact scales are defined[15] thus:

Major Change to key historic building elements, such that the resource is totally altered.
Total change to the setting.
Moderate Change to many key historic building elements, such that the resource is significantly modified.
Changes to the setting of an historic building, such that it is significantly modified.
Minor Changes to key historic building elements, such that the asset is slightly different.
Change to setting of an historic building, such that it is noticeably changed.
Negligible Slight changes to historic buildings elements or setting that hardly affect it
No change No change to fabric or setting

9.41 The table below, based on Figure 8 of PAN 45 entitled General Perception of a Wind Farm in an Open Landscape (with an additional comment on the maximum potential magnitude of effect) generalises the relationship between distance and magnitude of effect, without taking into account the sensitivity of receptors, or environment/ visibility. It is very possible that the maximum potential effect is not reached in most cases, given that most receptors will only have a partial view of the wind farm.

Table 9.4: Relationship Between Distance and Wind Farm Visibility

Distance	Description	Maximum potential magnitude of effect
To 2km	The wind farm is a prominent feature within the landscape	High
2-5km	The wind farm is a relatively prominent feature within the landscape	High
5-15km	Prominent in clear visibility and as part of the wider landscape	Medium
15-30km	Only prominent in very clear conditions and as a minor element within the landscape	Low

Setting

9.42 It is noteworthy that there are no agreed guidelines on the issue of the setting of cultural heritage features. SPP23 (paragraph 9) notes that *"The location of historic features in the landscape and the patterns of past use and activity are part of the historic environment. Setting is more than the immediate surroundings of a site or building and, for example, may be related to the function or use of a place, or how it was intended to fit into the landscape or townscape, the view from it or how it is seen from around, or areas that are important to the protection of the place, site or building".*

9.43 A note entitled Assessment of Impact on the Setting of the Historic Environment Resource – some general considerations[16] was included as an annexe with the Historic Scotland scoping opinion dated April 2008 and has been considered. In addition, the Institute of Field Archaeologists has recently established a working party to address this issue. On the basis of the above, Colcutt's (1999) definition of setting, as summarised in Lambrick (2008, below)[17] is used as follows:

- Intrinsic visual interest and listing visual qualities;

[14] http://www.standardsforhighways.co.uk/dmrb/vol11/section3/ha20807.pdf

[15] *ibid.*

[16] http://www.historic-scotland.gov.uk/scoping_of_development_proposals_2009.pdf

[17] Lambrick, G. 2008 *Setting Standards: A Review,* IFA Working Group on the Setting of Cultural Heritage Features.

- Topographic setting, identifying visual relationships to topography and natural features that can be linked with the function of the site or the reason for placement of the site in the landscape;
- Landuse setting, identifying whether the landuse is sympathetic to the site's intellectual understanding; and
- Group setting including both contemporary and diachronic groupings or patterning, listing other sites, above or below ground, that could assist with creating a network of relationships. This should acknowledge any spatial element.

Significance of Effects

9.44 The significance of effects is a combination of the value of the resource or asset and the magnitude of impact on that resource or asset. Effects can be adverse or beneficial. Beneficial effects are those that mitigate existing impacts and help to restore or enhance heritage assets, therefore allowing for greater understanding and appreciation. In line with Guidance Note 208/07 the following matrix is used for both sub-topics.

Table 9.5: Cultural Heritage: Significance of Effects Matrix

VALUE / SENSITIVITY					
Very High	Neutral	Slight	Moderate/ Large	Large or Very Large	Very Large
High	Neutral	Slight	Moderate/ Slight	Moderate/ Large	Large/Very Large
Medium	Neutral	Neutral/ Slight	Slight	Moderate	Moderate/ Large
Low	Neutral	Neutral/ Slight	Neutral/ Slight	Slight	Slight/ Moderate
Negligible	Neutral	Neutral	Neutral/ Slight	Neutral/ Slight	Slight
	No Change	**Negligible**	Minor	Moderate	Major
	MAGNITUDE OF IMPACT				

9.45 Where the matrix provides a split in the significance of effects, e.g. Moderate/Slight, the assessor will exercise professional judgement in determining which of the levels of significance is more appropriate.

9.46 Moderate or greater effects are considered to be significant.

Baseline Description

Site survey

9.47 A site visit and inspection was carried out in June 2009 to assess the potential survival of any visible archaeological monuments within the core study and their condition and extent, if applicable. Site access was via the existing and largely disused haul road to the Open Cast Coal Site (OCCS) adjoining the western boundary of the proposed development area.

9.48 No additional sites or features of potential archaeological significance were identified during the site visit. Several of the designated sites within the vicinity of the proposed development were visited to assess the potential visual impact on their settings.

Sites within the Proposed Wind Farm

9.49 No Scheduled Ancient Monuments lie within the boundary of the core study area. The WoSAS SMR holds no records of sites deemed to be of schedulable quality within the proposed development area boundary.

9.50 No listed buildings or other statutorily designated sites lie within the site boundary of the core study area.

9.51 The desk-based assessment identified 9 sites within the boundary of the core study area. The majority of these relate either to farmsteads and features associated with pastoral farming such as sheepfolds, or with the mid- to late- 19th century resurgence of coal mining activity in the vicinity of Glenbuck. Five of these sites are recorded by WoSAS (Table 9.6, Figure 9.1), although the field wall (WoSASPIN 46659) recorded by an earlier survey[18] has since been destroyed during OCCS activities.[19]

Table 9.6 Summary of sites within the Proposed Wind Farm

SMR No	NMRS No	Site Name	Description	NGR	Importance/ Sensitivity
17285		High Monkshead	Farmstead;Enclosures	NS 76653121	Local/Low
41245	NS73SE17	Monkshead	Farmstead;Enclosures	NS 77013004	Local/Low
41241	NS72NE30	Hareshaw Hill	Structure (Destroyed)	NS 76542938	Local/Low
46657	NS73SE14	Glenbuck	Railway (Dismantled)	NS 76173107-NS 76203187	Local/Low
46659	NS73SE12	Galawhistle	Field Wall (Destroyed)	NS76053100	Local/Low
		Galawhistle Burn	Sheepfold	NS 77073096	Local/Low
		Wedder Hill	Sheepfold	NS 77283127	Local/Low
		Shiel Hill	Sheepfold	NS 77212924	Local/Low
		Podowrin Burn	Circular Mound	NS78472953	Local/Low

9.52 Most of the proposed development area consists of unimproved and unenclosed land not previously disturbed by agricultural or industrial activity, and no prehistoric sites or associated finds have been recorded within the limits of the core study area. Prehistoric activity in the wider area appears to be limited to burial cairns at corresponding altitudes above 350m AOD, suggesting that the higher elevations of much of the proposed development area and the sites of turbine locations were unsuitable for prehistoric settlement. However, there remains a potential for the presence of prehistoric archaeological remains at lower elevations, as evidenced by a set of enclosures and a burnt mound (WoSASPIN numbers 9684, 9687, 9689) *c.* 6km west of the proposed development area at a height of *c.*290 AOD. A number of artefacts found by chance in the wider area also indicate a potential for further small-scale prehistoric remains to have survived below ground within the application area boundary.

[18] Dalland, M. 1999 *Spireslack, Glenbuck, East Ayrshire: Archaeological Survey*. Unpublished report by Headland Archaeology for Entec UK Ltd on behalf of Scottish Coal.
[19] McGrellis, B. 2005 Spireslack Wind Farm Environmental Statement vol 2. Report by Sinclair Knight Merz on behalf of Scottish Coal.

9.53 The earliest evidence for human activity in the vicinity of the core study area consists of the chance find of a medieval bronze ewer (WoSASPIN 9682) near the summit of Auchinstilloch Hill, 1km west of the nearest proposed turbine location and outside the application area boundary.

9.54 The post-medieval farmsteads of Monkshead (WoSASPIN 41245) and High Monkshead (WoSASPIN 17285) could conceivably overlie earlier precursors from the medieval period. Large monastic foundations such as Melrose Abbey are recorded as having held extensive outlying estates in this area for stock-rearing purposes.[20] The apparent ecclesiastical and biblical references (Monksfoot, Arrarat Hill, etc) in the local place-names could indicate a medieval monastic origin for these sites, while other local toponyms such as Wedder Hill, Sheil Hill and Hagshaw Hill are derived from terms used to describe sheep and could relate to the sheep-rearing activities in which many Cistercian monasteries were actively engaged.

9.55 The site visit indicated the presence of surviving earthworks within the High Monkshead enclosure, which probably represent the course of an earlier trackway. This feature is located in the area of the proposed substation constructions.

9.56 Early maps show relatively little detail of the area. Blaeu's 1654 Atlas of Scotland[21], records the place-names and settlements at *'Muksfoot'* and *'Mukshead'* and the surrounding topography while providing little additional information.

9.57 Roy's Military Survey of Scotland 1747-1755[22] provides greater accuracy and detail for the vicinity of the proposed development area. The Roy map depicts the settlements of Nether and Upper Muckshead (corresponding to Monkshead and High Monkshead) with indications of cultivation ridges surrounding them.

9.58 Cartographic evidence suggests that High Monkshead was abandoned during the 19th century, while the farmstead at Monkshead remained in partial use until the late 20th century. The drystone sheepfolds still extant within the core study area (Sites 6-10) provide evidence for communal grazing of the upland areas and are likely to be roughly contemporary with the surviving farmstead enclosures.

9.59 The development of the Glenbuck Ironworks around 1795 and the associated quarrying and coal-mining activities appear to have had only a minor impact within the core study area to the north east. The 1st edition OS 6" map of 1863-4 depicts a single unnamed coal mine directly west of the High Monkshead and outside the core study area boundary, although any direct association between this mine and the industrial developments at Glenbuck is unclear, as there is an absence of connecting tracks between this site and the Ironworks.

9.60 During the period covered by the 1st, 2nd and 3rd edition OS maps[23] there was a resurgence of coal mining in the area, with five coal mines opening in the vicinity of Galawhistle and Spireslack, outside the western boundary of the core study area. Coal from these pits was transported via railways and tramways to Bankhead. The 2nd edition map of 1898-9 records the Glenbuck branch line (WoSASPIN 46657), later extended as the Mid Lanark, Spireslack and Muirkirk line, cutting across the core study area from east to west. The railway line was subsequently closed and the line marked as dismantled by the time of the 1958 OS survey.

[20] Fawcett, R. & Oram, R. 2004 *Melrose Abbey*. Stroud: Tempus
[21] Blaeu, J. 1654 Glottiana Praefectura Inferior, cum Baronia Glascuensi, [vulgo] The nether ward of Clyds-dail and Glasco
[22] Roy, W. 1747-55 Military Survey of Scotland.
[23] Landmark Historical Mapping 1:10000 & 1:2500 Ordnance Survey maps 1860-2006

Assessment of Importance/ Sensitivity

9.61 The individual sites recorded in the chapter so far are, individually and in the main, of low sensitivity, given that they are generally unremarkable examples of farmsteads, mining infrastructure and pastoral farming with little evidence for protracted or multi-period use. Taken as a whole, the cultural heritage remains within the core study area have been assessed as being of **local importance/ low sensitivity.**

Sites outwith the Proposed Wind Farm

Sites within 1.5km of the Proposed Wind Farm

9.62 One designated site of national importance, the Scheduled Monument of Glenbuck Ironworks (SAM 2931), is situated 0.7km west of the proposed development area boundary and 1.25km from the closest proposed turbine location (Figure 9.1). The Glenbuck Ironworks scheduling comprises a furnace and other associated features representing the first phase of industrial exploitation of the area, and was located to exploit local reserves of coal and limestone. The physical traces of these extractive industries and associated infrastructure have been largely destroyed by later opencast mining activities. Glenbuck Ironworks is of **national importance/high sensitivity.**

9.63 No other scheduled monuments, listed buildings or designated sites lie within 1.5km of the application area boundary.

9.64 A small number of chance finds of prehistoric tools, enclosures and cropmarks of prehistoric or uncertain origin are recorded by the Sites and Monuments Record within 1.5km of the core study area (Table 9.7, Figure 9.1). In the main, non-designated sites consist of farmsteads and features related to pastoral agricultural, with a large industrial site being recorded on cartographic sources from the early 19th century onwards, and are assessed as being of **local importance/low sensitivity.**

9.65 A number of the features recorded in the WoSAS SMR and previous archaeological surveys and evaluations[24] (Dalland 1999 & 2000) have since been destroyed by ongoing OCCS activities in and around Spireslack Colliery, as noted by a subsequent ES Cultural Heritage Assessment for the proposed Spireslack Wind Farm.[25]

Table 9.7: Recorded sites within 1.5km of the Proposed Wind Farm

SMR No	NMRS No.	Site Name	Description	NGR	Importance/ Sensitivity
9642	NS72NE4	Glenbuck Ironworks	Ironworks	NS 75082949	Scheduled (SAM 2931) National/High
9682	NS73SE3	Auchinstilloch	Chance find Bronze Ewer	NS 75503150	Local/Low
13025	NS72NW12	Glenbuck	Mining Remains;	NS 74552975	Local/Low

[24] Cressey, M. 1997 *Environmental Assessment for proposed extraction of coal by opencast method at Spireslack, Glenbuck, Ayrshire.* Unpublished report by CFA Edinburgh on behalf of Scottish Coal.
Dalland, M. 1999 *Spireslack, Glenbuck, East Ayrshire: Archaeological Survey*. Unpublished report by Headland Archaeology for Entec UK Ltd on behalf of Scottish Coal, *Anon*, 2005, *Hagshaw Hill Wind Farm Environmental Statement*, Report prepared for CRE Energy,Scottish Power.
[25] McGrellis, B. 2005 Spireslack Wind Farm Environmental Statement vol 2. Report by Sinclair Knight Merz on behalf of Scottish Coal.

			Settling Tanks		
13026	NS72NW13	Glenbuck	Mining Remains; Mine Shafts; Subsidence Pits;Quarry	NS 74852925	Local/Low
9639	NS72NE1	West Glenbuck	Chance find Flanged Bronze Axe	NS 75202890	Local/Low
9640	NS72NE2	Parisholm	Tower (possible)	NS 76282811	Local/Low
9641	NS72NE3	Parisholm	Chapel	NS 76202800	Local/Low
9683	NS73SE4	Common Hill / Hagshaw Hill	Shieling-huts	NS 79703017	Local/Low
15720	NS72NE7	Parish Holm	Bastle-house (possible)	NS 76032787	Local/Low
15772	NS72NE9	Smithy Burn / Hagshaw Hill	Enclosure	NS 79022993	Local/Low
15765	NS73SE5	Henry's Hill / Hagshaw Hill	Cropmark	NS 79653115	Local/Low
15771	NS83SW23	Windrow Burn / Hagshaw Hill	Enclosure; Field Bank; Shieling	NS 80003005	Local/Low
15720	NS72NE7	Parish Holm	Bastle-house (possible)	NS 76152792	Local/Low
41240	NS72NE31	Parishholm Hill / Brackenlee S	Building	NS 77102771	Local/Low
41256	NS73SE16	Poniel Water / Craigenrig	Farmstead	NS 77713211	Local/Low
46668	NS72NW18	Spireslack	Farmstead	NS 74752985	Local/Low
46657	NS73SE14	Glenbuck	Railway	NS 75803100	Dismantled Local/Low
46658	NS73SE13	Galawhistle	Sheepfold	NS 75403100	Destroyed
9644	NS72NE6	Glenbuck, Rowan Bank	Cottages	NS 75102946 NS 75122944	Destroyed
46660	NS73SE11	Galawhistle	Industrial; Coal Pits	NS 75953115	Destroyed
46661	NS73SE10	Galawhistle	Building; Tramway; Coal Pits	NS 75703040	Destroyed
46662	NS73SE9	Rowan Bank	Enclosure	NS 75453000	Destroyed
46663	NS73SW9	Galawhistle Burn	Field Bank	NS 74503050	Destroyed
46665	NS72NE29	Rowan Bank	Trackway	NS 75402950	Destroyed
46666	NS72NE28	Hareshaw Hill	Sheepfold	NS 75602995	Destroyed
46667	NS72NE27	Hareshaw Hill	Industrial; Shaft; Bell Pits	NS 75622997	Destroyed
46669	NS72NW17	Glenbuck	Village	NS 74652945	Destroyed

Designated sites between 1.5 and 5 kilometres of the Proposed Wind Farm

9.66 The Scheduled Ancient Monument of St Bride's Chapel and graveyard (SAM 90265) is located 4.8km east of the proposed development area. St Bride's Chapel is also a Category A listed building.

9.67 A further Category A listed building, the Monument to James, Earl of Angus and three Category B listed buildings are located in Douglas approximately 4.8km east of the proposed development area.

9.68 The town of Douglas is designated as a Conservation Area, the western part of which lies within 5km of the proposed development area. There are a further 8 Category C(S) listed buildings within the Douglas Conservation Area but these have not been assessed in terms of indirect impacts as they are not widely considered to have a setting as such and are of local importance and low sensitivity.

9.69 However, WoSAS noted the possible issue of settings on the Category C(S) listed Martyr's Grave, a Covenanting memorial c. 3.5km to the west of the closest proposed turbine location.

9.70 The WoSAS SMR also records 4 non-statutory register (NSR) sites of potential national importance within 5km of the proposed development (Table 9.8, Figure 9.2)

Table 9.8: Sites of national significance or with statutory protection between 1.5 - 5 kilometres of the Proposed Wind Farm.

Index No	NGR	NMRS No	Name/ Description	Category	Importance/ Sensitivity
SAM 90265 HB1490	NS83583095	NS83SW57 NS83SW5	St Bride's Chapel and graveyard, Douglas	SAM & A listed building	National/High
HB 1457	NS83463095	NS83SW44	Monument to James Earl of Angus, Douglas	A listed building	National/High
WoSASPIN 9645	NS7162 2821	NS72NW1	Lightshaw, Standing Stone	NSR C (certainly of schedulable quality)	National/High
WoSASPIN 10142	NS80563209	NS83SW1	Arkney Hill	NSR V (probably of schedulable quality)	National/High
WoSASPIN 10061	NS 83102840	NS82NW2	Weston, Mound, Earthwork	NSR V	National/High
WoSASPIN 10064	NS82992659	NS82NW5	Shiel Burn, Enclosure, Turf Bank	NSR V	National/High
HBNUM 1451	NS 83473043	NS83SW34	Springhill, Douglas	B listed building	Regional/Medium
HBNUM 1453	NS 83523067	NS83SW36	Douglas Arms Hotel, Douglas	B listed building	Regional/Medium
HBNUM 1489	NS 83623054	NS83SW58	Mansefield Douglas	B listed building	Regional/Medium
HBNUM 14395	NS73023148	NS73SW3	Covenanter's Monument	C(S) listed building	Local/Low

Designated sites between 5km and 10km of the Proposed Wind Farm

9.71 A total of 8 Scheduled Ancient Monuments lie between 5 and 10 kilometres of the application area. Of these, Thorril Castle Bastle House (SAM 5425) and Thirstone Stone Circle (SAM 5094) lie outside the ZTV of the proposed development and there would thus be no potentially adverse indirect impacts on the settings of these statutorily protected monuments.

9.72 A total of 19 non-statutory register sites deemed to be of potential national importance and suitable for scheduling are recorded by the WoSAS SMR between 5 to 10 kilometres of the

proposed development area. Of these, 15 NSR sites lie within the ZTV of the proposed wind farm turbines.

9.73 Apart from the two Category A listed buildings within the Douglas Conservation Area listed in Table 9.8, no other Category A listed buildings are recorded within a 10km radius of the application area.

9.74 The Lesmahagow Conservation Area is situated more than 8km to the north east of the proposed development area and is of regional importance. Only a small proportion of the overall Conservation Area lies within the ZTV of the proposed Wind Farm.

Table 9.9: Sites of national significance between 5km -10 km of the Proposed Wind Farm

Index No	NGR	NMRS No	Name/Description	Category	Importance/ Sensitivity
6640	Centred on NS693255	NS62NE16	Muirkirk, remains of tar works, mines and structures	SAM	National/High
2848	NS675354	NS63NE1	Dungavel Hill,cairn	SAM	National/High
4234	NS853272	NS82NE1	Auchensaugh Hill,cairn	SAM	National/High
4631	NS724242	NS72SW1	Cairn Table,two cairns	SAM	National/High
4275	NS784214	NS72SE3	Cairn Kinny	SAM	National/High
3907	NS815407	NS84SW17	Craighead Mill,Lesmahagow	SAM	National/High
WoSASPIN 12141	NS68002961	NS62NE30	Middlefield; Limestone Quarry; Lime Kilns; Lime Clamp	NSR	National/High
WoSASPIN 9111	NS68582421	NS62SE6	Slackshaw Burn; Shieling-huts	NSR	National/High
WoSASPIN 12957	NS70292673	NS72NW8	Auldhouseburn; Coal Mine	NSR	National/High
WoSASPIN 12958	NS70972741	NS72NW9	Crossflat; Coal Mine	NSR	National/High
WoSASPIN 12960	NS70472731	NS72NW10.1	Auldhouseburn, Miners' Cottages	NSR	National/High
WoSASPIN 12961	NS70202621	NS72NW11.0	Muirkirk; Mining Remains	NSR	National/High
WoSASPIN 12962	NS70202621	NS72NW11.1	Muirkirk; Mine-shafts; Horse-engine Platforms	NSR	National/High
WoSASPIN 12963	NS69602641	NS72NW11.2	Muirkirk, Miners' Cottages	NSR	National/High
WoSASPIN 10066	NS83152572	NS82NW7	Andershaw; Sheepfold (possible)	NSR	National/High
WoSASPIN 9121	NS69463624	NS63NE4	Harting Rig; Cairn (possible)	NSR	National/High
WoSASPIN 9684	NS70273079	NS73SW1	Whitefield / Brown Hill, Enclosures	NSR	National/High
WoSASPIN 9687	NS70323065	NS73SW4	Whitefield / Brown Hill; Enclosures	NSR	National/High
WoSASPIN 9689	NS70403069	NS73SW6	Whitefield / Brown Hill; Burnt Mound (possible)	NSR	National/High
WoSASPIN 10078	NS83132472	NS82SW1	Andershaw; Chapel; Burial-ground; Well	NSR	National/High
WoSASPIN 10081	NS84212345	NS82SW4	Mosscastle Hill; Cairn	NSR	National/High

Assessment of Effects

Sites Within the Proposed Wind Farm Study Area

Direct Effects

9.75 The Core Study Area consists predominantly of unenclosed and unimproved grassland with no evidence for upstanding archaeological remains or other features apart from two farmsteads, sheepfolds associated with pastoral farming, and a dismantled railway. Consultations with WoSAS suggest that there remains a low potential for significant sub-surface archaeological remains to exist at elevations above 300m AOD, while the proposed turbine locations, associated access tracks and borrow pits are located at elevations between 300m - 460m AOD.

9.76 Proposed groundworks associated with location of substations and a borrow pit within the enclosures surrounding the farmstead at High Monkshead have the potential to disturb features of possible medieval origins, as indicated in paragraphs 9.54 and 9.55 above.

Indirect Effects

9.77 None of the sites identified within the core study area are regarded as having a setting outside of their immediate location, so the construction of the proposed wind farm will not have any effect on the setting of the identified sites.

Sites Outwith the Proposed Wind Farm Study Area

Direct Effects

9.78 There will be no direct effects on any cultural heritage resources outside the boundary of the core study area. The proposed access road between the A70 public road and the core study area adheres to the route of the existing OCSS access road and will have no additional direct effects on recorded sites in the immediate vicinity.

Indirect Effects

9.79 Various statutorily protected sites and monuments outwith the proposed development area will be affected to differing degrees by the proposed Wind Farm. The impacts will be purely visual on the setting of these monuments and buildings. The impact of the proposed Wind Farm on these sites is assessed on their historic setting. While hillforts, hilltop settlements and stone circles may have been located to provide long landscape or inter-site views, many other prehistoric sites no longer represent their original landscape context. Later medieval farmsteads and associated elements of the farming landscape were sited for advantageous use of agricultural land and not with reference to the wider landscape.

Designated Sites within 1.5km of the Core Study Area

9.80 The only designated site within a 1.5km radius of the proposed development is the Scheduled Ancient Monument of the Glenbuck Ironworks (SAM 2931). The site has been well documented by industrial archaeologists due to its historical and archaeological significance.[26]

[26] Donnachie I. L. & Butt, J. 1965 "Three 18th Century Scottish Ironworks", The Journal of Industrial Archaeology, vol 1 (1964-5) 213-21, Campbell, R.H. 1966 "The Iron Industry in Ayrshire" *Ayrshire Archaeological and Natural History Collections*, 2nd Series, vol 7 (1961-6), 90-102, Butt, J. 1969 "Glenbuck Ironworks", Ayrshire Archaeological and Natural History Collections, 2nd Series vol 8, 68-75.

9.81 The scheduling covers an area that straddles the former access road to the demolished village of Glenbuck and which now provides access to the OCCS site offices and operations, with the majority of the scheduled area lying to the south of the access road This portion of the SAM consists of sub-surface remains of bell-pits and earthworks associated with the Ironworks, which hardly possess a setting as such. Wireframe visualisations indicate that a maximum of 4 turbines on the summit of Hareshaw Hill may be partially visible from the more elevated portions of the Scheduled Ancient Monument south of the access road (Figure 9.4). Views eastward towards Hareshaw Hill are currently dominated by the intervening OCSS workings, spoil heaps and infrastructure and it therefore seems unlikely that the additional visual impact of the turbines would contribute significantly to the existing adverse impacts on the setting of the SAM.

9.82 To the north of the access road are the standing remains of a furnace, built into the hillside and partially obscured by spoil from previous OCSS activities on the hillslope above. Principal views of this feature are from the access road looking north (Figure 9.5), from where views east towards the nearest turbine locations on Hareshaw Hill are obscured both by the adjacent landform and the extent of the opencast workings and associated buildings immediately to the east of the furnace site. Based on the lack of a cohesive identity for the overall complex, the paucity of standing remains and the existing adverse visual impact of the adjacent and intervening OCCS workings, the impact of the proposed development on the Glenbuck Ironworks SAM is assessed as **minor adverse**. The effect of the proposed development on the overall site would be **slight adverse** at most.

9.83 No other designated sites lie within 1.5km of the core study area.

Designated Sites within 5km of the Proposed Wind Farm

Scheduled Monuments

9.84 One Scheduled Ancient Monument and Category A listed building, St Bride's Chapel and Graveyard in Douglas (SAM 90265, HB1490) is located c. 4.8km to the east of the proposed development. The ZTV indicates that there will be no intervisibility between this designated site and the proposed development. The impact of the proposed development on this scheduled monument is assessed as **no change**. The effect of the proposed development on the site would be **neutral**.

Listed Buildings and Conservation Areas

9.85 Similarly, the other listed buildings within the Douglas Conservation Area, including the Category A listed memorial to James, Earl of Angus (HB 1457) and the B-listed Douglas Arms Hotel (HB 1453) lie outside the ZTV indicating that there will be no intervisibility with the proposed development. The impact on these designated buildings is therefore assessed as **no change**. The effect of the proposed development on these designated sites would be **neutral**.

9.86 Part of the Conservation Area of Douglas lies within 5km of the proposed development and incorporates most of the designated sites referred to above. The ZTV indicates that only the more elevated eastern fringes of the Douglas Conservation Area will provide significant views westwards towards the proposed development area, with a potential of 1-3 turbines visible (Figure 9.3). Any intervisibility with the proposed development will be affected by the intervening array of turbines at the existing Hagshaw Hill Wind Farm c. 4km to the west of Douglas, with which the proposed turbines are likely to merge visually. The impact of the proposed development on the Douglas Conservation Area as a whole is assessed as **minor adverse**. The effect of the proposed development on this designated area would be **slight adverse** at most.

9.87 There may be partial intervisibility between the proposed development and two further Category B listed buildings (HBNUM's 1451, 1489) to the south of the Douglas Conservation Area boundary, with potentially 1-3 turbines visible at a distance of more than 5km. The settings of these residential buildings are the urban surroundings of Douglas, and the impact of the proposed development on these two designated sites is assessed as being **negligible**. The effect of the proposed development on the settings of these listed buildings would be **neutral**.

9.88 Although generally considered to be of local importance and as not possessing a setting as such, one Category C(S) listed building, a Covenanter's memorial monument, the Martyr's Grave (HBNUM 14395), has been included in this assessment of indirect affects as recommended by WoSAS. The monument is located in an exposed and remote location at a height 375m OD with uninterrupted views south east towards the proposed development and c. 3.4km from the closest proposed turbine location. The impact of the proposed development on this designated site is assessed as being **minor adverse**. The effect of the proposed development on the settings of this standing stone would be **slight adverse**.

Non- statutory Register sites

9.89 Four non-statutory register sites considered to be of potential national importance are located within 5km of the core study area and potentially within the ZTV of the proposed development. Three of these sites, at Arkney Hill (WoSASPIN 10142) Shiel Burn (WoSASPIN 10064) and Weston (WoSASPIN10061) lie within, or adjacent to, substantial tracts of forestry plantation which effectively screen intervisibility with the proposed development area. The impact of the proposed development on these three non-statutory register sites is assessed as being **no change**. The effect of the proposed development on the settings of these listed buildings would be **neutral**.

9.90 The one remaining non-statutory register site, a standing stone at Lightshaw (WoSASPIN 9645) is of probable prehistoric origin and considered to be of schedulable quality and national importance. The standing stone is located just north of the A70 road and 4.9km west of the nearest turbine location and has uninterrupted views eastwards towards the proposed development. However, the intervening landscape between this monument and the core study area currently consists of substantial and extensive OCSS workings, and the proposed development would not contribute significantly to the existing adverse effects on the monuments setting. The impact of the proposed development on this NSR site is assessed as being **minor adverse**. The effect of the proposed development on the settings of this standing stone would be **slight adverse** at most.

9.91 No other designated sites lie within 5km of the core study area.

Designated Sites between 5km and 10km of the Proposed Wind Farm

Scheduled Ancient Monuments

9.92 A total of 8 Scheduled Ancient Monuments lie within 10km of the core study area. The ZTV indicates that two of these, Thorril Castle Bastle House (SAM 5425) and Thirstone Stone Circle (SAM 5094) will have no intervisibility with, and will remain unaffected by, the proposed development.

9.93 Of the six remaining Scheduled Ancient Monuments, four consist of prehistoric hilltop monuments, which were probably located to be intervisible with other cairns and the landscape in which they lie. It is not considered that any of these sites are located with reference to the view of the proposed Wind Farm location, as no cairns have been identified within the proposed development area or the immediate vicinity.

9.94 The cairns at the summit of Cairn Table (SAM 4631) are in a prominent position overlooking most of the surrounding area with views north across the Ayr valley and are of national importance. There is no apparent relationship between this monument and the proposed development area, and at a distance of 6.5km, the proposed Wind Farm would only be visible as part of the wider landscape, and the impact of the proposed development on the scheduled monument is assessed as **minor adverse**. The effect of the proposed development on the site would be **slight adverse**.

9.95 Similarly, the site at Cairn Kinny (SAM 4275) shares no apparent visual relationship with the proposed development area, and at a distance of 7.5km from the proposed Wind Farm would only be visible as part of the wider landscape. The impact of the proposed development on this nationally important site is assessed as **minor adverse**. The effect of the proposed development on the scheduled monument would be **slight adverse**.

9.96 The hilltop cairn at Auchensaugh Hill (SAM 4234) is located on the southern slope of the hill looking south over the valley of the Black Burn, while the Dungavel Hill cairn (SAM 2848) , on the summit of a hill surrounded by and extensive belt of forestry would have only limited intervisiblity with the proposed Wind Farm development. The impact of the proposed development on these two designated sites, located at 7km and 9km from the proposed development area respectively, is assessed as being **negligible**. The effect of the proposed development on the settings of scheduled monuments would be **slight adverse** at most.

9.97 The remains of tar works, mines and structures to the south of Muirkirk and c. 8km from the proposed Wind Farm consists in the main of extensive low-lying earthworks representing components of a 19th century industrial site and are of national importance. The ZTV indicates that only a small portion of the overall site would be intervisible with the proposed development and would therefore not be significantly affected by construction of the proposed Wind Farm. The impact on this scheduled monument from the proposed development is assessed as being **negligible.** The effect of the proposed development on the setting of the scheduled monument would be **slight adverse** at most.

9.98 Craighead Mill, Lesmahagow, occupies a low-lying site directly north of an embanked section of the M74 motorway, at a distance of c. 9.75km from the proposed development area. There would be no intervisibilty between this nationally important site and the proposed Wind Farm development, and the impact on this scheduled monument is assessed as **no change**. The effect of the proposed development on the setting of Craighead Mill would be **neutral**.

Non-Statutory Register Sites

9.99 Of the 15 nationally important non-statutory sites located between 5km and 10km of the proposed Wind Farm, 7 sites consists of mining and quarrying remains in and around Muirkirk, including associated industrial features and miner's cottages (WoSASPIN's 12141,12957-8, 1260-63) and as such were not intended to have a setting. The impact on these features is assessed as being **negligible.** The effect of the proposed development on the setting of these cultural heritage receptors would be **slight adverse** at most.

9.100 The enclosures and burnt mound at Whitefield/ Brown Hill (WoSASPIN's 9684, 9687 & 9689) lie in an elevated location 5.75km to the west of the proposed development area. There will be a degree of visibility of the proposed Wind Farm from these cultural heritage receptors, although intervening belts of forestry may help to reduce the potential impact on the setting of these cultural heritage receptors. The impact on these nationally important features is assessed as being **negligible.** The effect of the proposed development on the setting of these cultural heritage receptors would be **slight adverse** at most.

9.101 Three further sites, Andershaw Chapel and burial-ground, a possible sheepfold (WoSASPIN 10078 &10066) and Mosscastle Hill cairn (WoSASPIN 10081) lie within or immediately adjoining a substantial tract of forestry to the south east of the proposed development area which will effectively screen these cultural heritage receptors from intervisiblity with the proposed Wind Farm. The impact on these features is assessed as being **no change.** The effect of the proposed development on the setting of the scheduled monument would be **neutral**.

9.102 Similarly the possible cairn site at Harting Rig (WoSASPIN 9121), over 8km north west of the proposed development area, adjoins a substantial tract of forestry plantation extending to the south east and screening the site from potential intervisiblity with the proposed Wind Farm. The impact on these features is assessed as being **no change.** The effect of the proposed development on the setting of the scheduled monument would be **neutral**

Conservation Areas

9.103 There will be a degree of intervisibility between some parts of the Conservation Area at Lesmahagow and the proposed development as indicated by the ZTV, although this is likely to be limited to relatively few of the proposed turbines and at a distance of more than 8km would be perceived as part of the wider landscape. The impact on this regionally important designated site is assessed as being **negligible**. The effect of the proposed Wind Farm on the setting of the Conservation Area would be **neutral**.

Historic Gardens and Designed Landscapes

9.104 The nearest Inventoried Gardens and Designed Landscapes to the proposed development area are those of the Falls of Clyde (ID No 353), 13.5km to the north east and Lee Castle (ID No 253), more than15km to the north east. The ZTV indicates that there will be no intervisibility between these designated sites and the proposed Wind Farm. The impact on these Gardens and Designed Landscapes will be **no change**. The effect of the proposed development on their settings would be **neutral**.

World Heritage Sites

9.105 The World Heritage Site at New Lanark lies more than 14km to the north east of the proposed development area. The ZTV indicates that there will be no intervisibility between this internationally important site end the proposed Wind Farm. The impact on the World Heritage Site will be **no change**. The effect of the proposed development on its settings would be **neutral**.

9.106 A summary of the indirect effects predicted for sites within 10km of the proposed development are listed in Table 9.9.

9.107 Overall, it is considered that the magnitude of indirect impact of the development will be negligible, leading to the conclusion that the significance of the effects will be slight adverse at most.

Cumulative effects

9.108 A number of developments, either in planning, consented or operational, have been identified as having the potential to create cumulative impacts when combined with the application area.

9.109 Within 10km of the proposed Wind Farm site, these developments include Hagshaw Hill wind farm and extension and Clyde wind farm, which are either consented or operational, while Nutberry, Andershaw, Dungavel and Bankend Rig wind farms have had applications submitted.

9.110 When viewed from the majority of the cultural heritage receptors recorded between 5 and 10km, the proposed Wind Farm will present a relatively seamless relationship and tend to merge on the horizon with the existing Hagshaw Hill wind farm on an adjacent site to the east.

9.111 Although there is a degree of intervisibility, few if any cultural heritage features are located within the zone of combined theoretical visibility and there would be no cumulative effect on the settings of cultural heritage features.

Mitigation

9.112 The site layout has been developed to take into account cultural heritage features wherever possible, and as such much of the proposed mitigation has been built into the design. The evidence suggests that there is a low potential for previously unrecorded sub surface archaeological remains to be present in unenclosed areas at elevations above 300m AOD, where the proposed turbines and associated access tracks and borrow pits are predominantly sited.

9.113 No mitigation measures against direct impacts are envisaged as being necessary in areas outside the enclosures surrounding the High Monkshead farmstead.

9.114 At the High Monkshead farmstead, groundbreaking activities may require archaeological mitigation works, consisting of monitoring of construction works.

9.115 All archaeological mitigation works would be agreed with WoSAS and detailed in a Written Scheme of Investigation (WSI). The WSI would provide for the excavation of any features of archaeological interest, the production of reports of any archaeological findings, post-excavation analyses and publication of results where appropriate and archiving of the project materials and records.

9.116 The design of the proposed Wind Farm is such that effects on the settings of cultural heritage receptors have been reduced or nullified.

Residual effects

9.117 Any direct effect on cultural heritage features would be permanent and non-reversible. No such effects are predicted.

9.118 Any indirect effect on the settings of cultural heritage features would be temporary and reversible following the end of use and decommissioning of the proposed development.

9.119 A summary of the indirect effects predicted for sites within 10km of the proposed development are listed in Table 9.10

9.120 Overall, it is considered that the magnitude of indirect impact of the development will be negligible, leading to the conclusion that the significance of the effects will be slight adverse at most.

Significance of Effect

Table 9.10: Summary of effects on key sites within 10km of proposed development

INDEX No	NMRS No	Name/ Description	Category	Importance/ Sensitivity	Significance of Effect
WoSASPIN 9642 (SAM 2931)	NS 75082949	Glenbuck Ironworks	Scheduled	National/High	Slight
WoSASPIN 10142	NS83SW1	Arkney Hill	NSR	National/High	Neutral
HBNUM 14395	NS73SW3	Covenanter's Memorial	C(S) listed building	Local/Low	Slight
WoSASPIN 10061	NS82NW2	Weston, Mound, Earthwork	NSR	National/High	Neutral
WoSASPIN 9645	NS72NW1	Lightshaw, Standing Stone	NSR	National/High	Slight
HBNUM 1451	NS83SW34	Springhill, Douglas	B listed building	Regional/ Medium	Neutral
HBNUM 1453	NS83SW36	Douglas Arms Hotel, Douglas	B listed building	Regional/ Medium	Neutral
		Douglas	Conservation Area	Regional/ Medium	Slight
HBNUM 1489	NS83SW58	Mansefield Douglas	B listed building	Regional/ Medium	Neutral
SAM 90265 HB1490	NS83SW57 NS83SW5	St Bride's Chapel and graveyard, Douglas	Scheduled & A listed building	National/High	Neutral
HB 1457	NS83SW44	Monument to James Earl of Angus, Douglas	A listed building	National/High	Neutral
WoSASPIN 10064	NS82NW5	Shiel Burn, Enclosure, Turf Bank	NSR	National/High	Neutral
WoSASPIN 10066	NS82NW7	Andershaw; Sheepfold (possible)	NSR	National/High	Neutral
WoSASPIN 12957	NS72NW8	Auldhouseburn; Coal Mine	NSR	National/High	Slight
WoSASPIN 12958	NS72NW9	Crossflat; Coal Mine	NSR	National/High	Slight
WoSASPIN 9684	NS73SW1	Whitefield / Brown Hill, Enclosures	NSR	National/High	Slight
WoSASPIN 9687	NS73SW4	Whitefield / Brown Hill; Enclosures	NSR	National/High	Slight
WoSASPIN 9689	NS73SW6	Whitefield / Brown Hill; Burnt Mound (possible)	NSR	National/High	Slight
WoSASPIN 12963	NS72NW11.2	Muirkirk, Miners' Cottages	NSR	National/High	Slight
WoSASPIN 10078	NS82SW1	Andershaw; Chapel; Burial-ground; Well	NSR	National/High	Neutral
WoSASPIN 4631	NS72SW1	Cairn Table,two cairns	Scheduled	National/High	Slight
WoSASPIN 4234	NS82NE1	Auchensaugh Hill,cairn	Scheduled	National/High	Slight
WoSASPIN 4275	NS72SE3	Cairn Kinny	Scheduled	National/High	Slight
WoSASPIN 12960	NS72NW10.1	Auldhouseburn, Miners' Cottages	NSR	National/High	Slight
WoSASPIN 12961	NS72NW11.0	Muirkirk; Mining Remains	NSR	National/High	Slight
WoSASPIN 12962	NS72NW11.1	Muirkirk; Mine-shafts; Horse-engine Platforms	NSR	National/High	Slight
WoSASPIN 6640	NS62NE16	Muirkirk, remains of tar works, mines and structures	Scheduled	National/High	Slight

WoSASPIN 10081	NS82SW4	Mosscastle Hill; Cairn	NSR	National/High	Neutral
WoSASPIN 12141	NS62NE30	Middlefield; Limestone Quarry; Lime Kilns; Lime Clamp	NSR	National/High	Slight
		Lesmahagow	Conservation Area	Regional/ Medium	Neutral
WoSASPIN 9121	NS63NE4	Harting Rig; Cairn (possible)	NSR	National/High	Neutral
WoSASPIN 9111	NS62SE6	Slackshaw Burn; Shieling-huts	NSR	National/High	Slight
WoSASPIN 2848	NS63NE1	Dungavel Hill,cairn	Scheduled	National/High	Slight
WoSASPIN 3907	NS84SW17	Craighead Mill, Lesmahagow	Scheduled	National/High	Neutral

Statement of Significance

9.121 All the proposed wind turbines have been located to avoid direct effects on any above ground cultural heritage receptors or potential below ground archaeological features within the proposed Development area.

9.122 Construction of substations within and adjacent to High Monkshead farmstead may require archaeological monitoring during construction activities. No other mitigation measures against direct impacts are necessary or proposed within the boundaries of the proposed development.

9.123 Other than those stated above, no significant effects on the settings of cultural heritage features requiring mitigation have been identified, as summarised in Table 9.10.

9.124 Following decommissioning, the effect of the proposed development on cultural heritage features would revert to its current status.

9.125 Overall, the effects on cultural heritage are **not significant** under the terms of the Environmental Impact Assessment (Scotland) Regulations and other applicable legislation.

Chapter 10 – Noise & Vibration

Introduction

10.1 This chapter reports the likely significant noise and vibration effects of the proposed Galawhistle Wind Farm with respect to the construction, operation and decommissioning of the development.

10.2 The chapter describes the methods used to assess the baseline conditions currently existing at the site and surroundings; along with a description of the measures incorporated to reduce or offset any significant adverse effects.

10.3 Background information on wind turbine noise is provided in Appendix 10A.

Consultations

10.4 A scoping opinion was sought from South Lanarkshire Council and East Ayrshire Council but no responses were received despite numerous attempts to contact the Environmental Health Departments between 28th July – 11th August 2009. A list detailing the attempts is shown in Appendix 10B. The scoping letter included details of the proposed baseline monitoring methodology and that the assessment would be undertaken according to ETSU-R-97 'The Assessment & Rating of Noise from Wind Farms' and a recent statement on wind turbine noise prediction published in the Institute of Acoustics Bulletin. It was also proposed that the fixed quiet daytime noise limit would be set at the lower level of 35dB $L_{A90,\ 10min}$, the night-time fixed limit would be 43dB $L_{A90,10min}$ and, for any householders with a financial interest, a limit of 45dB $L_{A90,10min}$ regardless of time of day would be used.

Planning Policy and Legislative Context

10.5 The following policy and guidance documents have been used:

- PAN 56: Planning and Noise
- PAN 45: Renewable Energy Technologies
- The Control of Pollution Act 1974, Part III
- Environmental Protection Act 1990
- The Assessment & Rating of Noise from Wind Farms – The Working Group on Noise from Wind Turbines (Report ETSU-R-97)
- British Standard 5228 (Construction Noise and Vibration) 2009

Planning Advice Note PAN 56: Planning and Noise

10.6 PAN 56 provides advice to local authorities in Scotland on the use of their planning powers to minimise the adverse impact of noise. It also advises that impact assessments should be conducted for noisy development [paragraph 14] and should:

- *"Measure or predict and describe noise levels to be generated by the proposed development;*
- *Establish criteria for assessing the impact of noise on its surroundings; and*
- *Outline measures available to reduce noise impact to acceptable levels".*

10.7 PAN 56 provides, inter alia, guidance on ways of mitigating the adverse impacts of noise, and the use of planning conditions relating to noise. With regard to wind farms, the PAN states that:

"Good acoustical design and siting of turbines is essential to ensure that there is no significant increase in ambient noise levels as they affect the environment and any nearby noise-sensitive property."

10.8 PAN 56 does not propose specific standards or criteria for the assessment of noise from wind turbine installations.

Planning Advice Note PAN 45: Renewable Energy Technologies

10.9 PAN 45 provides specific planning advice on the assessment of renewable energy technologies including noise from wind turbines. PAN 45 refers to 'The Assessment & Rating of Noise from Wind Farms' and according to paragraph 68 of PAN 45 *"this report (ETSU-R-97) presents a series of recommendations that can be regarded as relevant guidance on good practice".*

Legislation

The Control of Pollution Act 1974, Part III

10.10 The Control of Pollution Act 1974 (COPA) is specifically concerned with the control of noise pollution. Section 60, Part III of the COPA refers to the control of noise on construction sites. It provides legislation by which local authorities can control noise from construction sites to prevent noise disturbance occurring. In addition, it recommends that guidance provided by BS 5228 be implemented to ensure compliance with Section 60.

10.11 Section 61, Part III of the COPA refers to prior consent for work on construction sites. It provides a method by which a contractor can apply for consent to undertake construction works in advance. If consent is given, and the stated method and hours of work complied with, then the local authority cannot take action under Section 60.

10.12 Section 72, Part III of the COPA refers to best practicable means (BPM). The COPA defines BPM as 'reasonably practicable, having regards among other things to local conditions and circumstances, to the current state of technical knowledge and to the financial implications'. Whilst 'means' includes 'the design, installation, maintenance and manner and periods of operation of plant and machinery, and the design, construction and maintenance of buildings and acoustic structures'.

Environmental Protection Act 1990

10.13 The Environmental Protection Act 1990 (EPA) deals with statutory nuisance, including noise. Section 79, Part III of the EPA, places a duty on local authorities to regularly inspect their areas to detect whether a statutory nuisance exists. This section also considers and defines the concept of 'Best Practicable Means' (BPM) which originates in Section 72, Part III of the COPA, where BPM is defined as means that are:

'reasonably practical having regard, among other things, to local conditions and circumstances, to the current state of technical knowledge and to the financial implications'.

Standards and Guidance

The Assessment & Rating of Noise from Wind Farms – The Working Group on Noise from Wind Turbines (Report ETSU-R-97)

10.14 The ETSU-R-97 report is the result of the DTI Working Group on Noise from Wind Turbines. The working group was set up in 1993 to address difficulties experienced in applying various noise guidelines existing at the time to wind farm noise assessments. The report is referred to in PAN 45, as the methodology by which noise from wind farms should be assessed.

10.15 ETSU-R-97 provides a framework for the assessment and rating of noise from wind turbine installations. It has become the accepted standard for wind farm developments in the UK, and the methodology has therefore been adopted for the present assessment. Although it has been over ten years since the publication of ETSU-R-97, the UK Department for Communities and Local Government (DCLG) wrote to all of England's Local Planning Authorities and the Planning Inspectorate in November 2006 to confirm that the advice contained within PPS22 (English equivalent to PAN 45), which states that ETSU-R-97 should be used for the assessment and rating of noise from wind farms, should continue to be followed. Although there has been no such communication with Scottish planning authorities, ETSU-R-97 is still relevant and this has been reinforced via Reporter decisions. Notwithstanding the above, continuing research on wind farm noise has taken place and supporting information is provided in Appendix 10A.

10.16 ETSU-R-97 recommends that noise limits should be applied to external locations used for relaxation or where a quiet environment is highly desirable. These limits should be set relative to the background noise and should reflect the variation in both the wind turbine source noise and background noise with wind speed. Separate noise limits apply for day-time and for night-time as during the night the protection of external amenity becomes less important and the emphasis should be on preventing sleep disturbance.

10.17 Further details on the ETSU-R-97 methodology and noise limits are reported within the Methodology section.

British Standard 5228 (Construction Noise and Vibration)

10.18 BS 5228: Code of practice for noise and vibration control on construction and open sites – Part 1: Noise and Part 2: Vibration provides guidance, information and procedures on the control of noise and vibration from construction sites. In its previous versions the Standard, in its various parts, was adopted under s. 71 of COPA.

10.19 There are no set standards for the definition of the significance of construction noise effects. BS 5228 does not promote specific limits for construction noise and vibration, with the exception of vibration from piling. The assessment of whether changes in noise levels due to construction constitute significant effects will be dependent on the absolute levels of ambient and construction noise, as well as the magnitude, duration, time of occurrence and frequency of the noise change. BS 5228 does, however, provide guidance on controlling, predicting and measuring noise and vibration.

10.20 The BS5228 Standard includes a comprehensive best practice guide to minimising the adverse effects of noise and vibration from construction sites and a database of plant and activity noise levels for undertaking noise assessments.

Methodology

Construction Noise

10.21 Potentially noisy activities related to wind farm sites include: construction of access tracks; crane pads; contractors compound; borrow pits and turbine foundations; erection of turbines; site cabling and the installation of the substation and control building.

10.22 With respect to hours of work, BS 5228 makes reference to the fact that noise levels generated during the evening (19:00 to 23:00) may need to be lower than the daytime (07:00 to 19:00) period (a figure of 10dB is quoted) and also that for any night-time operations (23:00 to 07:00) levels should be quieter still. The Standard does not, however, offer guidelines with respect to acceptable levels.

Significance Criteria – Construction Noise

10.23 Since there are no set standards for the definition of the significance of construction noise effects, the assessment of whether changes in noise levels due to construction constitute significant effects, will be dependent on the absolute levels of ambient and construction noise, as well as the magnitude, duration and time(s) of occurrence. Having examined the assessment criteria used for other projects, it is considered that a significant impact would occur at a residential receptor when the construction noise level ($L_{Aeq,T}$) is predicted to be greater than the noise thresholds given in Table 10.1.

Table 10.1: Construction Noise Criteria

Assessment Period		Construction Noise Threshold
Day of Week	Time of Day	
Monday to Friday	07:00 to 19:00 hours	65dB $L_{Aeq,12hr}$
Saturday	08:00 to 13:00 hours	65dB $L_{Aeq,5hr}$
Sunday, Public Holidays, Bank Holidays	~	No Noisy Activity

Operational Noise

10.24 ETSU-R-97 recommends the application of noise limits at the nearest noise-sensitive properties, to protect amenity spaces outdoors and prevent sleep disturbance inside dwellings. ETSU-R-97 proposes that site-specific noise criteria are adopted based on the wind varying background noise. According to ETSU-R-97, wind farm noise assessments should therefore consider the site-specific relationship between wind speed and background noise, along with the particular noise emission characteristics of the proposed wind turbines.

10.25 ETSU-R-97 provides a method for determining existing background noise. Typically the baseline assessment requires the measurement of background noise ($L_{A90,10min}$) at sensitive receptors, along with wind speed at the location of proposed turbines measured 10m above ground level.

10.26 Predicted noise levels from the proposed wind farm are compared with criteria based on noise limits specified in ETSU-R-97. The noise limits proposed by ETSU-R-97 are based on the $L_{A90,10min}$, assuming free field conditions. Separate noise limits apply for quiet day time and night time. Quiet day time is defined as:

- 18:00 – 23:00 weekdays and Saturday;
- 13:00 – 18:00 on Saturday; and

- 07:00 – 23:00 on Sundays.

10.27 During the above periods, the guidance prioritises the protection of outdoor amenity for residents, by applying noise limits that would not significantly affect the enjoyment of areas such as gardens.

10.28 ETSU-R-97 proposes the adoption of a site standard of 5dB $L_{A90,10min}$ above the prevailing wind varying background noise level. This is based on wide experience in environmental acoustics that noise from a new source is unlikely to cause annoyance where the predicted increase is less than 5dB above the existing background (based on British Standard 4142:1997 "Method for Rating industrial noise affecting mixed residential and industrial areas").

10.29 In addition to the limit of 5dB above the $L_{A90, 10min}$, an allowance is included for a fixed limit to be applied at wind speeds or locations where background noise levels are low. When the quiet daytime background noise level is less than 30-35dB $L_{A90,10min}$, the limit is defined as 35-40dB $L_{A90,10min}$. For the purposes of this assessment and as stated in the consultation documentation, the more onerous limit of 35dB $L_{A90,10min}$ has been adopted. The quiet daytime limit also applies to all other daytime periods, with the noise limits based on the quiet daytime background noise level.

10.30 Different standards apply at night, where sleep disturbance is the primary concern rather than the requirement to protect outdoor amenity. Night time is considered to be all periods between 23:00 and 07:00. A minimum limit of 43dB $L_{A90,10min}$ is recommended for night-time at wind speeds or locations where the background noise level is less than 38dB $L_{A90,10min}$. This is relevant to the assessment as in rural areas the background can be significantly quieter at night. When background noise levels exceed 38dB $L_{A90,10min}$ the limit is set to 5dB above the background noise level.

10.31 Where the occupier or owner of a property has some financial involvement with the proposal (a stakeholder), the day and night-time lower noise limits can be increased to 45dB $L_{A90,10min}$ and consideration should be given to increasing the permissible margin above background.

Significance Criteria – Operational Noise

10.32 Operational noise will affect the closest properties to the wind farm more than those further away and therefore for the purposes of this assessment, only those properties identified within 2km of the Wind Farm have been considered. At distances greater than 2km, wind turbine noise levels are not perceptible. No properties have a financial interest in the proposals.

10.33 When the ETSU-R-97 limits are applied, it is possible for a situation to arise at low wind speeds, where the predicted noise level complies with the fixed limit (i.e. is less than 35dB or 43dB $L_{A90,10min}$ as appropriate) but exceeds the background noise by more than 5dB. A provision has therefore been made for this situation in the significance criteria which have been adopted for this assessment, as follows:

- Predicted turbine noise levels that comply with the ETSU-R-97 limits and that are no more than 5dB above background noise levels at all wind speeds are considered to be of a negligible impact and hence not significant.
- Predicted turbine noise levels that comply with the ETSU-R-97 35dB limits but which exceed background noise levels at some wind speeds by more than 5dB are considered to be a minor impact and hence not significant.
- Predicted turbine noise levels that exceed the ETSU-R-97 limits are considered to be an adverse impact and hence significant.

Baseline Description

Description of Local Noise Environment

10.34 The application site is described in Chapter 3 (Project Description). To the east of the site is the village of Douglas and to the west is the village of Muirkirk (distances from each of these villages to the site are detailed in Table 3.1 in Chapter 3). There are a small number of individual farm properties surrounding the site in all directions.

Noise-Sensitive Receptors

10.35 ETSU-R-97 states that the nearest noise-sensitive properties to the proposed wind farm should be assessed. Potential noise sensitive receptors (NSRs) have been identified through examination of ordnance survey mapping, public domain websites and confirmed through site visits as listed in Table 10.2.

10.36 It should be noted that the list of NSRs does not include all those properties within 2km of the Wind Farm. The NSRs are however representative of other locations within the study area and therefore for the purposes of this assessment, the significance of the Wind Farm's noise effects will be judged on the basis of the operational noise effect at each of the NSRs listed below.

10.37 Potential NSR properties were identified from examination of 1:25,000 OS mapping, from which it was assumed all buildings to be dwellings. After closer inspection using aerial photography, it appears that this may not be the case. Properties marked * appear to be uninhabited and unsuitable for future occupancy, therefore these properties have not been included in the assessment. However, the impact of the Wind Farm on the uninhabited properties has been reported in Appendix 10C for completeness.

Table 10.2 Identified Noise Sensitive Receptors

Receptor	OS Grid Coordinate		Distance to closest turbine /m
	Easting	Northing	
1 – Debog	277468	628084	1486
2 – Monksfoot	278573	628537	772
3 – Glenbuck Home Farm*	275451	629113	1116
4 – Darnhunch	274343	628273	2489
5 – South Bankend*	278701	633066	1769
6 – Glespin	280599	628225	2466
7 – Longhouse	280206	627969	2253
8 – Low Broomerside	279640	629148	1286
9 – High Broomerside*	279382	629635	1085
10 – Monkshead*	276995	630036	524
11 – Parish Holm	276303	628144	1347
12 – Glenbuck Lodge	275337	629066	1240
13 – Cumberhead	277560	634594	2783

* Properties are currently taken to be un-inhabited and unsuitable for future occupancy

Baseline Noise Monitoring

10.38 Baseline noise monitoring has been conducted in accordance with ETSU-R-97 at four locations which are considered to be either the most sensitive NSRs or representative of the remaining NSRs based upon site visits and professional judgement. Surveys were carried out in August

2009 at Debog, Monksfoot, Glenbuck Lodge to the south of the site and Cumberhead to the north of the site. The survey locations are shown in Figure 10.1, together with the identified NSRs. Baseline noise levels at the remaining NSRs have been estimated from these surveys as discussed later in this chapter.

10.39 The noise surveys were carried out using 01 dB Solo Class 1 Sound Level Meters (SLMs) which were installed complete with full environmental protection kits and wind shield housings. The calibrations of the SLMs were checked using a Rion NC 74 calibrator before and after monitoring and no significant deviations were found (less than 0.2dB).

Debog

10.40 The survey was set up in the yard to the west of the residential building, at a height of 1.5m above local ground level and in a free-field position (at least 3.5m away from any reflecting surfaces excluding the ground, consistent with the advice contained with PAN 56 and ETSU-R-97). Sound levels were measured from 4th August to 25th August 2009. During the installation and removal of the monitoring equipment onsite observations made by the noise consultant indicated that road traffic movements were audible from the A70. This is a working farm.

Monksfoot

10.41 The survey was set up in the garden to the south of the residential building, at a height of 1.5m above local ground level and in a free-field position (at least 3.5m away from any reflecting surfaces excluding the ground, consistent with the advice contained with PAN 56 and ETSU-R-97). Sound levels were measured from 4th August to 25th August 2009. During the installation and removal of the monitoring equipment onsite observations made by the noise consultant indicated that distant road traffic movements were audible from the A70 and children playing on a quad bike in adjacent field. This is a working farm.

Glenbuck Lodge

10.42 The survey was set up in the garden to the west of the residential building, at a height of 1.5m above local ground level and in a free-field position (at least 3.5m away from any reflecting surfaces excluding the ground, consistent with the advice contained with PAN 56 and ETSU-R-97). Sound levels were measured from 4th August to 24th August 2009. During the installation and removal of the monitoring equipment onsite observations made by the noise consultant indicated that a stream running adjacent to the garden was audible and wind rustling trees. The road leading to the working mines runs close to this house.

Cumberhead

10.43 The survey was set up in the garden to the south of the residential building, at a height of 1.5m above local ground level and in a free-field position (at least 3.5m away from any reflecting surfaces excluding the ground, consistent with the advice contained with PAN 56 and ETSU-R-97). Sound levels were measured from 4th August to 25th August 2009. During the installation and removal of the monitoring equipment onsite observations made by the noise consultant indicated that wildlife noise was audible and the most significant noise source.

Meteorological Data

10.44 A temporary 10m high meteorological mast was originally established within the vicinity of the proposed turbines to monitor the wind speed and wind direction concurrently with the noise surveys. The wind monitoring was carried out using a Wind Observer II Ultrasonic Observer installed at a height of 10m at the location of the proposed permanent met mast. However due to a technical problem with the Wind Observer data logger which corrupted the wind dataset a modified assessment approach was used to derive site specific wind speed data as outlined below.

10.45 Rain observations were made using data obtained from the Met Office at Drumalbin meteorological station, which is approximately 16km from the Wind Farm site. ETSU-R-97 specifies that periods of heavy rainfall should be excluded from the baseline noise data used in deriving the noise limits. This is typically due to elevated levels of background noise, either due to the presence of water on road surfaces, rain fall noise on monitoring equipment and the ground or increased noise from streams/waterways. The later influence being difficult to determine since its may take a period of time for increased water noise to occur. Examination of the Met Office data showed periods when there was significant rainfall and whilst ETSU-R-97 does not define what constitutes heavy rainfall, data which was greater than 0.5mm in any one hour was excluded.

10.46 Wind speed and direction data is typically consistent across an area with local variations due to specific turbulence effects caused by physical structures, including for example unusual topographical features and/or tall buildings. The neighbouring Hagshaw Hill Wind Farm includes a permanent onsite met mast and this data, supplied as 24 hour average wind speeds for each day has also been used as follows:

- Representative wind speed data measured as hourly average values was obtained from the nearby Drumalbin meteorological station for the duration of the monitoring exercise. As ETSU-R-97 requires 10 minute sample, each hourly value was applied to each 10 minute value.
- A comparison of the Drumalbin data and the Hagshaw Hill data (corrected for 10m height) was then undertaken and the resulting difference was less than a $1ms^{-1}$ difference in the two datasets which supports the premise that the Met Office data is representative of the local area and is therefore satisfactory for the purposes of this assessment.
- In 2005, Scottish Coal commissioned an Environmental Impact Assessment for the Spireslack Wind Farm, whose application boundary occupies part of the Galawhistle Wind Farm site. Baseline noise and meteorological measurements were taken for a one week period. The Spireslack Environmental Statement includes wind speed data and this data has been used to supplement the analysis since measurements were taken close to the Glenbuck Lodge.
- A sensitivity test of a previous wind farm has been undertaken based on the use of one hour data for each 10 minute period. The variation between a complete 10 minute analysis and one hour analysis resulted in less than a 0.5dB variation in the derived wind varying noise curve noise. This small variation is considered negligible and for the purposes of this assessment supports the alternative approach.

10.47 Only 10m high wind speed data was available from Drumalbin and as no higher elevation wind speed measurements are available, there has been no assessment of wind shear. However a qualitative assessment of the potential significance of wind shear has been undertaken as discussed in paragraph 10.77.

Baseline Noise Levels

10.48 Table 10.3 summarises the results of the long-term noise monitoring undertaken at the monitoring location. The data summarises the range of wind speeds and background noise data measured.

Table 10.3 Long-term Noise Survey Summary

Location	Period	Wind Speed Range (ms-1 @ 10 m)		Background Noise Level Range (dB, $L_{A90, 10 mins}$)		Number of Data Samples
		Min	Max	Min	Max	
Debog	Quiet Daytime	1.5	14.4	31.9	62.3	840
	Night-time	0.0	12.3	32	57.3	828
Monksfoot	Quiet Daytime	1.5	14.4	28.2	48.6	840
	Night-time	0.0	12.3	28.2	48	828
Glenbuck Lodge	Quiet Daytime	1.5	14.4	40.8	60.1	810
	Night-time	0.0	12.3	41	60.2	792
Cumberhead	Quiet Daytime	1.5	14.4	18.1	50.8	840
	Night-time	0.0	12.3	18.1	48.1	828

10.49 Baseline noise levels at Debog, Monksfoot and Cumberhead are considered to be representative of a quiet rural area. Noise levels at Glenbuck Lodge are elevated due to a nearby burn causing constant water noise.

10.50 The measured background noise levels were then plotted against the derived wind speeds for the quiet daytime and night-time periods (see Charts 10.1 to 10.8). A regression line (line of best fit within the data points) was applied to the datasets to calculate the 'derived background noise levels', which were subsequently used to derive the assessment's operational noise limits. The choice of regression analysis was partially determined by which curve produced the lowest derived background noise levels, which would then result in a more onerous, worst case assessment. It was concluded that a linear regression analysis was appropriate based upon the variation of wind speed and noise data (see Appendix 10C for a more detailed explanation of the significance of the choice of regression line).

Existing and Future Situation

10.51 The cumulative assessment of wind farms is discussed in ETSU-R-97 and it is important to consider the influence of any operational wind turbines when conducting baseline noise monitoring. As the nearby Hagshaw Hill wind farm is operational, there could be a cumulative effect. However given the significant spatial separation of over 1km to the nearest residential receptor (upwind of the wind farm site) the influence of operational noise on baseline noise levels is not considered significant.

10.52 In addition, the Hagshaw Hill Wind Farm including Hagshaw Hill Extension and Nutberry Hill Wind Farm could materially influence the EIA assessment with respect to increased wind turbine noise. This aspect is discussed later in the cumulative assessment section.

10.53 As noted in paragraph 10.37, the assessment has concentrated on those properties which are currently occupied. However those properties which are currently unsuitable for occupation (e.g. ruined/abandoned) have been assessed. Should their future occupancy situation change in the future then the assessment presented within Appendix 10C would be applicable.

Assessment of Effects

10.54 The proposed development would comprise 22 wind turbines, (18 with a maximum height to hub of 69m and four with a maximum hub height of 80m), a control building and substation, an anemometry mast and access tracks.

10.55 During the construction phase of the wind turbines, the Wind Farm would also include a construction compound and crane hardstandings or crane pads, and un-surfaced lay down/turbine assembly areas next to each turbine location. There would also be four borrow pits within the site. A description of the development can be found at Chapter 3 (Project Description) which also outlines the main construction activities.

10.56 The following sections describe the proposed development during the construction and operational phases of the development with respect to the assessment of noise and vibration.

Construction Effects

Construction Traffic

10.57 Abnormal loads transporting turbine components (wind turbine blades, nacelles and tower components) will follow a predefined route to the site (see Chapter 11, Traffic and Transport, for a description of the abnormal load route). Turbine components will be delivered by sea to a suitable port of entry in the region and transported to the site by a specialist heavy haulage contractor.

10.58 The turbine blades, nacelles and tower components would be delivered on long HGVs. These large deliveries would travel slowly along the predefined route to the site. Travelling slowly means less noise will be generated by the tyres on the road but it does mean the noise of the engine on the HGVs going past any NSR would be of longer duration than a vehicle moving at the speed limit. The noise impact of the HGVs would probably be noticeable to any NSRs passed along the route but this would be only for a short duration as the vehicles move past and would be no different to other vehicles; HGVs and agricultural vehicles.

10.59 Chapter 11 (Traffic and Transport) provides an indication of the number of construction traffic movements. This information can be used to assess the noise impact of construction traffic on the two receptors closest to the access road into the wind farm site. Using a worst case basis (ref. para 11.40 of traffic assessment) of 50 two-way HGV movements during the concrete pour for each turbine foundation. The closest receptors to the site access are locations 3 and 12 (Glenbuck Home Farm and Glenbuck Lodge, as shown in Figure 10.1). These receptors are approximately 590m and 330m respectively from the site access route. The following noise levels have been derived from BS 5228 haul road method (section F.2.5.2) using an hourly flow of 6.5 movements, a vehicle site speed of 20mph and a vehicle sound power level of 106dB(A). At Glenbuck Home Farm the one hour L_{Aeq} has been calculated to be 38.9dB, and at Glenbuck Lodge the $L_{Aeq,1hr}$ is calculated to be 41.5dB. These levels of noise are not significant in relation to the proposed criteria in Table 10.1.

10.60 For off site locations, the noise impact of HGVs would probably be significant to any NSRs passed along the route but this would be only for a short duration as the vehicles move past, and would be no different to other passing vehicles, HGVs and agricultural vehicles. Taking all these factors into account, the noise from passing HGVs is considered to be not significant for other receptors along the construction traffic route.

Construction on Site

10.61 The construction works will follow a 14 month programme, with the main activities taking place within eight months (up to turbine erection). During this time noise from construction is likely to arise during: construction of access tracks and crane pads, construction of lay down area, construction compound, borrow pit workings and turbine foundations; erection of turbines; site cabling and substation installation. Construction of the turbine foundations may use piling techniques depending upon local ground circumstances. This worst case activity would have the potential for the greatest noise impact. However due to the large separation distance (>800m) between the majority of working areas and the nearest residential properties and the adherence to a construction environmental management plan, it is highly unlikely that construction activities would give rise to any significant adverse effects.

10.62 Due to the distance attenuation that would occur, no further assessment of construction noise is considered necessary and the predicted impact is, at the most, minor and hence **not significant**.

Vibration Effects During Construction

10.63 From previous project experience vibration effects are only significant if NSRs are closer than 500m during impact piling. Owing to the spatial separation between the work sites and nearest NSRs, vibration impacts during construction of the foundations are considered to be negligible and, therefore, not significant. There would be no vibration effects associated with any other phase of the development, including borrow pit activities.

Operation Effects

10.64 Noise associated with the substations and routine maintenance visits is considered negligible and therefore only noise associated with the operation of the turbines has been determined.

10.65 Candidate turbines are often used when assessing the noise effects of a wind farm because the final turbine choice is only made when the developer enters into commercial contract negotiations with a range of turbine manufacturers. The final turbine choice would have similar noise emissions to the candidate turbine as it is normal to control the noise emissions by a suitable planning condition, rather than by specifying a single turbine type.

10.66 For the purposes of this assessment, a candidate wind turbine, the Vestas V80 2MW (hub height of 69m and 80m), has been used to determine the likely operational noise effects of the proposals.

10.67 Manufacturer's guaranteed noise emission data has been used in the prediction process, and are summarised in Table 10.4. Noise emission test data are reported for a 68m hub height as obtained from a Vestas noise report. Any noise differences between the Wind Farm's proposed 69m and 80m hub heights are considered negligible compared to the data presented in Table 10.4. For the purposes of this assessment, the Vestas V80 model does not require a tonal penalty under the requirements of ETSU-R-97.

Table 10.4 Vestas V80 2MW – Manufacturer's Noise Data

Windspeed / ms^{-1}	6	7	8	9
LWA / dB	103.6	104.8	105.2	105.3

Dated taken from test report dated 23rd May 2001 for a 68m hub height turbine

10.68 A SoundPLAN computer model has been constructed and used to predict noise levels resulting from the operation of the proposed Galawhistle Wind Farm, based on the methodology detailed in ISO 9613-2. The use of this technique is considered most appropriate for predicting the noise from the proposed wind turbines. Full details of the modelling procedure are given in Appendix 10C, however, conservative assumptions have been made in the modelling process and it is more likely that the model will over-predict than under-predict noise levels. The ISO 9613 method predicts noise levels likely to occur under conditions favourable for noise propagation, i.e. downwind or under a moderate ground-based temperature inversion (which usually occur in the evening or at night). Upwind conditions may reduce the predicted turbine noise levels by up to 10dB.

10.69 Noise levels have been calculated using SoundPLAN at the 13 identified NSRs over the range of wind speeds provided in Table 10.4. The results for the occupied properties are shown in Table 10.5. The results for the unoccupied properties can be seen in Appendix 10C. The NSR numbering system is as per Table 10.2.

Table 10.5 Vestas V80 2MW - Predicted Turbine Noise Levels (all turbines)

Receptor	Noise Level $L_{A90,10min}$ / dB			
	Wind speed / ms^{-1}			
	6	7	8	9
1 - Debog	35.3	36.5	36.9	37.0
2 - Monksfoot	38.1	39.3	39.7	39.8
4 - Darnhunch	29.5	30.7	31.1	31.2
6 - Glespin	28.7	29.9	30.3	30.4
7 - Longhouse	29.9	31.1	31.5	31.6
8 - Low Broomerside	34.3	35.5	35.9	36.0
11 - Parish Holm	35.1	36.3	36.7	36.8
12 - Glenbuck Lodge	30.0	31.2	31.6	31.7
13 - Cumberhead	22.5	23.7	24.1	24.2

10.70 Charts 10.1 to 10.8 show the predicted noise levels at the four measurement locations (receptors 1, 2, 12 and 13).

10.71 The charts also show the relevant quiet daytime and night-time noise limits. Table 10.6 summarises the numerical data displayed in the charts for the occupied properties. Data for the remaining properties can be seen in Appendix 10C. A noise contour plot has been created as shown in Figure 10.2 for the highest noise level range i.e. 8-9ms^{-1}.

10.72 Unless otherwise indicated for all NSRs where noise monitoring was not undertaken the derived noise limits have been obtained from Cumberhead which is considered to be representative of the quietest location monitored. This approach therefore demonstrates an absolute worst case approach to the assessment.

Table 10.6 Predicted Operational Noise Levels and Noise Limits

Receptor	Factor	Wind Speed at 10 m Height (ms-1)			
		6	7	8	9
		Noise Level (dB $L_{A90, 10mins}$)			
1 - Debog	Quiet Daytime Limit	48	50	52	54
	Night-time Limit	51	53	54	56
	Predicted Noise Level Turbine	35	37	37	37
2 - Monksfoot	Quiet Daytime Limit	42	43	44	46
	Night-time Limit	43	44	45	45
	Predicted Noise Level Turbine	38	39	40	40
4 - Darnhunch	Quiet Daytime Limit	35	36	38	40
	Night-time Limit	43	43	43	43
	Predicted Noise Level Turbine	30	31	31	31
6 - Glespin	Quiet Daytime Limit	35	36	38	40
	Night-time Limit	43	43	43	43
	Predicted Noise Level Turbine	29	30	30	30
7 - Longhouse	Quiet Daytime Limit	35	36	38	40
	Night-time Limit	43	43	43	43
	Predicted Noise Level Turbine	30	31	32	32
8 - Low Broomerside	Quiet Daytime Limit	35	36	38	40
	Night-time Limit	43	43	43	43
	Predicted Noise Level Turbine	34	36	36	36
11 - Parish Holm	Quiet Daytime Limit	35	36	38	40
	Night-time Limit	43	43	43	43
	Predicted Noise Level Turbine	35	36	37	37
12 - Glenbuck Lodge	Quiet Daytime Limit	49	51	52	54
	Night-time Limit	51	52	53	53
	Predicted Noise Level Turbine	30	31	32	32
13 - Cumberhead	Quiet Daytime Limit	35	36	38	40
	Night-time Limit	43	43	43	43
	Predicted Noise Level Turbine	23	24	24	24

Chart 10.1 Debog
Quiet Daytime Predicted Noise Levels and Noise Limit

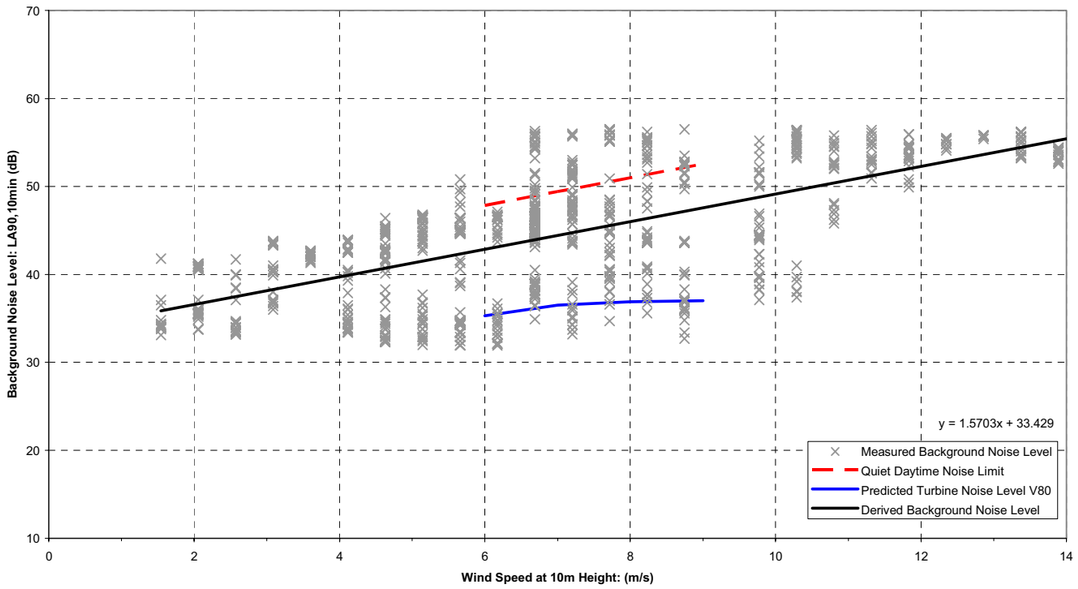


Chart 10.3 Moonksfoot
Quiet Daytime Predicted Noise Levels and Noise Limit

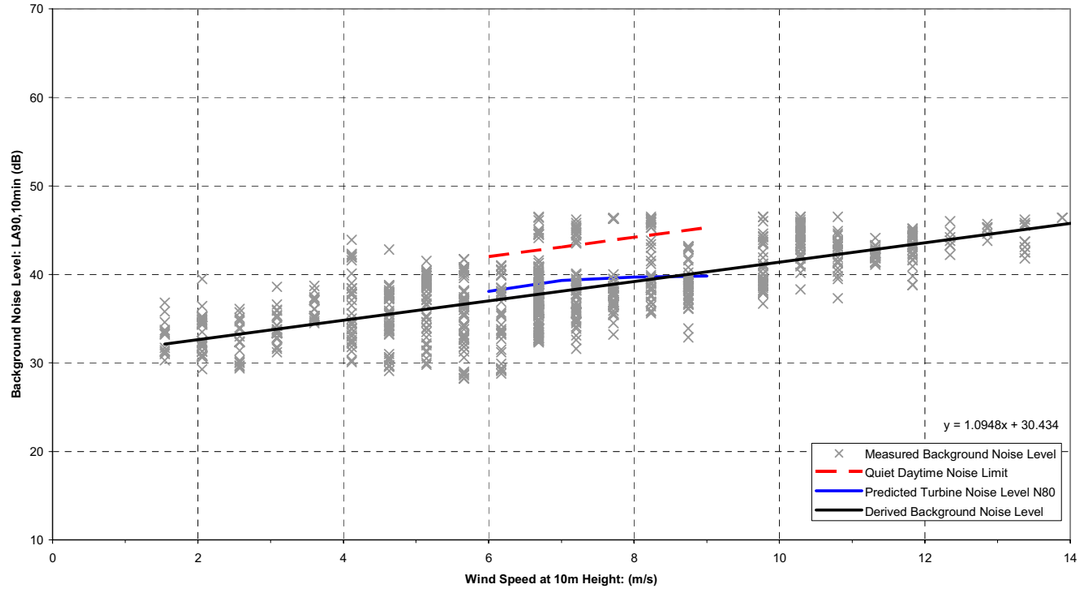


Chart 10.2 Debog
Night-time Predicted Noise Levels and Noise Limit

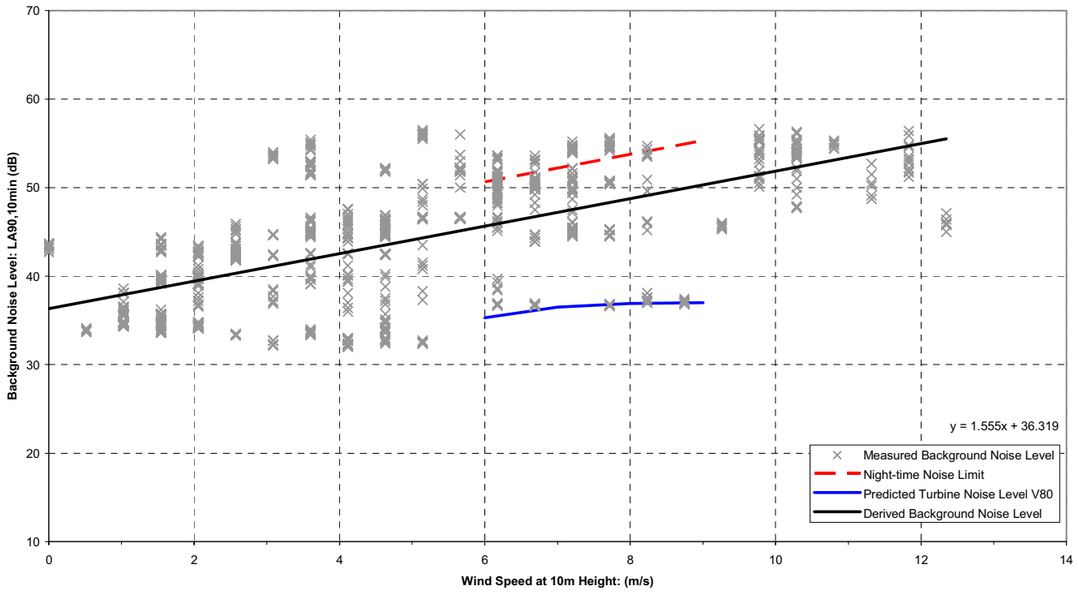


Chart 10.4 Moonksfoot
Night-time Predicted Noise Levels and Noise Limit

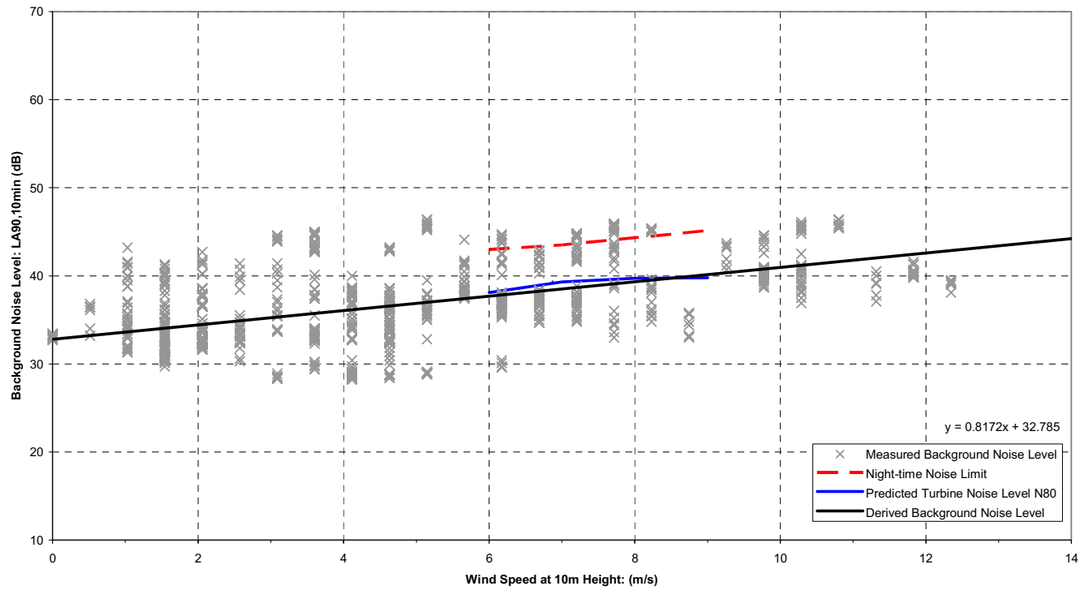


Chart 10.5 Glenbuck Lodge
Quiet Daytime Predicted Noise Levels and Noise Limit

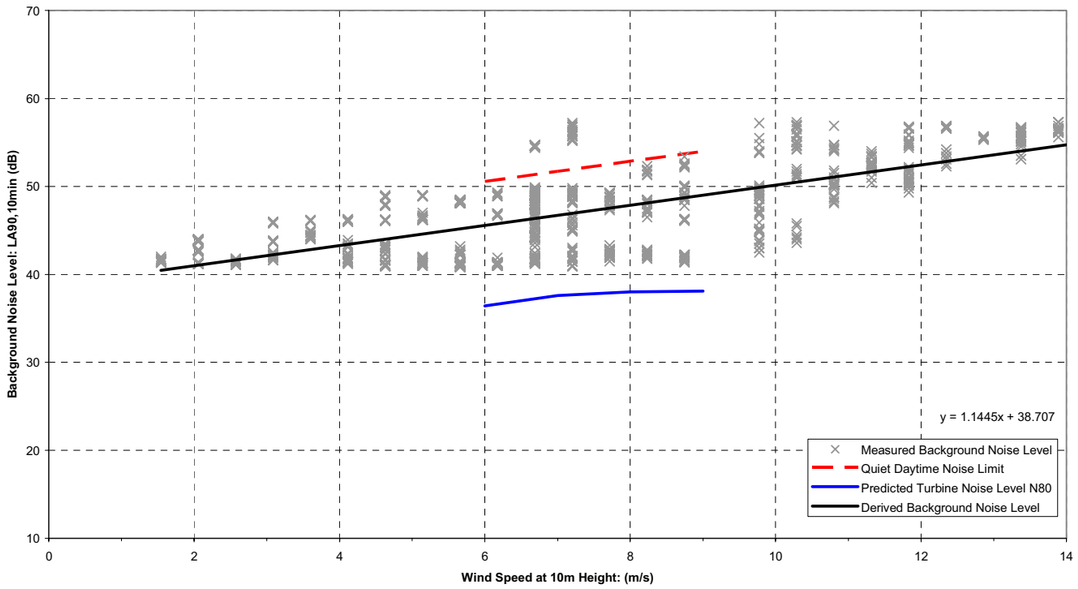


Chart 10.7 Cumberhead
Quiet Daytime Predicted Noise Levels and Noise Limit

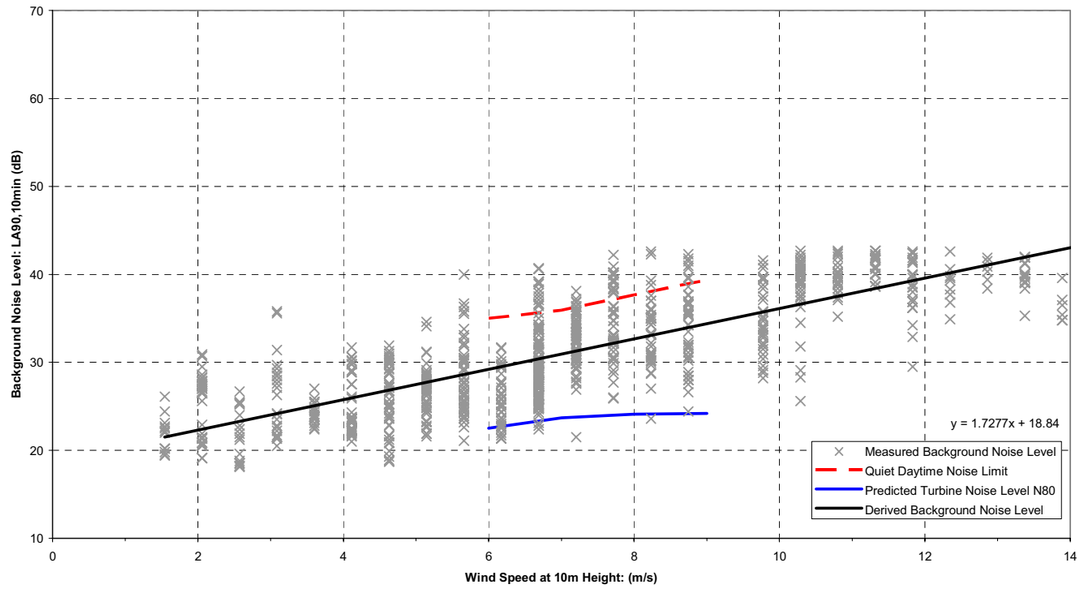


Chart 10.6 Glenbuck Lodge
Night-time Predicted Noise Levels and Noise Limit

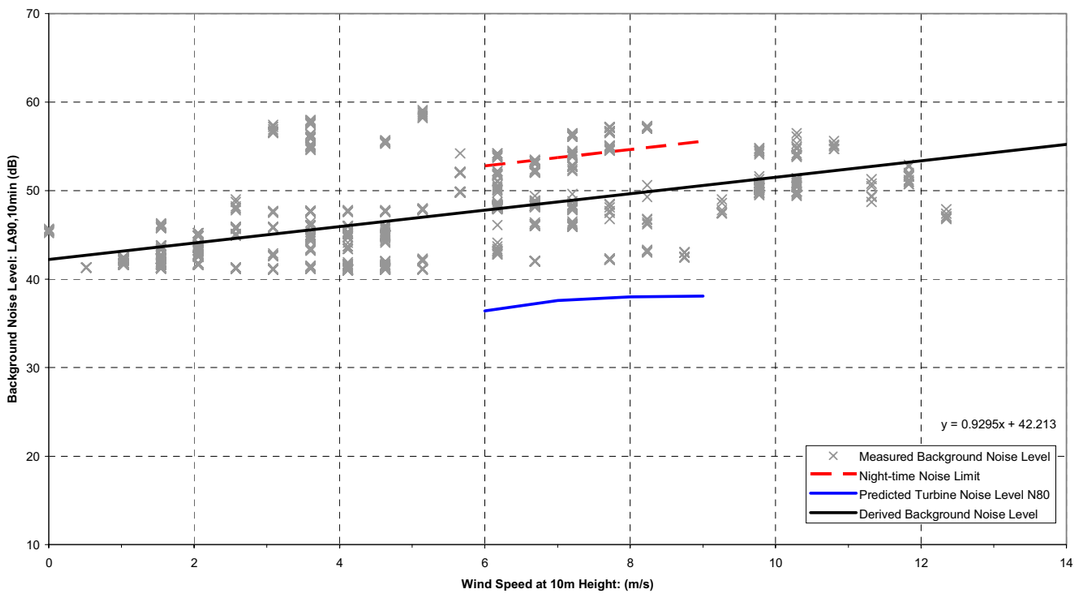
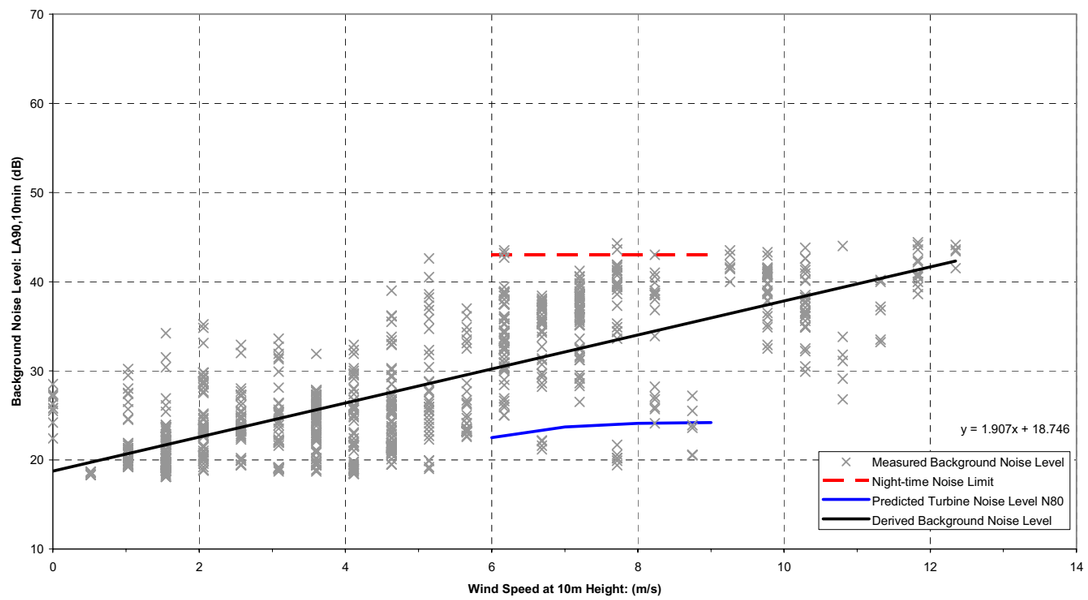


Chart 10.8 Cumberhead
Night-time Predicted Noise Levels and Noise Limit



10.73 As can be seen from Charts 10.1 to 10.8 the predicted levels of turbine noise comply with the operational noise criteria for each monitored residential receptor for both daytime and night-time periods. Table 10.7 summarises the significance of the effects at each occupied NSR. The significance of each remaining NSRs can be seen in Appendix 10C.

Table 10.7 Table of Significance

Receptor	Significant?	
	Day	Night
1 - Debog	not	not
2 - Monksfoot	not	not
4 - Darnhunch	not	not
6 - Glespin	not	not
7 - Longhouse	not	not
8 - Low Broomerside	not	not
11 - Parish Holm	not	not
12 - Glenbuck Lodge	not	not
13 - Cumberhead	not	not

10.74 The predicted levels of turbine noise comply with the ETSU-R-97 noise limits for both quiet daytime and night-time at all currently habitable locations.. Therefore the predicted noise levels at occupied NSRs and are **not significant**.

Model Uncertainty & Validation

10.75 The operational noise predictions cannot be validated until the development is built. The modelling is however sufficiently conservative in its assumptions to ensure that any under prediction is unlikely. The model predictions are based on a widely validated prediction algorithm, manufacturer's published data and detailed design layout.

10.76 As can be seen from each noise chart (Charts 10.1 to 10.8), there is sufficient margin (at least 4dB) between the predicted turbine noise levels and derived noise limits to satisfy any concerns regarding the reliability of either the noise data or wind speed data derivation. As noted earlier a sensitivity test was performed based on the alterative approach to the derivation of wind speed data using existing wind data from another wind farm. As the variation between the two approaches was less than 0.5dB, it can be concluded that even though the assessment chose to use an alternative means of deriving wind speed data due to unforeseen technical issues with the temporary met mast, the analysis would still conclude that the ETSU-R-97 noise limits are achieved at all locations.

10.77 As mentioned in paragraph 10.46, a wind shear analysis has not been undertaken. The effects of wind shear would be to move the derived wind varying background noise curve to the left or right of the charts. As wind speeds will generally increase with increasing height the curves shown on the charts would move to the right, i.e. closer to the predicted wind turbine noise levels. From observation of the curves it would take at least a $3ms^{-1}$ shift in the wind speed to have any effect on the noise assessment. This magnitude of wind shear is highly improbable and provides assurance that wind shear effects would not be significant. Wind shear corrections of ~<$1ms^{-1}$ are typical

Low Frequency Noise, Infrasound and Amplitude (Aerodynamic) Modulation

10.78 Low frequency noise, infrasound and amplitude modulation are sometimes cited as adverse effects of operational wind farms. Appendix 10.A explains the potential sources of these effects and considers their significance. In summary, under normal circumstances, the levels of low frequency noise and vibration generated by modern wind turbines are well below both the limits of perception, and recommended exposure limits at the nearest properties.

Decommissioning Effects

10.79 In the same way as for the construction period, it is anticipated that the activities associated with the future decommissioning of the wind farm would be confined to days of the week and hours of working agreed with Council officers through the use of planning conditions. It is unlikely that this activity would lead to any greater disruption, since it is expected that decommissioning of the wind farm will be generally similar to, or quieter than, the construction phase. This is because the activities involved would be broadly similar and the plant used would either be similar or quieter as improvements in plant technology progress in future years.

10.80 A noise assessment would be carried out prior to the start of the decommissioning programme and noise control measures appropriate to the requirements at the time identified and agreed with the appropriate authority.

10.81 Decommissioning noise levels are therefore considered to be **not significant**.

Cumulative Effects

10.82 Potential cumulative effects are considered to occur as a result of the Hagshaw Hill Wind Farm to the east of the site, including its Extension, and the Nutberry Hill Wind Farm to the north of the site. Based on calculations of additional wind turbine noise, the presented noise levels reported in this chapter would not materially change the significance of the identified effects at any of the currently occupied residential dwellings.

Opportunities for Further Mitigation

Construction Phase

10.83 Standard construction measures would be implemented as part of a construction management plan and therefore noise and vibration impacts would be considered at most minor significant, i.e. **not significant**.

Operational Phase

10.84 No mitigation measures are required.

Decommissioning Phase

10.85 A noise assessment will be carried out prior to the start of the decommissioning programme and noise control measures appropriate to the requirements at the time identified and agreed with the appropriate authority.

Summary of Effects

10.86 Potential noise and vibration effects during construction, operation and decommissioning of the proposed wind farm have been assessed.

10.87 Baseline noise levels were measured at four locations representative of the nearest noise-sensitive receptors and turbine noise levels were predicted based on the manufacturer's guaranteed sound power level data for a Vesta V80 2MW turbine (69 and 80m hub height) at nine locations surrounding the proposed wind farm.

10.88 The assessment has been conducted in accordance with The Assessment & Rating of Noise from Wind Farms – The Working Group on Noise from Wind Turbines (Report ETSU-R-97) and guidance on noise and vibration from construction projects.

10.89 During construction, effects at all nearby receptors are **not significant**.

10.90 Noise from operation of the proposed wind farm would comply with the requirements of ESTU-R-97 at all residential locations and will are **not significant**.

10.91 Potential noise and vibration effects during decommissioning of the proposed wind farm have also been assessed as being **not significant**.

Statement of Significance

10.92 Overall, the noise and vibration effects during construction, operation and decommissioning of the proposed Wind Farm are **not significant** under the terms of the Environmental Impact Assessment (Scotland) Regulations.

Appendix 10.A – Wind Turbine Noise

Wind turbine noise is generated by rotation of the turbine blades. This only occurs above the 'cut-in' wind speed and below the 'cut-out' wind speed. Below the cut-in wind speed there is insufficient energy in the wind to generate electricity and above the cut-out wind speed the turbine is automatically shut down to prevent any malfunctions or damage occurring. The cut-in wind speed at turbine hub height is normally around 4 metres per second (ms^{-1}) and the cut-out wind speed is normally around $25ms^{-1}$. The cut-in wind speed of the Vestas V80 is ~$3ms^{-1}$ and cut-out speed is $25ms^{-1}$ (~7mph-56mph).

As the blades rotate in the air, aerodynamic noise is generated, which sounds like a swishing noise. Noise is also produced by the internal machinery, ie gearbox and, to a lesser extent, the generator (mechanical noise). The blades are aerodynamically efficient such they extract the maximum 'turning energy' from the wind, which means that any noise produced is minimised. The hub at the top of the tower is usually insulated to minimise noise radiation from the gearbox, generator and other components. The hub is also isolated from the tower and the blade assembly to prevent structure borne noise occurring, which in turn prevents any vibrations being transmitted to the ground.

The Assessment & Rating of Noise from Wind Farms – The Working Group on Noise from Wind Turbines (Report ETSU-R-97)

In 1993 a working group was established by the DTI to examine the difficulties experienced in applying various noise guidelines to wind farm noise assessments. The ETSU-R-97 report is the result of the group's work and the report is referred to in PPS22, as the methodology by which noise from wind farms should be assessed. The use of ETSU-R-97 is also referred to in PAN45.

In 2007 the Department for Communities and Local Government (DCLG) wrote to all planning authorities in England and the Planning Inspectorate to confirm that the advice in PPS22 and its Companion Guide, that ETSU-R-97 should be used for the assessment and rating of noise from wind farms, is unchanged. In Scotland there are no decisions made by Scottish Ministers in relation to wind farm planning applications which have not applied the ETSU-R-97 assessment procedure or noise limits.

ETSU-R-97 recommends that noise limits should be applied to external locations used for relaxation or where a quiet environment is highly desirable. These limits should be set relative to background noise and should reflect the variation in both the wind turbine source noise and background noise with wind speed. Separate noise limits apply for day-time and for night-time as during the night the protection of external amenity becomes less important and the emphasis should be on preventing sleep disturbance.

Predicted noise levels from a wind farm are compared with criteria based on noise limits specified in ETSU-R-97. The noise limits proposed by ETSU-R-97 are based on the $L_{A90,10min}$, assuming free field conditions. Separate noise limits apply for quiet day-time and night time, as outlined below. Quiet daytime is defined as 18:00 – 23:00 every day, as well as 13:00 – 18:00 on Saturday and 07:00 – 18:00 on Sundays. During these periods, the guidance prioritises the protection of outdoor amenity for residents, by applying noise limits that would not significantly affect the enjoyment of areas such as gardens.

ETSU-R-97 proposes the adoption of a site standard of 5dB $_{LA90,10min}$ above the prevailing wind varying background noise level. This is based on wide experience in environmental acoustics that noise from a new source is unlikely to cause annoyance where the predicted increase is less than 5dB(A) above the existing background. In addition to the limit of 5dB above background, an allowance is included for a fixed limit to be applied at wind speeds or locations where background noise levels are low. Where the quiet daytime background noise level is less than 30-35dB $L_{A90,10min}$, the limit is defined as 35-40dB $L_{A90,10min}$. The quiet daytime limit also applies to all other daytime periods, with the limits based on the quiet daytime background noise level.

Different standards apply at night, where sleep disturbance is the primary concern rather than the requirement to protect outdoor amenity. Night-time is considered to be all periods between 23:00 and 07:00. A minimum limit of 43dB $L_{A90,10min}$ (derived from World Health Organisation Guidelines on noise levels that can cause sleep disturbance) is recommended for night-time at wind speeds or locations where the background noise level is less than 38dB $L_{A90,10min}$. This is significantly relevant to the assessment as in rural areas the background can be significantly quieter at night. Where background noise levels exceed 38dB $L_{A90,10min}$ the limit is set to 5dB above the background noise level.

Low frequency noise

Noise from modern wind turbines is essentially broadband in nature in that it contains similar amounts of noise energy in all frequency bands from low to high frequency. As the distance from a wind farm site increases, the noise level decreases as a result of the geometric spreading-out of the sound energy, but also due to air absorption which increases with increasing frequency. Accordingly, higher frequencies are attenuated more than lower frequencies.

A recent DTI study (2006) measured low frequency noise at three properties. The level of low frequency noise was below the criterion values recommended by Defra (2005). Therefore, low frequency noise levels from wind farms are not significant.

Infrasound

Infra-sound is defined as noise occurring at frequencies below 20Hz, which is considered to be the lowest frequency which is normally audible. In this frequency range, for sound to be perceptible, the amplitude of the sound has to be very high. It is generally considered that when such sounds are perceptible, then they can cause considerable annoyance.

Wind farms have often been cited as significant producers of infra-sound. Old technology wind turbines used to produce an audible low frequency thumping sound. These turbines were known as 'downwind' turbines and were common in the USA. Downwind turbines are configured with the blades downwind of the tower, such that the blades pass through the turbulent wake left in the wind stream by the tower resulting in a regular audible thump, with infra-sonic components, each time a blade passes the tower. Virtually all turbines installed in the UK nowadays, including the Vestas V80, are upwind turbines. In this configuration, the blades are upwind of the tower, such that this 'thumping' effect is eliminated.

A recent study carried out for the DTI (Salford 2005) concluded that:

> *"Infrasound noise emissions from wind turbines are significantly below the recognised threshold of perception for acoustic energy within this frequency range. Even assuming that the most sensitive members of the population have a hearing threshold which is 12dB lower than the median hearing threshold, measured infrasound levels are well below this criterion".*

The study goes on to state that based on information from the World Health Organisation:

> *"there is no reliable evidence that infrasounds below the hearing threshold produce physiological or psychological effects' it may be concluded that 'infrasound associated with modern wind turbines is not a source which may be injurious to the health of a wind farm neighbour."*

Amplitude Modulation of Aerodynamic Noise

It is acknowledged in ETSU-R-97 that all wind turbines exhibit blade swish to a certain extent and that the noise limits specified in those recommendations take this into account without requiring any correction to be applied.

Work carried out recently to investigate the extent of low frequency and infrasonic noise received from three UK wind farms (DTI 2006) concluded that:

> *"the common cause of complaints associated with noise at all three wind farms is not associated with low frequency noise, but is the audible modulation of the aerodynamic noise, especially at night".*

It suggests that:

> *"it may be appropriate to re-visit the issue of aerodynamic modulation and the means by which it should be assessed".*

In 2007 the University of Salford investigated the amplitude modulation of aerodynamic noise (which essentially means 'varying noise level') on behalf of the DTI. The objectives of the study were:

- To establish the levels and nature of the reported noise complaints received across the UK relating to noise issues from wind farms, both historic and current, and determine whether AM is a significant effect;
- To review and understand the level of knowledge/understanding that exists throughout the world on AM, and whether AM can be predicted.

In July 2007 The Department for Business, Enterprise and Regulatory Reform (BERR formerly DTI) stated:

> *"The Salford University study has now been published. The study concluded that although AM cannot be fully predicted, the incidence of AM resulting from wind farms in the UK is low. Out of the 133 wind farms in operation at the time of the study, there were four cases where AM appeared to be a factor. Complaints have subsided for three out of these four sites, in one case as a result of remedial treatment in the form of a wind turbine control system. In the remaining case, which is a recent installation, investigations are ongoing.*

Based on these findings, Government does not consider there to be a compelling case for further work into AM and will not carry out any further research at this time; however it will continue to keep the issue under review. "

The statement concluded that:

> *"Government continues to support the approach set out in Planning Policy Statement (PPS) 22 – Renewable Energy. This approach is for local planning authorities to "ensure that renewable energy developments have been located and designed in such a way to minimise increases in ambient noise levels", through the use of the 1997 report by ETSU to assess and rate noise from wind energy developments."*

Furthermore, there is no compelling evidence to suggest that there are any adverse health effects associated with wind farms.

W/45/00656/00/00 The Measurement of Low Frequency Noise at Three UK Windfarms. Department of Trade and Industry 2006

DEFRA NANR45 Project Report Proposed Criteria for the Assessment of Low Frequency Noise Disturbance Moorhouse A., Waddington D, & Adams M. University of Salford 2005

University of Salford, 'Research into Amplitude Modulation of Wind Turbine Noise'. April 2007, NANR233

Appendix 10.B – Noise Modelling and Assessment Details

There is no wind farm specific British or International Standard which prescribes the method to calculate wind turbine noise emissions.

However, it is accepted by UK acoustic consultants that wind farm noise is calculated according to ISO 9613-1 and ISO 9613-2 "Acoustics – Attenuation of sound during propagation outdoors". Although there are other sound propagation methodologies, the ISO is regarded as a very useful tool when calculating sound emission levels.

Due to the complexity of the equations contained within parts 1 and 2 of the ISO, it is standard practice to undertake these calculations using commercially available computer modelling software programmes. These programmes are fully quality assured and assuming that the correct input data is used then the results are highly unlikely to be subject to any user generated errors.

Parts 1 and 2 of ISO 9613 are incorporated within SoundPLAN sound modelling software. SoundPLAN was used to generate the Scheme's turbine sound levels at the identified sites and to produce noise contour maps.

Wind Turbine Modelling

As with any noise modelling exercise there are a number of potential constraints which will influence the accuracy/uncertainty of any calculated sound levels and these are discussed below.

The ISO provides calculation procedures for the following physical effects:

- Geometric divergence (A_{div}) - reduction in sound level due to distance - (not frequency dependent)
- Atmospheric absorption (A_{atm}) - absorption of sound by the air (frequency dependent)
- Ground effect (A_{gr}) - absorption of sound by the ground (frequency dependent)
- Reflection from surfaces (not frequency dependent, rarely employed for wind farms)
- Screening by obstacles (A_{bar}) - shielding by a feature or the ground, this causes a reduction in the noise level (frequency dependent)
- Miscellaneous effects (A_{misc}) - such as propagation through trees.

These effects are combined with the sound power level of the turbine (Lw) in the following equation to derive the sound pressure level (Lp) for each turbine.

$$Lp = Lw - (A_{div} + A_{atm} + A_{gr} + A_{bar} + A_{misc})$$

For the purposes of modelling, a wind turbine is considered to have a singe emission point, the hub of the turbine. Within SoundPLAN the turbines are modelled as an industrial point source at the hub height of the proposed turbines and single spot receivers are used to calculate the combined turbine noise levels at the closest NSRs. There are no corrections for the directivity of the sound emitted from the turbine.

The SoundPLAN model does not take into account the shielding effects of barriers or buildings or miscellaneous effects such as the influence of sound propagation through foliage.

Manufacturer's guaranteed noise emission data has been used in the prediction process and are summarised below. For the purposes of this assessment, the Vestas V80 model does not require a tonal penalty under the requirements of ETSU-R-97.

Vestas V80 2MW – Manufacturer's Noise Data

Windspeed / ms^{-1}	6	7	8	9
L_{WA} / dB	103.6	104.8	105.2	105.3

Dated taken from test report dated 23rd May 2001 for a 68m hub height turbine

The sound power levels are based on the assessment approached stated in International Standard IEC-61400-11 Wind turbine generator systems – Part 11: Acoustic noise measurement techniques. The Standard enables the overall A-weighted sound power and one-third octave band spectrum to be obtained at normalised integer wind speeds. It also enables the directivity and the tonality of the noise emission to be determined.

Assessment Assumptions

The assessment was based on the methodology specified in ISO 9613. Conservative assumptions have been made in the modelling process and it is more likely that the model will over-predict than under-predict noise levels. The assumptions made were:

- Air Pressure = 1013.25 mbar;
- Relative Humidity = 70%;
- Temperature = 10°C;
- Semi-Hard-ground attenuation occurred between the turbines and the NSRs (G=0.5);
- Manufacturer's guaranteed sound power level data together with a 1dB(A) safety factor for normal power operating mode;
- One-third octave band frequency spectra has been used in the calculations;
- Day time calculation height of 1.5m to represent outdoor amenity areas;
- Night time calculation height of 4.0m to represent first floor bedroom windows; and
- Calculation locations were considered to be representative of the most exposed façade of the property, i.e. the closest façade to the wind farm.

Possible uncertainties in the modelling approach may arise from the use of the ground effect methods in section 7.3 of ISO9613-2. The ISO suggests two methods:

- Method 1 - spectral dependent term and is applicable to ground which is generally flat, either horizontally or with a constant slope.
- Method 2 - applicable to ground surfaces of any shape but is only used when the overall sound pressure level is of interest, i.e. not spectral dependent.

Method 1 was used to derive the wind turbine noise levels presented within the ES assessment since the ground is generally sloping with no significant changes in elevation across the sites and spectral data was available for the turbine sound levels.

The ISO 9613 method predicts noise levels likely to occur under conditions favourable to noise propagation, i.e. downwind or under a moderate ground-based temperature inversion that may occur at night. Additional meteorological conditions, as described in ISO 9613, were not considered further as charts in ISO 9613 show there is negligible change to the noise level and during extreme meteorological conditions background noise levels would raise inline with the turbine noise.

Site Specific Issues

In addition to the potential uncertainties that may be introduced by means of calculating the wind turbine noise level, there may also be uncertainties introduced by the method of deriving the location specific wind varying background noise level.

Appendix C of ETSU-R-97 provides commentary on the measurement of background noise data and the use of regression analysis to derive the prevailing wind varying background noise level. ETSU-R-97 notes that care must be taken when deriving background noise levels at the extremes of the data, i.e. at the low and high wind speed ends of the data. The situation could arise that at low wind speeds the derived line increases with decreasing wind speed or similarly the derived line decreases with increasing wind speed. These two situations are counterintuitive, i.e. the data should level off at the extremes of the data. Therefore the choice of regression analysis is important and it is often appropriate to use a combination of linear, 2nd or 3rd order polynomial 'data-fits' to ensure the highest correlation and most sensible regression analysis.

ISO 9613-2, Acoustics - Attenuation of Sound During Propagation Outdoors. International Organization for Standardization, 1996

Manufacturer's Datasheet Extract for Vestas V80 SMW

944484.R0

Date 2001-05-17 Page 1 of 2

Summary of analysis of results, in accordance with IEC 61400-11, of the noise emission measurement on the wind turbine

WINDTEST
Kaiser-Wilhelm-Koog GmbH

Vestas V80–2.0 MW OptiSpeed™ "105.1 dB" at Sörup

Wind turbine technical data:

Type: ..... Vestas V80–2.0 MW OptiSpeedTM "105.1 dB"
Manufacturer: ..... Vestas
Turbine serial number: 11900,0
Rated power:: ..... 2.000 kW
Hub height above ground: ..... 68,0 m
Hub height above top of foundation: ..... 67,0 m
Turbine control/power limiting: ..... OptiSpeed™ and OptiTip™
Tower type: ..... conical steel
Rotor diameter: ..... Vestas
Rotorblatttyp: ..... Vestas 39m
Rotorblattseriennummern: 24006, 24008, 24009
Rotordurchmesser: ..... 80,0 m
Rotor axis (horizontal/vertikal): ..... horizontal
Rotor (upwind/downwind): ..... upwind
Number of rotor blades: 3,0
Rotor speed (range): ..... 8,57-16,74 /min
Rotor speed at reference wind speed (8 m/s at 10 m height, roughness class 2) ..... 16,74 /min
Rotor speed at rated power ..... 16,74 /min
Gearbox manufacturer: ..... Lohmann & Stolterfoht
Gearbox type: ..... GPV 440
Gearbox serial number: 3040,0
Generator manufacturer: ..... Weier
Generator type: ..... Weier 2MW
Generator serial number: 3040,0
Generator speed: 860-1680
Generator power output: ..... 2 MW

Measurement geometry:

Measurement distance R_0: ..... 107,0 m
Height of foundation h_F: ..... 1,0 m
Height of microphone h_A: ..... 0,0 m
Horiz. distance rotor centre to tower axis. d: ..... 4,5 m

Measurement conditions:

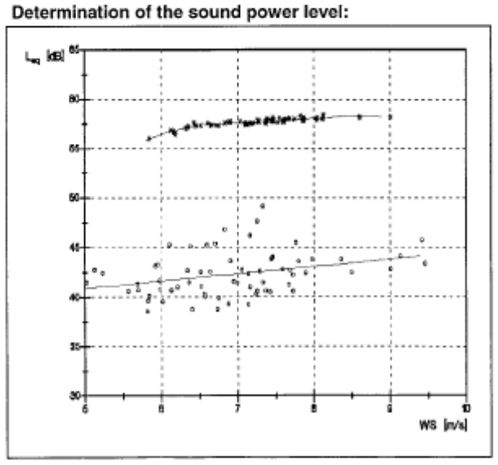
Date(s) of measurements: ..... 2001-01-22 / 23
Wind speed measured at a height of 10 m, 1-min-averages, WS_{10m}: ..... 3.7 – 13.2 m/s
Wind direction: ..... S on 22-01, SE on 23-01
Real elec. power, 1-min-avg, $P_{e\,real}$: ..... 400-2000 kW
Atmospheric air pressure p_{atmos}: 1006 hPa on 22-01, 996 hPa on 23-01
Atmospheric air temperature T_{atmos}: 1 C on 22-01, 3 C on 23-01
Atmospheric air humidity: ..... 70 % rel.

Power curve*:

From report:
Testing Authority: (berechnet)
Measurement Period:

WS (m/s)	Power (kW)	WS (m/s)	Power (kW)	WS (m/s)	Power (kW)
1,0	0,0	10,0	1279,0	25,0	2000,0
4,0	44,1	11,0	1590,0		
5,0	135,0	12,0	1823,0		
6,0	261,0	13,0	1945,0		
7,0	437,0	14,0	1988,0		
8,0	669,0	15,0	1998,0		
9,0	957,0	16,0	2000,0		

Determination of the sound power level:



Wind speed at 10m height (m/s)	L_{Aeq} (dB)	L_R (dB)	$L_{Aeq,c}$ (dB)	L_{WA} (dB)
6,0	56,4	41,6	56,3	103,6
7,0	57,6	42,4	57,5	104,8
8,0	58,1	43,1	57,9	105,2
9,0	58,2	43,9	58,0	105,3
9,1**	58,1	43,9	57,9	105,2

Graph key
* = One minute averages of total noise measured (background noise plus turbine noise)
o = One minute averages of background noise only

Appendix 10.C – IMPACT ON UNOCCUPIED PROPERTIES

Potential noise sensitive residential properties were identified from examination of 1:25,000 OS mapping, from which it was assumed all buildings to be occupied dwellings. After closer inspection using aerial photography, site inspections and websites, a number of properties were identified as being unoccupied and some were in ruins as noted in Photos 1 and 2.

Accordingly, noise levels have been calculated using SoundPLAN at the four identified unoccupied NSRs over the range of wind speeds provided in Table 10.4 of the main ES chapter. The results are shown below

Vestas V80 2MW - Predicted Turbine Noise Levels (all turbines)

Receptor	Noise Level $L_{A90,10min}$ / dB			
	Wind speed / ms^{-1}			
	6	7	8	9
3 - Glenbuck Home Farm	36.4	37.6	38.0	38.1
5 - South Bankend	33.4	34.6	35.0	35.1
9 - High Broomerside	36.5	37.7	38.1	38.2
10 - Monkshead	45.4	46.6	47.0	47.1

The table below summarises the numerical data for the uninhabited properties.

Table 10.6 Predicted Operational Noise Levels and Noise Limits

Receptor	Factor	Wind Speed at 10 m Height (ms^{-1})			
		6	7	8	9
		Noise Level (dB $L_{A90, 10mins}$)			
3 - Glenbuck Home Farm (based on receptor 12)	Quiet Daytime Limit	49	51	52	54
	Night-time Limit	51	52	53	53
	Predicted Noise Level Turbine	36	38	38	38
5 - South Bankend	Quiet Daytime Limit	35	36	38	40
	Night-time Limit	43	43	43	43
	Predicted Noise Level Turbine	33	35	35	35
9 - High Broomerside	Quiet Daytime Limit	35	36	38	40
	Night-time Limit	43	43	43	43
	Predicted Noise Level Turbine	37	38	38	38
10 - Monkshead	Quiet Daytime Limit	35	36	38	40
	Night-time Limit	43	43	43	43
	Predicted Noise Level Turbine	45	47	47	47

The significance of the findings is outlined in the following table.

Table of Significance

Receptor	Significant?	
	Day	Night
3 - Glenbuck Home Farm	not	not
5 - South Bankend	not	not
9 - High Broomerside	yes	not
10 - Monkshead	yes	yes

At Monkshead significant effects are considered to occur during both the daytime and night-time for all wind speeds assessed. However, this property is currently uninhabited and unsuitable for future occupancy.

At High Broomerside significant effects are considered to occur during the quiet daytime and only for winds speeds below $9ms^{-1}$. This property is in ruins.

Photo 1 - South Bankend Ruins – Copyright of geograph.org.uk

Photo 2 – Monkshead

Chapter 11 - Traffic and Transport

Introduction

11.1 This chapter identifies and assesses the potential access, traffic and transport effects of the construction and operation of the proposed Galawhistle Wind Farm. It also identifies the routes proposed for the transportation of wind turbine components and construction materials.

11.2 Specifically, this chapter considers the:

- Physical effects of the proposed Galawhistle Wind Farm on the public road infrastructure; and
- Potential environmental effects of the proposed Galawhistle Wind Farm that may arise from construction traffic passing through towns and villages.

11.3 The chapter concludes by assessing the significance of the projected traffic increases in the light of recognised thresholds of significance.

Key Issues

- Access route for abnormal loads;
- Access route for construction vehicles;
- Locations of sensitive receptors on access routes to the site;
- Impact of construction traffic on the local highway network; and
- Proposed mitigation measures to minimise environmental impacts.

Methodology

Consultations

11.4 Consultations in relation to the proposed access route for abnormal loads were undertaken with the following authorities to agree the principle of the proposed access route to the site:

- Transport Scotland;
- Jacobs on behalf of British Rail Residuary;
- South Lanarkshire Council; and
- Ayrshire Council.

11.5 These consultations confirmed that the proposed route is acceptable to these authorities.

11.6 Figure 11.1 illustrates the proposed traffic routes.

Legislation and Guidance

11.7 Chapter 4 (Planning and Renewable Energy Policy Context) provides a detailed description of the planning and renewable energy policy context relevant to the application. The transport and traffic issues described in the following planning advice and guidance documents have been taken into account in this assessment:

- Scottish Planning Policy Guideline (SPPG) 17: Planning for Transport;
- Planning Advice Note (PAN) 75: Transport and Planning; and
- Guidelines for the Environmental Assessment of Road Traffic, Institute of Environmental Assessment, 1993.

Scottish Planning Policy (SPP) 17: Planning for Transport

11.8 Paragraphs 72 and 73 note:

Safe and appropriate access design should reflect the type of road involved, the scale of the development, the nature of the area, and the volume and character of traffic likely to use both the road and access. Direct access on to strategic roads should be avoided as far as practicable.

Following full Transport Assessment, the residual traffic impact of developments on the strategic road network should be mitigated to achieve "no net detriment" to the flow and safety of traffic on the network. It will be appropriate to require the developer to fund major road or junction improvements where the volume or character of traffic or type of road warrant it.

PAN 75: Planning for Transport

11.9 Paragraphs 40 and 41 state:

SPP17 requires a transport assessment to be produced for significant travel generating developments. Transport Assessment is a tool that enables delivery of policy aiming to integrate transport and land use planning…

All planning applications that involve the generation of person trips should provide information which covers the transport implications of the development. The level of detail will be proportionate to the complexity and scale of impact of the proposal…

Guidelines for the Environmental Assessment of Road Traffic, Institute of Environmental Assessment, 1993

11.10 The 'Guidelines for the Environmental Assessment of Road Traffic[1] produced by the Institute of Environmental Management and Assessment (IEMA 1993) (the IEMA Guidelines) are referred to throughout this assessment of the potential traffic and transport issues. The IEMA Guidelines suggest two broad rules can be used as a screening process to identify the appropriate extent of the assessment area, as detailed in paragraph 11.15.

Baseline Studies

11.11 A route access study, including a visual route assessment, was undertaken to determine the most suitable access route for abnormal loads and access point to the site to be identified. A subsequent desktop study enabled suitable access routes for Heavy Goods Vehicles and associated study area to be defined. As discussed in paragraph 11.4, the proposed abnormal load route has subsequently been consulted on and agreed as appropriate with the relevant structural authorities.

11.12 Baseline traffic flows and personal injury accident data along the routes within the study area were obtained from South Lanarkshire and East Ayrshire councils and reviewed in order to consider the effect of construction vehicles on road capacity and road safety. This data has

[1] Institute of Environmental Assessment: Guidance Notes No.1 – Guidelines for the Environmental Assessment of Road Traffic (1993)

been growthed in order to reflect the traffic conditions during the proposed construction period (2012).

11.13 A schedule for the construction of the Wind Farm is presented in Chapter 3 (Project Description). Table 11.5 outlines the vehicle trips that are expected over the 14 month construction period. The vehicle trips associated with the construction and operation of the proposed wind farm were assigned to the road network and an assessment of the impacts made based on the appropriate traffic assessment guidance. As there is no set guidance on or rules to determine for example, delay and intimidation, professional judgment and experience have been applied.

11.14 In addition to construction workers, HGVs and cranes, abnormal loads carrying wind turbine components and foundation inserts will access the site. In order to reduce congestion and delays on the road network, Transport Scotland advise that, where appropriate, abnormal loads requiring Special Orders should utilise the nearest suitable water port. King George V port in Glasgow is suitable for the expected turbine components.

Assessment of Significance

11.15 The IEMA Guidelines for the Environmental Assessment of Road Traffic suggest that two broad rules of thumb can be used as a screening process to delimit the scale and extent of the assessment. These are:

- Rule 1 - Include highway links where traffic flows will increase by more than 30% (or the number of HGVs will increase by more than 30%);
- Rule 2 - Include any other specifically sensitive areas where traffic flows will increase by 10% or more[2].

11.16 These guidelines are intended for the assessment of the environmental impact of road traffic associated with major new developments and are more pertinent to the operational phase of the wind farm than the construction phase. However, in the absence of other guidance they are used here to assess the short term construction phase.

11.17 The IEMA guidelines identify general thresholds for traffic flow increases of 10% and 30%. Where the predicted increase in traffic flows is lower than the thresholds, the guidelines suggest the significance of the effects can be stated to be low or insignificant and further detailed assessments are not warranted. However, to ensure a relative assessment in environmental terms the following criteria outlined in Table 11.1 is used.

Table 11.1 Significance Criteria

Change in Traffic Flow	Significance
Change in total traffic or HGV flows over 90%	Substantial
Change in total traffic or HGV flows of 60 - 90%	Moderate
Change in total traffic or HGV flows of 30 – 60%	Minor
Change in total traffic or HGV flows of less than 30%	Negligible

Note: Sensitive locations are defined as receptors sensitive to traffic for example hospitals, churches, schools, historical buildings (Paragraph 2.5 IEMA Guidelines, 1993)

11.18 The following categories of significance criteria have been used:

[2] IEMA Guidelines Paragraph 3.20 defines sensitive areas as including "accident blackspots, conservation areas, hospitals, links with high pedestrian flows etc."

Table 11.2 Categories of Receptors

Magnitude of Impact	Significance
Substantial	Receptors of greatest sensitivity to traffic flows: schools, colleges, playgrounds, accident blackspots, retirement homes, urban / residential roads without footways that are used by pedestrians.
Moderate	Traffic flow sensitive receptors including: congested junctions, doctors' surgeries, hospitals, shopping areas with roadside frontage, roads with narrow footways, un-segregated cycleways, community centres, parks, recreation facilities.
Minor	Receptors with some sensitivity to traffic flow: places of worship, public open space, nature conservation areas, listed buildings, tourist attractions and residential areas with adequate footway provision.
Negligible	Receptors with low sensitivity to traffic flows and those sufficiently distant from affected roads and junctions.

11.19 The magnitude of change and the sensitivity of the receptor are then compared to determine significance.

Table 11.3 Determination of Significance of Effects

Sensitivity of Receptor	Magnitude of Impact			
	Substantial	**Moderate**	**Minor**	**Negligible**
Substantial	Substantial	Substantial	Moderate	Minor
Moderate	Substantial	Moderate	Minor	Negligible
Minor	Moderate	Minor	Negligible	Negligible
Negligible	Minor	Negligible	Negligible	Negligible

Baseline Description

11.20 This section considers the proposed access routes to the Wind Farm and examines the existing road conditions along the routes. Baseline conditions have been established through visual route inspections during April and November 2008 and desktop studies during July 2009.

Proposed Routes

11.21 It is envisaged that all abnormal loads and all construction deliveries are likely to access the site from the M74 at junction 11. This traffic will then proceed south along B7078 and west along the A70 to the site entrance at OS Grid ref: NS 72560 28380. Alternative routes for abnormal loads are also being investigated.

11.22 The majority of construction personnel are expected to be employed from the local area, and where employed further afield, personnel would typically stay in the local area during construction, and therefore construction personnel will access the site via a number of routes:

- Route 1 - from M74 (as described above);
- Route 2 - from the north via the B743 from Strathaven and the A70;
- Route 3 - From the west via the B743 from Nethershield and the A70; and
- Route 4 - from the southwest via the A70 from Cumnock.

11.23 The proposed routes are illustrated by Figure 11.1.

Road Traffic Accident Data Record

11.24 To enable an assessment of the existing road safety record of the access routes to the site, road traffic accident data was obtained for the most recent available 3 year periods from South Lanarkshire and East Ayrshire councils.

11.25 The road traffic accident data obtained indicated that a total of 62 road traffic accidents occurred on the access routes to the site during the study period. No significant clustering of accidents was indicated by the data; however, as expected, more accidents occurred on the more highly trafficked A70. Eight of the 62 accidents involved vulnerable road users and nine involved HGVs. Given the size of the study area, it is concluded that there are no inherent road safety problems on the routes to be used to access the site

Sensitive Receptors

11.26 A desktop assessment was carried out to identify potential sensitive receptors on the proposed access route, through examination of Ordnance Survey 1:50,000 and 1:25,000 maps.

11.27 Sensitive receptors are found on all routes accessing the site within the traffic study area, including:

- Residential areas of Cumnock, Muirkirk, Sorn, Douglas and Smallburn;
- School to northwest of A70 at Douglas;
- School to north of A70 near Glespin;
- School to north of A70 at Muirkirk; and
- School on entry to Cumnock from northeast.

Baseline Traffic Counts

11.28 Traffic flow data was obtained for the four Assessment Point locations shown in Figure 11.1. East Ayrshire Council provided survey data from 2009 for Assessment Points 1 and 4. In line with the IEMA guidance, the traffic flows have been extrapolated into 12 hr Annual Average Weekday Traffic (AAWT) flows. Data for Assessment Points 2 and 3 was collected during the period 24 August – 2 September 2009.

11.29 Although some construction is expected to take place between the hours of 0900 and 1200 on Saturdays, this is not expected to generate significant traffic and the assessment is therefore based around a 5 day week. This is considered to be a more robust and thus worst case assessment, as the traffic is condensed into five days instead of six.

11.30 Due to limitations with the data, the traffic flows for Assessment Point 4 (the A70, southwest of its junction with the B743) has been factored from 24 hour flows to 12 hour flows. This factor is based upon data of the A70 East of the site (Assessment Point 1). This has the effect of lowering the baseline traffic flows and therefore the calculated percentage increase in traffic flows associated with the construction of the windfarm will be greater, thus representing a worst-case scenario.

11.31 The baseline 2009 data was subsequently growthed to provide baseline traffic flows for 2012 (the proposed year of construction) using National Road Traffic Forecast 1997 (NRTF) low growth factors. By using low growth factors, the assessment represents a worst-case scenario as the baseline traffic flows are kept to a minimum and therefore the addition of the construction traffic will again result in a greater percentage increase. NRTF predicts a growth factor of 3.5% for the period of 2009-2012. These traffic flow data are shown in Table 11.4.

Table 11.4: Two-way 12 hr AAWT Baseline Traffic Counts

Assessment Point	Location	Total Flows (vehicles)	
		AAWT (2009)	Predicted AAWT (2012)
1	A70 West of Douglas	2373	2456
2	B743 at Dungavel Hill	566	586
3	B743 East of Limmerhaugh	1130	1169
4	A70 Northeast of Lugar	4237	4385

Assessment of Effects

Construction effects

11.32 During the 14 month construction phase, the following traffic will access the site:

- Low loaders and HGVs, to deliver plant and equipment to the site;
- 20-tonne trucks, to deliver sand for cable trenches;
- Flat-bed trucks, to deliver cables, substation components and building materials;
- Semi-low extendable trailers, to deliver turbine components and the substation transformer (requiring police escort);
- Cranes, delivered as mobile units and on low-loaders;
- Deliveries of fuel by tanker; and
- Construction personnel, by light vehicles (private cars and small vans).
- Either 8m^3 mixer trucks of ready mixed concrete in the event concrete batching is not undertaken or 30 tonne bulk powder tankers for cement and 20 tonne trucks of aggregate and sand if batching undertaken.

11.33 Table 11.5 outlines the predicted traffic levels associated with the construction of the wind farm.

Table 11.5 Monthly Construction Traffic Movements

Movement	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14
Concrete Movements (HGVs)	6	6	19	457	457	460	460	460	9	6				
Steel Movements (HGVs)				33	33	33	33	33						
Cable Movements (HGVs)		94	94	94	94				47	47				
Other Movements (HGVs)	108	40	42	40	40	65	65	65	79	40	296	296		54
Project Management (Cars & LGVs)	120	164	164	164	164	164	164	164	164	162	162	162	162	102
Balance of Plant – Civils (Cars & LGVs)	348	348	348	428	428	508	408	408	210	110	94	94	54	54
Balance of Plant - Electrical (Cars & LGVs)		8	16	16	16	4	16	16	16	16				
Grid Substation (Cars & LGVs)		770	770	770	770	770	770	770	770	770				
Wind Turbine Supply (Cars & LGVs)										30	360	360	200	40
Total	583	1,431	1,453	2,003	2,003	2,005	1,917	1,917	1,295	1,182	912	912	416	250

Table 11.6 Daily Total Construction Traffic Movements

Route	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	Max
Route 1 - HGV Movements + Abnormal Loads + Staff Movements	12	23	24	48	48	46	45	45	21	18	23	23	5	5	48
Route 2 - Staff Movements	6	16	16	17	17	18	17	17	15	14	8	8	5	2	18
Route 3 - Staff Movements	6	16	16	17	17	18	17	17	15	14	8	8	5	2	18
Route 4 - Staff Movements	6	16	16	17	17	18	17	17	15	14	8	8	5	2	18

Notes: HGV movements include Abnormal Loads. All stone to be sourced on-site. Assumes that ready mix concrete will be delivered to the site.

11.34 Table 11.6 summarises the total construction traffic movements per day on each route used to access the site based on an assumed 20 day working month. It is possible that some construction delivery traffic will route from the west, via route 4. However, to provide a robust assessment, all construction traffic has been routed along route 1.

Cumulative Effects

11.35 The Ponesk Remainder Open Cast Coal Site (OCCS) is located immediately adjacent to the proposed Galawhistle Wind Farm site. A planning application is currently under way to enable coal extraction operations at this site.

11.36 If planning permission is granted the proposed operations would produce ten trips per hour over a three year period, possibly coinciding with the construction of Galawhistle wind farm. Assuming that the development will be operational for 12 hours per day, this equates to 120 trips per day. These trips are anticipated to occur between the Ponesk Remainder site and the Killoch Rail Disposal Point to the west. This traffic has therefore been taken account of in the assessment of the traffic impact at assessment site four.

11.37 Table 11.7 shows the traffic impact of the proposed development during its peak.

Table11.7 Traffic Impacts

Assessment Location	2012 12hr AAWT	Galawhistle Wind Farm related traffic	Ponesk OCCS related traffic	% impact
Site 1 - A70 West of Douglas	2,456	48	-	1.95
Site 2 - B743 at Dungavel Hill	566	18	-	3.18
Site 3 - B743 East of Limmerhaugh	1,169	18	-	1.54
Site 4 - A70 Northeast of Lugar	4,385	18	120	3.15

11.38 Table 11.7 shows that none of the sites assessed will encounter an increase in traffic of more than 10% during construction of the proposed development. As discussed above, the IEMA's Guidelines for the Environmental Assessment of Road Traffic suggest that environmental impact should be assessed at locations in the vicinity of sensitive receptors if the level of traffic is to increase by more than 10%. It is therefore not considered necessary to fully assess the environmental impacts of the traffic generated by the construction phase of the proposed development.

11.39 It is also worth noting that the abnormal load wind turbine deliveries will be limited to a two month period (months 11 and 12) and it is anticipated that the delivery of the sub-station transformer will occur in months 8 or 9, thereby minimising the duration of the effects associated with the movement of these large components.

11.40 Despite the low levels of traffic associated with the proposed development, some environmental impacts will arise from the transportation of deliveries to the site, particularly the abnormal loads movements associated with the transportation of the wind turbine components. These include:

- Noise;
- Vibration;
- Driver delay;
- Pedestrian delay; and
- Fear and intimidation.

11.41 The magnitude of these impacts will be mitigated through traffic management in agreement with East Ayrshire Council. This is outlined in the mitigation section below.

Operational effects

11.42 During the operational phase of the development, it is not envisaged that there will be permanent staff based on the site. There will be LGV and HGV movements associated with the maintenance of the wind turbines; however these movements will be infrequent and low in number. It is therefore not considered necessary to assess the environmental impacts of the traffic generated by the operational phase of the proposed development.

Decommissioning effects

11.43 Prior to decommissioning a further traffic assessment will be carried out and traffic management procedures agreed with East Ayrshire Council, South Lanarkshire Council and the emergency services. The levels of traffic associated with decommissioning are however likely to be lower than those required during construction.

Mitigation

11.44 A transport management plan will be drawn up and agreed with East Ayrshire and South Lanarkshire Council's Transportation Department, providing the following information:

- Restrictions and approved access routes;
- Removal and replacement of street furniture such as bollards and handrails and road signs;
- Arrangements with Police or suitable alternative for escort of turbine loads from Port of Entry;
- Signage warning other users of turbine movements;
- Ground preparation including protection of services and lowering of pavements;
- Arrangements for road maintenance and cleaning;
- Timing of deliveries;
- Arrangements for parking restrictions along access route;
- Road maintenance and cleaning; and
- Wheel cleaning arrangements.

11.45 A police escort or suitable alternative will accompany movement of turbine components from port of entry with timings agreed with the local highway authorities.

11.46 Turbine components will be transported via the approved transport route shown in Figure 11.1. This route was selected in order to minimise road upgrades and improvements required.

11.47 In order to mitigate the need for construction traffic to use the local highway network, it is envisaged that rock will be sourced from on site borrow pits (as shown in Figure 1.2) This removes many of the trips associated with the construction phase of the proposed Wind Farm from the routes used to access the site.

11.48 In order to further reduce traffic impacts from construction of the proposed Wind Farm, construction personnel will be encouraged to car-share where practicable.

Residual Effects

11.49 The mitigation measures described above and the short term increase in traffic will ensure that there will be minimal residual environmental impact. This is justified by the:

- Relatively low level of traffic generated by the proposed development during both the construction and operation phases;
- Surrounding highway network having sufficient capacity to cater for the predicted levels of construction and operational traffic;
- Increase in site traffic will be short term with the highest levels concentrated during months 4-6 and on the route proposed for construction deliveries; and
- Effects associated with the operational phase are not significant.

Summary of Effects

Table 11.8 Summary of potential effects and mitigation measures

Potential Effect	Mitigation	Residual Effect
Construction		
Increase in traffic on the access routes to the site	Traffic management	Negligible
Potential traffic delays by abnormal loads on the A70	Abnormal loads to be escorted. Timings to be agreed with East Ayrshire Council, South Lanarkshire Council, and Strathclyde Police. Traffic Management Plan.	Negligible and temporary
Increased risk of accidents and impact on road safety	Abnormal load and construction movements to be restricted to outside of peak traffic hours. Traffic Management Plan.	Negligible and temporary
Operation		
Increased risk of accidents and impact on road safety	None required	Negligible and temporary
Potential replacement of large turbine components	Transport arrangements and mitigation measures to be agreed with East Ayrshire Council, South Lanarkshire Council, and Strathclyde Police.	Negligible and temporary
Decommissioning		
As construction impacts, but likely to be of lower magnitude	Traffic management plan to be prepared and agreed with East Ayrshire Council and South Lanarkshire Council prior to decommissioning	Negligible

Statement of Significance

11.50 In accordance with the IEMA significance criteria, this traffic assessment of the construction phase concludes that there will be a temporary increase in HGV traffic of **negligible significance** on the routes used to access the proposed Wind Farm. These increases are associated with construction of the Wind Farm only and will only occur over a period of 14 months. The busiest period of construction will be during months 4-6.

11.51 Mitigation measures during the construction phase will include the timing of abnormal load deliveries during off-peak periods in order to avoid delays to other road users and will be escorted by the police.

11.52 Traffic generated during the operation and maintenance of the wind farm is minimal and will be **not significant.**

11.53 Traffic generated during decommissioning of the Wind Farm is likely to be lower than the levels associated with construction and will be subject to a further traffic assessment, agreed with East Ayrshire and South Lanarkshire Councils.

Chapter 12 – Socio-economics, Tourism and Land use

Introduction

12.1 This assessment will follow the four stage systematic approach for all technical assessments as outlined in Chapter 2 (Approach to EIA):

- Description of baseline conditions - using scoping and further consultation responses, detailed desk studies and a site visit.
- Identification and assessment of potential environmental impact - through consultation with relevant statutory and non-statutory bodies and evaluation of relevant and updated legislation and guidance relevant to the development (including evaluation of the significance of the impact);
- Identification of mitigation measures - in this case no monitoring is considered necessary due to the impact being identified as of minor significance; and
- Proposed monitoring - in this case no monitoring is considered necessary due to the impact being identified as of minor significance.

12.2 For clarity of presentation, the four stages outlined above are dealt with separately for each of the three topics in this assessment: socio-economic, tourism and landuse. There is a summary table at the end of the chapter which brings together all three topics.

12.3 Detailed analysis of the impacts on landscape and visual aspects, cultural heritage, noise and traffic is contained within other chapters and therefore not covered here.

Key Issues

12.4 The main issues raised were the following:

- Developer contributions to the local community;
- Possible disruption to the River Ayr Way during construction;
- The A70 is the main tourist route into East Ayrshire from the M74; and

Methodology

12.5 This assessment will involve the following:

- Detailed desk studies and a site visit to establish the baseline conditions of the Galawhistle Wind Farm site;
- Review of relevant legislation and guidance;
- Consultation with relevant statutory and non-statutory bodies;
- Description and evaluation of relevant and updated legislation and guidance relevant to the development;
- Description of the potential effects of the proposed wind farm and the effects these could have on tourism, recreation and the socio-economic environment;
- Evaluation of the significance of these effects by consideration of the sensitivity of the wind farm site and the potential magnitude of these effects;
- Identification of possible measures to avoid, and mitigate against, any potential adverse effects resulting from this development; and
- The residual significance of the potential effects following mitigation.

Consultations

12.6 As part of the scoping exercise and additional consultation a number of national and local groups were consulted, as listed in Chapter 2 (EIA Process). In relation to tourism, socio-economics and land-use issues these were:

- South Lanarkshire Council;
- East Ayrshire Council;
- Visit Scotland;
- Scottish Natural Heritage;
- Scottish Rights of Way and Access Society;
- British Horse Society;
- Muirkirk Angling Association;
- Clyde River Foundation; and
- Sustrans.

Socio- economics

Legislation and Guidance

12.7 There is no specific legislation applicable to socio-economic impact so this assessment follows the methodology of Economic Impact Analyses which measure the cumulative impact of a development on the economy. Information sources such as wind farm opinion surveys are used in this chapter as guidance. In addition, the policies relevant to socio-economics are detailed in Chapter 4 (Planning and Renewable Energy Policy Context)

Baseline Description

Population

12.8 The majority of the site is located in South Lanarkshire and the rest of the site is located in East Ayrshire. In the 2001 national census, South Lanarkshire has a population of 302,216 - 6.0% of the national population - which increased by approximately 7,250 people to 309,500 by 2007[1]. This increase was in line with the national increase. In the 2001 national census, East Ayrshire had a population of 120,235; 2.4% of the national population. The population decreased by 635 people to 119,600 by 2007[2], and relatively to 0.1% less of the national proportion than 2001.

12.9 South Lanarkshire covers approximately 1,772 km^2 and therefore the population density is 175 per km^2. East Ayrshire covers approximately 1,262 km^2 and therefore the population density is 95 per km^2 (only one third denser than the national average of 64 per km^2 which includes the sparsely inhabited areas in the north of Scotland).

12.10 Muirkirk, approximately 6.1km to the west of the site in East Ayrshire and the largest settlement in the vicinity, had a total population of 1,181 in the 2001 national census[3].

[1] https://www.nomisweb.co.uk/reports/lmp/la/2038432149/report.aspx
[2] https://www.nomisweb.co.uk/reports/lmp/la/2038432129/report.aspx
[3] http://www.scrol.gov.uk/scrol/browser/profile.jsp?profile=Employment&mainLevel=Locality&mainText=muirkirk&mainTextExplicitMatch=false&compLevel=CountryProfile&compText=&compTextExplicitMatch=null

12.11 Other than Muirkirk, other settlements in close vicinity of the Wind Farm site include:

- Coalburn, approximately 4.5km north east of the site and within the administrative area of South Lanarkshire Council, with a population of 1,247[4]; and
- Douglas, approximately 5.1km east of site and within the administrative area of South Lanarkshire Council, with a population of 1,676[5].

Employment

12.12 In the 2001 national census, Muirkirk had 6.6% unemployment[6], over 2.5% greater than the national average. East Ayrshire had 5.47% unemployment, 1.5% higher than the national average[7].

12.13 In the 2001 national census, South Lanarkshire had 3.8% unemployment, almost 0.2% lower than the national average[8]. In 2006, South Lanarkshire's unemployment was 4.5% and in 2007 it had decreased to 3.1%[9]. The model based prediction for 2007 unemployment was 4.0%, showing that the economy has fared better than expected.

12.14 In 2006, East Ayrshire's unemployment was 6.4% and in 2007 had increased to 6.8%[10]. The model based prediction for 2007 unemployment was 5.7%[11], showing that the economy has fared worse than expected.

12.15 Table 12.1 shows the employment by occupation statistics for South Lanarkshire for October 2007 to September 2008[12]. This shows that South Lanarkshire has an employment distribution very similar to the national average. The Standard Occupation Classification (SOC) 2000[13] employment groups have been determined by the Office of National Statistics.

Table 12.1 South Lanarkshire employment by occupation 2008

Occupation	% South Lanarkshire	% Scotland
Soc 2000 major group 1-3*	**39.7**	**40.7**
Managers and senior officials	15.2	13.0
Professional occupations	10.3	12.7
Associate professional and technical	14.1	14.9
Soc 2000 major group 4-5	**23.7**	**23.0**
Administrative and secretarial	13.4	11.3
Skilled trades occupations	10.3	11.7
Soc 2000 major group 6-7	**18.4**	**17.1**
Personal service	10.3	9.0
Sales and customer services	8.1	8.1
Soc 2000 major group 8-9	**18.2**	**19.1**
Process plant and machine operatives	8.9	7.4
Elementary occupations	9.3	11.6

12.16 Table 12.2 shows the employment by occupation statistics for East Ayrshire for October 2007 to September 2008[14]. This shows that East Ayrshire differs from the national average with over 5% less employed in the top three employment groups, and almost 3% more employed in the two bottom employment groups.

Table 12.2 East Ayrshire employment by occupation2008

Occupation	% East Ayrshire	% Scotland
Soc 2000 major group 1-3*	**35.3**	**40.7**
Managers and senior officials	10.8	13.0
Professional occupations	11.9	12.7
Associate professional and technical	12.6	14.9
Soc 2000 major group 4-5	**24.4**	**23.0**
Administrative and secretarial	9.8	11.3
Skilled trades occupations	14.7	11.7
Soc 2000 major group 6-7	**18.2**	**17.1**
Personal service	11.5	9.0
Sales and customer services	6.8	8.1
Soc 2000 major group 8-9	**22.0**	**19.1**
Process plant and machine operatives	9.8	7.4
Elementary occupations	12.2	11.6

12.17 Table 12.3 shows the industry of employment statistics from the 2001 national census for Muirkirk, taken from SCROL (Scotland's Census Results Online)[15]. Muirkirk has almost double the national percentage employed in construction, this deficit is balanced by lower percentages in real estate and public administration.

[4] http://www.southlanarkshire.gov.uk/portal/page/portal/EXTERNAL_WEBSITE_DEVELOPMENT/SLC_ONLINE_HOME/SLC_THE_AREA/AREA_PLACES?CONTENT_ID=1803
[5] http://www.southlanarkshire.gov.uk/portal/page/portal/EXTERNAL_WEBSITE_DEVELOPMENT/SLC_ONLINE_HOME/SLC_THE_AREA/AREA_PLACES?CONTENT_ID=1804
6 http://www.scrol.gov.uk/scrol/browser/profile.jsp?profile=Employment&mainLevel=Locality&mainText=muirkirk&mainTextExplicitMatch=false&compLevel=CountryProfile&compText=&compTextExplicitMatch=null
7 http://www.scrol.gov.uk/scrol/browser/profile.jsp?profile=Employment&mainLevel=CouncilArea&mainArea=East Ayrshire&mainText=&mainTextExplicitMatch=false&compLevel=CountryProfile&compText=&compTextExplicitMatch=null
[8] http://www.scrol.gov.uk/scrol/browser/profile.jsp?profile=Employment&mainLevel=CouncilArea&mainArea=South+Lanarkshire&mainText=&mainTextExplicitMatch=false&compLevel=CountryProfile&compText=&compTextExplicitMatch=null
[9] http://www.scotland.gov.uk/Publications/2008/06/25095306/18
[10] http://www.scotland.gov.uk/Publications/2008/06/25095306/18
[11] https://www.nomisweb.co.uk/reports/lmp/la/2038432129/report.aspx
[12] https://www.nomisweb.co.uk/reports/lmp/la/2038432149/report.aspx
[13] http://www.statistics.gov.uk/methods_quality/soc/section1.asp
[14] https://www.nomisweb.co.uk/reports/lmp/la/2038432129/report.aspx
[15] Scrol - http://www.scrol.gov.uk/scrol/browser/profile.jsp?profile=Population&mainLevel=Locality&mainText=muirkirk&mainTextExplicitMatch=false&compLevel=CountryProfile&compText=&compTextExplicitMatch=null

Table 12.3 Industry of employment for Muirkirk locality

Industry of employment	Muirkirk	Scotland
All persons aged 16 – 74 in employment (excluding full-time students)	483	2,163,035
% Agriculture and hunting and forestry	2.69	2.20
% Fishing	0.00	0.31
% Mining and quarrying	10.56	1.29
% Manufacturing	14.29	13.65
% Electricity and gas and water supply	0.21	1.02
% Construction	14.29	7.76
% Wholesale and retail trade and repairs	14.29	13.30
% Hotels and restaurants	2.28	4.95
% Transport and storage and communication	10.97	6.89
% Financial intermediaries	2.28	4.74
% Real estate and renting and business activities	7.45	11.42
% Public administration and defence and social security	3.73	7.23
% Education	2.90	7.42
% Health and social work	10.14	12.63
% O.P.Q. Other	3.93	5.18

Assessment of Effects

Potential Effects

12.18 Three separate publications summarise surveys that have investigated public attitudes toward wind farms in Scotland and the UK. The overarching opinion, as shown in Table 12.4 below, is positive.

Table 12.4 - Summary of surveys on public opinion of wind farms

Title	Date	Prepared for	Prepared by	Method	Key Points
Wind Farms Telebus (UK)	Aug 2006	British Wind Energy Association	GfK NOP	972 telephone interviews of a nationally representative sample	76% agreed with the statement, 'wind farms are necessary so that we can produce renewable energy to help us meet current and future energy needs in the UK'. This compared to 80% in Sep 2005, 77% in May 2005, 79% in January 2005 and 74% in August 2004. 27% agreed with the statement, 'wind farms are, or would be, ugly and a blot on the landscape'. This compares to 27% in 2005, 28% in May 2005, 30% in January 2005, and 27% in August 2004.
Public attitudes to the environment in Scotland	2005	Scottish Executive Social Research	George Street Executive	4000 adults interviewed in their homes	59% would be happy to live next to a wind farm. 85% felt wind farms should be created, with only 2% saying they should not.
Public attitudes to wind farms	2003	Scottish Executive Social Research	MORI	1,810 telephone interviews of people living within 5km, 5-10km & 10-20km of a wind farm	0.3% mention wind farms as a negative aspect of where they live. 20% feel that wind farms have had a broadly positive impact on the area, 7% feel a negative impact, and 73% were ambivalent. 12% say the landscape has been spoiled, 6% say there were problems with additional traffic and 4% say there was noise or disturbance from traffic during construction.

12.19 The capital cost of the Galawhistle Wind Farm is estimated to be £75M-£100M and the Wind Farm will therefore have the potential to influence the local economy. This money will be spent on a range of activities during design, development and construction of the Wind Farm, including the procurement of the principal wind turbine components from suppliers, and placement of contracts for the civil and electrical infrastructure works required. These impacts will be primarily concentrated over a timescale of 1-2 years.

12.20 Other expenditure will include business rates and rents.

12.21 The use of local contractors for construction, operation and maintenance work will be actively encouraged and promoted. This will be achieved through the identification of suitable local contractors during project development by means of local contacts and through public exhibitions. Thereafter, a database of local contractors will be drawn up for use at the actual contracting stage of the project. It is anticipated that local companies will have the necessary skills and expertise to provide auxiliary equipment such as electrical installations, and provide construction support services such as plant hire and road construction materials, fencing etc.

12.22 During the construction phase, there will be between 17-34 workers employed during the construction phase. Throughout the 25 year lifetime of the Wind Farm, the establishment of a local service team will be promoted.

12.23 A full-time operations manager will oversee day-to-day wind farm operations. Employees from the turbine manufacturer and/or suitably qualified contractors will carry out maintenance at regular intervals. Turbine maintenance will be carried out, along with any other maintenance required by manufacturers' specifications and will likely include the following:

- Initial servicing;
- Scheduled routine maintenance and servicing;
- Unplanned maintenance or call outs; and
- Blade inspections.

12.24 Servicing will include the performance of tasks such as maintenance of bolts to the required torque, adjustment of blades, inspection of blade tip brakes, inspection of welds in the tower and re-lubrication of moving components. In addition, sampling and testing of oil from the main gearbox with replacement of oil as required will be undertaken. Oil filters will be replaced at regular intervals.

12.25 Employment opportunities will also arise during the decommissioning process. Due to the weak economic statistics identified in the Baseline Conditions section, these employment opportunities are considered of great value.

12.26 The Wind Farm will further have the potential to contribute to the local economy through providing a community fund of approximately £2.7m over the project's 25 year operational lifetime. Infinis have been and will continue to engage with the local community and local authorities to ensure that this community fund is distributed in the most appropriate and fair manner.

12.27 A community fund of approximately £2.7 million could be expected to generate additional benefits in the local area and using a multiple of 1.53 (income multiplier for other service activities) gives a net benefit to the community of £4.13 million[16].

12.28 Infinis will also be investigating other options to ensure the proposed Galawhistle Wind Farm brings as much benefit to the community as it can if it is granted planning permission. This may include:

- Heritage trails;
- Recreation paths across the site; and
- Educational visits to the site.

12.29 The socio-economic impact of the wind farm is considered **minor** and **positive**.

Cumulative Effects

12.30 Socio-economic effects are not considered to have any significant effects on the other technical constraints assessed in this EIA.

[16] http://www.scotland.gov.uk/Topics/Statistics/Browse/Economy/Input-Output/IOTIIMults9804

Mitigation

12.31 Due to no identification of significant adverse impacts, there is no requirement for related mitigation measures.

Statement of Significance

12.32 The socio-economic impact is considered **minor** and **positive** due to the local employment opportunities and the community improvement schemes.

Tourism and Recreation

Legislation and Guidance

12.33 There is legislation concerning scenery and access rights. The Town and Country Planning (Scotland) Act 1997 and the Planning Etc. (Scotland) Act 2006 established a statutory basis for National Scenic Areas[17]. The Land Reform (Scotland) Act 2003 established statutory access rights to most land and inland water, subject to these rights being exercised responsibly; it also introduced very specific duties and powers for local authorities and national park authorities for upholding access rights, and for planning and managing access. Furthermore Scottish Natural Heritage (SNH) produced guidance on the Environmental Impact Assessment in May 2005[18]

Consultations

12.34 Table 12.5 presents the scoping responses received relevant to tourism and recreation, and table 12.6 presents the information sources used in the tourism desk-based study.

Table 12.5 Scoping Responses relevant to tourism

Organisation	Response
Visit Scotland	No specific concerns
The Scottish Rights of Way and Access Society	No Rights of Way are within the vicinity of the proposal.
Sustrans	No objections.

Table 12.6 Information Sources used in the tourism desk study

Topic	Source of Information
Tourism	• Scottish Tourism Economic Activity Monitor (STEAM 2007), Global Tourism Solutions (UK) Ltd • South Lanarkshire Council website (www.southlanarkshire.gov.uk) • East Ayrshire Council website (www.east-ayrshire.gov.uk/) • Visit Scotland website (www.visitscotland.com)

[17] SPICe briefing Town and Country Planning – www.scottish.parliament.uk/business/research
[18] http://www.snh.org.uk/publications/on-line/heritagemanagement/EIA/

Topic	Source of Information
Paths	• Scottish Rights of Way and Access Society records of Rights of Way • East Ayrshire Core Path Plan 2008
Cycling routes	• Sustrans (www.sustrans.org.uk) • East Ayrshire Council website[19]
Recreation	• A Handbook on Environmental Impact Assessment, SNH, 2005

Baseline Description

12.35 Tourism is one of the biggest business sectors in Scotland worth more than £4 billion a year to the economy and employing over 9% of the labour force. Most of this is spent within the Highland region or in the cities of Edinburgh and Glasgow[20]. In 2007 over 16 million tourists took overnight trips to Scotland with overseas tourists accounting for approximately 18% of total tourists[21].

12.36 In March 2006, the Scottish Executive stated that the new tourism initiative target of 50% revenue growth in the ten years leading up to 2015 was on track[22]. This opinion was reiterated in a 2008 Economy, Energy and Tourism Committee Report[23]. The Office of National Statistics reports that revenue was £4.214 billion in 2005, £4.159 billion in 2006 and £4.203 billion in 2007; 2008 figures are not yet available[24]. These figures appear to contradict the government's confidence that the 50% increase can be reached.

12.37 Tourism brings around £213 million to the Lanarkshire economy each year[25]. In Greater Glasgow and the Clyde Valley, 60,300 people were employed in tourism in 2005 and 62,300 people were employed in tourism in 2006 - 8.3% of total employment.

12.38 In 2005, tourism generated approximately £315 million for the Ayrshire and Arran economy; less than 20% of this, £56 million, was generated in East Ayrshire[26]. The relatively small proportion generated in East Ayrshire is attributed to South Ayrshire and North Ayrshire and Arran having 'long established and internationally recognised tourism products comprising golf, coastline and other visitor attractions.'[27]

12.39 There were 13,100 people employed in the tourism industry in Ayrshire and Arran in 2005 and 14,200 in 2006 - 11% of total employment[28].

12.40 The nearest tourist attractions to the Galawhistle Wind Farm site include:

- Fishing at Glenbuck Loch, adjacent to the southwest of the site;
- River Ayr Way, starting approximately 300m west of the site and running west for 66km from the source of the River Ayr to the sea;
- Various walks around Muirkirk, including John Brown's Walk which passes through the hamlet of Glenbuck;
- Muirkirk, approximately 7km southwest of the site, a historical Covenanter village;
- Fishing on the River Ayr and Greenock Water, starting from approximately 7km west of site;
- Sorn, approximately 13km west of site, a conservation village with a church built in 1658; and
- Cumnock, 16km southwest of the site, also a historical Covenanter town and the location of one of William Wallace's residences.

12.41 The Coalfield SIP Outdoor Access Project has helped to develop four core routes in East Ayrshire. The River Ayr Way is the first source to sea route in Scotland and starts approximately 300m west of the site, on the northern shore of Glenbuck Loch. The route then moves west, passing within 100m of the access track. The East Ayrshire Council website states that this path has the capacity to attract 70,000 visitors to the area each year.[29]

12.42 The nearest National Cycle Network (number 74, combination of on-road and traffic free) is approximately 10km east of the site (next to the M74).

12.43 The Scottish Coal Cycle Route was initially planned to finish in Coalburn which would have meant it passing near to the site. However the Scottish Coal Cycle Route now finishes in Muirkirk and therefore does not pass near the site.

Assessment of Effects

Potential Effects

12.44 Table 12.7 summarises the results of five surveys on tourist opinion on wind farms and the Scottish landscape. The overarching opinion is positive and suggests that the impact of wind farms on tourism is unlikely to be significant. It is therefore considered that there will be no significant impact on existing tourism nor to the new tourism initiative target of 50% increased revenue by 2015.

[19] http://www.east-ayrshire.gov.uk/comser/paths/ayrshire_paths-cycle.asp
[20] The Scottish Government Statistics - http://www.scotland.gov.uk/Topics/Statistics/Browse/Tourism-Culture-Sports/TrendExpenditureVisits
[21] http://www.visitscotland.org/research_and_statistics
[22] http://www.visitscotland.org/framework_for_change.pdf
[23] http://www.scottish.parliament.uk/S3/committees/eet/reports-08/eer08-06-00.htm
[24] http://www.visitscotland.org/research_and_statistics/national_facts_and_figures/tourism_in_scotland.htm
[25] http://www.southlanarkshire.gov.uk/portal/page/portal/EXTERNAL_WEBSITE_DEVELOPMENT/SLC_ONLINE_HOME/HOME_NEWS_FULL_STORY?content_id=18981
[26] http://www.east-ayrshire.gov.uk/portal.asp?URL=/devser/docs/EATourismStrategy.pdf&REF=http://www.google.co.uk/search?sourceid=navclient&ie=UTF-8&rlz=1T4ADBR_enGB285GB287&q=ayrshire+and+arran+steam+report
[27] http://www.east-ayrshire.gov.uk/portal.asp?URL=/devser/docs/EATourismStrategy.pdf&REF=http://www.google.co.uk/search?sourceid=navclient&ie=UTF-8&rlz=1T4ADBR_enGB285GB287&q=ayrshire+and+arran+steam+report
[28] http://www.visitscotland.org/ayrshire___arran_2007-2.pdf
[29] http://www.east-ayrshire.gov.uk/portal.asp?URL=http://www.theriverayrway.org&REF=http://www.east-ayrshire.gov.uk/comser/paths/ayrshire_paths-projects.asp

Table 12.7 Summary of surveys on tourist opinion on wind farms

Title	Date	Prepared for	Prepared by	Method	Key Points
The Visitor Experience	Dec 2008	VisitScotland	Harris Interactive	Visitors recruited whilst on holiday then telephone interview once returned home. Number surveyed not specified.	Principal highlight is scenery and beautiful landscapes (24% of those surveyed).
The economic impacts of wind farms on Scottish tourism	Mar 2008	The Scottish Government	Glasgow Caledonian University, Moffat Centre and cogentsi	GIS studies, interceptor surveys (380 people), internet based UK and US studies (800 people) and economic assessment.	From interceptor study: 75% felt wind farms had a positive or neutral effect on the landscape. 68% agreed with the statement, 'a well sited wind farm does not ruin the landscape'.
The Visitor Experience	2005	VisitScotland	Harris Interactive	Visitors recruited whilst on holiday then telephone interview once returned home. Number surveyed not specified.	92% say scenery is important in their choice of Scotland as a holiday destination.
Tourist Attitudes towards Wind Farms	Sep 2002	Scottish Renewables Forum and British Wind Energy Association	MORI	307 tourists interviewed in Argyll and Bute.	Tourism and wind energy can happily co-exist. Of the 40% of tourists aware of wind farms, 86% felt their presence had a positive or neutral effect, 8% felt it had a negative effect, and 6% didn't know.
Investigation into the potential impact of wind farms on tourism in Scotland	2002	VisitScotland	NFO System Three	Telephone and face-to-face interviews with tourist boards, local authorities, and tourism companies, UK and overseas case studies, and visitor survey.	From visitor survey: 29% stated wind farms detracted from the countryside experience. 18% stated wind farms enhanced the experience.

12.45 The tourism and recreation impact is considered **minor** and **temporary** and will occur only during construction of the Wind Farm site.

Cumulative Effects

12.46 The opinions expressed appear generally to be positive and suggests that the impact of wind farms on tourism is unlikely to be significant. Any detrimental effect on tourism may affect socio-economic issues such as employment, however as Table 12.8 above shows, this is not considered to be negative.

12.47 Three separate publications summarise surveys that have investigated public attitudes toward wind farms in Scotland and the UK.

Table 12.9 - Summary of surveys on public opinion of wind farms

Title	Date	Prepared for	Prepared by	Method	Key Points
Wind Farms Telebus (UK)	Aug 2006	British Wind Energy Association	GfK NOP	972 telephone interviews of a nationally representative sample	76% agreed with the statement, 'wind farms are necessary so that we can produce renewable energy to help us meet current and future energy needs in the UK'. This compared to 80% in Sep 2005, 77% in May 2005, 79% in January 2005 and 74% in August 2004. 27% agreed with the statement, 'wind farms are, or would be, ugly and a blot on the landscape'. This compares to 27% in 2005, 28% in May 2005, 30% in January 2005, and 27% in August 2004.
Public attitudes to the environment in Scotland	2005	Scottish Executive Social Research	George Street Executive	4000 adults interviewed in their homes	59% would be happy to live next to a wind farm. 85% felt wind farms should be created, with only 2% saying they should not.
Public attitudes to wind farms	2003	Scottish Executive Social Research	MORI	1,810 telephone interviews of people living within 5km, 5-10km & 10-20km of a wind farm	The poll examined the views of local people living within 20km of Scotland's 10 largest wind farms. The poll also found that those people living closest to wind farms tended to be more positive about them (i.e. 44% of those living within 5km say the wind farm have had a positive impact, compared with 16% of those living 10-20km away).

12.48 The opinions expressed appear generally to be positive and suggests that the impact of wind farms on residents living close to the site is unlikely to be significant.

12.49 There is potential for disturbance to walkers on the River Ayr Way by construction traffic, however this is considered **minor** and **temporary**.

Mitigation

12.50 Signs will be erected to inform walkers of the situation before, during and after construction and information will be provided to Scotways, East Ayrshire and South Lanarkshire Councils to allow them to keep walkers informed through their websites. Alternative routes will be provided where necessary.

Land Use

Legislation and Guidance

12.51 There is no specific legislation regarding land use, therefore this assessment as considered the loss of the land use of the site in the context of the amount of that land use within the region.

12.52 Information has been sourced from visits to the Wind Farm site and surrounding area, and from an examination of Ordnance Survey 1:25,000 Explorer Map, Sanquhar and New Cumnock, Dumfries and Galloway, Sheet 328, 2006

Baseline Description

12.53 The Wind Farm site covers an area of approximately 593 hectares including the access track from the A70 to the site. The site is almost entirely covered by rough grazing land with deep gullies running northwest - southeast across the site.

12.54 Adjacent to the west of the site is an Open Cast Coal Site (OCCS) which the access track runs through. Adjacent to the north of the site is an area of forestry. Glenbuck settlement and Glenbuck Loch are adjacent to the southwest corner of the site. The majority of the rest of the surrounding land is rough grazing.

Assessment of Effects

Potential Effects

12.55 Most of the Wind Farm planning boundary lies in South Lanarkshire - 565 hectares or 95%. In the 2002 agricultural census, there was 88,349 hectares of rough grazing land in the Clyde Valley[30], therefore the wind farm will potentially displace 0.6% of the rough grazing land in the region.

12.56 The remaining area of the Wind Farm is in East Ayrshire - 28 hectares or 5%. In the 2002 agricultural census, there was 98,174 hectares of rough grazing land[31] in Ayrshire therefore the Wind Farm will potentially displace 0.03% of the rough grazing land in the region.

Cumulative Effects

12.57 Effects on land use are not considered to have any significant effects on the other technical constraints assessed in this EIA.

Mitigation

12.58 Habitat restoration onsite is discussed in detail in Chapter 6 (Ecology).

Summary of Socio-economic, Tourism and Land Use Effects

Table 12.10 - Summary of potential impact

	Pre-Mitigation Impact	Mitigation	Residual Impact
Construction			
Disruption of the River Ayr Way	Minor	Alert walkers of the changes. Provide alternative routes.	Minor significance, temporary
Local employment and education opportunities	Minor positive	None	Minor positive
Operation			
Removal of rough grazing land	Negligible	None	Negligible
Decommissioning			
As construction	-	-	Long term positive effects as a result of habitat management during the operation of the wind farm and linking existing pathways with the proposed ways through the site

Statement of Significance

12.59 12.62 This chapter has assessed the likely significance of the effects of the proposed Wind Farm development on socio-economics, tourism and land use issues. Overall the effects are considered to be **not significant** under the terms of the Environmental Impact Assessment (Scotland) Regulations.

[30] http://www.scotland.gov.uk/Publications/2002/05/14773/4585
[31] http://www.scotland.gov.uk/Publications/2002/05/14773/4585

Chapter 13 - Other Considerations

Introduction

13.1 This chapter describes and assesses the significance of potential effects of the proposed Wind Farm on:

- Communications;
- Aeronautical interests;
- Other infrastructure;
- Shadow flicker;
- Waste management; and
- Safety and security.

Methodology

13.2 With respect to each of the potential impacts, the general approach to this assessment is outlined in Chapter 2 (EIA Approach) and the requirements of the EIA Regulations have been followed.

13.3 Baseline conditions have been established through consultation with relevant bodies and a detailed desk-top study taking account of consultee responses. Potential effects of the Wind Farm have been identified and assessed. If appropriate, suitable mitigation measures have been identified.

Communications

Potential Effects of Wind Farms on Communications

13.4 Wind turbines, like most structures, reflect a proportion of the radio (electromagnetic) waves which strike them. The magnitude of this effect is dependent both on the surface area facing the wave source and the materials used in the structure. Unlike most other structures, the wind turbine turns depending on wind direction thereby presenting a variable surface area to the wave source. Thus both the magnitude and direction of wave reflection varies over time.

13.5 Wind turbines can cause impairment of electromagnetic wave based communication systems in two ways. The turbines can reflect waves away thus preventing them reaching the receiving aerial or dish. Alternatively, turbines may cause waves to reach the receiving aerial or dish through multiple routes, a direct route and one or more reflected routes. These multiple routes result in the signals being received at slightly different times. This is known as multi-path interference.

13.6 The effects of the Wind Farm have been assessed for the following forms of telecommunications:

- Microwave Fixed Links;
- Television Re-Broadcast Links; and
- Television and Radio Broadcasting.

Microwave Fixed Links

13.7 Point-to-Point communications, or Fixed Links, require a clear line of sight between the transmitting and receiving dish. Wind turbines placed too close to the path of the link may impair its operation.

Television Re-Broadcast Links

13.8 Television re-broadcast links connect together transmitters and studios. Several different methods including landlines and fixed links are used in this network. As noted above, wind turbines may adversely affect fixed links.

Television and Radio Broadcast Reception

13.9 Wind turbines can adversely affect domestic television reception either by reflecting away some of the transmitted signal or by introducing multi-path interference. Multi-path interference to television signals can cause “ghosting” where an object in the picture appears several times in slightly different positions.

13.10 Ofcom and the BBC have collaborated to create an online wind farm tool which assesses turbine co-ordinates for their impact on TV reception at residential properties in the local area. Ofcom and the BBC have used the generally accepted rule that only properties within 500m of a turbine and those 5km behind the turbine from the transmitter direction will be affected, and the tool uses this rule and the TV Licence database to calculate the number of properties that will have no alternative off-air service.

Guidance and Method of Assessment

13.11 Planning Advice Note PAN62 considers disruption to radio systems caused by large structures due to the obstruction and reflection of signals. It advises that planning permission can be granted for such structures subject to a planning condition that, prior to development, the developer proposes measures to maintain the quality of reception by systems potentially affected by the proposal.

Consultation and Baseline Assessment

13.12 Table 13.1 provides a summary of the communications consultation responses. Consultation was carried out with all the main communication providers in the area of the development from 2008-09.

Table 13.1 Summary of Telecommunication Scoping Consultee Responses

Consultee	Response
Arqiva	Development unlikely to affect any UHF TV links.
British Telecommunications	Proposal should not result in any interference to BT’s radio link and satellite
Five	Arquiva should be contacted on behalf of Channel Five Group

Consultee	Response
Joint Radio Committee	Do not foresee any potential problems based on known interference scenarios and the data provided.
O2	No response to date. Ofcom do not recommend contacting.
Ofcom	Found one Orange fixed link and one BT fixed link in the proposed development area
Orange	No fixed links will be affected by the proposal.
Scottish Ambulance Service	No response to date
T-mobile	No response to date. Ofcom do not recommend contacting.
Vodafone	Unlikely to be any adverse impacts on the existing or proposed network.

13.13 The consultation process indicated that the proposed Wind Farm is unlikely to interfere with the known operations of the main communication providers.

13.14 Arqiva is responsible for providing the BBC's transmission network and maintaining the integrity of re-broadcast links. Arqiva requested that the site be assessed in accordance with the BBC we-based assessment tool[1] which determines interference to domestic reception.

Assessment of Effects

Microwave Fixed Links

13.15 Consultation with microwave fixed linked operators and radio broadcaster providers indicated that the operation of the Wind Farm would not interfere with the known operation of these facilities.

13.16 Responses are awaited from the Scottish Ambulance Service, O2 and T-Mobile. Ofcom recommended that O_2 and T-mobile do not require to be contacted further. Should it be discovered that there is a potential effect on these services then turbines could be microsited to mitigate any potential impacts on fixed links.

Television and Radio Broadcast Reception

13.17 The proposed Wind Farm has been assessed in accordance with the BBC wind farm tool based on the finalised turbine layout. The results of this assessment indicated that there was 1 unidentified household in the area that could be affected which would have no alternative off-air service. The transmitters from which television signals were likely to be affected are Black Hill CH5 and Blackhill.

[1] http://windfarms.kw.bbc.co.uk

13.18 Properties may receive signals which pass through the turbines or receive reflections from the turbines. In some cases however, properly fitted aerials/receivers are believed to prevent effects on the signal quality. In the event that interference is experienced, suitable mitigation measures will be implemented. Possible mitigation measures are described below.

Mitigation

Television and Radio Broadcast Reception

13.19 Any adverse effects with regard to television and radio interference resulting as a direct effect of the proposed Wind Farm will be resolved through technical solutions. A detailed technical study will be undertaken by a specialist consultant to confirm the location of properties at risk of TV interference as a result of operation of the Wind Farm. Those properties identified as being at risk will, with the owner's agreement, have their TV picture quality recorded pre-construction of the Wind Farm. If potential interference is identified during or after construction the most appropriate technical solution will be determined on a case-by-case basis. Potential cases of interference will be checked to ensure that the problem is not caused by e.g. a damaged aerial, poor aerial alignment, damaged cables or by an aerial feeding into too many television sets.

13.20 Mitigation examples that have addressed reception issues include:

- Use of alternative transmitters;
- Re-siting of existing aerial arrays on houses;
- Installation of better quality aerials;
- Change in aerial height; and
- Use of satellite installations.

13.21 Effects on TV reception will be investigated together with affected properties for up to one year after the Wind Farm becomes operational.

Residual Effects

13.22 Residual effects of no significance are anticipated.

Aeronautical Interests

Potential Impacts of Wind Farms on Aeronautical Interests

13.23 The location and operation of wind turbines have the potential to interfere with radar. Potential effects include masking, radar clutter or interference, and scattering, which occurs when the rotating turbine blades reflect or refract radar waves in the atmosphere. If the turbines are visible by the radar, they will generate radar clutter which can mask the existence of aircraft. These effects on radar can have an adverse effect on aircraft safety. Due to their height, wind turbines may also present a collision risk to low flying aircraft, such as those approaching or taking off from airports or taking part in military training exercises.

Guidance

13.24 The Ministry of Defence (MoD) and Civil Aviation Authority (CAA) have joined with the British Wind Energy Association (BWEA) to publish guidance on aviation issues (Wind Energy and Aviation Interests: Interim Guidelines (DTI, 2002)).

13.25 The Civil Aviation Authority launched the second edition of CAP 764 - Policy and Guidance on Wind Turbines for consultation in February 2009.

Consultation and Baseline Assessment

13.26 Table 13.2 provides a summary of the aeronautical consultation responses.

Table 13.2 Summary of Scoping Consultee Responses

Consultee	Response
BAA Glasgow Airport	The project proposals will not have any adverse effect on the operations at the airport and if submitted for planning approval would not attract an objection.
Civil Aviation Authority	May be a requirement to install aviation obstruction lighting. An anticipated amendment to international aviation regulatory documentation will require that the rotor blades, nacelle and upper 2/3 of the supporting mast of wind turbines that are deemed to be an aviation obstruction should be painted white, unless otherwise indicated by an aeronautical study.
National Air Traffic Services (NATS)	The radar safeguarding assessment reveals that the wind farm development is located within an area where there is insufficient terrain shielding from the Primary Radar Service at Lowther Hill. Accordingly, NERL objects to the proposal.
Defence Estates	The turbine(s) will be within Low Flying Area 20T and will unacceptably affect military activities. These are areas made available for Military Operational Low Flying Training. Within Tactical Training Areas, military fast jets and Hercules aircraft may operate down to a height of 100ft separation distance from the ground and other obstacles. The proliferation of obstacles within this area, therefore, is not only a safety hazard but also severely impacts on the utilisation of the area for this essential Low Flying Training. **Comment:** Subsequent to this scoping opinion, a meeting took place between Infinis and the Defence Estates. The conclusion of this meeting was that the development is likely to be acceptable to the RAF if the turbines numbered 1, 28 and 27 in the scoping report are removed from the scheme. Turbines 1, 27 and 28 have since been removed from the development as shown by Figure 2.1 in Chapter 2 (EIA process).
Prestwick Airport - Infrantil	The proposed development appears to be entirely terrain shielded from Glasgow Prestwick Airport's surveillance radar. In light of this, they do not envisage any objections to the construction of the Wind Farm on radar or any other safeguarding grounds.

13.27 During the scoping phase, a pre-planning pro-forma was submitted to the CAA and Defence Estates detailing information about the number of turbines, turbine design, turbine hub heights, blade length turbine coordinates and above ordnance datum of the tower base. This was then updated and submitted again with detail of the final turbine coordinates as shown by the layout in Figure 1.2 of Chapter 1 (Introduction). The CAA and Defence Estates did not provide a response to the updated proforma detailing of the final layout.

Assessment of Effects

13.28 The consultation process indicated the proposed Wind Farm will not interfere with operations at Glasgow and Prestwick Airports. Changes in the design of the Wind Farm have removed concerns of the Defence Estates in respect to low flying area and will therefore not affect military activities. It is therefore considered that the effect will be of no significance in regard to these stakeholders. On this basis there is unlikely to be a need for lighting to be placed on the turbines.

13.29 It is considered likely that the Wind Farm will interfere with the Primary Radar Service at Lowther Hill. Therefore, the Wind Farm is likely to have an effect of **major significance** on NATS current safeguarding pre mitigation.

Mitigation

13.30 Resolving effects on radar can be very technical in nature and can take time. The concerns raised by NATS regarding the potential effects on their operations at Lowther Hill have been recognised. In addition, research is currently underway involving NATS technical experts which could solve the problem of radar interference from wind turbines[2].

13.31 Mitigation by changing the layout design of the proposed wind farm is unlikely to remove all of NATS's concerns. However, there are a number of research projects currently underway investigating possible solutions to the potential effects that wind turbines can have on radar. NATS are fully engaged in these activities and Infinis will, itself, engage with NATS and other parties to help facilitate the identification and development of these solutions.

Other Infrastructure

Consultation and Baseline Assessment

Table 13.3 provides a summary of the consultation responses.

Consultee	Response
National Grid	No issues, the risk to existing networks is negligible.
Scottish Power	Sent an indicative plan showing 11kV overhead lines in the surrounding development location **Comment:** There are no wind turbines within 250m of the 11kV overhead lines.
Scotland Gas Networks	No response to date. **Comment:** Scotland Gas Networks have been contacted by telephone

[2] http://www.decc.gov.uk/en/content/cms/news/pn117/pn117.aspx

Consultee	Response
	and email post-scoping on two occasions.
Scottish Water	No pipelines have been found near or within the vicinity of the site.

Assessment of Effects

13.32 The consultation indicated that the proposed Wind Farm will not adversely affect the surrounding service infrastructure. It is therefore considered that the likely effect on known infrastructure will be of no significance.

13.33 Responses are awaited from Scotland Gas Networks. Should it be discovered that any of their services cross the site the layout will be reviewed and if necessary turbines micro-sited to remove any potential conflict.

Mitigation

13.34 Although 11kv overhead lines are present on site, they will not interfere with the proposed Wind Farm. Scottish Power will be consulted prior to construction to ensure the Wind Farm development does not interfere with existing overhead lines.

Shadow Flicker

Introduction

13.35 This section presents an assessment to identify whether shadow flicker is likely to occur at properties surrounding the proposed Wind Farm, and if so, the predicted times of day and year along with the duration of these effects.

13.36 Shadow flicker may occur under certain combinations of geographical position and time of day, when the sun passes behind the rotors of a wind turbine and casts a shadow over neighbouring properties. As the blades rotate, the shadow flicks on and off, an effect known as shadow flicker. The effect occurs inside buildings, where the flicker appears through a window opening. The likelihood and duration of the effect depends upon:

- Direction of the property relative to the turbine(s): in the UK, only properties within 130 degrees either side of north, relative to the turbines, can be affected, as turbines do not cast long shadows on their southern side;
- Distance from turbine(s): the further the observer is from the turbine, the less pronounced the effect would be. Shadow flicker effects have been proven to only occur within ten rotor diameters of a turbine;
- Turbine height and rotor diameter;
- Time of year and day; and
- Weather conditions (i.e. cloudy days reduce the likelihood of effects occurring).

13.37 An assessment has been carried out to identify whether shadow flicker is likely to occur at properties neighbouring the proposed Wind Farm, and if so to predict times of day and year, and duration of these effects.

Methodology

Legislation and Guidance

13.38 The following documents provide guidance on the environmental effects of wind farms, and have been referenced during this assessment:

- Planning Advice Note PAN 45: Renewable Energy Technologies; and
- Planning for Renewable Energy, A Companion Guide to PPS 22.

Planning Advice Note (PAN) 45

13.39 PAN 45 provides the following information about shadow flicker (para. 64):

"Under certain combinations of geographical position, time of day and time of year, the sun may pass behind the rotor and cast a shadow over neighbouring properties. When the blades rotate, the shadow flicks on and off; the effect is known as "shadow flicker". It occurs only within buildings where the flicker appears through a narrow window opening. The seasonal duration of this effect can be calculated from the geometry of the machine and the latitude of the potential site. Where this could be a problem, developers should provide calculations to quantify the effect. In most cases however, where separation is provided between wind turbines and nearby dwellings (as a general rule 10 rotor diameters), shadow flicker should not be a problem".

Baseline Studies

13.40 A study area is defined based on a distance of 10 rotor diameters from the proposed wind turbine locations, by mapping the wind farm site using GIS (Geographical Information Systems) software. The study area was based on a worst case assumption of 82.4m diameter rotor blades. This was then further refined to include only areas within 130° to the east and to the west of north of each proposed wind turbine location. Properties within this 824m/130° area were identified from OS 1:25,000 scale digital map data. Figure 13.1 shows this study area and that no habitable properties that lie within it. Therefore there will be no significant shadow flicker effects arising from the proposed Wind Farm.

Waste Management

13.41 The purpose of this section is to provide an assessment of the potential waste streams generated during construction, operation and decommissioning of the proposed Wind Farm. Methods to incorporate best practice waste management techniques and incorporation of the waste hierarchy into all aspects of the site management are described. The management of both construction waste and operational waste is considered, whilst management of wastewater arising from construction is considered in Chapter 8 (Hydrology, Hydrogeology and Geology).

13.42 During construction of the wind farm the developer will demonstrate:

- That the development includes construction practices to minimise the use of raw materials and maximise the use of secondary aggregates and recycled or renewable materials; and
- Waste material generated by the proposal is reduced and re-used or recycled where appropriate on site (for example in landscaping). The ES addresses these aspects.

Consultation

13.43 SEPA stated that removal of peat should be minimised and disposed of onsite, method statements should be produced which identify the waste implications of the project and waste should be disposed of at a licensed / exempt management facility.

Assessment of Waste Streams

Construction

13.44 A number of potential waste streams have been identified in the construction phase. Wastes likely to arise during the construction phase of the Wind Farm development include the following:

- Wastes from non-metalliferous excavation, gravel, tailings and crushed rocks;
- Oil wastes including hydraulic oils, engine gear and lubricating oils;
- Wastes from metal degreasing and machinery maintenance, including solvents;
- Packaging, including absorbents, wiping cloths, filter materials and protective clothing;
- Miscellaneous waste including batteries and accumulators, welfare facility waste; and
- Mixed construction waste including concrete waste.

Operation

13.45 Wind turbines produce very limited pollutants or waste emissions. However, there will be a small amount of waste associated with the operation of the Wind Farm. This is likely to be restricted to waste associated with the control building from employees and visiting contractors, storage of chemicals/fuel, septic tank sludge and waste oils from e.g. gearbox maintenance.

Decommissioning

13.46 It is anticipated that waste generated during decommissioning will be similar to that generated during construction. However, the decommissioning and disposal of end-of-life turbines will generate a greater amount of waste. Many of the components of end-of-life turbines are likely to be recyclable.

Mitigation

13.47 The following sections describe the mitigation measures to be adopted during the construction, operation and decommissioning phase of the Wind Farm with regard to waste management.

Construction

13.48 Generally, there are few wastes associated with the construction of the Wind Farm. All turbine components and infrastructure are pre-fabricated and will be assembled on-site. To manage wastes effectively during construction, best practices will be followed to ensure appropriate management of different waste streams. These are summarised in Table 13.4.

Table 13.4 Management of Waste Arising from Construction

Waste	Proposed Management
Waste resulting from excavations	Likely to comprise excavated peat, stone, rock and gravel. It is proposed to recycle as aggregate in roads or fill where suitable. Smaller aggregate size class can be crushed, screened then used as backfill for cable trenches, if required, to minimise sand requirements. Generally, materials generated from these activities are re-used or recycled where appropriate on site (for example in landscaping). All topsoil (where present and requiring removal) will be reused. Reuse of peat onsite is discussed in Chapter 6 (Ecology).
Oil Wastes	Disposal of oil and any accumulation of fuel residues in the bunded refuelling area will be disposed of as Special Waste in accordance with Duty of Care requirements to a suitably licensed or permitted facility.
Packaging	Most packaging materials will be returned to manufacturers, including cable drums and pallets
Wastes not otherwise specified	Septic tank systems will be emptied as Special Waste by licensed carriers in line with Duty of Care requirements.

13.49 In addition, best practice guidelines will be adhered to by the contractors as summarised below:

- Storage and handling of waste-site operatives will segregate different waste types to maximise potential for re-use. Waste containers will be clearly marked with intended content. Containers suitable for contents will be used to minimise risk of accidental spillages and leaks. Covers and bunds will be provided to prevent evaporation and spillage of wastes and to ensure that wastes cannot be blown away.
- Care will be taken to dispose of waste arising in accordance with the Environmental Protection Act 1990 (as amended) and the Environmental Protection (Duty of Care) Regulations 1991 (as amended). Waste leaving the site will be accompanied by a waste transfer note or special waste consignment note that records the description of the waste, its current holder, the person collecting it and its destination.
- Reducing, reusing and recycling: the site operative will reuse and recycle wastes generated on–site whenever possible.

13.50 Detailed method statements which identify the waste implications of the project will be produced and agreed with SEPA prior to construction. The removal of peat and reuse onsite is discussed further in Chapter 6 (Ecology) and Chapter 8 (Hydrology, Hydrogeology and Geology).

Operation

13.51 Sludge from one septic tank will be collected by an authorised waste carrier and disposed of to a consented wastewater treatment works.

Decommissioning

13.52 The-end-of-life scenario for turbine disposal cannot be accurately predicted. However turbines will be disposed of in accordance with industry best practice at the time.

Conclusion

13.53 A number of waste streams will be generated throughout the construction, operation and decommissioning phases. Implementing general techniques to handle, store and audit waste will reduce initial generation of waste. Specific reduction/recycling and reuse methods will be employed to manage construction wastes. Disposal of residual wastes will be undertaken in accordance with current environmental legislation. The effect is likely to be of no significance following implementation of mitigation measures.

Safety and Security

13.54 The proposed development will be constructed and operated in accordance with relevant health and safety legislation including the Health and Safety at Work Act 1974.

Construction

13.55 All site based activities will be conducted in accordance with the Construction (Design and Management) Regulations 2007, which implement parts of the EU Mobile and Temporary Construction Sites Directive. All site based workers will conform to the requirements of a site-specific Health and Safety Plan.

13.56 All potentially hazardous areas such as excavation and electrical installation works will be fenced off and all unattended machinery will be stored in the site compound or immobilised to prevent unauthorised use.

Operation

13.57 Wind farms have a proven track record for safety. Turbines are extremely reliable, requiring minimal intervention and maintenance during operation. They are designed and constructed to withstand extreme wind and weather conditions. The turbines selected for this site will have a proven record in terms of safety and reliability.

13.58 The likelihood of major failures such as fire, collapse or blade throw is extremely low. The SCADA (Supervisory Control and Data Acquisition) system provides monitoring information, which can detect and provide warning of abnormal operating conditions to allow automatic shut down and intervention before emergency situations occur.

13.59 The operation of the Wind Farm would comply with all relevant health and safety regulations. The design of the Wind Farm incorporates a number of security measures such as security fencing around the control building and anemometer mast. Appropriate warning signs would also be installed to advise of any restricted areas such as transformers, switchgear or metering systems, or to advise of temporary access restrictions for maintenance activities.

Electric and Magnetic Fields

13.60 Electric and magnetic fields (EMFs) are present in the natural environment and are produced wherever electricity is used. Electric fields are produced by voltage and are very easily screened, for example by buildings or trees. Magnetic fields are produced by current and in contrast to electric fields pass readily through most structures.

13.61 Studies into the potential health risks associated with exposure to high levels of EMFs is ongoing and the interpretation of the data remains controversial with a spectrum of opinion within the scientific community and elsewhere. Many reviews have been undertaken by national and international bodies to assess the scientific data available in order to establish guidelines on safe levels of EMF exposure[3.]

13.62 Within the UK, EMF exposure limits for the public are based on the recommendations of the Health Protection Agency and guidelines published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) as follows:

- Magnetic Fields – 100 µT (microteslas)
- Electric Fields – 5000 V/m (volts per metre)

13.63 These guidelines indicate levels at which ICNIRP recommends detailed investigation and are lower than the UK permitted level of exposure. The Health Protection Agency undertakes a process of review on the published scientific data in the field in order to monitor the implications to the exposure limits.

13.64 All power transmission at the proposed Wind Farm will be in compliance with UK guidelines and legal requirements.

Decommissioning

13.65 Decommissioning activities will be carried out in accordance with relevant Health and Safety Regulations and Construction Regulations at the time of decommissioning. All potentially hazardous areas will be fenced off and all unattended machinery will be stored in the site compound or immobilized to prevent unauthorised use.

Conclusion

13.66 Adverse effects of safety and security are unlikely to be significant during construction, operation and decommissioning of the Wind Farm.

Summary of Effects

13.67 The impact of the construction and operation of the proposed Wind Farm on communications, aeronautical interests, other infrastructure, shadow flicker, waste management and safety and security have been assessed.

13.68 It is anticipated that technical solutions will be reached such that the effect will be **not significant** on television and radio reception or telecommunications.

13.69 NATS stated that the turbines will cause unacceptable interference to safeguarding mechanisms at Lowther Hill. The effect is considered to be of **major significance**. In respect to other aviation interests any effects will be **not significant.**

[3] Review of Scientific Evidence for Limiting Exposure to Electromagnetic Fields (0-300 hz). NRPB 2004

13.70 An assessment of potential shadow flicker effects resulting from the operation of the proposed Wind Farm has been carried out for properties within a distance of 850m (10 rotor diameters) from the proposed turbine locations. This assessment has identified that no inhabited properties lie within a distance of 850m from the proposed turbine locations. The shadow flicker effects are therefore considered to be **not significant**.

13.71 With appropriate management of the limited quantities of wastes generated by construction, operation and decommissioning of the Wind Farm site, any residual effects are considered to be **not significant**.

13.72 Procedures for safety and security at the site have been described that will result in any residual adverse effects being **not significant**.

Statement of Significance

13.73 With proposed mitigation, the effects assessed in this chapter with respect to communications, shadow flicker, waste management and safety and security will be **not significant** in the context of the EIA Regulations.

13.74 With respect to national air traffic services, mitigation methods are still being evaluated with a view to ensuring that the resultant residual effects from the proposed Wind Farm on safeguarding at Lowther Hill will be **not significant**.