Glenkerie Wind Farm

ENVIRONMENTAL STATEMENT REPORT

VOLUME 1

December 2007

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Submitted by

Prepared by

atmos CONSULTING

In association with

CFA ARCHAEOLOGY LTD

west coast energy

ENVIROS

RSKENSR GROUP

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GLENKERIE WIND FARM

VOLUME 1 ENVIRONMENTAL STATEMENT

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CHAPTER ONE: INTRODUCTION

1.1 THE APPLICATION

1.1.1 This Environmental Statement (ES) supports an application to Scottish Borders Council (SBC) by Novera Energy plc (Novera) for consent under the *Town and Country Planning (Scotland) Act 1997* for the construction of an 11 turbine wind farm and associated ancillary development at Kingledores Farm. The proposal will be referred to as the Glenkerie Wind Farm.

1.1.2 The development site lies approximately 5km north west of Tweedsmuir and 12km southeast of Biggar, as illustrated in Figure 1.1 (Volume 3). The site is currently used for sheep grazing and rough pasture. The OS national grid reference for the site centre is approximately NT 090 280 (1:25,000, OS Explorer Sheet 336).

1.1.3 The final capacity of the site will be dependant on the turbine selected for the development. This will be a function of a whole range of factors with the wind characteristics of the site being the primary driver. However, it is envisaged that each of the 11 wind turbines will be rated at between 1.8 megawatts (MW) and 2.5MW, with a possible total generating capacity for the site of between 19.8 MW and 27.5MW.

1.1.4 The Glenkerie windfarm has secured a grid connection and the output of the windfarm closely matches the demand at the connection sub-station. This will ensure that properties and businesses in the local area that are supplied from the sub-station will all be using clean energy.

1.1.5 The maximum base to blade tip height of the majority of the turbines would be up to 105m at the point where the blades reach their highest point. For five of the 11 turbines on the lower subsidiary ridges, the blade tip height would be up to 120m.

1.1.6 Ancillary development will include the construction of approximately 9.3km of new access track, 1.3 km of upgraded access track, an underground electricity cable network, crane hardstandings adjacent to each turbine, a temporary construction compound/storage/office area, one 70 metre anemometer mast and a site control building. Figure 1.2 (Volume 3) provides details of the site layout.

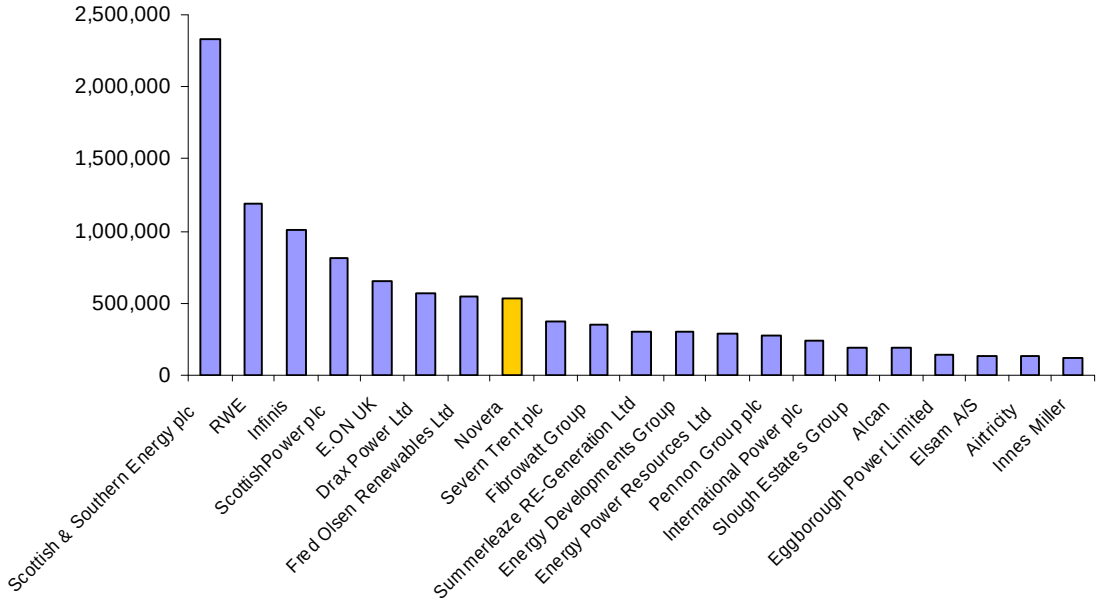
1.2 THE APPLICANT

1.2.1 Novera Energy plc is an established renewable energy company listed on the London Stock Exchange 'Alternative Investment Market' (AIM). The company generates electricity from a diverse range of renewable sources, focused in the UK. Novera's strategy is to concentrate on UK renewable energy generation through a portfolio of three businesses: wind power, landfill gas and advanced energy from waste.

1.2.2 Novera is one of the UK's top ten renewable electricity generators (Figure 1.2) and aims to build one of the largest renewable energy portfolios in the UK. Novera is also investing in renewable energy generation across the UK that will contribute to the Government's renewable energy targets and, the country's energy self sufficiency and CO_2 reductions. Novera has professional experience across all key disciplines including planning, environmental services, wind turbine technology, law and financing. Through careful attention to design, planning and development and consultation with the local community, Novera has the proven ability to plan, build and operate wind farms in the UK.

1.2.3 Novera has a portfolio of landfill gas, water and waste, hydro and wind assets, generating renewable power at 58 sites across the UK with a total installed capacity of 122 MW. Novera is one of the largest generators of renewable energy in the UK (see figure below) and with over 140 members of staff is one of the largest employers in the UK renewables sector.

Top 20 generators in the UK compiled from OFGEM ROC Register



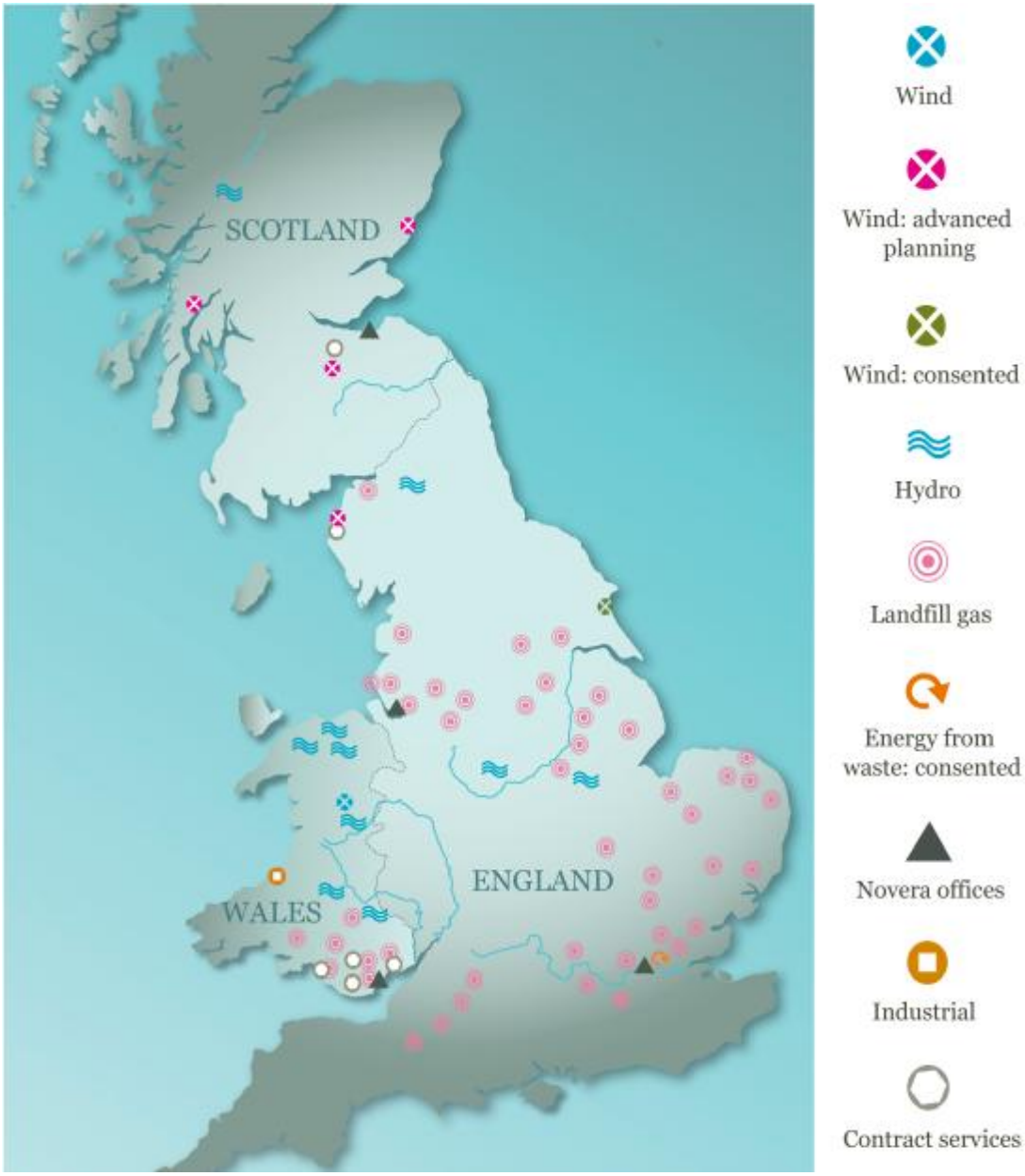
Novera has a significant development program aimed at expanding the company's generation businesses. Currently this includes:

- **Wind power** – Novera's growing portfolio of development wind projects includes our consented 30 MW Lissett Airfield wind farm and our 7.5 MW Mountboy scheme in Scotland, submitted to Angus Council Planning Department, with further projects in Scotland and Northern England to follow this year. Novera have a total of 152 MW of projects in the EIA, pre-planning phase, with 430 MW of additional sites under appraisal throughout the UK.

- **Advanced Energy from Waste** – 10 MW Sustainable Energy Facility using waste gasification technology in East London at Ford's Dagenham plant received planning consent in September 2006. A further 5 sites totalling over 50 MW are in development.

Details of the spread of Novera's operational assets are as follows:

Figure 1.1: Novera's Operational Renewable Energy Assets



1.2.4 Novera's Approach & Expertise

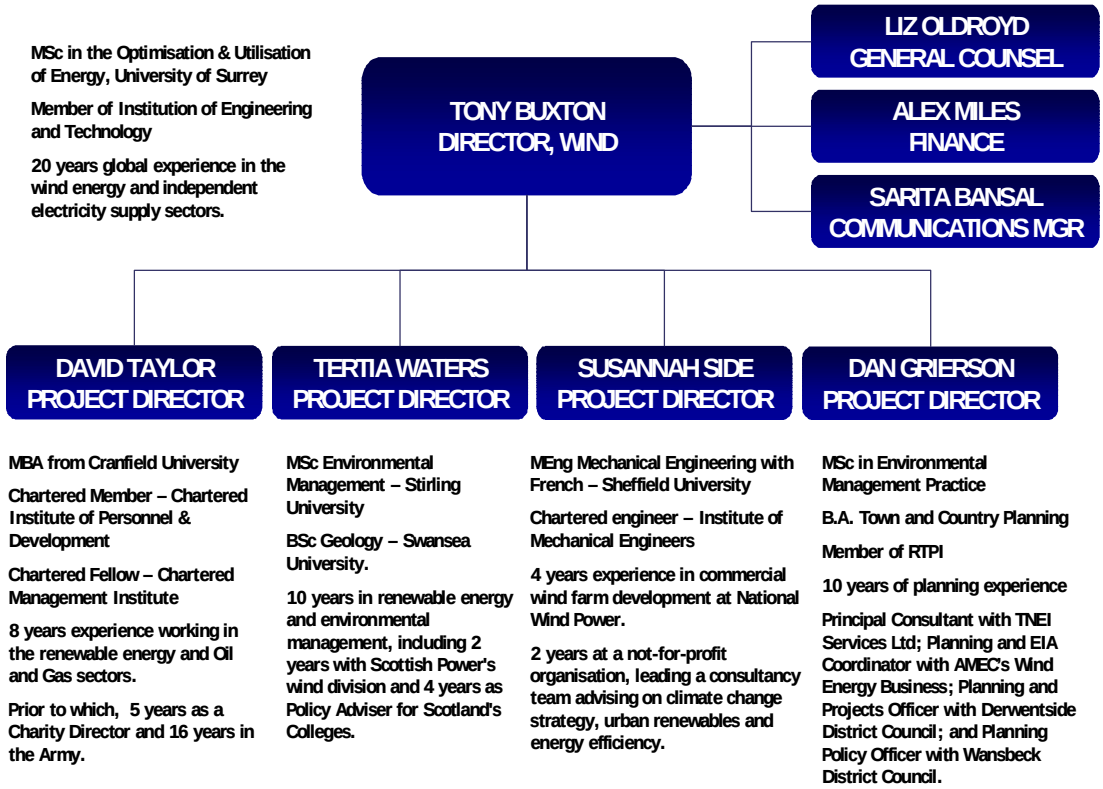
Novera is a specialist developer of small and medium scale wind farms. As a responsible developer we recognise the importance of wide and open consultation throughout the planning process. Comments from local residents are addressed in our final designs before we submit formal planning applications. We continue to consult after a planning application is submitted and, if we are granted consent, during the construction and operation of the wind farm.

"Novera is to be praised for both publicising and explaining to the local community precisely what it is they wish to achieve" – Greg Knight, MP – 6th September 2006.

As an investor in renewable generation, Novera owns and operates its wind farm developments. As we have a long term interest in our projects and the local area in which they are located we are committed to developing quality projects with good community and stakeholder relations. Novera's development approach and expertise enables us to achieve this.

Novera has a leading team of renewable energy professionals, with many combined years of experience in wind farm development. With a diverse portfolio of projects Novera has worked successfully with a wide range of organisations and landowners across the UK.

Figure 1.2: Novera's Wind Energy - Senior Management Team



During development, Novera works with leading independent experts and consultants. Typically Novera will appoint and manage a team of experts to survey a site, prepare the planning application and environmental impact assessment, and provide technical input. This multidisciplinary approach ensures a high quality development.

As a responsible developer Novera believes in an open approach to wind farm development, involving extensive community and stakeholder consultation. Novera is committed to providing income for communities via trust funds and community ownership.

1.2.5 Atmos Consulting Ltd is acting as agent to manage the environmental impact assessment for the Glenkerie windfarm application process on behalf of Novera.

1.3 THE ENVIRONMENTAL STATEMENT

1.3.1 The Environmental Statement (ES) has been prepared in accordance with Schedule 4 of *The Environmental Impact Assessment (Scotland) Regulations 1999*[1]. It describes all of the elements of the wind farm development, its construction, operation and decommissioning, the nature of the site and its surroundings, the likely effects of the development, and measures proposed to mitigate any adverse impacts on the environment.

1.3.2 The purpose of the ES is to:

- Explain the need for the proposals and describe the physical characteristics, scale and design of the wind farm;
- Examine the existing environmental character of the application site and the area likely to be affected by the wind farm;
- Predict the possible environmental impacts of the wind farm;
- Describe measures which would be taken to avoid, offset or reduce adverse environmental impacts; and,
- Provide the public, the planning authority and other consultees with information on the proposals, which would assist the planning authority in the determination of the wind farm application.

Assessment of Environmental Effects and Their Significance

1.3.3 The environmental effects and the impact of the proposal have been assessed using a combination of the sensitivity of the environment to change, and the degree of alteration or 'magnitude of change' which is

[1] Scottish Executive (1999) Environmental Impact Assessment (Scotland) Regulations http://www.scotland.gov.uk/library2/doc04/eia-00.htm

predicted to arise as a result of the development. The significance of these effects is defined in relation to their magnitude, geographical extent, duration, frequency, reversibility and any regulatory standards that might apply. It does not necessarily follow, for example, that a high magnitude change will always be significant; conversely a low magnitude change will not necessarily always be insignificant. Where an assessment of significance cannot be determined (due to lack of information, unpredictable nature of an effect or uncertainty over magnitude of change) this is highlighted and discussed within the text.

Scoping

1.3.4 The EIA Regulations provide for obtaining a scoping opinion from the planning authority as to the information to be provided in the ES. The planning authority is then obliged to consult other 'consultation bodies' before issuing their opinion.

1.3.5 The scoping report, submitted to Scottish Borders Council in July 2005, described the proposed EIA methodology and the key issues to be addressed, along with a description of the project. The project size at that time was 11 turbines. A formal scoping opinion reporting on the responses from the consultation bodies was issued by the planning authority in January 2005 and this has helped to define the aspects to be covered in the ES.

1.4 CONSULTATION

1.4.1 As part of the consultation process, scoping and/or consultation documents were sent to the following consultees (Table 1.1):

Table 1.1: Consultee List

Scottish Borders Council	Historic Scotland
Scottish Water	JMP Consulting
Scottish Executive	Health & Safety Executive
South Lanarkshire Council	Scottish Natural Heritage
Scottish Environment Protection Agency (SEPA)	Royal Society for the Protection of Birds
Historic Scotland	British Geological Survey
Health and Safety Executive	Tweed Foundation
National Monuments Record of Scotland	Borders Council Sites and Monuments Records
National Trust for Scotland	Scotways
Lothian and Borders Raptor Study Group	Scottish Borders Biological Records Centre
Ministry of Defence	NATS
Ofcom	Civil Aviation Authority
BT	British Broadcasting Corporation
Joint Radio Company	CSS Spectrum Management Services

1.4.2 A meeting of close neighbours to the wind farm site took place at Kingledores Farm on 26th July, 2007. This was an informal gathering where a preliminary turbine layout for Glenkerie was presented, giving neighbours the opportunity to comment on the design. The design was altered after this meeting to take account of the comments received.

1.4.3 A public exhibition detailing the EIA work to date was held at Tweedsmuir Village Hall on Friday 31st August and Saturday 1st September 2007.

1.4.4 Prior to the exhibition a newsletter providing information about the proposal in general and giving details of the exhibition was distributed to all residents living within 8km of the site. This included the town of Biggar and the larger settlements of Skirling, Broughton and Drumellezier.

1.4.5 To coincide with the application being registered in January 2008, an 8 page newsletter was distributed to the same addresses as the first newsletter. This newsletter provided information about the finalised layout and included photomontages of the predicated views of the windfarm and detailed information about the Environmental Impact Assessment work and the application folders can be reviewed.

1.5 LIST OF CONSULTANTS

1.5.1 During the preparation of the Environmental Statement, the following independent consultants were commissioned to undertake the individual baseline studies, impact assessments, and input specialist advice towards mitigation measures and the project design process:

- Landscape and Visual Assessment – RSK Environment Ltd;
- Cultural Heritage – CFA Archaeology Ltd;
- Ecology – Atmos Consulting Ltd;
- Ornithology – Atmos Consulting Ltd;
- Hydrogeology – Atmos Consulting Ltd;
- Noise – Enviros Consulting Ltd;
- Roads & Transportation – Atmos Consulting Ltd; and
- Project Management, Figures, Planning Policy, Socioeconomic Impacts, Infrastructure and Safety, Environmental Statement Compilation and Authoring – Atmos Consulting Ltd.

1.6 STRUCTURE OF THE DOCUMENTS

1.6.1 There are 4 volumes of documentation submitted with the planning application for the Glenkerie Wind Farm.

1.6.2 This Environmental Statement, Volume 1, contains the Environmental Impact Assessment including the reports on the surveys and assessments. The structure of Volume 1 is as follows:

- Chapter 1 Introduction
- Chapter 2 Site Selection and Design
- Chapter 3 Needs and Benefits
- Chapter 4 Planning Policy
- Chapter 5 Project Description
- Chapter 6 Cultural Heritage
- Chapter 7 Landscape and Visual Assessment
- Chapter 8 Ecology
- Chapter 9 Ornithology
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- Chapter 15 Conclusions

1.6.3 Volume 2 contains the appendices of information that support the assessments presented in Volume 1.

1.6.4 Volume 3 is an A3 Volume containing the maps and figures that support the assessments presented in Volume 1.

1.6.5 Volume 4, the Non-Technical Summary (NTS), is an executive summary of the Environmental Statement (Volume 1), summarising the proposed development, its potential environmental effects and proposed mitigation measures.

1.6.6 Copies of all four volumes of ES documentation will be made available for public inspection at:

- Tweedsmuir Village Hall, near Broughton, ML12 6QN;
- Peebles Public Library, High Street, Peebles, EH45 8AG.

And other suitable locations as determined by Scottish Borders Council.

1.6.7 The NTS can also be downloaded from:

www.noveraenergy.com.

1.6.8 Copies of the full application documentation can be purchased for £250 and CD copies of the ES will be charged at £30. Hard copies of the Non-Technical Summary (NTS) are available free of charge on request while stocks last.

For hard copies of the full ES and the CD, contact:

Atmos Consulting Ltd,
Tower Mains Studios,
18g Liberton Brae,
Edinburgh,
EH16 6AE,

Tel: 0131 672 1888,

email: mark.mccarthy@atmosconsulting.com.

CHAPTER TWO: SITE SELECTION AND DESIGN

2.1 SITE SELECTION

2.1.1 Whilst there is no requirement within the UK planning system for applicants to demonstrate that they have selected and acquired the most appropriate site for a particular development, the EIA Regulations state that an outline of the main alternatives studied by the applicant or appellant, and an indication of the main reasons for its choice, taking into account the environmental effects, should be included in the environmental statement.

2.1.2 This chapter provides an overview of the alternatives that Novera considered in selecting the Glenkerie wind farm site.

2.1.3 The selection of an appropriate site with the potential to support a wind farm development involves examining and balancing a wide range of technical, economic, environmental and planning issues. Only when it has been determined that a site is not subject to major known technical, economic, environmental or planning restrictions is the decision made to invest further resources in developing the proposal and carrying out an Environmental Impact Assessment ('EIA').

2.1.4 Novera Energy plc undertook an extensive site search within Scotland and northern England. As a result, several sites were progressed to pre-EIA feasibility assessment. The criteria used to identify these sites included:

- good wind resource;
- access to the national grid;
- consistency with development plan policies;
- suitable topography;
- access for construction;
- distance from residential properties; and,
- location with respect to national or international designations.

2.1.5 Further assessment was then conducted to ensure the selection of the most environmentally and socially acceptable sites whilst offering potential for technically and commercially viable projects. This detailed assessment considered a wide range of technical, environmental, planning, socio-economic and commercial criteria including:

2.1.5.1	Commercial criteria
	Land available Exposed location with good wind speeds Site capacity 5-50MW
2.1.5.2	Technical criteria
	Suitable topography for construction Proximity to grid connection of suitable voltage Accessible for transport and construction vehicles
2.1.5.3	Environmental & Planning criteria
	Accordance with national guidance and planning policy Accordance with development plan policy Landscape and nature conservation designations in wider area Species and habitats on or close to the site Hydrology and geomorphology Landscape character Cultural heritage – direct and indirect effects Aviation and MOD interests TV reception and communications links Other infrastructure on or under the site – pipelines or cables Land uses – previous and current Cumulative effects with other wind farms and proposals
2.1.5.4	Socio-economic criteria
	Distance to properties and communities Visual effects Noise effects Sensitive viewpoints Tourism and recreation interests Reliance on or use of site

Sites with the potential to deliver net environmental, community and economic benefits were prioritised, for example where a wind farm would provide an opportunity to support innovative community projects (like the Crook Inn Community buyout), regenerate Brownfield land or enhance natural habitats.

2.1.6 Novera generates electricity using a range of renewable energy technologies including wind power, hydro and biomass. Whilst the primary objective of the site search exercise was to identify wind farm sites, the potential for use of an alternative technology or combination of technologies for sites was also considered.

A total of 39 sites were screened in detail during 2005/6, with an initial shortlist of 8 sites being progressed to scoping. The proposed Glenkerie wind farm is one of these sites.

2.1.7 The Glenkerie site was identified in this initial search and was then screened against a more detailed list of around 50 criteria covering technical, economic, construction, planning, cumulative, landscape, ecology, ornithology, cultural heritage, community, infrastructure, aviation and land use issues. Following this screening process Glenkerie was considered suitable for a wind farm based on the following criteria:

- There is a high mean annual wind speed across the site;
- The site does not support any national landscape designations;
- In terms of visibility the site is well contained, with limited views from surrounding areas;
- The site is not located within any aviation or military safeguarding zones;
- The nearest turbine is over 1,000m from the nearest property;
- There is sufficient grid capacity to accommodate the proposal;
- Road access to the site is feasible;
- The landowner has agreed to the proposal.

2.2 DETAILED DESIGN STATEMENT

2.2.1 In accordance with PAN 68 *Design Statements*, this design statement describes the principles on which the design of the development is based and explains the resulting design solution.

2.2.2 Having identified a site, the layout and individual siting of turbines and associated infrastructure has been through a number of iterations and refinements ('dynamic design process') with the aim of producing an appropriate design. These layout iterations and refinement have minimised the potential effects of the proposal to an acceptably low level in EIA terms and with the local population.

2.2.3 The wind turbines have been positioned to capture the maximum energy within defined environmental and technical constraints. This is achieved through a combination of wind flow modelling, on and off-site wind speed data and many years of wind farm design experience. For example, it is necessary to space the turbines at least four rotor diameters apart to minimise the wake effects (i.e. increases in air turbulence) between adjacent turbines. Spacing design is also affected by environmental constraints such as landscape and visual effects.

Glenkerie Dynamic Design Process

2.2.4 Table 2.1 below describes the main phases of the dynamic design process. Detailed images of the four main design iterations (Design's A, G, I and R) are provided in Figure 2.1 (Volume 3).

The main purpose of the design process is to achieve a site design that is visually sympathetic and sustainable within the surrounding environment.

The phases of iterative design were determined by a continuous process of site evaluation, environmental appraisal, and repeated consultations with various statutory and non-statutory organisations (see Table 1.1, Chapter 1 for organisations who have been consulted).

This process of environmental engineering has enabled the project design to inherently avoid (mitigate) potential environmental effects (i.e. 'embedded mitigation').

Table 2.1: Dynamic Design Process - Designs A to K

Site Layout	Details of Design Rationale
Design A (11 turbines)	Initial concept layout with turbines sited in a linear formation along the ridgeline extending from Broomy Law to Blakehope Head. This design was based on an initial assessment of the sites physical capacity to accommodate turbines and to make the most efficient use of available land and wind resource.

Site Layout	Details of Design Rationale
	This layout was presented in the Scoping Report to Scottish Borders Council in July 2005. The main concern raised by the Council and SNH was the visual impact on the National Scenic Area (NSA). Subsequent design iterations sought to address this.

Site Layout	Details of Design Rationale
Design G (8 turbines)	Design's B to F were developments of the ridgeline Design (A) that were attempts at reducing the impact on the NSA. None of them were successful so a radical design of a clustered turbine arrangement was developed utilising two spurs around Cocklie Rig Head. This layout involved detailed landscape and visual assessment, which in particular concentrated on reducing the visual impact of the proposal on local residential areas within a 5km radius of the site and on distant viewing areas within the NSA. Various environmental surveys and technical assessments were conducted based on this design and the findings were also embedded in the design process.

Site Layout	Details of Design Rationale
Design I (10 turbines)	From consultants' baseline reports, detailed wind analysis, and liaison with consultees and the local community, the development of the Design G idea was taken forward with a new 10 turbine layout. Design I was also optimised by repositioned turbines to avoid a cluttered appearance. The following environmental and technical constraints were considered: • Concurrence with guidelines on noise limits; • All properties beyond 10 rotor diameters (i.e. 800 metres) and therefore not within the potential shadow flicker zone; • Avoidance of watercourses; • Avoidance of cultural heritage features; • Optimisation of the design in visual terms from key receptors such as nearby residential properties and within the Area of Great Landscape Value (AGLV) and National Scenic Area (NSA). This design was presented at a public exhibition in September 2007. Photomontages, wireframes and ZTVs were put on display to give a full visual representation of the wind farm. A 3D graphic model illustrating the Glenkerie Wind Farm in operation was set up on a projector screen to allow people to navigate to any area within a 5 km radius of the site and judge the aesthetics of the wind farm for themselves.

Site Layout	Details of Design Rationale
Design R (11 turbines)	Following the public exhibition, a series of further design iterations followed (Design's J to Q). An internal design session was then held with members of the consultant team (including landscape architects, planning advisors, technical consultants and modelling specialists) to review the design, reflect on public comments and improve the visual appearance of the wind farm from a number of key viewpoints. Using the same design principles as Design I, turbines were repositioned and an extra turbine was added to provide more continuity to site design. Analysis of Design R found no discernable difference to local or distant views when compared with Design I and in particular had no extra impact on views of the wind farm from within the NSA. Design R was therefore adopted as the finalised design for the windfarm planning application.
Access tracks	Redevelopment of existing tracks on the site has reduced the need for the construction of all new access tracks. Re-siting of turbines and subsequent alteration to access tracks layout has been an important part of the design process, and aimed to reduce the already minor visual impact of the proposal on the NSA.
Control building and other infrastructure	Cabling between the turbines and the control building will be underground. There is a buffer of at least 100 metres between the proposed locations for the site compound and watercourses.

Conclusions

2.2.5 Novera Energy's decision to pursue the development of the Glenkerie Airfield wind farm follows a comprehensive and methodical review of the planning, environmental and technical constraints facing the development of wind turbines in the Scottish Borders.

2.2.6 The site-selection process has resulted in the identification of an application site that is largely unconstrained in planning and environmental terms. The site possesses favourable characteristics in terms of:

- There is a high mean annual wind speed across the site;
- The site does not support any national landscape designations;
- In terms of visibility and the site's AGLV status, the development is well contained, with limited views from surrounding areas;
- The site is not located within any aviation or military safeguarding zones;
- The nearest turbine is over 1,000m from the nearest property;
- There is sufficient grid capacity to accommodate the proposal;
- Road access to the site is feasible;
- The landowner has agreed to the proposal.

all of which are required to enable development of a viable wind farm.

2.2.7 The micro-siting of turbines within the application site has resulted from an iterative design process, based upon a series of technical and environmental studies undertaken at the site and following public consultation exercises.

2.2.8 The final application design (Design R) for the Glenkerie wind farm therefore responds positively to and addresses the potential environmental impacts identified in this statement.

CHAPTER THREE: NEEDS AND BENEFITS

3.1 INTRODUCTION

3.1.1 This chapter identifies the environmental impacts associated with conventional fossil fuel electricity generation and contrasts these impacts with the non-polluting carbon free nature of renewable energy developments, in particular wind energy.

3.1.2 The economic and social benefits of the development of a windfarm at Glenkerie are discussed in detail at Chapter 12: Socio-economics. Discussion on the needs and benefits of the Glenkerie windfarm therefore focuses on national and international efforts to increase the utilisation of wind energy as well as other renewable energy resources. Also considered are the UK's and Scotland's wind energy conditions and goals for the generation of renewable energy production until the year 2020.

3.1.3 The positive policy environment for wind energy and other forms of renewable energy in the UK is largely motivated by the UK's commitment to international agreements on reductions in the emissions of climate change gases. While this has been the primary motivation there are a number of other important benefits of renewable energy, which have been recognised in UK policy. These include:

- The reduction in the "mining" of valuable and scarce global fossil fuel supplies;
- Curbing the emission of other trans-boundary pollutants such as nitrous oxides and sulphur dioxide;
- Greater self sufficiency in energy supply;
- Advantages in decentralised embedded generation including reduction in transmission losses and power supply failures.

3.1.4 While these other advantages are important and may have been the initial motivation for the funding of renewable energy research in the 1970s and 1980s, rising international concern over climate change has dominated renewable energy policy over the last decade.

3.2 CLIMATE CHANGE: EVIDENCE AND CONSEQUENCES

3.2.1 The phenomenon of 'climate change' is widely regarded as the most pressing environmental concern of the current century. Even if the causes of climate change are successfully tackled over this century, it is generally accepted that the climatic effects of emissions already released will cause environmental and economic problems extending centuries into the future.

3.2.2 Change in global and regional temperatures and precipitation patterns is a natural phenomena and there have been a number of cooling and warming periods recorded over the last millennium. However, in the late 1980s, a growing concern emerged that the climate was being influenced by human activity beyond these normal fluctuations. The issue of 'climate change' is normally used to mean that of anthropogenic forcing of mean global temperatures through emissions to the atmosphere and land use changes.

3.2.3 Scientific consensus is that climate change is starting to have far-reaching effects on all aspects of the world's environment, economy, society and health and if no action is taken to reduce greenhouse gas emissions, this situation will get worse. The Government commissioned report, the Economics of Climate Change (Nov 2006), by economist Sir Nicholas Stern (the Stern Review) summarises the effects of climate change:

'Most climate models show that a doubling of pre-industrial levels of greenhouse gases is very likely to commit the Earth to a rise of between 2 – 5°C in global mean temperatures. This level of greenhouse gases will probably be reached between 2030 and 2060. A warming of 5°C on a global scale would be far outside the experience of human civilisation and comparable to the difference between temperatures during the last ice age and today. Several new studies suggest up to a 20% chance that warming could be greater than 5°C. If annual greenhouse gas emissions remained at the current level, concentrations would be more than treble pre-industrial levels by 2100, committing the world to 3 – 10°C warming, based on the latest climate projections'.

3.3 IMPACTS OF CLIMATE CHANGE

3.3.1 The Stern Review on the Economics of Climate Change (Nov 2006) is the most recent and comprehensive study of the economics of climate change. The Review highlights the impacts and risks arising from uncontrolled climate change and the costs and opportunities associated with action to tackle it. The Review reports that the following effects are predicted to occur as a result of unchecked climate change:

- Melting glaciers will increase flood risk during the wet season and strongly reduce dry-season water supplies to one-sixth of the world's population;
- Declining crop yields, especially in Africa, are likely to leave hundreds of millions without the ability to produce or purchase sufficient food;
- Ocean acidification, a direct result of rising carbon dioxide levels, will have major effects on marine ecosystems, with possible adverse consequences on fish stocks;
- Rising sea levels will result in tens to hundreds of millions more people flooded each year with a warming of 3 or 4°C. There will be serious risks and increasing pressures for coastal protection in South East Asia (Bangladesh and Vietnam), small islands in the Caribbean and the Pacific, and large coastal cities, such as Tokyo, Shanghai, Hong Kong, Mumbai, Calcutta, Karachi, Buenos Aires, St Petersburg, New York, Miami and London;
- Climate change will increase worldwide deaths from malnutrition and heat stress. Vector-borne diseases such as malaria and dengue fever could become more widespread;
- By the middle of the century, 200 million more people may become permanently displaced due to rising sea levels, heavier floods, and more intense droughts, according to one estimate;
- Ecosystems will be particularly vulnerable to climate change, with one study estimating that around 15 – 40% of species face extinction with 2°C of warming.

Pasterze Glacier - March 1875

Pasterze Glacier - March 2004

3.3.2 The consequences of climate change are predicted to become disproportionately more damaging with increased warming. Higher temperatures are predicted to increase the chance of triggering abrupt and large-scale changes that lead to regional disruption, migration and conflict:

- Warming may induce sudden shifts in regional weather patterns like the monsoons or the El Niño. Such changes would have severe

consequences for water availability and flooding in tropical regions and threaten the livelihoods of billions;

- Melting or collapse of ice sheets would raise sea levels and eventually threaten at least 4 million km^2 of land, which today is home to 5% of the world's population.

3.3.3 The Stern Review on the Economics of Climate Change (Treasury, 2006), highlights the costs associated with uncontrolled climate change. If climate change is not tackled within a decade, significant economic effects are forecast, including a contraction of global output by 20%, costing £3.68 trillion, or £566 per person on the planet. Taking action now would cost 1% of the world's gross domestic product or £184 billion.

3.3.4 Within the UK, the Government's 2005 sustainable development strategy, 'Securing the Future', predicts that the following effects of climate change will be seen:

- Relative sea level will continue to rise around most of the UK's shoreline. By the 2080s sea levels in the Thames Estuary may have risen by as much as 86 cm;
- Winters will become wetter and summers may become drier everywhere. By the 2050s average soil moisture in the summer may be reduced by up to 30% over large parts of England. By the 2080s this could be a loss of 40% or more;
- High summer temperatures will become more frequent and very cold winters will become increasingly rare. A very hot summer, such as that experienced across Europe in 2003, may occur as often as one year in two in the 2040s, and could be considered a 'cold' summer by the end of the century;
- Increased numbers of heat related deaths, cases of food poisoning and skin cancer and a higher risk of major disasters caused by severe winter gales and flooding. By 2050s, heat related deaths may increase by 2,000 cases per year, cases of food poisoning by perhaps 10,000 per year and skin cancer may increase by 5,000 cases per year. However, cold related winter deaths may reduce by perhaps 20,000 per year.

3.3.5 The UK Climate Change Impacts Review Group has estimated the predicted changes in climate imply a northward shift of natural habitats, wildlife species and farming zones of 200 - 300km per degree C of warming or 50 - 80km per decade. Within 50 years, the species composition of about half of the statutory protected areas in the UK may alter significantly. For example, the Ptarmigan's habitat in Scotland will disappear within this timescale if action is not taken now.

Ptarmigan – February 2005 Cairngorm Plateau

3.3.6 As noted above, certain greenhouse gases (SO_2, N_2O, O_3) also give rise to acid rain. In the UK and many other European countries there has been a degree of soil and surface water acidification, which causes damage to moorland, rivers and trees. Reports produced by English Nature (now Natural England), and Friends of the Earth reveal that over 1,000 of Britain's best wildlife habitats are at risk from acid rain. In Germany and Scandinavia increased pH levels have led to dead lakes and affected the health of forests, as fish and plant species have difficulty adapting to higher acid levels.

3.3.7 In Scotland, research commissioned by the Scotland and Northern Ireland Forum for Environmental Research (Sniffer) found that climate change has already had a significant impact over the last 40 years, including[1]:

- Temperatures have increased in every season and in all parts of Scotland since 1961. This has been the fastest period of warming identified in the analysed records (1914 – 2004)

- Since 1961 daily maximum temperatures have been increasing at a faster rate than minimum temperatures. This is contrary to the trends seen since 1914 in Scotland (and globally) when minimum, or night time, temperatures increased at the faster rate;

- Since 1961 Scotland has become wetter with an average increase of almost 60% in winter months in northern and western Scotland. For the majority of the country there has not been a significant change in rainfall in summer months although some parts of North West Scotland have become up to 45% drier.

[1] Scottish Executive, March 2006, Scottish Climate Change Programme: Changing Our Ways

3.3.8 The UK Climate Impacts Programme, in its 2002 report, Climate Change Scenarios for the United Kingdom, has predicted the following impacts in Scotland by the 2080s:

- Annual temperatures averaged across Scotland will rise by up to 3.5 degrees Celsius in the summer and 2.5C in the winter;
- Summers will become generally drier across Scotland. There may only be a slight reduction in rainfall in the north west but as much as a 40% reduction in the south and east;
- Scotlands growing season will become longer, by between 30 and 80 days;
- Scotland's sea levels will rise, perhaps up to 600mm around the mainland;
- Average snowfall amounts will decrease, perhaps by up to 90% less depending on location, and snow-less winters may become normal in some parts;
- Scotland will have more severe extreme rainfall events, with rainfall in 24 hours from storms expected to occur on average every 2 years up by 25%, especially in the east.

3.4 INTERNATIONAL AGREEMENTS ON CLIMATE CHANGE EMISSIONS

UN Framework Convention on Climate Change

3.4.1 The United Nations took up the issue of climate change in 1988 and adopted a resolution on the "Protection of global climate for present and future generations of mankind". The UN General Assembly launched negotiations on a framework convention on climate change and established an Intergovernmental Negotiating Committee (INC) to conduct those negotiations.

3.4.2 On 9 May 1992, the INC adopted the United Nations Framework Convention on Climate Change. The Convention (also known as the 'Rio Declaration' and 'Climate Change Convention') was opened for signature at the "Earth Summit", in Rio de Janeiro, Brazil, on 4 June 1992, and came into force on 21 March 1994. Currently 186 governments and the European Community are parties to the Convention. The ultimate long-term objective of the Convention is to stabilise atmospheric concentrations of greenhouse gases at so-called "safe" levels. These levels, which the Convention does not quantify, should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change and to enable economic development to proceed in a sustainable manner (United Nations Framework Convention on Climate Change).

Kyoto Protocol

3.4.3 When governments adopted the Convention, it was understood that its commitments would not be sufficient to achieve its ultimate long-term objective. They therefore included a series of review mechanisms in the Convention to ensure that its commitments could be tightened in the future. The first of these, the Kyoto Protocol was adopted 11 December 1997. The Kyoto Protocol commits Annex 1 Parties (industrialised countries listed in the Convention's Annex) to individual, legally-binding targets to limit or reduce their greenhouse gas emissions, adding up to a total cut of at least 5 % from 1990 levels in the "commitment period" 2008 – 2012. The targets cover emissions of the six main greenhouse gases, namely: carbon dioxide (CO_2); methane (CH_4); nitrous oxide (N_2O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6).

3.4.4 The Protocol establishes three innovative "mechanisms", known as joint implementation, emissions trading and the clean development mechanism, which are designed to help Annex 1 parties reduce the costs of meeting their emission targets by achieving or acquiring reductions more cheaply in other countries than at home. The Kyoto Protocol was open for signature between 16 March 1998 and 15 March 1999. 84 countries signed the Protocol during that period, including all but two Annex 1 parties. In order to enter into force, the Protocol must now be ratified. Although nearly 40 countries have already ratified or acceded to the Protocol, only one Annex 1 party has yet done so (United Nations Framework Convention on Climate Change).

European Climate Change Programme

3.4.5 The European Union has been the driving force of international agreement on climate change policy since the conception of the Framework Convention on Climate Change a decade ago. It has played a particularly key role in negotiations following the signing of the Kyoto Protocol in 1997, on mechanisms, monitoring and reporting for implementation of the Protocol, which culminated in November 2001 in Marrakech (European Commission – website resource). It is therefore strongly motivated to ensuring that its Member States collectively meet the EU's commitments to the Kyoto Protocol.

3.4.6 The means by which the EU will enable this is currently being developed by the European Climate Change Programme (ECCP), which was launched in March 2000. The ECCP was tasked with identifying this action in the form of additional policies and measures as well as an emissions trading scheme (European Commission, 2001).

Drought in the Amazon 2007

High Tide in Tuvaluan Isles 2007

EU White Paper on Renewable Energy Sources

3.4.7 The work focused on the energy, transport, industry and agricultural sectors, with energy supply and demand as the subjects of two separate working groups. The ECCP strategy is that each sector should contribute to reductions in greenhouse gas emissions but with emphasis on the most cost effective measures between and within the action areas. 40 cost effective measures were identified which could reduce the greenhouse gas emissions of the EU by 664 - 765 Mt of CO_2 equivalent, as compared to the estimate by the European Environment Agency of a required 336 Mt CO_2 equivalent to meet the 8% reduction target. One of these, which lies within the Energy Supply working group area, is a target for 12% of gross inland energy consumption to come from renewable sources by 2010. This target was drawn from existing EU renewable energy policy given in the EU's 1997 White Paper on Renewable Energy Sources (European Commission, 1997).

EU Renewable Energy Directive

3.4.8 At the Kyoto summit in 1997, it was agreed that the European Union would have the freedom to decide the contribution of the individual Member States to the overall 8% reduction commitment of the EU as a whole. The UK's contribution has been set at reducing greenhouse gases to 12.5% below 1990 levels by 2008 - 2012. By 2000, EU member States emission inventories showed that the overall basket of emissions had been reduced by 4% over 1990 levels i.e. half way towards the 2008 – 12% target (European Environment Agency Press Release 2001). It was understood that each measure identified within the ECCP including the 12% renewable energy target, would vary in its application to each Member State, both with regard to compatibility with the Member State's individual greenhouse gas reduction target but also the current conditions in the energy, transport, industry or agricultural sector as appropriate, within that Member State.

3.4.9 The measure was to be the subject of an EU Renewable Energy Directive, issued by the European Council in September 2001. The Directive commits Member States to the setting of national targets for consumption

of energy from renewable sources in terms of a proportion of total electricity consumption. Each Member State shall adopt and publish a report setting out such targets not later than 27 October 2005 and further targets need to be set every five years thereafter (European Council, 2001).

3.4.10 The Directive gives indicative first targets for each Member State in an Annex to the Directive. The UK's indicative target is set at 10.0%. The UK had the second lowest 1997 figure of all the Member States of electricity consumption coming from renewable sources (1.7%), Belgium being the bottom nation (1.1%). If the 2010 targets are achieved the UK would move up to the third lowest user of renewable energy in the EU.

3.5 THE UK CLIMATE CHANGE PROGRAMME

3.5.1 In the UK, the response to global warming and the drive to increase the level of electricity generation from renewable sources can be traced back to the Electricity Act of 1989, which created the concept of the Non-Fossil Fuel Obligation, under which each of the Regional Electricity Companies had to buy a proportion of their fuel from renewable sources. The subsequent White Paper "This Common Inheritance" in 1990 identified an initial renewable generating capacity of 1000 MW by 2000. This figure was raised to 1500 MW in 1993 following the Government's review of the coal industry.

3.5.2 November 2000 saw the publication of the Government's "Climate Change, The UK Programme"**,** which set out a comprehensive strategy, and a package of policies and measures to deliver the Kyoto commitments for a reduction in greenhouse gases and the domestic goal for a reduction in carbon dioxide emissions. It focused on the challenge of the need to make bigger emission cuts, by ensuring a fundamental shift in the way the UK generates and uses energy over the coming century. The programme set out a substantial integrated package of policies and measures, including accelerating the take up of low carbon technologies such as renewables, and stimulating more efficient sources of power generation.

3.5.3 The Energy Review of the Performance and Innovation Unit in the Cabinet Office was published in 2002. This suggested that the focus of UK policy should be to establish new sources of energy which are, or can be, low cost and low carbon; the promotion of energy efficiency and the role of renewables; that the target for the proportion of electricity generated from renewables should be increased to 20% by 2020; and that institutional barriers, specifically planning problems, should be addressed urgently. In particular, national planning guidance needed to make it clear where there is a national case for new investment in energy related facilities by establishing the relevant national and regional context for each type of development.

3.5.4 The Governments Energy White Paper, "Our Energy Future – Creating a Low Carbon Economy", published on 24th February 2003, reaffirmed the 10% by 2010 target for renewable energy, and stated a wish to see this figure doubled by 2020, which is in line with the PIU target. A 60% reduction of carbon dioxide by 2050 was also set in order to tackle climate change. The White Paper confirmed the decline in indigenous energy supply, stating that by 2020 the UK could be dependent on imported supply for three quarters of its primary energy needs. Such dependency would add to the cost of imports and affect the country's security and reliability of supply.

3.5.5 Importantly, the White Paper confirmed the vital role of renewable energy in the future low carbon economy and the important part that technologies such as onshore wind, offshore wind and biomass will play in achieving the 10% target. The Government's domestic target for renewable energy was in line with the European Union's Renewables Directive (2001/77/EC October 2001).

Scottish Climate Change Programme

3.5.6 The Scottish Climate Change Programme sets out the measures that the Scottish Executive is taking to help the UK in meeting the Kyoto obligation, and move towards the UK domestic goal of reducing carbon dioxide emissions by 20% by 2010 (Scottish Executive, 2000). In that programme, the Scottish Executive set a target to increase further the use of electricity from renewable sources in Scotland to around 18% by 2010. The Scottish Programme supplemented the UK Climate Change Programme by identifying the measures to be taken in Scotland to tackle the causes of climate change across all sectors, working in partnership with the UK Government in delivering the domestic goal of reducing carbon dioxide emissions by 20% by 2010.

3.5.7 Having already satisfied its target of generating 18% of electricity from renewable sources by 2010, the Scottish Executive has now confirmed its commitment to generate 11% of Scotland's electricity from renewable resources by 2011 and to generate 50% by 2020 (Scottish Executive 2007).

3.5.8 The Scottish Climate Change Programme recognised the crucial role played by renewable energy generation in achieving its objectives. Following a consultation exercise, the Scottish Executive published its response document, "Securing a Renewable Future" (Scottish Executive, 2003). It anticipated that established technologies such as on-shore wind and hydro would continue to play a major part in achieving 18% of electricity generated within Scotland by renewable means by 2010. The response document explained that:

".....to reach our interim target of 18% by 2010 will require an additional 1000 MW of generation by 2010. In itself, this represents an increase in build rate of around 500% over the previous decade. The level of

renewable variables such as our ability to reduce overall demand, and the contribution by then from conventional power sources. However, by way of illustration, current peak demand in Scotland is met by around 6000 MW capacity. Subsequently if we postulate demand growth ranging between 0% and 1% per annum, and a capacity margin of 25%, it seems reasonable to assume that Scotland would require at least around 2000 – 2500 MW of new renewable generation by 2020. This represents a constant build rate of around 120 – 150 MW per annum between now and 2020."

3.5.9 The Forum for Renewable Energy Development in Scotland (FREDS) chaired by the Deputy First Minister and Minister for Enterprise & Lifelong Learning, published its' report "Scotland's Renewable Energy Potential: Realising the 2020 Target" which again confirmed Scotland's 40% target and estimated an installed capacity of around 6 GW of renewable energy would be required by 2020 to meet the target (FREDS, 2005).

3.5.10 In November 2007, Energy Minister Jim Mather announced a new target to generate 50% of Scotland's electricity from renewables by 2020. An interim target to generate 31% of electricity from renewable sources by 2011 was also established and equates to 5000MW in installed capacity. The Minister announced that:

"*Scotland is already a world leader in the energy and engineering sectors and is known for its innovation and talent. Harnessing this talent to generate more renewable energy will give us a vibrant energy sector that makes a significant contribution to Scotland's future prosperity and help build increased, sustainable economic growth. The absence of new nuclear power stations in our energy mix will not cause an energy gap in a Scotland as we have the natural resources and ingenuity to become a non-nuclear energy exporter. Meanwhile, we believe that the risks and uncertainties of nuclear power, in terms of waste disposal, decommissioning, security and health concerns, or cost, are far too great.*

Renewable Energy Obligation Scotland (ROS)

3.5.11 The Renewables Obligation Scotland (ROS) Order 2002 provides a powerful incentive for generators to supply progressively higher levels of renewable energy, by placing a legal obligation on every licensed electricity supplier in Scotland to supply a percentage of electricity from renewable sources.

3.5.12 The power to set the ROS has been granted to the Scottish Executive by The Utilities Act 2000. Following the initial consultation period a further final statutory consultation was launched in August 2001 and the ROS made into law through a Statutory Instrument in April 2002. Amendments to extend the ROS were made in 2004 and 2005.

3.5.13 Scottish Renewable Obligation Certificates (SROCs) are granted to the owners of qualifying renewable energy electricity generation plant according to the amount of electricity they produce. These are traded on an open market within the UK as a whole, so that those suppliers with a deficit of SROCs from their own generation plant may buy SROCs from those suppliers with a surplus of SROCs, until they meet the renewables obligation for the region they are supplying to. The Statutory Instrument sets the obligation for suppliers supplying in Scotland for each year (i.e. the proportion of electricity supplied that should come from renewable sources). The obligation will rise year on year by increments reaching 15.4% in 2015.

3.6 LATEST CLIMATE CHANGE AND RENEWABLE ENERGY POLICY

3.6.1 In March 2006, the UK Government published the document "Climate Change: The UK Programme 2006" and "Scotland's Climate Change Programme". Within the foreword, the Prime Minister states that he has made climate change a top priority for the government, at home and internationally.

3.6.2 The 2006 Climate Change Programme sets out detailed policies, proposals and actions designed to deliver the UK's Kyoto Protocol target of reducing emissions of the basket of six greenhouse gases by 12.5% below base year levels over the commitment period 2008-2010. It also aims to move the UK closer to the domestic goal to reduce carbon dioxide emissions by 20% below 1990 levels by 2010, and to put the UK on a path to cutting carbon dioxide emissions by some 60% by about 2050, with real progress by 2020.

3.6.3 The increasing supply of renewable energy into the electricity market was identified by the Climate Change Programme as an important element of the drive to cut carbon dioxide emissions. The Programme recognised that at the end of 2004, generation from renewable sources in the UK stood at only 3.1% of electricity supplied and that there is still a long way to go if the 10% target is to be met by 2010.

3.6.4 The Government announced an Energy Review in November 2005, and in July 2006 a report on the conclusions of the review was published, "The Energy Challenge". In the foreword to the Review, the Prime Minister stated that:

'It is clear that we must significantly increase investment in, and support for renewable energy so that it plays a larger role in our energy needs. This is vital, not just to give us a secure source of energy but also to meet our obligations to our children to tackle climate change.'

3.6.5 The Energy Review re-affirms that renewable energy is an integral part of the Government's strategy for tackling climate change and a range of measures are proposed to promote the growth of renewable electricity to

achieve 20% of electricity coming from renewable sources by 2020. The Review found however, that in 2005 the total generation from renewable sources of energy was still only around 4% of total electricity supplied to UK consumers. It acknowledges that if the 20% target is to be realised, both onshore and offshore wind will need to make a significant contribution and a number of proposals are put forward to further enable the deployment of these and other renewable technologies which will be the subject of a White Paper at the end of 2006.

3.6.6 Significantly, the planning system was identified as being a particular constraint to the deployment of renewable energy generation and in order to assist the planning determination process, Annex D of the Review sets out a clear statement of the need for renewable energy.

3.6.7 The Energy Review also acknowledges that the planning system in Scotland is devolved and that the Scottish Executive is committed to an ambitious strategy for the deployment of renewables in Scotland by speeding up the consenting process in order to bring forward the achievement of its target for 40% of renewable electricity by 2020.

3.6.8 The report puts forward a range of key elements in order to move to a low carbon economy and increasing the deployment of renewable energy technologies is seen as crucial in the fight to tackle climate change. Given the importance of this Review, it is worth quoting what Sir Nicholas Stern said when he presented the report to Government:

"The conclusion of the Review is essentially optimistic. There is still time to avoid the worst aspects of climate change if we act now and act internationally. Government business and individuals all need to work together to respond to the challenge. Strong, deliberate policy choices by Governments are essential to motivate change. However, the task is urgent. Delaying actions, even by a decade or two, will take us into dangerous territory. We must not let this window of opportunity close."

3.6.9 The Review highlights the role of the planning system in helping the world to deal with the impact of climate change. Later in 2006, the Department for Communities and Local Government (DCLG) is to publish new formal guidance to planning authorities on their role in combating climate change.

3.6.10 These latest and up to date European and UK Government statements on renewable energy therefore establish a strategic need for renewable energy provision in the UK.

3.6.11 To help meet this need, in her speech on 15 November 2006, the Queen announced the Government's intention to progress its Climate Change Bill. The main provisions of the Bill are:

- Put the Government's long-term goal to reduce carbon dioxide emissions by 60% by 2050 into statute. Interim targets will also be considered;

- Establish an independent body - the Carbon Committee - to work with Government to reduce emissions over time and across the economy which will be similar to the independent Monetary Policy Committee that sets interest rates;
- Create enabling powers to put in place new emissions-reduction measures;
- Set out new monitoring and reporting arrangements, including how Government reports to Parliament.

3.7 WIND ENERGY IN THE UK AND SCOTLAND

3.7.1 The UK benefits from the best wind conditions in Europe and has been estimated as having around 40 % of the total wind resource in Europe. The highest wind speeds and therefore the greatest potential for energy production from wind energy are found mainly along the coastlines and in the upland areas of Scotland, England and Wales. Of this 40 %, about 25 % is in Scotland (BWEA, 2006). In November 2006 the total installed wind capacity in the UK had reached approximately 1,944 MW being produced by 129 onshore and 5 offshore operating wind farms (BWEA, 2006), enough to meet the needs of 1,086,986 households and reduce CO_2 emissions by 4,393,596 tonnes. However, while the potential for offshore wind energy has been estimated by the ETSU to be 98.6 TWh per year (Matthies HG *et al.*, 1995), the vast majority of turbines currently operating in the UK have been built onshore (129 operating wind farms onshore / 5 wind farms offshore (BWEA – Statistics, 2006)).

3.7.2 Table 3.1 Operational Projects UK, October 2007 (BWEA, 2007)

Projects	Turbines	Megawatts	Homes Equivalent	CO_2 reductions (tonnes/yr)	SO_2 reductions (tonnes/yr)	NO_X reductions (tonnes/yr)
152	1865	2186	1,222,235	4,940,275	57,445	17,234

3.7.3 In October 2005, BWEA undertook research to forecast the delivery of onshore wind capacity in the UK by 2010. This report produced a range of scenarios and concluded that the most realistic cumulative onshore wind capacity is at least 6,000 MW or around 16 TWh of output by 2010, equating to nearly 5% of projected electricity supply (BWEA, 2006). This means onshore wind is expected to deliver almost half the Government's 10% renewable energy target.

3.7.4 Scotland is expected to make the greatest contribution as it benefits from having the best wind resource in the UK. From the expected 6,000 MW onshore capacity in the UK by 2010, England is expected to deliver about 1,774 MW (28%), Northern Ireland and Wales are expected to produce less than 10% each, and Scotland is expected to produce 3,397 MW (55%).

3.8 RELIABILITY OF SUPPLY

3.8.1 Europe is facing an energy crisis. According to the European Commission's baseline business-as-usual-scenario, the electricity demand will increase by 52% between 2000 and 2030. At present, Europe imports 50% of its energy needs, and this is projected to increase to 70% within two decades. At a time of increasing prices, diminishing resources and their concentration into fewer, geopolitically sensitive regions, with the constant fear over the security of supply coming from these politically unstable regions, Europe and the UK are running out of indigenous energy resources (for example, the fossil fuel resources in the North Sea are in rapid decline). Moreover, the prices of oil and gas have more than tripled since 2001 and the last three global recessions were caused by oil price rises.

3.8.2 Facing this situation, the UK government has expressed the desire to become less dependent on imported supply, knowing that increasing imports will add to energy costs and jeopardise the country's reliability of energy supply. In July 2001 the Government (DTI, 2006) announced a review of long-term energy objectives and opportunities for supply, which focused on the role renewables could play in maintaining a secure, indigenous and diverse supply of energy. The outcome of the review as set out in the "Energy White Paper" (February 2003) and "Our Energy Future – Creating a Low Carbon Economy" (DTI, Feb 2003) is that, due to the decline in the UK's indigenous energy supplies, the Government is committed to promoting energy diversity.

3.8.3 The Energy White Paper set out the UK's strategy for maintaining energy reliability, being guided by the following considerations:

- Reliable energy supplies are fundamental to the economy as a whole and to sustainable development. An adequate level of energy security must be satisfied in both the short and longer term;

- Liberalised and competitive markets will continue to be a cornerstone of energy policy. Where the market alone cannot create the right signals (e.g. on the environment) the government will take steps that encourage business to innovate and develop new opportunities to deliver the required outcomes;
- The policies should take account of impacts on all sectors of society;
- Specific measures are needed for particular groups of people (e.g. to support those for whom energy bills form a disproportionate burden).

3.8.4 The recent 2006 Energy Review (DTI, 2006) re-affirms the Government's commitment to maintaining security of energy supply. This will be achieved through:

- A strong international agenda to promote more open and competitive markets; and
- A market framework in the UK that is positive for investment and diversity of supplies and for the growth of our own home-grown energy.

3.9 ECONOMIC DEVELOPMENT

3.9.1 The *Renewables Supply Chain Gap Analysis* found that in 2004 about 8,000 people were employed by the renewable energy industry. Wind dominated with 4,000 jobs associated with on and offshore projects. The study concluded that by 2020 there is the potential to create between 17,000 and 35,000 new jobs in this sector (DTI, 2004). Many of these new jobs would be in manufacturing and in rural areas. Planning, designing, manufacturing and the delivery of these new technologies also present a major economic opportunity, not only within the UK, but also in terms of export potential.

3.9.2 The local economic benefits are outlined in Chapter 12: Socio Economics.

3.10 ENVIRONMENTAL BENEFITS OF GLENKERIE WIND FARM

3.10.1 The Glenkerie Wind Farm could have an installed capacity of up to 27.5MW based on 11 turbines operating at up to 2.5MW. Using a standard capacity factor of 32%, which takes in to account the variable nature of the wind resource through each year, it is calculated that on average some 77,000 kWh of electricity will be produced annually.

3.10.2 Every unit (kWh) of electricity produced by wind displaces a unit of electricity which would otherwise have been produced by a power station burning fossil fuel and the amount of CO_2 savings made is a function of the fossil fuel displaced. The Electricity Industry matches the ongoing fluctuating daily and seasonal electricity demand from a variety of generation sources of which nuclear stations generate at a constant rate and are termed base load because of their inability to follow load

fluctuations. Other sources of base load energy have in recent years been natural gas fired Combined Cycle Gas Turbines (CCGT) and large scale coal fired plant. The majority of the load following has been carried out by older, smaller but more flexible coal fired generators and it is the output from this flexible plant, which is displaced by wind energy. The CO_2 emissions from fossil fuel fired generators vary from 400 grams (natural gas) to 860 grams (coal) of CO_2 per kWh of electricity. Hence the CO_2 savings over recent years have been against coal fired generation (860g/kWh). Due to the recent ASA ruling, a range of values illustrating carbon emissions from coal fired plant is shown in Table 3.2.

Table 3.2: CO2 Emissions Savings from a Coal Fired Plant

400g CO2/kWh	500g CO2/kWh	620g CO2/kWh	740g CO2/kWh	860g CO2/kWh
30,835	38,544	47,794	57,045	66,295

3.10.3 Using BWEAs emissions figures for coal fired plant, it is estimated that the proposed wind farm could displace the following gaseous emissions which would otherwise have been produced by a power station burning fossil fuels:

- CO_2 (Carbon dioxide): up to 66,295 tonnes;
- SO_2 (Sulphur dioxide): up to 770 tonnes; and
- NO_x (Nitrogen oxides): up to 231 tonnes.

3.10.4 Utilising updated figures of average UK household electricity consumption of 4,700 kWh per annum, it is calculated that the proposed wind farm will be sufficient to supply the average annual domestic needs of approximately 16,400 households or nearly 34,000 people. This is the equivalent of over 30% of the population of Scottish Borders local authority area.

3.10.5 Emissions associated with the manufacture and construction of wind energy developments are insignificant compared to the emission savings during operation. This is emphasised by the fact that the average wind development in the UK will payback the energy used in its manufacture within 3 to 5 months of operation[2]. From this date until the decommissioning of the wind farm, the development will be a net contributor of environmentally clean electricity.

3.10.6 The electricity produced will also make a valuable contribution towards Scotland's targets of generating 31% of energy from new renewable sources by 2011 and 50% by 2020.

[2] Milborrow (1998) Dispelling the Myths of Energy Payback Time, Windstats, vol 11

3.11 CONCLUSION

3.11.1 Global warming and climate change, primarily caused by the burning of fossil fuels, is widely recognised as one of the most serious problems facing the world.

3.11.2 The UK Government and the Scottish Executive is committed to reducing carbon dioxide and other polluting gases, and to meet this commitment, is seeking to increase the proportion of energy from renewable sources. The UK target is to increase the proportion of renewable energy from the current 4% to 10% by 2010 and 20% by 2020. Scotland has a target of generating 31% electricity from new renewable sources by 2011 and generating 50% by 2020.

3.11.3 The latest renewable energy planning guidance published by the Scottish Executive, SPP6, commits the Scottish Executive to supporting a range renewable generation technologies and recognises that onshore wind power is expected to make the most significant contribution towards meeting national energy targets.

3.11.4 The UK is lagging behind the other leading European countries in developing renewable energy, despite possessing 40% of Europe's wind resource, the majority of which is in Scotland[3]. Thus the Scottish wind resource is of Europe and UK wide significance and is a major component of the UK's drive for renewable energy sources.

3.11.5 The proposal to generate electricity from wind power at Glenkerie arises as a direct response to the above UK Government's and Scotland's policies and targets. Glenkerie will provide the following benefits:

- Displace the emission of over 1,682,400 tonnes of carbon dioxide and other polluting gases over its 25 year expected operational life;
- Provide enough electricity to power approximately 16,400 households, equivalent to over 30% of the households in the Scottish Borders Council area;
- Assist in the delivery of Scotland's climate change commitments and sustainable development strategy;
- Make a significant contribution towards the Scottish target of generating 50% of its electricity from renewable sources by 2020 and the UK wide target of 10% of energy from renewable sources by 2010 and 20% by 2020.

3.11.6 Wind power provides greater diversity in the energy mix, independent of outside fuel sources and is undepletable. These factors ensure that wind energy will continue to act as a renewable alternative to traditional fossil

[3] http://www.bwea.com/media/news/070813.html

fuels and provide continuity and security of supply in an uncertain energy market.

REFERENCES

BWEA (2007) British Wind Energy Association website resource http://www.bwea.com, accessed on 18.10.2007

David Cameron, Nov 2006, article for The Independent newspaper

DEFRA, Scottish Parliament, Welsh Assembly, Northern Ireland Assembly, March 2006, Climate Change – the UK Programme 2006

DETR, Scottish Executive, National Assembly for Wales, Department of the Environment (N. Ireland), November 2000, Climate Change: The UK Programme.

Department of Trade & Industry (2003) „Our Energy Future – Creating a Low Carbon Economy" (London: HMSO)

DTI - Department of Trade and Industry (2006) ENERGY REVIEW, Consultation Document

DTI (2006), UK Energy in Brief July 2006

DTI, 29 June 2006, Renewable energy information pack

DTI, July 2006, The Energy Challenge – Energy Review Report.

DTI (2004). Renewable Supply Chain Gap Analysis (online). DTI website www.dti.gov.uk/energy/renewables/publications/pdfs/renewgapreport.pdf

European Commission (1997) Energy fort he Future: Renewable Sources of Energy White Paper for a Community Strategy and Action Plan com (97)599

European Commission (2001) European Climate Change Programme Report 2001

European Commission website resource http://europa.eu.int/comm/environment/climat

European Council (2001) Directive 2001/77/EC on the Promotion of Electricity Produced from Renewable Energy Sources in the Internal Energy Market

European Environment Agency press release 20/04/2001: EU greenhouse gas emissions down 4 %, more cuts needed – EEA, Copenhagen

EWEA (2006) European Wind Energy Association website resource, http://www.ewea.org

FREDS (2005), Scotland's Renewable Energy Potential: Realising the 2020 Target. Future Generation Group Report 2005

Matthies HG et al. (1995) Study of Offshore Wind Energy in the EC. ETSU Report w/35/00250

Milborrow, (1998) Dispelling the Myths of Energy Payback Time Windstats, vol 11, no 2. at

http://www.bwea.com/energy/myths.html

Performance and Innovation Unit (2002) Energy Review

Scotland's Census 2001 website resource, http://www.scrol.gov.uk

The Scottish Executive, SE/20000/208 (November 2000): Scottish Climate Change Programme

Scottish Executive (2003), Securing a renewable future: Scotland's Renewable Energy

Scottish Executive (2002), Renewable Obligation (Scotland) Order 2002

Treasury, Nov 2006, Stern Review on the Economics of Climate Change

United Nations Framework Convention on Climate Change web site resource: http/unfccc.int/resource/process/components/response

CHAPTER FOUR: PLANNING POLICY

4.1 INTRODUCTION

4.1.1 This chapter identifies the national, strategic and local planning policies and guidance, which are relevant to the determination of the Glenkerie Wind Farm proposal.

4.1.2 Whilst the Scottish Climate Change Programme and the Renewable Obligation (Scotland) are key drivers in the development of renewable energy (see Chapter 3, Needs and Benefits), the local planning system has a crucial role to play in helping to deliver the Scottish Executive's targets and goals for renewable energy generation.

4.1.3 The Scottish Borders Development Plan is generally supportive of renewable energy and wind farm development, with recent and up to date policies that are reflective of current planning policy initiatives for renewable energy and climate change.

4.1.4 This planning chapter demonstrates that the Glenkerie Wind Farm proposal is in accordance with the policies within the Development Plan, and considers that a successful determination of the planning application will be consistent with national and local priorities for delivering sustainable development. In addition, it will contribute towards Scotland's renewable energy target of generating 31% of electricity from renewable sources by 2011 and 50% by 2020.

4.2 NATIONAL PLANNING GUIDANCE

4.2.1 At the national level, current planning guidance and advice is contained within Scottish Planning Policy (SPP) and National Planning Policy Guidance (NPPG), supported by Planning Advice Notes (PANs). The following SPP, NPPG and PAN documents are considered to be relevant to the determination of this application:

- SPP 1 The Planning System
- SPP 2 Economic Development
- SPP 6 Renewable Energy
- PAN 45 Renewable Energy Technologies
- NPPG 14 National Heritage
- PAN 60 Planning for Natural Heritage
- SPP 15 Rural Development
- PAN 73 Rural Diversification
- NPPG 18 Planning and Historic Environment

- NPPG 5 Archaeology and Planning
- PAN 42 Archaeology – The Planning Process and Scheduled Monument Procedures
- PAN 51 Planning and Environment Protection
- PAN 56 Planning and Noise
- PAN 58 Environmental Impact Assessment

Scottish Planning Policy

4.2.2 SPP 1 provides an overview of the land use system in Scotland and sets out the key principles for the planning system. Its primary aim is to guide policy formulation and decision making towards more sustainable forms of development.

4.2.3 Paragraph 7 states that development plan policies should address sustainable development at a local level whilst reflecting national and international goals.

4.2.4 The Glenkerie proposal will contribute towards the planning systems aim to deliver more sustainable development by:

- Displacing over 1,600,000 tonnes of CO2 and other polluting gases over the lifetime of the wind farm which would otherwise have been emitted by conventional fossil fuel based generation;
- Helping to diversify the rural economy and creating job opportunities in the local economy;
- Contribute towards meeting Scottish and UK targets for reducing carbon emissions (as discussed in Chapter 3: Needs and Benefits).

4.2.5 Scotland's planning policy in relation to economic development is set out in SPP 2, which supports the role of planning departments by encouraging new business and promoting national economic growth. This policy also states the importance of sustainable development. Planning Authorities are advised to include positive policies in favour of rural development and rural diversification in "*order to satisfy economic and employment needs ... whilst safeguarding, and enhancing the natural and built heritage*".

4.2.6 It is considered that the Glenkerie Wind Farm will contribute not only to the wider Scottish economy, but also to the local economy with opportunities for local contractors during the construction phase and through the use of local services both prior to, during and after construction of the site. In addition, the establishment of a charitable fund package, linked to the electricity output of the site, will bring added economic strength to the community and allow local residents to have a greater involvement in the provision of social and charitable services in their community.

4.2.7 SPP 6 was published in March 2007 and replaced NPPG 6 Renewable Energy Developments (2000) as Scotland's primary renewables and wind farm policy document. This policy sets out the strategic advice that Planning Authorities should consider when preparing development plans and when determining planning applications. One of the key statements in SPP 6 is the acknowledgment that on-shore wind power is likely to be the single biggest contributor towards meeting Scotland's renewable energy targets.

4.2.8 Paragraph 16 of SPP 6 advises Planning Authorities to make positive provision for renewable energy developments by:

- Supporting a diverse range of renewable energy technologies including encouraging the development of emerging and new technologies;
- Recognising the importance of fully engaging with local communities and other stakeholders at all stages of the planning process;
- Providing clarity on the issues that will be taken into account when assessing specific proposals;
- Maximising environmental, economic and social benefits;

While at the same time:

- Meeting international and national statutory obligations to protect designated areas, species and habitats and protecting the historic environment from inappropriate forms of development; and
- Ensuring impacts on local communities and other interests are satisfactorily addressed.

4.2.9 Community planning is another important element of SPP 6 with communities encouraged to invest in ownership of renewable energy projects or to develop their own projects.

4.2.10 SPP 6 has a detailed Annex A entitled 'Spatial Framework for Wind Farms over 20MW' which clearly identities what Planning Authorities should consider when formulating policy and in determining planning applications. Wind farms under 20MW are also relevant to Annex A and it is significant that SPP 6 states that in considering the design and location of any development:

"*the existence of natural heritage designations and other constraints should not be incompatible with the need to encourage smaller scale wind developments*"

4.2.11 Annex A advises Planning Authorities to identify through their Development Plans, the following measures:

- Broad areas of search where proposals are likely to be supported subject to specific proposals satisfactorily addressing all other material considerations;

- Areas that can be afforded significant protection through spatial policies; and
- Criteria to be followed in the remainder of the plan, where the approach will be to consider applications on their merits, against clear criteria and mindful of the support given in SPP 6 to the promotion of renewable energy developments.

4.2.12 In addition to the above measures, wind farms will also be assessed against development plan policies relating to natural heritage, historic environment, green belts, tourism and recreation, aviation and defence, communities, cumulative impact and wind resource.

4.2.13 PAN 45 is an accompaniment to SPP 6 and provides information and advice on the technologies for harnessing renewable energy. Paragraphs 36-93 state the issues that should be considered in developing a wind energy project, which include:

- Safety;
- Electro-magnetic interference, to both civilian and military aircraft and television reception;
- Proximity to roads and railways;
- Shadow flicker;
- Noise;
- Siting and visual impact;
- Birds and nature conservation;
- Cumulative effects; and
- Decommissioning, re-equipping and site reinstatement.

4.2.14 In considering the detailed planning policy and advice as contained within SPP 6 and PAN 45, it is concluded that the Glenkerie Wind Farm proposal does accord with the Scottish Executives criteria and objectives for renewable energy and in particular, wind energy development. This is achieved by:

- Contributing to Scotland's mix of diverse renewable energy technologies;
- Engaging with, and having the support within the local community;
- Involving the community in the project through provision of a Community Benefits Package;
- Protecting the biodiversity, landscape and cultural heritage values of the site;
- Protecting views of the site from the NSA, RSA and AGLV through careful site design to minimise visual impact;

- Paying back the energy used in the construction of the wind farm within 3 to 5 months, thereby illustrating the sustainable credentials of the project;
- Negating noise, shadow flicker and communications interference through detailed consultation and assessment.

4.2.15 SPP 6 provides the main policy document for wind energy development and its guidelines overlap with other national policies, which will also be required to be assessed as part of this ES. Some of these key policies relate to natural heritage, rural development, the historic environment and environmental protection. Appraising the proposal against the planning criteria of these areas is important in discussing the acceptability of the Glenkerie Wind Farm at this location in the Scottish Borders.

4.2.16 NPPG 14 sets out the Scottish Executives objectives for safeguarding and enhancing the country's natural heritage. Areas afforded certain levels of protection against inappropriate development include:

- Internationally designated sites including Ramsar Sites, Special Protection Areas (SPAs), Special Areas of Conservation (SACs) and Natura 2000 sites;
- National sites including National Scenic Areas (NSAs), Sites of Special Scientific Interest (SSSI's), National Nature Reserves (NNRs), National Parks and Natural Heritage Areas (NHAs);
- Regional or local designations including Areas of Great Landscape Value (AGLV), Local Nature Reserves (LNRs), Wildlife sites and Regional Important Geological/Geomorphological sites (RIGS).

4.2.17 PAN 60 complements NPPG 14 and provides advice on how development and the planning system can contribute to the conservation, enhancement, enjoyment and understanding of Scotland's natural environment. PAN 60 states that:

"development can play an important role in improving the natural environment"

The PAN also seeks to ensure that conservation and enjoyment of the natural heritage brings benefit to local communities and provides opportunities for sustainable social and economic progress.

4.2.18 It is not considered that the Glenkerie Wind Farm will have a significant impact on the designated sites afforded protection through NPPG 14. The site is not located within any sites designated for their international or national importance. The site is located about 4 km south west of the Upper Tweeddale NSA and 3 km east of the South Clydesdale RSA. The impact on both these designations in discussed in Chapter 7 Landscape and Visual Impact and has been assessed as 'not significant'.

4.2.19 The proposed wind farm is situated within the Tweedsmuir Hills/Upper Tweeddale AGLV, which is a scenic designation of local importance and

thus not afforded the same weight of protection as the NSA or RSA. Again, the impact on this designation is not considered to be 'significant' and is discussed in more detailed in Chapter 7 Landscape and Visual Impact.

4.2.20 The eastern boundary of wind farm lies adjacent to the River Tweed which, along with its major tributaries, is a designated SSSI. To ensure that impacts on the River Tweed, Kingledores Burn and other tributaries are avoided. Turbines and access tracks have been sited an appropriate distance from watercourses and mitigation measures will be put in place to ensure compliance with SEPA guidelines. The impact of the proposal on the SSSI is not considered to be significant and is addressed in more detail in Chapter 10: Hydrogeology and Soils

4.2.21 SPP 15 advises that sustainable development in rural areas should be:

"encouraged and development should be accommodated after taking due regard of environmental effects"

This policy highlights how new forms of sustainable development can benefit local communities, and states that diversification of the rural economy should be actively encouraged.

4.2.22 PAN 73 is an accompaniment to SPP 15, and states that rural diversification in its simplest form can mean the establishment of new enterprises in rural locations. Rural diversification is stated to help broaden the economic activity of rural areas providing opportunity and creating a more balanced and stable economy.

4.2.23 As previously stated for SPP 2: Economic Development, the Glenkerie Wind Farm will help make a significant contribution to the local economy through diversification and opportunities for local contractors during the construction phase of development.

4.2.24 NPPG 18 sets out the Scottish Executive's planning policies in relation to the historic environment with a view to its protection, conservation and enhancement, including:

- National policy on the historic environment which local authorities should consider in formulating and assessing development proposals;
- Protection of the historic environment and the promotion of opportunities for change that can contribute to sustainable development.

4.2.25 Planning applications with the potential to impact on the historic environment should be accompanied by sufficient information on the architectural, environmental and archaeological significance of the site along with nature of the proposed development, so that the impact of the proposal can be assessed and proposals justified.

4.2.26 NPPG 5 sets out how archaeological remains and discoveries should be handled through the development plan system, including the weight to be

given to them in planning decisions and the use of planning conditions. This policy seeks to encourage the preservation of heritage sites and landscapes of archaeological interest so that they can be passed on to, and appreciated by, future generations.

4.2.27 PAN 42 supports both NPPG 18 and NPPG 5 and advises on the historic environment and land use issues, and specifically on the handling of archaeological matters under the Ancient Monuments and Archaeological Areas Act 1979 over Scheduled Ancient Monuments. EIA should include information relating to any significant effects on natural assets and the cultural heritage and measures to avoid, reduce or remedy adverse effects.

4.2.28 The impact of the Glenkerie Wind Farm on the historic environment and on archaeological features is discussed in Chapter 6: Cultural Heritage. The impact of the proposal on cultural heritage features is low, with only potentially minor impacts, which would not compromise the character or setting of sensitive features.

4.2.29 PAN 51 considers the relationship between sustainable development, environmental pollution and development planning and control. The guidance outlines regimes for integrated pollution control including pollution of controlled waters and statutory noise. Chapter 5 - Project Description, Chapter 10 - Hydrology and Soils and Chapter 11 - Noise, discuss how mitigation measures will be applied to ensure compliance with PAN 51.

4.2.30 PAN 56 examines the role of the planning system in preventing and limiting the adverse effects of noise without prejudicing investment in enterprise, development and transport. Paragraph 34 deals specifically with noise from wind farms and covers sources of noise from the turbines and the importance of the existing noise environment in assessing the impact of potential noise from the turbines. It states that:

"*Good acoustical design and siting of turbines is essential to ensure there is no significant increase in ambient noise levels as they affect the environment and any nearby noise-sensitive property*".

4.2.31 The issue of noise is considered in more detail in Chapter 11. Turbines have been sited to ensure compliance with regulatory noise thresholds for outputs from operating turbines. The potential noise generated by the operating Glenkerie Wind Farm has been calculated to be within these thresholds, with the assessment therefore concluding that noise impact will be not be significant.

4.2.32 PAN 58 identifies both the positive and negative environmental effects of a development in two stages. It recommends that an assessment is undertaken to identify environmental issues during the design of the project and that the results are published in an Environmental Statement (ES). Planning Authorities are advised to critically evaluate the ES and determine whether there is sufficient information to understand the environmental effects of the project and specify mitigation measures to

compensate for any negative impacts. The statutory requirement for EIA is outlined in the Environmental Impact Assessment (Scotland) Regulations 1999.

4.3 DEVELOPMENT PLAN POLICY

4.3.1 In consideration of planning policy at local level, the policies as contained in the relevant structure and local development plans are of prime importance. SPP 1 advises, and Section 25 of the Town and Country Planning (Scotland) Act 1997 requires, that: "....*where in making any determination under the Planning Acts, regard is to be had to the development plan; the determination shall be made in accordance with the Plan unless material consideration indicates otherwise*".

4.3.2 The site for the proposed Glenkerie Wind Farm is situated within the Scottish Borders Council Area. The documents that comprise the Development Plan policies for the application area are as follows:

- Scottish Borders Structure Plan (2002);
- Scottish Borders Finalised Local Plan (2005).

Scottish Borders Structure Plan (2002)

4.3.3 The Borders Council Structure Plan was approved in 2002 and sets out the strategic long-term framework for development in the council area. The main objective of the Structure Plan is to encourage growth, which supports the development of a sustainable Scottish Borders community and, within it, the development of individual sustainable communities.

4.3.4 Policy I19 - Renewable Energy, states the Councils support for the development of renewable energy sources. Locational advice for wind energy development as defined in Policy I19 is illustrated in Table 4.1.

Table 4.1 Areas of Search for Wind Farm Developments

Sensitive	**Potentially Sensitive**	**Preferred**
Special Area of Conservation (SAC) Special Protection Area (SPA) Ramsar Site National Scenic Area (NSA)	Area of Great Landscape Value (AGLV) Site of Special Scientific Interest (SSSI) National Nature Reserve (NNR)	Areas outside any environmental designations

4.3.5 The Glenkerie Wind Farm is located within the Tweedsmuir/Upper Tweeddale AGLV and is therefore classified as a 'potentially sensitive' area of search. As discussed in previous sections and confirmed in Chapter 7:

Landscape and Visual Impact, it is not considered that the impact on the AGLV or NSA will be significant.

In addition, the location of the wind farm in relation to the River Tweed SAC/SSSI and the potential impact to these watercourses from on site burns has been suitably addressed in the hydrological assessment contained within this ES, which has concluded that any significant impacts on the values of these designations can be adequately mitigated for.

4.3.6 Policy I20 - Wind Energy Developments, states that proposals for wind energy developments will be assessed against the following planning policy criteria:

- The landscape character of the area, as guided by the Landscape Character assessment;
- The Structure Plan's environmental policies;
- The impact of noise on residential and other noise sensitive developments;
- Interference with aircraft activity;
- 'Shadow Flicker' or 'Driver Distraction'; or
- Any unacceptable cumulative impacts.

4.3.7 Policy N9 - Maintaining Landscape Character, states that proposals for development and land use change will be guided by the Scottish Borders Landscape Assessment with the aim of maintaining the integrity of the landscape character and enhancing its quality. The assessment will be used to inform policy reviews and guidelines on topics, which have implications for the landscape resource.

4.3.8 Policy N10 - National Scenic Areas, follows in the same theme as N9 stating that development will only be permitted where;

- The objectives of the designation and the overall landscape value of the site will not be compromised; or
- Any significant adverse effects on the qualities for which the site has been designated, are clearly outweighed by social or economic benefits of national importance.

4.3.9 Policy N11 - Areas of Great Landscape Value, seeks to safeguard landscape quality with particular regard to the landscape impact of the proposed development. Proposals that have a significant adverse impact will only be permitted where the impact is clearly outweighed by social or economic benefits of national or local importance.

4.3.10 In terms of Policies N9, N10 and N11, it is considered that the Glenkerie proposal will not compromise the value or quality of the landscape designations highlighted above. Indeed, the limited impact of the wind farm coupled with the clear national priority for renewable energy development, and particularly wind energy, demonstrates that the social

and economic importance of the proposal is significant when considered in the national sense.

4.3.11 Policy N14 - National Archaeological Sites, states that development proposals, which would destroy or adversely affect the appearance, fabric or setting of Scheduled Ancient Monuments or other nationally important sites not yet scheduled will not be permitted unless:

- The development offers substantial benefits, including those of a social or economic nature, that clearly outweigh the national value of the site;
- There are no reasonable alternative means of meeting that development need, and the proposal includes a mitigation strategy acceptable to Historic Scotland.

Policy N15 - Regional and Local Archaeological Sites, states that development proposals, which adversely affect an archaeological site of regional or local significance, will only be permitted where it can be demonstrated that the benefits of the proposal will clearly outweigh that archaeological value of that site or feature.

In terms of Policies N14 and N15, it is considered that the impact on the Scheduled Ancient Monuments or other nationally and locally important sites is not significant and this issue is addressed in Chapter 6: Cultural Heritage.

4.3.12 Policy N3 - National Sites, states that development proposals which will have an adverse effect, either directly or indirectly, on a Site of Scientific Interest will not be permitted unless:

- The development will not adversely affect the integrity of the site; and
- The development offers substantial benefits, including those of a social or economic nature that clearly outweigh the nature conservation of the site.

The River Tweed and Kingledores Burn are designated as a SAC and SSSI. The potential impacts of the wind farm proposal on these designations is discussed in Chapter 8: Ecology and Chapter 10: Hydrology and Hydrogeology. These assessments have found that impacts resulting from the wind farm development can be reduced to low or minor significance through the use of appropriate mitigations. It was not considered that the integrity or value of National Sites would in any way be compromised.

The Finalised Scottish Borders Local Plan (2005)

4.3.13 The Local plan is the main mechanism through which the strategic policies of the Structure Plan are taken forward to a detailed level. The underlying strategies of the Local Plan are underpinned by the principle of sustainability.

4.3.14 Policy D4 - Renewable Energy Development, is the primary local plan policy which the Glenkerie Wind Farm will be assessed against and states that renewable energy developments will be approved where:

- There are no unacceptable adverse impacts on the natural heritage including the water environment, landscape, biodiversity, built environment and archaeological heritage, or that any adverse impacts can be satisfactorily mitigated;
- There is no unacceptable adverse impact on recreation and tourism, including access routes, or that any adverse impacts can be satisfactorily mitigated.

4.3.15 With regard to commercial wind farms, Policy D4 states that the following measures will be used to determine the outcome of an application for wind farm development:

1. Large scale wind farms will normally be acceptable within "preferred areas" and outwith environmental designations as set out in the Structure Plan;

2. Locations within large scale landscape settings defined as Upland type in the Borders Landscape Assessment will normally be more acceptable than other landscape character types subject to detailed assessment of the fragility of the area to change;

3. Locations where there is:

   "surrounding landform that minimises the external visibility of the development, where there is no interference with prominent skylines or where there is no conflict with sensitive habitats",

   will be looked on more favourably than other locations;

4. In assessing the landscape impacts of wind farm developments, particular attention will be given to the effects on high sensitivity receptors including major tourist routes and important landscape viewpoints;

5. Additionally, the following sensitivities must be addressed:

   i. Impact on landscape character;

   ii. Views of the wind farm from sensitive receptors;

   iii. Cumulative visual impact of wind farms, shadow flicker and driver distraction. Visual impact will be measured against the criteria of Table 4.2 below.

Table 4.2 Effect of Distance on Perceived Visual Impact

Distance	**Impact**
0 – 2.5 km	Dominant [1]
2.5 km – 5.0 km	Major Impact[2]
5.0 km – 7.5 km	Moderate Impact
7.5 km – 10 km	Low Impact
Over 10 km	Negligible

iv. Generation of noise;

v. Traffic generation;

vi. Ecology and ornithology, particularly protected species and habitats, species and habitats of conservation concern or species valuable to wind farms by virtue of their behaviour;

vii. Interference with radio communications and aviation;

viii. Provisions for decommissioning, land restoration, after care and after use;

ix. Cumulative impact of wind farm development.

4.3.16 Policy D4 further states that developers must demonstrate that they have considered options for minimising the operational impact of the development including:

- Positioning of the wind farm in relation to landscape character, surrounding landform, wind farms and power lines;
- Positioning of the wind farm in relation to the biodiversity interest of the site and surrounding area;
- Siting and design of tracks and ancillary development;
- Turbine positioning and separation from residential properties and radio telecommunications;
- Turbine specifications and technical controls, including consideration of predicted noise levels at specific properties closest to the wind farm at wind speeds corresponding to cut in, full rated power and maximum operational wind speed, along with background noise levels and wind speeds;
- Colours and finishes;
- Routeing and timing of construction traffic; and
- Road access and improvements, taking account of constraints posed by wetland and upland habitats.

[1] Based on blade tip height of 100m
[2] Major impact is defined as potentially visually intrusive

4.3.17 In consideration of this detailed planning advice, the following characteristics of the Glenkerie proposal are highlighted to justify the proposal's accordance with this policy. These characteristics include:

- Avoiding significant impact on sensitive landscapes, biodiversity, built environment and cultural heritage designations through careful site design based on comprehensive site survey and environmental assessment;
- Limiting the visual impact of the proposal on the A701 - an important tourist route;
- Iterative site design to ensure limited visual impact on the AGLV, NSA and on local residential properties and settlements, thereby "*minimising the external visibility of the development*";
- Ensuring that views of the site from major viewpoints are consistent in scale and layout;
- Ensuring no interference with radio communication, aviation or military interests;
- Compliance with national guidance for wind turbine noise outputs;
- Limiting where possible the number of vehicular movements to and from the site.

4.3.18 Additional policies to safeguard the landscape and visual qualities of NSAs and AGLVs have limited information and refer to Structure Plan policy. These include Policy EP1 National Scenic Areas and Policy EP2 Areas of Great landscape Value.

4.3.19 Other policies of relevance to this proposal include: NE3 Local Biodiversity, NE5 Development affecting the Water Environment, NE6 River Engineering Works, BE2 Archaeological Sites and Ancient Monuments, BE3 Gardens and Designed Landscapes, G1 Quality Standards for New Development, G5 Developer Contributions, BE6 Protection of Open Space, EP5 Air Quality and NE4 Trees, Woodlands and Hedgerows.

In all cases, the Glenkerie Wind Farm proposal has been demonstrated to comply with these Development Plan policies.

4.4 CONCLUSION

4.4.1 This chapter has undertaken a full consideration of the relevant National and local planning policy framework in relation to the Glenkerie Wind Farm application, concluding that:

- The project will help to deliver the Scottish Executive's commitment to generate 31% of Scotland's electricity from renewable sources by 2011, and to generate 50% by 2020.

- There is a need for the project as recognised by SPP 6, which acknowledges that onshore wind power will be the most significant contributor to the delivery of renewable energy targets in the immediate future.

- The Scottish Executive advises that sustainable development such as wind farms in rural areas should be encouraged and that the socio-economic benefits of the construction and operation of such development can diversify the local farming industry and the rural economy as a whole.

- There are no statutory or non statutory environmental designations on the Glenkerie site except for one crossing of the Kingledores Burn SSSI and SAC. The effect on this designation can be conditioned through measures to be agreed in consultation with SEPA, SNH and Scottish Borders Council. The impact of the proposal on this designation has been assessed in the Hydrology and Has being of low significance.

- The potential visibility of the proposed wind farm within the surrounding landscape is limited. The site is well contained by hills and ridges which effectively serve to almost completely screen the development from the surrounding area.

- The site is located within an AGLV where its potential visual impact has been assessed as limited with only localised effects. The site is also located approximately 4 km south west of the Upper Tweeddale NSA and 3 km east of the South Cydesdale RSA. In both cases the visual impact is limited and indirect. In general landscape terms, it is considered that Glenkerie will not have a significant visual impact and will not compromise the value of the host landscape, or the nearby Regionally and Nationally designated landscapes.

- The potential impacts of the proposal on the settings of Listed Buildings and Historic Gardens and Designed Landscapes (HGDLs) would be indirect and are not considered to be significant. The potential impact of the proposal on archaeological sites has also been found to be of low significance. These impacts are discussed in more detail in Chapter 6 Cultural Heritage.

- In summary it is considered that the development of the Glenkerie Wind Farm would comply with the policy criteria governing such development as set out in National planning guidance and the Scottish Borders Development Plan.

REFERENCES

Scottish Borders Structure Plan 2002

Scottish Borders Finalised Local Plan 2005

FREDS (2005) *Scotland's Renewable Energy Potential: Realising the 2020 Target*. Future Generation Group Report 2005

Scottish Executive (2002) Scottish Planning Policy SPP 1: *The Planning System*

Scottish Executive (2007) Scottish Planning Policy SPP 6: *Renewable Energy*

Scottish Executive (2002) Planning Advice Note PAN 45: *Renewable Energy Technologies*

Scottish Executive (1998) National Planning Policy Guideline NPPG 5: *Archaeology and Planning*

Scottish Executive (1999) National Planning Policy Guideline NPPG 14: *Natural Heritage*

Scottish Executive (2005) Scottish Planning Policy SPP 15: *Rural Development*

Scottish Executive. 1998. National Planning Policy Guideline NPPG 18: *Planning and Historic Environment*

Scottish Executive (2005) Scottish Planning Policy SPP 20: *Role of Architecture and Design Scotland*

Scottish Executive (1994) Planning Advice Note PAN 42: *Archaeology The Planning Process and Scheduled Monument Procedures*

Scottish Executive (1997) Planning Advice Note PAN 51: *Planning and Environment Protection*

Scottish Executive (1999) Planning Advice Note PAN 56: *Planning and Noise*

Scottish Executive (1999) Planning Advice Note PAN 58: *Environmental Impact Assessment*

Scottish Executive (2000) Planning Advice Note PAN 60: *Planning for Natural Heritage*

Scottish Executive (2003) Planning Advice Note PAN 68: *Design Statements*

Scottish Executive (2005) Planning Advice Note (PAN) 73: *Rural Diversification*

Scottish Executive (2003) *Securing a renewable future: Scotland's Renewable Energy*

Scottish Executive (2001) *A Policy on Architecture*

CHAPTER FIVE: PROJECT DESCRIPTION

5.1 INTRODUCTION

5.1.1 This chapter describes the proposed Glenkerie Wind Farm in terms of its various permanent and temporary elements, and includes details about the design and construction of the project. The descriptions used allow for an assessment of the maximum potential effect of the development within each assessment area.

5.1.2 The main components of the scheme are as follows:

- Installation of 11 wind turbines, each with a maximum power output of 2.5MW and blade tip heights of between 105m on the ridgeline and 120m on lower areas of the ridges;
- Approximately 8 km of new on-site access tracks;
- Upgrading of approximately 1.3 km of existing on-site access tracks;
- Crane hardstandings adjacent to each turbine base;
- Control building;
- Connecting underground cabling;
- One permanent wind monitoring mast; and
- A temporary construction compound.

5.1.3 Figure 1.2 shows the proposed layout of the wind farm which would have a potential generation capacity of up to 27.5MW.

5.2 WIND TURBINES

5.2.1 It is proposed to install 11 wind turbines generators with an individual electricity generating capacity of between 1.8MW and 2.5MW. The total possible generating capacity for the site would be between 19.8 MW and 27.5MW. Each turbine will be mounted on a tapered tubular steel tower and would consist of a nacelle containing the gearbox, generator and associated equipment to which are attached a hub and rotor assembly including three glass/carbon fibre-reinforced polyester blades. The potential generation capacity of the wind farm will be up to 27.5MW. An example of typical turbine model type is shown in Figure 5.1.

5.2.2 Electricity generated by the individual turbines will be transmitted along underground cables to the on-site control building (Figure 1.2), from which it will be exported from the site. The transmission of the output from the Windfarm to the grid connection will be underground or on existing wooden poles. At the date of submission of this application, a grid connection offer has been accepted by Novera and Scottish Power have been contracted to take the output from the Windfarm. However, the route of the underground cable has not been confirmed by Scottish Power, with two alternatives under consideration.

5.2.3 The maximum height from the turbine base to the top of the blade tip will be 105 metres when the blades reach their highest point, for 6 of the turbines, and 120 metres for 5 of the turbines on the lower parts of the ridgeline. The turbine hub height will be up to 70 metres for 6 of the turbines, and up to 85m for 5 of the turbines on the lower ground. The rotor (blade) radius will be up to 40 metres for all of the turbines (Figure 5.1). The colour for the towers would be semi-matt light grey, designed to blend into a sky background and thus present an aesthetically sympathetic appearance. The final turbine colour specification would be determined by consultation with Scottish Borders Council.

5.2.4 The turbines would start operating when the wind speed reaches approximately 3.5 metres per second. When the wind speed sensors mounted on each turbine determine there is a sufficient wind speed for operation, the yaw mechanism turns the turbine so that the blades face into the wind. The rotor blades of each of the turbines on the site would all rotate in the same direction. In the event that the wind speed exceeds approximately 25 metres per second, the control system of each turbine would feather the turbine blades to capture a minimum amount of wind energy and then apply the mechanical brakes. This process will stop the rotation of the rotor and shut down the turbine. When the wind speed drops below the maximum limit, control systems will signal the turbine to start up again. The turbines are designed to withstand wind speeds in excess of 55 metres per second (125 miles per hour) and have a failsafe shut down system. The design life of the turbines is approximately 25 years.

5.2.5 The turbines are equipped with lightning protection, which protects the entire turbine from the tips of the blades to the foundation. In the event of a lightning strike, the system is designed to lead the lightning energy around the sensitive parts of the turbine and down into the ground minimising damage to equipment. Noise damping is also an integral part of the turbine design to ensure that noise emissions are kept within statutory limits.

5.3 SITE CONSTRUCTION

5.3.1 It is anticipated that construction of the Glenkerie Wind Farm will being in late 2009 or 2010, subject to planning consent being awarded during 2008.

Construction Period

5.3.2 The estimated on-site construction period is 6-9 months. This timetable includes a programme to reinstate the temporary working areas. Normal hours of operations for construction purposes will be between 07:00 - 19:00; 65 hours over a Monday to Saturday week, with the latter being 07:00 to 12:00 hours. The construction programme will consist of the following operations:[1]

- Siting of a temporary construction compound near the site entrance for storage of wind farm components, temporary site facilities, etc (Figure 5.2);
- Construction of site access tracks to wind turbine locations for use by civil engineering plant and construction equipment (Figures 5.3);
- Construction of wind turbine foundations and hardstanding areas (Figure 5.2);
- Excavation of cable trench and cable laying (Figure 5.3);
- Construction of control building (Figure 5.4);
- Erection of wind turbines (Figures 5.1);
- Connection of on site electrical power and signal cables;
- Commissioning of the site equipment;
- Site reinstatement and restoration.

[1] A number of construction operations will take place concurrently.

Construction Materials

5.3.3 The following main materials will likely be required for the construction of the track, turbine and control building foundations, hardstanding and cable trenches:

- Crushed stone;
- Geotextile matting;
- Cement;
- Sand;
- Concrete quality aggregate;
- Steel reinforcement;
- Electrical cable.

5.3.4 The foundation concrete would be a high strength structural grade, which is not prone to significant leaching of alkalis (for more detail, refer to Chapter 10 Hydrology and Hydrogeology).

Turbine Foundations

5.3.5 The detailed design specification for each foundation would depend on the geotechnical site investigation of the land on which the turbine would be located. Standard concrete foundations, typical of existing wind farm sites, will be used.

5.3.6 It is anticipated that up to 350m^3 of concrete per turbine base will be required. Concrete will be imported to the site ready mixed. The foundations would be approximately 15.7m square and up to 3.1 metres deep, in the form of an 'inverted T' design. Actual turbine foundation design and dimensions will be specific to the site conditions as verified during the detailed site construction investigations undertaken before commencing project installation.

5.3.7 The ground excavation methods used at each turbine site would vary depending on the local ground conditions and the nature of the surface vegetation. The general process, however, would be as follows:

- The top vegetation layer and topsoil would be stripped, keeping the top 200mm of turf intact - this material would be stored adjacent to the base working area;
- The stored material would not exceed 2m in height to minimise the risk of overheating;
- Subsoil would then be stripped and stored, keeping this material separate from the topsoil or turf;

- Excavation of the turbine foundation would then take place followed by the installation of the steel reinforcement bars and the casting of concrete;
- The excavation would be open for about a week and after the foundation concrete has been poured the area would be backfilled as soon as practicable with spoil, pending turbine erection.

5.3.8 Once the turbine has been installed, the immediate construction area around the turbine base would be restored using the retained topsoil and turf to within 1m of the tower base. A one metre wide gravel path would then be laid down around the tower base. Surplus material won from foundation excavations would, if suitable, be utilised in the construction of site infrastructure.

On-Site Tracks

5.3.9 On-site track construction would use appropriate methods developed at other wind farm sites. In particular, the SNH publication *Constructed tracks in the Scottish Uplands* will be adhered too. Alternative types of track may be required for different sections of the site, depending on local ground conditions. An outline of the two principal track types is given below and typical construction and restoration profiles are shown on Figure 5.3.

5.3.10 Prior to the commencement of site construction, detailed engineering criteria on the access track design will be submitted to the planning authority as part of the Construction Environmental Management Plan (CEMP), see Section 5.7 below.

5.3.11 The layout of on-site access tracks has been designed to avoid any sensitive environmental constraints. Where possible, the access route has followed existing tracks within the site.

5.3.12 The access tracks will be left in place after completion of the wind farm construction, as they will provide:

- Access for wind farm site maintenance and repairs;
- Improved access for existing land users;
- Access for decommissioning of the wind farm.

5.3.13 A total of approximately 8 km of new on-site access track will be constructed to provide full transport access to all the turbine locations. Upgrading works for up to 1.3 km of existing site track is anticipated.

5.3.14 As Figure 5.3 shows, the access track design is anticipated to be of two main types, as follows:

(a) Tracks on free draining soils

Where there is topsoil overlying freely draining subsoil, or where there is a shallow depth of soft ground, the topsoil and turf would be

stripped to expose suitable subsoil/bedrock up to 0.6m below ground level. A geotextile membrane would be laid, except where the track was being laid directly onto a rock base, to minimise the need for stone and to reduce the impact on soils. The track would then be built up on the geotextile by layering and compacting crushed rock up to a total maximum thickness of approximately 0.6m dependant upon ground conditions.

Soils and turf removed from the excavated area would be stored separately in piles adjacent to, or near the tracks. Reinstatement work will be carried out as track construction progresses to minimise the storage time of the soils and turf.

(b) Tracks (Floating) on poorly drained soils

Considerable effort has been made in the site design and layout to avoid areas of soft/wet ground (e.g. peat), both for engineering and ecological reasons. The Geo-technical survey of the turbine and track areas did not find any areas of deep peat and only one small area of wet ground. When it is not possible to avoid such areas, appropriate engineering designs would be utilised, whereupon the track 'floats' on top of the existing ground matrix, thus maintaining the hydrological continuity and associated floral and fauna communities at the site.

In cases where the track needs to be constructed on soft ground with a high water table, approximately 0.3m to 0.6m of locally won granular fill would be laid on at least one, if not more, layers of geogrid reinforcement material, incorporating associated granular fill. The base geogrid would be laid directly onto the vegetation mat to provide additional support.

In locations where tracks cross certain types of drainage features, additional engineering works will be undertaken such as small bore drainage pipes to assist in maintaining the hydrological continuity at the site.

5.3.15 Due to the earthmoving requirements for the proposed access track construction, it is anticipated that borrow pits for road base material will not be required. Rock material won from cuttings made during construction of the access track will be used as a base material to form the access tracks. It is recommended that a geotechnical investigation should be carried out to assess the suitability of this material and sections of track located near watercourses are constructed from aggregate sourced from outwith the development. This is due to the fine-grained sedimentary properties of underlying rock which may be vulnerable to erosion and could lead to pollution. This is discussed in more detail in Chapter 10 Hydrology and Hydrogeology.

Turbine Erection

5.3.16 The wind turbines will be erected using two large all terrain cranes. A set consists of the main lifting crane and the tail crane. The main lifting crane

would have a lifting capacity of up to 850 tonnes while the second, or tail, crane would have a lifting capacity of up to 500 tonnes. Indicative dimensions and layout for the crane hardstanding areas are shown in Figure 5.2. The crane pads would be retained for operational use during the life of the windfarm but would be allowed to revegetate. The two cranes would lift the turbine tower sections and blades from the delivery vehicles and into their assembly position. The larger crane would be used to lift the tower sections, turbine nacelle and the hub and blade assembly into their erection position. The tail crane would help to align and position the components whilst being installed. As each turbine is assembled and installed, the two cranes would be moved to the next turbine position.

5.3.17 Construction of the temporary crane hard standing areas would be similar to the construction of the site tracks (see above). Peat or topsoil and subsoil would be removed and stored separately adjacent to the site and crushed stone laid down to form the hardstanding area.

5.3.18 Surplus excavated material will be removed from the site, or used for track maintenance during construction, as appropriate. Surplus topsoil will be used to restore track edges after construction. This progressive reinstatement has been found to assist with reestablishment of the local ecology as it minimises the time that soil and turf are in storage.

5.4 SITE ACCESS

5.4.1 The design of the access route onto and within the site would meet the requirements of the Highway Authority with regard to visibility, construction materials, surface water drainage, gradient and safety of other road users. General signing would be provided in the vicinity to indicate to other road

users the potential of heavy vehicle movements. The main site access will be directly from the A701, as indicated on Figures 1.2 and 13.1.

5.4.2 The proposed route to site is from the M74 and north along the A701 through Moffat, past the 'Devil's Beaftub' to the site entrance.

5.4.3 All other HGV traffic related to the project will utilise the local road network, subject to detailed consultation and agreement with the Scottish Borders Council Roads Department and the local community.

5.4.4 Chapter 13, Transport, addresses in detail the local and wider transport effects of the development during construction and operation.

5.5 ELECTRICAL CONNECTIONS

Control Building

5.5.1 The proposed location of the control building is shown on Figure 1.2. The location has been chosen because:

a) It is relatively central to all the site components, therefore minimising the amount of underground cabling required together with associated electrical losses; and

b) It minimises the visual effect of the building due to landform screening;

5.5.2 Illustrations and the dimensions of a typical 33kV control building are shown on Figure 5.4.

5.5.3 The building would:

- have permanent vehicular access with a hard standing area that would be surfaced with gravel;
- not contain exterior lighting;
- comply with the Electricity Supply Regulations 1988 (as amended) with regard to the installation of safety signs.

5.5.4 The control building would accommodate all of the electrical switchgear, fault protection and metering equipment required to connect the wind farm to the electricity distribution network (switch room). A separate section of the building would house all of the equipment necessary for automatic remote control and monitoring of the wind farm (control room).

5.5.5 The control building would be constructed on a concrete slab foundation. Final design will be subject to site specific conditions determined prior to site construction and with allowance of the required elements to be installed within the structure. It will be constructed and finished using materials that are in keeping with existing buildings in the area and in

accordance with details to be approved by Scottish Borders Council as a Planning Condition.

5.5.6 The 33kV underground cabling leading from each turbine to the Control Building will be laid in cable trenches, typically up to 1.2m deep and 0.65m wide. The cabling will be located directly adjacent to the access track. The cables will be laid on a sand bed and backfilled using suitably graded material (see Figure 5.3 for indicative cable trench detail).

Grid Connection

5.5.7 Novera have recently accepted an offer from Scottish Power for connection of the Wind Farm to the electricity grid. The connection from the site control building to the local grid would take the form of an underground cable and the use of existing wooden poles. The actual connection point has yet to be determined by Scottish Power.

5.5.8 The grid connection would require planning approval and would be the subject of a separate application under Section 37 of the *Electricity Act 1989*.

5.6 TEMPORARY STRUCTURES

5.6.1 One temporary construction compound (laydown) will be required during the construction phase of the wind farm, as illustrated on Figure 1.2. As Figure 5.2 shows, the compound area will be approximately 50m by 100m and will be used to:

- Situate temporary 'portacabin' type structures to be used for secondary site offices and toilet facilities;
- Store and assemble turbine components;
- Store fuels, tools, small parts and materials required for construction;
- Provide parking for cars and construction vehicles;
- Park and unload delivery vehicles, in particular abnormal loads; and
- Refuel construction vehicles;

5.7 CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN (CEMP)

5.7.1 A site specific CEMP would be drawn up, in consultation with Scottish Borders Council, SEPA and SNH, when the main contractor has been appointed and prior to the commencement of construction. The CEMP would define how any significant environmental issues would be dealt with by the construction team. The CEMP would be reviewed and updated as necessary during the course of the construction period.

5.7.2 The main contractor with Novera's approval would produce a set of control standards for sub-contractors working on the Glenkerie Wind Farm site.

The control process for sub-contractors would include distribution of appropriate sections of the CEMP and associated procedures prior to the commencement of work. All sub-contractors would receive induction training, including site specific environmental training, prior to commencing work on the site.

5.7.3 The main contractor would be required to carry out the construction works in such a way that, as far as is reasonably practicable, the amount of spoil and waste to be disposed of is minimised.

5.7.4 Careful consideration would be given to the location of any fuel storage facilities. Such facilities would be designed in accordance with SEPA guidelines, such that they are self-bunded, including the hoses and stored in a secure compound to avoid vandalism. All vehicles and plant would be regularly inspected for fuel, oil and hydraulic fluid leaks. An oil spill kit and interceptor will be installed to prevent pollution in the event of a spillage. Only sufficient diesel fuel for plant will be held on site and would be stored in a bunded area (i.e. compound area).

5.7.5 Construction works would also be carried out in accordance with the relevant SEPA Pollution Prevention Guidelines, in order to prevent pollution of nearby watercourses by debris, silt and oils. Temporary soil/peat mounds would be sited away from watercourses and drains, as far as is practicable. Surface water would be directed away from construction activity to avoid silty runoff entering watercourses or ecologically sensitive areas. Further discussion on the potential impacts and mitigation proposed to manage possible pollutants on-site is presented in Chapter 10 (Hydrology and Hydrogeology).

5.7.6 High standards of health and safety will be established and maintained through all phases of the project. At all times activities will be undertaken in a manner compliant with applicable health and safety legislation and with relevant good practice as defined under applicable statutory approved codes of practice and guidance. Applicable legislation includes:

- Health and Safety at Work Act 1974;
- Management of Health and Safety at Work Regulations (MHSWR) 1999;
- Construction (Design and Management) Regulations (CAD) 1994;
- Provision and Use of Work Equipment Regulations (PUWER) 1998;
- Control of Substances Hazardous to Health (COSHH) 1999.

5.8 SITE REINSTATEMENT

5.8.1 Reinstatement will be carried out as soon as possible after each part of the project is completed and as temporary areas are no longer required. Areas of the site will be reinstated to agreed s75 conditions. Turbine foundations and the verges of tracks will be re-graded with topsoil (stored adjacent to each excavation) and then re-seeded, re-turfed or cultivated as appropriate. The temporary site office and compound areas will be cleared of any additionally placed hardcore and, if appropriate, restored by landscaping soil to a natural profile.

5.8.2 All reseeding work within the site will utilise material obtained from the local seed bank.

5.9 DECOMMISSIONING

5.9.1 When the wind farm ceases operation all major equipment and structures will be removed from the site. This process will take approximately 2 months. The upper sections of the foundations will be removed to a depth, which would permit the continuation of current land use practices.

5.9.2 Unless otherwise agreed, and required in connection with ongoing agricultural or forestry operations, additional on-site access tracks will be removed and the affected area reinstated. The control building will also be removed from the site and the area reinstated as appropriate. All underground cables will be left in place. All crane hardstandings adjacent to turbines will be removed, if required, and reinstated.

CHAPTER SIX: CULTURAL HERITAGE

6.1 EXECUTIVE SUMMARY

6.1.1 This chapter considers the likely effects on cultural heritage interests of the construction, operation and decommissioning of the proposed wind farm. The assessment has been undertaken by CFA Archaeology Ltd.

6.1.2 Thirty-two sites of cultural heritage interest have been identified within the proposed development area, from a range of desk-based sources (Figure 6.1). One site is a Scheduled Ancient Monument of national importance. Six sites are of regional importance and two others are of possible regional importance. Twelve sites are of local importance and two others of possible local importance, and seven features are of lesser importance.

6.1.3 Direct impacts arising from the construction of the site access road are predicted to affect two sites of local importance and two features of lesser importance; none are deemed significant. The possibility that there may be direct and adverse impacts on any surviving buried features of archaeological interest is considered and mitigation measures are presented to offset the predicted adverse impacts.

6.1.4 Fifty-five Scheduled Ancient Monuments of national importance and eight Category B Listed Buildings of regional importance in the wider landscape are predicted to receive indirect, visual effects on their settings arising from the presence of the proposed wind farm in the wider landscape.

6.1.5 In general terms, the predicted impact of the proposed development on the cultural heritage resource is low. Direct impacts are predicted on two features of local importance for which appropriate offset mitigation has been presented. Potentially significant, indirect effects are predicted on two sites of national importance but the predicted effects would not seriously undermine an appreciation or understanding of the function and character of the affected sites nor of their relationships to other contemporary and related sites in the landscape.

6.1.6 The development proposals have been assessed against the cultural heritage baseline. In overall terms, it is considered that the impact of the development on the cultural heritage resource would not be contrary to the aims of the Structure and Local Plans, or significant in terms of the requirements of The Environmental Impact Assessment (Scotland) Regulations 1999.

6.2 INTRODUCTION

6.2.1 This chapter considers the likely effects on cultural heritage interests of the construction and operation of the proposed wind farm at Glenkerie, near Kingledores, Scottish Borders (NGR: NT 28 09 centred). The assessment has been undertaken by CFA Archaeology Ltd, informed by comments and information provided in scoping opinions by Historic Scotland and Scottish Borders Council's Archaeologist.

6.2.2 The specific objectives of the cultural heritage study were to:

- Identify the cultural heritage baseline within the proposed development site and key receptors in the vicinity;
- Consider the proposed development area in terms of its archaeological and historic environment potential;
- Assess the potential and predicted effects of the construction and operation of the proposed development on the cultural heritage resource within the context of relevant legislation and planning policy guidelines; and
- Propose measures, where appropriate, to mitigate any predicted adverse effects.

6.2.3 Figure 6.1 depicts the proposed layout of the wind farm together with the locations of archaeological sites and monuments identified by the cultural heritage study. Appendix 6.1 provides a gazetteer of the cultural heritage sites and features within the proposed wind farm and an indication of the relative importance of each site. The layout of the proposed wind farm has been designed to avoid archaeological constraints wherever possible, and, as such, contains embedded mitigation.

6.2.4 The predicted direct impacts on cultural heritage sites and features, arising from construction activities, are identified and appropriate mitigation measures are proposed.

6.2.5 Figure 6.2 shows the proposed wind farm in its wider landscape setting together with the zone of theoretical visibility (ZTV) and the locations of key cultural heritage receptors within 15km that have theoretically views that would include one or more turbines.

6.3 PLANNING AND LEGISLATIVE BACKGROUND

Context

6.3.1 Cultural heritage resources include:

- Scheduled Ancient Monuments and other archaeological features;
- Listed Buildings and other buildings of historic or architectural importance;
- Conservation Areas and other significant historic townscapes; and,
- Historic Gardens and Designed Landscapes and other significant historic landscapes.

6.3.2 Those relevant to this assessment are Scheduled Ancient Monuments and other archaeological features, Listed Buildings and other buildings of historic or architectural importance, and Conservation Areas. Unless directly affected by the development, Historic Gardens and Designed Landscapes are considered in the Landscape and Visual section of the Environmental Statement (Chapter 7), which considers the effect of the wind farm on the surrounding landscape.

Scheduled Ancient Monuments and other Archaeological Features

6.3.3 Under the Ancient Monuments and Archaeological Areas Act 1979 (1979 Act), the Scottish Ministers are required to compile and maintain a Schedule of monuments considered to be of national importance. The statutory consent of the Scottish Ministers is required before any works are carried out which would have the effect of demolishing, destroying, damaging, removing, repairing, altering, adding to, flooding or covering up a Scheduled Ancient Monument (SAM). Effects of proposed development works upon the setting of a SAM form an important consideration in the granting or refusal of planning consent to conduct development works. Further information on development control procedures relating to SAMs is provided in National Planning Policy Guideline 5, Archaeology and Planning (NPPG 5) and Planning Advice Note 42, Archaeology (PAN 42).

6.3.4 Archaeological sites and monuments without statutory protection are curated by the local planning authority. NPPG 5 and PAN 42 provide national planning policy guidance and advice on the treatment of this resource. PAN 42 indicates that the principle that should underlie all planning decision-making is preservation of cultural resources, in situ where possible, and by record if destruction cannot be avoided. It is recognised in the document that preservation may not always be possible, and where damage is unavoidable various mitigation measures may be proposed.

Listed Buildings

6.3.5 Under the Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997 (1997 Act), the Scottish Ministers are required to compile a list of buildings of special architectural or historic interest. Such buildings are classified into Categories A, B and C(s), in decreasing order of importance. Sustainable development is the principle underlying Government policy towards the historic environment. Planning authorities and the Scottish Ministers are required to have special regard for the desirability of preserving Listed Buildings and their settings and any features of special architectural or historic importance they possess. The term 'setting' has no definition in the Act, although the Memorandum of Guidance on Listed Buildings and Conservation Areas 1998 (Memorandum; published by Historic Scotland) advises planning authorities to interpret the term broadly. The Memorandum states that a Listed Building should, at all times, remain the focus of its setting, and that attention should not be distracted from it by the presence of any new development. Government policy and guidance is also stated in National Planning Policy Guideline 18, Planning and the Historic Environment (NPPG 18).

Conservation Areas

6.3.6 Under the 1997 Act, areas of special architectural or historic interest can be designated as Conservation Areas, the character or appearance of which it is desirable to preserve or enhance. Planning authorities are required to consider planning applications affecting the appearance, character, or setting of Conservation Areas.

Regional and Local Planning Policy Guidance

Structure Plan

6.3.7 The Scottish Borders Structure Plan (Approved September 2002) contains policies relating to the protection and enhancement of the built and historic environment.

6.3.8 Policy N14 states that development proposals, which would destroy or adversely affect the appearance, fabric, or setting of Scheduled Ancient Monuments or other nationally important sites not yet scheduled will not be permitted unless:

a) the development offers substantial benefits, including those of a social or economic nature, that clearly outweigh the national value of the site;

b) there are no reasonable alternative means of meeting that development need; and

c) the proposal includes a mitigation strategy acceptable to the council.

6.3.9 Policy N15 states that development proposals, which will adversely affect an archaeological site of regional or local significance, will only be

permitted if it can be demonstrated that the benefits of the proposal will clearly outweigh the archaeological value of the site or feature.

6.3.10 Policy N16 sets out the Council's position with regard to archaeological preservation and recording. Where development is approved, which would damage an archaeological site or feature, the Council will require that such development be carried out in accordance with a strategy designed to minimise the impact of development upon the archaeology and to ensure that a complete record is made of any remains that would otherwise be damaged by the development.

6.3.11 Policy N17 states that the Council will seek to preserve the character of Listed Buildings, their setting and related fixtures, and will encourage their repair and the re-use of derelict listed buildings wherever possible.

Local Plan

6.3.12 The Tweeddale Local Plan 1996 is the current Adopted Local Plan covering the proposed development area and the policies cited here are derived from that document. The Scottish Borders Local Plan (Finalised Draft December 2005) has been through the Inquiry stage but is not yet formally adopted. Relevant policies in the forthcoming Local Plan are BE1 (Listed Buildings), BE2 (Archaeological Sites and Ancient Monuments), BE3 (Historic Gardens and Designed Landscapes) and BE4 (Conservation Areas).

6.3.13 Policy 43 states that the Regional Council will continue to protect and enhance the special character and appearance of Conservation Areas and will ensure that any development is of a quality and design which is appropriate to the area.

6.3.14 Under Policy 47, the Regional Council will seek the preservation of statutorily Listed Buildings, their setting, and related fixtures, whether in towns, villages or the countryside.

6.3.15 Policy 48 states that the Regional Council will operate a general presumption against developments that would result in damage to, or destruction of, sites of archaeological or historic importance or their setting. Under Policy 49, the Regional Council will require the undertaking of archaeological investigation and recording prior to the commencement of any development, which would permanently cover up or destroy an archaeological site. Under Policy 50, the Regional Council will continue to negotiate access agreements to sites of archaeological interest and to provide interpretative facilities for the benefit of the public. The Regional Council will also encourage the provision of such facilities through private enterprise.

6.4 APPROACH TO ASSESSMENT

Data Collection and Consultations

6.4.1 This assessment was conducted in accordance with the Institute of Field Archaeologists Code of Conduct (IFA 2006) and Standard Guidance for Archaeological Desk-based Assessment (IFA 2001).

6.4.2 A list of sources consulted during the assessment is provided in Section 6.9.

Consultation

6.4.3 Consultation letters and requests for information pertinent to the proposed development were sent to Historic Scotland, Scottish Borders Council's Archaeologist, and Biggar Museum Trust on 31 August 2007. The responses to these consultations are presented in Section 6.6.

Proposed Development area

6.4.4 Information on known archaeological sites and monuments within and adjacent to the proposed development area was obtained from the National Monuments Record of Scotland (NMRS). Scottish Borders Council's Archaeologist provided information on relevant sites and monuments recorded within the Council's Sites and Monuments Record (SMR).

6.4.5 Ordnance Survey maps and other early maps held by the Map Library of the National Library of Scotland were examined, to provide information on sites of potential archaeological significance and on historic land-use development.

6.4.6 An assessment was made of vertical aerial photograph collections held by The Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS). Sorties dating from 1946, 1988, 1989, and 2001 were available for examination.

6.4.7 Bibliographic references were consulted to provide background and historical information. No attempt was made within the remit of this study to conduct detailed historical analysis.

6.4.8 A reconnaissance field survey was undertaken of the proposed development area. The survey focussed on the area to be occupied by turbines and included targeted visits to previously recorded archaeological sites. The fieldwork was conducted in order to assess the presence/absence, character and condition of the sites, monuments and landscape features identified by the desk-based assessment and to identify any further features of cultural heritage interest not detected from the desk studies. Field surveys were carried out in August and September 2007.

6.5 ASSESSMENT OF SIGNIFICANCE OF EFFECTS

6.5.1 The type of effects of the proposed development on cultural heritage interests are assessed in the following categories:

- Direct: where there would be a physical effect on a site caused by the proposed development. Direct effects may be caused by a range of activities associated with the construction and operation of proposed development features. Construction activities may include ground-disturbing excavations for turbine foundations, cable trenches, access roads and borrow pits. In addition, above-ground disturbance, such as caused by vehicle movement, and soil and overburden storage, may produce irreversible effects upon archaeological features. Direct effects on cultural heritage features are normally adverse, permanent, and irreversible.

- Indirect: where the setting of a site may be affected. Indirect effects may relate to new development reducing views to or from cultural heritage features with important landscape settings, may result from increased noise or vibration, or may cause increased fragmentation of the historic landscape and the loss of connection between its component parts. Such effects are likely to occur during the construction phase of the development and persist through the operational phase. Indirect effects on cultural heritage features can be adverse, neutral, or beneficial in effect. The longevity and permanency of an indirect effect will depend upon the nature of the development feature causing the effect. For example, the indirect effects of wind turbines at Glenkerie would be temporary and reversible, since these features would be removed with the decommissioning of the wind farm. Development features that would outlast the lifespan of the wind farm, such as retained access roads, are considered to have permanent effects.

- Uncertain: where there is a risk that the works may impinge on a site, for example where it is not clear where the location or boundaries of a site lie or where the baseline condition of a site cannot be established satisfactorily.

6.5.2 Potential effects, direct and indirect, have been assessed in terms of their longevity, reversibility and nature (beneficial / neutral / adverse).

- Permanent effects are those that persist beyond the predicted operational lifetime of the proposed development. All direct effects are considered to be permanent;

- Temporary effects arise because of the presence of elements of the proposed development but which would be removed by the dismantlement of those elements. Temporary effects can be short-term (e.g. construction phase effects); or long-term (arising from the long-term presence of buildings or other structures affecting the setting of a receptor);

- Reversible effects are those that are removed by the decommissioning/dismantling of the proposed development;

- Irreversible effects are those that persist beyond the lifetime of the proposed development. All permanent and direct effects are irreversible;

- Beneficial effects are those that contribute to the value of a receptor through enhancement of desirable characteristics or the introduction of new, positive attributes. In terms of cultural heritage, beneficial effects include those that add to an appreciation of the receptor and/or its setting;

- Neutral effects occur where the development can be accommodated comfortably by the receptor while neither contributing to nor detracting from the value of the receptor; and,

- Adverse effects are those that detract from the value of a receptor through a reduction in, or disruption of, valuable characterising components or patterns, or the introduction of new inappropriate characteristics. In terms of cultural heritage, adverse effects include those that detract from an appreciation of the receptor and/or its setting, or compromise views to or from the receptor.

6.5.3 The assessment of significance of effects was undertaken using two key criteria: sensitivity of receptor and magnitude of effect. In gauging sensitivity, the importance of cultural heritage resources is assessed principally according to the criteria published in NPPG 5 and the Memorandum. The main thresholds of archaeological importance defined in NPPG 5 are national importance, regional and local importance, and lesser importance. Table 6.1 summarises the relative importance of key cultural heritage resources.

Table 6.1 Definitions of sensitivity of cultural heritage resources

Importance / sensitivity	**Site types**
International/National	World Heritage Sites Scheduled Ancient Monuments Category A listed buildings Outstanding Conservation Areas
Regional	Archaeological sites and areas of distinctive regional importance Category B listed buildings Conservation Areas
Local	Archaeological sites and areas of local importance Category C(s) listed buildings
Lesser	Other archaeological sites Find spots Unlisted buildings and townscapes of some historic or architectural interest

6.5.4 Magnitudes of effect are assessed in the categories high, medium, low, and imperceptible, and are described in Table 6.2.

Table 6.2 Definitions of magnitude of effect

Level of magnitude	**Definition**
High	Major effects fundamentally changing the baseline condition of the receptor, leading to total or major alteration of character or setting.
Medium	Moderate effects changing the baseline condition of the receptor materially but not fundamentally, leading to partial alteration of character or setting.
Low	Minor detectable effects which do not alter the baseline condition of the receptor materially.
Imperceptible	A very slight and barely distinguishable change from baseline conditions, approximating to the "no change" situation.
None	No discernible change to the baseline condition of the character or setting of the receptor.

6.5.5 Table 6.3 combines these criteria to provide an assessment of whether an effect is considered to be significant or not significant as required by the Environmental Impact Assessment (Scotland) Regulations 1999.

Table 6.3 Matrix for assessing significance of effect.

Magnitude				
High	Minor	Moderate	Major	Major
Medium	Negligible	Minor	Moderate	Major
Low	Negligible	Negligible	Minor	Moderate / Minor
Imperceptible	Negligible	Negligible	Negligible	Minor
None	None	None	None	None
	Lesser	**Local**	**Regional**	**National / International**
	Sensitivity			

6.5.6 Moderate and major effects are considered significant. Sites of National Importance are more capable of absorbing low magnitude temporary and reversible indirect impacts on their setting than they are low magnitude permanent and irreversible impacts on their character. For that reason, low magnitude direct impacts on sites of National Importance are considered to produce moderate and significant effects, whereas low magnitude impacts on the settings of such sites are considered to produce minor and non-significant effects.

6.5.7 All Category C Listed Buildings outwith the proposed development site boundary are excluded from the assessment because such listed buildings are considered lesser examples of any period, style or building type, and/or simple traditional buildings. As such, their individual settings are considered as not significantly affected by the proposed development.

6.6 BASELINE CONDITIONS

General

6.6.1 Thirty-two sites of cultural heritage interest have been identified within the proposed wind farm site boundary (Figure 6.1). Appendix 1 provides tabulated gazetteer information on the character and baseline condition of each site. Site numbers are shown in bold and in brackets in the following sections.

Consultation Responses

6.6.2 In its scoping opinion (17 August 2005) Historic Scotland identified no specific sites of particular concern but noted that it is likely that a wind farm in this location will have a visual impact on scheduled ancient monuments in the wider landscape. Historic Scotland also requested that possible cumulative visual impacts, together with other wind farms in the area, on scheduled ancient monuments should be assessed. In response to a further consultation (September 2007) Historic Scotland identified one SAM within the proposed wind farm area (Glenkerie Burn Fort) and provided digital GIS data for SAMs, Listed Buildings and Historic Gardens and Designed landscapes up to 15km from the site.

6.6.3 Scottish Borders Council's Archaeologist provided a scoping opinion (01 August 2005) which raised no specific concerns relating to any particular sites. It was noted that this part of the Borders is rich in archaeological sites and monuments, but that at the altitude of the proposed wind farm much of the archaeological heritage of the area would be avoided. In response to a second consultation (September 2007) Scottish Borders Archaeologist provided GIS files extending to 500m around the proposed wind farm boundary and highlighted the presence of Glenkerie Burn Fort (SAM No 3084) within the proposed wind farm boundary. The possibility of the presence of peat deposits containing palaeoenvironmental information was raised.

6.6.4 Biggar Museum Trust provided no response to a consultation but a report by the Trust (Ward 2005) provided detailed information on an extensive field study that includes the proposed wind farm location.

Results of data collation

6.6.5 There is one Scheduled Ancient Monument (**4**) within the proposed development area boundary (Glenkerie Burn Fort).

6.6.6 There are no Listed Buildings within the proposed development area boundary and no part of the proposed wind farm lies within a Conservation Area or Historic Garden and Designed Landscape.

6.6.7 The NMRS contains records relating to fifteen cultural heritage sites within the proposed development area. These sites include six burnt mounds (**1**, **2**, **3**, **8**, **12**, **and 13**), a fort (**4**), former cultivation terraces (**5**, **10**, **and 11**), a group of cairns (**6**) and the remains of a small building and sheepfold (**7)**. The site of a former 13th century chapel (**20**), the farmstead of Kingledoors (**21**) and the Talla Reservoir Railway (**30**) are also recorded. The Scottish Borders SMR contains records relating to the same collection of sites.

6.6.8 Examination of historic cartographic sources led to the identification of nine additional sites. These included three trackways (**14**, **19**, **32**), a gravel pit (**15**), a parish boundary defined by boundary markers (**18**), three enclosures (**23**, **24**, **26**) and a sheepfold (**25**).

6.6.9 Examination of aerial photographs led to the identification of an area of former rig and furrow cultivation (**28**), close to Kingledores farmstead.

6.6.10 Field survey established the baseline conditions of those sites located by the desk-based study within the proposed development area that survive as visible features. Field survey also identified three new features: a small enclosure (**22**), a cairn (**29**), and a length of revetment wall (**31**).

6.6.11 Three sites not recorded elsewhere (**33**-**35**) were identified from the results of previous survey in this area by Biggar Museum Trust (Ward 2005).

Character of the Cultural Heritage Resource

Prehistoric sites

6.6.12 Bronze Age and Iron Age settlement and activity within and in the immediate vicinity of the proposed wind farm is represented by numerous sites along the Kingledoors Burn and its tributaries (Figure 6.1; Appendix 6.1).

6.6.13 The remains of Kingledoors Fort (**4**) occupy a low knoll to the north of the Kingledoors Burn and has a more recent sheepfold built on top of it. Although described as a fort, the site is small and not in a favourable defensible position, being easily overlooked from the hillside to the north. It is probably more correctly described as a defensive homestead; its position in the landscape selected more for the avoidance of flooding and for visual prominence than for military defence.

6.6.14 On-going research in the upper Tweed Valley by Biggar Museum Trust (Ward 2005) has identified six burnt mound sites (**1**, **2**, **3**, **8**, **12**, **13**) along the banks of small watercourses draining into the Kingledoors Burn from the NW. Commonly, burnt mounds comprise crescent-shaped

mounds of burnt stone, often surrounding a stone or wooden trough and normally date to the middle Bronze Age. Various options for the purpose of burnt mounds have been proposed including cooking sites (O'Kelly 1954), primitive saunas (Barfield and Hodder 1987) and, more recently, prehistoric beer-making (Peterkin 2007). A possible further burnt mound (**34**) was also recorded along the Benshaw Burn.

6.6.15 Evidence for small-scale agricultural activity along the Kingledoors Burn valley bottom is provided by three groups of cultivation terraces, two either side of the Glenkiely Burn (**10**, **11**) and one on the west side of the Glenkerie Burn (**5**). Further indication of agricultural activity is provided by a group of field clearance cairns (**6**) close to the small fort (**4**). Features such as these are known to be characteristic of agricultural practices in later prehistoric periods but they could alternatively be of medieval or later date.

Medieval or later rural settlement

Farmsteads and buildings

6.6.16 The settlement of Kingledores (**21**), located at the mouth of the Kingledoors Burn valley, appears on 18th century maps by Edgar (1741), Roy (1747-55) and Armstrong (1775). Kingildurrs appears on Blaeu's Atlas (1654) indicating that this settlement has much earlier origins.

6.6.17 The remains of an isolated building with an associated sheep bucht (**7**) lie close to the mouth of the Glenkerie Burn, on the opposite bank from the fort and sheepfold (**4**). This may have been a shepherd's cottage. A group of three structures (**35**) on the lower slopes of Kingle Rig may be the remains of buildings, or they may be simple sheep buchts.

6.6.18 A 13th century chapel of St Cuthbert (**20**) is recorded in the NMRS as having formerly stood on the south side of the Kingledoors Burn and was possibly as a perpetuation of the cell or oratory of Christin the Hermit (Gunn 1931). The grid reference provided for the site is indicative only of its general location and the exact site of the chapel is unknown.

Enclosures

6.6.19 Two sheepfolds (**4**, **25**), two plantation enclosures (**24**, **26**) and two other possible enclosures (**23**, **27**) were identified by the desk-based assessment. Remains of five of these were identified during the field survey. One of the possible enclosures (**27**), which is shown on the Ordnance Survey 1st Edition map, was not identified on the ground; three others (**23**, **24**, **and 26**) are very poorly preserved. The two sheepfolds are both upstanding to their original heights and are well preserved. Field survey led to the identification, on Glenkerie Rig, of a further small enclosure (**22**), which may be the remains of a small building, or an animal pen.

Other features

6.6.20 The remains of former rig and furrow cultivation (**28**) are present to the south of Kingledores Farm, on the slopes of Nicklebeard Hill.

6.6.21 A gravel pit (**15**) is depicted on the Ordnance Survey 1st Edition map alongside a trackway (**14**) but it was not found during the field survey.

6.6.22 Three tracks (**14**, **19**, **32**) are depicted on the Ordnance Survey 1st Edition map. Track **14** links Kingledores with the settlement of Glencotho to the northwest, and track **19** follows the north bank of the Kingledoors Burn as far as Hopehead Farm. Both tracks are also depicted on maps by Armstrong (1775) and Thomson (1821). Track **32** links Kingledores with the current A701. Tracks **14** and **32** are in good condition and are in current use, but much of track **14** is poorly defined and overgrown.

6.6.23 A parish boundary (**18**), presently defined by a post and wire fence, crosses the summits of Broomy Law, Glenlood Hill, Cocklie Rig and Benshaw Hill. A number of square wrought iron posts along the fenceline are probably the boundary markers depicted on the Ordnance Survey 1st Edition map.

6.6.24 A cairn (**29**) comprised of a heap of large angular rock lies immediately to the south of track **32**. The cairn is a relatively recent feature and is either field clearance or a dump of material for the construction of field walls. A length of revetment wall (**31**) alongside the track (**19**) to Hopehead creates a small bay alongside the track and partly retains the hillside above it.

6.6.25 A silted up dam (**33**) was recorded by Biggar Museum Trust (Ward 2005) along the Benshaw Burn and the former Talla Reservoir Railway (**30**) runs alongside the A702.

Assessment of Importance of Cultural Heritage Features

6.6.26 Using the criteria detailed in Section 6.4, Appendix 6.1 includes a column that provides an assessment of the importance of each cultural heritage site within the proposed wind farm.

6.6.27 Kingledoors fort (**4**) is a Scheduled Ancient Monument and is of national importance.

6.6.28 Six burnt mounds (**1**, **2**, **3**, **8**, **12**, **13**) of probable Bronze age date are considered to be of Regional importance.

6.6.29 Twelve sites are considered to be of local importance. These include the, three cultivation terraces (**5**, **10**, **and 11**) and the group of cairns (**6**) considered possibly to be of prehistoric date. Other locally important remains include a former building and sheep bucht (**7**), a series of parish boundary markers (**18**), the farmstead at Kingledores (**21**), an enclosure (**23**), a further sheepfold (**25**), an area of relict rig and furrow (**28**), the

Talla Reservoir railway (**30**), a dam (**33**), and a group of three structures (**35**).

6.6.30 A former quarry (**15**), three trackways (**14**, **19, 32**), two former plantation enclosures (**24**, **26**), a modern stone cairn (**29**) and a section of revetting wall (**31**) are considered to be of lesser importance.

6.6.31 Two sites are of unknown but possibly regional importance. These are the site of a former 13th century chapel chapel (**20**) and a possible burnt mound (**34**).

6.6.32 A small roughly built structure (**22**) and an enclosure (**27**), depicted on the Ordnance Survey 1st edition map but not detected on the ground, are of unknown importance, but they are likely to be of no more than local importance.

Assessment of Archaeological Potential of the Study Area as a Whole

6.6.33 The presence of a number of features of probable prehistoric date along the Kingledoors Burn indicates that this is an area of high archaeological potential. The presence of a fort, burnt mounds, field clearance cairns and cultivation terraces demonstrate that the area was occupied during the Bronze Age and that the occupation continued through the Iron Age and into the medieval period. In the wider landscape, there are numerous homesteads, settlements and forts of probable prehistoric date spread along the Tweed valley and its many tributaries.

6.6.34 Historic maps show the current pattern of land-use across the proposed development area to have remained fairly consistent for at least the last 250 years. The settlement at Kingledores was certainly in existence during the middle of the 18th century, as indicated by its annotation on maps by Edgar (1741) and Roy (1747-55), and it is likely that it has earlier origins, indicated by the presence of a settlement named as Kingledores on Bleau's Atlas (1654). Documentary sources also suggest that there was a chapel at Kingledores during the 13th century.

6.6.35 Based upon the available baseline information, it is considered that the likelihood for the proposed development area to contain buried remains of archaeological interest is variable. The most likely places to preserve buried sites or features of archaeological significance would be along the banks of the Kingledoors Burn and close to the smaller watercourses that flow into it, where permanent settlement is more likely to have been located. The lower ground along watercourses is considered to be of moderate potential, while the higher ground is considered to be of low archaeological potential.

Key Receptors in the Vicinity of the Proposed Wind farm

6.6.36 There are fifty-five SAMs within 15km of the proposed wind farm that would have theoretical views of the proposed turbines, based on assessment of the blade tip ZTV. Amongst these are 15 prehistoric forts

and one dun, 17 prehistoric settlement sites and seven enclosures, eight probable burial cairns and two barrows, a standing stone and a tower house. There are eight category B listed buildings within 15km, two of which are within 5km; the remainder being more than 10km from the proposed wind farm.

6.6.37 The ZTV model shows that the visibility of the proposed wind farm from cultural heritage receptors in the wider landscape is well constrained by the surrounding topography (Figure 6.2). Six SAMs within 2km of the proposed turbines and a further nineteen within 5km have views that would include turbine blade tips (Appendix 6.2).

6.7 EFFECTS AND MITIGATION

General

6.7.1 The assessment of predicted effects has been carried out with reference to the design layout shown on Figure 6.1. Using the assessment criteria detailed in Section 6.5, Appendix 6.1 provides a final column, which provides an assessment of the predicted significance of the effects of the proposed development on the identified cultural heritage sites within the proposed wind farm.

Construction Effects

6.7.2 Ground-breaking activities associated with the construction of the proposed wind farm (such as may be required for turbines bases and crane stances, access tracks, cable routes, compounds, etc) have the potential to disturb or destroy features of cultural heritage interest. Other construction activities, such as vehicle movements, soil and overburden storage and landscaping also have the potential to cause direct impacts on the cultural heritage.

Direct Effects

6.7.3 Taking into account the embedded avoidance mitigation, there are predicted direct effects on four cultural heritage features. Each of these effects would occur because of the construction of the principal site access road from the A701 to the wind farm. The following sites would be affected:

Site 5 – possible cultivation terraces and field clearance cairns.

6.7.4 The proposed main site access track would cross the Glenkerie Burn, near to the scheduled fort (**4**) and traverse the hillside, skirting the NE and NW edges of a large modern enclosure. The NMRS records a group of cultivation terraces (**5**) in this area and other sources have identified several clearance cairns (**5b**, **5d**, **5e**) and a possible standing stone (**5c**) within this enclosure and close to the Glenkerie Burn (Figure 6.1). The proposed route would coincide with one of the group of clearance cairns (**5d**) and would cross a lynchet (**5a**) that is probably associated with the cultivation terracing. The similarity between the clearance cairns here and

those to the east of the fort (**6**) suggests that they may very well be contemporary and possibly related to the occupation of the fort.

6.7.5 A high magnitude direct and adverse impact is predicted to affect two separate features in this group. Cairn **5d** would be lost to the construction of the access track, which would also truncate a possible terrace lynchet (**5a**) and cross the northern part of the wider area of cultivation terracing (**5**). The resulting effect on these two site components would be of moderate significance. Mitigation to offset the predicted effect is detailed below.

Site 19 – historic trackway

6.7.6 The proposed main site access track between Kingledores Farm and the Glenkerie Burn would follow the alignment of the present farm access track, which is an historic trackway (**19**) first recorded on Armstrong's map (1775). It does not appear on William Roy's Military Survey (1747-55), which may indicate that it is late 18th century in date. This trackway, currently 3-4m wide and surfaced with gravel would be upgraded and widened to 5m to serve as the main site access. The trackway appears to have been in almost continuous use since its construction and is currently used as a farm access track. The trackway as a whole is of lesser cultural heritage importance and the proposed upgrading would affect only a relatively short stretch of the overall route. The proposed upgrading would have a medium magnitude direct but neutral impact on the remains, resulting in an effect of negligible significance.

Site 28 – rig and furrow cultivation remains

6.7.7 Close to Kingledores Farm the main site access road would cross an area of relict rig and furrow (**28**). The rig is poorly preserved but visible as upstanding remains. The construction of the proposed access track would have a high magnitude direct and adverse impact on the remains, leading to the loss of the northern part of the surviving area of rig and an effect of moderate significance. Mitigation to offset the predicted effect is detailed below.

Site 30 – Talla Reservoir railway

6.7.8 At the point where the proposed site access road leaves the A701 it would cross the former Talla Reservoir railway line (**30**), which was constructed in 1895-6 and has been closed and dismantled since the 1960s. The railway track bed runs alongside and parallel to the A701, with the remains of drystone boundary walls separating the two. A direct and neutral impact of low magnitude would result in an effect of negligible significance.

Uncertain Effects

6.7.9 The construction of the proposed wind farm could result in direct and adverse impacts on any buried sites, features, or deposits of archaeological significance that may exist within the proposed development area. The archaeological potential is considered to be moderate along the low-lying ground and low on the higher levels. The limited landtake required by the various elements of the proposed

development means that the probability of encountering archaeologically significant sites or features is likely to be low.

Mitigation

6.7.10 In accordance with the guidance contained in NPPG5 and PAN 42, the preferred option for mitigation is preservation of important remains *in situ* wherever practicable and by record where preservation is not possible. The mitigation measures presented below take account of the planning guidance and offer various options for recording and ensuring that, where practical, upstanding sites and features are preserved intact in order to retain the present historic elements of the landscape. All mitigation measures are subject to the agreement and approval of Scottish Borders Council and would be set out in a Written Scheme of Investigation (WSI) for the approval of the Scottish Borders Council Archaeologist prior to the commencement of construction works on site. The WSI would include the following elements:

Preservation in situ / Fencing off

6.7.11 Where sites of local or greater importance survive as upstanding features and lie in close proximity to proposed wind farm features they would be avoided as far as is practicable in order to ensure their preservation *in situ*. Where appropriate, sites would be fenced off to prevent avoidable, accidental damage occurring to the remains during construction activities in their vicinity. Fencing would be hi-visibility temporary fencing placed a minimum of 10m from the visible extent of the site and facing the working area. Sites that would warrant protection by fencing off include:

- Three clearance cairns (**5b**, **6b**, **29**) that lie in close proximity to the route of the proposed main site access track would be fenced off to avoid damage during construction works.

- The remains of a possible building and sheep bucht (**7**) would be fenced off to avoid damage during construction works.

- The remains of two enclosures (**24, 26**) that lie alongside the route of the proposed main site access track would be fenced off to avoid damage during construction works.

Watching briefs and excavation

6.7.12 The proposed main site access road would pass through Site (**5**), an area of clearance cairns and possible cultivation terraces, and would have a direct and adverse impact on two upstanding features of archaeological interest: a possible terrace lynchet (**5a**) and a clearance cairn (**5d**).

- A clearance cairn (**5d**), which lies on the line of the proposed main access track, would be subject to full archaeological excavation

- An archaeological evaluation trench would be excavated across the possible terrace lynchet (**5a**) that would be crossed by the proposed site access track. The excavation would be carried out to record a section through the feature and a stratigraphic profile through the putative terrace.

6.7.13 Any requirement for the archaeological monitoring of works through watching briefs would be agreed in consultation with the Council's Archaeologist. Where there is a possibility that construction activities may encounter buried remains a watching brief would be carried out.

- A watching brief would be carried out where the proposed main site access track passes the scheduled fort (**4**). The watching brief would extend from the eastern extent of Site 6 to the westernmost extent of the area of putative terracing (**5a**).

- Further watching briefs may be required at proposed turbine locations, along proposed access track routes and at borrow pit locations.

6.7.14 If significant discoveries are made during archaeological monitoring, and preservation *in situ* of any sites or features is not possible, provision would be made for the excavation, where necessary, of any archaeological remains. This provision would include the consequent production of written reports on the findings, with post-excavation analyses and publication of the results of the work, where appropriate.

Construction guidelines

6.7.15 Written guidelines will be issued for use by all construction contractors, outlining the need to avoid causing unnecessary damage to known archaeological sites. That document will contain arrangements for calling upon retained professional archaeological support in the event that buried archaeological remains of potential archaeological interest (such as building remains, human remains, artefacts etc) should be discovered in areas not subject to archaeological monitoring. The guidance will make clear the legal responsibilities placed upon those who disturb artefacts or human remains.

Operation and Decommissioning

Impacts

6.7.16 The presence of development features also may have indirect impacts on the setting of sites of cultural heritage interest in proximity to the proposed wind farm and in the wider landscape. Wind turbines and, to a lesser extent, anemometer masts have the potential to cause indirect visual impacts over a wide area. In particular, there is potential for the development to be present in views of and from SAMs, Listed Buildings and other cultural heritage sites and areas near the proposed wind farm. There are 55 SAMs and 8 Category B Listed Buildings within 15km of the proposed wind farm that have predicted views that would include turbines.

6.7.17 A list of sites predicted by the ZTV to have views of one or more turbines and therefore considered in this study is contained in Appendix 6.2; this also provides an assessment of predicted impacts on a site-by-site basis using the criteria detailed in Section 6.5 and Tables 6.1-3. Scheduled Ancient Monuments, Category A and B listed buildings and Conservation

Areas up to 15km from the proposed extension are assessed. Historic Gardens and Designed Landscapes are dealt with in Chapter 7; Landscape and Visual Assessment.

6.7.18 The assessment of magnitude of impacts provided in Appendix 6.2 has been based on analysis of the blade tip ZTV (Figure 6.2), taking into account the distance of the assessed site from the proposed wind farm and the number of turbine blade tips visible. The ZTV model is, however, a coarse predictive tool, based on bare-earth surface topography and maximum blade-tip height and takes no account of obstructions to visibility caused by existing forestry and other vegetation or by buildings and or other man-made features. In practice, it is likely that the proposed extension would be screened from view from many of the sites by the presence of intervening features in the landscape. Wireframe visualisations have been used to further assess the predicted effects on individual sites, identified from analysis of the ZTV, whose settings could be adversely affected by the proposed wind farm.

SAMs

6.7.19 Six SAMs are within 2km of the nearest proposed turbine, 19 are between 2km and 5km distant, 12 are between 5km and 10km from the nearest proposed turbine and 18 SAMs are more than 10km distant (Figure 6.2; Appendix 6.2). Assessment of the predicted effects on the settings of these sites has taken account of the theoretical visibility as predicted by the ZTV and wireframe visualisations were commissioned for a selection of sites up to 15km from the proposed wind farm. These provided a graphic representation of the topographic setting of the sites and the degree of visibility of the proposed wind farm, enabling an assessment of the predicted impact of the presence of the wind farm on the settings of sites at similar distances and with similar predicted visual effects. Two SAMs are predicted to receive medium magnitude adverse effects on their settings that are considered to be of major significance.

Glenkerie Fort (Site 4; SAM 3084)

6.7.20 Described in the NMRS as a fort occupying a low knoll on the left bank of the Kingledoors burn, this site comprises the remains of an inner wall enclosing an oval area approximately 50m by 30m and two outer walls or ramparts. The inner wall is largely obscured by a modern sheepfold, which has been constructed overlying it. The two outer walls or ramparts have reportedly been largely destroyed through cultivation and are only visible as intermittent scarps. The modern sheepfold is the dominant feature on the site, standing to its full height of 1.2-1.3m. There is very little of the fort's original form visible on the knoll, although the modern sheepfold gives some impression of how the original structure may have appeared. The fort lies in a prominent position in the valley bottom and there is evidence of prehistoric field clearance and cultivation both to the NE and SW (**5**, **6**). The proposed turbines would be prominent in views both from the fort and to it from locations to the south and east, in particular from the track that runs alongside the Kingledoors Burn. The proposed site access track would also be prominent in views to and from the fort as it deviates from the existing valley bottom track (**19**) to climb

Kingle Rig. Taken together the resulting changes to the setting of the fort would represent a medium magnitude adverse effect that results in an effect of major significance. The change to the baseline setting would not however appreciably detract from an appreciation of the site or its function or interpretation.

Patervan Settlement (SAM 3215)

6.7.21 This site is described in the NMRS as a settlement on the NW slopes of Polmood Hill. Like Glenkerie Fort, the site is oval in plan measures approximately 40m by 30m within a stone-faced wall 2.4m thick. The entrance to the enclosure is in the WSW, a direction that faces towards the proposed wind farm. The site stands on the hillside approximately 200m SSE of Patervan Farm and has open views to the north, south and west; the views to the west being over a group of modern sheepfolds and farm buildings. The ZTV and the wireframe show that the hubs of all 11 turbines would be visible against the skyline in views from the site to the west across the Tweed Valley. The proposed development would provide a detectable change to the baseline setting of the site of medium magnitude, resulting in an effect of major significance. The change to the baseline setting would not however appreciably detract from an appreciation of the site or its function or interpretation

Other SAMs

6.7.22 All other SAMs within the 15km viewshed and that have a predicted view of the proposed wind farm would have no more than a minor significance indirect effect on their settings arising from the visibility of the proposed turbines.

Listed Buildings

6.7.23 None of the eight Category Listed Buildings would receive a significant effect on their settings arising from visibility of the proposed wind farm in the wider landscape. The closest Listed Building is Stanhope Farm 2.9km to the NE and there is a predicted view of all 11 turbines from this location. However, the setting of the farmhouse is the small settlement of Stanhope at the mouth of the Stanhope Burn and surrounded by trees an in a valley bottom riverside location. A low magnitude indirect impact is predicted, resulting in an effect of minor significance.

Cumulative Impacts

6.7.24 Cumulative effects on the cultural heritage resource result from changes to the baseline current setting of the resource caused by the proposed development in conjunction with other developments that occurred in the past, present or are likely to occur in the foreseeable future (cf Landscape Institute 2002, 85). Within a 35km radius of the Glenkerie proposal there are 14 other wind farms that are either operational, in planning, or being scoped. These are Auchencorth (18 turbines), Blacklaw (42 turbines), Blacklaw Extension (20 turbines), Bowbeat (23 turbines, Clyde (173 turbines), Earlshaugh (36 turbines), Hagshaw and Extension (36 turbines), Harestanes (71 turbines), Harrows Law (37 turbines), Limmer Hill (33 turbines), Minch Moor (12 turbines), Minnygap (15 turbines), Pates Hill (six turbines) and Tormywheel (15 turbines).

6.7.25 Fifty-five SAMs and eight Category B Listed Buildings have been identified within 15km of the Glenkerie proposal that are predicted to have views that would include the proposed turbines. Two of these sites – Glenkerie Fort (**3084**) and Patervan Settlement (**3215**) are predicted to receive indirect effects of medium magnitude and major significance from the proposed Glenkerie wind farm. Neither has any predicted visual effect from any of the other 14 wind farm proposals considered here.

6.7.26 One listed building (Stanhope Farm, **2012**) and 17 SAMs (Appendix 6.2) (**876**, **2675**, **2768**, **3065**, **3086**, **3153**, **3216**, **3262**, **3467**, **4253**, **8155**, **8156**, **8157**, **8162**, **8164**, **8165**, **8204**) are predicted to receive low magnitude indirect visual effects on their settings from the Glenkerie proposal. Of these, 20 sites only Whiteside Rig Fort and Enclosure (**8164**) would have a view of Glenkerie and be within 10km of and have a view of another wind farm proposal, that of Earlshaugh, 10km distant. From Whiteside Rig Fort, there would also be a theoretical view of turbines of the Clyde wind farm, 14km distant.

6.7.27 The assessment of cumulative effects takes into account the separation distances between the potentially affected cultural heritage site, the proposed Glenkerie wind farm and the other wind farms considered here. Taking account of the Borders Hills topography and the locations of the various cultural heritage sites assessed, there are no predicted significant cumulative effects arising from the Glenkerie proposal in combination with any other constructed or proposed wind farm within 35km.

Residual Impacts

6.7.28 In addition to the embedded mitigation resulting from the design of the wind farm, the applicant commits to mitigation that would ensure the preservation *in situ* of six known features of cultural heritage interest (**5b**, **6b**, **7**, **24**, **26**, **and 29**) within the proposed development area. Offset mitigation, through archaeological excavation, of two features (**5d**, **5b**) that would be directly affected by the proposed access road construction has been presented that would ensure the recovery of archaeological information and preservation by record of the two affected features. Taking account of the proposed offset mitigation there would be no significant impact on the known cultural heritage resource.

6.7.29 There may be residual impacts on any previously undiscovered sites and features that may be discovered during any watching brief that may be required. In line with the requirements of NPPG5, any archaeological remains that are identified will be either preserved in situ or excavated and recorded to a standard agreed with Scottish Borders Council, leading to the accrual of archaeological information and preservation by record. Taking into account the known baseline and the archaeological mitigation, the residual impact on the archaeological resource would be of low magnitude and not significant.

6.7.30 For the external receptors (Appendix 10.2), two predicted impacts are considered to be potentially significant but for which no further mitigation is practical. Residual impacts on external receptors would be the same as

the predicted impacts. These will all be temporary and reversible lasting for the lifetime of the wind farm.

6.8 CONCLUSION

6.8.1 Thirty-two sites of cultural heritage interest have been identified within the proposed wind farm site boundary (Figure 6.1). One site is a Scheduled Ancient Monument of national importance, six sites are of regional importance, and two others are of possible regional importance. Twelve sites are of local importance and two others of possible local importance, and seven features are of lesser importance. A direct impact of moderate significance is predicted to affect one site of local importance. One other site of local importance and two sites of lesser importance would receive direct impacts of negligible significance. The possibility that additional, buried and unrecorded remains of archaeological significance survive across the proposed development area is considered to be low. Mitigation measures have been set out to preserve sites in situ where practicable and to offset the predicted direct effects through an appropriate watching brief strategy to be agreed with Scottish Borders Council.

6.8.2 Sixty-three sites in the wider landscape are predicted to receive indirect effects on their settings arising from the presence of the proposed wind farm. Two of these effects, on SAMs within 2km of the nearest turbines are considered significant indirect impacts. No practical mitigation is possible in respect of these predicted effects.

6.8.3 There are no predicted significant cumulative effects arising from the Glenkerie proposal in combination with any other constructed or proposed wind farm within 35km.

6.8.4 In general terms, the predicted impact of the proposed development on the cultural heritage resource is low. Direct impacts are predicted on two features of local importance for which appropriate offset mitigation has been presented. Potentially significant, indirect effects are predicted on two sites of national importance but the predicted effects would not seriously undermine an appreciation or understanding of the function and character of the affected sites nor of their relationships to other contemporary and related sites in the landscape.

6.8.5 The development proposals have been assessed against the cultural heritage baseline. It is considered that, in overall terms, the impact of the development on the cultural heritage resource would not be contrary to the aims of the Structure and Local Plans, or significant in terms of the requirements of The Environmental Impact Assessment (Scotland) Regulations 1999.

REFERENCES

Vertical Aerial Photographs

Sortie	Frames	Date	Scale
106G/Scot/UK87	3294-3296	10.05.1946	1:10 000
106G/Scot/UK86	4158-4154	10.05.1946	1:10 000
61089	149-148	05.05.1989	1:24 000
63199	028-027	07.08.1988	1:24 000
OS/01/054	120-118 115-117	07.05.2001	1:15 600

Historic maps

Ainslie, John (1821) - Ainslie's Map of the Southern Part of Scotland.

Armstrong, Mostyn (1775) County of Peebles and Tweedale

Blaeu, Joan (1654) Tvedia - Upper Tweedsdale

Edgar W (1741) The Shire of Peebles and Tweedale

Ordnance Survey (18xx) 1st Edition. Peebles-shire Sheet XIX

Ordnance Survey (18xx) 2nd Edition. Peebles-shire Sheet 19NE

Roy, W (1747-55) A Military Survey of Scotland

Thomson, J (1821) Peebles-Shire

Bibliographic

Barfield, L, and Hodder, M 1987 ‘Burnt mounds as saunas, and the prehistory of bathing’. Antiquity 61 (1987) 370-79

Buchan, W (1900) 'Note on a bronze scabbard-tip found on Glencotho Farm, Peebleshire', Proc Soc Antiq Scot, 34, 1899-1900, 254-6,

Gunn, C B (1931) The Book of the Church of Drumelzier, Books of the Church series, 13, Peebles, 1,

Haldan, Rev Bernard (1791-99) Statistical Account of Scotland. Parish of Glenholm

Marshall, P (2005) Peebles railways, Usk, Monmouth, 162-168,

O'Kelly, M. J (1954) 'Excavations and experiments in ancient Irish cooking-places'. The Journal of the Royal Society of Antiquaries of Ireland 84 (1954) 105-55

Paul, Rev Hamilton (1845) New Statistical Account of Scotland. Parish of Broughton, Glenholm, and Kilbucho

Peterkin 2007, 'Bronze Age brew proves a vintage ale' Sunday Telegraph, 13/08/2007

RCAHMS (1967) The Royal Commission on the Ancient and Historical Monuments of Scotland. Peeblesshire: an inventory of the ancient monuments, 2v, Edinburgh, 127, No.295,

Sommerville, Rev James (1845) New Statistical Account of Scotland. Parish of Drummelzier

Ward, T (2000) 'Tweeddale, Scottish Borders (Broughton, Glenholm & Kilbucho; Drumelzier; Tweedsmuir parishes), survey', Discovery Excav Scot, 74,

Ward, T (2004) Upper Tweed Archaeological Survey.

Ward, T (2005) 'Tweeddale, Scottish Borders (Broughton, Glenholm & Kilbucho; Drummelzier; Stobo; Tweedsmuir parishes), survey', Discovery Excav Scot, 6, 2005, 122,

CHAPTER SEVEN: LANDSCAPE AND VISUAL

7.1 EXECUTIVE SUMMARY

7.1.1 This report presents the findings of a landscape and visual assessment that considered the potential effects of the proposed Glenkerie Wind Farm and associated works on the landscape character and visual amenity around the windfarm. The assessment included a 35km radius around each proposed turbine and a 60km cumulative impact study.

7.1.2 With reference to SNH Policy Statement No. 02/02 Strategic Locational Guidance for Onshore Wind Farms in respect of the Natural Heritage, the proposed Glenkerie Wind farm is situated entirely within Zone 2 – Land with medium natural heritage sensitivity to wind farm development.

"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 in a way which is acceptable in natural heritage terms. "

7.1.3 With reference to the Borders Landscape Assessment, the proposed site is located within the Southern Uplands with Scattered Forest, Broadlaw Group (Borders Landscape Assessment).

7.1.4 The assessment has concluded that the direct effects on the landscape fabric of the proposed Glenkerie Wind Farm site area will be minimal in extent and reversible when decommissioned and therefore, acceptable in landscape fabric terms.

7.1.5 There would be very limited and localised significant residual or cumulative landscape effects to the upland landscapes within the immediate 2.5km radius study area around the proposed development. There would be no significant residual landscape effects to any valued landscape, designated for protection due to its inherent qualities and characteristics. Significant cumulative landscape effects would only occur for the NSA within the 15km radius local scale landscape. However, such significant cumulative effects would only occur on the basis that all the proposed and scoped wind farms are consented and constructed. It is considered that this is unlikely and therefore the cumulative landscape effects of the Glenkerie Wind Farm are assessed as not being significant.

7.1.6 The visual assessment concludes that significant visual effects are very limited and localised, and only likely to be experienced by sensitive receptors located in the upland hills surrounding the proposed development, and a very limited number of local residential properties within the Tweed Valley. No significant cumulative visual effects are anticipated as a result of the introduction of the proposed Glenkerie Wind Farm in relation to those existing operational and consented wind farms. Significant cumulative effects may only occur on the basis that all the proposed and scoped wind farms are consented and constructed.

7.1.7 Due to the very limited and localised landscape effects the proposed Glenkerie Windfarm development is considered to be acceptable in this location.

7.2 INTRODUCTION

7.2.1 This report presents the findings of a landscape and visual assessment that has considered the potential effects of the proposed Glenkerie Wind Farm and associated works on the landscape character and visual amenity of a 35km radius around the proposals.

7.2.2 This report sets out the:

- Methodology employed;
- Description of the baseline Landscape and Visual environment;
- Assessment of the Landscape and Visual and Cumulative effects;
- Mitigation measures employed;
- Provides an assessment of the residual significance of effects; and
- Conclusions.

7.3 METHODOLOGY

Best Practice Guidance and Baseline Information Sources

7.3.1 As a matter of best practice, the assessment has been undertaken in accordance with the advisory guidelines set out in The Landscape Institute and Institute of Environmental Management and Assessment (2002). Guidelines for Landscape & Visual Impact Assessment, Second Edition. Reference has also been made to a number of other publications, published reports and government policies. These included:

- Carys Swanwick, Dept. of Landscape, University of Sheffield and Land Use Consultants. (2002). Landscape Character Assessment – Guidance for England and Scotland;
- Scottish Natural Heritage. (2001). Guidelines on the Environmental Impacts of Wind Farms and Small Scale Hydroelectric Schemes;
- University of Newcastle. (2002). Visual Assessment of Wind Farms Best Practice. Scottish Natural Heritage Commissioned Report F01AA303A;
- Horner & Maclennan/Envision. (2006). Visual Representation of Windfarms Good Practice Guidance. Report for Scottish Natural Heritage, The Scottish Renewables Forum & The Scottish Society of Directors of Planning;
- Scottish Natural Heritage. *Strategic Locational Guidance For Onshore Wind Farms in Respect of the Natural Heritage*. Scottish Natural Heritage Policy Statement No. 02/02;

- Scottish Natural Heritage. *Cumulative Effect of Windfarms.* Scottish Natural Heritage Guidance (Version 2 revised 13/04/2005);
- Scottish Planning Policy 1– The Planning System (SPP6);
- Scottish Planning Policy 6 – Renewable Energy (SPP6);
- Planning Advice Note 45 (PAN 45) (Revised 2002);
- National Planning Policy Guidelines 14 – Natural Heritage (NPPG14);
- Planning Advice Note 58 (PAN 60) – Environmental Impact Assessment
- Planning Advice Note 60 (PAN 60) – Planning for Natural Heritage;
- National Planning Policy Guidelines 18 – Planning and the Historic Environment (NPPG18);
- Scottish Borders Structure Plan (approved 2002);
- Scottish Borders Local Plan (Finalised December 2005);
- Scottish Borders Local Plan - Supplementary Planning Guidance 18: Renewable Energy – June 2007; and
- South Lanarkshire Local Plan (Finalised August 2006);

Study Area

7.3.2 The study area was determined following consultations with Scottish Borders Council and SNH. The study area covers a 35km threshold radius around the proposals, in line with current best practice.

7.3.3 In addition, a cumulative study area of 60km was determined in order to establish the existing cumulative wind farm baseline. This provides the context for the cumulative landscape effects relating to the introduction of the proposals to the baseline of existing, consented and potential future wind farm development. The wind farms included in the cumulative assessment were agreed with Scottish Borders Council and SNH. This included existing and consented wind farms, along with wind farms currently at a planning and scoping stage. In line with current best practice, detailed consideration will be given with regard to the cumulative effects resulting from different wind farm developments within 35km of the proposed Glenkerie Wind Farm.

7.3.4 Within the 35km study area, four sub-thresholds were identified for assessment purposes.

- Broad scale - outward to 35km radius;
- Local scale - outward to 10km radius;
- Immediate scale - outward to 2.5km radius; and
- The proposed Glenkerie Wind Farm site.

7.3.5 This was based on current best practice and guidance provided in Policy D4 of the Scottish Borders Local Plan.

Computer Modelling and Analysis

7.3.6 6 of the 11 turbines will have a hub height of 70m and a maximum base to blade tip height of up to 105m at the point where the blades reach their highest point. For 5 of the 11 turbines on lower parts of the subsidiary ridges, the hub height will be 85m and the blade tip height would be up to 120m.

7.3.7 The nearest turbine to the NSA is over 3km and the furthest is 4km. To the RSA the nearest turbine is 2.3km and the furthest is 3.5km.

7.3.8 In order to assess the potential landscape and visual effects of the development, ZTVs were produced using data for each turbine to show the maximum potential areas of visibility at blade tip height. ZTVs were also produced for the blade tip height of the different wind farms forming part of the cumulative assessment. It should be noted that the ZTVs only take account of the ground level topography and does not take into account low level screening effects resulting from trees, vegetation or man-made structures such as or buildings, and therefore represents the worst-case scenario. On this basis, ZTVs only indicate theoretical potential visibility; the actual effects of the proposed wind farm are assessed through a more detailed analysis of specific viewpoints.

7.3.9 In order to illustrate and assist the assessment of the potential visual effects of the proposed Glenkerie Wind Farm a number of wireframe and photomontage images were produced for the different wind farms forming part of the cumulative assessment.

7.3.10 Further details of how the ZTVs and wireframe and photomontage images were prepared can be found in Appendix 7.1.

Assessment of Landscape Effects and Cumulative Landscape Effects

7.3.11 Landscape character is defined as a distinct and recognisable pattern of physical and cultural elements that occur consistently in a particular area. Aspects such as landform, hydrology, vegetation and landcover, land use pattern and cultural and historic features and associations interact and combine to create a common ‘sense of place’ and identity.

7.3.12 Landscape assessment seeks to identify the key features of the landscape within the study area, and considers the changes that the development would have on that character. Cumulative landscape assessment considers the changes brought about by the addition of the proposed Glenkerie Wind Farm to a baseline that may consist of one or more existing, consented, proposed and scoped wind farm developments. This may result in substantial changes in the character of the landscapes affected. Effects may occur within designated landscapes, such as those protected by local or national designations.

7.3.13 There are three key stages to the overall assessment process. The assessment process is iterative, in which the baseline conditions and the

analysis and evaluation of potential effects resulting from the proposal inform the progression of the scheme design, layout and mitigation measures.

7.3.14 The first stage is the assessment of baseline landscape character. This relates to the recording and classification of existing landscape character and the visual context of the receiving environment through desk based and field-based appraisal. This includes the physical fabric of the landscape as well as its characteristic aesthetic patterns and perceptual qualities. Together, these can be combined to provide an overall description of the character of the landscape.

7.3.15 Based on these results, the sensitivity of the landscape can then assessed. This is a function of landscape value, landscape character sensitivity and landscape visual sensitivity. Sensitivity is assessed according to the following criteria; Very Low, Low, Medium, High, Very High. Landscapes of higher value whose key elements are sensitive to the type of development proposed and which have a greater visual sensitivity to the type of development proposed will be of higher sensitivity, and vice versa. Further details of how the baseline character is described and assessed in terms of its sensitivity can be found in Appendix 7.1.

7.3.16 The second stage involves an assessment of the magnitude of landscape change resulting from the proposed Glenkerie Wind Farm. This relates to the extent to which the proposed Glenkerie Wind Farm would emerge as a new component in the landscape and change the balance between components that currently constitute baseline character. An assessment of the cumulative magnitude of landscape change is also made. This examines the change in the balance between components that currently constitute baseline character resulting from the combined effects of the proposed Glenkerie Wind Farm and the other wind farms within the cumulative assessment. As these involve related, but different, types of change, separate criteria have been developed for each. The magnitude of landscape change and cumulative landscape change is assessed according to the following criteria; Very Small, Small, Medium, Large, Very Large. Larger changes relate to more dominant and noticeable changes in baseline character, and vice versa. Further details of how magnitude of landscape change and cumulative magnitude of landscape change are assessed can be found in Appendix 7.1.

7.3.17 The third stage relates to the assessment of the significance of residual landscape effects and cumulative landscape effects, taking into account sensitivity to change and magnitude of change, along with the primary and secondary mitigation measures. Table 7.1 indicates the criteria used for this assessment.

Assessment of Visual Effects and Cumulative Visual Effects

7.3.18 Visual receptors relate to the residents, visitors and users of the areas neighbouring the proposed Glenkerie Wind Farm site. The assessment of visual effects is based on identification of the sensitivity of visual receptors located within the study area and the magnitude of change to views that would result from introduction of the proposals.

7.3.19 Desk based analysis of the visual baseline using ZTVs forms the first stage in the assessment of visual effects, and illustrates the broad visual context of the proposed Glenkerie Wind Farm. The visual baseline identifies the extent of the likely visibility of the proposed Glenkerie Wind Farm within the study area, and the particular fixed visual receptors and linear receptors (i.e. roads and other public rights of way) which are likely to be affected. Analysis of the ZTVs of the different wind farms forming part of the cumulative assessment also allows the identification of where cumulative visual effects are likely to occur.

7.3.20 This permits for the initial identification of viewpoints, cumulative viewpoints and linear receptors for field investigation. Field investigation allows refinement of the visual baseline to occur, and the assessment of the likely effects upon the viewpoints and linear receptors previously identified.

7.3.21 All representative viewpoint locations were identified and agreed with Scottish Borders Council and SNH to illustrate the potential effects that the proposals would have on a range of locations and receptors within the study area.

7.3.22 The sensitivity to change for the different viewpoints and linear receptors relates to their nature, location and context. Generally, receptors where visual amenity is a prime concern are more sensitive, while receptors where the primary focus would not be on the surrounding landscape views are less sensitive. Sensitivity is assessed according to the following criteria; Very Low, Low, Medium, High, Very High. Further details relating to the criteria for sensitivity to change used in the visual assessment are provided in Appendix 7.1.

7.3.23 Each viewpoint was visited and surveyed during field visits, using the wireframe and photomontage visualisations discussed previously to contextualise the proposed Glenkerie Wind Farm. Appendix 7.1 provides information related to the method of field assessment. The results of the Viewpoint and Cumulative Viewpoint Assessment were used in order to assess the Magnitude of Visual Change. This relates to the degree and type of change to existing views which result from the proposed Glenkerie Wind Farm. The Magnitude of Cumulative Visual Change was also assessed. This relates to the degree and type of change to existing views which result from the combined effects of the proposed Glenkerie Wind Farm and the other wind farms within the cumulative assessment. The magnitude of visual change and cumulative visual change is assessed according to the following criteria; Very Small, Small, Medium, Large, Very Large. Further details relating to the criteria used in the visual assessment are provided in Appendix 7.1.

7.3.24 The assessment of the significance of residual effects for viewpoints and cumulative viewpoints involves the relation of assessed magnitude of visual change/cumulative visual change, taking into account primary and secondary mitigation measures, to the sensitivity of the viewpoint receptors. Table 7.1 indicates the criteria used for this assessment.

Sequential and Cumulative Sequential Visual Analysis

7.3.25 Sequential and cumulative sequential effects relate to the effects on visual amenity along the different linear receptors arising from the proposed Glenkerie Wind Farm, and the different wind farms forming part of the cumulative assessment. As is the case for fixed receptors/viewpoints, sensitivity to change relates to their nature, location and context and is assessed according to the following criteria; Very Low, Low, Medium, High, Very High.

7.3.26 Assessment of the magnitude of sequential and cumulative effects builds on the analysis of the ZTVs for the study area combined with field investigation, giving additional consideration to the speed, frequency and direction of travel along local roads and main highways. As for fixed receptors/viewpoints, this is assessed according to the following criteria; Very Small, Small, Medium, Large, Very Large. The criteria used to evaluate the magnitude of sequential effects and cumulative sequential effects are outlined in Appendix 7.1.

7.3.27 The assessment of the significance of residual sequential and cumulative sequential effects involves the relation of assessed magnitude of visual change/cumulative change, taking into account primary and secondary mitigation measures, to the sensitivity of the linear receptors. Table 7.1 indicates the criteria used for this assessment.

Residual Significance of Effect:

7.3.28 The significance of effects is assessed by consideration of the relationship of sensitivity to change and magnitude of change for the aspect of the landscape and visual assessment in question.

7.3.29 Professional judgement is used to arrive at the declared residual effect, based on the following impact significance matrix. Full account is taken of the effect mitigation measures would have in offsetting or effectively minimising potentially adverse impacts.

Table 7.1. Significance of Residual Effects

Magnitude of Change	**Sensitivity**				
	Very High	**High**	**Medium**	**Low**	**Very Low**
Very Large	Major	Major	Major-Moderate	Moderate	Moderate-Minor
Large	Major	Major-Moderate	Moderate	Moderate-Minor	Minor
Medium	Major-Moderate	Moderate	Moderate-Minor	Minor	Minor-Negligible
Small	Moderate	Moderate-Minor	Minor	Minor-Negligible	Negligible

	Sensitivity				
Very Small	Moderate-Minor	Minor	Minor-Negligible	Negligible	Negligible/Nil

7.3.30 The significance of the impact may be negative, neutral or positive. For the purposes of this assessment and with reference to the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 1999, 'Significant' landscape effects would be those effects assessed to be major or major/moderate.

7.4 BASELINE DESCRIPTION

Statutory Legislative Framework

7.4.1 Over a number of years, a legislative framework has developed which is designed to safeguard the natural heritage, using both conservation and planning legislation.

7.4.2 Within this framework it is the Government's objectives to conserve, safeguard and, where possible, enhance Scotland's natural heritage including:

- The overall populations and natural ranges of native species and the quality and range of wildlife habitats and ecosystems;
- Geological and physiographical features;
- The natural beauty and amenity of the countryside and the natural heritage interest of urban areas; and
- Opportunities for enjoying and learning about the natural environment.

7.4.3 Such legislation established the system of Scottish Planning Policies (SPPs) (formerly known as National Planning Policy Guidance (NPPGs)), providing statements of Scottish Executive policy and Planning Advice Notes (PANs), providing advice on good practice and other relevant information. A number of these are of relevance to this assessment of the proposed Glenkerie Wind Farm. These include SPP6 – Renewable Energy, PAN 45 – Renewable Energy Technlogies (Revised 2002), NPPG 14 – Natural Heritage (NPPG14), PAN 60 and NPPG 18 – Planning and the Historic Environment.

7.4.4 In addition the Scottish Borders Council Structure Plan and Local Plan set out a number of development planning policies of relevance to the Glenkerie Wind Farm. These include policies and statements of intent the that serve to protect, conserve and enhance specific areas by landscape designations, or specific landscape features such as hedgerows and trees, which form important nature conservation habitats and visual focal points within the landscape. General planning policy issues are explored within the Chapter 4 of this ES. However, a number of policies of particular

relevance to the landscape and visual assessment are set out in Appendix 7.2

SNH Policy Statement No. 02/02 Strategic Locational Guidance for Onshore Wind Farms in Respect of the Natural Heritage

7.4.5 SNH has issued 'Strategic Locational Guidance for Onshore Wind Farms in respect of the Natural Heritage'. It provides a geographic interpretation of the policy principles set out in SNH Policy Statement 01/02 'Renewable Energy' as they apply to wind farms

7.4.6 The guidance takes account of landscape designations at international, national and local levels, and wild land issues that are determined to be sensitive to wind farm development. Scotland is subdivided into three zones ranging from Zone 1 – Land with least natural heritage sensitivity and the greatest opportunity for wind farm development up to Zone 3 with the highest natural heritage sensitivity. Map 5 – Zones of Natural Heritage Sensitivity illustrates the distribution of the differing zones.

7.4.7 The proposed Glenkerie Wind Farm is situated entirely within Zone 2– Land with medium natural heritage sensitivity to wind farm development.

"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 in a way which is acceptable in natural heritage terms. Zone 2 comprises 47% of Scotland's land area, though around two thirds of the area is shown hatched to indicate that the sensitivities only affect a proportion of the area indicated. "

Designated/Protected Landscape Areas

7.4.8 This section describes the relevant statutory and non-statutory national and local landscape designations of particular significance to the proposed Glenkerie Wind Farm within the study area. It should be noted that landscape areas designated for special protection do not preclude wind farm development (refer to SPP6).

7.4.9 Within the study area designated landscapes include:

- National Scenic Area;
- Regional Scenic Area;
- Area of Great Landscape Value; and
- Historic Gardens and Designed Landscapes.

7.4.10 The location and extent of these designated areas are illustrated on Figure 7.4

7.4.11 At its closest point the nearest turbine of the proposed Glenkerie Wind Farm over 3km to but has very limited visibility from the Upper Tweeddale

National Scenic Area (NSA). National Scenic Areas are a national designation that identifies areas of outstanding natural beauty and amenity to be safeguarded as part of the national heritage.

7.4.12 Regional Scenic Areas and Area of Great Landscape Value are local designations safeguarding locally important areas of scenic character or quality. The Glenkerie Wind Farm is within the Upper Tweeddale AGLV.

7.4.13 Historic Gardens and Designed Landscapes (HGDL) are historic designed landscapes or extensive planned gardens of national importance for cultural heritage and their contribution to the character and enjoyment of the countryside. They are often established as the setting for a historic building. They are identified on a national inventory compiled and maintained jointly by Historic Scotland and Scottish Natural Heritage. HGDL is a non-statutory designation.

7.4.14 Within the study area 15 HGDL's have been identified, of which only one, Stobo Castle falls within the ZTV Woodland.

7.4.15 The national and local policies in relation to such designated areas are set out in Appendix 7.2.

BASELINE WIND FARMS FORMING PART OF THE CUMULATIVE ASSESSMENT

7.4.16 Figure 7.9 illustrates the location of all existing and proposed public domain proposals within 60km of the proposed Glenkerie Wind Farm and includes all known proposals as of December 2007.

7.4.17 While consideration is made of the potential cumulative effects of all wind farms identified within 60km of the proposed Glenkerie Wind Farm, only those existing and proposed developments within approximately 35km of the Glenkerie Wind Farm proposal are assessed in detail. This follows SNH best practice guidelines. The wind farms forming part of the assessment are listed in Table 7.2. For the purposes of this assessment the operational Hagshaw Hill and Hagshaw Hill extension have been assessed as one development.

Table 7.2 Wind Farms Forming Part of the Cumulative Assessment

Wind Farm	Distance from Glenkerie	Status	Number of Turbines	Hub height	Blade Tip Height
Black Law (A & B)	30.0km	Operational	4	70	80
Bowbeat	25.7km	Operational	24	46	60
Hagshaw Hill	28.4km	Operational	26	45	65.5

Wind Farm	Distance from Glenkerie	Status	Number of Turbines	Hub height	Blade Tip Height
Hagshaw Hill Extension	27.1km	Operational	20	60	95
Harestanes	28.1km	Consented	71	80	90
Pates Hill	30.8km	Consented	6	60	80
Tormywheel	31.5km	Consented	15	80	90
Auchencorth Moss	29.2km	Submitted	18	62	80
Black Law Extension (C)	31.0km	Submitted	18	70	80
Clyde Airtricity	8.5km	Submitted	173	80	90
Harrows Law	22.5km	Submitted	37	65	90
Limmer Hill	16.34km	Submitted	33	80	90
Minch Moor	25.7km	Submitted	12	67	80
Minnygap	30.34km	Submitted	15	80	90
Earlshaugh	10.3km	Scoping	36	80	90

7.4.18 The effects and significance of the introduction of the proposed Glenkerie Wind Farm are assessed against these wind farms, which act as the baseline for cumulative assessment. It must be noted that the assessment findings are not a substitute for the individual development-specific assessments for each of the wind farms named above, and that the findings are based on an assessment of available information.

LANDSCAPE BASELINE

7.4.19 Within the 35km radius study area, four different levels of detail have been used to describe the baseline landscape character, based on distance from the proposed turbines. These are:

- The landscape character of the development site itself (the Planning Application boundary);
- The landscape character of the immediate landscape setting (2.5km radius around the proposed turbines);
- The landscape character of the local landscape setting (15km radius around the proposed turbines); and

- The landscape character of the wider landscape (35km radius around the proposed turbines).

7.4.20 The landscape character baseline is described using a combination of existing published landscape character assessments and the results of field survey work. Reference is made to the viewpoints used within the visual assessment in order to illustrate landscape character within the 35km radius study area.

PUBLISHED LANDSCAPE CHARACTER ASSESSMENTS

7.4.21 The National Programme of Landscape Character Assessment, undertaken by Scottish Natural Heritage in partnership with local authorities and other agencies, has involved the assessment of landscape character for all of Scotland.

7.4.22 A number of published landscape assessments are of relevance to the assessment of landscape effects. These include;

- ASH Consulting Group 1998. The Borders landscape assessment. Scottish Natural Heritage Review. No 112;
- Land Use Consultants 1999. Glasgow and the Clyde Valley landscape assessment. Scottish Natural Heritage Review No. 116;
- ASH Consulting Group 1998. The Lothians landscape character assessment. Scottish Natural Heritage Review No 91;
- Land Use Consultants 1998. Dumfries and Galloway landscape assessment. Scottish Natural Heritage Review No 94; and
- Land Use Consultants 1998. Ayrshire landscape assessment. Scottish Natural Heritage Review No 111.

7.4.23 The different landscape character types and areas that fall into the 35km study area are indicated in Table 7.3 below. A detailed analysis of landscape character is carried out for the development site itself, the immediate landscape setting within 2.5km of the proposed turbines, and the local landscape setting within 15km radius of the proposed turbines.

7.4.24 This is in accordance with the assessment methodology and current best practice and guidance provided in Policy D4 Renewable Energy of the Scottish Borders Local Plan.

7.4.25 On this basis, the more detailed landscape descriptions within the landscape character areas are used for assessment within 15km of the site, while the less detailed descriptions of landscape types and regional character areas are used for assessment over the wider 35km broad-scale landscape.

Table 7.3: Published Landscape Character within 35km of the Proposed Glenkerie Wind Farm.

Landscape Character within 2.5km of the Proposed Glenkerie Wind Farm	
Landscape Character Assessment	**Landscape Character Areas/Types**
The Borders landscape assessment	Landscape Type (LT)/Landscape Character Area (LCA) BDR4 (BG) Southern Uplands with Scattered Forest, Broadlaw Group; LT/LCA BRD22 (UT) Upland Valley with Pastoral Floor, Upper Tweed
Glasgow and the Clyde Valley landscape assessment	Regional Character Area (RCA)/LCA STC (vi) 21 Southern Uplands, Southern Uplands;
Landscape Character within 15km of the Proposed Glenkerie Wind Farm	
Landscape Character Assessment	**Landscape Character**
The Borders landscape assessment	LT/LCA BDR4 (BG) Southern Uplands with Scattered Forest, Broadlaw Group; LT/LCA BDR 22(UT) Upland Valley with Pastoral Floor, Upper Tweed; LT/LCA BDR 22(BW) Upland Valley with Pastoral Floor, Biggar Water; LT/LCA BDR 22(MW) Upland Valley with Pastoral Floor, Manor Water; LT/LCA BDR 22(LY) Upland Valley with Pastoral Floor, Lyne Water; LT/LCA BDR 25(MT) Upland Valley with Woodland, Middle Tweed; Type/Area BDR 3(BH) Plateau Outliers, Broughton heights; LT/LCA 11S Grassland with Hills, Skirling
Glasgow and the Clyde Valley landscape assessment	RCA/LCA STC (VI) 21 Southern Uplands, Southern Uplands; RCA/LCA STC (VI) 14 Southern Uplands, Upland Glen; RCA/LCA STC (X) 13 Southern Upland Foothills, Broad Valley Uplands; RCA/LCA STC (X) 15 Southern Upland Foothills, Foothills
Dumfries and Galloway landscape assessment	Landscape Character Type (LCT)/Landscape Unit (LU) DGW21a Foothills with Forests; LCT/LU DGW22 Southern Uplands, North Moffat; LCT/LU DGW11 Upland Glens, Moffat;
Landscape Character within 35km of the Proposed Glenkerie Wind Farm	
Landscape Character Assessment	**Landscape Character**
The Borders landscape assessment	Midland Valley RCA; Central Southern Uplands RCA, Lammermuir and Moorfoot Hills RCA

Landscape Character within 35km of the Proposed Glenkerie Wind Farm	
Landscape Character Assessment	**Landscape Character**
Glasgow and the Clyde Valley landscape assessment	Clyde and Ayrshire Basins Moorlands RCA; Central Plateau Moorlands RCA; Southern Uplands RCA; Clyde Basin Farmlands RCA; Inner Clyde Valley RCA; Southern Upland Foothills RCA; Pentland Hills RCA
The Lothians landscape character assessment	Uplands LCT; Upland Fringes LCT; Lowland River Valleys LCT; Lowland Plateaux LCT; Lowland Plains LCT
Dumfries and Galloway landscape assessment	West Southern Uplands RCA
Ayrshire landscape assessment	Ayrshire Rim RCA; Southern Upland RCA

THE LANDSCAPE CHARACTER OF THE DEVELOPMENT SITE

7.4.26 The proposed Glenkerie Wind Farm site and planning application boundary lies west of the A701, approximately 9.75km south east of Biggar. The majority of the site occupies a series of rounded, dome shaped hills with a general southwest to northeast orientation. These include Broomy Law (~550m AOD), Kingle Rig (~430m AOD), Glenlood Hill (566m AOD) and Cockle Rig Head (489m AOD). The north eastern section of the proposed Glenkerie Wind Farm site and planning application boundary drops in elevation along a valley side to meet the A701 east of the property of Kingledores, which lies within the planning application boundary. The total area of the planning application boundary is 390ha

7.4.27 The physical fabric of the site is varied. Generally, the site consists of a typical 'upland mosaic' of different land cover. Semi-improved acid grassland, acid dry dwarf shrub heath, dry heath/acid grassland mosaic, wet dwarf shrub heath, wet heath/blanket bog mosaic, wet heath acid grassland mosaic, blanket bog, wet modified bog and marshy grassland all represent common components of land cover. Also present but less common are areas of scattered bracken. Remnant cleuch broadleaved (rowan and birch) woodlands are found alongside the Glenkerie and the Glenkiely Burn.

7.4.28 To the east of the site, land cover along the more sheltered lower valley sides includes semi improved and improved grassland, with broad leaved and coniferous shelter planting around Kingledores. An area of semi-natural broad-leaved woodland follows the burn meandering to the River Tweed.

7.4.29 The area within the planning application boundary is relatively unenclosed at higher elevations, with some post and wire fencing being present.

Lower lying fields within the valley to the east are enclosed with post and wire fencing and are small in size.

7.4.30 A number of small watercourses drain from the raised topography to the centre of the proposed Glenkerie Wind Farm site to the valley located to the east and west, including Glenkerie Burn and Hare Burn.

Landscape Sensitivity

7.4.31 The sensitivity of the different landscape elements within the proposed Glenkerie Wind Farm site is connected to their value as assessed within the assessment of ecological effects in chapter eight. On this basis, the blanket bog, upland acid grassland and heath and cleuch broadleaved (rowan and birch) woodland land cover types are assessed as being of **Medium** landscape sensitivity. Due to the time required for full recovery post-reinstatement, coniferous plantation woodland is also assessed as being of **Medium** sensitivity.

7.4.32 The other land cover types are assessed as being of **Low** landscape sensitivity.

THE LANDSCAPE CHARACTER OF THE IMMEDIATE LANDSCAPE SETTING (2.5KM RADIUS AROUND PROPOSED TURBINES)

7.4.33 Table 7.3 above lists the landscape character types within which the Planning Application boundary and immediate surroundings are located, and these are illustrated on Figure 7.7 and represented by Viewpoints (VPs) 2, 9, 10, 12, 14, 17 and 27.

Overall Character

7.4.34 The 2.5km radius immediate landscape falls into two main categories, upland and valley landscapes. The upland landscapes are open, large scale, remote, windswept and rolling in character, with landform comprising distinctive domed and conical hills with a simple, coarsely textured upland mosaic land cover. Manmade influences on these upland landscapes relate to existing wind farm developments, telecommunications masts, coniferous woodland and farming. In contrast, the valley landscapes are smaller in scale and enclosed, even intimate in character, with a simple but finely textured land cover dominated by pasture, rough grazing and woodland.

Landscape Sensitivity

7.4.35 **Landscape Value**: The entire 2.5km radius immediate landscape falls into the Tweedsmuir Hills/Upper Tweeddale AGLV. The northern edge of the immediate landscape is over 3km from the Upper Tweeddale NSA, and the south-western edge of the immediate landscape is 2.3km from the South Clydesdale RSA. In policy terms, this indicates that the landscape is locally, and to some degree nationally, valued for its aesthetic

characteristics. The landscape is assessed as being of **High to Medium** sensitivity.

7.4.36 **Landscape Character Sensitivity:** Using the descriptions of the landscape characteristics above and as detailed in Appendix 7.4 overall, the upland landscapes within the 2.5km radius immediate area around the proposed Glenkerie Wind Farm are assessed as being of **High** landscape character sensitivity. The valley landscapes are assessed as being of **Medium** sensitivity.

7.4.37 **Visual Sensitivity:** For the upland landscapes the visual sensitivity is assessed as being **High.** For the valley landscapes, visual sensitivity of valley landscapes is assessed as being **Medium.**

7.4.38 Taking into account the assessment of Landscape Value, Character Sensitivity and Visual Sensitivity the overall Landscape Sensitivity of the upland landscapes is assessed as being **High**, and Landscape Sensitivity for the valley landscapes is assessed as being **Medium**.

THE LANDSCAPE CHARACTER OF THE LOCAL LANDSCAPE SETTING (15KM RADIUS AROUND PROPOSED TURBINES)

7.4.39 Table 7.3 above lists the landscape character types within the local landscape setting, and these are illustrated on Figure 7.7 and represented by Viewpoints (VPs) 2, 6, 9, 10, 12, 14 16, 17, 18, 20, 21, 27, 28, 29, 30 and 32.

Overall Character

7.4.40 The 15km radius local landscape largely once again falls into upland and valley landscapes. As before, the upland landscapes are open, large scale, remote and rolling in character, with land form comprising distinctive domed and conical hills with a simple, coarsely textured upland mosaic land cover. Manmade influences on these upland landscapes relate to existing wind farm developments, telecommunications masts, coniferous woodland and farming. In contrast, the valley landscapes tend to be smaller in scale and enclosed, even intimate in character, with a simple but finely textured land cover dominated by pasture, rough grazing and woodland. However, the broader river valleys are wider and larger in scale.

Landscape Sensitivity

7.4.41 **Landscape Value:** The central, eastern and southern sections of the 15km radius local landscape falls into the Tweedsmuir Hills/Upper Tweeddale AGLV. The northern eastern section of the local landscape falls within the Upper Tweeddale NSA, and western section of the local landscape falls within the South Clydesdale RSA. This indicates that the local landscape is both locally and nationally recognised for its aesthetic characteristics. The landscape is assessed as being of **High** value within

the South Clydesdale RSA and Tweedsmuir Hills/Upper Tweeddale AGLV, and of **Very High** value within the Upper Tweeddale NSA.

7.4.42 **Landscape Character Sensitivity:** Using the descriptions of the landscape characteristics above and as detailed in Appendix 7.4 overall, the upland landscapes within the 15km radius local area around the proposed Glenkerie Wind Farm are assessed as being of **High** landscape character sensitivity. The valley landscapes, including the broader valleys, are assessed as being of **Medium** sensitivity.

7.4.43 **Visual Sensitivity:** For the upland landscapes, the visual sensitivity is assessed as being **High**. For the valley landscapes, visual sensitivity is assessed as being **Medium**.

7.4.44 Taking into account the assessment of Landscape Value, Character sensitivity and Visual Sensitivity the overall Landscape Sensitivity of the South Clydesdale RSA and Tweedsmuir Hills/Upper Tweeddale AGLV upland landscapes are assessed as being of **High** landscape sensitivity, with the valley landscapes as being of **Medium to High** sensitivity. Within the Upper Tweeddale NSA upland landscapes are assessed as being of **High to Very High** landscape sensitivity, and valley landscapes, taking into account the presence of broader valleys here, as being of **High** sensitivity.

HISTORIC GARDENS AND DESIGNED LANDSCAPES WITHIN THE LOCAL LANDSCAPE SETTING (15KM RADIUS AROUND PROPOSED TURBINES)

7.4.45 Two Historic Gardens and Designed Landscapes are located within the 15km radius local study area. These are the Dawyck botanic gardens and the grounds to Stobo Castle, located approximately 7.5km and 9km north east of the proposed Glenkerie Wind Farm respectively. As Dawyck is not visible within the ZTV for the proposed Glenkerie Wind Farm, it will not be considered further within this assessment.

Stobo Castle

7.4.46 **Physical Fabric:** Stobo Castle is located on the B712 ~9.5km southwest from Peebles and ~19km east of Biggar. It is situated adjacent to the River Tweed, on the lower slopes of Harrow Hope and Trahenna Hill. The B712 forms the western boundary of the designed landscape. The castle is surrounding by farmland, coniferous woodland and heather moorland. The Weston Burn runs through the grounds. An extensive area of parkland contains a variety of broadleaved and deciduous tree species.

7.4.47 **Characteristics:** The elements within the grounds of Stobo reflect its origins as a designed parkland landscape, and are of high quality and condition. The park is enclosed by woodland, although extensive views up and down the Tweed Valley and across to the foothills of Dollar Law, the highest mountain in the Southern Uplands (871m AOD), are possible. The skyline is likely to comprise a combination of surrounding woodland

and the surrounding topography beyond. Stobo Castle exists as an attractive, naturalistic, relatively simple and balanced parkland landscape, and, due to a combination of the surrounding woodland and wider setting, is experienced as tranquil landscape.

7.4.48 **Landscape Sensitivity:** Using the descriptions of the landscape characteristics above and as detailed in Appendix 7.4 overall, the sensitivity of Stobo Castle to wind energy development located outwith and some distance from its boundaries is **Medium**. However, it should be noted that due to tree cover, no view of the windfarm is possible from the immediate area of the Castle.

THE LANDSCAPE CHARACTER OF THE WIDER LANDSCAPE SETTING (35KM RADIUS AROUND PROPOSED TURBINES)

7.4.49 Table 7.3 above lists the Regional Character Areas and Landscape Types landscape within the 35km radius local landscape around the proposed Glenkerie Wind Farm. The landscape within 15km is represented by Viewpoints (VPs) 2, 6, 9, 10, 12, 14 16, 17, 18, 20, 21, 27, 28, 29, 30 and 32. VPs 22 and 24 illustrate the landscape character within the 35km radius study area outside of this local landscape.

Overall Character

7.4.50 The 35km radius area contains a variety of different landscapes. The upland landscapes again tend to be open, large scale, remote, windswept and rolling in character, with landform comprising distinctive domed and conical hills with a simple, coarsely textured upland mosaic land cover. Manmade influences on these upland landscapes relate to existing wind farm developments, telecommunications masts, coniferous woodland and farming. Many of the valley landscapes contrast sharply with this, tending to be smaller in scale and enclosed, even intimate in character, with simple but fine grained land cover dominated by pasture, rough grazing and woodland. Settlements in such valleys typically comprises dispersed properties, although these valleys may function as conduits for communication links. A number of broader, larger scale valleys are located within the study area, as are generally larger scale flatter, farmed areas. These tend to have more in the way of settlement, along with associated infrastructure and communications links. Generally, the valleys and upland landscapes are remote and tranquil in character. The broader valleys and farmed areas tend to have more movement and noise associated with them, especially in proximity to settlements.

Landscape Sensitivity

7.4.51 The landscape will vary in terms of its sensitivity to the type of development proposed. The sensitivities assessed for the wider landscape are based on the assessment of the upland landscapes within 15km of the proposed Glenkerie Wind Farm. These relate to a broad scale assessment of sensitivity.

7.4.52 Upland landscapes are assessed as being generally of **Medium to High** landscape sensitivity, of **High** landscape sensitivity within the South Clydesdale RSA and Tweedsmuir Hills/Upper Tweeddale AGLV, and of **High to Very High** landscape sensitivity in the Upper Tweeddale NSA.

7.4.53 Valley landscapes are assessed as being generally of **Medium** landscape sensitivity, of **Medium to High** landscape sensitivity within the South Clydesdale RSA and Tweedsmuir Hills/Upper Tweeddale AGLV, and of **High** landscape sensitivity in the Upper Tweeddale NSA.

7.4.54 Broader valley and flatter, farmed landscapes are assessed as being of generally **Medium to Low** sensitivity, of **Medium** landscape sensitivity within the South Clydesdale RSA and Tweedsmuir Hills/Upper Tweeddale AGLV, and of **Medium to High** landscape sensitivity in the Upper Tweeddale NSA.

7.4.55 Table 7.4 below summarises the sensitivity of the baseline landscape.

Table 7.4 Summary of Baseline Landscape Sensitivity

Extent of Effects	Landscape	Designation	Landscape Sensitivity
Proposed Glenkerie Wind Farm Site	Land within planning application boundary	AGLV	Medium
Immediate Landscape Setting (2.5km radius around proposed turbines)	Upland Landscapes	NSA RSA	High
	Valley Landscapes	AGLV	Medium
Local Landscape Setting (15km radius around proposed turbines)	Upland Landscapes	NSA	High to Very High
	Valley Landscapes		High
	Upland Landscape	RSA	High
	Valley Landscapes	AGLV	Medium to High
	Upland Landscape (Grassland with Hills)	None	Medium to High
	Stobo Castle	HGDL	Medium
Wider Landscape Setting (35km radius around	Upland Landscapes	NSA	High to Very High
	Valley Landscapes		High

Extent of Effects	Landscape	Designation	Landscape Sensitivity
proposed turbines)	Broader valley and flatter farmed landscapes		Medium to High
	Upland Landscapes	RSA AGLV	High
	Valley Landscapes		Medium to High
	Broader valley and flatter farmed landscapes		Medium
	Upland Landscapes	None	Medium to High
	Valley Landscapes		Medium
	Broader valley and flatter farmed landscapes		Medium to Low

VISUAL BASELINE

7.4.56 Figures 7.2 and 7.3 indicate the blade tip and hub height ZTVs within 35km of the proposed Glenkerie Wind Farm. These indicate that the proposed Glenkerie Wind Farm is well contained visually. Additionally, it should be noted that ZTVs should be considered to be a 'worst-case scenario' as they only reflect landform, and not other factors affecting visibility such as vegetation and built form.

7.4.57 The exact nature of visibility is linked to variations in landform and land cover, as discussed above in relation to landscape character. Following the description of baseline landscape character, three different levels of detail have been used describing the baseline visual environment, based on distance from the proposed Glenkerie Wind Farm:

- The immediate visual environment (2.5km radius around the proposed turbines);
- The local visual environment (15km radius around the proposed turbines); and
- The wider visual environment (35km radius around the proposed turbines).

Visual Receptors

7.4.58 To represent and illustrate the potential effects that the proposed Glenkerie Wind Farm may have on a range of sensitive fixed and linear route receptors found within the study area, viewpoint locations have

been identified and agreed with Scottish Borders Council and SNH. These sensitive receptors and locations are listed in Table 7.5 below and are illustrated on ZTV Figures 7.2 and 7.3.

7.4.59 In addition, a series of linear receptors, relating to roads and other public rights of way through the 35km study area, were chosen for the assessment of sequential and cumulative sequential effects, following consultation with Scottish Borders Council and SNH. These are:

- A701;
- B7016;
- John Buchan Way;
- A702;
- A721; and
- A70.

Table 7.5 Viewpoint Locations and Rationale

VP	*Description*	*Easting*	*Northing*	*Rationale*
2	Culter Fell	305323	629071	RSA, Hill Top View
6	Pykestone Hill	317300	631260	NSA. Footpath, panoramic hilltop view.
9	Stanhope	312066	629708	AGLV, Local residential property
10	Polmood House	311392	627062	AGLV, Local residential property
12	Kingledores Farm	310528	628146	AGLV, Local residential property
14	Patervan Farm	311172	628721	AGLV, Local residential property
15	Tinto Hill	295293	634383	RSA. Panoramic hilltop view.
16	Trahenna Hill	313592	637408	NSA. Panoramic hilltop view
17	Glencotho	308420	629950	AGLV, Local residential property
18	Hopecarton	312720	631000	AGLV, Local residential property
20	Broadlaw	314571	623625	AGLV. Panoramic hilltop view. Viewpoint identified by consultation with neighbours
21	John Buchan Way	312656	639221	NSA. Footpath/trail. Viewpoint identified by consultation with neighbours

VP	*Description*	*Easting*	*Northing*	*Rationale*
22	White Meldon	321934	642844	Hilltop fort.Views across NSA.
23	A701 Source of the Tweed Car Park	304947	614607	AGLV, Tourist route, Road user, Source of the Tweed
24	Hods Hill	300474	609487	RSA. Southern Upland Way. Panoramic hilltop view.
26	Minor Road South of Bellscraig	302750	641797	Road users. Views across RSA
27	A701 near Worm Hill	311651	630053	AGLV, View from A701 Scenic Route, VP recommended by Borders Council.
28	Talla Reservoir	310738	622899	AGLV, VP recommended by Borders Council.
29	Minor Road in NSA near Dreva and Quarry Hill	314810	636080	NSA, Road Users, VP recommended by SNH and Borders Council.
29a	1 & 2 Dreva Cottages	314275	636010	Residential properties within NSA
30	B7016 W of Broughton	309747	636946	Road Users, VP recommended By SNH.
31a	Elsrickle	306482	643625	RSA. Residential views from village
32	Minor Road North of Skirling	307560	639490	Road Users, VP recommended By SNH.

The Immediate Visual Environment (2.5km Radius Around the Proposed Turbines)

7.4.60 VP's 2, 9, 10, 12, 14, 17 and 27 illustrates representative views within 2.5km of the nearest turbines. Landform exerts a strong influence on visibility of the proposed Glenkerie Wind Farm. The upland landscapes described above generally have open, long distance panoramic views across the landscape. Such views are demonstrated by VP2. Conversely, views from within valley landscapes are typically constrained by landform, as illustrated by VPs 9, 10, 12, 14, 17 and 27. The ZTVs show that while much of the raised upland topography in the immediate landscape falls within the ZTV, the majority of the valley landscapes fall outside of the ZTV, with the exception being where proximity to the site or breaks in landform allow views. Visual receptors in the valley landscapes are limited

to dispersed properties and roads. Walkers and other leisure users are likely to represent the main visual receptors for the upland landscapes.

The Local Visual Environment (15km Radius Around the Proposed Turbines)

7.4.61 Much of the local visual environment to the south, west and east of the proposed Glenkerie Wind Farm reflects that of the immediate visual environment, in terms of landform. VPs 2, 6, 20 and 23 represent the open panoramic views from upland landscapes within the local visual environment, while VPs 9, 10, 12, 14, 17, 18, 27 and 28 illustrate the generally more enclosed views from within the valley landscapes.

7.4.62 To the north and north east of the proposed Glenkerie Wind Farm, the local visual environment is more varied. Upland landscapes here continue to demonstrate similar characteristics to those to the south, west and east of the proposed Glenkerie Wind Farm. However, broader valley landscapes allow more significant middle distance views than the narrower valleys discussed previously. They also contain more settlement and communication routes, and therefore more visual receptors are present. VPs 15, 16 and 21, illustrate the uplands to the north while VPs 29, 29a and 30 illustrate the broader valley landscapes.

7.4.63 The ZTV indicates that potential visibility of some part of the proposed turbines is relatively limited within the local landscape. Due to the effects of landform, visibility occurs along a general north to south axis. This largely takes in upland areas, although some of the broader valley landscapes are also affected.

The Wider Visual Environment

7.4.64 Outside the 15km local study area to the north, the ZTVs indicate that visibility of the proposed Glenkerie Wind Farm is very limited. Limited visibility may occur at distant, remote, elevated locations and forested areas in the Moorfoot hills beyond Peebles, to the northeast, in the Pentland Hills to the north, and in the northwest of the study area to the northwest of Lanark.

7.4.65 To the south and southwest of the study area theoretical visibility is even more limited, and again is restricted to very few areas of remote hilltops and forested areas of the Lowther Hills as represented by VP24 Hods Hill.

7.5 IMPACT ASSESSMENT

LANDSCAPE AND VISUAL EFFECTS DURING CONSTRUCTION AND DECOMMISSIONING

7.5.1 A project description of the Glenkerie Wind Farm is provided in Chapter 5. This identifies a number of different temporary activities and features during construction and decommissioning which have the potential to cause both landscape and visual effects. These effects are considered separately to those that may occur during the operation of the proposed Glenkerie Wind Farm.

7.5.2 Temporary effects on landscape fabric will occur during the construction phase, which will have a duration of between six and nine months. This will involve the removal of some of the features and land cover making up the fabric of the development site. This primarily relates to the temporary loss of 'upland mosaic' land cover, although a limited loss of other types of land cover may occur. However, with the exception of the effects of the elements of the wind farm to be retained during its operational phase, any disturbance to the landscape fabric arising from construction activities will be reinstated post-construction. During decommissioning, the landscape fabric of the site will be reinstated to its pre-wind farm condition, with underground cables being left buried in-situ and foundations and hard standings being removed to a depth that would allow the continuation of current land use practices. Unless otherwise agreed and required for agricultural or forestry operations, on site access tracks will be removed and the affected area reinstated.

7.5.3 During the construction and decommissioning phases of the project, there will be temporary visual effects, which would last for approximately six to nine months and two months respectively. The more significant temporary construction visual effects relate to vehicle movements to and from and on the site itself and the use of cranes in turbine erection, which will be tall prominent features in the local landscape. More limited visual effects will relate to vehicles entering and leaving the site via the designated access point and the temporary construction compound. The compound has been sited so as to make use of existing screening by landform and trees to the east. The construction/decommissioning activity resulting in the most prominent visual effect to the public will be when the turbines are delivered to the site and erected and, at the end of their operational life, dismantled and removed.

7.5.4 Temporary effects on landscape character will also occur during the construction phase. This will relate to changes to landscape character due to the addition of temporary new elements as a result of construction activities. This will involve the presence of the construction compound, vehicles and cranes on site. Similar temporary effects on landscape character will result from decommissioning activities.

7.5.5 As a result of the limited extent of the disturbance, and the reinstatement of working areas, the construction and decommissioning phases will have

only a limited, but negative, effect on landscape fabric and landscape character. Furthermore, as a result of the short duration of the works, the construction and decommissioning phases will have only a short-term and temporary effect on visual amenity.

LANDSCAPE EFFECTS DURING OPERATION

7.5.6 Within the 35km study radius, four different levels of detail have been used to describe the baseline landscape character, based on distance from the proposed Glenkerie Wind Farm. The same level of detail is used in the assessment of landscape effects during operation of the proposed Glenkerie Wind Farm. Please refer to the detailed landscape assessment provided in Appendix 7.4.

7.5.7 Table 7.6 provide a summary of the landscape effects arising as a result of the introduction of the proposed Glenkerie Wind Farm into the landscape. Significant landscape effects are limited to the upland landscapes within the immediate 2.5km radius study area around the proposed Glenkerie Wind Farm.

Table 7.6 Summary of Landscape Effects

Extent of Effects	Landscape	Design -ation	Landscape Sensitivity	Magnitude of Landscape Change
Proposed Glenkerie Wind Farm Site	Land within planning application boundary	AGLV	Medium	Small
Immediate Landscape Setting (2.5km radius around proposed turbines)	Upland Landscapes	NSA RSA	High	Large
	Valley Landscapes	AGLV	Medium	Large
Local Landscape Setting (15km radius around proposed turbines)	Upland Landscapes	NSA	High to Very High	Small
	Valley Landscapes		High	Small
	Upland Landscape	RSA	High	Small (RSA), Small to Medium (AGLV)
	Valley Landscapes	AGLV	Medium to High	Small

Extent of Effects	Landscape	Design-ation	Landscape Sensitivity	Magnitude of Landscape Change
	Upland Landscape (Grassland with Hills)	None	Medium to High	Small
	Stobo Castle	HGDL	Medium	Very Small
Wider Landscape Setting (35km radius around proposed turbines)	Upland Landscapes	NSA	High to Very High	Very Small
	Valley Landscapes		High	Very Small
	Broader valley and flatter farmed landscapes		Medium to High	Very Small
	Upland Landscapes	RSA AGLV	High	Very Small
	Valley Landscapes		Medium to High	Very Small
	Broader valley and flatter farmed landscapes		Medium	Very Small
	Upland Landscapes	None	Medium to High	Very Small
	Valley Landscapes		Medium	Very Small
	Broader valley and flatter farmed landscapes		Medium to Low	Very Small

Landscape Effects – The Development Site

7.5.8 A number of temporary effects to the landscape fabric of the site during construction and decommissioning have been identified above. Operational effects on the landscape fabric will relate to the limited removal of some of the features and land cover making up the fabric of the development site and their replacement with the following features: the control building, the met mast, the access tracks, the crane hardstandings (the cranes themselves will be present only during construction and for emergency repairs/maintenance to the turbines); and the wind turbines and foundations. A description of the characteristics of

these features is provided in Chapter 5. Following decommissioning, the landscape fabric of the site will be reinstated to its pre-wind farm condition, with underground cables being left buried in-situ and foundations and hard standings being removed to a depth that would allow the continuation of current land use practices. Unless otherwise agreed and required for agricultural or forestry operations, on site access tracks will be removed and the affected area reinstated.

7.5.9 The proposed Glenkerie Wind Farm represents a temporary medium-term (25 year) effect on a small proportion of the landscape fabric of the site. The majority of the landscape elements to be removed relate to loss of 'upland mosaic' land cover, although a limited loss of other types land cover may also occur. These land cover elements are common at a local, regional and national scale.

Landscape Effects – Immediate Landscape Setting (2.5km Radius around the Proposed turbines)

7.5.10 The landscape character types within which the proposed turbines and immediate surroundings are located are illustrated on Figure 7.7 and represented by Viewpoints (VPs) 2, 9, 10, 12, 14, 17 and 27.

7.5.11 The ZTVs indicate that the visibility of the proposed Glenkerie Wind Farm is mainly confined to the areas identified as upland landscapes, VP 2 illustrates views from such upland landscapes.

7.5.12 These landscapes are open and large in scale and coarse in texture, with little in the way of screening, which reduces their contrast in scale with the proposed turbines. The regular pattern of rounded hilltops also provides a framework within which the turbines are anchored, helping to provide a context that further reduces contrasts in scale. On this basis, while the turbines would represent prominent elements that are uncharacteristic within the immediate upland landscapes, the characteristics of those landscapes serve to reduce contrasts in scale to some degree.

7.5.13 Within 2.5km of the proposed Glenkerie Wind Farm VPs 9, 10, 12, 14, 17 and 27 represent views from within valley landscapes. The ZTV indicates that the proposed Glenkerie Wind Farm affects only limited sections within the valley landscapes. This indicates that the proposed turbines have the potential to influence landscape character within a very limited part of these landscapes.

7.5.14 The magnitude of landscape change in the immediate setting is assessed as **large,** but the effects are not significant.

Landscape Effects – Local Landscape Setting (15km Radius around the Proposed turbines)

7.5.15 The landscape character types within the local landscape setting are illustrated on Figure 7.7 and represented by Viewpoints (VPs) 2, 6, 9, 10, 12, 14 16, 17, 18, 20, 21, 27, 28, 29, 30 and 32.

7.5.16 The ZTV indicates that visibility of the proposed Glenkerie Wind Farm within the local landscape falls within limited areas of upland and valley landscapes within the Tweedsmuir Hills/Upper Tweeddale AGLV, South Clydesdale RSA, and Upper Tweeddale NSA. The ZTV's also indicates potential effects to Stobo Castle HGDL.

7.5.17 Stobo Castle is the only HGDL to fall within the ZTV within the 15km local landscape. The ZTV indicates that the proposed Glenkerie Wind Farm would only be visible in the western, wooded sections of Stobo Castle. This indicates that effects on the setting would be limited, with the turbines forming an inconspicuous feature that would not affect landscape quality.

7.5.18 The intermittent visibility indicated in the ZTV mainly relates to upland landscapes, although limited sections of valley landscapes may also be affected.

7.5.19 The effects of the proposed Glenkerie Wind Farm are limited in extent within the northern section of 15km radius local landscape. Wind turbines are already a readily recognisable feature within the landscape and from within the NSA due to the presence of the existing Bowbeat Wind Farm, in addition the presence of existing telecommunications masts mean that vertical features are part of the existing landscape baseline, especially with regard to the Upper Tweeddale NSA. The effect of distance and the elements within the different landscapes all serve to reduce contrasts in scale with the proposed turbines. This indicates that the proposed Glenkerie Wind Farm would relate to the introduction of elements that are already apparent in the landscape. The turbines would therefore represent features that do not quite fit into the landform and scale of the landscape, but that would not be uncharacteristic.

7.5.20 With regard to the upland landscapes located within the local landscape setting Tweedsmuir Hills/Upper Tweeddale AGLV, the proposed Glenkerie wind farm would be not be out of scale with the landscape, or at odds with the local pattern and landform, but would represent the introduction of noticeable features.

7.5.21 Given the more limited extent of effects within the valley landscapes, the turbines here would relate to features that would be apparent, but not dominant, within the landscape.

7.5.22 To the west of the Tweedsmuir Hills/Upper Tweeddale AGLV within the local landscape lies the Lower Clydesdale RSA. The majority of this RSA falls outside of the ZTV. The most notable exceptions to this are Tinto Hill (VP15) and the Biggar Hills north east of Biggar. Given the limited visibility of the turbines within this landscape, effects are also likely to be limited, and relate to features that would be apparent, but not dominant, within the landscape as a whole.

7.5.23 To the north of the proposed Glenkerie Wind Farm, the ZTVs indicate a similar, intermittent pattern of visibility to that described above for the south of the local study area. Some of this intermittent visibility relates to upland landscapes (Refer to VPs 16 and 21), including the grassland

with hills near Skirling. In addition, the broader valley landscapes described in Appendix 7.2 are also affected (Refer to VPs 26,29, 29a, 30, 31a and 32). This includes upland and broader valley landscapes within the to the north east of the 15km radius local study area (VPs 16, 29 and 29a).

7.5.24 The magnitude of landscape change in the Local Landscape setting is assessed as small to medium in the AGLV and very small for Stobo Castle.

Landscape Effects on the Wider Landscape Setting (35km radius around the Proposed turbines)

7.5.25 The ZTV indicates that extent of the effects of the proposed Glenkerie Wind Farm beyond the 15km local scale landscape is limited. VP 22 and 24 illustrate views from within the limited area where effects would occur. Where visibility of the turbines is possible, they would appear as a minor, inconspicuous feature in the wider landscape, and would have little or no effect on existing landscape quality. Wind turbines are already a readily recognisable feature of the wider landscape due to the presence of the existing wind farms and therefore the proposed Glenkerie Wind Farm would not be uncharacteristic in this context.

7.5.26 The magnitude of landscape change in the wider setting is assessed **as very small**.

CUMULATIVE LANDSCAPE EFFECTS DURING OPERATION

7.5.27 Within the 35km cumulative study radius, four different levels of detail have been used describing the baseline landscape character, based on distance from the proposed Glenkerie Wind Farm. The same level of detail is used in the assessment of cumulative landscape effects during operation of the proposed Glenkerie Wind Farm please refer to the detailed landscape assessment provided in Appendix 7.3.

7.5.28 Table 7.7 provide a summary of the cumulative landscape effects arising as a result of the introduction of the proposed Glenkerie Wind Farm. Significant cumulative landscape effects would only occur for the NSA within the 15km radius local scale landscape. However, such significant cumulative effects would only occur on the basis that all the proposed and scoped wind farms are consented and constructed.

Table 7.7 Summary of Cumulative Landscape Effects

Extent of Effects	Landscape	Designation	Landscape Sensitivity	Magnitude of Landscape Change
Proposed Glenkerie Wind Farm Site	Land within planning application boundary	AGLV	Medium	Very Small

Extent of Effects	Landscape	Designation	Landscape Sensitivity	Magnitude of Landscape Change
Immediate Surroundings (2.5km radius around proposed turbines)	Upland Landscapes and Valley Landscapes	RSA AGLV	Medium to High	Small (Existing, consented and proposed wind farms); Medium (Existing, consented, proposed and scoped wind farms);
Local Landscape (15km radius around proposed turbines)	Upland Landscapes Valley Landscapes and Stobo Castle	NSA RSA AGLV HGDL	Medium to Very High	Very Small (Existing and consented wind farms); Small (Existing, consented and proposed wind farms); Medium (Existing, consented, proposed and scoped wind farms);
Broad Landscape (35km radius around proposed turbines)	Upland Landscapes Valley Landscapes and Broader valley and flatter farmed landscapes	NSA RSA AGLV None	Low to Very High	Very Small (Existing and consented wind farms); Very Small (Existing, consented and proposed wind farms); Small (Existing, consented, proposed and scoped wind farms);

Cumulative Effects - Landscape Fabric

7.5.29 As described above, the landscape fabric of the Planning Application site does not possess rarity value at even a local scale and the magnitude of effect on the landscape fabric is assessed as small. On this basis, there will not be a cumulative effect on rare or valued landscape elements.

Cumulative Landscape Effects – Immediate Landscape (2.5km Radius around the Proposed turbines)

7.5.30 The cumulative ZTVs (Figures 7.10 to 7.23) all indicate the visibility of the proposed Glenkerie Wind Farm and the different wind farms forming part of the cumulative assessment.

7.5.31 The ZTVs suggest that cumulative effects within the immediate landscape involving the proposed Glenkerie Wind Farm and the operational or

approved wind farms would be minor in nature. The distance from the local landscape to the existing and consented wind farms and the limited extent of their effect on that landscape means that very limited interactions would be possible with the Glenkerie Wind Farm.

7.5.32 In terms of proposed wind farms, the Clyde Airtricity, and to a lesser extent, Limmer Hill Wind Farm would have some capacity to produce a cumulative effect if they are consented in conjunction with the proposed Glenkerie Wind Farm. This would relate to wind farms becoming a more evident feature of the immediate scale landscape.

7.5.33 The scoped Earlshaugh Wind Farm, in conjunction with proposed wind farms in the cumulative assessment and the proposed Glenkerie Wind Farm, would similarly contribute to wind farms becoming a feature of the immediate scale landscape. It is likely that this would lead to an obvious, but not dominant, change in the landscape.

Cumulative Landscape Effects – Local Landscape (15km Radius around the Proposed turbines)

7.5.34 The cumulative ZTVs (Figures 7.10 to 7.23) all indicate the visibility of the proposed Glenkerie Wind Farm and the different wind farms forming part of the cumulative assessment.

7.5.35 The distance from the local landscape to the existing and consented wind farms and the limited extent of their effect on that landscape means that very limited interactions would be possible with the Glenkerie Wind Farm.

7.5.36 In terms of proposed wind farms, the Clyde Airtricity, and to a lesser extent, Limmer Hill Wind Farm would have the capacity to produce a cumulative effect. In addition cumulative effects may also arise with the introduction of the scoped Earlshaugh Wind Farm. This would result in wind farms becoming a more frequent feature of the local scale landscape.

Cumulative Landscape Effects on the Broad-scale Landscape (35km radius around the proposed turbines)

7.5.37 The ZTV indicates that extent of the effects of the proposed Glenkerie Wind Farm beyond the 15km local scale landscape is limited. This suggests that the proposed Glenkerie Wind Farm has limited potential for cumulative interactions with other wind farms on the landscape. The distance from these landscapes to the proposed Glenkerie Wind Farm reinforces this.

7.5.38 If the proposed and scoped proposals were constructed, the possibility increasingly exists that wind farms would be perceived as a common feature of the wider 30km radius broad scale landscape. While this may relate to a significant cumulative landscape effect, the role of the proposed Glenkerie Wind Farm within this would not be significant.

VISUAL EFFECTS DURING OPERATION

7.5.39 A total of 33 viewpoints were selected and investigated to represent the potential outlook from existing vantage point or viewpoints, existing residential properties, public open spaces, outdoor recreation areas and linear receptors.

7.5.40 Following preliminary field survey, design optimisation and consultation with Scottish Borders Council and Scottish Natural Heritage this list was refined to a total of 23 viewpoints.

7.5.41 A full description of the existing view, proposed view and assessed magnitude of change for each of the 23 viewpoints can be found in the Appendix 7.5. A summary of the assessment of these viewpoints, including the magnitude of visual change and significance of effect resulting from the proposed Glenkerie Wind Farm, is indicated in Table 7.10

7.5.42 Of the 23 viewpoints, 7 were chosen in order to represent the likely cumulative effects resulting from the interaction of the proposed Glenkerie Wind Farm with other wind farms within the study area. The theoretical visibility of the different wind farms forming part of the cumulative assessment together with the assessed magnitude of cumulative visual change and the significance of effect resulting from the proposed Glenkerie Wind Farm is indicated in Table 7.11

7.5.43 The ZTV's (Figures 7.2 & 7.3) indicate that the proposed Glenkerie Wind Farm is theoretically visible over a very limited proportion of the study area and from a small number of different sensitive receptors including fixed and linear route receptors. The visual effects of the proposed Glenkerie Wind Farm on such receptors have been identified by a viewpoint analysis and the results of this assessment are presented in the following sections.

7.5.44 The cumulative ZTVs (Figures 7.10 to 7.23) also indicate that cumulative visual effects may be experienced in combination, succession, and sequentially as a result of the introduction of the proposed Glenkerie Wind Farm in addition to those existing, consented, proposed and scoping wind farms included as part of this assessment.

7.5.45 Visualisations of the proposals within the baseline context, and within the cumulative context, at representative viewpoint locations are depicted on photomontage and wire frame illustrations in Figures 7.25 to 7.47

7.5.46 The visual assessment has found that there will be a variety of sensitive receptors affected by the proposed Glenkerie Wind Farm. Such receptors include fixed and linear route receptors such as residential properties, settlements, tourist destinations, public rights of way, hilltops, walking routes and trails, and cycleways.

7.5.47 Visual effects relate to the introduction of large-scale kinetic structures into the landscape.

7.5.48 However, the assessment has found that, whilst there is potential for a high magnitude of change as a result of the introduction of the proposed Glenkerie Wind Farm, significant effects are limited and localised. Limited effects would occur in sensitive upland areas with direct close or middle distance views of the whole development. Such sensitive receptors have been identified at elevated upland hill top locations at viewpoints 2, 6 and 20. Limited effects would also be experienced by a limited number of sensitive receptors at close range within the local valley landscapes, where the turbines appear as prominent features of the horizon above as is represented by Viewpoints 9, 12, 14.

7.5.49 For the majority of sensitive visual receptors, the proposed Glenkerie Wind Farm would not give rise to significant effects. Within the lowland and valley landscapes much of the development is often screened by intervening topography and vegetation.

7.5.50 From the upland landscapes, again the turbines are often screened by intervening landform, however, where visible, the turbines relate well to the scale of landscape elements and the landform, particularly in the uplands where the large-scale landscape easily accommodates and dominates the scale of the proposed Glenkerie Wind Farm.

7.5.51 From elevated upland locations the turbines appear as a compact, balanced group, with a recognisable pattern and rhythm due to the well-ordered and regular spacing of the layout. The turbines appear contained within the large scale surrounding landform, and are seen against the backdrop of the moorland hills.

7.5.52 Cumulative visual effects are limited and localised, and may only be experienced from elevated upland locations. The proposed Glenkerie Wind Farm would form a noticeable or conspicuous element of successive and combined cumulative views from these few locations. This would result in a localised significant or moderate increase in the proportion of the view over which wind farms are visible. Such effects are illustrated by upland locations at VP's 2, 6 and 20.

7.5.53 However, in the wider landscape and from more distant locations, whilst potentially visible, the proposed Glenkerie Wind Farm respects the scale of the landscape, and in the majority of views the turbines would appear as a small or very minor element of the wider landscape and of cumulative views. From the majority of locations identified the proposed Glenkerie Wind Farm would form a minor element of combined or successive cumulative views, and often only results in a slight or negligible increase in the proportion of the view over which wind farms are visible. Significant cumulative effects would primarily be as a result of the successive and combined views of other existing and proposed wind farms, which may serve to bring the presence and prominence of wind turbines closer to sensitive receptors and increase the frequency of readily available views of turbines within the landscape.

7.5.54 Within the study area, a limited number and variety of sensitive visual receptors exist and those fixed visual receptors identified within 15km of the proposed development are listed in Tables 7.8 & 7.9 below. Those

falling within the ZTV and where field survey indicates some visibility occurs are highlighted in bold. It should be noted that this list is not exhaustive and some omissions may occur. Where larger settlements are noted these include associated conurbations unless specifically mentioned

Table 7.8 Visual Receptors within 2.5km of the Proposed Glenkerie Wind Farm.

Properties
Glencotho (VP17), Kingledores (VP12), Logan Cottage, Patervan Farm (VP14), Polmood (VP10), Hopehead, Holms Waterhead, Glenkirk, Glenhighton
Settlements
None identified

Table 7.9 Visual Receptors within 2.5 to 15km of the proposed Glenkerie Wind Farm.

Settlements
Stanhope (VP9), Drumelzier, Bellspool, Stobo, Castlehill, Crawford, Roberton, Lamington, Wandel, Wiston, Newton, Coulter, Symington, Thankerton, Biggar, **Elsrickle (VP31a),** **Skirling (32),** Candy Mill, Broughton,
Tourist Attractions/Recreational Facilities/
The Museum south of Broughton, Dawyck Botanic Gardens, Forest walk and picnic area south east of Southey Hill, Viewpoint, walk and picnic area at Megget Reservoir, Castle and campsite at Crawford, Viewpoint on A701, Campsite at Wiston, **Viewpoint at Tinto Hill (VP15)**, Campsite at Biggar

7.5.55 To assist the assessment Ordnance Survey Address Point data (held to be accurate on 24th November 2005) was purchased in order to identify all properties within a 5km radius of the turbines. These addresses were then plotted onto OS mapping, and the ZTV was overlain in order to determine which properties fell within the ZTV and as a consequence may have a potential view of the turbines.

7.5.56 A total of 84 postal addresses were identified in the Address Point data. Of these 84 addresses, only 16 were found to be within the ZTV. The locations of these addresses are illustrated on Figure 7.24, which shows the blade tip ZTV of the proposed turbines.

7.5.57 Significant visual effects would be experienced by a limited number of sensitive receptors at close range within the local valley landscapes, where the turbines appear as prominent features of the horizon above as is represented by Viewpoints 9, 12, 14.

Table 7.10 Summary of Viewpoint Analysis

VP No	Location	East	North	Visual Receptor Type/s	Receptor Sensitivity	~ Distance to Nearest Turbine (km)	Aspect of View	No. of Hubs (H) & Blade Tips (T) Theoretically Visible	~Field of View Turbines Occupy	Magnitude of Effect	Significance
2	Culter Fell	305323	629071	Walkers	Very High	3.0km	Direct/Uninterrupted	10H 11T	34^{O}	Large	Major
6	Pykestone Hill	317300	631260	Walkers	Very High	8.2km	Direct/Uninterrupted	11H 11T	9^{O}	Medium	Major/Moderate
9	Stanhope	312066	629708	Residential	High	2.8km	Oblique	8H 10T	22^{O}	Large	Major/Moderate
10	Polmood House	311392	627062	Residential	Low	2.4km	Oblique/Obstructed	5H 6T	43^{O}	No Change	NIL
12	Kingledores	310528	628146	Residential	High	1.1km	Direct/Uninterrupted	7H 9T	63^{O}	Very Large	Major
14	Patervan Farm	311172	628721	Residential	High	1.7km	Direct/Slight Oblique	5H 10T	41^{O}	Large	Major/Moderate
15	Tinto Hill	295293	634383	Walkers	High	14.4km	Direct/Uninterrupted	1H 3T	3^{O}	Very Small	Minor
16	Trahenna Hill	313592	637408	Walkers	Very High	9.3km	Direct/Uninterrupted	9H 11T	5^{O}	Small	Moderate
17	Glencotho	308420	629950	Residential	Medium	1.2km	Oblique/Limited/Obscured	3H 3T	26^{O}	Large	Moderate
18	Hopecarton	312720	631000	Residential	Medium	3.8km	Slight Oblique/Uninterrupted	5H 10T	9^{O}	Medium	Moderate/Minor
20	Broadlaw	314571	623625	Walkers	Very High	7.0km	Direct/Uninterrupted	11H 11T	17^{O}	Medium	Major/Moderate
21	John Buchan Way	312656	639221	Footpath/trail. Walkers	High	10.6km	Transient/Oblique	5H 9T	4^{O}	Small	Moderate/Minor

VP No	Location	East	North	Visual Receptor Type/s	Receptor Sensitivity	~ Distance to Nearest Turbine (km)	Aspect of View	No. of Hubs (H) & Blade Tips (T) Theoretically Visible	~Field of View Turbines Occupy	Magnitude of Effect	Significance
22	White Meldon	321934	642844	Hilltop fort	Very High	18.6km	Direct/Uninterrupted	7H 10T	2^{O}	Very Small	Moderate/Minor
23	A701 Source of the Tweed Car Park	304947	614607	Tourist. Scenic Route. Road users.	Medium	13.0km	Transient/Direct/Obscured	8H 9T	4^{O}	Small	Minor
24	Hods Hill	300474	609487	Southern Upland Way. Walkers	High	19.3km	Direct/Uninterrupted	11H 11T	3^{O}	Very Small	Minor
26	Minor Road South of Bellscraig	302750	641797	Road users	Low	14.7km	Transient/Oblique	4H 6T	4^{O}	Very Small	Negligible
27	A701 near Worm Hill	311651	630053	Tourist. Scenic Route. Road users.	Medium	2.5km	Transient/Oblique	0H 3T	13^{O}	Very Small	Minor/Negligible
28	Talla Reservoir	310738	622899	Road Users, Recreational	Low	5.0km	Oblique/Obscured	0H 1T	$<1^{O}$	No Change	NIL
29	Minor Road in NSA near Dreva and Quarry Hill	314810	636080	Road users	Medium	8.8km	Transient/Oblique	1H 6T	1^{O}	Very Small	Minor/Negligible
29a	1 & 2 Dreva Cottages	314275	636010	Residential	High	8.4km	Oblique	2H 5T	1^{O}	Very Small	Minor
30	B7016 W of Broughton	309747	636946	Road users	Low	7.8km	Transient/Oblique	0H 1T	$<1^{O}$	No Change	NIL

VP No	Location	East	North	Visual Receptor Type/s	Receptor Sensitivity	~ Distance to Nearest Turbine (km)	Aspect of View	No. of Hubs (H) & Blade Tips (T) Theoretically Visible	~Field of View Turbines Occupy	Magnitude of Effect	Significance
31a	Elsrickle	306482	643625	Residential, Road users	Medium, Low	14.7km	Direct, Transient/Oblique	5H 9T	6^{O}	Small	Minor, Minor/Negligible
32	Minor Road North of Skirling	307560	639490	Residential, Road users	Low	10.5km	Direct/Obscured	4H 5T	4^{O}	No Change	NIL

Table 7.11 Summary of Cumulative Viewpoint Analysis

VP No	Location	~ Distance to Glenkerie	Operational Wind Farms Theoretically Visible (~Distance)	Consented Wind Farms Theoretically Visible (~Distance)	Proposed Wind Farms Theoretically Visible (~Distance)	Scoped Wind Farm Theoretically Visible (~Distance)	Receptor Sensitivity	Cumulative Magnitude of Change	Cumulative Significance
2	Culter Fell	3.0km	Black Law (A & B) - 28.6km Bowbeat - 28.9km Hagshaw Hill & Ext - 24.4km	Harestanes - 29.4km Pates Hill - 29.8km Tormywheel - 30.1km	Auchencorth - 31.2km Black Law Ext - 28.9km Clyde - 6.1km Harrows Law - 22km Limmer Hill - 13.8km Minnygap - 31.8km	Earlshaugh - 12.4km	Very High	Large	Major
6	Pykestone Hill	8.2km	Black Law (A & B) - 34.7km Bowbeat - 18.9km Hagshaw Hill & Ext - 36.3km	Harestanes - 35.4km Pates Hill - 32.3km Tormywheel - 34km	Auchencorth – 24.9km Black Law Ext – 34.7km Clyde – 18.2km Harrows Law – 23.8km Limmer Hill – 25.9km	Earlshaugh – 17.2km	Very High	Medium	Major/Moderate

VP No	Location	~ Distance to Glenkerie	Operational Wind Farms Theoretically Visible (~Distance)	Consented Wind Farms Theoretically Visible (~Distance)	Proposed Wind Farms Theoretically Visible (~Distance)	Scoped Wind Farm Theoretically Visible (~Distance)	Receptor Sensitivity	Cumulative Magnitude of Change	Cumulative Significance
15	Tinto Hill	14.4km	Black Law (A & B) - 19.5km Bowbeat - 35.1km Hagshaw Hill & Ext - 14.3km	Harestanes - 34.8km Pates Hill - 24.3km Tormywheel - 23km	Auchencorth - 33.2km Black Law Ext – 20.1km Clyde – 8.3km Harrows Law – 18.6km Limmer Hill – 5.7km	Earlshaugh – 21.5km	High	Very Small	Minor
16	Trahenna Hill	9.3km	Black Law (A & B) - 27.8km Bowbeat - 17.3km Hagshaw Hill & Ext - 33.2km	Harestanes - 39.5km Tormywheel - 27km	Auchencorth – 20.0km Black Law Ext – 27.8km Clyde – 17.5km Harrows Law – 16.6km Limmer Hill – 24.0km Minnygap – 41.5km	Earlshaugh – 21.3km	Very High	Small	Moderate
20	Broadlaw	7.0km	Black Law (A & B) - 38.2km Bowbeat - 26.8km Hagshaw Hill & Ext - 34.4km	Harestanes - 27.4km Pates Hill - 37.9km Tormywheel - 38.9km	Auchencorth – 32.9km Black Law Ext – 38.6km Clyde – 12.7km Harrows Law – 29.4km Limmer Hill – 23.2km Minch Moor – 22.2km Minnygap – 28.9km	Earlshaugh – 9.3km	Very High	Medium	Major/Moderate
22	White Meldon	18.6km	Bowbeat – 7.4km Hagshaw Hill & Ext - 28.4km	Not Visible	Auchencorth – 13.0km Clyde – 27.5km Harrows Law – 19.2km Minch Moor – 16.6km	Not Visible	Very High	Very Small	Moderate/Minor
24	Hods Hill	19.3km	Not Visible	Harestanes - 9.5km	Clyde – 1.6km Limmer Hill - 19.8km Minnygap – 12.3km	Earlshaugh – 3.5km	High	Very Small	Minor

Visual Effects During Operation - Sequential and Cumulative Sequential Effects

7.5.58 The ZTV's indicate that the proposed Glenkerie Wind farm may be visible from a number of linear route receptors within the study area. Figure 7.8 illustrates linear routes within the study area where the ZTV's indicate some visibility of the proposed Glenkerie Wind farm and which have been subject to detailed viewpoint analysis in Appendix 7.5

7.5.59 As may be seen from the detailed viewpoint analysis, visibility of the proposed turbines, and potential significant effects are very limited and localised. Significant effects are only anticipated to receptors in the upland surrounding the proposed development, and in the lowland valleys from a limited number of residential properties.

7.5.60 In the uplands there are two identified walking routes. The John Buchan Way (VP 21) routed from Broughton to Peebles, and the Southern Upland Way (VP 24), routed in the Lowther Hills in the distant southwestern corner of the study area. The ZTV's indicate that there is extremely limited visibility of the proposed development from these routes.

7.5.61 VP 21 is representative of the very limited short sections of the John Buchan Way where any visibility of the proposed Glenkerie Wind Farm may be gained. As identified within the detailed viewpoint analysis at his viewpoint location, from this route, views of the turbines are distant, and they appear as a very small element of the wider landscape dominated by the large scale of the landform. The magnitude of change is assessed as being small.

7.5.62 VP 24 at Hods Hill is representative of the very limited short sections of the Southern upland Way where any visibility of the proposed Glenkerie Wind Farm may be gained. As identified within the detailed analysis of this viewpoint location the proposed turbines would be distant and barely perceptible feature forming an inconspicuous element of the wider large-scale landscape and may be easily missed by the observer or receptor. The magnitude of change is assessed as being very small.

7.5.63 Whilst there are opportunities for prolonged views towards the development site from such walking routes due to the speed of travel, there would however be infrequent availability of views and the magnitude of change is assessed as being **very small.**

7.5.64 Within the lowland valleys linear receptors identified are the A701 (VP's 23 & 27), A721 (VP 31a), B7016 (VP 30), minor road within the NSA between Broughton and Bellspool (VP's 29 & 29a). The ZTVs indicate very limited availability of views along these routes.

7.5.65 VP23 is representative of distant views of the proposed development from the A701 for road users travelling north. And VP27 is representative of closer distant views for road users travelling south. The ZTV's indicate that there is very limited opportunity for views of the proposed Glenkerie Wind farm along this route. Views would be of short duration and would

quickly change from direct to oblique and then out of view as the direction of travel, elevation of the road change, or intervening topography or vegetation screen views. Though not illustrated, the ZTV indicates visibility of the proposed development form the A701 in the very near vicinity of this route near Kingledores. However views would be very oblique and are generally screened by mature adjacent coniferous vegetation along this section. Where visible the turbines would appear as a small element of the wider large scale landscape, and views would be very brief in duration, as a consequence and due to the infrequent availability of such views the magnitude of effects is assessed as being **very small**.

7.5.66 VP31a is representative of distant oblique views available to road users on the A721 at Elsrickle travelling southwest. The ZTV indicates the availability of views from this route would be infrequent and limited. As identified within the detailed analysis of this viewpoint location the proposed turbines would be distant but apparent and constitute a small element of the wider large-scale landscape that may be missed by the casual observer or receptor. The magnitude if change is assessed as being **small.**

7.5.67 VP30 is representative of distant oblique views available to road users on the B7016. As identified within the detailed analysis of this viewpoint location a small amount of the proposed development would be visible and due to the transient and oblique nature of views to road users, **no change** to the existing view would be discerned. More of the development may be discerned from very limited locations along this route however such views would be infrequent and therefore the magnitude of change is assessed as being **very small.**

7.5.68 VP's 29 and 29a are representative of oblique views form the minor road between Bellspool and Broughton for road users travelling west. This route is located within the National Scenic Area. As identified within the detailed analysis of these viewpoint locations the turbines would appear as a very small, compact feature above the horizon, and is contained by the landform. The majority of the development is effectively screened by intervening landform. Views would be brief and infrequent and therefore the magnitude of change is assessed as being **very small**.

7.5.69 Whilst the ZTV's indicate the potential for sequential visibility of other exiting, consented, proposed and scoped wind farms within the study area, as identified above, the proposed Glenkerie Wind Warm would result in a very limited increase in the frequency and duration of sequential views of wind farms. The proposed development is generally would form an inconspicuous minor element of sequential views. And therefore the magnitude of cumulative sequential change as a result of the introduction of the proposed Glenkerie Wind farm is assessed as being **very small.**

7.5.70 Therefore no significant sequential or cumulative sequential effects are anticipated as a result of the introduction of the proposed Glenkerie Wind Farm.

7.6 MITIGATION AND RESIDUAL IMPACTS

7.6.1 Chapter 2 provides a description of the wider site selection process and iterative design process that led to the finalised design of the development. In particular information is presented in Chapter 2 relating to the location and general layout of the wind turbines, which has been determined by the prevailing wind resource. In addition, the turbines have been located to minimise their visual impact.

7.6.2 The main purpose of the design process is to achieve a site design that is visually sympathetic and sustainable within the surrounding environment. The phases of iterative design for the Glenkerie site were determined by a continuous process of site evaluation, environmental appraisal, and repeated consultations with various statutory and non-statutory organisations.

7.6.3 In terms of the final layout of the development, the micro-siting of these elements has taken account of other constraints together with the landscape and visual considerations identified during the environmental impact assessment process.

7.6.4 Tower and hub heights have been varied so the turbines on the lower slopes will appear as a similar height to turbines located on hilltops when viewed from distant areas, and to provide continuity of appearance. The turbines will have tubular towers and will have three blades. Research (Stevenson and Griffiths, 1995) has suggested that tubular towers reduce visual clutter and are preferred by the public to lattice, pylon-style structures. It is also generally accepted that three blades provide a more restful motion than two, particularly when the rotor is viewed from the side, as the movement of three bladed rotors appears more constant and regular motion, whereas the motion of two bladed rotors can appear intermittent when viewed from the side.

7.6.5 The choice of material and colour for the proposed turbines is important as this can increase or diminish the visual impact. Neutral colours with a matt finish, sympathetic to the surroundings, will be applied to all new features in order to assist in integrating the development into the wider landscape. Matt colours would be non-reflective which would assist in reducing potential impact during sunny conditions, in particular under certain sunlight conditions 'flashing' or 'glinting' from the blades. The proposed turbines would have a blade and tower colour of semi-matt grey (e.g. RAL 7038). Although off-white has been an accepted colour for turbines, more recently constructed wind turbines have been a mid-grey tone, which reduces the distance over which the turbines are visible, especially in dull weather conditions or low light conditions.

7.6.6 The proposed development has also been mitigated through the design process. Figure 2.2 illustrates the main phases of the wind farm design for the windfarm. This layout has been tested by way of three dimensional design work and revised continuously to ensure the most efficient design is utilised in terms of project visibility and environmental and visual impact.

7.6.7 Local sources will be used for sand, gravel and crushed stone, reducing the amount of traffic generated as a result of construction activities and the associated visual impact of vehicles moving to and from, and within the site.

7.6.8 All on-site ground disturbances will be restricted to the minimum area required for construction purposes. On completion of the construction phase, any ground disturbance adjacent to the access tracks, hardstandings and turbine bases will be reinstated. During operation, the access tracks will be partially recovered, reducing their width to 3-4m for the operational lifetime of the proposed Glenkerie Wind Farm. During construction excavated topsoil will be stripped and carefully stored, and will be re-used for the purposes of reinstatement, thus negating or minimising the need for importation from other sources.

7.6.9 The number of visual elements present over the 25-year operational phase has been minimised by keeping all the site cables underground. Onsite tracks are sensitively routed according to the site topography as far as possible.

7.6.10 The construction of the grid connection and control building will be single storey, and will be of traditional construction using brick or other local materials. The external materials will be agreed with Scottish Borders Council to ensure that the building is sympathetic to the local surroundings. The grid connection and control building will be situated in the corner of an existing field in order to maximise screening by tree and hedgerows.

7.6.11 Potential landscape and visual effects during the decommissioning phase will be minimised by limiting the duration of the works, by removing all above ground structures, by leaving all below-ground structures in place, and by restoring the ground disturbed by the works.

Residual Impacts

7.6.12 The eleven turbines are the main elements of the proposed wind energy development that will be visible from the surroundings and have, therefore, the potential to affect the landscape character and visual amenity of the study area.

7.6.13 The following tables 7.12 and 7.13 set out the summary of residual landscape, cumulative landscape, visual and cumulative visual magnitude of change together with the significance of these effects.

Residual Landscape Effects

7.6.14 The assessment has found that the direct effects on the landscape fabric of the Planning Application site will be minimal in extent and reversible when the development is decommissioned.

7.6.15 The character of the landscape will only be significantly affected in a few places in the near vicinity of the proposed Glenkerie Wind Farm site.

Significant landscape effects are limited to the upland landscapes within the immediate 2.5km radius study area around the proposed development.

7.6.16 Within the wider landscape the effects of the proposed Glenkerie Wind Farm are very limited and indirect. The magnitude of the effects is such that the proposed Glenkerie Wind Farm would not give rise to any significant effects to landscape character.

7.6.17 Similarly, those designated landscapes found within the study area have a low capacity to accept wind energy developments. However the effects on such designated areas as a result of the introduction of the proposed Glenkerie Wind Farm are very limited and indirect, and the magnitude of the effects is such that the proposed Glenkerie Wind Farm would not detract from or give rise to any significant effects to landscape character.

7.6.18 The proposed Glenkerie Wind Farm would result in the introduction of elements that are considered not to be uncharacteristic when set within the wider landscape due to the presence of the existing operational wind farms. With particular reference to The Upper Tweeddale NSA, the existing Bowbeat Wind Farm already exerts some influence on this designated area, and wind turbines are therefore a readily recognisable feature.

7.6.19 Significant cumulative landscape effects would only occur in a few areas of the NSA within the 15km radius local scale landscape. However, such significant cumulative effects would only occur on the basis that all the proposed and scoped wind farms are consented and constructed. This is considered unlikely and therefore the effect is considered not to be significant.

7.6.20 Within the wider landscape, in addition to the existing operational wind farms, there are a number of consented and proposed, and scoped wind farms which have been considered as part of the cumulative assessment, and which form the baseline for such. Whilst there is potential for cumulative effects to occur, it has been assessed that no significant cumulative effects would occur to the landscape character, or designated landscapes as a result of the addition of the proposed Glenkerie Wind Farm to the cumulative baseline of wind farms.

Table 7.12 Summary of Landscape Effects

Extent of Effects	Landscape	Design-ation	Landscape Sensitivity	Magnitude of Landscape Change	Residual Significance of Landscape Effects
Proposed Glenkerie Wind Farm Site	Land within planning application boundary	AGLV	Medium	Small	Minor
Immediate Surroundings (2.5km radius around proposed turbines)	Upland Landscapes	NSA RSA AGLV	High	Large	Major/ Moderate
	Valley Landscapes		Medium	Large	Moderate
Local Landscape (15km radius around proposed turbines)	Upland Landscapes	NSA	High to Very High	Small	Moderate to Moderate/ Minor
	Valley Landscapes		High	Small	Moderate/ Minor
	Upland Landscape	RSA AGLV	High	Small (RSA), Small to Medium (AGLV)	Moderate/ Minor (RSA), Moderate to Moderate/ Minor (AGLV)
	Valley Landscapes		Medium to High	Small	Moderate/ Minor to Minor
	Upland Landscape (Grassland with Hills)	None	Medium to High	Small	Moderate/ Minor
	Stobo Castle	HGDL	Medium	Very Small	Minor/ Negligible
Broad Landscape (35km radius around proposed turbines)	Upland Landscapes	NSA	High to Very High	Very Small	Moderate/ Minor to Minor
	Valley Landscapes		High	Very Small	Minor
	Broader valley and flatter farmed landscapes		Medium to High	Very Small	Minor to Minor/ Negligible
	Upland Landscapes	RSA AGLV	High	Very Small	Minor
	Valley Landscapes		Medium to High	Very Small	Minor to Minor/ Negligible

Extent of Effects	Landscape	Design-ation	Landscape Sensitivity	Magnitude of Landscape Change	Residual Significance of Landscape Effects
	Broader valley and flatter farmed landscapes		Medium	Very Small	Minor/ Negligible
	Upland Landscapes	None	Medium to High	Very Small	Minor to Minor/ Negligible
	Valley Landscapes		Medium	Very Small	Minor/ Negligible
	Broader valley and flatter farmed landscapes		Medium to Low	Very Small	Minor/ Negligible to Negligible

Table 7.13 Summary of Cumulative Landscape Effects

Extent of Effects	Landscape	Design ation	Landscape Sensitivity	Magnitude of Landscape Change	Residual Significance of Landscape Effects
Proposed Glenkerie Wind Farm Site	Land within planning application boundary	AGLV	Medium	Very Small	Minor to Negligible
Immediate Surroundings (2.5km radius around proposed turbines)	Upland Landscapes; and Valley Landscapes	NSA RSA AGLV	Medium to High	Very Small (Existing and consented wind farms); Small (Existing, consented and proposed wind farms); Medium (Existing, consented, proposed and scoped wind farms);	Minor to Minor/Negligible (Existing and consented wind farms); Moderate/Minor to Minor (Existing, consented and proposed wind farms); Moderate to Moderate/Minor (Existing, consented, proposed and scoped wind farms);

Extent of Effects	Landscape	Designation	Landscape Sensitivity	Magnitude of Landscape Change	Residual Significance of Landscape Effects
Local Landscape (15km radius around proposed turbines)	Upland Landscapes Valley Landscapes and Stobo Castle	NSA RSA AGLV HGDL	Medium to Very High	Very Small (Existing and consented wind farms); Small (Existing, consented and proposed wind farms); Medium (Existing, consented, proposed and scoped wind farms);	Moderate/Minor to Minor/Negligible (Existing and consented wind farms); Moderate to Minor (Existing, consented and proposed wind farms); Major/Moderate to Moderate/Minor (Existing, consented, proposed and scoped wind farms);
Broad Landscape (35km radius around proposed turbines)	Upland Landscapes Valley Landscapes and Broader valley and flatter farmed landscapes	NSA RSA AGLV None	Low to Very High	Very Small (Existing and consented wind farms); Very Small (Existing, consented and proposed wind farms); Small (Existing, consented, proposed and scoped wind farms);	Moderate/Minor to Negligible (Existing and consented wind farms); Moderate/Minor to Negligible (Existing, consented and proposed wind farms); Moderate to Minor/Negligible (Existing, consented, proposed and scoped wind farms);

Residual Visual Effects

7.6.21 The visual assessment has found that there will be a variety of sensitive receptors affected by the proposed Glenkerie Wind Farm. Such receptors include fixed and linear route receptors such as residential properties, public rights of way, hill tops, and walking routes and trails

7.6.22 Residual visual effects would result from the presence of the operational turbines.

7.6.23 As identified in section 7.5 above, significant residual effects are limited and localised. Limited effects would occur in sensitive upland areas with direct close or middle distant views of the whole development. Such sensitive receptors have been identified at elevated upland hill top locations at viewpoints 2, 6 and 20. Limited effects would also be experienced by a limited number of sensitive receptors at close range within the local valley landscapes, where the turbines appear as

prominent features of the horizon above as is represented by Viewpoints 9, 12, 14.

7.6.24 Where visible however, the turbines relate well to the scale of landscape elements and the landform, particularly in the upland where the large-scale landscape easily accommodates and dominates the scale of the proposed Glenkerie Wind Farm.

7.6.25 From elevated upland locations the turbines appear as a compact, balanced group, with a recognisable pattern and rhythm due to the well-ordered and regular spacing of the layout. The turbines appear contained within the large scale surrounding landform, and are seen against the backdrop of the moorland hills.

7.6.26 Similarly cumulative visual effects are limited and localised, and may only be experienced from elevated upland locations where the proposed Glenkerie Wind Farm would form a noticeable or conspicuous element of successive and combined cumulative views and effectively bringing the presence and prominence of turbines closer to the receptor.

7.6.27 However, the proposed Glenkerie Wind Farm respects the scale of the landscape, and in the vast majority of views the turbines would appear as a small or very minor element of the wider landscape and of cumulative views. Significant cumulative effects would primarily be as a result of the successive and combined views of other existing and proposed wind farms, which may serve to bring the presence and prominence of wind turbines closer to sensitive receptors and increase the frequency of readily available views of turbines within the landscape.

Table A7.5.7 Summary of Viewpoint Analysis

VP No	Location	Easting	Northing	Visual Receptor Type/s	Receptor Sensitivity	Magnitude of Effect	Significance
2	Culter Fell	305323	629071	Walkers	Very High	Large	Major
6	Pykestone Hill	317300	631260	Walkers	Very High	Medium	Major/Moderate
9	Stanhope	312066	629708	Residential	High	Large	Major/Moderate
10	Polmood House	311392	627062	Residential	Low	No Change	NIL
12	Kingledores	310528	628146	Residential	High	Very Large	Major
14	Patervan Farm	311172	628721	Residential	High	Large	Major/Moderate
15	Tinto Hill	295293	634383	Walkers	High	Very Small	Minor
16	Trahenna Hill	313592	637408	Walkers	Very High	Small	Moderate
17	Glencotho	308420	629950	Residential	Medium	Large	Moderate
18	Hopecarton	312720	631000	Residential	Medium	Medium	Moderate/Minor
20	Broadlaw	314571	623625	Walkers	Very High	Medium	Major/Moderate

VP No	Location	Easting	Northing	Visual Receptor Type/s	Receptor Sensitivity	Magnitude of Effect	Significance
21	John Buchan Way	312656	639221	Footpath/trail. Walkers	High	Small	Moderate/Minor
22	White Meldon	321934	642844	Hilltop fort	Very High	Very Small	Moderate/Minor
23	A701 Source of the Tweed Car Park	304947	614607	Tourist. Scenic Route. Road users.	Medium	Small	Minor
24	Hods Hill	300474	609487	Southern Upland Way. Walkers	High	Very Small	Minor
26	Minor Road South of Bellscraig	302750	641797	Road users	Low	Very Small	Negligible
27	A701 near Worm Hill	311651	630053	Tourist. Scenic Route. Road users.	Medium	Very Small	Minor/Negligible
28	Talla Reservoir	310738	622899	Road Users, Recreational	Low	No Change	NIL
29	Minor Road in NSA near Dreva and Quarry Hill	314810	636080	Road users	Medium	Very Small	Minor/Negligible
29a	1 & 2 Dreva Cottages	314275	636010	Residential	High	Very Small	Minor
30	B7016 W of Broughton	309747	636946	Road users	Low	No Change	NIL
31a	Elsrickle	306482	643625	Residential, Road users	Medium, Low	Small	Minor, Minor/Negligible
32	Minor Road North of Skirling	307560	639490	Residential, Road users	Low	No Change	NIL

Table A7.5.8 Summary of Cumulative Viewpoint Analysis

VP No	Location	Total No. of Operational Wind Farms Theoretically Visible	Total No. of Consented Wind Farms Theoretically Visible	Total No. of Proposed Wind Farms Theoretically Visible	Total No. of Scoped Wind Farms Theoretically Visible	Receptor Sensitivity	Cumulative Magnitude of Change	Cumulative Significance
2	Culter Fell	3	3	6	1	Very High	Large	Major
6	Pykestone Hill	3	3	5	1	Very High	Medium	Major/ Moderate
15	Tinto Hill	3	3	5	1	High	Very Small	Minor
16	Trahenna	3	2	6	1	Very High	Small	Moderate

VP No	Location	Total No. of Operational Wind Farms Theoretically Visible	Total No. of Consented Wind Farms Theoretically Visible	Total No. of Proposed Wind Farms Theoretically Visible	Total No. of Scoped Wind Farms Theoretically Visible	Receptor Sensitivity	Cumulative Magnitude of Change	Cumulative Significance
	Hill							
20	Broadlaw	3	3	7	1	Very High	Medium	Major/ Moderate
22	White Meldon	1	0	4	0	Very High	Very Small	Moderate/ Minor
24	Hods Hill	0	1	3	1	High	Very Small	Minor

7.7 CONCLUSION

7.7.1 This assessment has considered the potential magnitude and the significance of the predicted changes to the landscape and visual amenity baseline in the study area. For the purposes of this assessment and in reference to the Environmental Impact Assessment (Scotland) Regulations 1999, significant landscape and visual effects would be those effects that give rise to Moderate/Major or Major effects. Significant landscape and visual effects are not necessarily adverse, and if adverse, they are not necessarily unacceptable.

7.7.2 The assessment has concluded that the direct effects on the landscape fabric of the proposed Glenkerie Wind Farm site area will be minimal in extent and reversible when decommissioned and therefore, acceptable in landscape fabric terms.

7.7.3 There would be very limited and localised significant residual or cumulative effects to the landscape character of the upland landscapes within the immediate 2.5km radius study area around the proposed development

7.7.4 There would be no significant residual landscape effects to any valued landscape, designated for protection due to its inherent qualities and characteristics. Significant cumulative landscape effects would only occur for the NSA within the 15km radius local scale landscape. However, such significant cumulative effects would only occur on the basis that all the proposed and scoped wind farms are consented and constructed. This is considered unlikely and therefore the effect is not significant.

7.7.5 The visual assessment concludes that there will be a small number of sensitive receptors affected by the proposed Glenkerie Wind Farm. However, significant effects are very limited and localised, and only likely to be experienced by sensitive receptors located in the upland hills surrounding the proposed development, and a very limited number of local residential properties within the Tweed Valley.

7.7.6 Similarly cumulative visual effects of the proposed Glenkerie Wind Farm in addition to the other existing operational, consented, and proposed/scoped wind farms in the area are limited and localised, and no significant effects are anticipated as a result of the introduction of the proposed Glenkerie Wind Farm in relation to those existing operational and consented wind farms. Significant cumulative effects may only occur on the basis that all the proposed and scoped wind farms are consented and constructed.

7.7.7 No significant sequential or cumulative sequential visual effects are anticipated as a result of the introduction of the proposed Glenkerie Wind farm.

7.7.8 In the local and wider landscape and from the majority of viewpoint locations whilst potentially visible, the proposed development respects the scale of the landscape, with the scale of the surrounding landform remaining the dominant characteristics. The scale of the landscape can easily and readily accommodate the scale and nature of the proposed Glenkerie wind farm development. In the majority of distant views the turbines would appear as a small or very minor element of the wider landscape and of cumulative views.

7.7.9 Due to the very limited and localised nature of significant effects the proposed development is considered to be acceptable in this location.

REFERENCES

Carys Swanwick, Dept. of Landscape, University of Sheffield and Land Use Consultants. (2002). Landscape Character Assessment – Guidance for England and Scotland;

Scottish Natural Heritage. (2001). Guidelines on the Environmental Impacts of Wind Farms and Small Scale Hydroelectric Schemes;

University of Newcastle. (2002). Visual Assessment of Wind Farms Best Practice. Scottish Natural Heritage Commissioned Report F01AA303A;

Horner & Maclennan/Envision. (2006). Visual Representation of Windfarms Good Practice Guidance. Report for Scottish Natural Heritage, The Scottish Renewables Forum & The Scottish Society of Directors of Planning;

Scottish Natural Heritage. Strategic Locational Guidance For Onshore Wind Farms in Respect of the Natural Heritage. Scottish Natural Heritage Policy Statement No. 02/02;

Scottish Natural Heritage. Cumulative Effect of Windfarms. Scottish Natural Heritage Guidance (Version 2 revised 13/04/2005).

Scottish Planning Policy 1 – The Planning System (SPP6);

Scottish Planning Policy 6 – Renewable Energy (SPP6);

Planning Advice Note 45 (PAN 45) (Revised 2002);

National Planning Policy Guidelines 14 – Natural Heritage (NPPG14);

Planning Advice Note 58 (PAN 60) – Environmental Impact Assessment

Planning Advice Note 60 (PAN 60) – Planning for Natural Heritage;

National Planning Policy Guidelines 18 – Planning and the Historic Environment (NPPG18);

Scottish Borders Structure Plan (approved 2002);

Scottish Borders Local Plan (Finalised December 2005);

Scottish Borders Local Plan - Supplementary Planning Guidance 18: Renewable Energy – June 2007; and

South Lanarkshire Local Plan (Finalised August 2006)

CHAPTER EIGHT: ECOLOGY

8.1 EXECUTIVE SUMMARY

8.1.1 This chapter provides an assessment of the ecological impacts of the proposed wind farm development at Glenkerie following best practice guidelines. The assessment excludes ornithology, which is considered in Chapter 9.

8.1.2 Desk and field studies were completed to identify the main ecological receptors within the development area. Desk studies included consultation with amongst others Scottish Natural Heritage and Scottish Borders Biological Records Centre. Field surveys completed within the 3.9km^2 development area and its surroundings included a Phase 1 habitat survey and protected species survey.

8.1.3 The River Tweed Special Area of Conservation (SAC) designation includes the Kingledores Burn, which lies within the development area. The main stem of the River Tweed lies within 500 m from the eastern development area boundary.

8.1.4 Otter, Atlantic salmon, bat, adder, common lizard, mountain and brown hare were identified in small numbers both within and adjacent to the development area. Information relating to other sensitive mammals has been removed from this copy of the ES.

8.1.5 Twelve Phase 1 habitat types were recorded within the development area. The upland areas of the site are covered in a mosaic of heath and semi-improved acid grassland, which is managed for grazing livestock. Cleuch woodlands and blanket bog habitat are also present in the upland areas. Habitats of improved grassland, rush pasture and plantation woodland cover most of the lowland ground of the development area.

8.1.6 The wind farm has been specifically designed to avoid areas identified as potentially sensitive due to the presence of protected fauna, it has also been designed to minimise the loss of potentially sensitive habitats.

8.1.7 Following implementation of the proposed mitigation measures, it has been assessed that no significant impacts are predicted for fauna and habitats identified within the development area during construction, operation, and decommissioning.

8.2 INTRODUCTION

8.2.1 The principal objectives for this assessment was to identify the habitats and species present in the study area and determine their nature conservation value. In addition, any potential impact on these habitats and species through the construction and operation of a wind farm at Glenkerie was also assessed.

8.2.2 To achieve these goals a desk study and a field survey were carried out. Atmos Consulting Ltd (Atmos) (formally the consulting division of West Coast Energy Ltd) performed the baseline surveying.

8.2.3 The baseline survey information was then used in the completion of an ecological impact assessment of the proposed wind farm following best practice methods from the Institute of Ecology and Environmental Management (IEEM, 2006). Mitigation measures are also proposed where appropriate to avoid or minimise any potential impacts on ecological receptors of value. Any significant impacts on ecological receptors are identified.

8.2.4 The scope of this ecology assessment excludes impacts on birds, which are considered in Chapter 9 Ornithology. Reference is made to the assessment of hydrological impacts (Chapter 10 Hydrology) where appropriate.

8.3 POLICY CONTEXT

8.3.1 The ecological impact assessment completed in this chapter is considered in the context of relevant legislation and policies described below.

8.3.2 ***Wildlife and Countryside Act 1981*** (as amended): This Act provides protection to sites designated as Sites of Special Scientific Interest (SSSIs), and protects various wild animal and plant species from disturbance.

8.3.3 ***The Nature Conservation (Scotland) Act 2004****:* This act makes provision for the conservation of biodiversity, and for the protection and enhancement of the natural heritage of Scotland. It is the principal legislation for nature conservation in Scotland, expanding on and adding to existing law. It introduces a general duty on public bodies to further the conservation of biodiversity in Scotland, enhances existing protection of SSSIs, and extends the laws relating to the protection of species. The publication of the Scottish Biodiversity List, a list of flora, fauna and habitat considered to be of principal importance for biodiversity conservation, was a requirement of this Act.

8.3.4 ***The Conservation (Natural Habitats etc) Regulations 1994****:* The Habitats Regulations, as amended, implement the European Council Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna (the Habitats Directive) in the UK. The Habitats Directive

requires member states to designate Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) to form a network of protected areas known as Natura 2000 designed to maintain or restore the distribution and abundance of species and habitats of European interest. The Habitats Regulations also provide protection for priority habitats and species outside of protected areas.

8.3.5 ***National Planning Policy Guidance (NPPG) 14: Natural Heritage***: This NPPG gives guidance on planning and nature conservation policies in Scotland. The planning system plays a key role in nature conservation and the protection of biodiversity. The main objective in relation to nature conservation is to provide for a diversity of wildlife and habitats. The guidance states that there may be opportunities to enhance the natural heritage through the development process by careful siting and design of development, and by providing for wildlife on development sites.

8.3.6 ***Planning Advice Note (PAN) 60: Planning for Natural Heritage***: This PAN provides guidance on good practice in relation to conservation and natural heritage in Scotland. It covers the protection of biodiversity, designated sites and the wider natural heritage. It includes the provision that full regards should be given to the natural heritage in development control, and that mitigation is required for any adverse effects. The guidance determines that the precautionary principle should be applied where development effects are uncertain in relation to designated sites.

8.3.7 ***The Scottish Borders Biodiversity Partnership***: The Scottish Borders Biodiversity Action Plan (BAP) was published in 2001 (Scottish Borders Council / SNH, 2001). Its main aims are to determine which habitats and species are of value to the Scottish Borders, and to identify actions and targets for those habitats and species that would help to protect of enhance biodiversity in the area. The plan is divided into five broad areas: farmland, freshwater, peatlands, urban and woodlands and there are habitat and species action plans within each area. The maintenance of the distribution and status of the local BAP habitats and species is a material consideration for the Environmental Statement (ES).

8.4 BASELINE STUDIES

Methods

8.4.1 A desk study was completed to gather existing information on the site and its surroundings. Information on statutory designated sites [Special Areas of Conservation (SACs), Special Protection Areas (SPAs), Sites of Special Scientific Interest (SSSIs) and National Nature Reserves (NNRs)] and non-statutory site [e.g. Local Nature Reserves (LNRs), and Sites of Importance to Nature Conservation (SINCs)] was mapped using GIS (Figure 8.1).

8.4.2 Information on the site and the surrounding area was requested from Scottish Natural Heritage (SNH) and the Scottish Wildlife Trust (SWT). A search for protected species records for the 10 km square in which the

development lies was also completed on the National Biodiversity Network (NBN) Gateway (http://www.searchnbn.net/).

8.4.3 The following field surveys were completed:

- Mammal survey - September 2006; and
- Phase 1 habitat survey - August 2007.

8.4.4 Details of the surveys and the study area are given in the following sections.

8.4.5 A Phase 1 habitat survey (including a protected species walkover) was carried out, by Atmos Consulting Ltd, within the proposed development area in August 2007 according to the standard methods (JNCC, 2003).

8.4.6 Faunal surveys were carried out in September 2006, by Alba Ecology Ltd, to determine the presence of mammals listed by Annex IV of the Habitats Directive (European Protected Species), Schedule 5 of the Wildlife and Countryside Act 1981 and / or the Local and UK National Biodiversity Action Plans. Species listed include Wildcat (*Felis sylvestris*), Otter (*Lutra lutra*), Red Squirrel (*Sciurus vulgaris*), Pine Marten (*Martes martes*), Water Vole (*Arvicola terrestris*), Mountain Hare (*Lepus timidus*) and Brown Hare (*Lepus europaeus*).

8.4.7 All tracks and roads, all streams and rivers, and all forest edges and rides were walked by the fieldworker during daylight hours, within the proposed development area plus an additional buffer zone of 500m depending upon habitat features and access restrictions. Open areas of ground were crossed in a zigzag fashion paying particular attention to prominent features and habitat boundaries.

8.4.8 Diurnal searches followed recommendations in e.g. Birks et al., 2004, Gurnell et al., 2001, Harris et al., 1989, Kitchener, 1998, MacDonald & Tattershall, 2001, MacDonald et al., 2004, Neale & Cheeseman, 1996, Strachan, 1998, Wilson et al., 1997, and comprised searches for the following:

- Faeces;
- Footprints;
- Hair, especially at restricted passageways through undergrowth or fences;
- Scratch posts;
- Tracks or slides;
- Shelters, dens, setts, holts or burrows; and
- Feeding signs (gnawed cones, fish remains, etc)

8.4.9 Registrations of mammal signs were noted on a large scale map, and a 10 figure grid reference tabulated with the aid of a handheld GPS. Samples

were taken of any faeces, hair, or other evidence, which could not be immediately identified in the field, for examination back at the laboratory.

Desk Study Findings

8.4.10 River Tweed and its tributaries are a European Designated Special Area of Conservation (SAC), under the EU Habitats Directive, designated for:

- Annex 1 habitats Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation; and
- Annex 11 species Atlantic salmon (*Salmo salar*) and otter (*Lutra lutra*), with sea (*Petromyzon marinus*), brook (*Lampetra planeri*) and river lamprey (*Lampetra fluviatilis*) as Annex 11 qualifying features.

8.4.11 The proposed development area is included in the Central Southern Uplands Environmentally Sensitive Area (ESA). ESA schemes were set up to assist the management of the habitats, landscape, and archaeological features of the Southern Uplands in a sensitive way through appropriate farming activities. This designation refers to agricultural practices and is therefore beyond the scope of this Chapter.

8.4.12 The search of the nearest NBN Gateway 10 km square revealed a number of historical mammal records: roe deer, otter, mink and mole had all been recorded within the 10 km square before 1993 (Mammals Database, Biological Records Centre).

8.4.13 Otter were recorded on the River Tweed during the 1991 otter survey of Scotland (Scotland Otter Survey Database, JNCC).

Table 8.1: Consultation Results

Consultation Authority	Consultation Results
JNCC, Scotland Otter Database	• Otter recorded on the River Tweed during the 1991 survey;
Tweed Foundation	• No response received at time of the report issue;
Scottish Borders Biodiversity Partnership – Scottish Borders BAP	• UK and LBAP species action plans relevant to site include: otter, adder, brown trout, and mountain/brown hare; • UK and LBAP habitat action plans relevant to site include River Tweed (Rivers and Burns HAP), rushes and marginal vegetation, upland heath with acid grassland mosaic, blanket bog, and broadleaved woodland (Cleuch Woodland).
SEPA	• Under the Water Framework Directive, Water Environment and Water Services 9Scotland) Act 2003 – statutory requirement to protect the ecological quality of watercourses. SEPA therefore recommend bridging rather than a culverting of watercourses on site. • Need to adhere to PPG5 – works in vicinity to watercourses and PPG6 working at construction sites.
Scottish Natural Heritage	• The site is not designated for nature conservation or geology; • The River Tweed is a SAC: • The site is part of the Central Southern Uplands Environmentally Sensitive Area (ESA). This designation relates to farming practices; • Undertake habitat and mammal surveys following recognised methodologies; • Incorporate habitat enhancement objectives and details of how to be achieved in the ES; • SNH do not have any records of protected species for the area; and • Make provisions for recreation and public access to the site.
Tennant Farmer (Kingledores)	Anecdotal Evidence includes the following species seen in and around the farm: • Common lizard and adder; • Otter, and roe deer; • Bats; and • Mountain hare and brown hare.

Consultation Authority	Consultation Results
Scottish Borders Biological Records Centre – Species of Conservation Concern	• Records of Atlantic salmon, eel, lamprey and otter on the Kingledores Burn (2000); • Records of Pipistrelle bat, adder, lizard and brown hare in the local area (1999); • Records pre 1993 of roe deer, otter, mink and mole in the 10km grid square; and • No records of any plants of concern within the site boundary.

Field survey findings - Flora

8.4.14 The development area was surveyed to Phase 1 habitat level, and particular attention was paid to the proposed locations of access tracks and turbine locations. Target notes and species list are given in Appendix 8.1. Common names have been used for plant species in the report, the species list includes common and scientific names of plants recorded at the time of the survey. The habitats are listed below in the order that they appear in the Phase 1 habitat survey handbook (JNCC, 2003), but are then described in order of the most dominant habitat first.

8.4.15 The following habitats listed were recorded in the development area. These are mapped on Figure 8.1 and a summary of habitat composition is shown in Table 8.2:

- Woodland – plantation (A1)
- Woodland – scattered trees, broadleaved (A3)
- Semi Improved acid grassland (B1)
- Improved grassland (B4)
- Marshy grassland (B5)
- Bracken (C1)
- Dry heath (D1)
- Wet heath (D2)
- Heath and grassland mosaics (D5/6)
- Mire (E1)
- Open water - running water (G2)
- Boundaries – hedge, fence and stone wall (J2)

8.4.16 The site is covered in a mosaic of heath, mire, and grasslands, with small conifer and broadleaved plantations. The upper slopes of the site are characterised by semi improved acid grassland, wet, and dry heath and small areas of mire. The steeply incised burn valleys are improved grasslands covered in bracken. Rushes dominate the Kingledores Burn valley.

8.4.17 There are three types of woodland on site:

- Conifer plantation – Sitka spruce and European larch (to 15m);
- Broadleaved plantation – Small stands of ash and beech woodland (to 20m); and
- Scattered broadleaved and conifer – remnant Scots pine, rowan and birch cleuch woodlands within the steep burn valleys.

8.4.18 There are three types of grassland on site:

- Semi improved acid grassland – the drier more heavily grazed upland areas are dominated by mat grass, fescues, bents and hair grasses, with heath rush, tormentil and bedstraw;
- Improved grassland – several enclosed fields on the lowlands are dominated by sown mixes of clover, poa's, rye grasses, crested dog's-tail and bents; and
- Marshy grassland (rush pasture) – only present along the narrow flood plain of the Kingledores Burn, dominated by soft rush and marsh thistles over improved grassland.

8.4.19 All the tributaries on the northwest side of Kingledores Burn within the site boundary are covered in dense bracken scrub. This scrub only extends a couple of hundred meters up slope from the Kingledores Burn.

8.4.20 The semi improved acid grasslands transition uphill into heath habitat. The main areas of dry heath are either a dense short (through burning and grazing) monoculture of heather with pleurocarpous mosses or in addition it contains some bell heather.

8.4.21 The small number of small wetter heath areas are dominated by heather and hummocks of mosses such as *Sphagnum capillifolium* and S. *compactum*, purple moor grass and cross leaved heath.

8.4.22 The small mire areas are located in the saddles between the hill tops along the ridge running from Cocklie Rig Head in the north to Broomy Law in the south west, and on the spur running down from north west to south east from the Broomy Law top. This particular mire has been cut over and drained in the past. Several exposures of peat show depth to be up to 1m in places on top of a fractured bedrock. The habitat is dominated by cotton grasses and Sphagnum moss species (*S. papillosum* and *S. palustre*), with cross-leaved heath, bilberry, crowberry and deer grass.

8.4.23 The site is dominated by the Kingledores Burn and its tributaries, which drain to the River Tweed. There are no ponds or areas of standing water on the site.

8.4.24 The uplands are bounded by wire fences, the low-lying improved fields are enclosed by a mixture of stone walls and wire fences.

8.4.25 The underlying soils are thin with localised areas of shallow peat (see Chapter 10 Hydrology) deposits. The fields within the proposed development area are used for sheep and cattle grazing. There are no plans to change the management of the land following construction of the proposed development.

8.4.26 The encroachment of bracken within the site is controlled through the use of chemical sprays.

Table 8.2: Habitat Composition of the Study Area

Phase 1 habitat type	**Area of habitat (ha)**	**% of study area**
Plantation woodland	5.2	1.4
Broadleaved woodland	1.2	0.3
Semi improved acid grassland	62.9	16.1
Improved grassland	32.4	8.3
Marshy grassland	3.6	0.9
Bracken (continuous and	102.9	26.3
Dry heath	45.4	11.6
Dry heath-acid grassland mosaic	66.0	16.9
Wet heath	19.2	4.9
Wet heath-acid grassland mosaic	25.0	6.4
Wet heath-blanket bog mosaic	0.02	0.0
Mire (blanket bog)	11.0	2.8
Wet Modified bog	11.7	3.0
Scree	0.9	0.2
Spoil ground (soil store)	0.8	0.2
Built up areas	2.3	0.6
Total area	**390.70**	**100**

Field survey findings - Fauna

8.4.27 A faunal survey was completed at the site in September 2006 and additional information was collected during the Phase 1 habitat survey in 2007. The following section outlines the results of these surveys.

8.4.28 During both of the surveys, the weather was dry, with wind speeds of Beaufort Scale 4 or less, and with good visibility.

8.4.29 No evidence of wildcat, pine marten, red squirrel, or water vole was found at any location.

8.4.30 The surveys for otter were positive, with several fresh spraints (fish scales and bones) and tracks found along the Kingledores Burn. No lay-ups, couches or holts (or habitat suitable for a couch site) were found in the study area (the woodlands and plantations adjacent to the Burn but outwith the site were also searched). Anecdotal evidence of regular otter sightings was given by the tenant farmer.

8.4.31 Evidence was found (footprints, droppings, fur, and a recent road kill corpse on the A701) and sightings made of mountain hare, anecdotal evidence was also given by the tenant farmer of historic hare shoots on the hills (this however no longer occurs due to the decline in hare population in the area).

8.4.32 Roe deer, field vole and red fox signs were common around the site (fox are lamped on a regular basis by the farmer).

8.4.33 Other mammal signs recorded included hedgehog (*Erinaceus europaeus*) (evidence found along the driveway through woodland), rabbit (*Oryctolagus cuniculus*) (seen) and mole (*Talpa europaea*) (molehills present on low-lying parts of site).

8.4.34 Low numbers of bats (Pipistrelle species) are known to frequent the more mature broadleaved and conifer woodlands outwith the development area, in and around the Kingledores Farm buildings in the low lying parts of the site (anecdotal evidence from the farmer).

8.4.35 No survey or assessment for bats was undertaken for the following reasons:

- No historic bat records for the development area were identified during the scoping process;
- The low levels of bat activity are concentrated on the Kingledores Farm buildings which are outwith the proposed development area;
- The main habitat within the development area, improved grassland, and heath is not considered to provide optimal foraging habitat for bats;
- No trees are proposed to be felled;
- No structures demolished;
- The nearest turbine is to be located more than 1km from the woodlands surrounding the farm;
- The access track is proposed to run along an existing track adjacent to the conifer woodlands to the south of Kingledores Farm, no trees are proposed to be felled; and
- The site compound is proposed to be located some 50 to 100m from any woodlands to the south east of the farm and so no significant impact is predicted.

8.4.36 Although no impact is predicted, precautionary mitigation is to be undertaken at the site compound, this will be discussed later in this Chapter.

8.4.37 Although outwith the development area and although no impacts are predicted on bat species, the buildings and woodlands around the Kingledores Farm could be surveyed before construction and monitored during and after construction to confirm no impacts and inform should any mitigation be required.

8.4.38 Common lizard was identified during the habitat survey of 2007 on the upper heath and acid grassland areas of the site. The local farmer also has anecdotal evidence of lizard and adder (visual and sheep with adder bites) on the site.

8.4.39 The habitat of the Kingledores Burn is suitable for salmonid fish spawning. Brown trout were observed in the Kingledores Burn in 2007, and anecdotal evidence was provided by the farmer of regular small Atlantic salmon runs in the Burn. Fisheries are discussed in the Chapter 10 Hydrology.

8.5 ASSESSMENT OF EFFECTS

Method of Assessment

8.5.1 The ecological impact assessment has been carried out using the most recent best practice guidance from the Institute of Ecology and Environmental Management (IEEM, 2006) and modified matrices from the Transport Analysis Guidance (TAG 2004). The ecological features and resources have been identified from the baseline studies, and their value assessed. Following the guidelines, the biophysical changes likely to result from the proposed development that may affect the valued ecological resources and features have been identified. An assessment of whether these changes are likely to result in significant impacts has then been assessed, any mitigation or compensation measures are then considered and the residual impacts re-assessed for significance.

8.5.2 All ecological features and resources within the development area have been identified in the baseline studies. In this section, the sites, habitats, and species identified are evaluated according to best practice guidelines (IEEM, 2006 and TAG 2004). The value of ecological resources and features are determined within a geographical context: very high, high, medium, lower and negligible (modified from TAG 2004). Designated sites have already been assigned a level of value through their designation, and these values are followed in this assessment. Other ecological features and resources are evaluated for their importance in terms of biodiversity, and following published criteria where available. Legal protection for sites and species is also taken into account where relevant.

8.5.3 In evaluation of habitats and species, a number of factors are considered:

- animal or plant species that are rare or uncommon, and habitats and species considered to be under threat;
- the ecosystems and their parts that support rare or uncommon species;
- the importance of habitat diversity and connectivity;
- notably large concentrations of animals;
- habitats that are natural or semi-natural vegetation types;
- species on the edge of their range; and
- species rich assemblages.

8.5.4 In order to assess the ecological impacts of a proposed development on the ecological features and resources identified on the development site, it is necessary to identify the changes to the baseline conditions that are likely to arise from the various activities associated with the proposal. The impact assessment is undertaken in relation to the baseline conditions that would be expected to occur if the proposed development were not to take place, and therefore will include possible predictions of future changes to baseline conditions such as environmental trends and other completed or planned development.

8.5.5 Impacts should be assessed with reference to aspects of the ecological structure and function on which each ecological feature depends, for example available resources, ecological processes and relationships, ecological roles or functions and human influences. Impacts are described according the following parameters:

- positive or negative;
- magnitude;
- extent;
- duration;
- reversibility; and
- timing and frequency.

8.5.6 The likelihood of impacts occurring has also been considered in a qualitative way and noted to be certain or near-certain, probable, unlikely or extremely unlikely.

8.5.7 It is a requirement of ecological impact assessment to determine the significance of each impact identified. An ecologically significant impact is defined by the best practice guidelines (IEEM, 2006) as '*an impact (negative or positive) on the integrity of a defined site or ecosystem and/or the conservation status of habitats or species within a given geographical area'*.

8.5.8 The integrity of a site can be defined as follows: '*The integrity of a site is the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified.'* In order to determine whether site integrity may be affected, the following questions should be considered:

- will any site/ecosystem processes be removed or changed?
- what will be the effects on the nature, extent, structure and function of component habitats?
- what will be the effect on the average population size and viability of component species?
- will the site move towards or away from favourable condition?

8.5.9 The conservation status of habitats at a defined geographical level '*is determined by the sum of influences acting on the habitat and its typical species, that may affect its long-term distribution, structure and functions as well as the long-term survival of its typical species within a given geographical area'*.

8.5.10 The conservation status of species at a defined geographical level '*is determined by the sum of influences acting on the species concerned that may affect long-term distribution and abundance of its populations within a given geographical area'*.

8.5.11 Potential impacts on each ecological receptor evaluated above are identified, and the significance of these impacts assessed following the methods outlined, taking into account the proposed mitigation measures.

8.5.12 The conservation status for every habitat and species was taken into account in assigning a level of value. Table 8.3 shows the matrix used for the classification of the nature conservation value with examples on how these values could be applied.

Table 8.3: Classification of the Nature Conservation Value of Features

Value	Criteria	Examples
Very High	High importance and rarity, international scale and limited potential for substitution.	Internationally designated sites. Qualifying feature of an internationally designated site
High	High importance and rarity, national scale, or regional scale with limited potential	Nationally designated sites. Regionally designated sites with limited potential for substitution.

Value	Criteria	Examples
	for substitution.	European Protected Species (EPS) and habitats Regionally significant number of a Schedule 1, 5 and 8 species
Medium	High or medium importance and rarity, local or regional scale, and limited potential for substitution.	Regionally important sites with potential for substitution. Locally designated sites. Locally important number of a Schedule 1, 5 and 8 species Regionally important population/area of a species and habitat of Principal Importance or UK BAP priority species and habitats
Lower	Low or medium importance and rarity, local scale.	Locally important population of a species of Principal Importance or a UK BAP priority species and habitats. A population of a species and habitat that is listed in a Local BAP because of its rarity in the locality. Other species and habitats which are, in the opinion of the assessor, of note and for which mitigation measures may be required
Negligible	Very low importance and rarity, local scale.	Other species and habitats with little or no local biodiversity or earth heritage interest.

Evaluation of designated sites

8.5.13 The **River Tweed SAC**, which lies approximately 500m downstream to the east of the proposed development area, and its tributary the Kingledores Burn which flows through the proposed development area, are considered to be of **Very High** value due to the statutory European designation.

Evaluation of habitats

8.5.14 The **Kingledores Burn** is a tributary of the River Tweed SAC, an international designation for the primary interests of the Annex I aquatic macrophyte species rich habitat and Annex II species Atlantic salmon and

otter. The UK BAP has the broad habitat type *Rivers and Streams*, and the Scottish Borders BAP has a *Rivers and Burns Habitat Action Plan*. The Kingledores Burn has a history of small Atlantic salmon runs, eel, brown trout and otter activity, and as such, it is considered to be of **Very High** value due to the statutory European designation.

8.5.15 The site has several small fragmented upland areas of shallow **blanket bog** habitat. These mire habitats are listed on the UK BAP and as European Protected Habitats under the EU Habitats Directive. The blanket bogs on the site are not designated at international or national level, they are not associated with any rare plant species, and the habitats on site have been heavily influenced and affected by past and present land use. As they are a priority habitat of the local Biodiversity Action Plan (LBAP), they are therefore considered to be of **Medium** value.

8.5.16 The majority of the proposed development area is covered in a mosaic of **upland acid grassland and heath**. The heath habitats are listed on the UK BAP and as European Protected Habitats under the EU Habitats Directive. The habitats on site are not associated with any rare plant species, it is also a habitat heavily influenced and affected by the land use. As it is a locally important habitat of the local Biodiversity Action Plan (LBAP), it is therefore considered to be of **Medium** value.

8.5.17 There are remnant **cleuch broadleaved (rowan and birch) woodlands** within the Glenkerie and the Glenkiely Burn corridors. The cleuch woodland habitat is a locally important habitat of the local Biodiversity Action Plan (LBAP), therefore considered to be of **Medium** value.

8.5.18 The remainder of the proposed development area contains improved grasslands, rushes and marginal grasslands (providing suitable habitat for amphibians and small mammals) along the Kingledores Burn, plantation woodlands made up of conifers (spruce), and broadleaved (ash) species. The habitats on site are not associated with any rare plant species, it is also a habitat heavily influenced and affected by the land use. These habitats are of value for local biodiversity and are therefore considered to be of **Lower** value.

Evaluation of species

8.5.19 Otter are present along the Kingledores Burn. It is possible that otter may also travel between watercourses and cross the site, although no evidence was recorded during the field survey to confirm this. No holts or lying up sites were recorded however, so otter are likely to either be travelling or foraging within the development area. An otter territory may cover a significant linear length of watercourse (range from 3-50km, see Chanin, 2003b) and the development area is therefore likely to be a small part of an otter territory.

8.5.20 **Otter** is listed in Annexes II and IV of the EC Habitats Directive and is protected in the UK under the Wildlife and Countryside Act 1981 and the Conservation (Natural Habitats, etc.) Regulations 1994 (the Habitats Regulations), as amended. If the proposed development works will affect otters or their resting places, it would be necessary to obtain a licence to disturb otter from the Scottish Executive under Regulation 44 of the Conservation (Natural Habitats, etc.) Regulations 1994 (Scottish Executive, 2001). Otters are a UK BAP and LBAP priority species, with a local priority to maintain the otter population at its current level. Otters are also listed on the Scottish Biodiversity List as a species of importance for the purpose of biodiversity conservation in Scotland. Due to otter being a European Protected Species and a primary feature for the River Tweed SAC, otter are considered to be of **Very High** value.

8.5.21 **Fisheries** - The River Tweed and Kingledores Burn have been identified as official Salmonid Waters by SEPA, and are designated as a SAC and SSSI for their fish populations (Atlantic salmon, brook, river and sea lamprey) among other qualifying interests. The river also supports significant populations of sea trout and brown trout, with suitable gravel bed spawning habitat for all species widespread. Both salmon and brown trout are known to use Kingledores Burn as a spawning ground, and have been recorded in the watercourse.

8.5.22 Due to Atlantic salmon being a European Protected Species and a primary feature for the River Tweed SAC, Atlantic salmon, along with a suite of other fish species, are considered to be of **Very High** value.

8.5.23 **Mountain hare** and **brown hare** were seen on site during surveys and *forms* were found across the site. A mountain hare corpse was recovered from the road just outwith the site in 2006. Hare traditionally have been shot seasonally in the local area (anecdotal evidence from the tenant farmer). Mountain hare are now listed under Annex V of the EC Habitats Directive whereby its taking in the wild may be subject to management measures. Mountain hare are also a species on the Scottish Borders BAP. The development area is considered to be of **Lower** value for mountain hare.

8.5.24 **Adder** and **common lizard** were present on the site. As both common lizard and adder are protected by the Wildlife and Countryside Act 1981 (as amended). The development area is considered to be of **Lower** value for these reptiles.

8.5.25 Table 8.4 summarises the value of the ecological feature and resources within the study area.

Table 8.4: Summary of the Values of Ecological Features and Resources

Ecological Feature or Resource	**Level of Value**
Habitats:	
Kingledores Burn (River Tweed SAC)	Very High
Blanket bog	Medium
Upland acid grassland and heath mosaics	Medium
Cleuch woodlands	Medium
Improved grasslands, rushes, marginal grasslands, and plantation woodlands.	Lower
Species:	
River Tweed SAC qualifying interests - Otter and Atlantic salmon	Very High
Mountain and brown hare	Lower
Reptiles (Adder and Common Lizard)	Lower

Impact Significance Criteria

8.5.26 Table 8.5 shows the criteria that have been used to assess the magnitude of impacts of the proposed development. Each impact is given a magnitude, which is then assessed in conjunction with the value of the ecological receptor to provide an indication of impact significance. This is undertaken for construction, operation and decommissioning of the wind farm.

Table 8.5: Criteria for Determining the Magnitude of Impact

Magnitude	**Criteria**
Major Negative	The proposal (either on its own or with other proposals) may adversely affect the integrity of the site/population, in terms of the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the population levels of species of interest.
Intermediate Negative	The site's integrity will not be adversely affected, but the effect on the site/population is likely to be significant in terms of its ecological objectives. If, in the light of full information, it cannot be clearly demonstrated that the proposal will not have an adverse impact on integrity, then the impact should be assessed as major negative.

Magnitude	**Criteria**
Minor Negative	Neither of the above applies, but some minor negative impact is evident. (In the case of Natura 2000 sites, a further appropriate assessment may be necessary if detailed plans are not yet available).
No Change	No observable impact in either direction.
Minor Positive	Impacts which provide a net gain for wildlife overall.
Intermediate Positive	The impact will not contribute positively to the site's integrity, but the effect on the site is likely to be significantly positive in terms of its ecological objectives.
Major Positive	The impact will positively contribute to the integrity of the site.

8.5.27 Table 8.6 was then used to determine the overall impact significance of the proposed development on the valued ornithological receptors.

Table 8.6: Estimating the overall Impact Significance

Magnitude of potential Impact	Nature conservation value of features damaged or improved				
	Very High	**High**	**Medium**	**Lower**	**Negligible**
Major Negative	Very large Adverse	Very Large Adverse	Moderate Adverse	Slight Adverse	Neutral
Intermediate Negative	Large Adverse	Large Adverse	Moderate Adverse	Slight Adverse	Neutral
Minor Negative	Slight Adverse	Slight Adverse	Slight Adverse	Slight Adverse	Neutral
No Change	Neutral	Neutral	Neutral	Neutral	Neutral
Minor Positive	Slight Beneficial	Slight Beneficial	Slight Beneficial	Slight Beneficial	Neutral
Intermediate Positive	Large Beneficial	Large Beneficial	Moderate Beneficial	Slight Beneficial	Neutral
Major Positive	Very Large Beneficial	Very Large Beneficial	Moderate Beneficial	Slight Beneficial	Neutral

Impacts and Mitigation

Design

8.5.28 The wind farm has been designed to ensure that ecological impacts are minimised and Chapter 5 explains the design iteration process that led to changes in the design to minimise the impact on possible ecological receptors.

8.5.29 An existing track is to be used for initial access to the development area, and a new track will be constructed to access the turbine locations by crossing heath and semi-improved grassland habitat mosaics, and a small area of mire habitat. This route was selected to minimise the loss of the high conservation value heath and mire habitats found on the site.

8.5.30 The wind farm components have been located, where possible, on areas of degraded heath, mire and semi-improved acid grassland.

8.5.31 No trees are proposed to be felled or limbed during the construction process.

8.5.32 The medium conservation value remnant cleuch woodlands have been avoided.

8.5.33 Lower value conservation areas have been avoided in the design process, and a suitable buffer distance from the construction activities employed (Figure 8.2).

8.5.34 In order to ensure that very high conservation watercourses will not be affected during wind farm construction, best practices will be adhered to during the construction period, and a Pollution Prevention Plan (PPP) and specific mitigation measures during construction will be implemented and checked continuously across the site, as detailed in Chapter 10 Hydrology.

8.5.35 During and on completion of the construction period, habitats will be reinstated in appropriate locations, such as along track verges and around turbine bases. Where available, turf that has been removed and stored during construction will be used to reinstate these areas. If turf is not available, top soils will be used and seeded with an appropriate heath/grassland seed mix, to be agreed with SNH.

8.5.36 Construction activities will, were possible, be completed during daylight hours.

8.5.37 There will be no removal of any scattered trees within the development area.

8.5.38 A suitably qualified Ecological Clerk of Works (ECoW) will be appointed for the duration of the construction period. The ECoW will oversee ecological issues relating to the PPP and associated hydrological mitigation measures, as well as all other ecological issues on site, to ensure that ecological impacts are avoided or minimised. The ECoW will also:

- Make contractors aware of the presence of wildlife on the site, and brief them accordingly on any course of action to take should wildlife be encountered;

Designated sites

8.5.39 The Kingledores Burn catchment flows from the development area directly into the River Tweed SAC (as described in Chapter 10 Hydrology).

8.5.40 The wind farm design process has minimised any direct impacts on the Kingledores Burn.

8.5.41 The potential direct impacts on the Kingledores Burn during construction and operation of the wind farm are as follows:

- The upgrading of the exiting access track along the Kingledores Burn valley;
- The installation of two new culverts (on the Glenkerie and Glenkiely Burns); and
- The installation of a new Kingledores Burn crossing.

8.5.42 The potential indirect impacts on the Kingledores Burn during construction and operation of the wind farm are as follows:

- Pollution, changes in runoff, and releases of sediments.

8.5.43 These impacts on the River Tweed SAC are however considered to be extremely unlikely and of temporary duration, but which could be of a **Major negative** magnitude.

8.5.44 In mitigation:

- Implementation of the Pollution Prevention Plan (as proposed in Chapter 10);
- Constant monitoring of the PPP mitigation and water quality by the ECoW;
- The new culverts will be designed to allow fish passage (see details in the section on Atlantic salmon 8.5.63);
- The existing crossing of the Kingledores Burn will be left in place to avoid any negative impacts on the water quality of the Burn; and
- The new crossing will be a Bailey Bridge design which will have no significant impacts on the water quality or the riparian habitats (as proposed in Chapter 10).

8.5.45 It is therefore extremely unlikely that any potential impacts, which would affect the integrity of the SAC, will occur. The magnitude of impact on the Kingledores Burn catchment is expected to be **No Change**.

8.5.46 The overall impact significance, following mitigation, on the River Tweed SAC or its primary features (Atlantic salmon and otter) is therefore predicted to be **Neutral**.

8.5.47 As the current farming practices are not proposed to be altered by the development activities, the overall impact significance on the Central Southern Uplands ESA is therefore expected to be **Neutral**.

Habitats

8.5.48 The main impact on the habitats is direct habitat loss during the construction period. The areas of habitat to be lost directly to the proposed development are shown in Table 8.7. The calculations of habitat loss are based on the dimensions of the wind farm components described in the Project Description Chapter. Table 8.8 summarises the areas of habitat loss for each habitat type.

8.5.49 All direct habitat loss will be certain to occur and is considered permanent (in terms of the 25-year lifespan of the windfarm). The total area of permanent habitat loss is calculated to be 0.3 km^2.

8.5.50 Where possible, to minimise habitat losses, reinstatement of habitats will be completed following construction, for example along track verges and around turbines.

8.5.51 Overall permanent habitat loss comprises a loss of 7.7% of the total development area of 3.9 km^2. The habitat losses breakdown as:

- 3.6% (0.14km^2) loss of the upland habitat mosaic comprising heath and semi-improved acid grassland – **Minor negative** impact on a habitat of medium value – overall impact significance of **Slight Adverse**;
- 1.3% (0.05km^2) loss of the mire habitat - **Minor negative** impact on a habitat of medium value – overall impact significance of **Slight Adverse**; and
- 2.8% (0.11km^2) loss of other habitats - **Minor negative** impact on a habitat of medium value – overall impact significance of **Slight Adverse**.

8.5.52 This level of habitat loss is unlikely to have any permanent impacts on the integrity of the habitats or the species using those habitats, although some fragmentation may occur. It is expected that there would be an overall impact significance of **Slight Adverse**.

8.5.53 There is also the potential for indirect impacts on surrounding habitats due to changes in drainage patterns following construction of wind farm components. There may be some drying out of wet heath and mire areas immediately adjacent to wind farm components, resulting in a slightly greater loss than that predicted for direct habitat loss. However, it is unlikely that there will be any significant negative impact on the integrity of these habitats. It is expected that there would be **Minor negative** indirect impacts due to habitat loss. It is expected that there would be an overall impact significance of **Slight Adverse**.

Table 8.7: Areas of Habitat Loss as a Result of the Proposed Wind Farm

	Habitat Type	Sum of Area (ha)		
Wind Farm Feature	**Description**	**Permanent**	**Temporary**	**Grand Total**
Access Tracks	Acid Dry Dwarf Shrub Heath	4.22	0.41	4.63
	Blanket Bog	1.88	0.25	2.13
	Built up-areas and Buildings	0.11	0.02	0.13
	Continuous Bracken	0.94	0.21	1.15
	Dry Heath/Acid Grassland Mosaic	4.68	0.64	5.31
	Improved Grassland	0.60	0.11	0.71
	Marshy Grassland	1.44	0.31	1.76
	Semi-improved Acid Grassland	5.73	0.62	6.36
	Spoil Ground	0.36	0.03	0.39
	Wet Dwarf Shrub Heath	0.06	0.03	0.09
	Wet Heath/Acid Grassland Mosaic	2.75	0.46	3.20
	Wet Modified Bog	0.74	0.10	0.84
	Access Tracks Total	**23.52**	**3.19**	**26.70**
Construction Compound	Semi-improved Acid Grassland	0.43	0.09	0.53
	Construction Compound Total	**0.43**	**0.09**	**0.53**
Crane Hardstanding	Acid Dry Dwarf Shrub Heath	0.88	0.09	0.97
	Blanket Bog	1.73	0.27	2.00
	Dry Heath/Acid Grassland Mosaic	1.35	0.21	1.55
	Semi-improved Acid Grassland	0.16	0.06	0.21
	Wet Heath/Acid Grassland Mosaic	1.22	0.21	1.43

	Habitat Type	Sum of Area (ha)		
	Wet Modified Bog	0.59	0.13	0.72
	Crane Hardstanding Total	**5.92**	**0.97**	**6.89**
Substation	Blanket Bog	0.02	0.01	0.03
	Wet Heath/Acid Grassland Mosaic	0.01	0.01	0.01
	Substation Total	**0.02**	**0.02**	**0.05**
Turbines	Acid Dry Dwarf Shrub Heath	0.01	0.06	0.06
	Blanket Bog	0.02	0.15	0.16
	Dry Heath/Acid Grassland Mosaic	0.02	0.15	0.17
	Semi-improved Acid Grassland	0.00	0.04	0.04
	Wet Heath/Acid Grassland Mosaic	0.01	0.11	0.12
	Wet Modified Bog	0.01	0.05	0.06
	Turbines Total	**0.06**	**0.56**	**0.61**
	Grand Total	**29.95**	**4.83**	**34.78**

Table 8.8: Summary of Permanent Habitat Loss

Habitat type	Total area lost (km^2)	% of total habitat loss	Conservation value
Acid dry dwarf shrub heath	0.05	1.3	Medium
Wet dwarf shrub heath	0.01	0.3	
Dry heath/semi-improved acid grassland mosaic	0.06	1.4	
Wet heath/semi improved acid grassland mosaic	0.02	0.6	
Total heath habitat	**0.14**	**3.6**	
Blanket bog	0.04	1.0	Medium
Modified blanket bog	0.01	0.3	
Total mire habitat	**0.05**	**1.3**	
Semi improved acid grassland	0.07	1.8	Lower
Improved grassland	0.01	0.3	
Marshy grassland (rush pasture)	0.02	0.6	
Bracken	0.01	0.3	
Total other habitats	**0.11**	**2.8**	
Total habitat loss	**0.3**	**7.7**	

8.5.54 There are no further predicted impacts on habitats during operation. During decommissioning, there will be loss of small areas of re-vegetated habitat when the turbines are removed. This is not expected to result in any significant impact. The methods to be used during decommissioning to avoid or minimise impacts on habitats would be detailed in a method statement to be completed and agreed with the relevant authorities prior to the commencement of decommissioning.

8.5.55 Potential impacts on water quality are considered in Chapter 10 Hydrology including pollution and sedimentation.

Species

8.5.56 **Otter** - Signs of foraging otter were recorded along the Kingledores Burn. No breeding or resting places for otters were recorded within the development area.

8.5.57 Most otter foraging activity would be expected to occur on or close to (within approximately 10m) the watercourses. It should be noted that otters are more active at night or around dawn and dusk, and otters are generally aware of human activity and co-exist with it (reviewed in Chanin, 2003b).The existence of good quality watercourses providing suitable areas for breeding and foraging are essential to maintain otter populations.

8.5.58 The potential direct impacts on otters during construction and operation of the wind farm are as follows:

- Disturbance of foraging otters through general construction activities. Disturbance is probable specifically during construction of the new bridge across the Kingledores Burn, the replacement of several culverts on the tributaries and during the upgrade of the access track along the Kingledores valley (probable, temporary, **Minor negative**);
- Accidental collision risk through a temporary increase in construction traffic. As otter are nocturnal the risk window is restricted to a short period after dusk and before dawn that will overlap normal daytime construction activities (extremely unlikely, temporary **Major negative**). As traffic levels during operation are expected to be low and traffic activity will be restricted to daylight hours no risk is expected during operation; and
- It is possible that otters using the site at night will become trapped in trenches, pipes or excavations left exposed overnight (unlikely, temporary **Major negative**).

8.5.59 The potential indirect impacts on otters during construction and operation of the wind farm are as follows:

- pollution of watercourses resulting in a reduction in quality of foraging habitat used by otters (temporary/permanent, **Intermediate negative**); and

8.5.60 In mitigation:

- A suitable buffer has been maintained around the Burns through the design process;
- The PPP and associated mitigation proposed in Chapter 10 Hydrology will ensure the maintenance of water quality in the watercourses;
- As otters are mainly nocturnal, in mitigation the bridge construction work will only be undertaken during daylight hours;

- Either covering excavations and or the provision of suitable escape ramps will prevent mammals becoming trapped in excavations, also any open pipes will be capped overnight;
- No in-burn obstructions (fencing, flood lighting or diversions) will be employed;
- The bridge design and construction will incorporate otter friendly measures (over sized and will contain ledges); and
- The risk of collision with site vehicles will be mitigated for by imposing speed limits on site of 15mph, the erection of wildlife warning signs, and the site ECoW will provide tool box talks on protected species to construction staff.

8.5.61 During operation, vehicle activity will be low and otters are used to existing in areas where there is human activity close to watercourses. It is therefore extremely unlikely that there will be any permanent impacts on the conservation status of otters in the development area resulting from construction or operation of the proposed wind farm. Following mitigation the overall residual impact significance is considered as **Neutral**.

8.5.62 **Atlantic salmon -** (this section includes for all fish interests of the River Tweed SAC) The strongest run of salmon on the River Tweed SAC occurs in the autumn, with a smaller spring run mainly into the Whiteadder Water and Ettrick Water. Sea trout run all parts of the river from spring to autumn and spawn in the upper reaches of the tributaries.

8.5.63 Visual inspection of Kingledores Burn during the surveys confirmed that the bed substrate is both suitable for both salmon and trout spawning, and that Salmonid fish were present within the Kingledores Burn. The desk study and consultation process identified both anecdotal and historic records of a small Atlantic salmon run in the Kingledores Burn.

8.5.64 No impacts are predicted during the operation of the wind farm. The potential direct and indirect impacts on fish interests during construction of the wind farm are as follows:

- Pollution of watercourses through sediment release during construction activities (access road and new crossings). Atlantic salmon spawning occurs between November and December, and the eggs will usually hatch in early spring, depending on water temperature. The young fish (alevins) will remain developing within the gravel until they emerge in April or May (www.atlanticsalmontrust.org). Salmon and trout will therefore be potentially most sensitive between November/December and April/May, when the eggs and alevins could be smothered by sediment deposits (probable, temporary **Intermediate negative**);
- Pollution of watercourses through sediment release during construction activities (access road and new crossings). River, brook and sea lamprey have slightly different life cycles and habitat

requirements to salmonids. River and brook lamprey spawn in March or April, once the water temperature increases to 10 or 11°C, in areas of gravely and stony bed substrate. The eggs will hatch within one month, and the larvae will travel to slower flowing nursery areas of sandy silt substrate. Sea lamprey have similar habitat requirements for spawning and nursery areas, but spawning will take place slightly later in May/June. River, brook and sea lamprey will be most sensitive to potential impacts of the development (e.g. smothering of spawning and nursery areas with fine sediments) between March and July/August (probable, temporary **Intermediate negative**);

- In burn obstructions during sensitive times of year – restricting Atlantic salmon and sea trout runs. Construction activities in watercourses, the use of temporary weirs and diversions during bridge building and poor culvert design (probable, temporary **Intermediate negative**);
- Negative impacts on water quality could have associated indirect temporary Intermediate negative impacts on riparian habitats and the overall conservation status of the watercourses.

8.5.65 In mitigation:

- Implementation of the Pollution Prevention Plan and specific mitigation measures proposed in Chapter 10 to prevent pollution of watercourses;
- No bridge construction activities will be undertaken within the watercourse – a bailey bridge will be used to avoid any bank works and potential associated sediment releases, and to avoid the use of a culvert with the potential for sediment release from fill material;
- One culvert, on the Glenkiely Burn, currently operates as a barrier to fish movement - this will be replaced with a culvert designed to allow fish passage(following - River Crossings and Migratory Fish: Design Guidance – Scottish Executive (2004)) – this impact significance is considered **Slight Beneficial**; and
- No culvert construction will be undertaken during sensitive times of year for Atlantic salmon (between November/December and April/May) and lamprey species interests (between March and July/August).

8.5.66 Following mitigation, it is extremely unlikely that there will be any temporary or permanent negative impacts on the conservation status of qualifying fish features of the River Tweed SAC resulting from construction or operation of the proposed wind farm. The overall residual impact significance is therefore considered to be **Neutral**.

8.5.67 **Common lizard** - The upland heath and grassland mosaics within the development area provide suitable prey species, habitat and vegetation structure to support reptile populations. Both common lizard and adder

have been identified as present across the mosaic of heath and semi improved grassland on the site uplands.

8.5.68 Potential direct and indirect impacts on reptiles during construction activities are as follows:

- crushing by site machinery during construction activities on the mosaic of heath and semi-improved grassland on the site uplands (a probable, **Intermediate negative** impact);
- other damaging activities include: archaeological and geotechnical investigations; installing cables; and storing construction material in sensitive areas;
- loss of heath and semi-improved grassland habitat, on the site uplands through access track and turbine base construction (a certain, **Intermediate negative** impact);

8.5.69 To ensure the potential impact on reptiles using the site is minimised, the exact mitigation methodology will be agreed with SNH and the local council biodiversity officer prior to the start of any construction activities. The following outline mitigation will be undertaken:

- A survey will be undertaken (in late spring between April to June 2008 – weather dependent) to determine the exact locations and the population numbers of reptiles on the site and inform the mitigation methodology for the site;
- The site construction activities will be phased (so that capture effort can be concentrated on small areas). The access track, turbine bases and storage areas will be excluded using suitable reptile fencing (which will be maintained) and hand cleared of reptiles (this may involve some habitat strimming to concentrate animals) during the spring (however the length of capture will depend upon the population density);
- Should any holding in captivity be required - as the adder is listed under the Dangerous Wild Animals Act 1976 – suitable consideration will be taken and the methodologies will be agreed with SNH;
- The reptiles will be released on adjacent suitable habitat within the site, these areas will be managed and enhanced for reptiles;
- Following the hand clearance of a phased section of access track the vegetation will be stripped, under the supervision of a suitably qualified ecologist;
- No construction materials will be temporarily stored within identified suitable reptile habitat; and
- The reptile populations will be monitored during and after construction (details to be agreed with SNH).

8.5.70 Following detailed mitigation no significant impacts are expected on reptiles. The loss of suitable reptile habitat is predicted to be permanent **Minor negative**. It is also considered likely that the constructed access

tracks and other features will eventually provide some suitable replacement reptile habitat (basking and possible refugia) on the site. Overall residual impact significance for reptiles is considered to be **Slight adverse**.

8.5.71 **Mountain hare** – Both mountain and brown hare were identified, in low densities, within the development area during the surveys. The site offers suitable upland heath and grassland habitat mosaics for mountain hare. In addition, rush pasture and improved fields in the lower valley floors are suitable for brown hare. It is possible that at certain times of year (spring) higher concentrations are likely.

8.5.72 Potential direct and indirect impacts on reptiles during construction activities are as follows:

- Both species of hare will potentially be impacted by the small permanent loss of habitat. It should be noted that the adjacent habitat outwith the development area offers suitable habitat capable of supporting this temporary displacement of hare. Construction activities are predicted to have a certain temporary **Minor Negative** displacement impact on hare species.
- During the construction and operation period, hare will potentially be at risk of disturbance from human activity. This impact will take the form of temporary displacement from the development area. the impacts of disturbance are predicted to be probable temporary **Minor Negative**.
- Risk of collision from site vehicles (this risk will be relative to the frequency of vehicle movements). The impacts of collision are predicted to be extremely unlikely permanent **Intermediate Negative**.

In mitigation:

- The habitat lost temporarily will be reinstated following completion of construction activities;
- Suitable site speed limit (15mph) will be implemented;
- Signs warning of wildlife activity will be erected; and
- Toolbox talks with the construction teams for protected species present on site will be undertaken.

8.5.73 Following mitigation, the levels of displacement, disturbance, and collision risk to hare on the site are predicted to be low. Overall impact significance on hare species is therefore considered to be **Slight Adverse**.

8.5.74 **General biodiversity** - Some temporary disturbance to other species present in the development area, such as fox, roe deer, and small mammals is likely to occur during the construction period, resulting from increased noise and activity on the site.

8.5.75 It is likely that these activities may cause temporary disturbance to these species and some species may be displaced from the development area during construction. However, no impacts on the integrity of the habitats used by these species are expected, and it is likely that following completion of construction, these species will return to the development area.

8.5.76 It is unlikely that there would be ongoing impacts on these species during wind farm operation. There is the potential for increased recreational disturbance, for example walkers, due to the presence of new tracks on the site. However, the new tracks cover only a small part of the development area and suitable habitat is available in other parts of the development area. It is therefore unlikely that there will be significant impacts on mammal species during construction or operation of the wind farm.

8.5.77 **Bat** – Although no bats were identified using the development area, the site compound will be located approximately 100m from the woodlands, which are outwith the site, adjacent to the Kingledores farm buildings.

8.5.78 Whilst no direct impacts are predicted on bats it is proposed that low level external flood lighting be utilised at the site compound. This will minimise any potential disturbance impacts on foraging bats outwith the development area.

8.5.79 It is recommended that the low number of bats utilising the Kingledores farm woodlands, outwith the site, but adjacent to the site compound and access track are monitored to inform on required mitigation measures should any impacts be identified during the construction period.

Cumulative Impacts

8.5.80 There may be cumulative impacts of wind farms on flora and fauna, with the greatest theoretical risk being of significant impacts arising on species and habitats of national or international importance resulting from a number of wind farms being present in a relatively small area (e.g. Landscape Design Associates, 2003). Current guidance suggests that the highest priority for cumulative impact assessment is for species and habitats that are declining and/or not in favourable conservation status and that species and habitats of very high conservation importance or those vulnerable to wind farms may be targeted for cumulative assessments (SNH, 2005).

8.5.81 At this site, there are no habitats of international importance present within the study area, or species of very high conservation value, or qualifying species from SACs. There are three species identified to be of high importance (otter, bat and red squirrel), however no significant impact is predicted on these species.

8.5.82 Due to the assessment that the wind farm development is expected to have no significant impact on the species and habitats present within the

study area, and the lack of species and habitats of very high conservation importance it was considered unlikely that there would be significant cumulative impacts arising from the proposed wind farm development. A detailed cumulative impact assessment was therefore not completed.

Table 8.9: Summary of Impacts on Habitats

Phase	Effect	Value	Nature of effect	Timescale of effect	Likelihood of occurrence	Mitigation	Significance of residual impact
Construction and Decommissioning	River Tweed SAC water quality – Pollution	Very High	Negative	Temporary or Permanent	Extremely unlikely	Burns have been avoided (and a suitable buffer employed) in the design process; The new crossing will be a Bailey Bridge design to avoid any in- channel or riparian impacts; The old bridge structure will be retained to avoid any pollution or disturbance to the riparian areas; Construction of new crossing and new culvert will be undertaken during September and October to avoid any fisheries issues;	Neutral
	Blanket bog habitat - Loss	Medium	Negative	Temporary or Permanent	Certain	Design has minimised loss of habitat. Reinstatement of habitats following construction where possible to minimise losses	Slight Adverse
	Upland heath and acid grassland mosaic - Loss	Medium	Negative	Temporary or Permanent	Certain	Design has minimised loss of habitat. Reinstatement of habitats following construction where possible to minimise losses	Slight Adverse
	Cleuch woodlands - Loss	Medium	Negative	Temporary or Permanent	Extremely unlikely	Habitat has been avoided in the design process	Neutral
	Other habitat - Loss	Lower	Negative	Temporary or Permanent	Certain	Design has minimised loss of habitat. Reinstatement of habitats following construction where possible to minimise losses	Slight Adverse

Table 8.7: Summary of Impacts on Species

Phase	Effect	Value	Nature of effect	Timescale of effect	Likelihood of occurrence	Mitigation	Overall Impact Significance
Construction and Decommissioning	River Tweed SAC qualifying features (Atlantic salmon, lamprey) – Pollution	Very High	Negative/ Slight Beneficial	Temporary or Permanent	Extremely unlikely	Implementation of the PPP and specific mitigation measures in Chapter 10; A bailey bridge will be used to avoid any bank works and potential associated sediment releases; Culverts designed to allow fish passage (following - River Crossings and Migratory Fish: Design Guidance – Scottish Executive (2004); and No culvert construction will be undertaken during sensitive times	Neutral
	River Tweed SAC qualifying feature Otter - Disturbance and loss	Very High	Negative	Temporary or Permanent	Extremely unlikely	Implementation of the PPP and specific mitigation measures in Chapter 10; A suitable buffer is to be maintained around the burns; The bridge construction work will only be undertaken during daylight hours; Covering excavations and or the provision of suitable escape ramps will prevent mammals becoming trapped in excavations, also any open pipes will be capped overnight; No in-burn obstructions (fencing, flood lighting or diversions); the bridge design and construction will incorporate otter friendly measures;	Neutral

Phase	Effect	Value	Nature of effect	Timescale of effect	Likelihood of occurrence	Mitigation	Overall Impact Significance
	Reptiles - Loss	Lower	Negative	Temporary or Permanent	Probable	Survey in late spring (between April to June 2008) to determine locations and population and inform the mitigation methodology for the site; Phased construction activities (so that capture effort can be concentrated on small areas); Construction areas to be excluded using suitable reptile fencing Hand clearance of reptiles during the spring; Adder - suitable consideration will be taken of the Dangerous Wild Animals Act 1976; The reptiles will be released on adjacent suitable habitat within the site, these areas will be managed and enhanced for reptiles; The vegetation will be stripped, under the supervision of a suitably qualified ecologist; No construction materials will be temporarily stored within identified suitable reptile habitat; and	Slight Adverse
	Hare (mountain and brown) and mammal biodiversity - Disturbance and loss	Lower	Negative	Temporary or Permanent	Probable	Temporary habitat lost will be reinstated following completion of construction activities; site speed limit (15mph) will be implemented; Signs warning of wildlife activity will be erected; and Toolbox talks with the construction teams for protected species present on site will be undertaken.	Slight Adverse
	Bats - Disturbance	Medium	No Change	Temporary	Extremely Unlikely	Low level external flood lighting to be utilised at the site compound; and Monitor the low number of bats utilising the Kingledores farm woodlands, outwith the site, but adjacent to the site compound and access track to inform on required mitigation measures should	Neutral

8.6 CONCLUSION

8.6.1 The Kingledores Burn, a tributary of the River Tweed SAC, runs through the proposed Glenkerie wind farm development area. Two primary features of the River Tweed SAC, Atlantic salmon and otter, were identified using the Kingledores Burn. No otter holts or resting places were found during the surveys.

8.6.2 Desk and field studies for the proposed Glenkerie wind farm development area identified:

- A number of habitat types, the most extensive of which was a mosaic of heath and semi improved acid grassland. The upland areas also contained small cleuch woodlands, modified areas of blanket bog and wet heath. The low-lying parts of the development area contained plantation woodlands (broadleaved and conifer), improved grassland and rush pasture habitat; and
- The presence of adder and common lizard were recorded within the development area using areas of heath and acid grassland habitat mosaic.

8.6.3 The River Tweed SAC was assessed as being of Very High value. Otters and Atlantic salmon were assessed as being of Very High value as they are qualifying features of the River Tweed SAC. Hares, and reptiles using the development area are considered to be of Lower value. None of the habitats identified on site were assessed as being of higher than Medium value.

8.6.4 Ecological constraints were taken into account in the wind farm design, and mitigation measures including the deployment of a permanent on site ECoW, are proposed to avoid or minimise impacts on the ecological receptors identified above.

8.6.5 Following implementation of these measures an ecological impact assessment, completed following best practice methods, concluded that there will potentially be an overall impact significance of **Slight Adverse** on ecological receptors during the construction, operation or decommissioning phases of the proposed wind farm development.

8.7 REFERENCES

Betts, S. 2006. Are British bats at risk from windfarm? *British Wildlife* **17**:339-345.

Chanin, P. 2003a.*Monitoring the otter.* Conserving Nature 2000 Rivers. Monitoring Series No. 10. English Nature, Peterborough.

Chanin, P. 2003b. *Ecology of the European Otter.* Conserving Natura 2000 Rivers. Ecology Series No. 10. English Nature, Peterborough.

Davidson-Watts, I. & Jones, G. 2006. Differences in foraging behaviour between *Pipistrellus pipistrellus* (Schreber, 1774) and *Pipistrellus pygmaeus* (Leach, 1825). *Journal of Zoology* **268**:55-62.

IEEM 2006. *Guidelines for ecological impact assessment in the United Kingdom*. IEEM, Winchester.

Joint Nature Conservation Committee 2003. *Handbook for Phase 1 habitat survey: a technique for environmental audit.* Peterborough, Joint Nature Conservation Committee.

Scottish Executive 2001. *European Protected Species, Development Sites, and the Planning System. Interim guidance for local authorities on licensing arrangements.* Scottish Executive, Edinburgh.

SNH factsheet. http://www.snh.org.uk/publications/on-line/wildlife/badgersanddevelopment/law.asp

South Lanarkshire Council / SNH 2003. *South Lanarkshire Biodiversity Action Plan*.

Strachan, R. & Moorhouse, T. 2006. *Water Vole Conservation Handbook*. 2nd Edition. Wildlife Conservation and Research Unit, University of Oxford.

CHAPTER NINE: ORNITHOLOGY

9.1 EXECUTIVE SUMMARY

9.1.1 This chapter provides an assessment of the ornithological impacts of the proposed wind farm development at Glenkerie, Peebleshire, Scottish Borders.

9.1.2 Consultation and field studies were completed to identify the main ornithological receptors within the development site. Field surveys completed were undertaken with reference to SNH 2005 guidelines for bird surveys at wind developments. An upland breeding bird survey was completed in 2005 and 2006, and vantage point watches were completed over the turbines area during the breeding and non-breeding seasons of 2005 and 2006.

9.1.3 Four species: black grouse, pink-footed geese (regional value), curlew and lapwing (local value) were considered to be of medium sensitivity to wind farms, curlew (1 pair 2005 and 3 pairs 2006) and lapwing (2 pairs 2006) were identified as breeding on the development site. Skylark (up to 12 pairs), song thrush (up to 2 pair), linnet and reed bunting were considered to be of regional value and of low sensitivity. Linnet and reed bunting were not identified as breeding in the development site.

9.1.4 Information relating to Schedule 1 raptors has been omitted from this copy of the ES.

9.1.5 Black grouse were identified lekking close to the development site but no observations of breeding were made.

9.1.6 A further 19 breeding and non-breeding species were identified to be of local value, a further 26 breeding and non-breeding species of site value were identified.

9.1.7 Mitigation measures proposed to minimise impacts on bird species, where practicable, include ensuring any vegetation clearance is completed out with the bird-breeding season to avoid impacts on nesting birds. Mitigation plans have been prepared so that construction activities can be undertaken during the breeding season and during the peak black grouse lekking season.

9.1.8 Impact significance for the identified three species sensitive to wind farms are:

- Minor disturbance impacts on black grouse will potentially occur during the construction phase, if operations are carried out during the peak spring lekking period. The presence of the wind farm will have a negligible impact on lekking black grouse. No significant impacts on black grouse are predicted to occur within the development site.
- Minor impacts on curlew are predicted, in particular curlew are likely

to be potentially temporarily displaced during the construction phase if operations are carried out during the breeding season. Collision risk assessment showed that there would be minor significant collision risk to curlew, 0.06 collision risk to curlew (i.e. one collision every 17 years).

- No impacts on other breeding waders are predicted.
- No impacts on pink-footed geese are predicted to occur within the development site.

9.1.9 No impacts on any other bird species of international, regional and local value are predicted during construction, operation or decommissioning of the wind development.

9.1.10 From the studies conducted, it is concluded the development site is an area identified to be of low sensitivity for impacts on birds.

9.1.11 The only species sensitive to the proposed wind farm development at Glenkerie is black grouse. The minor disturbance impact on this species would be most significant during the construction phase if operations are carried out during the lekking period between mid March to mid May. Once construction is completed this minor, impact should reduce to a negligible impact.

9.2 INTRODUCTION

9.2.1 The principal objectives for this assessment were to identify the ornithological interests present in the study area and determine their nature conservation value. Desk study and baseline field surveys were carried out by West Coast Energy Ltd (now Atmos Consulting Ltd), which included breeding bird surveys and year-round vantage point watches.

9.2.2 The baseline survey information was then used in the completion of an ecological impact assessment of the proposed wind development following best practice methods (IEEM, 2006). Mitigation measures are also proposed where appropriate to avoid or minimise any potential impacts on ornithological receptors of value. Any significant impacts on ornithological receptors are identified.

9.3 RELEVANT GUIDANCE

9.3.1 The ornithological impact assessment completed in this chapter is considered in the context of relevant legislation and policies. The policies and legislation described in Chapter 8 Ecology are relevant to this assessment. Additional policy and guidance followed is described below.

9.3.2 In 2002, Scottish Natural Heritage (SNH) produced guidance on survey methods to be used to assess impacts of wind developments on upland bird communities (SNH, 2002). This guidance was designed to provide information on the survey effort and types of surveys required to ensure

sufficient information on bird interests at proposed wind development sites was collected to allow impact assessments to be completed. The guidance was updated and replaced by more detailed guidelines on survey methods for onshore wind farm bird surveys in 2005 (SNH, 2005).

9.3.3 SNH has also prepared draft guidance, in conjunction with British Wind Energy Association (BWEA) on assessing the impacts of proposed wind farms on birds (SNH, 2000a). This guidance outlines three main risks to birds from wind developments: displacement from the wind development and surrounding area; death through collision with turbine blades; and direct loss of habitat through construction of wind development components. SNH has also provided guidance on methods for assessing the collision risk of bird species at a wind development site with turbine blades through a simple model (SNH, 2000b).

9.3.4 More recently, SNH has produced updated guidance on assessing the significance of impacts from onshore wind farms on birds at sites out with designated areas (SNH, 2006). In particular, this guidance identifies species that may be particularly at risk from wind development impacts. The Royal Society for the Protection of Birds (RSPB) has also recently produced a bird sensitivity map for Scotland to help provide guidance on location of suitable wind development sites (Bright *et al.*, 2006).

9.3.5 In 2002, the RSPB produced a list of bird Species of Conservation Concern in the UK (Gregory *et al.*, 2002). Species that are considered to be of conservation concern are listed in two categories: red (high conservation concern) and amber (medium conservation concern).

9.4 BASELINE STUDIES

Consultations were undertaken with Royal Society for the Protection of Birds (RSPB), Scottish Raptor Study Group (SRSG), and Borders Region Biological Records Centre (BRBRC) A summary of responses and comments are given in Table 9.1.

Table 9.1: Consultation Results

Consultee	Issues raised and recommendations
RSPB	Response dated 04 10 2007. Royal Society for the Protection of Birds is unaware of any species or populations of birds of significant conservation concern. Also stated there are no local, national or international ecological designations at or adjacent to the site. The environmental impact assessment should include ornithological survey work carried out in the breeding season and over the winter, following SNH guidance paper (2005). This should include a comprehensive baseline survey of the breeding birds on site and within a 500m buffer distance beyond the outermost turbine position. The appropriate method for this is Brown and Shepherd, as referred to in the SNH Guidance. Black grouse surveys work carried out in general area was rather dated but did show that there was a presence of a few birds. Golden plover may also be present, and should be detected by the breeding bird survey.

SRSG	Scottish Raptor Study Group. Data in the process of being compiled.
BRBRC	Response dated 04 10 2007. Borders Region Biological Records Centre. A comprehensive list of species was supplied, with a historical record of black grouse being seen on the 12 01 2002 on Glenlood Hill (NT0828), although no number was mentioned. Their most recent record for black grouse was 21 04 2006 near Stanhope NT 122 294.

Survey Methods

9.4.1 Baseline survey methods were selected following a scoping visit in May 2005 during which the likely species assemblage on site were identified, and assessment of the habitat and its likely potential suitability to support other species was considered. Full details of the methods are given in Appendix 9.1.

9.4.2 The following baseline studies were completed using the methods laid out in the SNH survey guidance for onshore wind farms (SNH, 2005). Full details of dates and timings of surveys completed are provided in Appendix 9.1:

- Brown & Shepherd breeding bird survey 2005 (May to July);
- vantage point (VP) watches breeding season 2005 (May to September);
- vantage point watches non-breeding season 2005/2006 (October to March);
- Brown & Shepherd breeding bird survey 2006 (May to July);
- Black Grouse survey (May 2006);
- vantage point watches breeding season 2006 (May to September);
- vantage point watches non-breeding season 2006 (October to December); and
- goose vantage point watches autumn migration season 2006 (September to December);

9.4.3 The Brown & Shepherd upland wader survey method was adapted to record all species. This method is considered most appropriate for upland bird assemblages (SNH, 2005). This survey was completed over the development sites only, which varied due to changes in site layout between years. The SNH guidance states that a 500m buffer zone should also be surveyed around components of the wind development. The 500m buffer area around the turbines of the proposed layout was mostly covered by the survey areas of 2005 and 2006 (see Figures 9.2 and 9.3)

9.4.4 In May 2005, vantage point surveys were started at VPs 1, 2 and 3, in June an additional VP (VP4) was added. VP1 was dropped after July 2005, as there was considerable overlap between VP1 and VP4; VP4 was retained as it gave better coverage of the original layout than VP1. From October 2005, VP2 was dropped and replaced with VP5 to the southwest.

During the period October 2005 to January 2006 inclusive VPs 3, 4 and 5 were used to cover the sites revised layout. VPs 3, 4 and 5 were sufficient to cover the new layout, as there was overlap of the 2 kilometre viewsheds. After a third revision of the site layout in February 2006, VP5 was dropped and VPs 2 and 3 were used to cover the smaller revised layout until surveys stopped in December 2006. In June 2006, a surveyor erroneously attended VP4, rather than VP2 for one vantage point observation period. This has been taken into account in subsequent analyses.

9.4.5 The current layout succeeds those that were current during the survey period, but both VP 2 and 3 give good coverage of this layout, VP4 overlaps with the viewshed of VP3.

9.4.6 The location and viewshed from the VPs, which gave coverage over the survey areas is shown in Figure 9.1.

9.4.7 Time was lost in June and October 2005 due to bad weather and only 3 hours out of the intended 6 hours per VP was surveyed in October. In February 2006, no surveys were completed due to continued bad weather.

9.4.8 April 2006 no surveys were undertaken due to the farmer (at Kingledores) requesting that staff did not come on to the site during lambing time.

Survey Findings

9.4.9 Species recorded during n initial walkover visit in 2005 were curlew, lapwing, song thrush, wheatear, skylark, meadow pipit, buzzard, and kestrel. The site was considered likely to support a typical upland breeding bird assemblage, including some waders, although the potential for raptor species of note was judged low. Upland breeding bird surveys and year round vantage point watches were therefore considered suitable survey methods to use on this site. Subsequently black grouse and winter goose migration surveys were also considered necessary.

9.4.10 In 2005, the area covered during the breeding bird survey was from Glenkerie Burn in the southwest to the northern slopes of Worm Hill in the northeast. The eastern limit of the survey area was along the ridge between Gleenlood Hill (in the south) to Blakehope Head via Cocklie Rig, Benshaw Hill and Middle Hill summits. The southern boundary followed Kingledores Burn then along the A701.

9.4.11 The survey area covered in 2006 was smaller than in 2005 and is mostly within the development site; during this survey, the proposed access route (at that time) to the north was also covered.

9.4.12 Part of the development site was not covered by the breeding bird surveys in 2005 and 2006 the area around Kingle Rig.

9.4.13 The components of the wind development are confined to only part of the development site. Due to the scale of the proposed development, it is considered that sufficient information on breeding birds was obtained from the completed surveys to assess potential impacts fully. The coverage from the VPs should have ensured that any species considered sensitive to wind farms breeding on Kingle Rig were recorded. As Kingle Rig is of similar habitat it can be assumed that this area probably supports a similar assemblage of breeding birds identified in the survey areas of 2005 and 2006.

9.4.14 Four species of breeding waders were recorded during the breeding bird surveys. Three species were within the development site:

- curlew (1 pairs 2005 and 3 in 2006);
- lapwing (2 pairs 2006); and
- Snipe (one pair in 2006).

9.4.15 Additionally, one pair of oystercatchers nested close to the development site in 2006.

9.4.16 Other species considered as probable breeding in the development site included skylark, song thrush, (red-listed species regional value), red grouse, lapwing, meadow pipit, grey wagtail, stonechat, mistle thrush, willow warbler, (amber-listed species local value), northern wheatear, blackbird, pied wagtail, wren, robin, whitethroat, wood pigeon, blue tit,

great tit, and chaffinch (site value). Full details of the results of the breeding bird surveys for 2005 and 2006 are presented in Appendix 9.1. Maps showing the approximate centre locations of breeding territories are shown in Figures 9.1 and 9.2.

9.4.17 VP observations used in date analyses exclude those hours accumulated from VPs 1 and 5, (VP1 overlaps VP4, and V5 is more than 2 kilometres from the present development site). VP1 recorded no target species. A map showing viewsheds from the five VPs are shown in Figure 9.3. Figure 9.4. shows all target species flight lines.

9.4.18 VP watches for the breeding season of 2005 were undertaken in the months May to September inclusive. A total of 84 hours 20 minutes of site coverage was completed (see Appendix 9.1 for details). During this period, curlew were the only target species recorded on 8 occasions, four flights were within the development site, all of which were within the height band of the rotor swept area.

9.4.19 VP watches were undertaken for the non-breeding season between October 2005 and March 2006. A total of 55 hours 55 minutes of observation was completed during this period. Two observations were recorded in October of two small skeins of pink-footed geese flying just to the north of the development site. Also in March there was one flight of a skein of 75 pink-footed geese observed flying at collision risk height over the development site. Other observations recorded during VP watches included one flight of two unidentified geese to the west of the development site, and one flight of four greylag geese just to the north east of the development site.

9.4.20 VP watches were undertaken for the breeding season of 2006 between May and September, with a total of 59 hours 45 minutes observation time during this period, curlew was the only target species recorded, being seen on four occasions. Two of these observations were of birds on the northern edge of the development site below collision risk height. Other species recorded during VP watches were one flight of three greylag geese; these flew over the northern part of the development site below collision risk height.

9.4.21 VP goose watches were undertaken for the autumn migration period between Mid September 2006 and December 2006, specifically for geese (but not exclusively). A total of 84 hours of observation was completed during this period. No geese or other target species were observed during this period.

9.4.22 VP watches were undertaken for the non-breeding season between October 2006 and December 2006. A total of 36 hours of observation was completed during this period.

9.4.23 Full details of results of the VP watches for each season including individual flight details are presented in Appendix 9.1 and Figure 9.5.

Species Observed from all Surveys

9.4.24 58 species of breeding or non-breeding birds were identified, five species were identified as of international value, a further five species of regional value, 19 species of local value were recorded, as well as 26 other species.

Other Species

9.4.25 No information has been gathered regarding the use of the site by nocturnal birds. There is potential for barn owl and tawny owl to breed in the trees and buildings around the margins of the site, and in the surrounding area. However, there was no evidence to suggest that these species were present in the development site (excluding the first section of the access route). If these species are present, they are unlikely to be disturbed by the presence of the turbines as the turbine locations are not situated in habitat ideal for these species. Barn and tawny owl are most likely to be found in the lower areas of the valley bottom around the woodland areas.

9.5 ASSESSMENT OF EFFECTS

Method of Assessment

9.5.1 The ornithological impact assessment has been carried out using the most recent best practice guidance from the Institute of Ecology and Environmental Management (IEEM, 2006). The ornithological features and resources have been identified from the baseline studies, and their value assessed. Following the guidelines, the biophysical changes likely to result from the proposed development that may affect the valued ornithological resources and features have been identified. An assessment of whether these changes are likely to result in significant impacts has then been made, any mitigation or compensation measures are then considered, and the residual impacts re-assessed for significance.

9.5.2 All ornithological features and resources within the development site have been identified in the baseline studies. In this section, species identified are evaluated according to best practice guidelines (IEEM, 2006). The value of ornithological resources and features are determined within a geographical context: international, regional, UK, national, local or site (from IEEM, 2006). For the purposes of this assessment, regional refers to the Natural Heritage Zones (NHZ) as defined by SNH (SNH, 2000) Glenkerie lies in the NHZ 20, Border Hills zone. Statutory designated sites have already been assigned a level of value through their designation, and these values are followed in this assessment. Other ornithological features and resources are evaluated for their importance in terms of biodiversity, and following published criteria where available. Legal protection for sites and species is also taken into account where relevant.

9.5.3 In evaluation of species, a number of factors are considered:

- bird species that are rare or uncommon, and species considered to be under threat;
- the ecosystems and their parts that support rare or uncommon species;
- the importance of habitat diversity and connectivity;
- notably large concentrations of birds;
- habitats important to bird species that are natural or semi-natural vegetation types;
- species on the edge of their range; and
- species rich assemblages.

9.5.4 In order to assess the ecological impacts of a proposed development on the ornithological features and resources identified on the development site, it is necessary to identify the changes to the baseline conditions that are likely to arise from the various activities associated with the proposal. The impact assessment is undertaken in relation to the baseline conditions that would be expected to occur if the proposed development were not to take place, and therefore will include possible predictions of future changes to baseline conditions such as environmental trends and other completed or planned development.

9.5.5 Impacts should be assessed with reference to aspects of the ecological structure and function on which each ornithological feature depends, for example available resources, ecological processes and relationships, ecological roles or functions and human influences. Impacts are described according to the following parameters:

- positive or negative;
- magnitude;
- extent;
- duration;
- reversibility; and
- timing and frequency.

9.5.6 It is a requirement of ecological impact assessment to determine the significance of each impact identified. An ecologically significant impact is defined by the best practice guidelines (IEEM, 2006) as '*an impact (negative or positive) on the integrity of a defined site or ecosystem and/or the conservation status of habitats or species within a given geographical area*'.

9.5.7 The conservation status (favourable, stable or unfavourable) of species at a defined geographical level '*is determined by the sum of influences acting on the species concerned that may affect long-term distribution and abundance of its populations within a given geographical area*'.

9.5.8 Potential impacts on each ornithological receptor evaluated above are identified, and the significance of these impacts assessed following the methods outlined, taking into account the proposed mitigation measures.

9.5.9 The assessment considers the three main ways in which wind developments may affect birds (Percival *et al.*, 1999):

- collision with turbines;
- direct habitat loss from construction of wind development components; and
- displacement and indirect habitat loss through disturbance in the vicinity of the wind development site.

Evaluation of Ornithological Features

9.5.10 All species recorded in the development site during the bird surveys and their conservation level are listed in Appendix 9.1. A list and further detail on recorded species considered to be of value are shown in Table 9.3 and subsequent paragraphs below, respectively. Criteria used to determine which species are considered to be of value are laid out in Table 9.2.

Table 9.2: Definition of Terms Relating to the Sensitivity of the Ornithological Interests of the Site.

Sensitivity	Definition
Very High	Cited interest of SPAs, or Ramsar sites and SSSIs. Species that are a qualifying feature for which the site is designated (SPA/SAC) or notified (SSSI)
	Species listed in Annex 1 of the EU Birds Directive (if in internationally or nationally significant numbers)
High	Cited interest of SSSIs. Species that are a qualifying feature for which the site is notified
	Species listed in Annex 1 of the EU Birds Directive or Schedule 1 of the Wildlife and Countryside Act 1981
Medium	Species included in the UK BAP priority list;
	Species and Habitats Considered to be of Principal Importance for Biodiversity Conservation Scotland; (Nature Conservation (Scotland) Act 2004)
Low	Red listed species on the RSPB's Birds of Conservation Concern list (Gregory *et al.*, 2002);
Negligible	Amber listed species on the RSPB's Birds of Conservation Concern list Gregory et al., 2002); and species with no specific designation

Table 9.3: Species of Value Recorded in the Development site

Species	Annex 1 EU Birds Directive	Schedule 1 WCA 1981	UK BAP priority species	Red R, Amber A List	Sensitive to wind farms?
Species of Medium Sensitivity					
Black Grouse *Tetrao tetrix*			√	R	√
Pink-footed Goose *Anser brachyrhynchus*				A	√
Curlew *Numenius arquata*				A	√
Lapwing *Vanellus vanellus*				A	
Species of Low Sensitivity					
Skylark *Aluada arvensis*			√	R	
Song Thrush *Turdus philomelos*			√	R	
Linnet *Carduelis cannabina*			√	R	
Reed Bunting *Emberiza schoeniclus*			√	R	
Species of Negligible Sensitivity					
Greylag Goose *Anser anser* (feral)				A	
Kestrel *Falco tinnunculus*				A	
Red Grouse *Lagopus lagopus scoticus*				A	
Oystercatcher *Haematopus ostralegus*				A	
Common Snipe *Gallinago gallinago*				A	
Common Gull *Larus canus*				A	
Lesser Black-Backed Gull *Larus fuscus*				A	
Herring Gull *Larus argentatus*				A	
Cuckoo *Cuculus canorus*				A	
Swallow *Hirundo rustica*				A	
House Martin *Delichon urbica*				A	
Meadow Pipit *Anthus pratensis*				A	
Grey Wagtail *Motacilla cinerea*				A	
Dunnock *Prunella modularis*				A	
Whinchat *Saxicola rubetra*				A	
Stonechat *Saxicola toruata*				A	
Fieldfare *Turdus pilaris* *		√		A	
Redwing *Turdus iliacus* *		√		A	
Mistle Thrush *Turdus viscivorus*				A	
Willow Warbler *Phylloscopus trochilus*				A	
Goldcrest *Regulus regulus*				A	
Lesser Redpoll *Carduelis cabaret*				A	
Snow Bunting *Plectrophenax nivalis* *		√		A	

* Rated as negligible sensitivity as they are not part of the breeding population.

9.5.11 Each species listed in Table 9.3 has been evaluated according to the best practice guidelines for ecological impact assessment (IEEM, 2006). The species conservation status and the distribution of the species within the development site were taken into account in assigning a level of value to each species. Table 9.3 shows the evaluation of bird species within the wind development site. Three species black grouse, pink-footed geese (regional value) lapwing, and curlew (local value) are of medium

sensitivity to wind farms. Skylark, song thrush, linnet, and reed bunting (regional value) are considered to be of low sensitivity to wind farm developments. The remaining species in Table 9.3 are considered to be of local value, and of negligible sensitivity.

9.5.12 Greylag geese have not been considered here as the flights have been of small numbers, and are probably feral birds rather than part of the Icelandic population. One flight of three birds over the current development site (below collision risk height). One other flight of four greylag geese recorded flying above 100 metres was observed to the north east of the development site and a flight of two unidentified geese were also observed to the north west of the current development site.

Table 9.3: Ornithological Evaluation

Species	Population / distribution in development site	Geographical context
Species of Medium Sensitivity		
Black Grouse *Tetrao tetrix*	A lek of five black cock was identified at (NT 08900 26575) approximately 0.5 Km to the south of the development site. A single black cock was observed at (NT 09405 27350) close to the south eastern boundary of the development site.	Regional
Pink-footed Goose *Anser brachyrhynchus*	Three flights were recorded (skeen numbering 20, 26 and 75individuals) only one skeen of 75 flew over the development site	Regional
Curlew *Numenius arquata*	Small numbers recorded on the site. Most records were in the central area of the site with probable breeding of 1 pairs in 2005 and 3 pairs in 2006 on the development site.	Local
Lapwing *Vanellus vanellus*	Small numbers were recorded on the site. Highest concentrations were in the lower slopes of the south eastern boundary of the site. Probable breeding of 2 pairs in 2006 on the development site.	Local
Species of Low Sensitivity		
Skylark *Alauda arvensis*	The species was distributed over the surveyed areas, up to 16 breeding territories identified in the development site.	Regional
Song Thrush *Turdus philomelos*	Two pair's probable breeding in the development site in 2006.	Regional
Linnet *Carduelis cannabina*	Recorded in very small numbers, with most records occurring in the northern sector of the survey area. No breeding territory identified.	Regional
Reed Bunting *Emberiza schoeniculus*	Small numbers were recorded. One probable breeding pair was identified on the access route proposed in the layout surveyed in 2006 (out with the proposed development site).	Regional
Species of Negligible Sensitivity		
Kestrel *Falco tinnunculus*	Single kestrels were frequently observed over the site. Records were distributed throughout the site with no concentrations recorded. There is potential for this species to breed in the small woods and trees on the lower slopes.	Local
Red Grouse *Lagopus lagopus scoticus*	Small numbers were recorded on the site. Most records were on the higher less steep areas on top of the hills. Probable breeding of 0 pairs in 2005 and 2 pairs in 2006 within the development site.	Local
Oystercatcher *Haematopus ostralegus*	One pair probable breeding near the development site in 2006.	Local
Snipe *Gallinago gallinago*	Small numbers recorded on the site. 1 probable breeding pair on the current development site in 2006.	Local
Curlew *Numenius arquata*	Small numbers recorded on the site. Most records were in the central area of the site with probable breeding of 1 pairs in 2005 and 3 pairs in 2006 on the current development site.	Local
Common Gull *Larus canus*	Small numbers were recorded flying over the site.	Local
Lesser Black-backed Gull *Larus fuscus*	Small numbers were recorded flying over the site.	Local
Herring Gull *Larus argentatus*	Small numbers were recorded flying over the site.	Local
Cuckoo *Cuculus canorus*	Small numbers were recorded. Potential breeding species	

Species	Population / distribution in development site	Geographical context
Swallow *Hirundo rustica*	Small numbers were recorded feeding over the site.	Local
House Martin *Delichon urbica*	Small numbers were recorded feeding over the site.	Local
Meadow Pipit *Anthus pratensis*	The species was distributed throughout the whole site. 23 probable breeding territories were identified in 2005 and 12 in 2006 on the current development site.	Local
Grey Wagtail *Motacilla cinerea*	Small numbers were recorded in the southern section of the site. 2 pairs probably breeding within the development site in 2005	Local
Dunnock *Prunella modularis*	Small numbers were recorded. Potential breeding species	Local
Whinchat *Saxicola rubetra*	Small numbers were recorded. Potential breeding species	Local
Stonechat *Saxicola torquata*	Small numbers were recorded. Probable 1 pair territories in the development site 2006.	Local
Fieldfare *Turdus pilaris*	Winter passage species	Local
Redwing *Turdus ilacus*	Winter passage species	Local
Mistle Thrush *Turdus viscivorus*	The species were restricted to the lower slopes on the south eastern section of the development site. 1 probable breeding territory were identified in 2005 and 3 in 2006.	Local
Willow Warbler *Phylloscopus trochilus*	Small numbers were recorded. The majority of records were restricted to the lower slopes on the south eastern section of the development site. 1 probable breeding territory was identified in 2005 and 2 in 2006.	Local
Goldcrest *Regulus regulus*	Small numbers were recorded. One probable breeding pair was identified on the access route proposed in the layout surveyed in 2006.	
Lesser Redpoll *Carduelis cabaret*	Small numbers were recorded.	Local
Snow Bunting *Plectrophenax nivalis*	Only two records of single birds in the winter season.	Local

Mitigation

9.5.13 All nesting birds are protected under the Wildlife and Countryside Act 1981 and therefore all species need to be taken into consideration during any construction activities that may be carried out during the breeding season (March to July inclusive).

9.5.14 If any construction activities are required to be carried out during the breeding season. If any operations are to be undertaken during the breeding season, Species Protection Plans will be produced and implemented to avoid or minimise disturbance. An appointed Ecological Clerk of Works would be responsible for overseeing implementation of such Plans.

Impacts on Birds

9.5.15 As described previously, bird species within the development site were evaluated to be of international, national, regional, or local value their sensitivity is categorised as shown in Table 9.2. In the following sections, potential impacts of the construction and operational periods of the proposed wind development on species of very high sensitivity (none), high sensitivity (4 species), and medium sensitivity (4 species) are considered. Species of low or negligible sensitivity have been considered as a whole. Decommissioning impacts are expected to be similar to those identified during construction.

9.5.16 At Glenkerie surveys have identified species sensitive to the risk of impacts from onshore wind farm developments (SNH 2006; Bright *et al* 2006);black grouse, pink-footed geese, (regional value, medium sensitivity) curlew and lapwing (local value, medium sensitivity). An additional species, lapwing, has been added due to its conservation status. Impacts on these species in particular are therefore considered in detail, including assessment of collision risk following the recommended method (SNH, 2000b). The southern part of the wind farm development is located within an area where avian sensitivity is rated by the RSPB Bird Sensitivity Map (Bright *et al.*, 2006) as a highly sensitive bird area, the western part of the site is moderate sensitivity and eastern part low sensitivity suggesting that the site is potentially of sensitivity to birds from potential wind farm impacts.

Impacts on Black Grouse (medium sensitivity)

9.5.17 Populations of black grouse in the region (NHZ 20, Border Hills) are considered to be decreasing. (Natural Heritage Futures National Assessment website). Five males were recorded lekking approximately 300 metres from the development site boundary in May 2006. The habitat to be lost directly to components of the wind development is small, any direct loss of habitat is also considered as a negligible significance as no birds were observed on the site and the areas around the turbine bases not being of optimal breeding habitat, it is unlikely that the loss of this habitat would have any significant impact on breeding black grouse within the development site.

9.5.18 Disturbance of lekking black grouse has been found to be a significant problem especially at remote isolated leks (Anon., 2003). Disturbance to lekking birds is expected to be a significant impact highest during construction and less significant during the operation of the wind development. During construction, if works are undertaken during the lekking season, minor impacts on black grouse are predicted, disturbance can be reduced further if operations are restricted or avoided during the lekking season. At Glenkerie the identified lek is approximately 1 kilometre from the nearest turbine and the maximum distance that disturbance has been reported is 1 kilometre in Currie and Elliot (1997). In addition, lekking takes place at dawn (5am) and dusk (9pm). During the potential lekking period, no construction traffic or activity will start until 8.30am and will stop at 6pm. This indicates that potential for disturbance of the lek is negligible during the operational phase of the development.

9.5.19 During operation of the wind development, if black grouse do fly over the development site, there may be risk of collision with turbines. Black grouse were not observed flying over the development site during the survey period between May 2005 and December 2006. As no flights were observed, no data is available to estimate collision risk significance. Black grouse may on occasions during display flights reach heights of 30 metres (Bright et al 2006) as the lowest sweep of the proposed turbine blades at Glenkerie is to be 25 metres and this is on turbines on the higher contours

of the development site collision impacts are considered of negligible significance.

Impacts on Pink-footed Geese (medium sensitivity)

9.5.20 Pink-footed geese were observed on three occasions once over the development site in March 2006 with a total observation time of 8 minutes 26 seconds, 0.04% of the total observation time recorded between May 2005 and September 2006.

9.5.21 No habitat loss or disturbance will result in the displacement of pink-footed geese as this site offers no suitable feeding or roosting habitat

9.5.22 Pink-footed geese may be at risk of collision with turbines, due to only one flight passing over the development site; impact on this species is negligible and is not considered a significant effect over the 25-year lifetime of the wind development.

Impacts on Curlew (medium sensitivity)

9.5.23 Heathlands, grazing and rough pasture are important habitat for ground-nesting waders such as curlew, and populations and distribution will depend on factors such as the vegetation structure and composition, water levels, habitat management and levels of disturbance. Populations of curlew in the regional (NHZ 20, Border Hills) are considered to be stable. (Natural Heritage Futures National Assessment website). A maximum of three pairs of curlew were recorded breeding within the development site. The area of habitat to be lost directly to components of the wind development is small; it is unlikely that the loss of this habitat would have any significant impact on breeding curlew within the development site, as there is adjacent suitable habitat available and as there is a small population alternative suitable habitat is available.

9.5.24 Breeding curlew may be sensitive to disturbance, particularly during the construction period. Although studies are limited, some monitoring[1] has suggested that curlew numbers may go down during construction of wind farms, but that the populations recover within 1-2 years following completion of construction. On that basis, a maximum of three breeding pairs of curlew may be lost from the development site during construction, although this loss is likely to be only short-term. Vegetation clearance would be completed outwith the breeding season to avoid direct impacts on nesting birds. A minor significant disturbance impacts on breeding curlew is therefore expected during construction, through out the operational phase of the wind farm negligible disturbance impact is predicted.

9.5.25 During operation of the wind development, if curlews continue to utilise the development site, there may be risk of collision with turbines. Curlew were observed flying over the development site on 11 separate occasions

[1] Landscape Design Associates 2003. *Cumulative Effects of Wind Turbines. Volume 3: Report on result of consultations on cumulative effects of wind turbines on birds*. ETSU W/14/00538/REP/3.

between May 2005 and December 2006, with a total observation time of 12 minutes 55 seconds, 0.07% of the total observation time. Details of the collision risk assessment are provided in Appendix 9.1. The model shows that, using the precautionary 95% avoidance rate, a collision risk of 0.06 collisions per year (equivalent to 1 collision every 16.57 years) is predicted, this is considered a minor impact over the 25 years of the wind farms operation.

Impacts on Lapwing (medium sensitivity)

9.5.26 Grazing, rough pasture and improved grasslands are important habitat for ground-nesting waders such as lapwing, and populations and distribution will depend on factors such as the vegetation structure and composition, water levels, habitat management and levels of disturbance. Populations of lapwing in the regional (NHZ 20, Border Hills) are considered to be stable. (Natural Heritage Futures National Assessment website). A maximum of two pairs of lapwing were recorded breeding within the development site. It is unlikely that the loss of habitat would have any significant impact on breeding lapwing within the development site, as there is adjacent suitable habitat available and this species is found on the lower slopes and valley bottom away from the turbine bases and main development areas.

9.5.27 Breeding lapwing may be sensitive to disturbance, particularly during the construction period. Although studies are limited, some monitoring[2] has suggested that lapwing numbers may go down during construction of wind farms, but that the populations recover within 1-2 years following completion of construction. On that basis, a maximum of two breeding pairs of lapwing may be lost from the development site during construction, although this loss is likely to be only short-term. No significant disturbance impacts on breeding lapwing are therefore expected during construction or operation of the wind farm.

9.5.28 If lapwing were (no flight activity recorded) to fly over the development site, there may be risk of collision with turbines. The conclusion is that any impact is negligible and is not considered to represent a significant effect over the 25-year lifetime of the wind development.

Impacts on Other Species (low and negligible sensitivity)

9.5.29 Impacts on birds during construction of the wind development are most likely to be caused by habitat loss and disturbance resulting from construction activities. The area of habitat to be lost directly to components of the wind development is small at less than 9% (approximately 35ha) of the development site (Chapter 8 Ecology). Generally, this level of habitat loss is not considered a major concern in terms of impacts on birds outside designated sites (e.g. RSPB/Birdlife, 2003). It is therefore considered unlikely that the loss of this habitat would have any significant impact on any breeding species within the

[2] Landscape Design Associates 2003. *Cumulative Effects of Wind Turbines. Volume 3: Report on result of consultations on cumulative effects of wind turbines on birds*. ETSU W/14/00538/REP/3.

development site of regional or local value. Impacts resulting from disturbance are more likely to affect breeding bird populations, and these are dealt with below.

9.5.30 It can be difficult to predict the responses of birds to construction disturbance. There is an extensive scientific literature on bird responses to disturbance (e.g. Hockin *et al.*, 1992, Hill *et al.*, 1997, Davidson and Rothwell, 1993) identifying a range of factors that influence a species' sensitivity to disturbance, such as size, flocking behaviour and use of habitats. It is not possible, however, to determine from this literature specific thresholds at which birds will experience disturbance in the case of wind development construction operations. It is widely accepted that disturbance is unlikely to occur to birds more than 600m from wind farms (Drewitt & Langston, 2006), although some studies have suggested much lower distances for breeding birds (e.g. no more than 300m, Percival, 2000). There may also be a barrier effect of a wind farm, resulting in birds altering flight paths to avoid wind farms (SNH, 2000a). However, the Glenkerie proposal is a small site of 11 turbines, and any effects of flight path alterations to avoid the turbine area are unlikely to have a significant effect on bird movements.

9.5.31 Two species of regional value (low sensitivity) were recorded breeding within the development site: skylark and song thrush. It is possible that some breeding territories of these species will be disturbed, although this is most likely to occur temporarily during the construction period of the wind development. However, these species have not been identified as particularly sensitive to wind development impacts, and it is unlikely that disturbance impacts would affect the conservation status of these species in the longer-term at a regional level due to their population size and distribution. No significant impacts on these species are therefore expected to result from the construction, operation or decommissioning of the proposed wind development.

9.5.32 The remaining species recorded within the development site are all considered to be of local or of site; value (negligible sensitivity) and most species were recorded in small numbers. Vegetation clearance would be completed outwith the breeding season to avoid direct impacts on nesting birds, if operations were to proceed during the breeding season. Due to the small area to be affected by the proposed wind development, it is expected that there would be no significant impacts on the conservation status of any species of local/site value resulting from disturbance during construction or operation of the wind development.

Cumulative Impacts

9.5.33 There may be cumulative impacts of wind farms on birds, with the most risk being of significant impacts arising on species of national or international importance resulting from a number of wind farms being present in a relatively small area (e.g. Landscape Design Associates, 2000). Current guidance suggests that the highest priority for cumulative impact assessment is for species that are declining and/or not in favourable conservation status at a NHZ level or above (SNH, 2006), and

that species of high conservation importance or those vulnerable to wind farms may be targeted for cumulative assessments (SNH, 2005).

9.5.34 At this site, there are no breeding species that are considered as "very high" or of "high" sensitivity (see Table 9.2) breeding within the development site. Skylark and song thrush are breeding in the development site, both are considered as "low" sensitivity and both are listed as species either stable or unknown in NHZ 20 Border Hills. Curlew and lapwing (local value, medium sensitivity) were identified to be potentially at risk from wind farm impacts (SNH, 2006), and they are considered to be stable in NHZ 20 Border Hills. Black grouse are identified as a species of "medium" sensitivity and are in decline in the Border Hills (Natural Heritage Futures National Assessment website).

9.5.35 Due to the species composition present within the development site, the lack of breeding species of international importance it was considered unlikely that there would be significant cumulative impacts arising from the proposed wind development. A detailed cumulative impact assessment was therefore not completed.

Table 9.4: Summary of Impacts on Birds

Phase	Effect	Value	Nature of effect	Timescale of effect	Mitigation	Significance of residual impact
Construction / Decommissioning	Disturbance to pink-footed geese	International	No effect	Temporary (for construction period)	none	None
	Disturbance to black grouse	Regional	Negative	Temporary (for construction period)	Avoid operations during Mid March to May main lekking period	Minor
	Disturbance to breeding waders	Up to regional	Negative	Temporary (for construction period)	Vegetation clearance to be completed outside breeding period, if practicable. Species Protection Plans to be implemented. Habitats to be reinstated following decommissioning.	Minor
	Disturbance to breeding passerines	Up to regional	Negative	Temporary (for construction period)	Vegetation clearance to be completed outside breeding period, if practicable. Species Protection Plans to be implemented. Habitats to be reinstated following decommissioning.	Negligible
	Loss of habitat	Up to international	Negative	Permanent (for life of wind development)	Vegetation clearance to be completed outside breeding period, if practicable. Habitats to be reinstated following decommissioning.	Negligible
Operation	Collision risk to eight sensitive species	Up to international	Negative	Permanent (for life of wind development)	Wind development site does not support high levels of activity of sensitive species	Negligible
	Disturbance of birds around wind development	Up to international	Negative	Permanent (for life of wind development)	Wind development site does not support high levels of activity of sensitive species	Negligible

9.6 CONCLUSION

9.6.1 Bird surveys completed during 2005 and 2006 identified the presence of a number of important bird species. Small numbers of four breeding waders (all of local value) were identified three within the development site: curlew, lapwing, and snipe. Six species (pink-footed geese, black grouse, skylark, song thrush, linnet, and reed bunting) were considered to be of regional value. Of these, curlew (up to 3 pairs), lapwing (2 pairs), snipe (1pair), skylark (up to 12 pairs), and song thrush (2 pairs) were recorded breeding within the development site, black grouse could potentially breed in the development site although no evidence of this were recorded. A further 19 breeding and non-breeding species were identified to be of local value and a further 26 breeding and non-breeding species were identified to be of site value.

9.6.2 Black grouse ("medium" sensitivity) are the only species considered at risk of disturbance due to the presence of the wind farm, sensitivity for this species would be most significant during the construction phase of the development. Avoidance or restriction of operations close to the lek site during the lekking season. In particular at Glenkerie, because of the distance from the lekking site; adequate mitigation could involve an EcoW ensuring that no work in the vicinity of the lek started until well after dawn lekking time and that work stops well before evening lekking times. This will minimise any disturbance with the closest construction activity on the access track being phased outwith the lekking dates. During construction, the disturbance impact will be of a minor impact even if carried out during the lekking season. In addition, because the lek is approximately 1 kilometre from the nearest turbine, operational disturbance is considered negligible.

9.6.3 No significant impacts on any other bird species of regional or local value are predicted during construction, operation or decommissioning of the wind development.

9.6.4 The southern part of the development site lies in an area that is identified as a highly sensitive bird area as described by the RSPB Bird Sensitivity Map. The western part of the site is moderate sensitivity and eastern part low sensitivity for impacts on birds.

9.6.5 Overall, the development site is an area of low bird sensitivity, and the selection of this site has ensured that there will be no significant impacts on populations of important or sensitive bird species.

REFERENCES

Anon. (2003) Black Grouse Action Plan. UK UK Biodiversity Group Tranche 2 Action Plans-VolumeVI: Terrestrial and freshwater species and habitats (October 1999, Tranche 2, Vol VI p17).

Bibby, C.J., Burgess, N.D., Hill, D.A. & Mustoe, S. 2000. *Bird Census Techniques*. 2nd Edition. Academic Press, London.

Bright, J.A., Langston, R.H.W., Bullman, R., Evans, R.J., Gardner, S., Pearce-Higgins, J. & Wilson, E. 2006. *Bird Sensitivity Map to provide locational guidance for onshore wind farms in Scotland.* RSPB Research Report No. 20. RSPB, Bedfordshire.

Currie, F. & Elliot, G (1997) Forest and Birds: A guide to managing forests for rare birds. Forestry Authority Report.

Davidson, N. and Rothwell, P. 1993. Disturbance to waterfowl on estuaries. *Wader Study Group Bulletin* **68** Special Issue.

Drewitt, A.L. & Langston, R.H.W. 2006. Assessing the impacts of wind farms on birds. *Ibis* **148**: 29-42.

Gregory, R.D., Wilkinson, N.I., Noble, D.G., Robinson, J.A., Brown, A.F., Hughes, J., Procter, D., Gibbons, D.W. and Galbraith, C. 2002. The population status of birds in the United Kingdom, Channel Islands and Isle of Man: an analysis of conservation concern 2002-2007. *British Birds* **95**: 410-448.

Hill, D.A., Hockin, D., Price, D., Tucker, G., Morris, R. and Treweek, J. 1997. Bird disturbance: improving the quality of disturbance research *Journal of Applied Ecology* **34** 275-288.

Hockin, D., Ounsted, M., Gorman, M., Hill, D., Keller, V. and Barker, M.A. 1992. Examination of the effects of disturbance on birds with reference to its importance in ecological assessments *Journal of Environmental Management* **36** 253-286.

Institute of Ecology and Environmental Management (2006) *Guidelines for Ecological Impact Assessment in the United Kingdom* (version 7 July 2006). http://www.ieem.org.uk/ecia/index.html

Landscape Design Associates 2003. *Cumulative Effects of Wind Turbines. Volume 3: Report on results of consultations on cumulative effects of wind turbines on birds*. ETSU W/14/00538/REP/3.

Langston R.H.W & Pullan, J.D. 2003. *Windfarms and birds: An analysis of the effects of wind farms on birds, and guidance on environmental assessment criteria and site selection issues*. RSPB/Birdlife, Sept 2003.

Madders M. & Whitfield, D.P. 2006. Upland raptors and the assessment of wind development impacts. *Ibis* **148**: 43-56.

Percival, S.M. 2000. Birds and wind turbines in Britain. *British Wildlife* **12**: 8-15.

Percival, S.M., Band, B. & Leeming, T. 1999. Assessing the ornithological effects of wind farms : developing a standard methodology. *Proceedings of the 21st British Wind Energy Association Conference, 1999*.

Ratcliffe, D.A. 1993. *The Peregrine Falcon*. 2nd Edition. T & AD Poyser, London.

Scottish Natural Heritage 2000a. *Methodology for assessing the effects of wind farms on ornithological interests*. SNH Guidance Note Series. SNH, Battleby.

Scottish Natural Heritage 2000b. *Windfarms and birds: calculating a theoretical collision risk assuming no avoidance action.* SNH Guidance Note Series. SNH, Battleby.

Scottish Natural Heritage 2002. *Survey methods to assess windfarm impacts on upland bird communities*. SNH Guidance. SNH, Battleby.

Scottish Natural Heritage 2005. *Cumulative effect of windfarms .* Version 2 Revised. SNH Guidance, SNH, Battleby.

Scottish Natural Heritage 2005. *Survey methods for use in assessing the impacts of onshore windfarms on bird communities.* SNH Guidance. SNH, Battleby.

Scottish Natural Heritage 2006. Assessing significance of impacts from onshore *windfarms* on birds outwith designated areas. SNH Guidance, SNH, Battleby.

SNH Natural Heritage Futures National Assessment website: http://www.snh.org.uk/futures/Data/species/speciesGuide.htm

CHAPTER TEN: HYDROLOGY AND HYDROGEOLOGY

10.1. EXECUTIVE SUMMARY

10.1.1. The potential impacts associated with the construction and operation of the proposed Glenkerie Wind Farm on hydrology, hydrogeology, geology and soils have been identified and assessed in this chapter.

10.1.2. The wind farm site occupies an upland site with an area of 3.9km^2, located approximately 10km southeast of Biggar. The majority of the site is covered in a mixture of dry heath and semi-improved acid grassland, and is currently utilised for sheep and cattle grazing. The site is characterised by a steep-sided ridge of hills, running southwest to northeast, rising between two river valleys (Kingledores Burn to the south and Holms Water to the north), with steep-sided 'V'-shaped tributary valleys incised into the ridge from both sides.

10.1.3. The majority of the site is underlain by strongly folded sedimentary rocks of the Ordovician and Silurian Llandovery groups, including greywackes, siltstones, shales and brown mudstones. An igneous sill traverses the site from southwest to northeast, generally following the hilltop ridge, and consisting of rhyolitic tuff and West Linton breccia, with many fragments of rhyolitic rock. Across the majority of the site the bedrock lies at or near the surface. Superficial deposits of boulder clay occur in the steep-sided tributary valleys, while Kingledores Burn and Holms Water are underlain with alluvial deposits. A small area of peat, up to 2m deep in places, is located on Kingle Rig in the south of the site.

10.1.4. The bedrock underlying the site is impermeable, with groundwater confined to near-surface cracks and joints. The vulnerability of groundwater to chemical contamination is high, due to the limited opportunity for attenuation of contaminants before they reach the bedrock layers.

10.1.5. One private water supply has been identified which may be vulnerable to damage during construction activities. A Scottish Water supply pipe also crosses 3m under the entrance route to the site, and could be vulnerable to damage during construction of the access track. A livestock drinking pool, to supply livestock held in a lambing field, is located off the Glenkerie Burn above its confluence with Kingledores Burn. This supply will be cut off by the proposed access track route, and an alternative supply will be provided.

10.1.6. The River Tweed, and its tributaries, is designated as a Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI) for its Atlantic salmon, Brook lamprey, River lamprey, Sea lamprey, otter and floating water-crowfoot vegetation. These qualifying features (especially migrating and spawning fish populations) will be very sensitive to any sediment and chemical contamination originating from the wind farm development site. Robust mitigation measures are planned for the

construction, operation and decommissioning of the site and are detailed later in the chapter.

10.1.7. Part of the proposed development access route crosses the active Kingledores Burn floodplain. There is a risk of flooding in this area during construction activities, which poses a potential health and safety risk to site operatives and also a risk to water quality if construction materials have been stored within the floodplain. In both cases mitigation procedures will be implemented.

10.1.8. Wind farm construction, operation and decommissioning will involve many activities which may potentially affect the hydrological and hydrogeological receiving environment. These activities have been identified, an assessment made of their potential effects and mitigation planned to remove or minimise the impacts.

10.1.9. Potential polluting activities are most likely to occur during the construction phase. The effects most likely to be associated with construction of a wind farm are:

- Changes to the natural drainage patterns;
- Effects on base flows;
- Effects on runoff rates and volumes;
- Effects on erosion and sedimentation;
- Effects on water quality, of both groundwater and surface waters;
- Effects on groundwater levels;
- Effects on water resources i.e. private and public water supplies;
- Effects on flooding and impediments to flows.

10.1.10. Potential effects most likely to impact on the receiving environment include chemical pollution (from fuel or concrete) and sedimentation/ erosion during the construction phase. These effects are most likely to have detrimental impact on the sensitive receptors identified above without any mitigation.

10.1.11. Best practice measures to mitigate against all potential effects during the construction, operation and decommissioning phases have been outlined. In order to ensure that these measures are carried out, a site Construction Method Statement (CMS) will be drawn up and adhered to by all site contractors.

10.1.12. With adoption of the proposed mitigation measures, the wind farm development has been assessed as having the potential to give rise to adverse impacts of minor significance or lower in relation to soils, geology hydrology and hydrogeology.

10.2. INTRODUCTION

10.2.1. This chapter presents an assessment of the potential impacts of the proposed Glenkerie Wind Farm on hydrology, hydrogeology, geology and soils.

10.2.2. Key objectives of the assessment were:

- To identify key baseline hydrological and hydrogeological catchment conditions of the site;
- To identify potential sensitive receptors;
- To identify the potential effects of the proposed development on baseflows, runoff rates and volume, erosion and sedimentation, water quality, water resources, and upstream and downstream flooding;
- To provide mitigation measures for the identified potential effects;
- To assess the significance of residual impacts of the development on hydrology, hydrogeology, geology and soils; and
- To identify a suitable borrow pit location.

10.3. METHODOLOGY

Baseline Studies

10.3.1. A baseline description of the local environment was formed through:

- Consultation with relevant statutory bodies and key stakeholders;
- Review of legislative framework and assessment guidance;
- Walkover survey of the site;
- Desk review of published information; and
- Assessment of catchment characteristics using Flood Estimation Handbook (FEH) software.

Assessment of Effects

10.3.2. On completion of the baseline review, the potential effects of the wind farm development were assessed through:

- Identification of construction and operational activities and their potential effects on hydrology, hydrogeology, geology and soils;
- Identification of appropriate mitigation measures;
- Assessment of the significance of residual impacts of the wind farm, taking into account the sensitivity of the receiving environment, the potential magnitude (scale of duration) of effect, and the likelihood of that effect occurring after mitigation.

10.3.3. Diagram 10.1 shows that the residual significance (the significance following mitigation) of an effect depends on the predicted magnitude of

the impact and the sensitivity of the receiving environment, as outlined in Table 10.1 The likelihood of the impact occurring is then also taken into account, as outlined in Table 10.2.

Diagram 10.1: Summary of Process to Identify Significance of Impacts

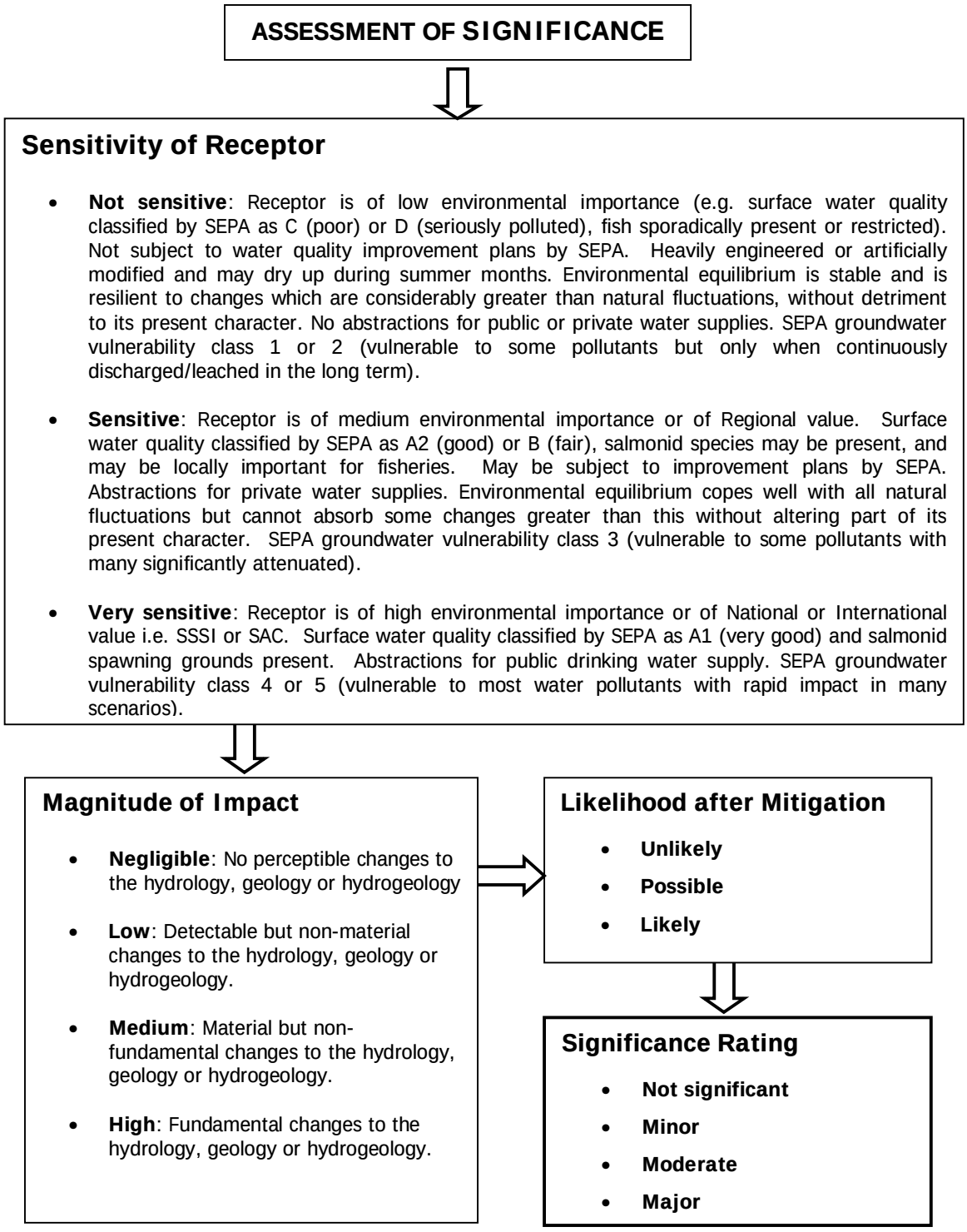

Table 10.1: Sensitivity v Magnitude

	Sensitivity		
Magnitude Category	**Not sensitive**	**Sensitive**	**Very Sensitive**
Negligible	Not significant	Not significant	Minor
Low	Not significant	Minor	Moderate
Medium	Minor	Moderate	Moderate
High	Minor	Moderate	Major

Table 10.2: Residual Significance

	Likelihood		
Sensitivity v Magnitude	**Unlikely**	**Possible**	**Likely**
Not Significant	Not significant	Not significant	Not significant
Minor	Not significant	Minor	Minor
Moderate	Not significant	Minor	Moderate
Major	Minor	Moderate	Major

10.4. BASELINE STUDIES

Consultation

10.4.1. Table 10.3 shows the responses received during consultations:

Table 10.3: Consultation responses

Consultee	Response
Scottish Borders Council	No specific comments regarding hydrology or hydrogeology.
SEPA, Edinburgh Office	The ES should address: • Construction works associated with the development and mitigation of pollution risk; • Treatment of surface water run-off from site and use of SUDS; • Disposal of foul drainage from the proposed development; and • Stream crossings and other engineering works. Water quality: • Construction activities pose a threat of water pollution due to release of sediment from exposed surfaces, accidental spillage, and concrete works. Risk of pollution is increased during period of high rainfall. Steps must be taken to ensure that the work does not cause mud, silt or concrete to be washed away during construction stage or as a result of subsequent erosion; • Refer to SEPA's Pollution Prevention Guidelines; • Provide bunding or containment to retain spillage or leakage of fuel oil and other chemical substances stored on site. Standard requirement is provision of containment capacity of 110% of the volume stored; • Consider requirements for disposal of sewage if 'Portaloos' are not to be used; • Ensure no pollution to nearby private water supplies during or after construction; and • SEPA prefer bridge crossings instead of culverts where possible.

Consultee	Response
SNH	Recommend that SEPA and Tweed Foundation are consulted over water quality, river classifications and fisheries matters.
Scottish Borders Council Environmental Health	Provided information on private water supplies located in the vicinity of the development site.
Scottish Water	• There are SW water assets in the area that may be affected by the proposed development. It is therefore essential that these assets are protected from the risk of contamination and damage. This also applies to watercourses that feed into reservoirs; and • Provided plans of Scottish Water infrastructure in the vicinity of the proposed development area.
Tweed Foundation	No response received at the time of report issue.

Legislative Framework and Assessment Guidance

10.4.2. The Glenkerie Wind Farm proposal has been assessed in accordance with the Environmental Impact Assessment (Scotland) Regulations 1999 and under the legislative framework of the Control of Pollution Act 1974 (as amended) Part II: Pollution of Water, and the Water Framework Directive (WFD) (2000/60/EC). This legislation provides the overall objective to protect, maintain and in some cases improve the water environment.

10.4.3. The WFD has been translated into Scottish Legislation through the Water Environment and Water Services (Scotland) Act 2003 (WEWS Act) and has been implemented through the Water Environment (Controlled Activities) Regulations 2005 (known as "CAR"). The CAR have upgraded existing statute and introduced new regimes to ensure Scottish law is compliant with the WFD. The new regulations address point source pollution, abstraction and impoundments, and building and engineering works in, or adjacent to, the fresh water environment. Under the regulations it is now necessary to gain a CAR authorisation, through 'General Binding Rules' , Registration, or Licence (depending on the potential risk associated with the activity), to carry out the above activities.

10.4.4. The legislation and guidance used in the assessment is outlined in Table 10.4.

Table 10.4: Assessment and Mitigation Methodology Guidance

Topic	Sources of Information
Legislation	Water Environment (Controlled Activities) Regulations 2005 Water Framework Directive (2000/60/EC)(WFD), and Water Environment and Water (Scotland) Act (WEWS Act) 2003 Environmental Impact Assessment (Scotland) Regulations 1999 Control of Pollution Act 1974 (as amended) Part II: Pollution of Water EC Freshwater Fish Directive (78/659/EEC), and the Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003
SEPA Policies	No. 19: Groundwater Protection Policy for Scotland, Dec 2003 No. 26: Policy on the Culverting of Watercourses No. 54: Land Protection Policy
National Planning Policy Guidelines	NPPG 7 Planning and Flooding
Scottish Executive Planning Advice Notes (PANs)	PAN 58 Environmental Impact Assessment PAN 61 Planning and Sustainable Urban Drainage Systems
SEPA Pollution Prevention Guidelines (PPGs)	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: Pollution incident response planning PPG22: Dealing with spillages on highways
CAR Guidance	SEPA: Water Environment (Controlled Activities) (Scotland) Regulations 2005 – A Practical Guide, March 2006 SEPA: Special Requirements for Civil Engineering Contracts for the Prevention of Pollution V2, 2006, Ref SG31 SEPA: Position Statement to support the implementation of the Water Environment (Controlled Activities) (Scotland) Regulations 2005, Culverting of watercourses V2, December 2006

Topic	Sources of Information
Other Guidelines	CIRIA: Environmental Good Practice on Site, 2005 CIRIA: Sustainable Urban Drainage Systems Design Manual for Scotland and Northern Ireland, March 2000 CIRIA: Control of water pollution from construction sites, C532, 2001 CIRIA: Control of water pollution from linear construction projects, C648, 2006 Forestry Commission: Forests and Water Guidelines Edition 4, 2003 HMSO Preparation of Environmental Statement for Projects that Require Environmental Assessment A Good Practice Guide, 1995. SNH: A Handbook on Environmental Impact Assessment SNH: Constructed Tracks in the Scottish Uplands, September 2006 SNIFFER: Development of a groundwater vulnerability screening methodology for the Water Framework Directive, September 2004. Scottish Executive: River Crossings and Migratory Fish: Design Guidance, April 2000

Data Sources

10.4.5. A desktop study was carried out in order to gather baseline data on the development site; the sources consulted are outlined in Table 10.5.

Table 10.5: Baseline Data and Published Information Collected

Topic	Sources of Information
Geology	Geological Survey of Scotland 1:50,000 Sheet 24(W), Biggar, Soild and Drift Edition; 16(W), Moffat, Drift Edition (no solid edition available).
Soils	Soil Survey of Scotland 1:63,360 Sheet
Climate	The National River Flow Archive: http://www.ceh.ac.uk/data/nrfa/index.html
Topography	Ordnance Survey 1:50,000 map sheet 72, 1:25,000 map sheet 336, and 1:10,000 map (digital edition)
Surface Waters	Ordnance Survey 1: 50,000 map sheet 72, 1:25,000 map sheet 336 and 1:10,000 map (digital edition) http://www.sepa.org.uk/data/classification/index.htm National River Flow Archive: http://www.ceh.ac.uk/data/nrfa/index.html Institute of Hydrology (IH), 1999. Flood Estimation Handbook and CD ROM.
Groundwater	British Geological Survey Groundwater Vulnerability Map of Scotland 1: 625,000. Hydrogeological map of Scotland, British Geological Survey, scale 1: 625,000, 1988. SEPA Groundwater Vulnerability Maps Institute of Hydrology (IH), 1999. Flood Estimation Handbook and CD ROM.

Description of Baseline Environmental Information

10.4.6. A baseline description of the local environment was formed through:

- A desktop study of relevant information (outlined in Table 10.5);
- Consultation with the relevant bodies (outlined in Section 10.4.1); and
- Field surveys, as outlined below.

10.4.7. A site visit was carried out on the 2nd August 2007. The weather conditions were warm and dry. The weather conditions in the week preceding the site visit had been mixed with occasional showers. The site visit included:

- An inspection of land use, topography, soils and surface water features in order to understand the local topography and hydrological regime;
- Verification of printed data provided by geology, soil and hydrogeology maps;
- Inspection of each of the proposed turbine locations and watercourse crossing points; and
- Identification of areas suitable for potential borrow pit locations.

10.4.8. This level of site investigation is sufficient for the purposes of this assessment.

10.5. BASELINE DESCRIPTION

10.5.1. This section presents information gathered regarding the existing topographical, geological, hydrological and hydrogeological conditions at the proposed site and its immediate surroundings.

Site Description

10.5.2. The proposed wind farm occupies an upland site with an area of 3.9 km^2, located approximately 10km southeast of Biggar. The majority of the site is covered in a mixture of dry heath and semi-improved acid grassland, and is currently utilised for sheep and cattle grazing. The site is characterised by a steep-sided ridge of hills rising between two river valleys (Kingledores Burn to the south and Holms Water to the north), with steep-sided 'V'-shaped tributary valleys cutting into the ridge from both sides. The highest point on the site is Glenlood Hill at 566m AOD (above Ordnance Datum). The lowest point is at the entrance to the site by Kingledores, at approximately 230m AOD.

Hydrology

10.5.3. The area surrounding the site can be split into two main catchments based on the drainage patterns, namely Kingledores Burn to the south

and Holms Water to the north, each of which can be further divided into several sub-catchments, as shown in Figure 10.1. All watercourses draining from the site subsequently feed into the River Tweed.

Kingledores Burn Catchment

10.5.4. The Kingledores Burn catchment drains an area of 15km^2 before it joins the River Tweed, 3.5km downstream from the development site. The catchment drains the south eastern half of the site via four sub-catchments, namely Hare Burn, Glenkerie Burn, Glenkiely Burn and Benshaw Burn. Each sub-catchment is characterised by steep-sided 'V'-shaped valleys, containing predominantly rainwater fed, moderate to fast flowing upland streams, originating from wet flushes in their upper reaches. Each sub-catchment shows signs of erosion and instability of the thin soils on the steep valley sides, with evidence of landslips and scouring apparent in numerous locations. The most heavily eroded areas can be seen on the 1:10,000 OS map as shown in Figure 10.1.

10.5.5. Kingledores Burn itself flows in a north easterly direction just outside but along the south eastern boundary of the site. The burn is approximately 2 to 3m wide, and meanders across a wide (50 to 200m), well-developed floodplain. The bed substrate consists of gravels and cobbles, potentially suitable as spawning grounds for Salmonids and other fish (see paragraph 10.5.35 for further details). In places the valley sides have been eroded by undercutting of the river meanders. There is also evidence of recent flooding, with debris and trash lines on the river floodplain.

10.5.6. Two additional unnamed tributaries of Kingledores Burn cross the access track entrance route to the east of Kingledores Burn. These are small watercourses, approximately 1m wide, originating from springs on the northern slope of Nicklebeard Hill. The burns converge and join Kingledores Burn near the farm buildings at Kingledores.

10.5.7. An abandoned and degraded weir, with evidence of a sluice gate controlling a former off-take pipe, was found at National Grid Reference (NGR) NT 10241 27968 (see Figure 10.1). This off-take was part of a small hydro-electric scheme, which at one time was used to supply electricity to the Kingledores properties prior to connection with the National Grid. In its current state of condition the defunct weir may present a barrier to fish migration during low flows.

10.5.8. A livestock drinking water point is located on Glenkerie Burn at NGR NT 09223 27264, to allow drinking water access by livestock held in the lambing field to the west (see Figure 10.1).

10.5.9. Several existing bridges and culverts were identified within this catchment. Table 10.6 summarises the characteristics of each crossing.

Table 10.6: Existing Culverts and Bridges

Map ID	Location (NGR)	Watercourse	Bridge / Culvert	Dimensions	Condition and additional notes
A	308409 626451	Hare Burn	Bridge	3m wide, 2m span	Constructed from wooden beams on iron supports. No evidence of flooding upstream, no barrier to fish migration. Will not require upgrading as part of the development.
B	309060 627103	n/a	Culvert	300mm diameter	Plastic pipe culvert beneath access track. No watercourse at this point and no water at time of the visit. Installed for field drainage purposes.
C	309246 627275	Glenkerie Burn	Bridge	4m wide, 2m span	Pre-cast concrete bridge where existing access track crosses Glenkerie Burn. No evidence of flooding upstream and no barrier to fish migration. Will not require upgrading as part of the development.
D	309664 627745	Glenkiely Burn	Culvert	1200mm diameter	Cast iron culvert beneath existing access track. Large drop at downstream end (>2m). Barrier to fish migration. May require extending as part of the development.
E	310205 628014	Kingledores Burn	Bridge	3m wide, 3m span	Pre-cast concrete bridge where existing access track crosses Kingledores Burn. Evidence of flooding upstream from the bridge, no barrier to fish migration. This crossing will require upgrading/ replacing as part of the proposed development.

Holms Water Catchment

10.5.10. The Holms Water catchment drains an area of 26km^2, upstream from where it joins the River Tweed, approximately 8km downstream from the development site. The catchment drains the north western half of the site via two sub-catchments, namely Glencotho Burn and Hare Burn North. As with Kingledores Burn, each sub-catchment is characterised by steep-sided 'V'-shaped valleys, containing predominantly rainwater fed, fast flowing upland streams, with limited groundwater baseflow. Each sub-catchment also shows signs of erosion and instability on the steep valley sides, with evidence of landslips and scouring apparent in numerous locations.

10.5.11. Holms Water itself flows in a north easterly direction from the site, and appears to be more heavily modified than Kingledores Burn, with evidence of field drainage ditches across parts the floodplain. This watercourse also has a lower water quality classification than Kingledores Burn (see Section 10.5.34), due to modification by human activities. A weir is located on Holms Water approximately 7km downstream from the site at

NGR NT 111 341. This may present a barrier to fish migration further upstream.

10.5.12. There are no other hydrological features of note within the Holms Water catchment and its associated sub-catchments. None of the proposed wind farm infrastructure is located within this catchment.

10.5.13. **Key hydrological features** are summarised as:

- Two catchments drain the proposed development site; Kingledores Burn to the south and Holms Water to the north;
- Steep-sided 'V'-shaped valleys containing tributary streams draining from the site, with significant evidence of erosion and instability on the steep slopes;
- An abandoned weir on Kingledores Burn at the downstream end of the development site;
- A livestock drinking water point on the Glenkerie Burn;
- Several bridges and culverts within the Kingledores Burn catchment, some of which will require upgrading/ replacing as part of the proposed development.

10.5.14. Identified catchment features are shown in Figure 10.1.

Solid Geology

10.5.15. The 1:50,000 Geological Survey of Scotland Solid Geology Map (Biggar, Scotland Sheet 24(W)) indicates that the majority of the site is underlain by strongly folded sedimentary rocks of the Ordovician group, including greywackes, siltstones and shales. The south eastern edges of the site are underlain by sedimentary rocks of the Silurian Llandovery group, namely greywackes and shales, brown mudstones and siltstones. An igneous sill (approximately 100m wide) traverses the site from southwest to northeast, generally following the hilltop ridge, and consisting of rhyolitic tuff and breccia of West Linton, with many fragments of rhyolitic rock. A small area (max 500m by 150m) of Carboniferous limestone from the Lower Limestone Group is located to the north of Cocklie Rig Head at NGR NT 089 293. A disused quarry was identified at this approximate location (see Figure 10.1). No solid geology map of the southern portion of the site has been published.

10.5.16. It is proposed that rock material won from cuttings made during construction of the access track will be used as a base material to form the access tracks. This will save a considerable amount of road movements and this option is discussed in detail in Chapter 13 (Transport). However, it is recommended that a detailed geotechnical investigation to assess the suitability of this material for road construction is included in any consent as a planning condition. It is also recommended that aggregate for road capping purposes within 50m of any watercourse and within the Kingledores floodplain is sourced from outside the development site. This is because the fine-grained

sedimentary properties of the underlying rock material may be vulnerable to erosion and could lead to sedimentation of watercourses.

10.5.17. The solid geology is representative of the region, and no features of geological note have been identified. Consequently, the sensitivity of the solid geology at Glenkerie is assessed as **low**.

Superficial Geology and Soils

10.5.18. The 1:50,000 Geological Survey of Scotland Drift Geology Maps (Biggar and Moffat, Scotland Sheets 24(W) and 16(W)) indicate that across the majority of the site the bedrock lies at or near the surface. Superficial deposits of boulder clay (tenacious brown or blue-grey clay with a variable sand content, containing many rounded and striated pebbles and boulders, mostly of local rock types) occur in the steep-sided valleys containing Benshaw Burn, Glenkerie Burn, Glencotho Burn and Hare Burn. Kingledores Burn and Holms Water. These are underlain with alluvial deposits, and the area surrounding Kingledores and the site entrance is overlain with glacial meltwater deposits.

10.5.19. The BGS drift map identifies no peat deposits on site, suggesting that there are no areas with a peat depth greater than 0.5m. A peat depth survey of the site was undertaken on 2nd August 2007. All measurements taken were less than 0.5m deep. Further field investigation revealed some localised areas where the peat depth may be up to 2m on Kingle Rig. This is inferred from old peat cuttings across the Kingle Rig spur, where the bedrock can be seen to be between 1 and 2m below the peat surface. Localised wet modified bog habitat was also identified on the Kingle Rig spur (see Figure 8.1), indicating peat depths of at least 0.5m.

10.5.20. No evidence of historical and/or current peat landslide activity or indicators of instability were found on the site. Typical indicators searched for included historical and recent failure scars and debris, evidence of 'peat creep', presence of seeps, springs and waterbodies, presence of cracking relating to drying/drainage, and presence of features indicative of tension (cracks and tears) or compression (ridges or extrusions).

10.5.21. In those areas where the peat depth is between 0.5 and 2m, the slopes encountered are less than 1 in 10. Due to the generally shallow peat depths, and low slope angles encountered in areas of deeper peat, it is considered that there is **low** peat slide risk on the development site.

Hydrogeology

10.5.22. The Groundwater Vulnerability Map of Scotland (BGS, 1995) describes the bedrock in the area as weakly permeable, not widely containing groundwater in exploitable quantities. However, some formations can locally yield water supplies in sufficient quantities for private/domestic use.

10.5.23. The 1:625,000 Hydrogeological Map of Scotland (BGS, 1988) shows that the region is underlain by impermeable rocks from the Silurian and Ordovician eras (as described from the solid geology maps of the area), generally without groundwater except at shallow depth. These rocks are largely shales and greywackes, with groundwater confined to near-surface cracks and joints. Rare springs and boreholes produce weakly mineralised water except where contact is made with sulphide-rich black shales.

10.5.24. SEPA's Aquifer and Groundwater Vulnerability Maps have also been consulted. The majority of the site does not contain any superficial aquifers, although the area surrounding Glencotho Burn to the north is underlain with a superficial aquifer of low productivity intergranular flow. Groundwater flow within bedrock beneath the site is by means of fracture flow only, and of low productivity. The Groundwater Vulnerability Map shows that the vulnerability of the uppermost aquifer beneath the development site area is classed as between 5 and 4c (where 5 is most vulnerable and 1 is least vulnerable). The high vulnerability is due to the limited opportunity for attenuation of contaminants, as groundwater flow within the bedrock is by fracture flow only. The highest vulnerability is found on the highest parts of the site where bedrock is at or near the surface, with the lower classes (4a, b and c) in the valleys containing superficial boulder clay deposits.

10.5.25. Groundwater is classed as a **very sensitive receptor**, because flow is through fractures only and there is little opportunity for attenuation of contaminants. The bedrock is of relatively low productivity as an aquifer, so the volumes of groundwater present are likely to be generally low, but local fractures may produce larger local volumes of groundwater.

Water Resources

10.5.26. Scottish Borders Council Environmental Health was consulted regarding private water supplies within and near the development site. Properties near the site, obtaining their drinking water from private water supplies located within sub-catchments draining from the site, are shown on Figure 10.1. Table 10.7 summarises the information available on each of these supplies.

Table 10.7: Private Water Supplies

Map ID	Property	Grid Reference	Type of Supply	Treatment	Catchment
1	Holmswaterhead	NT 07129 28570	Stream abstraction	None	Hare Burn North
2	Glencotho	NT 08405 29965	Spring	None	Glencotho Burn
3	Kingledores	NT 10541 28104	Spring	None	Kingledores Burn

10.5.27. The Kingledores private water supply originates from a spring located on the northern slope of Nicklebeard Hill, from which it is piped to the Kingledores properties below the proposed access route. The supply pipe therefore crosses under the proposed access route and will be vulnerable to damage during construction of the access track. The catchment area

of the spring itself lies above the proposed development, and the supply will therefore not be vulnerable to temporary sediment or chemical pollution during construction activities. The Holmswaterhead and Glencotho water supplies are unlikely to be impacted by construction activities, as no wind farm infrastructure is located within the Holms Water catchment.

10.5.28. Scottish Water was consulted regarding public water supply infrastructure within or near the development site. A Scottish Water supply pipe, transporting water from the Talla and Fruid reservoirs to Edinburgh, crosses the entrance route to the site (see Figure 10.1). This pipe is 3m below the ground surface, and could be vulnerable to damage during construction of the access track unless mitigation measures are implemented. A Scottish Water man hole, for accessing the supply pipe, is also located adjacent to the access track at NGR NT 10609 27873.

10.5.29. A livestock drinking water point is located on Glenkerie Burn at NGR NT 09223 27264, to allow drinking water access by livestock held in the lambing field to the west. This will need to be repositioned to facilitate the track construction.

10.5.30. Water resources are therefore classed as a **very sensitive** receptor.

Water Quality

10.5.31. SEPA's River Quality Classification (2006 data) Interactive Map was consulted to identify the existing water quality of streams draining from the development site.

10.5.32. Kingledores Burn, above the A701, and the River Tweed, at Lyneford, have both been classified as A1 'Excellent', as they are of excellent quality in terms of biology, chemistry, nutrients and aesthetics. This means these watercourses have not been impacted by human activity and support a sustainable fish population. Kingledores Burn and the River Tweed are therefore **very sensitive receptors**.

10.5.33. Holms Water has been classified as B 'Fair'. Consultation with the SEPA Galashiels office confirmed that this classification is due to the watercourse ecology. No further information on this classification was available. Holms water is therefore classified as a **sensitive receptor**.

Fisheries

10.5.34. The River Tweed and Kingledores Burn have been identified as official Salmonid Waters by SEPA, and are designated as a SAC and SSSI for their fish populations (Atlantic salmon, brook, river and sea lamprey) among other qualifying interests (see Section 10.5.40 for further details). The river also supports significant populations of sea trout and brown trout, with suitable gravel bed spawning habitat for all species widespread. Both salmon and brown trout are known to use Kingledores Burn as a spawning ground, and have been recorded in the watercourse in 2006 and 2007.

10.5.35. The strongest run of salmon occurs in the autumn, with a smaller spring run mainly into the Whiteadder Water and Ettrick Water. Sea trout run all parts of the river from spring to autumn and spawn in the upper reaches of the tributaries. Visual inspection of Kingledores Burn confirmed that the bed substrate is potentially suitable for both salmon and trout spawning. Spawning will occur between November and December, and the eggs will usually hatch in early spring, depending on water temperature. The young fish (alevins) will remain developing within the gravel until they emerge in April or May (www.atlanticsalmontrust.org). Salmon and trout will therefore be most sensitive to potential impacts of the development (e.g. release of sediments) between November/December and April/May, when the eggs and alevins could be smothered by sediment deposits.

10.5.36. River, brook and sea lamprey have slightly different life cycles and habitat requirements to salmonids. River and brook lamprey spawn in March or April, once the water temperature increases to 10 or 11°C, in areas of gravely and stoney bed substrate. The eggs will hatch within one month, and the larvae will travel to slower flowing nursery areas of sandy silt substrate. Sea lamprey have similar habitat requirements for spawning and nursery areas, but spawning will take place slightly later in May/June. River, brook and sea lamprey will be most sensitive to potential impacts of the development (e.g. smothering of spawning and nursery areas with fine sediments) between March and July/August.

10.5.37. The Tweed Foundation in Melrose were consulted regarding the development proposal on 31st July and 17th October 2007. No response was forthcoming at the time of writing.

10.5.38. Fisheries are classed as a **very sensitive** receptor due to the presence of Salmonids and lamprey species, which are of ecological, social and economic value.

Designations

10.5.39. The River Tweed, including Kingledores Burn and Holms Water, is designated as a SAC. Qualifying features include Atlantic salmon (*Salmo salar*), Brook lamprey (*Lampetra planeri*), River lamprey (*Lampetra fluviatilis*), Sea lamprey (*Petromyzon marinus*), otter (*Lutra lutra*) and floating water-crowfoot vegetation (*Ranunculion fluitantis* and Callitricho-*Batrachion*).

10.5.40. The River Tweed, excluding Kingeldores Burn and Holms Water, has also been designated as a SSSI. Notified features include Atlantic salmon (*Salmo salar*), Brook lamprey (*Lampetra planeri*), River lamprey (*Lampetra fluviatilis*), Sea lamprey (*Petromyzon marinus*), beetles, flies, and its vascular plant assemblage.

10.5.41. The River Tweed and its tributaries are therefore **very sensitive receptors** in terms of their designations.

Climate

10.5.42. SEPA operate a rain gauge at Kingledores on the River Tweed (NGR NT 109285), approximately 1km east of the development site. Rainfall data collected at this site from 1993 to 2007 indicates an average annual rainfall of 1227 mm (data provided by SEPA, Galashiels Office). The Hydrogeological Map of Scotland (1988) indicates that the regional rainfall is between 1200 and 1600 mm per year. The Institute of Hydrology Flood Estimation Handbook CD Rom catchment descriptors for the site give an average annual rainfall of 1348 mm per year.

10.5.43. Table 10.8 shows the 1993 to 2007 average monthly rainfall data from Kingledores, River Tweed.

Table 10.8: Average monthly rainfall at Kingledores, River Tweed

Month	**1993 to 2003 Average rainfall (mm)**
January	137
February	120
March	92
April	74
May	79
June	71
July	78
August	80
September	87
October	142
Novermber	123
December	144
Year	**1227**

Catchment Analysis

10.5.44. Two river gauging stations are located on the River Tweed near the development site. Kingledores gauging station (station number 021014, NGR NT 109285) is located on the River Tweed approximately 50m upstream from its confluence with Kingledores Burn. Lyne Ford gauging station (station number 021005, NGR NT 206397) is located on the River Tweed approximately 15km downstream from the development site. However, the catchments draining the development site are ungauged, therefore design flows have been calculated using the methodology detailed below.

10.5.45. The Flood Estimation Handbook (FEH) provides guidance on the most up-to-date methods for assessing the hydrological properties of rivers and burns in the UK, with the accompanying Digital Terrain Model (DTM) providing details on the extent and characteristics of each water catchment. The FEH has been used to determine catchment boundaries and design flows for a range of hydrological features. Figure 10.1 shows the catchments identified by the FEH DTM model.

10.5.46. The FEH CD Rom and the revitalised FSR/FEH rainfall runoff method spreadsheet v1.3 have been used to estimate design flows for each catchment. Low flows have been estimated using the methodology recommended in the Institute of Hydrology Report No. 108 (1992), 'Low flow estimation in the UK'. These flows are summarised in Table 10.9.

Table 10.9: Indicative catchment design flows

Catchment Drainage Areas								
Watercourse	**Kingledores Burn**	**Hare Burn South**	**Glenkerie Burn**	**Glenkiely Burn**	**Benshaw Burn**	**Holms Water**	**Glencotho Burn**	**Hare Burn North**
Area (km^2)	15.14	0.9	1.17	0.67	0.87	11.57	1.71	1.15
NGR location	310850 628500	308400 626450	309300 627250	309650 627750	310300 628200	308200 630000	308250 629900	307100 628600
Return Period (Years)	**Discharge (m^3s^{-1})**							
2	14.1	1.4	1.6	0.9	1.1	11.6	2.1	1.7
5	18.6	1.9	2.2	1.3	1.5	15.3	2.8	2.2
10	22.2	2.3	2.7	1.6	1.8	18.2	3.4	2.7
25	26.8	2.8	3.3	1.9	2.2	21.9	4.1	3.3
50	30.9	3.2	3.8	2.2	2.6	25.2	4.7	3.9
100	35.8	3.8	4.5	2.6	3.0	29.1	5.5	4.6
200*	50.2	5.4	6.4	3.6	4.3	40.6	7.7	6.5
Low Flows Q95	0.047	0.002	0.003	0.002	0.003	0.043	0.006	0.003
Mean Flow	0.443	0.026	0.034	0.018	0.023	0.346	0.048	0.034

N.B. Potential evaporation is taken as 424 mm/yr (Hydrometric Register and Statistics 1996-2000, Tweed at Kingledores). *20% added to the 200 year flood to allow for climate change

Flood Risk

10.5.47. SEPA's Indicative River and Coastal Flood Map of Scotland was consulted to identify those areas potentially at risk of flooding. Within the development site boundary, the Kingledores Burn floodplain is identified as having a 0.5% or greater chance of flooding each year (i.e. lies within the 1 in 200 year flood level). Anecdotal evidence of flooding, from a local landowner, suggests that Kingledores Burn has been known to flood in its lower reaches (around the existing bridge at NGR NT 102280), up to a level of 1m above the current ground surface level at the bridge.

10.5.48. Out with the site boundary, the Kingledores Burn, where it joins the River Tweed, and the River Tweed floodplain itself, downstream from the development site, are identified in places as having a 0.5% or greater chance of flooding each year. The Holms Water floodplain, to the north of the development site, is also within the 1 in 200 year flood level.

10.5.49. The properties located at Kingledores, downstream from the development site, lie above the 1 in 200 year flood level.

10.5.50. Scottish Borders Council holds no records of historical flooding on the River Tweed between Kingledores and Drumelzier (7km downstream).

10.5.51. The Kingledores Burn floodplain, and the properties located at Kingledores, are potentially **very sensitive** to flood risk caused by changes in surface runoff volumes from the development site, construction of infrastructure within the Kingledores floodplain, and upstream and downstream changes in water level on the River Tweed.

10.6. ASSESSMENT OF EFFECTS

Site Sensitivity

10.6.1. Hydrologically sensitive receptors for the site, as identified in Section 10.5, are considered to be surface watercourses (for their environmental designations, water quality and fisheries interests), groundwater, and public, private and livestock water supplies. Parts of the site, within the Kingledores floodplain, are also at risk of flooding.

10.6.2. Surface watercourses, groundwater and public water supplies are considered to be **very sensitive receptors**, while private and livestock water supplies are considered to be **sensitive receptors** (refer to Diagram 10.1 for a full explanation).

10.6.3. The following section will therefore address the potential impacts of all phases of the proposed wind farm development (construction and operation) on the above sensitive receptors. Decommissioning activities are assumed to be similar to construction activities, and are therefore not discussed separately in this assessment.

Assessment of Construction Effects

10.6.4. The construction phase of the wind farm development is the phase most likely to give rise to adverse environmental effects, as many of the activities involved can cause runoff and mobilisation of sediments which in turn could lead to pollution of surface and ground water and hence require control and management. Activities relating to chemical contamination during construction and operation may also require management and control.

Construction Activities

10.6.5. **Access Road** – the access road comprises approximately 7.8 kilometres of new track (width 5 metres), and upgrading of 1.3 kilometres of existing track. Five new watercourse crossings will be required as part of the development. Watercourse crossings may require a CAR registration or licence from SEPA:

- Crossing 1 (NT 10479 27924) – proposed culvert crossing of small tributary (<1m wide) of Kingledores Burn;
- Crossing 2 (NT 10378 27964) – proposed culvert crossing of small tributary (<1m wide) of Kingledores Burn;
- Crossing 3 (NT 10204 28005) – proposed bailey bridge crossing of Kingledores Burn, upstream from existing bridge crossing;
- Crossing 4 (NT 09664 27745) – proposed replacement of existing culvert crossing (culvert D on Figure 10.1) over Glenkiely Burn with a bottomless culvert;

- Crossing 5 – proposed bottomless culvert crossing of Glenkerie Burn, upstream from existing bridge crossing.

10.6.6. Potential effects of the construction of the access track without any mitigation include:

- Release of sediments into local watercourses following stripping of soils to build the access roads;
- Risk of land slippage on steep slopes if excavated material is stock-piled on slopes above and below access track route, resulting in release of sediments into watercourses below;
- Destruction of salmonid and lamprey spawning beds, and negative impacts on fish larvae during their growth stage, caused by release of sediments into watercourses during sensitive periods;
- Risk of chemical pollution from spillage or leakage of oils and fuels from the machinery during excavation and construction;
- Risk of sediment or chemical contamination of private water supplies;
- The livestock drinking water supply point for the lambing field will be destroyed by the proposed access track route. An alternative supply will be provided;
- Risk of damage during construction activities to Scottish Water's public water supply mains pipe, which crosses the site entrance route
- Alteration of drainage characteristics by providing either new overland flow paths or a barrier to overland and subsurface flow;
- Risk of compaction of soils from movement of construction traffic, leading to reduced permeability and rainfall infiltration. This could lead to an increase in runoff and therefore an increase in erosion;
- Increased runoff may also occur from the increase in hardstanding;
- Increased flood risk to downstream properties (especially at Kingledores) caused by increased surface runoff and/or inappropriately designed watercourse crossings and access tracks
- Barriers to fish migration caused by inappropriately designed watercourse crossings; and
- A health and safety risk to site operatives associated with construction of the access track across the Kingledores floodplain.

10.6.7. **Turbine bases** – the proposed turbines will require excavation of foundations to a suitable depth, as determined by a detailed geotechnical survey. These will be filled with concrete and reinforced steel and, if found to be of suitable material, the excavated material will be used as hard core for road construction and for the adjacent temporary surface required for construction. Potential effects of construction of turbine bases include:

- Excavations have the potential to fill with rain water, surface runoff, and passive groundwater seepage from cut faces, and in such instances water will have to be pumped out, contributing to runoff from the site. Water pumped from excavations is likely to contain a

moderate level of dissolved and suspended solids. If left to drain in a concentrated flow path, it is likely to result in erosion and convey a sediment load to the downstream watercourse;

- Physical cut-offs or dewatering of turbine excavations could alter soil interflow patterns. Cut-offs divert flow away from the excavation, while dewatering temporarily lowers the water table in the vicinity of the excavation;
- A risk to water quality exists due to the use of concrete in the foundations. Concrete is highly alkaline and corrosive making it lethal to fish and other aquatic life. Any spillage to a local watercourse would be detrimental to water quality. There is a small risk of concrete spillage/ leakage during transport of concrete to turbine foundations, during pouring operations, and during concrete washout operations.

10.6.8. **Crane pads** – each covering approximately 400 m^2, will be built adjacent to each turbine foundation, and left in place for the duration of the development. These areas of hardstanding will be constructed of permeable crushed rock aggregate, and therefore will not markedly increase runoff rates. Accidental spillages and leaks cannot readily be contained on permeable surfaces, and therefore present a risk to groundwater quality.

10.6.9. **Site Compound/office area** – potential effects of construction of the site compound area include:

- Risk of erosion and sedimentation due to runoff from the exposed site and from exposed stockpiles of excavated soils;
- Risk of chemical pollution from spillage or leakage from chemical stores within the site compound area;
- Risk of chemical pollution from spillage or leakage from on-site toilet facilities; and
- Increased runoff may also occur from the increase in hardstanding.

10.6.10. **Cabling** – electrical cables will be laid in trenches underground from the turbines to the substation. Potential effects include:

- Risk of changes to the drainage pattern of the site as cable routes may act as conduits to transport water; and
- Laying of new cabling under watercourses has the potential to increase sedimentation to the watercourses and temporarily disrupt flow during construction.

10.6.11. **Concrete Batching** – there will be no concrete batching on site. Where concrete is needed it will be transported to the required location from out with the development site. There is a small risk of chemical pollution from spillage and splashing during the transport of concrete to turbine locations;

10.6.12. **Borrow pits** – no borrow pits will be required as part of the proposed development.

Mitigation

10.6.13. An Ecological Clerk of Works (ECoW) and a Drainage Expert will be employed full time on site during the construction of the windfarm to ensure that there are no pollution or sedimentation of the receptors identified in this report.

10.6.14. Most of the potential construction impacts have been addressed in the design and layout of the wind farm infrastructure, by avoiding certain features, such as watercourses, where possible, and observing appropriate buffer zones. However, construction activities still have the potential to cause pollution of the water environment, if appropriate mitigation measures are not incorporated into the construction phase.

10.6.15. During the contractor tendering process for the construction works, environmental specifications and objectives will be included in the tender documents so that all contractors can allow for mitigation measures in their tender costs. In addition, the use of the construction contract conditions as recommended by SEPA Special Requirements for Civil Engineering Contracts for the Prevention of Pollution V2 (2006) will be applied.

10.6.16. The conditions to prevent pollution will be addressed within a Construction Method Statement (CMS), to be prepared in consultation with SEPA and to be submitted at least one month prior to the commencement of development. This CMS will systematically identify the pollution risks associated with each operation, and will include:

- A Pollution Prevention Plan (PPP) detailing mitigation measures as identified within this ES and any supplementary statements, to address each of the identified pollution risks;
- Details of any monitoring proposals and emergency contingency plans, including a water quality monitoring scheme to be implemented by a designated ECoW;
- A location map of all areas of disturbance with the potential to generate silt-laden run-off, with details of the proposed mitigation at each point as recommended by CIRIA guidance documents;
- Preparation of a Drainage Management Plan, detailing proposed surface drainage measures to deal with surface runoff from the site, designed in accordance with SuDS principals;
- A location map of all potential chemical contamination sources, including all fuel, oil and chemical storage areas, vehicle compounds, refuelling sites, waste depots and on-site sewage systems;
- Procedures for dealing with water contaminated from cement deliveries and the excavations into which the cement is to be poured;
- Timing of works, including a programme of works which takes into consideration high rainfall periods (see Table 10.8), and periods of greatest sensitivity to suspended sediments in terms of spawning fish activities (see paragraphs 10.5.36 to 10.5.37).

10.6.17. Mitigation measures to deal with the potential impacts identified in paragraphs 10.6.4 to 10.6.12, and to be incorporated into the CMS, are outlined below.

10.6.18. **Chemical Pollution** – measures to prevent chemical pollution will include:

- Storage – all equipment, materials and chemicals will be stored within the site compound area, at least 100m from all watercourses. Chemical, fuel and oil stores will be sited on impervious bases within a secured bund of 110% of the storage capacity, within the laydown area, as per CIRIA guidelines.
- Vehicles and refuelling – standing machinery will have drip trays placed underneath to prevent oil and fuel leaks causing pollution to surface water and groundwater. Where practicable, refuelling of vehicles and machinery will be carried out on an impermeable surface in one designated area, well away from any watercourse or drainage systems.
- Maintenance – only emergency maintenance to construction plant will be carried out on site, and will preferably be carried out in one designated area on an impermeable surface well away from any watercourse or drainage, except where vehicles have broken down necessitating maintenance at the point of breakdown.
- Toilet facilities – on-site toilet facilities will be adequately designed and maintained to ensure all sewage is disposed of appropriately. This will take the form of tankering and off-site disposal.
- Cement and concrete – wet concrete operations will not be carried out within watercourses or close to watercourses. Due to a lack of suitable flat areas for batching outside the Kingledores floodplain, concrete will be transported from off site.
- Buffer zones – suitable buffer zones (as specified by the Forests and Water Guidelines, 2003) will be maintained between all access tracks, turbine bases, new ditches and existing local watercourses to trap sediments and protect the riparian zone.

10.6.19. **Runoff, erosion and sedimentation** – measures to prevent runoff and sediment laden water entering watercourses will include:

- New ground excavation works will be restricted during heavy rainfall events to minimise creation of sediment laden surface runoff, and weather forecast information will be utilised to plan the timing of excavation work;
- Exposed ground and soil stockpiles will be minimised in extent, and reinstated/covered over at the earliest possible opportunity;
- No concentrated loads, such as soil stockpiles, will be stored on steep slopes where the potential for land slippage is greatest. Excavated material will be transported to stable ground located away from nearby watercourses and outside the 1 in 200 year flood level area on Kingledores floodplain (as delineated in the SEPA Flood Risk Map).

Construction operations will be supervised on a full time basis by experienced geotechnical personnel;

- Buffer zones, silt traps and settlement ponds will be used to avoid sediment reaching watercourses;
- The construction of drainage ditches will be kept to a minimum, but where necessary the length of individual drains will be minimised to avoid intercepting large volumes of water, concentrating flows and diverting water into adjacent catchments;
- The gradient of drainage ditches will be kept as shallow as possible to avoid high velocities during storm events;
- Track drainage, designed to prevent the build up of large volumes of water, will be porous and act as soakaways thereby preventing any direct discharge to watercourses;
- The length of track drainage will be minimised and tracks will be cambered to maximise runoff and avoid ponding;
- Potential pumping of water from turbine bases will either be to areas of ground capable of absorbing the water or to settlement ponds. Pumped water will not be discharged directly into surface watercourses under any circumstances;
- During construction all new and existing crossings will be regularly checked for blockages, especially during and after periods of heavy rainfall;
- Cabling across watercourses will be avoided where possible in the design process. Where unavoidable, cable crossings will be undertaken using recognised construction techniques as approved by SEPA, to minimise disturbance to the watercourses. Construction near the watercourse will be undertaken in accordance with PPG5: Works in, near or liable to affect watercourses.

10.6.20. **Change in groundwater levels** - groundwater controls such as dewatering or physical cut-offs will be avoided where possible. The effects of groundwater control during construction are likely to be temporary and reversible. Localised lowering of the groundwater table around drainage ditches will be reduced by minimising the depth of the ditches. Permanent physical cut-offs will be avoided and groundwater routed around the turbine bases.

10.6.21. **Impediments to flows** - drainage ditches and watercourses will be regularly inspected for blockages.

10.6.22. **Compaction** - traffic access will be restricted to tracked areas. Land surrounding the immediate construction area will be fenced off, or otherwise demarcated, to prevent inadvertent intrusion from construction plant.

10.6.23. **Increased flood risk** – surface runoff from increased hardstanding will be attenuated on-site to prevent any increased flood risk downstream from the development site. Watercourse crossing designs will be agreed with SEPA prior to construction. A flood risk assessment will be carried out

for the Kingledores properties as part of a post consent condition related to the design for watercourse crossing 3 and associated access tracks crossing the river floodplain.

10.6.24. **Barriers to fish migration** – watercourse crossings will be designed in line with *Scottish Executive: River Crossings and Migratory Fish: Design Guidance, April 2000* and comply with the latest SEPA Position Statement on Culverting. Watercourse crossings will require authorisation from SEPA under CAR, and detailed designs will be submitted at the time of application for a CAR registration or licence as required. It is recommended that this requirement becomes s75 condition.

10.6.25. **Impact on private water supplies** – private water supplies considered to be at risk will be monitored before, during and after construction activities to ensure they conform with *The Private Water Supplies (Scotland) Regulations 2006*, and an alternative supply provided if required.

10.6.26. **Impact on public water supplies** – Scottish Water has been informed of the proposed access route, and the exact depth of the mains pipe will be determined prior to construction. The supply pipe will be avoided during any excavation work and a land bridge over the supply pipe will be provided to remove any possibility of damage to the pipe. Access to the Scottish Water manhole located adjacent to the access route will also remain unrestricted.

10.6.27. **Impact on livestock water supply** – the water supply for livestock in the lambing field will be cut off by the proposed access route. An alternative supply will be provided by creating an off-take from Glenkerie Burn to a supply tank/pond in the lambing field;

10.6.28. **Impact on geology** – should features of geological note be uncovered during the excavation for turbine foundations, they will be reported to Scottish Borders Council and other relevant consultees.

Residual Effects – Construction

10.6.29. The above mitigation measures will substantially reduce the magnitude and likelihood of potential effects. As shown in Table 10.10, the significance of residual effects, assessed in accordance with Diagram 10.1, is considered to be negligible to minor.

Table 10.10: Significance of Potential Construction Effects

Receptor	Sensitivity	Potential Effect	Magnitude	Likelihood after Mitigation	Residual Significance
Surface Water Kingledores Burn, Holms Water and River Tweed	Very sensitive	Change to flow	Low	Unlikely	Not significant
		Chemical spillage (fuel/concrete)	Low	Unlikely	Not significant
		Sedimentation	Low	Unlikely	Not significant
		Obstruction of flow/blocked watercourse crossing	Low	Unlikely	Not significant
		Increased flood risk	Low/ Medium	Possible	Minor
Groundwater	Very Sensitive	Change to flow	Low	Possible	Minor
		Chemical pollution	Low/ Medium	Possible	Minor
Designations River Tweed SSSI and SAC	Very sensitive	Change to flow to site	Low	Unlikely	Not significant
		Chemical pollution (fuel/concrete)	Low	Unlikely	Not significant
		Erosion/sedimentation	Low	Unlikely	Not significant
Water Resources Livestock water supplies, public and private water supplies	Sensitive	Change to flow	Low/ Medium	Possible	Minor
		Sedimentation	Low/ Medium	Possible	Minor
		Chemical pollution	Low/ Medium	Possible	Minor
Fisheries Kingledores Burn and River Tweed	Very Sensitive	Change to flow	Low	Unlikely	Not significant
		Chemical pollution (fuel/concrete)	Low	Unlikely	Not significant
		Erosion/sedimentation	Low	Unlikely	Not significant
Geology Other Formations	Not Sensitive	Loss of rock	Low	Unlikely	Not significant

Assessment of Operational Effects

Potential Effects – Operations

10.6.30. The potential medium and long term effects of the wind farm development are associated with the permanent site infrastructure, such as access roads, turbine bases and hard standings. It should be noted that most of the effects discussed below will be significantly reduced or wholly avoided through best practice design and construction of the wind farm infrastructure.

- Modification of drainage patterns - surface flows may be locally altered by new drainage systems. Groundwater flow patterns may also be locally modified by turbine bases, the foundations of other wind farm buildings and cable trenches, which may act as groundwater conduits.
- Increase in runoff rate and volume - access tracks and hardstanding areas will form impermeable areas which may increase runoff due to rainwater being unable to infiltrate through these surfaces. Increased surface runoff could lead to increased downstream flood risk.
- Increased erosion and sedimentation - ruts forming in poorly made tracks may form preferential flow paths which will erode rapidly.
- Impediments to flows in watercourses - poor design of river crossings, particularly culverted river crossings, may result in upstream flooding and downstream erosion.
- Modification of groundwater levels - there may be localised disruption of groundwater flow paths in the vicinity of the turbines and a slight lowering of the groundwater table near drainage ditches. However, this is unlikely to have a significant effect on groundwater levels.
- Pollution risk - during the operational phase of the wind farm there will be significantly less on-site activity than during the construction phase, however potential pollutants will still be present. These include: lubricants for the turbine gearboxes, transformer oils, fuel and oil leaks from maintenance vehicles and the control room welfare facilities.
- Barriers to fish migration – poor design of culverted water crossings may result in barriers to potential fish migration.

10.6.31. A small portion of the development site, on Kingle Rig, is sited on land underlain by peat. Peat is a major store of carbon accumulated from dead plant remains over many years. The wetness and acid conditions prevent the growth of bacteria which would otherwise rot the vegetation. As the wind farm is constructed, areas of peat may be drained, begin to dry out and oxidise, thus resulting in the gradual release of carbon dioxide (CO_2) into the atmosphere. This CO_2 released through oxidation is offset by the 'clean' electricity produced by the wind farm itself. The CO_2 saving from generation has been calculated to be up to 57,180 tonnes per annum (see Chapter 3, Needs & Benefits).

10.6.32. The CO_2 emitted through the peat oxidation process before mitigation is calculated below. The calculation gives the worst case, but highly unlikely scenario in that all peat that may be disturbed would be destroyed. The following is also assumed:

- Total track length across peat on Kingle Rig = 350m, track width (including drainage) = 7m;
- One turbine foundation in peat on Kingle Rig, foundation size = 17 x 17m;
- Peat damage is assumed to extend 10m from access tracks and turbine foundations;
- Peat covers Kingle Rig to an average depth of 1m.

CO_2 emissions from peat oxidation

Peat damaged by access tracks	=350 x (10 + 7 + 10) x 1	= 9,450	m^3
Peat damaged by turbine bases	$=(10 + 17 + 10)^2$ x 0.7 x 1	= 1,369	m^3
Total volume of peat damaged	=(sum of above)	= 10,819	m^3
Thus CO_2 emitted by peat oxidation	=(10,819 x 55kg C/m^3 x 44/12)/1000	= 2,182	tonnes
Payback time for emissions from peat oxidation	=2,182 ¸ 57,180 tCO_2/year	= 0.04 14	years, or days

NOTE: The carbon content of dry peat is assumed to be 55kg/m^3, mass conversion factor of carbon to CO_2 is 44/12 (Dr M J Hall, 2006).

10.6.33. Under the worst case and highly unlikely scenario (which assumes all disturbed peat is destroyed), the CO_2 emitted by peat oxidation could reach 2,182 tonnes over the lifetime of the development. Assuming this figure, the payback time for emissions from peat oxidation is 14 days, significantly less than the 25 year life time of the development.

10.6.34. There are no potential impacts from the operational phase of the wind farm on private water supplies.

Mitigation – Operations

10.6.35. It should be noted that many of the impacts and subsequent mitigation measures discussed are common to both the construction and operational phases of the wind farm proposal. Therefore the construction mitigation section should be referred to for detail on common mitigation measures.

10.6.36. It is important to emphasise that many potential operational impacts have been, or will be, addressed in the design and layout of the wind farm infrastructure.

10.6.37. **Modification of drainage patterns** – will be minimised through the appropriate design and construction of tracks, drainage ditches, culverted river crossings and drainage pipes. Cable trenches will be backfilled with the original excavation material and compacted to a suitable standard, clay bunds will be constructed within the cable trench at intervals to prevent longitudinal drainage. Any residual modification of both surface

and groundwater drainage patterns is likely to be localised due to the extent and size of the turbine foundations and track drainage.

10.6.38. **Increase in runoff rate and volume and erosion and sedimentation** – will be similarly addressed through best practice design of tracks and drains, and the use of sustainable drainage systems (SuDS) techniques in the trackside drainage network. CIRIA guidance will be followed to incorporate a variety of measures such as swales, silt traps, settlement ponds and buffer strips into the drainage system to attenuate peak flows and allow sediment to settle before water is discharged to the natural watercourses. An adequate camber and lateral drains or water bars will prevent ruts and rapid erosion of tracks occurring. On-site drainage systems will be regularly inspected and maintained for the duration of the wind farm. Surface runoff will be attenuated on-site to prevent increased flood risk downstream.

10.6.39. **Impediments to flows** - will be prevented through the adequate design and sizing of river crossings, in particular piped river crossings and cross drains. Piped river crossings, drainage ditches and watercourses will be regularly inspected and blockages removed.

10.6.40. **Pollution risk** - the pollution prevention measures outlined in the construction mitigation section will continue to be followed in the operational phase, as appropriate. The construction phase contingency plans will be modified as necessary.

10.6.41. **Barriers to fish migration** – culverts and burn crossings will be designed and maintained in accordance with the Scottish Executive Guidance on River Crossings and Migratory Fish.

Residual Effects – Operations

10.6.42. The residual significance of the operational impacts with mitigation measures in place is summarised in Table 10.11. The significance of residual effects, assessed in accordance with Diagram 10.1, is considered to be negligible.

Table 10.11: Significance of Operational Effects

Receptor	Sensit-ivity	Potential Effect	Magnit-ude	Likelihood after Mitigation	Residual Significance
Surface Water Kingledores Burn, Holms Water, River Tweed	Very Sensitive	Alteration of flow	Low	Unlikely	Not significant
		Chemical Pollution	Low	Unlikely	Not significant
		Sedimentation	Low	Unlikely	Not significant
Groundwater	Very Sensitive	Alteration of flow	Low	Unlikely	Not significant
		Chemical pollution/ sedimentation	Low	Unlikely	Not significant
Designations River Tweed SSSI and SAC	Very Sensitive	Alteration of flow	Low	Unlikely	Not significant
		Chemical pollution/ sedimentation	Low	Unlikely	Not significant
Water resources Public and private water supplies, livestock water supplies	Sensitive	Alteration of flow	Low	Unlikely	Not significant
		Chemical pollution/ sedimentation	Low	Unlikely	Not significant
Fisheries Kingledores Burn and River Tweed	Very sensitive	Chemical pollution (fuel/concrete)	Low	Unlikely	Not significant
		Erosion/sedimentation	Low	Unlikely	Not significant

10.7. SUMMARY OF EFFECTS

10.7.1. A summary of the Significance of Effects identified for all phases of the wind farm are detailed below in Table 10.12.

Table 10.12: Summary of Effects

Potential Effect	Mitigation	Residual Effect
Construction		
Change to/interruption of groundwater and surface water flow	Avoidance of groundwater dewatering or physical cut-offs. Use of silt fences, sediment entrapment, matting and settlement ponds. Water crossings and cables crossing watercourses will be designed in accordance with SEPA Guidance and the Controlled Activities Regulations (CAR).	Minor (groundwater, private water supplies)
Chemical pollution	Oil/chemical stored in 110% bund, drip trays, refuelling within designated area, concrete batching away from watercourses in accordance with SEPA approved method statement.	Minor (surface water, groundwater, fisheries, private water supplies)
Sedimentation	Minimise exposed ground and soil stockpiles, use of silt fences and sediment entrapment matting, buffer zones, silt traps and settlement ponds/silt busters. Minimise drainage ditches, use of low gradient drainage ditches, dirty water pumped to ground or settlement ponds. Follow CIRIA guidelines for control of pollution from construction projects.	Minor (surface water, fisheries, private water supplies)
Loss of rock	Minimise road stone requirement by use of existing tracks. No on-site borrow pit.	Not significant
Operation		
Alteration of groundwater and surface water flow	Appropriate design and construction of tracks, drainage ditches, piped river crossings and drainage pipes. Cable trenches backfilled with original excavation material. Drainage ditches associated with access tracks appropriately sized. Attenuation of surface runoff using SUDS to prevent increased flood risk downstream.	Not significant
Sedimentation	Use of SuDS in areas of hardstanding, attenuation of peak flows using swales, silt traps, attenuation and settlement ponds or buffer strips. Ongoing maintenance and regular inspection of all site drainage systems.	Not significant
Chemical Pollution	Oil/chemical stored in 110% bund, drip trays, refuelling within designated area only	Not significant
Decommissioning		
As per construction	-	-

10.8. STATEMENT OF SIGNIFICANCE

10.8.1. Construction of the wind farm involves several phases and activities which may potentially affect the hydrology, geology and hydrogeology of the receiving environments. These activities have been identified and an assessment of their potential effects made.

10.8.2. The identified sensitive receptors are surface watercourses (for their environmental designations, water quality and fisheries interests), groundwater, and water resources (public, private and livestock water supplies). Parts of the site, within the Kingledores floodplain, are also at risk of flooding.

10.8.3. Groundwater is a very sensitive receptor because flow is through fractures only and there is little opportunity for attenuation of contaminants. However, the bedrock is of relatively low productivity as an aquifer, so the volumes of groundwater present are likely to be generally low.

10.8.4. One identified private water supply pipe is considered to be at risk from potential damage during construction activities. This supply will be monitored during and after construction to ensure it complies with The Private Water Supplies (Scotland) Regulations 2006, and an alternative supply provided if required. All other identified private water supplies near the development site are not considered to be at risk as they lie within separate catchment areas.

10.8.5. The River Tweed, and its tributaries, is designated as an SAC and SSSI for its Atlantic salmon, Brook lamprey, River lamprey, Sea lamprey, otter and floating water-crowfoot vegetation. These qualifying features (especially migrating and spawning fish populations) will be very sensitive to any sediment and chemical contamination originating from the wind farm development site.

10.8.6. Part of the proposed development access route crosses the active Kingledores Burn floodplain. There is a risk of flooding in this area during construction activities, which poses a potential health and safety risk to site operatives and also a risk to water quality if construction materials have been stored within the floodplain. It is therefore recommended that no materials are stored within the 1 in 200 year flood level area (as delineated on the SEPA Flood Risk Map). It is also recommended that construction activities within the Kingledores floodplain are avoided in the wettest months of the year where possible (see Table 10.8), when the risk of flooding will be greatest. It is also possible that the increase in hardstanding associated with the development, and the construction of a crossing over the Kingledores Burn, could increase the risk of flooding at the properties located downstream from the development at Kingledores. A flood risk assessment will be carried out for the Kingledores properties as part of a post consent condition related to the design for watercourse crossing 3 and associated access tracks crossing the river floodplain.

10.8.7. Mitigation measures have been proposed which will reduce the likelihood and magnitude of the potential effects on all of the sensitive receptors,

such that any adverse residual effects are assessed as being of minor significance or lower. These effects are not considered significant in terms of the EIA regulations. In order to ensure that these mitigation measures are carried out, environmental specifications and objectives will be included in the tender documents so that all contractors can allow for mitigation measures in their tender costs. A Construction Method Statement will be drawn up and on-site supervision put in place to ensure that the mitigation measures are adhered to by all site contractors. Continued consultation with SEPA will be carried out in order to ensure on-going agreement regarding the proposed mitigation measures.

CHAPTER ELEVEN: NOISE

11.1 EXECUTIVE SUMMARY

11.1.1 An assessment has been undertaken of the noise effects that are predicted to occur due to the operation of the proposed Glenkerie Wind Farm. The noise assessment has considered the combined effect of all 11 proposed turbines operating simultaneously under normal circumstances.

11.1.2 The assessment has been set in the context of existing planning guidance for Scotland (SPP 6 'Renewable Energy', PAN 45 'Renewable Energy Developments', PAN 56 'Planning and Noise') and best practice as published by ETSU for the DTI, 'The Assessment and Rating of Noise from Wind Farms', ETSU-R-97.

11.1.3 This approach was agreed with the Environmental Health Department of Scottish Borders Council. In ETSU-R-97 the Noise Working Group (NWG) recommends that the current practice on controlling wind turbine noise is by the application of noise limits at the nearest noise sensitive receptors. Hence compliance with the recommended noise limits will constitute the measure of significance by a candidate turbine.

11.1.4 The operational noise predictions for this assessment have been undertaken within the computational noise model, LIMA. The LIMA model uses the methodology set out in ISO 9613-2 'Attenuation of Sound during Propagation of Noise Outdoors'. The locations and heights of the proposed turbines, their properties and noise characteristics have been used in the model to predict the noise impact at each identified receptor.

11.1.5 An initial calculation based on the candidate turbine and its sound power level was used to give a worst case assessment of the likely noise levels at the nearest receptors and to determine whether any background noise monitoring was required. Of the residential areas identified, two locations were considered to be representative of the surrounding areas and appropriate for background monitoring.

11.1.6 The ETSU guidance is to limit the noise from the wind farm relative to the existing background noise (plus 5 dB) as modified by the lower limit value. The recommended night-time criteria limit in ETSU-R-97 is 43 dB(A), based on an indoor value of 35 dB(A) as defined in the WHO Environmental Noise Criteria 1980.

11.1.7 The recommended daytime criteria limit is in the range 35 to 40 dB(A). In this assessment, consultations with the Environmental Health Department of Scottish Borders Council agreed that the lower limit of 35 dB(A), as modified by the background curve, was appropriate.

11.1.8 The assessment shows that the noise emission from the candidate turbine does not exceed these target criteria as defined in ETSU-R-97 at the identified receptor locations. By using current available technologies, these noise limits are achievable by all the possible candidate turbines

since the predictions demonstrate compliance at all wind speeds and give confidence that the limits can be achieved under operational conditions.

11.2 INTRODUCTION

11.2.1 This chapter describes and assesses the potential noise and vibration effects of the proposed Glenkerie Wind Farm. This assessment considers the effect of all 11 proposed turbines, operating simultaneously under normal circumstances. The assessment also considers the noise arising from the temporary construction phase of the development.

11.2.2 Noise can have an effect on the environment and on the quality of life enjoyed by individuals and communities. The effect of noise can therefore be a material consideration in the determination of planning applications. This assessment aims to determine the effect of noise at the nearest identified receptors due to the proposed development.

11.2.3 The chapter is set in the context of existing planning guidance (PAN 45 'Renewable Energy Developments', PAN 56 'Planning and Noise') and best practice as published by ETSU for the DTI ('The Assessment and Rating of Noise from Wind Farms', ETSU-R-97). The assessment of potential noise impacts is carried out according to the guidance in ETSU-R-97, which takes as its starting point the principles of British Standard BS 4142:1997 'The Method of Rating Industrial Noise Affecting Mixed Residential and Industrial Areas'.

Acoustic Terms and Concepts

11.2.4 The PAN 45, PAN 56 and ETSU-R-97 guidance documents and all other British Standards refer to noise levels in decibels (dB). The decibel scale is logarithmic rather than linear; a 3 dB increase in the sound level represents a doubling of the sound energy present. Judgement of the loudness of a sound is subjective, but as a general guide, a change of 10 dB corresponds to a doubling of loudness.

11.2.5 The A-weighted sound level, dB(A), takes this response into consideration and is used for measurement of environmental noise. It can be used to indicate the subjective human response to noise.

11.2.6 Environmental noise usually varies continually from second to second. It is impractical to specify the sound level for each second. As such, human response has been related to various units, which allow for this fluctuating nature of sound. These include;

LAeq,t - The A weighted equivalent continuous sound pressure level. This descriptor is a representation of a continuous sound level containing the same amount of sound energy as the measured varying noise, over the measurement period. t.

LA90,t - The A weighted sound pressure level that is exceeded for 90% of the measurement period t. As well as being the main descriptor for

wind farm noise, it is also commonly used as the 'background noise level' for assessing the effects of industrial noise in the UK.

11.2.7 The ETSU guidance states that the $L_{A90,10min}$ descriptor should be used for both the background noise and the wind farm noise. The use of $L_{A90,10min}$ descriptor for wind farm noise allows reliable measurements to be made without corruption from relatively loud, transitory noise events from other sources.

Potential Effects

11.2.8 Table 11.1 summarises the potential effects of noise at the nearest receptors relating to the development.

Table 11.1 Potential Noise Effects

Activity	Specific Element	Potential Effects
Construction	Construction plant and construction traffic	Temporary increase in ambient noise levels at identified receptors
Operation	Turbines	Long term aerodynamic noise during turbine operations

11.2.9 The assessment does not address noise from operational traffic, which is not considered to be significant.

11.2.10 The relatively large distances and minor construction activity means that vibration levels during the development are not considered likely to affect sensitive receptors. Construction vibration has therefore not been considered further in this assessment.

Policy Context and Planning Guidance

11.2.11 PAN 45, published in January 2002, provides the following advice on noise emissions from wind farms.

11.2.12 *"There is a perception that noise from wind turbines is a significant problem. This is not necessarily the case however and the issue is discussed in detail in the relevant section of this PAN."*

11.2.13 *"Well designed wind turbines are generally quiet in operation. The table below gives an indication of the noise generated by wind turbines compared with other everyday activities."*

Table 11.2 Indicative Noise Levels (Reference: Pan 45, Figure 6)

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

11.2.14 *"Wind generated background noise increases with wind speed, and at a faster rate than wind turbine noise increases with wind speed. The difference between the noise of the wind farm and the background noise is therefore liable to be greatest at low wind speeds. Varying the speed of the turbines in such conditions can if necessary reduce the sound output from modern turbines."*

11.2.15 *"PAN 45 describes a framework for the measurement of wind farm noise and gives indicative noise levels thought to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development or adding unduly to the costs and administrative burdens on wind farm developers or planning authorities. PAN 45 presents a series of recommendations that can be regarded as relevant guidance on good practice."*

11.2.16 The central planning document relating to environmental noise in Scotland is PAN 56. This document provides detailed guidance on the introduction of noise sources into a noise-sensitive area and gives recommendations for the standards which should apply to noise from construction sites and wind farms. PAN 56 provides the following advice relating to noise from wind farms;

11.2.17 *"There are two sources of noise from wind turbines; the mechanical noise from the turbines and the aerodynamic noise from the blades. Mechanical noise can be reduced through engineering design. Aerodynamic noise depends upon rotor speed which varies with wind speed. Noise from the wind normally increases at a faster rate than the turbine noise."*

11.2.18 *"This means that aerodynamic noise of wind turbines is generally greatest at low wind speeds. However, in sheltered positions where 'wind shadow' occurs, such as in leeward valleys, existing noise levels may remain low when turbines on adjacent higher ground are operating at higher wind speeds. Equally, noise levels at properties affected by prevailing winds may well be greater than in other areas. Good acoustical design and siting of turbines is essential to affect the environment and any nearby noise-sensitive property".*

Assessment Procedure

11.2.19 The Control of Noise (Codes of Practice for Construction and Open Sites) (Scotland) Order 2002, states that British Standard BS 5228:1997 'Noise Control on Construction and Open Sites' is approved as being suitable for the purpose of giving guidance on appropriate methods for minimising noise from construction activities.

11.2.20 PAN 56 provides advice on construction site noise and also advises the use of BS 5228:1997 as the appropriate assessment methodology.

11.2.21 BS 5228:1997 provides guidance relating to the prediction and control from open sites where noise from fixed plant and mobile plant has the potential to be an issue with regards to the potential disturbance of residents.

11.2.22 In particular, this document provides guidance that is relevant to this noise assessment relating to;

- Noise, its potential for affecting neighbours of open sites;
- The prediction of environmental noise levels associated with fixed and mobile plant;
- Criteria for setting noise control targets;
- The control of noise emissions from open sites;
- The calculation of noise levels associated with plant which foes not operate continuously.

11.2.23 Additionally this document includes reference noise level data for various types of plant commonly associated with activities on construction sites. Noise levels generated by construction activities are regulated by guidelines and subject to local authority control. Guidance is contained within BS 5228:1997 but no fixed limits are suggested in the document.

11.2.24 The World Health Organisation (WHO) 'Guidelines for Community Noise' states that general daytime outdoor noise levels of less than 55 dB $L_{Aeq,t}$ are desirable to prevent any significant community annoyance and so this level has therefore been adopted as an acceptable design target for noise from general construction activities at noise-sensitive receptors, in order to avoid significant levels of disturbance.

11.2.25 The operational noise impact from the proposed turbines has been assessed according to the recommendations contained within ETSU-R-97 'The Assessment and Rating of Noise from Wind Farms', as recommended by PAN 45. This approach was agreed with the Environmental Health Department of Scottish Borders Council.

11.2.26 In ETSU-R-97 the Noise Working Group (NMG) recommends that the current practice on controlling wind farm noise is by the application of noise limits at the nearest noise-sensitive properties and this has been defined by the guidance as the most appropriate approach.

11.2.27 The report presents a series of recommendations that can be regarded as relevant guidance on good practice, including the following;

- Noise limits should be applied to external locations and should apply only to those areas frequently used for relaxation or activities for which a quiet environment is highly desirable;
- Separate noise limits should apply for daytime 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;
- The daytime and night-time noise limits are based on a level 5 dB(A) above the measured background noise levels, as modified by a lower limit. Thus where the night-time criterion curve is found to be lower than 43 dB(A) then the limit is fixed at 43 dB(A). For daytime, this lower limit is chosen to be within the range of 35 to 40 dB(A). In this instance, the lower limit of 35 dB(A) for the daytime period was discussed and agreed with Scottish Borders Council; and,
- For distant properties where the noise can be limited to 35 dB $L_{A90,10min}$ at wind speeds up to 10m/s at 10m height, then no background noise survey is necessary.

11.2.28 Hence, compliance with these recommended noise limits will constitute the measure of significance.

11.3 BASELINE DESCRIPTION

11.3.1 The initial phase of the noise impact assessment identified the nearest noise-sensitive properties. These properties were then assessed as to their requirement for a background noise survey. The purpose of baseline monitoring is to determine any requirement for modifying the fixed limits for protection of sleep disturbance and daytime amenity, based on background noise levels. The guidance from the ETSU-R-97 report is that where it can be demonstrated that the expected levels of wind farm noise would not exceed 35 dB(A) at a property for wind speeds of up to 10m/s at 10m height then no background noise survey is required for that property.

11.3.2 An initial calculation based on the noisiest candidate turbine and its sound power level was used to give a worst case assessment of the likely noise levels at the nearest receptors and to determine whether any background

noise assessment was required. This initial calculation plot is shown in Figure 11.1.

11.3.3 The closest residential properties identified within the 35 dB(A) contour line were discussed with Scottish Borders Council and are described as follows;

- Glencotho - This occupied house is located to the north west of the proposed wind farm.
- Kingledores - This occupied house is located to the east of the proposed wind farm, just of the A702.

11.3.4 A background noise survey was carried out at these properties for the purpose of defining the existing noise environment. Integrating sound level meters with all-weather microphones were used for the survey. Each monitoring point was set up more than 3m from the nearest building façade, with the microphone approximately 1.5m above ground level. This noise survey was undertaken during August and September 2007.

Measurement Periods

11.3.5 In accordance with the ETSU guidance, data was collected in contiguous 10 minute samples throughout the measurement periods. Data for L_{A90} background noise level has been extracted and retained for each sample at each of the locations. This data was synchronised with wind speed data, collected at 10m on an anemometer mast located on the proposed wind farm site, which was downloaded at 10 minute intervals, simultaneous with the noise data.

11.3.6 Background noise curves were obtained for both night-time (2300 – 0700) and amenity or 'quiet daytime' (1800 – 2300 weekdays, 1300 – 2300 Saturdays and 0700 – 2300 Sundays) periods by filtering the data for these time periods and fitting a polynomial regression curve to the data.

11.3.7 The measured noise levels give an indication of the existing noise environment in the vicinity of the wind farm site and the proposed turbine locations. Regression analysis indicates what relationship exists between background noise levels and wind speeds.

11.3.8 Figures A11.1.2 and A11.1.3 show the background noise levels that were recorded at the two locations identified above, and the corresponding wind speeds that were measured by an anemometer at a height of 10m above ground level, in accordance with the ETSU guidance. The background noise level refers to the ambient noise level that is already present within the environment. It is measured in the absence of any noise that would be generated by the wind farm.

11.3.9 The relationship between background noise (measured in dB(A)) and wind speed (measured in m/s) is shown by plots of background noise levels as $L_{A90,10min}$ values. These plots were produced for the two locations during both amenity hours and night-time hours. The results of the polynomial

regression analysis are shown in the form of a regression curve for each series of plots.

11.3.10 Figures A11.1.4 to A11.1.7 show the regression line fits for daytime amenity and night-time noise levels against wind speed at Glencotho and Kingledores. It can be seen that there is a spread of noise levels at all wind speeds at both locations. Although there is a wide spread of noise levels, the bulk of values are concentrated along the regression curve line, which has been used for definition of the limit criterion.

11.3.11 Figures A11.1.8 to A11.1.11 show the noise criterion curves that were produced for both locations based on the ETSU guidance. Each figure shows three curves; the regression curve based on the measured background data, the level 5 dB above this regression curve, and the ETSU noise limits of 35 dB(A) for daytime periods and 43 dB(A) for night-time.

11.3.12 Figures A11.1.12 to A11.1.15 show the criterion curves for each receptor location for both the daytime and night-time period, based on the ETSU guidance as modified by the background curve. These limits were agreed with the Environmental Health Department of Scottish Borders Council.

11.4 IMPACT ASSESSMENT

Construction Noise

11.4.1 Likely construction phase activities have been addressed based on the previous experience of the developer and Enviros. The precise nature of the construction activities will not be known until more detailed engineering design has been completed following consent..

11.4.2 Within the development area, site operations will involve activities associated with the access tracks and site infrastructure. Site preparation would involve the arrival of equipment on site and preparation of the construction compound. The cable installation would be in trenches adjacent to the access tracks. Erection of the wind turbines would then be followed by turbine commissioning.

11.4.3 Noise associated with the construction of the wind farm will occur from a number of sources. There will be different sources depending on the activity. These can be considered in two phases: installation of the turbine support structure, followed by construction of the turbine tower and assembly of the turbine.

11.4.4 The main construction activities with respect to noise are likely to be;

- Construction of tracks and hardstandings;
- Construction of turbine foundations;
- Excavation of trenches and cable laying;

- Erection of wind turbines and wind monitoring mast;
- Commissioning of the wind turbines.

11.4.5 Many of the operations described above will be carried out concurrently, although predominantly in the order identified. At different parts of the site, civil engineering work will be continuing whilst wind turbines are being erected.

11.4.6 Construction will only take place during normal working hours on weekdays and for limited periods at the weekend. Typical construction plant would be used on site, including;

- Earth moving plant to include excavators and dump trucks;
- Lifting equipment such as cranes and hoists;
- Crusher and grader;
- Concrete batching equipment including mixers and pumps;
- Miscellaneous equipment such as compressors, hand tools and generators;
- Heavy Goods Vehicles delivering equipment.

11.4.7 The following plant activities will not be undertaken at Glenkerie:

- Crusher and grader;
- Concrete batching equipment including mixers and pumps.

11.4.8 Using BS 5228: 1997 Part C it has been possible to calculate indicative plant noise levels for two broad phases of the development. Table 11.3 shows this.

Table 11.3: Indicative Plant Noise Levels

Equipment	Number	Plant Sound Power Level dB(A)	Estimated On-Time Activity %	Equivalent Continuous SWL dB(A)
Phase 1 – Site Preparation				
Scraper	2	110	50	110
Tracked Excavator	2	110	50	110
Dozer	3	112	50	114
Lorry (actually on-site)	3	103	50	105
Dump Truck	2	110	100	113
Pneumatic Breaker	2	113	50	113

Equipment	Number	Plant Sound Power Level dB(A)	Estimated On-Time Activity %	Equivalent Continuous SWL dB(A)
Compressor	1	100	100	100
Pumps (dewatering)	2	100	50	100
Trenching Machine	2	105	50	105
Road Roller	2	108	25	105
CUMULATIVE:				**120**
Phase 2 – Process Installation				
Heavy Crane	2	100	50	100
Mobile Crane	2	110	50	110
Dump Truck	2	110	100	113
Lorry (actually on-site)	4	103	50	106
Hand Tools	15	105	10	107
Generator	3	100	100	105
Compressor	2	100	100	103
CUMULATIVE:				**117**

11.4.9 Using the indicative noise data above, the resulting noise levels at the sensitive receptors have been calculated to represent the worst case (not allowing for any screening or soft ground attenuation). The predicted levels at the residential sensitive receptors are shown in Table 11.4.

Table 11.4: Predicted Construction Noise Levels at the Nearest Sensitive Receptors

Activity	Sound Power dB(A)	Distance (m)	Resultant Level, dB(A)
Glencotho			
Phase 1 (Site Preparation)	120.0	1280.0	49.9
Phase 2 (Building/Installation)	117.0	1280.0	46.9
Kingledores			
Phase 1 (Site Preparation)	120.0	1086.0	51.3
Phase 2 (Building/Installation)	117.0	1086.0	48.3

11.4.10 The above distances are from the nearest turbine location, but construction activity is unlikely to be based as close as this for significant periods. It is therefore considered a worst case assessment.

11.4.11 Noise levels generated by construction activities are regulated by guidelines and subject to local authority control. Guidance is contained within BS 5228:1997 but no fixed limits are suggested within this document. However, from previous wind farm assessments in similar areas of Scotland construction noise levels at the nearest receptor in the order of 50 to 60 dB(A) were deemed acceptable targets during daytime periods. These predictions are also below the World Health Organisation (WHO) noise guidance limits, as recommended in the 'Guidelines for Community Noise'. A limit of 55 dB(A) for outside living spaces and balconies is recommended and it can be seen that in all cases, construction noise has been predicted to fall below the WHO guidelines.

11.4.12 It is clear from the predicted noise levels in Table 11.4, that construction noise is unlikely to be unacceptable at the nearest sensitive receptors over the relatively short period envisaged.

Operational Noise

11.4.13 The operational noise predictions for this assessment have been undertaken within the computational noise model, LIMA. LIMA is widely used in the UK to calculate noise levels using the relevant national methodologies for a variety of sources. The LIMA software uses geographical (including height data) information to generate a model of the study area. The model includes objects that may affect the propagation of noise, such as topography.

11.4.14 The LIMA model uses the methodology set out in ISO 9613-2:1996 'Attenuation of Sound during Propagation Outdoors'. This calculates resultant noise levels at receptors, based on the turbine sound power level, distance to receptors and an atmospheric attenuation factor. The location of the proposed turbines, the properties and noise characteristics has been used in the model to predict the noise impact at each identified receptor location.

11.4.15 The noise levels at the nearest receptors have been predicted in accordance with the guidance given in ISO 9613-2. The interpretation of individual elements of this method is described below. The noise from a specific noise source at any receiver position depends on a number of factors;

- Source Sound Power Level;
- Geometric Spreading;
- Atmospheric Absorption;
- Refraction by metrological gradients; and

- Barrier Losses.

11.4.16 The sound power level that has been used for the noise predictions is based upon information provided by a turbine manufacturer for their 2.3MW machine, at both 70m and 85m hub height. This is a candidate wind turbine, since the final specification has yet to be determined. The reference sound power level of this turbine depends on the blade pitch, but the following has been assumed for this assessment;

LWA, ref = 103 dB(A) at 95% rated power, for both the 70m and 85m hub height

11.4.17 Tonal noise from older wind farms has previously been linked to gearbox noise being transmitted into the turbine supporting structure. Modern turbine manufacturers now ensure that sufficient forethought is given to the design of quieter gearboxes and to the means by which vibration transmission paths may be broken. No tonal penalties have therefore been applied to the predicted noise levels.

11.4.18 The noise source is considered as a single point in free space and the sound energy is assumed to spread out equally in all directions, resulting in a reduction of noise level of 6 dB per doubling of distance from the source.

11.4.19 Sound propagation through the atmosphere is attenuated by the conversion of the sound energy into heat. This attenuation is dependent on the pressure, temperature and relative humidity of the air through which the sound is travelling and is frequency dependent with little attenuation at low frequency. The reduction is proportional to the distance between receiver and source. The atmospheric absorption coefficient for broadband noise used for this assessment is 0.003 dB(A) per metre.

11.4.20 The way is which a sound wave travels through the atmosphere to a receiving position is dependent upon the way temperature and wind velocity change with height above ground level. As temperature and wind velocity, and thus sound velocity, change with height above ground level, so a sound velocity profile is created bending the sound waves towards or away from the ground depending on exact conditions.

11.4.21 Decreasing temperature with height results in the sound being sent away from the ground and increasing temperature with height results in sound waves being bent towards the ground. Similarly, the propagation of sound up-wind results in the bending of the sound waves away from the ground and down-wind the sound waves are bent back towards the ground.

11.4.22 Temperature inversion effects are fairly unpredictable and, although they have been noted to increase noise levels over the expected predicted levels quite significantly under certain very infrequent conditions, they have not been included in our model as wind effects are normally more dominant around wind farm sites.

11.4.23 The effect of any barrier between the noise source and the receiver position is that noise will be reduced according to the relative heights of the source, receiver and barrier. Our initial predictions have therefore been carried out including the effects of the screening from the topography. An assumption on ground absorption has also been used in the assessment.

11.4.24 The factors described above have been used to predict the noise levels at each of the identified sensitive receptors. In order to assess the significance of predicted noise levels from the proposed development, the predicted noise levels were compared with the fixed noise criteria of 43 dB(A) during the night and 35 dB(A) during the day, or 5 dB above the background noise level, whichever is the greater.

11.4.25 It should be noted that the ISO 9613 method predicts the noise levels under meteorological conditions favourable to propagation i.e. when the wind blows from every turbine to the property in question, and so the resultant levels can be considered to be the highest that are likely to occur.

11.4.26 Figures A11.1.16 to A11.1.19 show the predicted noise levels at both receptor locations, in the scenario of all 11 wind turbines operating simultaneously under normal conditions. The wind turbine noise level refers to the noise level that is generated due to the combined effect of all wind turbines. The wind turbine estimated wind to noise gradient has been applied to the source sound power levels for the 70m and 85m hub heights. The gradient shows the variation of noise levels at varying wind speeds from 3 to 12 m/s.

11.4.27 Figures A11.1.16 and A11.1.17 show the daytime and night-time noise limits compared to the predicted noise levels resulting from the wind farm at Glencotho. It can be seen that the predicted levels are below the criteria during the day and night at all wind speeds.

11.4.28 Figures A11.1.18 and A11.1.19 show the daytime and night-time noise limits compared to the predicted noise levels resulting from the wind farm at Kingledores. It can be seen that the predicted levels are below the criteria during the day and night at all wind speeds.

11.5 MITIGATION AND RESIDUAL IMPACTS

11.5.1 The assessment predicted that there will be no significant construction noise effects at identified sensitive receptors, so it will not be necessary to develop specific mitigation measures. However in line with good practice, the best practicable method of minimising noise on the site will be adopted and in this respect guidance is given in British Standard BS 5228: Parts 1 and 2 (1997) 'Noise Control on Construction and Open Sites'.

11.5.2 The following examples are applicable;

- For any particular job, the quietest plant and/or machinery will be used. Where appropriate, they must be constructed to meet the requirements of EEC Directives;

- All equipment will be maintained in good working order and fitted with the appropriate silencers, mufflers or acoustic covers where applicable;

- Stationary noise sources will be sited as far away as possible from noise sensitive receptors and will be compliant with BS 5228;

- The movement of vehicles to and from the site will be controlled and employees will be supervised to ensure compliance with the noise control measures adopted; and,

- Disturbance due to noise from blasting (if required) will be controlled by means of liaison over suitable hours with the local authority.

11.5.3 The proposed wind farm has been sited and designed to minimise noise levels at residential properties in the vicinity of the site. Accordingly, it is not anticipated that there will be any significant operational noise effects at these properties and so no specific mitigation measures are required.

11.6 CONCLUSION

11.6.1 An assessment has been performed of the noise impact that is predicted to occur due to the construction and operation of the proposed wind farm.

11.6.2 The assessment has taken account of current guidance which is contained in Planning Advice Note PAN 45 'Renewable Energy Technologies', PAN 56 'Planning and Noise', ETSU Report ETSU-R-97 'The Assessment and Rating of Noise from Wind Farms' and relevant British Standards and other documents relating to noise and its effects upon humans.

11.6.3 This noise assessment shows that the noise impact from the wind farm, assuming that all turbines are operating simultaneously at normal speed at the same time, would not exceed any of the target criteria defined in ETSU-R-97. Separate target criteria have been developed for both night-time and daytime periods in order to protect both the sleep of local residents and to protect the outdoor amenity of the area.

11.6.4 Predicted levels from candidate turbine at the identified sensitive receptors are below the criteria during the day and night, ensuring an acceptable level of protection to the amenity of local residents.

11.6.5 In terms of construction noise, the distances from the proposed working area to the nearest properties are large, so the likelihood of disturbance due to construction noise to be very small. Guidance given in BS 5228: 1997 will be used to ensure that best practicable method of minimising noise on the site will be adopted.

11.6.6 The distances between the proposed wind farm and the nearest residential properties are large enough that there will be no vibration impacts.

11.6.7 As a result it is not anticipated that there will be any significant disturbance from noise at properties within the vicinity of the proposed wind farm. All predicted noise levels are shown with the criteria curves in Appendix 11, Figures A11.1.16 to A11.1.19.

11.7 REFERENCES

Planning Advice Note 45, Renewable Energy Technologies, Scottish Executive Development Department, 2002

ETSU-R-97, The Assessment and Rating of Noise from Wind Farms ETSU for the Department of Trade and Industry, 1996

ISO 9613-2 Acoustics – Attenuation of Sound during Propagation Outdoors, Part 2: General Method of Calculation, International Organisation for Standardisation, 1996

ISO 9613-1 Acoustics – Attenuation of Sound during Propagation Outdoors, Part 1: Method of Calculation of the Attenuation of Sound by Atmospheric Absorption, International Organisation for Standardisation, 1992

CHAPTER TWELVE: SOCIO-ECONOMICS

12.1 EXECUTIVE SUMMARY

12.1.1 An assessment of the impact of the proposed development on tourism and recreation, socio-economic and land use issues was completed via desk-top research and through consultation with local groups, organisations and residents.

12.1.2 No evidence of past events or trends exists that indicates that the construction of a wind farm will result in a fundamental or material change in population, structure of the local community, local services or employment. Surveys and precedent indicate that tourists are not discouraged from visiting areas in which there are wind farms and that people living close to operating wind farms tend to feel positively towards them.

12.1.3 The construction of the wind farm will result in a local, short-term economic benefit due to the creation of local jobs and through opportunities for local companies to tender for contracts and provide services during the construction period. The landowner and his tenant receiving a rent from the wind farm will also benefit from diversification of the core business which will help safeguard local employment. Any other potential socio-economic effects will be at a local level, and would be projected to be minor, short term and thus not significant.

12.1.4 Public consultation is integral to the environmental impact assessment process and helps to deliver a quality assessment which takes account of local views and priorities. During the development process, a local neighbour meeting was held at which all 12 households that may be able to see a turbine where invited to attend. In addition, a full-scale public exhibition was held to inform the local community of the progress of the development. Several newsletters were distributed to local households within 12km of the site and advertisements were placed in the local newspapers detailing the timing and venue of the exhibition.

12.1.5 Questionnaires were also distributed at the exhibition to seek people's views.

12.1.6 The most common perceived benefits of the proposal were the generation of clean, green energy and a reduction of carbon dioxide emissions from traditional fossil fuel burning power stations. In addition a high proportion of respondents were in favour of the community benefits package which it was felt will help aid the local economy

12.1.7 The main concerns raised were the visual impact of the proposal on the local landscape, cumulative impact with other wind farms, noise and increased traffic levels on local roads and uncertainty over the use of overground rather than underground transmission links. All these issues where addressed during the consultation that took place locally throughout the development

12.2 INTRODUCTION

12.2.1 This chapter provides an assessment of the tourism and recreation, socio-economic and land use issues likely to be impacted by the proposed development, such as:

- Local visitor attractions and tourism issues;
- Impact of the proposal on the local economy;
- Existing land-uses at and close to the site.

12.2.2 The chapter firstly presents the methodology used to assess the potential effects of the wind farm on tourism and recreation, socio-economics and land use by describing the consultation process and providing information gained during the public consultation exercise. Baseline conditions with regard to the above topics are then described and the significance of effects of the development explained. A summary of the potential effects of the development is provided at the end.

12.3 METHODOLOGY

12.3.1 The assessment of socio-economic impacts involved a desk-based study, correspondence with key stakeholders and wide ranging community consultation. A participatory approach was taken as far as possible in assessing the impacts on quality of life and establishing the need for, and nature of, any mitigation measures. Public exhibitions and Local Neighbour Briefings allowed local residents to express their views on the proposal.

12.3.2 There are no known published standard approaches to determining the significance of land use, community or socio-economic effects. The assessment of effect significance has therefore been determined using criteria developed from best practice techniques and expert knowledge.

Consultation

12.3.3 Novera takes a strategic approach to community involvement, which ensures that a wide range of groups are able to comment on its development proposals. To do this, Novera undertook the task of identifying those individuals, groups and organisations (including statutory consultees) that it felt should be involved in the proposed wind farm development. These stakeholders were then engaged in a pre-application dialogue and their comments on the proposed wind farm at Glenkerie sought.

12.3.4 As part of the scoping exercise a number of local groups and organisations were contacted. These included Scottish Borders Council, Scottish Natural Heritage, the Scottish Rights of Way and Access Society (ScotWays), RSPB Scotland and the Tweed Foundation. A full list of consultees is illustrated in Table 1.1 Consultee List.

12.3.5 ScotWays informed that there are no rights of way across the proposed site.

Community Involvement

12.3.6 In addition to the stakeholder consultation process, Novera sought to ensure that the consultation exercise captured the views of local residents and provided the opportunity for them to comment and influence the proposal.

12.3.7 The owners or tenants of the 12 properties close to the development that from the ZTV were identified as possibly being able to see a hub of at least one turbine. Early on in the development their residents were invited to an informal meeting to discuss the proposal with Novera Energy.

12.3.8 A public exhibition was held in Tweedsmuir Village Hall on 31st August and 1st September 2007 to present and discuss the proposed development with the local community. Approximately 80 people attended the exhibitions. At the meeting, attendees were given the opportunity to discuss the proposed development, and to complete a questionnaire allowing them to express their expectations and concerns.

12.3.9 A newsletter providing information about the proposal in general and giving details of the exhibition was distributed to residents living within 12 km of the site. In particular, the newsletter focused on encouraging people to comment on the proposal and provided them with details of opportunities to do so. Contact details for Novera Energy were provided in the newsletter to encourage people to comment on the proposal.

12.3.10 A questionnaire was included with the newsletter and also distributed at the public exhibition. In total there were 38 responses. Of those, 60% were in favour of the proposed development, 24% were against and 16% were undecided. 92% of respondents felt personally concerned with the effects of climate change and 79% of respondents viewed wind farms as a positive source of generating electricity.

12.3.11 The most common perceived benefits of the proposal were the generation of clean, green energy and a reduction of carbon dioxide emissions from traditional fossil fuel burning power stations. In addition a high proportion of respondents were in favour of the community benefits package which it was felt will help aid the local economy and will serve as a educational 'green' tool for the community. Other benefits associated with the development included lower electricity costs and a reduction in the use and demand for nuclear power.

12.3.12 The main concerns raised were the potential visual impact of the proposal on the local landscape, cumulative impact with other wind farms, noise and increased traffic levels on local roads and uncertainty over the use of overground rather than underground transmission links.

12.3.13 The key issues identified throughout the public consultation exercise have been addressed as follows:

- Chapter 7 - Landscape and Visual Impact. Only 6 houses can see more than one hub and the cumulative and visual windfarm impact of the development is assessed as minimal;
- Chapter 8 - Ecology. The impact on the ecological status of the site was assessed as minor and not significant;
- Chapter 9 - Ornithology. The impact on birds was assessed as minor and not significant;
- Chapter 10 – Hydrology and Hydrogeology. The impact on hydrology of the site was assessed as minor and not significant:
- Chapter 11 - Noise. Impact assessed as nil;
- Chapter 13 – Transport. Slightly increased road traffic during construction. Overall impact assessed as minor;
- Chapter 14 – Infrastructure. No extra over ground poles or pylons. Impact assessed as nil;

In addition, a high proportion of local residents consulted suggested that all or a significant amount of the Glenkerie Wind Farm Trust money should be earmarked to support the local community buyout of the Crook Inn. Novera have agreed that this would meet the socio-environmental objectives of the charitable trust.

12.4 TOURISM AND RECREATION

Baseline Studies

12.4.1 The baseline description has been prepared after referencing a number of different source materials. The websites of Scottish Enterprise (www.scottish-enterprise.com), Scottish Borders Council (www.scotborders.gov.uk), Scottish Executive (www.scotland.gov.uk), Sustrans (www.sustrans.org.uk) and Visit Scotland (www.visitscotland.org) have been reviewed for relevant information. Information was also obtained from various published leaflets and from responses obtained during the public exhibitions in August and September 2007.

Assessment of Significance

12.4.2 The potential impact of the proposal on tourism and recreation is closely related to public attitudes towards wind turbines in the landscape, and is therefore linked with the landscape and visual assessment of the proposal (Chapter 7), which examines a number of viewpoints that have local tourism significance including Pykestone Hill and Culter Fell. Impacts on historic buildings are further discussed in Chapter 6, Cultural Heritage.

12.4.3 A number of studies on the public's attitude towards wind farms have been carried out, the most substantial and recent of which have been examined in detail and the relevant conclusions discussed below.

12.4.4 The criteria employed to assess the significance of effects on recreation (and indeed recreational tourism) at the site is in line with SNH guidance[1]. Significant impacts are those that would lead to permanent or long-term effects on facilities provided under statutory powers, or where the proposals affect recreational resources that have more than local use or importance.

Baseline Description

12.4.5 Tourism is a major source of income and expenditure throughout the Scottish Borders with the main sources of income being game sports, walking and cycling activities. Attractions in the area around the site include the Dawyck Botanic Garden, 9km to the north-east which attracted 21,000 visitors in 2006[2] and the Glenholm Centre, 4km to the north of the site, has walking trails, wildlife attractions and a tea room. There are also a number of small historical sites within the vicinity of the proposed wind farm. It should be noted that none of these attraction can see the proposed windfarm at Glenkerie other than when visitors use the walks at Glenholm.

12.4.6 The Clyde Valley Tourist route runs from Abington to Biggar along the A702 and then from Biggar and Lanark along the A72. It is only possible to see the proposal for short periods from the A702. However, at the closest point on the A702, the proposal is approximately 9km from the site.

12.4.7 There are no scheduled monuments, listed buildings, historic gardens or designed landscapes on the proposed site. The closest Historic Gardens and Designed Landscapes are Dawyck (9km to the north-east) and Stobo Castle (10km to the north-east). Stobo Castle operates as a popular luxury health spa. It should be noted that the proposed wind farm is not visible from Stobo Castle and is only visible from the outskirts of the Historic Gardens and Designed Landscapes at Dawyck.

12.4.8 The Glenholm Centre promotes a number of walks of varying lengths within its vicinity. These walks take in Glenhighton and Blakehope Head approximately 2km from the development site.

12.4.9 The John Buchan Way is a waymarked walk running from Peebles to Broughton and at the closest point, it would be 7km to the nearest turbine. The proposal will be visible from places on this walk but the impact has been assessed as negligible in Chapter 7.

12.4.10 There are no cycle routes in the vicinity of the site.

12.4.11 ScotWays informed that there are no rights of way across the proposed site which indicates that the site may be used as a walking route. However, the OS 1:50,000 base map shows a path running from Glencotho to Kingledores. The local farmers confirm that this path is only used occasionally.

[1] *Scottish Natural Heritage – A Handbook on Environmental Impact Assessment (Appendix 5 – Countryside Access Impact Assessment), January 2002*

Assessment of Effects

12.4.12 Two separate surveys have looked at the effect of wind farms on tourism in Scotland. A MORI poll commissioned by the Scottish Renewables Forum and the British Wind Energy Association in 2002 found that over 90% of visitors would return to Scotland for a holiday whether or not there were wind farms in the area. Of those that had actually seen wind farms whilst on holiday, 8% had come away with a negative impression. Eight out of ten said they would go to a wind farm information/visitor centre during their stay.[3]

12.4.13 Another survey in 2004 by the Visit Scotland tourism agency recorded that 75% of visitors were either positive or neutral towards wind farm development in general, although less positive about specific visual impacts. The attitude of those who had actually experienced a wind farm tended to be more positive than those who had not. The majority said it would make no difference to their decision to holiday in Scotland if the number[4] of wind farms increased.

12.4.14 In terms of effects on tourism, experience to date in the UK shows that wind energy developments can have a positive effect on tourism and can themselves be tourism destinations, as the following examples indicate[5]:

- The UK's first commercial wind farm, at Delabole in Cornwall, received 60,000 visitors in the first year and total of 350,000 visitors in its first eight years;

- In Norfolk, visitors queue to climb the 300 steps to the top of the UK's tallest turbine at the EcoTech Centre. A specially designed viewing platform situated below the turbine nacelle gives views over the surrounding countryside. 70,000 visitors have climbed the turbine since it opened, with many thousands more visiting the centre and learning about sustainability issues. A survey of local residents showed that at least 90% would be in favour of having another turbine 'in their back yard', and a second turbine was erected near the town in July 2003.

12.4.15 A study carried out for the Wales Tourist Board in 2003, *Investigation into the Potential Impact of Wind Farms on Tourism in Wales*, found that 78% of all respondents had a neutral or positive view on wind farm development and only 21% had a negative view. 68% would be interested in attending a visitor centre at a wind farm development. 68% said it would make no difference to their likelihood to take holidays in the Welsh countryside if the number of wind farms increased.

12.4.16 The University of St Andrews in December 2005[6] carried out research at several wind farms in the Scottish Borders and in southwest Ireland.

[3] *Source: "Tourist Attitudes Towards Wind Farms", MORI Scotland, 2002, Sample: 307 Tourists*
[4] *Source: "Investigation into the Potential Impact of Wind Farms on Tourism in Scotland", VisitScotland, 2002, Sample: 180 Visitors*
[5] *BWEA (May 2006) The impact of wind farms on the tourist industry in the UK*
[6] DTI, 29 June 2006, Renewable Energy Information Pack

Tourism is economically important in both regions and they are renowned for their scenic beauty, so the prospect of an upsurge of wind farms was a cause for concern. However, Dr Charles Warren of the School of Geography and Geosciences established that, although people expected a range of negative impacts, these fears were not realised. In most cases, people found that their worries about landscape impacts and noise were unfounded, with surprising numbers finding the wind farms a positive addition.

12.4.17 A study in 2003 by MORI Scotland, commissioned by the Scottish Executive, examined the views of local people living within 20km of Scotland's 10 largest windfarms.[7] Three times the number of residents stated that their local wind farm has had a broadly positive impact on the area (20%) than say that it has a negative impact (7%). Most (73%) felt it has had neither a positive nor negative impact, or expressed no opinion. When asked what the shortcomings of the areas in which they live were, most commonly mentioned were lack of amenities (20%) and poor public transport (18%); only 0.3% of people expressly mentioned wind farms as a negative aspect of their area.

12.4.18 The 2003 MORI study also found that those people living closest to the wind farms tend to be more positive about them (i.e. 44% of those living within 5km say the wind farm has had a positive impact, compared with 16% of those living 10-20km away). People are also most supportive of expansion of the sites (i.e. 65% of those in the 5km zone support 50% expansion, compared with 53% of those in the 10-20km zone).

12.4.19 A report published by the BWEA in May 2006, The Impact of Wind Farms on the Tourist Industry in the UK, looked at several surveys and reports investigating wind energy and tourism conducted by reputable poll companies and consultants. It reported that the results from all these surveys demonstrate that the effect of wind farms on tourism is negligible at worst, with many respondents taking a positive view to wind farms, and saying it would not affect their likelihood of returning to an area.

12.4.20 Wind farms draw attention to energy consumption and can make people be more conscious about their usage. This can have a positive impact on the energy savings awareness of the local community but it could also be a stimulating factor for the development of eco tourism concepts in the Glenkerie area.

12.4.21 The visual impact of the wind farm on residents and visitors to the area is examined in Chapter 7, Landscape and Visual Assessment.

Recreation in the vicinity of Glenkerie

12.4.22 There are limited recreational opportunities in the direct vicinity of the proposed wind farm. The steep terrain of the site makes it unsuitable for most types of recreation. During construction, public access onto some areas of the site would be limited and although the construction period will last 6 to 9 months, no impacts are predicted due to the limited public

[7] *Source: "Public Attitudes to Wind Farms: A Survey of Local Residents in Scotland", MORI for the Scottish Executive, 2003, Sample: 1,800 Residents*

use of the site. When construction is completed, the whole site would be reopened and there would be no access limitations.

12.5 SOCIO-ECONOMICS

Baseline Studies

12.5.1 The socio-economic baseline information has been sourced from the website of Scottish Borders Council.

Assessment of Significance

12.5.2 In terms of socio-economic factors, effects would be significant if the wind farm proposal, during either construction or operation, resulted in any fundamental or material changes in population, structure of the local community, local service or employment.

Baseline Description

12.5.3 The population of the Scottish Borders is approximately 110,000[8]. In September 2007, the unemployment rate[9] in the area was 1.2% (excluding full-time students), compared to 2.2% in Scotland as a whole[10].

12.5.4 The workforce sector is made up as follows[11]:

- Agriculture, fishing, energy and water – 6% (3%);
- Manufacturing – 14.7% (9.6%);
- Construction – 7.4% (5.4%);
- Distribution, hotels and restaurants – 23.3% (22.4%);
- Transport and communications – 3.6% (5.4%);
- Banking, finance and insurance – 8.9% (18.5%);
- Public administration, education and health – 31.2% (30.3%); and
- Other services – 5% (5.3%).

12.5.5 The Scottish Borders Regional Economic Strategy[12] has found that the Scottish Borders has an over dependence on a narrow range of industrial sectors and in particular on manufacturing and primary industries. Growth potential has been identified within the tourism, forestry and food sectors.

[8] *http://www.scotborders.gov.uk/outabout/aboutborders/population/*
[9] *Based on number of people claiming unemployment benefit.*
[10] *http://www.scotborders.gov.uk/pdf/21052.pdf*
[11] *http://www.scotborders.gov.uk/outabout/aboutborders/employment/index.html*
[12] *http://www.scotborders.gov.uk/pdf/11346.pdf*

Assessment of Effects

12.5.6 The capital cost of the Glenkerie Windfarm is expected to be approximately £27.5 million, of which approximately £9.5 million will be spent on construction of civil and electrical infrastructure. The project has the potential to have a beneficial effect on the local economy in terms of employment during the construction and operational stages, as this investment creates a number of economic opportunities for local businesses.

12.5.7 The use of local contractors for construction, operation and maintenance work will be encouraged wherever possible, as long as they satisfy technical requirements and are cost competitive. Local manufacturers will also be given priority for sourcing auxiliary equipment such as electrical installations (medium voltage cables, optical fibre cables), fences and road construction materials. The estimated value of contracts that will be available for tender by local sub-contractors during the construction stage of the development is approximately £9.5 million.

12.5.8 During the construction phase (approximately 6-9 months) there will be an average of 16 to 18 workers on site per day and one person will be employed as site security staff. Throughout the 25-year lifetime of the wind farm, the establishment of a local service team will be promoted, depending on the wind turbine manufacturer's requirements. This would create 1 or 2 full time jobs. In addition, one local person will be employed on a part-time basis to conduct on-going monitoring of the wind farm, to react to minor error messages that are sent out by the wind farm control system and periodically to check the site for any damage.

12.5.9 A Windfarm Trust Fund will also be established and the Windfarm subsidiary of Novera Energy plc will donate £2,000 per MW installed to the Trust. For 11 x 2.5MW turbines this will in the 1st year of operation, result in £55,000 a year, index linked (more than £2M over 25 years) being donated to the Community. Following wide consultation, it was agreed that a large proportion of the Glenkerie Windfarm Trust money could if required, be earmarked to supporting the Local Community Buyout of the Crook Inn.

12.5.10 The Windfarm company also pays Business Rates like any other company and so over £110,000 will be accrued each year which will result in over £3M of rates being paid.

12.5.11 Employment opportunities will also arise during the decommissioning process.

12.6 LAND USE

Baseline Studies

12.6.1 The land use information has been sourced from visits to the site and surrounding area and through examination of the Ordnance Survey map covering the area[13] .

Assessment of Significance

12.6.2 Effects on land use would be considered significant if the development caused the removal of rare habitats, or removal of a significant proportion of a habitat type in the Scottish Borders. In terms of roads and settlements/residential properties, significant effects would include closure of roads due to the development, particularly during the construction and decommissioning phases, or hindering access of residents to their properties.

Baseline Description

12.6.3 The site of the proposed wind farm is located at approximately 480m AOD on rough grazing land.

12.6.4 The land on and around the wind farm site is currently used as rough grazing land for sheep. The habitats on site are mainly heath and grassland with pockets of blanket bog existing in the dips between the peaks. Chapter 9, Ecology describes the habitats on the wind farm in more detail.

12.6.5 There is a very small area of semi-natural broadleaved woodland in the east of the site.

12.6.6 Two watercourses on the site are part of the River Tweed Special Area of Conservation (SAC). This SAC is designated for its Atlantic salmon, otter, brook lamphrey, river lamphrey, sea lamphrey and floating water-crowfoot interests. Chapter 10, Hydrology provides further information on this.

12.6.7 The nearest classified road to the windfarm site is the A701 running to the east and south-east of the site from Broughton to Tweedsmuir, passing 1.2 km to the east of Turbine 9 at its closest point. There is an unclassified road approximately 1 km to the north of the site.

12.6.8 The nearest settlements to the site are Tweedsmuir, located approximately 4km south-east of the site, Broughton approximately 7km north-north-east of the site and Drumelzier approximately 7km north-east of the site. Residential properties located in the vicinity of the site include:

- Kingledores, 1000m (from the nearest turbine); and
- Glencotho, 1200m.

[13] *Ordnance Survey 1:25 000 scale Explorer Map 343*

12.6.9 There are no properties located within the proposed site boundary.

Assessment of Effects

12.6.10 Impacts on habitats and species are discussed in detail in Chapter 8, Ecology.

12.6.11 The wind farm will be visible from various points along the Clyde Valley Tourist route including short stretches of the A702 as outlined and assessed in Chapter 7, Landscape and Visual Assessment.

12.6.12 There may be short-term road closures during the delivery of the turbine components to the site as detailed in Chapter 14, Traffic and Transport. Due to the short-term and temporary nature of this impact, it is not considered to be significant.

12.7 SUMMARY OF EFFECTS

12.7.1 No evidence of past events or trends exists which indicate that construction of a wind farm will result in a fundamental or material change in population, structure of the local community, local services or employment.

12.7.2 Surveys and the practical experience of areas around operating wind farms indicates that tourists are not discouraged from visiting areas in which there are wind farms and that people living close to operating wind farms tend to feel positively towards them.

12.7.3 The construction of the wind farm will result in a local, long term benefit from the diversification of farming income. Short-term economic benefit will be due to the creation of local jobs and through opportunities for local companies to tender for contracts and provide services during the construction period. Any other potential socio-economic effects will be at a local level, and would be projected to be minor, short term and thus not significant.

CHAPTER THIRTEEN: TRANSPORT

13.1 EXECUTIVE SUMMARY

13.1.1 The potential impacts associated with the increase in heavy goods vehicle (HGV) traffic during the construction, operation and decommissioning of the proposed 11 turbine wind farm at Glenkerie have been assessed.

13.1.2 The preferred route for abnormal loads has been selected in order to minimise road upgrades and disturbance to other road users. This route is outlined below:

- Motorway network to junction 15 on the A74(M);
- Leave A74(M) and proceed to Moffat;
- Continue through Moffat on the A701 proceeding North; and
- Continue on A701 to the site access point at Kingledores.

13.1.3 An alternative route has been considered from Edinburgh. This route is outlined below:

- From Imperial Docks at Leith Edinburgh continue towards the A720 City Bypass;
- Leave A720 for the A701 at Straiton;
- Continue on A701 and exit onto on the B7026 at Milton Bridge;
- Travel along B7026 to Howgate and join the A6094;
- Continue on the A6094 to Leadburn and join the A701 heading south west;
- Continue on A701 to Blyth Bridge;
- Join the A72 after Blyth Bridge heading South West;
- Rejoin the A701 by Kaimrig End; and
- Continue south on the A701 until the site access point is reached at Kingledores.

13.1.4 Construction of the wind farm is expected to start in 2009. The loads associated with construction have been calculated and include traffic generated from turbine delivery, site preparation the delivery of cement for the turbine foundations and aggregate for use in track and hardstanding construction.

13.1.5 The main potential effects from increases in HGV traffic include:

- Traffic noise and vibration;
- Disruption and delay;

- Accidents and safety;
- Air pollution; and
- Dust and dirt.

13.1.6 A Transport Management Plan will be drawn up by and agreed with Scottish Borders and Dumfries and Galloway Council (as appropriate) following consent. Potential management measures to mitigate against the impacts are outlined in this chapter and include timing of deliveries to avoid sensitive periods of the day, traffic control and temporary diversions, parking restrictions and signage, and arrangements for road maintenance and cleaning, wheel cleaning and dirt control.

13.1.7 The A701 northbound from A74(M) is the preferred route for abnormal loads delivering turbine components. Effects from this vehicle type are associated more with the presence of long, slow-moving vehicles on the road network than with the number of vehicles involved.

13.1.8 Abnormal load deliveries would be escorted by police and would occur during off-peak periods in order to avoid delays to other road users. Measures to mitigate the disruption, delay, noise and vibration caused by these deliveries will be outlined within the Transport Management Plan.

13.1.9 In summary, the assessment concludes that the effects of traffic generated by construction of the wind farm are as follows:

- A short-term significant increase in HGV traffic levels on the A701;
- A temporary significant impact as a result of the delivery of abnormal loads i.e. turbine components and cranes along the preferred route to site;
- A short-term adverse effect on the A701 at the turn off to the site during the construction period;
- Traffic generated during the operation and maintenance of the wind farm will be minimal and would not result in any significant impact; and
- Traffic generated during decommissioning of the wind farm will be lower than the levels during construction.

13.2 INTRODUCTION

13.2.1 This chapter evaluates the transport and access aspects of the proposed Glenkerie Wind Farm and includes an assessment of the impact of traffic increases arising from development on the local road network. The results are reported in this chapter and a preferred route to site is outlined.

13.3 TRAFFIC IMPACT ASSESSMENT METHODOLOGY

13.3.1 The general approach to the assessment of effects as required by The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 has been followed.

13.3.2 Baseline conditions have been established through a detailed desk-top study, consultation with relevant transport and planning stakeholders and use of traffic survey data. Potential effects have been identified and assessed, and where relevant, mitigation measures identified.

13.3.3 The significance of potential effects has been assessed in light of:

- Recognised thresholds of significance from published guidance (as discussed below); and
- Atmos' experience of carrying out this type of assessment.

Guidance

13.3.4 The transport and traffic issues described in the following planning advice and guidance documents have been taken into account in this assessment:

- National Planning Policy Guidance Note (NPPG) 17: Transport and Planning;
- Planning Advice Note (PAN) 57: Transport and Planning; and
- Guidelines for the Environmental Assessment of Road Traffic, Institute of Environmental Assessment, 1993.

PAN 57: Transport and Planning

13.3.5 Paragraph 2 on Transport Assessment notes that:

"The policy framework referred to in NPPG 17 requires developers to produce a Transport Assessment for significant travel generating developments. The Transport Assessment is to be distinguished from an Environmental Assessment, but may, where a formal Environmental Assessment is required, form part of it."

13.3.6 Paragraph 8 of the PAN refers to Local Transport Impacts. It notes that:

"Transport Assessments should cover the local transport impacts of the development including those during construction of the development, any impacts on the operation of the public transport network, and those relating to freight and servicing the development".

13.3.7 Under the terms of the above guidance, a formal Transport Assessment is not required for the proposed Glenkerie Wind Farm, as the PAN principally relates to developments that generate significant increases in

travel as a direct consequence of their function, e.g. retail parks. However, in providing the information required to be presented in an Environmental Statement, this chapter addresses the local transport impacts of the development during construction and operation and therefore addresses the issues that would be assessed within a Transport Assessment.

Consultation

13.3.8 Scottish Borders Council were initially consulted for a scoping opinion in July 2005. JMP Consulting who act as consultants to the Scottish Executive Trunk Road Network Management Division (TRNMD) were contacted by the council for their views on the proposed development as they have responsibility for managing and maintaining the M74, A74 (M) and the A701 in the vicinity of the Glenkerie proposal.

13.3.9 Scottish Borders Council, Dumfries and Galloway Council and Transport Scotland were contacted with requests for baseline traffic flow figures. These figures were provided by all parties and have been incorporated into this chapter, where appropriate.

13.3.10 JMP Consulting responded that the ES should provide information relating to the preferred route options for the movement of heavy loads, and anticipated construction staff movements via the trunk road network during the construction period. In addition, information regarding the potential environmental impacts on the trunk road network once the proposal is operational, together with appropriate mitigation measure should be made available at request. Environmental impacts such as noise and air quality should be assessed and where these impacts have been fully investigated and found to be of little or no significance, the transport assessment should state that:

- Where this assessment has been undertaken in the ES;
- The impact of this; and
- Why it is not significant.

Assessment of Effects and Significance Criteria

13.3.11 The increase in traffic numbers has been calculated by comparing predicted vehicle numbers with existing traffic numbers on the public roads used to access the site. The increases have been expressed as percentages, and their significance assessed in terms of recognised criteria, detailed below.

13.3.12 The Guidelines for the Environmental Assessment of Road Traffic[1] 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:

[1] Institute of Environmental Assessment: Guidance Notes No.1 – Guidelines for the Environmental Assessment of Road Traffic

- Rule 1 - Include highway links where traffic flows would increase by more than 30% (or the number of HGVs would increase by more than 30%); and
- Rule 2 - Include any other specifically sensitive areas where traffic flows would increase by 10% or more[2].

13.3.13 Where the predicted increase in traffic flow is lower than these thresholds, the significance of the effects can be stated to be low or insignificant, and further detailed assessments are not warranted.

13.3.14 These guidelines are intended for the assessment of the environmental impact of road traffic associated with major new developments. The assessment is therefore 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.

13.4 ROUTE TO SITE

Site Access

13.4.1 The main access to the site will be the A701. While abnormal loads will be expected to approach from the south of the site, ancillary construction traffic such as cars, minibuses and LGVs could also approach from the north of the site on the A701. These routes are shown in Figure 13.1.

Abnormal Load Route

13.4.2 Turbine components are expected to use the Motorway network from the port of entry. Once on the Motorway network components will approach the A701 from the north or south on the A74(M).

13.4.3 The turbine components will be delivered using the following route, as shown on Figure 13.1:

- Motorway network to junction 15 on the A74(M);
- Leave A74(M) and proceed to Moffat;
- Continue through Moffat on the A701 proceeding North; and
- Continue on A701 to the site access point at Kingledores.

13.4.4 Delivery from Edinburgh was also considered for turbine components. This route has been outlined as an alternative in 13.1.3.

13.4.5 Additional routes were considered in a desktop study exercise but these were considered unsuitable due to the constraining nature of road and junction alignments for the movement of long trailers carrying turbine components.

[2] IEA Guidelines Paragraph 3.20 define sensitive areas as including "accident blackspots, conservation areas, hospitals, links with high pedestrian flows etc."

Other Construction Traffic

13.4.6 HGV traffic associated with the project will utilise the local road network, subject to detailed consultation and agreement with Scottish Borders Council roads department and the local community.

13.4.7 Ancillary construction site traffic may use the A701 from either the north or south of the site, dependent upon the source of the service or equipment provider.

Sensitive Receptors

13.4.8 The following sensitive receptors (as identified in the IEA guidelines) have been identified using OS 1:25,000 scale maps, site visit and drive-over of access routes:

- Residential properties located along the A701 between J15 on the A74(M) and Moffat;
- Properties and businesses in Moffat;
- A local School in Moffat;
- Residential properties located along the A701 between Moffat and the site access point at Kingledores;
- The Devils Beef Tub tourist attraction located by the A701; and
- The Source of the Tweed tourist attraction located by the A701.

13.5 BASELINE TRAFFIC VOLUMES

13.5.1 Scottish Borders Roads Department provided traffic count data for the A701 south of Broughton.

13.5.2 Transport Scotland provided data for the A74(M) south of J14.

13.5.3 Data was provided as hourly flows (both directions), divided into four vehicle categories for the A701 and 5 for the A74(M). Summary tables of the 12-hour (0700-1900) flows were calculated from the hourly data, to reflect anticipated working times and illustrated below.

13.5.4 Table 13.1 provides a summary of these data.

Table 13.1: Traffic Counts for A701 and A74(M)

A701 South of Broughton – Tuesday 6th March 2007

	Vehicle Length Classification			
	<= 5.2m	5.2-6.5m	6.5–11.5m	>11.5m
Northbound	620	35	34	3
Southbound	579	15	31	29
Total	**1199**	**50**	**65**	**32**

A74(M) south of J14[3]

	Vehicle Classification				
	Cars and Taxis	Motorcycles	Larger Buses and Coaches	Light Vans	HGV
Northbound	7833	42	49	1222	1295
Southbound	8256	44	52	1287	1364
Total	**15644**	**86**	**101**	**2509**	**2659**

13.6 ASSESSMENT OF POTENTIAL EFFECTS

Infrastructure Upgrades

13.6.1 No major pinch points (areas considered problematic for the delivery of abnormal loads) were identified on the preferred route. Some access restrictions and temporary road closures may be required during delivery of the turbine components to site. In addition, the following general steps will required

- All hedges, shrubs and overhanging branches along the route to be trimmed to allow a minimum envelope on the road of 5.0 m wide by 5.0 m high; and
- Street furniture (signage, benches etc.) would require to be temporarily removed where necessary to allow a minimum envelope on the road of 5.0 m wide by 5.0 m high.

13.6.2 Due to the nature of the existing roads, it is likely that the modifications would be kept to a minimum, as much of the route is sufficient to accommodate the required widths and lengths.

13.6.3 Levelling and preparation of areas of verge to accommodate axle loads may be required at certain points along the route. Some general road

[3] Data for the A74(M) was provided in total vehicles figures only. The figures stated above have been adjusted according to the statistical relative fraction of each vehicle type taken from *Table 7.4 Road Traffic: by type of vehicle and class of road: 2005, DTI transport statistics 2006, http://www.dft.gov.uk/pgr/statistics/datatablespublications/tsgb/2006edition/sectionsevenroadsandtraffic last accessed October 2007.*

widening is anticipated along the A701 between Moffat and the site access point as the verges may be required for abnormal load vehicle movements. Some trimming of trees and shrubs may also be required to accommodate long loads. Any potential upgrading works will be subject to approval from Scottish Borders and Dumfries and Galloway Councils.

13.6.4 Ten sections were defined as potentially requiring verge widening, tree pruning or temporary signage removal between Moffat and the site access point. These are (all NT to nearest 10m); 0757 0623, 0739 0691, 0639 0867, 0593 1120, 0628 1204, 0627 1239, 0610 1254, 0454 1359, 0899 2389 and 1121 2698. It is anticipated that abnormal load delivery vehicles may require the use of the whole road at these locations at least and potentially at others.

13.6.5 These road works would be consented separately under The Roads (Scotland) Act 1984, if required by either Scottish Borders or Dumfries and Galloway Council. A pre-construction survey would be undertaken and the road restored to the same condition on completion of construction works.

13.6.6 In addition the temporary removal of street furniture and signs would be agreed with Scottish Borders or Dumfries and Galloway Roads Departments and the Police to ensure that safety for all road users is not compromised. Short term parking restrictions may also have to be applied in Moffat to ensure the unrestricted movement of abnormal load delivery traffic. A traffic management plan would be presented in advance for agreement, and temporary structures and signs would be used where necessary.

Construction Impacts

Estimated Construction Traffic Volumes

13.6.7 Construction is anticipated to commence in 2009. The estimated levels of construction traffic are summarised in Table 13.2 below.

13.6.8 The vehicle types that will be needed during the construction phase include:

- Ancillary i.e. Cars, minibuses and other Light Goods Vehicles (LGVs) as required;
- Heavy goods vehicles (HGVs) i.e. standard HGVs, 21 and 25 tonne HGVs; and
- Exceptional (heavy and/or large) loads[4] that will deliver the turbine components (towers, hubs, blades and nacelle units) and cranes for turbine assembly and erection.

[4] Exceptional vehicles can also be referred to as 'Abnormal Load Vehicles'.

Table 13.2: Construction Traffic Summary

Activity	**Details**	**Approximate Loads**
Turbine erection	Low loader vehicles to transport blades may be up to 40m. For tower sections overall vehicle length will be less than 30 m. For transport of nacelles gross vehicle weight is expected to be in the region of 100 tonnes. An 800 tonne main lifting crane and a 500 tonne auxiliary crane will also be required (1 load each).	90 abnormal loads[5] 22 HGV loads, (2 per turbine of additional components.)
Site preparation, pre-construction works and closure of the site	Laying down and removal of temporary construction compound at the start and end of construction phase. Vehicles will transport materials that include portacabins, compactors, fencing, generators, cabling, diesel, etc.	45 HGV loads
Construction of access track	Importation of stone aggregate for track and passing place capping purposes.	230 HGV loads[6]
Construction of foundations	Off-site concrete batching will reduce potential impact to watercourses. This is discussed further in Chapter 10 Hydrology and Hydrogeology.	726 HGV loads[7]
Sand required for cable bedding	Sand for bedding cables within track-side trench.	98 HGV loads
Control building construction and cable works, including grid connection	Construction and fitting out of the control building and the transformer.	100 HGV loads
Ancillaries (e.g. fuel, and other construction materials when required)	Approximately 5 loads of other materials will be required per week for the duration of the construction period[8].	180 HGV loads
Total HGVs	**Not including Abnormal Loads**	**1401**
Total HGV and Abnormal Load Vehicles	**Includes Abnormal loads**	**1491**

[5] Main turbine components will include 3 towers (3 loads), 1 nacelle (1 load), 3 blades (up to 3 loads depending on trailers used to transport blades), 1 hub and 1 generator (1 load) plus craneage requirements.
[6] Calculation based on 17820m² of surface capped to a depth of 200mm.
[7] Based on 5m³ per delivery.
[8] Anticipated to be 6-9 months.

13.6.9 It is recommended that a geo-technical investigation is carried out to assess the suitability of rock material for track construction. It is expected that material won from cuttings will be used to form a base material for construction of tacks.

13.6.10 Aggregate for track capping purposes will be sourced off-site for the section of road adjacent to the Kingledores Burn flood plane, due to its sensitivity as a main tributary to the River Tweed SAC. This section of the access track is estimated as 2.5km.

13.6.11 If detailed geo-technical surveys are found to necessitate importation of further material for track and hardstanding construction, consultation will be carried out with all relevant stakeholders to inform them of the additional short term adverse effect as a result of the increase in HGV traffic volume.

13.6.12 It is the intention of the developer to import all concrete for the turbine foundations from outside the site as a Hydrological mitigation measure.

13.6.13 Each load generates 2 vehicle movements, the journey to the site and the return journey. Only the delivery journey of turbine components is classified as an abnormal load. On the return journey the extendable trailers will be contracted to become normal HGV traffic. The total number of abnormal load and HGV vehicle movements associated with the construction of the wind farm is estimated as follows:

- 2892 standard HGV movements (including 90 abnormal loads returning); and
- 90 abnormal load movements.

13.6.14 The levels of manning will vary according to the phase of the project, with the highest levels at the point where civil works are nearing completion, turbines are being installed, electrical systems are being installed, and initial testing of turbines has commenced for commissioning.

13.6.15 Table 13.3 outlines the predicted vehicle movement associated with the construction of the wind farm which is estimated to last 6-9 months and incorporates the return journey figure of 2 loads per delivery.

Table 13.3: Projected Monthly Vehicle Loads (Incorporating Delivery and Return Journey)

	Month of Construction									
Activity	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
Turbines: abnormal/ HGV			30/45	30/45	30/44					90/ 134
Site preparation, closure	45								45	90
Importation of stone for capping tracks and hardstandings	153	153	154							460
Imported Concrete Material		363	363	363	363					1452
Sand for Cabling				98	98					196
Control building and grid connection construction				66	67	67				200
Ancillaries (e.g. fuel)	40	40	40	40	40	40	40	40	40	360
Total HGVs	238	556	602	612	612	107	40	40	85	**2892**
Total Abnormal			30	30	30					**90**
Total All Vehicles	238	556	632	642	642	107	40	40	85	**2982**

Assessment of Construction Traffic Impacts

13.6.16 This section considers the significance of the potential increase in HGV and abnormal load traffic to the known traffic volume baselines of the local and motorway road network at the following assessment location:

- A701 South of Broughton (March 2007); and
- A74(M) South of Junction 14.

13.6.17 Table 13.3 shows that the peak number of HGV deliveries occurs during Months 2-5 and is ~612 (month 4-5), there will be an additional 30 abnormal load movements during this month totalling **642** vehicle movements. Assuming a 5 day working week (20 days a month), this equates to an average of 32 HGV vehicle movements per day.

13.6.18 The predicted 12 hour HGV daily flow on the A701 in 2009[9] is 101, assuming that only vehicles above 6.5m are HGV's. The additional worst case HGV movements generated by the windfarm construction represents a **32% increase**. A worst-case scenario has been assumed, whereby all construction traffic movements occur at the location under consideration. In practice, with the exception of the abnormal loads, traffic is likely to travel to the site from both directions of the A701.

13.6.19 The predicted peak increases in HGV traffic on the A701 is therefore above the 30% threshold of significance for highway links. The increase in traffic has therefore been assessed as a significant short-term adverse effect on the A701.

13.6.20 The predicted 12 hour HGV daily flow on the A74(M) in 2009[10] is 2712. The additional HGV movements generated by the windfarm construction represents a <**2% increase**. Any impact on the A74(M) has been assessed as negligible.

13.6.21 The effects from abnormal load vehicles are associated more with the presence of long, slow-moving vehicles on the road network than with the number of vehicles involved. As there is predicted to be up to 30 movements of such vehicles per month during Months 3,4 and 5 of the construction period, the presence of abnormal loads on the preferred route for abnormal loads has been assessed as a temporary significant adverse effect.

13.6.22 It is unlikely that there will be significant increases in traffic during the AM and PM peak periods as routing agreements will aim to reduce the movement of construction vehicles during this time.

13.6.23 This increase in HGV traffic has the potential to result in the following environmental impacts, for which mitigation measures are presented in Section 13.7.

- **Traffic noise and vibration:** Construction noise in areas immediately surrounding the site is assessed in Chapter 11, Noise. The impacts due to noise outwith the site will be temporary in nature and characteristic of existing traffic noise.
- **Disruption and delay:** The increase in construction traffic has the potential to cause disruption and delay to other users of the local road network.
- **Accidents and safety:** Any increase in traffic numbers has the potential to result in an increased risk of accidents.
- **Air pollution:** Emissions from vehicles have the potential to impact on local and wider air quality. The temporary nature of the increases in traffic, the distribution of movements throughout the working day and the open nature of the area will ensure that any short-term local air quality issues are insignificant.

[9] Assuming an annual increase in traffic volumes of 2%.

[10] Assuming an annual increase in traffic volumes of 2%.

- **Dust and dirt:** HGVs can potentially cause dust and dirt from the site to be carried onto the local road network.

Operational Effects

13.6.24 On completion of the wind farm development, only site maintenance personnel vehicles will normally be required on the site. Weekly visits to the control building by maintenance personnel in four wheel drive or conventional passenger vehicles will occur following the commissioning phase.

13.6.25 It is estimated that the operation and routine maintenance of the wind farm will typically require no more than two vehicles per day, resulting in four vehicle movements per day.

13.6.26 Under certain circumstances, should additional servicing or maintenance be required, it may be necessary for a greater number of vehicles to access the site. These would not approach those experienced during the construction phase.

13.6.27 No significant effects on the local road network are predicted to occur during the operation of the wind farm.

Decommissioning Effects

13.6.28 The levels of traffic associated with decommissioning are likely to be lower than those required during construction. Prior to decommissioning a further traffic assessment will be carried out and procedures agreed with appropriate authorities.

13.7 MITIGATION

General HGV Construction Traffic

13.7.1 The applicant will ensure that the vehicles will be routed as agreed with the Council to minimise disruption and disturbance to the local community. If necessary, the applicant will agree to require the selected supplier/installer for the project to enter into a legal agreement relating to construction vehicle routing to the site, including issues relating to public safety and road maintenance.[11]

13.7.2 A Transport Management Plan will be drawn up by and agreed with Scottish Borders and Dumfries and Galloway Councils. Potential management measures to mitigate against the impacts could include:

- **Noise and Vibration:** timing of deliveries, traffic control;
- **Disruption and delay:** parking restrictions, signs warning other users of turbine movements, traffic control; and

[11] Legal agreement would include conditions set out within a Highway Transport Management Plan (HTMP) agreed between the developer, haulage contractor, local police and the relevant roads authorities. The HTMP would include issues of public safety and maintenance upkeep of local council roads.

- **Dust and dirt:** arrangements for road maintenance and cleaning, wheel cleaning and dirt control arrangements at key stages of construction.

13.7.3 In order to safeguard the interests of other users of the road network, such as visitors to the area, walkers and cyclists, measures will be put in place to ensure that these parties are aware of the presence of increased traffic, such as:

- The use of notices and leaflets in local tourist information centres and visitor facilities;
- Temporary signage;
- Providing information to appropriate organisations (e.g. Sustrans, The Rambler's Association) and requesting this information to be made available through their websites; and
- Temporary diversions, if necessary.

Abnormal Load Traffic

13.7.4 Scottish Borders and Dumfries and Galloway Councils and Lothian and Borders and Dumfries and Galloway Police will be notified, where appropriate in advance of proposed exceptional vehicle movements delivering turbine components to the site.

13.7.5 In order to mitigate the disruption, delay, noise and vibration caused by the movement of turbine components, the following measures are proposed:

- An appropriate escort will accompany movement of turbine components from the Port of Entry;
- Only the approved route will be utilised for delivery of turbine parts;
- The preferred transport route has been selected in order to minimise road upgrades and improvements required;
- Timings of turbine deliveries will be agreed with the local highways authorities and emergency services;
- Traffic control measures during turbine movements; and
- Warning signs.

13.7.6 If it is seen to minimise disruption, and with agreement of the Roads Authorities and local community, it may be possible to bring in abnormal loads in convoys of 3 at a time.

Operational Effects

13.7.7 As no significant impacts are expected as a result of the operation of the wind farm, no mitigation measures are required.

Decommissioning Effects

13.7.8 Mitigation measures will be adopted, as outlined for construction effects.

13.8 RESIDUAL EFFECTS

13.8.1 Due to the local road network having sufficient capacity to accommodate the predicted traffic levels, the temporary nature of the traffic increases and the use of the mitigation measures outlined above, it is considered that there will be no permanent significant residual effects on the road network from the increases in traffic.

13.8.2 Short-term significant adverse effects have been identified along the A701 during part of the construction period.

13.9 SUMMARY OF EFFECTS

Table 13.4: Summary of Effects

Potential Effect	**Mitigation**	**Residual Effect**
Impact on local roads	Infrastructure upgrades	N/A
Construction Phase		
Increase of 32% in HGV traffic along the A701	Traffic Management Plan, publicity, arrangements for road maintenance and cleaning	Significant short-term adverse
Disruption due to abnormal loads on the preferred route for abnormal loads	Traffic Management Plan Appropriate escorts, agreed emergency procedures, parking restrictions, signage	Significant temporary adverse
Operational Phase		
None	None Required	No Significant Effects
Decommissioning Phase		
Significant increase in traffic	Traffic Management Plan	No Significant Effects

13.10 STATEMENT OF SIGNIFICANCE

13.10.1 This traffic assessment concludes that there would be a temporary, significant increase in general HGV traffic levels on the A701. A worse-case scenario whereby all HGV vehicles approach the site from the same direction has been applied.

13.10.2 There will be a total of 90 abnormal load deliveries delivering turbine components and cranes during Months 3-5. If agreed with Scottish Borders and Dumfries and Galloway Council Roads Departments, convoys of up to 3 trailers at one time would be used to minimise disruption. These trailers will reduce to HGV length for the return journey.

13.10.3 Delivery of the turbine components is expected to be over a period of 2-3 months and is assessed as having a short-term adverse effect on the local road network. Abnormal loads would be normally timed during off-peak periods in order to avoid delays to other road users and would be escorted by the police.

13.10.4 Traffic generated during the operation and maintenance of the wind farm is minimal and would not result in any significant impact.

13.10.5 Traffic generated during decommissioning of the wind farm will be lower than the levels associated with construction.

CHAPTER FOURTEEN: INFRASTRUCTURE AND SAFETY

14.1 INTRODUCTION

14.1.1 Due to the blocking effect resulting from the movement of rotors, wind turbines have the potential to interfere with electromagnetic signals, particularly radar, communication and television signals.

14.1.2 This chapter evaluates the potential effect that the proposal may have on aviation safety, defence, telecommunications links and television reception in the vicinity of the development, specifically with reference to electromagnetic interference (EMI).

14.1.3 Safety issues such as the structural durability of the wind turbines, the likelihood of other potential effects, such as shadow flicker and any impacts on infrastructure are also considered.

14.2 CONSULTATION

14.2.1 Planning Advice Note 45 (Revised 2002): Renewable Energy Technologies provides guidance on organisations that may have interests affected by EMI. Organisations with an interest in telecommunications, television, aviation safety, defence and infrastructure in the vicinity of the site, which may potentially be affected, were consulted to ascertain what level of interference the proposed wind farm might cause, if any.

14.2.2 The consultation process was undertaken by Atmos Consulting Ltd. The following organisations were consulted:

- Ofcom;
- Ministry of Defence (MOD)/Defence Estates;
- National Air Traffic Services (NATS);
- Civil Aviation Authority (CAA);
- BT;
- CSS Spectrum Management Services;
- National Air Traffic Services (NATS);
- Civil Aviation Authority (CAA);
- Ofcom;
- BBC;
- JRC;
- Scottish Water;
- Scotways.

14.3 ASSESSMENT OF EFFECTS

Communication Links

14.3.1 Several organisations advised that the proposal could potentially interfere with communication links. The locations of these links were identified and it was determined that no interference would be caused by the proposal to these current or any presently planned communication links.

14.3.2 CSS Spectrum Management Services has no objections to the proposal.

14.3.3 The JRC does not foresee any potential problems with the Glenkerie proposal.

Radar

14.3.4 The MOD has been consulted regarding the potential impact of the proposal on radars. Defence Estates advised that the MOD has no concerns with the proposal.

14.3.5 The location of the proposed turbines is approximately 29km from the Seismological recording station at Eskdalemuir and therefore falls within the statutory safeguarded area for this site. Defence Estates advised that the proposed scheme would not interfere with Eskdalemuir operations and that it was well within the available seismic noise budget.

14.3.6 NATS En Route (NERL) Plc is responsible for the safe movement in the en-route phase of flight for aircraft operating in the UK, using radars, communications systems and navigational aids. Consultation with NATS advised that the proposal site falls in the peripheral zone of an area where wind farms are likely to interfere with the operational infrastructure of NERL radars.

14.3.7 Further assessment by Atmos Consulting Ltd has shown that the proposed turbines at the Glenkerie site would not be visible from Lowther Hill. NATS will determine whether or not the proposal has an unacceptable effect on NERL Air Traffic Control operations once a planning application for the wind farm is submitted. Because the Glenkerie Wind Farm turbines would not be visible from Lowther Hill, it is expected that the proposal will be deemed acceptable by NATS.

14.3.8 The CAA reports no observations in relation to the proposal.

Television Reception

14.3.9 The BBC's automated checking tool was used as a "first pass" assessment and indicated that the proposed wind farm may affect the television reception of up to 2 homes with no alternative off-air service. It should be noted that the BBC tool provides a worst case scenario.

14.3.10 The television transmitters providing coverage to the area surrounding the Glenkerie site are at Black Hill and Black Hill CH5.

14.3.11 Wind turbines can affect analogue television reception where the television sets are in the shadow of weak signal transmissions. This effect rarely extends beyond 2km from a turbine between the receiver and transmitter. There are only isolated properties within 2km of the Glenkerie site, therefore, few homes are likely to experience television reception interference.

14.3.12 Digital television signals from satellite and terrestrial digital transmitters are very rarely affected by wind turbines. The Scottish Borders will switch over to digital television reception by 2009.

14.3.13 In the event that the television reception of any local households is adversely affected by the turbines, the applicant will commit to appropriate mitigation measures, which can be secured by way of a planning condition.

14.4 INFRASTRUCTURE

14.4.1 The Health and Safety Executive advised that there are no pipelines or hazardous installations within the area of the proposed development.

14.4.2 A Scottish Water supply pipe, transporting water from the Talla and Fruid reservoirs to Edinburgh, crosses well under the entrance route to the site (see Figure 10.1). This pipe is between 2m and 5m below the ground surface, and could be vulnerable to damage during construction of the access track. Scottish Water will be informed of the proposed access route, and the exact depth of the mains pipe will be determined prior to construction. The supply pipe will be avoided during any excavation work and a land bridge will be deployed if Scottish Water request it.

14.5 PUBLIC ACCESS AND SAFETY

Public Access

14.5.1 Scotways has confirmed that there are no Rights of Way which cross the Glenkerie site, therefore the proposed turbines and associated infrastructure will not conflict with any Rights of Way during the operation of the wind farm.

14.5.2 To ensure the safety of members of the public during the construction of the wind farm, appropriate access control measures for the site in general will be established.

Safety

14.5.3 The safe operation of the turbines is ensured through a combination of design, quality control and manufacture of high safety standards (i.e. Best Available Technology).

14.5.4 The wind energy industry has an exemplary health & safety record; in over 25 years of generation with more than 70,000 machines installed worldwide, no member of the public has ever been injured during the normal operation of a wind farm[1]. Correspondingly, the Glenkerie Wind Farm should pose no danger to the public. All turbine equipment will be enclosed and therefore public access to the site should pose no danger to any person(s).

14.5.5 The wind turbines installed at Glenkerie, using the latest available technology, would be designed and manufactured to withstand the most extreme weather conditions (i.e. wind speeds, turbulence and temperature) which can potentially occur within the UK.

14.5.6 The primary safety system of the wind farm would include, within the substation building, a central computer monitoring system, which is also linked to a remote (offsite) link facility. This would enable the wind farm to operate un-manned, with monitoring and control of turbine operations constantly supervised by the onsite central computer and remote link facility.

14.5.7 The turbine blades will begin to rotate when the wind speed reaches about 3.5 metres per second. When wind speeds exceed 25 metres per second, or when there is a loss of power, the blades cease to rotate, as part of the safety system design. In each circumstance, the safety system automatically 'feathers' the blades (blade pitching) and applies a failsafe mechanical brake which operates without power. When the wind speed drops below the maximum limit of operation, the safety systems are reset automatically and the turbines will start up again.

14.5.8 Vibration sensors would be fitted to the turbine blades which would detect any imbalance caused by ice accumulation. In the event of ice build-up on the blades, the sensors would trigger the safety system to automatically shut down turbine operation.

14.5.9 The turbines would also include lightning protection measures so that their susceptibility to lightening strikes would be minimised. The protection measures would ensure lightning is conducted into the earth, avoiding any sensitive components of the turbines.

[1] BWEA (2006). British Wind Energy Association website. http://www.bwea.com/ref/faq.html#safe. Accessed on 07.12.06.

Highway Safety

14.5.10 A detailed discussion of highway and traffic impacts associated with the proposed wind farm are presented in Chapter 13, Transport. The remaining potential issue of highway safety relates to what is known as "driver distraction". Concerns have been expressed in relation to a number of wind farm projects, that dangers to users of the public highway may arise either because wind turbines are a novel and interesting 'attractor of attention', or because the turbines may appear suddenly and unexpectedly to drivers.

14.5.11 The public highway system in the vicinity of the application site comprises the A701, which is tourist route linking the M74 with. Edinburgh. The visibility of the wind turbines from the A701 is discussed fully within Chapter 7, Landscape and Visual Assessment. Only fleeting views of the windfarm for a one km stretch of the A701 are identified in Chapter 7. In reality because of tree cover on the verges of the A701 and extensive forestry blocks the windfarm will only be visible for a 100m stretch of the road.

14.5.12 The nearest view from the A701 to the location of the turbines at Glenkerie is from immediately east of Kingledores Farm, approximately 1.5km from the nearest turbine. Indeed there are projects in Cornwall and the Scottish Borders where not only do motorists pass at speed within a few hundred metres of turbines but also where the turbines appear suddenly from behind a landscape feature. To date, no recorded accidents or incidents have been attributed to driver distraction resulting from wind turbines adjacent to any road.

14.6 SHADOW FLICKER

14.6.1 The rotating turbine blades of a wind farm can cast moving shadows that cause a flickering effect. When the sun is low in the sky and shines on a building from behind a turbine rotor, the shadow of the moving turbine blades is cast onto the building. When this shadow is viewed through a narrow opening, such as a window, it is known as shadow flicker.

14.6.2 The probability of shadow flicker occurring and the extent of its effect depends on a number of factors including the direction of the residential property relative to the turbine, distance from the turbine, turbine hub height and rotor diameter, speed of blade rotation, time of year, and the proportion of daylight hours in which the turbines are operational.

14.6.3 In the UK, only properties within 130 degrees either side of north, relative to the turbines can be affected by shadow flicker. As a general rule of thumb, a property must also be within ten rotor diameters of the turbine; or as in the case of the Glenkerie Wind Farm within 700 metres of the nearest turbine.

14.6.4 There are no properties within 700 metres of the Mountboy turbines, therefore no adverse shadow flicker impacts are predicted as a result of the proposed wind farm.

14.7 CONCLUSION

14.7.1 Organisations with an interest in telecommunications, television, aviation safety, defence and infrastructure in the vicinity of the site were consulted to ascertain potential interference from the proposed wind farm. The proposal will not interfere with any EMI links and is not expected to interfere with aviation interests. Potential impact on local television reception is unlikely; however the developer will remedy any impacts if required.

14.7.2 There are no Rights of Way crossing the site.

14.7.3 The wind turbines would be equipped with systems to ensure their safe operation, proven to be reliably working at over 70,000 installations worldwide.

14.7.4 As there are no properties within 700 metres of the proposed Glenkerie turbines, there is no predicted shadow flicker.

CHAPTER FIFTEEN: CONCLUSIONS

15.1 INTRODUCTION

15.1.1 The Glenkerie Wind Farm application seeks permission for the installation of eleven wind turbines of up to 105m and 120m tip height. Ancillary development includes the construction of approximately 7.8km of new access track, 1.3 km of upgraded access track, an underground electricity cable network, crane hardstandings, a temporary construction compound/storage/office area, one 70 meter anemometer mast and a site control building. The site is located approximately 5km north west of Tweedsmuir and 12km southeast of Biggar in the Scottish Borders.

15.1.2 The Glenkerie Wind Farm will be critically assessed and determined against local and national planning policy guidelines. The Scottish planning system exists to guide the future development and use of land in the long term public interest. The planning system aims to ensure that new developments occur in suitable locations, are sustainable and appropriate with regard to the existing natural heritage and built environment.

15.1.3 In the case of the Glenkerie Wind Farm, the role of the planning system is to balance national policy and the benefits of exploiting clean renewable energy generation with the potential for local effects resulting from such development. The following principal aspects were considered within the ES:

(i) The conformity and contribution of the wind farm proposal to Scottish and UK National Government renewable energy policy and targets;

(ii) The potential landscape and visual effects of the proposal on the character and appearance of the local landscape;

(iii) The potential effects of the proposal on the hydrology and natural heritage;

(iv) The effect of the proposal on cultural heritage interests;

(v) The potential effect of the proposal on local residential amenity; and

(vi) Conformity of the proposal with Scottish Borders Council's Development Plans.

15.1.4 This Environmental Statement (ES) has been based upon the findings and expertise of independent environmental scientists' studies and survey of the proposed application site and surrounding area. These specialist studies include landscape and visual impact, ecology, hydrogeology, ornithology, cultural heritage, noise, socio-economics, transport and infrastructure and public safety. The findings of these studies are summarised below.

15.2 UK NATIONAL & SCOTTISH POLICY ON RENEWABLE ENERGY

15.2.1 Global climate change, primarily caused by the burning of fossil fuels, is widely recognised as presenting a serious threat to all living systems on Earth. The UK Government and Scottish Executive are committed to reducing carbon dioxide and other polluting gases.

15.2.2 In November 2007 the Scottish Executive announced a new target to generate 31% of Scotland's electricity from renewable sources by 2011 and 50% by 2020. In announcing this commitment, Energy Minister Jim Mather stated:

"*Scotland is already a world leader in the energy and engineering sectors and is known for its innovation and talent. Harnessing this talent to generate more renewable energy will give us a vibrant energy sector that makes a significant contribution to Scotland's future prosperity and help build increased, sustainable economic growth".*

15.2.3 With a generating capacity of between 19.8MW and 27.5MW, the Glenkerie Wind Farm will make a meaningful contribution to these targets.

15.2.4 The Glenkerie Wind Farm has the potential to:

- Produce enough clean electricity to power the equivalent of up to 16,400 homes;
- Over its anticipated operational life of 25 years displace the emissions of up to 1,600,00 tonnes of carbon dioxide (CO_2) (over 66,000 tonnes per annum);
- Provide local employment and contracting opportunities during the construction of the wind farm; and
- Aid the local community through a Windfarm Trust Fund.

15.2.5 The proposed wind farm would prevent significant amounts of greenhouse gas emissions from entering the atmosphere and would be part of Scottish Borders Council's contribution to the Scottish government's target of reducing CO_2 emissions.

15.2.6 It is against this policy background relating to the need for renewable energy development that any perceived local environmental effect should be addressed. The desirability and benefits to be gained from exploiting a clean sustainable energy source can then be weighed against any potential impacts on landscape character and visual amenity, nature conservation and local residential amenity.

15.3 LOCAL PLANNING POLICY

15.3.1 Consideration of current planning policy indicates that the Glenkerie Wind Farm is consistent with national and local planning policy guidelines. This is by virtue of the following reasons:

- The need for wind energy projects is recognised by SPP 6, which acknowledges that onshore wind power will be the most significant contributor to the delivery of renewable energy targets in the immediate future;
- The Scottish Executive advises that sustainable development such as wind farms in rural areas should be encouraged and that the socio-economic benefits of the construction and operation of such development can diversify the local farming industry and the rural economy as a whole;
- The Scottish Borders Structure Plan and Local Plan are generally supportive of renewable energy and wind farm development, with recent and up to date policies that are reflective of current planning policy initiatives for renewable energy and climate change;
- There are no statutory or non statutory environmental designations on the Glenkerie wind farm site except for one crossing of the Kingledores Burn a SSSI and SAC. Any potential effect on this designation can be mitigated though measures to be conditioned by SEPA, SNH and Scottish Borders Council;
- The potential visibility of the proposed wind farm within the surrounding landscape is limited. The site is well contained by hills and ridges which effectively serve to almost completely screen the development from the surrounding area;
- Any potentially negative environmental impacts have been accounted for in terms of site design and mitigation measures;
- It is considered that the Glenkerie Wind Farm would comply with the policy criteria governing such development as set out in National planning guidance and the Scottish Borders Development Plan.

15.4 LANDSCAPE AND VISUAL

15.4.1 This landscape and visual assessment considered the potential effects of the proposed Glenkerie Wind Farm and associated works on the landscape character and visual amenity in a 35km radius around the site.

15.4.2 The visual assessment found that significant visual effects are very limited and localised, and only likely to be experienced by sensitive receptors located in the upland hills, and a very limited number of local residential properties within the Tweed Valley.

15.4.3 There would be very limited and localised significant landscape effects to the upland landscapes within the immediate 2.5km radius study area around the proposed development.

15.4.4 Within a 2.5km radius there will be no significant cumulative visual effects as a result of the introduction of the proposed Glenkerie Wind Farm. Significant cumulative effects may only occur on the basis that all the proposed and scoped wind farms are consented and constructed. This is considered very unlikely.

15.4.5 Outwith the local 2.5km landscape radius the NSA and the RSA are the only sensitive receptors which have very minor impacts. These have been assessed as non significant and this is illustrated on Figure 7.2 Blade Tip ZTV.

15.4.6 There would be no significant residual landscape effects to any valued landscape, designated for protection due to its inherent qualities and characteristics. .

15.4.7 Due to the very limited and localised landscape impact of the Glenkerie Wind Farm the proposed development has been assessed as being acceptable in environmental terms.

15.5 ECOLOGY

15.5.1 Following desk studies and field surveys, a total of twelve Phase 1 habitat types were recorded within the main study area. The upland areas of the site are covered in a mosaic of heath and semi-improved acid grassland, which is managed for grazing livestock. Cleuch woodlands and blanket bog habitat are also present in the upland areas. Habitats of improved grassland, rush pasture and plantation woodland cover most of the lowland ground of the development area.

15.5.2 The River Tweed Special Area of Conservation (SAC) designation includes the Kingledores Burn, which lies within the development area. The main stem of the River Tweed lies within 500 m from the eastern development area boundary.

15.5.3 Otter, Atlantic salmon, bat, adder, common lizard, mountain and brown hare were identified both within and adjacent to the development area.

15.5.4 The wind farm has been specifically designed to avoid areas identified as potentially sensitive due to the presence of protected species, it has also been designed to minimise the loss of potentially sensitive habitats.

15.5.5 A suitably qualified Ecological Clerk of Works (ECoW) will be appointed for the duration of the construction period. The ECoW will oversee ecological issues relating to a Pollution Prevention Plan and associated hydrological mitigation measures as well as all other ecological issues on site. This will ensure that ecological impacts are avoided or minimised

15.5.6 The Ecology Assessment found that no significant impacts are predicted for fauna and habitats identified within the development area during construction, operation, and decommissioning.

15.6 ORNITHOLOGY

15.6.1 The potential impacts of the Glenkerie Wind Farm on birds in terms of the risk of collision, habitat loss and disturbance during each phase of development from construction through to decommissioning have been assessed.

15.6.2 Four species: black grouse, pink-footed geese, curlew and lapwing were considered to be of medium sensitivity to wind farms. Curlew and lapwing were identified as breeding on the development site. Skylark, song thrush, linnet and reed bunting were considered to be of regional value and of low sensitivity. Linnet and reed bunting were not identified as breeding in the development site.

15.6.3 Sensitive information relating to Schedule 1 raptors has been omitted from this copy of the ES.

15.6.4 Black grouse were identified lekking close to the development site but no observations of breeding were made.

15.6.5 Mitigation measures proposed to minimise impacts on bird species, where practicable, include ensuring any vegetation clearance is completed out with the bird-breeding season to avoid impacts on nesting birds. Plans have been prepared so that construction activities can be undertaken during the breeding season and during the peak black grouse lekking season.

15.6.6 During the survey period four species have been identified as sensitive to wind farm developments (pink-footed geese, black grouse curlew and lapwing). The impact on these species was assessed as follows:

- Minor disturbance impacts on black grouse could potentially occur during the construction phase, if operations are carried out during the peak spring lekking period. However, the presence of the wind farm will have a negligible impact on lekking black grouse.
- Minor impacts on curlew are predicted, in particular curlew are likely to be potentially temporarily displaced during the construction phase if operations are carried out during the breeding season. Collision risk assessment showed that there would be minor significant collision risk to curlew, 0.06 collision risk to curlew (i.e. one collision every 17 years).

15.6.7 Overall, the development site is an area of low bird sensitivity, and the selection of this site for a wind energy development has ensured that there will be no significant impacts on populations of important or sensitive bird species.

15.7 HYDROLOGY AND HYDROGEOLOGY

15.7.1 Construction of the wind farm involves several phases and activities which may potentially affect the hydrology, geology and hydrogeology of the receiving environments. The effects most likely to be associated with construction of a wind farm are:

- Changes to the natural drainage patterns;
- Effects on base flows;
- Effects on runoff rates and volumes;
- Effects on erosion and sedimentation;
- Effects on water quality, of both groundwater and surface waters;
- Effects on groundwater levels;
- Effects on water resources i.e. private and public water supplies;
- Effects on flooding and impediments to flows; and
- Pollution risk.

15.7.2 The River Tweed, and its tributaries, is designated as a Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI) for its Atlantic salmon, Brook lamprey, River lamprey, Sea lamprey, otter and floating water-crowfoot vegetation. These qualifying features (especially migrating and spawning fish populations) will be very sensitive to any sediment and chemical contamination originating from the wind farm development site.

15.7.3 The identified sensitive receptors on Glenkerie are surface watercourses (for their environmental designations, water quality and fisheries interests), groundwater, and water resources (public, private and livestock water supplies).

15.7.4 Parts of the site, within the Kingledores floodplain, are at risk of flooding. Part of the proposed development access route crosses the active Kingledores Burn floodplain. There is a risk of flooding in this area during construction activities, which poses a potential health and safety risk to site operatives and also a risk to water quality if construction materials have been stored within the floodplain.

15.7.5 It is also recommended that construction activities within the Kingledores floodplain are avoided in the wettest months of the year where possible, when the risk of flooding will be greatest. A flood risk assessment will be carried out for the Kingledores properties as part of a post consent condition related to the design for watercourse crossing no.3 and associated access tracks crossing the river floodplain.

15.7.6 Mitigation measures have been proposed which will significantly reduce the likelihood and magnitude of the potential effects on all of the sensitive receptors, such that any adverse residual effects are assessed as being of minor significance or lower. These effects are not considered significant in terms of the EIA regulations. In order to ensure that mitigation measures are carried out, environmental specifications and objectives will

be included in the tender documents so that all contractors can allow for mitigation measures in their tender costs. A Construction Method Statement will be drawn up and on-site supervision put in place to ensure that the mitigation measures are adhered to by all site contractors. Continued consultation with SEPA will be carried out in order to ensure on-going agreement regarding the proposed mitigation measures.

15.8 CULTURAL HERITAGE

15.8.1 Thirty-two sites of cultural heritage interest have been identified within the proposed development area. One site is a Scheduled Ancient Monument (SAM) of national importance. Six sites are of regional importance and two others are of possible regional importance. Twelve sites are of local importance and two others of possible local importance, and seven features are of lesser importance.

15.8.2 Fifty-five Scheduled Ancient Monuments of national importance and eight Category B Listed Buildings of regional importance in the wider landscape are predicted to receive indirect, visual effects on their settings arising from the presence of the proposed wind farm in the wider landscape.

15.8.3 The SAM within the proposed site is the Kingledoors Fort which dates back to prehistoric times. Other features within the site include six burnt mounds, a fort, cultivation terraces, a group of cairns and the remains of a small building and sheepfold.

15.8.4 In general terms, the predicted impact of the proposed development on the cultural heritage resource is low. It is considered that the impact of the development on the cultural heritage resource would not be contrary to the aims of the Structure and Local Plans, or significant in terms of the requirements of The Environmental Impact Assessment (Scotland) Regulations 1999.

15.9 NOISE

15.9.1 The noise effects resulting from the construction and operation of the proposed wind farm on residential properties in the surrounding area has been assessed.

15.9.2 Background noise measurements were carried out at the two closest residential properties to the proposed wind farm, Kingledores Farm and Glencotho. The results were used to derive noise limits for day-time and high hours, in accordance with ETSU-R-97 guidelines as specified in PAN 45.

15.9.3 The noise assessment found that the impact from the wind farm, assuming that all turbines are operating simultaneously and at normal speed, would not exceed any of the target criteria defined in ETSU-R-97. Separate target criteria have been developed for both night-time and daytime periods in order to protect local residents from noise disturbance as well as to protect the outdoor amenity of the area.

15.9.4 The distances between the proposed wind farm and the nearest residential properties are large enough that there will be no vibration impacts.

15.10 TRANSPORT

15.10.1 The potential impacts associated with the increase in HGV traffic during the construction, operation and decommissioning of the proposed wind farm at Glenkerie have been assessed.

15.10.2 The preferred route for abnormal loads is outlined below:

- Motorway network to junction 15 on the A74(M);
- Leave A74(M) and proceed to Moffat;
- Continue through Moffat on the A701 proceeding North; and
- Continue on A701 to the site access point at Kingledores.

15.10.3 This route is preferred as it minimises the requirement for road alterations and therefore disruption.

15.10.4 The loads associated with construction have been calculated and include traffic generated from turbine delivery, site preparation the delivery of cement for the turbine foundations and aggregate for use in track and hardstanding construction.

15.10.5 The main potential effects from increases in HGV traffic include:

- Traffic noise and vibration;
- Disruption and delay;
- Accidents and safety;
- Air pollution; and
- Dust and dirt.

15.10.6 A Transport Management Plan will be drawn up by and agreed with Scottish Borders and Dumfries and Galloway Council (as appropriate) following consent. Potential management measures include timing of deliveries to avoid sensitive periods of the day, traffic control and temporary diversions, parking restrictions and signage, and arrangements for road maintenance and cleaning, wheel cleaning and dirt control.

15.10.7 Abnormal load deliveries would be escorted by police and would occur during off-peak periods in order to avoid delays to other road users. Measures to mitigate the disruption, delay, noise and vibration caused by these deliveries will be outlined within the Transport Management Plan that is expected to be a condition of planning consent.

15.10.8 The transport assessment found that the main effects of traffic generated by construction of the wind farm are as follows:

- A short-term significant increase in HGV traffic levels on the A701;
- A temporary significant impact as a result of the delivery of abnormal loads i.e. turbine components and cranes along the preferred route to site;
- A short-term adverse effect on the A701 at the turn off to the site during the construction period;
- Traffic generated during the operation and maintenance of the wind farm will be minimal and would not result in any significant impact; and
- Traffic generated during decommissioning of the wind farm will be lower than the levels during construction.

15.11 SOCIO-ECONOMICS

15.11.1 An assessment of the impact of the proposed development on tourism and recreation, socio-economics and land use issues was completed via desk-top research and through consultation with local groups, organisations and residents.

15.11.2 Surveys indicate that tourists are not discouraged from visiting areas in which there are wind farms and that the majority people living close to wind farms tend to feel positively towards them.

15.11.3 The Glenkerie Wind Farm will contribute to the Scottish economy, and also to the local economy with opportunities for local contractors during the construction phase and through the use of local services both prior to, during and after construction of the site. In addition, the establishment of a charitable fund package, linked to the electricity output of the site, will bring added economic strength to the community and allow local residents to have a greater involvement in the provision of social and charitable services in their community.

15.11.4 Public consultation is integral to the environmental impact assessment process and helps to ensure an application which has taken account of local views and priorities. During the development process, an exhibition was held to keep the local community aware of the progress of the development. A newsletter was produced and circulated to local residents, and advertisements were placed in the local newspapers detailing the timing and venue of the public meetings.

15.11.5 Questionnaires were distributed both by mail and at the exhibition to seek people's views. The most common perceived benefits of the proposal were the generation of clean, green energy and a reduction of carbon dioxide emissions from traditional fossil fuel burning power stations. The main concerns raised were the potential visual impact of the proposal on the local landscape, cumulative impact with other wind farms, noise and increased traffic levels on local roads and uncertainty over the use of overground rather than underground transmission links.

15.11.6 A second newsletter will be distributed at the time of the planning applications submission to Scottish Borders Council. This 8 page newsletter updates the local community on the progress of the wind farms development; summarises the main EIA studies and informs the local population how to comment on the application. The newsletter also invites community members to attend a day visit to the operational wind farm at Bowbeat.

15.12 PUBLIC SAFETY AND INFRASTRUCTURE

15.12.1 Organisations with an interest in telecommunications, television, aviation safety, defence and infrastructure in the vicinity of the site were consulted to ascertain potential interference from the proposed wind farm. The proposal will not interfere with any EMI links and is not expected to interfere with aviation interests. Potential impact on local television reception is unlikely; however the developer will remedy any impacts if required.

15.12.2 There are no Rights of Way crossing the site.

15.12.3 The wind turbines would be equipped with systems to ensure their safe operation, proven to be reliably working at over 70,000 installations worldwide.

15.12.4 As there are no properties within 700 metres of the proposed Glenkerie turbines, there is no predicted shadow flicker.

15.13 SUMMARY

15.13.1 The Glenkerie Wind Farm will contribute to national renewable energy targets by providing enough electricity to supply up to 16,400 homes with electricity.

15.13.2 It is anticipated that over the wind farms operational life of 25 years, up to 1,600,00 tonnes of carbon dioxide (CO_2) that would otherwise have been produced by traditional fossil fuel burning plants will be displaced by electricity generated by the Glenkerie Wind Farm.

15.13.3 The Scottish Executive is committed to generating 31% of Scotland's electricity from renewable sources by 2011 and 50% by 2020. The Glenkerie Wind Farm will make a significant contribution on behalf of the Scottish Borders to achieving this target.

15.13.4 The Glenkerie Wind Farm will contribute to the local economy with opportunities for local contractors during the construction phase and through the use of local services both prior to, during and after construction of the site.

15.13.5 The establishment of a charitable fund package, linked to the electricity output of the site, will bring added economic strength to the community

and allow local residents to have a greater involvement in the provision of social and charitable services in their community.

15.13.6 Novera's committed approach to community consultation and public participation has resulted in a majority of the local population being in favour of the Glenkerie proposal. This has been confirmed through questionnaire responses, exhibition attendances, community meetings and through the development of a Community Trust.

15.13.7 The proposal is in compliance with national and local planning guidance for renewable energy:

- There are no statutory or non statutory environmental designations on the Glenkerie site except for one crossing of the Kingledores Burn SAC and SSSI which can be mitigated following best practice guidelines;
- The potential visibility of the proposed wind farm within the surrounding landscape is limited. The site is well contained by hills and ridges which effectively serve to almost completely screen the development from the surrounding area;
- The predicted noise levels are below threshold limits of accepted guidance;
- The development site is an area of low bird sensitivity, and the selection of this site has ensured that there will be no significant impacts on populations of important or sensitive bird species;
- Potential effects of the proposed development on ecological receptors are not expected to be significant;
- Mitigation proposals and adherence to best practice guidelines during construction will ensure that no significant hydrological impacts will result from the proposal.
- The impact on the cultural heritage resource of the site and surrounding area was assessed as low;
- As there are no properties within 700m it is not predicted that there will be any shadow flicker effect;

15.13.8 From a technical perspective the Glenkerie Wind Farm has significant advantages over other wind farm developments where often there is uncertainty over radar and communications links. Glenkerie can be built shortly after consent because Novera has secured a grid connection; has an immediate supply of turbines; and the development will cause no interference to any civil or military radar, or telecommunication links.

15.13.9 In summary it is considered that the Glenkerie is an acceptable proposal to Scottish Borders Council. The wind farm is in compliance with national and local planning policies; has the support of the local community; has limited visual and environmental impact and will contribute to Scotland's short and long term targets for generating renewable energy.