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KYPE MUIR

Wind Farm Proposal

SUPPLEMENTARY ENVIRONMENTAL INFORMATION

BANKS

BANKS

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1. INTRODUCTION

BACKGROUND

1.1 Banks Renewables (Kype Muir Wind Farm) Limited (the Developer) submitted an application to the Scottish Government for consent under Section 36 of the Electricity Act 1989, and deemed planning permission under the Town and Country Planning (Scotland) Act 1997, Section 57(2), for the construction and operation of a wind farm at Kype Muir, in August 2011. This application was supported by an Environmental Statement (ES).

1.2 Since submission of this application the Developer has been undertaking a range of stakeholder engagement on the application. This has been taking place alongside the formal consultation that the Scottish Government has been undertaking with statutory consultees and members of the public in relation to the application.

1.3 Despite the ES concluding that the proposed development will have a small number of significant effects as would be expected for the type of development proposed, a number of issues have been raised in relation to the application by consultees through formal representations to the application and discussions with the Developer.

PURPOSE OF DOCUMENT

1.4 This Supplementary Environmental Information (SEI) aims to address the issues that have been raised and provide further information on the proposed development.

REQUIREMENT FOR SUPPLEMENTARY INFORMATION

Habitat Management Plan, Woodland Removal and Compensatory Planting

1.5 Following discussions with Forestry Commission Scotland, Scottish Natural Heritage (SNH) and South Lanarkshire Council the draft Habitat Management Plan (HMP) (appendix 17) submitted with the application has been amended. The amended HMP:

a) Refines the areas of blanket bog proposed;

b) Reconsiders the felling and replanting requirements to ensure compliance with the Scottish Government's Policy on Control of Woodland Removal; and

c) Incorporates guidance provided by SNH on mitigation measures for Leisler's bats.

1.6 The amendments to the draft HMP have resulted in alterations to the Ecology, Carbon Balance and Forestry and Woodland chapters of the ES. The revised Forestry and Woodland Removal chapter sets out the Developers intentions to provide off-site compensatory planting to off-set the removal of woodland form the site.

1.7 The revisions to the draft HMP do not alter the judgements of the ES in relation to the ornithology conclusions and therefore the ornithological chapter remains unchanged.

Ornithology

1.8 SNH have requested further information to that presented in the ES to the competent authority on the potential effects of the Development on the Muirkirk and North Lowther Uplands Special Protection Area (SPA), (originally presented in paragraphs 6.96 et. al. of the ES), as regards the conservation objectives that are relevant to the Development, under the terms of the Habitat Regulations and the SPA citation at classification.

1.9 Additional information is provided within this document to address this request

Noise

1.10 As stated in paragraph 8.45 of the ES the noise assessment assumed that H8 (Kype Lodge) was financially involved in the development. Since submission of the application the situation has changed and the property is no longer financial involved in the wind farm. Furthermore, following a discussion with South Lanarkshire Council's Environmental Health Department further information has been provided on the noise assessment that had been undertake in relation to the proposed development.

1.11 A revised noise chapter and ETSU-R-97 report have been provided to amend the noise limits at H8 accordingly, while further information requested by the Environmental Health Officer (EHO) has been included in this submission as an additional appendix to the ES.

1.12 At the meeting with the EHO potential noise conditions were discussed. A copy of the example noise conditions presented by Banks Renewables at this meeting is included in this submission as an additional appendix to the ES.

Aviation

1.13 During the consultation process the Scottish Government has received two letters of objection from aviation stakeholders in relation to the proposed development. Objections were received from:

- BAA Airports in relation to possible impacts on their radar infrastructure at Glasgow International Airport; and
- NATS en Route Ltd in relation to the possible impacts on radar functioning at their Lowther Hill facility.

1.14 Since submitting the application Banks Renewables have been engaged with a variety of potential solution providers to provide mitigation for both impacts. An update on the progress of these solutions is provided in this submission.

Amendment to introductory chapters

1.15 There are some small typing mistakes within Section 1 of the ES. Amended copies of the chapter have been provided within this submission.

CONTENTS OF SUBMISSION

1.16 This package of supplementary information therefore includes:

Statement

a) Part 1:Replacement ES Chapters

- Revised Introduction
- Revised Ecology and Nature Conservation
- Revised Noise
- Revised Forestry and Woodland
- Revised Carbon Balance

b) Part 2: Further Information

- Ornithology
- Noise
- Aviation

Plans

a) Replacement Plans

- Replacement ES22: Draft HMP

Appendices

a) Part 1: Replacement Appendices

- Replacement Appendix 7.1: ETSU-R-97 Noise Assessment
- Replacement Appendix 14.2: Compartment Schedules
- Replacement Appendix 16: Carbon Balance
- Replacement Appendix 17: Draft Habitat Management Plan

b) Part 2: Additional Appendices

- Further Noise Information
- Example Noise Conditions

FORMAT OF INFORMATION

1.17 Where replacement chapters are provided they are preceded by a summary of the changes to the chapter and what the impact of these changes are on the overall conclusions of the chapter.

INFORMATION NOT CHANGING

1.18 Apart from the chapters, appendices and plans set out above the contents of the ES and supporting information submitted in August have not changed. Furthermore, submission of this information has not change the overall conclusions of the ES.

1.19 Table 1.1 below provides a summary of the contents of the ES submitted in August 2011 and what has been replaced by this submission.

Table 1.1 – Summary of Revisions

Environmental Statement			
Section number	**Title**	**Replaced**	**Further Information**
1	Introduction	Yes	No
2	The Proposed Development	No	No
3	Construction, Operation and Decommissioning	No	No
4	The Environmental Impact Assessment	No	no
5	Landscape and Visual Impact	No	No
6	Ornithology	No	Yes
7	Ecology and Nature Conservation	Yes	No
8	Noise	Yes	Yes
9	Archaeology and Cultural Heritage	No	No
10	Traffic and Transportation	No	No
11	Aviation	No	Yes
12	Geology and Ground Conditions	No	No
13	Hydrology and Hydrogeology	No	No
14	Peat Stability	No	No
15	Forestry and Woodland	Yes	No
16	Shadow Flicker	No	No
17	Telecommunication	No	No

18	Carbon Balance	Yes	No
19	Socio-economic	No	No
20	Other Effects	No	No
21	Proposed Mitigation	No	No
22	Conclusions	No	No
Plans and Drawings			
Drawing Number	**Title**	**Replaced**	**Additional Information**
PA01	Location Plan	No	No
PA02	Site Planning Application Boundary/Off-site Road Improvements Planning Application Boundary	No	No
PA03	Construction Site Layout/Operational Site Layout	No	No
PA04	Details of Typical Wind Monitoring Mast	No	No
PA05	Structure of Typical Wind Turbine	No	No
PA06	Detail of Indicative Turbine Foundation and Crane Pad	No	No
PA07	Site Access for Abnormal Loads	No	No
PA08	Indicative Site Compound	No	No
PA09	Typical Access Track Cross-sections	No	No
PA10	Indicative Control Building and Substation	No	No
PA11	Typical Borrow Pit	No	No
			No
ES01	South Lanarkshire Sieve Map	No	No
ES02	Existing Features Plan	No	No
ES03	Site Constraints Plan	No	No
ES04	Design Iterations	No	No
ES05	Cumulative Impact Plan	No	No
ES06	Nature Conservation Designated Sites	No	No
ES07	Phase 1 Habitat Management Plan	No	No
ES08	Indicative NVC Survey	No	No

ES09	Otter Survey Plan	No	No
ES10	Electrofishing Survey	No	No
ES11	Operational Noise Assessment Locations	No	No
ES12	Construction Noise Assessment Locations	No	No
ES13	Cultural Heritage – On-site Features	No	No
ES14	Cultural Heritage – External Receptors	No	No
ES15	Cultural Heritage – Wireframes	No	No
ES16	Private Water Supplies	No	No
ES17	Hydrological Features – Site Features	No	No
ES18	Hydrological Features – Surrounding Environment	No	No
ES19	Peat Thickness Plan	No	No
ES20	Shadow Flicker Assessment Locations	No	No
ES21	Grid Connection Plan	No	No
ES22	Draft HMP	Yes	No
Appendices			
Appendices Number	**Title**	**Replaced**	**Additional Information**
1	Scottish Government Application Checklist	No	No
2	Draft Planning Conditions	No	Yes
3	Consultee List	No	No
4 (4.1 to 4.6)	Landscape and Visual Impact Assessment Supporting Information	No	No
5 (5.1 to 5.3)	Ornithology Supporting Information	No	No
6 (6.1 to 6.6)	Ecology Technical Reports	No	No
7.1	ETSU-R-97 Noise Assessment	Yes	Yes
7.2	Construction Noise	No	No

	Assessment		
8 (8.1 to 8.4)	Archaeology and Cultural Heritage	No	No
9 (9.1 to 9.2)	Traffic and Transportation	No	No
10	Aviation Impact Assessment	No	Yes
11	Desk Study Report	No	No
12	Hydrology and Flood Risk	No	No
13	Peat Landslide Hazard Assessment	No	No
14.1	Forest Plan	No	No
14.2	Compartment Schedules	Yes	No
14.3	Forest Felling Areas	No	No
15	Shadow Flicker Assessment	No	No
16	Carbon Balance Technical Report	Yes	No
17	Draft Habitat Management Plan	Yes	No
18	Draft Construction Method Statement	No	No
19	Draft Environmental Management Plan	No	No

PART 1: REPLACEMENT ES CHAPTERS

2. INTRODUCTION

Summary of Changes:

- Amendments to typing mistakes in original ES chapter
- Amendments to felling area outlined in the proposed development section to reflect revised draft HMP.

Impact on Conclusions:

- No alteration to the overall conclusions of chapter

THIS CHAPTER REPLACES SECTION 1 OF THE ES SUBMITTED AUGUST 2011

THIS DOCUMENT

2.1 This document forms the Environmental Statement (ES) accompanying the application made by Banks Renewables (Kype Muir Wind Farm) Limited to the Scottish Government for the development of Kype Muir Wind Farm. The proposed site is located on land to the south of Strathaven, South Lanarkshire.

2.2 The preparation of this ES has been co-ordinated by Banks Renewables (the agent) on behalf of Banks Renewables (Kype Muir Wind Farm) Limited. These companies are wholly owned subsidiaries of The Banks Group. Where appropriate detailed assessment of the potential environmental effects of the proposed development have been undertaken by specialist consultants.

THE PROPOSED DEVELOPMENT

2.3 The proposed development comprises:

- Felling of 443.5 ha of coniferous woodland to facilitate the development of the wind farm;
- 26 wind turbines which will have a maximum tip height of between 125 meters and 132 meters;
- Construction of new vehicular access road from the B743;
- Road improvement measures to the B743 at Brown's Bridge;
- Approximately 15km of on-site access tracks, comprising 13km of new access tracks and the upgrading of 2km of existing forest tracks;
- Underground electrical cabling;
- Power Performance Mast (anemometer) 80m in height;

- Control building measuring approximately 10m x 6m and sub-station within a 29m x 43.1m compound;

- Temporary laydown area and construction compound including hard standing and fences;

- Up to 4 borrow pits; and

- Other associated infrastructure.

2.4 The environmental effects of developing each of these elements are assessed in this ES.

2.5 The installed capacity of the proposed Kype Muir Wind Farm would be up to a maximum capacity of 104MW, based on the potential use of 4MW turbines, with a minimum capacity of 65MW, based on the use of 2.5MW turbines.

2.6 The application and this ES have been based on a 3.4MW candidate turbine, the REpower 3.4M. Although the final choice of turbine will not be made until post planning, this turbine is felt to be most representative of what is likely to be developed on the site. This turbine has a tip height of 132m and would provide an installed capacity of 88MW.

2.7 The proposed development as set out in this ES is the product of an iterative design process (see accompanying design and access statement for further details of this process). It is the view of the project team that it represents the most environmentally acceptable option for this site and provides an exciting opportunity to deliver substantive benefits local and national benefits.

PROJECT BENEFITS

2.8 The project will provide the following benefits:

- A reduction in greenhouse gas emissions by harnessing power from the wind to generate electricity for approximately 50.000[1] rather than transporting and burning fossil fuels. Within 14 months it is anticipated the wind farm would be a carbon free source of power;

- Making a contribution to the recently increased Scottish Governments target that 100% of Scotland's electricity consumption is produced by renewable sources by 2020;

- Production of an indigenous energy supply, reducing reliance on imported fossil fuels;

- Support Scotland's growing renewables industry which as the potential to be a world leading. Up to 130,000[2] could be created in the low carbon sector in Scotland by 2020 according to the SNP Government;

[1] Based on 88MW output and average annual household consumption 4,700kWhr (RenewablesUK, 2010)
[2] SNP "Our Ambitions for Clean, Green Energy – Scotland's Electricity Capacity in 2020"

- Generate new construction contracts which will provide jobs, training and skills development during the construction period. With reasonable endeavours being taken to ensure that where possible contracts are granted to locally based companies this will support local construction jobs and training opportunities;

- Create an opportunity for indirect economic benefits through local sourcing of materials and increased trade from construction workforce; and

- Establish a community benefits package of approximately £6.5 million to finance projects identified by local communities surrounding the wind farm.

THE BANKS GROUP

2.9 This application has been submitted by Banks Renewables (Kype Muir Wind Farm) Limited on behalf of the Banks Group. Since its foundation in 1976 The Banks Group has undergone carefully planned growth and diversification into new business areas. The Group now operates in four business areas:

- Renewable energy;

- Mineral extraction;

- Waste management; and

- Property development.

2.10 The Group's renewable energy division now operates from its offices in Meadowfield, Durham and Hamilton, South Lanarkshire and draws upon the company's 30 years of experience successfully developing significant projects in minerals, waste and property sectors. The entrance into the Renewable Energy sector was a natural progression for a developer with both experience in identifying and delivering successful projects, and an existing relationship with energy generators throughout the UK.

2.11 The renewable energy division is exploring opportunities for generating green electricity throughout Scotland, as well as the rest of the UK and considers itself to be well placed to contribute towards the ambitious renewable energy targets set by the Scottish Government.

2.12 The Banks Group's success in delivering major projects has largely been attributed to its 'Development with Care' approach, which is central to the aims and objectives of the business. Our commitment to the local community is demonstrated by the way in which we strive for total satisfaction in all of our dealings. The Group publish and adhere to best practice policies and encouraging community participation in projects. Banks are continually improving our performance and competitiveness, using exciting new ideas. The company has a real commitment to 'Development with Care' in all of their work. This is demonstrated through the Community work that Banks Renewables have undertaken and are proposing to continue in relation to Kype Muir Wind Farm.

THE PROJECT TEAM

2.13 The ES has been co-ordinated by Banks Renewables with specialist input from the following consultants in their specialist areas of expertise:

- Stephenson Halliday – Landscape and Visual Amenity;
- Natural Research Projects - Ornithology;
- Land Use Consultants - Ecology and Nature Conservation;
- TNEI Services Ltd – Noise and Shadow Flicker;
- CFA – Archaeology and Cultural Heritage;
- Halcrow – Hydrology and Hydrogeology, Traffic and Transportation, Geology and Ground Conditions, Peat Stability, Telecommunications, and Carbon Balance;
- Osprey – Aviation; and
- Bidwells – Forestry.

STRUCTURE OF ES

2.14 The ES describes the proposals set out above in more detail and reports the findings of the Environmental Impact Assessment (EIA). The ES consists of the following documents:

- Non-technical summary – describing the proposals and summarising the findings of the EIA process;
- Statements and drawings (this document) – providing a detailed description of the proposals and all its potential effects, reporting the findings of the EIA and providing relevant background information;
- Appendices – containing the detailed reports of the specialist consultants;
- Landscape and Visual Assessment Graphics – containing graphical material to support the landscape and visual assessment; and
- Visualisations – containing visualisations prepared to accompany the landscape and visual assessment, including photomontage and wire frame diagrams from selected viewpoints;

2.15 In addition to this ES, a

- Planning statement addressing the relevant planning policy at national and local level;
- Pre-Application Consultation Report setting out the community and stakeholder engagement that has been undertaken prior submission of the application; and

- Design Statement outlining the design iteration process that the development proposals have been though

have been prepared in support of the application. These statements form part of the application but not the ES.

2.16 This ES is split into 4 main parts:

a) Part 1 – Describes the EIA process, the policy context for the proposed development, the site and the development proposals;

b) Part 2 – Summaries the findings of the EIA with regard to each of the following potential significant environmental effects which have been identified through the formal scoping exercise:

- Landscape and visual amenity;
- Ornithology;
- Ecology and nature conservation;
- Noise; and
- Archaeology and cultural heritage;

c) Part 3 – Provides a description of other potential effects:

- Traffic and transportation;
- Aviation;
- Geology and ground conditions;
- Hydrology and hydrogeology;
- Peat stability;
- Forestry and woodland;
- Shadow flicker;
- Telecommunications;
- Carbon balance;
- Socio-economic; and
- Other effects.

d) Part 4 – Provides an overview of the proposed mitigation measures set out in each chapter.

2.17 The approach taken in this EIA to the identification and assessment of potential significant effects of the proposals are consistent with guidelines published by the Institute of Environmental Management and Assessment (IEMA). The standard format for each section is as follows:

- A description of the methodology used to assess the impacts, including reference to specific guidance documents used;
- A summary of the relevant consultation responses received, relating to that specific assessment;
- A description of baseline information, including the relevant features of the site and a description of the available information arising from the baseline monitoring undertaken;
- A description of the likely impacts of the development on the environment;
- A summary of proposed mitigation, where applicable;
- An evaluation of the significance of residual impacts; and
- A summary of the assessment.

2.18 As part of the conclusions to this ES a summary of the proposed mitigation proposed in each chapter is provided in Chapter 21.

2.19 Throughout this document reference is made to Banks Renewables intention to produce and adhere to the provisions of both a Construction Management Statement (CMS) and an Environmental Management Plan (EMP) prior to construction. Draft copies of both the CMS and EMP for the site are included as appendices 18 and 19 respectively. In addition a draft Habitat Management Plan (HMP) has also been produced for the site, Appendix 17.

2.20 It is envisaged that the scope and final versions of these plans will be agreed with the Local Planning Authority, in consultation with its relevant specialist advisors, e.g. Scottish Natural Heritage (SNH) and Scottish Environment Protection Agency (SEPA), through the use of appropriate conditions.

BACKGROUND

The Need for Renewable Energy

2.21 In 1997 the UK, along with 180 other countries signed the Kyoto protocol which committed all signatories to significantly reduce greenhouse gas emissions. Since the signing up to these international targets the UK government has produced a range of documents to ensure compliance with international targets.

2.22 This has included a range of energy White Papers which have all recognised the important contribution that the development of renewable energy can make towards addressing climate change and achieving the targets that have been set at an international level.

2.23 The most recent Energy White Paper “Meeting the Energy Challenge”(2007) placed into policy a statement of need for renewable energy:

2.24 *'New renewable projects may not always appear to convey any particular local benefit, but they provide crucial national benefits. Individual renewable projects are part of a growing proportion of low carbon generation that provides benefits shared by all communities both through reduced emissions and more diverse supply of energy, which helps the reliability of our supplies. This factor is a material consideration to which all participants in the planning system should give significant weight when considering renewable energy proposals. These wider benefits are not always immediately visible to the specific locality in which the project is sited. However, the benefits to society and the wider economy as a whole are significant and this must be reflected in the weight given to these considerations by decision makers in reaching their decisions.'*

2.25 The Climate Change Act, which received royal assent in 2008, introduced legally binding targets for the UK as a whole to reduce greenhouse gas emissions by at least 80% by 2050. It reinterred the UK Government's commitment to the role of renewable energy as an important factor in the move to a low carbon economy.

2.26 In June 2010 the Climate Change Committee (CCC), the independent body set up to advise the UK Government on the implementation of the Climate Change Act, submitted its second report to Government. There were main findings of the report relevant to this proposal:

- A step change in the pace of efforts to reduce emissions is still needed;
- Wind power (both onshore and offshore) remains the most likely proven energy technology to make a significant contribution towards the step change needed; and
- In order to facilitate significant increased levels of investment in the development of renewable energy technologies, improvements in the planning process are required to address significant delays in gaining the necessary consents.

2.27 These findings were reiterated in the third report published by the committee in May 2011.

2.28 Tackling climate change is a devolved matter and therefore the Scottish Government has a responsibility to ensure compliance with international and UK targets. The world leading Climate Change (Scotland) Act 2009 created a statutory framework for the reduction of greenhouse gas emissions in Scotland. It set an 80% reduction target for 2050, with an interim target of a 42% reduction in emissions by 2020. The act requires all public bodies, including local authorities to act in a way that contributes and helps deliver these targets.

2.29 A key aspect of reducing greenhouse gas emissions to achieve the targets set by the Climate Change Act is increasing the amount of energy produced by renewable sources. In 2008 the Scottish Government set clear targets for the amount of electricity that should be generated through renewable sources:

- 31% of gross annual electricity consumption by 2011; and
- 50% of gross annual electricity consumption by 2050.

2.30 In recognition of the potential that Scotland has in terms of renewable energy the targets were increased in September 2010 to 80%. The recently elected SNP

Government have further increased the targets to 100%, reiterating their commitment to renewable energy.

2.31 There are also strong socio-economic arguments in the support of the development of renewable energy. International increases in the price of gas and oil, and increased instability in the availability of imports from some countries have led to a review of the country's future energy sources. Renewable energy seeks to redress the balance by delivering greater self-sufficiency in energy supply. There are also benefits in decentralising embedded electrify generation including a reduction in the amount of electricity lost during transmission and supply failures.

2.32 Investment in renewable energy development offers significant economic benefits at both regional and national level. In their Renewables Action Plan (2009) the Scottish Government recognised the potential that low carbon energy has to provide enormous opportunities for sustainable economic growth, coupled with the creation and retention of more wealth in Scotland.

2.33 The proposed Kype Muir Wind Farm should be considered in light of the above, which are the most recent expressions from both the UK and Scottish Government on renewable energy development. There is a need for the type of development proposed to ensure that the targets set at both an international and national level can be met and the potential socio-economic benefits realised.

The Rationale behind the Project

2.34 The rationale for the proposed development can be summarised as follows:

- The UK has signed up to the Kyoto Protocol which commits all signatories to significantly reduce greenhouse gas emissions by fixed targets. This has lead to the imposition of targets to reduce greenhouse gas emissions by both the UK and Scottish Government's;

- Government guidance on tackling climate change recognises the need to develop renewable energy sources. This is reflected in the Scottish Government's recent increase in targets;

- The decline in the finite indigenous energy supplies of the UK (mostly fossil based) and the need to provide a range of alternative sources;

- Wind energy is an inexhaustible and indigenous energy source (Scotland is the windiest country in Europe) and is currently recognised as the most economically viable source of green electricity generation;

- The site has been identified by South Lanarkshire Council as a broad area of search for wind farm development;

- The site has a viable wind resources; and

- The site has been comprehensively assess by Banks Renewables and found to the relatively unconstrained. It has been identified as being suitable for wind energy proposals.

Emissions Savings

2.35 Every unit (kWh) of electricity produced through wind power can displace a unit of electricity which might otherwise have been produced by a power station burning fossil fuel. Nuclear power stations operate constantly at base-load such that the output from mainly coal-fired and, increasingly over time gas-fired plant is adjusted to meet the increases in electricity demand above this base load on the system. As such, the electricity generated by wind turbines could effectively replace the output of coal-fired or gas-fired power stations, unit for unit.

2.36 The energy generated by the proposed Kype Muir Wind Farm has been calculated using:

- Manufactures wind speed curves for the candidate turbine (Repower 3.4M) for a range of wind speeds between 2 and 25 m/s;
- On –site wind speed data collected from the wind masts located on the site; and
- Energy losses due to scheduled maintenance and other reasons that are inherent in the design and operation of the wind farm.

2.37 Assuming an installed capacity of 88MW, the Kype Muir Wind Farm would provide electricity to supply around 50,000 households[3]. This equates to 37% households in South Lanarkshire[4].

2.38 Based on an installed capacity of up to 88MW, Kype Muir Wind Farm would have the potential to offset the emissions of up to 163,287 of CO^2 per annum. Further details can be found on carbon capture in chapter 18 of this report.

Planning Policy

2.39 The development plan for the proposed development comprises:

- Glasgow and Clyde Valley Structure Plan 2006;
- South Lanarkshire Local Plan 2009; and
- South Lanarkshire Local Plan Supplementary Planning Guidance: Renewable Energy 2010 and accompanying Spatial Framework for Wind Farms.

2.40 This EIA has also taken account of National Planning Policies including Scottish Planning Policy, National Planning Framework 2 and Planning Advice Note (PAN) 45. A full assessment of the proposed development against planning polices is provided in the accompanying Planning Statement, while the individual sections of this ES have made reference to the planning policy relevant to areas of expertise where required.

[3] Based on 88MW output and average annual household consumption 4,700kWhr (RenewablesUK, 2010)
[4] Total number of households in South Lanarkshire in 2009 136,389 – National Records for Scotland

3. ECOLOGY AND NATURE CONSERVATION

Summary of Changes:

- Updated to reflect the amended draft HMP. Replanting areas amended to 86.27 ha broadleaf woodland and 5.54 ha planted as feathered woodland scrub edge.
- Updated bat section to reflect comments from SNH in relation to Leisler's Bats. Increased absolute minimum buffer between the rotor edge and woodland replanting from 100m to 150m.

Impact on Conclusions:

- No alteration to the overall conclusions of chapter and overall significance of impacts.

THIS CHAPTER REPLACES SECTION 7 OF THE ES SUBMITTED AUGUST 2011

INTRODUCTION

3.1 This chapter presents the findings of the Ecological Impact Assessment (EcIA) undertaken by LUC in relation to the proposed wind farm development at Kype Muir. The (EcIA) was informed by a combination of desk based assessments and field surveys.

3.2 The chapter considers the potential effects of the proposed Kype Muir Wind farm (the Development) on ecological receptors. It includes an assessment of potential effects of the Development on flora and fauna in terms of direct effects, such as habitat loss, and indirect effects such as disturbance to species. Findings of bird surveys carried out within and in the vicinity of the Development Area (all areas included within the application boundary) and the potential effects of the proposed Development on bird interest are presented in Chapter 6: Ornithology**.**

Study Area Description

3.3 The proposed Development Area covers 883ha and is situated approximately 3.8km to the south of Strathaven, South Lanarkshire. The Development Area is gently undulating and is predominantly covered by commercial plantation woodland, with the exception of four large open areas, including Kype Muir, Araburn Rig, the Long Knowe Burn valley and an area to the west of Middle Rig. These areas, as well as numerous rides and wayleaves separating the forestry blocks support a range of non-forested habitats including grasslands, heathlands and mires.

3.4 The access route to the Development crosses enclosed pasture fields, passing the settlements of Kirkwood House, and to the north of South Kirkwood and Lambhill.

3.5 Watercourses within the Development Area are restricted to the burns on its periphery, and include the Lochar Water and its tributaries (the Struther Burn, the Sound Burn and the Spout Burn) along the western boundary; the Hareshaw

Burn along the northern boundary, and the Ara Burn in the eastern part of the Development Area. The Long Knowe Burn drains to the southern boundary, and flows into the Kype Reservoir.

3.6 The predominant land use within the Development Area is commercial plantation forestry, which is currently actively being felled. Sheep grazing occurs within the lower lying fields of the access route corridor. The Development Area is surrounded by enclosed pasture land to the north, whilst similar commercial plantations are found to the south and west. Extensive open moorlands at Dunside Rig and Feeshie Moss and Willowsheugh Moss are located to its west and south-east.

3.7 The study area for ecological surveys was based on both the Development boundary and the potential for effects to extend outwith this boundary. The survey area for the habitat surveys covered the whole Development boundary plus a 250m buffer of turbine locations and 100m buffer of access track locations where these extended outwith the Development boundary. A survey buffer was applied for protected species surveys as follows:

- Otter: 200m beyond the Development boundary;
- Water vole: 50m beyond the Development boundary;
- Badger: 100m beyond the Development boundary.

3.8 Bat roost surveys were conducted on all obvious potential roost sites within 500m of the first layout iteration. Activity surveys were conducted within the Development boundary along obvious likely flight lines and concentrating on potential turbine locations where these were known.

3.9 Electro-fishing surveys covered all watercourses on site which were assessed as having potential to support fish species.

3.10 Consideration of potential effects on designated sites for nature conservation extended to a 15km radius around the Development boundary. This distance is based on previous experience of wind farm projects.

Effect Assessed in Full

3.11 The following effects of the Development have been assessed in full:

- Direct and indirect effects on terrestrial habitats within the Development Area;
- Direct and indirect effects on watercourses within the Development Area and downstream of the Development;
- Direct and indirect effects on Groundwater Dependent Terrestrial Ecosystems (GWDTEs);
- Direct and indirect effects on protected species, including otter, water vole, badger, bats and fish species;
- Operational effects on bats;

- Cumulative effects with other wind farm schemes (proposed, consented and operational) within 15km of the Development.

Effects Scoped Out

3.12 On the basis of the desk study and survey work undertaken, professional judgement, experience from other relevant projects and policy guidance and standards, the following topic areas have been 'scoped out', as set out in the Scoping Report:

- direct and indirect effects of the Development on red squirrel, reptiles and great crested newt. Surveys for these species concluded that great crested newts and red squirrel are likely to be absent from the Development Area and that common lizards are present only at low densities. Consultation with SNH confirmed that on the basis of survey results these species could be scoped out of the assessment (Technical Reports relating to these species can be found in appendices 6.1 to 6.3).

- Effects on habitats and all protected species (except for bats) as a consequence of wind farm operation and maintenance. Maintenance of the turbines and wind farm infrastructure will involve vehicular access along the new access tracks only and any maintenance on turbines will be rare and sporadic work, typically carried out by a small number of maintenance staff inside the turbines and using hand held tools and therefore creating only a minimal amount of disturbance to species. Access via the constructed tracks only will ensure that damage and disturbance to adjacent habitats are avoided. Run-off from construction surfaces potentially affecting water quality will be controlled to prevent contamination of watercourses.

CONSULTATION

3.13 Account has been taken of relevant scoping responses received from statutory and non-statutory consultees. A summary of relevant consultation responses is provided in Table 7.1.

Table 7.1: Consultation Responses

Consultee	Scoping/Other Consultation	Issue Raised	Response/ Action Taken
South Lanarkshire Council	Scoping	The Environmental Statement (ES) should set out full details of the survey and assessment of the effects on ecology and ornithology as required by SNH and the RSPB. Particular attention should be given to the adjacent SPA and SSSI's and to the cumulative effects of this proposal, consented and proposed wind farms.	Full survey and assessment of ecological receptors has been conducted as required by SNH. Effects on designated sites are considered and a cumulative assessment is provided.

SEPA	Scoping	Timing of works should avoid high rain fall. Therefore the ES should identify the periods of the year when construction activities will be undertaken in line with best practice, taking into account the need to avoid pollution risks and other environmental sensitivities affecting operational timing such as fish spawning and bird nesting.	Good practice with regards to timings of work is noted in the ES, particularly in relation to fish species.
		A large area of the site is designated as a Site of Importance for Nature Conservation (SINC) (Willochsheuch Moss and Feeshie Moss) which is noted to include active blanket bog and other wetland habitats.	The area designated as a SINC has been removed from the proposals.
		Phase 1 habitat survey should include use of 'SNIFFER (2009) Water Framework Directive 95 –A functional Wetland Typology for Scotland' to help identify wetland areas. An NVC survey may be required for wetland areas identified on the site to ensure there are no direct or indirect changes on wetlands. This should be done on any wetland area outside the development boundary that could be impacted by the development.	An assessment of effects on Groundwater Dependent Terrestrial Ecosystems (GWDTEs) as defined by SEPA is provided.
		The results of the ecological surveys should inform the final proposed wind farm layout. Wind farm infrastructure should not have direct or indirect effects on wetlands. Peatland (especially blanket bog) should be avoided.	Wind farm layout has been designed to avoid effects on blanket bog habitats as far as practicably possible.
SNH	Scoping	The EcIA for the proposal needs to cover the likely effects on habitats covered by the nearby SINCs.	Effects on designated sites are fully addressed. The Development Area has been adjusted and no longer covers the SINC at Feeshie Rig and Kype Rig.
		Any construction should be sited away from areas of deep peat. The	The Development

		ES should include the analysis of the likely effects on peatland in terms of its value as a habitat. Surveys for otter, great crested newt and bat species must be undertaken and appropriate design and mitigation carried out to avoid significant effects on these species. Surveys for badgers and water vole must be undertaken and appropriate design and mitigation carried out to avoid significant effects on these species.	Area has been designed to minimise effects on peatland habitats. Surveys for all recommended species have been undertaken and effects and mitigation assessed accordingly. No surveys for invertebrates (specifically butterfly species) have been conducted. The large area of open upland habitat at Feeshie Rig and Kype Rig to which this requirement related was removed from the site boundary.
SNH	Post-submission	Stand-off distances to prevent collision between turbines and Leisler's bat should be at least 150m beyond the rotor swept zone.	These changes have been incorporated into Version 3 of the outline HMP.
Forestry Commission	Scoping	The requirements of the Control of Woodland Removal Policy should be considered in the design of any Habitat Management Plan for the site. The plan should be designed in consultation with the FCS, Local Authority and SNH. The developer should carry out an assessment of the implications of the wind farm proposals on	An outline HMP has been developed in consultation with the Local Authority, SNH and FCS. It takes into account the Control of Woodland Removal Policy. A full assessment of effects on

		biodiversity including priority habitats and priority species.	biodiversity is provided in this chapter.
Marine Scotland	Scoping	Electro-fishing surveys will provide useful baseline data. In addition to baseline surveys, further quantitative fish surveys should be conducted during and after construction.	Electro-fishing surveys have been conducted and outline details for post construction monitoring provided.
		The range of potential effects should be considered in the ES including altered hydrological pathways, pollution, physical obstruction through road construction, and loss of fish habitat including spawning habitat.	The range of potential effects on watercourses and fish are considered in full in this chapter.
		The Scottish Executive guidance "River Crossings and Migratory Fish" (2000) should be consulted to ensure free passage for fish movement if tracks cross streams.	The Scottish Executive guidance "River Crossings and Migratory Fish" (2000) will be used to inform the design and upgrade of crossings.
		If the development is likely to cause effects on the macro-invertebrate community then a monitoring programmes should be carried out before, during and after construction.	Significant effects on watercourses and macro-invertebrates are unlikely due to the limited number of watercourse crossings and distance between construction and watercourses.
		The combined effect of other wind farms in the area should also be considered in relation to water quality and fisheries issues.	A cumulative assessment of impact of this scheme and other wind farms within 15km is provided in this chapter.

Association of Salmon Fisheries Board	Scoping	The effects of the development including obstruction to upstream and downstream migration, disturbance of spawning beds, increased silt and sediment loads, and point source pollution incidents should be assessed in the Environmental Statement.	Electro-fishing surveys have been conducted and effects on fish species are fully addressed in the Ecology Chapter.

METHODOLOGY

Assessment Structure

3.14 The assessment is structured around the consideration of the following potential effects:

- Potential felling and construction effects of the Development on habitats;
- Potential felling and construction effects of the Development on otter, water vole, badger, bats and fish species;
- Potential operational effects of the Development on bats; and
- Cumulative effects as a result of the combined effects of the Development with all other wind farm developments with 15km.

Data Sources and Guidance

3.15 Searches for historical records of protected species relevant to the Kype Muir Wind farm were conducted on the National Biodiversity Network (NBN) Gateway[5].

3.16 Relevant wind farm Environmental Statements were consulted as part of the cumulative assessments.

Guidance

3.17 The ecological assessment was carried out in accordance with the following guidance documents:

- Guidelines for Ecological Impact Assessment in the United Kingdom (version 7) (Institute of Ecology and Environmental Management (IEEM), 2006);
- Guidelines for Baseline Ecological Assessment (Institute of Environmental Assessment, 1995); and,
- Interim Guidance on European Protected Species, Development Sites and the Planning System (Scottish Executive, 2001).

[5] www.nbn.org

Field Survey

3.18 Details of all ecological surveys, survey methodologies and survey results are listed in the Existing Conditions section of this chapter. Survey extent and methodologies were agreed in consultation with SNH. The following surveys were undertaken and are detailed in this assessment:

- Phase 1 Habitat survey (LUC, 2010);
- National Vegetation Classification (NVC) survey (LUC, 2010);
- Otter Survey (Direct Ecology Ltd, 2010);
- Water Vole Survey (Direct Ecology Ltd, 2010);
- Badger Survey (LUC and Direct Ecology Ltd, 2010);
- Bat Survey (Direct Ecology Ltd, 2010);
- Electro-Fishing Survey (Mouchel, 2010).

Assessing Significance

Significance Criteria

3.19 Ecological Impact Assessment (EcIA) is based on a number of factors, primarily consideration of the value of a site or feature being assessed, and the anticipated magnitude of the resulting effects. The Institute of Ecological and Environmental Management (IEEM) has produced guidelines to assist with ecological evaluation and impact assessment (IEEM, 2006); these are used as a general guide in this assessment. These guidelines have no legal standing and are not a substitute for professional judgement and interpretation, particularly where the ecological value of a site and/or the magnitude of effects are not clear or are borderline between two categories of value/magnitude.

Sensitivity/Value of Ecological Receptors

3.20 The sensitivity, or value of ecological receptors, is normally ascertained according to specific 'biodiversity benefits' that they provide to the environment, people or wider society. These benefits can include the conservation of genetic diversity, people's enjoyment or understanding of biodiversity, or the health benefits of biodiversity. A summary of an approach to valuing ecological receptors in Scotland can be found in Table 7.2. The table shows how ecological value or level of sensitivity can be ascertained using a combination of statutory measures (legally protected sites and species) and non-statutory but widely accepted measures, such as the presence of notable habitats and species listed in Biodiversity Action Plans. Use can also be made of the Ratcliffe assessment criteria[6] for the selection of sites with nature conservation value (Ratcliffe, 1977).

[6] Ratcliffe (1977) considers following criteria for Nature Conservation Evaluation:
Size – large, continuous areas of habitat are considered to be of greater importance than small fragmented areas.
Diversity – species and habitat diversity increase wildlife value.
Naturalness – the amount of modification of the land by man. Generally a less modified area results in an increase in the nature conservation value.

All these criteria can vary at different geographical scales.

Table 7.2: An Approach for Assessing the Value or Sensitivity of Ecological Receptors in Scotland

Maximum level of sensitivity or value	Examples
International	An internationally designated site or candidate site (SPA[7], pSPA[8], SAC[9], cSAC[10], pSAC[11], Ramsar site[12], Biogenetic Reserve[13]) or an area which Scottish Natural Heritage has determined meets the published selection criteria for such designations, irrespective of whether or not it has yet been notified. A viable area of a habitat type listed in Annex 1 of the Habitats Directive, or smaller areas of such habitat that are essential to maintain the viability of that ecological resource. Any regularly occurring population of an internationally important species, i.e. those listed in Annex 1, 2 or 4 of the Habitats Directive.
National	A nationally designated site (SSSI[14], NNR[15], Marine Nature Reserve[16]) or a discrete area which SNH has determined meets the published selection criteria for national designation irrespective of whether or not it has yet been notified. A viable area of a Priority Habitat identified in the UK BAP[17], or smaller areas of such habitat which are essential to maintain the viability of that ecological resource. A regularly occurring population of a nationally important species i.e. a priority species listed in the UK BAP and/or Schedules 1, 5 (S9 (1, 4a, 4b)) or 8 of the Wildlife and Countryside Act. A regularly occurring and viable population of a UK Red Data Book species.
Council	Viable areas of key habitat identified in Council BAPs and/or the Natural Heritage Zone profile or smaller areas of such habitats that are essential to maintain the viability of that ecological resource. Any regularly occurring, locally significant population of a species listed as being nationally scarce (occurring in 16-100 10km squares in the UK) or in a relevant Council BAP or Natural Heritage Zone profile on account of its rarity or localisation.

Rarity – the scarceness of habitat and presence of rare/uncommon species.
Fragility – fragile habitats are those where changes due to human intervention, environmental factors or natural succession can threaten it.
Typicalness – Quality of the habitat in terms of how good an example it is of a recognised type.

[7] Special Protection Area classified under the EU Birds Directive for their importance to birds.
[8] Potential Special Protection Area.
[9] Special Area of Conservation Area classified under the EU Habitats Directive for important habitat or non bird species.
[10] Candidate Special Area of Conservation.
[11] Potential Special Area of Conservation.
[12] Wetland of international importance designated under the Ramsar Convention.
[13] Sites deemed representative examples of particular habitats in Europe.
[14] Site of Special Scientific Interest designated under UK law as being the best examples of the UK's flora, fauna, geological or physiographical features.
[15] National Nature Reserve designated under UK law as containing the best examples of natural or semi-natural ecosystems in Britain.
[16] Marine Nature Reserve designated under UK law to conserve marine flora, fauna and geological features.
[17] Biodiversity Action Plan identifies targets for improving and protecting biodiversity in an area to meet the UK's commitments under the Rio Convention.

Maximum level of sensitivity or value	Examples
	Non-statutory designated wildlife sites (e.g. SNCIs[18], SINCs[19]), including semi-natural ancient woodland greater than 0.25ha. Networks of species-rich hedgerows.
District	District sites and other sites which the designating authority has determined meet the published ecological selection criteria for designation, e.g. Local Nature Reserves. Semi-natural ancient woodland smaller than 0.25ha. Sites/features that are scarce within the district or which appreciably enrich the district habitat resource.
Neighbourhood	Commonplace and widespread semi-natural habitats e.g. scrub, poor semi-improved grassland, coniferous plantation woodland, intensive arable farmland etc.
Less than Neighbourhood	Habitats of little or no ecological value e.g. amenity grassland or hard standing.

Effect Magnitude

3.21 Effect magnitude refers to changes in the extent and integrity of an ecological receptor. The term ecological integrity is used here in accordance with the definition adopted by the ODPM Circular 06/2005 on Biodiversity and Geological Conservation whereby designated site integrity refers to *'…coherence of ecological structure and function…that enables it to sustain the habitat, complex of habitats and/or levels of populations of species for which it was classified.'* The circular does not define integrity in relation to non-designated areas, but the principles can equally be applied to such areas. Therefore for the purpose of this assessment, we have defined integrity for non-designated areas as follows*: "the coherence of ecological structure and function, that enables it [the site, habitat or population] to maintain the habitats, complex of habitats and/or levels of populations of species in its/their pre-development condition"*

3.22 Effect magnitude seeks to characterise the degree of change in an ecological receptor. It takes into consideration the fact that different sources of change can result in permanent or temporary effects, that different effects have different probabilities of occurring, and that some changes may be positive (beneficial). The magnitude of effects is also dependent on their timing and/or frequency of occurrence, and whether they can be reversed. These factors are all components of ecological effect magnitude.

3.23 Effect magnitude can be high, medium, low, or neutral. A summary of this approach is provided in Table 7.3.

[18] Site of Nature Conservation Importance. Locally important sites of nature conservation adopted by local authorities for planning purposes.
[19] Sites of Importance for Nature Conservation. Locally important sites of nature conservation adopted by local authorities for planning purposes.

Table 7.3: Criteria for Describing Effect Magnitude

Effect magnitude	Description
High	High magnitude effects may include those that result in large-scale, permanent changes in an ecological receptor, and likely to change its ecological integrity. These effects are therefore likely to result in overall changes in the conservation status of a species population or habitat type at the location(s) under consideration.
Medium	Medium magnitude effects may include moderate-scale permanent changes in an ecological receptor, or larger-scale temporary changes, but the integrity of the feature is not affected. This may mean that there are temporary changes in the conservation status of a species-population or habitat type at the location(s) under consideration, but these are unlikely to be long-term.
Low	Low magnitude effects may include those that are small-scale temporary or permanent changes, and where integrity is not affected. These effects are unlikely to result in overall changes in the conservation status of a species population or habitat type at the location(s) under consideration.
Neutral	There is no change in the ecological receptor.
Positive	*The changes in the ecological receptor are considered to be beneficial – this can be low, medium or high in magnitude, but positive effects should only be assessed to be medium or high if magnitude if they are considered to be significant effects.*

3.24 The predicted significance of the effect is determined through a standard method of assessment based on professional judgement, considering both sensitivity and magnitude. Combining ecological value/sensitivity and effect magnitude gives ecological effect significance (Table 7.4). Effects judged to be of major or moderate significance are considered to be 'significant effects' in accordance with the EIA Regulations. Ecological receptors with effects of moderate or major significance will be priorities for mitigation and/or enhancement. In some cases, such as protected species, there may also be a legal obligation to provide such mitigation. The matrix below provides an indication of how sensitivity and magnitude could be combined to determine significance but is not intended to be applied without professional judgement to test and refine ratings of significance. The relevant paragraphs relating to the determination of the significance of ecological effects must be read in conjunction with the matrix.

Table 7.4: Matrix for Determining Significance of Ecological Effects

Effect Significance Level		**Magnitude of Effect (Positive or Negative)**			
		High	Medium	Low	Neutral
Value/sensitivity of ecological	International	**Major**	**Major**	**Moderate**	No effect
	National	**Major**	**Moderate**	**Moderate**	No effect
	Council	**Moderate**	**Moderate**	Minor	No effect
	District	**Moderate**	Minor	Minor	No effect
	Neighbourhood	Minor	Minor	Negligible	No effect

Effect Significance Level		Magnitude of Effect (Positive or Negative)			
		High	Medium	Low	Neutral
	Less than Neighbourhood	Minor	Negligible	Negligible	No effect

BASELINE

3.25 This section details the findings of the ecological baseline surveys conducted within the proposed Development Area and relevant buffer zones.

Designated Sites

Statutory Designated Sites

3.26 Statutory and non-statutory designated sites within 10km of the Development are shown in Drawing ES06. There are no statutory designated sites within the application boundary.

3.27 There are four sites with international designations within 10km of the Development boundary.

3.28 The nearest internationally designated site is Muirkirk and North Lowther Uplands Special Protection Area (SPA), located 1.4km to the south of the Development boundary. The site is designated for its breeding populations of raptors and upland wader species, as well as its wintering population of hen harriers. The site is also designated as Muirkirk Uplands Site of Special Scientific Interest (SSSI), its designated features including an assemblage of upland habitats, blanket bog, an assemblage of breeding birds, aggregations of breeding short-eared owl and breeding and non-breeding hen harrier. This SPA and SSSI is considered in detail in Chapter 6: Ornithology**.**

3.29 Clyde Valley Woods Special Area of Conservation (SAC) is located 7.5km to the north-east of the Development and is designated for mixed woodlands on base-rich soils associated with rocky slopes. Coalburn Moss SAC is situated 8.7km to the east of the Development and its designated features include active and degraded raised bogs. This site is also designated as a SSSI. Waukenwae Moss SAC is situated 9.2km to the north of the Development and is designated for its degraded and active raised bogs. This site is also designated as a SSSI.

3.30 In addition to the aforementioned SSSIs, there are ten further sites designated at a national level within 10km of the Development boundary. Five of these are geological SSSIs, including: Dunside SSSI, Birk Knowes SSSI, Birkenhead Burn SSSI, Ree Burn and Glen Buck Loch SSSI and Shiel Burn SSSI. All geological SSSIs are at least 2km from the Development Area. The remaining five biological SSSIs include:

- Blood Moss and Slot Burn SSSI is located 5.5km to the south-west of the Development and it is designated for its paleontological interest as well as blanket bog.

- Upper Nethan Valley Woods SSSI is situated just over 7km to the north-east of the Development and is designated for upland mixed ash woodland and wet woodland.

- Cander Moss SSSI is located 7.2km to the north-east of the Development and its designated features include raised bog.

- Avondale SSSI is situated 7.5km to the north-east of the Development and is designated for presence of upland mixed ash woodland.

- Nethan Gorge SSSI is located 9.5km to the north-east of the Development and is designated for upland mixed ash woodland and its beetle assemblage.

Non-statutory Designated Sites

3.31 Four Sites of Importance for Nature Conservation (SINCs) are located adjacent to, or within 500m of the site boundary.

3.32 Feeshie and Willochsheugh Moss SINC is important as the largest area of actively growing blanket mire within the East Kilbride District and lies immediately adjacent to the south-west boundary of the development site. Chucket Knowe/ Kypes Rig SINC is characterised by the presence of species-rich acid grassland along the edge of coniferous plantation and lies immediately adjacent to the northern boundary of the site. Kype Water SINC comprises semi-improved acid grassland in the Kype Water corridor and lies partially within the eastern part of the site. Kype Water Reservoir SINC is of importance as one of the two larger water bodies in the upland area in the south of the East Kilbride District and lies immediately adjacent to the south-east boundary of the site.

3.33 In addition to the above sites, further SINCs are found within the 10km of the Development, although all of these are located more than 500m away from the Development boundary.

3.34 There are no Scottish Wildlife Trust (SWT) Reserves within the Development boundary. Cander Moss SWT Reserve is part of the Cander Moss SSSI and Upper Nethan Gorge SWT Reserve is part of the larger Upper Nethan Valley Woods SSSI, as described above.

3.35 There are no ancient woodlands within the Development boundary. A number of ancient woodland sites are found within 10km of the Development, although, none of these are less than 2km from the Development boundary.

Habitats Survey Methodology

3.36 Phase 1 Habitat Survey is a standard habitat survey technique, providing a nationally recognised means of classifying and mapping habitats. The methodology for Phase 1 Habitat Survey is described in the JNCC publication Handbook for Phase 1 Habitat Survey - A Technique for Environmental Audit (1990).

3.37 All land within the proposed Development boundary was surveyed over 10 man days between April and August 2010. Habitats were marked using the standard Phase 1 classification and mapping codes. A minimum mappable unit of 40 x 40m was used, and aerial photography was used to help define habitat boundaries. Use was made of target notes to aid classification of habitats.

Species abundance within different habitats was assessed using the DAFOR scale[20]. Mapped habitats were subsequently transferred to a digital map base within a Geographical Information System (GIS).

3.38 The National Vegetation Classification survey broadly followed the methodology described in the JNCC publication the National Vegetation Classification Users' Handbook (2006) and vegetation communities were classified in accordance with British Plant Community keys (Volumes 1- V) (Rodwell *et al*., 1991- 1995). A quadrat size of 2x2m (4x4m where appropriate) was used and the abundance of species within the quadrat was assessed according to the Domin scale[21]. Quadrat results combined with survey experience and knowledge of habitats in the area were used to classify habitats. NVC survey was conducted over eight man days during June and August 2010 and focused on heath and mire habitats with other habitats sampled less extensively. Survey results were subsequently transferred to a digital map base within a GIS.

Habitats Survey Results

3.39 The Phase 1 Habitat Map is shown in Drawing ES07 and indicative NVC communities are shown in Drawing ES08. In total, 21 habitat types were identified within the Development Area, including woodlands, grasslands, heathlands, mires, and farmland, aquatic and man-made habitats.

Woodlands

3.40 Woodland habitats covered the majority of the site (692.9ha, 78.4% of the Development Area) and were predominantly represented by coniferous plantation woodland, covering 606.70ha, (68.7% of the Development Area). The majority of these woodlands comprised Sitka spruce *Picea sitchensis*, with smaller proportions of lodgepole pine *Pinus contorta* and were typical species-poor, densely-planted, predominantly mature stands of woodland with limited growth in the understorey.

3.41 Areas of clear fell were classified as recently felled coniferous plantation woodland and covered (at the time of survey) 86.15ha.

3.42 A small extent of mixed semi-natural woodland was recorded within the access track corridor of the Development, covering less than <0.01% of the Development Area.

Grassland Habitats

3.43 Grasslands habitats covered a total of 57.9ha (6.55% of the Development Area), with marshy grassland being the most frequent grassland type, covering an area of 26.1ha. The majority of marshy grasslands were dominated by soft rush *Juncus effusus*, with smaller extents where sharp-flowered rush *Juncus acutiflorus* dominated. The extent of this habitat type within the Development Area was generally limited to stream corridors or some of the wayleaves separating forestry blocks.

[20] DAFOR scale: D = Dominant, A = Abundant, F = Frequent, O = Occasional, R = Rare.
[21] Domin scale (% cover): 1 = few individuals, 2 = several individuals, 3 = many individuals, 4 = 4-10%, 5 = 11-25%, 6 = 26-33%, 7 = 34-50%, 8 = 51-75%, 9 = 76-90%, 10 = 91-100%.

3.44 In terms of the NVC, the marshy grasslands were represented by the following communities:

- M23a *Juncus acutiflorus - Galium palustre* rush pasture, dominated by sharp-flowered rush, with a number of other vascular associates present, including common sedge *Carex nigra*, tormentil *Potentilla erecta*, sheep's sorrel *Rumex acetosa*, and marsh violet *Viola palustris*;

- M23b *Juncus effusus – Galium palustre* rush pasture, dominated by soft rush within an otherwise relatively species-poor sward with a few vascular associates, including marsh bedstraw *Galium palustre*, hoary willowherb *Epilobium hirsutum*, marsh thistle *Cirsium palustre* and mosses *Polytrichum commune* and *Rhytidiadelphus squarrosus*.

3.45 Both of these communities were closely associated with watercourses marked on the OS maps or with minor drains with a visible flow of water. The most extensive areas of marshy grasslands were recorded in the Lochar Water corridor and along its tributaries, as well as along the Long Knowe Burn.

3.46 Improved grassland was the second most extensive grassland type recorded within the Development Area, covering a total of 20.3ha. This habitat type was entirely limited to the lower lying enclosed fields within the wind farm access corridor and was dominated by perennial rye-grass *Lolium perenne*, with few other vascular associates in the sward.

3.47 Unimproved neutral grassland covered a total of 8.08ha. This grassland type was dominated by a number of grass species including cock's-foot *Dactylis glomerata*, meadow foxtail *Alopecurus pratensis* and Yorkshire fog *Holcus lanatus,* and was restricted to the valley slopes of the Lochar Water tributaries, and the corridor of the existing forestry access track in the western section of the Development Area.

3.48 A small extent of semi-improved neutral grassland was also recorded, covering an area of 0.67ha and limited to a single wayleave in the northern section of the Development Area.

3.49 Unimproved acid grassland covered an area of 2.76ha. Its extent was limited to the northern half of the large rectangular open area to the west of Middle Rig. The grassland was grazed and was co-dominated by mat-grass *Nardus stricta* and heath rush *Juncus squarrosus*, with a number of other species present in the sward, including heath bedstraw *Galium saxatile* and tormentil.

3.50 In terms of the NVC, unimproved acid grasslands were represented by U5/U6 intermediate community between *Nardus stricta – Galium saxatile* grassland and *Juncus squarrosus – Festuca ovina* grassland, where the dominant species of the sward (mat-grass and heath rush) varied locally in relation to grazing and substrate conditions.

Mire Habitats

3.51 Large unfragmented extents of mire habitats were recorded in the unplanted open areas at Kype Muir, Araburn Rig and west of Middle Rig, with smaller extents found within the wayleaves separating the forestry coups. In total, mire habitats covered an area of 114.4ha (13.0% of the Development Area).

3.52 Blanket bog was the most extensive mire habitat recorded, covering a total of 56.5ha (6.40% of the Development Area). Large extents of this habitat type were recorded at Kype Muir, Araburn Rig and the open area to the west of Middle Rig, with smaller extents recorded within the forestry wayleaves and in the Lochar Water corridor. Distribution of blanket bog was generally closely linked to the distribution of deep peat substrate (see Chapter 13: Hydrology and Hydrogeology). Occasionally, blanket bogs were found on peat of lower depth (<50cm), but peat-building blanket bog indicator plants were found to be present in the sward, including hare's-tail cottongrass *Eriophorum vaginatum*, *Sphagnum papillosum* and/or *Sphagnum magellanicum*.

3.53 In terms of the NVC, the blanket bogs were represented by the following communities:

- M18 *Erica tetralix – Sphagnum papillosum* blanket mire, with an even sward of heather *Calluna vulgaris* and hare's-tail cottongrass interspersed with thick *Sphagnum* layer, comprising *Sphagnum papillosum* and *Sphagnum magellanicum*. In addition to the above species, cranberry *Vaccinium oxycoccos*, round-leaved sundew *Drosera rotundifolia* and bog asphodel *Narthecium ossifragum* were frequently found within the sward. This type of blanket bog was only recorded within the corridor of the Red Bog Burn valley.

- M19 *Calluna vulgaris – Eriophorum vaginatum* mire, associated with drier deep peat substrate and co-dominated by heather and hare's-tail cottongrass, with other associates of this community including blaeberry *Vaccinium myrtillus* and *Sphagnum capillifolium*. This was the most common blanket bog NVC type on site.

3.54 In the area to the south of Araburn Rig and to the east of Kype Muir, the uptake of planted conifers has been poor and has resulted in a distinctive area of low density conifer growth over blanket bog. Such habitat was classified as blanket bog/coniferous plantation woodland mosaic and covered an area of 9.51ha.

3.55 Dry modified bog was found to cover an area of 44.4ha (5.03% of the Development Area). This habitat type was also associated with deep peat substrate, although the ericoid species were notably lacking in the sward as a result of grazing pressure or other management interventions, resulting in vegetation in which hummock-forming hare's-tail cottongrass dominated over other typical blanket bog species.

3.56 In terms of the NVC, this habitat type was classified as M20 *Eriophorum vaginatum* blanket mire, dominated almost exclusively by hummock-forming hare's-tail cottongrass, with runnels supporting *Sphagnum* species (particularly *Sphagnum fallax*) or other bryophyte species, such as *Pleurozium schreberi* and *Polytrichum commune*.

3.57 A total of 3.98ha was classified as acid flush. This habitat type comprised a combination of rushes and/or sedges over a thick layer of *Sphagnum* mosses and *Polytrichum commune* and was predominantly associated with upper reaches of watercourses, indistinct streams or areas saturated with water, such as localised depression within Kype Muir, Araburn Rig and the large open area to the west of the Middle Rig.

3.58 In terms of the NVC, acid flushes were classified as M6c *Carex echinata – Sphagnum recurvum/auriculatum* mire, *Juncus effusus* sub-community, with soft

rush being the dominant species growing over a carpet of *Sphagnum* mosses, particularly *Sphagnum fallax*, *Sphagnum palustre* and *Sphagnum cuspidatum*.

Heathland Habitats

3.59 Heathland habitats were represented by both dry and wet dwarf shrub heath and mosaics of these habitats with acid grassland.

3.60 Dry dwarf shrub heath covered a total of 3.70ha. Dry heaths were associated with shallower peats in better drained areas, enabling development of vegetation dominated by heather and blaeberry, with an abundant bryophyte layer in the understorey. The largest extent of this habitat type was recorded in the open area to the west of Middle Rig, where it was surrounded by blanket bog. Smaller extents of dry heath were found flanking the northern slopes of the Long Knowe Burn valley.

3.61 In terms of the NVC, dry heaths were classified as H12 *Calluna vulgaris – Vaccinium myrtillus* dry heath, co-dominated by heather and blaeberry, with few other vascular associates but an abundant bryophyte layer, including *Pleurozium schreberi*, *Hypnum cupressiforme* and *Hylocomium splendens*.

3.62 In addition to 'pure' stands of dry dwarf shrub heath, a mosaic habitat of dry heath and unimproved acid grassland was also recorded, covering an area of 0.42ha. This habitat type was only recorded on the better drained northern slopes of the Long Knowe Burn valley.

3.63 Wet dwarf shrub heath covered 1.61ha. This habitat was associated with shallow peat depths and was characterised by a lack of peat-building plants such as hare's-tail cottongrass and large *Sphagnum* species. It was dominated by various proportions of heather, cross-leaved heath *Erica tetralix*, purple moor-grass *Molinia caerulea* and deergrass *Trichophorum cespitosum*. The distribution of wet heaths was limited to the Long Knowe Burn valley, where this habitat type flanked the higher-lying valley slopes.

3.64 In terms of the NVC, wet heaths were classified as M15d *Scirpus cespitosus – Erica tetralix* wet heath, *Vaccinium myrtillus* sub-community, dominated by deergrass, with mat-grass, heath rush and wavy hair-grass *Deschampsia flexuosa* being prominent components of the sward.

3.65 In addition to 'pure' stands of wet heath, a mosaic habitat of wet heath/unimproved acid grassland was also recorded, covering 1.69ha and distributed within the same area as wet heath stands.

Open and Running Water

3.66 A small extent (0.03% of the Development Area) of open water habitat was recorded within the Development Area, represented by a single water body in the Long Knowe Burn valley. The trophic status of the water within this water body was not confirmed.

3.67 In total, 14.6km of streams and rivers were recorded within the Development Area. The main watercourses include the Lochar Water and its tributaries draining the western part of the Development Area, the Long Knowe Burn in the south, the Ara Burn and the Hareshaw Burn draining east into the Kype Water.

Other Habitats

3.68 Less than 0.01ha of the Development Area was classified as arable land (under crops). Man-made habitats recorded within the Development Area included existing access tracks (9.97ha) and building (0.02ha). A total of 0.38ha of land was taken up by quarry.

Valuing Ecological Receptors

3.69 Using the ecological criteria for establishing the level of sensitivity/value of an ecological receptor (see Table 7.2), the value of all habitat types within the Development Area is summarised in Table 7.5. Habitats which cover more than 5% of the Development Area are highlighted in grey. The ecological value of faunal receptors is presented in Table 7.7.

Table 7.5: Ecological value of Phase 1 Habitat types within the site

Habitat	Level of ecological value	Extent within the Development Area (ha) (% of Development Area)	Description
Access track	<Neighbourhood	9.97 (1.13%)	Man-made habitat of low ecological value.
Acid flush	National	3.98 (0.45%)	Priority Habitat under the UK BAP for upland flushes, fens and swamps. Although limited in distribution within the Development Area, these flushes are important as part of the hydro-ecological functioning of the site.
Arable land	Neighbourhood	<0.01 (<0.01%)	Common and widespread habitat in South Lanarkshire.
Blanket bog	International	56.5 (6.40%)	Active blanket bog is a Priority Habitat under Annex 1 of the EC Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Fauna (the Habitats Directive) and is also a Priority Habitat in the UK BAP. This habitat is important within the Development Area as part of the wider habitat mosaic.
Blanket bog/coniferous plantation woodland	National	9.51 (1.08%)	Active blanket bog is a Priority Habitat under Annex 1 of the EC Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Fauna (the Habitats Directive) and is also a Priority Habitat in the UK BAP. Although this habitat has been affected to some degree through tree planting, it is important within the

Habitat	Level of ecological value	Extent within the Development Area (ha) (% of Development Area)	Description
			Development Area as part of the wider habitat mosaic.
Building	<Neighbourhood	0.02 (<0.01%)	Man-made habitat of low ecological value.
Coniferous plantation woodland	Neighbourhood	606.7 (68.7%)	Common and widespread habitat in South Lanarkshire.
Dry dwarf shrub heath	International	3.70 (0.42%)	Certain types of dry heaths are a Priority Habitat under Annex 1 of the EC Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Fauna (the Habitats Directive). It is also a Priority Habitat in the UK BAP and is included in the Upland Action Plan in the South Lanarkshire BAP.
Dry dwarf shrub heath/acid grassland mosaic	National	0.42 (0.05%)	Dry heath is a Priority Habitat under Annex 1 of the EC Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Fauna (the Habitats Directive). It is also a Priority Habitat in the UK BAP and is included in the Upland Action Plan in the South Lanarkshire BAP. The mosaic of dry heath with acid grassland has been modified through grazing but is still important as part of the wider upland habitat mosaic.
Dry modified bog	National	44.4 (5.03%)	The key NVC type, M20, is listed as a UK BAP Broad Habitat. Despite its reduced species and structural diversity when compared to unmodified stands of blanket bog, it is important for its position in the ecological mosaic and potential ecological value if factors contributing to its modification are managed and reduced.
Improved grassland	Neighbourhood	20.3 (2.30%)	Common and widespread habitat in South Lanarkshire.
Mixed semi-natural woodland	Council	<0.01 (<0.01%)	All types of woodland are included in the Woodland Action Plan of the South Lanarkshire Biodiversity Action Plan.
Marshy grassland	Council	26.1 (2.95%)	The marshy grasslands on site are mostly the M23b NVC community

Habitat	Level of ecological value	Extent within the Development Area (ha) (% of Development Area)	Description
			which are species-poor and therefore excluded in the definition of rush pasture in the UK BAP. However, this habitat is important for its potential value within the habitat mosaic and within the Development Area as habitat for waders and other birds.
Open water	Council	0.26 (0.03%)	Standing open water habitat is important to a wide number of species as well as a habitat in its own right.
Quarry	<Neighbourhood	0.38 (0.04%)	Man-made habitat of low ecological value.
Recently felled coniferous plantation woodland	Neighbourhood	86.2 (9.75%)	Common and widespread habitat in South Lanarkshire. Where trees were planted over deep peat, there is potential for this low ecological value habitat to be restored to mire habitat of higher ecological value.
Semi-improved neutral grassland	Neighbourhood	0.67 (0.08%)	Common and widespread habitat in South Lanarkshire.
Unimproved acid grassland	Council	2.76 (0.31%)	Common and widespread habitat in the Scottish uplands.
Unimproved neutral grassland	Neighbourhood	8.08 (0.91%)	Common and widespread habitat, but with value for a number of typical species of birds and invertebrates.
Wet dwarf shrub heath	International	1.61 (0.18%)	Certain types of wet heath are Priority Habitats under Annex 1 of the EC Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Fauna (the Habitats Directive). It is also a Priority Habitat in the UK BAP and is included in the Upland Action Plan in the South Lanarkshire BAP.
Wet dwarf shrub heath/acid grassland mosaic	National	1.69 (0.19%)	Certain types of wet heath are Priority Habitat under Annex 1 of the EC Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Fauna (the Habitats Directive). It is also a Priority Habitat in the UK BAP and is included in the Upland Heaths

Habitat	Level of ecological value	Extent within the Development Area (ha) (% of Development Area)	Description
			Action Plan in the South Lanarkshire BAP. The mosaic of wet heath with acid grassland has been modified through grazing but is still important as part of the wider upland habitat mosaic.
TOTAL		883.3 (100%)	
Streams and rivers	Council	14.6km within the Development Area	Rivers and burns are important to a wide number of species as well as a habitat in their own right.

Species

Otter

3.70 Introduction

a) The otter *Lutra* is protected by the Conservation (Natural Habitats, etc.) Regulations 1994. This legislation makes it an offence to capture, harass, injure or kill an otter; obstruct access to, damage or destroy a breeding site or resting place of an otter; disturb an otter in such a way as is likely to affect their distribution or abundance or disturb otter in such a way as is likely to impair their ability to survive or breed. Each of these actions is considered to be an offence whether the action is deliberate or reckless, except in the case of damaging or destroying a breeding site or resting place, which is a strict liability offence. The otter is also protected by the Wildlife and Countryside Act (1981) as amended and by the Nature Conservation (Scotland) Act (2004).

b) A licence is required for all developments that will affect otters. Disturbance is defined by both SNH and the Scottish Executive as any new impact occurring within a minimum of 30m of an otter shelter. This disturbance is likely to increase for high impact activities such as blasting or track-laying, or in remote locations, or where the shelter in question is regarded as being high-status. If breeding is suspected, SNH might request a non-intervention zone of 100-200m or that work be suspended pending further investigation.

3.71 Field Survey Methodology

a) Otter surveys were carried out within the Development Area by experienced surveyors between July and September 2010, over 15 man days. All watercourses and water bodies within the Development boundary and its 200m buffer were surveyed for evidence of otter. This involved systematic walking of all watercourse corridors or shorelines of water bodies and carrying out searches for otter signs, including faeces (spraints), shelters, feeding remains, slides, prints and tracks. Otter survey was carried out

under optimal, dry survey conditions, with normal water levels in the streams. All signs of otter activity, including confirmed and potential shelters, were noted and their location was recorded using a hand-held GPS. Survey findings were subsequently transferred into a digital map base within a GIS.

3.72 Results

a) Historical Records

- Historical records of otter were sourced from the NBN Gateway. No historical records of otter were found within 1km of the Development Area. The nearest otter record was from the Logan Water, over 2km away from the Development, dated pre-1991.

b) Field Survey

- Otter survey results are shown in Drawing ES09.

- No otter were seen during the surveys, although numerous signs of otter activity were recorded, including six confirmed otter shelters and a further seven potential otter shelters.

- The majority of otter activity within the Development Area was associated with the Lochar Water and its tributaries, including the Feeshie Burn, the Red Bog Burn, the Struther Burn and the Sound Burn. In total, four confirmed otter lie-ups (resting shelters without breeding potential) were identified within the above system, one of which was associated with the Sound Burn, with the remaining three lie-ups located on the Lochar Water. Use of these shelters by the species was confirmed by presence of otter spraint(s). The majority of shelters were located in cavities within the root systems of bankside trees. However, the lie-up on the Sound Burn was found under a small bridge crossing the stream.

- In addition to confirmed otter shelters, five potential otter shelters were identified on the Lochar water. These features were identified as being suitable for otter shelter but no evidence confirming current use by otter was found.

- The entire length of the Lochar Water and to a lesser degree its tributaries was marked with otter spraints. A number of sprainting locations here included multiple spraints.

- Further otter activity was recorded on the Long Knowe Burn and the Hareshaw Burn. Two potential otter shelters were recorded on the Long Knowe Burn, as well as six sprainting locations.

- Two couches (nest-like structures used for daytime resting) and seven sprainting locations were recorded on the Hareshaw Burn, with couches comprising flattened areas of grass or rushes adjacent to the stream and marked by spraints.

3.73 Discussion

a) Evidence of otter activity was recorded on all main watercourses within the Development Area as well as on some of their smaller tributaries. This is

likely to be due to the potential of the streams to provide suitable habitat for both shelter and forage. The fisheries survey recorded presence of brown trout (paragraph 1.28) in all of the main watercourses and some of the tributaries, indicating that otter prey is present in most watercourses within the Development Area. There is also an abundance of drainage ditches within the standing as well as felled forestry, all of which have the potential to be used periodically by otter for shelter or as movement corridors.

Water V*ole*

3.74 Introduction

a) The water vole *Arvicola terrestris* is protected by the Wildlife and Countryside Act (1981, as amended) and the Nature Conservation (Scotland) Act (2004). It is an offence to intentionally or recklessly disturb a water vole in its place of shelter, or to intentionally or recklessly damage, destroy or obstruct access to a shelter.

b) The water vole is currently regarded as the most rapidly declining land mammal in Britain, and it is a Priority Species in the UK BAP. Water vole is a relatively habitat-specific animal favouring densely-vegetated, slow or sluggish watercourses or static water bodies with soft, steep banks, suitable for borrowing. In Scotland, water vole distribution extends to at least 600m AOD, with presence being confined to watercourses with a stream gradient of <3 degrees. Upland colonies are assuming greater significance for the conservation of the species because they occur above the level of habitat management activities most detrimental to water vole habitat (drainage, over-grazing, bank maintenance), and beyond the core activity zone of feral mink, which is the main predator of water vole.

3.75 Field Survey Methodology

a) Water vole survey was carried out alongside the otter survey between July and September 2010. All sections of watercourses within the Development Area and its 50m buffer, with a stream gradient of < 3 degrees were surveyed for evidence of the species. Water vole survey followed the methodology described in Water Vole Conservation Handbook (2006) and involved searches of the stream margins for water vole signs such as feeding stations, latrines, footprints, borrow s and runs.

3.76 Results

a) Historical Records

- Historical records of water vole were sourced from the NBN Gateway. No historical records of water vole were found within 1km of the Development Area. There were no recent records (within the last 10 years) of the species in the proximity of the Development.

b) Field Survey

- No water vole or water vole signs were identified during the field surveys.

c) Discussion

- The main watercourses within the Development Area are largely unsuitable for the species, being predominantly fast flowing with rocky stream beds and banks. Such habitats do not provide opportunities for borrowing into banks, and typically do not support vegetation required by water vole for forage and cover. The tributaries of the main burns were considered to constitute more suitable habitat for the species, with their slower flow and soft peaty banks. However, no water vole signs were identified and all recorded vole signs were those of a field vole *Microtus agrestis*, a common and widespread vole species. Evidence of mink was found within the Development Area and further minimised the likelihood of water vole presence, as mink is a known water vole predator and instances of total eradication of water vole following introduction of mink are known from localities across Scotland.

- As water vole presence was not confirmed within the Development Area, the species is not considered any further in this assessment.

Badger

3.77 Introduction

a) Badger *Meles meles* and its setts are protected in Scotland by the Protection of Badgers Act 1992 as amended by the Nature Conservation (Scotland) Act 2004. This makes it illegal to wilfully kill, injure or take a badger or attempt to do so, cruelly ill-treat a badger, interfere with a sett by damaging it or any part of it, destroying it, obstructing access to it or disturbing a badger while it is occupying a sett.

b) Disturbance is defined by SNH as any new procedure which approaches within a minimum of 30m of a sett margin. For particularly severe effects, this buffer zone may be extended to 100m. Activities within these zones can only be undertaken legally under a licence from SNH.

3.78 Field Survey Methodology

a) Badger survey was carried out by experienced surveyors across 10 man days between July and September 2010.

b) The survey methodology described in Harris *et al*. (1989) was adopted and focused on identification of badger signs, including paths, prints, latrines, hair and shelters within the suitable areas of the Development Area. The survey extended 50m beyond the Development boundary and concentrated on the development footprint, woodland margins and wayleaves separating the woodland blocks, as well as drier parts of the Development Area including the agriculturally improved areas and enclosed fields.

c) All identified badger signs, confirmed or potential, were noted and their location was recorded using a hand-held GPS. Survey findings were subsequently transferred into a digital map base within a GIS.

3.79 Results

a) Historical Records

- Historical records of badger were sourced from the NBN gateway. No historical records of badger were found within 1km of the Development Area. There were no recent records (within the last 10 years) of the species in the proximity of the Development.

b) Field Survey

- No maps or details of identified badger sett locations are provided here due to animal protection issues associated with the persecution of badgers. A Confidential Annex containing this information has been submitted to SNH and South Lanarkshire Council.

c) Discussion

- A full discussion of badger activity within the Development Area is provided in the Confidential Annex. The majority of the Development Area is dominated by coniferous plantation woodland or felled coniferous plantation woodland, which within the Development Area was considered sub-optimal for both sett building and foraging due to the wet and saturated peat habitats that this woodland was situated on. Badger activity was generally concentrated within the enclosed pasture fields, with some evidence of badger activity within the coniferous woodland in the eastern section of the Development Area, as well as the drier banksides of river valleys.

Bats

3.80 Introduction

a) All British bats are species of European importance and are protected by the Conservation (Natural Habitats, etc.) Regulations 1994 as well as the Wildlife and Countryside Act (1981) as amended by the Nature Conservation (Scotland) Act 2004. This legislation makes it an offence to capture, harass, injure or kill a bat; obstruct access to, damage or destroy a breeding or other roost of a bat; disturb bats in such a way as is likely to affect their distribution or abundance or disturb bats in such a way as is likely to impair their ability to survive or breed. Each of these actions is considered to be an offence whether the action is deliberate or reckless, except in the case of damaging or destroying a breeding site or resting place which is a strict liability offence. A licence is required for all developments which will affect areas known to contain bat roots.

b) Bats use different structures, especially trees, at different times of the year for roosting purposes and it is possible to find bats in trees throughout the year. Because bats tend to reuse the same places to breed and shelter (roost sites), legal opinion is that the roost is protected whether or not the bats are present at the time of inspection.

c) Apart from roost sites, bats require feeding sites and flyways (which allow them to navigate between roost and feeding sites) to survive. Bats use linear landscape features such as tree lines and stream and river valleys as flyways. Loss of integrity of these features by gaps of as little as 10m can render them unusable for navigation and can lead to unfavourable effects on local bat populations.

3.81 Methodology

a) Desk Study

- The NBN Gateway was searched and the Clyde Bat Group was consulted for desk study records of bats on the site (and up to 5km surrounding it). In addition, some bat survey data (Anabat remote recordings) was obtained from Peter Leach (undertaking Amphibian Survey on the site on behalf of Land Use Consultants) from two locations on the site during May and June in 2010.

b) Field Survey

- Bat surveys were carried out between 25 May and 16 September 2010 by specialist bat sub-consultants Direct Ecology Ltd. Surveys were based on best practice guidelines (adapted as appropriate for the Development Area) including Bats and Onshore Wind Turbines, Interim Guidance Technical Information Notes 51 (2009) and Survey Guidance for assessing Bat activity at Proposed On-shore wind farms (2008).

- A walkover survey was undertaken in May 2010 to identify potential features likely to be used by bats (roosts, foraging areas etc.). These were followed by night time commuting watches and transect surveys in June, July and September 2010, and remote Anabat monitoring survey at 25 points across the site with up to five Anabats being left out on the site at any one time. The Anabat detectors resulted in 128 full nights' and two part nights' worth of Anabat survey data. Locations of transects and Anabats are show in Appendix 6.4 – Map 2.

- All identified bat signs were noted during survey and findings were subsequently transferred into digital map base within a GIS.

3.82 Results

a) Historical Records

- Two pipistrelle species – soprano pipistrelle *P. pygmaeus* and common pipistrelle *P. pipistrellus* have been recorded within grid square NS74, which encompasses the north east of the site. The exact location and date of the *P. pipistrellus* record is unknown but *P. pygmaues* was recorded near Stonehouse, c. 7km north north-east of the site centre in 2006. *P. pipistrellus* has also been recorded in the 10km grid square NS73 but dates back to 1868 (i.e. it is not evidence that the species is present in 2010/11).

- There is one Natterer's bat *Myotis nattereri* roost site recorded within grid square NS74, with a large number of records in the same location dating from 2000, and a more recent record in June 2008 near Kirkmuir c. 6km to the northeast of the site centre. There is one record of a long-eared bat *Plecotus* sp. recorded within the 10km grid square NS74, north-east of the site centre (location known only to the 10km grid square scale). This record is provided by a dataset dated 1736-1960 and may not provide an accurate representation of the current population.

b) Field Survey

- Bat survey results are shown in Appendix 6.4 – Maps 5 to 9.

- Six species of bat were recorded during the field surveys, namely common pipistrelle, soprano pipistrelle, Nathusius pipistrelle *Pipistrellus nathusii*, Daubenton's bat *Myotis daubentonni*, brown long-eared bat *Plecotus auritus* and Leisler's bat *Nyctalus leislerii*.

- Activity levels varied substantially from night to night, linked to weather conditions. More activity was expected on calm nights and less on windy and wet nights. Some seasonal variation in bat activity was also seen. Nathusius pipistrelle was only recorded in September.

- Some areas of the site had very little bat activity. The open moorland area had a single recording of a pipistrelle, and this habitat is therefore considered to be of negligible value for bats. Dense plantation areas and the southern section of plantation on the site also saw little bat activity. However, the watercourses, the plantation edges and the rides had higher levels of bat activity. Indeed, both the range of species and the amount of activity recorded in these areas was considered to be generally higher than might be expected in a large coniferous plantation.

- No roost sites were positively identified on the site, although there is a possibility that locations outwith the Development Area could support maternity or non-breeding roosts, such as the buildings at Lambhill, Hawkwood, Burnside, Hazliebank and High Dykes. Trees with the potential for bat roosts were identified adjacent to the plantation area but fall outwith the felling area

c) Discussion

- Due to a lack of previous bat survey effort in the area, and hence comparable bat records, it is difficult to place a value on the Kype Muir site for bats. However, given the variety of bat species recorded using the main turbine area, and the rarity locally of two of these species (Leisler's bat and Nathusius pipistrelle), the site is assessed to be of at least Council value for bats. This value rating would be higher if roost sites for these species, and a greater number of individuals, had been positively identified.

Fisheries

3.83 Introduction

a) The Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003 came into force in April 2005. Under this legislation it is an offence (*inter alia)* to knowingly injure or destroy salmon fry or parr, injure or disturb salmon spawn, or disturb spawning beds or any bank or shallows in which the spawn of salmon may be. Atlantic salmon *Salmo salar* is a priority species in the UK BAP and have a widespread distribution in Scotland, requiring high quality, cool freshwaters for spawning.

b) The brown trout *Salmo trutta* is widespread throughout the British Isles, occurring in a variety of different freshwater environments from upland lochs

and pools to lowland chalk streams. Populations of brown trout are thought to be in decline and following a review in 2007 brown trout was added to the UK BAP priority species list. Brown trout are non-migratory but are thought to be members of the same species as the migratory sea trout. Brown trout require certain key environmental factors in order to sustain viable populations. These include good water quality, access to clean spawning gravels and a varied physical habitat (with deeper pools, shallow riffles and overhanging banks and vegetation) for the different stages of its lifecycle.

c) The Freshwater Fish Directive (FFD) (2006/44/EC) aims to "protect or improve the quality of those running or standing freshwaters which support, or which, if pollution were reduced or eliminated, would become capable of supporting fish belonging to:

- indigenous species offering natural diversity; or,
- species, the presence of which is judged desirable for water management purposes by the competent authorities of the Member States".

d) Member states are required, under the FFD, to designate waters according to likely species assemblages. The designation is split into either Salmonid or Cyprinid waters. Member states are then required to set physical and chemical water quality objectives according to the designations, thus placing a duty upon each member to comply with the standards set. The FFD is formally transposed into national legislation through the Surface Waters (Fishlife, Classification (Scotland) Directive 1999), which identifies the standards that are required for Scotland. Standards are set for dissolved oxygen, pH, hydrocarbons and phenols, ammonia, ammonium, zinc and chlorine.

3.84 Methodology

a) Historical Records

A detailed desktop study was undertaken to identify any statutory, non-statutory or designated sites relevant to the aquatic environment within the study area. The following sources were consulted:

- SEPA website[22] - provides information of the classification of waters under the FFD;
- the National Biodiversity Network - provides details of historical records of species;
- the Clyde Foundation for records of previous electro-fishing surveys.

3.85 Field Survey

a) Habitat Assessment

- The assessment of habitat suitability for fish on watercourses within the Development Area and its proximity was carried out between 5 and 7 October 2010. Data recorded for each watercourse included: width,

[22] www.sepa.org.uk/water/protected_areas/freshwater_fisheries.aspx

depth, substrate composition, in-stream vegetation, flow types, bank side cover, presence of obstructions to fish migration and general land use. All assessed watercourses considered suitable for fish were then subject to an electrofishing survey.

b) Electro-Fishing

- Electro-fishing was carried out using standard electro-fishing techniques. Electro-fishing survey locations are shown on Drawing ES10[23]. These locations included two sampling points on the Kype Water, two locations on the Ara Burn and one location on each of the Hareshaw Burn, Lochar Water, Sound Burn, Red Bog Burn, Feeshie Burn, Dykes Burn and an unnamed Dykes Burn tributary. Electrofishing points were selected based on the habitat assessment described above and the proposed location of crossing points for the scheme.

- The survey was undertaken by an electro-fishing team from Mouchel between 5 and 7 October 2010, following Scottish Fisheries Co-ordination Centre (SFCC) protocols[24]. Surveys were led by SFCC level III qualified electro-fishing team leader, and frame mounted bankside generator equipment (Electro-catch). Immobilised fish were retained in well oxygenated holding buckets, anaesthetised in a diluted solution of benzocaine, identified, counted, weighed and measured prior to being returned to the watercourse unharmed.

- Fully quantitative sampling was carried out where possible. However, some reaches were qualitatively surveyed due to the remoteness of their location or the amount of equipment required to carry out the quantitative survey. Qualitative sampling was undertaken by identifying 100m^2 of watercourse for survey and capturing fish present in this area. Fish numbers (and their characteristics) at each survey location were recorded.

- Water quality parameters were also recorded at each survey location including temperature, pH, dissolved oxygen, total dissolved solids and conductivity. Water temperature during the survey was between 9 and 11°C and was considered to be within the effective temperature range for electro-fishing.

3.86 Results

a) Historical Records

- The Lochar Water and the Kype Water both receive classification under the Water Framework Directive. This designation does not extend to their tributaries. According to this classification, the status of fish fauna within the two watercourses is high and the status of fish ecology and the fish barrier element being also high.

- All watercourses within the fisheries survey study area are designated under the Surface Waters (Fishlife, Classification (Scotland) Directive

[23] Assessment locations number 8 and 11 on the Struther Burn and a tributary of the Feeshie Burn are not shown on this plan. These tributaries were assessed for their suitability to support fish species but were not considered suitable and therefore were not fished.
[24] www.scotland.gov.uk/Topics/marine/science/sfcc/protocols

1999) as *Salmonid* waters and fall under the River Clyde designation (UKS7865929).

- A search of the NBN Gateway did not reveal the presence of freshwater fish species within the study area in the last 15 years. However, a number of fish species were identified within the 10km grid squares containing the Development Area (NS63, NS64 and NS74), including Atlantic salmon, brown trout, European eel *Anguilla*, grayling *Thymallus*, stone loach *Barbatula*, three-spined stickleback *Gasterosteus aculeatus*, perch *Perca fluviatilis* and roach *Rutilus*.

b) Field Survey

Habitat Assessment

- Habitat suitability assessment concluded that the majority of watercourses within the study area were suitable to support viable fish populations, having high potential for fish utilisation and providing suitable spawning habitat. Full electro-fishing survey was not considered necessary on two of the assessed watercourses, the Struther Burn and a tributary of the Feeshie Burn. These streams were of insufficient water depth and variation in flow structure and substrate composition and have become overgrown by rush vegetation. In addition, a culvert drop considered impassable for fish was observed on the Struther Burn. These two streams were excluded from full electro-fishing survey.

Electro-Fishing Survey

- Fish species were recorded on all but one of the sampled watercourses (Sample location 13 Dykes Burn tributary). In total, three fish species were recorded, including brown trout, stone loach and minnow *Phoxinus phoxinus*. Brown trout was the most frequently recorded species, being present at every sampling location. Stone loach was recorded at both sampling locations on the Kype Water and minnow was only recorded at one of the sampling points on the Kype Water.

- Composition and abundance of fish species at each sampling location are shown in Table7.6.

Table 7.6: Results of Electrofishing Survey within the Kype Muir Wind Farm Study Area

Site	Site Name	Grid Ref. (Start)	Grid Ref. (End)	Composition and Abundance	Length Range (mm)	Weight Range (g)
1	Kype Water	NS 74266 39977	NS 74287 39964	Brown trout: 7 Stone loach: 7 Minnow: 58	Brown trout: 70 – 185 Stone loach: 40 -90 Minnow: 10 - 85	Brown trout: 4 – 72 Stone loach: <1 - 8 Minnow: <1 - 8
2	Hareshaw Burn	NS 73597 40001	NS 73568 39984	Brown trout: 18	Brown trout: 60 - 200	Brown trout: 4 - 115

Site	Site Name	Grid Ref. (Start)	Grid Ref. (End)	Composition and Abundance	Length Range (mm)	Weight Range (g)
3	Kype Water	NS 73235 37995	NS 73193 37963	Brown trout: 5 Stone loach: 1	Brown trout: 70 – 115 Stone loach: 65	Brown trout: 5 – 27 Stone loach: 3
4	Ara Burn	NS 73218 37987	NS 73355 38816	Brown trout: 4	Brown trout: 75 - 90	Brown trout: 5 - 14
5	Ara Burn	NS 73607 38794	NS 73579 38804	Brown trout: 8	Brown trout: 63 - 170	Brown trout: 4 - 69
6	Sound Burn	NS 69756 39290	NS 69877 39126	Brown trout: 11	Brown trout: 62 - 187	Brown trout: 4 - 87
7	Lochar Water	NS 69991 38713	NS 69879 39111	Brown trout: 5	Brown trout: 73 - 158	Brown trout: 5 - 44
9	Red Bog Burn	NS 74286 39970	NS 70312 38822	Brown trout: 5	Brown trout: 56 - 115	Brown trout: 3 - 26
10	Feeshie Burn	NS 69987 38792	NS 69988 38792	Brown trout: 3	Brown trout: 75 - 105	Brown trout: 5 - 20
12	Dykes Burn	NS 66761 38355	NS 66780 38335	Brown trout: 6	Brown trout: 67 - 150	Brown trout: 5 - 43
13	Dykes Burn tributary	NS 66927 37897	NS 66902 37865	No fish recorded		

3.87 Discussion

a) The fish fauna present are typical of upland watercourses in the River Clyde catchment, with brown trout being the most frequent species caught. The absence of Atlantic salmon indicates the likely presence of significant barriers to migration downstream of the study area. An absence of other fish species is not uncommon in headwaters such as these, as they are generally either unsuitable with regards to habitat, or the water velocities and flows tend to exceed the swimming capabilities of many species. The abundance and variety of fish species identified by this study mean that the site is of Council value for its fish fauna.

Table 7.7: Ecological Value of Faunal Receptors

Species	Level of ecological value on the Site	Description
Otter	National	Protected by the EC Habitats Directive. Priority species in the UK BAP. Listed in the South

Species	Level of ecological value on the Site	Description
		Lanarkshire BAP. Widespread evidence of use of the site by otter.
Badger	Council	Protected under the Protection of Badgers Act 1992. A small population of badger is present on the site.
Bat species	Council	All species of bat are protected by the EC Habitats Directive and are priority species in the UK BAP. The site was found to support a moderate level of bat activity, but activity was limited on areas of open moorland and dense plantation and no roost sites were identified.
Fisheries	Council	Brown trout are priority species in the UK BAP. A self-sustaining population is present in the larger watercourses on site.

ASSESSMENT OF EFFECTS

Wind Farm Layout Considerations

3.88 The majority of the Development Area is covered in coniferous plantation woodland. Within these woodlands there are a number of large open areas supporting predominantly blanket bogs, and to a lesser degree dry modified bogs and wet and dry heaths. These are sensitive habitats of high ecological value and were identified as the key ecological constraints to Development design. The design has therefore sought to minimise the loss of mires and heaths and locate the access tracks and other wind farm infrastructure away from these habitats.

3.89 Several design iterations were carried out, each seeking to reduce the amount of infrastructure located on, or adjacent to, these habitats. As a result of these iterations, the final wind farm layout avoids any large unfragmented areas of the above habitats, and compared to earlier design iterations significantly limits the loss of mire and heath habitats. The design specifically avoids placing infrastructure in the open habitats at Kype Muir, Araburn Rig and the large area to the west of Middle Rig.

3.90 The following buffers relevant to protected species and watercourses were also applied during the constraint mapping exercise to inform the wind farm design:

- Otter shelters – 50m (considered to be the standard distance within which construction activities may have a potentially detrimental effect on non-breeding otter shelters);

- Badger shelters – 30m (considered to be the standard distance within which construction activities may have a potentially detrimental effect on badger setts);

- Watercourses – a 129m buffer was applied to watercourses within the northern section of the Development Area to provide a 100m clear stand-off distance between the edge of the turbine rotor sweep and watercourses to

protect bat flight lines and bat feeding areas associated with this aquatic habitat. This is based on the guidance and formula provided in the Natural England Interim Guidance on Bats and Wind farm Developments and is calculated for a 85m hub height and 52m long blades[25].

CONSTRUCTION EFFECTS OF KYPE MUIR WIND FARM

3.91 Due to the nature and scale of the proposal, it is possible that direct and indirect effects may occur as a result of construction of the Development.

3.92 Potential direct effects of construction include:

- Direct loss of habitat through land take for infrastructure construction (turbine bases, access tracks, site compound, borrow pits); and
- Direct loss of or harm to species through construction activities.

3.93 Potential indirect effects of construction include:

- Changes to existing hydrology that could lead to detrimental changes in wetland flora and fauna as a result of increased drainage and/or dewatering;
- Increased pollution risk associated with accidental spillage of fuels and oils and increases in silt-laden run-off and dust emission;
- Fragmentation of habitats through construction of tracks; and
- Species and habitat disturbance effects.

Predicted Effects - Designated Sites

3.94 Due to the distance between the site boundary and the nearest statutory designated site being 1.4km there will be no direct or indirect effects on ecological receptors of statutory designated sites. Effects on ornithological features of designated sites are considered in Chapter 6: Ornithology.

3.95 Feeshie and Willochsheugh Moss SINC is situated on the opposite side of the Lochar Water from the Development Area. It is unlikely that the blanket bog habitat of this SINC and the blanket bog habitats within the Development Area are hydrologically connected. It is not considered likely that the Development will have direct or indirect effects on this site.

3.96 Kype Water Reservoir SINC is situated downstream of the Long Knowe Burn which drains from the site. However, the closest infrastructure is over 200m from the Long Knowe Burn and provided that the pollution prevention measures outlined in Chapter 13: Hydrology and Hydrogeology are implemented there are no predicted direct or indirect effects on this site.

3.97 Kype Water SINC comprises an area of acid grassland that partially falls within the eastern boundary of the Development Area. No felling or construction will take place within 200m of this site and therefore no effects are predicted.

[25] Final turbine dimensions have not yet been determined. A 52m blade length was confirmed by the developer as being the maximum potential blade length. A 100m clear buffer was applied, as a precautionary approach and doubles the minimum buffer required by Natural England guidance.

3.98 Chucket Knowe and Kype Rig SINC is located immediately adjacent to the Development boundary. Felling will occur right up to the edge of this SINC but the site itself will not be affected. A Habitat Management Plan for the Development Area is described later in this chapter and aims to reinstate a mosaic of open upland habitats including acid grassland which will connect with this site and reduce its isolation, thus providing some positive effects. Overall the effect on this SINC is considered to be neutral.

Predicted Effects - Habitats

Direct Effects

3.99 A Geographic Information System (GIS) was used to determine the 'footprint' of the Development. This included land take for the construction of access tracks, turbine bases, crane hardstandings, rotor assembly areas, site compound, substation, borrow pits and two anemometer masts. A summary of the dimensions used to calculate habitat loss is shown in Table 7.8. Habitat loss dimensions are in some instances larger than the dimensions of infrastructure (see construction details in Chapter 3: Construction, operation and decommissioning) to allow for creation of batters (sloping road verges), and peripheral habitat loss during construction. An overlay of this footprint with the Phase 1 Habitat Map (Drawing ES07) was used to calculate the extent of habitats lost as a result of the wind farm construction (Table 7.9).

Table 7.8: Dimensions used in Habitat Loss Calculations

Component	Actual Dimensions	Dimensions used for Habitat Loss
Turbine bases, crane hardstandings and rotor assembly areas	26 @ 104m diameter with ancillary areas for crane access	As per actual dimensions
Access track	5.5m (running width)	10.5m (to account for road batters)
Access track widening locations (at track junctions)	Rectangular shapes of 72 x 3m and 42 x 3m Triangular shapes (30m side length and 10m side length)	Buffered by 2.5m to account for road batters
Temporary site compound	1 @ 250 x 100m	1 @ 260 x 110m
Borrow pits	1 @ 188 x 220m 1 @ 152 x 246m 1 @ 173 x 236m 1 @ 231 x 234m	As per actual dimensions
Substation	60 x 20m	70 x 30m
Anemometer mast	1 of a circular footprint 33m across	As per actual dimensions

Indirect Effects

3.100 Hydrological issues are covered in detail in Chapter 13: Hydrology and Hydrogeology. If inadequately controlled, temporary and permanent changes in the pattern, quantity and quality of surface and ground waters can lead to detrimental effects on the overall ecological integrity of mire and wet dwarf shrub heath habitats, as well as standing water bodies and the watercourses themselves. Altering current patterns of drainage may cause droughting or flooding of peat-based habitats, sheet wash of peat, reduced stability of habitats on steep slopes and potentially 'bog burst'. Peat slide risk is considered in more detail in Chapter 13: Hydrology and Hydrogeology.

3.101 Disruption of the hydrological patterns within blanket bogs and other water-dependent habitats as a result of built infrastructure is an area lacking empirical research. Most existing data refer to the effects of ditching and ploughing as part of afforestation projects (Anderson *et al*., 2000; Gilman, 1994) and which may or may not be transferable to construction situations. Gilman (1994) suggests that alterations in blanket bog water levels do not extend further than c. 10m from the nearest forestry drain whereas some estimates quote effects occurring up to 50m from drains (Natural England, 2010). As there is no current consensus on the issue an estimate of indirect effects on water-dependent habitats has been made here via the calculation of the area of such habitats within a 25m buffer around the development footprint. However, it is recognised that this does not account for micro-scale variations in hydrological functioning of bog mesotopes within the development footprint that may be indirectly affected by construction, and hence there may be variation in the zone of influence. It may therefore be an under-estimate for some types of bog. Nevertheless, the estimate allows the identification of areas where indirect effects are predicted to be higher or lower on bog habitats, within timescale and resource constraints.

3.102 If inadequately controlled, there is potential for construction operations to cause pollution of wetland (and terrestrial) habitats through accidental spillage of vehicular fuels and oils, and from road surface slurry formed from dust deposition during the laying and use of access tracks. The risk of silt-laden run-off is greatest during periods of heavy rain; for dust emissions it is highest during dry weather. These could lead to negative effects on receiving aquatic and terrestrial habitats, and their associated fauna.

3.103 As with indirect effects, quantification of fragmentation effects as a result of wind farm construction is also difficult. However, this source of habitat deterioration is acknowledged qualitatively within the assessment.

Predicted Effects - Habitat Effects

3.104 Table 7.9 details construction phase habitat effects prior to mitigation. It is anticipated that 413.6ha, comprising 11 different habitat types, will be directly lost as a result of the felling and wind farm construction. A further two habitats (flushes and watercourses), could also be affected indirectly as a result of wind farm construction.

Table 7.9: Summary of Construction Effects on Habitats Prior to Mitigation

Habitat	Level of Ecological Value	Area of Habitat Loss (ha) and % contribution to the total habitat loss	Indirect Effects	Effect Magnitude	Effect Significance
Access track	< Neighbourhood	4.06 (<0.94%)	None	Low	No impact (track re-use)
Acid flush	National	0.00 (0.00%)	≈0.05	Low	Negligible
Arable land	Neighbourhood	0.01 (<0.10%)	None	Low	Negligible
Blanket bog	International	0.70 (0.16%)	≈2.19	Low	Moderate negative
Blanket bog/coniferous plantation woodland	National	1.94 (0.45%)	≈2.25	Low	Moderate negative
Coniferous plantation woodland	Neighbourhood	419.15 (96.7%)	None	High (as a result of clear fell rather than loss of habitat to the development footprint).	Minor negative
Dry modified bog	National	2.05 (0.47%)	≈4.22	Low	Moderate negative
Improved grassland	Neighbourhood	0.82 (0.19%)	None	Low	Negligible
Marshy grassland	Council	0.43 (0.10%)	≈1.73	Low	Minor negative
Quarry	< Neighbourhood	0.11 (0.03%)	None	Low	Negligible
Recently felled coniferous plantation woodland	Neighbourhood	3.52 (0.81%)	None	Low	Minor negative
Unimproved neutral grassland	Neighbourhood	1.22 (0.28%)	None	Low	Negligible
TOTAL		434.00ha			
Streams and rivers	Council	None (no new crossings)	None	Low	Minor negative

3.105 The majority of habitat loss (419.15ha, 96.7% of the total habitat loss) is associated with the loss of coniferous plantation woodland. A total of 45.17ha of this area falls directly under the construction footprint whilst the remaining woodland is scheduled for clear felling. In addition, a further 4.06ha of habitat loss is represented by re-use of existing access tracks or a loss of quarried habitat. The remaining 10.8ha (2.5%) of habitat loss is comprised of nine habitat types. This includes 3.52ha of recently felled coniferous woodland, 2.05ha of dry modified bog, 1.94ha of blanket bog/coniferous woodland mosaic habitat and 1.22ha of unimproved neutral grassland. Direct losses of the remaining habitats (blanket bog, marshy grassland, improved grassland and arable land and quarry) are less than 1ha each. In addition, a small length of species poor hedgerow (beech/hawthorn) will be lost as a result of construction of the new access track.

3.106 In addition to direct habitat loss, indirect effects are predicted for water-dependent habitats as a result of changes to hydrology and drainage. The greatest indirect habitat effects are predicted for dry modified bog (≈4.22ha), blanket bog (≈2.19ha) and blanket bog/coniferous plantation woodland mosaic habitat (≈2.25ha). Additional indirect effects are predicted for acid flush (≈0.05ha) and marshy grassland (≈1.73ha).

3.107 Other than at stream crossings, the majority of wind farm infrastructure is located at least 50m from watercourses. Potential indirect effects on watercourses may include:

- Soil and silt run-off into the watercourse;
- Localised changes to surface water hydrology and flow;
- Changes to bankside structures;
- Acidification effects as a result of felling operations; and,
- Pollution of burns through accidental spillages and incidents.

3.108 However, due to the application of the water pollution prevention measures described in Chapter 13: Hydrology and Hydrogeology, the potential for silt or pollution run-off effects is considered to be low magnitude.

3.109 Considering both direct habitat loss and indirect effects, impacts of high magnitude are predicted for coniferous woodland. As a result of the low nature conservation value of coniferous woodland, this is considered to be an impact of minor negative significance. The losses of all other habitat types are considered to be low in magnitude, due to the small-scale losses of these habitats. Given the value of bog habitat types, the effects on blanket bog, dry modified bog and blanket bog/coniferous woodland mosaic habitats are considered to be of moderate negative significance.

3.110 Effects on all other habitat types are considered to be of minor negative or negligible significance.

Predicted Effects - Ground Water Dependent Terrestrial Ecosystems

3.111 SEPA has recently introduced Groundwater Dependent Terrestrial Ecosystems (GWDTEs) in to their remit. SEPA currently defines GWDTEs on the basis of specific NVC communities, and requires that direct and indirect effects on

GWDTEs are assessed for all wind farm developments. SEPA stipulates that indirect effects on GWDTEs could occur as far as 250m from borrow pits and turbines, and 100m from all other infrastructure, and require that an assessment of all potential GWDTEs is made within these buffers. SEPA Guidance Note 4 (LUPS-GU4) provides a table detailing the definition of GWDTEs as per the NVC. It includes a number of mire, flush, swamp, grassland and wet woodland communities.

3.112 Drawing ES08 shows the NVC map for Kype Muir. Only a limited number of potential GWDTEs have been identified within the Kype Muir Development Area and the majority of habitat loss is of non-GWDTE habitat (predominantly coniferous plantation). Table 7.10 shows the areas of individual GWDTE habitats within a 250m buffer of turbine bases and borrow pits, and 100m of infrastructure.

Table 7.10: Direct and Indirect Effects on GWDTEs

Habitat Type	NVC Community	UK GW Dependency Score[26]	Direct Effects	Indirect Effects[27]
Flush	M6c *Carex echinata – Sphagnum recurvum/auriculatum* mire	1	None	2.15ha
Marshy grassland	M23a *Juncus acutiflorus - Galium palustre* rush pasture and M23b *Juncus effusus – Galium palustre* rush pasture	2	0.43 ha	8.24 ha
Unimproved acid grassland	*U5 and U6 intermediate: Nardus stricta – Galium saxatile* grassland and *Juncus squarrosus – Festuca ovina* grassland	2 - 3	None	2.42 ha

3.113 Direct losses of GWDTES are negligible due to the sensitive layout of infrastructure. Small areas of GWDTEs with a range of levels of dependency on groundwater are however present within a buffer of the scheme layout. However, any effects will be restricted to small isolated patches of wetland habitats located within forest rides and it is not considered that there will be effects on large scale habitat areas. On the basis of the low areas of direct and indirect GWDTE loss, effects on GWDTEs are considered to be of negligible significance.

Predicted Effects - Otter

3.114 No otter shelters will be directly impacted by felling and construction activities. The shortest separation distance between an otter shelter and a turbine is approximately 170m (turbine 10) and between an otter shelter and an access

[26] A score of 1 equates to a high potential groundwater dependency and a score of 3 equates to a low potential groundwater dependency.
[27] Based on a 250m buffer of turbines and borrow pits and a 100m buffer of access tracks.

track within the turbine envelope area is 170m (access track leading to turbine 10). In addition there is an otter shelter within 62m of the existing tarmac road at Lambhill. Direct effects on otter, such as damage to shelters and causing harm to an otter during wind farm construction are highly unlikely to result at these distances.

3.115 Two upgrades of watercourse crossings are proposed (on the Sound Burn and the Struther Burn). The wind farm has been designed so that no new watercourse crossings are required. Effects as a result of obstructions to watercourses are therefore highly unlikely as any upgrades will be designed according to the (then) Scottish Executive (2000) guidance.

3.116 Disturbance effects during construction activity (light, noise and vibration) are considered possible during construction within 100m of watercourses. However, the majority of construction is likely to occur within daylight and designated working hours, outwith the main period of otter activity. If otters are resting in the identified shelters during the day time, disturbance may occur where activities take place in proximity to these structures.

3.117 As no shelters will be directly impacted by the development, there are no proposed new crossings and the majority of infrastructure is over 100m from watercourses, the effects on otter are considered to be neutral in magnitude and therefore of negligible significance.

Predicted Effects - Badger

3.118 No badger setts will be directly impacted by felling and construction works for the proposed Development.

3.119 A number of badger setts are located within 20-50m of existing tracks and roads that will be used for wind farm construction, and a main sett and an outlier sett are located within 10 - 20m of proposed felling operations for the wind farm and a proposed borrow pit. Indirect effects are therefore possible and may include:

- Disturbance effects on badger as a result of noise, vibration and human presence;
- Indirect effects to sett structure integrity as a result of felling work;
- Potential increase in road mortality as a result of increased traffic volumes; and,
- Loss of foraging habitat.

3.120 Further detail on effects on badgers is provided in the Confidential Badger Annex. Effects are considered to be medium in magnitude and of moderate negative significance.

Predicted Effects - Bats

3.121 Based on the current survey results there will be no direct loss of roosts or impact on bats or their roosts through felling and construction activities. Effects on bats during construction phase will be neutral in magnitude and therefore there are considered to be no impacts on bats.

Predicted Effects - Fisheries

3.122 No new watercourse crossings will be required during felling and construction of the Development. The existing track into Kype Forest includes a culverted crossing of the Struther Burn and the Sound Burn. These two crossings may require upgrading as part of the access track works for the wind farm.

3.123 Upgrading of the Struther Burn crossing may result in moderate positive effects. The current culvert design and construction prevents passage of fish upstream. Any new culvert would be designed in accordance with the guidance on watercourse crossings and migratory fish provided by the Scottish Executive (2000) and would therefore ensure improved passage of fish into the Struther Burn.

3.124 Upgrade of the Sound Burn crossing will not result in the loss of any further habitat but may result in temporary disturbance to fish species during upgrade works. Potential indirect effects may include:

- Soil and silt run-off into the watercourse;
- Localised changes to surface water hydrology and flow;
- Changes to bankside structures; and,
- Pollution of burns through accidental spillages and incidents.

3.125 However, it is anticipated that the above effects will be avoided through the good practice measures listed previously and by the implementation of stringent pollution prevention measures which have been designed in accordance with SEPA requirements (see Chapter 13: Hydrology and Hydrogeology). All felling works would be carried out in accordance with the Forestry Commission 'Forest and Water Guidelines' (Forestry Commission 2003) to avoid and reduce effects such as acidification of watercourses. Indirect effects on other watercourses are unlikely to occur as the majority of infrastructure is located at least 100m from watercourses.

3.126 On this basis, indirect and direct effects on fish are likely to be of low magnitude and, based on the scheme layout and pollution prevention measures are considered to be of minor negative significance.

OPERATIONAL EFFECTS OF KYPE MUIR WIND FARM

Predicted Operational Effects

3.127 Operational phase effects on habitats and all protected species with the exception of bats have been scoped out of the assessment (see 'Introduction' of this chapter). Operational phase effects on bats are addressed below.

Bats

3.128 Pipistrelle Species

a) Common and soprano pipistrelles are assessed by Natural England guidance (2009) to be of medium risk in terms of collision but low risk in terms of collisions posing any threat to their population levels. Distances between

turbines and watercourses are provided in Table 7.12 below[28]. As turbines are located away from watercourses and woodland edges with a clear 50-100m buffer between the edge of the rotor sweep to watercourses for all turbines. The collision risk between turbines and common and soprano pipistrelles is therefore considered to be low as this distance of buffer doubles the minimum distance required by Natural England.

b) The Nathusius pipistrelle bat is classed as being at high risk of collision due to its fast and direct flight, and it being less manoeuvrable than the common pipistrelle species (Dietz *et al*. 2009). Nathusius pipistrelle was recorded at two locations on the site, both on the northern boundary of the site, but not on the site itself. This species was only noted in September and activity was limited to two passes. Given the low levels of activity and the location of the passes being beyond the proposed turbine area it is considered that potential collision effects are unlikely to be significant.

3.129 Myotis and Brown Long–Eared Bats

a) There have been few recorded deaths of Daubenton's or brown long-eared bats in European wind farm studies (see Jones et al. 2009). The Daubenton's bat is generally associated with watercourses and other linear features such as woodland edge and if turbines are situated away from these then potential collision risks should be minimised. The brown long-eared bat is classified as low risk by Natural England guidance. At Kype Muir it was found to be widespread throughout the plantation to the east although low numbers.

b) It has been possible to achieve a clear buffer of 100m between the edges of the turbine rotor sweep on 23 out of 26 turbines. Of the remaining three turbines two are very close to achieving this distance with a 95m and 96m buffer. Turbine 20 is located in a position which provides a clear 77m buffer between the rotor sweep and watercourse edge. Buffers are based on a maximum turbine rotor diameter of 52m and micro-siting is subject to a stipulation that turbines cannot be moved closer to watercourses (see draft conditions in Appendix 1). Therefore these buffers provide the 'worse-case' scenario and in reality all turbines will be at or close to achieving a clear 100m buffer from watercourses. Collision risk for these species at Kype Muir is therefore predicted to be low.

3.130 Leisler's Bats

a) The Leisler's bat is classed as a high collision risk species and is of high risk in terms of potential effects on populations. Given the uncertainty of potential collision risks and records of Leisler's bats across the main turbine areas at Kype Muir there could be potentially significant effects to this species as a result of the proposals.

b) However, the majority of the survey area will be clear felled and not replanted (see the habitat management proposals provided in Drawing ES22 and Appendix 17) and this would reduce activity levels of the species in the

[28] Distances are measured direct from the turbine hub to the nearest point on a watercourse. The buffer distance is calculated using the Natural England formula (Natural England, 2009) and is based on a maximum 52m blade. The turbine model has not yet been selected but a 52m blade is the absolute maximum that would be used.

vicinity of the turbines and potentially reduce the collision impact to the species to a non-significant level. Although Leisler's bats are known to cross open areas when commuting, no definite commuting routes were confirmed across the site and it is thought that most bats were foraging individuals. As for any bat species, clear-fell will not provide optimum foraging conditions and activity over this habitat will be reduced as it is restored to open habitats including blanket bog, heath and acid grassland during the lifetime of the wind farm.

c) Native woodland replanting is proposed on the margins of the site as part of the habitat management proposals. However, following advice from SNH bat specialists, an absolute minimum buffer of 150m between the rotor edge and woodland replanting has been proposed for all turbines on site, to minimise the collision risk between Leisler's bats and turbines. .

d) Based on available information the collision risk will therefore remain at non-significant levels.

Table 7.12: Buffers between Turbines and Watercourses

Distance from Watercourse	Turbine Number	Buffer between Rotor Sweep Edge and Watercourses	Collision Risk Between Bats and Turbines
>129m	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 22, 23, 25, 26	Greater than a 100m buffer between the edge of the rotor sweep and turbines – more than doubling the Natural England 50m recommended buffer.	Very Low
123m and 124m	21, 24	Provides a 95 and 94m buffer between the edge of the rotor sweep and turbines. With micro-siting these turbines are likely to have a 100m clear buffer.	Low
106m	20	Provides a minimum 77m buffer between the edge of the rotor sweep and turbines which will be increased through micro-siting.	Low - Medium

Habitat Loss and Replanting Proposals

3.131 Habitat loss of coniferous woodland will be long-term as a result of clear-felling and construction of new access tracks and turbine bases. The main habitat that would be lost is coniferous woodland which is not the optimum foraging habitat for bats. However survey data has indicated widespread use of the plantation area, particularly forest edges and watercourses, by bats. Removal of the plantation may have little effect on some species such as pipistrelle species which prefer to forage in less 'cluttered' habitats. Those species that rely more heavily on wooded habitat and woodland boundary features such as brown long-eared and Leisler's bats will lose habitat in the short-term, at least.

3.132 The current outline Habitat Management Plan (see Drawing ES22 and Appendix 17) proposes replanting some areas on the site margins with semi-natural broad-

leaved woodland. In the longer-term these marginal areas of broad-leaved woodland and scrub could provide improved foraging habitat for bat species.

3.133 Habitat management proposals have included a minimum 150m clear buffer that will be left free of woodland planting for all turbines. A large number of turbines will be situated in an extensive area of open habitat restoration including blanket bog and dry heath which will be unattractive to foraging and commuting bats. In addition, "fingers" of woodland planting between turbines have been avoided, again to reduce the potential for bats to fly across clearings.

3.134 In conclusion, short-term loss of coniferous woodland on site could reduce the bat foraging potential of the site, although key commuting routes (watercourses) and potential roost features (which are outwith the Development Area) will remain unaffected, and in the long-term, native woodland planting will provide enhanced habitat and foraging resource for bats.

RESIDUAL EFFECTS

Proposed Mitigation

Habitats

3.135 Construction phase best practice mitigation measures relevant to all habitats within the Development Area (described in more detail in Chapter 13: Hydrology and Hydrogeology and the draft CMS and EMP – Appendices 18 and 19) will be implemented as follows to reduce habitat loss and effects:

- An Ecological Clerk of Works (ECoW) will monitor ecological features on site during the construction period and ensure that good practice measures for habitats and species are implemented;

- Access tracks will be designed to maintain or impede drainage through wetland habitats where either of these scenarios would be beneficial to habitat quality and the hydrological regime. Turbine construction will be micro-sited where necessary following the pre-construction checks and sensitive habitat mapping by the ECoW, and designed so as to minimise sheet wash and peripheral habitat disturbance;

- During construction, silt interception traps will be provided to minimise unchecked contaminated run-off. Up-slope interceptor ditches will be incorporated into the design and culverts utilised so that uncontaminated run-off is fed into existing drainage features;

- Habitat reinstatement techniques will be employed where appropriate. Reinstatement of peat-based habitats (blanket bog, blanket bog/marshy grassland mosaic and wet heath) will be carried out where possible by replacing stripped and stored turfs and peat. Reseeding will only be used as a last resort if translocation fails in these habitats. Re-using existing soils and vegetation ensures the restoration of species of local provenance and prevents the creation of bright green swards typically produced by commercial seed mixes. However, re-seeding will be carried out on all infrastructure edges in grassland habitats using a mix agreed by SNH and South Lanarkshire Council as appropriate;

- Where access tracks are built on peat-based habitats, turfs will be stripped back from the edge of construction surfaces, retaining the vegetated portion within 150-250mm of peat at the top of the storage pile. Turfs and seed sources can remain viable for two to three months in winter, but only a few weeks in summer months. Track construction will therefore occur in stages to allow on-going restoration. Stored turfs will be watered in summer months to increase the longevity of the seed bank;

- All felling works will be carried out in accordance with the guidance in the Forest and Water Guidelines (Forestry Commission, 2003);

- Details of the proposed borrow pit restoration are provided in Chapter 2 of this ES and the draft CMS.

Faunal Species

3.136 The consideration of faunal species effects is based on good practice measures for the protection of species being an integral part of the scheme design. Chapter 13: Hydrology and Hydrogeology provides specific good practice measures relating to the protection of watercourses and hence species dependent on these habitats. In addition a number of measures of the scheme design have been included to reduce effects on species including:

- Pre-construction surveys will be carried out for otter and badger. All stream and river crossings will be surveyed prior to commencement of construction to identify any otter shelters created since the surveys described here. The survey will extend to a 200m buffer around infrastructure. All areas within 100m of infrastructure will be surveyed for badger. If necessary a disturbance licence will be sought for any setts or shelters depending on the proximity to the proposed works and the likelihood of any disturbance.

- Pre-construction felling checks of woodland areas and individual trees will be carried out to identify any trees that might support bat roosts. The majority of spruce and lodgepole trees on site have low bat roost potential. Pre-construction surveys will focus on searches for other tree species, particularly broad-leaved species on the woodland margins and where necessary dusk emergence and dawn return surveys will be conducted on any trees with medium or high bat roost potential.

- No turbines will be micro-sited within 100m of a watercourse or 150m from the woodland edge.

- Construction areas will be searched for reptiles and reptile hibernacula no more than 14 days in advance of ground clearance. Buffer zones or supervised hand destruction will be implemented to prevent harm to reptiles. Where appropriate (as advised by the ECoW), following pre-construction surveys, strimming of vegetation in construction areas will be carried out to reduce habitat suitability and attractiveness to reptiles in advance of construction works.

- All upgraded watercourse crossings will be designed in accordance with the River Crossings and Migratory Fish Design Guidance produced by the (then) Scottish Executive. Crossings will also incorporate a mammal culvert, ledge or other means of facilitating dry passage of otters.

- Unavoidable in-stream works will be carried out between May and September to minimise the potential for damage to fish eggs and fry and will avoid periods of very wet weather.

- General good practice measures for working around watercourses will be adhered to as described in Chapter 13: Hydrology.

- High quality capping material will be used for the access tracks, as lower quality rock can easily break down into fines which can then wash into watercourses. Any roadside drains that are constructed will not directly discharge into streams (or drainage channels leading directly into streams), and specifically designed silt traps will be used where necessary to act as filters.

- Pumps used to extract water from watercourses will be fitted with an appropriate screen or filter to prevent the damage to fish.

- During the hours of darkness, machinery and floodlights will be directed away from the watercourses. The use of heavy machinery, pile drivers and rock blasting will be limited to avoid two hours before and after dawn and dusk which are the times of day when otter are most active. This will apply to construction activity within 250m of areas of high otter activity and otter shelters.

- During construction, chemicals will be stored securely within the temporary construction compound, trenches and excavations will be covered at the end of each working day, or will include ramps to enable the escape and stored pipes will be capped to prevent entrapment of animals.

- A site speed limit of 15mph for all construction traffic will be in place to protect badgers and otters, particularly at watercourse crossings.

- The site induction for construction personnel will include a “Toolbox Talk” on otters, badgers, reptiles and identification of the shelters of these species. In addition the Toolbox Talk will emphasise the importance of protection of watercourses.

Habitats: Kype Muir Habitat Management Plan

3.137 Habitat loss associated with blanket bog and wet heath habitats is predicted as a result of the construction of Kype Muir Wind farm. As blanket bog is listed on Annex I of the Habitats Directive, it is considered to be a habitat of international importance and it is predicted that these losses will constitute an impact of moderate negative significance. As significant effects on Annex I Habitats are likely, these will require mitigation (and/or compensation). A Habitat Management Plan is therefore proposed for the Kype Muir Wind farm, to compensate for the loss of ecologically important habitats as well as to provide ecological enhancement of the Development Area beyond its baseline status.

3.138 An outline HMP document is provided in Appendix 17. The plan has been designed to strike a balance between forestry, ecology and ornithological issues, including:

- The Control of Woodland Policy (Forestry Commission, 2009) and how this applies within the Development Area;

- Potential effects to bird species (positive and negative) with particular reference to the nearby Muirkirk and North Lowther Uplands Special Protection Area (discussed in detail in Chapter 6: Ornithology);

- Requirement of land management to mitigate/prevent adverse effects of operation on bat species, in particular Leisler's bats; and,

- Opportunities to create priority habitats, particularly those included under the UK Biodiversity Action Plan (UK BAP), and to tie in with the aims and objectives of the South Lanarkshire Upland Habitats Biodiversity Action Plan.

3.139 The felling of mature coniferous forest offers significant opportunities to enhance the biodiversity value of the Kype Muir Development Area, in particular it provides opportunities to create UK BAP habitats, improve the condition of existing bog habitat within the Development Area and reduce the fragmentation of semi-natural habitats. Two broad aims have been included in the outline Habitat Management Plan for the Development, including the restoration of upland habitats (heath and blanket bog), and the creation of broad-leaved woodland and scrub.

Restoration of Upland Heath and Blanket Bog

3.140 Blanket bog and heathland habitats will be restored in felled areas of coniferous plantation, to increase connectivity between the unfragmented but isolated blanket bog habitats at Kype Muir and Araburn Rig and other open habitats in the area.

3.141 Areas proposed for blanket bog and heath restoration are shown in Drawing ES22 and further detail is provided in Appendix 17. Selection of areas for upland heath and blanket bog restoration has been based on the following criteria:

- Areas with deep underlying peat (based on peat mapping): considered suitable for blanket bog restoration;

- Areas where conifer crops have failed or are poor indicating high water levels and deep peat (based on conifer crop mapping): considered suitable for blanket bog restoration;

- Areas outlined for felling which if restored to bog or heath habitat will restore connectivity between the existing bog and heath habitats at Araburn Rig and Kype Muir; and

- Areas where buffer zones around turbines are required to be left unplanted to reduce collision risk between bats and turbines (see 'operational effects' section).

3.142 A total of 78.99ha will be restored to blanket bog habitat. A further 285.1ha will be restored to a mosaic of blanket bog, heathland, marshy grassland, acid grassland, low density scrub and flush, depending on the ground conditions and potential for restoration.

Creation of Broad-Leaved Woodland and Scrub

3.143 Cleared woodland habitats which have not been identified under the criteria listed in paragraph 7.141 as being suitable for restoration to bog or heathland habitats will be replanted with native broad-leaved woodland, comprising species such as birch, rowan and willow. In addition, areas will be selected for the creation of feathered woodland wedges and scattered scrub planting, to increase the extent of suitable habitat for black grouse and juniper planting within the Development Area. A total of 86.27ha will be replanted with broad-leaved woodland, and a further 5.54ha planted as feathered woodland scrub edge.

Target Species: Black Grouse

3.144 Felling and restructuring of forest areas at Kype Muir is considered to offer significant opportunities for improving the habitat mosaic for black grouse. Black grouse prefer the transition zone between forest and moorland habitats, with woodland areas providing shelter in winter and buds for feeding in spring, and open areas providing good quality feeding in summer with shrubs and heather for nesting. Black grouse favour ground cover in young plantations, but as the plantation thickens they leave these areas. Preferred habitat management for the species is the creation of blocks of woodland which 'feather' out, gradually thinning to low growing shrubs, accompanied by open habitats (mosaics of heath, bog and acid grassland) with favoured food plants such as blaeberry, crowberry, cottongrass and heath rush.

3.145 Habitat management proposals are shown in Drawing ES22. Woodland planting would predominantly comprise birch, rowan and willow species which are favoured food and shelter species of black grouse. The area proposed for woodland planting forms a 'horse-shoe' around central areas of the site which has been outlined for more open habitat restoration. On its outside edge, this new woodland would abut with the remaining standing coniferous plantation.

3.146 The exact mosaic of habitats in the centre of the 'horse-shoe' is uncertain at present but is likely to include heathland and acid grassland restoration in drier areas on shallower peat; blanket bog where the peat is deeper, and provision of feathered woodland planting from woodland blocks, extending out into open areas and grading to patches of shrubs. Favoured shrub species for planting will include willow, with potential for trialling planting of juniper scrub.

HMP Implementation

3.147 Implementation of the HMP will include a schedule of monitoring to establish the success of management prescriptions. The prescriptions of the HMP may change over time in response to changes in habitat condition as a result of management and the outcomes of monitoring of the habitat, black grouse or other species prescriptions.

3.148 The HMP will be developed post consent in further detail in conjunction with relevant stakeholders, to include the landowner, Banks Renewables, South Lanarkshire Council, Scottish Natural Heritage and Forestry Commission Scotland.

Species

3.149 Construction phase effects on otter, bats and fish species are of minor negative significance or less, therefore no mitigation is proposed beyond implementation of the good practice measures described above.

Badger

3.150 A licence will be required from SNH to carry out activities that will potentially disturb badger setts. No setts will require to be closed. However, the licence will require detailing mitigation that will be put in place to protect badgers. Mitigation is described in the Confidential Badger Annex but will include:

- Implementation of appropriate felling methods for any trees within 30m of badger sett entrances. A method statement for felling will be written for the licence application and will include: no felling in the 30m zone during the badger breeding season; felling of trees to fall away from sett entrances, use of low ground pressure vehicles for felling, and ground skidding with a winch to be used to remove any trees from the 30m buffer zone. Further detail is provided in Appendix 6.5.

- Implementation of a 15mph speed limit on all access routes within the Development Area and along the road from West Cauldcoats to Lambhill;

- Provision of a toolbox talk on badgers, identification of badger setts and mitigation measures to protect badgers for all contractors on the Development;

- Blasting activity at borrow pits to be restricted to the time between two hours after dawn and two hours before dusk, i.e. to avoid the period when badgers tend to be active;

- Badger-proof fencing to be installed around the borrow pit at Araburnrig to prevent access by badgers; and,

- Provision of an artificial sett east of Araburnrig to provide shelter for badgers in this area if construction works result in disturbance of their normal sett.

3.151 In addition, in the long-term the habitat management plan for the Kype Muir Wind farm as described above, will provide a much more diverse and open woodland habitat for badger. It may provide additional foraging and shelter opportunities in the newly created broad-leaved woodland areas allowing badger populations to expand in the years following construction.

Operational Mitigation

3.152 No operational mitigation is required. Micro-siting stipulations which should be included as a planning condition, will be used to ensure that a suitable distance between turbines and watercourses are achieved. Habitat management proposals are at an outline stage and have considered the balance between creating priority habitats, improving habitats for black grouse and protecting bat species. These will be subject to discussion and agreement to the satisfaction of the consultees post consent. Again, this should be subject to a planning condition.

Residual Construction Effects

3.153 Residual construction phase effects are summarised in Table 7.11. Following the implementation of mitigation measures, and subject to further revisions and approval of the HMP by SNH and South Lanarkshire Council, all construction phase residual effects are reduced to minor negative significance or negligible.

Table 7.11: Residual Construction Phase Effects

Habitat/ Species	Value	Effect magnitude	Effect type	Effect significance prior to mitigation	Residual Effect following mitigation or enhancement
Designated sites	International - Council	None	No Impact	No Impact	No Impact
Blanket bog	International	Low	Direct and Indirect	Moderate negative	Negligible
Blanket bog/coniferous plantation mosaic	National	Low	Direct and Indirect	Moderate negative	Negligible
Dry modified bog	National	Low	Direct and Indirect	Moderate negative	Negligible
All other habitats	<Neighbourhood - National	Low	Direct and Indirect	Minor negative - negligible	Minor negative - negligible
Streams and rivers	Council	Low	Direct and Indirect	Minor negative	Minor negative
Otter	National	Neutral	Indirect	Negligible	Negligible
Bats	Council	Neutral	No impact	No impact	No impact
Badger	Council	Medium	Indirect	Moderate negative	Minor negative
Fisheries	Council	Low	Indirect	Minor negative	Minor negative

Residual Operational Effects

3.154 Bat species have been carefully considered during the design of the Kype Muir Wind farm. Turbines have been placed in locations where the effects on bats have been minimised and the Habitat Management Plan has sought to achieve a balance between creation of priority habitats and protection of bat species. A limited number of bat collisions may occur but these are unlikely to affect the integrity and population status of bat species in the area, and therefore residual operational effects on bat species will be of low magnitude and therefore of minor negative significance.

CUMULATIVE EFFECTS

3.155 A total of six wind farms are located within 15km of Development. These include:

- Hagshaw Hill Wind farm and its extension: an operational site 8.6km to the south-east of the Development.
- Galawhistle Wind farm: an application site 9.4km south-east of the Development.
- Dungavel Wind farm: a consented wind farm, 2.8km south-west of the Development.
- Bankend Rig Wind farm: a consented wind farm, 6.7km south-west of the Development.
- Calder Water Wind farm: a consented wind farm, 8.5km west of the Development.
- Whitelee Wind farm: an operational site with two consented extensions, approximately 14km west of the Development.

3.156 In the absence of specific guidance for conducting cumulative ecological impact assessment for wind farms, a 15km buffer of the site is considered an appropriate distance at which to assess cumulative impact assessments, as it covers the likely territory ranges of most non-avian species under consideration. This assessment considers two separate elements of cumulative effects on each faunal receptor:

- In-combination effects of all or some of the wind farms on individual animals, groups or shelters; and
- In-combination effects of all of the wind farms on local /regional population status.

3.157 A qualitative approach has been taken to assessing the effects on habitats.

Cumulative Construction Effects

Habitats

3.158 Quantitative cumulative assessment of habitat loss as a result of the wind farm schemes is not possible due to the differing methods that have been used to assess effects on habitats for each of the schemes. The main habitat lost by all schemes is coniferous woodland, with the loss of much smaller areas of other habitats including blanket bog and heath.

3.159 Kype Muir, Calder Water, Dungavel, Bankend Rig and Whitelee Wind Farms, all propose large-scale habitat management plans which could result in modest positive effects through the gain of priority habitat types. The status of habitat management plans at Galawhistle and Hagshaw Hill is unknown.

3.160 Provided that the habitat management plans for each site are appropriate, implemented to a high standard and fit with local and national biodiversity action

plans, it is likely that cumulative positive effects on habitats will result when all schemes are considered.

Otter

3.161 None of the schemes predicted residual significant effects on otter.

3.162 Whitelee Wind farm which is already operational and is therefore unlikely to have ongoing significant effects on otter populations. The two proposed extensions to Whitelee drain into different catchments (the River Irvine and the Craufurdland Water) to the Development and other developments under consideration. It is therefore considered unlikely that significant cumulative effects on individual otters and their territories will result.

3.163 Galawhistle and Hagshaw wind farms are also some distance from the Development (9.5km and 8.5km respectively) and drain separate catchments (the Douglas Water and River Nethan). Despite the possibility of some cross-catchment movement by otter it is unlikely that any cumulative effects on individual otters and their territories will be significant.

3.164 The Calder Water Wind farm, Bankend Rig Wind farm, Dungavel Wind farm and the Development all drain into the River Avon catchment. Each of these schemes predicted residual effects of minor negative significance or less, with no direct effects on otters or their shelters. Large sections of watercourse will remain undisturbed due to the distance along watercourses between the sites (generally 10km or more), and cumulative effects on individual otters and their territories as a result of these schemes are not predicted to be significant.

3.165 None of the schemes will result in the loss of shelters or the requirement for licences and mitigation to prevent significant disturbance of shelters. Large sections of watercourse will remain undisturbed during construction and additionally construction related disturbance will be temporary. On this basis the cumulative effect on the regional otter population is not considered to be significant.

Badger

3.166 Major roads (including the A41) separate Whitelee Wind farm, Whitelee Wind Farm extensions and Calder Water Wind farm from the Development. Given this barrier, as well as the extensive areas of suitable lowland farmland and woodland habitats separating these schemes and the Development, it is highly unlikely that badgers will move between the sites and therefore cumulative effects on individual badgers or setts are not predicted.

3.167 Galawhistle and Hagshaw Wind farms are also distant from the Kype Muir site. The habitat between the wind farm sites is dominated by upland heathland and bog and coniferous woodland at significant altitudes (400m). The low suitability of these habitats for badger means that it is unlikely that badgers will forage or move between sites and therefore cumulative effects on individual badgers or setts are not predicted.

3.168 The Bankend Rig Wind Farm did not record signs of badger and therefore there is no scope for cumulative effects with this scheme. The Environmental statement for Dungavel wind farm recorded limited badger activity within the forested areas. However, despite only 2km separating the two sites, badgers

would need to cross extensive bog habitat and watercourses to reach Kype Muir. It is therefore unlikely that badgers move between the two sites and cumulative effects on individual badgers or setts are not predicted to occur.

3.169 All schemes predicted non-significant effects on badger (effects of minor significance or less), following the application of mitigation. None of the schemes predicted that local badger populations would be reduced as a result of construction or operational disturbance of habitat changes on the wind farm sites and it has been determined above that there will be no increased effects on badgers as a result of geographical connectivity. The in-combination effects of these minor impacts mean that cumulative effects of the schemes on the regional badger population are considered to be of minor negative significance.

Bats

3.170 None of the schemes predicted the loss of bat roosts as a result of wind farm construction. Significant cumulative effects are therefore not predicted.

Fisheries

3.171 Galawhistle and Hagshaw Wind Farms and the proposed Whitelee Wind Farm extensions drain separate catchments from the development so in-combination effects on individual stretches of watercourse are not predicted. In addition, Whitelee Wind farm is already constructed and so it is unlikely that the scheme will affect watercourses and fish species. The proposed Bankend Rig, Dungavel, Calder Water and Kype Muir Wind Farms all drain the River Avon catchment. However, siltation effects would need to be major for cumulative effects to occur:

- Silt from Calder Water Wind Farm would have to persist in the Calder Water for 8km to reach the River Avon watercourse;
- Silt from Kype Muir would have to persist in the Lochar Water for 5km to reach the River Avon watercourse; and
- Silt from Bankend Wind Farm and Glengavel Wind Farm would have to persist for 8 – 10km to reach the same point on the River Avon where the Lochar Water and Calder Water enter.

3.172 Therefore significant in-combination effects on individual watercourses or stretches of watercourse are not considered to be significant.

3.173 As all schemes predicated effects on fisheries and watercourses of minor significance or less, and made commitments to implement pollution prevention measures (as listed in each of the Environmental Statements) cumulative effects on the regional fisheries resource will be of minor negative significance or less. In addition, It is unlikely that the construction period for those schemes that are yet to i.e. constructed will overlap entirely, and therefore although cumulative effects are unlikely to be significant, it may be that the longevity of the cumulative impact on individual catchments is greater, and may extend into the short to medium term until all construction work is complete.

Cumulative Operational Effects

3.174 Bat species are the only ecological receptor that is considered to be potentially affected by wind farm operation. However, cumulative assessment of operational

effects on bats is not possible. The majority of schemes considered in this assessment have not conducted bat surveys or have not assessed operational effects on bat species, and where surveys have been conducted the approach to impact assessment is varying in this relatively new and uncertain topic area.

3.175 Some tentative conclusions can be drawn from a landscape scale assessment but the usefulness of this in conducting a cumulative assessment is limited. Despite the fact that some species of bats can travel many kilometres, they tend to follow specific linear flight lines such as woodland edges and watercourses. Survey at Kype Muir has indicated that featureless upland hillsides have virtually no bat activity. It is therefore likely that most of the wind farm schemes considered in this cumulative assessment will experience only low levels of bat activity. It is also unlikely that bats fly between the majority of the sites considered in this assessment due to the featureless upland terrain that they would have to cross. For bats to move between the Galawhistle and Hagshaw Hill Wind Farms and the Kype Muir site as they would have to fly over 3km of featureless terrain including Dunside Hill and Grouse Hill. Bat surveys on Kype Rig to the south of Kype Muir found virtually no bat activity, suggesting that bats are not travelling from the proposed Dungavel and Bankend Wind Farm sites to the Kype Muir area, as again this could involve a featureless journey across Kype Rig.

3.176 Theoretically, bats could follow a complex network of a number of watercourses and forest boundaries to cross between these sites and the wind farm sites at Calder Water and Whitelee. However it is far more likely that bats would forage more locally or fly greater distances down major watercourses, to more lowland areas outwith the wind farm boundaries, as these areas will have better foraging opportunities when compared to the relatively low foraging and roosting potential of the wind farm sites. There in-combination effects on individual bat or roost populations are not considered likely.

3.177 Given the upland nature of all of the wind farm sites, and the low foraging value of most of the sites, the potential for moderate or high levels of bat activity or cross-site movement is likely to be limited. It is likely that all schemes will result in only a low level of bat collisions due to the low quality of foraging and roosting habitat they provide. On the basis of current data and methods for assessment the cumulative effects on bat species are likely to be of minor significance.

FURTHER SURVEY REQUIREMENTS AND MONITORING

3.178 Pre-construction protected species surveys for otter and badger will be undertaken in suitable areas of habitat within 200m of infrastructure for otter, and within 100m of infrastructure for badger.

3.179 Pre-felling checks will be carried out to identify any non-coniferous trees with medium or high bat roost potential. Where trees with medium or high bat roost potential are identified and are located within the felling area dusk emergence and dawn return surveys will be conducted.

3.180 Monitoring of habitats and black grouse will be on-going during the operation of the wind farm for the Habitat Management Plan. Further details are provided in Appendix 17.

SUMMARY OF EFFECTS

3.181 Table 7.13 below summarises the predicted significant effects of the Kype Muir Wind Farm on ecological receptors.

Table 7.13: Summary of Predicted Significant Effects

Predicted Effect	Significance	Mitigation	Long-term Significance of Residual Effect
Construction			
Blanket bog: direct and indirect loss.	Moderate negative	Implementation of a large-scale habitat management plan across the felling area with plans to restore large areas of blanket bog in areas with suitable ground conditions. Planting proposals will also seek to provide open habitat around turbines to function as buffers for bat species. The enhancement plan will be subject to the approval of SNH and SLC and the requirements of the Control of Woodland Removal Policy.	Negligible
Dry modified bog: direct and indirect loss.	Moderate negative		Negligible
Blanket bog and coniferous woodland mosaic: direct and indirect loss.	Moderate negative		Negligible
Badger: Indirect disturbance effects	Moderate negative	Provision of tool box talks to contractors; specific felling method statements to be followed within a 20m buffer of sett entrances, enforcement of a site wide speed limit; restrictions of times of blasting; construction of an artificial sett and installation of badger proof fencing.	Minor negative

4. NOISE

Summary of Changes:

- Amendments to remove any reference to financially involved properties. Reduction in ETSU-R-97 day time and night time noise criterion to 40dB and 43dB respectively at H8 to reflect this change.
- Additional information on mitigation measures to ensure that the revised noise criterion can be achieved. Details are provided on 2 mitigation options, micro-sitting of the turbines closest to H8 or operating one turbine in a lower noise mode for certain wind sectors and wind speeds.

Impact on Conclusions:

- Mitigation measures are required to ensure that the predicted turbine noise levels at H8 are below the ETSU-R-97 defined noise criteria for that property.

THIS CHAPTER REPLACES SECTION 8 OF THE ES SUBMITTED AUGUST 2011

INTRODUCTION

4.1 This chapter summarises the findings of the construction and operational noise assessments undertaken by TNEI Services Ltd. The construction noise assessment report is included in full in Appendix 7.2 and the operational noise assessment report is included in full in Appendix 7.1. The noise monitoring and assessment locations for the operational noise assessment are shown on Drawing ES11 and for the construction noise assessment are shown on Drawing ES12.

CONSULTATION

4.2 Consultation took place with the Environmental Health Department at South Lanarkshire Council prior to the background noise assessment to agree noise monitoring locations and the methodology for the construction and operational noise assessments. The Environmental Health Officer (EHO) at South Lanarkshire Council responded to the consultation by email and agreed with the methodologies proposed and the background noise monitoring locations. In addition the EHO also requested justification for the use of the upper quiet daytime noise limit of 40dB(A). Further information on the justification for the use of the upper quiet daytime limit of 40dB(A) can be found in Section 8.48-8.54.

4.3 Details of the consultation responses are provided in the full noise report contained within Appendix 7.1.

METHODOLOGY

4.4 The methods of assessment used the following combination of guidance and assessment methodologies:

- Planning Advice Note PAN 1/2011: ‘Planning and Noise’;
- Web Based Renewables Advice: ‘Onshore Wind Turbines’;
- ETSU-R-97 ‘The Assessment and Rating of Noise from Wind Farms’;
- ISO9613: 1996 ‘Acoustics – Attenuation of sound during propagation outdoors Part 2: General method of calculation’;
- Institute of Acoustics Bulletin March/April 2009 ‘Prediction and assessment of wind turbine noise’;
- BS5228-1: 2009 ‘Code of practice for noise and vibration control on construction and open sites - Noise’; and
- Local Policy.

Construction Noise Assessment Methodology

4.5 The construction noise assessment has been undertaken in accordance with the updated standard, British Standard (BS) 5228-1: 2009 ‘Noise’.

4.6 BS5228-1:2009 provides useful guidance on practical noise control. Part 1, provides recommendations for basic methods of noise and vibration control including sections on community relations, training, occupational noise effects, neighbourhood nuisance and project supervision. The annexes provide information on noise sources, mitigation measures and their effectiveness.

4.7 BS5228-1:2009 contains sound power level data for a variety of construction plant. The data tabulated in the standard was obtained from field measurements of actual plant operating on construction and open sites in the United Kingdom.

4.8 Issues relating to construction noise are addressed in detail within the construction noise report (Appendix 7.2).

Operational Noise Assessment Methodology

4.9 ETSU-R-97 provides a robust basis for determining noise limits for wind farm developments and these limits should not be breached. Consequently, the test applied to operational noise is whether or not the calculated wind farm noise levels at nearby noise sensitive properties lie below the noise limits derived in accordance with ETSU-R-97.

4.10 Limits differ between quiet daytime and night-time periods. The quiet daytime criteria applies to the ‘quiet periods of the day’ comprising:

- All evenings from 18:00 to 23:00; plus
- Saturday afternoons from 13:00 to 18:00; and
- All day Sunday 07:00 to 23:00.

4.11 Night-time periods are defined as 23:00 to 07:00 with no differentiation made between weekdays and weekends.

4.12 ETSU-R-97 recommends that wind farm noise for the quiet daytime periods should be limited to 5 dB(A) above the prevailing background or a fixed minimum level within the range 35 - 40 dB $L_{A90,10min}$, whichever is the higher. The precise

choice of criterion level within the range 35 - 40 dB(A) depends on a number of factors, including the number of dwellings in the neighbourhood of the wind farm (relatively few dwellings suggest a figure towards the upper end), the effect of noise limits on the number of kWh generated (larger sites tend to suggest a higher figure) and the duration and level of exposure to any noise.

4.13 For night time periods the recommended limits are 5 dB(A) above prevailing background or a fixed minimum level of 43 dB $L_{A90,10min}$, whichever is higher.

4.14 The aim of the noise assessment is therefore to derive the ETSU-R-97 noise criteria and demonstrate that the proposed Kype Muir Wind Farm can meet the criteria. Nevertheless, depending on the levels of background noise, the satisfaction of the criteria can, at times lead to a situation whereby, at some locations under some conditions and for a certain proportion of the time, the noise associated with the scheme may be audible, although, if it is within the noise criteria it is deemed to be at an acceptable level.

4.15 The exact model of turbine to be used at the site will be the result of a future tendering process. Achievement of the noise limits determined by this assessment will be a key determining factor in the final choice of turbine for the site. In the absence of a confirmed turbine model the noise assessment was based upon a candidate turbine which is considered typical of the type of turbines which could be installed at the site. Predictions of wind turbine noise have been made, based upon sound power level data for the REpower 3.4M 3.4MW, 80m hub height wind turbine and a noise prediction model that was considered to provide a realistic impact assessment.

4.16 Issues relating to operational noise such as Amplitude Modulation, Low Frequency Noise and Vibro-Acoustics Disease are addressed in detail within the ETSU-R-97 assessment (Appendix 7.1).

Significance Criteria

Construction Noise

4.17 BS5228-1:2009, Appendix E Part E.3.2 clearly sets criteria for assessing the significance of construction noise effects and gives examples of acceptable limits for construction noise. For the purposes of this assessment the Daytime Category A noise limits are most applicable and have been utilised to assess the significance of the construction impacts during each of the key construction phases. The significance criteria adopted for this assessment are based on Appendix E part E.3.2 of BS5228-1:2009 as detailed in Section 2.2.8 of the Construction Noise Report (Appendix 7.2).

4.18 Criteria for determining the significance of construction noise effects are provided in Table 8.1 below.

Table 8.1 Construction Noise Significance Criteria

Assessment Category and Threshold Value Period	Significance Level	
	Not Significant	**Significant**
Category A Daytime (07:00 – 19:00) and	≤65dB $L_{Aeq, 12 hr}$	>65dB $L_{Aeq, 12 hr}$

Assessment Category and Threshold Value Period	Significance Level	
	Not Significant	Significant
Saturdays (07:00 to 13:00)		

4.19 The impact of increased traffic movements on the B743 South of Strathaven Road have been assessed based on Appendix E part E.3.3 of BS5228-1:2009, 5dB(A) change. If the addition of the construction noise exceeds the pre-construction ambient background levels by greater than by 5dB a significant impact is deemed to occur.

Operational Noise

4.20 ETSU-R-97 does not define significance criteria, but 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. Achievement of ETSU-R-97 derived noise limits ensures that wind turbine noise will meet current Government guidance.

4.21 In terms of the EIA Regulations the terminology of significance used in this chapter refers to compliance/non-compliance with the ETSU-R-97 derived noise limits. For situations where predicted wind turbine noise meets or is less than the noise limits defined in ETSU-R-97, then the noise impact is deemed not significant. Any breach of the ETSU-R-97 derived noise limits is deemed to result in a significant effect.

4.22 For the purposes of this assessment, all residential properties are considered to be sensitive receptors.

BASELINE CONDITIONS

4.23 The proposed development is located within a rural location where existing background noise levels are relatively low. The predominant noise sources in the area are wind induced noise (wind passing through vegetation and around buildings), distant and local road traffic noise, tree felling activities, agricultural noise and birdsong.

4.24 The noise survey to determine the existing background noise environment at noise sensitive receptors neighbouring the proposed development was undertaken in accordance with the guidance contained within ETSU-R-97.

4.25 Background noise monitoring was undertaken at the eight locations shown on Drawing ES11. The measurement locations were selected on the basis of preliminary noise predictions which indicated that for a wind condition of 10 ms^{-1} measured at 10 metres above ground level these properties would be the most sensitive. Predictions of turbine noise were made at the closest properties. The candidate wind turbine used for modelling was the REpower 3.4M. Sound power level data provided by REpower was used to predict turbine noise at the closest properties (defined as the assessment locations).

4.26 The assessment locations used in the construction and operational noise assessments are detailed in Tables 8.2 and 8.3 below. For the purposes of the construction noise assessment the assessment location is generally 3.5m from the façade of the noise sensitive receptor whereas for the operational noise

assessment the assessment location is generally at the edge of the amenity area which reflects the closest point to the wind farm.

Table 8.2 - Construction Noise Assessment Locations

Receptor	Easting (m)	Northing (m)	Elevation (m AOD)
H1 - Lambhill Lodge	269595	639803	265
H2 - Kirkwood House Cottage	268953	640116	236
H3 - Hazliebank Cottage	270032	640951	247
H4 - High Dyke House	272190	640932	276
H5 – Hareshawhead	273713	639632	281
H6 – Kype Lodge	273485	638644	289

Table 8.3 - Operational Noise Assessment Locations

Receptor	Easting (m)	Northing (m)	Elevation (m AOD)	Approximate Distance to Nearest Kype Muir Turbine (m) *
H1-High Dyke Farm	266884	638686	244	3,670
H2-Gainerhill Cottages	267568	639679	227	3,055
H3-Hawkwood Farm	268548	639523	245	2,065
H4- Lambhill Steading	269623	639718	268	1,105
H5-Hazliebank Cottage	270045	640953	247	1,525
H6-High Dyke House	272177	640934	276	1,140
H7-Hareshawhead	273719	639652	281	1,095
H8-Kype Lodge	273490	638643	289	900

* Please note the distances to the nearest turbines quoted above may differ from those reported elsewhere. Distances for the noise assessment are taken from the nearest turbine to the closest edge of the amenity area.

4.27 Background noise monitoring was undertaken over the period 12 August 2010 to 12 November 2010. However due to the delay with the installation of the meteorological mast only the noise data collected from 15 September 2010 onwards was used in this assessment. The sound level meters were set to log the L_{A90} and L_{Aeq} noise levels over the required ten minute intervals continuously over the deployment period.

4.28 Simultaneous wind speed/direction data were recorded on a 70m meteorological mast at a height of 35m and 70.75m, which was located at the proposed wind farm site.

4.29 In accordance with the methodology outlined in an article published in the Institute of Acoustics bulletin, 10m wind speed data has been standardised using the data collected by the 70m mast which is located on site. Data collected at 35m and 70.75m was used to derive the hub height wind speed, this was then standardised to a height of 10m using a standard ground roughness length of 0.05. Further information on the wind shear calculation methodology can be found in Appendix 5, Section 2.6.

4.30 Wind speed/direction data and rainfall data were collected over the same time-scale, and averaged over the same ten minute periods as the noise data to provide the analysis of the measured background noise as a function of wind speed and direction.

4.31 The noise meters were calibrated on deployment, calibration and battery changes took place at approximately weekly intervals. No drifts greater than 0.3 dB(A) in calibration were found to have occurred on any of the noise meters. This is within the normal tolerances described in BS EN 61672-1:2003.

4.32 Table 8.4 provides a summary of the range of background noise levels measured during the monitoring period. Background noise levels during periods of rainfall have been excluded from this data.

Table 8.4 - Summary of Background Noise Levels (dB(A))

Receptor	Quiet Daytime $L_{A90, 10 min}$	Night-time $L_{A90, 10 min}$
H1-High Dyke Farm	17.6-54.1	16.3-54.7
H2-Gainerhill Cottages	17.5-60.4	16.5-59.1
H3-Hawkwood Farm	22.7-59.2	22.1-62.1
H4- Lambhill Steading	18.5-52.8	17.3-52.5
H5-Hazliebank Cottage	19.4-55.9	18.4-58.5
H6-High Dyke House	17.2-55.2	16.1-54.6
H7-Hareshawhead	17.7-53.8	17.2-54.9

Receptor	Quiet Daytime $L_{A90, 10 min}$	Night-time $L_{A90, 10 min}$
H8-Kype Lodge	16.3-57.6	16.2-58.8

ASSESSMENT OF EFFECTS

Construction Effects

4.33 This section of the ES considers the noise issues associated with the construction of the proposed wind farm. The aims of this construction noise assessment are therefore, to:

- Identify the noise sensitive receptors;
- Establish the current baseline noise levels during the day time period;
- Objectively predict the potential impacts (with predictions split into construction phases where necessary);
- Compare predicted noise levels against existing background noise levels;
- Develop suitable mitigation measures, where necessary, to minimise any adverse effects during the construction phase; and
- Assess these against the relevant standards.

4.34 The construction of the wind farm is expected to take approximately 24 months. The construction process will be undertaken in several successive phases. During each stage the plant and equipment, and the associated traffic, will influence the noise generated. The selection of plant and equipment to be used will be determined by the main contractor and detailed arrangements for on site management will be decided at that time. This assessment has therefore been based upon a typical selection of plant for a project of this type. In view of this, the plant has been modelled operating at the closest point to each receptor for a given activity in each construction phase whereas in reality only certain plant will be working at the closest point. The hours of operation are anticipated to be 07:00 – 19:00 weekdays and Saturdays 07:00 to 13:00.

4.35 The construction programme comprises four main phases and a number of sub phases:

- Phase 1A - involves site preparation and site establishment, timber felling and extraction, earthworks associated with the upgrading of existing or construction of new tracks and crane pads, the construction of the site compound and borrow pits excavation;
- Phase 1B – timber felling and extraction, importation and compaction of hardcore material for existing tracks and new tracks and crane pads, the construction of the site compound and borrow pits excavation;
- Phase 1C – timber felling and extraction, laying of asphalt near H2 and borrow pits excavation;

- Phase 2 – timber felling and extraction, construction of turbine foundations which involves borrow pit and turbine site excavation, preparation of steel reinforcement for the turbine foundations and concreting, together with the construction of cable trenches alongside access tracks and laying of cables;

- Phase 3 - turbine delivery and erection; and

- Phase 4 - restoration post commissioning.

4.36 During construction it is anticipated that the total daily vehicle movement numbers would vary each month peaking during Month 12 at 3,812 movements as indicated in Chapter 10 of the Environmental Statement. This will peak when bringing in concrete and turbines in Phases 2 and 3 in conjunction with the movements during timber extraction. There will be a number of large loads bringing equipment to site which may require special measures and these cannot be assessed in the same way as the Calculation of Road Traffic Noise (CRTN) methodology as it does not work with very low traffic flows. In order to assess the impact of increased traffic a simplified version of the CRTN methodology, developed by the National Physics Laboratory together with traffic flow data for the B743 South of Strathaven, as detailed in Table 4.2 of Appendix 9.1 – Transport Assessment. Using a baseline traffic flow of 97.42 vehicles per hour, travelling at 80 kilometres per hour, with 3.34% HGV and assuming no gradient and an impervious road surface the hourly L_{A10} would be 60.2 dB(A). Increasing this to reflect additional construction traffic of 14.44 vehicles (5.67 light vehicles and 8.77 HGV) would equate to 10.75% HGV and the L_{A10} would increase to 62.2 dB(A), an increase of 1.9 dB(A) on normal traffic levels. The impact from increased traffic movements has been assessed in terms of the significance criteria established in the BS5228-1:2009 5dB level change method and as such the impact is deemed not significant.

The noise-generating equipment assessed for each construction phase is detailed in Tables 5.1 - 5.6 of Appendix 7.2, which shows actual data measured at 10m. Using the data contained in these tables the noise levels for phases 1-4 have been calculated. The predicted noise levels emitted from each phase that will be incident at each receptor are shown in Table 8.5. Background noise monitoring for the ETSU-R-97 operational noise assessment included L_{Aeq} and L_{A90} levels across a range of wind speeds. In order to determine the existing daytime noise levels at each receptor the data from a day where low wind speeds ($<5ms^{-1}$) had been recorded was selected. For that day the $L_{Aeq,\ 10mins}$ data for the period 7am – 7pm at each receptor was considered and the $L_{Aeq,\ 12\ hr}$ value was calculated. This value was used for comparison against the predicted construction noise levels.

Table 8.5: Predicted Construction Noise Effects (Phases 1-4)

Location	Existing L_{Aeq} dB	Rounded Ambient L_{Aeq} dB	Category	Predicted $L_{Aeq,12H}$ dB	Change dB	Category A Threshold dB	Threshold Exceeded	Signifcance Rating
Phase 1A								
H1 - Lambhill Lodge	40.8	40	A	62	21.2	65	No	Not Significant
H2 - Kirkwood House Cottage	40.8	40	A	72.5	31.7	65	Yes	Significant
H2 - Kirkwood House Cottage*	40.8	40	A	63.8	23	65	No	Not Significant
H3 - Hazliebank Cottage	41.5	40	A	41.7	0.2	65	No	Not Significant
H4 - High Dyke House	42.5	40	A	35.5	-7	65	No	Not Significant
H5 – Hareshawhead	38.5	35	A	42.8	4.3	65	No	Not Significant
H6 – Kype Lodge	37.9	40	A	45	7.1	65	No	Not Significant
Phase 1B								
H1 - Lambhill Lodge	40.8	40	A	60.3	19.5	65	No	Not Significant
H2 - Kirkwood House Cottage	40.8	40	A	69.8	29	65	Yes	Significant
H2 - Kirkwood House Cottage*	40.8	40	A	63.1	22.3	65	No	Not Significant
H3 - Hazliebank Cottage	41.5	40	A	41.8	0.3	65	No	Not Significant
H4 - High Dyke House	42.5	40	A	35.9	-6.6	65	No	Not Significant
H5 – Hareshawhead	38.5	35	A	43	4.5	65	No	Not Significant
H6 – Kype Lodge	37.9	40	A	44.9	7	65	No	Not Significant
Phase 1C								
H1 - Lambhill Lodge	40.8	40	A	32.2	-8.6	65	No	Not Significant
H2 - Kirkwood House Cottage	40.8	40	A	47.2	6.4	65	No	Not Significant
H3 - Hazliebank Cottage	41.5	40	A	30.6	-10.9	65	No	Not Significant
H4 - High Dyke House	42.5	40	A	35.6	-6.9	65	No	Not Significant
H5 – Hareshawhead	38.5	35	A	42.8	4.3	65	No	Not Significant
H6 – Kype Lodge	37.9	40	A	44.8	6.9	65	No	Not Significant
Phase 2								
H1 - Lambhill Lodge	40.8	40	A	58.3	17.5	65	No	Not Significant
H2 - Kirkwood House Cottage	40.8	40	A	55.9	15.1	65	No	Not Significant
H3 - Hazliebank Cottage	41.5	40	A	46.8	5.3	65	No	Not Significant
H4 - High Dyke House	42.5	40	A	36.8	-5.7	65	No	Not Significant
H5 – Hareshawhead	38.5	35	A	43.3	4.8	65	No	Not Significant
H6 – Kype Lodge	37.9	40	A	46	8.1	65	No	Not Significant
Phase 3								

Location	Existing L_{Aeq} dB	Rounded Ambient L_{Aeq} dB	Category	Predicted $L_{Aeq,12H}$ dB	Change dB	Category A Threshold dB	Threshold Exceeded	Signifcance Rating
H1 - Lambhill Lodge	40.8	40	A	50.4	9.6	65	No	Not Significant
H2 - Kirkwood House Cottage	40.8	40	A	54.3	13.5	65	No	Not Significant
H3 - Hazliebank Cottage	41.5	40	A	39.9	-1.6	65	No	Not Significant
H4 - High Dyke House	42.5	40	A	37.1	-5.4	65	No	Not Significant
H5 – Hareshawhead	38.5	35	A	43.5	5	65	No	Not Significant
H6 – Kype Lodge	37.9	40	A	46.1	8.2	65	No	Not Significant
Phase 4								
H1 - Lambhill Lodge	40.8	40	A	50.7	9.9	65	No	Not Significant
H2 - Kirkwood House Cottage	40.8	40	A	54.3	13.5	65	No	Not Significant
H3 - Hazliebank Cottage	41.5	40	A	40.7	-0.8	65	No	Not Significant
H4 - High Dyke House	42.5	40	A	38.0	-4.5	65	No	Not Significant
H5 – Hareshawhead	38.5	35	A	44.3	5.8	65	No	Not Significant
H6 – Kype Lodge	37.9	40	A	47.0	9.1	65	No	Not Significant

Note - Construction plant operating >100m either side of closest point to property H2

4.37 As detailed in Table 8.5 above the predicted construction noise levels during phase 1 exceed the Category A Threshold value of 65dB at one receptor, location H2 by 7.5dB(A) during phase 1A and by 4.8dB(A) during phase 1B which has the potential to cause a significant noise impact during the day. This will be a short term temporary impact associated with the construction, upgrading and widening of the haul road. At H2 the exceedence is anticipated to occur when activities are occurring within 100m either side of the dwelling. All predictions assume that all plant is operating in full operational mode on the access tracks and within the site itself (borrow pits, internal access tracks) to provide a worst case scenario whereas in reality only a proportion of the plant may be operating. Table 8.5 also shows predicted noise levels for H2 for the remaining period of Phase 1, where noise levels are predicted to be not significant.

4.38 For all other construction phases, the predicted noise impacts at all receptors are below acceptable guidelines and are deemed not significant.

4.39 It should be noted that the proposed construction phases are temporary, short term and are therefore unlikely to give rise to any long term effects. In practice for much of the working day the noise associated with construction activities will be less than predicted, whilst the background noise may be greater. At these times the impact will therefore be less than indicated in the above table.

Operational Noise

4.40 Noise levels arising from the operation of the proposed wind farm were calculated using the propagation model contained within Part 2 of International Standard ISO 9613-2, Acoustics – Attenuation of sound during propagation outdoors. The model uses as its acoustic input data the octave band sound power output of a candidate wind turbine considered suitable for this development (in this case the Repower 3.4M) and calculates, on an octave band basis, attenuation due to geometric spreading, atmospheric absorption and ground effects. The noise model was set up to provide realistic noise predictions, including semi-soft ground attenuation (G=0.5), no barrier effects, and atmospheric attenuation relating to 70% Relative Humidity and 10°C.

4.41 The assessment of the proposed wind farm noise is contained within Section 6 of the Noise Assessment (Appendix 5). This provides an assessment of the wind farm in accordance with the requirements of ETSU-R-97. The assessment is summarised in Tables 8.6 and 8.7.

Table 8.6 - Compliance table to show the ETSU-R-97 defined Quiet Daytime Noise Criterion compared to the predicted L_{A90} Wind Turbine Noise Emission Levels at each of the Noise Assessment Locations

Location		Wind Speed Standardised to 10m Height (v_{10}) ms^{-1}									
		3	4	5	6	7	8	9	10	11	12
High Dykes (H1)	Prevailing Measured Background Noise Level: Quiet Daytime	28.6	29.2	30.1	31.5	33.1	35	37.1	39.4	41.8	44.3
	ETSU-R-97 Noise Criterion*	40	40	40	40	40	40	42.1	44.4	46.8	49.3
	Predicted Wind Turbine Noise L_{A90} **	-	-	22.3	25.9	27.5	27.8	27.8	27.8	27.8	27.8
	Exceedance Level L_{A90}	-	-	*-17.7*	*-14.1*	*-12.5*	*-12.2*	*-14.3*	*-16.6*	*-19*	*-21.5*
Gainerhill Cottages (H2)	Prevailing Measured Background Noise Level: Quiet Daytime	29.9	31.1	33	35.3	37.9	40.8	43.8	46.7	49.6	52.2
	ETSU-R-97 Noise Criterion*	40	40	40	40.3	42.9	45.8	48.8	51.7	54.6	57.2
	Predicted Wind Turbine Noise L_{A90} **	-	-	24	27.6	29.2	29.5	29.5	29.5	29.5	29.5
	Exceedance Level L_{A90}	-	-	*-16*	*-12.7*	*-13.7*	*-16.3*	*-19.3*	*-22.2*	*-25.1*	*-27.7*
Hawkwood Farm (H3)	Prevailing Measured Background Noise Level: Quiet Daytime	31.9	32.6	33.9	35.8	38.1	40.7	43.5	46.4	49.2	51.8
	ETSU-R-97 Noise Criterion*	40	40	40	40.8	43.1	45.7	48.5	51.4	54.2	56.8
	Predicted Wind Turbine Noise L_{A90} **	-	-	27.3	30.9	32.5	32.8	32.8	32.8	32.8	32.8
	Exceedance Level L_{A90}	-	-	*-12.7*	*-9.9*	*-10.6*	*-12.9*	*-15.7*	*-18.6*	*-21.4*	*-24*
Lambhill Steading (H4)	Prevailing Measured Background Noise Level: Quiet Daytime	26.4	27.4	29	31	33.3	36	38.9	41.9	44.9	48
	ETSU-R-97 Noise Criterion*	40	40	40	40	40	41	43.9	46.9	49.9	53
	Predicted Wind Turbine Noise L_{A90} **	-	-	32.4	36	37.6	37.9	37.9	37.9	37.9	37.9
	Exceedance Level L_{A90}	-	-	-7.6	-4	-2.4	-3.1	-6	-9	-12	-15.1
Hazliebank Cottage (H5)	Prevailing Measured Background Noise Level: Quiet Daytime	29.4	30.1	31.4	33.3	35.7	38.3	41.1	44.1	47	49.8
	ETSU-R-97 Noise Criterion*	40	40	40	40	40.7	43.3	46.1	49.1	52	54.8
	Predicted Wind Turbine Noise L_{A90} **	-	-	29.8	33.4	35	35.3	35.3	35.3	35.3	35.3
	Exceedance Level L_{A90}	-	-	*-10.2*	*-6.6*	*-5.7*	*-8*	*-10.8*	*-13.8*	*-16.7*	*-19.5*
High Dyke House (H6)	Prevailing Measured Background Noise Level: Quiet Daytime	28.2	28.9	30.1	31.7	33.7	36	38.5	41.1	43.7	46.4
	ETSU-R-97 Noise Criterion*	40	40	40	40	40	41	43.5	46.1	48.7	51.4
	Predicted Wind Turbine Noise L_{A90}	-	-	32.6	36.2	37.8	38.1	38.1	38.1	38.1	38.1
	Exceedance Level L_{A90}	-	-	*-7.4*	*-3.8*	*-2.2*	*-2.9*	*-5.4*	*-8*	*-10.6*	*-13.3*
Hareshawhead (H7)	Prevailing Measured Background Noise Level: Quiet Daytime	27.7	28.4	29.6	31	32.9	34.9	37.3	39.7	42.4	45.1
	ETSU-R-97 Noise Criterion*	40	40	40	40	40	40	42.3	44.7	47.4	50.1
	Predicted Wind Turbine Noise L_{A90} **	-	-	32.1	35.7	37.3	37.6	37.6	37.6	37.6	37.6
	Exceedance Level L_{A90}	-	-	*-7.9*	*-4.3*	*-2.7*	*-2.4*	*-4.7*	*-7.1*	*-9.8*	*-12.5*
Kype Lodge (H8)	Prevailing Measured Background Noise Level: Quiet Daytime	25.8	26.3	27.6	29.6	32.1	35.1	38.4	41.9	45.5	49
	ETSU-R-97 Noise Criterion*	40	40	40	40	40	40.1	43.4	46.9	50.5	54
	Predicted Wind Turbine Noise L_{A90} **	-	-	34.4	38	39.6	39.9	39.9	39.9	39.9	39.9
	Exceedance Level L_{A90}	-	-	*-5.6*	*-2*	*-0.4*	*-0.2*	*-3.5*	*-7*	*-10.6*	*-14.1*

**Based on the Upper ETSU-R-97 Quiet Daytime Noise Limit of 40dB as detailed in Appendix 5, Section 6.5.*
*** assumes four turbines are microsited as detailed in Section 8.63.*

Table 8.7 - Compliance table to show the ETSU-R-97 defined Night-Time Noise Criterion compared to the predicted L_{A90} Wind Turbine Noise Emission Levels at each of the Noise Assessment Locations

Location		Wind Speed Standardised to 10m Height (v_{10}) ms^{-1}									
		3	4	5	6	7	8	9	10	11	12
High Dykes (H1)	Prevailing Measured Background Noise Level: Night-Time	22.7	23.7	25.4	27.6	30.2	33.1	36.2	39.2	42.2	45
	ETSU-R-97 Noise Criterion	43	43	43	43	43	43	43	44.2	47.2	50
	Predicted Wind Turbine Noise L_{A90} *	-	-	22.3	25.9	27.5	27.8	27.8	27.8	27.8	27.8
	Exceedance Level L_{A90}	-	-	*-20.7*	*-17.1*	*-15.5*	*-15.2*	*-15.2*	*-16.4*	*-19.4*	*-22.2*
Gainerhill Cottages (H2)	Prevailing Measured Background Noise Level: Night-Time	22.4	24.1	26.8	30.3	34.2	38.3	42.5	46.4	49.7	52.4
	ETSU-R-97 Noise Criterion	43	43	43	43	43	43.3	47.5	51.4	54.7	57.4
	Predicted Wind Turbine Noise L_{A90} *	-	-	24	27.6	29.2	29.5	29.5	29.5	29.5	29.5
	Exceedance Level L_{A90}	-	-	*-19*	*-15.4*	*-13.8*	*-13.8*	*-18*	*-21.9*	*-25.2*	*-27.9*
Hawkwood Farm (H3)	Prevailing Measured Background Noise Level: Night-Time	28.6	30.3	32.1	34.1	36.2	38.5	41	43.7	46.5	49.5
	ETSU-R-97 Noise Criterion	43	43	43	43	43	43.5	46	48.7	51.5	54.5
	Predicted Wind Turbine Noise L_{A90} *	-	-	27.3	30.9	32.5	32.8	32.8	32.8	32.8	32.8
	Exceedance Level L_{A90}	-	-	*-15.7*	*-12.1*	*-10.5*	*-10.7*	*-13.2*	*-15.9*	*-18.7*	*-21.7*
Lambhill Steading (H4)	Prevailing Measured Background Noise Level: Night-Time	23.5	24.5	26.1	28.1	30.5	33.1	35.9	38.8	41.6	44.3
	ETSU-R-97 Noise Criterion	43	43	43	43	43	43	43	43.8	46.6	49.3
	Predicted Wind Turbine Noise L_{A90} *	-	-	32.4	36	37.6	37.9	37.9	37.9	37.9	37.9
	Exceedance Level L_{A90}	-	-	-10.6	-7	-5.4	-5.1	-5.1	-5.9	-8.7	-11.4
Haziebank Cottage (H5)	Prevailing Measured Background Noise Level: Night-Time	25.2	26.4	28.2	30.6	33.3	36.3	39.5	42.6	45.7	48.5
	ETSU-R-97 Noise Criterion	43	43	43	43	43	43	44.5	47.6	50.7	53.5
	Predicted Wind Turbine Noise L_{A90} *	-	-	29.8	33.4	35	35.3	35.3	35.3	35.3	35.3
	Exceedance Level L_{A90}	-	-	*-13.2*	*-9.6*	*-8*	*-7.7*	*-9.2*	*-12.3*	*-15.4*	*-18.2*
High Dyke House (H6)	Prevailing Measured Background Noise Level: Night-Time	23.8	25.5	27.5	29.8	32.1	34.6	37.2	39.7	42.2	44.6
	ETSU-R-97 Noise Criterion	43	43	43	43	43	43	43	44.7	47.2	49.6
	Predicted Wind Turbine Noise L_{A90} *	-	-	32.6	36.2	37.8	38.1	38.1	38.1	38.1	38.1
	Exceedance Level L_{A90}	-	-	*-10.4*	*-6.8*	*-5.2*	*-4.9*	*-4.9*	*-6.6*	*-9.1*	*-11.5*
Hareshawhead (H7)	Prevailing Measured Background Noise Level: Night-Time	25.3	26.1	27.4	29.2	31.3	33.8	36.4	39.1	41.9	44.6
	ETSU-R-97 Noise Criterion	43	43	43	43	43	43	43	44.1	46.9	49.6
	Predicted Wind Turbine Noise L_{A90} *	-	-	32.1	35.7	37.3	37.6	37.6	37.6	37.6	37.6
	Exceedance Level L_{A90}	-	-	*-10.9*	*-7.3*	*-5.7*	*-5.4*	*-5.4*	*-6.5*	*-9.3*	*-12*
Kype Lodge (H8)	Prevailing Measured Background Noise Level: Night-Time	23	23.7	25.2	27.5	30.2	33.4	36.8	40.3	43.8	47.1
	ETSU-R-97 Noise Criterion	43	43	43	43	43	43	43	45.3	48.8	52.1
	Predicted Wind Turbine Noise L_{A90} *	-	-	34.4	38	39.6	39.9	39.9	39.9	39.9	39.9
	Exceedance Level L_{A90}	-	-	*-8.6*	*-5*	*-3.4*	*-3.1*	*-3.1*	*-5.4*	*-8.9*	*-12.2*

** assumes four turbines are microsited as detailed in Section 8.63.*

4.42 Tables 8.6 and 8.7 detail the prevailing background noise, relevant criteria and predicted wind turbine noise levels for ETSU-R-97 quiet daytime hours and ETSU-R-97 night-time hours. The tables also show the exceedance level which is the level of turbine noise relative to the noise criteria. A negative exceedance level indicates satisfaction of the noise criteria.

4.43 Predicted wind turbine emission levels and measured background noise levels indicate that for receptors neighbouring the proposed site, wind turbine noise will meet the quiet daytime and night-time noise criteria proposed within ETSU-R-97.

4.44 If the proposal receives planning permission further data will be obtained from the supplier for the final choice of turbine model to demonstrate compliance with the noise limits derived in this report.

Choice of Daytime Limit between 35 - 40dB

4.45 The ETSU-R-97 noise limits are derived by establishing the 'best fit' correlation between background noise level and wind speed. These limits, sometimes referred to as the 'criterion curve', are based on a level 5dB (A) above this best fit correlation curve, over a wind speed range from 0 to 12ms^{-1}. Where the derived criterion curve for the quiet daytime period lies below a fixed level in the range 35 - 40dB (A) then ETSU provides that the criterion curve may be set at an absolute level somewhere within that range.

4.46 The quiet daytime limits are chosen to protect external amenity, the precise choice of level within the range 35dB(A) to 40dB(A) depends on a number of factors, including the number of noise affected properties, the duration of exposure of these properties and the detrimental effect of using tighter limits on the potential power output of the wind farm.

4.47 In terms of the number of properties affected this is clearly limited at this site, there being just one dwelling within 1km radius of the proposed turbines and 18 dwellings within a 1.5km radius of the proposed turbines, 14 of which are clustered to the west at Lambhill. With a predominant west-southwest wind these properties will be upwind of the wind farm for a significant proportion of the time, consequently the predicted noise emission levels shown for H4 in Tables 9.3 and 9.4 above will over estimate the actual noise.

4.48 In terms of duration and level of exposure, ETSU states (on page 65):

'The proportion of the time at which background noise levels are low and how low the background noise level gets are both recognized as factors which could affect the setting of an appropriate lower limit. For example, a property which experienced background noise levels below 30dB(A) for a substantial proportion of the time in which the turbines would be operating could be expected to receive tighter noise limits than a property at which the background noise levels soon increased to levels above 35dB(A). This approach is difficult to formulate precisely and a degree of judgment should be exercised.'

4.49 The candidate turbine cut in wind speed is approximately 2.5ms^{-1} which is based on a hub height cut in wind speed of 3.5ms^{-1} standardised to 10m height. When comparing the turbine cut in wind speed against the background noise plots in Figures 5.10 to 5.17 this indicates that the fixed minimum limits would apply for wind speeds between 2.5ms^{-1} up to 7 or 8ms^{-1} after which the background +5dB levels exceed 40dB(A). Within this window, background noise levels of 30dB (A) or less only occur for a proportion of the time when the turbines would be operating. Considering the quietest locations, for example at receptor H7 this is 36%, at H6 33% and at H4 38%. This clearly does not represent a substantial proportion of the time. If this data were filtered further, to identify the proportion of time when levels were less than 30dB (A) and the wind was blowing from the turbines toward the receptor, these percentages would reduce even further. This locality should not be considered a particularly low noise environment and as such there is no justification to set a limit towards the lower end of the range.

4.50 In addition, the imposition of a lower noise limit would seriously impact upon potential power generation. In order to meet a 35dB(A) lower noise limit, turbines 4, 10, 17, 23, 24, 25 & 26 would need to be removed, resulting in a reduction of

up to 28MW power generation (based on the 4MW maximums) i.e. 27% of the scheme overall.

4.51 After due consideration of these points, a fixed lower limit of 40dB (A) has therefore been adopted for the proposed wind farm.

Micrositing

4.52 A calculation has been undertaken to predict the possible impact of micrositing the wind turbines. If the turbines (excluding turbines 16, 21 ,22 and 26) are relocated 50m in any direction from the proposed turbine coordinates (detailed in Appendix 7.1, Table 5.2), compliance with ETSU-R-97 limits will still be achieved based on modelling on semi-soft ground. Based on the candidate turbine modelled in this assessment mitigation will be required to ensure compliance with the noise limits established for receptor H8. Further details on the micrositing options are contained in Section 5.63. Turbines 16, 21, 22 and 26 cannot be microsited any further to the east than the positions detailed in Table 8.12.

CUMULATIVE IMPACTS

4.53 E.ON Renewables UK Ltd were mindful to grant planning permission subject to signing a section 75 legal agreement at South Lanarkshire Councils planning committee on 1st December 2009 for the installation of 13 wind turbines and associated infrastructure on land at Dungavel Hill, south of Strathaven. The proximity of Kype Muir with the consented Dungavel scheme may have the potential to lead to a cumulative operational noise impact at certain noise sensitive receptors. Predictions have been undertaken to assess the likely cumulative impact from both wind farms operating concurrently.

4.54 The cumulative assessment (summarised in Table 8.8 and Table 8.9 below) shows that the predicted cumulative wind farm noise emission levels meet the ETSU-R-97 derived noise limits at receptor locations surrounding the proposed Kype Muir Wind Farm.

Table 8.8 - Compliance table to show the ETSU-R-97 defined Quiet Daytime Noise Criterion compared to the predicted L_{A90} Wind Turbine Noise Emission Levels from both Wind Farms at each of the Kype Muir Noise Assessment Locations

Location		Wind Speed (v_{10}) ms^{-1}									
		3	4	5	6	7	8	9	10	11	12
High Dykes (H1)	Prevailing Measured Background Noise Level: Quiet Daytime	28.6	29.2	30.1	31.5	33.1	35	37.1	39.4	41.8	44.3
	ETSU-R-97 Noise Criterion*	40	40	40	40	40	40	42.1	44.4	46.8	49.3
	Predicted Wind Turbine Noise L_{A90}	-	-	27.1	31.5	32.9	33	33	33	33	33
	Exceedance Level L_{A90}	-	-	-12.9	-8.5	-7.1	-7	-9.1	-11.4	-13.8	-16.3
Gainerhill Cottages (H2)	Prevailing Measured Background Noise Level: Quiet Daytime	29.9	31.1	33	35.3	37.9	40.8	43.8	46.7	49.6	52.2
	ETSU-R-97 Noise Criterion*	40	40	40	40.3	42.9	45.8	48.8	51.7	54.6	57.2
	Predicted Wind Turbine Noise L_{A90}	-	-	25.6	29.6	31.1	31.3	31.3	31.3	31.3	31.3
	Exceedance Level L_{A90}	-	-	-14.4	-10.7	-11.8	-14.5	-17.5	-20.4	-23.3	-25.9
Hawkwood Farm (H3)	Prevailing Measured Background Noise Level: Quiet Daytime	31.9	32.6	33.9	35.8	38.1	40.7	43.5	46.4	49.2	51.8
	ETSU-R-97 Noise Criterion*	40	40	40	40.8	43.1	45.7	48.5	51.4	54.2	56.8
	Predicted Wind Turbine Noise L_{A90}	-	-	28.2	32	33.5	33.8	33.8	33.8	33.8	33.8
	Exceedance Level L_{A90}	-	-	-11.8	-8.8	-9.6	-11.9	-14.7	-17.6	-20.4	-23
	Prevailing Measured Background Noise Level: Quiet Daytime	26.4	27.4	29	31	33.3	36	38.9	41.9	44.9	48

Lambhill Steading (H4)	ETSU-R-97 Noise Criterion*	40	40	40	40	40	41	43.9	46.9	49.9	53
	Predicted Wind Turbine Noise L_{A90}	-	-	32.5	36.2	37.8	38	38	38	38	38
	Exceedance Level L_{A90}	-	-	-7.5	-3.8	-2.2	-3	-5.9	-8.9	-11.9	-15
Hazliebank Cottage (H5)	Prevailing Measured Background Noise Level: Quiet Daytime	29.4	30.1	31.4	33.3	35.7	38.3	41.1	44.1	47	49.8
	ETSU-R-97 Noise Criterion*	40	40	40	40	40.7	43.3	46.1	49.1	52	54.8
	Predicted Wind Turbine Noise L_{A90}	-	-	29.8	33.5	35.1	35.4	35.4	35.4	35.4	35.4
	Exceedance Level L_{A90}	-	-	-10.2	-6.5	-5.6	-7.9	-10.7	-13.7	-16.6	-19.4
High Dyke House (H6)	Prevailing Measured Background Noise Level: Quiet Daytime	28.2	28.9	30.1	31.7	33.7	36	38.5	41.1	43.7	46.4
	ETSU-R-97 Noise Criterion*	40	40	40	40	40	41	43.5	46.1	48.7	51.4
	Predicted Wind Turbine Noise L_{A90}	-	-	32.6	36.2	37.8	38.1	38.1	38.1	38.1	38.1
	Exceedance Level L_{A90}	-	-	-7.4	-3.8	-2.2	-2.9	-5.4	-8	-10.6	-13.3
Hareshawhead (H7)	Prevailing Measured Background Noise Level: Quiet Daytime	27.7	28.4	29.6	31	32.9	34.9	37.3	39.7	42.4	45.1
	ETSU-R-97 Noise Criterion*	40	40	40	40	40	40	42.3	44.7	47.4	50.1
	Predicted Wind Turbine Noise L_{A90}	-	-	32.2	35.8	37.4	37.7	37.7	37.7	37.7	37.7
	Exceedance Level L_{A90}	-	-	-7.8	-4.2	-2.6	-2.3	-4.6	-7	-9.7	-12.4
Kype Lodge (H8)	Prevailing Measured Background Noise Level: Quiet Daytime	25.8	26.3	27.6	29.6	32.1	35.1	38.4	41.9	45.5	49
	ETSU-R-97 Noise Criterion*	40	40	40	40	40	40.1	43.4	46.9	50.5	54
	Predicted Wind Turbine Noise L_{A90} **	-	-	34.4	38	39.6	39.9	39.9	39.9	39.9	39.9
	Exceedance Level L_{A90}	-	-	*-5.6*	*-2*	*-0.4*	*-0.2*	*-3.5*	*-7*	*-10.6*	*-14.1*

**Based on the Upper ETSU-R-97 Quiet Daytime Noise Limit of 40dB as detailed in Section 6.5.*
*** assumes four turbines are microsited as detailed in Section 8.63.*

Table 8.9 - Compliance table to show the ETSU-R-97 defined Night-Time Noise Criterion compared to the predicted L_{A90} Wind Turbine Noise Emission Levels from both Wind Farms at each of the Kype Muir Noise Assessment Locations

Location		Wind Speed (v_{10}) ms^{-1}									
		3	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
High Dykes (H1)	Prevailing Measured Background Noise Level: Night-Time	22.7	23.7	25.4	27.6	30.2	33.1	36.2	39.2	42.2	45
	Noise Criterion : ETSU-R-97	43	43	43	43	43	43	43	44.2	47.2	50
	Predicted Wind Turbine Noise L_{A90}	-	-	27.1	31.5	32.9	33	33	33	33	33
	Exceedance Level L_{A90}	-	-	-15.9	-11.5	-10.1	-10	-10	-11.2	-14.2	-17
Gainerhill Cottages (H2)	Prevailing Measured Background Noise Level: Night-Time	22.4	24.1	26.8	30.3	34.2	38.3	42.5	46.4	49.7	52.4
	Noise Criterion : ETSU-R-97	43	43	43	43	43	43.3	47.5	51.4	54.7	57.4
	Predicted Wind Turbine Noise L_{A90}	-	-	25.6	29.6	31.1	31.3	31.3	31.3	31.3	31.3
	Exceedance Level L_{A90}	-	-	-17.4	-13.4	-11.9	-12	-16.2	-20.1	-23.4	-26.1
Hawkwood Farm (H3)	Prevailing Measured Background Noise Level: Night-Time	28.6	30.3	32.1	34.1	36.2	38.5	41	43.7	46.5	49.5
	Noise Criterion : ETSU-R-97	43	43	43	43	43	43.5	46	48.7	51.5	54.5
	Predicted Wind Turbine Noise L_{A90}	-	-	28.2	32	33.5	33.8	33.8	33.8	33.8	33.8
	Exceedance Level L_{A90}	-	-	-14.8	-11	-9.5	-9.7	-12.2	-14.9	-17.7	-20.7
Lambhill Steading (H4)	Prevailing Measured Background Noise Level: Night-Time	23.5	24.5	26.1	28.1	30.5	33.1	35.9	38.8	41.6	44.3
	Noise Criterion : ETSU-R-97	43	43	43	43	43	43	43	43.8	46.6	49.3
	Predicted Wind Turbine Noise L_{A90}	-	-	32.5	36.2	37.8	38	38	38	38	38
	Exceedance Level L_{A90}	-	-	-10.5	-6.8	-5.2	-5	-5	-5.8	-8.6	-11.3
Hazliebank Cottage (H5)	Prevailing Measured Background Noise Level: Night-Time	25.2	26.4	28.2	30.6	33.3	36.3	39.5	42.6	45.7	48.5
	Noise Criterion : ETSU-R-97	43	43	43	43	43	43	44.5	47.6	50.7	53.5
	Predicted Wind Turbine Noise L_{A90}	-	-	29.8	33.5	35.1	35.4	35.4	35.4	35.4	35.4
	Exceedance Level L_{A90}	-	-	-13.2	-9.5	-7.9	-7.6	-9.1	-12.2	-15.3	-18.1
High Dyke House (H6)	Prevailing Measured Background Noise Level: Night-Time	23.8	25.5	27.5	29.8	32.1	34.6	37.2	39.7	42.2	44.6
	Noise Criterion : ETSU-R-97	43	43	43	43	43	43	43	44.7	47.2	49.6

	Predicted Wind Turbine Noise L_{A90}	-	-	32.6	36.2	37.8	38.1	38.1	38.1	38.1	38.1
	Exceedance Level L_{A90}	-	-	-10.4	-6.8	-5.2	-4.9	-4.9	-6.6	-9.1	-11.5
Hareshawhead (H7)	Prevailing Measured Background Noise Level: Night-Time	25.3	26.1	27.4	29.2	31.3	33.8	36.4	39.1	41.9	44.6
	Noise Criterion : ETSU-R-97	43	43	43	43	43	43	43	44.1	46.9	49.6
	Predicted Wind Turbine Noise L_{A90}	-	-	32.2	35.8	37.4	37.7	37.7	37.7	37.7	37.7
	Exceedance Level L_{A90}	-	-	-10.8	-7.2	-5.6	-5.3	-5.3	-6.4	-9.2	-11.9
Kype Lodge (H8)	Prevailing Measured Background Noise Level: Night-Time	23	23.7	25.2	27.5	30.2	33.4	36.8	40.3	43.8	47.1
	Noise Criterion : ETSU-R-97	43	43	43	43	43	43	43	45.3	48.8	52.1
	Predicted Wind Turbine Noise L_{A90} *	-	-	34.4	38	39.6	39.9	39.9	39.9	39.9	39.9
	Exceedance Level L_{A90}	-	-	*-8.6*	*-5*	*-3.4*	*-3.1*	*-3.1*	*-5.4*	*-8.9*	*-12.2*

** assumes four turbines are microsited as detailed in Section 8.63.*

Dungavel Wind Farm

4.55 The cumulative assessment (summarised in Table 8.10 and Table 8.11 below) shows that the predicted cumulative wind farm noise emission levels meet the ETSU-R-97 derived noise limits at receptor locations surrounding the consented Dungavel Wind Farm. The noise limits used in this Section are based on those provided in the Environmental Statement for the Dungavel wind farm.

Table 8.10 - Compliance table to show the ETSU-R-97 defined Quiet Daytime Noise Criterion compared to the predicted L_{A90} Wind Turbine Noise Emission Levels from both Wind Farms at each of the Dungavel Noise Assessment Locations

Location		Wind Speed (v_{10}) ms^{-1}									
		3	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Burnside Farm (H9)	Prevailing Measured Background Noise Level: Quiet Daytime*	28	30.1	32	34	35.9	37.8	39.7	41.5	43.3	45
	ETSU-R-97 Noise Criterion**	40	40	40	40	40.9	42.8	44.7	46.5	48.3	50
	Predicted Wind Turbine Noise L_{A90}	-	-	28.1	32.6	33.9	34	34	34	34	34
	Exceedance Level L_{A90}	-	-	-11.9	-7.4	-7	-8.8	-10.7	-12.5	-14.3	-16
Glengavel House (H10)	Prevailing Measured Background Noise Level: Quiet Daytime*	24.8	26.8	29.1	31.7	34.5	37.5	40.8	44.3	48.1	52.2
	ETSU-R-97 Noise Criterion**	40	40	40	40	40	42.5	45.8	49.3	53.1	57.2
	Predicted Wind Turbine Noise L_{A90}	-	-	26.7	31.2	32.6	32.6	32.6	32.6	32.6	32.6
	Exceedance Level L_{A90}	-	-	-13.3	-8.8	-7.4	-9.9	-13.2	-16.7	-20.5	-24.6
5 Hamilton Drive (H11)	Prevailing Measured Background Noise Level: Quiet Daytime*	30.1	31.9	33.6	35.4	37.2	38.9	40.7	42.4	44.2	45.9
	ETSU-R-97 Noise Criterion**	40	40	40	40.4	42.2	43.9	45.7	47.4	49.2	50.9
	Predicted Wind Turbine Noise L_{A90}	-	-	27.1	31.7	33	33.1	33.1	33.1	33.1	33.1
	Exceedance Level L_{A90}	-	-	-12.9	-8.7	-9.2	-10.8	-12.6	-14.3	-16.1	-17.8

** Derived from* polynomial *regression lines included in the Dungavel Environmental Statement (Charts 11.1-11.6*).
*** Dungavel Quiet Daytime Noise Limits are based on the Upper Quiet Daytime ETSU-R-97 Noise Limit of 40dB as detailed in Section 7.1.5.*

Table 8.11 - Compliance table to show the ETSU-R-97 defined Night-Time Noise Criterion compared to the predicted L_{A90} Wind Turbine Noise Emission Levels from both Wind Farms at each of the Dungavel Noise Assessment Locations

Location		Wind Speed (v_{10}) ms^{-1}									
		3	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Burnside Farm (H9)	Prevailing Measured Background Noise Level: Night-Time*	24.1	26.5	28.9	31.3	33.7	36.1	38.4	40.8	43.1	45.4
	ETSU-R-97 Noise Criterion	43	43	43	43	43	43	43.4	45.8	48.1	50.4
	Predicted Wind Turbine Noise L_{A90}	-	-	28.1	32.6	33.9	34	34	34	34	34
	Exceedance Level L_{A90}	-	-	-14.9	-10.4	-9.1	-9	-9.4	-11.8	-14.1	-16.4

Glengavel House (H10)	Prevailing Measured Background Noise Level: Night-Time*	20.1	22.7	25.3	27.9	30.5	33.2	35.8	38.5	41.1	43.8
	ETSU-R-97 Noise Criterion	43	43	43	43	43	43	43	43.5	46.1	48.8
	Predicted Wind Turbine Noise L_{A90}	-	-	26.7	31.2	32.6	32.6	32.6	32.6	32.6	32.6
	Exceedance Level L_{A90}	-	-	-16.3	-11.8	-10.4	-10.4	-10.4	-10.9	-13.5	-16.2
5 Hamilton Drive (H11)	Prevailing Measured Background Noise Level: Night-Time*	21.4	24.3	27.1	30	32.8	35.6	38.3	41.1	43.8	46.5
	ETSU-R-97 Noise Criterion	43	43	43	43	43	43	43.3	46.1	48.8	51.5
	Predicted Wind Turbine Noise L_{A90}	-	-	27.1	31.7	33	33.1	33.1	33.1	33.1	33.1
	Exceedance Level L_{A90}	-	-	-15.9	-11.3	-10	-9.9	-10.2	-13	-15.7	-18.4

** Derived from* polynomial *regression lines included in the Dungavel Environmental Statement (Charts 11.1-11.6).*

4.56 Based on the information available, the cumulative assessment shows that the predicted cumulative wind farm noise emission levels meet the ETSU-R-97 derived noise limits at noise sensitive receptor locations surrounding the proposed Kype Muir and consented Dungavel Wind Farms. Further information on the cumulative noise assessment can be found in Appendix 7.1.

MITIGATION

Construction Noise

4.57 BS 5228-1:2009 provides useful guidance on practical noise control. Part 1 provides recommendations for basic methods of noise and vibration control including sections on community relations, training, occupational noise effects, neighbourhood nuisance and project supervision. The annexes provide information on noise sources, mitigation measures and their effectiveness.

4.58 A significant impact is predicted at one receptor (H2) during the initial Phase 1A and Phase 1B works, while for all other locations and phases' construction activities are not anticipated to cause any significant adverse impacts.

4.59 At this stage of the proposal the assessment is based on a worst case scenario as a detailed construction programme is not available. Careful consideration will be given to the type of plant to be used when constructing the road adjacent to these properties and the contractors will inform the residents when particularly noisy activities are likely to take place to ensure any disruption is kept to a minimum during these periods.

4.60 Good site practices can be implemented to minimise the potential effects. Section 8 of BS5228-1: 2009 recommends a number of simple control measures as summarised below.

4.61 Generally construction activities will be confined to the periods 7am - 7pm Monday to Friday and 7am – 1pm Saturday. However there may be the requirement for extended operating hours to minimise traffic disruptions during the movement of abnormal loads. The principal contractor will:

- keep local residents informed of the proposed working schedule, where appropriate, including the times and duration of any abnormally noisy activity that may cause concern;
- ensure site work continuing throughout 24 hours of a day shall be programmed, when appropriate, so that haulage vehicles will not arrive at or leave the site between 7pm and 7am, with the exception of abnormal loads that will be scheduled to avoid significant traffic flows;

- ensure all vehicles and mechanical plant will be fitted with effective exhaust silencers and be subject to programmed maintenance;

- select inherently quiet plant where appropriate - all major compressors will be 'sound reduced' models fitted with properly lined and sealed acoustic covers, which will be kept closed whenever the machines are in use;

- ensure all ancillary pneumatic percussive tools will be fitted with mufflers or silencers of the type recommended by the manufacturers;

- instruct that machines will be shut down between work periods or throttled down to a minimum;

- regular maintenance of all equipment used on site, including maintenance related to noise emissions;

- vehicles will be loaded carefully to ensure minimal drop heights so as to minimise noise during this operation; and

- ensure all ancillary plant such as generators and pumps will be positioned so as to cause minimum noise disturbance and if necessary, temporary acoustic screens or enclosures should be provided.

Operational Noise

4.62 Based on the candidate turbine modelled in this assessment mitigation measures are required to ensure that the predicted turbine noise levels at receptor H8 are below the ETSU-R-97 defined noise criteria for that property. There are two mitigation options which could be implemented which include micrositing the closest turbines or operating one turbine in a lower noise mode for certain wind sectors and wind speed. Table 8.12 details the micrositing options based on the candidate turbine modelled in this assessment.

Table 8.12 Micrositing Options

Turbine	Original Easting (m)	Original Northing (m)	Revised Easting (m)	Revised Northing (m)	Distance Moved Easting (m)	Distance Moved Northing (m)	Total Distance moved on the ground (m)
T16	272340	637882	272317	637839	23	43	48.8
T21	272605	638956	272580	638997	25	-41	48
T22	272650	638312	272639	638277	11	35	36.7
T26	272652	639406	272632	639445	20	-39	43.8

4.63 Alternatively T22 could be operated in a lower noise mode for wind sectors 240 – 300 degrees and wind speeds 7-9ms^{-1} during the quiet daytime periods.

4.64 The exact model of turbine to be used at the site will be the result of a future tendering process. Achievement of the noise limits determined by this assessment will be a key determining factor in the final choice of turbines for the site. Predictions of wind turbine noise have been made, based upon sound

power level data for the REpower 3.4M wind turbine and a noise prediction model procedure that can be considered to give a realistic impact assessment.

RESIDUAL IMPACTS

4.65 Predicted wind farm operational noise levels at all residential properties lie below the ETSU-R-97 quiet daytime and night time criterion curves. However due to the low background noise levels, at some locations under some wind conditions and for a certain proportion of the time, the wind farm noise may be audible. However, it will be at an acceptable level in relation to the ETSU-R-97 guidelines.

4.66 Predicted construction noise levels are below the assessment criteria at all receptors for all construction phases except for an initial period during phase 1A and phase 1B where the noise levels are likely to be exceeded at one receptor (H2). Due to the low background noise levels construction noise is likely to be audible at the closest residential receptors for certain periods during the construction phase.

SUMMARY OF EFFECTS

4.67 This ES chapter summarises the potential construction and operational noise effects from the proposed development. The guidance contained within ETSU-R-97 was used to assess the potential operational noise impact of the proposed development and the guidance contained in BS5228-1:2009 – Part 1 was used to assess the potential construction noise impacts.

4.68 The assessment has taken account of noise from felling and extraction activities that form part of the initial construction phases. Ordinarily felling activities are not assessed for noise, however given the inclusion of felling within the Construction Management Statement for the Kype Muir Wind Farm the potential noise impacts from all activities have been assessed to provide a worst case scenario.

4.69 Predicted construction noise levels compared with measured background noise levels indicate that for receptors neighbouring the proposed development construction noise will result in a significant impact at one receptor (H2) during part of Phases 1A and Phase 1B. However this impact will be short term and once the construction activities near property H2 when plant is operating at a distance greater than 100m either side of closest point to property H2 the impact is deemed not significant.

4.70 For all other construction phases, the predicted noise impacts at all receptors are below acceptable guidelines and are therefore deemed to be not significant. All predictions assume that all plant is operating in full operational mode on the access tracks and within the site itself to provide a worst case scenario whereas in reality only a proportion of the plant may be operating.

4.71 The impact from increased traffic movements has been assessed in terms of the significance criteria established in the BS5228-1:2009 5dB level change method and as such the predicted increase in noise levels of 1.9dB is deemed not significant.

4.72 It should be noted that proposed construction phases are short term and temporary in nature and are not likely to cause any long term impacts.

4.73 To protect the amenity of local residents, the construction noise activities can be controlled under The Control of Pollution Act 1974 (COPA) which is specifically concerned with the control of noise pollution. In particular Section 60, Part III of the COPA refers to the control of noise on construction sites. It provides legislation by which a local authority can control noise from construction sites to

prevent noise disturbance occurring. In addition, it recommends that guidance provided by BS 5228 be implemented to ensure compliance with Section 60.

4.74 Predicted levels and measured background noise levels indicate that for dwellings neighbouring the proposed site, wind turbine noise will meet the Noise Criteria proposed within ETSU-R-97, therefore the operational noise impact is deemed not significant. Based on the candidate turbine modelled in the assessment mitigation measures are required to ensure that the predicted turbine noise levels at receptor H8 are below the ETSU-R-97 defined noise criteria for that property. There are two mitigation options which could be implemented either micrositing the closest turbines or operating one turbine in a lower noise mode for certain wind sectors and wind speed.

4.75 The cumulative operational noise assessment shows that the predicted wind farm noise emission levels meet the ETSU-R-97 derived noise limits at receptor locations surrounding the proposed Kype Muir and consented Dungavel Wind Farms under all conditions for both quiet daytime and night-time periods. As detailed in Section 1.75 above mitigation measures are required to ensure that the predicted turbine noise levels at receptor H8 are below the ETSU-R-97 defined noise criteria for that property.

4.76 There are a range of turbine models that may be appropriate for the proposed Kype Muir Wind Farm. If the proposal receives planning permission, further data will be obtained from the supplier for the final choice of turbine model to demonstrate compliance with the noise limits derived in this report.

5. FORESTRY AND WOODLAND

Summary of Changes:

- Updated to reflect the changes in the HMP. Figures for amount of woodland to be removed and replanted on-site revised. 509ha of existing woodland area would have an alerted use as a result of revised draft HMP proposals. With the proposed on-site replanting of native broadleaved woodland/edge woodland and commercial conifers, together with the restoration of EU priority habitats, this would lead to a net area of woodland removal of 332ha based on the draft HMP.
- The net forest removal area will be subject of a programme off-site compensatory planting of woodland, equivalent to the loss of public benefit of the area of coniferous forest in the finalised HMP, subject to grant aid being made available to developers.

Impact on Conclusions:

- Based on the draft HMP some 332ha of woodland would be lost as a result of the proposed development. Off-site compensatory planting equivalent to the public benefit loss of coniferous forest in the finalised HMP is proposed.

THIS CHAPTER REPLACES SECTION 15 OF THE ES SUBMITTED AUGUST 2011

INTRODUCTION

5.1 The proposed Kype Muir Windfarm, lies within an area, the current principal land use of which is the production of commercial coniferous timber, although a significant proportion of the site was not originally planted due to the presence of bog habitat. Development of the site as a windfarm will have a significant impact on the long term commercial coniferous production capacity of some 508 hectares (ha) of land which is currently planted with conifers, or has recently (2010/11) been felled.

5.2 This chapter will provide information on the forestry aspects of the development, including the requirements to fell the existing commercial woodland to facilitate the development of the wind farm and the plans for restoration of the site post construction. The chapter has been compiled by Bidwells and is supported by the information presented in Appendix 14 and the Draft HMP (Appendix 17).

CONSULTATION

5.3 During the development of the site design and drafting of this ES, account has been taken of the relevant responses received in relation to the scoping report submitted by Banks Renewables. A summary of the relevant responses is provided in table 15.1.

Table 15.1 - Comments on forestry issues are summarised in the following table

Organisation	Comment	Response
Energy Directorate, Scottish Government	Strong Presumption Against deforestation. Scottish Governments Control of Woodland Removal Policy to be applied.	See Draft HMP and mitigation section of this chapter.
	Indicate areas of trees to be removed, with evidence to support scale and sequence of felling.	Draft HMP and assessment of effects section of this chapter.
	Detail any trees or woodland likely to be indirectly affected.	Assessment of effects section of this chapter
	Consider landscape, natural heritage and historic environment implications of deforestation and/or tree felling.	Chapter 5: Landscape and Visual Assessment and section 5 of this chapter.
	Consider impacts of forestry activities on soil and water environment.	Chapter 13: Hydrology and Hydrogeology and assessment of effects and mitigation sections of this chapter.
	Details of methodology of onsite timber disposal.	Assessment of effects section of this chapter.
	Details of replanting plan.	Draft HMP and mitigation section of this chapter.
	Provide description of woodland.	Baseline Information section of this chapter.
	Provide visualisations of areas to be felled.	Chapter 5: Landscape and Visual Assessment
Scottish Natural Heritage	Strongly supports assessment of deforestation impacts	
	Provide baseline information on existing forestry.	Baseline information section of this chapter.
	Detail presence of other landscape features.	Chapter 5: Landscape and Visual Assessment
	Provide landscape and visual assessment.	Chapter 5: Landscape and Visual Assessment
	Details of proposed felling scheme.	Assessment of effects section of this chapter.
	Routes for extraction of timber.	Assessment of effects section of this chapter and Chapter 10: Traffic and Transportation.
	Plans for disposal of any timber felled to waste.	Assessment of effects section of this chapter.
	Design of re-structured forest.	Draft HMP and mitigation section of this chapter.

Organisation	Comment	Response
	Restoration of ground conditions following forest removal.	Mitigation section of this chapter.
Forestry Commission Scotland	Strong presumption against deforestation.	
	Application of Scottish Governments' Control of Woodland Removal Policy.	Draft HMP and mitigation section of this chapter.
	Indicate areas of trees to be removed, with evidence to support scale and sequence of felling.	Draft HMP and assessment of effects section of this chapter.
	Consider wildlife implications of tree felling.	Chapter 7: Ecology and Nature Conservation
	Consider impacts on water environment, particularly acidification and nutrient leaching.	Chapter 13: Hydrology and Hydrogeology and assessment of effects and mitigation sections of this chapter.
	Methodology for onsite timber disposal.	Section assessment of effects section of this chapter.
	Details of replanting plan.	Draft HMP and mitigation section of this chapter.
	Provide description of woodland.	Baseline information section of this chapter.
	Refer to FC guidance documents.	Throughout.
	Carbon sequestration and climate change mitigation.	Chapter 18: Carbon Balance and proposed mitigation section of this chapter.
	Assess implications of biodiversity, potential consequences of loss of woodland cover.	Draft HMP and mitigation section of this chapter.
	Assess landscape effects.	Chapter 5: Landscape and Visual Assessment
	Account for cultural heritage of ancient woodlands and veteran trees.	Baseline information section of this chapter.
	Prepare long term management plan.	Draft HMP.

METHODOLOGY

5.5 Following the production of a general layout plan for the development showing proposed locations of turbines, a study was undertaken on the affects of trees on wind yield and turbulence within the development area.

5.6 This, in conjunction with habitat surveys undertaken to inform the production of the Outline Habitat Management Plan (appendix 17) provided the basic parameters for treatment of existing crops on site, and subsequent treatment of areas to be felled. These requirements can be summarised as:-

- Provision of tree free buffer zones of sizes recommended by SNH to comply with bat protection requirements.
- Minimisation of vegetation in excess of 5m in height during the operational period of the windfarm throughout the area defined in the wind yield study.
- Restoration of previously afforested land to priority habitats under the EC Habitats Directive in sections of the site where appropriate and possible.
- Replanting of other sections with native broadleaves/scrub woodland to enhance the conservation and biodiversity values of the general area – particularly in relation to improving habitats for Black grouse.
- The provision of improved public benefit for recreation and environmental education, by utilising the improved access (roads and tracks) which would be created as part of the development.

POLICY CONTENT AND REGULATION

5.7 The control of forestry felling is normally administered under the Forestry Act 1967 (as amended). Woodland removal, defined as "the permanent removal of woodland for the purposes of conversion to another land use" falls within the scope of the Environmental Impact Assessment (Forestry) (Scotland) Regulations 1999 (as amended), except in cases when woodland removal is associated with development. In such cases, any significant environmental impacts of woodland removal are assessed in accordance with the Environmental Impact Assessment (Scotland) Regulations 1999, or with Sections 36 and 37 consents under the Electricity Act 1989, under the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000.

5.8 In general, there is a strong presumption against woodland removal, and replanting of harvested forests is a normal condition of felling approval being granted. The ability of woodlands to sequester carbon, and hence their role in possible mitigation of climate change is an important factor in shaping regulatory mechanisms.

5.9 The Scottish Governments' policy document on Control of Woodland Removal provides details and background on the latest guidance and policy in respect of forestry removal on development sites. It aims to provide direction for decisions on woodland removal in Scotland. According to the policies guiding principles woodland should only be removed where it would achieve significant and clearly defined additional public benefits. Where woodland is removed there may be the requirement for compensatory planting to form part of the balance.

5.10 Removal of woodland without the requirement for compensatory planting is only likely to be appropriate where removal of the woodland would contribute significantly to:

- Enhancing priority habitats and their connectivity;
- Enhancing populations of priority species;
- Enhancing nationally important landscapes, designated historic environments and geological SSSI;
- Improving conservation of water or soil resources; or
- Public safety.

5.11 The policy sees the removal of woodland for the development of renewable energy projects which help Scotland mitigate or adapt to climate change as acceptable provided compensatory planting is provided.

5.12 Within this development, the Control of Woodland Removal Policy has been fully taken into account, with felled areas either being replanted with high environmental value native woodland/scrub, or restored to priority habitats under the EC Habitats Directive. Detailed prescriptions for onsite treatments will be agreed following the granting of planning consent and felling of existing conifer crops as part of an agreed Habitat Management Plan. Where woodland loss is not compensated for on site, the developers will undertake to provide compensatory tree planting of the appropriate scale at other locations in Scotland, to be agreed.

BASELINE INFORMATION

5.13 The development area, falling within that land which is covered by the Draft HMP (Appendix 17) extends to 576.1 ha. Within this area some 523.9 ha comprises either existing woodland including integrated open space or recently (at November 2011) felled conifer woodland (81.2 ha).

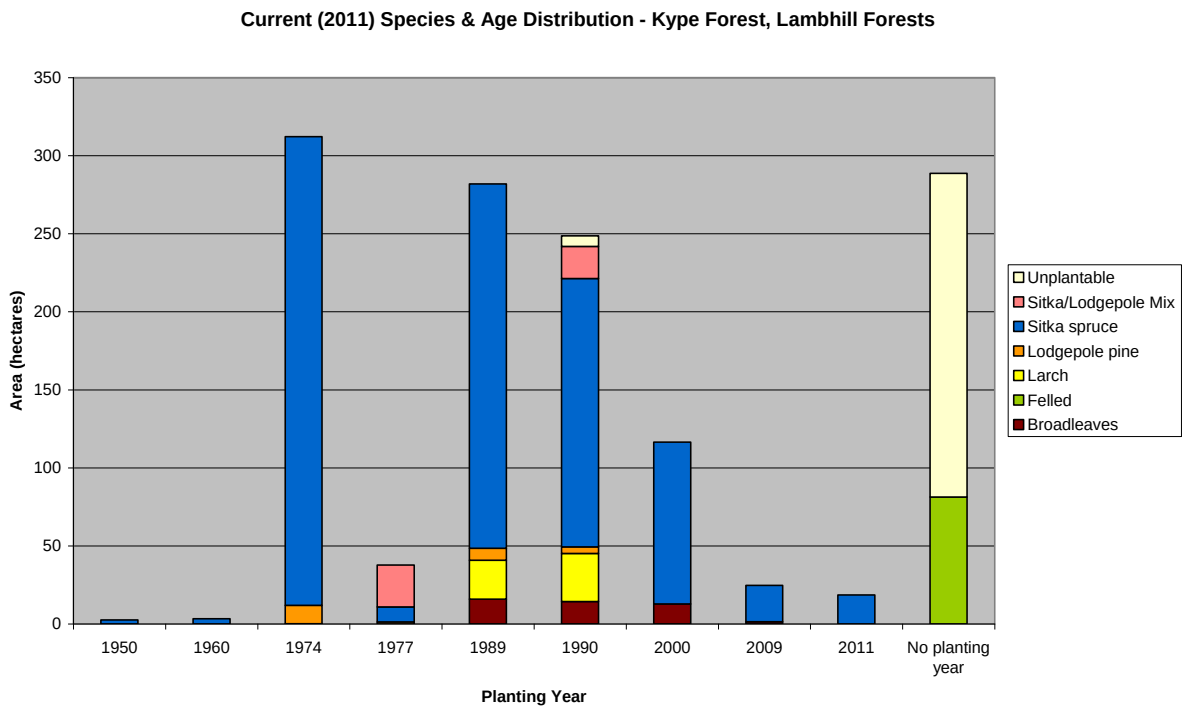
5.14 Three separate forests, under two different ownerships are directly affected by these proposals, these being referred to as Kype Forest (total area 554.6 hectares), Lambhill E (total area 156.8 hectares) and Lambhill F (total area 623.1 hectares).

5.15 Using base data as supplied by the forest managers (some of which has not been recently updated by them) the following summary of tree crops on site as at November 2011 can be derived.

Table 15.2 - Summary of Forests by Species and Planting Year (all areas ha) [29]

	Species							
Planting Year	Broadleaves	Felled	Japanese larch	Lodgepole pine	Sitka spruce	Sitka/Lodgepole Mix	Unplantable	Grand Total
1950					2.5			**2.5**
1960					3.3			**3.3**
1974	0.07			11.79	300.35			**312.21**
1977				1.3	9.62	26.81		**37.73**
1989	15.9		24.9	7.6	233.5			**281.9**
1990	14.3		30.8	4.3	171.9	20.6	6.7	**248.6**
2000	12.8				103.6			**116.4**
2009	1.38				23.28			**24.66**
2011					18.5			**18.5**
No Plant Yr		81.24					207.43	**288.67**
Totals	**44.45**	**81.24**	**55.7**	**24.99**	**866.55**	**47.41**	**214.13**	**1334.47**

Figure 15.1 - Summary of Forests By Species and Planting Year at November 2011 (from data supplied by forest manager)



5.16 With the exception of two small shelter belts planted in 1950 and 1960, the forests were planted between 1974 and 1990. Kype Forest was developed between 1974 and 1977, and is currently in full production, some 124.4 hectares of the planted area of 474.3 hectares (over 26%) having been felled and partially

[29] From data supplied by forest managers – November 2011

replanted in the recent past. A copy of the current Kype Forest Plan is given as Appendix 2. This plan allows for the felling and replanting (principally with commercial conifer species) of the site, within a planned timescale of 2004 to 2024.

5.17 Lambhill E was largely planted in the year 2000 and Lambhill F during 1989 and 1990. Both of these forests are not yet at the stage where commercial timber harvesting, as part of normal forestry operations, has started.

5.18 None of the woodlands are on ancient woodland sites, and no historic or veteran trees are present within the development area. Full compartment schedules and summaries of each property are given in Appendix 14.2.

5.19 Growth rates of the commercial crops are variable, largely dependent on soil conditions present and range from very good (estimated Yield Class 18) on sites dominated by relatively fertile mineral soils, to very poor over significant areas where trees were planted on deep peats. This is particularly the case within Kype Forest, where unplanted blanket bog currently extends over 43 hectares of the property, located within the Outline Habitat Management Plan zone (refer to Figure 3.2 of HMP). It is estimated within the Outline Habitat Management Plan that, as a worst case scenario, a total area of 127.6 hectares of land comprises either existing unplanted blanket bog or land which is capable of being restored to such.

5.20 Following the felling of existing crops, detailed site investigation will be undertaken to inform the process of agreeing a full Habitat Management Plan. This will then determine the actual extent of area treatments.

5.21 Under current guidelines for afforesting land, these areas would not now be approved for planting, being EU priority habitats. In addition current FC guidance (see appendix 4 Forestry Peat Soils and GHG) gives a general presumption against new woodland creation on soils with peat exceeding 50cm in depth, relating largely to Greenhouse Gas Emissions which may be caused by disturbance of such sites.

ASSESSMENT OF EFFECTS

5.22 Table 15.2 provides data on those crops (as at November 2011) which lie within the Draft HMP area.

Table 15.2 - Composition of Crops within Outline Habitat Management Plan area as at November 2011 (all areas in hectares)

Sum of Fell Area (ha)	**Species**							
P Yr	BL	Felled	JL	LP	SS	SS/LP	UP	Grand Total
1960					2.26			2.26
1974				11.79	238.77			250.56
1977				1.30	9.62	26.81		37.73
1989	0.24		3.80		90.06			94.10
1990				1.60		7.50		9.10
2000					24.00			28.23
2009					7.43			7.43
2011		63.50			18.50			18.50
No Plant Yr		47.61					84.80	132.41
Total	0.24	47.61	3.80	14.69	390.65	34.31	84.80	576.10

5.23 For "worst case scenario" planning purposes of this chapter it is assumed that all crops within this area, a net total of some 443.5 ha, gross area including currently felled over land and integral open space of 523.9 ha, be felled in 2014. In reality, it is likely that following receipt of planning consent, felling would commence in 2012 and take place until 2015. This will help to reduce impacts of rapid crop removal over such a large area, and will also lead to less intensive use of public roads by timber haulage operations resulting from this development.

5.24 A full yield class survey of existing tree crops has not been undertaken, but using a combination of information on growth rates supplied by the forestry managers, best estimates of growth rates derived from site inspection and analysis of aerial photography, it is estimated that this felling programme would result in the production of approximately 148,000m^3 or c. 133,500 tonnes of merchantable timber.

5.25 Appendix 14.3 provides a detailed analysis of how this figure has been calculated.

5.26 Harvesting of all crops of merchantable timber size would be undertaken using standard forestry harvesting equipment, and utilising well constructed brash lanes (approximately 10 – 15m apart) as routes over which harvesting and extraction machinery would travel, in order to create minimum disturbance and compaction/damage to soils.

5.27 Where trees are of non merchantable size (generally below c.9m in crop height), these would be mulched on site using specialist mulching equipment.

5.28 It is envisaged that mulching would be undertaken over approximately 30 ha of crops (principally in Lambhill E) where crop age dictates that little or no merchantable timber would be present in 2014. During felling operations, it may

be that severely growth checked areas of older crops throughout the felling zone would also be mulched. The intention however, would be to conventionally harvest, and sell to timber merchants, all utilisable timber.

5.29 Areas of young conifer crops, such as those areas replanted in 2009 and 2011 would have conifers cut and left to degrade on site.

5.30 Brash from conventional harvesting would remain, in lanes, on site to degrade naturally, and chips arising from mulching operations would be spread over the mulched areas.

5.31 The loss of some 508 ha of coniferous forestry of approximate average yield class 14 reduces the sustainable yield of conifer timber by approximately 6,000 tonnes per annum. This has a minor effect (in national terms) on commercial timber production and hence on carbon sequestration and employment figures. Current coniferous timber production figures from Scottish forests (2010) is provisionally estimated at over 6.2 million tonnes, so the loss of 6,000 tonnes represents less than 0.1% of the national total. Taking into account the mitigation measures which are proposed to be undertaken (see mitigation of this chapter and Draft HMP – Appendix 17) including the planting of 102 ha of native broadleaves, negative effects of the loss of conifer forest as a result of this development are considered insignificant.

5.32 A net loss of conifer area totalling 508 ha is proposed, with, for the purposes of calculating a required compensatory planting area as defined by the Control of Woodland Removal Policy, a net proposed loss of woodland habitat (following implementation of the proposals in the Draft HMP) of approximately 332 ha.

5.33 Carbon balances are dealt with in chapter 18.

5.34 Traffic implications of the proposed harvesting programme in relation to windfarm development are included within the detailed Transport Assessment section of this ES (chapter 10). All timber to be extracted will be over the main windfarm access route via Lambhill.

5.35 Landscaping effects of the forestry felling are dealt with in chapter 5 of the ES. It is not anticipated that any other areas of trees or woodland will be affected by these proposals.

PROPOSED MITIGATION

5.36 The major impact on woodland area resulting from the proposed development is the net loss of 322 ha of currently existing forest, including integral open space.

5.37 Whilst some 523.9 ha of land currently comprising either woodland or recently felled conifer woodland is affected, the Draft HMP proposes the following summarised habitat development.

Table 15.3 - Summary of Habitat Development (all areas in ha)

	Current	**Proposed**	**Change**
Coniferous Woodland (inc. open space associated with woodland)	523.7	15.2	-508.5

Blanket Bog (Priority Habitat)	43.0	127.6	84.6
Other Open Habitats	9.2	320.6	311.4
Broadleaved Woodland	0.2	86.3	86.1
Woodland Edge/Scrub	0	5.5	5.5
Roads and Infrastructure	0	20.9	20.9
	576.1	576.1	

5.38 Restoration of EU Priority Habitats (84.5 ha of blanket bog) together with the replanting of some 91.6 ha of native broadleaved woodland / edge woodland and replanting of 15.2 ha with commercial conifers, leads to a net area of woodland removal (as defined by the Control of Woodland Removal Policy) of 332 ha.

5.39 It is suggested that whilst there will be potentially significant environmental and public benefits provided by the restoration of priority habitats and conversion of commercial conifer to native broadleaved woodland the net forest removal area of 332 ha will be the subject of a programme (to be agreed) of offsite compensatory planting of woodland, equivalent to the loss of public benefit of this area of coniferous forest, subject to grant aid (at rates equivalent to SRDP forest restructuring rates) being made available to the developers. All compensatory planting would be carried out in accordance with good forestry practice, as laid out in the latest UK Forestry Standards. It is the intention of the developers to have compensatory planting undertaken within two clear spring planting seasons of onsite commencement of windfarm construction activity (e.g. if construction commences in June 2012, compensatory planting to be undertaken by end spring 2014).

5.40 Draft details of site restoration/replanting are provided within the Draft HMP, and following the granting of conditional Planning Consent for the development a definitive HMP would be produced following consultation with statutory authorities. This would include proposals for offsite compensatory planting.

5.41 In brief however, on site woodland proposals are:

- Following felling of existing crops, all brash to remain in brash mats to degrade. This will avoid undue disturbance of the site and risk of soil compaction. The area does not lie within, or adjacent to, a "Critical load exceedance square" (see appendix 6 Forest and Water Guidelines Fourth edition). It is considered that the risk of acidification caused by nitrate flushing from degrading foliage is not significant. As brash is to be left on site, there should be no risk of long term acidification effects on soils due to base cation depletion.

- Within areas identified for broadleaved woodland replanting (86.3 ha), the main tree species proposed for replanting will be downy birch (Betula pubescens), rowan (Sorbus aucuparia) and willow (Salix aurita, Salix cinerea). These will be replanted to achieve an average stocking density of

no less than 1,100 stems per hectare. Planting stock will be sourced from local provenance seed sources, and trees will be individually guarded in 1.2m securely staked tree tubes until established. Replacement of failed trees will be undertaken as necessary to maintain stocking levels. Weeding, using approved herbicides will be undertaken if required.

Where ground conditions require, ground preparation will be undertaken by mounding, otherwise broadleaves will be planted on the top of remnant ploughing from the original crop.

- Areas identified for scrub/feathered woodland edges, totalling 5.5 ha are designed to achieve a woodland canopy cover of approximately 20% over the area. This is designed to provide maximum woodland edge effect for the encouragement of principally black grouse.

  Main species to be used for this habitat type will comprise hawthorn (Crataegus monogyna), juniper (Juniperus communis) and small quantities of downy birch (Betula pubescens) and willow (Salix spp).

  Trees will be planted and maintained as per the broadleaved area mentioned previously, but at varying densities to achieve a mosaic of open space, scattered trees and denser groups. An average stocking density over the entire 5.5 hectare area of scrub/feathered woodland edge of 300 stems per hectare is envisaged.

- An area of 15 ha is identified for replanting with commercial conifers – Sitka spruce, in order to help maintain the commercial forestry element of the remaining forest – of which some 594 ha will remain within the total forest area of 1,334 ha (see section baseline information section of this chapter). Land will be restocked following ground preparation by mounding, to achieve a minimum established density of 2,500 stems per ha. Crop protection and maintenance to be undertaken as necessary.

- All operations will conform to the latest published edition of the Forests and Water Guidelines.

RESIDUAL EFFECTS

5.42 With the exception of the potential annual average loss of approximately 6,000 tonnes of coniferous timber, it is considered there are no significant residual effects attached to the forestry element of the development.

5.43 Implementation of the operations specified in the Draft HMP are anticipated to provide significant environmental and social benefit in terms of the forestry element of this development.

SUMMARY OF ASSESSMENT

5.45 The proposed development lies within an area of commercial coniferous forest, of varying quality depending on the underlying site. Some 524 ha of land within the 576 ha site which constitutes the felling extent and Draft HMP area is, at May 2011, either coniferous woodland or recently felled coniferous woodland.

5.46 Of this conifer area, over 97% (509 ha) would have an altered land use as a result of these proposals, this being largely conversion to open land, native broadleaved woodland or EU Priority Habitats (Blanket Bog).

5.47 Under the definitions of the Control of Woodland Removal Policy, some 332 ha of woodland will be lost i.e. not replanted or restored to Priority Habitat. The net public gain resulting from the development, creation of significant areas of native broadleaved woodland, habitat creation for black grouse, and improved amenity for visitors, is considered to be important, but off site compensatory planting of an area equivalent to the public benefit loss of 332 ha of coniferous forest is proposed as being a condition of Planning Consent.

6. CARBON BALANCE

Summary of Changes:

- Recalculated using the updated guidance from Scottish Government.
- Amendments to take account to the changes to the draft HMP. Alterations to the woodland felling and replacement figures and areas to be restored to blanket bog.

Impact on Conclusions:

- Increase in the expected payback time to 20 months (best case scenario 16 and worst case scenario 50 months)
- Reduction in the expected CO_2 savings to 3,993,816tCO_2e. This is equivalent to saving 171,068 tCO_2e per year or supplying carbon neutral electricity to 61,191 UK homes per year.

THIS CHAPTER REPLACES SECTION 18 OF THE ES SUBMITTED AUGUST 2011

INTRODUCTION

6.1 This chapter considers the potential impacts of the proposed wind farm at Kype Muir on greenhouse gas emissions (referred to as carbon emissions[30]). The objective of the proposed development is the generation of electricity in line with Scottish Government targets for generating electricity from renewable sources. The Scottish Government has a target to generate 100 per cent of Scottish electricity consumption to come from renewable sources by 2020[31]

6.2 The analysis considers carbon losses and gains associated with land-use change, carbon emissions associated with the manufacture, construction and operation of the wind farm and balances these with the carbon benefits achieved through the generation of renewable energy and displacement of fossil fuel based energy generation.

6.3 This chapter provides a summary of the Carbon Balance Technical Report which is included in Appendix 16 to this ES.

METHODOLOGY

6.4 The methodology adopted to assess the carbon balance is taken from the report to the Scottish Government: *Calculating Carbon Savings from Wind Farms on Scottish Peatlands – A New Approach*, Final Report, June 2008 (Nayak et al. 2008, updated 29/06/2011)[32]. The approach provides a full life cycle analysis focussing on the potential impacts of peat removal, disturbance, drainage and

[30] Carbon is used as short hand to refer to the basket of six greenhouse gases recognised by the Kyoto Protocol. GHGs are converted to carbon dioxide equivalents (CO_2e), which is a unit for comparing the global warming impact of a greenhouse gas in terms of the amount of CO_2 that would have an equivalent impact.

[31] http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-sources/19185/17612/

[32] http://www.scotland.gov.uk/Publications/2008/06/25114657/0

dissection over both the lifetime of the wind farm and the longer term impacts on the peatland.

6.5 The report's carbon calculator tool: Scottish Government Carbon Calculator for Wind Farms on Peatlands - Version 2.0.0[33] uses information about the proposed site preparation, construction, operation and decommissioning phases of the project and the potential effects on the peatland's ecology, soils and hydrology.

6.6 The methodology estimates the impacts of wind farms on the carbon dynamics of peatlands based on:

- loss of carbon due to wind turbine life (manufacturing, transportation, erection & site construction, operation, and dismantling);
- loss of carbon from backup generation, which comprises a range of benchmark generation alternatives;
- loss of carbon-fixing potential of peatland:
- loss of carbon stored in peatland;
- loss of carbon due to forest felling; and
- carbon gains due to the restoration of habitat.

6.7 The methodology compares these carbon impacts providing total carbon losses and carbon gains over the life of the wind farm. It estimates the carbon payback time for the wind farm based on the source of power being displaced (i.e. the time needed to generate carbon savings equivalent to the amount of carbon lost).

6.8 The Nayak report is the most comprehensive and complete approach to the assessment of carbon balance calculations for wind farms. The authors reviewed and built upon the existing information available, including the *Windfarms & Carbon Savings, Technical Guidance Note* (SNH 2003), and revised the method used for estimating carbon savings where knowledge has improved since it was published. One of the features of the Nayak approach is that it calculates a number of scenario outputs from the carbon balance calculations, producing an expected, minimum (best case) and maximum (worst case) carbon payback. This is achieved through using ranges of data around the expected values for each data input.

6.9 The Nayak methodology is also based on work from the Estimating Carbon in Organic Soils - Sequestration and Emissions (ECOSSE) model that simulates carbon and nitrogen turnover in highly organic and mineral soils (Smith et al. 2007) as an improvement to the rough estimates used by the internationally accepted standard default methodology by International Panel on Climate Change (IPCC). The ECOSSE study considered in detail the dynamics of peatlands in Scotland and its findings were used to underpin the Nayak methodology.

[33] http://www.scotland.gov.uk/Resource/Doc/229725/0062212.xls

BASELINE AND DEVELOPMENT DESCRIPTION

6.10 Baseline conditions and data requirements for the Nayak methodology are described in detail in the Carbon Balance Technical Report (Appendix 16). The following sections provide a summary of key baseline conditions and development parameters affecting the calculations.

Site Description

6.11 The proposed development site covers an area of 883ha. The majority of the site is forested with numerous access tracks and firebreaks segmenting the forest, and is currently managed as commercial forestry.

6.12 Data acquired from the British Geological Survey (BGS) indicates the site is partially covered by peat beneath the forest cover. Peat depths are variable across the site; ground investigations have revealed a maximum peat depth of 3.45m. The peat extent and probed depths are shown in Plan ES19. Grips are locally visible in the peat underlying the forest having the effect of draining the site.

Peat Extent and Depth

6.13 Plan ES19 shows the proposed site layout, peat extent and probed peat depths. The depth of peat at each turbine location which mapped peat areas has been estimated.

6.14 An average depth of peat has been estimated for use in the carbon balance calculation by taking an average of all peat depth measurements taken from the site as part of the peat study. For the carbon balance calculations an average peat depth of 1.0m has been applied across the whole site. This is based on an estimation of peat depths at individual turbine locations where they are shown to be in peat areas. The 12 turbines outside peat areas are modelled as having a peat depth of 0.5m which is representative of some of the sampling locations. It is important to note that sampling data is not available covering the whole site; therefore this averaged depth is a best estimate.

6.15 An estimated minimum average peat depth of 0.7m has been applied to the whole site. This has been derived though modelling the 14 turbines shown to be located on peat with their estimated peat depths (as per the expected peat depth), and the 12 remaining turbines to be on land with a zero metre peat depth.

6.16 A maximum average depth of peat of 2.1m has been applied to the whole site. This has been derived though modelling the 14 turbines located on peat soil to have a depth of 3.45m (the surveyed maximum) and all other turbines to have a peat depth of 0.5m (as per the expected scenario).

Forestry Characteristics

6.17 The carbon balance calculation methodology accounts for changes in the area and type of forestry at the development site. In particular, it calculates the carbon losses associated with forestry felled as part of the development. The Nayak approach requires that if the forestry was planned to be removed, with no further rotations planted before the wind farm development, the area to be felled should be entered as zero.

6.18 At Kype Muir the gross area within the felling zone is 576.1ha, however, not all this area is currently bearing trees. Within the felling area there is a total of 443.7ha of majority coniferous plantation woodland with a further 47.6ha that has been recently felled. The Habitat Management Plan proposes the replanting of 86.3ha with broadleaf woodland, 15.2ha with commercial coniferous woodland and a further 5.5ha with scattered broadleaves and scrub. Offsite compensatory planting is proposed for approximately 332ha. This is assumed to comprise 285ha of coniferous woodland and 47ha of broadleaf woodland. Replanting is expected to occur 2 years after felling and usually tree seedlings will be 2 or 3 years old from seed.

6.19 The Scottish Government carbon calculator calculates the carbon losses or gains from forest felling and replanting based on the net change in carbon sequestration of trees, the carbon emitted in harvesting operation and removal of timber, the carbon losses from areas of exposed forest floor, and any carbon savings from using the felled timber as a biofuel.

6.20 Due to the various crop types being proposed for Kype Muir the maximum and minimum scenarios factor the areas proposed to be replanted based on the yield class (and hence carbon sequestration rate) of the crop. The coniferous woodland to be planted is expected to have a yield class of 16m^3/ha/yr, broadleaf woodland is expected to have a yield class of 6m^3/ha/yr, and scrub approximately 2m^3/ha/yr. The existing woodland is majority Sitka Spruce with a yield class ranging between 12 and 18m^3/ha/yr. The Scottish government methodology uses a yield class of 14m^3/ha/yr in the calculations which may slightly under report carbon losses at Kype Muir where the average yield class of the Sitka Spruce is estimated to be 15m^3/ha/yr.

6.21 Table 18.1 shows the proposed areas of replanting and the expected yield class (YC). For each scenario the modelled equivalent area (in hectares) is shown, converting the proposed areas for replanting to its equivalent in YC14.

Table 18.1 - Proposed forestry replanting areas and equivalent areas used for carbon balance calculations

Proposed replanting	Expected yield class (YC) (m^3/ha/yr)	Equivalent area (ha) (to YC14)		
		Expected	Minimum	Maximum
86.6ha broadleaf (on-site)	6	37.0 (YC6)	37.0 (YC6)	37.0 (YC6)
15.2ha coniferous (on-site)	16	15.2 (YC14)	17.3 (YC16)	15.2 (YC14)
5.5ha scattered coniferous (on-site)	2	0.8 (YC2)	0.8 (YC2)	-
285ha coniferous (off-site)	16	285 (YC14)	326 (YC16)	285 (YC14)
47 ha broadleaf (off-site)	6	20.1 (YC6)	20.1 (YC6)	20.1 (YC6)
On-site replanting total area (ha)	-	52.2	54.3	52.2
Off-site compensatory planting total area (ha)	-	305	346	305
Total (ha)	-	357	400	357

6.22 In the maximum scenario we have discounted the area of scrub planting and modelled broadleaf replanting at the expected yield class and coniferous replanting at the same yield class as the felled area.

6.23 In the minimum scenario coniferous replanting is modelled at the expected yield class greater than that of the felled area.

6.24 Timber will normally be moved off site using articulated lorries, each with a payload of 25 tonnes. The anticipated felling programme is estimated to produce 133,500 tonnes of timber, requiring a total of 10,680 lorry movements (in empty and out laden). Transport distances are dependant on markets, however, for the purpose of this assessment an average round trip distance of 250km has been used.

6.25 Emission factors obtained from Morrison *et al.* (2011) cited in the Scottish Government guidance are used to estimate emissions associated with felling and timber removal and the transport of timber off site. If clear felling is assumed to be performed by a harvester and timber is assumed to be extracted using a forwarder emissions are modelled as 6.657kgCO_2/m^3. Assuming transportation by diesel powered haulage vehicles with 20% of the journey undertaken on forest roads transport emission factors are assumed to be 3.933kgCO_2/km (ranging between 3.850 to 4.015kgCO_2/km).

Counterfactual Emission Factors

6.26 Counterfactual emissions are those being displaced from the electricity generation network by the commissioning of the windfarm. This displacement is therefore one of the most significant gains when assessing the carbon balance of a proposed windfarm. In operation, electricity generated from wind is carbon free and by delivering this power to the grid is deemed to have replaced generation from other sources that do have associated carbon emissions.

6.27 The Nayak methodology allows for the counterfactual emissions to be calculated against three alternative generation options:

- coal-fired generation;
- fossil fuel mix generation; or
- grid mix generation.

6.28 For grid mix electricity we have used 0.52462 kgCO_2e/kWh (the five year rolling average to 2009) for the expected grid mix factor, this is the most recent factor published Defra/DECC for company reporting (August 2011)[34].

6.29 Projections made by DECC for grid GHG emission factors to 2025 have been used to determine the possible range in grid electric emission factors[35]. The DECC central case projection predicts that by 2025 the UK grid emission factor will be 0.26640 kgCO_2e/kWh having declined from 0.51330 kgCO_2e/kWh in 2005 and should be currently 0.48100 kgCO_2e/kWh (2011).

[34] http://archive.defra.gov.uk/environment/business/reporting/pdf/110807-guidelines-ghg-conversion-factors.pdf

[35] UEP July 2009 Central Case (UEP38 - LCTP)

6.30 For the grid mix counterfactual emission factors we have used a range with a minimum value of 0.26640 $kgCO_2e/kWh$ and a maximum of 0.52462 $kgCO_2e/kWh$. It is acknowledged that this minimum grid electricity factor will present an exaggerated worst case scenario as a significant number of renewable energy development, such as Kype Muir, will be required to achieve this factor. As such grid electricity at this level will not be displaced by the development.

6.31 For specific fossil fuel electricity generation emission factors the Digest of UK Energy Statistics (DUKES), Chapter 5[36] provides emission factors for coal and all fossil fuels. The most recent estimates are for 2007-2009. The 2009 factors will be used as the expected values in the carbon balance calculations – 0.91500 $kgCO_2e/kWh$ for coal-fired generation and 0.59800 $kgCO_2e/kWh$ for all fossil fuels.

6.32 The 2009 factor for coal has the highest carbon intensity in the range so will also be used as the maximum value. The 2008 factor of 0.90300 $kgCO_2e/kWh$ will be used as the minimum. For all fossil fuels the maximum is 0.62600 $kgCO_2e/kWh$ (2007), the 2009 figure is also the minimum.

Details of Excavations and Construction on Site

6.33 The carbon balance calculation considers the carbon losses associated with the removal of peat. The following data has been used to determine the volume of peat removed due to site excavation activities.

Access tracks

6.34 New access tracks, as defined by the Kype Muir Construction Method Statement, are a combination of floating road (8,000m) and conventional road (5,000m). Floating road construction has a potential double benefit for the carbon calculations:

- Floating tracks require no excavation on site and so result in less peat loss; and
- Floating tracks may require less material for construction and so may have lower embodied carbon content than permanent structures.

6.35 It is assumed that the sections of floating road are used in all peat areas to remove the requirement for peat excavation. Conventional construction is assumed to be used in all non-peat areas and therefore will not lead to the excavation of any peat. In the carbon balance calculations a road excavation depth in peat of 0 metres has therefore been used as the expected depth for both road types as no peat is expected to be excavated for access track construction. A maximum depth of 0.75 metres has been used for the length of standard construction road as a worst case scenario that this construction occurs on peat areas.

6.36 Access tracks will have an expected running width of 5.5m, however, to allow for cambered edges the expected width of peatland surface covered is 6m (range of

[36] Table 5A: Estimated carbon dioxide emissions from electricity generation 2007 to 2009 http://www.decc.gov.uk/assets/decc/Statistics/publications/dukes/311-dukes-2010-ch5.pdf

5.0m to 6.0m allowing for widening at some bends and narrowing where track running surface is not raised significantly above the peatland surface).

6.37 As part of the Kype Muir development proposal, existing tracks are identified for improvement as part of the works. The carbon costs associated with this cannot be included within the general modelling, but could be incorporated into a site specific embodied carbon analysis at a later point. The total length of track for improvement is 2000m

Borrow pits

6.38 The proposed location of the borrow pits are all shown to be outside areas of peat. An average and minimum depth in peat of 0 metres has therefore been applied with a maximum depth of 1 metre as a worst case scenario. Large areas of the site are indicated to have no peat, therefore it is likely that proposed borrow pit locations can be adjusted to avoid peat areas if necessary following further site investigation.

6.39 The four proposed borrow pits are estimated to have dimensions of 100m x 100m and 10m depth in the Construction Method Statement. A range of 75m-125m has been used for these dimensions to account for an increased or reduced demand for site-won aggregates.

Wind turbine foundations

6.40 Turbine foundations typically have dimensions of 15m x 15m and 2m in depth as defined in the Kype Muir Construction Method Statement. The given length and width dimensions have been used in all scenarios (expected, maximum and minimum). Peat depth on the site varies between 0m – 3.45m. However, given the current configuration of turbine locations in relation to peat areas this range would not provide a representative minimum and maximum average excavation depth.

6.41 Estimated peat depths at turbine locations are discussed in detail in section 0 and illustrated in Appendix A of the Carbon Balance Technical Report. An expected peat depth of 1m will be applied across all turbine locations with a maximum of 2.1m and a minimum of 0.7m, based on the peat depth data measured in the site survey.

Areas of hard standing

6.42 Areas of hard standing for cranes are located with each turbine. The expected dimensions are 20m x 50m as defined by the Kype Muir Construction Method Statement.

Cable trenches

6.43 The Construction Method Statement estimates that 15,000m of cable trench will be required at a depth of 0.75m. All identified cable trenches will run alongside access tracks and can therefore be excluded from the calculations using the Nayak approach. Therefore an expected and minimum value of zero has been used for the length of cable trench that follows access tracks. As a worst case the full 8,000m of cable trench that passes over peat areas (floating road) has been modelled as the maximum value with an excavation depth of 0.75m.

Improvements to Land

6.44 A number of improvements to land will be made to the site as part of the planned development. The Kype Muir Habitat Management Plan (HMP) details the following proposals for improvements:

- 79.0ha will be restored to blanket bog;
- 15.8ha of existing blanket bog will be improved;
- 285.1ha will be restored to a range of priority habitats including heath, marshy grassland, acid grassland and scrub;
- 86.3ha will be replanted with broad-leaf woodland;
- 15.2ha will be replanted with coniferous woodland planting; and
- 5.5ha will be replanted with low growing broad-leaved trees and scrub

6.45 It is also understood that excess excavated peat may be used to block site drainage.

6.46 The impact of restoring areas of blanket bog in terms of their impact on water table depth (an important factor in the carbon storage potential of peat, see Carbon Balance Technical Report) has not been assessed at the time of writing this report. We have therefore been unable to include an assessment of restoring areas of blanket bog in the carbon balance calculations expected scenario. If site improvements significantly raise the water table depth in peat areas this has the potential to impact on the carbon balance calculations in a positive manner realising further carbon gains at the site. To provide a potential magnitude of impact the areas highlighted above have been considered using a maximum water table improvement from 0.451mto 0.1m in the maximum scenario. This should only be considered to be indicative in the absence of hydrological data.

6.47 Carbon gains associated with broadleaf woodland planting are discussed in the forestry characteristics section.

ASSESSMENT OF EFFECTS

Carbon Emission Savings

6.48 The energy produced from the wind farm is assumed to substitute energy production by entirely coal-fired generation; a mix of fossil fuels or the national grid mix of energy generation. A renewable energy development would have a maximum potential to save carbon emissions if it is substituting coal fired generation, but it is not possible to define the electricity source for which this renewable electricity project would substitute.

6.49 The methodology states that the level of carbon savings is likely to be somewhere towards the higher level assuming displacement from coal-fired plants from the grid is most likely. However this cannot be certain, and so we recommend that for carbon balance purposes the current grid-mix emissions factor is used as the worst case scenario (longest payback) and fossil-fuel mix is used as the likely case.

6.50 The range of carbon savings potential per year is shown in Table 18.2.

Table Error! No text of specified style in document.**8.1: Project carbon savings from Kype Muir wind farm**

Wind farm emissions saving (tCO_2e/yr)	**Expected**	**Minimum**	**Maximum**
Coal-fired electricity generation	261,751	189,502	283,425
Grid mix electricity generation	150,076	55,906	162,203
Fossil Fuel mix electricity generation	171,068	125,495	193,906

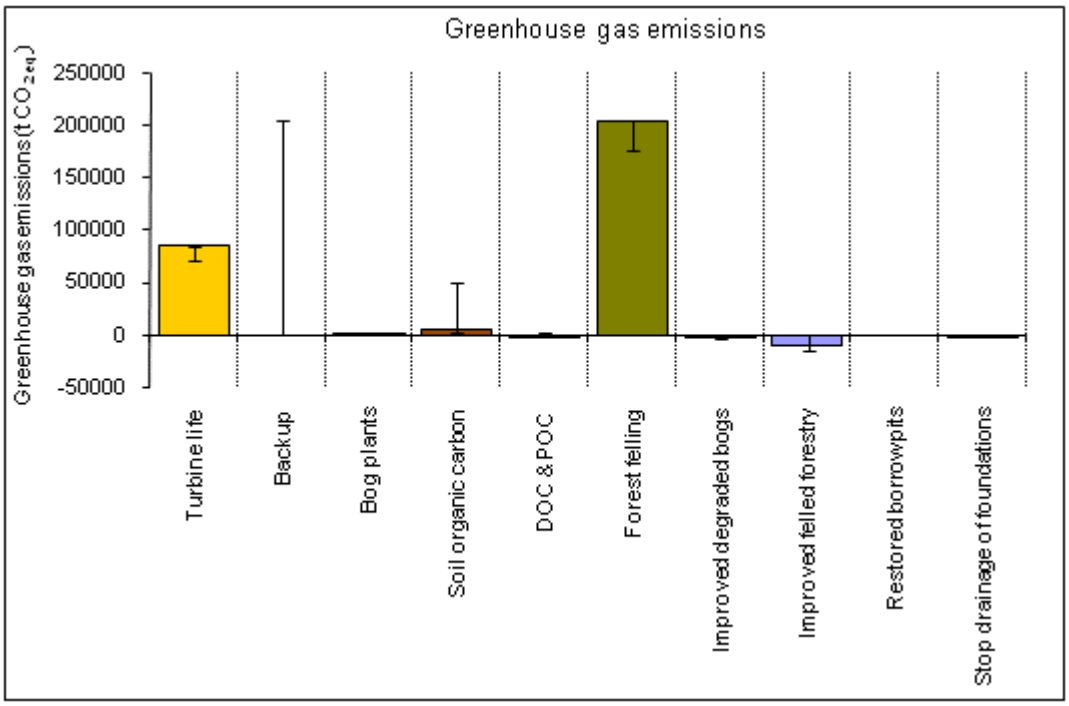
6.51 As the carbon gains from the wind farm correspond to the electrical energy generation output from the turbines. In effect, each turbine is responsible for a carbon gain of 6,580 tCO_2e per year when compared to fossil fuel mix generation in the expected case for generation (or 10,067tCO_2e for coal and 5,772tCO_2e for grid mix).

Carbon Losses and Gains

6.52 The Nayak approach estimates the carbon losses and gains associated with wind farm developments including consideration of turbine life, back-up power generation, land-use changes and site improvements.

6.53 Figure 18.1 shows the estimated carbon emissions associated with the Kype Muir wind farm with the graph bars presenting the expected emissions and error bars presenting the maximum and minimum range.

Figure 8.1: Estimated carbon emissions at Kype Muir (tCO_2e)



Carbon losses from the wind farm

6.54 The breakdown of the carbon losses arising from the Kype Muir wind farm are summarised in Table 18.3.

Table 18.3: Projected carbon losses from Kype Muir

Wind farm emissions losses (tCO_2e/yr)	**Expected**	**Minimum**	**Maximum**
Losses due to turbine life (e.g. manufacture, construction, decommissioning)	85,016	70,440	85,016
Losses due to backup power generation	0	0	204,301
Losses due to reduced carbon fixing potential	639	205	1,379
Losses from soil organic matter	5,841	1,640	49,855
Losses due to DOC & POC leaching	162	1	3,196
Net losses due to felling forestry	204,104	175,468	204,213
Total losses of carbon dioxide	295,761	247,755	547,960

6.55 Table 18.3 indicates the most significant loss of carbon dioxide associated with the site is as a result of felling of forestry and of turbine life under the expected scenario, contributing 69.0% and 28.8% of total losses respectively in the expected case.

6.56 This pattern is generally reflected in the minimum scenario.

6.57 Under the maximum 'worst case' scenario, losses from soil organic matter (peat) account for significant losses at approximately 9.1%. Losses due to backup make up a further 37.2%, with losses due to DOC (dissolved organic carbon) and POC (particulate organic carbon) leaching accounting for less than one percent of total losses.

6.58 The sections below discuss carbon losses in further detail

Losses associated with wind farm life

6.59 The carbon emissions associated with turbine life are those associated with the manufacture, construction, maintenance and decommissioning activities associated with the turbine unit and any associated civil/electrical engineering. Without a specific turbine design specified this study has used the average 'embodied' carbon per turbine derived in the Nayak spreadsheet.

6.60 It should be noted that the counterfactual emission factors used by the Nayak model and these calculations only consider the direct emissions associated with traditional energy generation mixes. The most recent Defra/DECC emission factors also include indirect GHG emissions associated with UK electricity generation, which for 2008 are $0.07185tCO_2e/MWh$ (compared to direct emissions of $0.54522tCO_2e/MWh$). Considering the indirect emissions associated with traditional power generation would raise the grid-electric counterfactual emission factors by approximately 13% and reduce carbon payback time.

Losses associated with Forestry

6.61 Felling represents the most significant carbon losses at the Kype Muir site which is currently largely forested. Losses are partially offset by the proposed on-site re-planting and off-site compensatory planting of 107ha and 324ha respectively

6.62 The losses associated with forest felling are sensitive the assumptions used for the yield class of both the forestry to be felled and that proposed for on-site and off-site compensatory planting.

6.63 The methodology models Sitka Spruce as having a yield class of 14m^3/ha/yr, this is below the estimated average yield class at Kype Muir of 15.4m^3/ha/yr. As outlined in section 4 we have used a variety of yield classes to model the proposed replanting resulting in expected carbon losses of 204,104tCO_2e in the expected scenario to minimum losses of 175,468tCO_2e.

Losses due to backup power generation

6.64 When intermittent electricity supply sources make up a significant proportion of the grid mix back-up power generation is required to provide a margin of extra capacity in order to prevent the risk of a power cut due to insufficient generation. Wind generation is one such example of an intermittent source.

6.65 The Nayak guidance recommends that where it is assumed that at least 20% of grid electricity is generated by wind energy back-up power generation should be factored into the calculations.

6.66 Whilst this is not currently the case (total wind energy generation in both Scotland and the UK is below 20%) it is likely to become the case over the lifetime of the windfarm if renewable electricity generation targets are to be met. Therefore, for Quixwood Moor, whilst currently not included due to the UK energy mix, losses associated with back-up power generation of 204,301tCO_2e could potentially be incurred over the lifetime of the windfarm as the energy mix changes.

6.67 The Nayak guidance suggests that a figure of 15% of installed capacity should be used to account for back-up power generation where wind generation contributes more than 20% to the grid mix.

6.68 Whilst these carbon 'losses' may be incurred by the UK grid, this is outside of the developers control and an accepted consequence of a higher proportion of renewable power generation where supply to the grid is variable.

6.69 The Nayak methodology makes the assumption that back-up power will be generated using fossil fuel energy at the high estimate of carbon intensity per kWh. This is likely to be an overestimate and does not allow consideration of other potential sources of back-up power generation such as nuclear.

Losses associated with soil and organic matter

6.70 Generally losses due to disturbance to soil and organic matter including removal, drainage and leeching are modest at the Kype Muir site. This is because, due to the consideration of peat depths during the site design process, relatively little peat will be impacted on with only 14 of the 26 turbines expected to require the

excavation of peat and no peat excavations expected for other structures and civil engineering. It is intended that borrow pits should be located outside of peat areas and access tracks over peat areas should be constructed as floating roads.

6.71 The maximum carbon losses of 49,855tCO_2e associated with the removal and drainage of peat occur due to the worst case scenario used for the excavation of peat. Based on the survey data for the Kype Muir site and turbine configuration it is expected that 29,250 m^3 peat excavated from the site due to the wind farm construction. This is all from turbine foundations and areas of hard standing.

6.72 In the worst case scenario this raises significantly to 146,425m^3 peat. The additional peat is mainly due to borrow pits (62,500m^3) and access tracks (22,500m^3) being modelled as located in areas of peat. In the expected scenario borrow pits and access tracks will not require the extraction of any peat. The worst case scenario is further exaggerated using the maximum expected dimensions for both the borrow pits and access tracks. These additional volumes, whilst possible, are unlikely due to the greater opportunity to mitigate though siting of borrow pits and access track construction methods.

6.73 The remaining 61,425m^3 of peat excavated in the worst case scenario is due to excavations for turbine foundations and areas of hard standing, with an average peat depth of 2.1m assumed across the site. Whilst this represents an increase of 32,175 m^3 over the expected scenario of 29,250m^3 the total impact would remain relatively small with a short payback period.

6.74 It is unlikely that the worst case assessment of losses associated with soil and organic matter will occur at Kype Muir and further refinement of peat extents and depths will allow the uncertainty in the model to be reduced. A ‘micro-siting’ allowance for turbines following further site investigation along with the proposal to site borrow pits outside of peat areas and the proposal for floating road construction should ensure peat disturbance and associated carbon losses are minimised.

6.75 Carbon losses due to peat disturbance at Kype Muir are expected to be relatively small. The Nayak approach assumes a worst case scenario for carbon losses associated with peat disturbance, in that it calculates losses on the basis that all carbon stored in peat is lost. Mitigation through management of peat on site during the construction process can avoid these maximum impacts and losses.

Carbon Gains from the Wind Farm

6.76 Proposed site improvements are detailed in the Habitat Management Plan (HMP). The two main improvements with significant potential to improve the carbon fixing potential of the site are the restoration of felled area to blanket bog and the on and off-site forestry replanting.

6.77 Restoration of land to blanket bog can lead to carbon gains through increasing the carbon fixing potential of the peat in restored area by raising the water table depth. Improvements to felled forestry area are included in the expect case scenario may lead account for a carbon gain of 10,399tCO_2e whilst improvements to existing degraded bog may lead to a carbon gain of 2,082tCO_2e. These gains are based on the restoration of 79ha of felled land and 15.8ha degraded bog and a raise in water table depth from an assumed current depth of 0.451m to a restored depth of 0.1m. However, in the absence of

hydrological data to verify water table depths a high level of uncertainty is attached to both these carbon gains

6.78 Forestry replanting has been factored into the carbon balance calculations described in section 0, losses associated with forestry and offsets a proportion of the losses associated with forest felling. In the expected scenario the proposed on and off site replanting accounts for offsetting 249,232tCO_2e or 55% of total carbon losses due to deforestation.

Carbon Payback Time

6.79 The carbon payback time is the time taken for the carbon losses associated with the wind farm development to be recovered through the carbon gains from displaced fossil fuel power generation and any site improvements.

6.80 The payback period for the whole site is shown in Table 18.4.

Table 18.4: Carbon payback periods for Kype Muir

Wind farm emissions losses (tCO_2e/yr)	**Expected**	**Minimum**	**Maximum**
Losses due to turbine life (e.g. manufacture, construction, decommissioning)	85,016	70,440	85,016
Losses due to backup power generation	0	0	204,301
Losses due to reduced carbon fixing potential	639	205	1,379
Losses from soil organic matter	5,841	1,640	49,855
Losses due to DOC & POC leaching	162	1	3,196
Net losses due to felling forestry	204,104	175,468	204,213
Total losses of carbon dioxide	295,761	247,755	547,960

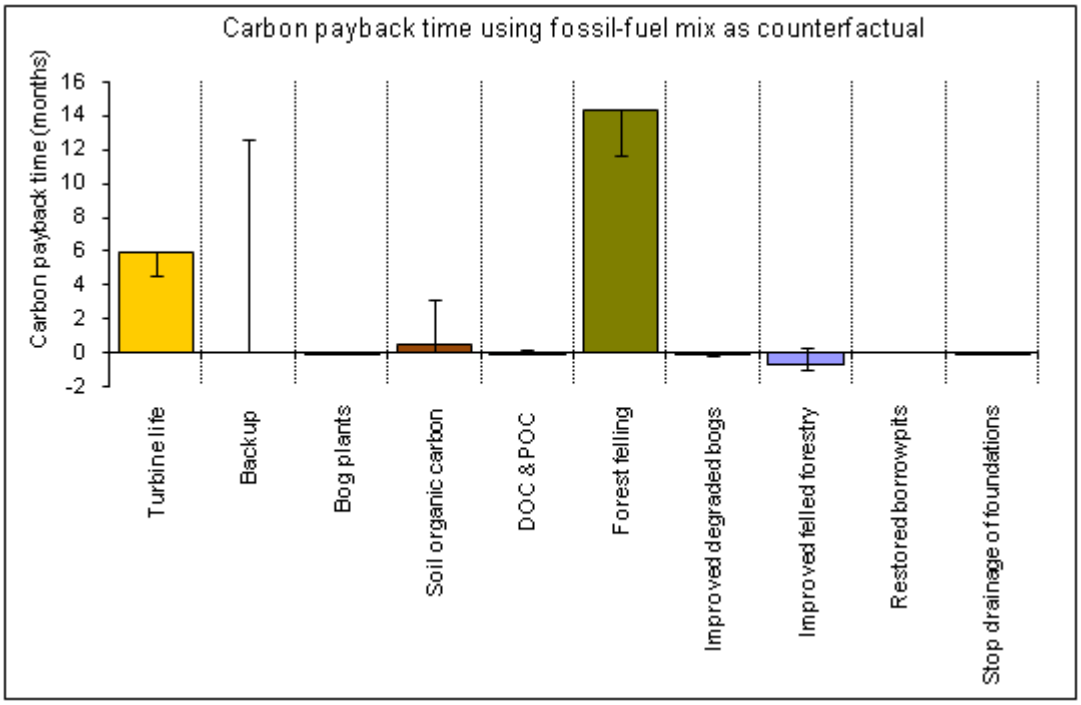
6.81 The table shows the expected payback for the site is 20 months if fossil fuel mix electricity is assumed to be displaced, with a worst case of 50 months and a best case of 16 months against the fossil fuel electricity generation mix

6.82 This payback period can be broken down into the various sources of carbon losses and gains (non-currently included) presented in Figure 18.2.

6.83 It should be noted that the 114 months payback period in the worst case scenario using a grid electricity counterfactual emission factor represents a highly exaggerated worst case by considering the maximum losses (547,960tCO_2e) against the minimum windfarm carbons savings when compared to grid electricity (55,906tCO_2/annum). These minimum savings are calculated using the minimum counterfactual emission factor for grid-mix electricity of 0.2554tCO_2e which is only expected to be achieved beyond 2025 when renewable generation makes up a significant proportion of grid electricity.

6.84 Therefore, for a realistic payback period the displacement of fossil fuels should be considered giving a best case scenario of 16 months and a worst case of 50 months.

Figure 18.2: Carbon payback period for Kype Muir



6.85 Figure 18.2 presents the relative impact of each carbon loss in the overall payback period. It confirms that carbon losses associated with the turbine life, and forest felling are the most significant impacts.

6.86 The greatest uncertainty exists for losses associated with backup power generation, forest felling and soil organic carbon and gains associated with improvements to degraded bogs as discussed in the previous section. The uncertainty presented for soil organic carbon is likely to be significantly reduced with improved data on site peat, whilst the predicted losses shown are unlikely to change significantly as a result. Gains associated with improvements to degraded bog and felled areas are likely to be realised, however, can only be considered indicative be confirmed in the absence of hydrological data on current site water table depths.

6.87 Backup power generation represents a potentially significant carbon loss if wind power generation increases to supply more than 20% of electricity nationally. However, this is outside of the developers control to influence, as it is an issue for the national grid.

6.88 The sensitivity is discussed in further detail in the Carbon Balance Technical Report, Appendix 16 to the ES.

MITIGATION

Mitigation Measures Associated with the Carbon Balance

6.89 The mitigation measures for carbon gains and losses will be developed and applied in two areas. The first will be to develop construction and management plans to minimise peat loss and monitor impacts. These should include:

- agreeing a Habitat Management Plan (HMP);
- minimising the area of disturbance during construction including the amount of peat disturbed and removed through micro-sitting of turbines and infrastructure;
- using floating tracks for the construction and maintenance of the wind farm;
- undertaking where possible, work during drier periods i.e. over the spring and summer, to minimise compaction and rutting of soils;
- storing soils in an appropriate manner to prevent soil compaction from vehicle movements, prior to the re-spreading and reseeding;
- minimising drainage on site and a developing a programme to monitor the water table (pre and post construction).

6.90 The second part of the mitigation measures should be to manage the wind turbines to maintain operational efficiency during their lifetime. Maintenance plans for wind turbines should be developed to maximise use, efficiency and energy generated. The planned efficiency for this site is 31.4%.

6.91 A maintenance efficiency plan will be developed and implemented. Key performance indicators to monitor and track operational efficiency will be developed and this could be disclosed publicly on a periodic basis.

6.92 Discussion of other specific mitigation measures can be found in more detail in the Carbon Balance Technical Report (see Appendix 16).

SUMMARY

6.93 The proposed development of a wind farm at the Kype Muir site is expected to result in carbon savings of 171,068tCO_2e/yr by displacing fossil fuel generated electricity. The wind farm is expected to have a payback time of 20 months where fossil fuel generated electricity is displaced with a best case scenario of 16 months and a worst case scenario of 50 months. Overall these payback periods are relatively short compared to the 25 year design life of the wind farm. Within a maximum of five years, and a potential minimum of less than 18 months, all electricity generated by this development will be carbon neutral.

6.94 The site design and proposed construction techniques have aimed to minimise disturbance to peat soils and hence carbon losses associated with peat drainage or removal. As a consequence carbon losses due to peat disturbance are expected to be only two percent of total carbon losses, or 5,841tCO_2e. These losses will be paid back in less than 2 weeks of the expected renewable power generation.

6.95 Losses associated with forest felling represent the most significant source of site specific carbon losses within the developers control. In the expected scenario losses associated with forest felling, including accounting for proposed on and

off-site replanting, account for 204,104tCO_2e or 69% of total losses, and requiring a 14 month payback period when displacing fossil fuel generated electricity.

6.96 The proposed on and off site replanting will offset 55% of potential gross losses due to forest felling in the expected scenario. Improvements to the area of felled land, outlined in the Habitat Management Plan, including restoration to blanket bog have the potential to further offset some of these losses, as presented in the best case scenario. Carbon gains due to improvements to areas of felled forestry could amount to up to 15,713tCO_2e carbon gains.

6.97 Over the 25 year design life of the wind farm, based on the displacement of fossil fuel generated electricity and the carbon losses and gains presented in the expected scenario, the Kype Muir wind farm development is expected to save 3,993,816tCO_2e. Beyond the expected 20 month payback period this equivalent to saving 171,068 tCO_2e per year or supplying carbon neutral electricity to 61,191 UK homes per year.

PART 2: FURTHER INFORMATION

7. ORNITHOLOGY

INTRODUCTION

7.1 During post-application communication with statutory consultees concerning the proposed development SNH requested reconsideration the information presented by the ES to the competent authority on the potential effects of the Development on the Muirkirk & North Lowther Uplands Special Protection Area (SPA) (originally presented in paragraphs 6.96 et al. of the ES), as regards the conservation objectives that are relevant to the Development, under the terms of the Habitats Regulations and the SPA citation at classification. SNH did not feel that the fourth conservation objective of the SPA ("*Ensuring for the qualifying species that the distribution of the species within the site is maintained in the long term"*) had been adequately addressed in the information provided within the ES.

7.2 As such Natural Research Projects have provided the following information in relation to the fourth conservation objective. This should be read in addition to the information presented in paragraphs 6.69 – 6.115 of the ES.

7.3 The information provided below does not change the overall conclusions of the ES that the development will not compromise the conservation objectives underpinning the protection of the qualifying interests of the SPA, when considered in isolation or in combination with other developments in the vicinity of the SPA.

POTENTIAL EFFECT ON SPA

Conservation Objective 4

7.4 Given the location of the Development with respect to the SPA, objective 4 (4: "*Ensure for the qualifying species that the distribution of the species within the site is maintained in the long term*") is clearly not potentially compromised directly. However, in theory (and refer to the revised Scottish Executive Circular: SERAD 2000) indirect effects occurring outside the boundary of the SPA can potentially impinge on this conservation objective. For example:

- Severe effects of habitat loss through displacement and/or collision mortality imposed by a project close to, but outside, a SPA boundary and within the range-use of SPA interests, could influence the occupation of breeding sites of those interests within the SPA boundary;

- Through adverse effects on food availability and/or the availability of birds for breeding site reoccupation, respectively.

7.5 Hence, severe indirect effects occurring outwith the site (as delimited by the SPA boundary) could potentially influence the distribution of birds within the site.

7.6 Nevertheless, in the case of the Development, and as described elsewhere, the prospect of such indirect adverse effects on this conservation objective are exceedingly small. Indeed, due to the draft HMP and the low baseline use of the Development area by hen harrier and merlin, the net effect of the Development should be, at worst, neutral and it is safe to conclude that this conservation objective will not be compromised by the Development.

8. NOISE

OVERVIEW

8.1 Following a meeting with South Lanarkshire Council's Environmental Health Officer (EHO) on the 28 October Banks Renewables submitted a letter to the EHO providing further information on the noise assessment contained within the ES. The letter provided:

- Information of the percentage of data excluded from the background noise data collected;
- The wind rose for the site and how this relates to the amount of noise exposure, especially at Lambhill Steadings;
- Details of the proposed measures that will be put in place to ensure the 40dB noise limit can be meet at Kype Lodge; and
- An indication of how long the significant noise associated with the construction of the access track is going to last.

8.2 A copy of this letter is contained within this submission (see appendices) as an additional appendix to the original ES. This is provided in addition to the revised chapter and ETSU-R-97 assessment. It does not change the conclusions of the revised chapter or ETSU-R-97 report.

9. AVIATION

INTRODUCTION

9.1 During the consultation process the Scottish Government has received two letters of objection from aviation stakeholders in relation to the proposed development. Objections have been received from:

- BAA Airports in relation to possible impacts on their radar infrastructure at Glasgow International Airport; and
- NATS en Route Ltd in relation to the possible impacts on radar functioning at their Lowther Hill facility.

9.2 Banks Renewables do not anticipate any further objections on aviation grounds in relation to the proposed development.

9.3 Since submitting the application Banks Renewables have been engaged with a variety of potential solution providers to provide mitigation for both impacts. An overview of these discussions is provided below. This builds upon discussions that were held with the Scottish Governments Energy Consents Unit (ECU) on 14 September 2011.

UPDATE ON AVIATION SOLUTIONS

9.4 Banks Renewables are currently engaged with a variety of potential solution providers to provide mitigation for potential impacts on both Glasgow Airport radar infrastructure and NATS en Route Ltd Lowther Hill facility. The ES chapter on Aviation (section 11) outlined the options that Banks Renewables assumed could provide suitable mitigation to any impact at the objecting facilities.

9.5 To date none of those measures have been ruled out, if anything there are additional opportunities. Banks Renewables are further along the road to assessing suitable mitigation options and are in discussions currently with a variety of potential solution providers to establish the practicality of delivering solutions, commercially and technically.

9.6 The parties Banks Renewables are in discussions with have the capability to mitigate the impacts on either or both objecting parties' infrastructure.

9.7 The mitigation solutions currently being advanced include:

- Potential radar infill from a new radar at Glasgow Prestwick Airport;
- Potential radar infill from Kincardine radar;
- Benefitting from any radar upgrades at Lowther Hill through 'Raytheon';
- Infill solutions from a variety of additional radars with suitable coverage over Kype Muir; and
- Alternative new radar solutions which could assist with one or both of the objections we have received.

9.8 There are many evolving commercial discussions, technical assessments and associated works ongoing at this time. The current position is a very positive one. There are a number of options available that will sufficiently mitigate the respective radar infrastructure to ultimately have the objections removed, or conditions discharged, which Banks Renewables would anticipate, given the current potential programme to resolution of matters, to be the more likely scenario. Unfortunately, when it comes to radar mitigation measures being agreed it is a slow process. However Banks Renewables are doing everything within their powers to move things along in a timely manner.

9.9 Having reviewed the emerging guidance from the Scottish Government on "Dealing with Aviation Objections and Associated Negative Conditions in Wind Turbine Consents", Banks Renewables are confident that Kype Muir will adhere to the guidance. There is sufficient evidence of a likely technical solution being realised within a reasonable timeframe.

9.10 Banks Renewables are confident that necessary mitigation measure(s) will be delivered within the appropriate time to deliver the proposed development within the life of any planning consent.

BANKS Renewables
development with care

Our Ref: RCM/LJH RE/S/713/PL

9 December 2011

[redacted]
Branch Manager
Energy Consents and Deployment Unit
Scottish Government
4th Floor
5 Atlantic Quay
150 Broomielaw
Glasgow
G2 8LU

Dear [redacted]

KYPE MUIR: SUBMISSION OF SUPPLEMENTARY INFORMATION

Please find enclosed a hard copy and electronic copy of Banks Renewables (Kype Muir Wind Farm) Limited's Supplementary Environmental Information for Kype Muir Wind Farm.

The Supplementary Environmental Information consists:

1. Statement
    a) Part 1: Replacement ES Chapters
        i. Revised Introduction
        ii. Revised Ecology and Nature Conservation
        iii. Revised Noise
        iv. Revised Forestry and Woodland
        v. Revised Carbon Balance
    b) Part 2: Further Information
        i. Ornithology
        ii. Noise
        iii. Aviation
2. Plans
    a) Replacement Plans
        i. Replacement ES22: Draft HMP
3. Appendices
    a) Part 1: Replacement Appendices
        i. Replacement Appendix 7.1: ETSU-R-97 Noise Assessment
        ii. Replacement Appendix 14.2: Compartment Schedules
        iii. Replacement Appendix 16: Carbon Balance
        iv. Replacement Appendix 17: Draft Habitat Management Plan
    b) Part 2: Additional Appendices
        i. Further Noise Information
        ii. Example Noise Conditions

A copy of the consultees that have been sent a copy of the application has also been included with this letter. The Supplementary Environmental Information has been posted out to these consultees today.

BANKS
Banks Renewables Ltd, Block C, Brandon Gate, Leechlee Road, Hamilton, Lanarkshire ML3 6AU
T: 0844 209 1535 F: 0844 209 1585 W: www.banksgroup.co.uk E: enquiries@banksgroup.co.uk

Adverts (text of which has already been agreed with yourself) will appear in the following papers to notify local residents to the submission of this information:

- Edinburgh Gazette – Tuesday 13 and 20 December
- East Kilbride News – Wednesday 14 and 21 December
- Hamilton Advertiser – Thursday 15 and 22 December

If you have any queries regarding this supplementary information, or any other aspect of the application please do not hesitate to contact me on the details outlined below.

Yours sincerely

[redacted]

[redacted]
Development Planner

DD: [redacted]
E: rachael.macleod[redacted]

Enc: Supplementary Environmental Information (hard copy and electronic)
Consultee List

KYPE MUIR WIND FARM
Supplementary Environmental Information - December 2011

Consultee List

	Consultee Name	Contact Name	Address 1	Address 2	address 3	address 4	Postcode	e-mail Address	Tel No	Format (hard copy/paper)
	Statutory Consultees									
1	South Lanarkshire Council								[redacted]–	Hard (x3)/Electronic (x3)
2	SEPA									Hard
3	SNH								[redacted]	Hard
	Internal Consultees									
4	Forestry Commission									Electronic
5	Historic Scotland								[redacted]	Electronic
6	Marine Scotland								[redacted]	Electronic
7	Transport Scotland									Electronic
8	Halcrow Group Ltd									Electronic
9	Scottish Government Library									Electronic
	Non Statutory Consultees									
10	BT								[redacted]	Electronic (email in first instance)
11	Civil Aviation Authority - Airspace								[redacted[	Electronic
12	The Crown Estate								[redacted]	Electronic
13	Defence Estates									Electronic
14	Joint Radio Company									Electronic
15	NATS Safeguarding								[redacted]	Electronic
16	RSPB Scotland								[redacted]	Electronic
17	OFCOM								[redacted]	Electronic
18	Mountaineering Council of Scotland								[redacted]	Electronic
19	Mountaineering Council of Scotland									Electronic
20	Scottish Water								h[	Electronic
21	Visit Scotland								[redacted]	Electronic
22	Maggie Keegan									Electronic
23	BAA - Central Airside Operations									Electronic
24	Prestwick Airport								[redacted]	Electronic
	Additional Consultees									
25	Sandford and Upper Avondale Community Council									Hard
26	Strathaven Community Council									Hard
27	Stonehouse Community Council									Hard
28	Lesmahagow Community Council									Hard
29	Clyde River Foundation									Electronic
	Copies for Public Viewing									
30	South Lanarkshire Council Offices									
31	South Lanarkshire Council Offices									
32	Strathaven Library									