

9 Ecology

Introduction

- 9.1 This chapter considers the potential effects of the proposed wind farm on ecological receptors. It includes an assessment of potential effects of the proposed wind farm on flora and fauna in terms of direct effects, such as habitat loss, and indirect effects such as disturbance to species. The Ecological Impact Assessment (EclA) was undertaken by Land Use Consultants and was informed by a combination of desk based assessments and field surveys. Bat surveys were carried out by Direct Ecology Ltd and detailed botanical surveys were carried out by Ben Averis (specialist botanical consultant).
- 9.2 Findings of bird surveys carried out within, and in the vicinity of, the site¹, and the potential effects of the proposed wind farm on bird interest, are presented in **Chapter 10: Ornithology**.

Study Area Description

- 9.3 The proposed wind farm site covers just over 663 ha and is situated approximately 10 km to the east of Lockerbie, in Dumfries and Galloway shown in Figure 1.1. The site² rises from south-east to north-west, with the main hills being Allfornought Hill (233 m AOD), an un-named high point (at 244 m AOD) and Gowdmuir Hill (247 m AOD). The north-western half of the proposed wind farm site is dominated by commercial Sitka spruce plantation. The open south-eastern part of the site includes open moorland, with a mosaic of bog, heath and grassland on the higher ground, dropping down to enclosed semi-improved pastures and marshy grassland with wooded burn valleys and small coups of mixed woodland in the lower lying areas. The south-east of the site area is managed as grazing land for cattle and sheep.
- 9.4 A number of watercourses arise on the site and its peripheries. These include tributaries of the River Sark to the south, and the Kirtle Water to the north-west of the proposed wind farm. The principal watercourses draining the north-west part of the site are the Hallsike Burn, Alder Well, Gowdmuir Sike and Pokeskine Sike. The Palling Burn flows through the centre of the south-east part of the site towards the Woodside Burn and eventually reaching the River Sark. Paragraphs 9.51 to 9.53 provide further detail on the study areas for individual ecological surveys.

Legislation and Policy Context

- 9.5 Details of the planning policies relevant to the proposed wind farm are provided in **Chapter 2: Planning Policy Context**. The key legislation relevant to the protection of habitats and species at Solwaybank are: The Conservation (Natural Habitats etc.) Regulations 1994; The Wildlife and Countryside Act (1981, as amended); The Nature Conservation (Scotland) Act (2004); the Wildlife and Natural Environment (Scotland) Act (WANE Act, 2011) and, The Protection of Badgers Act

¹ The term site is taken to mean the area encompassed by the red line boundary of the planning application and includes all on site access tracks, turbines and other infrastructure and includes the proposed felling area.

(1992). Further details of the relevance of these pieces of legislation are provided throughout the chapter.

Effects Assessed in Full

- 9.6 The following effects of the proposed wind farm have been assessed in full:
- direct and indirect effects on terrestrial habitats within the proposed wind farm site during construction;
 - direct and indirect effects on watercourses within, and downstream of, the proposed wind farm site during construction;
 - direct and indirect effects on Groundwater Dependent Terrestrial Ecosystems (GWDTes) within, and up to 250 m of, the proposed wind farm site during construction;
 - direct and indirect effects on protected species, including otter, badger, bats, red squirrel, reptiles and fish species during construction;
 - operational effects on bats; and
 - cumulative effects with the Ewe Hill grid connection and a general assessment of potential cumulative effects with other wind farms up to 20 km from the proposed wind farm.

Effects Scoped Out

- 9.7 On the basis of the desk study and survey work undertaken, professional judgement, experience from other relevant projects and policy guidance and standards; and based on the findings and conclusions of the previous Environmental Statement (ES) for the 2009 wind farm scheme³, the following topic areas have been 'scoped out':
- Direct and indirect effects on water vole. Water vole presence was not identified during surveys carried out for the 2009 wind farm application or during surveys carried out in 2011. It is concluded with a high degree of certainty that the species is absent from the site.
 - 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 of turbines will be rare and sporadic, typically carried out by a small number of maintenance staff inside the turbines using hand held tools, and therefore creating only a minimal amount of disturbance to species. Access solely via the constructed tracks will ensure no damage or disturbance to adjacent habitats. Run-off from constructed surfaces potentially affecting water quality will be controlled to prevent siltation of watercourses.

³ RES, Solwaybank Wind Farm Environmental Statement (2009)

Issues Identified during Consultation

Table 9.1: Issues Identified during Consultation

Consultee	Scoping/Other Consultation	Issue Raised	Response/Action Taken
Scottish Natural Heritage (SNH)	Response to 2009 Solwaybank ES	No objections to the proposal but raised a number of issues. Advised that an Ecological Clerk of Works be appointed for the construction and restoration phases of the scheme. Made recommendations for a habitat condition survey and submission of a Construction Method Statement and Habitat Management Plan. Requested that habitat condition surveys were conducted on the site and that these be used to inform habitat management and micro-siting.	Updated Habitat Surveys have now been conducted and include detailed NVC survey and Upland Land Management Impact Survey of the open habitats on site. Full details are provided in Appendix 9.1: Botanical Appendix . Habitat Surveys and other ecological work have been used to design a comprehensive Habitat Management Plan which includes open and wooded habitats on site. This is included as Appendix 9.4. The current chapter makes clear recommendations for the appointment of an Ecological Clerk of Works for by RES for the duration of felling and construction.
	Consultation response to the proposed methodology for the current application	No issues raised. SNH were content with the proposed survey and assessment methodologies and had no further issues to raise beyond those highlighted in their response to the 2009 application.	N/A
Scottish Government	Response to 2009 Solwaybank ES	No comments to make on the proposals	N/A
Scottish Environment Protection Agency (SEPA)	Response to 2009 Solwaybank ES	Welcomed the plans to produce a Construction Method Statement (CMS) in conjunction with SEPA and SNH and indicated that good practice should be put in place for storage of potentially polluting materials (chemicals and oils). Highlighted that bridged crossings should be used in preference to culverts and that road construction should consider potential effects on peatland habitats.	Chapter 12: Geology, Hydrology and Hydrogeology provides further details with regard to pollution prevention and crossing construction. Design stages have sought to reduce the number of proposed watercourse crossings as well as locating as much infrastructure as possible away from sensitive peatland habitats.
Forestry Commission Scotland	Response to 2009 Solwaybank ES	Indicated that compensatory planting would be likely to be required but had no	A detailed Habitat Management Plan is included as Appendix 9.4:

Consultee	Scoping/Other Consultation	Issue Raised	Response/Action Taken
		further comments in relation to the application.	Solwaybank Habitat Management Plan to this ES chapter. It includes plans for replanting on the site and re-design of the Forest Plan. It also considers the implications of the Control of Woodland Removal Policy which has been brought into place since the previous application (discussed further in Chapter 6).
Dumfries and Galloway Council (DGC) and Local County Councils	Response to 2009 Solwaybank ES	No concerns related to ecology associated with the proposals.	N/A
Galloway Fisheries Trust & Annan Fisheries Trust	Consultation response to the current application	The proposed development lies over three catchments - the River Kirtle, River Sark and Border Esk; the management of which is divided between the Galloway Fisheries Trust (GFT) and the Annan Fisheries Board. Concerns centred around the potential for construction to lead to effects such as siltation, erosion, pollution, hydrological changes, riparian and in-stream habitat loss. The GFT have no fisheries data covering the site but suggest that surveys are carried out for assisting the micro-siting process.	Watercourse crossings have been avoided where possible and those that are proposed are in stream headwaters where habitat for fish (spawning or other) is limited. All crossings will be designed in accordance with Migratory Fish crossing design guidance originally produced by the Scottish Executive. Appropriate pollution prevention control measures will be implemented and Construction Method Statement will be agreed with SEPA - Further details are provided in Chapter 11: Geology, Hydrology and Hydrogeology .

- 9.8 In addition to the above, the Biodiversity Officer for DGC was contacted for updated information on non-statutory designated conservation sites in the area. The Red Squirrels in South of Scotland group was contacted for up-to-date squirrel records for the Site. Both organisations provided the relevant up-to-date records.

Assessment Methodology

Baseline Characterisation

Phase I Habitat and National Vegetation Classification Surveys

- 9.9 Phase I Habitat Survey is a standard habitat survey technique providing a nationally recognised means of classifying and mapping habitats. The methodology for Phase I Habitat Survey is described in the JNCC Handbook for Phase I Habitat Survey - A Technique for Environmental Audit (1990)⁴.
- 9.10 All land within the site was surveyed over 9 days between November 2010 and March 2011. Although this is not the key period for flowering species, it is still possible to identify vegetative species to allow allocation of Phase I Habitats. More detailed vegetation survey (NVC) was carried out in July 2011, during the peak flowering period. During the Phase I Habitat Survey, Habitats were mapped using the standard Phase I classification and mapping codes. A minimum mappable unit of 40 x 40 m was adopted 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 DAFOR⁵ scale. Mapped habitats were subsequently transferred to a digital map base within a Geographical Information System (GIS).
- 9.11 The National Vegetation Classification survey broadly followed the methodology described in the National Vegetation Classification Users' Handbook (2006)⁶ and vegetation communities were classified in accordance with British Plant Community keys (Volumes I-V) (Rodwell *et al.*, 1991-1995)⁷. A quadrat size of 2x2 m (4x4 m where appropriate) was used and the abundance of species within the quadrat was assessed according to the Domin⁸ scale. Quadrat results combined with survey experience and knowledge of habitats in the area were used to classify habitats. NVC survey was conducted over three days in mid-July 2011 by Ben and Alison Averis Botanical Consultants.

ULMIS Survey

An Upland Land Management Impact Survey (ULMIS) (MacDonald *et al.*, 1998⁹) was carried out within the site. This is a rapid field survey method developed by SNH for assessment of the effect of various management techniques such as burning and grazing. Although not strictly a condition assessment technique, it can provide an indication of the type and intensity of management activities on a site, as displayed through vegetation response. The ULMIS survey was conducted over two days in mid-July 2011 by Ben and Alison Averis Botanical Consultants and full methodology details are provided in **Appendix 9.1: Botanical Appendix**.

Otter Survey

Legislation

⁴ JNCC (1993). *A Handbook for Phase 1 Habitat Survey - a technique for environmental audit*. JNCC, Peterborough.

⁵ DAFOR scale: D = Dominant, A = Abundant, F = Frequent, O = Occasional, R = Rare.

⁶ JNCC (2001). *National Vegetation Classification. Field Guide to Mires and Heaths*. JNCC, Peterborough.

⁷ Rodwell, J.S. (ed.) (1991- 1995). *British Plant Communities Volumes I-V*. Cambridge University Press, Cambridge.

⁸ Mueller-Dombois, D.R. & Ellenberg, H. (1974). *Aims and Methods of Vegetation Ecology*. Wiley, Colorado.

⁹ MacDonald, A., Stevens, P., Armstrong, H., Immirzi, P. and Reynolds, P. (1998) *A Guide to Upland Habitats. Surveying Land Management Impacts*. Scottish Natural Heritage, Battleby, Perth.

- 9.12 The otter *Lutra 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 an 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 (i.e. there is no defence). The otter is also protected by the Wildlife and Countryside Act (1981) as amended and by the Nature Conservation (Scotland) Act (2004).

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

Field Survey Methodology

- 9.14 Otter surveys were carried out within the proposed wind farm site by experienced surveyors over four days in May 2011. All watercourses and waterbodies within the site boundary and a 250 m buffer of this were surveyed for evidence of otter. This involved systematic walking of all watercourse corridors 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 recorded using a hand-held GPS. Survey findings were subsequently transferred into a digital map base within a GIS.

Badger Survey

Legislation

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

Field Survey Methodology

- 9.17 A badger survey was carried out by experienced surveyors across four days in May 2011.
- 9.18 The survey methodology described in Harris *et al.* (1989)¹⁰ was adopted and focussed on identification of badger signs, including paths, prints, latrines, hair and shelters within suitable

¹⁰ Harris S., Cresswell P & Jeffries D. (1989). *Surveying for badgers*. Occasional Publication of the Mammal Society, London.

parts of the site. The survey extended 50 m beyond the site boundary and concentrated on the footprint of the proposed wind farm from infrastructure, woodland margins and wayleaves separating the woodland blocks as well as drier parts of the site including the agriculturally improved areas and enclosed fields in the south-east of the site.

- 9.19 All identified badger signs were noted and their location recorded using a hand-held GPS. Survey findings were subsequently transferred into a digital base map within GIS.

Bat Survey

Legislation

- 9.20 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 bat roosts.
- 9.21 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.
- 9.22 Apart from roost sites, bats require feeding sites and flyways (which allow them to navigate between roost and feeding sites) to survive. Many species of bats use linear landscape features such as tree lines and stream and river valleys as flyways. Loss of integrity of these features through creation of gaps can make them unusable for navigation and can lead to unfavourable effects on local populations of these bat species.

Field Survey Methodology

- 9.23 Bat surveys were undertaken between January and September 2011 and included
- an initial walkover survey and potential roost survey;
 - night transect surveys;
 - commuting surveys;
 - remote monitoring using Anabats;
 - dusk roost survey at Pingle Farm.
- 9.24 The Bat Survey Technical Appendix (**Appendix 9.2**) details all bat survey undertaken including dates, weather conditions and times. (see paragraph 9.32 to 9.34 for survey methodology).

Initial Walk-over Survey for Bats

- 9.25 An initial walk-over was carried out in January 2011 with some additional areas covered in May 2011, (the turbine area and approximately a 500 m buffer of this, and the access track corridor and

approximately a 50 m buffer of this) to identify any potential roost sites, foraging areas and bat commuting routes.

Night Transect Surveys

- 9.26 Two transects comprising of a maximum of 22 stopping points were selected to provide good coverage of the turbine area. Transect routes are shown on Figure 9.1a. Survey visits were conducted on 6 June 2011, 4 August 2011 and 24 September 2011 and both transects were walked during each survey visit. Transects commenced around 30 minutes after sunset and five minute time stops were undertaken at each stopping point, during which the number of bat passes¹¹ was recorded. Any bat passes were also recorded en route between the stopping points. Noted information included species of bat, activity, flight height and direction of travel.

Commuting Survey

- 9.27 The watercourses in the turbine area (including the Palling Burn) and the plantation edges of the woodland were identified as potential bat commuting routes. Along with an assessment of commuting routes from the static remote Anabat detectors (see later), four manual commuting watches were undertaken at two locations as shown on Figure 9.1b, including:
- near Anabat location L12 (19 and 24 September 2011)
 - near Anabat location L14 (19 and 24 September 2011)
- 9.28 Each commuting watch point was surveyed on two occasions. Surveys started approximately 30 minutes before sunset and each watch continued for approximately one hour.

Anabat Remote Survey Recording

- 9.29 Three periods of remote detector survey were undertaken in May/June, July/August and September 2011. A total of fourteen Anabat locations were used to provide good overall coverage of the site, focussing particularly on the proposed turbine area, but also taking into account the wider range of habitat features present on the site. Anabat locations are shown on Figure 9.1b. Ten Anabats were present on site at any one time. Anabat recording was carried out on site for a total of 17 nights over the survey period, giving a total of 170 nights of data at all locations. Recordings were analysed to confirm species, times and dates of bat activity.
- 9.30 A number of the Anabat locations used during the Anabat remote survey were positioned adjacent to potential commuting routes. Data recorded from these locations have been used to provide further information regarding the use of potential commuting routes on the site. **Appendix 9.2** provides full details of all survey undertaken.

Roost Survey

- 9.31 A dusk watch was carried out on 13 September 2011 at Pingle Farm which was the only building identified as potential roost site within the site. Survey was undertaken by two surveyors, starting approximately 15 minutes before sunset and continuing for 75 minutes after sunset in order to cover the likely emergence times of all species. A note was made of any bats emerging from the building

¹¹ A single bat pass was defined as an unbroken stream of echolocation up to 15 seconds long.

including the number of bats and species, as well as the point of emergence. The direction of flight after emergence was also recorded where possible along with any foraging activity.

Survey Conditions and Guidance

- 9.32 Survey methods were based on best practice guidelines in particular the Natural England *Bats and Onshore Wind Turbines, Interim Guidance*¹² which have been endorsed by SNH. Other guidance referred to includes the Bat Conservation Trust (BCT) Good Practice Guidelines¹³. The new BCT Guidelines issued in May 2011 have also been considered during the surveys but not followed in their entirety as they were issued mid-season and the guidelines have yet to be adopted by SNH. The survey methodology (including the level of effort) adopted for bats at Solwaybank was discussed and agreed with SNH (Blair Urquhart, 13 June 2011) prior to surveys commencing.
- 9.33 Recording equipment at Solwaybank included Anabat detectors and frequency division ultra sound detectors such as the Duet. Recordings were made on to an MP3 player for the Duet and onto a memory card for the Anabat. Recordings were later analysed to confirm species identification.
- 9.34 It was aimed to conduct all manual surveys in dry calm and warm conditions, with temperatures greater than 8°C at dusk. However, survey on the 19 September was abandoned after the commuting watch due to heavy rain. Weather during the static Anabat surveys was variable as detailed in **Appendix 9.2**.

Limitations

- 9.35 The main bat active season is from late April through to September, with breeding taking place between June and July. The survey was therefore undertaken within this period, although no survey was carried out during the winter months for hibernating bats. Despite this, a bat habitat suitability assessment was conducted during the initial site walkover in January and no key potential hibernation sites were identified on, or in close proximity to the site.
- 9.36 Anabat detectors are considered to be an effective means of monitoring bat activity. However, their range is limited and will vary between c. 5m and 100m dependant on a variety of factors including the sound characteristics of the bat call which varies between species, and the location of the bat in relation to the microphone. Brown long-eared bats in particular have very weak echolocation calls and may only be recorded at c. 5m and these can be under-recorded by detector surveys, whereas *Nyctalus* species have much stronger calls and may be detected up to 100m away. Despite these limitations, remote detectors are considered the most sensitive and suitable instruments available for surveys of bat activity on wind farm sites.
- 9.37 The analysis of bat detector calls could potentially be prone to some subjectivity, but has been undertaken here by experienced surveyors, following appropriate guidance and in consultation with other experts in the field where necessary. In addition, it is not always possible to identify some *Pipistrelle*, *Myotis* and *Nyctalus* bats to species level. For example, differentiating between the echolocation calls of the common pipistrelle (which echolocates at a peak frequency of approximately 45 kHz) and the soprano pipistrelle (which peaks at approximately 55 kHz) can be impossible where recordings peak at the intermediate frequency of 50 kHz. These passes are therefore simply classified as pipistrelle species. Similarly it is not always possible to differentiate

between the calls of Noctule bats and Leisler's bats. Calls were only identified as Leisler's if the peak frequency was above 24 kHz and as Noctule if the frequency was below 21 kHz. Other intermediate calls were classed as *Nyctalus* species. Echolocation calls produced by the *Myotis* bat species are very similar and where calls are of poor quality it can be impossible to distinguish between them and in these instances such recordings are classed as *Myotis* species. Further details are provided in **Appendix 9.2**.

- 9.38 The Anabat detectors were located on or close to the ground, positioned pointing upwards, and not at proposed rotor blade height as there were no available structures to mount them on (no anemometer mast was on site at the time). It is important to note that for most species, bat activity at ground level is likely to be much higher than at the rotor height of the proposed turbines. However for *Nyctalus* species activity levels may be similar at height and ground level, or even more frequent at height.
- 9.39 The survey only recorded activity on the site within the current conditions i.e. forested. It should be noted that post-felling, bat activity levels could be very different. Due to the dense nature of the coniferous forest on site not all trees could be assessed for bat roost potential but the vast majority of the coniferous plantation on site was dominated by Sitka spruce, which over very low roosting potential, with a lack of rot holes and splits in branches and trunks (see results later).

Red squirrel

Legislation

- 9.40 Red squirrel *Sciurus vulgaris* is protected by the Wildlife and Countryside Act (1981, as amended) and the Nature Conservation (Scotland) Act (2004) against intentional or reckless killing, injury or taking (capturing), damage, destroying or obstructing access to any structure or place which a red squirrel uses for shelter or protection, or disturbance whilst it is occupying a structure or place which it uses for that purpose.
- 9.41 In 2011, both of these Acts were amended by the Wildlife and Natural Environment (Scotland) Act ("WANE Act"). Section 18(2)(a) and (b) of the WANE Act insert a new licensable purpose into section 16 of the Wildlife and Countryside Act. The effect is that Scottish Ministers can licence disturbance of squirrels (including removal of dreys) for over-riding reasons of social, economic and environmental reasons provided there is no satisfactory alternative. The power to grant licences has been granted to SNH. Disturbance to a red squirrel drey (shelter) may be considered to occur within a 20-50 m radius, depending on the activity and whether or not breeding is suspected.
- 9.42 The red squirrel population is in decline in the UK and has been replaced over most of England, Wales and central and south-east Scotland by the grey squirrel *Sciurus carolinensis*. Red squirrel is primarily a conifer specialist, and population densities are highest in stands containing conifer tree species of a variety of ages and with reliable cone crops. Due to extensive afforestation schemes in the region, southern Scotland is now thought to contain around 20 % of the remaining British red squirrel population, largely confined to Dumfries and Galloway, South Lanarkshire and the southern Scottish Borders.

Field Survey Methodology

- 9.43 No dedicated red squirrel surveys were carried out within the site as these were not requested by the statutory consultees and previous surveys conducted in 2006 had identified no signs of squirrels of either species. However, recent records of red squirrel (provided by the Dumfries and Galloway

¹² Natural England. 2009 (February). Bats and Onshore Wind Turbines: Interim Guidance. Technical Information Note 51.

¹³ Bat Conservation Trust. (2007) Bat Survey Good Practice Guidelines. BCT London.

Red Squirrel Officer) from the site and its vicinity were obtained, and these, alongside an appraisal of the suitability of habitats on site, have been used to assess potential effects on red squirrel.

Reptiles

Legislation

9.44 All native reptiles in Scotland are protected under the Wildlife and Countryside Act (1981, as amended) and the Nature Conservation (Scotland) Act (2004) against intentional or reckless killing, injury and sale (or advertising for sale). In 2011, both of these Acts were amended by the Wildlife and Natural Environment (Scotland) Act ("WANE Act"). Section 18(2)(a) and (b) of the WANE Act insert a new licensable purpose into section 16 of the Wildlife and Countryside Act. The effect is that Scottish Ministers can licence disturbance to reptiles for over-riding reasons of social, economic and environmental reasons provided there is no satisfactory alternative. The power to grant licences has been granted to SNH. Of the six reptile species native to the UK, adder, common lizard and slow worm are found in Scotland.

9.45 Adder, slow worm and common lizard are species with similar habitat preferences, requiring habitat that provides cover and food as well as basking opportunities. The common lizard is frequently found in habitat with an open aspect with good locations for basking; it is commonly recorded in habitats such as heath and moorland, including wet heaths and bogs, where abundant invertebrates provide feeding opportunities. Adder and slow worm are also typical of heathland areas but tend to remain close to areas of cover or denser vegetation. All three species hibernate in a range of features (known as hibernacula) including piles of rocks, grass clippings and log piles. Reptile species emerge from hibernation in spring time and are generally active until mid-autumn.

Field Survey Methodology

9.46 No dedicated reptile surveys were carried out as these were not requested by the statutory consultees. However, incidental sightings of reptiles were made during other faunal and habitat surveys, and these, alongside an appraisal of the suitability of the site for reptiles, have been used to assess potential effects on reptiles.

Fisheries

Legislation

9.47 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 shallow in which the spawn of salmon may be. Atlantic salmon *Salmo salar* is also a priority species in the UK Biodiversity Action Plan (BAP). Atlantic salmon have a widespread distribution in Scotland and require high quality, cool freshwaters for spawning.

9.48 The brown trout *Salmo trutta* is widespread throughout the British Isles, occurring in a variety of different freshwater environments from upland lochans 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 list of priority species for biodiversity action.

9.49 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 life stages of the species).

Field Survey Methodology

9.50 Habitat suitability appraisals were conducted with respect to fish. The appraisal of watercourses on site is provided at paragraph 9.168. A high waterfall, considered to act as a significant barrier to fish migration, was identified on the Palling Burn (at the northern end of the Palling Wood) and the remaining watercourses on site were small and ephemeral, and therefore it was decided not to carry out fish surveys. Records of fish species in the vicinity of the site were collated from National Biodiversity Network (NBN) Gateway¹⁴ along with some limited electro-fishing data of the Woodside Burn obtained from the Environment Agency¹⁵. In combination with a habitat suitability assessment of key watercourses draining the proposed wind farm site, this has been used to assess the likely effects of the proposals on fish species.

Method of Assessment (including Significance Criteria)

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

- potential felling and construction effects of the proposed wind farm on habitats;
- potential felling and construction effects of the proposed wind farm on otter, badger, bats, red squirrel, reptiles and fish species;
- potential operational effects of the proposed wind farm on bats; and
- cumulative effects as a result of the combined effects of the proposed wind farm with the Ewe Hill grid connection and a general assessment of cumulative effects with other wind farms within 20 km.

Study Area

9.52 The study area for ecological surveys was based on the site boundary, and the potential for effects to extend outwith that boundary. The survey area for the habitat surveys covered the whole site plus a 300 m buffer of proposed turbine locations and 100 m buffer of access track locations where these extended outwith the site boundary. A survey buffer was applied for protected species surveys as follows:

- otter: 250 m beyond the site boundary; and
- badger: 50 m beyond the site boundary.

9.53 Bat roost assessment was undertaken within 500 m of all proposed turbine location and 50 m of the proposed access route¹⁶. Activity surveys were conducted within the site boundary along likely flight lines (tree lines, forest edge and watercourses) and concentrating on potential turbine locations (where these were known).

¹⁴ www.nbn.org

¹⁵ The Woodside Burn flows over the English-Scottish border, and the Environment Agency, rather than SEPA have adopted responsibility for this watercourse.

¹⁶ Early design iterations for this scheme, not the previous application.

9.54 Consideration of potential effects on designated sites for nature conservation extended to a 10 km radius around the site boundary, based on professional judgement and the likelihood of effects beyond the site boundary.

Data Sources and Guidance

9.55 Searches for historical records of protected species relevant to the proposed wind farm were conducted on the NBN Gateway.

9.56 The previously submitted 2009 ES for the Solwaybank Wind Farm was also consulted during production of this chapter.

9.57 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).

9.58 The Ewe Hill Grid Connection, Ewe Hill Wind Farm, Ewe Hill Wind Farm Extension, Minsca Wind Farm, Hallburn Wind Farm and Beck Burn Wind Farm ES Chapter were also used for the cumulative assessment¹⁷¹⁸¹⁹²⁰²¹²².

Significance Criteria

9.59 Ecological Impact Assessment (EclA) 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.

Value of Ecological Receptors

9.60 The value or sensitivity, 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 9.2. 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 for the selection of sites with nature conservation value (Ratcliffe, 1977)²³. All these criteria can vary at different geographical scales.

Table 9.2: An Approach for Assessing the Value or Sensitivity of Ecological Receptors in Scotland

Maximum level of value or sensitivity	Examples
International	An internationally designated site or candidate site (SPA ²⁴ , pSPA ²⁵ , SAC ²⁶ , cSAC ²⁷ , pSAC ²⁸ , Ramsar site ²⁹ , Biogenetic Reserve ³⁰) 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 is 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 ³¹ , NNR ³² , Marine Nature Reserve ³³) 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 ³⁴ , 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.

²³ Ratcliffe D.A. (1977). *A Nature Conservation Review*. Cambridge University Press.

²⁴ Special Protection Area classified under the EU Birds Directive for importance to birds.

²⁵ Potential Special Protection Area.

²⁶ Special Area of Conservation classified under the EU Habitats Directive for important habitat or non bird species.

²⁷ Candidate Special Area of Conservation.

²⁸ Potential Special Area of Conservation.

²⁹ Wetland of international importance designated under the Ramsar Convention.

³⁰ Sites deemed representative examples of particular habitats in Europe.

³¹ Site of Special Scientific Interest designated under UK law as being the best examples of the UK's flora, fauna, geological or physiographical features.

³² National Nature Reserve designated under UK law as containing the best examples of natural or semi-natural ecosystems in Britain.

³³ Marine Nature Reserve designated under UK law to conserve marine flora, fauna and geological features.

³⁴ Biodiversity Action Plan identifies targets for improving and protecting biodiversity in an area to meet the UK's commitments under the Rio Convention(1992 Earth Summit - Convention on Biodiversity).

¹⁷ SP Transmission. 2011. Gretna Substation to Ewe Hill and Newfield Windfarms 132kV Transmission Line Environmental Statement.

¹⁸ Scottish Power. 2005. Ewe Hill Windfarm Environmental Statement: Chapter 8 Ecology

¹⁹ Scottish Power. 2009. Ewe Hill Windfarm Environmental Statement: Chapter 6 Ecology

²⁰ Entec. 2003. Minsca Windfarm Environmental Statement: Section 9 Ecology and Nature Conservation

²¹ Hyder (commissioned by Cornwall Light and Power). 2010. Hallburn Windfarm Environmental Statement: Chapter 6 Ecology

²² SKM Enviro (commissioned by EDF Energy Renewables). 2010. Beckburn Windfarm Environmental Statement: Chapter 7 Ecology.

Maximum level of value or sensitivity	Examples
Council (Dumfries and Galloway)	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 10 km squares in the UK) or in a relevant Council BAP or Natural Heritage Zone profile on account of its rarity or localisation. Non-statutory designated wildlife sites (e.g. SNCIs ³⁵ , SINC ³⁶ and LWSs ³⁷), including semi-natural ancient woodland greater than 0.25 ha. Networks of species-rich hedgerows.
District (Eskdale Muir)	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 0.25 ha. Sites/features that are scarce within the district or which appreciably enrich the district habitat resource.
Neighbourhood (Site and its vicinity including areas of habitats contiguous with or linked to those on site)	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 limited ecological value e.g. amenity grassland or hard standing.

Effect magnitude

- 9.61 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 Office of the Deputy Prime Minister (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, integrity for non-designated areas has been defined 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.
- 9.62 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. Changes may be adverse or beneficial. The magnitude of effects is also dependent on their timing and/or frequency of

³⁵ Site of Nature Conservation Importance. Locally important sites of nature conservation adopted by local authorities for planning purposes.

³⁶ Sites of Importance for Nature Conservation. Locally important sites of nature conservation adopted by local authorities for planning purposes.

³⁷ Local Wildlife Sites. Locally important sites of nature conservation adopted by local authorities for planning purposes.

occurrence, and whether they can be reversed. These factors are all components of ecological effect magnitude.

9.63 Effect magnitude can be high, medium, low, or neutral. A summary of this approach is provided in Table 9.3.

Table 9.3: 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 those that are 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 usually 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.
<i>Beneficial</i>	<i>The changes in the ecological receptor are considered to be beneficial.</i>

9.64 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 9.4). 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.

9.65 Unless otherwise stated, effects described in the chapter are adverse.

Table 9.4: Matrix for Determining Significance of Ecological Effects

Effect Significance Level		Magnitude of Effect (Beneficial or Adverse)			
		High	Medium	Low	Neutral
Value/sensitivity of ecological receptor	International	Major	Major	Moderate	Negligible
	National	Major	Moderate	Moderate	Negligible
	Council	Moderate	Moderate	Minor	Negligible
	District	Moderate	Minor	Minor	Negligible

Effect Significance Level		Magnitude of Effect (Beneficial or Adverse)			
		High	Medium	Low	Neutral
	Neighbourhood	Minor	Minor	Negligible	Negligible
	Less than Neighbourhood	Minor	Negligible	Negligible	Negligible

Baseline Conditions

Current Baseline

9.66 This section details the findings of the ecological baseline surveys conducted within the site and relevant buffer zones.

Sites Designated for Nature Conservation

9.67 Statutory and non-statutory designated nature conservation sites within 10 km of the site are shown in Figure 9.2. There are no statutory or non-statutory designated sites within the site boundary.

9.68 The Langholm and Newcastleton Hills Special Protection Area (SPA), is located 8.1 km to the north-east of the site. This SPA is designated for a breeding population of hen harrier *Circus cyaneus*, regularly supporting over 2.7% of the British population of this species. This site is also designated as the Langholm and Newcastleton Hills Site of Special Scientific Interest (SSSI), and its designated features cover a mosaic of upland habitats (including blanket bog), and its breeding bird assemblage (including hen harrier).

9.69 The Raeburn Flow Special Area of Conservation (SAC) is located 5.3 km to the south of the site and is designated for the active and degraded raised bog that it supports. It is also designated as a SSSI.

9.70 Three further SSSIs are located with 10 km of the site, two of which are designated for geological features. The third, the Bells Flow SSSI, is located 1 km to the south of the site, and is designated for its good examples of raised bog in the Annandale and Eskdale area (see Figure 9.2).

9.71 Four Local Wildlife Sites (LWSs) are located within 10 km of the site, all supporting areas of raised bogs. The nearest of these sites to the proposed wind farm is Cadgill Flow LWS, located 3.5 km to the south. Greenwrae Flow LWS, Cowgarth Flow LWS and Burtnfoothill Moss LWS are located 5.2 km, 5.6 km and 4.9 km away from the site boundary respectively.

9.72 There are no Scottish Wildlife Trust Reserves within 10 km of the site.

9.73 There are three areas of woodland classified on the SNH Ancient Woodland Inventory as ‘ancient, of semi-natural origin’ within a 500 m buffer of the site. These are Palling Wood, the woodland adjacent to the Woodside Burn immediately north of Solwaybank Farm, and the woodland immediately south of the unclassified road close to Woodside Farm (Rigg Bottom).

Habitats

9.74 The Phase I Habitat Map is shown in Figure 9.3. In total, 45 habitat types were identified within the site, including woodlands, grasslands, heathlands, mires, open water habitats and man-made habitats. A full report of the NVC survey, including maps, is provided in **Appendix 9.1: Botanical Appendix**. The following paragraphs summarise the habitats present on site based on the Phase 1 survey.

Woodlands

9.75 Woodland habitats dominate the north-west part of the site, with additional small areas in the south. In total, woodland habitats account for 251.8 ha (37.6%) of the site, the vast majority of which (227.8 ha) is coniferous plantation woodland, mainly comprising mature Sitka spruce *Picea sitchensis*. Felled areas were classified as recently felled coniferous plantation woodland, covering a further 20.7 ha. A small extent of broad-leaved plantation woodland (3.33 ha) comprising mostly sycamore *Acer pseudoplatanus* was recorded within the coniferous plantation.

9.76 Small areas of scattered scrub/bracken mosaics were recorded on drier areas of south facing slopes, mainly in the enclosed fields around Woodside Farm and account for less than 1% of the site.

9.77 Woodland habitats are described further in **Appendix 9.1: Botanical Appendix**.

Grasslands

9.78 Grassland habitats cover a total of 151.1 ha, representing 22.5% of the site.

9.79 Marshy grassland was the most common grassland type, accounting for 11.4% of the site. This habitat was recorded in an extensive area of heavily grazed, wet fields in the south of the site where it forms relatively species-poor stands dominated by soft rush *Juncus effusus*. Swathes of marshy grassland were also recorded along the upper corridor of the Palling Burn where the grassland was richer and in places dominated by sharp-flowered rush.

9.80 In terms of the NVC, the marshy grasslands are represented by the following communities:

- M23a *Juncus effusus/acuteiflorus* - *Galium palustre* rush pasture - *Juncus acuteiflorus* sub-community;
- M23b *Juncus effusus/acuteiflorus* - *Galium palustre* rush pasture - *Juncus effusus* sub-community.

9.81 In places, a type of marshy grassland is present that does not correspond with any NVC community, where tall tussocks of *Juncus effusus* are abundant and are growing with a shorter acid grassland or other rush vegetation. It is common in heavily grazed areas.

9.82 The marshy grasslands on site frequently form a mosaic with other habitats in areas where there is a transition between wetter ground and drier areas. A marshy grassland/unimproved acid grassland mosaic (11.0 ha) was frequently recorded on the margin between enclosed fields and the open upland habitats. A marshy grassland/semi-improved acid grassland mosaic (42.6 ha) was recorded in a number of wetter fields with significant grazing pressures leading to a patchwork of the two habitats. Mosaics of marshy grassland/acid grassland and neutral grassland (0.4 ha) and marshy grassland/semi-improved neutral grassland (4.6 ha) were recorded in the northern part of the site, generally associated with the road verges. Small areas of marshy grassland/continuous bracken mosaics (0.8 ha) were recorded on the hummocky slopes around the Palling Burn.

9.83 Acid grassland was frequently encountered at Solwaybank, and included unimproved acid grassland (3.3 ha) in limited small patches on the open hillside and semi-improved acid grassland (11.9 ha,) in enclosed fields around Pingle Farm. In addition, a small extent (0.4 ha) of acid grassland/semi-improved neutral grassland mosaic was recorded in the upper reaches of the Pokeskine Sike. In terms of the NVC, the acid grassland on site are represented by the following communities:

- U4a and b *Festuca ovina* - *Agrostis capillaris* - *Galium saxatile* grassland;
- U5a and c *Nardus stricta* - *Galium saxatile* grassland;

- U6a and d *Juncus squarrosus* - *Festuca ovina* grassland.

9.84 The U4 grasslands are widely but thinly scattered, found on well drained soils with gentle to moderate slopes. Where the U4b community is present, there is an indication that the grassland has been subject to historical agricultural improvement. U5 and U6 communities typically occur on the damper soils across the site in association with other habitats such as bog and marshy grassland.

Heathland Habitats

9.85 Heathland habitats are limited in extent within the site, covering 16.8 ha. The key areas of wet heath are west and east of Allfornought Hill (9.2 ha, 1.4% of the site). This is typically of the M15d *Trichophorum cespitosum* - *Erica tetralix* wet heath, *Vaccinium myrtillus* sub-community; a grassy form of wet heath with clear evidence of animal browsing.

Mire Habitats

9.86 Large unfragmented areas of mire habitats were recorded on the open hillside around Allfornought Hill, totalling an area of 200.2 ha (30.0 % of the site).

9.87 Blanket bog is the most common mire habitat at Solwaybank, accounting for 127.4 ha, 19.0% of the site. It covers large areas of flat ground on the hill tops, north and south of the Palling Burn and is closely linked to areas of deeper peat. The blanket bog areas typically support a dense *Sphagnum* layer including *Sphagnum papillosum* and *Sphagnum magellanicum*. The blanket bogs around Allfornought Hill and to the east of the fenceline leading north from Allfornought Hill are particularly diverse and botanically rich, with thick layers of abundant *Sphagnum* mosses and frequent occurrence of bog rosemary *Andromeda polyfolia* and cranberry *Vaccinium oxycoccos*. Blanket bog habitat to the west of this fenceline and north of the Palling Burn is much more heathery but still supports frequent hare's-tail cottongrass *Eriophorum vaginatum*, *Sphagnum* species and hypnaceous mosses.

9.88 In terms of the NVC, the blanket bogs within the site are represented by the following NVC communities:

- M18 a and b: *Erica tetralix* - *Sphagnum papillosum* blanket mire;
- M19a: *Calluna vulgaris* - *Eriophorum vaginatum* blanket mire.

9.89 The vast majority of blanket bog belongs to the M18b sub-community, with smaller areas of the wetter M18a community which is distinguished by an almost continuous carpet of Sphagna. M19 blanket bog is limited in extent, and is only found in one small area in the north-west of the site.

9.90 Dry modified bog was recorded on the south eastern slopes of the site, covering a total of 19.9 ha. The term 'modified' is somewhat misleading as this bog type tends to occur as a transitional habitat on slopes over thinner peat. The dry modified bog is dominated by hare's-tail cottongrass, with abundant *Sphagnum fallax* and only occasional heather *Calluna vulgaris*. In terms of the NVC, this habitat type is classified as M20b *Eriophorum vaginatum* blanket mire, being dominated almost exclusively by hummocks of hare's-tail cottongrass. Where the dry modified bog in which hare's-tail cotton grass is the most abundant species also has enough other species typical of the M18 community, it has been classified as an intermediate between M18 and M20.

9.91 Due to its position as a transitional habitat, dry modified bog was also recorded as a mosaic with blanket bog where peat was still patchily deep in flatter areas and hollows.

9.92 Wet modified bog covers 2.7% (17.9 ha) of the site and was recorded as a discrete area bounding the south-east of the coniferous forest as well as in other smaller areas across the site. In terms of the NVC, this habitat type is classified as M25a and b *Molinia caerulea* - *Potentilla erecta* mire. Heather cover is reduced in this habitat type, and the dominant species is purple moor-grass *Molinia caerulea*, often covering extensive areas, as well as fairly consistent hare's-tail cottongrass, with few other species. This habitat is likely to have been derived from bog vegetation as a result of grazing and burning.

9.93 Further areas were classified as a mosaic of blanket bog and wet modified bog. These habitats were often intermediate between the M18 and M25 mires, with many of the species of the M18 and mires such as heather, cross-leaved heath *Erica tetralix*, cranberry and bog asphodel *Narthecium ossifragum* being present under a dense cover of purple moor-grass.

9.94 A small area of wet modified bog/dry heath mosaic (0.03% of the site) was recorded along the forestry access track in the northern part of the site, associated with peat side castings along the track. In addition, various mosaics of modified bog types and grassland habitats types were recorded within the forestry wayleaves, including wet modified bog/marshy grassland/acid grassland mosaic (2.5 ha), wet modified bog/dry modified bog mosaic (1.1 ha), wet modified bog/dry modified bog/marshy grassland mosaic (7.3 ha) and wet modified bog/marshy grassland mosaic (2.1 ha).

9.95 Small areas of acid flush (0.6 ha) are located in the headwaters of the Palling Burn and its tributaries. This habitat type comprises a combination of rushes and/or sedges over a thick layer of *Sphagnum* mosses and *Polytrichum commune*. In terms of the NVC, the majority of acid flushes within the site are classified as M6 *Carex echinata* - *Sphagnum fallax/denticulatum* mire. Three separate sub-communities are present including those where rushes (*Juncus effusus* and *Juncus acutiflorus*) are present on a carpet of *Sphagnum* and one community where the sedge *Carex echinata* is present with *Sphagnum* mosses. Further details can be found in the **Appendix 9.1: Botanical Appendix**.

9.96 In one small location, east of Solwaybank Farm, and marked on the OS base map as a spring, an area of M37 *Palustriella* - *Festuca rubra* spring was recorded. This spring is dominated by the moss *Palustriella commutata* with smaller amounts of other mosses as well as a sparse vascular flora.

Other Habitat Types

9.97 A total of 4.4 ha (0.7%) of land is covered in continuous bracken habitat, restricted to steep valley slopes of the Palling Burn. In the middle reaches of this burn, sparse tree growth was recorded over bracken stands and such areas were classified as continuous bracken with scattered broad-leaved trees, covering an area of 1.5 ha (0.2%). Much of the bracken dominated areas corresponded with the U20 *Pteridium aquilinum* - *Galium saxatile* community where bracken occurs over a short acid grassland.

9.98 A small field of unharvested crops, classified as arable land was recorded in the north of the site, adjacent to the forestry track. Open water habitat, represented by fire ponds within the forested part of site and by two fishing ponds close to Woodside Farm, cover 0.2 ha.

9.99 Man-made habitats found within the site included forestry access tracks and hardstanding (5.56 ha) and buildings (0.3 ha).

Groundwater Dependent Terrestrial Ecosystems

9.100 SEPA has recently introduced Groundwater Dependent Terrestrial Ecosystems (GWDTEs) into their remit. SEPA currently defines GWDTEs on the basis of specific NVC communities. SEPA Guidance Note 4 (LUPS-GU4)³⁸ provides a table detailing the definition of GWDTEs as per the NVC. These include a number of mire, flush, swamp, grassland and wet woodland communities.

9.101 A Phase I Habitat Map for the proposed wind farm is provided in Figure 9.3 and an NVC map for Solwaybank is provided in **Appendix 9.1: Botanical Appendix**. Table 9.5 provides details of the habitats present on site and their UK Groundwater Dependency Score. A few generalisations can be made with regards the potential GWDTEs that are present on the site:

- Much of the non-wooded habitat within the vicinity of the infrastructure on site is classified as M18 blanket bog. This habitat is considered to have a low dependency on groundwater and therefore has a low sensitivity to changes to the groundwater system. The small patches of M25 blanket bog on site have generally been derived from areas of M18 which have experienced heavier grazing and burning pressures. M25 is considered to be a GWDTE with moderate dependency on groundwater.
- The corridor of the Palling Burn comprises a mosaic of habitats, the majority of which are considered to be GWDTEs including M25 mire, M23 rush-pasture, M6 flushes and small patches of wet heath. M6, M15 and M23 all have a high dependency on groundwater and are GWDTEs.
- The route of the access track from Pingle Farm passes through rough grazing fields in its lower section. In places, these fields are wetter and there are areas of M23 and MG10 rush pasture, both of which are GWDTEs.
- The forest rides generally comprise mosaics of habitats similar to those in the Palling Burn corridor. In particular, there are extensive areas of M25 mire which is GWDTE.

Valuing Ecological Receptors

9.102 Using the ecological criteria for establishing the level of sensitivity/value of a receptor (see Table 9.2), the value and GWDTE status of all potentially affected habitat types within the site are summarised in Table 9.5.

Table 9.5: Ecological Value and Groundwater Dependency of Phase 1 Habitat Type.

Habitat & NVC communities	Level of Ecological value	Area (ha) within the Development boundary (% of Site)	Description
Access track and hardstanding (No corresponding NVC community)	< Neighbourhood	5.3 (0.8%)	Value: Habitat of low ecological value. Groundwater Dependency: No dependency on groundwater.

Habitat & NVC communities	Level of Ecological value	Area (ha) within the Development boundary (% of Site)	Description
Acid flush (M6 sub-communities and M37)	National	0.6 (0.1%)	Value: Acid flushes within the site are primarily NVC community M6, which is listed as a Priority Habitat in the UK BAP for upland flushes, fens and swamps. Upland springs and flushes are listed as local priority habitats in the Dumfries and Galloway Local Biodiversity Action Plan (LBAP). Although limited in distribution within the site, these flushes are important as part of the hydro-ecological functioning of the site. Groundwater Dependency: Acid flushes (M6 and M37) have a high dependence on groundwater (UK groundwater dependency score of 1)
Acid grassland/semi-improved neutral grassland (U4, U5 and U6 with Mg1 and MG5)	District	0.4 (0.6%)	Acid grasslands are listed as local priority habitats in the Dumfries and Galloway LBAP. Whilst their mosaics with bracken habitats are commonplace and widespread habitats, they are of value for a number of typical faunal species.
Blanket bog (M18 sub-communities and some M19)	International	127.4 (19.2%)	Value: Active blanket bog is a Priority Habitat under Annex 1 of the EC Directive 92/43/EEC on the Conservation of Natural Habitats and Wildlife Fauna (The Habitats Directive). Blanket bog on site is mainly represented by the M18 community, which is listed under the description for blanket bog in the Directive. It is also a priority habitat in the UK BAP and included as a local priority habitat in the Dumfries and Galloway LBAP. Groundwater Dependency: M18 has a low groundwater dependency (UK groundwater dependency score of 3). At the site, in places, it is found as a mosaic with M25 which has a moderate dependency on groundwater.
Blanket bog/wet modified bog mosaic (M18 and M25 sub-communities)	National	2.8 (0.4%)	Value: Active blanket bog is a Priority Habitat under Annex 1 of the EC Directive 92/43/EEC on the Conservation of Natural Habitats and Wildlife Fauna (The Habitats Directive). Mosaics of blanket bog are considered to have resulted from some modification of more pristine blanket bog. Despite this, the habitats are still of value as part of the upland habitat mosaic and are considered to be of at least national value. Groundwater Dependency: See above for blanket bog.
Broad-leaved plantation woodland (W8 and W11 communities)	Neighbourhood	3.3 (0.5%)	Value: A common and widespread habitat. Groundwater Dependency: No dependency on groundwater.

³⁸ SEPA (2010). *Land Use Planning System (SEPA Guidance Note 4). Planning Guidance on Windfarm Developments*. SEPA

Habitat & NVC communities	Level of Ecological value	Area (ha) within the Development boundary (% of Site)	Description
Coniferous plantation woodland (No corresponding NVC community)	Neighbourhood	227.8 (34.3%)	Value: A common and widespread habitat displaying limited botanical and structural diversity, with low ecological value. Groundwater Dependency: No dependency on groundwater.
Dry modified bog (M20 sub-communities)	National	19.9 (3.0%)	Value: The key NVC type, M20, is listed as a UK BAP broad habitat type. 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. At the site, it forms a mosaic with a number of other habitat types which are included in the Dumfries and Galloway or UK BAP or forms a mosaic with more degraded or dried out patches of blanket bog. Groundwater Dependency: M20 has a low groundwater dependency score (3). At the site, it is found in a mosaic with U4 and U5 acid grassland, both of which also have a low dependency on groundwater, as well as U6 (moderate groundwater dependency)
Dry modified bog / acid grassland mosaic (M20 with a mosaic of U4, U5 and U6 habitats)	National	12.7 (1.9%)	
Marshy grassland (M23 sub-communities)	Council - National	76.2 (11.4%)	Value: The marshy grasslands present on site include M23a and M23b NVC communities. They are generally good quality and relatively species rich. Purple moor-grass and rush pastures are included in the UK BAP and Dumfries and Galloway LBAP. This habitat type is frequent within the site on its own and as part of habitat mosaics and is also of value for a number of typical faunal species. Its value on site is considered to range between council and national with richer stands, which have not been invaded by neutral and acid grassland falling under the classification of purple-moorgrass and rush pastures included in the UK BAP definition. Groundwater Dependency: M23 communities have a high dependency on groundwater (UK groundwater dependency score of 1). At the site, they are found in mosaics with habitats with no groundwater dependency (MG1, MG6 and MG7), low groundwater dependency (MG5, U4, U5 and U6) and moderate groundwater
Marshy grassland/acid grassland mosaic (M23, MG9, MG10 & U4, U5 & U6 mosaic)	Council - National	11.0 (1.66%)	
Marshy grassland/acid grassland/neutral grassland (as above with MG1, MG5, MG6 and MG7)	Council - National	0.40 (0.1%)	
Marshy grassland/semi-improved neutral grassland mosaic (as above with MG1 and MG5)	Council - National	4.6 (0.7%)	

Habitat & NVC communities	Level of Ecological value	Area (ha) within the Development boundary (% of Site)	Description
Marshy grassland/tall ruderal/ scattered broad-leaved trees (as above with a variety of NVC types)	Neighbourhood	1.7 (0.3%)	dependency (MG9, MG10 and U6).
Recently felled coniferous plantation woodland (No corresponding NVC community)	>Neighbourhood	20.7 (3.1%)	Value: A short term-degraded habitat as a result of felling operations. Groundwater Dependency: No dependency on groundwater.
Semi-improved acid grassland & semi-improved acid grassland/marshy grassland mosaic (M23 with U4, U5 and U6)	Council	10.1 (1.5%) (semi-improved acid grassland)	Value: Acid grasslands are listed as local priority habitats in the Dumfries and Galloway LBAP. Whilst being commonplace and widespread habitats, they can be botanically diverse and provide important cover and forage for bird species. Groundwater Dependency: Acid grasslands have variable groundwater dependency (U4 & U5 low dependency, U6 moderate dependency). M23 has a high groundwater dependency (UK groundwater dependency score of 1).
		38.0 (5.7%) (semi-improved acid grassland/marshy grassland mosaic)	
Unimproved acid grassland (U4, U5 and U6 NVC communities)	Council	3.3 (0.5%)	Value: Acid grasslands are listed as local priority habitats in the Dumfries and Galloway LBAP. Whilst being commonplace and widespread habitats, they can be botanically diverse and provide important cover and forage for bird species. Groundwater Dependency: U4 and U5 both have low dependency on groundwater (dependency score of 3). U6 is moderately dependent on groundwater.
Wet heath (M15 sub-communities)	International	9.2 (1.4%)	Value: Wet heath (NVC community M15) is a Priority Habitat under Annex 1 of the EC Directive 92/43/EEC on the Conservation of Natural Habitats and Wildlife Fauna (The Habitats Directive). It is also a priority habitat in the UK BAP and a local priority habitat in the Dumfries and Galloway LBAP. Within the site, it is present as relatively discrete, unmodified stands and is important as part of the wider ecological mosaic. Groundwater Dependency: M15 is moderately dependent on groundwater with a score of 2. At the site, it also forms a mosaic with U6 (moderately dependent) and U4 and U5 (low dependency on groundwater).

Habitat & NVC communities	Level of Ecological value	Area (ha) within the Development boundary (% of Site)	Description
Wet heath/acid grassland mosaic (M15 sub-communities with U4, U5 and U6)	National	5.9 (0.9%)	Value: This is a degraded form of wet heath which is starting to exhibit signs of over-grazing and succession to grassland. This habitat is important due to its position in the ecological mosaic and potential ecological value if factors contributing to its modification are managed and reduced allowing it to be restored to a condition comparable undisturbed areas of wet heath. Groundwater Dependency: See above.
Wet modified bog (M25 sub-communities)	National	17.9 (2.7%)	Value: The key NVC type, M25, is listed as a UK BAP broad habitat type. 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. At the site, it forms a mosaic with a number of other habitat types which are included in the Dumfries and Galloway or UK BAP. Groundwater Dependency: M25 has a UK groundwater dependency score of 2 (moderately dependent on groundwater). At the site, it forms a mosaic with a number of habitat types including those with no groundwater dependency (H12), those with low groundwater dependency (M20, U4 and U5), a single habitat type with moderate groundwater dependency (U6) and a single habitat type with high dependency (M23).
Wet modified bog/dry heath (M25 with H12)		0.2 (0.03%)	
Wet modified bog/marshy grassland/acid grassland (M25 with M23 and U4, U5 and U6)		2.5 (0.4%)	
Wet modified bog/dry modified bog mosaic (M25 - M20 mosaic)		1.1 (0.2%)	
Wet modified bog/dry modified bog/marshy grassland mosaic (M25, M20, M23 mosaic)		7.3 (1.1%)	
Wet modified bog/marshy grassland mosaic (M25 & M23 mosaic)		2.1 (0.3%)	
Other unaffected habitats	<Neighbourhood - National	51.2 (7.7%)	Various habitat types within the site boundary which will not be affected by the proposed wind farm including bracken dominated habitats, scrub and arable areas.
TOTAL		663.4 (100%)	
Streams and rivers	Council	16,487 m	Watercourses are included in the Dumfries and Galloway Local BAP.

Upland Land Management Impact Survey (ULMIS)

- 9.103 Full details of the ULMIS survey are provided in **Appendix 9.1: Botanical Appendix**. Table 9.6 provides a summary of the findings of the assessment.
- 9.104 The eastern part of the site, which is non-forested, is grazed by cattle and sheep and low to moderate level grazing, burning and drying effects were generally recorded across much of the blanket bog habitat, regardless of NVC type. Where there are small areas of non-bog habitat (acid grassland, and wet heath) these are being preferentially grazed and are showing moderately high effects from grazing pressures. Burning intensity was generally found to be low within the site, although a number of areas outwith the boundary are being burned with much higher intensity. Although burning is low intensity, the bog vegetation exhibits signs of moderate frequency of burning. Drainage channels are evident across much of the blanket bog plateau, and in some areas, drains are spaced at less than 20 m apart. Drying effects across the bog are therefore moderate or moderate to low, dependent on drain spacing.
- 9.105 It should be noted that despite the range of effects across the blanket bog on site, if the bog areas were assessed according to the Common Standards Monitoring system (used to assess SSSIs), much of the bog would be assessed as being in favourable condition (**Appendix 9.1: Botanical Appendix**).
- 9.106 The majority of other habitats on site were principally assessed in terms of grazing effects. All grassland types on site are showing signs of at least moderate grazing and trampling effects, and for most areas, this impact level was high. The small areas of grassland within the extensive areas of blanket bog are likely to experience a disproportionate amount of grazing. Similar patterns of grazing were seen on the flush and heathland habitats on site.

Table 9.6: Summary of ULMIS Survey Results³⁹

NVC Type	ULMIS Criteria Used	Grazing, Browsing & Trampling	Burning Intensity	Burning Frequency	Drying & Peat Loss	Agricultural Improvement
H12a	Dwarf shrub heath	L - M	n/a ⁴⁰	L - M	n/a	n/a
H12c	Dwarf shrub heath	M (M - H)	n/a	n/a	n/a	n/a
M6 & M23	Flush	L - M (M)	n/a	n/a	n/a	n/a
M15d	Dwarf shrub heath	M (M- H)	L	n/a	n/a	n/a
M18a	Blanket bog	L - M	L	L - M	L - M	n/a
M18b	Blanket bog	L - M	L	M	M	n/a
M18 - 20	Blanket bog	M - H	L - M	M	L - M	n/a
M18x ⁴¹	Blanket bog	L - M	L - M	L - M	L - M	n/a

³⁹ L = Low impacts; M = Moderate impacts; H = High impacts. Ratings in brackets indicate where a more subjective assessment of impact class was carried out by surveyors, where the most frequent impact class resulting from the ULMIS assessment does not quite match the one which is likely to apply based on a more general subjective assessment.

⁴⁰ n/a - assessment criteria not applicable to habitat type.

⁴¹ M18x and M18y are types of M18 NVC communities but did not fit with the defined sub-communities - further detail is provided in the botanical appendix.

NVC Type	ULMIS Criteria Used	Grazing, Browsing & Trampling	Burning Intensity	Burning Frequency	Drying & Peat Loss	Agricultural Improvement
M18y	Blanket bog	L - M	L - M	L - M	L - M	n/a
M19a	Blanket bog	L - M	L	M	M	n/a
M25a	Blanket bog	M	L	M	L - M	n/a
M25b	Tussock grassland	M - H	L	n/a	n/a	n/a
M37	Flush	M	n/a	n/a	n/a	n/a
MG5	Smooth grassland	M (M - H)	n/a	n/a	n/a	L
MG6 & MG7	Smooth grassland	M - H (H)	n/a	n/a	n/a	H
MG9 & MG10	Tussock grassland	M (M - H)	n/a	n/a	n/a	n/a
U4a	Smooth grassland	M (H)	n/a	n/a	n/a	L
U4b	Smooth grassland	M (H)	n/a	n/a	n/a	M
U5 & U6	Tussock grassland	M - H (H)	L	n/a	n/a	n/a
Je	Tussock grassland	M	n/a	n/a	n/a	n/a

Otter

Historical Records

9.107 Three historical records of otter were found within 5 km of the site:

- a record from 1991 on the Kirtle Water at Fallford, 500 m downstream of the site;
- a record from 1991 on the Kirtle Water at Craigs, 1 km downstream of the site;
- a record from 1991 on the Bigholm Burn at Bloch Farm, 3 km downstream of the site.

Field Survey Results

9.108 The findings of the otter survey are shown on Figure 9.4. Evidence of otter activity was recorded on the Pingle Sike, the Palling Burn and its tributaries, the Hallsike Burn, the Muir Burn, tributaries of the Pokeskine Sike and around a number of fire ponds in the coniferous woodland.

9.109 In total, four otter shelters were recorded, all associated with the lower reaches of the Palling Wood and its tributaries. All of these shelters were classified as lie-ups (daytime resting shelters without breeding potential). Two shelters recorded on the Palling Burn, and a shelter on the lower reaches of an unnamed tributary of the Palling Burn, were cavities located under overhanging bank or tree root systems. The fourth lie-up was recorded under a small wooden bridge in the upper reaches of this tributary. Use of the shelters by otter (at the time of survey) was confirmed by presence of otter spraint(s).

9.110 In addition to confirmed otter shelters, five potential otter shelters were recorded, all associated with the lower reaches of the Palling Burn and its tributaries. Four of these shelters were classified as potential lie-ups, and the fifth was classified as potential holt, comprising of a tunnel leading into a stream bank. Whilst of all the potential shelters were considered suitable for otter use, no evidence of otter use was recorded at these locations.

9.111 A total of five sprainting locations were recorded on the lower reaches of the Palling Burn and its tributaries. All of these sprainting locations were downstream of the northern edge of Palling Wood with no evidence of otter upstream of this point. A staggered waterfall, rising 10 m, was noted on the edge of the woodland.

9.112 Signs of otter activity on the Pingle Sike were limited to six spraints at a single location under Pingle Bridge. There was no sprainting evidence to indicate that otters use the watercourse further upstream.

9.113 A single spraint was noted on the Gowdmuir Sike and on an un-named tributary of the Pokeskine Sike south of the Gowdmuir Sike. Several spraints were also recorded around the fire pond close to this un-named tributary and at two other fire ponds at Keppock Rig and to the west of Haggy Hill.

9.114 Further sprainting activity (at four sprainting locations) was recorded on the Muir Burn draining east of the site.

Discussion

9.115 The majority of watercourses on the site do not appear to be used by otter. The sections of the Hallsike Burn and the Alder Well that fall within the site are all narrow watercourses, being little more than drainage ditches. They offer virtually no shelter opportunities for otter and it is likely that they do not support fish populations in their upper reaches.

9.116 The Palling Burn is the main watercourse on site and otter are active on the lower reaches, from the northern edge of Palling Wood downstream, where overhanging banks, tree root cavities and in places rocky banks provide shelter opportunities for the species. The waterfall at the upper end of Palling Wood is likely to create a barrier to the movement of fish species, and beyond this point, no evidence of otter was identified, suggesting that the upper stretch of the burn does not offer suitable foraging and shelter opportunities for the species.

9.117 Low levels of otter activity in the northern part of the site on the Pokeskine Sike, Gowdmuir Sike and one unnamed tributary suggest that there are suitable foraging opportunities in this area. However, no shelters were recorded and it is likely that otters are more active on the Kirtle Water downstream, where there may be better foraging and shelter opportunities.

Badger

Historical Records

9.118 No detailed records of sett locations were available. However, records show that badger activity has been recorded within the Chapelknowe, Waterbeck and Eaglesfield areas, all within 5 km of the site.

Field Survey Results

9.119 No maps or details of identified badger sett locations are provided in this chapter due to animal protection issues associated with the persecution of badgers. A Confidential Annex containing this information has been submitted to SNH and Dumfries and Galloway Council.

Discussion

9.120 A full discussion of badger activity at the site is provided in **Appendix 9.3: Badger Survey (Confidential Appendix)**. Badger was found to be active across the site. In particular, high levels of badger activity were recorded in areas of coniferous plantation woodland where trees had been planted on drier soils rather than peat. These areas fall outwith the proposed wind farm infrastructure areas i.e. they will not be directly affected by construction activity. Other evidence of badger activity in the forested part of the site was concentrated along the woodland edge with activity and setts also recorded in the enclosed pasture within, and adjacent to the site. No signs of badger were recorded on the higher unenclosed moorland area.

9.121 It is likely that the lower altitude parts of the site provide an optimal mix of habitats suitable for badger shelter and forage, including woodland, areas of dry soil for sett excavation and pasture fields and small woodland coups. These provide good quality foraging with links to badger habitat off site.

Bats

Historical Records

9.122 Within the general south-west Scotland area the following bat species are known to be present:

- common pipistrelle *Pipistrellus pipistrellus*
- soprano pipistrelle *Pipistrellus pygmaeus*
- Nathusius' pipistrelle *Pipistrellus nathusii*
- Daubenton's bat *Myotis daubentonii*
- Natterer's bat *Myotis nattereri*
- whiskered bat *Myotis mystacinus*
- brown long-eared bat *Plecotus auritus*
- noctule *Nyctalus noctula*
- Leisler's *Nyctalus leisleri*

9.123 The Bat Records for Scotland (1970-2007) supplied by Scottish Natural Heritage and accessed on NBN Gateway provided some records including a small number of recordings of general bat species (*Chiroptera* spp.), brown long-eared bats, Daubenton's bat and Pipistrelle species. The records are centred around Waterbeck, Eaglesfield, and Springkell which are all within approximately 4 - 6 km of the west of the site.

9.124 Bat records were also supplied by the Dumfries and Galloway Environmental Resources Centre. A total of 11 records were supplied within a 10 km radius of the site, dating from 1998 to 2008. The majority of these records were from roost sites and included *Chiroptera* (one record); noctule (one record), brown long-eared bat (two records); pipistrelle species (five records); common pipistrelle (one record) and soprano pipistrelle (one record). The closest record was for a pipistrelle bat (unconfirmed species) approximately 2 km to the north-east of the site, with most of the other

records being between 2.4 to 4 km from the site to the south and the west, particularly around the Waterbeck and Craigs area. The noctule record was from Paddockhole, 6 km north-west of the site boundary. The record is from 2007 and was a bat pass, not a roost.

9.125 The 2009 ES⁴² for the site was consulted. Limited bat survey was undertaken and this included a day walk-over survey and two night time transects in September 2005. Activity levels of bats recorded were not high and were restricted to commuting and foraging of common and soprano pipistrelle bats.

Field Survey Results

Roost Survey

9.126 No actual or potential roost sites were identified in buildings within the turbine area. However some potential for roosting bats was noted in the main house and outbuildings at Pingle Farm which, although 1.8 km from the closest turbine, is located at between 20 - 50 m from the proposed access route and could be subject to disturbance. During the dusk survey and Anabat survey at this location, the farmhouse was identified as a roost site for common pipistrelle and potentially Daubenton's bat⁴³.

9.127 The building at Callisterhall was assessed in 2005 in the 2009 ES. No evidence of bats was recorded at the time. The building was not assessed during this round of surveys, as it is located approximately 90 m from the proposed access track and on the opposite side of the B7068, as a result no direct or indirect effects are considered likely and further survey was not considered necessary.

9.128 The bridge under the B7068 was assessed as not having suitability for bat roosts, with no deep cracks or crevices and no signs of bats noted. No other bridge crossings were required to be considered.

9.129 The trees within the main plantation area of the site are predominantly mature sitka spruce or lodgepole pine, and do not have potential to support bat roosts. Away from the main turbine area, a number of trees were noted to have bat roost potential, including a number of mature beech trees and some Scot's pine trees. These include a defunct tree line on the southern boundary of the site, bordering the open moorland, and a number of mature broad-leaved and Scot's pine trees in the wider open rides in the Alder Well area, as well as some mature oak in the walled broad-leaved area, 200 - 300 m south west of Turbine 11 and Turbine 12. No bat roosts were confirmed, but as these trees are outwith the turbine area, survey was limited to a day time assessment only.

Transect Survey Results

9.130 Detailed results of the transect surveys are given in Appendix 9.2 and survey results are shown on Figure 9.5a. The following species of bats were recorded on transects:

- soprano pipistrelle
- common pipistrelle
- Daubenton's bat

⁴² Previous 2009 Solwaybank Environmental Statement

⁴³ A dawn watch survey was not carried out at this location but during the static Anabat survey, a detector was left in place at the farmhouse and provided data on activity before and during the dawn period.

- Natterer's bat

- 9.131 Levels of activity were high across both transect routes and bat activity was recorded on the majority of the timed stops. The highest levels of activity were recorded in August, with similar levels in June and September. The total number of passes for both the north and south transects was as follows: June 197; August 344, and September 180. More passes were recorded on the north transect in June and August and on the south transect in September.
- 9.132 Pipistrelle bats were the most frequent recorded species, and as with the static detector surveys the common pipistrelle bat was more frequently recorded than the soprano pipistrelle bats. The highest levels of activity were recorded around the plantation edges with frequent activity within the plantation and lower levels of activity on the moorland.
- 9.133 Daubenton's bats and other unidentified *Myotis* bats were the next most frequently recorded bats. Some passes from Daubenton's bats were associated with the unnamed watercourses running towards Allfornought farm. Other Daubenton's bat activity was within the plantation and along the edge of the plantation.
- 9.134 Natterer's bats were only recorded in June, with low numbers of passes on both transects in the plantation or on the plantation edge. There were no records of brown long-eared bats or *Nyctalus* bats on the transects.
- 9.135 In summary, the highest levels of activity for all species were recorded along the edges of the main plantation block, with pipistrelle species being by far the most commonly encountered. Natterer's bats were only recorded on rides within the plantation, whereas Daubenton's bats were recorded within the plantation as well as on the open moorland.

Anabat Remote Monitoring Survey

- 9.136 Detailed results of the Anabat remote monitoring survey can be found in **Appendix 9.2**, and summaries of the survey results are shown in Figures 9.5b, 9.5c and 9.5d. Six species of bat were recorded by the Anabat remote monitoring survey:
- soprano pipistrelle
 - common pipistrelle
 - Daubenton's bat
 - Natterer's bat
 - Noctule
 - brown long-eared bat
- 9.137 For a number of other bat recordings it was only possible to identify the call to genus level and these recordings were classified as *Pipistrelle spp.*, *Myotis spp.* or *Nyctalus spp.* It is possible that these recordings could represent species not identified above including whiskered bat and Leisler's bat although no records of these species were identified from NBN or from the Dumfries and Galloway Environmental Records Centre and therefore it is unlikely they would be present.

Anabat Remote Monitoring Survey: Activity Levels

- 9.138 Anabat location numbers are referred to throughout this section and are shown on Figure 9.1b. Anabat survey results are shown on Figures 9.5b, 9.5c and 9.5d.

- 9.139 Activity levels varied between locations but were high throughout much of the site. The location with the highest level of activity was the Pingle Farm location (L2) where 766 passes were recorded on average per night during the May 2011 survey period. This Anabat was located at the edge of a small broad-leaved woodland block, facing a number of old stone outbuildings. It was over 1.8 km from the nearest turbine, but was located in close proximity to the proposed access track.
- 9.140 The location with the second highest level of activity was L3 (West Alder Well fencepost) where 540 passes were recorded on average per night during the May 2011 survey period. This Anabat was located to the south-west of the main plantation block on a wide ride with a number of mature broad-leaved and Scots' pine trees. This location was over 750 m from the nearest proposed turbine but was located on the edge of the proposed felling area.
- 9.141 Activity levels within the main proposed turbine area of the site were much lower, with the highest levels of activity recorded at the plantation edges (L7, L8, L12 and L14 with 235, 242, 218 and 81 average passes per night respectively). Noticeably lower levels of activity were recorded on rides within the conifer plantation (with the exception of L4) and on the open moorland. At the inner plantation locations, (L1, L5, L6, and L11), the recorded average bat passes per night were 87, 33, 92 and 88 respectively. L4 (East Alder Well), located within the plantation (rather than on the plantation edge) was the only exception, with a recorded average of 172 passes per night. This location is close to the East Alder Well Burn.
- 9.142 Activity levels were reduced further at the moorland locations (L9, L10 and L13), with an average of 4, 68 and 36 bat passes per night over the entire survey season.

Anabat Remote Monitoring Survey: Species Distribution/Abundance

Pipistrelle species

- 9.143 The distribution and activity levels of different bat species varied throughout the site, but the common and soprano pipistrelles were the most widespread species, recorded at all 14 locations. Pipistrelle bat species were also the species with the greatest number of bat passes at all locations with the common pipistrelle being by far the more abundant of the two. This contrast was shown most clearly at L7 where 1215 common pipistrelle passes were recorded in total across the survey season, compared to 157 soprano pipistrelle passes and eight Daubenton's bat passes. A higher number of common pipistrelles was the case at all locations with the exception of L11 where soprano pipistrelles were more frequently recorded.

Myotis species

- 9.144 Two *Myotis* bat species were recorded during the static activity surveys: Daubenton's and Natterer's bats, as well as some *Myotis spp.* bats which could not be identified to species level. The Daubenton's bats were the most commonly recorded *Myotis* species, recorded at 13 out of 14 locations. However, despite being recorded at nearly all locations, the numbers of Daubenton's bat passes were considerably lower than pipistrelle passes at the same location. At L6, a total of 55 Daubenton's passes were recorded throughout the survey season, compared to 911 common and 547 soprano pipistrelle passes. Daubenton's activity ranged from as little as 0.4 average passes per night at L5 and L11 to over 239 at Pingle Farm (L2). Within the main turbine area of the site (excluding L2 and L3) the highest levels of Daubenton's activity were recorded next to the main watercourses, at L10 (next to the Palling Burn) and L12 (next to the Collin Burn), where 5.1 and 6.5 passes were recorded on average per night respectively. Natterer's bats were less widespread than Daubenton's bats, being recorded at only six out of the 14 locations. Numbers of passes at each

location were also significantly lower, with the highest total number of passes at any location being five (L6) and the highest average number of passes per night being 0.3 (at L2 and L6).

Plecotus species

9.145 Brown long-eared bats were recorded at 10 of the 14 Anabat locations, but similarly as with Natterer's bats only relatively low numbers of passes were recorded at each location. The location with the highest number of passes was L1 (Gowdmuir ride) with 11 passes in total (an average of 0.6 passes per night), but at all other locations the recorded numbers of passes were between one and seven (between 0.1 and 0.5 average passes per night). Interestingly, the highest numbers of brown long-eared passes were recorded on the forest rides within the plantation as opposed to along the plantation edge.

Nyctalus species

9.146 Noctule bats and unidentified *Nyctalus* species were recorded at seven of the 14 survey locations, but again the number of passes at each location was low with 26 passes from 170 night's worth of Anabat data. The highest number of noctule passes recorded in total at any one location was five (Locations 1 and 3) and the highest number of unidentified *Nyctalus* (either noctule or Leisler's bat) passes was three (at L8).

9.147 Further analysis was carried out on the timing of noctule and *Nyctalus* passes to assess whether they might be roosting within close range of the site. Out of the total of 26 *Nyctalus spp.* and noctule passes, the earliest pass was recorded at the L10 and L6, 29 minutes after sunset. The majority of the rest of the passes were recorded at 37 minutes and 80 minutes after sunset. The latest pass was recorded at 38 minutes before sunrise at L3. Two of the passes indicated commuting along the gas pipeline ride. Noctule and Leisler's bats are early emerging bats which would ordinarily be expected to leave a roost between 0-30 minutes after sunset and sometimes even earlier, flying long distances very quickly after this⁴⁴. The timing and location of the passes of noctule indicate that bats are roosting within the nearby area (within 5 km) but not on site, and commuting across the site from a number of different directions.

Anabat Remote Monitoring: Hourly Analysis of Data

9.148 Overall, although there are peaks of activity at different locations, bat activity levels did not drop off after any fixed period of time. The data show that after approximately 1 - 1.5 hours after sunset and around 1 - 1.5 hours before dawn, activity levels remain relatively constant. Activity levels at each location also did not seem to fluctuate; where they are high, (for example at L3 and L8), they remained reasonably high throughout the night. This pattern of activity would indicate foraging bats rather than commuting bats.

9.149 In addition, the data show that activity from the Anabats on the edge of the plantation, record bat activity earlier than those within the inner areas of the plantation. Further details are provided within Technical Appendix 9.2.

9.150 There were some seasonal differences identified when comparing data from the six Anabat locations that were surveyed in all three survey periods. More activity was consistently recorded in September 2011. For example at L4, a total of 362 passes were recorded in September 2011 compared to 50 in May/June 2011 and 89 in July/August 2011. Some exceptions to this were noted for example at L8 (the east plantation edge) and L10 (the Palling Burn fenceline) where the highest

levels of recorded activity were in July/August. Temperatures during the September survey session were relatively warm for the time of year, which may have contributed to the higher levels of activity. In addition, bats may be foraging further afield after breeding and juvenile bats may increase the bat population levels. Further detail is provided in **Appendix 9.2**.

Commuting watches

9.151 Details of the commuting watches are provided in **Appendix 9.2**. Low levels of bat activity were recorded during the commuting watches, with only one pipistrelle species bat recorded in total. This pass was recorded at L2, 35 minutes after sunset.

Discussion

9.152 Six species of bat and high levels of activity were recorded on many areas of the site. However, the majority of bat passes were from common and soprano pipistrelle bats which are common throughout the UK. *Myotis* bat species, including Daubenton's and Natterer's bats were also widespread across the site, but with much less activity, indicating the presence of far fewer individuals. Very low levels of *Nyctalus* species were recorded, and at fewer locations; this activity is attributed to low numbers of passing individuals. If *Nyctalus* species were using the site to forage rather than just passing through, much higher levels of activity would be expected.

9.153 Other than the roost identified at Pingle Farm, no other roosts were identified on site. However, the timing of the Noctule and *Nyctalus* species passes suggests that bats are roosting in the nearby surrounding area and it is likely that other pipistrelle roost sites may be present within several kilometres of the site.

9.154 Information gathered from the analysis of the timing of bat activity across the site, coupled with the presence of relatively high levels of bat activity at all survey locations, suggests that bats (excluding *Nyctalus* species) are specifically using the site as a foraging habitat and not simply passing through it. Activity at Anabats on the peripheries of the wooded part of the site occurred earlier than locations within the woodland, suggesting bats are commuting into the site to forage. The key areas identified for foraging were L2 (Pingle Farm) and L3 (West Alder Well) where the highest levels of activity were recorded. Both of these locations are some distance away from the turbine locations (approximately 1.8 km and 750 m) respectively and are both associated with areas of broad-leaved woodland.

9.155 Key areas for bat foraging within the main turbine areas were the plantation edge locations as well as L4 (within the plantation on the Alder Well Burn). It is possible that significantly higher levels of activity at L4, compared to all other locations within the plantation itself, can be attributed to bats commuting up the Alder Well Burn from the direction of L3 at the West Alder Well.

9.156 Levels of bat activity recorded on the open moorland suggests that although bats are present and actively using the open moorland, they are not using these areas to forage to the same extent as the forested parts of site. Records are more likely to represent passing bats, foraging as they move across the site. Furthermore, activity levels on the moorland were highest at L10 next to the Palling Burn and lowest at L9 which was over 100 m from the nearest watercourse. This indicates that the Palling Burn (and potentially other watercourses including the Collin Burn) is being used as a commuting route by bats, travelling from roosts within the surrounding area to the plantation in order to forage.

⁴⁴ Waters D., Jones G. and Furlong M. 1999. Foraging ecology of Leisler's bat (*Nyctalus leisleri*) at two sites in southern Britain. *Journal of Zoology*, London. **249** (2): pg 173 - 180

9.157 Despite six species of bat and high levels of activity being recorded, the two most common species i.e. the pipistrelle bats, made up the majority of the activity. Although the less common Noctule bat (and *Nyctlaus* species calls) were recorded, the levels of activity were low and not indicative of high numbers or frequent usage of the site. Despite roost site(s) being present at Pingle Farm, including roosts for pipistrelle and Daubenton's bats, this roost is not located within the main proposed turbine area. No off-site monitoring was undertaken, but the level of bat activity at Solwaybank is not considered likely to be higher than bat activity in the surrounding area within c.10 km of the site, as much of the surrounding landscape supports excellent habitat networks, with pockets of mature woodland, scattered trees, grazed pasture and larger watercourses. Therefore, although the bats at Solwaybank are primarily common and widespread, and there are no roosts in the main turbine area on site, it is assessed as being of Council value to bats.

Red squirrel

Historical Records

9.158 The nearest record at 1 km resolution was from 2000, located east of Grange Fell, approximately 1.5 km to the west of the site. The nearest record at 10 m resolution was from Kirtle Bridge, approximately 3 km to the south-west of the site, dating from 2010. In addition to these, recent grey squirrel records dating from 2008 onwards were available from locations along the B7068 road, within 1-3 km of the site boundary. Squirrel surveys conducted in 2006 for the 2009 ES did not find any signs of squirrels (red or grey) within the forested parts of the site.

9.159 Further red squirrel records obtained from the Dumfries and Galloway Red Squirrels office in 2011, included a 2010 record from within the site. In addition, a sighting of a red squirrel was made in 2011 within the forested part of the site by a surveyor during their fieldwork. No other squirrel sightings or signs were made during the ecological surveys undertaken for this Ecological Impact Assessment.

Discussion

9.160 The incidental sighting of red squirrel, as well as recent records, suggest that the species is present in the forested areas on site. The population size is unknown, although it is likely to be low given the low encounter rate in 2011. It is assumed that the species has colonised the woodland at the site relatively recently, given the lack of historical red squirrel records from the area and the results of previous surveys. Lurz (Lurz *et al.*, 1998)⁴⁵ suggests that the red squirrel density in Sitka spruce coniferous plantations ranges between 0.02 - 0.2 red squirrel per hectare of woodland. The total extent of coniferous plantation woodland within the site is 227 ha, and therefore is expected to support between 5 and 46 red squirrels. Given the likely recent colonisation of woodland by the species and potential competition for resources with grey squirrel, the estimated red squirrel density is likely to be at the lower end of this suggested density range.

Reptiles

Historical Records

9.161 There were no historical records on the NBN Gateway for reptiles on the site. The closest record is that of an adder, dating from 1971 and located on moorland approximately 0.5 km east of the site

⁴⁵ Lurz, P. W. W., Garson, P. J. and Ogilvie, J.F. (1998). *Conifer species mixtures, cone crops and red squirrel conservation*. Forestry, 71, 67-71

boundary. There are numerous other records of adder dating from the 1990s in the Langholm area, approximately 5 km east of the site.

9.162 There are several records of common lizard in the Milltown, Chapelknowe and Canonbie areas, 1-4 km from the site. However, all of these records are relatively old, dating from the 1970s.

9.163 Records show slow-worm to be less common in this area, with the nearest records being around Langholm and Canonbie, 4 km east of the site. Most records are from the 1970s with the most recent being 1992.

Field Results

9.164 Incidental field records of reptiles, limited to common lizard, are shown on Figure 9.6, made whilst carrying out other ecological surveys during 2011. They are associated with habitats along the coniferous woodland edges and rides.

Discussion

9.165 Although the incidental records of reptiles are limited to common lizard, it is likely that the site supports viable populations of common lizard, adder and potentially slow-worm due to its habitat composition. Extensive blanket bog, along with sunny dry banks of bracken and acid grassland, provide ideal basking and foraging habitat, adjacent to reptile shelter habitat provided by heather and bracken. The open 'moorland' habitat in the south-east of the site connects directly with the grassland and mire habitats within the forestry rides, and it is likely that reptiles will also use the rides for foraging and basking, particularly in more sheltered, sunny areas.

9.166 The site is located adjacent to a larger expanse of moorland and rough grazing pasture to the east which also provides suitable habitats for reptiles. There are no barriers such as roads or watercourses separating the site from this potentially suitable habitat, and therefore any reptiles using the site are likely to be part of a wider population.

Fisheries

Historical Records

9.167 Brown trout fry and parr were recorded in the Woodside Burn during electro-fishing surveys conducted by the Environment Agency in July 2006. The Environment Agency, under the National Fisheries Classification Scheme (NFC), has assessed the trout fry status of the Woodside Burn as 'excellent' or 'Class A'. Atlantic salmon were recorded as absent from the Woodside Burn, and the results of the survey indicated that the watercourse is potentially impassable to the species at this location. No lamprey species or crayfish were found during the electro-fishing surveys, although three eels were recorded at the sampling location. The Environment Agency (Penrith office), during the original round of consultation, stated that all burns in the proposed wind farm area are unlikely to be used as salmonid spawning areas as they are located too high within the catchment. There is no new evidence to suggest that this situation has changed.

Habitat Assessment

9.168 Many of the watercourses within the site do not appear to be suitable for fish. The section of the Hallsike Burn and the Alder Well within the site and draining the north-west of the site are

predominantly narrow channels and feature banks of peat with soft rush along the margins. In places, they are deeply incised and ephemeral. In most places, they are narrow (generally less than 0.5 m wide) although periodically they widen, and in places, gravel, pebbles and bedrock can be seen along the channel base. Despite this, large sections are unlikely to provide suitable spawning habitat or other habitat for fish.

- 9.169 The Palling Burn is likely to provide good quality spawning habitat for fish species, including brown trout, in its lower reaches (downstream from the northern extent of Palling Wood). In this lower stretch, there are numerous small pools, gravely riffles and overhanging banks and tree roots providing suitable habitat for this species. Otter spraints recorded in this location show evidence of fish prey. At the northern boundary of the Palling Wood, a staggered waterfall, approximately 10-15 m in length and rising by approximately 10 m, will present a significant barrier to migrating fish species. Although not definitive, beyond this point no signs of otter were recorded and one reason for this may be the limited fish prey in the upper 2 km of the Palling Burn. An access track is proposed to cross the upper reaches of a tributary of the Palling Burn (further details of crossings is provided in Chapter 12: Geology, Hydrology and Hydrogeology). At the proposed crossing point, the burn is a deeply incised peat channel, generally no more than 0.3 m wide. In some places, pebbles and gravel are present on the bed of the stream, but in most places, adjacent bog vegetation hangs over the burn and the bed is predominantly comprised of eroded peat material.
- 9.170 The upper reaches of a number of burns including the Pokeskine Sike and the Gowdmuir Sike drain the north of the site and the upper reaches of the Woodside Burn and Pingle Sike drain the southern boundary of the site. All of these watercourses display some suitability for fish species, with gravely stretches and pools and no obvious obstructions within the reaches that were surveyed.

Discussion

- 9.171 The main watercourse within the site, the Palling Burn, is likely to be inaccessible to fish in its upper reaches, whilst the vast majority of other watercourses within the site are small tributaries of larger watercourses, and appear to have limited suitability. Information provided by the Environment Agency suggests that the site is inaccessible to Atlantic salmon. The main value of the watercourses to fish species therefore appears to be as a ‘feeder’ of larger watercourses downstream such as the Kirtle Water and River Sark, which are known to support a range of fish species. The site is therefore considered to be of council value for fish species.

Valuing Faunal Receptors

- 9.172 Using the ecological criteria for establishing the level of sensitivity/value of a receptor (see Table 9.2) and the analysis of the baseline surveys and data collection, the value of all faunal receptors within the site is summarised in Table 9.7 below.

Table 9.7: Ecological Value of Faunal Receptors

Species	Level of Ecological Value	Description
Otter	International	Otter activity levels indicate that otter are active on a number of watercourses on site with shelters identified on the lower reaches of the Palling Burn. Otter is protected by the EC Habitats Directive. Priority species in the UK BAP and local priority species on the Dumfries and Galloway LBAP.

Species	Level of Ecological Value	Description
Bats	Council	No roost sites were confirmed in the main turbine area, with the closest known roost 1.8 km from the nearest turbine. Bat activity levels on the site are moderately high and suggest widespread use of the plantation area in particular, with lower used of the moorland area. Activity levels are likely to be comparable to the surrounding landscape. All species of bat are protected by the EC Habitats Directive. Of those species recorded on site, soprano pipistrelle, brown long-eared and noctule bats are priority species in the UK BAP and are local priority species in the Dumfries and Galloway BAP along with common pipistrelle, Daubenton’s and Natterers bats.
Badger	National	Badger activity on the site is limited to a drier fields and woodland areas. Badgers are protected by the Protection of Badgers Act (1992) and Nature Conservation (Scotland) Act (2004). Badger is also listed on the Scottish Biodiversity List.
Red squirrel	National	Records of the species indicate that the site is likely to have been recently colonised by the species. Red squirrel is protected under the Wildlife and Countryside Act (1981 as amended) and Nature Conservation (Scotland) Act (2004). Red squirrel is a priority species in the UK BAP and also a local priority species in the Dumfries and Galloway LBAP. As a precautionary approach, red squirrel has been considered as being of national value in this assessment.
Reptiles	National	The site is known to support common lizard and is also likely to support adder. All native reptile species are protected under the Wildlife and Countryside Act (1981 as amended) and Nature Conservation (Scotland) Act (2004). Adder, common lizard and slow worm are Priority species in the UK BAP and adder is a local priority species in the Dumfries and Galloway LBAP. As a precautionary approach, reptiles have been considered as being of national value in this assessment.
Fisheries	Council	No watercourses on site provide high quality habitat for salmonids and the majority of watercourses are unlikely to support any fish species due to their ephemeral nature or barriers located on downstream stretches. European eel is a Priority Species in the UK BAP and also listed as a local priority species in the Dumfries and Galloway LBAP.

Future Baseline (‘Do-nothing’ Scenario)

- 9.173 In the event of the proposed wind farm not being constructed, current grazing and land management practices would continue in the south-east of the site. It is possible that grazing rates may increase over the next 25 years. Further increases in grazing levels could result in the deterioration of the condition of bog habitats within the site boundary.
- 9.174 The forestry in the north-west of the site would continue to be managed under the terms of the long-term forest plan for the woodland. This means that over the next 25 years, the existing forestry will be felled and replanted on a rolling programme. In the absence of Forest Design Plans for the site, it would be expected that the mid 80s plantings that are to be felled in the next five to

15 years will have to take into account the UK Forestry Standard⁴⁶s thereby replanting would have greater species diversity, improved internal and external landscape design and an increased amount of designed open space. The new woodland would therefore have increased conservation value.

Wind Farm Layout Considerations

- 9.175 The final wind farm layout was derived through a series of design iterations which sought to minimise the effects of the proposals on a number of factors, including ecological receptors.
- 9.176 The original wind farm application (2009) included a 21 turbine scheme with turbines distributed equally within the afforested part of the boundary of the site and the open habitats in the east of the site.
- 9.177 The scheme was subsequently reduced to a 15 turbine proposal with ten of the turbines being sited within the afforested area of site, reducing the loss of habitats of higher conservation value such as blanket bog, wet heath and modified bog. Where possible, turbines and infrastructure in the forested part of the site have been sited within the conifer plantation rather than on semi-natural habitats present in rides. Existing access track has also been re-used where possible.
- 9.178 The following buffers relevant to protected species and watercourses were also applied during the constraints mapping exercise to inform the wind farm design:
- Otter shelters - 50 m (considered to be the standard distance within which construction activities may have a potentially detrimental effect on non-breeding otter shelters).
 - Badger setts - 50 m (considered to be the distance within which construction activities may have a potentially detrimental effect on badger setts).
 - Watercourses and Woodland Edges - a 66 m buffer was applied to watercourses and proposed new woodland planting edges to provide a clear 50 m buffer between the edge of the turbine rotor sweep and watercourses or newly planted woodland edges to protect bat flight lines and feeding areas associated with these habitats. This is based on the guidance and formula provided in the Natural England Interim Guidance on Bats and Windfarm Developments and is calculated for a 80 m turbine hub height and 46.5 m blades and based on a 10 m feature height⁴⁷. Only at Turbine 13 was it not possible to fully achieve this buffer with part of the rotor swept edge only achieving a 48 m buffer from the new woodland edge.
- 9.179 This layout was then further refined to micro-site the access tracks and other wind farm infrastructure to reach a design freeze layout which balanced technical and economic requirements with a design sensitive to identified ecological receptors.

Potential Effects

- 9.180 The assessment of effects of the proposed wind farm on ecological receptors is based on the scheme description as detailed in **Chapter 4: Development Description** and is structured as follows:
- assessment of potential construction effects;
 - assessment of potential operational effects; and

⁴⁶ UK Forestry. The Government Approach to Sustainable Forestry . 2004.

[www.forestryresearch.gov.uk/pdf/\\$FILE/fcfc001.pdf](http://www.forestryresearch.gov.uk/pdf/$FILE/fcfc001.pdf)

⁴⁷ The formula is provided in the Natural England advice note (2009). Essentially the required linear distance between the turbine base and the bat flight line feature is calculated based on the buffer required to be maintained between the tip of the blade and the dimensions of the specific turbine that will be constructed. There is no equivalent guidance in Scotland.

- assessment of potential residual effects.

- 9.181 Decommissioning effects are not considered in detail. Effects are considered to be much lower than construction effects and will predominantly be limited to effects within existing infrastructure areas. Provided that pre-decommissioning protected species surveys are carried out, and a decommissioning restoration plan and species protection plan are written and agreed with SNH and the Dumfries and Galloway Council, the effects will be negligible.

Potential Construction Effects

- 9.182 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 proposed wind farm.
- 9.183 Potential direct effects of construction include:
- direct loss or disturbance of habitat through land take for infrastructure construction (turbine bases, access tracks, and site compounds); and
 - direct loss or harm of species through construction activities.
- 9.184 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
 - disturbance effects to faunal species.

Predicted Effects

Designated Sites

- 9.185 Due to the distances between all of the designated nature conservation described at paragraphs 9.67-9.73 and the proposed wind farm site boundary, there are no predicted effects on statutory or non-statutory designated sites.

Habitats

Direct Effects

- 9.186 GIS was used to determine the 'footprint' for the proposed wind farm. This included land-take for the construction of access tracks, turbine bases, crane hardstandings, anemometer mast, temporary parking areas, substation, site compounds etc as detailed in **Chapter 4: Development Description**. However, as a precautionary approach, all wind farm infrastructure components have been buffered by 5m on each dimension to allow for the creation of batters (sloping road verges), sidestepping of excavated material, construction of temporary and/or permanent drainage and general peripheral habitat loss during construction. An overlay of this footprint with the Phase 1 Habitat Map (Figure 9.2) was used to calculate the extent of habitats lost to construction.
- 9.187 As described in **Chapter 4: Development Description**, the land take associated with the proposed wind farm is approximately 8.3 ha. Based on the precautionary approach with buffers applied around the wind farm infrastructure to allow for any additional habitat disturbance, the overall habitat loss is anticipated to be 18.26 ha.

Indirect Effects

- 9.188 Hydrological issues are covered in detail in **Chapter 11: Geology, 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 waterbodies and watercourses. 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'. The causes of bog bursts are complex and not fully understood even by peatland specialists, but the risk of such events is thought to be increased where bog margins have been damaged by cutting or drainage and where the basal adherence of the peat to the bedrock is lessened by steepening of the slope. Removing or disturbing the edges of mire systems can destabilise the hydraulic gradient across the whole bog surface and uncertainties regarding the limits of a hydrological unit on which a mire is dependent means that the distance at which habitat effects can occur can also be uncertain and in cases could be substantial (further details of effects on peat can be found in **Chapter 12 Geology, Hydrology and Hydrogeology** and the associated appendices).
- 9.189 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)⁴⁸, Gilman, (1994)⁴⁹) 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. 10 m from the nearest forestry drain whereas some estimates quote effects occurring up to 50 m from drains (Natural England, 2010)⁵⁰. 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 25 m buffer around the infrastructure footprint. However, it is recognised that this does not account for micro-scale variations in hydrological functioning of bog mesotopes within the infrastructure 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.
- 9.190 Indirect effects are predicted for other water dependent habitats including groundwater dependent ecosystems (GWDEs), as a result of changes to hydrology and drainage. SEPA stipulate that indirect effects on GWDEs are considered for all wind farm developments within a buffer of 250 m from turbines and 100 m from all other infrastructure. In this assessment there has been consideration of all GWDEs within these buffers and NVC maps of habitat types within the buffers are included in the botanical appendix. However, the assessment of effects on GWDEs is based on a 25 m buffer as it was considered unlikely that effects would extend outwith this zone.
- 9.191 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 adverse effects on receiving aquatic and terrestrial habitats, and their associated fauna.

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

Good Practice Habitat Measures

- 9.193 The consideration of effects on habitats is based on good practice measures for the protection of habitats being an integral part of the scheme design. This reflects the current regulatory and planning context relating to wind farm construction. An Ecological or Environmental Clerk of Works (ECoW) will oversee construction to ensure that good practice measures with regards to ecology are implemented. Good practice measures will be implemented as follows:
- 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 and floral species mapping by an ECoW, and designed so as to minimise sheet wash and peripheral habitat disturbance.
 - Outwith forested areas and temporary construction compounds, temporary storage areas for peat and other excavated materials will not be allowed. Excavated materials for turbine bases will be stored on crane hardstanding areas to minimise habitat disturbance.
 - During construction, silt interception traps will be provided to minimise unchecked contaminated run-off. Culverts and up-slope interceptor ditches will be incorporated into the design so that uncontaminated run-off is fed into existing drainage features (further detail is provided in **Chapter 12 Geology, Hydrology and Hydrogeology**).
 - 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 Dumfries and Galloway Council as appropriate (see **Chapter 4: Project Description**).
 - 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 150-250 mm 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 couple of weeks in summer months. Track construction will therefore occur in stages to allow on-going restoration.
 - All felling works will be carried out in accordance with the Forests and Water Guidelines (Forestry Commission, 2003)⁵¹.
 - Wetland vegetation (including blanket bog, marshy grassland, flushes modified bog and wet heath) will not be used to filter silty run-off. These habitats are of high conservation value and are generally saturated so would not be appropriate to absorb and filter run-off.

⁴⁸ Anderson, A.R., Pyatt, D.G. (2000). *Physical and hydrological impacts of blanket bog afforestation at Bad a' Cheo, Caithness: the first 5 years*. Forestry, 73 467-478.

⁴⁹ Gilman, K. (1994). *Hydrology and wetland conservation*. Chichester, Wiley.

⁵⁰ Natural England (2010). *Investigating the Impacts of Windfarm Developments on Peatlands in England*. A report commissioned by Natural England. Number NECR032.

⁵¹ Forestry Commission. (2003). *Forest and Water Guidelines* (4th Edition). Forestry Commission, Edinburgh.

Habitat Effects

9.194 Table 9.9 details construction phase habitat effects prior to mitigation. It is anticipated that 18.3 ha, comprising 23 different habitat types, will be directly lost as a result of the proposed wind farm construction. As indicated by Table 9.9, there will be a loss of approximately 10 ha of broadleaved and coniferous woodland due to the construction of the wind farm infrastructure. In addition, a further 188 ha of forestry will be felled for the scheme, resulting in a total felled area of approximately 198 ha as described in **Chapter 6: Forestry**.

Table 9.9: Summary of Construction Phase Effects on Phase 1 Habitats Prior to Mitigation

Habitat	Level of Ecological Value	Extent of Direct Habitat Loss ⁵²	Estimate of Indirect Effects within 25 m of footprint	GWDE Habitats	Effect Magnitude	Effect Significance
Access track and hardstanding (represents track upgrade and re-use) ⁵³	< Neighbourhood	0.61 ha (3.23%) (excluded from total below)	N/A	N/A	Low	Negligible
Acid grassland/semi-improved neutral grassland	District	0.02 ha (0.11%)	≈ 0.20 ha	yes	Low	Minor
Blanket bog	International	3.80 ha (20.14%)	≈ 9.53 ha	no	High	Major
Blanket bog/wet modified bog mosaic	National	0.06 ha (0.32%)	≈ 0.33 ha	yes		
Broad-leaved plantation woodland	Neighbourhood	0.03 ha (0.16%)	N/A	no	Low	Negligible
Coniferous plantation woodland	Neighbourhood	9.95 ha (52.73%)	N/A	no	Medium	Minor
Dry modified bog	National	0.37 ha (1.96%)	≈ 1.41 ha	no	Medium	Moderate
Dry modified bog /acid grassland mosaic	National	0.36 ha (1.91%)	≈ 1.60 ha	yes		
Marshy grassland and mosaics with	National - Council ⁵⁴	0.92 ha (4.88%)	≈ 2.35 ha	yes	Medium	Moderate

⁵² Percentages and areas refer to habitat loss within the site footprint and do not include the additional 187.1 ha of clear felling.

⁵³ Excluded from totals at the bottom of the table.

⁵⁴ The assessment has been based on national value on a precautionary basis.

Habitat	Level of Ecological Value	Extent of Direct Habitat Loss ⁵²	Estimate of Indirect Effects within 25 m of footprint	GWDE Habitats	Effect Magnitude	Effect Significance
acid grassland, neutral grassland, semi-improved grassland, tall ruderal habitats and broad-leaved trees						
Marshy grassland/tall ruderal/scattered broad-leaved trees	Neighbourhood	0.37 ha (1.96%)	≈ 1.29 ha	yes	Low	Negligible
Recently felled coniferous plantation woodland	Neighbourhood	0.05 ha (0.26%)	N/A	no	Low	Negligible
Semi-improved acid grassland	District	0.13 ha (0.69%)	≈ 0.88 ha	yes	Medium	Minor
Semi-improved acid grassland/marshy grassland mosaic	Council	0.59 ha (3.13%)	≈ 2.07 ha	yes		
Unimproved acid grassland	Council	0.06 ha (0.32%)	≈ 0.19 ha	yes	Low	Minor
Wet heath	International	0.80 ha (4.24%)	≈ 1.94 ha	yes	Low	Moderate
Wet modified bog, including mosaics with dry heath, dry modified bog and marshy grassland	National	0.77 ha (3.14%)	≈ 3.15 ha	yes	Medium	Moderate
TOTAL (all habitats)⁵⁵		18.26⁵⁶ ha	≈ 24.9 ha	≈ 15.4 ha		
Streams and rivers	Council	24 m (@ four new stream crossings)	Low	N/A	Low	Minor

⁵⁵ Excluding access track and hard standing.

⁵⁶ Total area of habitat loss excludes the 0.61 ha of track re-use.

- 9.195 Nearly three quarters of the direct habitat loss comprises just two habitat types: coniferous plantation (52.7%) and blanket bog (20.1%). Marshy grassland habitats account for the third greatest habitat loss, with a total of 1.3 ha of marshy grassland habitat types being directly lost to the scheme (6.8%). Direct loss for all other habitat types is less than 1 ha for each habitat type.
- 9.196 Effects are also predicted for watercourses due to the potential direct loss of stream bed habitats through the construction of four new stream crossings. In total, 24 m of watercourse will be directly lost as a result of culvert construction for the new crossings. Indirect disturbance to the stream bed may also occur as a result of upgrading existing crossings (four in total).
- 9.197 Indirect effects are also predicted for water-dependent habitats (both groundwater and surface water) as a result of changes to hydrology and drainage. SEPA stipulate that indirect effects on GWDTEs are considered for all wind farm developments within a buffer of , 250 m from turbines and 100 m from all other infrastructure. A total of 3.4 ha of GWDTEs will be directly affected and 15.4 ha indirectly affected within 25 m buffer used for indirect effects (see paragraph 9.188). No GWDTEs were considered at risk beyond this distance.
- 9.198 Indirect effects for the proposed wind farm (for both surface water and groundwater dependent habitats) are predicted to extend up to 25 m from infrastructure. The greatest indirect effects are predicted for blanket bog (≈9.53 ha), wet modified bog habitat and its mosaics (≈3.15 ha), marshy grassland habitat and its mosaics (≈3.64 ha), dry modified bog habitat and its mosaics (≈3.01 ha) and semi-improved acid grassland and its mosaics (≈2.95 ha). Other than at stream crossings, the proposed wind farm infrastructure is located at least 50 m from watercourses. Combined with the high standards of water pollution prevention measures described in **Chapter 4: Development Description** and **Chapter 11: Geology, Hydrology and Hydrogeology**, the potential for silt or pollution run-off effects is considered to be low.
- 9.199 Considering both direct habitat loss and indirect effects, effects of high magnitude are predicted for blanket bog habitats. Furthermore, the construction of the access track, particularly the track from Pingle Farm, will result in the fragmentation of the wider habitats and peat bog. The majority of the blanket bog lost will be of the M18 *Erica tetralix* - *Sphagnum papillosum* community, much of which would be assessed as being in favourable condition. Consequently, potential effects on blanket bog habitats are considered to be of **major** significance, prior to mitigation.
- 9.200 Effects of **moderate** significance are predicted for dry modified bog (and its mosaics), marshy grassland (and its mosaics), wet modified bog (and its mosaics) and wet heath. For all of these habitats, the direct loss of habitat is relatively low (generally less than 1 ha when all mosaics are combined). However, when combined with indirect changes in hydrology, especially changes to groundwater to which the latter three habitats are especially vulnerable, the effects become more significant. As a result of the conservation value of these habitats, the potential effects are considered to be significant under the EIA Regulations.
- 9.201 Potential effects on all other habitat types are considered to be of minor significance or less. Loss of coniferous woodland is also considered to be of minor ecological significance, even when taking into account the loss of woodland for construction (10 ha) and the loss of woodland as part of the wider clear fell for the proposed wind farm (188 ha). Although this amounts to a substantial area of clear fell, the coniferous woodland is typically monoculture with no ground layer and limited conservation value.

Faunal Species Effects

Good Practice Measures

- 9.202 The consideration of faunal effects is based on good practice measures for the protection of these species being integral to the proposed wind farm design given the current regulatory and planning context for the construction of wind farm developments. These good practice measures include:
- Pre-construction surveys will be carried out for otter, red squirrel, badger and bat roosts. 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 250 m buffer around infrastructure. All areas within 50 m of infrastructure will be surveyed for badger and where this falls within afforested areas, surveys will also be conducted for red squirrel with an emphasis on identifying dreys. If necessary, a disturbance licence will also be sought for any relevant otter shelters or setts, depending on the proximity to the proposed works and the likelihood of disturbance. SNH will be consulted where any potential effects on squirrel dreys are identified, in accordance with the WANE Act.
 - All potential bat roost areas within 50 m of infrastructure, including Pingle Farm, the mature broad-leaved and Scots Pine trees near Alder Well and within 50 m of the felling edge (including the walled area of broad-leaved woodland), will have an update survey for bat roosts conducted in the appropriate season. If necessary a disturbance licence will be sought for any relevant bat roosts. Where any mature deciduous or Scot's pine trees are to be felled, and update surveys do not confirm a roost, they will be felled in sections (soft-felled) under the presence of a licensed bat worker.
 - No construction or use of the oversized load access track within 100 m of Pingle Farm will take place within an hour of dawn and dusk.
 - Construction areas will be searched for reptiles and reptile hibernacula no more than 14 days in advance of ground clearance for construction. Buffer zones or supervised hand destruction of identified refugia will be implemented to prevent harm to reptiles in relevant habitats as advised by the ECoW.
 - 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 watercourse crossings will be designed in accordance with the River Crossings and Migratory Fish Design Guidance produced by the (then) Scottish Executive (2000)⁵⁷. 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 wet weather.
 - General good practice measures for working in and near to watercourses will be adhered to, as described in **Chapter 11: Geology, Hydrology and Hydrogeology**.
 - High quality capping material will be used for the access tracks, as lower quality rock tends to break down into fines which can easily wash into watercourses. Any roadside drains that are constructed will not directly discharge into streams (or drainage channels leading directly to streams), and specifically designed silt traps will be used where necessary to act as filters.
 - If construction work is carried out during the hours of darkness, machinery and floodlights will be directed away from watercourses. Use of pile drivers and rock blasting will be limited to avoid two hours before and after dawn and dusk in areas where disturbance to badger setts and/or otter shelters is possible.

⁵⁷ Scottish Executive (2000). River Crossings and Migratory Fish: Design Guidance. <http://www.scotland.gov.uk/consultations/transport/rcmf-01.asp>.

- During construction, chemicals will be stored securely within the temporary construction compound. Trenches and excavations will include simple ramps and stored pipes will be routinely checked by the ECoW to ensure no entrapment of animals.
- A site speed limit of 15 mph for all construction traffic will be in place during the hours of darkness to protect otter and badger.
- Any pumps used to abstract water will be fitted with a filter to prevent loss or harm to fish.

9.203 The site induction for construction personnel will include a 'Toolbox Talk' (provided by the ECoW) on otter, red squirrel, bats reptiles and badger and identification of the shelters or potential shelter structures of these species. The Toolbox Talk will also emphasise the importance of protection of watercourses and key habitats including blanket bog and wet heath.

Construction and Felling Effects on Otter

9.204 No otter shelters will be directly affected by construction activities. The shortest separation distance between an otter shelter and a turbine is >1 km, and between a (non-breeding) shelter and an access track is 225 m. Direct effects such as damage to shelters or causing harm to otter during construction are highly unlikely at these distances.

9.205 Indirect effects, such as disturbance to otters, could potentially arise through:

- pollution events;
- disturbance as a result of noise, vibration and human presence;
- loss of forage habitat and territory areas (both aquatic and terrestrial);
- effects on prey species such as fish;
- potential increased risk of road mortality.

9.206 Eight watercourse crossings are proposed. Four of these involve existing crossings on the Gowdmuir Sike and on the upper reaches of the Pokeskine Sike, which will require upgrading. Four new crossings will be required, one on the upper reaches of the Hallsike Burn, one of the upper reaches of the Alder Well, two on un-named tributaries of the Palling Burn (refer to Figure 12.1 and further details of the crossings are provided in Chapter 12 Geology, Hydrology and Hydrogeology).

9.207 Potential obstruction of otter movement corridors and effects as a result of trying to pass through flooded culverts or crossings with high water levels could occur. However, the recorded levels of otter activity on these burns was minimal. Disturbance effects during construction activities (light, noise and vibration) are considered possible during construction within 100 m of watercourses.

9.208 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 lie-ups during the day time, disturbance may occur where activities take place in proximity to these structures. However, as no shelters will be directly affected by the proposed wind farm, the seven crossings are located in stream headwaters (where otter activity is minimal) and the majority of infrastructure is over 100 m from watercourses, the effects on otter are considered to be of low magnitude. According to Table 9.4, this could lead to a potential effect of moderate significance for otter. However, the good practice measures will significantly reduce the likelihood of such disturbance occurring and given the lack of evidence of otter on most watercourses on site, including the Palling Burn, effects on otter are considered to be of minor significance.

Construction & Felling Effects on Badger

9.209 No badger setts will be directly affected by the proposed wind farm. The shortest separation distance between a badger sett and a turbine is 580 m, and between a badger sett and the access track is 260 m. Direct effects such as damage to the setts or causing harm to badger during construction are highly unlikely at these distances.

9.210 A single outlier sett is located outwith, but within 30 m of, the proposed clear felling zone. Indirect effects on this sett, as well as, more generally, on badger foraging in the forestry area proposed for felling, are therefore possible and may include:

- disturbance effects 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.

9.211 Habitat loss may result in some displacement of badgers in the short to medium term. Suitable habitat for badger offering opportunities for both forage and sett building exist within the lower lying areas adjacent to the site boundary in the Solwaybank Farm and Chapelhill/Conhess area. In particular, the newly established semi-mature broad-leaved plantation woodland between Chapelhill/Conhess is likely to have developed into a habitat suitable for badgers by the time the felling scheme commences (estimated to be 2015). Felling within the site will however create additional pressures on the remaining habitat resources.

9.212 Given the proximity of the single sett to the proposed felling works and the apparent level of badger foraging activity on the western margins of the felling area, the combined potential effects are likely to be of medium magnitude and therefore of moderate significance.

9.213 Further details on effects on badger are provided in **Appendix 9.3: Badger Survey (Confidential Appendix)**.

Construction & Felling Effects on Bats

Roosts

9.214 The main potential for the loss of bat roosts would be during felling. However, based on the current survey results there are considered to be no direct effects on bats as a result of felling, as no trees that are planned to be felled were identified as supporting bat roosts.

9.215 There could be potential for disturbance effects to bat roosts in trees within 3 m of felling operations. In particular there are a number of mature beech and Scot's pine trees near Alder Well and a number of oak trees in the walled-in broad-leaved copse (approximately 200 - 300 m south-west of T11 and T12). Although, based on the current survey results no roosts have been identified, best practice measures (as described at paragraph 9.199) and including pre-construction surveys, will be conducted to ensure no effects on roosts.

9.216 Potential disturbance effects on the roost at Pingle Farm could occur during construction and use of the over-sized load access track which will come within close proximity (20 - 50 m) of the various farm buildings. The closest building is 25 m from the works, although no roost was confirmed in this building. The confirmed roosts within the farmhouse are approximately 60 m from the access track. Given the distance between the access track and this building, the potential disturbance effects are considered to be low. In addition, good practice measures will be conducted with restrictions in

activity around dusk and dawn and the requirement for update roost surveys. There are therefore considered to be no effects on bat roosts as a result of felling and construction.

Foraging and Commuting

- 9.217 In the short to medium term, following the felling of the plantation area there will be a marked reduced quality of bat foraging habitat. High levels of bat foraging were recorded throughout the plantation, in particular along the edges and associated with rides. It is difficult to predict accurately the extent of effects as a result of this, but the main effects will be on Pipistrelle species which were by far the most common species on site. There is potential for low magnitude effects, resulting in a reduction in the local population levels of pipistrelle bats in the short-term. It is likely that for other identified bat species, which use the site much less, that the population level effects will be minimal / negligible.
- 9.218 Within two years after construction, a large part of the site will be replanted (see Habitat Management Plan details at paragraph 9.270). The planting proposed under the Habitat Management Plan will predominantly be coniferous species which will minimise the potential effect of foraging loss. In the longer term the habitat management plan will provide an enhancement of some of the existing foraging associated with watercourses and tree rides through the planting of broad-leaved woodland and scrub in these areas.
- 9.219 Foraging resource of the open moorland habitat will not be directly affected.
- 9.220 Commuting routes along the forest rides will be temporarily lost as a result of the felling. Despite this, pipistrelles which are the main species on site, do cross open areas and may continue to use existing flight lines. However, combined with the loss of forestry and the loss of plantation edges, it is thought likely that there will be a reduction in the use of the site by these species. It is difficult to predict the magnitude of effect on commuting routes, but in the short term, as with loss of foraging this could result in low magnitude effects, reducing the number of pipistrelle bat species in the vicinity of the site. It is not considered that the effects would result in changes to the conservation status of bat species in the local area, and combined with replanting which will enhance the site in the medium to long-term, the effects of felling are considered to be of minor significance.

Construction & Felling Effects on Red Squirrel

- 9.221 No dedicated red squirrel survey was carried out within the proposed wind farm area and known red squirrel records from within the site are limited to historical records and incidental red squirrel sightings. A precautionary approach to the assessment of effects of the proposed wind farm on red squirrel has therefore been adopted.
- 9.222 Potential direct effects on red squirrel during the construction phase may include harm to animals or loss or damage to red squirrel dreys. In the short to medium term, felling activity may also affect habitat availability and foraging opportunities.
- 9.223 Adult red squirrels are highly mobile species, able to respond to disturbance caused by forestry machinery and seek refuge elsewhere. Juvenile red squirrels are much less mobile, and therefore the risk of harming or injuring an animal is higher during the breeding period (considered to be mid February to mid September inclusive).
- 9.224 Red squirrel dreys may also be damaged or destroyed during felling operations. The estimate of red squirrel numbers on site is in the region of 5 to 46 animals, and each squirrel can use several dreys

(generally considered to be up to five dreys per squirrel), the most important dreys being the ones used for rearing young.

- 9.225 In addition to the above direct effects, indirect effects on red squirrel are also predicted, due to noise disturbance and the loss of coniferous woodland habitat used for forage and shelter. A total of approximately 198 ha of coniferous woodland (10 ha of direct loss for the infrastructure and 188 ha of clear felling) will be lost during the felling phase of wind farm construction over a period of twelve months. The felling will be rapid and wholesale in comparison to the removal of the trees under normal forest rotation practices.
- 9.226 In the short to medium term, a total of 92.4 ha of coniferous woodland will remain at Kirtleton North, in the area of woodland joining to the south-west of the site (part of Alderwell) and a small area of forestry to the east of the main forest block (in Solwaybank Estate). In the longer-term, the site will be replanted with coniferous woodland providing replacement habitat (see 'mitigation and Habitat Management Plan').
- 9.227 The above likely direct and potential indirect effects on red squirrel are considered to be short to medium term medium magnitude effects and therefore of moderate significance prior to mitigation.

Construction & Felling Effects on Reptiles

- 9.228 Common lizard and adder are vulnerable to injury or death as a result of construction activity, particularly during late autumn and winter, as they hibernate underground, beneath rocks and woodpiles, often in large numbers. They are susceptible during this time to being excavated and/or crushed by machinery. During their active phase in spring, summer and early autumn, they are more capable of moving away from construction areas as they are quick to sense disturbance. Temporary displacement and disturbance of common lizard and adder may occur during construction. However, the availability of large areas of undisturbed habitat means that such effects are likely to be of low magnitude, and reptiles are highly unlikely to be directly or indirectly affected.
- 9.229 A low magnitude effect on reptiles would, according to Table 9.4, lead to a potential effect of moderate significance for reptiles. However, the good practice measures (including pre-construction checks focussing on areas within the construction footprint as well as features within the felling area that are highly suitable for reptiles such as forestry wayleaves, slopes with a southerly aspect exposure and drystone dykes) mean that direct effects on reptiles are highly unlikely to occur.
- 9.230 Indirect effects on reptiles as a result of habitat loss will be minimal due to the extent of unaffected non-forested habitat (c. 380 ha). The movement of reptiles over forestry and upland tracks is well documented and therefore these are not considered to be significant barriers. Effects on reptiles are therefore considered to be low in magnitude, and of minor significance.

Construction Effects on Fish

- 9.231 Of the eight watercourse crossings required, the Palling Burn is the only watercourse deemed suitable for fish species, and only then in its lower reaches. Therefore no direct effects on fish populations (i.e. loss of spawning habitat) are anticipated as a result of watercourse crossing points during construction.
- 9.232 In addition, a number of artificial drainage ditches will need to be crossed, and at these locations ditch blocking will occur. These ditches are part of an artificial drainage system on bog areas and are not considered suitable for fish species.

9.233 Potential indirect effects on fish as a result of construction activities could include:

- soil and silt run-off into these watercourses;
- localised changes to surface water hydrology and stream flows;
- changes to bankside structures; and
- pollution of burns through accidental spillages and incidents.

9.234 However, it is anticipated that the above effects will be avoided through the good practice measures listed previously, by maintaining the appropriate distances from watercourses (at least 50 m, except at watercourse crossing points) and the implementation of stringent pollution prevention measures designed in accordance with SEPA requirements (see **Chapter 4: Development Description** and **Chapter 11: Geology, Hydrology and Hydrogeology**). On this basis, indirect and direct effects on fish are likely to be of low magnitude and therefore of minor significance.

Potential Operational Effects

9.235 Operational impacts on habitats and all protected species, with the exception of bats, have been scoped out of the assessment. Operational phase effects on bats are addressed below.

Bats

9.236 Very few bat deaths have been reported at UK wind farms and all have been soprano pipistrelles⁵⁸, although this could be as a result of a lack of post-construction monitoring. Braes of Doune Wind farm in Scotland has had two records of soprano pipistrelle bats being killed as a result of direct collision with turbines. Braes of Doune is located in open moorland at 350 m AOD with no nearby woodland. Effects may either be as a result of direct collision or barotrauma due to a change in air pressure that causes fatal damage to a bats respiratory system⁵⁹

9.237 Further research and evidence is required to inform the assessment of bat collision risk, and in the absence of this, it is only possible to make judgements and provide advice about the likely effects of turbines on bats. A precautionary approach should therefore be undertaken where necessary following Natural England interim advice as endorsed by SNH.

9.238 Many bat species in the UK are, based on current evidence unlikely to come into contact with turbine blades during their normal movements. This is because UK bats are not known to migrate at high altitude and many UK species such as *Myotis* species rarely fly at heights that would intersect with the blades. However, some species in particular *Nyctalus* species (including Noctule and Leisler's) do fly at height and Direct Ecology Ltd has recorded both *Nyctalus* and pipistrelle species from a microphone at a height of 65 m in Scotland (Unpublished data). In addition, research by Collins and Jones⁶⁰ has shown frequent passes at height by pipistrelle species and *Nyctalus / Eptesicus* species.

9.239 Noctule bats are the most commonly recorded bats species killed by turbines (Jones *et al.* 2009). After emergence, noctules generally fly high, fast and straight, often at 10 - 50 m but sometimes at

several hundred metres above the ground⁶¹. The Collins and Jones study recorded bat activity from Anabat detectors positioned at 30 m and at ground level and recorded proportionately more *Nyctalus* passes at height than at ground level. These species are at a greater risk of collision as shown by the high levels of mortality in continental European studies.

9.240 The common pipistrelle is the second most frequently recorded species killed on European wind farm sites. This species generally forages at 5 - 25 m above the ground, and is associated with a range of different habitats, but as discussed above, does also occasionally fly at height.

9.241 It is not known if bats are actually attracted to turbines. Some authors (Jones *et al* 2009) have reviewed research that suggest bats may investigate turbines as potential roost sites; bats may be attracted to turbines as potential mating sites; bats might be attracted to feed on insects in areas of heat generated by the nacelles; or that bats may become trapped in vortices created by turbine blades which could potentially increase collision risk. However, there is currently no available evidence to suggest that these are issues in the UK.

9.242 Many bat species tend to fly close to landscape habitat features such as woodland edges and rivers, and are therefore probably less likely to collide with turbines if the turbines are located in the open, away from these features. Those species that fly higher, such as noctules, will be at greater risk, although their activity levels are likely to decline away from key habitat features.

9.243 Based on the available information of flight heights, speeds, hunting techniques, habitat preference and migration, Natural England has put species of UK bats into different risk categories - high, medium or low. The species have then been assessed based on their population levels and likely threats.

9.244 Common and soprano pipistrelle bat species are classified as medium risk species in terms of collision and due to their relatively high population levels in the UK they are only classified as of being of low risk in terms of the threat to their populations. *Myotis* and brown long-eared bats are low risk species in terms of both their collision and population threat. In comparison, noctule bats (and other *Nyctalus* species) are classified as being at high risk for both collision and potential population effects.

Potential Collision Risk at Solwaybank

9.245 Prior to the erection of turbines, there will be clear-felling of the entire plantation area around the proposed turbine area and a 500 m buffer of this. This is likely to alter bat activity on the site. In the short-term, this could lead to a reduction in bat activity on the site, with most species not likely to find optimal foraging over clear-fell areas. This would result in a reduction in collision risk compared to the existing habitat situation, with lower levels of foraging and therefore potential collision predicted on site, post-felling. However, in the longer-term there are proposals for replanting some areas. This will predominantly be commercial coniferous forestry with some native woodland along burns, rides and track edges. New planting will be undertaken in a manner designed to reduce potential collision effects in the longer term (further detail at paragraph 9.270) but whilst also improving foraging for bats in appropriate areas on and off site.

Pipistrelle Species

⁵⁸ Jones G, Cooper-Bohannon R., Barlow R., Parsons K. 2009. Scoping and Method Development Report: Determining the potential ecological impact of wind turbines on bat populations in Britain. University of Bristol and Bat Conservation Trust.

⁵⁹ Baerwald E.F., D'Amours G.H., Lug B.J. and Barclay R.M.R. 2008. Barotrauma is a significant cause of bat fatalities at wind turbines. *Current Biology*, Volume 18, Issue 16.

⁶⁰ Collins J. and Jones G. 2009. Differences in bat activity in relation to bat detector height: implications for bat surveys at proposed windfarm sites. *Acta Chiropterologica*, 11 (2): 343-350.

⁶¹ Dietz C., von Helversen o., Nill D. 2009. *Bats of Britain, Europe and Northwest Africa*. A&C Black, London.

9.246 Both pipistrelle species were recorded at reasonably high levels of activity on the site, with common pipistrelles being more frequently recorded. The species appear to be foraging throughout the plantation with more activity on the woodland edges. All turbines (except Turbine 13) are located away from watercourses and the new woodland edges to a minimum of 50 m from the rotor swept edge (see paragraph 9.176) and taking into account the usual low (<30 m) foraging heights of these two species, it is not thought likely that the majority of pipistrelle bats using the site would be at risk of collision effects with turbines. The minimum recommended buffer (as discussed in 9.178) between Turbine 13 and the newly planted woodland edge cannot be met due to landownership constraints and therefore some level of collision mortality could be expected at this turbine as well as potentially at others⁶². However, based on the available research and monitoring (i.e. the current evidence suggests that levels of mortality in Scotland are low), it is not thought that the effects would be at significant levels or levels that would affect the conservation status of the species in the local area. The operational effects on these species are therefore considered to be low in magnitude and of minor significance or less.

Myotis and Brown Long-eared Bats

9.247 There have been few recorded deaths of Daubenton's, Natterer's bats or brown long-eared bats in European wind farm studies, likely primarily as a result of their low flight heights. Brown long-eared bats and Natterer's bats were recorded at low levels across the site, in particular associated with the plantation. Daubenton's and *Myotis* species were recorded at low levels but more commonly associated with watercourses. As discussed above the design of the scheme, both through siting of turbines and design of replanting has sought to ensure that both new woodland edges and watercourses are no closer than 50 m to the edge of the rotor swept area (except at Turbine 13). Given this, and the lower levels of activity of these species on site, brown long-eared bats and *Myotis* species are assessed as being at a low risk of collision as a result of the development and the operational effects on these species are considered to be of minor significance or less. Only low levels of activity from brown long-eared bat and *Myotis* species were recorded in the vicinity of L4 and L7 which were located either side of the proposed location of Turbine 13. Despite the reduced buffer at this location, given the low levels of non-pipistrelle activity in this area, effects on *Myotis* and brown-long eared bats are not considered to be significant at a population level and the overall effect of the proposed wind farm on these species is considered to be of minor negative significance.

Noctule Bat

9.248 The noctule bat is classed as a high collision risk species and is of high risk in terms of potential effects on populations. Available data indicates this species is widespread but uncommon in south Scotland and England, but absent from Northern Scotland.

9.249 Although Anabats recorded noctules on site, it was not possible to determine any key flight paths or commuting routes, apart from in the case of one individual that was thought to be commuting along the ride of the gas pipeline. This lack of determination of flight paths and routes is as a result of

the low number of passes recorded. From 17 nights of Anabat survey, using ten detector locations, only 26 passes were recorded from noctule or *Nyctalus* species (most likely assumed to be Noctule bats). Times of flight did not indicate a roost on site, although one could be present within 5 km so it is likely that the bats recorded are occasional commuting bats.

9.250 It is known that noctules will cross open areas to commute and that they will often be flying high and fast. This activity is often close to dusk and dawn and bats will navigate by sight. However when flying later in the night, individuals are more likely to follow linear features and watercourses, as flight by sight is more difficult.

9.251 As discussed already, turbines have been positioned so that the rotor swept edge is a minimum of 50 m away from watercourses, maintained woodland edges and new woodland edge planting (except at Turbine 13). However, given the uncertainty in routes taken by noctules across the site, and the fact that in flight they do have a tendency not to follow linear features, it is believed there could be some potential effects on this species as a result of turbine operation. Despite this, activity levels on site are low, and the magnitude of collision of Noctule bats is likely to also be low. The Anabats located either side of the proposed location for Turbine 13 (L4 and L7) recorded no activity by noctules of *Nyctalus* species and it is therefore considered unlikely that the reduced buffer at this location would affect the conservation status of the species. The effects on noctule bats as a result of operation of all turbines are therefore considered to be of low magnitude and of minor significance.

Mitigation and Compensation

Habitats

9.252 Habitat loss associated with blanket bog, modified bog, marshy grassland habitats and wet heath habitats is predicted to be a significant effect as a result of the construction of the proposed wind farm. As these are Annex I and UK BAP habitats, mitigation (and/or compensation) will be required. A Habitat Management Plan (HMP) is therefore proposed for the proposed wind farm, to compensate for the loss of ecologically important habitats as well as to provide ecological enhancement of the sites current biodiversity value.

9.253 An outline HMP document is provided in **Appendix 9.4: Solwaybank Habitat Management Plan**. The plan has been designed to strike a balance between the operational requirements of the proposed wind farm, forestry and ecological issues, including:

- the Control of Woodland Removal Policy (Forestry Commission, 2009)⁶³ and how this applies at the site;
- the requirement for land management to mitigate for adverse effects of the proposed wind farm construction on red squirrel and badger;
- the requirement for land management to mitigate/prevent adverse effects of the proposed wind farm operation on bat species; 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 Dumfries and Galloway Biodiversity Action Plan.

⁶² The maximum buffer that can be achieved between the newly planted woodland edge and Turbine 13 is 48 m. A buffer of 66 m is required to provide a 50 m buffer between the rotor swept area and woodland edge.

⁶³ Forestry Commission Scotland (2009). *The Scottish Government's Policy on Control of Woodland Removal*. Forestry Commission Scotland, Edinburgh.

9.254 The key objectives within the HMP aimed at compensating for the loss of habitats fall under Aim 2 of the plan 'Restoration of Blanket Bog and Upland Habitats', and include:

- Objective 2.1: Restore a mosaic of heath, bog and grassland habitats in previously afforested areas.
- Objective 2.2: Improve the condition and maintain the extent of existing blanket bog and grassland habitat at Allfornought Hill.

9.255 Under Objective 2.1, a total of 39.1 ha of previously forested land will be restored to a mosaic of upland habitats including bog types, heath and grassland. The currently afforested area at the head of the Palling Burn is underlain by deeper peat (Figure 12.4) and already has a network of blanket bog habitats amongst the lodgepole pine coups. Similarly, the plantation edge adjacent to Collin Hags is believed to be situated on deep peat and this area is likely to have previously been part of a larger blanket bog area extending between Collin Hags and Allfornought Hill. Application of suitable management techniques, including drain blocking, will help to restore blanket bog in these deforested areas and in doing so, will reduce fragmentation of the current blanket bog resource at the site. Open habitat will also be created around the base of each turbine. These areas will be restored to a range of habitats, depending on ground conditions. On the plateau, habitats are more likely to include marshy grassland and rush pastures, and further down slope, where the substrate becomes less peat based and drier, restoration will include acid grassland and heathland types. Suitable restoration techniques will be applied and where necessary seeding, grazing and fencing will be used (see **Appendix 9.4: Solwaybank Habitat Management Plan**).

9.256 Restoration of habitats proposed under Objective 2.1 will recreate 39.1 ha of blanket bog, marshy grassland and wet heath, compensating for the direct and potential indirect effects on 36.62 ha of blanket bog, wet and dry modified bog, wet heath and marshy grassland.

9.257 Additionally, findings from the NVC survey and ULMIS assessment suggest that the condition of the existing upland habitats at Allfornought Hill could be improved. To this end, Objective 2.2 would seek to implement a drain blocking programme in areas of high drain density (as highlighted in the ULMIS survey and shown in Figure 9.7). A programme of hydrological monitoring would review the success of this. In addition, management agreements will be put in place to ensure that the practice of muirburn on the bog habitats on site is stopped, and grazing levels brought back in line with those recommended by Scotland's Moorland Forum⁶⁴. These management measures would be implemented over 76.2 ha on the areas shown in Figure 9.7.

HMP Implementation

9.258 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, red squirrel or other species prescriptions.

9.259 The monitoring scheme and the HMP more generally, will be developed in further detail post consent, in conjunction with relevant stakeholders, to include the landowners, RES, Dumfries and Galloway Council, Scottish Natural Heritage and Forestry Commission Scotland.

⁶⁴ Scotland's Moorland Forum (2003). Principles of Moorland Management. SNH, Battleby.

Species

9.260 Effects of the construction and operational phase of the wind farm on otter, reptiles and fish are of minor significance or less, therefore no mitigation is proposed beyond implementation of the good practice measures described earlier.

9.261 Measures to mitigate for the effects of the construction of the scheme on badger and red squirrel and effects of the operational of the proposed wind farm on bats are listed below.

Badger

9.262 Short term moderate effects on badger are predicted as a result of the proposed wind farm felling and construction, due to potential indirect effects, including disturbance and habitat loss.

9.263 Pre-felling and pre-construction checks for badger will be carried out within 50 m of the proposed wind farm infrastructure footprint and within the whole extent of the felling area. Measures as described above may apply for any badger setts identified during the pre-construction checks or during felling, depending on whether they are occupied and depending on their proximity to the works area and the nature of those works.

9.264 A badger disturbance licence would be applied for, for the felling that is predicted to occur within 20 m of the identified outlier sett. The terms of this licence will either allow the temporary closure of the set or will require appropriately sensitive felling and tree removal methods within the 20 m buffer of the sett, supervised by a qualified ecologist, with trees felled away from the sett to prevent any damage to the sett integrity. This felling would be undertaken outwith the badger breeding season.

9.265 Long-term badger habitat improvements are included in the HMP for the site and these will adequately mitigate for short to medium term habitat loss (see **Appendix 9.4: Solwaybank Habitat Management Plan**). Approximately 11.8 ha of coniferous woodland will be replaced with broad-leaved woodland planting, in particular, along the edges of a number of rides and watercourses on site which will provide improved open foraging corridors for badger. In the long-term, this will lead to a more diverse and open woodland ground flora and create increased foraging and shelter opportunities for badger across the site.

Red Squirrel

9.266 A number of precautionary short-term and longer-term measures will be implemented to reduce the effects of the proposed development on red squirrel.

9.267 Prior to construction, baseline surveys of red squirrel activity, including cone searches and hair tube transects, will be conducted across the entire forestry area at the site. Nest boxes will be installed in retained areas of woodland in the Keppock Rig and Conhess Sike areas. Boxes will be installed in suitable trees at least 15 years in age and will provide refuge for squirrels displaced from the proposed wind farm felling zone. Current data indicate that at the projected time of felling, (2015) all of the woodland south-west of the felling zone will be approximately 28 years old and parts of the woodland at Kirtleton North will be between 13 and 40 years old, and will therefore provide suitable mature trees for nest boxes. Boxes will be monitored during construction and for at least five years afterwards.

9.268 Felling will proceed in an east to west direction allowing squirrels to move towards the retained woodland. The felling plan will be designed and conducted in such a way that isolated pockets of woodland are not created, as far as reasonably practicable. Pre-construction checks for squirrel

dreys will be carried out by a suitably qualified Ecological Clerk of Works a minimum of 14 days in advance of felling. If dreys are identified, a 50 m buffer in which no felling can occur will be created around the drey. The buffer will also include a minimum 10 m corridor of trees connecting the buffer to the nearest area of retained trees. The buffer will be monitored and if it is demonstrated that the squirrel drey is not active, or is being used by grey squirrel, will removal of the drey be allowed. If the drey is identified as being actively used by red squirrel, a licence for removal of the drey will be applied for under the WANE Act. The licence application will include suitable mitigation recommendations and justification for removal of the drey.

- 9.269 Long-term mitigation for habitat loss will be provided through implementation of the HMP. The majority of the site will be replanted with coniferous woodland. However, re-planting will be staggered across a five year period to create a more structurally diverse woodland and at least 25% of the replanted woodland area (equivalent to 26.1 ha) will be planted with non-Sitka species of higher value to red squirrel, including larch and Scot's pine. In the long-term, this will lead to a more diverse woodland with greater forage and shelter opportunities and benefits for the species.
- 9.270 A squirrel monitoring programme will be implemented for the duration of the HMP. The principal aim of this will be to establish a red squirrel population estimate for the woodland and to monitor squirrel use of the newly established woodland. Monitoring will also assess the use of the woodland by grey squirrels and if necessary the results of the monitoring will be used to recommend, design and implement a grey squirrel control programme.
- 9.271 Further details are provided in the HMP (see **Appendix 9.4: Solwaybank Habitat Management Plan**).

Bats

- 9.272 Mitigation for potential operational effects on bats has been partially achieved through scheme design (siting turbines so that rotor swept areas are at least 50 m from watercourses and maintained woodland edges on all turbines except Turbine 13). Appropriate habitat management will supplement this. The HMP aims to reduce potential bat collision risk further by:
- reducing the suitability of deforested turbine buffer zones for bat species;
 - increasing the foraging value of habitats outwith turbine sweep areas, and
 - habitat enhancement through planting and provision of roost boxes.
- 9.273 **Appendix 9.4: Solwaybank Habitat Management Plan** and Figure 9.7 provide full details of the wind farm Habitat Management Plan.
- 9.274 There will be provision of a minimum 50 m buffer zone from the edge of the rotor sweep to the top of mature trees for all turbines except Turbine 13, and on some turbines the buffer will be extended to 100 m. This area will be kept clear of woodland or scrub planting, and will reduce the value of turbine areas to bat species for foraging and commuting activities, reducing the likelihood of collision effects. The buffer will be increased in some areas (see Figure 9.7), and take into consideration the wider buffer zones that are sometimes recommended in Europe⁶⁵. The aim of the buffer is to ensure an effective no fly zone for higher risk species such as noctule which were particularly recorded along the wide gas pipe ride on the site and along the south-eastern plantation edge.

⁶⁵ Rodrigues L., Bach L., Duborg-Savag M. J., Goodwin J., and Harbusch c. 2008. Guidelines for consideration of bats in wind farm projects. EUROBATS publication Series No. 3 (English version). UNEP/EUROBATS Secretariat, Germany.

- 9.275 In addition to this, broad-leaved woodland and scrub planting will be carried out across the site and will improve the habitat quality for bat species. The aim of the planting plan is to strengthen watercourses as potential flights and foraging corridors, as it is assumed that bats will still use these key features post-felling. The replanting area will be set back further from the watercourses and will include scattered broad-leaved trees. These watercourses will link into other strengthened flight lines with the aim of allowing bats to continue to move through and forage on site whilst keeping them away from turbine locations. As shown on Figure 9.7, there will be strengthened flight lines through the site following the ride along the existing gas pipeline, as well as along the ride from the Collin Burn to the Hallsike Burn and following the existing tracks from Hallsike out onto the open moorland. These areas will be planted with a 20 m buffer of broad-leaved woodland or scrub to encourage bats away from higher risk areas. This will create a more diverse woodland edge with higher feeding opportunities than the existing 'hard edged' coniferous woodland coups.
- 9.276 Further broad-leaved woodland planting mainly comprising of willow scrub, alder, and birch will be carried out along the corridor of the Palling Burn to link with the mature woodland at Palling Wood; and along the south-eastern boundary of the site to link to Scout Wood. This will lead to an enhancement of these key habitat features and will provide foraging and commuting habitat for bats. Any bats commuting up the Palling Burn will be able to fly through the site along the gas main ride that will also be a strengthened flight corridor. In addition, the fence line on the southern boundary of the site (bordering Allfornought moorland) will be strengthened with willow planting, also linking to strengthened rides in the woodland. This pattern of planting will provide strong flight lines on site, but outwith the turbine, linking to wider landscape features that are of value to bats including the mature woodland at Palling Wood.
- 9.277 A number of bat boxes will also be installed on suitable mature trees within Palling Wood. This will provide additional bat roosting habitat including for bats that currently roost in Pingle Farm. Bats use a number of different roost sites throughout the year, with boxes particularly used in the autumn.

Residual Effects

Residual Construction Effects

- 9.278 Residual effects on all habitat types are considered to be of minor negative significance or less. total of 39.1 ha of habitat creation in the previously afforested part of the will compensate for the bog, marshy grassland and heath habitats that will be directly and indirectly affected by the scheme. It is acknowledged that these restored habitats will not be of the same quality and condition as the habitat lost in the short to medium term and potentially the long-term, and as such a further 76.2 ha of existing habitat has been set aside for improved management under the HMP. In combination, these two objectives are considered to appropriately compensate for the loss of habitats.
- 9.279 Residual effects on badger are considered, in the medium- to long-term to be of minor significance or less. Disturbance of setts will be adequately mitigated for under the terms of a licence, whilst short term loss of foraging habitat will be compensated for in the long term through increased areas of broad-leaved woodland on site.
- 9.280 Residual effects on red squirrel are considered, in the long-term, to be of minor significance or less. Short- to medium-term significant effects will persist, until the new woodland planting and woodland design is sufficiently mature to offer benefits to the species. In the long-term, the

improved woodland structure, and diversification of conifer species will provide a woodland with greater opportunities and carrying capacity for red squirrel, resulting in effects which are at most, of minor negative significance.

9.281 Residual construction effects on otter, bats, reptiles and fisheries are all of minor negative significance or less.

Residual Operational Effects

9.282 Residual operational effects on bat species are considered to be of minor negative significance. Provision of a 50 m buffer zone from the edge of the rotor sweep to the top of mature trees (where this has been possible), which will be kept clear of woodland or scrub planting, will effectively reduce the value of area around turbines to bat species for foraging and commuting activities, reducing the likelihood of collision effects. In parallel with this, diversification of key ride margins to include a broad-leaved and scrub buffer, as well as increasing broad-leaved planting along the Palling Burn and the site boundary will result in improved foraging and roosting habitat for bat species effectively mitigating for effects on bat species.

Cumulative Effects

Introduction

9.283 The proposed wind farm is located within a cluster of operational, consented and proposed wind farm developments. Within a 20 km buffer of the site these include:

- Ewe Hill Wind Farm 3 km north of the site boundary with six turbines consented and an application for a further 16 turbines.
- Craig Wind Farm 4.9 km north of the site boundary with two operational turbines and an application for a further two turbines.
- Minsca Wind Farm 4.9 km west of the site boundary with 16 operational turbines.
- Newfield Wind Farm 11.8 km north-west of the site boundary with an application for 21 turbines.
- Blackburn Wind Farm 13 km south-east of the site boundary with an application for nine turbines.
- Hallburn Wind Farm 18.2 km south of the site boundary with an application for six turbines.

9.284 There are no other proposed developments within 20 km of the site at Solwaybank other than a proposal to route an overhead electricity line from Ewe Hill Wind Farm to a substation several kilometres south of the development (hereafter referred to as the Ewe Hill and Newfield OHL). The proposed route passes adjacent to the Solwaybank site, and therefore this assessment considers the potential cumulative effects resulting from the overhead line and the proposed wind farm.

Potential Cumulative Construction Effects

Ewe Hill and Newfield OHL

9.285 Cumulative effects as a result of the Ewe Hill and Newfield OHL arise as the proposed route skirts the north-western boundary of the site. The route for the line will require felling of a 70 m wide corridor along approximately 1.5 km of woodland which will border the proposed felling area for Solwaybank Wind Farm. The ES for the Ewe Hill and Newfield OHL did not highlight any significant

effects on ecological receptors following implementation of standard construction mitigation to protect watercourses, otters and badger. However, the assessment did highlight that levels of badger activity were high within the woodland at Conhess and that there was potential for additional badger setts beyond the ones identified within the ES, although provided that pre-felling checks were conducted and that disturbance licences were obtained for any setts encountered, the Statement concluded that effects would remain to be non-significant. The additional felling corridor is relatively narrow, and when assessed cumulatively with the Solwaybank Wind Farm, it is not considered that the additional effects on badger will be significant. As highlighted in this chapter, prior to mitigation, the effects on badger are likely to be moderately significant, but on the basis that firstly, appropriate construction phase mitigation will be put in place, and secondly that replanting is conducted, the long term effects are not considered to be significant.

9.286 The assessment for the Ewe Hill and Newfield OHL did not identify red squirrel as a potential ecological receptor. As the species has been identified on the site it is highly likely that the species at least forages within the general woodland area through which the overhead line will pass. Effects for the Solwaybank Wind Farm will be mitigated through replanting of more diverse coniferous woodland in some areas. The Ewe Hill OHL would result in the loss of some woodland areas adjacent to the west of the site as a corridor is required to be maintained clear of trees. Therefore, additional effects will therefore occur as a result of the loss of this corridor of habitat and include:

- permanent loss of the overhead line corridor as foraging habitats;
- fragmentation of woodland habitat due to the overhead line; and
- additional felling and construction disturbance, particularly if the construction and felling phases overlap.

9.287 Due to the extensive replanting proposed at the site, it is not considered that the long term loss of the woodland from the overhead line corridor route will represent a significant loss of woodland resource. Additionally, although the overhead line corridor is relatively wide (70 m), it will still be bounded by woodland on both sides and it is likely that red squirrels would still cross this to get to the separate habitat blocks. Therefore, assuming that the felling works for Ewe Hill and Newfield OHL follows the standard good practice mitigation described within this ES, the cumulative effects are unlikely to be significant.

Wind Farms

9.288 The ES ecology chapters for Ewe Hill Wind Farm and its extension, Minsca Wind Farm, Hall Burn Wind Farm and Beck Burn Wind Farm have been reviewed as part of the cumulative assessment. Despite repeated number of requests to the developers, the chapters for Newfield and Craig Wind Farms have not been made available, so a generalised assessment of potential cumulative effects of these has been conducted.

Habitats

9.289 A range of habitat types will be lost as a result of the wind farms considered in this cumulative assessment. Blackburn Wind Farm is situated on an active peat extraction site, and all of the habitat that will be lost is currently bare peat. The Hallburn site is on an old airfield and habitat loss is exclusively improved grassland, arable land and former concrete runway. Habitat loss for these two schemes was not considered to include habitats of conservation value, and effects were considered

to be minor significant and not significant respectively. There will be no cumulative effects on the woodland and upland habitats predominantly found on the Solwaybank Wind Farm and the other wind farms as a result of the Hallburn and Beckburn Wind Farms.

- 9.290 The Minsca Wind Farm ES concentrated on effects on bog habitats and concluded that a total of 1.56 ha of modified bog would be directly lost, and 0.88 ha of modified bog would be indirectly affected through drainage modifications. No figures were provided for other habitats. Much of the bog was highly modified through grazing and draining and better areas of bog were avoided through design. Effects were considered to be of minor significance and no habitat management proposals were put forward.
- 9.291 Larger losses of upland habitat types were predicted for the original Ewe Hill scheme, with a total loss of 39 ha of habitats including 11.82 ha of modified blanket bog, 10.21 ha of improved acid grassland, 9.49 ha of marshy grassland, and 1.30 ha of blanket bog. No reference was made to indirect hydrological effects. All effects on habitats were considered to be neutral or minor and not significant. Although a HMP was not proposed, the chapter justifies the loss on the basis of the improvement of >100 ha of upland habitats through removal of recently planted conifer in this area. Habitat loss as a result of the proposed extension is much lower (in the region of 9.8 ha) with a loss of 3.22 ha of acid grassland, 2.66 ha of marshy grassland and 2.27 ha of wet modified bog. No assessment of indirect effects was made. Effects were considered to be minor and not significant, and no HMP was proposed.
- 9.292 Only the assessments for Ewe Hill and Solwaybank predicted losses of unmodified blanket bog, with a combined direct loss of 5.6 ha, with the majority of the loss associated with Solwaybank. Minsca, Ewe Hill and Solwaybank all predicted losses of modified bog, acid grassland and marshy grassland habitats with a combined direct loss of 17.15 ha of modified bog, 14.15 ha of acid grassland, and 13.48 ha of marshy grassland, with the majority of the loss associated with Ewe Hill.
- 9.293 Solwaybank Wind Farm is the only scheme which makes a direct commitment to an HMP to reduce its effects to a non-significant level. Taking this into account, along with the predicted scale of direct losses, the cumulative effects on the upland habitat resource are not considered to be significant at a regional level. Craig Wind Farm may also affect upland habitats although the scheme (two turbines with an application for a further two) is relatively small and effects would be likely to be lower than all of Minsca, Ewe Hill and Solwaybank, provided that sensitive design principles were / are adopted. Newfield is located on lower lying farmland and is unlikely to affect significant areas of upland habitat.

Faunal Species

- 9.294 The assessment for Hallburn Wind Farm did not identify otter within the site and the ES concluded that there would be no effects on the species. Ewe Hill, Beckburn and Solwaybank assessments identified otter activity within their site boundaries, but did not identify any resting sites, shelters or holts within the development zone. All three assessments concluded that with standard good practice mitigation measures for construction, including stringent pollution control measures, that the indirect effects would be of minor significance or less. Although a number of the schemes eventually feed into the same watercourses, the commitment to pollution prevention measures, and on some sites, Ecological Clerks of Works, will be sufficient to ensure that the indirect effects on otter are not significant.
- 9.295 Surveys for the Ewe Hill Wind Farm extension, and the Hall Burn Wind Farm did not identify any signs of badger on site and concluded that there would be no effects on this species. In addition, at

Beckburn Wind Farm, although there was badger activity on the site periphery, none was identified within or in proximity to the infrastructure areas, and again the assessment concluded no significant effects. Only Minsca, Ewe Hill Wind Farm and Solwaybank Wind Farm identified badger activity. Neither Minsca nor Ewe Hill predicted direct effects on badgers due to the application of a 30 m buffer around identified sets. Both assessments concluded that indirect effects, principally disturbance, would not be significant. Minsca is already constructed and so there is no scope for cumulative construction effects on badger. Ewe Hill Wind Farm is not yet constructed and the distance between Ewe Hill and Solwaybank is within the distances ranged by badgers. However, as no setts will be directly affected, it is considered that the levels of indirect disturbance will not cumulatively result in significant disturbance effects, as the amount of undisturbed habitat in the general area (which is predominantly undeveloped) will mean that refuges for badger will always remain.

- 9.296 It is likely that Newfield and Craig Wind Farms will avoid all direct effects on otter and badger through suitable design and that provided best practice mitigation is applied they will not contribute significantly to cumulative effects on otter.
- 9.297 Neither Beckburn, Hallburn, or Ewe Hill Wind Farms identify suitable habitat for red squirrel on site and therefore concluded that there would be no effects of the developments on the species. At Minsca, small pockets of woodland suitable for red squirrel were present within the site boundary, but were avoided by scheme design, and therefore it was concluded that there would be no effects on the species. Newfield Wind Farm is unlikely to affect red squirrels (it is situated in what appears to be lowland pasture) and as a small scheme, any effects that Craig Wind Farm has on the species will be minor compared to the availability of several hundred hectares of undisturbed habitat which is situated adjacent to the site. Cumulative effects on red squirrel are not predicted.
- 9.298 All schemes considered here assessed that effects on watercourses would be of minor significance or less. This was based on the assurance within all of the ES Chapters that the schemes will be constructed in accordance with SEPA guidance, and will plan, implement and maintain appropriate water pollution prevention measures as well as ensuring that all watercourse crossings are designed in accordance with the (former) Scottish Executive guidance. On the basis of this, and despite the fact that some of the schemes are situated close to the same river systems, cumulative effects on fisheries and watercourses are considered to be non-significant.
- 9.299 Only Solwaybank Wind Farm and Beckburn Wind Farm assessed the potential effects on reptile species and both concluded that the effects would not be significant. Habitat loss associated with wind farms is generally small-scale in comparison to the wider habitat that is available and therefore, provided that pre-construction checks of suitable habitat for reptiles is conducted in advance of construction works, cumulative effects on reptiles are unlikely to be significant.
- 9.300 All of the wind farm schemes considered here, concluded that there would be no construction effects on bats. Therefore there are no cumulative construction phase effects on bat species.

Potential Cumulative Operational Effects

Ewe Hill and Newfield OHL

- 9.301 Potential cumulative effects as a result of the operation of Solwaybank Wind Farm and operation of the Ewe Hill and Newfield OHL are likely to be negligible. Operational effects of the Ewe Hill and Newfield OHL are likely to be limited to the clearance of scrub along the wayleave which are not

predicted to be significant. Operational effects of Solwaybank Wind Farm are limited to effects on bat species, and are considered to be of minor significance. There are no predicted operational effects of the OHL on bat species, and therefore there will be no cumulative operational effects for the two schemes.

Wind Farms

- 9.302 Bat species are the only ecological receptor considered to be potentially affected by wind farm operation. In terms of the cumulative effects of wind farm operation, the schemes considered in this assessment have adopted various approaches to the survey and assessment of bat species.
- 9.303 Surveys of bat activity at the site have indicated that where features suitable for bat foraging and commuting are present, activity levels can be moderately high. The six wind farms located within 20 km of the site each occupy different habitat types and have variable levels of bat activity.
- 9.304 The closest wind farm is at Ewe Hill. No bat survey work was undertaken as part of the original wind farm application as the habitat (mostly open moorland with few linear features) was considered to be of limited value to bats and no potential roost structure were identified. As part of the Ewe Hill extension, activity transects were conducted across the site, but identified only low activity of pipistrelle bats, with one possible pass of a brown long-eared bat. The assessment for the scheme concluded that there would be no effects on foraging, commuting routes and roosts and that the effects would be of negligible significance.
- 9.305 At Minsca two evening bat surveys were conducted which identified a roost in the main farmhouse, plus some activity along the burns around the site. Bats were considered to be of local importance and as turbines were sited away from watercourses and the farmhouse, the assessment concluded that the effects on bats would not be significant.
- 9.306 Six bat species were recorded during the bat activity surveys for the Beckburn Wind Farm, including common and soprano pipistrelles, brown long-eared bats, Natterer’s bat, noctule bat and one unidentified *Myotis* species. Common pipistrelles were the most frequently encountered species followed by noctule bats. Activity was high along woodland edges and within wetland areas, but no roosts were identified. Operational effects were not considered to be significant as most of the site (which is an active peat extraction site) is of low habitat value to bats, and where features such as tree lines were found with higher activity, a minimum buffer of 100 m between the rotor sweep and these features was included in the design.
- 9.307 Hallburn is the most distant of the schemes. Activity transects identified low levels of activity of common pipistrelle, soprano pipistrelle and *Myotis* species. Design of the scheme took this in to consideration and all turbines were designed to include a minimum 50 m stand-off distance from trees, woodland edges and watercourses. Due to the relatively low flight height of pipistrelles, and the fact that *Myotis* species on site were considered to only be occasional and migratory, the effects of wind farm operation were not considered to be significant.
- 9.308 The potential for significant in-combination effects of these wind farms on individual bats or roost populations is therefore limited. Due to the low levels of activity of Natterer’s bats and brown-long-eared bats at all sites, any in combination effects on these species can be discounted. Daubenton’s bats are strongly associated with watercourses and fly at low heights. No effects on this species have been predicted for the Solwaybank scheme, or other schemes, and despite the fact that this species will travel over 10 km from its roosts, it is considered that cumulative effects

would not be significant due to the very low levels of activity of this species on all of the wind farms and their low flight height.

- 9.309 For pipistrelle species, relatively high levels of activity were recorded at Solwaybank and all other sites recorded at least some degree of activity. Direct comparisons of activity levels between all the schemes is difficult, because different survey techniques and levels of effort have been applied. However, where comparable survey has been undertaken (i.e. transects in combination with static monitoring over three sessions) such as at Beckburn, similar levels of activity have been identified. Despite this, pipistrelle bat species rarely forage more than 5 km from roost sites and it is considered unlikely individual bats recorded at Solwaybank would be present on other wind farm sites considered in this assessment. All schemes assessed that their individual effects were not significant, and in some cases activity levels were quite low. In the absence of specific guidance on assessing effects of wind farms on bats, and based on the current level of understanding of the regional population levels of pipistrelle species, i.e. that they are common and widespread, it is not considered that individual minor effects from each scheme would result in significant cumulative effects.
- 9.310 The only other site which recorded noctule bats is Beckburn, where activity levels were low. This species can travel some distance between roosts and foraging areas, although the average distances have been shown in England to be only 4.5 km⁶⁶. Beckburn is located 13 km south of the Solwaybank scheme, and due to the low levels of activity on both sites, as well as the distance between the schemes, significant cumulative effects are not predicted for either scheme. It is unlikely that individual bats will use both sites and in addition the individual minor effects of both schemes on noctule bats are not considered to result in an overall significant effect on the species.
- 9.311 In summary, it is assessed that cumulative operational effects for all bat species will not be significant.

Residual Effects

- 9.312 Residual cumulative construction and felling phase effects are not considered to be significant on the basis that standard approaches to design and mitigation have been and will be adopted by all schemes in question. Operational cumulative effects on bats are not considered to be significant.

Summary

- 9.313 Table 9.10 provides a summary of the potential significant effects associated with the proposed wind farm, and identifies the mitigation proposed to reduce the effects and means of implementation.

Table 9.10: Summary of Potential Effects, Mitigation and Residual Effects

Likely Significant Effect	Mitigation Proposed	Means of Implementation	Outcome/Residual Effect
Construction			

⁶⁶ Mackie I.J. and Racey P.A. 2007. Habitat use varies with the reproductive status of Noctule bats (*Nyctalus noctula*) - implications for conservation. *Biological Conservation* 140 pg 70 -77.

Likely Significant Effect	Mitigation Proposed	Means of Implementation	Outcome/Residual Effect
Potentially significant loss of blanket bog, modified bog, marshy grassland, and wet heath habitats.	Creation of 39.1 ha of new upland habitats within previously afforested areas. Improved management of existing bog, grassland and heath habitat on site (76.2 ha).	Implementation of a HMP which includes suitable plans for forest re-design	Minor significance or less
Potentially significant disturbance of badger through construction activities and short term loss of habitat.	Pre-construction checks for setts. Felling within 20 m of setts under the terms of a licence including supervised, directional felling using appropriately sensitive methods. Re-planting of the woodland areas with increased broad-leaved woodland and open space.	SNH licence to disturb badger may be required to ensure implementation of mitigation for all setts within 20 m felling works. Implementation of a suitable HMP which includes plans for re-design of the forest including increased open areas and broad-leaved planting.	Minor significance
Potentially significant disturbance of red squirrel through construction activities and short term loss of habitat.	Pre-construction checks and suitable protection of any identified dreys. Installation of nest boxes in retained forest at Keppock Rig and Conhess Sike. Replanting of mixed coniferous woodland and small seeded broad-leaves with higher suitability for red squirrel. Squirrel monitoring and potential implementation of a grey squirrel control plan.	Employment of an ECoW for the duration of the felling and construction phase. Implementation of a suitable HMP which includes plans for re-design of the forest including increased mixed coniferous woodland planting.	Minor significance
Pollution effects on Burns and Watercourses	Design, implement and maintain high quality Water Pollution Prevention Measures.	Planning condition to include a requirement for Construction Method Statements to be approved by SNH and SEPA. Employment of an ECoW and a Planning Monitoring Officer to ensure appropriate implementation of pollution prevention measures.	Minor or less
Indirect Disturbance effects on otter	Standard good practice measures for construction sites as listed in this chapter including toolbox talks, speed limits, safe storage of materials, and good pollution prevention control measures.	Employment of an ECoW to oversee construction.	Minor or less

Likely Significant Effect	Mitigation Proposed	Means of Implementation	Outcome/Residual Effect
Disturbance to bat roosts and loss of foraging habitat and commuting lines as a result of felling.	Pre-construction surveys for roosts of any mature broad-leaved or Scots pines that will be felled or which are within 50m of the felling zone and soft felling of these trees supervised by a licensed ecologist. Restrictions on construction and traffic use of the oversized load access route within an hour of dawn and dusk and pre-construction surveys of the roost at Pingle Farm. Long-term replanting of the site under the terms of the HMP.	Employment of an ECoW to oversee construction.	Minor
Disturbance or harm of reptiles	Pre-construction checks of key habitats for reptiles and where necessary hand clearance of stone piles and drystane dykes.	Employment of an ECoW to oversee construction.	Minor or less
Operation			
Potential collision effects for bats.	Maintaining a minimum of 50 m open habitat (non-wooded) buffer between rotor swept edges and new woodland margins (on all turbines except Turbine 13). Improved woodland design and planting to include diverse broad-leaved woodland on key woodland ride margins and watercourses and increased broad-leaved woodland planting in key areas to provide links to features of value to bats in the wider landscape.	Implementation of a suitable Habitat Management Plan which includes suitable plans for forest re-design and creation of open habitats around turbines.	Minor significance
Cumulative			
Loss of habitats	Standard good practice construction measures. Habitat Management Plans where necessary,	Implementation via a planning condition and employment of an ECoW during construction.	Minor significance or less

Likely Significant Effect	Mitigation Proposed	Means of Implementation	Outcome/Residual Effect
Indirect pollution effects on fish and watercourses	Design, implement and maintain high quality Water Pollution Prevention Measures	Planning condition to include a requirement for Construction Method Statements to be approved by SNH and SEPA. Employment of an ECoW and a Planning Monitoring Officer to ensure appropriate implementation of pollution prevention measures.	Minor significance or less

Likely Significant Effect	Mitigation Proposed	Means of Implementation	Outcome/Residual Effect
Indirect disturbance of badger and otters	Standard good practice measures for construction sites as listed in this chapter including toolbox talks, speed limits, safe storage of materials, and good pollution prevention control measures. If necessary buffer zones should be implemented and where required licences obtained.	Employment of an ECoW to supervise construction. Use of a licence to implement mitigation where necessary.	Minor significance or less
Collision effects on bats	No mitigation proposed. All schemes should include design and habitat enhancement measures to reduce effects on bat species.	N/A	Minor Significance