Derrybrien Wind Farm Project

Gort Windfarms Ltd.

Remedial Environmental Impact Assessment
Chapter 7 - Biodiversity (Terrestrial Ecology)

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7.1 Introduction

7.1.1 Chapter Scope

This chapter identifies, describes and assesses the likely significant effects on terrestrial biodiversity associated with the construction, operation and decommissioning of the Derrybrien Wind Farm Project ('the Project'), which comprises the following:

- Derrybrien Wind Farm and associated ancillary works;
- Grid connection comprising Derrybrien-Agannygal 110kV Overhead Line (OHL) and Agannygal Substation connecting into the Shannonbridge - Ennis 110kV OHL and associated ancillary works; and
- Works undertaken in response to the peat slide and associated ancillary works

The baseline for receiving terrestrial biodiversity has been assessed based on data available for the period 1998 – 2001, prior to the construction of the wind farm.

Impacts have been assessed over the following phases of the life cycle of the project:

- *Impacts that have occurred*, i.e. during construction (2003-2006) and during the operation and maintenance phase of the project up to the Mid 2020; and
- *Impacts that are likely to occur*. i.e. during the remaining operation and maintenance phase of the wind farm, or during decommissioning (c. 2040).

Details of the construction, operation and decommissioning phases of the project can be found in Chapter 2: Project Description.

Specific consideration has been given to the peat slide that occurred on the site during construction in October 2003, including emergency measures implemented in response to the slide.

Mitigation measures and monitoring have also been identified for the remaining design life of the Project and for decommissioning, where required.

Residual impacts are also assessed, along with cumulative impacts arising in conjunction with other projects and activities in the area.

The likely significant effects of the project on aquatic biodiversity are addressed in Chapter 8 Aquatic Ecology and Fisheries.

A standalone remedial Natura Impact Statement (rNIS) has been produced, in accordance with the requirements of the Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (referred to in this report as the 'Habitats Directive') and the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011), which consider the potential impacts of the Project on European sites (sites designated as Special Areas of Conservation (SACs) and Special Protection Areas (SPAs)) within the Zone of Influence of the Project and should be read in conjunction with this chapter (see Volume 2, Section 5).

A standalone assessment of the Project with reference to its potential impact on species listed in Annex IV of the Habitats Directive (specifically bats and otter *Lutra lutra*), having regard to Article 12 of the Directive has also been prepared and should be read in conjunction with this chapter (see Volume 2, Section 7). The assessment of likely significant effects of the Project on bats and otter is presented in this chapter.

Figures are presented in A4 format as they are referenced within the chapter. Where necessary for clarity these are reproduced at A3 in Appendix 7-5.

7.1.2 Statement of Authority

This Chapter of the report has been prepared by Ciara Hamilton (Senior Ecologist ESB). Dr. Patrick Crushell (Wetland Surveys Ireland), Brendan Kirwan (Wetland Surveys Ireland), Dr. Brian Madden (Biosphere Environmental Services), Rachel Taylor (BSG Ecology), Owain Gabb (BSG Ecology) and Dr Peter Shepherd (BSG Ecology).

Ciara Hamilton (BSc MSc, MCIEEM) is a Senior Ecologist with ESB and has over 14 years' experience in Environmental Impact Assessment (EIA) and Appropriate Assessment (AA), for various development projects including wind energy, powerlines, road, light rail and port expansions. Ciara has considerable experience in the assessment of electricity infrastructure projects including high voltage transmission lines, substations and underground cables. She has also worked on large scale renewable energy projects across Ireland from pre-planning impact assessment stage through to the implementation and monitoring of mitigation measures during the operational stage. Ciara is a full member of the Chartered Institute of Ecology and Environmental Management (CIEEM).

Dr. Patrick Crushell (BSc Applied Ecology; MSc Environmental Resource Management, PhD Environmental Sciences, C. Ecol, MCIEEM) received an honors degree in Applied Ecology from UCC, a Masters degree in Environmental Resource Management from UCD and defended his PhD at Wageningen University, the Netherlands. He is a Chartered Ecologist of the Chartered Institute of Ecology and Environmental Management. Dr Crushell has been working in the area of nature conservation and ecological impact assessment for the past twenty years and has particular expertise in peatland habitats. Projects that he has been involved in include wetland inventory surveys; evaluation of proposed designated sites; restoration and management of peatland habitats; baseline ecological surveys and impact assessments of various development proposals including road, quarries, wind-farms, waste facilities, arterial drainage schemes, and residential developments; during and post-construction ecological monitoring. He has been working on the Derrybrien Wind farm Project since 2003.

Brendan Kirwan (BSc Wildlife Biology, ACIEEM) received an honors degree in Wildlife Biology from IT Tralee. He is an Associate Member of the Chartered Institute of Ecology and Environmental Management (ACIEEM). He has been working as a professional ecologist for six years, since Wetland Surveys Ireland in 2013. Brendan has undertaken a wide range of baseline ecology surveys and contributed to impact assessments of various development proposals, in particular within the renewable energy and electrical infrastructure sectors.

Dr. Brian Madden (BA Mod, PhD, MCIEEM) qualified in Natural Sciences at the University of Dublin in 1984 and earned a doctorate degree in 1990 from the National University of Ireland for research in peatland ecosystem processes. Since 1994, Brian has worked as an independent environmental consultant. Brian is an expert ornithologist and has carried out various surveys for the National Parks and Wildlife Service, including survey of breeding birds of western machair systems and co-ordination of the National Peregrine Survey in 2002. Brian has extensive experience in the assessment of electricity infrastructure projects including high voltage transmission lines, substations, underground cables and wind energy projects. For many of the projects, Brian has been involved from pre-planning impact assessment stage through to the implementation and monitoring of mitigation measures during the operational stage. Brian has been involved in the Derrybrien Wind Farm project since 2004.

Rachel Taylor (**BSc MSc ACIEEM).**

Rachel is an experienced bat ecologist with over 7 years' applied professional experience. She co-ordinated bat survey work at Derrybrien in 2016 and 2019. Her experience also includes co-ordination of bat monitoring on behalf of Innogy UK at Brechfa Forest West Wind Farm, for Vattenfall at Pen y Cymoedd, and for RES at Garreg Lwyd Hill Wind Farm for which she was also involved in the design of pre-construction and construction phase bat survey work. She has a key role in the design of bat survey work for all BSG Ecology's UK wind farm sites due to her understanding of bat ecology and experience in the application of industry standard guidance. She has been the ecological lead for bat monitoring (using dogs) at six operational UK and Irish wind farms to date.

Owain Gabb (BSc MSc MCIEEM CEnv) has worked on onshore wind and grid connection projects since 2003. He is currently directing BSG Ecology's programme of baseline survey and consultation in relation to Innogy's proposed Alwen Forest wind farm (Conwy), and confidential schemes in Blaenau Gwent, Torfaen, Neath Port Talbot, Pembrokeshire (for Innogy, RES and Infinergy respectively), in the Scottish Highlands (for Infinergy) and on Shetland (through ITP Energised working on behalf of Energy Isles Ltd).

He co-ordinated ecological work in relation to the Carrownaweelaun Wind Farm and grid connection (County Clare), and led the ornithological inputs to EirGrid's (withdrawn) GridLink project. He also oversaw the first year of operational phase ornithological and ecological monitoring for Wales's largest onshore wind farm, Pen y Cymoedd, which included agreeing the detailed scope of works with consultees, followed by nightjar, honey buzzard and bat fatality monitoring. He is currently also directing ornithological monitoring work at the Mynydd y Gwair wind farm (Swansea).

Owain has considerable experience of field survey, survey co-ordination, consultation, the production of technical reports, chapters for Environmental Statements and reports to inform Habitat Regulations Assessments and Natura Impact Statements. He has led the ornithological and ecological inputs to due diligence work ahead of the purchase of both sites and project portfolios.

Dr. Peter Shepherd (PhD, MCIEEM). Peter is one of the UK's leading bat consultants and has over 20 years' professional and research experience. He has provided editorial input to all three editions of the Bat Conservation Trust (BCT) guidance on bat survey in the UK to date, and provided advice on behalf of Renewables UK on the multi-agency (SNH *et al.,* 2019) bat guidance. Peter has provided input to the impact assessment and bat mitigation or monitoring proposals, and in resolving any complex protected species issues that may emerge. He has acted as an expert witness on bats at various wind farm public inquiries for clients including RES and E.ON Climate and Renewables. He has also provided training and monitoring projects for BCT for over 18 years.

7.2 Methodology

7.2.1 Overview

The baseline date for the assessment of environmental effects in the remedial Environmental Impact Assessment (rEIAR) is the date when the environmental impact assessment should originally have been carried out and taken into account by the decision-maker. The decisions in relation to the planning applications and appeals for the wind farm and grid connection were made in the period 1998 – 2001. Therefore, for the purposes of this rEIAR the baseline date is circa 1998 - 2001.

Baseline data to inform the construction phase impacts was collected from a desktop review of existing datasets and the original Environmental Impact Statements (EISs)[1] prepared for the Project during the pre-planning stages. Aerial photography (historic and recent) was used to assist in determining the type and distribution of habitats within the project area prior to the commencement of the construction phase. The nature and distribution of habitats allowed certain assumptions to be made in relation to fauna species likely to have been present pre-construction.

Ecological monitoring of the project began in 2003 during construction of the project. The monitoring has at various times included bird, bat, terrestrial habitats and aquatic ecology and fisheries field surveys. The results of these surveys have informed the impact assessment of the operational phase of the development and have also defined the existing receiving environment conditions against which the potential impacts associated with the decommissioning phase can be assessed.

This section describes the legislation, guidance and methodologies followed in the compilation of this chapter. Recognised guidelines have been followed in relation to every aspect of the scoping, survey and assessment.

[1] Environmental Impact Statement (EIS) submitted with GCC Reg. Ref. 97/3470 / ABP Reg. Ref. PL.07.106290 – 'the Phase 1 EIS',
EIS submitted with GCC Reg. Ref. 97/3652 / ABP Reg. Ref. PL.07.106292 – 'the Phase 2 EIS',
EIS submitted with GCC Reg. Ref. 00/4581 / ABP Reg. Ref. PL.07.122803 – 'the Phase 3 EIS'

7.2.2 Legislation and Policies

The following legislation and policy documents have been considered in preparing this chapter, where relevant:

- European Communities (Birds and Natural Habitats) Regulations 2011 S.I. 477 of 2011 (as amended).
- The EIA Directive 2011/92/EU as amended by Directive 2014/52/EU;
- European Union (EU) (Environmental Impact Assessment and Habitats) (No. 2) Regulations 2015. [S.I. No. 320/2015];
- Directive 2004/35/CE of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage
- The Habitats Directive (92/43/EEC) (as amended);
- The Birds Directive (2009/147/EC) (as amended);
- The EU Water Framework Directive (2000/60/EC);
- The Wildlife Act, 1976 (as amended);
- The Flora (Protection) Order 2015 [S.I. 356/2015];
- County Development Plan 2009 –2015 (Galway County Council, 2009)
- County Development Plan 2015 –2021 (Galway County Council, 2015)
- Environmental Report for the Galway County Development Plan 2015-2021
- Natura Impact Report In Support of the Appropriate Assessment of the Galway County Development Plan 2015- 2021
- Clare County Development Plan 2017 - 2023 (As Varied)
- National Biodiversity Action Plan 2017-2021. Department of Culture, Heritage and the Gaeltacht 2017.

7.2.3 Guidance

The assessment was carried out with regard to the following Environmental and Ecological Impact Assessment guidance and tailored accordingly based on professional judgement:

- EPA (Draft 2017) Guidelines on the Information to be contained in Environmental Impact Assessment Reports;
- EPA (Draft 2015) Advice Notes for preparing Environmental Impact Statements;
- European Commission (2013) Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment;

- CIEEM (2018) Guidelines for Ecological Impact Assessment in the United Kingdom and Ireland: Terrestrial, Freshwater and Coastal ('the CIEEM Guidelines, Second Edition') published by the Chartered Institute of Ecology and Environmental Management (CIEEM);
- Department of Environment, Heritage and Local Government (2009) Appropriate Assessment of Plans and Projects in Ireland. Guidance for Planning Authorities.
- Scottish Natural Heritage *et al. (*2019) Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation. [online] https://bit.ly/SNH_batsandwind farms_2019 accessed 29/04/2020;
- Bat Conservation Ireland. (2012). Wind Turbine/Wind Farm Development Bat Survey Guidelines, Version 2.8, December 2012;
- Hundt L (2012) Bat Surveys: Good Practice Guidelines, 2nd edition, Chapter 10: Surveying proposed onshore wind turbine developments. [online] https://bit.ly/BCT_2012 accessed 29/04/2020;
- National Roads Authority (2009) Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (Transport Infrastructure Ireland (formerly the National Roads Authority);
- National Roads Authority (2006a) Guidelines for the Treatment of Badgers prior to the Construction of National Road Schemes;
- National Roads Authority (2006b) Guidelines for the Treatment of Otters prior to the Construction of National Roads Schemes;
- National Roads Authority (2006c) Guidelines for the Treatment of Bats during the Construction of National Roads Schemes.

7.2.4 Desktop Study

A desktop study was conducted to examine the 'Zone of Influence' (see Section 7.2.5) of the Project and to identify any ecological receptors within this area which may have been affected or have the potential to be affected as a result of the Project.

The National Parks and Wildlife Service (NPWS) website database was examined in relation to designated nature conservation areas and relevant reports. GIS data was accessed using the NPWS mapviewer (accessed date June 2020).

Specific data requests were made to the NPWS in relation to a number of protected species. Information on the distribution of hen harrier breeding territories in the hinterland of the wind farm site (up to approximately 5 km distance from project boundary) for the pre-construction period 2000-2003 was provided by NPWS.

The desktop study included a review of historic and current mapping including aerial photographs, historic and current reports and data relating to the wind farm site and adjoining areas.

The following databases, websites and reports have been consulted:

- The National Parks and Wildlife Service (NPWS) of the Department of Culture, Heritage and the Gaeltacht (DCHG) (www.npws.ie);
- The National Biodiversity Data Centre (NDBC) (www.biodiversityireland.ie);
- Bat Conservation Ireland (www.batconservationireland.org);
- Aerial photography (past and present) and photographs taken at the site;
- Ordnance survey data (past and present) www.osi.ie;
- Information on water quality in the area available from www.epa.ie;
- Information on local watercourse catchments from www.catchments.ie;
- Information on soils, geology and hydrogeology in the area available from www.gsi.ie;
- Information on the status of EU protected habitats and species in Ireland (NPWS, 2019a, 2019b and 2019c);
- Review of specially requested records from the NPWS Rare and Protected Species Database for the hectads which overlap with the study area.
- Monitoring data for the Lesser Horseshoe Roost at Lough Cutra Castle was provided by National Parks and Wildlife Service.
- A search of the local planning authorities' websites for planning applications with bat data within 10 km of the Derrybrien Wind Farm within the last 10 years.
- Galway County Council Planning Website http://www.eplanning.ie/GalwayCC/searchexact to search for planning applications.

The following documents associated with Derrybrien Wind Farm have been reviewed to inform the assessment:

- Environmental Impact Statement (EIS) submitted with GCC Reg. Ref. 97/3470 / ABP Reg. Ref. PL.07.106290 – 'the Phase 1 EIS',
- EIS submitted with GCC Reg. Ref. 97/3652 / ABP Reg. Ref. PL.07.106292 – 'the Phase 2 EIS',
- EIS submitted with GCC Reg. Ref. 00/4581 / ABP Reg. Ref. PL.07.122803 – 'the Phase 3 EIS',
- Inis Environmental Services (2004a). Ecological Impact Assessment of Emergency and Stabilisation Work at Derrybrien Bog Slide Area. March 2004.
- Inis Environmental Services (2004b). Derrybrien Windfarm Peat Slip Environmental Impact Assessment on the Owendalulleegh River. March 2004.

– Inis Environmental Services (2004c). Impact assessment of Derrybrien Peat Slide on habitats, cormorants and Bat fauna of Lough Cutra, County Galway.

– Inis Environmental Services (2004d). Summer assessment of the lesser horseshoe bat roost at Lough Cutra demesne.

– Inis Environmental Services (2005). Ecological Recovery of Peat Slip Area at Derrybrien, Monitoring Survey. November 2005.

– Wilson (2012) Derrybrien Wind Farm Bat Assessment (Draft report)

7.2.5 Zone of Influence

The 'zone of influence' (ZoI) for a project is the area over which ecological features may be subject to significant effects as a result of the project and associated activities. This is likely to extend beyond the project site, for example where there are ecological or hydrological links beyond the site boundaries. The ZoI will vary for different ecological features depending on their sensitivity to an environmental change. It may therefore be appropriate to identify different zones of influence for different features. The features affected could include habitats, species, ecosystems and the processes on which they depend (CIEEM, 2018).

Departmental guidance in relation to Appropriate Assessment states that '*A distance of 15 km is currently recommended in the case of plans and derives from UK guidance (Scott Wilson et al., 2006). For projects, the distance could be much less than 15km and in some cases less than 100m, but this must be evaluated on a case-by-case basis….'* (DoEHLG, 2009 (Rev 1 2010)).

The first step in determining the ZoI is to analyse the characteristics of the Project and identify the range of ZoI using the source-pathway-receptor conceptual model. Impacts associated with the Project, both known, and potential have been used to establish the potential zone(s) of influence.

The mechanism for defining the ZoI is summarised as follows:

• The nature, size and location of the project have been considered;

• The sensitivities of the relevant ecological receptors have been considered; and

• The known and potential impact sources and pathways have been identified.

The ZoI for birds will vary with species and type of impact: relevant factors include conservation status, sensitivity to disturbance and species core foraging distances, as described in the Scottish Natural Heritage Guidelines (SNH, 2016a). Target bird species occurring within the study area were identified during the desk review and core foraging ranges were established for these species. For hen harrier, the core foraging range from nest sites during the breeding season is 2 km, with a maximum range of 10 km. With regards to merlin, the core foraging range from nest sites during the breeding season is 5 km. Whooper swan has a core foraging range from night roosts during the winter season of less than 5 km. Based on the bird species which have been identified as target species for the purpose of this assessment, the ZoI for birds is considered to be 10 km.

Bats are highly mobile species, and capable of travelling large distances to forage and during migration. Of particular importance is the area around a bat roost in which habitat availability and quality will have an influence on the resilience and conservation status of that roost (the core sustenance zone (CSZ)). For Irish bat species the core sustenance zone ranges from approximately 1 to 4 km (Collins, 2016), although individual flights can be longer. Shiels *et al.* (1999) found that the maximum (mean) flight distance recorded for individuals from two Leisler's bat maternity roosts ranged from approximately 4.5 km to 7.5 km throughout the year. Given the long distances that can be travelled by bats a zone of influence of 10 km for bat species is considered appropriate for the Project. This distance is supported by multi-agency guidance on assessing impacts of wind farms on bats, 'Bats and onshore wind turbines: survey, assessment and mitigation' (SNH *et al.,* 2019) and EUROBATS Guidelines for consideration of bats in wind farm projects (Rodrigues *et al.,* 2015) which both suggest that relevant bat information within 10 km of the proposed wind energy site is obtained as well as the location, number and size of turbines in other wind energy developments within the surrounding 10 km.

The ZoI for terrestrial habitats is considered to be within the red line boundary of the Project and immediately adjoining the site boundary. Direct impacts to habitats would be confined to the footprint of the development within the site boundary and any associated works. Habitats immediately adjoining the site boundary were assessed in relation to indirect impacts. Surface water dependent habitats are addressed in Chapter 8 Aquatic Ecology and Fisheries.

The Derrybrien Wind Farm site drains to three river catchments. The Owenaglanna flows east becoming the Duniry River eventually discharging into Lough Derg, whereas the Boleyneendorrish and the Owendalulleegh Rivers flow westward, the latter discharging to Lough Cutra and the former joining a nexus of tributaries and dropping underground into the karst geology just north east of Gort. The outflow from Lough Cutra, the Beagh River drops underground in the Punch Bowl and emerges again as the Cannahowna River which then flows north to Gort. Thereafter, known as the Gort River, it flows north before dropping underground at Pollatoophil at Castletown and emerges west north west near Kiltartan where it is joined by the combined flows of the Boleyneendorrish and Kilchreest Rivers which drain the northern slopes of the Slieve Aughty Mountains. These combined flows then continue west underground emerging into the Coole River which flows due south to the Coole-Garryland wetland complex. Flows from here continue entirely underground until they emerge west north west in Galway Bay at Kinvarra. All these underground watercourses discharge to the sea at Kinvarra Bay. A small section of the OHL and Agannygal Substation drain to Lough Atorick which is within one of the sub-basins of the Bleach River. The Bleach River flows from Lough Atorick on into Lough Graney which in turn flows into the lower portion of Lough Derg at Scarriff Co. Clare, part of the River Shannon catchment.

The peat slide which occurred at the wind farm in 2003, had a profound impact on fisheries in the upper sections of the Owendalulleegh River; refer to Chapter 8 Aquatic Ecology and Fisheries. On account of this, all European sites hydrologically connected to the Owendalulleegh River system, downstream of the Project, as far as the sea at Kinvara (hydrologically over 45 km from the Project), have been included for assessment (refer to rNIS Volume 2, Section 5 and Section 7.3.1.1). Although not impacted by the peat slide the same has been applied to the other river systems within the catchments of the Project.

Based on this review the ZoI for European sites designated for terrestrial habitats and species was determined to be 15 km (conservative approach). All European sites within a 15 km radius of the wind farm, OHL and Agannygal Substation have been identified and included for assessment (see Section 7.3.1.1). The ZoI for European sites designated for water dependent habitats and species has been defined as those sites hydrologically connected to the river systems draining the Project. In the case of the Owendalulleegh River, the ZoI extends up to approximately 45 km downstream. Chapter 8 of this rEIAR addresses impacts on aquatic ecology and fisheries.

7.2.6 Field Surveys

Field surveys undertaken to monitor the ecological impact of the wind farm project commenced either during construction or post-construction. The survey methods employed were appropriate for the purpose of monitoring target species and habitats during the construction and operational phases of the Project and were undertaken in line with best practice methods available at the time.

7.2.6.1 Terrestrial habitats

The following field surveys have informed the assessment presented in this report:

- Ecological assessment of peat slide. Surveys included a walkover habitat survey of peat slide area from the wind farm downstream as far as Flaggy Bridge. A Phase 1 habitat survey of the wind farm site itself was also undertaken focusing mainly on peatland areas (Inis Environmental Services, February 2004a).
- Monitoring of habitat recovery within peat slide area July 2004 (Inis Environmental Services)
- Monitoring of habitat recovery within peat slide area February 2005 (Inis Environmental Services)
- Monitoring of habitat recovery within peat slide area (Inis Environmental Services, October 2005)
- Habitat assessment of wind farm and peat slide area September 2011 (Wetland Surveys Ireland)
- Habitat survey of wind farm site to inform assessment of road upgrades June 2013 (Wetland Surveys Ireland)
- Habitat survey of wind farm site and peat slide area July 2015 (Wetland Surveys Ireland)
- Habitat survey of wind farm site, peat slide area, and the Derrybrien-Agannygal 110kV OHL corridor July 2018 (Wetland Surveys Ireland)

The most recent surveys of the site (2011 to 2018) followed methodology outlined in Smith *et al.* (2011). Detailed botanical and habitat descriptions were prepared for areas of ecological interest within the project area. Detailed habitat data was also recorded in the area affected by the peat slide in order to describe the establishment of vegetation and habitat structure during the period since the peat slide occurred. The most recent terrestrial habitat surveys of the wind farm site inform the impact assessment of the operational phase of the project and have also provided the receiving environment conditions against which the potential impacts associated with the decommissioning phase can be assessed.

Habitats recorded were classified according to Fossitt (2000) and where relevant according to Annex I of the EU Habitats Directive. Guidance in determining whether or not a habitat type may correspond to an EU Annex I type was sought from a variety of sources including European Commission (2013), and Fossitt (2000).

Attention was paid to the possible occurrence of plant species which are considered to be rare in both a national and local context (Scannell and Synnott 1987) with particular emphasis on plant species listed in the Irish Red Data Book for vascular plants (Curtis and McGough 1988), the Flora Protection Order (2015), and Annex II of the E.U. Habitats Directive.

Plant species nomenclature in this report follows Parnell & Curtis (2012) for vascular plants, Atherton *et al.* (2010) for mosses and liverworts, and Whelan (2011) for lichens.

7.2.6.2 Birds

7.2.6.2.1 Breeding Bird Surveys

A programme for monitoring of hen harrier *Circus cyaneus* distribution within the Derrybrien Wind Farm commenced in March 2004. The monitoring was in compliance with Condition 9 of Galway County Council Planning Ref. 02/3560, provided below. While not requested in Planning Condition no. 9, all other bird species observed or heard were recorded during the vantage point surveys and general time spent within the wind farm site and the surrounding areas. Post-construction monitoring of operational wind farms usually only focuses on target or key species. Hen harrier and merlin *Falco columbarius* were identified as target species given the designation of the Slieve Aughty Mountains SPA for both species, and the fact that both species are of high conservation importance.

Condition 9 of Galway County Council Planning Ref. 02/3560:

> "**9**. *The developer shall retain the services of a suitably qualified and experienced bird specialist to undertake appropriate surveys of this site for the Hen Harrier. Details of the surveys to be undertaken shall be agreed in writing with the planning authority prior to commencement of development.*
>
> *REASON: To ensure that the developer contributes towards knowledge of the local Hen Harrier population and of the impact of wind farms on that species."*

The objectives of the monitoring programme, which has continued at intervals up to the present (see below), were as follows:

- To determine if hen harriers that may nest in the vicinity (up to c.5 km from wind farm site) use any part of the wind farm site for nesting and/or foraging purposes
- To determine what distance foraging birds will approach wind turbines
- To determine if birds habituate to the presence of turbines

The survey methodology used was that as recommended for monitoring hen harriers at wind farm projects in upland areas by the National Parks & Wildlife Service (NPWS Hen Harrier Survey Methodology, Draft 12/03/03). At the time (2004), this was based on survey techniques established by Madders (2002); these were later developed by Scottish Natural Heritage as standard methods for survey of birds at onshore wind farm sites (current version SNH, 2017).

The method involves survey of the core wind farm site through the breeding season (March/April to July/August), with coverage also of a wide area (up to 5 km) around the wind farm site to establish locations of nesting pairs in the vicinity. Part of the route of the Derrybrien to Agannygal OHL was included as part of the wider 5 km study zone. The distance of 5 km was as recommended by NPWS methodology based on the distance where majority of hunting is done from a nest site. With the use of VHF transmitter tags, Irwin *et al.* (2012) showed that 89% of hunting was done within 5 km of the focal nest.

The core site survey area was defined as the wind farm site and a strip approximately 500 m beyond the outermost turbines. Two principal vantage points were established within the wind farm from which observations were made, as follows:

Vantage Point (VP)	Description
VP A : M 60560 05219	On track out on open bog with views back west into centre of site and views east over Caheranearl to Earl's Chair.
VP B : M 58704 04749	Looking over clearfell, open bog and forest edge at northwest corner of site from track c.300m north of '365m' high point on Cashlaundrumlahan.

Six hours of observations were made from each vantage point in each month of survey. Casual observations were also made from various other locations whilst travelling around the wind farm.

The wider area around the site, to approximately 5 km from the site boundary, was checked for breeding occupancy based largely on information available from previous surveys. This wider area is known as the hinterland or peripheral area. Surveys here were mainly in the early part of the season (March-May) when territorial birds are most active. However, later visits were made to occupied territories to assess breeding success.

Monitoring surveys for breeding birds were carried out in the following years:

- 2004 – construction works had commenced but were on hold due to peat slide and no turbines yet erected, site still largely afforested
- 2006, 2007, 2009, 2011, 2015, 2018 – operational phase

7.2.6.2.2 Winter Bird Surveys

Monitoring surveys for winter birds were carried out in the following years:

Winter 2011-12: a survey was carried out from November 2011 to January 2012. This included observations from the vantage points within the wind farm (9 hours in November, 7 hours in December, 8 hours in January) and search for night roosting hen harriers in the hinterland area (on six dates between November and January). The winter roost survey followed the method of the Irish Hen Harrier Winter Survey (O'Donoghue, 2019).

Winter 2019-20: a survey commenced in October 2019 and continued to March 2020. This included vantage point watches within the wind farm (6 hrs from each VP per month) and search for night roosting hen harriers in the hinterland area (following the method of the Irish Hen Harrier Winter Survey, O'Donoghue 2019).

7.2.6.3 Bats

Very limited data was available regarding the local bat population in the Slieve Aughty Mountains prior to monitoring surveys commencing in 2011. Bat activity surveys were commissioned by Gort Windfarms Ltd. to determine what species were present and the level of bat activity on the wind farm site. The purpose of gathering data over multiple years is to establish the species composition, spatial occurrence and activity levels of the local bat population. Knowledge of local bat populations is essential to understanding the significance of impacts associated with the operational wind farm.

7.2.6.3.1 Bat survey 2011

A bat activity survey was undertaken on 5 November 2011 (Wilson, 2012). Each turbine was visited during the survey and a bat detector used to record activity along tracks whilst driving between turbines. Surveys were completed using a Heterodyne Bat Detector (Pettersson D100), a Time Expansion Bat Detector (Pettersson D240) and a Frequency Division Bat Detector (Bat Box Duet).

7.2.6.3.2 Bat Survey 2016

The bat survey methods were derived with reference to guidance documents produced by BCI (2012), Natural England (2014) and the Bat Conservation Trust (Hundt, 2012).

Field surveys to inform the assessment for the Project comprised the following elements:

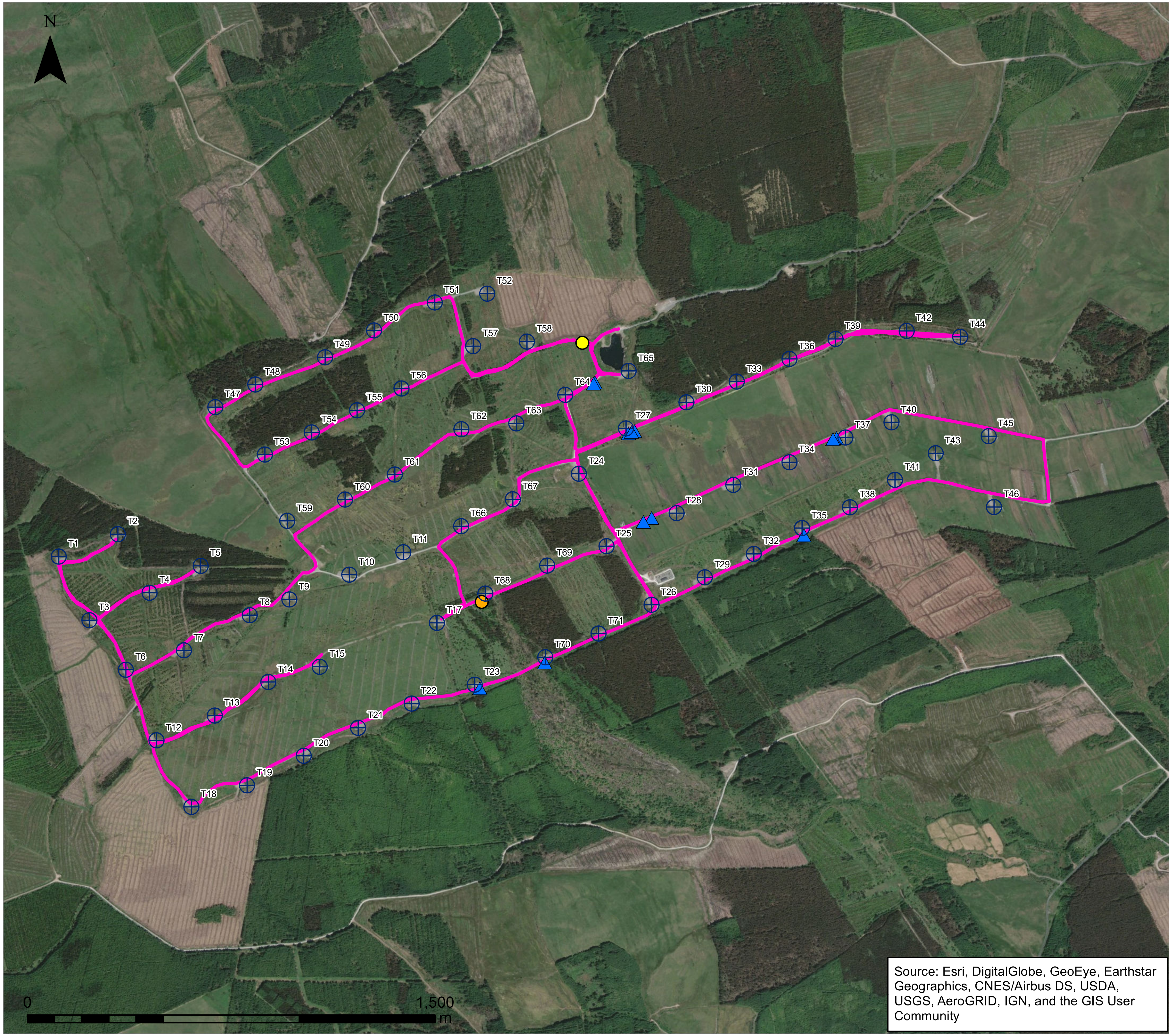
- Driven transect survey

- Static bat detector survey
- A search, using specially trained dogs, for bat corpses (accompanied by a scavenger removal study)

Driven transect survey

Driven transect surveys were carried out in April, June and August 2016. The survey route was designed to sample bat activity across the whole site. Driven transect surveys followed a predetermined route, passing as many turbines as possible without repeatedly driving along the same tracks. The car was driven at a constant speed of 15 mph. A Song Meter SM2BAT+ detector was placed in the car with an omnidirectional microphone attached by cable and bracket approximately 30 cm above the roof of the car. The direction that the route was driven was alternated between surveys, so that different parts of the route were surveyed at different times in relation to dusk. The driven transect route is shown on Figure 7.1.

Surveys were carried out when weather conditions were most suitable for bats to be active, avoiding temperatures below 10°C, heavy rain and high wind speeds. Surveys started at sunset, as recommended in BCT (2012) guidance, and took approximately 2.5 hours to complete. The timing of the surveys covered the bat emergence period and the period of most intense foraging activity when invertebrate prey is most abundant (Altringham, 2003).



R:\0010 Derrybrien Environmental\06 Mapping\ArcGIS\Mxds\Working\Environmental_Report\Chapter 7 - Biodiversity\Figure 7.1 - Driven transect route - Bat survey 2016.mxd

LEGEND

Turbines

Transect route

All bat passes

Leisler's bat

Common pipistrelle

Soprano pipistrelle

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PROJECT TITLE
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Figure 7.1 - Driven transect route – Bat survey 2016

DATE: 25.05.2020 CHECKED: RT SCALE: 1:13,500
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No dimensions are to be scaled from this drawing.
All dimensions are to be checked on site.
Area measurements for indicative purposes only.

Ordnance Survey Ireland data used in accordance with standard Authorised Third Party Users licence (customer: ESB International)

Sources: BSG Ecology survey data

Static detectors

The site was divided into three broad areas in order to allocate static detectors across the range of habitats present on site:

The western area (turbines including and west of T11, T17 and T23) which is bordered by forestry, but has no retained forest blocks within it. This area was formerly afforested and cleared for wind farm construction.

The eastern area of the site (turbines including and east of T24 - 26) which comprises an area of cutaway bog bounded to the north and south by plantation. The land is accessible to the public and there is unauthorized peat cutting.

The central and northern part of the site. This is irregular in shape and characterised by a mixture of open acid grassland and heather moor with small retained forest coupes. A flooded borrow pit/quarry is present in the north-eastern corner of the area, along with a number of smaller water bodies that may represent remnants of the original landscape and habitats prior to afforestation.

The forest edge (particularly mature stands offering shelter from the prevailing south-westerly wind), the retained compartments of forestry within the site, and the flooded borrow pit were all considered likely to offer greater foraging opportunities for bats than the rest of the site.

Song Meter (SM2+) bat detectors with external microphones were deployed in each of the above areas in order to obtain representative coverage of the habitats present (18 bat detector units overall). The SM2 detectors were configured to record above the level of ambient noise, such as from wind or rain using an adaptive trigger set to 6 decibels (dB) and were set to define a bat pass as a call note of >2 milliseconds (ms) which is separated from another by more than one second. Each bat detector was housed in a waterproof Peli-case. An external microphone was connected via a cable to the logger and attached to a pole or suitable tree approximately 2 m above ground level.

The following turbines were selected for detector deployment in 2016 (locations are shown on Figure 7.2).

- Western area: T5, T18, T21 (forest edge); T59, T13, T15, T11 (open regenerated grassland and moorland areas)
- Eastern area: T32, T33, T41 (forest edge); T27 (open cut away bog)
- Central and northern area: T54, T62, T67 (on potential bat commuting routes between retained forest compartments); T65 (close to water body); T17, T70, T71 (forest edge habitats – the former on the edge of an area of historical peat slide)

The static detectors were deployed each month with the aim of ensuring five nights of data were recorded each month from April to August 2016 inclusive (see Appendix 7-4, Table 1 for 2016 deployment dates). The detectors were set to record from half an hour before sunset to half an hour after sunrise, the period during which bats are usually active away from their roosts. The duration of recording per night varied throughout the survey period according to day/night length.

R:\0010 Derrybrien Environmental\06 Mapping\ArcGIS\Mxds\Working\Environmental_Report\Chapter 7 - Biodiversity\Figure 7.2 - Turbine and bat detector locations (2016).mxd

LEGEND

Turbines

Detector locations (2016)

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Figure 7.2 - Turbine and bat detector locations (2016)

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Ordnance Survey Ireland data used in accordance with standard Authorised Third Party Users licence (customer: ESB International)

Sources: BSG Ecology survey data

Bat Mortality (Corpse) Searches

BSG Ecology contracted Conservation Dogs (part of Wagtail UK), a company that trains anti-poaching and wildlife detection dogs, to complete carcass searches. The company regularly works in Ireland (principally undertaking drug searches) and has completed considerable wind farm related work in the UK.

Bat Carcass Searches

The objective of bat carcass searches was to identify whether there was any evidence that the operation of Derrybrien Wind Farm was resulting in bat fatalities. Turbines with the highest levels of bat activity (based on data collected using static detectors) were targeted for searching by the dogs.

The available evidence indicates that trained dogs are much more efficient than humans in locating bat corpses below wind turbines (Mathews *et al*, 2016). Dogs were used to search an area extending 60 m around each turbine tower. This included areas of hard-standing as well as semi-natural habitats. The area was defined based on the fact that a team of two dogs can typically search the area around six turbines during a working day (dawn to late morning in August / September) before becoming exhausted, with the area it is possible to cover around each turbine depending on habitat structure.

Searches were conducted on two consecutive mornings at 6 turbine locations (T11, T17, T18, T21, T27, and T71) on 31 August and 1 September 2016 to give an indication of bat mortality. During the survey the dogs were followed by the handler, who provided constant instruction. The dogs can effectively survey to 5 m either side of them when walking a transect.

In the event a bat carcass was found, the turbine(s) it was under was to be noted, as well as the position of the bat in relation to it (distance and direction from turbine base). The bat species was to be identified on site where possible, and if this could not be achieved (due to decomposition or inconclusive biometric data), the corpse was removed for identification via DNA analysis.

Carcass Scavenging Rate

In order to provide some information on the rate at which the corpses of dead animals are removed from the site (and therefore not be available for dogs to find), scavenger removal trials were completed.

A carcass was left at 6 locations (T11, T17, T18, T21, T27 and T71) within the wind farm and monitored through the use of a trail cam for 7 days (from 01 to 07 September). After 7 days the cameras were collected and notes were made on presence and degradation of the corpses. Bat carcasses are not readily available (as they are protected species) so rodents of equivalent body size (obtained from pet shops where they are supplied for feeding snakes etc.) were substituted.

Data Analysis

Bat Call Identification and calculation of relative activity

Recorded bat calls were analysed using Analook software to confirm the identity of the bats present. Where possible, the bat was identified to species level. Species of the genus Myotis were grouped together as overlapping call parameters make species identification problematic (Hundt, 2012).

For Pipistrelle species the following criteria, based on measurements of peak frequency, were used to classify calls:

Common pipistrelle	≥42 and <49 kHz
Soprano pipistrelle	≥51 kHz
Nathusius' pipistrelle	<39 kHz
Common pipistrelle / Soprano pipistrelle	≥49 and <51 kHz
Common pipistrelle / Nathusius' pipistrelle	≥39 and <42 kHz

Bat calls which could not be ascribed to any of these categories were not used in the analysis.

AnalookW (Version 3.8, 2010) software was used for all analysis of bat calls. The software enables analysis of the relative activity (referred to as 'activity' in the text below) of different species of bats by counting the number of bat passes (B) recorded within a unit of time (hour (h) was used). More than one pass of the same species was counted within a sound file if multiple bats were recorded calling simultaneously. During analysis of sound files, it was possible to estimate the minimum number of bats recorded on individual sound files but not whether consecutive sound files had recorded one bat or multiple bats. Although relative abundance cannot therefore be estimated from this analysis, the number of bat passes does provide an indication of the importance of features/habitats to bats by assigning a level of bat activity that is associated with that feature, regardless of the type of activity.

7.2.6.3.3 Bat survey 2019

Bat survey methods employed by BSG Ecology in 2019 were derived with reference to guidance documents produced by Bat Conservation Ireland (BCI) (2012), and multi-agency guidance published by Scottish Natural Heritage (SNH *et al.*, 2019)[2].

Sampling was completed during the autumn (29 August to 8 October) at each of 32 turbine locations using the static detectors (11 detectors were rotated between the 32 locations). The same locations were sampled as the surveys in 2016, along with an additional 14

[2] The SNH guidance supersedes previous guidance by Natural England (2014) and the Bat Conservation Trust (BCT) (Hundt, 2012). While this guidance is not specifically aimed at Ireland, it is broadly compatible with Bat Conservation Ireland's equivalent guidance (BCI, 2012), more prescriptive in some areas and more applicable to a wind farm of the scale of Derrybrien.

locations which were spread evenly across the site (locations for 2019 survey are shown on Figure 7.3). Ten consecutive nights of data were collected at each location.

Bat data were analysed using the same processes and parameters as the 2016 data.

7.2.6.4 Mammals (other than bats)

Otter

A survey of the Owendalulleegh River was undertaken by the Shannon Regional Fisheries Board (SRFB) and Inis Environmental Services between the 9th – 22nd December 2003 following the peat slide which occurred in October 2003. An OS 6" map of the river channel from Flaggy Bridge (located on the R353) to Lough Cutra was chained in 100 m sections according to the system used by the Office of Public Works and the Central Fisheries Board (Anon, 2004 & Inis Environmental Services, 2004b). The survey involved a visual assessment of the river, its banks, instream vegetation and nature and condition of riverbed substrate. Animal tracks and signs including those of otter were recorded during the survey.

A dedicated otter survey of the wind farm site was undertaken on 20th July 2018 and included a thorough search of the drains within the site. Otter signs were also recorded during aquatic habitat surveys on the Owendalulleegh River on 25th August 2018 and on the Boleyneendorrish River while undertaking Q-value assessments on October 10th, 2018.

Other mammals

Based on an assessment of current habitat suitability for other large mammals within the wind farm site and along the OHL corridor, no other dedicated large mammal surveys were undertaken.

7.2.6.5 Other fauna

Habitats within the wind farm site are not considered suitable for marsh fritillary butterfly (*Eurodryas aurinia*); this species is protected under Annex II of the Habitats Directive and is listed under the Wildlife Acts 1976 (as amended). The assessment was based upon percentage of Purple Moorgrass and Devil’s-bit Scabious, scrub cover, sward height and presence of tussocks (NRA, 2009). This species has been scoped out of further assessment.

LEGEND

- Turbines
- Detector locations (2019)

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PROJECT TITLE
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Figure 7.3 - Turbine and bat detector locations (2019)

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Ordnance Survey Ireland data used in accordance with standard Authorised Third Party Users licence (customer: ESB International)

Sources: BSG Ecology survey data

R:\0010 Derrybrien Environmental\06 Mapping\ArcGIS\Mxds\Working\Environmental_Report\Chapter 7 - Biodiversity\Figure 7.3 Turbine and Bat Detector Locations 2019.mxd

7.2.7 Assessment Methodology

The evaluation and assessment within this Chapter has been undertaken with reference to relevant parts of the '*Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine (2018)*' developed by the Chartered Institute of Ecology and Environmental Management (CIEEM, September 2018). Although these guidelines are recognised as the industry standard for ecological assessment in Ireland, they are not prescriptive; rather, they aim to "*provide guidance to practitioners for refining their own methodologies*". The impact assessment has also had regard to advice set out in the EPA draft guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR) published in August 2017.

7.2.7.1 Important Ecological Features

A first step in Ecological Impact Assessment (EcIA) is determination of which ecological features (habitats, species, ecosystems and their functions/processes) are important. Important features should then be subject to detailed assessment if they are likely to be affected by the development. It is not necessary to carry out detailed assessment of features that are sufficiently widespread, unthreatened and resilient to effects of the development, such that there is no risk to their viability.

Ecological features can be important for a variety of reasons and the rationale used to identify these is explained below. Importance may relate, for example, to the quality or extent of designated sites or habitats, to habitat/species rarity, to the extent to which they are threatened throughout their range, or to their rate of decline.

7.2.7.2 Evaluation: Determining Importance

The importance of an ecological feature should be considered within a defined geographical context. The following frame of reference has been used in this case:

- International and European
- National (Ireland)
- County (County Galway)
- Vice County (South Galway)
- Local (Slieve Aughty Mountains – defined by SPA boundary)
- Site (study area)

In certain circumstances particular receptors may be valued below the Site level. In these instances, they are described as being of negligible importance.

CIEEM guidance indicates that features of less than Local importance are generally considered unlikely to trigger a mitigation or policy response in EcIA terms.

The approach to evaluating terrestrial habitats included two categories in the local context, higher value and lower value. In this case, those habitats of lower value do not trigger a mitigation response.

7.2.7.3 Characterising and Quantifying Impacts and Assessing the Significance of Effects

The terms impact and effect are defined by CIEEM (2018) as:

- Impact – Actions resulting in changes to an ecological feature. For example, the construction activities of a development removing a hedgerow.
- Effect – Outcome to an ecological feature from an impact. For example, the effects on a dormouse population from loss of a hedgerow.

CIEEM (2018) guidelines state that when describing ecological impacts and effects, reference should be made to the following characteristics as required: positive or negative; extent; magnitude; duration; frequency and timing and reversibility.

Following the characterisation of impacts, an assessment of the ecological significance of their effects is made. The guidelines promote a transparent approach in which a positive or negative effect is determined to be significant or not, in ecological terms, in relation to the integrity of the defined site or ecosystem(s) and/or the conservation status of habitats or species within a given geographical area, which relates to the level at which it has been valued. The decision about whether an effect is significant or not, is independent of the value of the ecological feature; the value of any feature that will be significantly affected is then used to determine the implications, in terms of legislation and / or policy (CIEEM, 2018).

Significance is a concept related to the weight that should be attached to effects when decisions are made. For the purpose of this assessment, 'significant effect' is an effect that either supports or undermines biodiversity conservation objectives for 'important ecological features'. A significant effect is simply an effect that is sufficiently important to require assessment and reporting so that the decision maker is adequately informed of the environmental consequences of permitting a project. The EcIA guidelines (CIEEM, 2018) state that "*A significant effect does not necessarily equate to an effect so severe that consent for the project should be refused planning permission. For example, many projects with significant negative ecological effects can be lawfully permitted following EIA procedures as long as the mitigation hierarchy has been applied effectively as part of the decision-making process*". The assessment of significance is based on professional judgement.

The Environmental Protection Agency (EPA) provides defined terms for the description of effects (EPA, 2017. Table 3.3). Where relevant significant effects have been described using these terms.

7.2.8 Difficulties Encountered

In general, no significant difficulties were encountered in carrying out the assessment of the impact of the Project on biodiversity.

The primary difficulty was regarding information available for the baseline environment pre-construction. The assessment of the construction phase of the Project is partly based on information collated from a review of third-party datasets relating to the planning and construction phases of the development. The information on the baseline (pre-construction) environment within the Project area was gathered through a desktop review of literature prepared from 1998 to 2003 from various sources, and an analysis of aerial photography (Ordnance Survey Aerial Photographs, 1995 and 2000).

Limited and non-quantitative bird surveys were carried out within the wind farm project area for the original EISs and the pre-construction period, on behalf of Saorgus Energy Ltd. From the original EISs, assumptions have been made in considering baseline conditions for birds on site at the time.

Bats were not specifically considered in the original EIS documents prepared between 1998 and 2001. Therefore, the use of the area by bats pre-construction, during construction and during the operation phase (up to 2011) cannot be characterised based on empirical data. Instead assumptions have been made as to the likely use of the area by bats based on habitat type, species present in the wider area and species ecology.

The first detailed bat surveys of the wind farm site were completed in spring and summer 2016, ten years into the operational period. The autumn period was not sampled. Further detailed survey work to address this data gap was undertaken in autumn 2019.

Data collected during the operational phase is considered to provide appropriate baseline information to assess ongoing and future impacts of the wind farm on bats.

Despite these constraints, it is considered that the data available is adequate to describe and assess the baseline terrestrial environment present within the Project area prior to development. In addition, two of the authors of this chapter have been involved with the project since first visiting the site in the days following the peat slide event in late 2003.

7.3 Receiving Environment

This section sets out the findings of the desk study and baseline ecological survey work. It then goes on to evaluate the importance of the identified ecological features.

7.3.1 Designated Nature Conservation Sites

7.3.1.1 European sites

The Habitats Directive 92/43/EEC provides legal protection for habitats and species of European importance through the establishment of a network of European designated conservation sites. These sites are known as Special Areas of Conservation (SAC) under the Habitats Directive and Special Protection Areas (SPA) designated under the EU Birds Directive 79/209/EEC.

The potential for the Project to impact on European sites within the ZoI was considered as part of this assessment. The ZoI is described in Section 7.2.5 and considers all aspects of the Project, including the wind farm site, grid connection and associated works.

The Project is entirely within the Slieve Aughty Mountains SPA (site code 004168). The SPA had not been publicly notified at the time of the planning and construction of the Project (classified as a SPA in March 2007 and formally designated by Statutory Instrument in March 2012 (S.I. No. 83 of 2012)).

In addition to the Slieve Aughty Mountains SPA, 23 other European sites have been identified within the 15 km radius of the Project (in total 5 SPAs and 19 SACs). Some of these sites are hydrologically linked to the Project and while these links are over a distance greater than 15 km along the hydrological pathway the sites are located within the 15 km radius.

A further 6 European sites outside of the 15 km radius have been identified as being within the ZoI of the Project (i.e. having the potential to have been or be impacted by the Project) owing to the hydrological connection between these sites and the Project. One of these sites is a SPA (Inner Galway Bay SPA) and the other 5 sites are SACs - Galway Bay SAC; Cahermore Turlough SAC; Caherglassun Turlough SAC; Barroughter Bog SAC and Lough Derg North East Shore SAC. These sites were identified using GIS data downloaded from www.npws.ie (accessed July 2020). Refer to Table 7.1 and Figure 7.4 for details and locations of these sites.

All but two of the 30 sites had been proposed for designation under the Habitats and Birds Directives by the time works began on the Project. As mentioned previously, the Slieve Aughty Mountains SPA was proposed for designation in March 2007 and Lough Rea SPA was proposed for designation in February 2007. Work commenced on the wind farm project in June 2003 and was completed in early 2006.

Although many sites were not formally designated by Statutory Instrument until much later, legal protections, consummate with those set out in the Directives, have applied to the sites since initially proposed for designation either as Sites of Community Importance (SCI) for SACs or proposed Special Protection Areas (pSPAs).

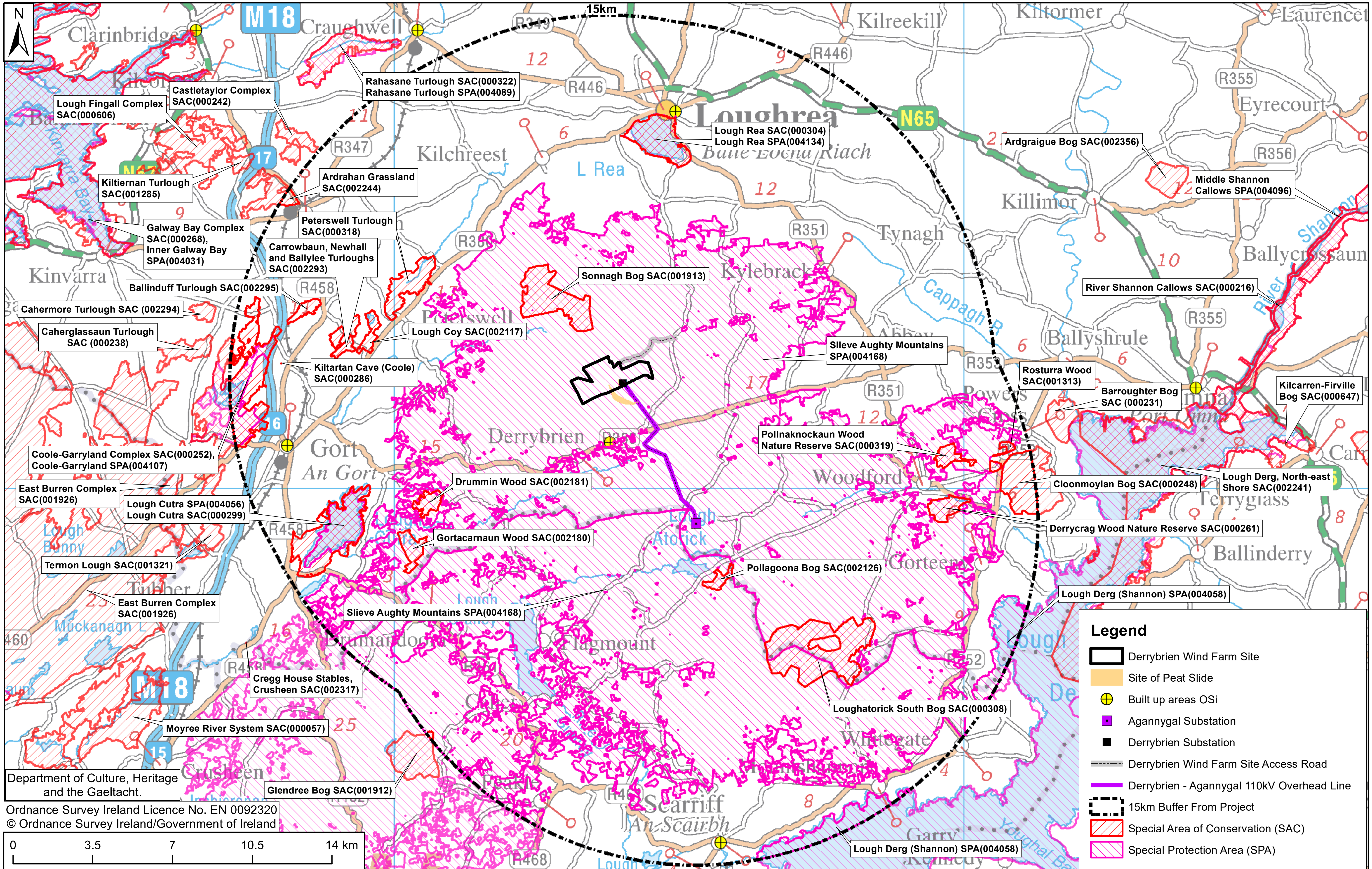
Table 7.1: SACs and SPAs within the Zone of Influence of the Project

European Sites (Natura 2000)	Distance from the Project (Approximate)
Slieve Aughty Mountains SPA (004168)	The entire wind farm project is within the boundary of the SPA.
Sonnagh Bog SAC (001913)	1.5 km north west of wind farm site 2.8 km north west of grid connection

European Sites (Natura 2000)	Distance from the Project (Approximate)
Drummin Wood SAC (002181)	7.4 km south west of wind farm site 9.3 km west of grid connection
Peterswell Turlough SAC (000318)	7.7 km north west of wind farm site 9.8 km north west of grid connection
Lough Rea SPA (004134)	8.9 km north of wind farm site 9.7 km north of grid connection
Lough Rea SAC (000304)	8.9 km north of wind farm site 9.7 km north of grid connection
Lough Coy SAC (002117)	9 km north west of wind farm site 11 km north west of grid connection
Pollagoona Bog SAC (002126)	9 km south east of wind farm site 2 km south of grid connection
Gortacarnaun Wood SAC (002180)	9 km south west of wind farm site 11 km west of grid connection
Carrowbaun, Newhall and Ballylee Turloughs SAC (002293)	9.6 km west of wind farm site 11.9 km west of grid connection 15 km from wind farm site hydrologically
Lough Cutra SPA (004056)	10 km south west of wind farm site 12 km west of grid connection 22 km from wind farm site hydrologically
Lough Cutra SAC (000299)	10 km south west of wind farm site 12 km west of grid connection 22 km from wind farm site hydrologically
Ballinduff Turlough SAC (002295)	11.7 km north west of wind farm site 13.7 km north west of grid connection
Pollnaknockaun Wood Natura Reserve SAC (000319)	12.6 km south east of wind farm site 10.9 km east of grid connection
Loughatoric South Bog SAC (000308)	12.8 km south east of wind farm project

European Sites (Natura 2000)	Distance from the Project (Approximate)
	6 km south east of grid connection
Kiltartan Cave (Coole) SAC (000286)	12.7 km west of wind farm site 15 km west of grid connection
Derrycrag Wood Natura Reserve SAC (000261)	13 km south east of wind farm site 10 km east of grid connection
Coole-Garryland Complex SAC (000252)	13.4 km west of wind farm site 15.5 km west of grid connection 30 km west of wind farm hydrologically
Coole-Garryland SPA (004107)	13.8 km west of wind farm site 16 km west of grid connection 30 km west of wind farm hydrologically
Ardrahan Grassland SAC (002244)	14.6 km north west of wind farm site 16 km north west of grid connection
Rosturra Wood SAC (001313)	15.5 km east of wind farm site 13.7 km east of grid connection
Cloonmoylan Bog SAC (000248)	15.9 km east of wind farm site 13.7 km east of grid connection
Glendree Bog SAC (001912)	16 km south west of wind farm site 15 km south west of grid connection
Barroughter Bog SAC (000231)	18 km east of wind farm 22 km from wind farm site hydrologically
Lough Derg (Shanon) SPA (004058)	18 km south east of wind farm site 13 km east of grid connection 23 km from wind farm site hydrologically
Lough Derg, North-east Shore SAC (002241)	18 km east of wind farm 23 km from wind farm site hydrologically
Caherglassaun Turlough SAC (000238)	16 km west of wind farm project 40 km west of wind farm hydrologically

European Sites (Natura 2000)	Distance from the Project (Approximate)
Cahermore Turlough SAC (002294)	16 km west of wind farm project 40 km west of wind farm hydrologically
Galway Bay Complex SAC (000268)	21 km north west of wind farm project 23 km north west of grid connection 45 km from wind farm site hydrologically
Inner Galway Bay SPA (004031)	21 km north west of wind farm site 23 km north west of grid connection 45 km from wind farm site hydrologically



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CLIENT: Gort Windfarms Ltd

PROJECT: Derrybrien Wind Farm Project

CONTRACT

PRODUCTION UNIT: Civil & Environmental Engineering

DRAWING TITLE: Figure 7.4 - European Sites within 15km radius of Project

DRAWN	PRODUCED	VERIFIED	APPROVED	APPROVAL DATE
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7.3.1.2 Natural Heritage Areas and Proposed Natural Heritage Areas

Natural Heritage Areas (NHAs) are sites that are designated for the protection of flora, fauna, habitats and geological sites of national importance. Management of NHAs is guided by planning policy and the Wildlife Acts, 1976-2012.

Proposed NHAs (pNHAs) were published on a non-statutory basis in 1995 but have not since been statutorily proposed or designated. These sites are of significance for wildlife and habitats.

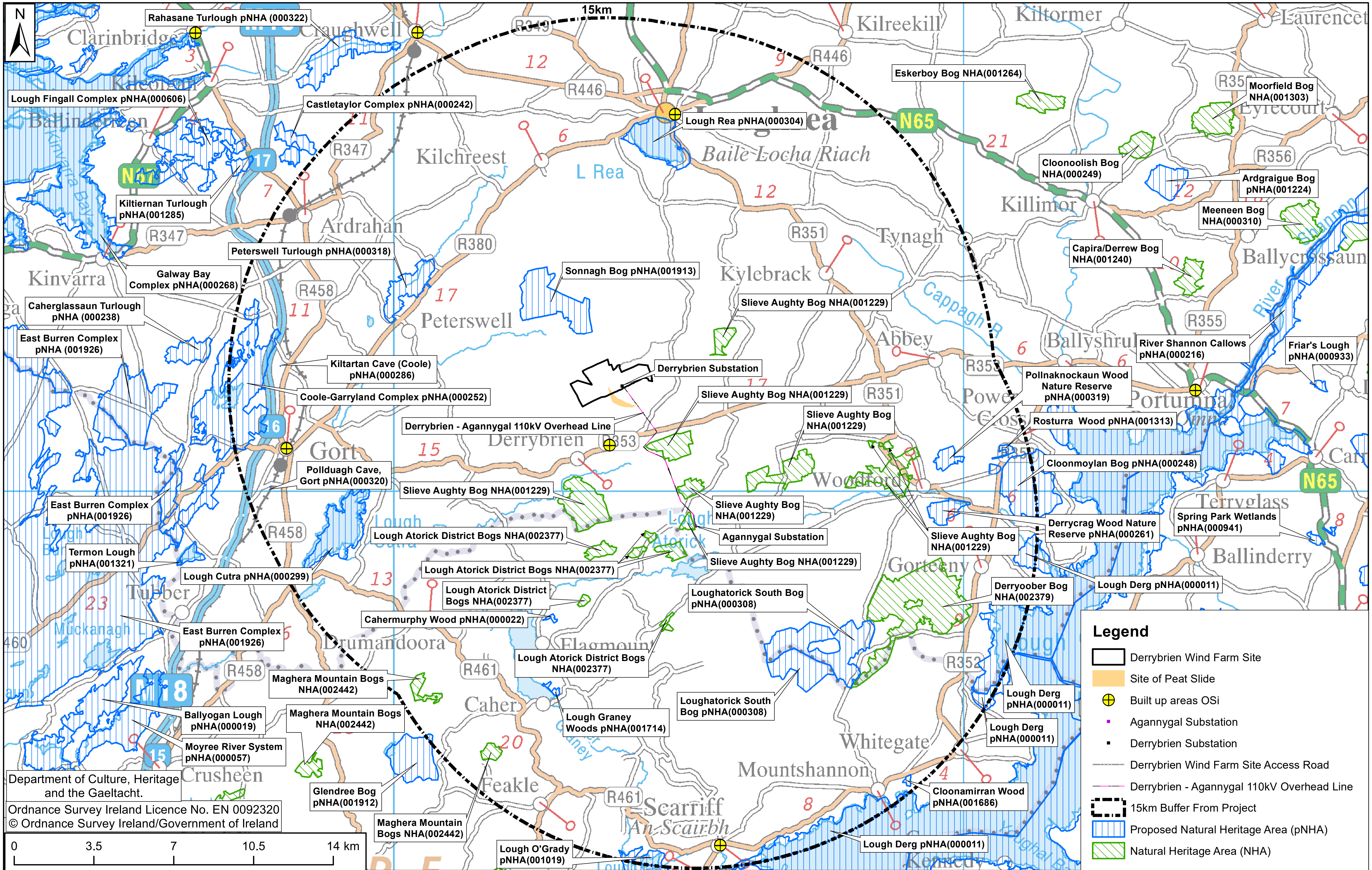
Four NHAs were identified and 19 pNHAs within the ZoI of the Project. Refer to Table 7.2 and Figure 7.5.

It should be noted that 13 of the pNHAs are also designated European sites (SAC or SPA) and the assessment of impacts to these sites is covered in the rNIS.

Table 7.2: NHAs and pNHAs within the Zone of Influence of the Project

Name of site	Distance from the Project (Approximate)
Sonnagh Bog pNHA/SAC (001913)	1.4 km north west
Slieve Aughty Bog NHA (001229)	2.3 km south of wind farm site, adjacent (east) to the OHL line at Derrybrien East and adjacent (west) to Agannygal Substation site
Lough Atorick District Bogs NHA (002377)	6.8 km south east
Peterswell Turlough pNHA/SAC (000318)	8.3 km north west
Lough Rea pNHA/SAC/SPA (000304)	8.9 km north
Cahermurphy Wood pNHA (000022)	9.1 km south west
Lough Cutra pNHA/SAC/SPA (000299)	10 km south west
Lough Graney Woods pNHA (001714)	12.1 km south west
Pollnaknockaun Wood Nature Reserve pNHA/SAC (000319)	12.6 km south east
Kiltartan Cave (Coole) pNHA/SAC (000286)	12.7 km west
Pollduagh Cave, Gort pNHA (000320)	14 km west
Loughatorick South Bog pNHA/SAC (000308)	12.8 km south east
Derrycrag Wood Nature Reserve pNHA/SAC (000261)	13 km south east
Rosturra Wood pNHA(001313)	15.5 km east
Derryoober Bogs NHA (002379)	13 km south east

Name of site	Distance from the Project (Approximate)
Coole Garryland Complex pNHA/SAC (000252)	13.4 km west
Maghera Mountains Bogs NHA (002442)	13.5 km south west
Glendree Bog pNHA (001912)	16 km south west
Cloonamirran Wood pNHA (001686)	21 km south east
Lough O'Grady pNHA (001019)	20 km south of wind farm
Caherglassaun Turlough pNHA/SAC (000238)	16 km west of wind farm project 40 km hydrologically
Galway Bay Complex pNHA (000268)	21 km north west of wind farm project 45 km hydrologically
Lough Derg pNHA (000011)	22 km east of wind farm project 23 km hydrologically



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CLIENT: Gort Windfarms Ltd

PROJECT: Derrybrien Wind Farm Project

CONTRACT

PRODUCTION UNIT: Civil & Environmental Engineering

DRAWING TITLE: Figure 7.5 - NHAs and pNHAs within 15km radius of Project

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7.3.1.3 Nature Reserves

A Nature Reserve is an area of importance to wildlife, which is protected under Ministerial order. Most are owned by the State. However, some are owned by organisations or private landowners, and persons interested in acquiring statutory protection for their lands can seek advice on this matter from the DCHG. The following Nature Reserves occur within 15 km of the Project -

- Coole-Garyland Nature Reserve is approximately 12.8 km from the Project and over 30 km downstream of the wind farm site.
- Caher (Murphy) Nature Reserve is 9.2 km south west of the Project.
- Pollnaknockaun Wood Nature Reserve is 12 km south east of the Project.
- Rosturra Wood Nature Reserve is12 km south east of the Project.
- Derrycrag Nature Reserve is 12 km south east of the Project.

Four of these five Nature Reserves (Coole-Garyland, Pollnaknockaun Wood, Rosturra Wood and Derrycrag) are also designated as European sites and impacts to these sites is addressed in the rNIS. Cahermurphy Natura Reserve is also designated as a pNHA and impacts to this site are addressed in Section 7.4.1.2.

7.3.2 Protected and/or Rare Species

A review of the National Biodiversity Ireland Database (NBDC) showed a number of records for protected mammal and amphibian species within the 10 km squares M50 and M60 occupied by the Project (Refer to Appendix 7-1).

The NPWS database produced no records for rare and/or protected flora and fauna species within the same 10 km squares.

7.3.3 Terrestrial habitats

7.3.3.1 Terrestrial Habitats within Project Area

A map illustrating the distribution of habitats within the wind farm site prior to development is presented in

Figure 7.6**.** Habitats along the OHL corridor and at the site of Agannygal Substation pre-construction are annotated on Figure 7.7**.** The distribution of habitats is primarily informed by:

- A review of the original EISs submitted in support of the original planning application for the Project (Saorgus Energy Ltd. 1998 - 2001).
- Interpretation of colour OSI Aerial Photography dated 2000.
- Habitat surveys undertaken during the construction phase (2003).

Terrestrial habitats recorded within the wind farm project area are described in the following paragraphs and summarised in Table 7.3. Habitat names and codes correspond with the Fossitt (2000) classification system which is a three-tier hierarchical approach.

Conifer plantation (WD4)

The wind farm site was developed on lands primarily used for the production of commercial forestry (conifer plantation (WD4)) occurring on upland blanket bog (PB2). The conifer forestry comprised single species stands of Sitka Spruce (*Picea sitchensis*) and Lodgepole Pine (*Pinus contorta*) of variable growth rates and stages. A review of planting dates provided by Coillte confirms that different parts of the site were planted at different times from 1963 to 1996. Mature stands with a dense canopy cover were present in the western, northern, and central sections of the site (varying planting dates from 1963 to 1980). Conifer forestry within the south central part of the site comprised immature open canopy with heathland / bog vegetation persisting in the ground layer (varying planting dates from 1993 to 1996). Parts of this area are likely to have corresponded with failed conifer plantations.

Conifer plantation also occurred along the entire length of the overhead line corridor, and as with the wind farm site itself, the plantation ages varied from mature closed canopy forestry to open recently planted heath and bog. A map showing the distribution of habitats along the route of the OHL and at the Agannygal Substation site is presented in Figure 7.7 below.

Mature conifer plantation occurred in the footprint of the Agannygal Substation and the associated access route (see Figure 7.7).

Evaluation

Extensive conifer plantations of varying ages dominated the Project area. These highly modified areas that were managed as commercial timber plantations are considered to have been of low ecological value with poor species diversity, altered hydrological conditions, and dominance of non-native tree species. This habitat is considered to be of Local importance, lower value.

Cutover bog (PB4)

Cutover bog (PB4) occurred throughout the eastern section of the wind farm site where active turbary was practiced (see Error! Reference source not found.). The habitat was n ot present elsewhere within the project area. Peat extraction continues to take place within this section of the site. Much of the cutover areas comprised old turf banks which extended into the small remnants of intact blanket bog (PB2). The vegetation within the cutover bog area was dominated by purple moor-grass (*Molinia caerulea*) with an abundance of cotton-grass (*Eriophorum* sp.) in places. Few *Sphagnum* species were recorded within the cutover bog, species that were recorded included *S*. *cuspidatum* and *S*. *capillifolium*. Turf cutting had negatively affected the quality of the blanket bog within the site, drainage channels and peat banks occurred regularly within the site (Saorgus Energy Ltd. 1998). From an assessment of the blanket bog within the wind farm site carried out in 1998 the blanket bog was described as being of ‘reasonable quality at best’. Remnant areas of blanket bog elsewhere in the site were recorded as having been negatively affected by drainage associated with afforestation.

Evaluation

The habitat was described as being relatively species poor. It was also determined that this area may have been subject to burning, with the bog being firm underfoot and dried out. Despite the degradation of this habitat, it represents a semi-natural habitat that, due to very extensive forestry planting, is relatively rare in the wider upland area and is considered to be of Local importance, higher value

Plate 7-1: Cutover bog in the eastern parts of the site (photo during operational phase)

Upland blanket bog (PB2)

There were two areas of intact blanket bog within the study area. One of these was located within the wind farm site boundary in the central part of the site. It was an area of unplanted blanket bog with a pool and hummock complex that was, prior to construction, surrounded by mature conifer plantation. This area supported vegetation typical of upland blanket bog. It is possible that the area was considered too wet for forestry in the past. The layout of the wind farm avoided this peatland area and it has remained unaffected by the development. This area of bog was not described in the original EIS, but the following description of the habitat in 2003 taken from Inis Environmental Service (2004a) is likely to accurately reflect the pre-construction character of the habitat:

> *Species in this area include the Bog Mosses Sphagnum cuspidatum occupying the wetter areas with Sphagnum capillifolium, Sphagnum magellanicum, and Sphagnum auriculatum also present. The large hummocks are principally dominated by the moss Racomitrium lanuginosum, as is typical of upland bog. In between these hummocks are large pools that appear to be orientated in an East – west direction. Bogland plants such as Cross-leaved Heath (Erica tetralix), Ling Heather (Calluna vulgaris), Bog Asphodel (Narthecium ossifragum), Crowberry (Empetrum nigrum), Deer-grass (Trichophorum caespitosum), Hare's-tail Cotton-grass (Eriophorum vaginatum), and Common Cotton-grass (Eriophorum angustifolium) are all present.*

The second area of intact blanket bog recorded was in the western portion of the study area, just outside the wind farm site boundary. This area is described here as it comprised the last remaining area of extensive intact blanket bog in proximity to the wind farm. As above, this area was first described in detail following a survey in 2003 (Inis Environmental Service, 2004a).

> *This blanket bog comprises a mosaic of Purple Moor-grass (Molinia caerulea) dominated blanket bog and Ling Heather (Calluna vulgaris) dominated blanket bog vegetation types. This distribution of vegetation types is likely to reflect past land use and management practices. The areas where heather dominates have an abundance of other bogland species such as Deer-grass (Trichophorum germanicum), Carnation Sedge (Carex panacea), Bog Asphodel (Narthecium ossifragum), Bilberry (Vaccinium myrtillus), Sphagnum capillifolium, Sphagnum magellanicum, and Sphagnum papillosum. The Purple Moor-grass (Molinia caerulea) areas have less bogland species apparent as they are shaded out by the dominance of Purple Moor-grass. The moss layer is dominated by Sphagnum capillifolium. Of note is the presence of Bog Rosemary (Andromeda polifolia) and Cranberry (Vaccinium oxycoccos) as both these species are deemed more typical of raised bogs. Cranberry is also reported from the nearby Sonnagh Bog (NHA / SAC) while Bog Rosemary is recorded in the nearby Pollagoona Bog (NHA / SAC).*

The habitat has remained unaffected by the development of the wind farm as illustrated in Plate 7-2.

<u>Evaluation</u>

The blanket bog within the wind farm site boundary was characterised by a pool and hummock complex surrounded by mature conifer plantation. Various *Sphagnum* mosses and other heathland bryophytes were frequent. The habitat corresponds with the Annex I habitat Active Blanket Bog and is deemed to be of high local importance.

Plate 7-2: Upland blanket bog within the wind farm site. Same area photographed in 2004 (LHS) and 2018 (RHS) (Grid Reference (ITM): E 558938 N 705040)

Dystrophic lake (FL1)

A small dystrophic lake (FL1) was present within the central part of the wind farm site. The layout of the wind farm avoided this small lake. The lake was first described following a site visit in late 2003 as follows:

> *The characteristics of the lake were typical of dystrophic conditions with a margin of Sphagnum cuspidatum around the edges. A narrow band of soft rush (Juncus effusus) was recorded along the southern margin of the lake. A small area of flush (poor fen and flush (PF2)) to the east of the lake was dominated by purple moor-grass, with an abundance of ling heather in places and Sphagnum capillifolium occurring in the ground layer. It was noted that the lake appeared to have been in a relatively natural state despite the planted forestry in the adjacent area* (see Plate 7.3).

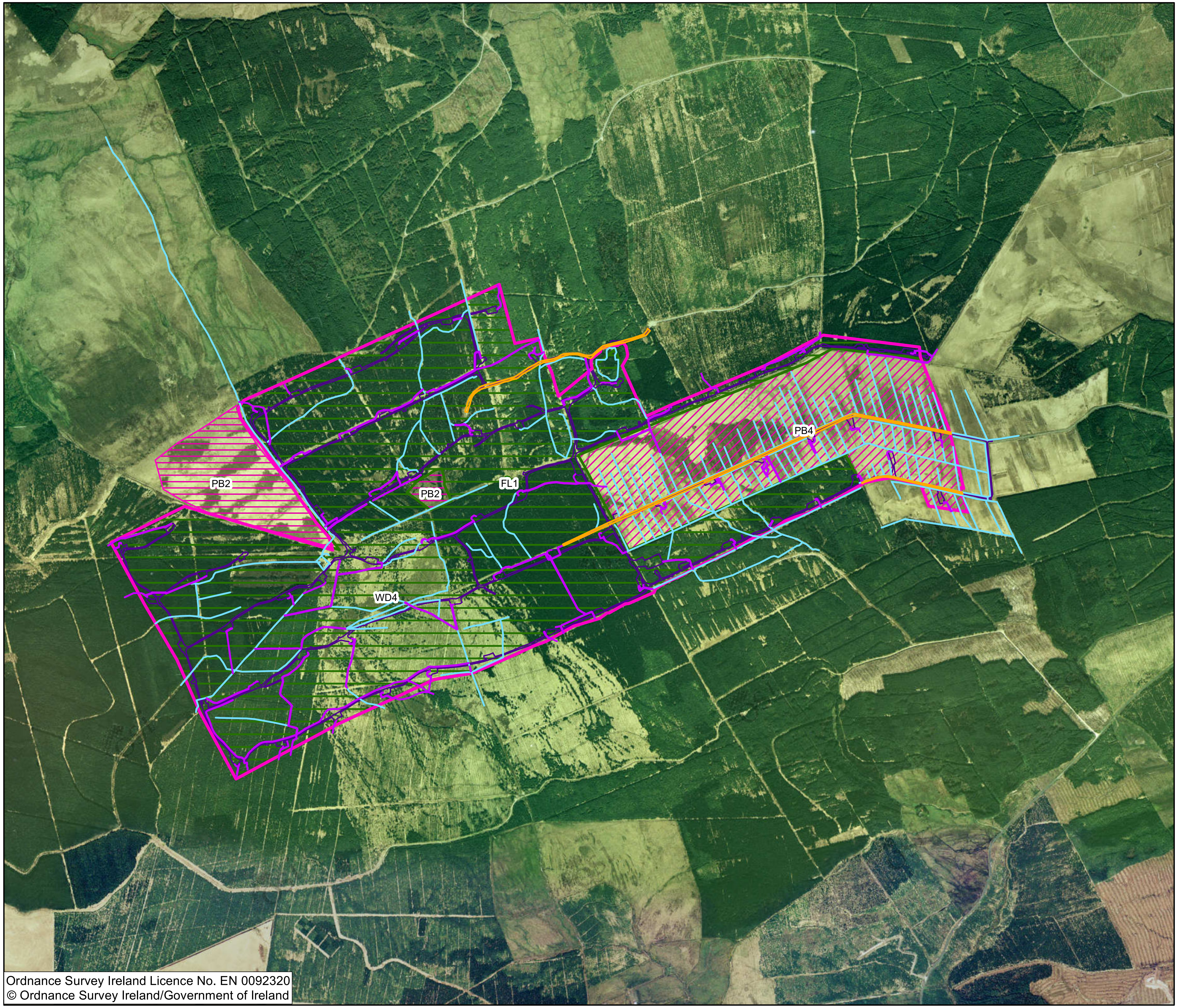
<u>Evaluation</u>

It was noted that the lake appeared to be in a relatively natural state. Natural dystrophic lakes and ponds are listed on Annex I of the EU Habitats Directive [habitat code 3160] and therefore the habitat is deemed to be of high local importance.

Plate 7.3: Small dystrophic lake located within the central part of the wind farm site. Same area photographed in 2004 (LHS) and 2018 (RHS) (Grid Reference (ITM): E559305 N705073

Table 7.3: Overview of terrestrial habitats present within the Project area prior to project development.

Habitat type	Occurrence	Evaluation
Conifer plantation (WD4)	**Dominant habitat throughout the wind farm site, the OHL corridor, and at Agannygal Substation (see** Figure 7.6 and Figure 7.7).	Local importance, lower value
Cutover bog (PB4)	**Eastern extent of wind farm site (see** Figure 7.6).	Local importance, higher value
Upland blanket bog (PB2)	**Two discrete areas of intact bog, one in central part of wind farm site and another directly to the north-west of wind farm site (see** Figure 7.6).	Local importance, higher value
Dystrophic lake (FL1)	**Single pond in central part of wind farm site (see** Figure 7.6).	Local importance, higher value



Legend

- Pre-Existing Drainage
- Constructed Drainage
- Derrybrien Wind Farm Site
- Access tracks and roads
- Road and hardstands (proposed)

Habitats (2000)

- FL1 Dystrophic lakes
- PB2 Upland blanket bog
- PB4 Cutover bog
- WD4 Conifer plantation

Basemap: OSI Aerial Photography dated 2000.

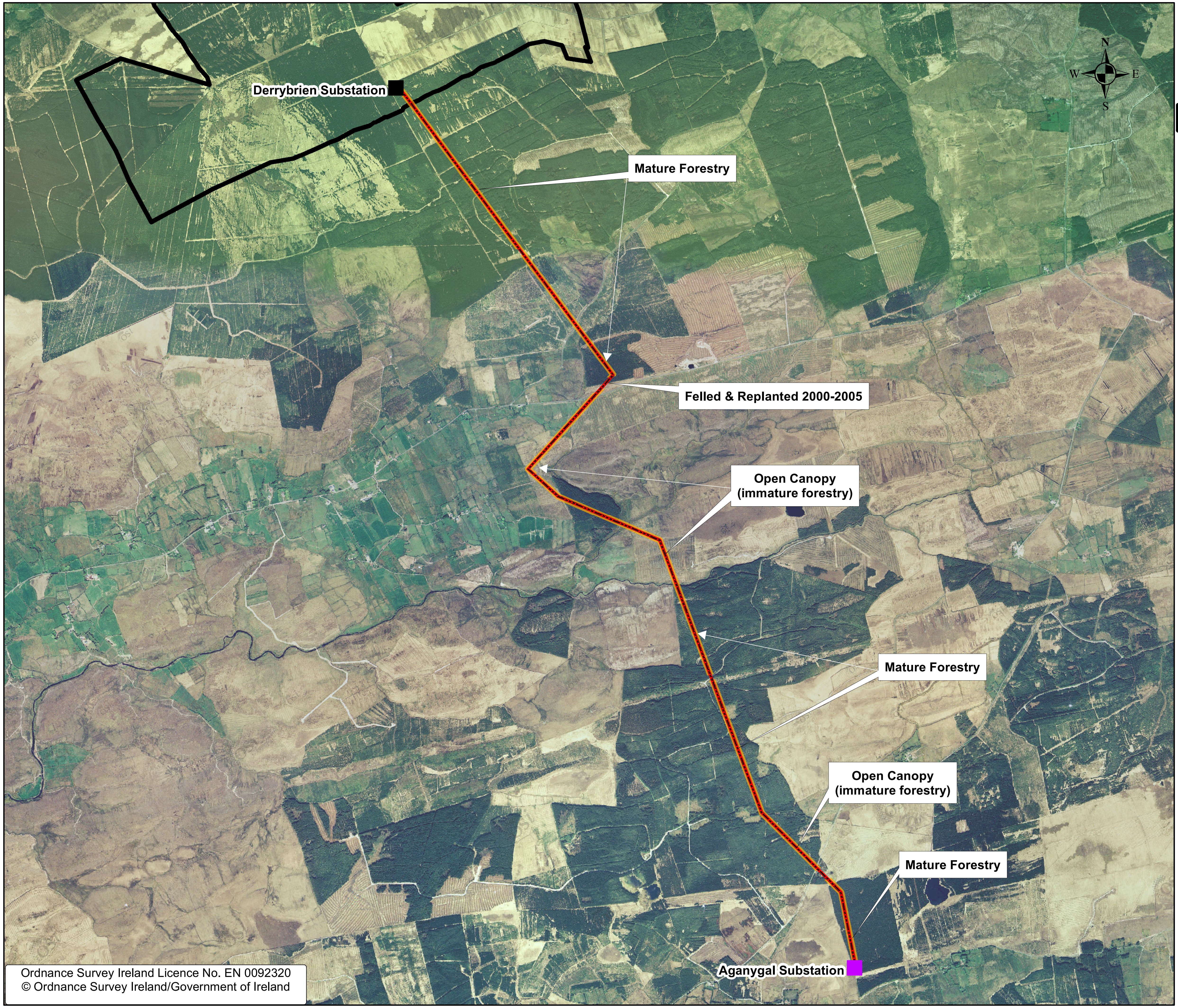
Figure 7.6 -Pre-construction habitat map of Derrybrien Wind Farm site overlain on aerial photography (2000)

N
W E
S

Date: 25 May 2020

0 125 250 500 750 Meters

wetland surveys ireland



Legend

- Agannygal Substation
- Derrybrien Substation
- Derrybrien Wind Farm Site
- Derrybrien - Agannygal 110kV Overhead Line
- Forestry along OHL corridor

Basemap: OSI Aerial Photography dated 2000

Figure 7.7 -Habitats present along the OHL route and at Agannygal Substation site pre-construction (overlain on aerial photography 2000)

Date:25 May 2020

0 125250 500 750 Meters

wetland surveys ireland

7.3.3.2 Terrestrial Habitats in Peat Slide Area

The peat slide largely occurred within Coillte owned lands to the south and south-east of the wind farm site, smaller areas of privately-owned land were also within the area of the peat slide. The habitat types that occurred in the area of the peat slide were discussed in an EcIA for emergency and stabilisation works associated with the slide (Inis Environmental Services, 2004a) and the recovery of same was later reported in 2005 (Inis Environmental Services, 2005). The route of the peat slide was described with reference to the location of barrage dams and bridge locations. Coniferous forestry (WD4) of different aged stands occurred between the southern boundary of the wind farm site and Barrage 1 and between Barrage 1 to Barrage 2. The section of the affected area from Barrage 2 to the Black Road Bridge included a stream (FW1) and potentially a natural stream channel with wet grassland (GS4) on either bank and in adjoining fields. The section of the peat slide extending from the Black Road Bridge to Flaggy Bridge to the south supported a tributary (FW1) of the Owendalulleegh River and associated banks, wet heath (HH3)vegetation, and conifer plantation (WD4). South and downstream of Flaggy Bridge, the slide was mostly confined to the river channel and adjacent riparian riverbank vegetation. Chapter 8 Aquatic Ecology and Fisheries addresses impacts on the aquatic environment.

An evaluation of habitats recorded along the peat slide area is presented in Table 7.4 The impacted habitats and subsequent recovery is discussed in the Section 7.4.2.2 below.

Conifer Plantation (WD4)

Much of the habitat affected by the peat slide comprised conifer forestry at various growth stages. A review of aerial photography available for the area pre-2003 was undertaken to determine the density of conifer forestry along the peat slide route. Aerial imagery indicates that there were some areas of open canopy forestry.

Evaluation

Conifer Plantation habitat is considered to be of Local importance, lower value

Wet Heath (HH3)

Remnant wet heath habitat was recorded along sections directly affected by the peat slide. The heath was dominated by ling heather and purple moor-grass. The wet heath habitat affected by the peat slide was small in extent and occurred on moderate to steep slopes either side of the peat slide area.

Evaluation

Wet heath habitat is considered to be of Local importance, higher value

Wet grassland (GS4)

This habitat was recorded in fields adjoining the area affected by the peat slide west-north west and upslope of Black Road Bridge (E561094; N703726). The wet grassland is likely to have been species poor sward dominated by soft rush (*Juncus effusus*), Yorkshire Fog (*Holcus lanatus*), and Creeping Buttercup (*Ranunculus repens*) as is typical of agricultural wet grasslands in the locality. Agricultural grassland is also the principal habitat adjoining the river downstream of Flaggy Bridge towards Lough Cutra.

Evaluation

Based on the quality of wet grassland in nearby areas, the likely value of the habitat is deemed to have been Local importance, lower value.

Eroding / upland streams (FW1)

A number of streams and rivers were directly affected by the peat slide and subsequent emergency works. Effects on water quality and aquatic ecology are assessed in Chapter 8 of the rEIAR.

Table 7.4: Overview of terrestrial habitats within the peat slide area.

Habitat type	Occurrence	Evaluation
Conifer plantation (WD4)	Dominant habitat throughout the area most impacted by the peat slide. Tree density and maturity varies from dense mature canopies to open immature trees. Mature trees within the main peat slide area occupied c. 4.5 ha (1.44 ha within wind farm site and 3.06 ha outside of wind farm site)	Local importance, lower value
Wet heath (HH3)	Small areas of wet heath occurred within the peat slide area on steep banks adjacent to the pre-existing watercourse, between Barrage 2 and Black Road Bridge, and between Black Road Bridge and Flaggy Bridge.	Local importance, higher value
Wet grassland (GS4)	Wet grassland occurred in the area upstream of Black Road Bridge, and more extensively on either side of the River downstream of Flaggy Bridge.	Local importance, lower value

7.3.4 Invasive species

No invasive species have ever been recorded within the project area.

7.3.5 Birds

7.3.5.1 Status of birds prior to construction (1998-2003)

An assessment of birds on the Derrybrien site was made presumably in the late 1990s as part of the original EISs (prepared by Saorgus Energy Ltd., 1998 & 2001). The presence of meadow pipit, skylark and snipe was noted from a site visit (date of visit not provided). It was considered that various other species could occur in the area, including merlin, hen harrier, woodcock and red grouse (source of information stated to be from local NPWS ranger). The following was noted in the bird section of one of the original EISs: "*One major limiting factor in the number of bird species found in the area is the extent of coniferous forestry plantation. This is such that the amount of open moorland is relatively small. The moorland is needed for hunting and food supply, while the forestry is mainly used for cover and nesting. Therefore, a dearth of open blanket bog would restrict the number of species frequenting the site*."

Information on the distribution of hen harriers within a radius of approximately 5 km of the wind farm was provided by NPWS to Brian Madden for 2003 (with comparable data, where available, dating back to 2000). For the 2003 breeding season, there was a total of 12 territories (possible duplication with 1-2 territories), with status as follows:

- Confirmed – 9
- Probable – 1
- Possible – 2

Up to seven of these territories had been known since the 2000 season (when confirmed breeding occurred at four).

The total population for the Slieve Aughty Mountains in the first National Hen Harrier Survey in 1998-2000 was 15-23 pairs (Norriss *et al.*, 2002)

None of the breeding hen harrier territories in the 2000-2003 period were within the area of the wind farm nor was there any information available to indicate a historic territory in this area. The nearest two territories in 2003 were approximately 2 km to the northwest and approximately 2 km to the southeast respectively. The territory to the southeast was approximately 1.5 km from the OHL corridor. A further possible territory was approximately 1 km south of the Agannygal Substation site.

7.3.5.2 Status of birds during construction phase (Mid 2003 – March 2006)

The 2004 survey took place during the period when construction works were on hold due to the peat slide. Tree felling had taken place to facilitate the wind farm infrastructure, but the greater part of the required felling had not yet occurred. The majority of the road network was in place as well as 37 of the turbine foundations.

The main finding of the 2004 survey (BES, 2004) was that hen harriers were using the unplanted part of the development site for foraging, with sightings over the bog in the eastern sector on three dates in May and June (see Table 7.5).

Table 7.5: Summary of hen harrier observations from Vantage Point watches for 2004 survey.

VP & line no.	Date	Durat-ion	Sex	Hab-itat	Behav-iour	Activity	Flight altitude
A No. 1	13 May 2004	300+ sec	Male	HB F	Fl H	Flew fast over bog and then foraged over forest to SE of site (joined by female).	Not recorded
A No. 2	13 May 2004	200 sec	Female	HB F	Fl	Flew over bog & joined male from above to fly over forest outside site.	Not recorded
A No. 3	12 June 2004	350 sec	Male	HB	Fl H	Glides over bog leisurely, forages	Not recorded
A No. 4	13 June 2004	120 sec	Male	HB	H	Forages over bog at extreme east end of site and continues over bog to east of site.	Not recorded

See Figure 7.8 for flight lines. See Appendix 7-2 for definition of Habitat and Behaviour codes.

Within the hinterland area (to c. 5 km of the wind farm site) a total of ten breeding territories were recorded, with nine confirmed and one possible. Distribution of territories was similar to that in 2003. The slight difference in number of territories between 2003 and 2004 is most likely due to natural variation (such as early breeding failure) or possibly duplication in totalling the number of pairs in 2003. As in 2003, there were two territories within a 2 km distance of the wind farm. There were no signs of territorial behaviour by hen harriers within the wind farm site during the 2004 season.

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Figure 7.8 - Hen Harrier Flight Lines 2004 Survey

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7.3.5.3 Status of birds during operation phase (2006 – 2020)

7.3.5.3.1 Hen harrier

Usage of wind farm site by hen harrier

Surveys for hen harriers and other bird species were carried out during the operational phase of the wind farm in the years 2006, 2007, 2009, 2011, 2015 and 2018. These comprised vantage point surveys within the wind farm and hinterland surveys to locate breeding territories.

At no time since monitoring commenced have hen harriers been suspected of nesting within the wind farm site or within at least a 1 km radius of the wind farm.

Hen harriers were, however, recorded foraging within or flying through the wind farm on at least one occasion in each of the survey years. There follows a summary of the observations of hen harrier within the wind farm during the various surveys, with details presented in **Error! Reference source not found.** and Figure 7.9 and Figure 7.10.

The survey in the 2006 season (BES 2006) was carried out when the wind farm was in full operation and most of the forestry within the site had been cleared. There were nine separate sightings of hen harriers within the site and/or along the boundaries of the site (within 200 m) during 2006, with one further sighting over 1 km to the northwest. Two of the sightings were in April, three in June, and four in July. All were of males apart from one female. Five of the birds were well within the site flying through and/or foraging between the turbines. Most of the activity was over the bog in the eastern end of the site, though birds were also recorded over the clearfell and remaining forest stands. Most of the birds were foraging within 10 m of the ground. However, birds were observed at altitudes up to 100 m over the site. At least one bird came within 10 m of the base of a turbine. One hen harrier was observed catching an avian prey item on site.

Further monitoring was carried out during the 2007 season (BES 2007). There was only one hen harrier sighting within the site and two others of male harriers off site but seen from within the site. (A further within-site sighting was reported by wind farm staff).

Monitoring was again carried out in the 2009 season (BES 2009). Three hen harrier flight lines were recorded in the 2009 season, all on 24th July. Two of the flight lines were of birds on site while a third came within 500 m of the site boundary. These involved at least two individual birds. A female came particularly close to the base of turbine no. 59 (to within c.10 m) at a height of 15-20 m and hunted slowly within the wind farm between turbines at the usual foraging height of under 10 m.

A further season of monitoring was carried out in 2011 (BES 2011). One hen harrier was recorded within the site in 2011 – an adult male flew low (< 10 m) through the south-west sector (east of T18 & T12) of the wind farm on 30th May.

Monitoring in the 2015 season resulted in two sightings (male and a female) within the site, one hunting over the bog in the east and one over the clearfell in the western sector (BES 2015).

There was one sighting of a hen harrier within the site in 2018 – a female flying over and at times foraging over clearfell in the centre of the site in April and passing within 50 m of T66 and continuing north between T60 and T61.

Table 7.6: Summary of Hen harrier observations from Vantage Point watches for surveys since 2006.

VP & line no.	Date	Durat-ion	Sex	Hab-itat	Behav-iour	Activity	Flight altitude
2006							
A No. 1	7 April 2006	245 sec	Male	HB F	Fl H	Foraging over bog at eastern end of site, also over forestry outside of site	<10 m
B No. 2	29 April 2006	14 sec	Male	CF	Fl	Flew over clear fell in western sector of site within 20 m of T9.	<10 m
B No. 3	1 June 2006	223 sec	Male	F	Fl	Flew over edge of forest just outside west end of site	20-100 m
A No. 4	1 June 2006	295 sec	Male	F HB	H Fl	Seen over forest to south of site, then passes over bog within site foraging, continues north of site.	<10 m 95 sec; 10-20 m 20 sec; 20-50 m 180 sec
B No. 5	3 June 2006	-	Male	F	C S	Circling and soaring to north-west of wind farm.	>200 m
A No. 6	3 July 2006	227 sec	Male	HB CF F	Fl H C S	Hunting around base of T41, aerial strike later over bog.	<10 m 163 sec; 10-20 m 20 sec; 10-50 m 44 sec
A No. 7	3 July 2006	221 sec	Male	HB F	H	Hunts between T37 and T40 then over forest parallel to line of turbines	<20 m
B No. 8	4 July 2006	54 sec	Female	HB	H Fl	Female arrives from NW and hunts	<10 m
A No. 9	5 July 2006	59 sec	Male	HB	H	Male hunting just east of site	<10 m
2007							
A. No. 10	14 July 2007	247 sec	Male	HB	H	Male hunting over bog, continues east of site	<10 m
2009							
A. No. 11	24 July	388 sec	Male	HB F	H Fl	Male flies and hunts between T43 and T45.	<10 m 170 sec;

VP & line no.	Date	Durat-ion	Sex	Hab-itat	Behav-iour	Activity	Flight altitude
	2009				C S	Continues east of site	10-50 m 34 sec; 50+ m 184 sec
B. No. 12	24 July 2009	197 sec	Female	HB CF	H S	Female soars into site close to T59, hunts by T9, T14 & T19 to within 50 m at times	50 m - <10 m
2011							
B. No. 13	30 May 2011	25 sec	Male	HB	Fl	Male flies through western end of site, east of T18 and T12	<10 m
2015							
B No. 14	7 May 2015	120 sec	Male	CF	H	Male hunting over clearfell between T13 & T14	<10 m
A No. 15	26 May 2015	60 sec	Female	HB	H	Female type over bog in east	<20 m
2018							
B. No 16	20 April 2018	90 sec	Female	CF	H Fl	Female flying and at times foraging over clearfell in centre of site, passed within 50 m of T66 and continued north between T60 and T61.	<20 m

See Figure 7.9 and Figure 7.10 for flight lines. See Appendix 7-2 for definition of Habitat and Behaviour codes.

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CONTRACT

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DRAWING TITLE: Figure 7.10 - Hen Harrier Flight Lines 2007-2018 Survey

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The survey in 2004 demonstrated that hen harriers used the strip of bog within the eastern sector of the site for foraging before any of the turbines were erected. At the time, much of the remainder of the site was covered with closed canopy conifer plantation and would have been largely unsuitable for foraging. From 2006 onwards, hen harriers have been recorded within the site in each year of monitoring. Usage, however, has been relatively low (apart from in 2006 which may have been due to the proximity of an active nest) but included both foraging birds and birds merely flying through the site. Sightings have been both in the vicinity of the unplanted bog in the eastern sector of the site (see Plate 1, Appendix 7-3) and in the areas which were clear felled to facilitate the wind farm (see Plates 2 & 3, Appendix 7-3). The clear-felled areas have developed to a mix of low scrub (brambles, willows etc.) and re-vegetating bog species (heather, grasses etc.). This mosaic of vegetation supports a range of potential prey items for hen harriers, especially meadow pipit and skylark.

While much of the wind farm has provided suitable foraging habitat for hen harrier during the operational phase, and will continue to do so to the time of decommissioning and beyond, the likelihood of birds availing of the foraging potential is considered to be influenced largely by (i) the proximity of nesting pairs to the site (see section on breeding territories), and (ii) the availability of foraging habitats in the surrounding area. The amount of foraging habitat in the surrounding area is partly dependent on forestry management practices, with the unplanted bog and heath remaining fairly constant in area over time. When a substantial area of forest is harvested and replanted, hen harriers will invariably be attracted to the pre-thicket stage forest for foraging purposes and possibly even to attempt nesting. Should such an area of second rotation be in proximity of the wind farm, the birds could be expected to also forage within the wind farm. For example, the forest area immediately to the west of the wind farm (46.2 ha) which was harvested and replanted by Coillte between 2016 and 2018 will provide suitable second rotation foraging habitat from about 2020 onwards – birds foraging here would be expected to also use the habitats within the wind farm.

Hen harrier breeding territories within 5 km radius of wind farm

As already noted, hen harriers have not been suspected of nesting within the wind farm site since monitoring commenced in 2004 nor were there any previous known attempts dating to at least the late 1990s (latter based on information supplied by NPWS).

Since the start of the monitoring surveys for breeding territories in 2004, up to 14 breeding territories were identified within an approximate 5 km radius of the wind farm. Most of these would have been traditional territories dating to at least the late 1990s. However, in any one year occupancy will vary, with some territories showing no evidence of occupancy or perhaps being abandoned early in the season. Also, within each territory the exact location of the nest site will often vary between years.

Table 7.7 shows a summary of the number of territories occupied in various years since 2004 within a 5 km radius of the wind farm. Data from the respective National Hen Harrier Surveys for 2005 and 2010 are also given to supplement the years when monitoring did not take place at the wind farm. Two categories of breeding are given – confirmed (where nesting actually took place though may not have been successful) and possible (where a territory was apparently occupied early in season only).

Table 7.7: Summary of the number of territories occupied in various years since 2004 within a 5 km radius of the wind farm

	2004	2005	2006	2007	2009	2010	2011	2015	2018
Confirmed	9	14	11	12	11	8	6	2	2
Possible	1	-	2	2	2	4	4	4	3
Total	**10**	**14**	**13**	**14**	**13**	**12**	**10**	**6**	**5**

Since monitoring commenced in 2004, there have been two regular territories within a 1-2 km distance of the Derrybrien Wind Farm site. In 2011, the only successful nesting (i.e. young birds fledged) by the 10 pairs within the 5 km radius of the wind farm was from one of these territories, and one was still occupied in both the 2015 and 2018 surveys (though no young known to be produced).

The monitoring of hen harrier territories within the 5 km radius of Derrybrien Wind Farm shows that the number of confirmed nesting attempts was fairly constant between 2004 and 2009 but there then followed a decline in 2011 which continued more markedly into 2015 and 2018 (with only 2 confirmed nesting attempts in each year). Between 2010 and 2018, the total number of pairs (confirmed and possible) dropped from 12 to 5.

Factors potentially affecting hen harrier breeding population within the Slieve Aughty Mountains

The population decline noted since about 2011 as recorded in the 5 km radius of the Derrybrien Wind Farm is reflected in the Slieve Aughty Mountains as a whole (see **Error! Reference source not found.**):

Table 7.8: Comparative population data from the national hen harrier surveys in 1998-2000, 2005, 2010 and 2015 for the Slieve Aughty Mountains (after Ruddock *et al.,* 2012, 2016)

1998-2000	2005	2010	2015	% change 2005 - 2015
10-21	24-27	16-24	8-14	-48.1%

Note: Survey effort in 1998-2000 survey was less than in subsequent surveys. Figures are total estimated pairs

A detailed study of hen harriers in three areas (Slieve Aughty Mountains, Ballyhoura Mountains & West Clare hills) by researchers from University College Cork showed population declines in all three areas between 2007 and 2011 and also that the numbers of young fledged at successful hen harrier nests was quite low compared to other populations (Irwin *et al.,* 2012).

The cause(s) of the marked population decline and low productivity within the Slieve Aughty Mountains SPA, and indeed in areas such as the Ballyhoura Mountains and the West Clare hills and several other SPAs, remain largely unknown but are expected to be due to a number of reasons, perhaps acting in combination, including the following (after Ruddock *et al.,* 2016):

- Habitat change (largely forest management affecting prey availability)
- Predation
- Persecution
- Access and recreation (walking paths, cycling tracks etc)
- Non-intensive grazing
- Wind energy & Utility and service lines

Habitat change

While open moorland is the natural nesting habitat for hen harriers in Britain and Ireland (Watson 1977), the population in Ireland has readily adapted to nesting within young conifer plantation since the widespread plantings in the 1960s and 1970s (as highlighted by Norriss *et al.,* 2002 in the first national hen harrier survey). Indeed, Wilson *et al.* (2009) have shown pre-thicket conifer plantations to be the most frequently used nesting site throughout Ireland. This trend is particularly prevalent in the Slieve Aughty Mountains and in the 2015 national survey, all confirmed nesting pairs were in conifer plantation (Ruddock *et al.,* 2016). Foraging activity, however, continues to indicate a preference for open habitats (bog-heath-grassland) though pre-thicket second plantation is also used extensively.

It can be assumed that over time the proportions of the main land uses within the Slieve Aughty Mountains SPA will remain fairly constant, which is roughly as follows: forestry 50%, bog/heath 30%, grassland 20% (NPWS, 2015).

Within the forestry component, however, there is continuous change as trees mature over the (average) 40-year cycle, are clearfelled and then replanted. As only the pre-thicket or open canopy phase of the forest cycle (usually forest not more than 10-12 years of age) provides useful nesting and foraging habitat for hen harriers, it follows that the status of the age cohorts of the forest in any one area at a given time is likely to have an important effect on the local hen harrier population. This trend was shown quite well in the 2005 National Hen Harrier Survey when a marked increase was recorded in the hen harrier population in the Ballyhoura Mountains since the 1998-2000 survey (Barton *et al.,* 2006).

The authors of the survey report considered that the increase in the amount of pre-thicket second rotation forest was a main reason for the increase in the number of birds.

In the 2010 National Hen Harrier Survey, Ruddock *et al.* (2012) wrote (page 55 of report) as follows: *'Forest maturation may be partly responsible for regional decreases in breeding hen harriers, as a shift in age structure of plantations was recorded between the two surveys with a general increase in older classes of suitable forest breeding habitats'*. In discussing significant population declines in three of the six SPAs designated for hen harrier, they noted further (page 57 of report): "*There has been a decrease in the forest age-classes suitable for hen harrier nesting and a decline in afforestation across all the SPAs which may have affected distribution. Afforestation in all SPA areas appears to have dramatically increased during 2006, immediately prior to SPA designation in 2007 and has since declined annually. The quality of open habitats for hen harriers may need to be improved in order to compensate for decreased availability of young forest habitats due to the changing age profile of forest plantations in these areas.*"

In discussing the decline in the population in the Slieve Aughty Mountains SPA between the 2010 and 2015 national surveys, Ruddock *et al.* (2016) wrote that surveyors observed that forest maturation is likely to have reduced the availability of suitable habitat since the previous survey and they suggest that this may have led to a redistribution of some breeding pairs from the Slieve Aughty Mountains to areas south of the SPA as some increases were recorded in the Slievefelim – Silvermines Mountains complex. From analyses carried out on forest age structure within all six SPAs selected for hen harriers in Ireland, Ruddock *et al.* (2016) predicts that the extent of usable forest habitat for nesting and foraging purposes will decline over the next 10 years.

Predation

Compared to open habitats, the increase and maturation of commercial forest plantations has led to an increase in potential predators of hen harrier nests due to the provision of cover and breeding sites. Avian predators include hooded crow, raven, magpie and more recently jay, while mammalian predators include fox, pine marten, mink and rat. In the 2015 national hen harrier survey, Ruddock *et al.* (2016) identified the main predators as fox, pine marten, hooded crow and mink.

While there is little direct evidence of predation in the Slieve Aughty Mountains SPA, other than a nest being predated by a fox in 2008 (recorded by nest camera), all the key predators are widespread throughout the SPA as well as in the Derrybrien area. Indeed, populations of species such as pine marten and fox have increased in the past decade or so.

Persecution

Persecution or illegal killing of hen harriers has been recorded in some parts of the country (including Kerry and west Clare) (Ruddock *et al.,* 2016). While there has been no evidence of such events in the Slieve Aughty Mountains, this does not necessarily rule out the possibility of persecution occurring.

Access and Recreation

Ruddock *et al.* (2016) identified disturbance to hen harriers from human presence as being widespread throughout the species range and probably responsible for nest abandonment in some cases. This category included dedicated walking and cycling tracks, quad bikes, as well as local paths. Disturbance can occur particularly when users leave the dedicated routes.

In the 2015 national survey, surveyors in the Slieve Aughty Mountains identified access tracks and cycling tracks, including use of non-paved forest roads, as a pressure on the hen harrier population.

Non-intensive grazing

Appropriate grazing levels to optimize habitat conditions for hen harrier can be difficult to achieve and will vary in any one area over time. While under-grazing may facilitate development of tall stands of heather suitable for nesting, the absence or near-absence of grazing may lead to scrub encroachment which may not be suitable for either nesting or foraging. Similarly, over-grazing can lead to unsuitable conditions for both nesting and foraging.

While Ruddock *et al.* (2016) does not identify grazing levels as an issue in the Slieve Aughty Mountains, they do note uncontrolled burning (which may be related to local grazing) as a pressure on the hen harrier population.

Wind energy & Utility and service lines

For the Stacks Mountains complex in Kerry and Cork, Ruddock *et al.* (2016) cited wind energy production as one of the most frequently recorded pressures on the hen harrier population. The effects of the presence of wind farms are considered mainly through loss of suitable habitat and disturbance to breeding during the construction phase. For the Slieve Aughty Mountains SPA, they note that there are 77 turbines located within the SPA boundary and no others within 500 m of the boundary. Wind energy was not reported as a main pressure on the hen harrier population within the SPA.

In respect of power lines, for the Slieve Aughty Mountains SPA, Ruddock *et al.* (2012) write the following:

> "*There appeared to be a positive association, although this was not statistically tested, and supported by behavioural observations, that habitat management (i.e. clearance) for power line infrastructure may provide corridors for movement and foraging by hen harriers within the forested landscape. The use of such corridors could prove useful to increasing connectivity with suitable nesting and foraging areas and particularly linking forested areas with open habitats which are shown to be used more frequently in Ireland*."

7.3.5.3.2 Status of breeding merlin in wind farm project area

Merlin is a scarce breeding bird within the Slieve Aughty Mountains, with the Site Synopsis for the Slieve Aughty Mountains SPA (NPWS, 2015) noting that "*The population size is not well known but is likely to exceed 5 pairs*"

There were no sightings of merlin within the wind farm project area during the various breeding bird surveys between 2006 and 2018. A single sighting was made in the hinterland area several kilometers from the wind farm on 10th May 2011 during a search for hen harrier territories which probably indicated local breeding.

As merlin is a difficult species to survey due to its discrete breeding behaviour (Lusby *et al.,* 2011), there is some chance that one or more pairs could breed in the hinterland of the wind farm and remain unnoticed. However, it is undoubtedly a rare breeding bird within the Slieve Aughty Mountains.

7.3.5.3.3 Other breeding bird species recorded within wind farm site

A range of bird species characteristic of bog, heath, scrub and forest habitats was recorded on site during the various monitoring surveys. These are listed in Table 7.9 along with their expected breeding status.

Four of the species, golden plover, red grouse, meadow pipit and grey wagtail, are Red-listed due to significant declines in the national breeding populations (Colhoun & Cummins 2013). Red grouse was recorded on site in both 2009 and 2015, with sightings on the bog in the eastern sector of the site and alongside tracks in the western clear-felled area. A pair of grouse was observed flying into the northwest sector (near T59) of the site in April 2009 and a bird was seen leaving in the same area of the site towards the bog in May 2015. Grouse are likely to be attracted to the site both to feed on the heather which can grow proficiently along track edges (see Plate 3, Appendix 7-3) and also to pick for grit on tracks which is required for their digestion.

Golden plover was recorded in 2009 only, when flocks of 550 and 150 birds were present roosting on the bog in the eastern sector on 10th and 12th April respectively. These were birds on migration and could be expected to drop off at the site on occasions to rest and/or feed.

Meadow pipit is widespread within the Derrybrien Wind Farm. Young fledged birds are often seen and post breeding flocks (often in excess of 50 birds) are a feature in late July and August. Grey wagtail is seen in most years and one pair probably breeds on site (often seen at the flooded borrow pit / quarry near site entrance).

A further 11 species recorded within the site are Amber-listed (i.e. of moderate conservation concern). A pair of teal has been recorded in several years and is expected to breed on site. Teal utilise ponds and large drains as nesting sites. Sparrowhawk has been confirmed breeding (young heard crying from plantation) and hunting birds are regularly recorded. Kestrel hunts within the site though is only an occasional visitor. Snipe has been recorded in suitable breeding habitat on several occasions and is likely to breed. Skylark is fairly widespread as a breeding species throughout the site. At least one pair of stonechat breeds on site in most years. Mistle thrush probably breeds on site and post-breeding flocking birds are a feature of the site in August. Goldcrest and robin both breed in scrub and woodland on site. Swallow is regularly seen feeding over the site though is not considered to breed on site. Wheatear has been recorded on migration in several of the surveys.

Other breeding species which are regular on site include mallard, cuckoo, whitethroat, chaffinch, lesser redpoll and reed bunting.

Table 7.9: Status of birds recorded at Derrybrien Wind Farm during various summer surveys, 2006-2018. Breeding status given as possible, probable, confirmed or non-breeding after Breeding Atlas (Balmer *et al.,* 2012). Conservation status after Colhoun & Cummins (2013).

Species	Breeding Status	Conservation Status
Mallard	Breeding probable – up to 5 birds seen together	G
Teal	Breeding probable in several years - a pair at small pond in clearfell in west of site	A
Sparrowhawk	Breeding confirmed – regularly seen and heard	A
Kestrel	Non-breeding – occasionally seen hunting	A
Red grouse	Recorded on site in 2009 and 2015 – seen flying into site near T59 from bog to NW. Nests on adjoining bogs.	R
Golden plover	Flock of up to 550 recorded on site in April 2009 – considered birds on migration	R
Snipe	Breeding possible – recorded several times	A
Woodpigeon	Breeding possible – regularly seen flying across site	G
Cuckoo	Breeding probable – annual summer visitor	G
Magpie	Breeding possible - occasional on site	G
Hooded crow	Breeding possible – regular on site, with flock of 24 in 2011	G
Raven	Non-breeding. Passes over site regularly	G
Goldcrest	Breeding probable – mainly conifers	A
Great tit	Breeding probable	G
Coal tit	Breeding confirmed – mainly conifers	G
Skylark	Breeding confirmed – widespread	A
Swallow	Non-breeding but regular over site	A
Willow warbler	Breeding probable	G
Whitethroat	Breeding confirmed	G
Wren	Breeding confirmed – widespread	G
Blackbird	Breeding probable	G
Song thrush	Breeding possible	G
Mistle thrush	Breeding probable – flocks of 20+ in August	A
Robin	Breeding confirmed	A
Stonechat	Breeding confirmed – 1-2 pairs	A
Wheatear	Occasional - non-breeding migrant birds	A

Species	Breeding Status	Conservation Status
Grey wagtail	Breeding confirmed - 1 pair	R
Meadow pipit	Breeding confirmed – widespread	R
Chaffinch	Breeding probable	G
Goldfinch	Breeding possible	G
Lesser redpoll	Breeding probable	G
Reed bunting	Breeding confirmed	G

Conservation Status: **R – Red**; **A – Amber**; **G – Green**

7.3.5.3.4 Winter bird species recorded within wind farm project area

Winter 2011/12

There were no sightings of hen harriers within or around the wind farm site during surveys between November 2011 and January 2012. However, a range of bird species characteristic of bog, heath, scrub and forest habitats was recorded.

Three of the species recorded on site, golden plover, red grouse and meadow pipit, are Red-listed (Colhoun & Cummins 2013), with golden plover also listed on Annex I of the EU Birds Directive.

On 21st December 2011, a flock of c.500 golden plover landed near T33. The flock then flew up above turbine height and landed again near T34. The flock was present on site for at least 3 hours and was generally very active, with flighting within and above the rotor sweep zone. On 23rd December, a flock of c.150 was still present on the bog near T33 and was again observed flying at and above turbine blade height. On 22nd January 2012, a flock of 15 golden plover took off from near T27 and flew north.

Three red grouse were recorded on bog in the northwest of the site (near T3) on 9th November 2011. There was a further record of grouse on 22nd January 2012, when two were flushed from along the roadside near T31.

Meadow pipit was present on site in all winter surveys, though in relatively low numbers (mostly single birds or small flocks up to 5).

Two further species recorded on site in winter 2011/12, sparrowhawk and snipe, are Amber-listed (i.e. of moderate conservation concern).

Other species associated with the site in winter were hooded crow, raven, wren, chaffinch, lesser redpoll and crossbill.

Winter 2019/20

Hen harrier was not recorded on site from October 2019 to March 2020, nor were any winter roost sites located within a distance of up to 5 km of the wind farm. Several sightings made in the hinterland of the site in October 2019 were likely to be lingering summer birds, as follows:

- Male – observed in late morning period c.2.5 km southwest of wind farm (Knocknarebana) during a reconnaissance visit on 12th October
- Immature male – observed hunting c.2 km northeast of Caheranearl at 10.45 hrs on 18th October
- Immature male – recorded at 17.25 hrs on a lone pine tree preening and then flying to the south c.4 km northeast of Caheranearl on 18th October – probable same bird as earlier.

Golden Plover were recorded as follows:

- 22nd October 2019: a flock of c.60 flew westwards over the site at a height just above turbine rotor tip height.
- 17th December 2019: a flock of 260 birds was observed over the eastern extremity of the wind farm and later landing on the bog within the site.
- 18th February 2020: flock of 16 on bog in eastern sector of site, later flew northwards out of site.
- 24th February 2020; flock of 110 observed circling high (> 100m) over site.

A merlin was recorded off-site near Knocknarebana during a hen harrier dusk roost watch on 17th October.

Meadow pipit was present on site in all winter surveys, though in relatively low numbers (mostly single birds or small flocks up to 5). A loose flock of c.40 was present within the wind farm on 22nd October 2019. Territorial birds present in March 2020.

On 22nd October 2019, a flock of c.80 fieldfares passed through the western sector of the site.

7.3.6 Bats

All Irish bat species are protected under the Wildlife Act 1976 (as amended) and Annex IV of the EU Habitats Directive 1992. Lesser Horseshoe bat is also included in Annex II. Bats are further protected across Europe under the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention, 1982) and the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979, enacted 1983).

This section sets out the findings of the desk study and baseline ecological survey work. It then goes on to evaluate the interest of the identified ecological features.

7.3.6.1 Pre-construction baseline data: 1998-2001

There is no baseline data available for bats between 1998 and 2001. It has been assumed for the purpose of this assessment that all bat species identified during field surveys as being present during the operational phase of the project were present pre-construction. Although habitat extent and condition has varied within the Project area since the pre-construction period, it is not likely that this variation would result in a different bat species composition being recorded.

7.3.6.2 Construction phase: circa June 2003-March 2006.

There is no bat data available for the Construction Phase circa June 2003 – March 2006. As described in Section 7.3.6.1, all bat species identified during field surveys as being present during the operational phase of the project are assumed to have been present during the construction phase.

7.3.6.3 Operation Phase: 2006 – Mid 2020

7.3.6.3.1 Desk Study

Bat Conservation Ireland (BCI) data were obtained for a 10 km search area around the site in 2011 (Wilson, 2012). Two lesser horseshoe *Rhinolophus hipposideros* bat roosts were identified, at Thor Ballylee and Cloonbeg (both in County Galway) 9.3 km and 10 km west of the site respectively. In addition, roosts of brown long-eared bat *Plecotus auritus*, soprano pipistrelle *Pipistrellus pygmaeus* and *Myotis* sp. were identified at a location approximately 10 km to the east of the site.

The review of bat records from the National Biodiversity Data Centre indicated that common pipistelle *Pipistrellus pipistrellus*, soprano pipistrelle, Nathusius's pipistrelle *Pipistrellus nathusii*, lesser horseshoe bat, Leisler's bat *Nyctalus leisleri*, brown long-eared bat, Daubenton's bat *Myotis daubentonii*, whiskered bat *Myotis mystacinus*, and Natterer's bat *Myotis nattereri* have been recorded within 10 km of the site. The information obtained from BCI (Wilson, 2012) matches this information, with no other species recorded.

One planning application was found within a 10 km radius of the Derrybrien Wind Farm Project that was submitted within the last five years; the Ballinakill Quarry Extension EIS. The EIS for this application had no mention of bats (McCarthy Keville O'Sullivan, 2015).

A number of EIS reports are available within the last 15 years. Of those reviewed only two made reference to bats (the redesign of Keelderry Wind Farm [2009], and Keelderry Grid connection and substations [2010] – 3 km west and 0.7 km south of the site respectively); the first recorded a partial pipistrelle bat pass during driven transects and the second concluded that no evidence of bat roosts or suitable roosting features were present following an assessment of habitat suitability for bats.

7.3.6.3.2 Bat survey results 2011

Two bat passes were recorded during activity surveys, an unidentified bat pass and an unidentified pipistrelle sp. pass.

No roosts were identified in the desk study of the 2011 bat assessment, although it was noted that there are buildings in the area around the wind farm which might support roosting bats. These buildings were off site and were not inspected. The closest building to the wind turbines identified on aerial imagery is approximately 1.5 km to the north (Bing Maps, 2019)

It was noted that the survey was carried out towards the end of the bat active season and that the results were likely to be an under-representation of bat activity at the site.

7.3.6.3.3 Bat survey results 2016

Driven transect survey

Details of the driven transect surveys are provided in

Table 7.10, the transect route along with all recorded bat passes are shown in Figure 7.1.

In total 14 bat passes were recorded during the driven transect surveys: 12 Leisler's bat passes in April; one common pipistrelle and one soprano pipistrelle pass in August. No bat passes were recorded in June during the driven transect survey.

All of the passes were recorded in the central – eastern sections of the site.

Table 7.10: Details of driven bat transect 2016

(Lead: Rachel Taylor (RT) and Caroline Lalor (CL). Non-technical second: Tom Lalor (TL))

Survey date	Surveyors	Sunset	Time	Weather
20/04/2016	RT, CL	20:40	START: 20:40 FINISH: 22:49	START: Wind F3, 3/8 cloud, no rain, 12˚C FINISH: Wind F2-3, 3/8 cloud, no rain, 10˚C
29/06/2016	CL, TL	21:55	START: 21:55 FINISH: 00:37	START: Wind F0-1, 7/8 high cloud, no rain, 10˚C FINISH: Wind F0-1, 7/8 high cloud, no rain, 10˚C
08/08/2015	CL, TL	21:15	START: 21:15 FINISH: 23:10	START: Wind F0-1, 5/8 , no rain, 11˚C FINISH: Wind F1-2, 0/8 , no rain, 11˚C

Static bat detector survey

Static bat detectors recorded bat calls for a combined total of 406 nights, equating to 3290.5 hours of survey time during April-August 2016. Table 1 in Appendix 7-4 gives details of static detector deployment dates and locations with the latter illustrated in Figure 7.2. On some occasions the battery life of the detectors was reduced by high frequency noise; in these cases the detectors were redeployed so that five night periods were still recorded (where possible) but these were not all consecutive. In June the detector at T54 failed to record, in July, the detector at T62 failed to record and in August the detectors at T59, T67 and T71 failed to record. This was accounted for in bat passes per hour calculations. Table 7.11 gives details of the number of passes and activity recorded during automated detector surveys.

A total of 13,109 passes from at least five species of bat were recorded.

Table 7.11: Total number of bat passes (P) and activity (P/h) for each bat species recorded during automated surveys in 2016.

Species	P	P/h
Common / Nathusius' pipistrelle	82	<0.1
Common pipistrelle	2751	0.8
Common / Soprano pipistrelle	49	<0.1
Soprano pipistrelle	360	0.1
Myotis species	97	<0.1
Myotis / Long-eared bat sp.	3	<0.1
Long eared bat sp.	20	<0.1
Leisler's bat	9747	3.0
Total	**13109**	**4.0**

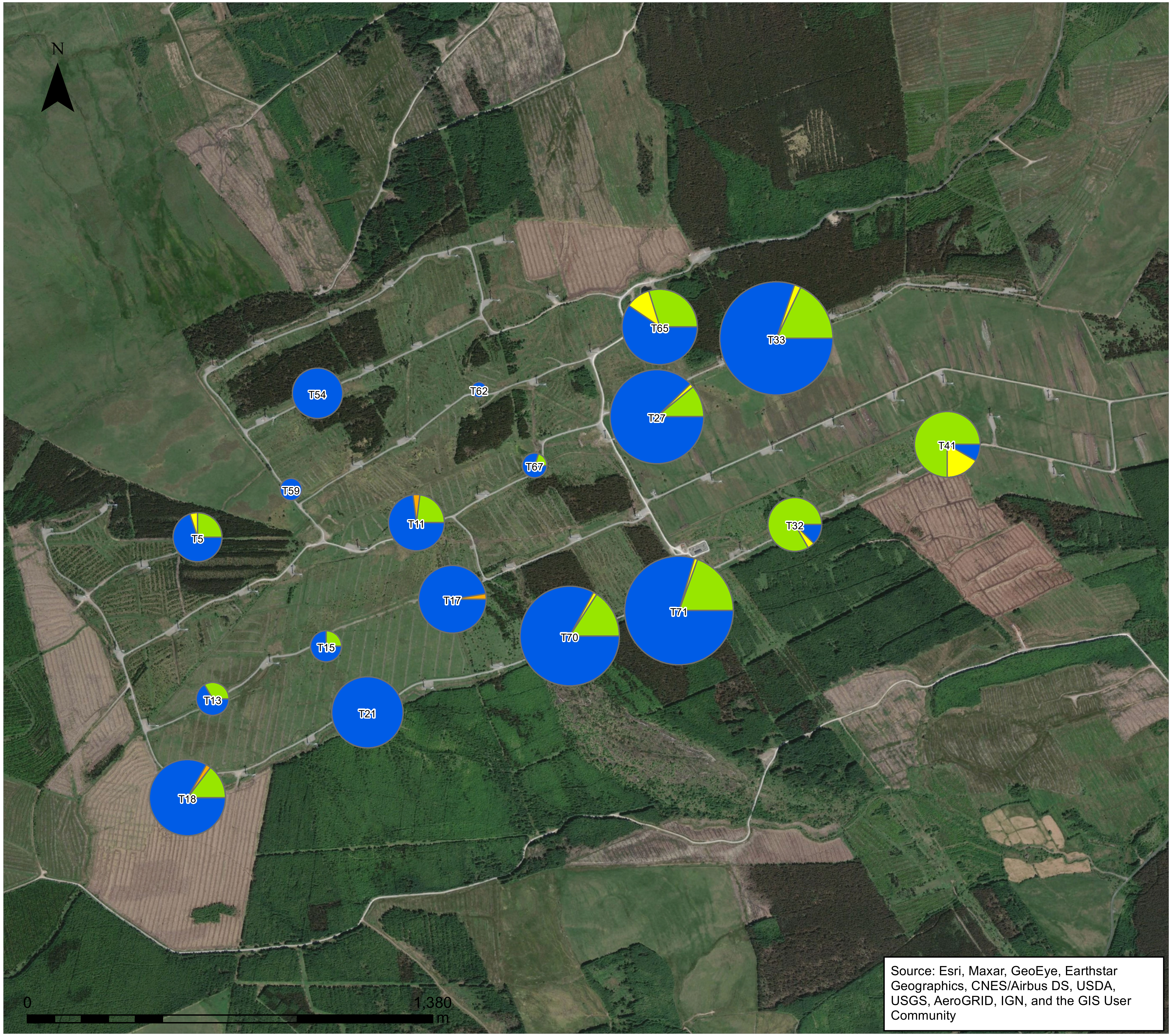
illustrates the proportion of activity (bat passes per hour) recorded for different species at each automated survey location. Data for which there were less than 0.1 bat passes per hour (P/h) (e.g. long-eared bat sp.) have not been illustrated.

Summary of Activity

The highest activity rate was recorded for Leisler's bat, at an average of 3 P/h with 74% of all the recorded passes identified as Leisler's bats. The next most commonly recorded species were common pipistrelle (0.8 P/h) and soprano pipistrelle (0.1 P/h). *Myotis* species and long-eared bat sp. were both recorded at low encounter rates of <0.1 P/h (97 and 20 bat passes respectively). There were 82 passes which fell within the call parameters for both common and Nathusius' pipistrelle[3] and 49 passes which fell within the call parameters for soprano and common pipistrelle.

The data presented in Table 7.12 show that much higher levels of relative bat activity were recorded in April, May and June (7.5, 6.4 and 6.2 P/h) than in July and August (0.7 and 0.4 P/h). Monthly changes in activity for individual species are discussed below.

[3] There was no clear evidence from any of the data that Nathusius' pipistrelle was present during the period sampled. Overlapping call parameters are typical of any wind farm sampling work, but on sites where Nathusius' pipistrelle would be expected to occur (based on what is known about distribution and relative abundance) calls are recorded that are outside the call parameters of common pipistrelle, as well as overlapping calls, that can be more confidently attributed to the species.



LEGEND

Total bat passes per hour

- Common pipistrelle
- Soprano pipistrelle
- Myotis sp.
- Leisler's bat

Circle size proportional to B/h

MAX

MIN

BSG | ecology

OFFICE: Swansea
T: (0044) 01792 363026 JOB REF: 8755.00

PROJECT TITLE
Derrybrien Wind Farm Project

DRAWING TITLE
Figure 7.11 - Total static bat detector results (2016)

DATE: 25.05.2020	CHECKED: RT	SCALE: 1:12,500
DRAWN: COH	APPROVED: OG	STATUS: FINAL

No dimensions are to be scaled from this drawing.
All dimensions are to be checked on site.
Area measurements for indicative purposes only.

Ordnance Survey Ireland data used in accordance with standard Authorised Third Party Users licence (customer: ESB International)

Sources: BSG Ecology survey data

R:\0010 Derrybrien Environmental\06 Mapping\ArcGIS\Mxds\Working\Environmental_Report\Chapter 7 - Biodiversity\Figure 7.11 - Total static bat detector results (2016).mxd

Table 7.12: Total number of bat passes (P) and activity (P/h) for each bat species recorded during automated surveys in 2016.

	April		May		June		July		August	
Species	**P**	**P/h**	**P**	**P/h**	**P**	**P/h**	**P**	**P/h**	**P**	**P/h**
Common / Nathusius' pipistrelle	21	<0.1	28	0.1	33	0.1	0	0	0	0
Common pipistrelle	320	0.4	74	0.1	2110	4.5	214	0.4	33	0.1
Common / Soprano pipistrelle	1	<0.1	3	<0.1	45	0.1	0	0	0	0
Soprano pipistrelle	25	<0.1	5	<0.1	277	0.6	26	<0.1	27	<0.1
Myotis species	21	<0.1	9	<0.1	28	0.1	25	<0.1	14	<0.1
Myotis / Long-eared bat sp.	0	0	0	0	3	<0.1	0	0	0	0
Long eared bat sp.	4	<0.1	3	<0.1	12	<0.1	0	0	1	<0.1
Leisler's bat	5652	7.0	3388	6.2	418	0.9	151	0.3	138	0.2
Total	6044	7.5	3510	6.4	2926	6.2	416	0.7	213	0.4

The data presented in Table 7.13 show the activity of each species at the different turbine locations sampled in 2016. This information is also illustrated as scaled pie charts in Figure 7.11 The number of bat passes recorded for each location can be found in Table 2 Appendix 7-4.

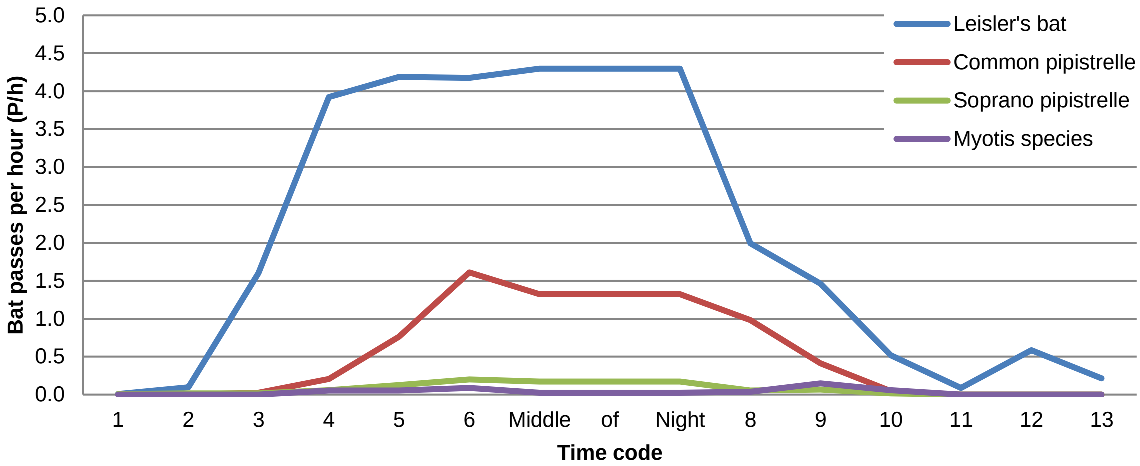
Table 7.13: Activity (P/h) of bat species at each detector location 2016

Species	Common / Nathusius' pipistrelle	Common pipistrelle	Common / Soprano pipistrelle	Soprano pipistrelle	Myotis species	Myotis / Brown long-eared bat	Brown long-eared bat	Leisler's bat	Total
T5	0	0.5	0	0.1	0	0	0	1.4	**2**
T11	0	0.6	0	0	0.1	0	0	1.9	**2.6**
T13	0	0.3	0	0	0	0	0	0.6	**1**
T15	0	0.2	0	0	0	0	0	0.6	**0.9**
T17	0	0	0	0	0.1	0	0	3.7	**3.8**
T18	0	0.7	0	0	0.1	0	0	4	**4.8**
T21	0	0	0	0	0	0	0	4.2	**4.2**
T27	0.1	0.8	0	0.1	0	0	0	6.4	**7.4**
T32	0	2	0	0.1	0	0	0	0.3	**2.6**
T33	0	1.9	0	0.2	0	0	0	8.5	**10.6**
T41	0	2.7	0.2	0.6	0	0	0	0.3	**3.8**
T54	0	0	0	0	0	0	0	2.1	**2.2**
T59	0	0	0	0	0	0	0	0.4	**0.4**
T62	0	0	0	0	0	0	0	0.2	**0.2**
T65	0	1.4	0	0.5	0	0	0	2.8	**4.7**
T67	0	0.1	0	0	0	0	0	0.4	**0.5**
T70	0.1	1.3	0	0.1	0	0	0	6.8	**8.4**
T71	0.1	1.9	0	0.1	0	0	0	7.8	**10**

The highest levels of activity (>7 P/h) were recorded at T33, T71, T70, and T27. All of these detectors were located near to the densest areas of coniferous forestry (see Figure 7.11). T5, T11, T17, T18, T21, T32, T41, T54, and T65 had activity between 2 and 5 P/h, most of these locations are bordered on at least one side by plantation woodland with the exception of T17 (although there is a block of plantation to the east) and T11 which is in an open area. T13, T16, T62 and T67 have activity of <1 P/h, all of these are in more open areas, where adjacent plantation (if present) is in narrow strips. Differences in activity for individual bat species at each detector location are discussed below.

Graph 7-1 shows the average activity of bats throughout the night (based on all recorded data). The highest levels of activity were recorded between 41 minutes after sunset and 101 minutes before sunrise. Differences in activity for individual bat species throughout the night are discussed below.

Graph 7-1: Activity (P/h) of bat species throughout the night.



Leisler's bat

Leisler's bats were recorded during every month of survey. There was a peak in activity in April and May (7.0 and 6.2 P/h respectively), and a marked decrease in activity in June, July and August (0.9, 0.3 And 0.2 P/h).

The highest levels of activity were recorded in locations T33, T71, T70 and T27. Lower levels of activity (between 4.2 and 1.9 P/h) were recorded at T21, T18, T17, T65, T54 and T11. The lowest levels of relative activity (<1.4 P/h) were recorded at T5, T13, T15, T32, T41, T59, T62 and T67.

In April the highest levels of activity were recorded at T21 and T71 (both 21.6 P/h) followed by T70, T17 and T18 (17.4, 14.1 and 12.5 P/h respectively). All other locations had activity below 7 P/h. In May, the highest levels of activity were recorded at T33 (40.8 P/h) followed by T21, T70, T65 and T27 (17.9, 10.3, 6.9 and 5.4 P/h respectively) with 3.1 P/h or less recorded at all other locations. In June the highest level of activity was recorded at T65 (5.6 P/h) with 1 P/h or less recorded at all other locations for July and August all locations recorded 1.1 P/h or less.

The highest activity was recorded from 61 minutes after sunset (4.2 P/h), with a peak 101-120 mins after sunset (6.1 P/h), continued through the night (5.9 P/h) until 101 minutes before sunrise when activity reduced. Low activity was recorded within the 20 minutes after sunset and before sunrise (<0.1 and 0.2 P/h respectively). 33 Leisler's bat passes were recorded before sunset (7 bat passes) or after sunrise (26 bat passes). Early / late bat passes were recorded at T27, T67 T18 and T41 over nine separate nights.

Common pipistrelle

Common pipistrelles were recorded during every month of survey. There was a peak in activity in June (4.5 P/h), and lower levels of activity in April, May, July and August (0.4, 0.1, 0.1 and 0.4 P/h respectively).

The highest level of activity was recorded at T41 (2.7 P/h) followed by T32, T33, T71 and T65 (2, 1.9, 1.9 and 1.4 P/h respectively). Relatively activity at all other detector locations was less than 1 bat pass per hour.

In June the highest levels of activity were recorded at T41 and T32 (14.9 and 11.3 P/h) followed by T65, T33 and T27 (6.1, 5.9 and 4.3 P/h respectively). All other locations had activity below 3.7 P/h.

The highest activity was recorded from 101-120 minutes after sunset (1.6 P/h), continued through the night (1.3 P/h) until 101 minutes before sunrise when activity reduced. Low activity was recorded within the 40 minutes after sunset and before sunrise (<0.1 P/h).

Soprano pipistrelle

Soprano pipistrelles were recorded during every month of survey and at all detector locations, apart from those located at T59 and T67. There was a peak in activity in June (0.6 P/h), and low activity in April, May, July and August (all <0.1 P/h).

The highest level of activity was recorded at T41 (0.6 P/h) followed by T65 and T33 (0.5 and 0.2 P/h respectively). Relatively activity at all other detector locations was 0.1 bat passes per hour or less.

In June the highest levels of activity were recorded at T41 and T65 (2.9 and 1.8 P/h) followed by T32 and T33 (Both 0.6 P/h). All other locations had activity below 0.5 P/h.

The highest activity was recorded from 101-120 mins after sunset (0.2 P/h), continued through the night at the same level until 101 minutes before sunrise when activity reduced. Low activity was recorded within the 40 minutes after sunset and before sunrise (<0.1 P/h).

Myotis sp.

Myotis sp. bats were recorded during every month of survey and at all detector locations, apart from T62. The highest activity was recorded in June (0.1 P/h). All other months had activity of <0.1 P/h. The highest levels of activity were recorded at T11, T17 and T18 (0.1 P/h). Relatively activity at all other detector locations was less than 0.1 bat pass per hour. *Myotis* sp. bats were recorded between 40 and 101 minutes after sunset and 100-61 minutes before sunrise (all 0.1 P/h) at all other times activity was <0.1 P/h.

Brown long-eared bat

Brown long-eared bat was recorded during every month of survey except June. Low numbers of passes were recorded at nine detector locations (T5, T11, T13, T15, T18, T27, T32, T41 and T70). The highest activity was recorded in June (0.1 P/h). All other months had activity of <0.1 P/h. The highest levels of activity were recorded at T11, T17 and T18 (0.1 P/h). Relatively activity at all other detector locations was less than 0.1 bat pass per hour.

Carcass searches and scavenger removal trials

During the carcass searches one dead bat was found by the search team. This bat (a soprano pipistrelle) was found at T11 in tall *Molinia caerulea* tussocks. Although searcher efficiency trials were not carried out, trials from other sites using the same dog team in similar habitats (in Wales and Scotland) suggests an efficiency level of 80% or higher is likely.

The carcass searching involved visiting six of the turbines twice (in effect 12 turbine searches). These were the turbines that (based on data analysed at that point) showed the highest levels of bat activity.

Table 7.14 shows the results from the scavenger removal trials. After 7 days all of the mouse corpses had been removed from view of the cameras. At T21 the mouse had been buried by sexton beetles *Nicrophorus* sp. and only the tail remained visible. At other locations the cameras recorded varying removal rates, with the fastest being 1 day at T71 and the slowest being 7 days. At T18 the camera was knocked out of alignment and it was not possible to determine when the mouse was removed, however it was not there when the cameras were collected (7 days). An average of 5 days removal rate was recorded for the site (discounting T18).

Table 7.14: Number of days the mouse corpses were present in photographs.

Location	T11	T17	T18	T21	T27	T71
Number of days before removal	7 days	6 days	N/A	7 days	4 days	1 days

7.3.6.3.4 Bat survey results 2019

Static bat detector survey

Static bat detectors recorded bat calls for a combined total of 311 nights, equating to 3519 hours of survey time during Autumn 2019. Detector locations are illustrated in

. On two occasions the battery life of the detectors was reduced by high frequency noise, recording 7 nights of data at T15 and 4 nights at T58. This has been accounted for in analysis. Table 7.15 gives details of the number of passes and activity recorded during automated detector surveys.

A total of 16264 passes from at least six species of bat were recorded.

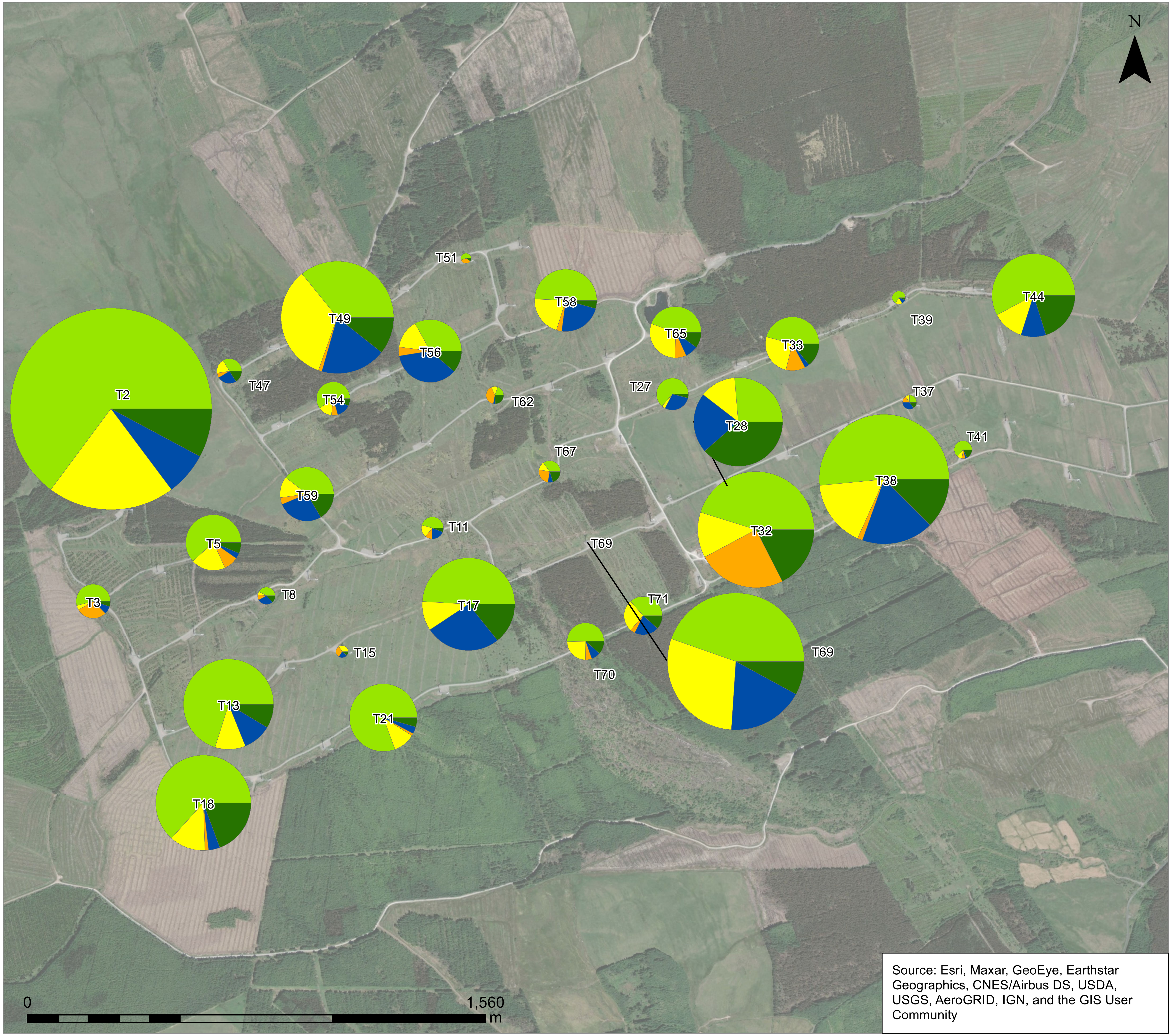
Figure 7.12 illustrates the proportion of activity (bat passes per hour) recorded for different species at each automated survey location. Data for which there were less than 0.1 bat passes per hour (P/h) (e.g. brown long-eared bat) have not been illustrated.

Table 7.15: Total number of bat passes (P) and activity (P/h) for each bat species recorded during automated surveys in 2019.

Species	P	P/h
Nathusius' pipistrelle	7	<0.1
Common / Nathusius' pipistrelle	189	0.1
Common pipistrelle	8397	2.4
Common / Soprano pipistrelle	1473	0.4
Soprano pipistrelle	2971	0.8
Myotis species	590	0.2
Myotis / brown long-eared bat	144	<0.1
Brown long-eared bat	156	<0.1
Leisler's bat	2039	0.6
Unidentified bat species	298	0.1
Total	**16264**	**4.6**

Summary of Activity

The highest activity rate was recorded for common pipistrelle, at an average of 2.4 P/h; 51% of all recorded passes were identified as common pipistrelle. The next most commonly recorded species were soprano pipistrelle (0.8 P/h) and Leisler’s bat (0.6 P/h). *Myotis* species and long-eared bat sp. were both recorded at low frequencies 0.2 P/h and <0.1 P/h respectively. Seven Nathusius’ pipistrelle passes were recorded. There were 189 passes which fell within the call parameters for both common and Nathusius’ pipistrelle and 1473 passes which fell within the call parameters for soprano and common pipistrelle.



LEGEND

Total bat passes per hour

- Common pipistrelle
- Soprano pipistrelle
- *Myotis* sp.
- Leisler's bat
- Other bat species

Circle size proportional to B/h

MAX

MIN

BSG ecology

OFFICE: Swansea

T: (0044) 01792 363026

JOB REF: P19-597

PROJECT TITLE

Derrybrien Wind Farm Project

DRAWING TITLE

Figure 7.12 - Total static bat detector results (2019)

DATE: 25.05.2020	CHECKED: RT	SCALE: 1:12,500
DRAWN: COH	APPROVED: OG	STATUS: FINAL

No dimensions are to be scaled from this drawing.
All dimensions are to be checked on site.
Area measurements for indicative purposes only.

Ordnance Survey Ireland data used in accordance with standard Authorised Third Party Users licence (customer: ESB International)

Sources: BSG Ecology survey data

R:\0010 Derrybrien Environmental\06 Mapping\ArcGIS\Mxds\Working\Environmental_Report\Chapter 7 - Biodiversity\Figure 7.12 Total static bat detector results (2019)_May_2020.mxd

The data presented in Table 7.16 show the activity of each species at the turbine locations sampled in 2019. This information is also illustrated as scaled pie charts in Figure 7.12. The number of bat passes recorded for each location can be found in Table 4 Appendix 7-4.

Table 7.16: Activity (P/h) of bat species at each detector location 2019.

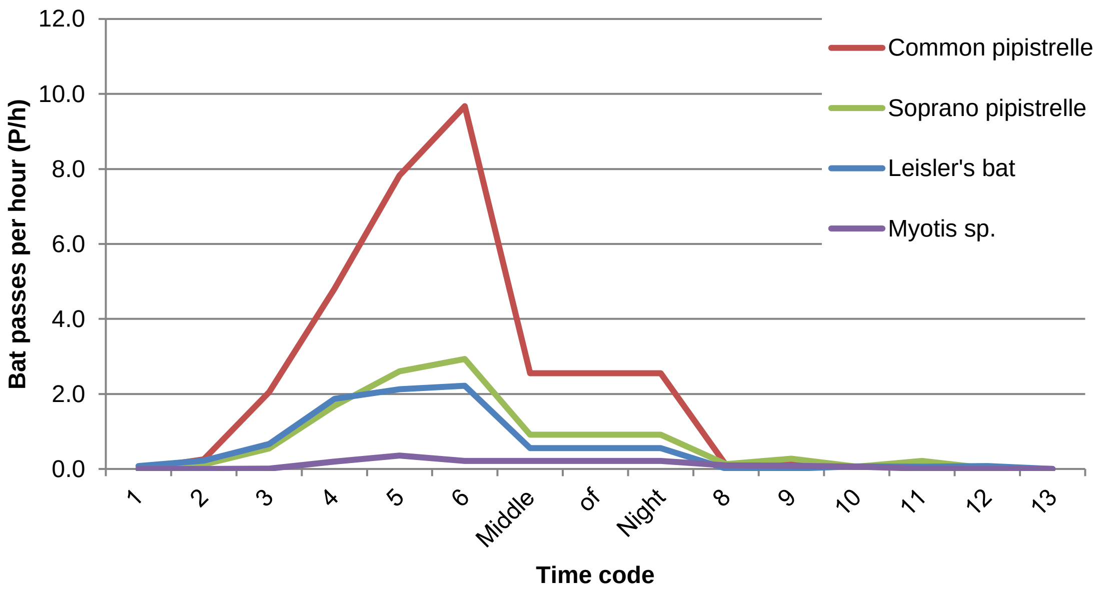
Turbine Location	Nathusius' pipistrelle	Common / Nathusius' pipistrelle	Common pipistrelle	Common / Soprano pipistrelle	Soprano pipistrelle	Myotis sp.	Myotis / Long-eared bat sp.	Long eared bat sp.	Leisler's bat	Unidentified bat species	Total bat P/h
T11	0.0	0.0	0.2	0.0	0.1	0.0	0.0	0.0	0.1	0.0	**0.4**
T13	0.0	0.1	4.7	0.4	0.7	0.0	0.0	0.0	0.7	0.0	**6.8**
T15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.1**
T17	0.0	0.2	3.5	0.6	0.7	0.1	0.1	0.1	1.9	0.0	**7.2**
T18	0.0	0.2	4.6	1.1	0.9	0.1	0.0	0.0	0.3	0.3	**7.6**
T2	0.0	0.2	21.9	2.3	6.9	0.2	0.0	0.2	2.4	0.1	**34.1**
T21	0.0	0.1	3.1	0.1	0.4	0.0	0.0	0.0	0.1	0.0	**3.9**
T27	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.2	0.0	**0.9**
T28	0.1	0.0	1.7	2.3	0.9	0.1	0.1	0.1	1.4	0.0	**6.6**
T3	0.0	0.0	0.5	0.0	0.0	0.3	0.0	0.0	0.1	0.0	**1.0**
T32	0.0	0.0	5.1	1.7	1.4	2.8	0.2	0.0	0.0	0.1	**11.4**
T33	0.0	0.0	1.1	0.1	0.6	0.3	0.1	0.1	0.1	0.0	**2.4**
T37	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	**0.2**
T38	0.0	0.2	7.2	1.4	2.3	0.2	0.1	0.1	2.5	0.1	**14.1**
T39	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.1**
T41	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.3**
T44	0.0	0.1	3.3	0.6	0.7	0.0	0.3	0.0	0.6	0.0	**5.8**

Turbine Location	Nathusius' pipistrelle	Common / Nathusius' pipistrelle	Common pipistrelle	Common / Soprano pipistrelle	Soprano pipistrelle	Myotis sp.	Myotis / Long-eared bat sp.	Long eared bat sp.	Leisler's bat	Unidentified bat species	Total bat P/h
T47	0.0	0.0	0.2	0.0	0.1	0.0	0.0	0.0	0.1	0.0	**0.5**
T49	0.0	0.1	3.8	0.8	3.6	0.1	0.1	0.1	2.0	0.0	**10.7**
T5	0.0	0.0	1.6	0.1	0.5	0.2	0.0	0.0	0.1	0.0	**2.6**
T51	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.1**
T54	0.0	0.0	0.6	0.0	0.1	0.1	0.0	0.0	0.1	0.0	**0.9**
T56	0.0	0.0	1.1	0.2	0.5	0.2	0.0	0.1	1.2	0.0	**3.3**
T58	0.0	0.0	1.6	0.0	0.7	0.1	0.0	0.0	0.7	0.0	**3.3**
T59	0.0	0.0	1.0	0.2	0.3	0.1	0.0	0.1	0.7	0.0	**2.4**
T62	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	**0.3**
T65	0.0	0.0	0.9	0.1	0.6	0.1	0.0	0.1	0.2	0.2	**2.2**
T67	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	**0.4**
T69	0.0	0.2	6.4	0.8	4.2	0.1	0.1	0.1	2.6	1.2	**15.8**
T70	0.0	0.0	0.6	0.1	0.3	0.1	0.0	0.0	0.1	0.0	**1.2**
T71	0.0	0.0	0.3	0.0	0.2	0.0	0.0	0.0	0.2	0.3	**1.2**
T8	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	**0.3**
Total bat P/h	**0.0**	**0.1**	**2.4**	**0.4**	**0.8**	**0.2**	**0.0**	**0.0**	**0.6**	**0.1**	**4.6**

The highest levels of overall bat activity (34.1 P/h) were recorded at T2, followed by T69, T38, T32 and T49 (all of which recorded between 10.7 and 15.8 P/h). All of these detectors were located near to the areas of plantation woodland. T37, T39, T15 and T51 had activity of <0.2 P/h; two of these locations are in open areas, the other two are at turbines which have coniferous forestry immediately to the north. Differences in activity for individual bat species at each detector location are discussed below.

Graph 7.2 shows the activity of bats throughout the night for species with activity levels above 0.1 P/h. The highest levels of activity for all species were recorded between 81 minutes after sunset and 100 minutes before sunrise, with the exception of brown long-eared bat and Nathusius' pipistrelle which were most frequently recorded in the middle of the night (i.e. not in the hours immediately post-dusk or pre-dawn). Differences in activity for individual bat species throughout the night are discussed below.

Graph 7.2: Activity (P/h) of bat species throughout the night.



Leisler's bat

The highest levels of activity (2.0 – 2.6 P/h) were recorded in locations T69, T38, T2 and T49. The lowest levels of relative activity (<0.1 P/h) were recorded at T32, T67, T15, T39, T62, and T41. No Leisler's bats were recorded at T51.

The highest activity was recorded from 61 minutes after sunset (1.9 P/h), with a peak 101-120 minutes after sunset (2.2 P/h). Low activity was recorded within the 20 minutes after sunset and before sunrise (0.1 and <0.1 P/h respectively). One Leisler's bat pass was recorded two minutes after sunrise. Early / late bat passes (within 20 minutes of sunset) were recorded at T28, T69, T17, T18, T2, T5 and T41 over five separate nights.

Nathusius' pipistrelle

Seven confirmed Nathusius' pipistrelle passes were recorded during the surveys. One pass was recorded at T33 in the middle of the night on 07 September 2019 and six passes were recorded at T28 in the middle of the night on 11 September 2019. The six passes all occurred within a two minute period.

Common pipistrelle

The highest level of activity was recorded at T2 (21.9 P/h) followed by T38, T69, T32, T13 and T18 (7.2, 6.4, 5.1, 4.7 and 4.6 P/h respectively). Activity at a further ten locations was between 1 and 3 P/h, the remaining sixteen recorded <1 P/h.

The highest activity was recorded from 61 minutes after sunset (4.8 P/h), with a peak 101-120 minutes after sunset (9.7 P/h). Activity dropped to 2.6 P/h over the night period and there was no peak in activity prior to sunrise. No passes were recorded within 20 minutes of sunset or sunrise.

Soprano pipistrelle

The highest level of activity was recorded at T2 (6.9 P/h) followed by T69, T49, T38 and T32 (4.2, 3.6, 2.3 and 1.4 P/h respectively). Activity at all other locations was between <1 P/h.

The highest activity was recorded from 61 minutes after sunset (1.7 P/h), with a peak 101-120 mins after sunset (2.9 P/h). Activity dropped to 0.9 P/h over the night period and there was low activity prior to sunrise with two small increases 100-81 mins before sunrise (0.3 P/h) and 60-41 minutes before sunrise (0.2 P/h). No passes were recorded within 20 minutes of sunset or sunrise.

Myotis sp.

Myotis sp. bats were recorded at all turbine locations, apart from T39. The highest levels of activity was recorded at T32 (2.8 P/h); activity at all other locations was <0.4 P/h.

A small peak in activity was recorded between 81 and 100 minutes after sunset (0.4 P/h), activity through the night was low (0.2 P/h) and there was no peak in activity prior to sunrise. No passes were recorded within 20 minutes of sunset or sunrise.

Brown long-eared bat

Brown long-eared bat was recorded at 21 turbine locations (of 32 locations sampled). The highest activity was recorded at T44 (0.3 P/h) and T32 (0.2 P/h). Activity was 0.1 P/h or under at all other locations brown long-eared bat was recorded.

Brown long-eared bat was recorded from 65 minutes after sunset to 82 minutes before sunrise, with most passes recorded during the middle of the night (0.1 P/h).

7.3.6.4 Evaluation of vulnerability of baseline bat assemblage

Industry standard guidance (SNH *et al.*, 2019) suggests that the vulnerability of bat populations to wind farms is based on three factors:

1. Relative abundance;
2. Collision risk (See Table 7.17); and
3. Bat activity recorded at the site.

Relative abundance is defined as ‘common’, ‘rarer’ and ‘rarest’ by SNH *et al.*, 2019; definitions adapted from criteria presented by Wray, *et al.* (2010), where:

- Rarest indicates populations under 10,000 within range (national)
- Rarer indicates populations under 10,000 – 100,000 within range (national)
- Common indicates populations over 100,000 within range (national)

Relative abundance of each British species is provided in the guidance for Scotland, England and Wales (as well as Northern Ireland in Wray *et al.,* 2010), but not for Ireland. For the purposes of this chapter relative abundance has been defined for each species based on Irish population data available (Marnell *et al.*, 2009).

SNH *et al.* (2019) provide a table (Table 7.17) categorising which bat species are potentially most vulnerable to collision with turbines based on physical and behavioural characteristics combined with evidence of casualty rates in Europe.

Table 7.17: Bat species which are potentially most vulnerable to collision base on physical and behavioural characteristics. Taken from SNH *et al.*, 2019.

Note Serotine *Eptisicus serotinus*, noctule *Nyctalus noctula* and barbastelle *Barbastellus barbastellus* are not considered to be resident or regularly occurring species in Ireland.

	Risk of turbine impact		
Factor	Low Risk	Medium Risk	High Risk
Habitat preference	Bats preferring cluttered habitat	Bats able to exploit background cluttered space	Bats preferring to use open habitat
Echolocation characteristics	• Short range • High frequency • Low intensity • Detection distance ~15m	Intermediate – more plastic in their echolocation[14]	• Long range • Low frequency • High intensity • Detection distance ~80m[15]
Wing shape	• Low wing loading • Low aspect ratio • Broadest wings	Intermediate	• High wing loading • High aspect ratio • Narrow wings
Flight speed	Slow	Intermediate	Fast
Flight behaviour and use of landscape	• Manoeuvre well • will travel in cluttered habitat • Keeps close to vegetation • Gaps may be avoided	Some flexibility	• Less able to manoeuvre • May avoid cluttered habitat • Can get away from unsuitable habitat quickly • Commute across open landscape
Hunting techniques	• Hunt close to vegetation • Exploit richer food sources in cluttered habitat • Gleaners	• Hunt in edge and gap habitat • Aerial hawkers	• Less able to exploit insect abundance in cluttered habitat • Aerial hawker • Feed in open
Migration	Local or regional movements.	Regional migrant in some parts of range	Long-range migrant in some parts of range
Conclusion	*Myotis* spp. Long eared-bats Horseshoe bats	Serotine Barbastelle	Common pipistrelle[16] Soprano pipistrelle Noctule Leisler's bat Nathusius' pipistrelle

Bat activity at the site was not recorded in a detailed and structured manner until 2016. Therefore, for the baseline, assumptions on bat activity for impacts that have occurred are made based on the species present in desk study data for the wider area, relative bat species abundance in Ireland (Marnell *et al.,* 2009) and a professional judgement-based assessment of the value of the habitat for bats.

For impacts that are occurring during operation and for impacts that are likely to occur, all available data on bat activity has been used to assess impacts. As the assessment is split in this way, data on bat activity is therefore presented in the operational phase impacts (see Section 7.4.2.3.3) rather than in the species evaluations below.

Common pipistrelle (*Pipistrellus pipistrellus*)

Common pipistrelles are common in Ireland, and together with soprano pipistrelles are the most frequently recorded species (Schofield & Mitchell-Jones, 2003). The population in Ireland is thought to be stable and is estimated to comprise 100,000+ mature individuals (Marnell *et al.*, 2009). Results from Bat Conservation Ireland's car-based bat monitoring scheme suggests populations of common pipistrelle increased between 2003 and 2009 (Roche *et al.*, 2011). The Terrestrial Mammal Red List for Ireland 2009 lists the species as of 'least concern' in Ireland (Marnell *et al.*, 2009).

The relative abundance of common pipistrelle is considered to be **Common** in Ireland.

Common pipistrelle feed in a wide range of habitats including woodland, hedgerows, grassland, farmland, suburban and urban areas (Dietz *et al.*, 2009; Schofield & Mitchell-Jones, 2003, Dietz & Keifer, 2016). Maternity roosts are mainly found in buildings, with males roosting in buildings and trees during the summer (Collins, 2016). Common pipistrelles have also been recorded roosting in bridges in Ireland (Masterson *et al.*, 2008). The species generally emerges from roosts around 20 minutes after sunset and flies 2-10 m above ground level (Bat Conservation Trust, 2010[a]).

The commercial plantation and open habitats at the site are widely available within the Slieve Aughty Mountains (local area). The condition of habitats and the ratio of commercial plantation to open habitats in this area are constantly changing due to the harvesting and planting of the coniferous plantation and the localised cutting of peat. The wind farm is positioned at the highest elevation in the Slieve Aughty Mountains and is therefore more exposed to higher winds and cooler temperatures than areas at lower elevations. Whilst common pipistrelle is known to use exposed upland sites, there is considerable similar habitat at lower, less exposed altitudes. Lower levels of activity are generally expected at these higher, more exposed altitudes.

The masonry bridges that were damaged during the peat slide are likely to have had a small number of crevices available that could have been used by roosting bats. Masonry bridges are a feature of stream crossings in the local area. There are stone buildings within 400 m of each bridge which could provide similar features for roosting bats.

<u>Evaluation</u>

The commercial plantation and open habitats available in the Project area are considered to have been of **site value** to common pipistrelle.

The masonry bridges damaged during the peat slide may have had potential for roosting common pipistrelle; the masonry bridges are considered to be of **site value** to common pipistrelle.

Common pipistrelles are considered to be at high risk of turbine collision (see Table 7.17 for detail).

Soprano pipistrelle (*Pipistrellus pymaeus*)

Soprano pipistrelles are common in Ireland, and together with common pipistrelles are the most frequently recorded species (Schofield & Mitchell-Jones, 2003). The population in

Ireland is thought to be stable and is estimated to comprise 100,000+ mature individuals (Marnell *et al.*, 2009). Results from Bat Conservation Ireland's car-based bat monitoring scheme suggests populations of soprano pipistrelle species increased between 2003 and 2009 (Roche *et al.*, 2011). The Terrestrial Mammal Red List for Ireland 2009 lists the species as of 'least concern' in Ireland (Marnell *et al.*, 2009).

The relative abundance of soprano pipistrelle is considered to be **Common** in Ireland.

Soprano pipistrelles typically feed in wetland habitats, for example over lakes and rivers, but also occur around woodland edge, along tree lines and hedgerows, and in suburban gardens and parks (Dietz *et al.*, 2009; Schofield & Mitchell-Jones, 2003; Dietz & Keifer, 2016). Soprano pipistrelle maternity roosts are mainly found in buildings (typically forming larger roosts than common pipistrelle), with males roosting in buildings and trees during the summer (Collins, 2016). Soprano pipistrelles have also been recorded roosting in bridges in Ireland (Masterson *et al.*, 2008). The species generally emerges from roosts around 20 minutes after sunset and flies 2-10m above ground level (Bat Conservation Trust, 2010[b]).

The commercial plantation and open habitats at the site are widely available within the Slieve Aughty Mountains (local area). The condition of habitats and the ratio of commercial plantation to open habitats in this area are constantly changing due to the harvesting and planting of the coniferous plantation and the localised cutting of peat. The elevation of the wind farm means it is more exposed than other areas in the Slieve Aughty Mountains. Whilst soprano pipistrelle is known to use exposed upland sites, there is considerable similar habitat at lower, less exposed altitudes. Lower levels of activity are generally expected at these higher more exposed altitudes.

The masonry bridges are likely to have had a small number of crevices available for use by roosting bats. There are stone buildings within 400 m of each bridge which could provide similar features.

<u>Evaluation</u>

The commercial plantation and open habitats available in the Project area are considered to have been of **site value** to soprano pipistrelle.

The masonry bridges that were damaged during the peat slide may have had potential for roosting soprano pipistrelle, the masonry bridges are considered to be of **site value** to soprano pipistrelle.

Soprano pipistrelles are considered to be at high risk of turbine collision (see Table 7.17 for detail).

Nathusius's pipistrelle (*Pipistrellus nathusii*)

Information on Nathusius' pipistrelle in Ireland is limited, it has been recorded breeding in Northern Ireland since 1997 and has been recorded on bat detectors in Ireland, but breeding has yet to be confirmed (Bat Conservation Ireland, 2019). The Terrestrial Mammal Red List for Ireland (2009) lists the species as of 'least concern' (Marnell *et al.*, 2009). Between 2003 and 2011, 147 records of Nathusius' pipistrelle were recorded during car-based bat monitoring surveys across the island of Ireland; 6,433 transects were driven during this time period. The closest record to the wind farm site is 18.5 km to the south west; this was recorded in 2007.

The relative abundance of Nathusius' pipistrelle is considered to be **Rarest** in Ireland.

Nathusius' pipistrelle typically forages in woodland, often near to large water bodies (Dietz *et al.*, 2009; Schofield & Mitchell-Jones, 2003; Collins, 2016). They are strong flyers, and are long distance migrants in mainland Europe (Dietz *et al.*, 2009; Marnell *et al.*, 2009).

The commercial plantation and open habitats at the site are widely available within the Slieve Aughty Mountains (local area). The condition of habitats and the ratio of commercial plantation to open habitats in this area are constantly changing due to the harvesting and planting of the coniferous plantation and the localised cutting of peat. The elevation of the wind farm means it is more exposed than other areas in the Slieve Aughty Mountains. Whilst Nathusius' pipistrelle is known to use exposed upland sites, there is considerable similar habitat at lower, less exposed altitudes. Lower levels of activity are generally expected at these higher more exposed altitudes.

Evaluation

The commercial plantation and open habitats available in Project area are considered to have been of **negligible value** to Nathusius' pipistrelle.

Nathusius' pipistrelles are considered to be at high risk of turbine collision (see Table 7.17 for detail).

Leisler's bat (*Nyctalus leisleri*)

Leisler's bat is considered to be common in Ireland, which is a stronghold for the species (Schofield & Mitchell-Jones, 2003). Initial results from Bat Conservation Ireland's car-based bat monitoring scheme suggests Leisler's bat populations have increased between 2003 and 2009 (Roche *et al.*, 2011). The population in Ireland is thought to be stable and is estimated to comprise 20,000+ mature individuals (Marnell *et al.*, 2009). The mammal red list for Ireland 2009 lists the species as of 'near threatened' (Marnell *et al.*, 2009).

The relative abundance of Leisler's bats is considered to be **Rarer** in Ireland.

Leisler's bats typically forage just above the canopy of trees, along forest trails and fire breaks, over waterbodies and around street lamps (Schofield & Mitchell-Jones, 2003). When they are hunting over pasture land, yellow dung flies and beetles are important dietary components and available throughout the year (Dietz *et al.*, 2009). Leisler's bats roost in both trees and buildings (Collins, 2016).

The commercial plantation and open habitats at the site are widely available within the Slieve Aughty Mountains (local area). The condition of habitats and the ratio of commercial plantation to open habitats in this area are constantly changing due to the harvesting and planting of the coniferous plantation and the localised cutting of peat. The elevation of the wind farm means it is more exposed than other areas in the Slieve Aughty Mountains. Whilst Leisler's bat is known to use exposed upland sites, there is considerable similar habitat at lower, less exposed altitudes. Lower levels of activity are generally expected at these higher more exposed altitudes.

Evaluation

The commercial plantation and open habitats available in the Derrybrien Wind Farm Project and associated works area are considered to have been of **site value** to Leisler's bat.

Leisler's bats are considered to be at high risk of turbine collision (see Table 7.17 for detail).

Brown long-eared bat (*Plecotus auritus*)

Brown long-eared bats are common and widespread in Ireland (Schofield & Mitchell-Jones, 2003). The population in Ireland is thought to be stable and is estimated to comprise 10,000+ mature individuals (Marnell *et al.*, 2009). Results from Bat Conservation Ireland's Brown Long-eared Bat Roost Monitoring Scheme suggest that brown long-eared bat populations in Ireland are stable (Aughney *et al.*, 2011; BCI, 2019[a]). The Terrestrial Mammal Red List for Ireland 2009 lists the species as of 'least concern' (Marnell *et al.*, 2009).

The relative abundance of brown long-eared bats is considered to be **Rarer** in Ireland.

Brown long-eared bats typically forage in woodlands, and roost in buildings and trees (Schofield & Mitchell-Jones, 2003), and have also been recorded roosting in bridges (BCI, 2010). Studies suggest that brown long-eared bats spend most of their time foraging within 500 m to 1 km of their roosts, and flight distances are typically under 10 km (Dietz *et al.*, 2009, Hundt *et al.*, 2012).

The commercial plantation and open habitats at the site are widely available within the Slieve Aughty Mountains (local area). The condition of habitats and the ratio of commercial plantation to open habitats in this area are constantly changing due to the harvesting and planting of the coniferous plantation and the localised cutting of peat. The elevation of the wind farm means it is more exposed than other areas in the Slieve Aughty Mountains. Whilst brown long-eared bat is known to use exposed upland sites, there is considerable similar habitat at lower, less exposed altitudes. Lower levels of activity are generally expected at these higher more exposed altitudes.

The masonry bridges are likely to have had a small number of crevices available for use by roosting bats. There are stone buildings within 400 m of each bridge which could provide similar features.

Evaluation

The commercial plantation and open habitats available in the Derrybrien Wind Farm Project and associated works area are considered to be of **site value** to brown long-eared bat.

The masonry bridges that were damaged during the peat slide may have had potential for roosting brown long-eared bats, the masonry bridges are considered to be of **site value** to brown long-eared bats.

Brown long-eared bats are considered to be at low risk of turbine collision (see Table 7.17 for detail).

Natterer's bat (*Myotis nattereri*)

Natterer's bats are widely distributed throughout Ireland (McAney, 2006; Schofield & Mitchell-Jones, 2003). The population in Ireland is thought to be stable and is estimated to comprise 5,000+ mature individuals (Marnell *et al.*, 2009). The Terrestrial Mammal Red List for Ireland 2009 lists the species as of 'least concern' (Marnell *et al.*, 2009).

The relative abundance of Natterer's bats is considered to be **Rarest** in Ireland.

Natterer's bats predominately forage in woodland and open parkland, and have broad wings enabling them to hunt within tree canopies or close to foliage (Dietz *et al.*, 2009; Schofield & Mitchell-Jones, 2003). They typically roost in trees, in both crevices and voids (BTHK, 2018; Dietz *et al.*, 2009) but have been recorded in crevices under bridges. Mortimer (2006) found 22 Natterer's bat roosts in coniferous plantation in North East Scotland, and that Natterer's were foraging within the plantation in which roosting occurred. Natterer's bats roosting sites typically change every 2-5 days and the size of some colonies varies constantly (Dietz & Keifer, 2016).

The commercial plantation and open habitats at the site are widely available within the Slieve Aughty Mountains (local area). The condition of habitats and the ratio of commercial plantation to open habitats in this area are constantly changing due to the harvesting and planting of the coniferous plantation and the localised cutting of peat. The elevation of the wind farm means it is more exposed than other areas in the Slieve Aughty Mountains. Natterer's bat is more likely to have used the coniferous plantation that was available prior to site development than other bats, although there is considerable similar habitat at lower, less exposed altitudes. Lower levels of activity are generally expected at these higher more exposed altitudes.

The masonry bridges are likely to have had a small number of crevices available for use by roosting bats. There are stone buildings within 400 m of each bridge which could provide similar features.

<u>Evaluation</u>

The commercial plantation and open habitats available in the Derrybrien Wind Farm Project and associated works area are considered to be of **local value** to Natterer's bat.

The masonry bridges that were damaged during the peat slide may have had potential for roosting Natterer's bats, the masonry bridges are considered to be of **site value** to Natterer's bat.

Natterer's bats are considered to be at low risk of turbine collision (see Table 7.17 *Myotis* sp. for detail).

Daubenton's bat (*Myotis daubentonii*)

Daubenton's bat is common and widespread in Ireland (Schofield & Mitchell-Jones, 2003). Results from Bat Conservation Ireland's All Ireland Daubenton's Bat Waterways Survey suggest that the Daubenton's bat populations in Ireland is stable and comprises 10,000+ mature individuals (Marnell *et al.*, 2009; Aughney *et al.*, 2012; BCI[c], 2019). The Terrestrial

Mammal Red List for Ireland 2009 lists the species as of ‘least concern’ (Marnell *et al.*, 2009).

The relative abundance of Daubenton’s bats is considered to be **Rarer** in Ireland.

Daubenton’s bats are fast, agile bats, which typically forage over calm waterbodies within 6 km of roost sites (Dietz *et al.*, 2009; Schofield & Mitchell-Jones, 2003). They are typically a tree dwelling species, favouring larger voids in trees rather than crevices (BTHK, 2018; Dietz *et al.*, 2009). Daubenton’s bats are also regularly recorded in bridges (BCI, 2010).

The commercial plantation and open habitats at the site are widely available within the Slieve Aughty Mountains (local area). The condition of habitats and the ratio of commercial plantation to open habitats in this area are constantly changing due to the harvesting and planting of the coniferous plantation and the localised cutting of peat. The elevation of the wind farm means it is more exposed than other areas in the Slieve Aughty Mountains. Whilst Daubenton’s bat may use exposed upland sites, there is considerable similar habitat at lower, less exposed altitudes. Lower levels of activity are generally expected at these higher more exposed altitudes.

The masonry bridges are likely to have had a small number of crevices available for use by roosting bats. There are stone buildings within 400 m of each bridge which could provide similar features.

<u>Evaluation</u>

The commercial plantation and open habitats available in the Derrybrien Wind Farm Project and associated works area are considered to be of **negligible value** to Daubenton’s bat.

The masonry bridges that were damaged during the peat slide may have had potential for roosting Daubenton’s bats; the masonry bridges are considered to be of **site value** to Daubenton’s bat.

Daubenton’s bats are considered to be at low risk of turbine collision (see Table 7.17 *Myotis* sp. for detail).

Whiskered bat (*Myotis mystacinus*)

Whiskered bats are widely distributed throughout Ireland. (McAney, 2006). The population is thought to be stable, and to comprise 5,000+ mature individuals (Marnell *et al.*, 2009). The Terrestrial Mammal Red List for Ireland 2009 lists the species as of ‘least concern’ (Marnell *et al.*, 2009). The relative abundance of whiskered bats is considered to be **Rarest** in Ireland.

Whiskered bats forage in a wide range of habitats including parkland, broadleaved and mixed woodland, wet woodland, gardens and along water courses, flying fast and close to vegetation (Dietz *et al.*, 2009; Schofield & Mitchell-Jones, 2003). Most known summer roosts are in buildings, but they will roost in crevices in trees and bridges (Dietz *et al.*, 2009; BCI, 2010; BTHK, 2018).

The commercial plantation and open habitats at the site are widely available within the Slieve Aughty Mountains (local area). The condition and ratios of these habitats is variable locally. The elevation of the wind farm means it is more exposed than other areas in the Slieve Aughty Mountains. Whilst whiskered bat may use exposed upland sites, there is considerable similar habitat at lower, less exposed altitudes. Lower levels of activity are generally expected at these higher more exposed altitudes.

The masonry bridges are likely to have had a small number of crevices available for use by roosting bats. There are stone buildings within 400 m of each bridge which could provide similar features.

<u>Evaluation</u>

The commercial plantation and open habitats available in the Derrybrien Wind Farm Project and associated works area are considered to be of **negligible value** to whiskered bat.

The masonry bridges that were damaged during the peat slide may have had potential for roosting whiskered bats; the masonry bridges are considered to be of **site value** to whiskered bat.

Whiskered bats are considered to be at low risk of turbine collision (see Table 7.17 *Myotis* sp. for detail).

Lesser horseshoe bat (*Rhinolophus hipposideros*)

Lesser horseshoe bat is mainly found in counties in the west of Ireland: Mayo, Galway, Clare, Limerick, Kerry and Cork, although its strongholds are found in Kerry/west Cork and in Clare (Roche *et al.,* 2015). The population in Ireland is thought to be stable and may be increasing (Roche *et al.,* 2015). It is estimated at approximately 12,500 mature individuals (Marnell *et al.*, 2009). The Terrestrial Mammal Red List for Ireland 2009 lists the species as of 'near threatened' in Ireland (Marnell *et al.*, 2009).

The relative abundance of lesser horseshoe bats is considered to be **Rarer** in Ireland.

Lesser horseshoe bats are typically associated with broadleaved woodland, and are agile flyers, foraging very close to vegetation (Dietz *et al.*, 2009; Schofield & Mitchell-Jones, 2003). Summer roosts are predominately in buildings, and winter roosts in caves and mines (Dietz *et al.*, 2009).

The closest known roost to the Project is at Lough Cutra Castle (approximately 13.5 km to the south west). Collins (2016) describes core sustenance zones for different bat species (based on extensive literature reviews). The term core sustenance zone refers to the area surrounding a communal bat roost within which habitat availability and quality will have a significant influence on the resilience and conservation status of the colony using the roost (Collins, 2016). The core sustenance zone for lesser horseshoe bats is given as 2 km. Therefore, bats from the Lough Cutra roost are unlikely to commute to the wind farm to forage.

The commercial plantation and open habitats at the site are widely available within the Slieve Aughty Mountains (local area). The condition and ratios of these habitats is variable locally. The elevation of the wind farm means it is more exposed than other areas in the Slieve Aughty Mountains. Whilst lesser horseshoe bats may use exposed upland sites, there is considerable similar habitat at lower, less exposed altitudes. Lower levels of activity are generally expected at these higher more exposed altitudes.

Evaluation

The commercial plantation and open habitats available in the Derrybrien Wind Farm Project and associated works area are considered to be of **Negligible Value** to lesser horseshoe bats[4].

Lesser horseshoe bats are considered to be at low risk of turbine collision (see Table 7.17 for detail).

7.3.7 Mammals (other than bats)

7.3.7.1 European Otter

The otter (*Lutra lutra*) is fully protected in Ireland under the Irish Wildlife Act 1976 (as amended). It is also listed on the Irish Red Data book as 'Internationally Important'. The otter is also protected under Annex II and IV of the EU Habitats Directive (92/43/EEC) giving it strict protection as a species of community interest for which EU member states must designate Special Areas of Conservation. The otter is also listed on Appendix II of the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention, 1982) which Ireland has ratified.

There was no data relating to otter in the original EISs prepared for the project.

During the survey of the Owendalulleegh River undertaken by the SRFB and Inis Environmental Services (2004b) in December 2003, following the peat slide which occurred in October 2003, otter signs were recorded at a number of locations along the Owendalulleegh River. The survey commenced at Flaggy Bridge and continued along the length of the river to Lough Cutra. Otter tracks were recorded on the tributary below Flaggy Bridge (within sub-catchment SC7(d) as shown on Figure 8.2 Chapter 8). Within the SC7(d) tributary, signs were noted within a 600 m stretch upstream of the confluence with the main channel of the Owendalulleegh River. Downstream of the confluence otter tracks were noted at several locations over the next 6.6 km along the main channel of the river.

No signs of otter were recorded during the survey of the wind farm site undertaken on 20th July 2018.

In August 2018 four sprainting sites were noted on the Flaggy Bridge tributary, the most upstream 300 m downstream of Flaggy Bridge and the most downstream 400 m upstream of the confluence with the Owendalulleegh. A further spraint was noted 580 m downstream of the confluence on the main channel. Most of the spraints were on large boulders and one was on a grassy bank. While undertaking Q-value assessments on the Boleyneendorrish River on October 10th a spraint was also recorded at site B3 (see Figure

[4] Lesser horseshoe bats have not been recorded within Derrybrien Wind Farm Project and associated works area.

8.2 Chapter 8). While the latter observations were mainly incidental, it is clear that otter use all of the main channels of the 3 main catchments and likely also use substantial proportions of all of the side tributaries for feeding and marking.

7.3.7.2 Other mammals

Preconstruction the 344.5 ha wind farm site had 265 ha of conifer plantation of which 222 ha was felled to facilitate construction of the wind farm. The eastern section of the site comprised cutover bog habitat used for turbary. These habitats would have had the potential to support a number of mammal species.

The original EISs prepared for the Project refer to evidence of Sika deer (*Cervus nippon*) being recorded during a site visit. Other species referenced as possible visitors to the site in the report include fox (*Vulpes vulpes*), mountain hare (*Lepus timidus hibernicus*), badger (*Meles meles*) and stoat (*Mustela erminea*) (source: local NPWS Conservation Ranger). The reports also make reference to the fact that the extent of coniferous forestry would serve to restrict the numbers and variety of mammals present.

A trail camera set up to record scavenger removal rates as part of the bat monitoring programme recorded pine marten on the wind farm site in July 2020. Pine marten (*Martes martes*) is protected under the Wildlife (Amendment) Acts (2000 & 2010), the Bern Convention (Appendix III) and Annex V of the EU Habitats Directive (1992).

Badgers are also likely to forage on site from time to time given the large expanses of forestry in the surrounding area. Badger is protected under the Wildlife Act (1976) and Wildlife (Amendment) Acts (2000 & 2010) and the Bern Convention (Appendix III).

Red squirrel (*Sciurus vulgaris*) has been recorded in both 10 km squares occupied by the Project and are likely to use the conifer forestry for feeding and breeding purposes. Red squirrel is protected under the Wildlife Act (1976) and Wildlife (Amendment) Acts (2000 & 2010) and the Bern Convention (Appendix III).

The surrounding coniferous plantations offer habitat suitable for breeding and foraging for all three mammal species, however, the habitats within the Project boundary only offer opportunities for foraging for badger and pine marten. Red squirrel is unlikely to occur regularly in the open habitats within the Project boundary.

7.3.8 Other fauna

Common frog (*Rana temporaria*), smooth newt (*Triturus vulgaris*) and the common lizard (*Lacerta vivipara*) are all protected species under the Wildlife Act 1976 (as amended) and are likely to occur on the wind farm site and along the OHL corridor as they have a widespread distribution in Ireland. Frogs and smooth newt can be found in drainage channels and other wetland habitats and both amphibians and reptiles live on bogs.

Prior to construction of the wind farm, the site had already been subjected to a programme of drainage to facilitate forestry (in the 1960s and 1970s) and turbary. The majority (27 km out of 39 km) of drainage channels on site were in place prior to the wind farm development. During construction of the wind farm the majority of the pre-existing channels were left unchanged except where there was a conflict with new infrastructure. The impact on amphibians using drainage channels is considered likely to have been minor and short term. The removal of 222 ha of conifer plantation would have been a positive impact and made the site more favourable for common lizard which basks in sunlight to raise its body temperature. The loss of approximate 0.7 ha cutover bog habitat in the footprint of the development is considered a minor permanent impact of no significance. The construction phase of the project is not likely to have had a significant effect on amphibians or lizards.

The drainage improvements that were carried out during the operation and maintenance period generally involved minor excavation of peat along existing drains and was undertaken gradually over a 6 year period. These works would likely have had a minor negative impact on amphibians. No significant drainage improvements are anticipated or scheduled for the site over the remaining design life of the wind farm.

The decommissioning phase of the Project will have no impact on amphibians and reptiles as only above ground infrastructure will be removed and the drainage network will be left in place. There is no potential for the Project to have significant effects on amphibians and reptiles and therefore they are not considered further in this assessment.

7.4 Impact of the Project

This section outlines the impacts of the Project which have occurred between 2003 – Mid 2020 and those impacts which are likely to occur i.e. during the remaining operation and maintenance phase of the wind farm, or during decommissioning (c. 2040). Details of the construction, operation and decommissioning phases of the Project can be found in Chapter 2 – Project Description.

7.4.1 Designated Nature Conservation Sites

7.4.1.1 European sites

As part of the rNIS (see Volume 2, Section 5), the AA Screening process considered the potential impacts and significance of effects on 30 European Sites identified within the ZoI of the Project (see Table 7.1). Based on the findings of the screening assessment, it was determined that the Project has not had nor is likely to have, either alone or in-combination with other plans and projects, significant effects on 28 out of 30 European site(s) assessed. Two sites were identified as having the potential to have been or to be significantly affected as a result of the Project.

The assessment identified the potential for significant effects to have occurred on Lough Cutra SPA, as a result of the peat slide which occurred during the construction phase of the Project. The potential for significant effects to occur during the operation and decommissioning phases of the Project were also identified.

As the project is entirely within the Slieve Aughty Mountains SPA, the assessment also identified the potential for significant effects to have occurred on the habitats and associated birds within the Slieve Aughty Mountains at the time of construction (prior to

SPA designation) and the potential for significant effects to occur during the operation and decommissioning phases in the absence of mitigation.

The rNIS concluded that the Project has not adversely affected the integrity of the Slieve Aughty Mountains SPA, Lough Cutra SPA or any other European site, either individually or in combination with other plans and projects and that with the implementation of prescribed mitigation measures will not adversely affect the integrity of any European sites during the continued operation and decommissioning phases.

7.4.1.2 Natural Heritage Areas and Proposed Natural Heritage Areas

Four NHAs and 19 pNHAs were identified within the ZoI of the Project (refer to Table 7.2). 13 of the pNHAs identified are also designated as European sites and potential impacts to these sites are assessed in the rNIS.

The four NHAs - Slieve Aughty Bog NHA (001229), Lough Atorick District Bogs NHA (002377), Derryoober Bogs NHA (002379) and Maghera Mountains Bogs NHA (002442) are all designated for peatland habitats. The Slieve Aughty Bog NHA comprises a number of discrete sites within close proximity to the Project. A single angle mast on the OHL is within the boundary of this NHA and was constructed in conifer plantation on the boundary of the site. The site is designated for intact blanket bog and this habitat was not impacted by the Project. Decommissioning works will involve the dismantling of structures along the OHL and leaving structure foundations in-situ to avoid unnecessary disturbance to habitats. These works will have no impact on the blanket bog habitat within the NHA.

The Ennis - Shannonbridge 110kV OHL was installed in 1952 with some further structures installed in 1968. There are two wooden polesets within the Slieve Aughty Bog NHA to the west of Agannygal Substation. Following decommissioning of the Agannygal Substation, it is proposed to replace the conductor on two short sections of this OHL coming out from the substation. These works will be undertaken from mast to mast and as such there will be no works undertaken within the NHA. The peatland habitat within the Slieve Aughty Bog NHA has not been and will not be affected by the Project.

The remaining three sites are too far removed from the Project to have been affected or to have the potential to be affected based on their feature of interest and as such have been scoped out from further assessment.

Three of the remaining 6 pNHAs, Cloonamirran Wood pNHA (001686), Cahermurphy Wood pNHA (000022) and Lough Graney Woods pNHA (001714) are designated for woodland habitats; given the nature of the habitats and distance between these sites and the Project it is considered that there is no potential for the Project to have impacted these sites.

Pollduagh Cave, Gort pNHA (000320) is designated for Daubenton’s bat. The commercial plantation and open habitats available in the Project area are considered to be of negligible value to Daubenton’s bat and this species was not recorded at Derrybrien Wind Farm during surveys undertaken in 2011, 2016 and 2019. The pNHA is also 14.2 km from the wind farm. The Project has not had nor is likely to have an impact on the pNHA.

Lough O'Grady pNHA (001019) is 13 km south of the Agannygal Substation and designated for Greenland White-fronted Geese. This species of bird has never been recorded during field surveys for the Project and given the distance from the Project is not likely to occur in the Project area.

Lough Derg pNHA (000011) is over 23 km from the Project and of significant ecological interest, with five habitats listed on Annex I of the EU Habitats Directive. The Lough Derg (Shannon) SPA (004058) approximately covers the same extend as Lough Derg pNHA but is designated for birds. Given the distance from the Project and the nature of the ecological features of interest in the site it is considered that there is no potential for impacts to have occurred or to occur to this site as a result of the Project.

Based on the above consideration, none of the listed NHAs or pNHAs require further assessment for impacts.

7.4.2 Impacts which have occurred

7.4.2.1 Construction: circa June 2003-March 2006

7.4.2.1.1 Terrestrial Habitats

There are two types of impacts associated with the construction of the Project; i) habitat loss and ii) habitat alteration. Direct habitat loss occurred within the footprint of site infrastructure whereas habitat alteration occurred within the Project boundary where large areas of commercial conifer forestry were felled. The elements of the Project which led to direct habitat loss and habitat alteration include:

- Felling of conifer forestry;
- Civil Works:
    - Site mobilisation – installation of site compound and delivery of welfare cabins, offices, etc;
    - Construction of site access tracks – approximately 17.5 km in total, 15.5 km of new access tracks were constructed, largely comprising floating roads and 2.0 km of existing floating roads were upgraded;
    - Construction of turbine bases and associated crane hardstanding areas;
    - Substation and associated compound construction; and
    - Site drainage works.
- Anemometer and telecommunications mast construction;
- Peat repository site development;
- Borrow pit development;

Cables and ducting installation;

- Overhead line development; and
- Agannygal Substation development.

The felling of c.222 ha of conifer forestry was required to facilitate the development of the wind farm site. Felling activity carried out on site included felling for a 15 m wide corridor along all access tracks and extended felling around a significant proportion of turbine bases, felling around borrow pits and in proximity to the substation.

Site mobilisation comprised the development of a site compound within the north-eastern corner of the site. The footprint of the compound was approximately 77 m x 38 m in extent. The site compound was developed either side of an existing Coillte access track.

Access tracks constructed largely comprised floating roads. Floating roads that were constructed were typically 4.5 m wide. Upgrade works to existing turbary track was also undertaken where necessary, upgrade works did not require the widening of existing access tracks. The total length of new access tracks constructed within the wind farm site was 15.5 km.

Hard standing areas were also constructed to facilitate turbine erection. A crane pad comprising a hard-standing area is located adjacent to each turbine location, 70 in total. These hard-standing areas were required during the construction phase of the development and will remain during the operational phase of the project. The footprint of individual crane pads had a land take of approximately 47 m x 18 m.

The extent of constructed wind farm drainage is considered to be relatively small scale in comparison to similar developments of this type and scale. Improvement works were undertaken on the 27 km (approx.) of pre-existing drainage within wind farm site and 12 km (approx.) of new drainage channels were constructed.

A 110 kV/20 kV substation (Derrybrien) and associated compound was constructed within the southern part of the wind farm site. The substation control building covers an area of approximately 202m² within the envelope of the compound which has a footprint of approximately 1494m².

A 110 kV OHL to connect the constructed wind farm to the electricity grid was developed in the southern section of the site to the Agannygal Substation 7.8 km to the south of the wind farm. The OHL comprises 43 structures, including 34 double wood pole structures, 2 end masts (1 within Derrybrien Substation), 6 angle masts and 1 intermediate mast. There are two additional masts within Agannygal Substation associated with the connection to the National Grid on the Ennis-Shannonbridge 110kV line.

There are three borrow pits on site which were used during construction to extract rock and clay for use in the construction of access tracks and hardstanding areas. The borrow pits have been closed since the completion of construction activities in 2005.

There are 32 small peat repository sites (up to 1 m in height) in areas of flat or gently sloping ground (less than 3°) across the wind farm site, for the storage of peat/spoil excavated from the turbine hard standing areas and substation locations.

Direct impacts

The initial phase of the wind farm development required the felling of c. 222 ha of conifer forestry. Site mobilisation comprised the installation of a construction site compound site along an existing Coillte access track that was upgraded and the subsequent construction of access roads and turbine hardstanding areas. The construction of access roads and hardstanding lead to permanent habitat loss of felled conifer forestry habitat. Direct habitat loss (turbine bases, hardstands, roads and the substation) affected an area of approximately 13.6 ha of conifer forestry habitat and approximately 0.7 ha of cutover bog (see Table 7.18).

A further 1.6 ha loss of conifer plantation occurred in the footprint of the Agannygal Substation and short access track. The very minor loss of conifer plantation habitat within the footprint of the 43 OHL structures is considered a negligible impact.

Considering the relatively low value of the conifer plantation, and small area impacted in the context of the site, the loss of this habitat is considered a **minor permanent negative impact** that has caused **no significant effect**.

Habitat alteration of commercial conifer plantations due to felling to facilitate the Project occurred throughout the wider area (within the wind farm site (222 ha) and along the corridor of the OHL (33.1 ha)). The felled plantations were not replanted, and natural regeneration of bog and heath vegetation occurred throughout the area (including the peat repository and borrow pit locations).

In those areas of young conifers where an open canopy persisted up until the time of felling, the habitat has rapidly regenerated with vegetation typical of upland blanket bog. Vegetation in these areas is dominated by Purple-moor grass (*Molinia caerulea*) with a frequent occurrence of Ling Heather (*Calluna vulgaris*) and Hare's-tail Cotton-grass (*Eriophorum vaginatum*). Bog Rosemary (*Andromeda polifolia*), Tormentil (*Potentilla erecta*) and Bilberry (*Vaccinium myrtillus*) are also present. The mosses present include *Sphagnum papillosum*, *Eurhynchium praelongum*, and *Sphagnum subnitens*. Moss cover is high (typically over 80%) with an abundance of *Sphagnum* species and feather mosses (see Plate 7.4). Locally there is abundant natural regeneration of Lodgepole Pine (*Pinus contorta*) and Sitka Spruce (*Picea sitchensis*) in places.

In those areas where a closed canopy mature plantation was felled, vegetation associated with disturbed conditions has become established being typically dominated by Soft Rush (*Juncus effusus*) with an abundance of Bramble (*Rubus fruticosus*), Willowherb (*Epilobium angustifolium*), Foxglove (*Digitalis purpurea*) and Bracken (*Pteridium aquilinum*).

Plate 7.4: Regenerating bog and heath in areas of previously felled conifer plantation. Areas of former open canopy forestry (LHS) and former closed canopy forestry (RHS) are regenerating at different rates

The topography of the felled forestry area is undulating throughout with tree stumps a common feature. Brash from the felling process has been wind rowed and is slowly decomposing.

Since the time of felling the heath and bog species have expanded and the habitat is likely to continue a trend towards upland bog habitat. This trend is most rapid and notable in areas with impeded drainage. The habitat is of higher value than conifer plantation with greater species diversity.

Habitat alteration from commercial forestry to open habitat is considered to be a **positive long-term impact of moderate magnitude** considering the low cover of open habitats in the wider landscape. The felled areas outside the footprint of site infrastructure have since developed more heath and bog vegetation and the habitat is likely to continue a trend towards upland blanket bog. The establishment of open habitat across approximately 255 ha is considered to be **a significant positive effect** by causing an overall improvement in the quality of terrestrial habitats within the area. The habitat that has established in the area since construction is deemed to be of local importance, higher value compared to the lower value of the pre-existing conifer plantation.

There were no direct impacts on hydrologically sensitive habitats and habitats deemed to be of high ecological value during the construction phase of the project. The intact upland blanket bog and dystrophic lake within the wind farm site remain unaffected by construction activity and associated drainage works.

An artificial lake currently occupies the footprint of a borrow pit used during the construction of the wind farm. The lake comprises deep water and lacks any aquatic or marginal vegetation being surrounded by steep exposed rock outcrops (see Plate 7.5). The other borrow pits on site were reinstated to near current ground level and are dominated by heath and rush dominated vegetation. The artificial lake is classed as being of low ecological importance and occurs in an area covered by mature conifer plantation. The habitat alteration in this area is deemed a **neutral permanent impact** that, based on the low value of the original habitats, has led to **no significant effect.**

Plate 7.5: Artificial lake located in footprint of a borrow pit that was used during the construction phase of the wind farm

Table 7.18: Summary of direct habitat loss in footprint of development.

Construction activity	Habitat(s) affected	Area Affected (ha) (Approximate)
Site access tracks	Felled conifer plantation (WS5) Cutover bog (PB4)	8.3
Turbine base and hardstanding areas	Felled conifer plantation (WS5) Cutover bog (PB4)	4.9
Derrybrien Substation	Felled conifer plantation (WS5)	0.4
Construction Compound	Access track (BL3) Conifer plantation (WD4)	0.29
Met masts	Felled conifer plantation (WS5) Cutover bog (PB4)	0.05
Agannygal Substation	Felled conifer plantation (WS5)	1.6

Indirect impacts

Drainage works associated with the wind farm development had the potential to alter the hydrology of the habitats in proximity to the drainage network. Surveys of hydrologically dependent habitats (upland blanket bog, dystrophic lake and associated flush) undertaken post construction demonstrate that the construction of the wind farm did not have a negative effect on these habitat types. Intact blanket bog and the dystrophic lake were avoided by site infrastructure and there is no evidence to suggest that they have been affected by drainage and / or other works This is based on the results of field surveys undertaken during the period 2003 and 2018 combined with an analysis of aerial photography. Similarly, the area of intact upland blanket bog adjacent to the northern boundary was not affected by drainage as no new drainage was developed in proximity to this area.

Areas of cutover bog were impacted by drainage prior to the construction phase of the Project. Apart from very localised drainage effects surrounding turbine bases and hard stand areas there is no indication that the habitat has changed since the development of the wind farm. These localised drainage effects are considered to have had a **minor negative long-term impact (no significant effect)** on the cutover bog.

7.4.2.1.2 Birds

The entire Project is within the Slieve Aughty Mountains SPA, however, it must be noted that the SPA designation had not been publicly notified at the time of the planning and construction of the project (classified as a SPA in March 2007 and formally designated by Statutory Instrument in March 2012 (S.I. No. 83 of 2012)).

Construction works on site commenced in June 2003 with tree felling operations which were undertaken by a contractor on behalf of Coillte. Civil engineering works commenced in July 2003 with road construction and excavations at turbine locations. The works were stopped on 16th October 2003 due to a peat slide on site (the impact of this on birds is considered in Section 7.4.2.2.2). Construction works recommenced in autumn 2004, including work on the Derrybrien to Agannygal 110kV OHL and Agannygal Substation, and were complete by March 2006.

The principal impacts on birds which occurred or had the potential to have occurred during the construction of the wind farm project were:

(i) Loss of habitats (including subsequent alteration/change of habitat),

(ii) Mortality of individual birds,

(iii) Disturbance to birds (noise, human presence etc)

Loss of habitats

Wind farm site

At the time of wind farm construction, the main habitats on the wind farm site were conifer plantation and cutover (blanket) bog. The conifer plantations were planted between 1963 and 1996 on areas dominated by blanket bog. At the time of construction, the plantations were largely in the closed canopy state though the trees planted in the 1993 to 1996 period (located in the south-southwestern sector of the site and measuring approximately 42 ha in total) still had open canopy in 2003. The cutover bog is located within the eastern part of the site.

Conifer plantation forest is a non-native habitat and is of low value for birds. As noted by Caravaggi *et al.* (2020a), commercial forest expansion across traditional open heath and blanket bog hen harrier habitats in the uplands of Ireland and the UK has been associated with population declines in these areas. Further, in an upland landscape, conifer plantation presents a threat to adjoining unplanted bog and heath habitats from spread of self-seeded conifer trees. While the pre-thicket phase is useful for supporting a range of small bird species (passerines) and also provides useful foraging and nesting habitat for hen harrier, it is a transient habitat that loses its value from about 10 -12 years of age onwards. The removal of approximately 222 ha of conifer forest (total of approximately 263 ha in wind farm site) as a habitat for birds due to the construction works is considered a **positive impact of long-term duration** because of the alien status of the habitat. With the clearance of conifer plantation and without replanting, bird species more typical of blanket bog (the natural habitat of the area) have had an opportunity to become re-established on the regenerating open habitats outside the construction footprint. This is considered to have had a **significant positive effect** on the local bird populations including meadow pipit (Red-listed), skylark (Amber-listed) and hen harrier (Annex I species).

At the time of felling, however, some stands measuring approximately 42 ha were still in the pre-thicket phase and would likely have provided suitable habitat for foraging and nesting hen harriers for perhaps another 5 years. While the loss at the time of this 42 ha is considered a **negative impact it is considered slight and of short-term duration**. It is noted that the subsequent creation of open habitat across the 42 ha would have been more valuable for birds such as hen harrier in the medium to long term as the area developed into regenerating bog/heath and scrub after several years (as shown by vegetation surveys), whereas the trees upon attaining closed canopy status would have been of little or no use for hen harriers.

Within the 222 ha of plantation forest which was cleared, the construction footprint, including turbine bases, hardstands, roads and the substation, measured approximately 13.6 ha. While built surfaces are not of significant value to birds, it is noted that species such as meadow pipit and skylark and occasionally red grouse, will utilize the road surfaces and hardstand areas, and especially the margins which adjoin the regenerating areas, for feeding and perching/resting purposes. On warm days, birds may also use the hard surfaces for dust bathing. When hunting, hen harriers will often follow linear features including embankments, tracks and road margins and therefore the wind farm roads/tracks can be considered of some value to foraging hen harriers. Of the 13.6 ha of conifer plantation that was removed to facilitate the wind farm infrastructure, the majority (approximately 11 ha) was closed canopy forest planted between the 1960s and 1980s. Without the wind farm development, it is expected that this would have been clear-felled and replanted at some stage up to the 2020s. The replanted pre-thicket forest phase would have provided potential foraging habitat for hen harrier from the age of approximately 3 years to 10 -12 years (depending on growth rate). It is noted that the felling and replanting of the 11 ha would have taken place at different times across the wind farm and the later plantings (1980s) would have remained as closed canopy forest into the 2020s. While the loss of up to 11 ha of future pre-thicket second rotation forest is considered a **negative impact**, the effect on hen harrier is rated of **slight significance and of medium-term duration** (i.e. potentially available to harriers for up to 10 years before canopy closes).

The construction works in the cutover bog in the eastern part of the site resulted in the loss of an estimated 0.7 ha of cutover bog (the tracks through the bog were already in place for forestry purposes). While mostly in a cutover state, the bog is well vegetated and apparently supported (at time of construction) species typical of bog such as skylark, snipe and meadow pipit (latter now Red-listed but not at time of construction). While this is a negative impact, the area of loss is minor in the context of the overall amount of cutover bog within the wind farm site (i.e. amounting to less than 1% of the area of cutover bog habitat). Overall, the loss of approximately 0.7 ha of cutover bog as a habitat for birds is considered a **long-term negative impact and did not result in a significant effect.**

Overhead line corridor and Agannygal Substation

The OHL linking the wind farm to the Agannygal Substation extends for approximately 7.8 km along a corridor of up to 45 m width. The line comprises 34 double wood pole structures, 2 end masts (1 within Derrybrien Substation), 6 angle masts and 1 intermediate mast.

Much of the line corridor was within commercial conifer plantation and required the removal of approximately 33.1 ha of forest. Only a small fraction of this was built on (i.e. polesets and angle masts) with the majority of the corridor allowed to regenerate to a mix of habitats including low scrub, wet grassland and regenerating bog vegetation (see Plate 4, Appendix 7-3). Overall, the removal of the conifer plantation from along the OHL corridor and without replanting is considered a **positive long-term impact** as the conifer habitat is alien to the landscape and of low value for birds. This is considered to have been a **significant positive effect** for local bird populations. The Agannygal Substation includes a control room in a palisade fenced compound. The base platform measures 72 m x 52 m (3,744 m^2). At the time of construction, the location for the Substation was closed canopy conifer plantation. A total of 1.6 ha of forest was cleared to facilitate the substation construction. Without the wind farm development, the conifer plantation would have been clear-felled and replanted at some stage up to the 2020s. The replanted pre-thicket forest phase would have provided potential foraging habitat for hen harrier from the age of approximately 3 years to 10-12 years (depending on growth rate). The loss of approximately 1.6 ha of future pre-thicket forest at the substation site is considered a **negative impact of medium-term duration** (i.e. potentially available to harriers for up to 10 years before canopy closes) and of **slight significance**.

Mortality of individual birds

Construction works involving felling of trees and ground excavations in cutover bog which took place between the summer months would likely have resulted in the loss of some active nests. It appears that pre-construction bird surveys, which could have identified areas to be temporarily avoided due to nesting birds, were not carried out on site. Species affected would likely have been mainly woodland species though species associated with bog (including meadow pipit, skylark and possibly snipe) could also have been involved.

The likely loss of active nests is considered a **negative** impact. However, at the population level the loss of some active nests for bird species which are all widespread in distribution (other than snipe) would not have resulted in a **significant effect**. The potential loss of a snipe's nest would have resulted in a **moderate negative impact** considered to be a **significant effect** as the national population has been in long-term decline since at least the late 1990s (Newton *et al.,* 1999). However, the physical loss of a nest was unlikely as snipe is a scarce species on site (not more than 1-2 pairs) confined at the time to the cutover bog in the east of the site.

Disturbance to birds

Construction works can cause disturbance to birds within surrounding areas. This arises from noise and the physical presence of humans, machinery etc. Potential disturbance is of most concern for breeding birds as nests could be deserted or at the least left unattended for prolonged periods. Foraging birds, including hen harriers, may be displaced from suitable habitats during the period of construction. In a review of potential displacement effects on birds at 12 wind farm sites in Britain, Pearce-Higgins *et al.* (2012) reported that observed negative effects of wind farms on bird species occur principally as a result of disturbance by high levels of activity during the construction phase rather than the operational phase.

The bird surveys undertaken in the late 1990s as part of the original EISs noted the presence of snipe, a relatively sensitive species, on site. However, it appears that there was no pre-construction survey to establish if snipe were nesting close to the work areas. Pearce-Higgins *et al.,* (2012) identified snipe as one of the species showing significant avoidance at wind farms and cited a disturbance distance of 400 m. On this basis, it can reasonably be expected that works during the breeding season could have caused disturbance to breeding snipe within the wind farm site (in the cutover bog area). Passerine bird species would be more tolerant of disturbance and would be expected to be disturbed only if very close to the works (say within several tens of metres).

The likely disturbance to breeding birds due to construction related activities is considered a **negative impact of short-term duration**. However, at the population level of most breeding species the loss of some breeding pairs for one season would not be a significant effect. The possible disturbance to breeding snipe (site unlikely to support more than 1-2 pairs) would be considered **a significant effect** as the national population has been in long-term decline since at least the late 1990s (Newton *et al.,* 1999).

It can reasonably be expected that foraging hen harriers could have been displaced from suitable foraging habitats within the site during the construction works. Such an effect is considered as **significant** but of **temporary** duration.

7.4.2.1.3 Bats

The construction of the Project comprised the clear felling of approximately 257 ha of coniferous woodland, creation of wind farm tracks, creation of turbine and angle mast bases, trenching of cables and creation of borrow pits. Working hours were between 07:00 and 19:00 Monday – Saturday, although it is noted in the construction methodology that hours were occasionally extended. The activities had the potential to result in the disturbance, displacement and temporary loss of habitat for bats.

Protected sites for bats

Lough Cutra SAC is of **International Importance** for lesser horseshoe bats.

The Project is hydrologically connected to Lough Cutra SAC via the Owendalulleegh River (over a distance of approximately 22 km). Woodlands within the SAC that are used by lesser horseshoe bats would not have been affected by construction works due to their distance from the Project. Any impacts on water quality are likely to have been local to the wind farm site, and even in the event that these resulted in a change to the hydrology of Lough Cutra, are unlikely to have affected lesser horseshoe bats (Wilson, 2012).

The habitats along the Owendalulleegh River vary between open farmland and narrow strips of riparian woodland. The rest of the area between the SAC and the Project area is a mixture of farmland, mixed aged coniferous plantation and cut over bog. There is no distinctive linear flight path linking the SAC and the wind farm that would allow bats to move between it and the SAC, and lesser horseshoe bat have not been recorded using the wind farm during any activity surveys at the site. It follows that the site is unlikely to have been of any importance to maintaining the SAC bat population, and temporary displacement effects resulting from construction are not likely to have occurred.

Construction phase impacts are **not likely to have had a significant effect** on the lesser horseshoe bat population of Lough Cutra SAC.

Bat species

The habitats within the wind farm site comprised coniferous plantation (265 ha) and open habitat, principally degraded blanket bog (67 ha). The habitats within the area of the OHL corridor and Agannygal Substation also comprised coniferous plantation (33.1 ha and 1.6 ha respectively).

The removal of coniferous plantation increased the amount of open habitat available, resulting in a net increase of c. 222 ha open habitats across the wind farm site. Additional edge habitat was created along the OHL corridor as an indirect effect of felling 33.1 ha of forestry.

Lesser horseshoe bat, whiskered bat, and Daubenton's bat

The commercial plantation and open habitats available in the Project area are considered to be of **negligible value** to lesser horseshoe bat, whiskered bat and Daubenton's bat.

The reduction of commercial plantation during the construction phase is considered likely to have had a **negligible impact** on lesser horseshoe bat, whiskered bat and Daubenton's bat. The net increase in open habitats / edge is also likely to have had a **negligible impact** on lesser horseshoe bat, whiskered bat and Daubenton's bat.

The effects on lesser horseshoe bat, whiskered bat and Daubenton's bat populations in the local area are **not considered to have been significant** given the value of the habitats for these species, and scale and duration of the impacts.

Brown long-eared bat

The commercial plantation and open habitats available in the Project area are considered to be of **site value** to brown long-eared bat.

The reduction of commercial plantation during the construction phase is considered likely to have had a **temporary negative impact on brown long-eared bats at site level.** The net increase in open habitats / edge is likely to have had a **long term[5] positive impact on brown long-eared bats at site level.**

The effects on brown long-eared bat populations in the local area are **not considered to have been significant** given their scale and duration.

Natterer's bat

The commercial plantation and open habitats available in the Project area are considered to be of **local value** to Natterer's bat.

Information on the use of commercial coniferous plantation by bats is limited, with most roosting records coming from bat box studies and roost surveys of buildings within plantation areas. Mortimer (2006) conducted a study on the use of Tentsmuir Forest, a 9,143 ha commercial coniferous plantation by Natterer's bats on the north-eastern coast of Fife, Scotland. The study found 22 natural tree roosts; of these 18 were in double-leadered Corsican pine *Pinus nigra*, three in woodpecker holes and one in a small cavity in a Scots pine.

Double-leadered trees are less favourable commercially than single-leadered trees and are generally managed out of commercial plantations. In addition, woodpecker species were not recorded breeding in Ireland until 2007 (McDevitt *et al.*, 2011). Therefore, the availability of suitable roosting locations in conifer plantation on site is likely to have been low pre-construction, although the presence of roosting features in some trees cannot be ruled out and a low number may have been lost.

The interface between coniferous woodland and open habitats such as blanket bog, as well as rides / tracks within the plantation will also have been suitable for use by foraging and commuting Natterer's bats.

The reduction of commercial plantation and potential loss of a low number of roost sites during the construction phase is considered likely to have had a **temporary negative impact on Natterer's bats at site level.** The net increase in open habitats / edge is likely to have had a **long term minor positive impact on Natterer's bats at site level.**

The effects on Natterer's bat populations in the local area are **not considered to have been significant** given the scale and duration of the impacts.

Nathusius' pipistrelle

The commercial plantation and open habitats available in the Project area are considered to have been of **negligible value** to Nathusius' pipistrelle.

The reduction of commercial plantation during the construction phase is considered likely to have had a **negligible impact** on Nathusius' pipistrelle. The net increase in open habitats / edge is likely to have had a **negligible impact** on Nathusius' pipistrelle.

The effects on the Nathusius' pipistrelle population in the local area are **not considered to have been significant** given the value of the habitats for this species and scale and duration of the impacts.

[5] Long-term is defined as 15 - 60 years (EPA, 2017. Table 3.3). Once decommissioned land management at the wind farm could change.

Common and soprano pipistrelle

The commercial plantation and open habitats available in the Project area are considered to have been of **site value** to common and soprano pipistrelle.

The reduction of commercial plantation and potential loss of a low number of roost sites during the construction phase is considered likely to have had a **temporary negative impact on common and soprano pipistrelles at site level.** The net increase in open habitats / edge is likely to have had a **long-term positive impact on common and soprano pipistrelles at site level.**

The effects on common and soprano pipistrelle populations in the local area are **not considered to have been significant** given the scale and duration of the impacts.

Leisler's bat

The commercial plantation and open habitats available in the Project area are considered to have been of **site value** to Leisler's bat.

The reduction of commercial plantation during the construction phase is considered likely to have had a **temporary negative impact on Leisler's bat at site level.** The net increase in open habitats / edge is likely to have had a **long term positive impact on Leisler's bat at site level.**

The effects on Leisler's bat populations in the local area are **not considered to have been significant** given the scale and duration of the impacts.

7.4.2.1.4 Mammals (other than bats)

Otter

Under most circumstances human disturbance is not likely to be the main factor influencing otter activity, and the availability of prey appears to be more important (Carrs, 1995). Otters can habituate to human activity, which is attested to by the fact that they are regularly sighted in waterways in the centre of Cork City (Sleeman and Moore, 2005). Moreover, disturbance was not noted as an important factor influencing their prevalence in the 2010/2012 national survey of the species (Reid *et al.*, 2013). No signs of otter were recorded during a survey of the wind farm site in summer 2018. This is not surprising given that there are no fish-bearing streams on the site. It is possible that otter, possibly young males at the margins of home ranges, may forage for frogs in and around the wind farm site in late winter early spring. However, given that there would have been no physical barriers to their entering the site during the construction period, it is unlikely that this foraging activity, had it been a feature of the area, would have been significantly impacted by on-site activity during the construction period, given that otter generally feed at dawn and dusk (Carrs, 1995). Overall, construction of the wind farm is considered to have had at most **a slight, negative and short-term impact** on any individuals which may have been using the site, taking the form of intermittent disturbance, mainly to frog foraging activity during winter and spring, which would likely have been offset by increased foraging outside the site by individuals potentially affected. This is **not believed to have had any significant effect on the local otter population in the area**. It is also worth noting that apart from the headwater tributary impacted by the peat slide in October 2003, which is discussed in more detail in Section 7.4.2.2.4, the construction phase would have had a minimal impact on all of the other tributaries draining the wind farm to three main river channels i.e. all those draining from sub catchment SC1-SC9 including SC7(a and c) but not including SC7(b) and SC7(d) (refer to Figure 8.3 in Chapter 8). So, while the fish resources in these small tributaries would likely not have been a major source of fish for otters in the area, as a resource it would not have been diminished by the construction phase.

Other large mammals

Pine martens have historically been associated with woodland areas, and in Europe they are most frequently found in coniferous and broadleaved woodland and scrub (NRA, 2009). The removal of coniferous forestry within the wind farm site, along the OHL corridor and at Agannygal Substation would likely have resulted in a loss of suitable habitat for pine marten. However, given the highly mobile nature of this species and the large expanses of coniferous forestry immediately adjacent to the felled areas, this impact is likely to have been **slight negative and long term with no significant effect** on the local pine marten population.

Red squirrels have a similar association with woodland areas, though through the course of the 20th Century, became more associated with areas of coniferous forestry due to displacement by the introduced grey squirrel (there is evidence of a reversal of this trend in recent years, due in part to the recovery of pine marten populations (Lawton *et al.* 2020). The removal of coniferous forestry as part of the Project would likely have resulted in a loss of suitable foraging habitat for red squirrel. There is also the potential for the disturbance or destruction of squirrel nests (dreys) to have occurred. Direct mortality to red squirrels is considered to have been limited as all felled areas were in direct proximity to retained forestry compartments, where any displaced animals could relocate to. Overall, given the large expanses of coniferous forestry in the surrounding areas, impacts are likely to have been **slight negative and long term with no significant effect** on the local red squirrel population.

Badgers are found throughout Ireland in areas of suitable habitat including mature coniferous woodland, though populations densities are typically lower in upland and mountainous areas; badger setts may be located in areas which facilitate ready access to both foraging areas and cover for sett entrances and are therefore most frequently located in areas with a mosaic of habitats. There is the potential for the disturbance of active setts to have occurred during the felling phase to facilitate construction, however given the elevation of the site and the close association of the plantation forestry with bog habitat considered sub-optimal for badger, the local population density is considered to be low. As a result, the likelihood of any such sett disturbance is expected to have been low. Overall, given the large expanses of coniferous forestry in the surrounding areas, impacts are likely to have been **slight negative and short term with no significant effect** on the local badger population.

Construction works associated with the wind farm most likely would have resulted in localised disturbance to foraging mammals, including pine marten, badger, red squirrel and deer but this would have been a **short term negative impact** and **no significant effect** would have resulted on local mammal populations.

7.4.2.2 Offsite peat slide works: Oct 2003-end 2005

7.4.2.2.1 Terrestrial Habitats

A peat slide occurred during the construction phase of the wind farm development in October 2003. The peat slide involved the disturbance and partial displacement of peat and forest debris onto Coillte owned land and areas of privately-owned land between the southern boundary of the wind farm site and the Flaggy Bridge to the south-east. Following the peat slide, emergency off-site measures were undertaken by geotechnical experts and Galway County Council. Emergency measures included the installation of a series of boulder dam barrages, four of which remain in situ in 2020. Barrages 1 and 2 are located upstream of Black Road Bridge over which access tracks have been constructed by Coillte to replace tracks displaced by the peat slide. Barrages 3 and 4 are located between the Black Road Bridge and Flaggy Bridge across a tributary of the Owendalulleegh River. Accumulated peat from two of the barrage locations (1) and (3) and from private land near the Black Road Bridge which resulted from the slide was placed within peat repository sites on adjacent Coillte lands.

The terrestrial habitats directly impacted by the peat slide largely occurred outside the wind farm site boundary and therefore the description of habitats affected by the slide were determined after the peat slide had occurred and through a review of pre 2003 aerial photography of the affected area. Terrestrial habitats that were directly affected by the peat slide comprised conifer forestry (WD4) (open canopy pre-thicket and mature closed canopy) and wet grassland used for agriculture (GS4). It was estimated that the peat slide had a direct impact on c. 25 ha of land, impacting conifer forestry and wet grassland.

Direct Impacts

The habitat characteristics of the peat slide area immediately following the event was described in a report prepared by Inis Environmental Services (2004a). The habitat recovery of the area was further reported again by Inis Environmental Services in October 2005. The area of terrestrial habitat most affected by the peat slide occurred in the area between the wind farm site and the Flaggy Bridge (see Figure 2.3 Chapter 2). Following the peat slide, much of the area towards the wind farm that was formerly afforested comprised bare peat and exposed mineral soil with isolated vegetated islands which continued to support typical bog / heath species and individual conifer trees. The following paragraphs describe the areas of the peat slide immediately after the event in October 2003 (Inis Environmental Services, 2004a), subsequent recovery, and a description and assessment of the direct impacts.

Impacts relating to watercourses and aquatic ecology are addressed separately in Chapter 8 of the rEIAR.

Wind Farm to Barrage 1

The following description is from the area between the wind farm site and Barrage 1 during February 2004 (Inis Environmental Services, 2004a):

> *In the upper areas of the peat slide much of the surface peat and vegetation remains in situ although obvious movement has taken place. It is estimated that more than 50% of the area has a cover of live vegetation compared to only 10% further downstream.*
>
> *The bare peat areas that exist along the path of the slide in this location are totally denuded of vegetation. At the time of the survey there was no evidence of mosses or vascular plants having colonised these areas.*
>
> *There is one small narrow stream (<50cm wide and c.20cm deep) formed in the northern areas within the wind farm site but this appears to split into a number of streams further downhill or possibly other streams originate in the path of the slide further downstream. Further down the slope from the wind farm site the situation changes and less of the surface peat remains in place (Grid Reference: 59743 04109).*
>
> *North of the main Barrage 1 the land is largely bare of peat and now stripped to the underlying mineral soil and bedrock. There are few clumps of vegetated surface peat that came to rest in the area (probably originated from further up the peat slide). The peat that was once in the area appears to have been carried downstream from this area. Mature displaced Spruce and Pine trees litter the area. Few isolated trees remain in situ.*
>
> *In the area just North of the Barrage 1 there are three newly formed streams. There is no peat remaining in the path of these streams that in the main part run over a fine silt-sand substrate. In steeper areas the substrate changes to bare rock surfaces. On the day of the survey the water of the streams appeared clear indicating that low levels of peat are present in the water, but it should also be noted that water levels were also low following a relatively dry period. Most of the peat that remains in the area is relatively shallow black peat. Other peat clumps that originate from surface peat that is deposited in places are firm un-humified brown peat. The peat clumps that are present in the area have surface vegetation remaining intact although they may not have come to rest upright. 80 to 90 % of the area in this location is bare peat and underlying mineral soil (an estimated 20% of which comprises stripped mineral subsoil and bare rock). Only c. 10 % of the area comprises deposited surface peat vegetation clumps, an isolated pine tree that remains in-situ following the peat slide.*
>
> *There are no major peat deposits on the northern side of the main boulder barrage (Barrage 1). This is probably due to the fact that the dam was only installed weeks after the major peat slides occurred and was built as a preventative measure in case of future peat slides.*

The habitat in the above area had stabilised and established moderate vegetation cover within 20 months as illustrated in Plate 7-6.

Plate 7-6: Recovery of peat slide area upslope of Barrage 1 in February 2004 (LHS) and October 2005 (RHS)

Habitat monitoring surveys undertaken along the peat slide areas in 2011 and 2018 have shown almost full recovery of vegetation and habitat structure throughout this area (see **Plate 7-14 (a-b)**). The area now comprises a mosaic of heath and scrub. There is a well-developed herb and shrub layer with Purple Moor-grass (*Molinia caerulea*) and Ling Heather (*Calluna vulgaris*) dominating. Other peatland species that are abundant include Common Cottongrass (*Eriophorum angustifolium*), Carnation Sedge (*Carex panacea*), and Deergrass (*Trichophorum cespitosum*). In places Soft Rush (*Juncus effusus*) is common particularly where mineral soil predominates. Mosses have become established throughout much of the ground layer with species typical of heathland and bog such as *Sphagnum capillifolium*, *Racometrium lanuginosum*, *Polytrichum commune*, *Aulacomnium palustre*, and *Hypnum jutlandicum*. The non-native *Campylopus introflexus* occurs in areas of bare peat together with Bulbous Rush (*Juncus bulbosus*). The tree layer continues to support scattered pine and spruce of varying ages, many of which are less than 4 m tall and appear to be self sown since the peat slide occurred. The low growing eared willow (*Salix aurita*), is also common throughout. The loss and transport of peat leading to extensive disturbance of low value habitat in this area was a **direct moderate negative impact of medium-term duration. Resulting in no significant effects** on the basis that the habitat affected was of low value and represented a relatively small area of conifer plantation that is common throughout the wider landscape. Since the peat slide event, the habitat has recovered and developed into a semi-natural mosaic of heath and scrub.

Emergency works in this area included the installation of Barrage 1 and the replacement of a forest access track, using stone sourced from an adjacent borrow pit. The loss of a small area (0.23ha) of low value habitat (conifer plantation) associated with the borrow pit is a **permanent minor impact** resulting in **no significant effects**. The footprint of the barrage and access road overlapped with a pre-existing access road and therefore did not lead to direct habitat loss.

Barrage 1 to Barrage 2

The following description is from the area between Barrage 1 and Barrage 2 during February 2004:

> *Just South of the Barrage 1 much of the area is similar to that just described North of the barrage with the land being relatively bare of peat and now stripped to the underlying mineral soil and bedrock. The peat in the area is relatively shallow estimated to be less than 1 meter in depth. There are a few clumps of vegetated surface peat that came to rest in the area (originated from further up the peat slide). The peat that was once in the area appears to have been carried downstream from this section of the peat slide. Mature displaced Spruce and Pine trees litter the area. Few isolated trees remain in situ. On the northern side of Barrage 2 there is an area of deep peat that has built up since the dam was put in place, this peat appears to be well-humified 'black peat'.*

The habitat in the above area had stabilised and established moderate vegetation cover within 20 months as illustrated in Plate 7-7.

Plate 7-7: Recovery of peat slide area downslope of Barrage 1 between February 2004 (LHS) and October 2005 (RHS)

Surveys undertaken along the peat slide areas in 2011 and 2018 have shown almost full recovery of vegetation and habitat structure throughout this area (see **Plate 7-14** (**c,d**)). The habitat that has established in this area is similar in character to that described above for the section between the wind farm and Barrage 1 being dominated by heath and scrub vegetation.

The loss and transport of peat leading to extensive disturbance of low value habitat in this area was a **direct moderate negative impact of medium-term duration**. This resulted in **no significant effects** on the basis that the habitat affected was of low value and represented a relatively small area of conifer plantation that is common throughout the wider landscape. Since the peat slide event, the habitat has recovered and developed into a semi-natural mosaic of heath and scrub.

Emergency works in this area included the installation of Barrage 2 across the peat slide (0.01 ha) and the installation of a new section of forest access track (0.1 ha), and the installation of a peat repository site in an adjacent area (0.42 ha). The loss of a small area

(0.53 ha) of low value habitat (conifer plantation) associated with these works is a **negative permanent minor impact** with **no significant effects**. The peat repository site now supports an area of willow (*Salix* spp.) scrub.

Barrage 2 to Black Road Bridge

The following description is from the area between Barrage 2 and Black Road Bridge during February 2004 (parts of this area were not surveyed at this time due to access difficulties):

> *There is little peat present in the area just to the South of Barrage 2. The area near the gorge has a steep incline and the peat slide would have moved rapidly through the narrow channel area. There is a light scattering of peat on the sides of the channel where it is possible to make out the level that the peat slide reached as it passed through the gorge. The banks of the stream in this area are steep and comprise a shallow wet heath type habitat dominated by Ling Heather and Purple Moor-grass with mineral influences from the mineral soil evident by the abundance of grasses and other minerotrophic species. This habitat appears to have remained largely intact following the peat slide.*
>
> *To the Northern side of the Black Road Bridge there are considerable quantities of peat and large surface peat clumps deposited. Galway County Council had constructed two earthen dams just north of the Black Road Bridge to slow the peat slip. Displaced peat mounded in the area above these dams which were subsequently overtopped. It appears that the area where most of this peat has been deposited was a natural river channel with wet grassland on a mineral based soil on either bank and adjoining fields prior to the peat slide episode (based on local information and surveying of adjoining lands). The area was probably used for agriculture. Based on the flora of the adjoining fields the vegetation of the area would have been dominated by grass species such as Yorkshire Fog and Soft Rush with an abundance of species such as Creeping Buttercup.*
>
> *Peat has deposited at different depths in this area depending on the underlying topography. In areas of shallow peat it is evident that the original vegetation of Soft Rush is already appearing up through the surface at the time of survey.*
>
> *There has been some land clearance in the area to the East of the river by heavy machinery as part of emergency drainage works. Some peat has been placed in 'lagoon' like features after being cleared. A diversion channel has been dug in a successful attempt to direct the river away from the large peat mass that has deposited in the area.*

The habitat in the above area had stabilised and established moderate vegetation cover, following the implementation of a range of emergency measures, within 20 months as illustrated in Plate 7-8.

Plate 7-8: Recovery of peat slide area upslope of Black Road Bridge between February 2004 (LHS) and October 2005 (RHS)

Surveys undertaken along the peat slide areas in 2011 and 2018 confirmed the full establishment of wet grassland and willow scrub throughout this area. The deposition of peat leading to extensive smothering of low value grassland in this area was a **direct moderate negative impact of medium term duration**. This led to **no significant effects** on the basis that the habitat affected was of low value and represented a relatively small area of wet grassland that is common throughout the wider landscape. Since the peat slide event, the habitat has recovered and re-established wet grassland and scrub vegetation.

Emergency works in this area included the temporary installation of Barrage A and B, some drainage works of areas adjacent to the peat slide, and the installation of a peat repository area (0.29ha) in an area of former conifer plantation. The loss of a small area (0.29ha) of low value habitat (conifer plantation) associated with these works is a **negative permanent minor impact** with **no significant effects**. This peat repository site now supports an area of willow (*Salix* spp.) scrub.

Black Road Bridge to Flaggy Bridge

The following description is from the area between Black Road Bridge and Flaggy Bridge during February 2004 (parts of this area were not surveyed due to access difficulties):

> *There are two dams installed between Black Road Bridge and Flaggy Bridge, the first Barrage 3 and the second Barrage 4. The river passes through a dense mature conifer plantation immediately South of Black Road Bridge and therefore access to these areas proved difficult. Considerable depths of peat have also been deposited by the slide on each side of the river, which made the area very difficult to survey and treacherous.*
>
> *From what was surveyed it is apparent that large deposits have resulted on each river-bank around the base of trees within the plantation and in the river channel, this continues down as far as the first dam (Barrage 3) south of Black Road Bridge. Immediately North of this dam the peat depth is considered to be extremely deep and appears to be highly humified black peat with high water content. The main concern in this area should be safety; this area of deep peat is a hazard.*

There is little vegetation in the area South of the first dam (Barrage 3) and the river appears in good condition although a light cover of peat has been deposited in places.

Immediately to the North of the second dam (Barrage 4) there is a deposit of peat extending 20m into the conifer plantation on each bank of the river. This peat appears to be at least 1 metre deep in places.

At the second dam (Barrage 4) there is a deposit of deep black peat to the East of the dam. The area just South of the second dam (Barrage 4) has a peat deposit (approximately 8m in width) on the western side of the river. Otherwise there is very little peat deposit between this dam and Flaggy Bridge, the lower banks of the river are washed clear of peat, further up the banks the natural Wet Heath vegetation dominated by Purple Moor-grass and Ling Heather was recorded and appears to have survived the disturbance of the peat slide.

The area immediately North of Flaggy Bridge has small quantities of peat deposited on western side of river. There has been land clearance in this area since the bog slide. An earthen dam constructed by Galway County Council at this location has been removed. It is evident that vegetation is already colonising much of the area with fresh growth of Soft Rush, Grasses, Creeping Buttercup and Dock species recorded.

The area upstream of Barrage 3 as described above had significant emergency measures undertaken between February 2004 and October 2005 (see Plate 7-9 and Plate 7-10).

The deposition of peat throughout the forestry areas near Barrage 3 and 4 caused a **minor medium-term negative impact** on this low value habitat with **no significant effects**. Riparian habitats downstream of the forestry and upstream of Flaggy Bridge suffered a **direct short-term impact** due to smothering of vegetation, the area recovered within a relatively short period. This short-term impact had **no significant effects**.

Emergency works in this area included the installation of Barrage 3 (0.02ha) and Barrage 4 (0.02ha), and the installation of a peat repository site (0.06ha) nearby Barrage 3. The loss of a small area (0.1ha) of low value habitat (conifer plantation) associated with the barrages and peat repository site is a **permanent minor impact** with **no significant effects**. The peat repository site has since established scrub vegetation.

Plate 7-9: Area between Black Road Bridge and Barrage 3 is dominated by mature conifer plantation. Deep peat deposits observed in this area in February 2004 (LHS) were removed by October 2005 (RHS)

Plate 7-10: North and upstream of Flaggy Bridge. Good recovery was noted here between October 2004 (LHS) and October 2005 (RHS)

<u>**Downstream of Flaggy Bridge to Lough Cutra**</u>

Riverside habitats downstream of Flaggy Bridge mostly corresponded with open wet grassland and conifer plantation. Terrestrial habitats closest to Flaggy Bridge were most affected following the peat slide with significant peat deposits. Reports prepared by Inis Environmental Services (2004a) and the Shannon Regional Fisheries Board (Anon 2004) based on a joint site visit in late December 2003 details the extent of peat deposition along the river corridor downstream of Flaggy Bridge in the period shortly after the peat slide. The survey approach taken was to divide the river into two hundred 100 m sections, each given a chainage number. Flaggy Bridge was denoted as chainage 200 and the Owendalulleegh River's inflow at Lough Cutra denoted as chainage 0. Riparian habitats from Flaggy Bridge (chainage 200) down as far as Derrybrien East (chainage 169) were reported as being severely impacted by scouring, and peat deposition recorded where low banks were present. Further downstream only occasional localised peat deposits were observed.

These areas recovered in a relatively short period with good vegetation cover dominated by grassland and scrub species observed in all areas in October 2005. The following text is from a monitoring report prepared by Inis Environmental Services (2005):

> *From the walkover survey of the affected stretch of riverine habitats below Flaggy Bridge it is clear that there has been a marked recovery since last year. The elements coupled with time have broken down the larger fractions of peat that stayed lodged in land pockets along the river and no peat banks remain on the lands adjoining the river. In many areas (see plates 25 – 30) there is no longer evidence of the peat slip. The habitats in these areas appear to have recovered.*
>
> *At certain points along on the river, especially at bridges, larger detritus such as tree stumps and large masses of root material still remains and will take years to break down completely. This however is not deleterious to the system as this matter provides additional habitat for invertebrates and fish alike and in doing so improves the health status of the river.*

As described above, the terrestrial grassland habitats along the riverbanks in this section had largely recovered by October 2005 as illustrated in Plate 7-11 through Plate 7-13.

Surveys undertaken of littoral habitats surrounding Lough Cutra suggest that no discernible impacts occurred (Inis Environmental Services, 2005).

The deposition of peat throughout the section from Flaggy Bridge to Derrybrien East caused a **moderate short term negative impact** on riparian habitats caused by scouring and smothering of vegetation. The impact was relatively small in extent being restricted in the most part to the immediate banks of the river, the impact only extended into adjacent fields in those areas with low banks. The impact led to **no significant effects** on the basis of relatively low value habitats being impacted and the duration of the impact being short term.

No emergency works were undertaken along this section of the peat slide.

Plate 7-11: Stream just south of Flaggy Bridge, immediately after peat slide (November 2003) and two years later (October 2005)

Plate 7-12: Ford crossings downstream of Flaggy Bridge (October 2005). Little evidence of disturbance from peat slide

Plate 7-13: Discrete clumps of peat was the only evidence of past peat slide amongst the riparian habitat downstream of Flaggy Bridge in October 2005

Indirect Impacts

Drainage works were carried out within areas of conifer forestry affected by the peat slide. Drainage works may have had a drying out effect on the peat substrate in the affected area. The conifer forestry had already been drained with a herring bone type system in place prior to the peat slide. It is considered that drainage works associated with the peat slide had a **neutral impact** on terrestrial habitats as it is unlikely that the works caused a noticeable change to the ecological value of the affected habitat. The felling of conifer forestry as a result of quarrying associated with barrage dam building is considered to be a **negligible impact (no significant effect)** as the area affected represents a very small fraction of the habitat type. The affected habitat, conifer forestry, is of low ecological value.

Impacts on watercourses and aquatic ecology are dealt with separately in Chapter 8 of the rEIAR.

Table 7.19: Summary of impacts of peat slide on terrestrial habitats.

Peat slide section	Terrestrial habitat receptors	Impact description	Impact assessment
Wind farm to Barrage 1	Conifer plantation	Loss and transport of peat leading to extensive disturbance of low value habitat. Recovery has progressed and the area stabilised with the development of a mosaic of scrub and wet heath.	Negative, direct, moderate impact of medium term duration, affecting c. 25 ha of low value habitat. Impact is non-reversible although recovery of semi-natural habitat has occurred in the medium term. No significant effects.
Barrage 1 to Barrage 2	Conifer plantation		
Barrage 2 to Black Road Bridge	Conifer plantation, wet grassland and wet heath	Extensive deposition of peat smothering dominant low growing vegetation.	Negative direct moderate impact of medium term duration, affecting low value habitat. Impact is non-reversible although recovery of semi-natural habitat in the medium term. No significant effects.
Black Road Bridge to Flaggy Bridge	Conifer plantation	Peat deposits throughout conifer plantation, smothering ground layer of low value habitat.	Negative moderate impact of medium term duration, affecting low value habitat. Impact is non-reversible although recovery of semi-natural habitat in the medium term. No significant effects
Flaggy Bridge to Lough Cutra	Riparian river bank mainly dominated by wet grassland	Localised smothering of vegetation due to peat deposition on riverbanks (mostly confined to upstream of confluence with Owendalulleegh	Direct negative impact due to habitat disturbance, moderate magnitude of short term duration. No significant effects.

		River). No discernible impacts observed on lower reaches of river and along lakeside habitats	

Plate 7-14: Series of photos showing recovery of habitat along peat slide area between 2005 (LHS) and 2018 (RHS). Following locations are illustrated: (a) peat slide area at wind farm site at Access Track / Barrage at T23-T70 (Grid Ref. E559396, N704396); (b) downslope of wind farm at Access Track / Barrage at T23-T70 (Grid Ref: E559433; N704355); (c) downslope of Barrage 1) (Grid Ref. E560277, 703918); (d) upslope of Barrage 2 (E560562, N703920); (e) upstream of Flaggy Bridge (Grid Ref. E561150, N702623)

7.4.2.2.2 Birds

The primary habitat affected by the peat slide was conifer plantation, both pre-thicket and closed canopy phases. Immediately following the slide, the area comprised bare peat and exposed mineral soil with isolated vegetated islands which continued to support individual conifer trees and typical bog-heath species. The total affected area was estimated at 25 ha.

Survey of the peat slide area in 2011 showed almost full recovery of vegetation and habitat structure throughout the area (see Section 7.4.2.2.1 above) (see Plates 5 & 6 in Appendix 7-3). The area was mapped as a mosaic of heath and scrub, with a well-developed herb and shrub layer dominated by ling heather (*Calluna vulgaris*) and purple moor-grass (*Molinia caerulea*). Soft rush (*Juncus effusus*) was common where mineral soil predominated. The tree layer supported scattered pine and spruce of varying ages, many of which appeared to be self-sown since the peat slide occurred. Willow was also common.

The impacts on birds owing to the peat slide are considered to be the following:

Mortality

As the slide occurred in October, it would not have impacted any nests of birds. Adult birds present in the area would not have been affected as they are mobile species.

Habitat loss

The area of the slide included both closed canopy and pre-thicket phase forest. The closed canopy forest is of low value to birds and the loss of this habitat without replanting is considered as a **positive impact of long-term duration** resulting in **no significant effects.**

The pre-thicket phase forest, which occurred in the slide area within and below the wind farm, would have been suitable for foraging by hen harriers for perhaps a further five years before the canopy would have closed. While the loss of pre-thicket forest is considered a negative impact, it is considered slight and of short-term duration. Also, the removal of the forest plantation created open habitat of considerably more value to hen harrier and other bird species in the short to long-term.

Habitat regeneration

Regeneration of the peat slide area to a mix of scrub and heath, with occasional conifer trees still standing and self-seeded trees becoming established (see Plates 5 & 6 in Appendix 7-3) provides excellent habitat for birds including hen harriers. The revegetation of the peat repository areas at the barrages was mainly with rushes – this provides low quality habitat for birds. The development of the new vegetation in the slide area after a short number of years is considered a **significant positive effect of long-term duration**.

7.4.2.2.3 Bats

The peat slide resulted in the loss of approximately 25 ha of coniferous woodland (some of which had to be felled due to the slide) and damage to three bridges. Immediate action to reduce the impact of the peat slide involved the creation of eight barrages and creation of peat repositories. These activities also had the potential to result in the disturbance and displacement of bats, temporary loss of bat habitat and permanent loss of potential roost sites in the three bridges. The peat slide resulted in an increase in the amount of open habitat available, resulting in a net increase of approximately 25 ha of open habitat.

Protected sites

Lough Cutra SAC is of **International Importance** for lesser horseshoe bats.

The peat slide resulted in peat entering the upper reaches of the Owendalulleegh River and flowing along its length to Lough Cutra (approximately 22 km downstream). At the time of the event a visible plume was observed at the confluence of the Owendalulleegh River with Lough Cutra.

Those habitats within range of the lesser horseshoe roost at Lough Cutra would have been unaffected by the peat slide at Derrybrien with the exception of Lough Cutra itself. The principal foraging habitat for lesser horseshoe bats has been shown through radio tracking studies to be woodlands with some use of pasture and wetlands, rarely foraging over open water (Biggane (2004a, 2004b, Bontadina *et. al*. (2002).

A survey of bats in the Lough Cutra Castle Demesne was undertaken in March and August 2004 by Inis Environmental Services (2004d) to assess the impact of the peat slide on bats roosting and foraging at the lake. The assessment found the following:

Lesser horseshoe bats were noted feeding along the lakeshore in vegetation to the southeast and southwest of the castle and along an inlet of the lake to the southwest. Earlier studies in March 2004 also indicated that bats feed along the woodland paths and in the woods themselves.

Activity along the lakeshore and over the lake was most intense on the night of August 8th, 2004. During observations in the area of the lake behind the castle, soprano pipistrelle, common pipistrelles, Daunbenton's bats and Leisler's were all active at the same time over the lake. It was very clear that insects were abundant in the vicinity of the lake especially where there was vegetation to provide shelter towards the lakeshore.

Given that any waterborne peat entered into the lake at the opposite side via the River Owendalulleegh, it is improbable that there has been any significant impact upon the invertebrate fauna that would constitute the prey items of the bat species of the castle and lodges.

In summary, bat activity, diversity and abundance was high in the Lough Cutra Estate and on Lough Cutra in August 2004. This clearly demonstrates that the slide did not have a significant effect on invertebrates in the lake on which bats feed.

Wilson (2012) also concluded that the peat slide, whilst causing a fish kill and degradation of water quality in the Owendalulleegh River, was not likely to have impacted on local bat populations in particular the lesser horseshoe bats in Lough Cutra Castle.

Given that the lesser horseshoe bat population at Lough Cutra Castle has ultimately remained stable and in some years has increased there would appear to be no negative impacts on this population from the peat slide and subsequent pollution event.

The impact of the peat slide on the Owendalulleegh River **is not likely to have had a significant effect** on the lesser horseshoe bat population of Lough Cutra SAC.

Lesser horseshoe bats

Habitats that were within the area of offsite peat slide works are also considered to have had negligible value to lesser horseshoe bats that are not part of the SAC. No effects on lesser horseshoe bat populations are likely to have occurred due to habitat loss and / or alteration related to the offsite peat slide works.

Whiskered bat

Habitats that were within the area of offsite peat slide works are considered to have had negligible value to whiskered bat. No effects on whiskered bat populations are likely to have occurred due to habitat loss and / or alteration related to the offsite peat slide works.

Daubenton's bat

Habitats that were within the area of offsite peat slide works are considered to have low value to Daubenton's bat. Effects on Daubenton's bat populations due to habitat loss and / or alteration are likely to have been minor and localised.

Offsite peat slide works resulted in damage to three bridges that may have had roosting potential for low numbers of Daubenton's bats. Masonry bridges are common within the local landscape. The loss of features is considered likely to have had a **permanent negative impact on Daubenton's bats at site level.**

Given the scale and duration of the impact, a precautionary assessment is that there is likely to be a **permanent negative significant effect at the site level**.

Brown long-eared bat

Habitats that were within the area of offsite peat slide works are considered to have had site value to brown long-eared bats. No significant effects on brown long-eared bats populations are likely to have occurred due to habitat loss related to the offsite peat slide works.

Offsite peat slide works resulted in damage to three bridges that may have had roosting potential for brown long-eared bats in low numbers. Masonry bridges are common within the local landscape. The loss of features is considered likely to have had a **permanent negative impact on brown long-eared bats at site level.**

Given the scale and duration of the impact, a precautionary assessment is that there is likely to be a **permanent negative significant effect at the site level.**

Natterer's bat

Habitats that were within the area of offsite peat slide works are considered to have had been of site value to Natterer's bats. No significant effects on Natterer's bat populations are likely to have occurred due to habitat loss related to the offsite peat slide works.

The availability of suitable roosting locations for Natterer's bat in conifer plantation is likely to have been low pre-peat slide, but the presence of roosting features suitable for this species in some trees cannot be ruled out.

The loss of coniferous plantation and open habitats is considered likely to have had a **temporary negative impact on Natterer's bats at site level.** The net increase in open habitats is likely to have had a **long term positive impact on Natterer's bats at site level.**

The effects on Natterer's bat populations in the local area are not considered to be significant given the scale and duration of the impacts.

Offsite peat slide works resulted in damage to three bridges that may have had roosting potential for Natterer's bats in low numbers. Masonry bridges are common within the local landscape. The loss of features is considered likely to have had a **permanent negative impact on Natterer's bats at site level.**

Given the scale and duration of the impact, a precautionary assessment is that there is likely to be a **permanent negative significant effect at the site level**

Nathusius' pipistrelle

Habitats that were within the area of offsite peat slide works are considered to have had been of negligible value to Nathusius' pipistrelle. No significant effects on Nathusius' pipistrelle populations are likely to have occurred due to habitat loss related to the offsite peat slide works.

Common pipistrelle

Habitats that were within the area of offsite peat slide works are considered to have had site value to common pipistrelles. No significant effects on common pipistrelle populations are likely to have occurred due to habitat loss related to the offsite peat slide works.

Offsite peat slide works resulted in damage to three bridges that may have had roosting potential for low numbers of common pipistrelle. Masonry bridges are common within the local landscape. The loss of features is considered likely to have had a **permanent negative impact on common pipistrelle at site level.**

Given the scale and duration of the impact, a precautionary assessment is that there is likely to be a **permanent negative significant effect at the site level**

Soprano pipistrelle

Habitats that were within the area of offsite peat slide works are considered to have had site value to soprano pipistrelles. No significant effects on soprano pipistrelle populations are likely to have occurred due to habitat loss related to the offsite peat slide works.

Offsite peat slide works resulted in the damage of three bridges that may have had roosting potential for low numbers of soprano pipistrelle. Masonry bridges are common within the local landscape. The loss of features is considered likely to have had a **permanent negative impact on soprano pipistrelle at site level.**

Given the scale and duration of the impact, a precautionary assessment is that there is likely to be a **permanent negative significant effect at the site level**

Leisler's bat

Habitats that were within the area of offsite peat slide works are considered to have had site value to Leisler's bats. No significant effects on Leisler's bat populations are likely to have occurred due to habitat loss related to the offsite peat slide works.

7.4.2.2.4 Mammals (other than bats)

Otter

As no otter surveys were undertaken as part of the original EISs, it is not known how many otters were present along the Owendalulleegh River or its tributaries, or where in the system they had holts or resting places. According to O'Neill *et al.* (2008), quoted in Reid *et al.,* 2013), in Ireland, the territory of female otters in mesotrophic rivers (i.e. those with an intermediate level of productivity) is approximately 7.5 ± 1.5 km. This would suggest that on the Owendalulleegh main channel there may have been up to 3 female otters. However, given that the Owendalulleegh is classified as an oligotrophic (i.e. low nutrient) system it might have a lower density than this. In a study in the Araglin Valley in the Munster Blackwater catchment, Ottino and Giller (2004) found four holts within the study catchments, three on the main channel and one on a small side channel. The authors estimated that 6 otters occupied the study area (56 km of channel) including 1 adult female, 2 cubs, 1 adult male and two sub-adults, presumed males. The family holt, where the female and cubs were present was situated about halfway along the system. The Araglin would be considered a more productive system than the Owendalulleegh given that there is more agricultural land in the lowlands. But if we take these figures for population size to be on the low size, combining them with those of O'Neill *et al.* (2008), we could speculate that there might have been 2 females with cubs within the overall Owendalulleegh system, and possibly another one close to or around Lough Cutra. Natal holts where the females raise cubs would be more likely situated in the more productive parts of the system, i.e. within the main river valley closer to the best feeding, rather than in the upper parts of tributaries where food resources would be lower. The one referred to in the Araglin study (Ottino and Giller, 2004) as the family holt was toward a more downstream part of the study area along the main channel. Ruiz-Olmo *et al.* (2005) in a study of female otters in northeastern Spain noted that females with small cubs showed a preference for river stretches with lower water speed, longer stretches of calm water, fewer waterfalls and a greater abundance of food. These observations would suggest that females and their cubs within the Owendalulleegh catchment were more likely to be concentrated toward the middle to lower reaches of the main channel. In those locations they would have likely avoided any risk of direct mortality from the peat slide. Adults and subadult males, being more mobile, even if they included the impacted tributary (SC7b/d) within their home range, would likely have been able to avoid any direct mortality from the peat slide. It is concluded therefore that the slide was very unlikely to have caused the direct mortality of any otters.

Reduction in Available Food

Records of otter footprints by the ShRFB (Anon, 2004) and Inis Environmental Services (2004a) personnel, 2 months after the slide in December 2003, confirmed that otters were still active in the Owendalulleegh including in the lower reaches of the impacted tributary after the peat slide. It is not known what these animals were feeding on but given that the signs were by the river there is a good chance that fish did form part of their diet. Although otter tracks were only noted in the first 6.6 km downstream of the confluence of the affected tributary from a point 600 m upstream on that tributary, there is no doubt that otter would also have been active in the lower reaches of the Owendalulleegh as well, given that the river is wider, and there are larger deeper pools in the middle and lower reaches with good fish holding capacity.

While the 2003 peat slide in Derrybrien resulted in a large fish kill in the Owendalulleegh River some fish may well have survived in the lower reaches of the river and there was no evidence of fish mortality in Lough Cutra. In addition, all fish in the main channel of the river upstream of the confluence of the affected tributary and in the smaller side tributaries would also have survived. Thus, while a significant proportion of the fish component of the diet of the otter in the Owendalulleegh catchment area would have been reduced, some fish would certainly have been available within normal foraging distances of any otter present, as this species is known to travel long distances to feed. In the initial days following the slide it is possible that otter in the area fed on recently dead fish as the species has been noted to take carrion (O'Sullivan 1994, quoted in Reid *et al.*, 2013). Importantly, however, otter would have been able to shift their diet to alternative foods sources, especially to frog, although frog normally appear in the diet in later winter early spring. They may also have availed of the diverse fish resource in Lough Cutra more during this period. It can be postulated therefore that for a few months after the slide, food resources may have been reduced for whatever number of animals that had a home range in the Owendalulleegh catchment and that these would have had to travel farther to find adequate fish prey and possibly to have shifted their diet more to non-fish prey types also.

The pressure of a reduction in food would have most acutely affected adult females with litters, as their energetic requirement are known to rise very sharply when lactating. Females without cubs would have been less impacted as their energetic requirement would have been normal. A 5-year study in Shetland, Kruuk *et al*. (1991) showed a significant positive relationship between the density of prey fish available in July-August and the number of cubs present along a 20 km stretch of coast. Similarly, in an 11-year study of otters on a river in northeastern Spain, the number of cubs per kilometre per year was positively correlated with the abundance of fish in any given year (Ruiz-Olmo, 2011). Thus breeding success is linked to food availability and in such a scenario one could postulate that in the breeding season immediately following the Derrybrien peat slide that the number of otter cubs in the local population might have been reduced, if the affected female (or females) were unable to substitute enough of the energy lost by the reduction in fish numbers with either fish from alternative locations or alternative prey sources. Such an effect, had it occurred would have lessened in each successive year as fish numbers recovered. This impact had it occurred would have been **temporary to short-term and constituted a minor to moderate negative impact at the local population scale**. Even had there been a reduction in cub numbers, due either to smaller litters or greater cub mortality, this is **not likely to have had a significant effect** on the adult population because as Kruuk *et al. (*1991) noted in the Shetland study, despite a large variability in annual recruitment, the adult otter population in the same area remained stable. They postulate that a compensatory mechanism may operate, such as variation in adult mortality, or immigration from elsewhere. It is important to note that none of these impacts would have occurred in either the Boleyneendorrish or Duniry catchments which were not impacted by the peat slide.

Other mammals

The conifer plantation lost during the peat slide would have had the potential to support several mammal species as described for the construction phase. Given the arboreal nature of pine marten and red squirrel, it is expected that these two species would have been able to rapidly transition away from the peat slide area. The slide occurred in October so there would have been no direct mortality of the young of either species. Badgers present in the peat slide area may have been subject to direct mortality or displacement due to loss of parts of (or entire) setts, though as noted above, the likelihood of setts in the Project area is considered to be low. The peat slide is therefore considered to have had a long term negative impact, with no significant effect resulting on local mammal populations.

7.4.2.3 Operation Phase: 2006 - Mid 2020

7.4.2.3.1 Terrestrial Habitats

A map showing the current distribution of habitats within and in proximity to the wind farm site is presented in Figure 7.13.

Direct Impacts

In the assessment of operational phase impacts from 2006 to Mid-2020 the following activities are considered:

- Maintenance of on-site road (c. 6 km length) and drainage network.
- Cutting back re-growth of trees in areas of felled forestry within the wind farm site and along the OHL route.
- Felling of forestry (46.2 ha) immediately west of the wind farm during the period 2016-18.

There has been very little additional habitat loss during the operational phase from 2006 to Mid-2020. Minor road widening works at culverts at Turbines T10, T24, T35, T50, and T56 were undertaken in 2014 where the existing road was too narrow and the side slope into drainage channels was too steep. These road widening works would have resulted in minor direct habitat loss of cutover bog and felled forestry habitat, each of these turbines is sited within felled forestry habitat with the exception of T24 where cutover bog occurs to the east of the turbine.

Occasional cutting back of re-growth of trees within the felled forestry areas prevents canopy closure occurring. As a result, the dominant heath / bog vegetation continues to occupy these areas. This is considered a **minor positive impact of long term duration** as the habitat is of higher biodiversity value than a closed canopy conifer plantation that would otherwise have established in the area (**significant positive effect**).

Offsite phased tree felling (approximately 46.2 ha in total) was undertaken by Coillte under felling licence (Ref FL 18197) immediately to the west of the wind farm site in 2016, 2017 and 2018 to optimise productivity of the wind farm. It is noted that these areas had been scheduled for felling as part of Coillte's routine tree felling programme and that the felled areas are being replanted. The habitat is of low ecological value and represents a modified habitat under forestry management. It is concluded that the felling and replanting of conifer plantation adjacent to the wind farm resulted in a neutral impact on terrestrial habitats (no significant effects).

Indirect Impacts

Following the completion of construction, drainage effects of the development are likely to have continued into the operational phase. However, considering the pre-existing drainage regime of the site coupled with the absence of sensitive habitats within proximity of the wind farm infrastructure, the impacts of continued drainage are considered **neutral (no significant effect)**. Results of field surveys demonstrate that the habitats most sensitive to hydrological impacts (dystrophic lake and upland blanket bog) remain in good condition and there is no evidence to suggest any drying out effects. Species composition and habitat structure within these remnant habitat areas remains unaffected by the presence of the wind farm.

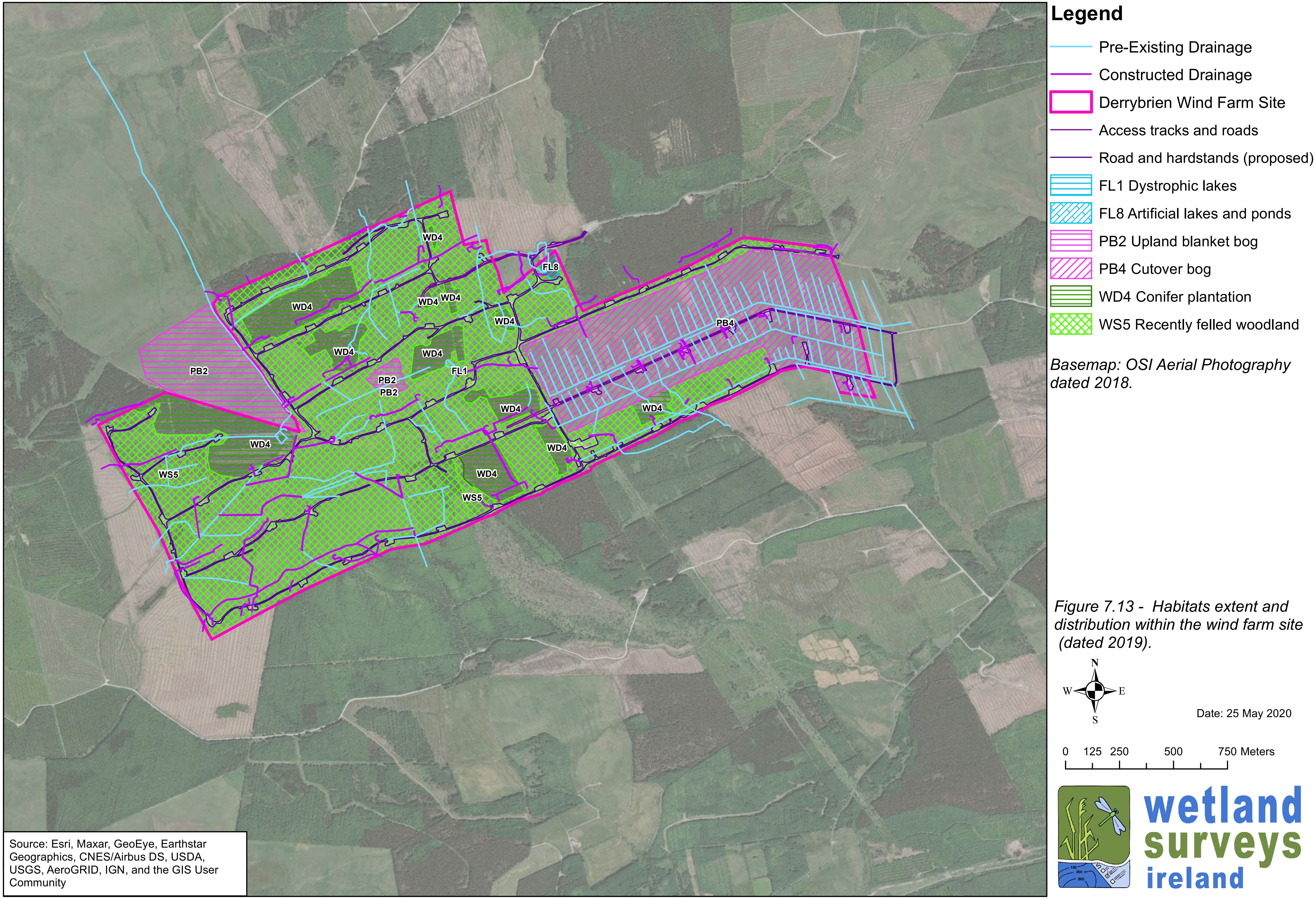


Figure 7.13 - Habitats extent and distribution within the wind farm site (dated 2019).

Date: 25 May 2020

7.4.2.3.2 Birds

The principal potential impacts on birds owing to the operation of the Project are:

- collision,
- displacement,
- impacts on reproductive output in relation to wind turbine proximity.
- barrier effects,
- development of habitats

In addition, maintenance works include maintenance and periodic upgrade of access tracks and drains, the cutting back of tree growth in previously felled areas, and substation inspections and maintenance.

The assessment is focused on the hen harrier, as the SPA supports a population of national importance. Also, according to McGuinness *et al.* (2015) this species is considered to be highly sensitive to wind farm development. The potential impact on other breeding bird species and on wintering birds are considered in separate sections.

Potential collision impact

Collision risk posed to bird species is one of the main environmental concerns associated with wind energy developments (Drewitt & Langston 2006, Band *et al.,* 2007, Drewitt & Langston 2008). However, bird species differ widely in their susceptibility to collision mortality. Essentially, birds are at risk of collision only when their flight path overlaps with the rotor blade sweep area of a turbine, and birds whose flight heights coincide with the height of turbine rotor blade sweep are most at risk. Previous studies have reported low flight heights for hen harriers (Whitfield & Madders 2006a, Madden & Porter 2007, Ruddock *et al.,* 2012), with low proportions (5-15%) of observations at rotor sweep height (Garvin *et al*., 2011). In general, when hen harriers are engaged in hunting behaviour they are outside of the area of greatest risk of collision with wind turbines. However, courtship displays such as sky dancing occur at heights of up to 100 m or more, overlapping with the rotor sweep of most modern wind turbines.

In a study of flight behaviour of adult and juvenile hen harriers at various wind farms in Ireland, Wilson *et al.* (2015) found that adult hen harriers spent most of their time (82.8%) flying below the reach of turbine blades. The study also showed that the time spent flying at heights with risk of collision (25m – 125m) was similar between wind farms and control sites, which suggests that hen harriers do not modify their flight height in areas where wind turbines have been installed. Of particular interest is that the study showed that recently fledged hen harriers (< 5 weeks) spent almost all of their time (99.1%) below 25 m and thus not within the collision risk zone.

It is important to note that there appears to be very few documented cases of hen harrier collision mortality from turbines in the literature (Johnson *et al.,* 2001, Smallwood & Thelander 2004, Whitfield & Madders 2006b, Scott & McHaffie 2008). At the Altamont Pass Wind Resource Area in the United States, which is the largest concentration of wind turbines anywhere in the world and is located on a busy bird migration route, only seven collisions by northern harriers (the US equivalent of the hen harrier) were documented over a 17 year period between 1989 and 2007 (Smallwood & Karas 2008).

At the Derrybrien Wind Farm, there have been no documented collisions during the various surveys since 2006, though it is noted that carcass search was not part of the routine monitoring. During the hen harrier summer surveys at Derrybrien between 2006 and 2018, hen harriers were observed within the wind farm site for a total of 2,457 seconds. The time spent by birds flying within the rotor sweep of the turbines was 637 seconds or 28.2% of the total, with the remainder (71.8%) of the time below 25 m height (and much of that below 10 m height). While the time spent within the rotor sweep area is somewhat higher than the figure of 18.2% given by Wilson *et al.* (2015), it is still relatively low and reflects the typical low flying behaviour of the hen harrier.

Collision with overhead lines is a well-documented cause of bird mortality (Bevanger 1998, Ferrer & Janss 1999, Jenkins *et al.,* 2010, SNH 2016b). Species at most risk are large birds such as eagles, vultures, storks, herons, swans and geese. While the birds may be able to manouever around large objects such as turbines or masts, their eyesight is rather poor at detecting thin horizontal objects ahead of them. In a review of 16 investigations of bird collision with power lines globally, Bevanger (1998) recorded collisions among hawks, vultures, eagles and falcons but did not list harriers. However, in a review of collision casualties with overhead lines for all bird species based on recovery data from the long-term BTO Ringing Scheme, Rose and Baillie (1989) recorded over 100 recoveries for hen harrier. The hit wire index (i.e. system to standardise the recovery samples) for hen harrier was particularly high relative to body size. They noted that hen harrier inhabits open moorland areas and may hunt at heights which make them particularly vulnerable to collisions with overhead wires.

For the Derrybrien to Agannygal 110kV OHL (which does not have bird flight diverters), the risk may be highest in the stretch at Knockavana where there is a traditional hen harrier breeding territory. Nesting has however been confirmed at this territory in each of the survey years 2006 to 2011 and by 2018 (when no birds were present) it was considered that the local habitat was no longer suitable due to conifer forest maturation.

Taking into account the findings from the various surveys at Derrybrien since 2006, the detailed study of hen harrier flight behaviour at Irish wind farms by Wilson *et al.* (2015), and also the studies from the international literature, it can be demonstrated that hen harriers are at low risk of collision with wind turbines as a result of their typically low flight height. However, in the absence of mitigation, the risk of collision with the overhead line is considered a potential **negative impact which could be of significance**.

Potential displacement impact

Displacement of birds from otherwise suitable habitat as a result of the presence of wind turbines has been reported as a potential indirect impact of wind turbines (Drewitt & Langston 2006, de Lucas *et al.,* 2007, Pearce-Higgins *et al.,* 2009). The displacement occurs as a result of behavioural responses that prevent or decrease the use of an area for activities such as nesting or foraging. However, the results of studies on potential displacement have varied widely and in an overall review of the literature Madders & Whitfield (2006b) concluded that displacement effects of wind turbines on raptors, and hen harrier in particular, are negligible for the most part. In a review of potential displacement effects on birds at twelve wind farm sites in Britain, Pearce-Higgins *et al.* (2009) reported an avoidance area of 250 m from turbines for hen harrier. In a further review (but not including hen harrier), Pearce–Higgins *et al.* (2012) reported that observed negative effects of wind farms on birds occur principally as a result of disturbance by high levels of activity during the construction phase. Various studies have also reported hen harriers breeding within a few hundred metres of turbines (Whitfield & Madders 2006b).

Wilson *et al.* (2015) studied the movement of adult hen harriers at wind farm and control sites in Ireland using GPS tags and data collected during vantage point watches. The study aimed to determine whether habitat use by foraging hen harriers differed at wind farm and control sites. The study found that at wind farm sites hen harriers favoured open habitats over afforested areas. Hen harriers at control sites foraged preferentially over peatland and young forest plantations, while those at wind farm sites foraged preferentially over natural and semi-natural open habitats (i.e. scrub, rough grassland) and to a lesser extent over peatland. While the authors noted that the selection of the somewhat different foraging habitats between the wind farm and control sites is difficult to explain, the study demonstrated that wind farms were actively used for foraging purposes.

At the Derrybrien Wind Farm, since 2006 hen harriers have been recorded both foraging and flying through the wind farm in all surveys (Biosphere Environmental Services 2006, 2007, 2009, 2011, 2015, also see Madden & Porter 2007). Birds were often seen flying close to wind turbines (<50 m) and on one occasion within 10 m of the base. The habitats within the wind farm, which comprise a mix of cutover blanket bog, regenerating bog/heath vegetation, scrub and stands of mature conifer trees, are considered as optimum for foraging by hen harriers. While breeding has not been known to have been attempted within the wind farm, there are two traditional territories approximately 1 – 2 km distance from the wind farm and it can be assumed that most, or at least a significant proportion, of the sightings within the wind farm involve birds from these territories. Research on the spatial ecology of hen harriers has shown that foraging females spend most of their time within 1 km of the nest, while males hunt mostly within 2 km of the nest (Irwin *et al.,* 2011, Arroyo *et al.,* 2014).

While there is conflicting evidence from the literature on displacement of foraging hen harriers from close to wind turbines, there is overwhelming evidence that hen harriers have continued to forage within the Derrybrien Wind Farm since its operation in 2006. Taking this into account, as well as the results of research by Wilson *et al.* (2015) and reviews such as Madders & Whitfield (2006b), it is considered that displacement of hen harriers from areas near turbines at Derrybrien has not been a significant impact and has not had a significant effect on the hen harrier population of the Slieve Aughty Mountains SPA.

Impact on reproductive output in relation to wind turbine proximity

Wilson *et al.* (2015) studied the breeding performance of hen harriers in relation to wind farm sites across Ireland (also see Fernandez-Bellon *et al.,* 2015). The results showed that there were no significant differences between the breeding outputs of hen harrier nests located at different distances from wind turbines. However, non-statistically significant lower nest success rates and productivity were observed within 1 km of wind turbines. Of the nine nests monitored in the 0-1 km band during the study, 33.3% were successful, while nest success in all other distance bands was 56.0% (n = 75). It was noted that hen harrier nest success rates vary considerably throughout their range and are influenced by many external factors. No trend was observed in fledged brood size with increasing distance from wind farms in their study, suggesting that potential impact of wind turbines on hen harrier breeding output is mediated through nest success rather than clutch or brood size.

At the Derrybrien Wind Farm, since 2006 hen harriers have been recorded nesting within a 1-2 km distance of the wind farm boundary, with one or two of these territories occupied in each year of survey. In all of the survey years, breeding was confirmed at one of the two territories, and in 2009 and 2011 both territories were occupied (possible and confirmed categories).

While there have been no breeding attempts or known historic territories within the 0-1 km distance band of the wind farm, there is no evidence to suggest that the wind farm has had any impacts on the reproductive output of the two regular hen harrier territories within a 1-2 km distance band.

Barrier effect due to turbines

The potential impact of lines of wind turbines creating a barrier effect to passing birds is mostly relevant to locations where migratory species pass regularly. Rees (2012) cites eight published studies of flight behaviour which reported changes in flight lines for swans or geese initially seen heading towards turbines, at distances ranging from a few hundred metres to 5 km (the larger distances were by birds on migration); 50-100% of individuals/groups avoided entering the area between turbines, but in some cases the sample sizes were small. Commenting on studies to assess the barrier effect, Rees writes "*Avoidance of turbines should be related to whether or not flights were initially in line with the wind farm, rather than in relation to all bird movements in the area, as including the latter artificially boosts sample sizes used for calculating avoidance rates*."

As the Project area is not used by migrating birds of prey or indeed species such as whooper swan, the issue of a possible barrier effect created by the turbines is not considered relevant.

Development of habitats in felled areas

As already noted, the removal of much of the plantation forest on site (c.255 ha) without replanting has allowed the subsequent development of habitats that are suitable for a range of bird species including species typical of unplanted upland areas (such as meadow pipit and red grouse). While the regenerating bog/heath vegetation is prone to invasion by self-seeded conifers, the operation of the wind farm requires the removal of such conifers when they reach a height of approximately 4 m – this has maintained the developing open sward for the remainder of the wind farm operation life. The replacement of non-native conifer plantation with an open sward is having a **positive impact of long-term duration** for birds including hen harrier, resulting in a **significant positive effect**.

Maintenance activities during operation phase

The main activities undertaken on site which are not specifically related to the operation of the turbines are the maintenance and periodic upgrading of access tracks and drains, the cutting back of self-seeded tree growth in previously felled areas (including along OHL corridor), and substation inspection and maintenance.

Maintenance and upgrading of access tracks within the wind farm is an occasional activity. Such works, which are assessed in advance for potential environmental impacts (including issue of peat stability), are relatively minor and localised within the site and largely confined to the original road footprint. Also, routine works such as this would usually be carried out outside of the bird nesting season. It is considered that track maintenance and upgrading works would not have any measurable effect on the foraging potential of the site for the local hen harrier population and would not affect the breeding of birds in the hinterland of the wind farm site.

Since the clearing of conifer plantations within the wind farm site and along the OHL corridor between 2003 and 2005, self-seeded conifer trees, mostly lodgepole pine, have become established throughout the site. These trees have now reached 4 m or more in height and in places the trees are encroaching along the access tracks. A programme to remove most of these trees over a 3-year period commenced in autumn 2018. The works in each year are carried out outside of the bird breeding season and so will not cause disturbance to nesting birds. Overall it is considered that the removal of the trees is a **positive impact of long-term duration** for birds such as hen harrier which naturally forage over open habitats such as bog, heath and low scrub.

Of particular relevance is the harvesting and replanting of the forest area immediately to the west of the wind farm (46.2 ha) by Coillte between 2016 and 2018 (this was done a few years before the due felling date to facilitate the wind farm). This area will provide suitable second rotation foraging habitat for hen harriers from about 2020 onwards to at least 2030 – birds foraging here and in other replanted areas around the wind farm would be expected to also use the habitats within the wind farm.

Maintenance works at the wind farm substation and the Agannygal Substation would not be expected to have any impacts on local bird populations or species such as hen harrier which nest in the hinterland of the wind farm as they are confined to the substation compounds.

Impact on other breeding bird species

While surveys were focused on the use of the wind farm site and surrounding areas by hen harrier, it is apparent that a substantial number of other bird species breed within, or feed in, the wind farm site. While these species were not subject to specific breeding surveys, young fledged birds (especially meadow pipit, skylark, stonechat etc) were often seen so it can be assumed that successful breeding does occur on site.

It is generally considered that passerine species are not significantly impacted by wind farms (SNH 2017). Wilson *et al*. (2015), however, found that breeding bird densities were lower at wind farm sites than at control sites and lower closer to wind turbines than further away. For forest birds, densities were significantly lower within 100 m of wind turbines. In the study, the proportion of calling birds recorded was lower at wind farm sites than at corresponding control sites but only within 100 m of turbines. Other studies have found that where reduced bird abundance has been reported at wind farms this effect has been confined to an area very close to the wind turbines and not extended into the wider landscape (Leddy *et al.,* 1999, Pearce-Higgins *et al.,* 2009).

At the Beinn Tharsuinn Wind Farm in Scotland, Douglas *et al.* (2011) found no significant differences in the changes in abundance of either breeding red grouse or golden plover between the wind farm and control site, and no evidence that changes in species' distribution were related to wind farm infrastructure. The analysis of species distribution highlighted a positive association between red grouse occurrence and turbine proximity. Anecdotal evidence suggests red grouse may use tracks as a source of grit, which they ingest to aid digestion (Watson & Moss 2008). The observations of red grouse within the Derrybrien Wind Farm in both summer and winter concur with the above.

It can be concluded that during the operation phase of the wind farm since 2006, the regenerating habitats have attracted a range of breeding bird species that are similar to those characteristic of open bog and heath habitats. This applies also to the OHL corridor and the peat slide area. Of particular importance is the frequency of meadow pipit, a Red-listed species, as well as skylark, mistle thrush, stonechat and linnet (all Amber-listed species). On occasions, red grouse (Red-listed) has been recorded within the former afforested areas of the site as well as the cutover bog habitat. The maintenance of open habitats on site during the operation phase of the wind farm is likely to have had **significant positive effect** on breeding and summer bird species.

Impact on winter bird species

While hen harrier was observed in the hinterland of the Derrybrien Wind Farm in October 2019 and at times could roost locally during the winter period (though no roosts located during winters 2011/12 or 2019/20, it is not expected that the feeding or roosting behaviour of this species in autumn or winter (if present) would be affected by the presence of the wind farm. Similarly, the wind farm project would not be expected to impact upon merlin which may be in the hinterland in the winter period (one recorded *c*.2.5 km from wind farm in October 2019).

Golden plover, a species of high conservation importance (Annex I & Red listed), was recorded on the wind farm site in winter and spring as well as several winter records in the hinterland. There is no evidence to indicate that this species is affected by the presence of the wind farm project.

7.4.2.3.3 Bats

The potential impact of operational wind farms on bats is fatality caused by interaction with wind turbines. This section of the assessment concentrates on those bat species that are at high risk of collision with wind turbines due to their ecology and for which empirical studies have shown, fatalities at wind farms are likely.

Common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle and Leisler's bat have been included in the impact assessment for the operational phase, as guidance suggests that these species are considered to be at high risk of turbine collision.

Since 2002, the State Bird Conservation Authority of the Brandenburg State Office for the Environment has been collating available data on collisions of birds and bats with wind turbines across Europe (Dürr, 2020). No published data are available on bat fatalities recorded at wind farms in Ireland, but 133 fatalities have been recorded at UK wind farms (and passed on to the recording centre). A summary of the data from UK and Europe (total) for high risk species recorded in Ireland are given in Table 7.20Table 7.20**.**

Table 7.20: Summary of bat fatalities (high risk species) at wind turbines in the UK and Europe (total including UK figure).

Bat species	UK	Europe
Nathusius' pipstrelle	1	1564
Common pipistrelle	46	2362
Soprano pipistrelle	52	439
Leisler's bat	0	711

One soprano pipistrelle corpse was found during mortality surveys, confirming that bat mortality has occurred during the operation phase of the Derrybrien Wind Farm.

Monitoring studies at other operational wind farm sites have demonstrated between year differences in fatality rates. These fatality rates do not always closely reflect bat activity data recorded pre and post-construction. It is therefore difficult to accurately predict future fatalities based on historical data. For this reason, a precautionary approach has been taken when determining the significance of effects on bat populations in the Project area.

Lesser horseshoe bat, whiskered bat, Daubenton's bat, Natterer's bat and brown long-eared bat

Lesser horseshoe bat, whiskered bat, Daubenton's bat, Natterer's bat and brown long-eared bats are considered to be at low risk of collision with turbines due to their foraging and commuting behaviours. **No effects** on Lesser horseshoe bat, whiskered bat, Daubenton's bat, Natterer's bat and brown long-eared bat populations are considered likely to have occurred during the operation phase.

Nathusius' pipistrelle

Nathusius' pipistrelle was recorded at the site on two nights in autumn 2019 (6 passes in three minutes on 11/09/2019 and 1 pass on 07/09/2019). On the basis of the data collected to date it is reasonable to assume that Nathusius' pipistrelles have been present throughout the operation phase, particularly in autumn.

The activity recorded is consistent with natural dispersal (following the summer breeding period) and migratory patterns of Nathusius' pipistrelle across Europe (Dietz and Keifer, 2016). Although the period over which Nathusius' pipistrelle is at risk of collision is limited, observations of Dürr and Bach (2004) found that the majority of all bat fatalities (89%) occurs during the autumn.

Nathusius' pipistrelle are considered to be at high risk of collision with turbines due to their foraging and commuting behaviours and the evidence of fatalities for the species at monitored wind farms across Europe.

It is likely that a **long term negative impact on Nathusius' pipistrelle bats has occurred at site level** between March 2006 and Mid 2020

The relative abundance of Nathusius' pipistrelle bats in Ireland is 'rarest', and it has not been recorded breeding to date. The levels of activity recorded suggest that low numbers of Nathusius' pipistrelle pass through the areas around the turbines. Given the indicative size of the population in Ireland, a precautionary assessment is that the effect of mortality is likely to have a **long term negative significant effect at the county level.**

Common and soprano pipistrelle

Common and soprano pipistrelle were recorded on site during 2016 and 2019, although comprehensive data were not collected prior to 2016, survey in 2012 confirmed that *Pipistrelle* sp. were present on site. It is reasonable to assume that common or soprano pipistrelles have been present throughout the operation phase.

In 2016, Common pipistrelles were recorded during every month of survey. There was a peak in activity in June (4.5 P/h), and relatively low activity in April, May, July and August (0.4, 0.1, 0.1 and 0.4 P/h respectively). Soprano pipistrelles were also recorded during every month of survey. There was a similar peak in activity in June (0.6 P/h), and far lower activity in April, May, July and August (all <0.1 P/h). Given that a peak in activity only occurred in June for both species, it likely that the bats were responding to a period of high food availability and / or calm weather.

The highest activity was recorded from 101-120 mins after sunset for both common and soprano pipistrelle; the lowest activity was recorded within the 40 minutes after sunset and before sunrise (<0.1 P/h both species). Both common and soprano pipistrelles are early emerging and late returning species, therefore the temporal data suggests that there are no large roosts of either species in close proximity to the site.

Common and soprano pipistrelle activity during the autumn of 2019 (29 August – 3 October inclusive), was lower than recorded in June 2016 for common pipistrelle (2.4 P/h) but slightly higher for soprano pipistrelle (0.8 P/h). Activity was lower in 2016 in all other months. Low activity was recorded within the 40 minutes after sunset and before sunrise for common and soprano pipistrelle (0.2 and 0.1 P/h respectively), suggesting a similar temporal pattern to that recorded in 2016.

Both species are considered to be at high risk of collision with turbines due to their foraging and commuting behaviours and the evidence of fatalities for both species at wind farm across the UK and Europe (and therefore assumed Ireland).

It is likely that a **long term negative impact on common and soprano pipistrelle bats has occurred at site level** between March 2006 and Mid 2020

The site is considered to be of site value to both common and soprano pipistrelles, the relative abundance of both species in Ireland is common, and monitoring data suggest both populations are stable.

The effect of mortality due to wind turbines on the favourable conservation status of common and pipistrelle bat populations is likely to have a **long term negative significant effect at the site level.**

Leisler's bat

Leisler's bats were recorded on site during 2016 and 2019.

In 2016, an average activity rate was recorded of Leisler's bats of 3 bat passes per hour (P/h) between April and August.

Leisler's bats were recorded during every month of survey. There was a peak in activity in April and May (7.0 and 6.2 P/h respectively) which coincides with the end of the hibernation period as bats start to move to their summer roosts, and a marked decrease in activity during bat maternity season in June, July and August (0.9, 0.3 And 0.2 P/h).

Low activity was recorded within the 20 minutes after sunset and before sunrise (<0.1 and 0.2 P/h respectively). Thirty-three Leisler's bat passes were recorded before sunset (7 bat passes) or after sunrise (26 bat passes). Early / late bat passes were recorded at T27, T67 T18 and T41 over nine separate nights. This temporal pattern suggests that it is unlikely that there was a permanent roost in or close to the wind farm during the recording period, but that individual bats may have opportunistically roosted nearby on a few occasions.

Leisler's bat activity during the autumn of 2019 (29 August – 3 October inclusive), was lower than recorded in spring 2016, and similar to the activity recorded in summer of the same year (average in autumn 2019 0.6 P/h). One pass was recorded after sunrise, and none before sunrise, suggesting a similar pattern to that recorded in 2016.

Leisler's bats are considered to be at high risk of collision with turbines due to their foraging and commuting behaviours and the evidence of fatalities for the species at wind farms across Europe (and therefore assumed Ireland). No Leisler's bat fatalities have been recorded in the UK, however, there have been Noctule fatalities recorded (11 bats), which is the more common *Nyctalus* sp. in the UK. It is reasonable to assume that Leisler's bats have been present throughout the operation phase.

It is likely that a **long term negative impact on Leisler's bats has occurred at a site level** between March 2006 and October 2019**.**

The habitats at Derrybrien Wind Farm project were considered to be of local value to Leisler's bat. The relative abundance of Leisler's in Ireland is rarer, however, monitoring data suggest populations in Ireland are stable.

The effect of mortality due to wind turbines on the favourable conservation status of Leiser's bat populations is likely to have a **long term negative significant effect at the local level.**

7.4.2.3.4 Mammals (other than bats)

Otter

The assessment of impacts on fisheries in Chapter 8 suggests that full trout biomass would likely have been restored in 3-5 years, with stone loach biomass being restored even sooner. These changes would have gradually relieved the reduction in prey availability for otter in the Owendalulleegh system, coinciding largely with the commissioning of the wind farm in 2006. After that time and up to the present, the operation of the wind farm is not believed to have had any significant negative impact on fish biomass within the Owendalulleegh catchment or any other river catchment draining the Project area and therefore no negative impact on the food availability of otter.

Other mammals

Offsite phased tree felling and replanting (approximately 46.2 ha in total) was undertaken immediately to the west of the wind farm site in 2016, 2017 and 2018 to optimise productivity of the wind farm. The impact of this scheduled felling, which was limited in extent and carried out on a phased basis is comparable to the impacts already discussed in relation to the felling prior to wind farm construction. Due to the overall small area of forestry felled and the phasing of felling, these operational activities are considered to have had a **short term negative impact** which **would not have resulted in a significant effect** on the local mammal population.

7.4.3 Impacts which are likely to occur

7.4.3.1 Mid 2020 - end of operational phase

7.4.3.1.1 Terrestrial Habitats

It is foreseen that the Derrybrien Wind Farm will operate until c. 2040. During that period, the site will be maintained as it has been since commencement of operation, with repairs to roads and other infrastructure as required. Self-seeded conifers will be controlled as necessary within the wind farm site and along the OHL corridor so that the vegetation will continue to be dominated by low growing heath / bog and low scrub species.

Direct Impacts

Cutting back of tree re-growth will maintain the dominance of open heath / bog vegetation throughout the felled areas. This will continue to have a **minor positive impact** on the overall ecological value of the area and will **not give rise to any significant effects**.

In-direct Impacts

There are no significant construction works planned for the Project site between Mid 2020 and the end of the operational phase. The impacts arising from site drainage during the operational phase have been shown to have no significant effects on hydrologically sensitive habitats. **No significant effects** owing to indirect impacts associated with the operational phase from 2020 to end of life have been identified.

7.4.3.1.2 Birds

It is envisaged that the Derrybrien Wind Farm will operate until circa 2040. During that period, the site will be maintained as it has been since commencement of operation, with repairs to roads and other infrastructure as required. Self-seeded conifer trees will be controlled as necessary within the wind farm site and along the OHL corridor so that the vegetation is expected to remain as a low sward dominated by bog, heath and scrub communities. The OHL will be fitted with bird flight diverters (see Section 7.6.1.2) so as to minimise collision risk.

The bird communities are expected to remain similar to that since post construction surveys commenced in 2006 subject to natural fluctuations in some species which can be expected over a 20 year period (for instance, severe winters can dramatically affect populations of species such as stonechat, wren and meadow pipit – see Madden and Lovatt 2016). The occurrence of sightings of hen harrier within the wind farm will be dependent on the size of the overall population in the Slieve Aughty Mountains. Should the marked decline in population since the 2010 period continue, less sightings would be expected in the vicinity of the wind farm. On the basis of the findings from the bird surveys since 2006 and from the literature review that has been carried out for the present report, it can be reasonably expected that the continuing operations at the Derrybrien Wind Farm project (including the OHL fitted with bird flight diverters) **will not have a significant effect** on the local hen harrier population in respect of risk of collision with turbines or the OHL or displacement from suitable habitats. Similarly, it is considered that the continuing operations at the Derrybrien Wind Farm project **will not have a significant effect** on the other breeding and wintering birds associated with the site.

The area of the peat slide outside of the wind farm is expected to become more dominated by self-seeded conifers and hence less suitable for supporting birds including hen harrier.

7.4.3.1.3 Bats

The same species assemblage has occurred in 2016 and 2019, with the exception of Nathusius' pipistrelle which has only been recorded in 2019.

The impacts and effects which are likely to occur between Mid 2020 and the end of the operational phase are considered to be the same as those that have occurred (see Section 7.4.2.3.3).

7.4.3.1.4 Mammals (other than bats)

There are no significant maintenance works anticipated for the remaining operation of the Project and therefore the impact from disturbance on mammals such as foraging badger or pine marten is considered likely to be slight and temporary in nature. The assessment on water quality impacts in Chapter 8 associated with the on-going operation of the Derrybrien Wind Farm has at most predicted localised slight reductions in water quality associated with drain cleaning but none that would cause a reduction in fish biomass overall. For these reasons the operation of the wind farm until the end of its operating life will have no significant effect on otter or other mammals which are likely to occur in the Project area.

7.4.3.2 Decommissioning

Decommissioning of the Project will involve the removal of the above ground elements of the wind farm, OHL and substations. The following elements of the wind farm will be left in-situ after decommissioning - turbine bases, crane pads, access tracks (including floating roads), trackside drainage network, on-site peat repository/storage area and borrow pits. The foundations of both substations will be removed and hardcore areas left in place.

Decommissioning of the OHL will entail the removal of the structures between the Derrybrien and Agannygal Substations. Potential access routes for decommissioning works have been identified and these will be subject to detailed design (see Figures 2.27 and 2.28 Chapter 2). The OHL wooden poles and mast elements will be cut at the base and removed from site. Structure foundations will remain in-situ.

It is not proposed to replant the wind farm site or OHL corridor with trees although natural regrowth of previously felled areas will likely continue.

The four remaining barrages constructed following the peat slide are no longer required as containment/stability measures. Barrages 1 and 2 form part of the Coillte forestry access track network and for this reason it is envisaged they will remain in place long term. Barrages 3 and 4 which are located in the Owendalulleegh River no longer serve a purpose and it is proposed to remove them both. The impacts associated with the removal of the barrages has been assessed in Chapter 8 Aquatic Ecology and Fisheries.

The duration of the decommissioning phase is expected to be approximately 24 months.

7.4.3.2.1 Terrestrial Habitats

The decommissioning phase will involve the removal of above ground infrastructure and substation foundations. Most works associated with the decommissioning of the wind farm will be undertaken from hard standing areas and therefore few direct or indirect impacts on semi-natural habitats are likely to occur. Minor localised disturbance impacts on semi-natural habitats associated with temporary road widening and minor upgrades to sections of access tracks for the decommissioning of OHL structures are foreseen. The drainage network will remain in place.

A summary of the works to be undertaken during decommissioning and associated impact assessment is presented in Table 7.21.

Table 7.21: Potential decommissioning impacts on terrestrial habitats.

Decommissioning Works	Potential Impact	Impacts on Terrestrial Habitats
Dismantling turbines, masts. Etc.,	Heavy plant associated with the works may potentially lead to vibration and compaction localised to areas in proximity to each turbine.	None identified
Demolition of control building	Use of mechanical demolition equipment and hydraulic breakers will generate vibration in proximity to the control building.	None identified
Temporary road widening	This section of road occurs within cutover bog. Temporary road widening may potentially lead to localised impacts on cutover bog.	**Minor temporary short-term impact** on cutover bog habitat (**no significant effect**).
Decommissioning of overhead line	Access to the overhead line will traverse areas removed from existing access tracks. Access routes to individual structures have been selected following geotechnical investigations. The line mainly consists of double timber polesets and galvanised steel angle masts that will require removal. Bog mats may potentially be required to facilitate access which may lead to localised compaction and shading impacts on vegetation directly beneath mats. Angle Mast 38 was located ca 500 m north of the Agannygal Substation and will likely require access along the OHL corridor where peat depths of up to 5 m were recorded during the construction phase.	Minor temporary short-term habitat disturbance in peatland habitat. **Minor temporary impact** (**no significant effect**).
Agannygal Substation decommissioning works.	There may be an option to remove the stone platform on which the substation is sited.	None identified
Decommissioning of off-site works associated with peat slide	The removal of two boulder dam barrages, both of which will require in-stream works. (refer to **Chapter 8 Aquatic Ecology & Fisheries**)	None identified

7.4.3.2.2 Birds

At any one-time, decommissioning works are expected to be localised to a small number of locations on site. It is reasonable to expect that the disturbance factor to birds will be low and hen harriers nesting at traditional sites in the hinterland of the wind farm would not be expected to be disturbed by the works as the nearest site (presently) is more than 1 km from the wind farm site. Ruddock & Whitfield (2007) cited a distance of up to 1 km for disturbance to hen harriers from human related activities, such as construction. It is considered that disturbance from activities during the decommissioning phase will **not have a significant effect** on breeding and/or wintering birds, including hen harrier, associated with the project area (though survey for birds prior to works commencing will be undertaken).

7.4.3.2.3 Bats

Most works associated with the decommissioning of the Project will be undertaken from hard-standing areas and therefore direct impacts on semi-natural habitats are unlikely to occur. There may be minor localised disturbance impacts on semi-natural habitats from some decommissioning activities such as updates to access tracks. The proposed works are only likely to have a **minor negative effect** on foraging and commuting bats.

7.4.3.2.4 Mammals (other than bats)

Otter

The strategy proposed for the decommissioning phase of the project is one of minimal ground disturbance in order to avoid generating suspended solids wash-out. For this reason, no negative impact is anticipated to affect the fish populations of the 3 main catchments draining the site and therefore no negative impact is anticipated to affect otters in the area. While intermittent localised disturbance may impact a small number of foraging male otters in the winter-spring period while foraging for frogs, this is expected to have at most a **slight, negative and short term impact** with **no significant effects**.

There will be temporary localised disturbance impacts at the crossing of the Owendalulleegh River where it is proposed to access structures on the OHL for decommissioning. The removal of the post-slide remedial structures namely Barrages 3 and 4 from the Owendalulleegh River will also result in temporary disturbance at these locations. Given the localised nature of the impact and the fact that otter are primarily nocturnal these activities on the Owendalulleegh River are **not likely to have a significant effect** on the local otter population.

Other mammals

The strategy proposed for the decommissioning phase of the project is one of minimal disturbance with most infrastructure will be left in-situ. There will be minor localised disturbance impacts on open semi-natural habitats associated with temporary widening and minor upgrades of sections of access roads and tracks. There will be no loss of woodland habitat.

Activities on site are likely to cause localised disturbance to mammals such as pine marten and badger which may use the site for foraging purposes. This is expected to have at most a **slight, negative and short-term impact with no significant effect.**

7.5 Cumulative Impacts

The following projects/activities in proximity to the Project have been considered in the assessment of cumulative impacts. It is noted that not all projects/activities are considered relevant to all ecological features of interest:

- Turbary activity
- Wind Farms in Slieve Aughty Mountains
- Adjacent coniferous forestry plantations
- Planting in lieu of felling on wind farm site
- Overhead Transmission Lines
- Works to Beagh Bridge

7.5.1 Cumulative impacts which have occurred

7.5.1.1 Terrestrial Habitats

7.5.1.1.1 Turbary activity

Historic turbary has modified the area of peatland in the eastern part of the wind farm site due to drainage and removal of the upper peat layers from individual plots. The entire c. 67 ha of drained bog has been impacted to some degree by this activity prior to development of the wind farm.

Turbary lands also extend immediately beyond the wind farm site to the east covering an area of approximately 15 ha. There are 136 turbary plots within or immediately adjacent to the windfarm site, 22 are partially or fully outside the wind farm site boundary. Individual plot sites range in area between approximately 0.55 ha and 1.10 ha.

The level of turbary activity within the site appears to have increased in recent years and is currently carried out by hand and mechanical means using an excavator and hopper. Mechanical peat extraction is currently being carried out in approximately 35 of the 136 plots and not all of these are cut each year.

The continued cutting of peat from the site is difficult to quantify as it varies from year to year. Despite this, a review of recent aerial photography together with personal observations suggests that a significant area of peatland is subject to turbary each year. Activities within these plots include peat cutting from turf banks which causes a direct loss of habitat, peat spreading across the bog surface causing temporary smothering of vegetation and surface compaction, and maintenance of perimeter drains which cause localised drying effects. Drains, undulating topography, and altered hydrology are characteristic features of this modified habitat and therefore the level of turbary activity does not threaten the long term viability of the habitat.

Turf cutting is having a significant localised effect on the peatland habitat in the area, however the likelihood of the effect occurring into the long term is difficult to determine.

It is estimated that the wind farm development has resulted in the loss of 0.7 ha of cutover bog due to construction of hard stand areas. This is considered a **minor negative impact of permanent duration** which when considered together with turbary does not increase the level of significance of that activity in isolation. The grid connection and peat slide areas are removed from cutover bog habitat and therefore cumulative impacts associated with these elements can be ruled out.

Turbary activities are removed from and do not impact on the intact areas of upland blanket bog within the wind farm site (highest quality peatland habitats) and therefore there are no cumulative impacts on this habitat.

Peat Disturbance in Turbary Area: In April 2020, a peat disturbance was noticed in the turbary area of the wind farm site. The exact date of the original occurrence of the disturbance is unknown. The disturbance was located south of the central turbary access track in an area between turbines T34, T37 and T38. The area of peat disturbed is approximately 0.25 ha. Following inspection by geotechnical specialists, it was concluded that no wind farm related activity could have contributed to the peat disturbance and that it was likely to have been caused by a combination of:

- Concentrated groundwater pressures in the peat within the turbary plot
- Undercutting for the drain along the toe of the slope
- Loading of the peat due to the more recent use of mechanical harvesting involving large hoppers

This peat disturbance therefore did not give rise to any cumulative impacts on terrestrial habitats. Further details in relation to this incident are provided in Chapter 10-Soils, Geology and Land.

Although no peat extraction activities subject to a development consent have been identified in the surroundings, the occurrence of considerable areas of cutover bog (see Figure 2.7 Chapter 2) throughout the wider landscape confirms that turbary operations are common. As these turbary operations are outside of the Project site there are no cumulative impacts identified.

7.5.1.1.2 Wind Farms in Slieve Aughty Mountains

The Sonnagh Old Wind Farm comprises a 9-turbine development with an output of 7.65MW, occurring ca 3 km to the north-west of Derrybrien Wind Farm. The Sonnagh Old Wind Farm was completed in 2004.

Keeldeery Wind Farm was granted planning permission in 2002 for a 45 x 1MW wind farm and associated works at Keeldeery approximately 3 km to the west of Derrybrien. Internal access roads were constructed as part of this project, but the rest of the development was never built.

Considering the distance removed from the Derrybrien Wind Farm and the characteristics of these two wind farm projects it is concluded that cumulative impacts on terrestrial habitats did not arise.

7.5.1.1.3 Adjacent coniferous forestry plantations

Coillte harvesting has occurred within conifer plantations that adjoin the wind farm site. Harvesting activity adjacent to and in proximity to the wind farm would have had no cumulative impacts on terrestrial habitats of conservation interest as this is restricted to discrete forest compartments comprising non-native tree species of low ecological value.

7.5.1.1.4 Planting in lieu of felling on wind farm site

Felling Licence FL3983 issued in 2003 granted permission by the Minister under Section 40 of the 1946 Forestry Act to fell or uproot trees at Derrybrien as part of the wind farm development. The felling was to take place on lands owned by Coillte, comprising 263 ha of lodgepole pine and Sitka spruce. The Licence also required that where the felling or uprooting took place the Licensee (the Landowner) must within 12 months after the date on which the authority conferred by the licence ceases to be exercisable or any extended period granted by the Minister, plant 119.3 ha, comprising 55% Sitka spruce, 30% Diverse Conifers and 15% Broad leaved species, in the townlands indicated in the Schedule to the Felling Licence.

Data provided by Coillte indicate that 119 ha of trees were planted in a total area of 150.81 ha at locations in Counties Tipperary and Roscommon between 2003 and 2008. All plots had been already planted for a Christmas tree crop and thus there was no change in habitat, i.e. land already classified as conifer plantation (WD4, after Fossitt 2000) at time of planting. A single plot at Coonmore (24.43 ha) was grassland (presumably wet grassland) prior to the planting of conifers in 2003.

The outcome of the assessment of the planting is presented in

Table 7.22 below. The assessment was informed by the interpretation of aerial photography and a review of various GIS datasets. It can be concluded that the planting of these sites did not give rise to any impacts on terrestrial habitats of conservation interest. Furthermore, as the sites are all far removed from the Project area (see Figures 2.34 and Figure 2.35 Chapter 2) it is concluded that there have been no cumulative impacts on terrestrial habitats.

Table 7.22: Assessment of planting in lieu of felling on wind farm site.

County	Townland	Compartment	Area (ha)	Designated lands	Pre-existing habitat
Roscommon	Ardcorcoran	73915C	17.83	NA	Conifer forestry
Roscommon	Brackloon	68170Q	5.22	NA	Conifer forestry
Roscommon	Brackloon	68170Q	13.26	NA	Conifer forestry
Roscommon	Oldtown	73918K	16.0	NA	Conifer forestry
Tipperary	Foilmahonmore	44777M	8.16	Slievefelim to Silvermines Mountains SPA Lower River Shannon SAC occurs adjacent to west of site.	Conifer forestry
Tipperary	Coonmore	44751I	24.43	Slievefelim to Silvermines Mountains SPA. Lower River Shannon SAC overlaps with southern part of site. No planting undertaken in designated SAC.	Wet grassland
Tipperary	Coonmore	44778H	14.26	Slievefelim to Silvermines Mountains SPA. Lower River Shannon SAC overlaps with southern part of site. No planting undertaken in designated SAC.	Conifer forestry
Tipperary	Knocknabansha	44776R	51.65	Slievefelim to Silvermines Mountains SPA.	Conifer plantation

7.5.1.1.5 Overhead Transmission Lines

Moneypoint-Oldstreet 400kV Line: This OHL was constructed prior to development of the Derrybrien Project, having been commissioned in 1984. Refurbishment of the structures along the line is ongoing and due to be completed during 2021. The overhead line passes over the Derrybrien – Agannygal 110kV OHL near the Agannygal Substation. Based on the timing and nature of the works associated with the original construction and refurbishment of the line it is concluded that there are no cumulative impacts on terrestrial habitats.

Ennis- Shannonbridge 110kV Line: The Ennis – Shannonbridge OHL was originally constructed in 1952 and 1968. The Derrybrien Wind Farm Project connected into this OHL via the Agannygal Substation, the construction of which resulted in the Ennis-Shannonbridge110kV OHL being split into two. Considering the timing and nature of the works of both projects it is concluded that there have been no cumulative impacts on terrestrial habitats

7.5.1.2 Birds

The following projects have been considered with regard to possible cumulative impacts on birds, especially the hen harrier population within the Slieve Aughty Mountains SPA:

7.5.1.2.1 Turbary activity

Turbary within and immediately adjacent to the wind farm site is described in detail in Section 7.5.1.1.1. As noted, it is difficult to know precisely how much peat was and is extracted in any given year. In 1998 prior to the project construction, it is understood that the turf cutting activities on the turbary lands within the wind farm site were low level. Over the intervening period until c. 2012, turf cutting by hand was carried out on a small number of plots, normally in late spring/early summer. In recent years a contractor has been retained by some plot owners to mechanically cut turf and there has been an increase in the number of plots where turf cutting has been carried out.

Caravaggi *et al.* (2020b) considered the significance of anthropogenic pressures within the breeding range of hen harriers in Ireland. The data analysed had been collected by surveyors during the 2015 National Hen Harrier Survey. While the mechanical removal of peat was not recorded as a pressure in survey areas with confirmed hen harrier territories, it accounted for 11% of ‘pressure occurrences’ in survey squares where there were no hen harrier territories (but potential foraging habitat). They note that pressures such as peat extraction or illegal burning may not occur until after egg laying and, hence, can impact on parental care and, ultimately breeding success. Such activities can essentially sterilise breeding habitat in the longer-term. Ruddock *et al.* (2016) had noted that at Slieve Beagh SPA the pressures observed were primarily degradation of habitat through extensive, mechanised turf-cutting.

While turf cutting by hand at the Derrybrien site has not resulted in a significant loss of habitat or a high level of disturbance, the recent mechanised cutting is of some significance in respect of both loss of foraging habitat and potential disturbance to foraging birds. It is concluded that mechanised peat cutting at Derrybrien, which is unrelated to the wind farm project, is contributing to an in-combination impact within the Slieve Aughty Mountains SPA. While the actual effect of peat cutting on the Special Conservation Interests of the SPA is not known (Ruddock *et al.,* 2016), there may be some localised effects on breeding territories. However, it can be concluded that the operation of the Derrybrien Wind Farm project is not contributing to a negative in-combination effect when considered with turbary and peat extraction activities within the SPA.

7.5.1.2.2 Wind Farms in Slieve Aughty Mountains

The Sonnagh Old Wind Farm is the only other wind farm within the Slieve Aughty Mountains SPA. This wind farm is located approximately 3.4 km to the northwest of Derrybrien. It comprises nine Vesta turbines each of 0.85 MW capacity and was commissioned in 2004. This wind farm was constructed within a conifer plantation. The Environmental Impact Statement for the Sonnagh project did not record hen harriers nesting within the site though foraging birds were recorded in the hinterland area (within 1 km). It appears that monitoring for hen harriers was not required at Sonnagh Old Wind Farm since the wind farm was commissioned.

It is concluded that there is no evidence to suggest that there is a cumulative impact on birds, and hen harrier in particular, by the operation of the two wind farms in the area.

7.5.1.2.3 Adjacent coniferous forestry plantations

As already referred to in this report (see Section 7.3.5.3.1), the age structure of the commercial forest plantations in the hinterland of the wind farm is an important factor in the amount of habitat available to hen harriers in any one period. The importance of forestry as an influencing factor on the size of the hen harrier population in the Slieve Aughty Mountains SPA (as well as other SPAs selected for hen harrier) was highlighted by Ruddock *et al.* (2012 & 2016). Since monitoring for hen harrier at Derrybrien commenced in 2004, there have been marked changes in the age structure of the forest plantations in the surrounding areas. Since about 2016, large areas along the wind farm entrance road have been clearfelled and replanted as part of normal Coillte forestry operations (see Plate 7, Appendix 7-3) and will provide suitable foraging habitat for hen harriers in the coming years.

As the conifer forest on the Derrybrien Wind Farm site has been largely removed and not replanted, from the perspective of value for foraging purposes the wind farm site now represents an area of habitat stability where foraging potential is available continuously (unlike the situation with commercial plantations). It is concluded that the Project is not contributing to an in-combination negative impact with forestry in the surrounding areas.

7.5.1.2.4 Planting in lieu of felling on wind farm site

The off-site planting that was undertaken by Coillte in lieu of the tree felling for the Project is described in detail in Section 7.5.1.1.4.

Data provided by Coillte indicate that 119 ha of trees were planted in a total area of 150.81 ha at locations in Counties Tipperary and Roscommon between 2003 and 2008. Of relevance to the present assessment is that parts of the planted lands selected by Coillte were located within the now designated Slievefelim to Silvermines Mountains SPA (code: 004165) (notice of designation was in 2007).

However, within the SPA the selected plots located within the townlands of Foilmahonmore (8.16 ha) and Knocknabansha (51.6 ha) had been already planted for a Christmas tree crop and thus there was no change in habitat, i.e. land already classified as conifer plantation (WD4, after Fossitt 2000) at time of planting. A single plot at Coonmore (24.43 ha) was grassland (presumably wet grassland) prior to the planting of conifers in 2003.

For the Coonmore plot, the impact of the planting from the perspective of usage by hen harrier was a change in habitat from open grassland to afforestation. While the planted Coonmore plot still provided suitable habitat for hen harrier, this was only for a number of years until the canopy closed (probably by c.2015) after which the plantation would be of little value to hen harrier until clear felled and replanted (issue of afforestation already discussed in this report). In contrast, open habitats such as rough grassland provide permanently available habitat for the birds. The Site Synopsis (NPWS, 2015) for the Slievefelim to Silvermines Mountains SPA notes that approximately 50% of the land area is afforested, with roughly a quarter of the land bog and heath and the remainder grassland used mainly for hill farming. With the total area of the SPA at 20,922 ha, the extent of afforestation at the time of designation would have been approximately 10,460 ha (which included the 24.43 ha at Coonmore), with approximately 5,230 ha of rough grassland. The impact by the planting at Coonmore was the removal of 0.46% of the total grassland component that would have been included within the SPA had the planting not occurred (i.e. grassland included within the SPA would have amounted to 5,254 ha approximately if the planting had not occurred).

In the context of the now designated Slievefelim to Silvermines Mountains SPA, the significance of the effect of the impact by the replacement of 24.43 ha of open grassland habitat (potentially available to hen harrier for foraging all the time) with plantation forest (potentially available to hen harrier for foraging and nesting for roughly 10 years out of a 40 year cycle) is considered to be slight.

It is noted that in the period 2005 to 2015, the Slievefelim to Silvermines Mountains SPA is one of only two of the six designated SPAs for hen harrier where the population has increased (Ruddock *et al.,* 2016). The numbers of hen harrier territories (probable & confirmed) recorded in the SPA during the three national surveys are as follows:

- 2005 5 territories
- 2010 7 territories
- 2015 10 territories

While a change in habitat (24.43 ha) from grassland to conifer plantation occurred as a result of planting in lieu of felling on the wind farm (considered a slight negative effect) prior to the designation of the Slievefelim to Silvermines Mountains SPA, it is considered that the Derrybrien project has not contributed to any adverse in-combination effect on the hen harrier population of Slievefelim to Silvermines Mountains SPA.

7.5.1.2.5 Overhead Transmission Lines

In addition to the OHL connecting Derrybrien Wind Farm to the Agannygal Substation, there are three further OHLs within the SPA, as follows:

- A 38kV OHL which runs from Sonnagh Old Wind Farm northwards towards Loughrea. Some minor maintenance works are due to take place on this OHL in 2020. These works, which are subject to AA Screening, will take into account the sensitivities of the area in respect of the SPA designation, with all required works taking place after August 15th when hen harriers, if present, would have completed breeding.
- A 110kV OHL (Ennis to Shannonbridge) which runs across the central part of the SPA and includes the Agannygal Substation. This line has been in place since the 1970s. There are no upgrade or maintenance works planned on this line for the foreseeable future.
- A 400kV OHL (Moneypoint-Oldstreet Galway West) which runs across the central part of the SPA. Refurbishment works commenced on this project in February 2020 and are due to finish in 2021. Work will require vegetation clearance for access to towers but without any tower replacements. As part of this project is within a Special Protection Area a Natura Impact Statement was prepared as part of the planning application for the Project. Significant effects have been ruled out in the NIS with the implementation of mitigation measures.

Hen harrier, as well as merlin, could be expected to utilise the OHL corridors at times for hunting or for moving between areas. Indeed, as already noted, in respect of OHLs within the Slieve Aughty Mountains SPA, Ruddock *et al.* (2016) wrote the following:

> *"There appeared to be a positive association, although this was not statistically tested, and supported by behavioural observations, that habitat management (i.e. clearance) for power line infrastructure may provide corridors for movement and foraging by hen harriers within the forested landscape. The use of such corridors could prove useful to increasing connectivity with suitable nesting and foraging areas and particularly linking forested areas with open habitats which are shown to be used more frequently in Ireland."*

As already discussed, (see Section 7.4.2.3.2), collision with unmarked overhead power lines is a well-documented cause of bird mortality. For hen harrier, the 38kV and 110kV OHLs would pose the most risk as these are within the usual flight height range of the birds.

It is considered that the Derrybrien to Agannygal OHL contributes with the other OHLs in the locality to a source of collision risk for birds including hen harrier. While there is no evidence to indicate that there have been bird casualties as a result of the overhead lines within the SPA site, on a conservative basis the effect of this potential cumulative impact (in absence of mitigation) is considered of moderate significance.

7.5.1.3 Bats

7.5.1.3.1 Turbary activity

Turbary activities have been relatively consistent prior to the construction of the wind farm and throughout the period the wind farm has been operational. The area within the wind farm site has been defined as cut over bog throughout and will remain cut over bog for the lifetime of the Project. The impact of turbary activities on habitat used by foraging bats is considered to be neutral. Therefore, no cumulative impact is considered likely to have occurred.

7.5.1.3.2 Wind Farms in Slieve Aughty Mountains

The Sonnagh Old Wind Farm is the only other operational wind farm within the Slieve Aughty Mountains SPA. The construction of the wind farm required clearance of commercial forestry.

No significant effects on bats were predicted as a result of the construction of the wind farm (Corr na Gaoithe Teo, 2000). No cumulative impact is considered likely to have occurred.

7.5.1.3.3 Adjacent coniferous forestry plantations

Commercial forestry activities in the surrounding area of the Project have been relatively consistent prior to the construction of the wind farm and throughout the period the wind farm has been operational. Forestry is a dynamically managed habitat type that results in regularly changing opportunities for bats that they are likely to readily adapt to. No cumulative impact is considered likely to have occurred.

7.5.1.3.4 Works to Beagh Bridge

Offsite peat slide works resulted in damage to three bridges that may have had roosting potential for low numbers of common pipistrelle, soprano pipistrelle, Natterer’s bats and Daubenton’s bats. Given the scale and duration of the impact, a precautionary assessment has been made that damage and repairs to the bridges is likely to have had a permanent negative significant effect at the site level for common pipistrelle, soprano pipistrelle, Natterer's bats and Daubenton's bats.

Masonry bridges are common within the local landscape. Stabilisation and repointing works were completed to Beagh Bridge in 2005. Beagh bridge is also approximately 20 km from the bridges identified as part of the Derrybrien Wind Farm Project, this is outside the geographical area described as Site Level.

Beagh Bridge appears to largely comprise close fitting concrete blocks and bricks with some stonework at the banks and is likely to have had very limited opportunities for roosting bats. There is no available information on the impact of loss of features for bats at Beagh Bridge, however it is unlikely that any impact could be significant to bat populations in the area given the limited roosting potential of the bridge.

No cumulative impact is considered likely to have occurred.

7.5.1.4 Mammals

The projects and activities listed above as potentially having given rise to cumulative impacts are deemed to have at most slight, temporary and localised negative impacts on water quality and none on fish biomass and therefore no negative impact would have affected otters, either at the level of the individual or at a population level, in any of the 3 river catchments.

Felling of forestry in surrounding areas during the construction phase of the wind farm was limited due to the felling being undertaken within the wind farm site. The turbulence felling and replanting to the west of the site was undertaken as part of normal Coillte forestry operations. The ongoing forestry management activities in areas surrounding the Project are not having a cumulative impact on mammals as there is no felling within the wind farm or OHL corridor except for the removal of scattered self-sown trees.

7.5.2 Cumulative impacts which are likely to occur

7.5.2.1 Terrestrial habitats

Cumulative site stability impacts arising from peat extraction in turbary plots on the wind farm site and adjacent to it could potentially occur where specific peat harvesting methodologies are utilised. The potential impact will not arise as a direct result of wind farm continued operational activities or decommissioning activities as these have been mitigated against but from the separate peat turbary activities occurring outside of the control of Gort wind farms as exercised under turbary rights. These potential site stability impacts from turbary activities relate primarily to the use of mechanical peat harvesting equipment on turbary plots which have been assessed as having a possible likelihood of a peat failure which could range from localised instability to potentially a large scale peat slide in the worst case scenario. Mitigation measures to reduce the potential for peat instability during the continued operation and decommissioning phases owing to turbary activities are described in Chapter 10 - Soils, Geology and Land.

Turbary activities are removed from and do not impact on the intact areas of upland blanket bog within the wind farm site (highest quality peatland habitats) and therefore there are no cumulative impacts on this habitat predicted.

7.5.2.2 Birds

For the future operation of the Project, cumulative impacts as already discussed are likely to remain unless further wind farms and/or overhead lines are built, or the intensity of mechanised peat cutting increases.

7.5.2.3 Bats

No significant effects were predicted on bats as a result of the operation of the Sonnagh Old Wind Farm. However, at the time of the application there was limited information about bat fatality at wind farms; it follows there is no reason to expect monitoring is being completed to test the accuracy of this conclusion.

There are 9 wind turbines at Sonnagh Old Wind Farm, which is located in similar upland habitats to the Derrybrien Wind Farm and is likely to support a similar bat assemblage including some animals that also use the airspace at Derrybrien (based on ranging distances). It follows there is potential for an increase in bat fatalities and a resulting cumulative impact on bat populations at the local (as opposed to site) level from the two wind farm projects.

Lesser horseshoe bat, whiskered bat, Daubenton's bat, Natterer's bat and brown long-eared bat.

No impacts are predicted on lesser horseshoe bat, whiskered bat, Daubenton's bat, Natterer's bat and brown long-eared bat populations during the operation phase as these species are not vulnerable to collision with wind turbines. No cumulative impacts are predicted.

Common pipistrelle

Long term negative effects significant at the site level may occur at Derrybrien Wind Farm as a result of the operation of the wind farm through the potential for a small number of common pipistrelle bats to be killed by the wind turbines.

A precautionary assessment is that the cumulative effect of the two wind farms would be a **long term negative significant effect at the local level.**

Soprano pipistrelle

Long term negative effects significant at the site level may occur at Derrybrien Wind Farm as a result of the operation of the wind farm through the potential for a small number of soprano pipistrelle bats to be killed by the wind turbines.

A precautionary assessment is that the cumulative effect of the two wind farms would be a **long term negative significant effect at the local level.**

Nathusius' pipistrelle

Long term negative effects significant at the county level may occur at Derrybrien Wind Farm as a result of the operation of the wind farm through the potential for a small number of Nathusius' pipistrelle bats to be killed by the wind turbines. This assessment is based on very limited information on Nathusius' pipistrelle populations in Ireland.

A precautionary assessment is that the cumulative effect of the two wind farms would be a **long term negative significant effect at the county level.**

Leisler's bat

Long term negative effects significant at the local level may occur at Derrybrien Wind Farm as a result of the operation of the wind farm through the potential for a small number of Leisler's bats to be killed by the wind turbines.

A precautionary assessment is that the cumulative effect of the two wind farms would be a **long term negative significant effect at the local level.**

7.5.2.4 Mammals (other than bats)

The projects/activities listed that could potentially give rise to cumulative impacts are deemed to at most cause slight, temporary and localised negative impacts on water quality and none on fish biomass and therefore no negative impact will affect otters, either at the level of the individual or at a population level, in any of the 3 river catchments.

7.6 Remedial (Mitigation) Measures and Monitoring

7.6.1 Remedial Measures & Monitoring for significant effects

7.6.1.1 Terrestrial Habitats

Emergency measures were undertaken to address significant impacts arising from the peat slide in 2003. These emergency measures, which mainly involved the installation of barrages and creation of repositories for peat debris, largely related to the safeguarding of downstream water quality and reducing the risk of further peat slides. Impacts on water quality and aquatic ecology are discussed in Chapter 8 of this rEIAR.

Significant effects on terrestrial habitats of highest conservation value (blanket bog and dystrophic lake) were avoided by the layout of the project. In addition, the use of floating roads reduced the likelihood of hydrological effects on these habitats.

As no significant negative effects on terrestrial habitats have been identified due to the construction, operation, or decommissioning of the wind farm project there is no requirement for specific mitigation or remedial effects.

7.6.1.2 Birds

Monitoring of the hen harrier population in the vicinity of the Project has been on-going since 2004. This has allowed for maintenance activities during the operational phase of the wind farm to be undertaken without causing disturbance to nesting birds in the area surrounding the wind farm. This monitoring will continue for the lifetime of the project to ensure that mitigation of future works is based on the most up-to-date information.

Other mitigation measures will also be implemented including the installation of bird flight diverters on the OHL.

Overhead power line

This assessment has identified the Derrybrien to Agannygal 110kV OHL as a potential collision risk to birds including hen harrier.

Line marking can reduce collision mortality quite effectively and for some species by 50-94% (see reviews by Frost 2008, Jenkins *et al.,* 2010, Prinsen *et al.,* 2011, SNH 2016b). Markers are simply physical devices to make the line visible to approaching birds. There are various types available but the basic requirement is to increase the visible thickness of the line by at least 20 cm for a length of at least 10-20 cm. The markers are usually installed on the shield (earth) wire but can be placed on the conductors if the shield wire(s) is absent. Markers on lines should be installed as close together as feasible and at least every 5-10 m along the line. The markers should be in contrasting colours for maximum visibility in different weather and light conditions. Movement of the device is likely to be important. Line markers will also need maintenance and replacement as necessary and the line should be checked at least once a year (preferably in late winter prior to the arrival of breeding birds to the uplands).

Bird flight diverters will be placed along the entire length (at appropriate spacing) of the 110kV OHL in order to minimise the risk of collision.

Maintenance works / Decommissioning

Prior to any future maintenance works or decommissioning works as part of the Project, a survey for territorial hen harriers within and around the wind farm project (to at least a 2 km radius from Project boundary) will take place as the breeding distribution is likely to have changed somewhat. Should a pair be found nesting within the wind farm project boundary or within a distance of 2 km from the project boundary, seasonal restrictions on works may be required (depending on location of works, local topography etc.) to minimise risk of disturbance.

Routine maintenance works, other than those associated with individual turbine maintenance and works within the substations, will be undertaken outside of the bird nesting season (1st March-31st August) in compliance with the Wildlife Acts 1976 & 2000.

Monitoring

As the wind farm is within the Slieve Aughty Mountains SPA, the monitoring programme for hen harriers will continue at intervals (suggested 3 year intervals) for the remainder of the wind farm operation. This will provide useful long-term data on the potential effects of wind farms on sensitive bird species (it is noted that there are few, if any, comparative long-term studies in Ireland) and will provide up-to-date baseline information on the distribution of breeding territories to ensure future maintenance activities have no potential to cause disturbance.

7.6.1.3 Bats

Bat boxes

The damage of three bridges due to the peat slide in 2003 may have resulted in the loss of potential roosting features for bats. Bat Conservation Ireland provides guidance for planners, engineers and developers on appropriate mitigation for the loss of roosting opportunities in bridges (BCI, 2010) – *“Ready-made roosting boxes or tubes are available and can be easily inserted into structures to provide roosting sites for bats. Where natural crevices are not available or cannot be retained, a bat tube should be attached to the structure. Ensure that the bat tube is located at sufficient height (at least 1m) above winter flood waters to prevent residing bats from being drowned. Bat boxes are also available for attachment to mature trees or buildings”*

A minimum of two bat boxes will be fixed to each of the three bridges that were affected by the peat slide. If suitable locations for the bat boxes cannot be found on the bridges, they should be placed on nearby trees at a suitable aspect.

Turbine curtailment

During a trial bat carcass search using dogs, undertaken over a two day period in 2016, a dead bat was recorded at the Derrybrien Wind Farm, demonstrating that bat fatality occurs at the site.

Monitoring studies at other operational wind farm sites have demonstrated between year and between season differences in fatality rates. As many of these operational sites are in upland habitats with typically low levels of bat use, these differences appear likely to relate to whether seasonal sampling periods coincide with warm, settled weather and the availability of insect prey[6].

Available guidance on the reduction of fatalities at wind farms sites states:

‘In order to minimise down time, the threshold values at which turbines are feathered should be site specific and informed by bat activity peaks at that location, but as an indication, they are likely to be in the range of wind speeds between 5.0 and 6.5 m/s and at temperatures above approximately 10 or 11ºC measured at the nacelle. Significant savings can be achieved by so-called “smart” curtailment over the other less sophisticated alternatives.’ (SNH *et al.*, 2019)

As a full survey season of bat activity data with paired weather data is not currently available, but a risk of significant fatalities for some bat species has been identified, a blanket curtailment scheme with the following cut off parameters will be implemented at all turbines in August 2020. The curtailment scheme will be in effect April to October (inclusive), it will stop the operation of turbines when temperatures are above 11 degrees Celsius and wind speed is below 5 m/s between dusk and dawn each night.

A central met mast will measure weather conditions and curtailment will be triggered when all thresholds are met.

[6] These are our observations based on monitoring in Scotland and Wales. Conversations with other consultants and developers that are conducting fatality monitoring suggest that they have had similar experiences.

To determine whether mitigation to reduce fatality levels is appropriate fatality monitoring during the spring, summer and autumn of each year will be completed for a minimum of three years commencing in August 2020. This will involve:

- Collection of bat activity, fatality and site-specific weather data in each of the three seasons. A proportion (32 of the 70 turbines) will be subject to monitoring[7] using specially trained search dogs.
- Collection of site-specific data on seasonal scavenger removal rates and on the efficiency of detection of animal carcasses by the dogs used for bat searching.
- Modelling / calculation of the level of bat fatality likely to occur over the active season based on the results of the work.
- The production of an annual report detailing the approach to, results and conclusions of the work. Statistical analysis of the relationship between weather and fatality levels will be included. The report will be issued to NPWS and the Determining Authority.
- Discussion of the results of the monitoring with the determining authority (we will also seek to involve NPWS), to determine an appropriate way forward. This will include a review of the adequacy of the monitoring effort (in light of the results) and discussion of whether turbine curtailment parameters should be varied based on any fatalities, activity and weather conditions recorded. Any variations to the mitigation will be monitored to confirm the mitigation is effective.

7.6.1.4 Mammals (other than bats)

No mitigation measures required.

7.7 Residual Impacts

7.7.1 Terrestrial Habitats

The permanent felling of conifer plantation has had a **significant positive effect** on the overall quality of terrestrial habitats within the project area. The removal of dominant non-native trees throughout the wind farm site and OHL corridor has allowed the re-establishment of native bog and heath vegetation suited to the area. A substantial portion of these areas is likely to develop into stable peatland habitats of significant ecological value similar to what would have been present prior to the original planting with conifers.

There are no residual negative significant effects on terrestrial habitats due to the construction, operation, and decommissioning of the wind farm project.

7.7.2 Birds

The principal residual positive impact on birds owing to the construction and operation of the wind farm has been the removal of a substantial area of conifer plantation without

[7] This is in line with the sample rate suggested in industry guidance (SNH *et al.*, 2019)

replanting. Conifer plantation is a non-native habitat which is of low value to birds. The regeneration in the felled areas of a mosaic of bog/heath vegetation and scrub has attracted bird species to the Project area which are typical of open upland habitats, including hen harrier, red grouse and meadow pipit. This is considered a **significant positive effect**.

7.7.3 Bats

7.7.3.1 Natterer's bat, Daubenton's bat, and brown long-eared bat

The loss of potential roost features at bridges affected by the peat slide resulted in a permanent negative impact significant at the site level. Mitigation for the loss of potential roost features by providing suitable bat boxes at the bridges will result in a **permanent positive residual significant effect at the site level.**

7.7.3.2 Nathusius's pipistrelle

During the operational phase of the project it is possible that some fatality has occurred to date as a result of blade strike. A precautionary assessment is that the effects of fatality at the wind farm and in combination with other projects may have resulted in a **residual long term negative effect on Nathusius' pipistrelle that is significant at the County level.**

Once mitigation is implemented during August 2020 the potential to affect the (local) favourable conservation status of Nathusius' pipistrelle will be reduced. It is considered likely that with mitigation in place there will be **no significant residual effect** at the wind farm or in combination with other projects **on Nathusius' pipistrelle populations** at any geographical level. This conclusion will be confirmed during the three years of monitoring post implementation.

7.7.3.3 Common pipistrelle

The loss of potential roost features at bridges impacted by the peat slide resulted in a permanent negative impact but was not considered to be significant. Mitigation for the loss of potential roost features by providing suitable bat boxes at the bridges will result in a **permanent positive residual significant effect at the site level.**

During the operational phase of the project it is likely that some fatality has occurred to date as a result of blade strike. A precautionary assessment is that the cumulative effects of fatality alone and in combination with other projects may have resulted in a **residual long term negative effect on common pipistrelle that is significant at the local level**.

Once mitigation is implemented during August 2020 the potential to affect the (local) favourable conservation status of common pipistrelle will be reduced. It is considered likely that with mitigation in place there will be **no significant residual effect** at the wind farm or in combination with other projects **on common pipistrelle populations** at any geographical level. This conclusion will be confirmed during the three years of monitoring post implementation

7.7.3.4 Soprano pipistrelle

The loss of potential roost features at bridges impacted by the peat slide resulted in a permanent negative impact but was not considered to be significant. Mitigation for the loss of potential roost features by providing suitable bat boxes at the bridges will result in a **permanent positive residual significant effect at the site level.**

During the operational phase of the project it is likely that some fatality has occurred to date as a result of blade strike. A precautionary assessment is that the cumulative effects of fatality alone and in combination with other projects may have resulted in a **residual long term negative effect on soprano pipistrelle that is significant at the local level**.

Once mitigation is implemented during August 2020 the potential to affect the (local) favourable conservation status of soprano pipistrelle will be reduced. It is considered likely that with mitigation in place there will be **no significant residual effect** at the wind farm or in combination with other projects **on soprano pipistrelle populations** at any geographical level**.** This conclusion will be confirmed during the three years of monitoring post implementation

7.7.3.5 Leisler's bat

During the operational phase of the project it is likely that some fatality has occurred to date as a result of blade strike. A precautionary assessment is that the cumulative effects of fatality alone and in combination with other projects may have resulted in a **residual long term negative effect on Leisler's bat that is significant at the local level**.

Once mitigation is implemented during August 2020 the potential to affect the (local) favourable conservation status of Leisler's bat will be reduced. It is considered likely that with mitigation in place there will be **no significant residual effect** at the wind farm or in combination with other projects **on Leisler's bat populations** at any geographical level. This conclusion will be confirmed during the three years of monitoring post implementation

7.7.4 Mammals (other than bats)

There are no residual significant effects on mammals due to the construction, operation, and decommissioning of the wind farm project.

7.8 References

Altringham, J.D. (2003) *British Bats*. New Naturalist Series, HarperCollins, London.

Anon (2004) *Investigation into the effects of Landslide of Peat bog at Derrybrien North into the Owendalulleegh River Catchment – Second Report – July 2004*. Shannon Regional Fisheries Board

Arroyo, B., Leckie, F., Amar, A., McCluskie, A. & Redpath, S. (2014) Ranging behaviour of Hen Harriers breeding in Special Protection Areas in Scotland. *Bird Study* 61: 48-55.

Atherton, I., Bosanquet, S., Lawley, M. (2010) [Eds.]: Mosses and liverworts of Britain and Ireland: a field guide.

Aughney, T., Langton, S. & Roche, N. (2011) Brown long-eared bat roost monitoring scheme for the Republic of Ireland: synthesis report 2007-2010. *Irish Wildlife Manuals,* No. 56. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

Aughney, T., Langton, S. and Roche, N. (2012) All Ireland Daubenton's Bat Waterway Monitoring Scheme 2006-2011. *Irish Wildlife Manuals*, No. 61. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Ireland.

Bailey, M. & Rochford, J. (2006) Otter Survey of Ireland 2004/2005. *Irish Wildlife Manuals No. 23.* National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

Balmer, D., Gillings, S., Caffrey, B., Swann, B., Downie, I. & Fuller, R.J. (2013*) Bird Atlas 2007-11: the breeding and wintering birds of Britain and Ireland.* BTO Books, Thetford.

Band, W., Madders, M., & Whitfield, S.P. (2007) Developing field and analytical methods to assess avian collision risk at wind farms. In *de Lucas, M., Hanss, G. & Ferrer, M (eds) Birds and Wind Farms: Risk assessment and mitigation*. Quercus.

Barova S and Streit A (editors) (2018) Action Plan for the Conservation of All Bat Species in the European Union 2018-2024. European Commission, UNEP and Eurobats, Brussels. [online] https://ec.europa.eu/environment/nature/conservation/species/action_plans/pdf/EU%20Bats%20Action%20Plan.pdf Accessed 27/11/2019

Barton, C., Pollack, C., Norriss, D.W., Nagle, T.A., Oliver, G.A. & Newton, S. (2006) The second national survey of breeding Hen Harriers *Circus cyaneus* in Ireland 2005. *Irish Birds* 8: 1-20.

Bat Conservation Ireland. (2010) Bats and waterways. Guidance notes for planner, engineers and developers. [online] https://www.batconservationireland.org/wp-content/uploads/2013/09/BCI_Guidelines_waterways.pdf Accessed 28/11/2019.

Bat Conservation Ireland. (2012). Wind Turbine/Wind Farm Development Bat Survey Guidelines, Version 2.8, December 2012. [online] https://www.batconservationireland.org/wp-content/uploads/2013/09/BCIreland-Wind-Farm-Turbine-Survey-Guidelines-Version-2-8.pdf Accessed 26/11/2019

Bat Conservation Ireland. (2019[a]) Brown long-eared bat roost monitoring scheme [online] https://www.batconservationireland.org/what-we-do/monitoring-distribution-projects/brown-long-eared-bat-roost-monitoring Accessed 26/11/2019

Bat Conservation Trust. (2010[a]) Common pipistrelle information sheet. [online] https://bit.ly/BCT_Pipi Accessed 29/04/2020

Bat Conservation Trust. (2010[b]) Soprano pipistrelle information sheet. [online] https://bit.ly/BCT_Pypy Accessed 29/04/2020

Bevanger, K. (1998) Biological and conservation aspects of bird mortality caused by electricity power lines: a review. Biological Conservation 86: 67-76.

Bibby, C.J. & Etheridge, B. (1993) Status of the Hen Harrier *Circus cyaneus* in Scotland in 1988-1989. *Bird Study* 40: 1-11.

Bing Maps (2019) [online] https://www.bing.com/maps/aerial Accessed 27/11/2019

Biosphere Environmental Services (2004) *Derrybrien Wind Farm, Hen Harrier Monitoring, 2004 Report*. Prepared for Hibernian Wind Power.

Biosphere Environmental Services (2006) *Derrybrien Wind Farm, Hen Harrier Monitoring, 2006 Report*. Prepared for Hibernian Wind Power.

Biosphere Environmental Services (2007) *Derrybrien Wind Farm, Hen Harrier Monitoring, 2007 Report*. Prepared for Hibernian Wind Power.

Biosphere Environmental Services (2009) *Derrybrien Wind Farm, Hen Harrier Monitoring, 2009 Report*. Prepared for Hibernian Wind Power.

Biosphere Environmental Services (2011) *Derrybrien Wind Farm, Hen Harrier Monitoring, 2011 Report*. Prepared for Hibernian Wind Power.

Biosphere Environmental Services (2015) *Derrybrien Wind Farm, Hen Harrier Monitoring, 2015 Report*. Prepared for Hibernian Wind Power.

BTHK. (2018) *Bat Roosts in Trees – A Guide to Identification and Assessment for Tree-Care and Ecology Professionals*. Exeter: Pelagic Publishing.

Caravaggi, A., Irwin, S., Lusby, J., McCarthy, A., Mee, A., Nagle, T., & O'Halloran, J. (2020a). Forest management and Hen Harrier *Circus cyaneus* conservation in Ireland. Irish Birds 42: 1–12 (2020a)

Caravaggi, A., Irwin, S., Lusby, J., Ruddock, M., A., Mee, A., Nagle, T., O'Toole, L., O'Neill, S. & O'Halloran, J. (2020b). Anthropogenic pressures within the breeding range of the Hen Harrier *Circus cyaneus* in Ireland, Bird Study

Carrs, D.N. (1995). Foraging behaviour and feeding ecology of the otter *Lutra lutra*: A selective review. *Hystrix*, 7 179-194.

CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd edition. (Chartered Institute of Ecology and Environmental Management).

Collins, J. (ed) (2016) *Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn)*. The Bat Conservation Trust, London.

Colhoun, K. & Cummins, S. (2013) Birds of conservation concern in Ireland 2014-2019. *Irish Birds* 9 (4): 523-544.

Corr na Gaoithe Teo (2000) Environmental Impact Statement for a proposed wind farm containing 10 No. 0.66 Mega Watt (Mw) wind turbines at Sonnagh Wind Farm, Loughrea, Co. Galway

Curtis, T.G.F. and McGough, H.N. (1988). *The Irish Red Data Book: 1 Vascular Plants.* Wildlife Service Ireland, The Stationery Office, Dublin.

Department of Agriculture, Food and the Marine, "Felling and Reforestation Policy", May 2017.

Department of Arts Heritage and the Gaeltacht (2011) Irelands National Biodiversity Plan: Actions for Biodiversity 2011 – 2016;

Department of Environment, Heritage and Local Government (2009) Appropriate Assessment of Plans and Projects in Ireland. Guidance for Planning Authorities. See www.npws.ie

De Lucas, M., Janss, G.F.E. & Ferrer, M. (2007) *Birds and Wind Farms*. Quercus. 275 pp.

Drewitt, A.L. & Langston, R.H. (2006) Assessing the impacts of wind farms on birds. *Ibis* 148: 29-42.

Drewitt, A.L. & Langston, R.H. (2008) Collision effects of wind power generators and other obstacles on birds. *Annals of the New York Academy of Sciences* 1134: 233-266.

Dietz, C., Helversen, O. & Nill, D. (2009). *Bats of Britain, Europe and northwest Africa*. A&C Black Publishers ltd. ISBN 9781408105313.

Dietz, C. & Keifer, A. (2016) *Bats of Britain and Europe*. Bloomsbury. ISBN 978-1-4729-2202-1

Douglas, D.J. Bellamy, P.E. & Pearce-Higgins J.W. (2011) Changes in the abundance and distribution of upland breeding birds at an operational wind farm. *Bird Study* 58: 37-43.

Dürr, T. (2019) [online] *Bat fatalities at wind turbines in Europe*. https://lfu.brandenburg.de/cms/detail.php/bb1.c.312579.de. Accessed 30/04/2020

Dürr T. & Bach L. (2004). Bat deaths and wind turbines: a review of current knowledge, and of the information available in the database for Germany. Bremer Beiträge für Naturkunde und Naturschutz 7:253–264.

EPA (Draft 2017). Guidelines on the information to be contained in Environmental Impact assessment reports. [Online] https://www.epa.ie/pubs/advice/ea/EPA%20EIAR%20Guidelines.pdf Accessed 12/02/2020

EPA (2015) Advice notes on current practice (in the preparation of Environmental Impact Statements) Draft September 2015;

European Commission (2013) Interpretation Manual of European Union Habitats. European Commission, DG Environment.

European Communities (Environmental Impact Assessment) (Agriculture) Regulations 2011 [S.I. No. 456 of 2011];

The European Communities (Birds and Natural Habitats) Regulations 2011 [S.I. No. 411 of 2011].

European Union (Environmental Impact Assessment and Habitats) Regulations 2011 [S.I. No. 473 of 2011];

European Union (Environmental Impact Assessment and Habitats) Regulations 2012 [S.I. No. 246 of 2012];

Fairley, J.S and Murdoch, B. (1989) Summer food of otters in the Lakes of Killarney. *Irish Naturalists Journal*. 23, 38-41

Fernandez-Ballon, Irwin, S., Wilson, M & O'Halloran, J. (2015) Reproductive output of Hen Harriers Circus cyaneus in relation to wind turbine proximity. *Irish Birds* 10: 143-150.

Ferrer, M. & Janss, G.F.E. (1999) *Birds and Power Lines. Collision, Electrocution and Breeding*. Madrid, Quercus.

Flora (Protection) Order, 2015 S.I. No. 356/2015

Frost. D. (2008) The use of 'flight diverters' reduces mute swan collision with power lines at Abberton Reservoir, Essex, England. *Conservation Evidence* 5: 83-91.

Fossitt, J. (2000) A Guide to Habitats in Ireland. The Heritage Council Ireland.

Garvin, J. C., Jennelle, C. S., Drake, D. & Grodsky, S. M. 2011. Response of raptors to a wind farm. Journal of Applied Ecology 48: 199-209.

Galway Planning Application search [Online] http://www.galway.ie/en/services/planning/onlineplanningsystems/ Accessed 23/11/2019

Hayden, T. J., & Harrington, R. (2000). Exploring Irish Mammals. Town House;

Hundt L (2012) Bat Surveys: Good Practice Guidelines, 2nd edition, Chapter 10: Surveying proposed onshore wind turbine developments. [online] https://bit.ly/BCT_2012 accessed 29/04/2020

Hutchinson, C.D. 1989. Birds in Ireland. Poyser, London

Inis Environmental Services (2004a). Ecological Impact Assessment of Emergency and Stabilisation Work at Derrybrien Bog Slide Area. March 2004.

Inis Environmental Services (2004b). Derrybrien Windfarm Peat Slip Environmental Impact Assessment on the Owendalulleegh River. March 2004.

Inis Environmental Services (2004c). Impact assessment of Derrybrien Peat Slide on habitats, cormorants and Bat fauna of Lough Cutra, County Galway.

Inis Environmental Services (2004d). Summer assessment of the lesser horseshoe bat roost at Lough Cutra demesne.

Inis Environmental Services (2005). Ecological Recovery of Peat Slip Area at Derrybrien, Monitoring Survey. November 2005.

Irwin, S., Wilson, M. W., Kelly, T. C., O'Mahony, B., Oliver, G., Troake, P., Ryan, B., Cullen, C., O'Donoghue, B. & O'Halloran, J. 2011. The breeding biology of Hen Harriers in Ireland over a five year period. *Irish Birds* 9: 165-172.

Irwin, S., Wilson, W., O'Donoghue, B., O'Mahony, B., Kelly, T., O'Halloran, J. (2012). Optimum scenarios for Hen Harrier Conservation in Ireland; Final Report 2012. Prepared for the Department of Agriculture, Food and the Marine by the School of Biological, Earth and Environmental Sciences, University College Cork.

Jenkins, A.R., Smallie, J.J. & Diamond, M. (2010) Avian collisions with power lines: a global review of causes and mitigation with a South African perspective. *Bird Conservation International* 20: 263-278.

Johnson, G. D., Erickson, W. P., Strickland, M. D., Good, R. E. & Becker, P. 2001. Avian and bat mortality associated with the initial phase of the Foote Creek Rim Windpower Project, Carbon County, Wyoming. Technical Report prepared by WEST, Inc. 32pp.

Kruuk, H., Conroy, J.W.H., and Moorhead, A. (1991) Recruitment to a population of otters (*Lutra lutra*) in Shetland, in relation to fish abundance. Journal of Applied Ecology, 28, 95-101.

Kennedy, P.G., Ruttledge, R.F. & Scroope, G.F. (1954) *The Birds of Ireland*. Oliver & Boyd, Edinburgh.

Lawton C., Hanniffy, R., Molloy, V., Guilfoyle, C., Stinson, M. & Reilly, E. (2020) All-Ireland Squirrel and Pine Marten Survey 2019. Irish Wildlife Manuals, No. 121. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht, Ireland.

Leddy, K. L., Higgins, K. F. & Naugle, D. E. 1999. Effects of wind turbines on upland nesting birds in conservation reserve program grasslands. Wilson Bulletin 11: 100-104.

Lusby, J., Fernandez-Bellon, NOrriss, D., Lauder, A. (2011) Assessing the effectiveness of monitoring methods for Merlin in Ireland: the Pilot Merlin Survey 2010. *Irish Birds* 9: 143-154.

McCarthy Keville O'Sullivan (2015) Ballynakill Quarry Extension Environmental Impact Statement.

Madden, B. & Lovatt, J.K. (2016) Recovery of breeding populations of Skylark, Wren, Stonechat and Meadow Pipit after the extreme cold winters of 2009/10 and 2010/11 at Bellacorick cutaway bog, County Mayo. Irish Birds 10: 359-364

Madden, B. & Porter, B. (2007) Do wind turbines displace Hen Harriers *Circus cyaneus* from foraging habitat? Preliminary results of a case study at the Derrybrien wind farm, County Galway. *Irish Birds* 8: 231-2360

Madders, M. (2000) Habitat selection and foraging success of Hen Harriers *Circus cyaneus* in west Scotland. *Bird Study* 47: 32-40.

Madders, M. & Whitfield, D.P. (2006) Upland raptors and the assessment of wind farm impacts. *Ibis* 148: 43–58.

Marnell., F., Kingston, N. & Looney, D. (2009) *Ireland Red List No. 3: Terrestrial Mammals*. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.

Martin, G.R. & Shaw J.M. (2010) Bird collisions with power lines: Failing to see the way ahead? Biological Conservation 143: 2695-2702.

Masterson, M., Buckley, D., O'Brien, M. & Kelleher, C. (2008) *An investigation into bridge usage by bats within the Sullane & Laney River Catchments, County Cork*. Cork County Bat Group.

Mathews, F.; Richardson, S.; Lintott, P.; Hosken, D. (2016). *Understanding the Risk of European Protected Species (Bats) at Onshore Wind Turbine Sites to Inform Risk Management.* Report by University of Exeter. Report for RenewableUK, . Report for UK Department of Energy and Climate Change (DECC).

McAney, K. (2006) A conservation plan for Irish vesper bats. *Irish Wildlife Manuals, No. 20*. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

McDevitt, A. D., Kajtoch, Ł., Mazgajski T. D., Carden, R. F., Coscia I., Osthoff, C., Coombes, R. H. & Wilson, F. (2011) The origins of Great Spotted Woodpeckers *Dendrocopos major* colonizing Ireland revealed by mitochondrial DNA. *Bird Study*, 58:3, 361-364

McGuinness, S., Muldoon, C., Tierney, D., Cummins, S., Murray, A., Egan, S. & Crowe, O. (2015) Bird Sensitivity Mapping for Wind Energy Developments and Associated Infrastructure in the Republic of Ireland. Guidance Document. BirdWatch Ireland, Wicklow.

Meek, E.R., Ribbands, J.B., Christer, W.G., Davy, P.R. & Higginson, I. (1993) The effects of aero-generators on moorland bird populations in the Orkney Islands, Scotland. *Bird Study* 40: 140-143.

Moran, P. and Wilson-Parr R. (2015) Hen Harrier Special Protection Areas Habitat Mapping Project 2014. Irish Wildlife Manual No. 83. NPWS, Department of Arts, Heritage and the Gaeltacht.

Mortimer, G. (2006) Foraging, roosting and survival of Natterer's bats, Myotis Nattereri, in a commercial coniferous plantation. Phd Thesis. [online] http://hdl.handle.net/10023/6483

National Biodiversity Network Centre [Online] http://maps.biodiversityireland.ie/#/Map Accessed 21 October 2019

Natural England (2014). Technical Information Note TIN051 Bats and onshore wind turbines (Third edition). [Online] http://publications.naturalengland.org.uk/publication/35010 Accessed: October 2019

NPWS (2003) Recommended Methodology for Assessment of Impacts of Proposed Wind farms on Breeding Hen Harrier within the Known Range of the Species in Ireland. NPWS, Unpublished Draft 12/03/03.

NPWS (2016) Lough Cutra SAC Site Synopsis [online] [https://www.npws.ie/protected-sites/sac/000299 Accessed 21 October 2019](https://www.npws.ie/protected-sites/sac/000299)

NPWS (2015) Slieve Aughty Mountains SPA Site Synopsis. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht.

NPWS (2019a). The Status of EU Protected Habitats and Species in Ireland. Volume 1: Summary Overview. Unpublished NPWS report. Edited by: Deirdre Lynn and Fionnuala O'Neill

NPWS (2019b). The Status of EU Protected Habitats and Species in Ireland. Volume 2: Habitat Assessments. Unpublished NPWS report. Edited by: Deirdre Lynn and Fionnuala O'Neill

NPWS (2019c). The Status of EU Protected Habitats and Species in Ireland. Volume 3: Species Assessments. Unpublished NPWS report. Edited by: Deirdre Lynn and Fionnuala O'Neill

National Roads Authority (2009) Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (Transport Infrastructure Ireland (formerly the National Roads Authority);

National Roads Authority (2006a) Guidelines for the Treatment of Badgers prior to the Construction of National Road Schemes;

National Roads Authority (2006b) Guidelines for the Treatment of Otters prior to the Construction of National Roads Schemes;

National Roads Authority (2006c) Guidelines for the Treatment of Bats during the Construction of National Roads Schemes;

Newton, S., Donaghy, A., Allen, D. & Gibbons, D. (1999) Birds of Conservation Concern in Ireland. *Irish Birds* 6: 333-344.

Norriss, D.W., Marsh, J., McMahon, D. and Oliver, G.A. (2002) A national survey of breeding Hen Harriers *Circus cyaneus* in Ireland 1998-2000. *Irish Birds* 7: 1-10.

O'Donoghue, B. (2010) The Hen Harrier *Circus cyaneus* in Ireland; its ecology and conservation. Unpublished Ph.D. thesis, University College Cork.

O'Donoghue, B. (2019) *Irish Hen Harrier Winter Survey. Survey Guide.* National Parks and Wildlife Service.

Ottino, P. and Giller, P. (2004) Distribution, density, diet and habitat use of the otter in relation to land use in the Araglin valley, southern Ireland. *Biology and Environment: Proceedings of the Royal Irish Academy*, 104B, 1-17

Parnell, J. and Curtis, T. Webb's An Irish Flora (8th edition)

Pearce-Higgins, J.W., Stephen, L, Langston, R.H.W., Bainbridge, I.P., & Bullman, R. (2009) The distribution of breeding birds around upland wind farms. *Journal of Applied Ecology* 46: 1323-1331.

Pearce-Higgins, J.W., Stephen, L., Douse, A. & Langston, R.H.W.. 2012. Greater impacts of wind farms on bird populations during construction than subsequent operation: results of a multi-site and multi-species analysis. *Journal of Applied Ecology* 49: 386-394.

Percival, S.M. (2005) Birds and wind farms : what are the real issues ? *British Birds:* 98: 194-204.

Prinsen, H.A.M., Smallie, J.J., Boere, G.C. & Pires, N. (eds.) (2011) *Guidelines on how to avoid or mitigate impact of electricity power grids on migratory bird in the African-Eurasian region.* Bonn: AEWA Conservation Guidelines No. 14, CMS Technical Series No. 29, AEWA Technical Series No. 50, CMS Raptors MOU Technical Series No. 3. t.

Rees, E.C. (2012) Impacts of wind farms on swans and geese: a review. *Wildfowl* 62: 37-72.

Reid, N., Hayden, B., Lundy, M.G., Pietravalle, S., McDonald, R.A. and Montgomery, W.I. (2013) National Otter Survey of Ireland 2010/12. *Irish Wildlife Manuals No. 76*. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

Roche, N., Langton, S., Aughney, T., Russ, J.M., Lynn, D. and Catto, C. (2011) A car-based monitoring method reveals new information on bat populations and distributions in Ireland. *Animal conservation*. 14: 642–651

Roche, N., Aughney T. and Langton S. (2015) Lesser horseshoe bat: population trends and status of its roosting resource. *Irish Wildlife Manuals, No. 85.* National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Ireland.

Rodrigues, Luisa & Bach, Lothar & Dubourg-Savage, Marie-Jo & Karapandža, Branko & Rnjak, Dina & Kervyn, Thierry & Dekker, Jasja & Kepel, Andrzej & Bach, Petra & Collins,, J. & Harbusch,, C. & Park, Kirsty & Micevski, Branko & Minderman, J.. (2015). Guidelines for consideration of bats in wind farm projects Revision 2014. [online] https://bit.ly/Eurobats2014 accessed 29/04/2020

Rose, Paul & Ballie, Stephen (1989) The Effects of Collisions with Overhead Lines on British Birds: An Analysis of Ringing Recoveries. BTO Research Report no. 42. BTO, Hertfordshire.

Ruddock, M. & Whitfield, D. (2007) A review of disturbance distances in selected bird species. A report for Natural Research Ltd. to Scottish Natural Heritage. 182 pp.

Ruddock, M, Dunlop, B.J., O'Toole, L., Mee, A., & Nagle, T. (2012*) Republic of Ireland National Hen Harrier Survey 2010.* Irish Wildlife Manual No. 59. NPWS, Dublin.

Ruddock, M, Dunlop, B.J., O'Toole, L., Mee, A., & Nagle, T. (2016*) The 2015 National Survey of Breeding Hen Harrier in Ireland.* Irish Wildlife Manual No. 93. NPWS, Dublin.

Ruiz Olmo, J., Batet, A., Jimenez, J. and Martinez, D. (2005) Habitat selection by female otters with small cubs in freshwater habitats in northeast Spain *Lutra* 48, 45-56

Ruiz-Olmo, J., Batet, A., Manas, F. and Martinez-Vidal, R. (2011) Factors affecting otter abundance and breeding success in freshwater habitats in the northeastern Iberian Peninsula. *European Journal of Wildlife Research*, 57, 827-842.

Scannell, M.J.P. and Synnott, D. (1987). *Census Catalogue of the Flora of Ireland*. 2nd edn. Stationery Office, Dublin.

Schofield, H. W. and Mitchell-Jones A. J. (2003) *The Bats of Britain and Ireland*. Vincent Wildlife Trust, London.

Scott, D. & McHaffie, P. (2008) Hen Harrier killed at wind farm site in County Antrim*. Irish Birds* 8: 436-437.

Scottish Natural Heritage, Natural England, Natural Resources Wales, Renewable UK, Scottish Power Renewables, Ecotricity Ltd, the University of Exeter and the Bat Conservation Trust (2019) Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation. [online] https://bit.ly/SNH_batsandwind farms_2019 accessed 29/04/2020

SNH (2017). *Recommended bird survey methods to inform impacts assessment of onshore wind farms.* SNH Guidance Note. Version 2.

SNH (2016a) *Assessing Connectivity with Special Protection Areas (SPAs). Guidance.* Version 3.

SNH (2016b). *Assessment and mitigation of impacts of power lines and guyed meteorological masts on birds. Guidance*. Version 1.

Shiel, C., Shiel, R., & Fairley, J. (1999). Seasonal changes in the foraging behaviour of Leisler's bats (Nyctalus leisleri) in Ireland as revealed by radio-telemetry. Journal of Zoology, 249(3), 347-358. doi:10.1111/j.14697998.1999.tb00770.x

Sleeman, D.P. and Moore, P.G. (2005) Otters Lutra lutra in Cork City. *Irish Naturalists Journal*, 28. 73-79

Smallwood, K.S. & Karas, B. (2008) Avian and bat fatality rates at old-generation and repowered wind turbines in California. The Journal of Wildlife Management 73: 1062-1071.

Smallwood, K.S. & Thelander, C.G. (2004) Developing methods to reduce bird mortality in the Altamont Pass Wind Resource Area. Final Report by BioResource Consultants to the California Energy Commission, Public Interest Energy Research Environmental Area. Contract No. 500-01-019.

Smith, G. F., O' Donoghue, P., O' Hora, K. & Delaney, E,. (2011). Best practice guidance for habitat survey and mapping, Heritage Council, Kilkenny.

Watson, D. (1977) *The Hen Harrier*. Poyser, Berkhamsted.

Watson, A. & Moss, R. 2008. *Grouse. The Natural History of British and Irish Species*. The New Naturalist Library. Collins, London.

Whelan, P. (2011). Lichens of Ireland – an illustrated introduction to over 250 species The Collins Press, Cork, 2011. Illus. 160 pp.

Whitfield, D.P. & Madders, M. (2006a) Flight height in the Hen Harrier and its incorporation in wind turbine collision risk modelling. Natural Research Information Note 2. Natural Research Ltd., Banchory, UK.

Whitfield, D.P. & Madders, M. (2006b) A review of the impacts of wind farms on Hen Harriers. Natural Research Information Note 1 (revised). Natural Research Ltd., Banchory, UK. 32pp.

Wilson, F. (2012). Derrybrien Wind Farm Bat Assessment. Provided to ESB International Consulting Engineers in draft.

Wilson, M., Irwin, S., Norriss, D.W., Newton, S.F., Collins, K., Kelly, TC, & O'Halloran, J. (2009) The importance of pre-thicket conifer plantations for nesting Hen Harriers *Circus cyaneus* in Ireland. *Ibis* 151: 332-343.

Wilson, M., Fernandez-Bellon, D., Irwin, S., & O'Halloran, J. (2015) The Interactions between Hen Harriers and Wind Turbines. WINDHARRIER. Final Project Report. January 2015. School of Biological, Earth & Environmental Sciences, University College Cork, Ireland.

Wray, S., Wells, D., Long, E. & Mitchell-Jones, T. (2010) Valuing Bats in Ecological

ECOLOGICAL RECOVERY OF PEAT SLIDE AREA AT DERRYBRIEN, CO. GALWAY

A MONITORING SURVEY

OCTOBER 2004

Prepared for: **ESBI, Stephens Court, Stephens Green, Dublin 2.**

Prepared by: **INIS Environmental Services, Edenvale, Ennis, County Clare.**

CONTENTS

1 INTRODUCTION

Inis Environmental Services have been commissioned to carry out monitoring on the ecological recovery of an area impacted on by a peat slip at Derrybrien, Co. Galway. This document reports on the ecological status of the slip area in October 2004 and reports on any changes that have occurred since an earlier survey in February 2004 (Inis Environmental Services 2004). The major peat slip occurred at the site during October 2003.

2 METHODOLOGY

2.1 Field Survey Work

A field survey was carried out during September / October 2004. The area from the windfarm site to the lower stretches of the Owendallulleegh River (See Figure 1) was walked and target notes made on sites that were being re-colonised by vegetation. Photographs were taken along the route so that a visual record could be kept and compared with photographs taken in February 2004.

2.1 Survey Personnel

This survey was carried out by INIS Environmental Services personnel. Mr. Howard Williams B.Sc. MIEEM specialising in aquatic ecology and Mr Patrick Crushell M.Sc. B.Sc. specialising in blanket bog ecology completed the survey.

3 RESULTS

Please note: Below, in normal text, are descriptions of the ecology along the survey area as of February 2004. A description of the changes, if any, that have occurred in the period February to October 2004 are presented in bold text within each section.

3.1 Windfarm Site to Flaggy Bridge

The area of the peat-slide from the windfarm site to Flaggy Bridge is split into Area I, II, III and IV (see Figure 2) as was done in the previous report on the ecological impacts of the peat slip event (Inis Environmental Services 2004).

Area I: Windfarm Site to Main Boulder Barrage (BD10)

The habitat of this area prior to the peat slide comprised plantation coniferous forestry, of different aged stands. In the upper areas of the peat slip much of the surface peat and vegetation remains *in situ* although obvious movement has taken place. It is estimated that more than 50% of the area has a cover of live vegetation compared to only 10% further down stream. The bare peat areas that exist along the path of the slide in this location are totally denuded of vegetation. At the time of the survey there was no evidence of mosses or vascular plants having colonised these areas.

The situation is similar in October 2004; throughout the growing season there has been much growth of vegetation where it remains intact since the slide. The bare peat areas remain largely un-vegetated. It is likely that as a result of the relatively harsh climate at this altitude, it may take longer for bare peat areas to re-vegetate than on lower ground. The bare peat areas remain saturated throughout. Little streamside vegetation has established.

There is one small narrow stream (<50cm wide and c.20cm deep) formed in the northern areas within the windfarm site but this appears to split into a number of streams further downhill or possibly other streams originate in the path of the slide further down stream. Further down the slope from the windfarm site the situation changes and less of the surface peat remains in place (Grid Reference: 59743 04109).

North of the main boulder barrage (BD10) the land is largely bare of peat and is presently stripped to the underlying mineral soil and bedrock. There are a few clumps of vegetated surface peat that came to rest in the area (probably originated from further up the peat slide). The peat that was once in the area appears to have been carried downstream from this area. Mature displaced Spruce and Pine trees litter the area. Few isolated trees remain in situ.

In the area just north of the Main Barrage (BD10) there are three newly formed streams. There is no peat remaining in the path of these streams, which now run over a fine silt-sand substrate. In steeper areas the substrate changes to bare rock surfaces. On the day of the survey the water of the streams appeared clear indicating that low levels of peat are present in the water but it should also be noted that water levels were also low following a relatively dry period. Most of the peat that remains in the area is relatively shallow black peat. Other peat clumps that originate from surface peat that is deposited in places are firm un-humified brown peat. The peat clumps that are present in the area have surface vegetation remaining intact although they may not have come to rest upright.

Eighty to ninety per cent of the area in this location is bare peat and underlying mineral soil (an estimated 20% of which comprises stripped mineral subsoil and bare rock). Only c. 10 % of the area comprises deposited surface peat vegetation clumps.

There are no major peat deposits on the northern side of the main boulder barrage (BD10). This is probably due to the fact that the dam was installed after the major peat slip occurred and was built as a preventative measure in case of future peat slides.

There has been only sparse re-vegetation of bare peat areas in this area of the peat slide. One species, Bulbous Rush, in particular was recorded re-colonising the bare peat areas. In areas where the underlying mineral soil are exposed at the surface there has also been little colonisation by vegetation, species that were recorded in these areas include Common Reedmace, Soft Rush and the moss Polytrichum strictum. Some areas of black peat are after drying out considerably and are relatively firm underfoot.

Area II: Main Boulder Barrage (BD10) to Gorge Boulder Dam (BD1)
Just South of the main boulder barrage much of the area is similar to that just described North of the barrage with the land being relatively bare of peat and now stripped to the underlying mineral soil and bedrock. The peat in the area is relatively shallow, estimated to be less than 1 metre in depth. There are a few clumps of vegetated surface peat that came to rest in the area (probably originated from further up the peat slide). The peat that was once in the area appears to have been carried downstream from this section of the peat slip. Mature displaced Spruce and Pine trees litter the area. Few isolated trees remain *in situ*. On the northern side of the dam inserted at the gorge (BD1) there is an area of deep peat that has built up since the dam was put in place, this peat appears to be well-humified 'black peat'.

The area just South of the main boulder barrage has been relatively well re-vegetated, with Bulbous Rush growing throughout. Soft Rush and Purple Moor-grass are also common re-colonising the bare peat areas. Some local areas have up to 80% cover of herb vegetation.

There remains a major deposit of black peat just North of the dam inserted at the Gorge, this peat is saturated and has not re-colonised by vegetation. It occurs in the middle of the stream and therefore is expected to remain saturated.

Area III: Gorge Boulder Dam (BD1) to Black Bridge
Much of this area was not surveyed because of access difficulties. There is little peat present in the area just to the south of the gorge dam (BD1). The area near the gorge has a steep incline and the peat slide would have moved rapidly through the narrow channel area. There is a light scattering of peat on the sides of the channel where it is possible to make out the level that the peat slide reached as it passed through the gorge. The banks of the stream in this area are steep and comprise a shallow wet heath type habitat dominated by Ling Heather and Purple Moor-grass with mineral influences from the mineral soil evident by the abundance of grasses and other minerotrophic species. This habitat appears to have remained largely intact following the peat slide.

The peat in this area has been re-colonised by original bank vegetation and there is little evidence of the major peat slide incident.

To the Northern side of the Black Bridge there are considerable quantities of peat and large surface peat clumps deposited. Galway County Council had constructed two earthen dams just north of the Black Road Bridge to slow the peat slip. Displaced peat mounded in the area above these dams, which were subsequently overtopped. It appears that the area where most of this peat has been deposited was a natural river channel with wet grassland on a mineral based soil on either bank and adjoining fields prior to the peat slide episode (based on local information and surveying of adjoining lands). The area was probably used for agriculture. Based on the flora of the adjoining fields the vegetation of the area would have been dominated by grass species such as Yorkshire Fog and Soft Rush with an abundance of species such as Creeping Buttercup.

Peat has deposited at different depths in this area depending on the underlying topography. In areas of shallow peat it is evident that the original vegetation of Soft Rush is already appearing up through the surface at the time of survey.

There has been some land clearance in the area to the East of the river by heavy machinery as part of emergency drainage works. Some peat has been placed in 'lagoon' like features after being cleared. A diversion channel has been dug in a successful attempt to direct the river away from the large peat mass that has deposited in the area.

There has been considerable work carried out in this area. To the east of the stream much of the peat has been removed and mixed with soil. The area on the eastern side of the stream is showing signs of good recovery with species such as Soft Rush and Yorkshire Fog growing throughout.

There remains large peat deposits to the West of the present course of the stream, while Soft Rush and Bulbous Rush is growing throughout, the peat mass remains saturated and hazardous to traverse on foot.

Area IV Black Road Bridge to Flaggy Bridge

There are two dams installed between Black Road Bridge and Flaggy Bridge, the first boulder dam (BD4) and the second boulder dam (BD5). The river passes through a dense mature conifer plantation immediately South of Black Bridge and therefore access to these areas proved difficult. Considerable depths of peat have also been deposited by the slide on each side of the river, which made the area very difficult to survey and treacherous.

There are few noticeable changes since the time of the original survey in February 2004. Some peat deposited in the area has dried out but vegetation cover is less than 20% on the bare peat areas. Little streamside vegetation has become established.

From what was surveyed it is apparent that large deposits have resulted on each river-bank around the base of trees within the plantation and in the river channel, this continues down as far as the first dam (BD4) South of Black Bridge. Immediately North of this dam the peat depth is considered to be extremely deep and appears to be highly humified black peat with high water content. The main concern in this area should be safety; this area of deep peat is a hazard.

Little has changed since the time of the original survey in February 2004. There is very little re-vegetation of the bare peat areas.

There is little vegetation in the area South of the first dam (BD4) and the river appears in good condition although a light cover of peat has been deposited in places.

Immediately to the North of the second dam (BD5) there is a deposit of peat extending 20m into the conifer plantation on each bank of the river. This peat appears to be at least 1 metre deep in places.

The situation remains similar in October 2004 with a deposit of black peat to the North of BD5, the significant deposit remains saturated and has little re-vegetation.

At the second dam (BD5) there is a deposit of deep black peat to the East of the dam. The area just south of the second dam (BD5) has a peat deposit (approximately 8m in width) on the western side of the river. Otherwise there is very little peat deposit between this dam and Flaggy Bridge, the lower banks of the river are washed clear of peat, further up the banks the natural Wet Heath vegetation dominated by Purple Moor-grass and Ling Heather was recorded and appears to have survived the disturbance of the peat slide.

The area immediately North of Flaggy Bridge has small quantities of peat deposited on western side of river. There has been land clearance in this area since the bog slide. An earthen dam constructed by Galway County Council at this location has been removed. It is evident that vegetation is already colonising much of the area with fresh growth of Soft Rush, Grasses, Creeping Buttercup and Dock species recorded.

The peat deposits remain at BD5 and little vegetation has colonised these deposits, the peat is saturated and liquid in consistency. The area just North of Flaggy Bridge has recovered well and there are no major deposits of peat present, the riverbank has re-vegetated particularly well.

3.2 Flaggy Bridge to Lough Cutra

This survey was carried out during mid September 2004, almost 12 months since the peat slide event.

The area that saw the most peat deposition, during the peat slip event, (approx. 2000 m^3 – estimated by ESBI engineers) was the area from Flaggy Bridge to the confluence of the Owendallulleegh River at Derrybrien East (Grid. Ref. M612 012). From this point to Lough Cutra there was peat deposited at various bends in the river and also in some low lying fields that are prone to flooding under spate conditions.

There has been considerable re-vegetation and stabilization of any remaining peat deposits that are present along the banks of the river and this is especially obvious at the areas where most deposited peat was observed in February 2003 (See plates 14 –17). The peat that was deposited at the time of the peat slip on the riverbanks was black peat with high water content and had a liquid consistency. In the most part these peat deposits have dried out considerably and much of the fine organic peat particles have been washed away by precipitation leaving behind clear areas with some peat clumps that mainly have a matted root structure (See plates 20 & 21). This peat is firm and being colonised by vegetation relatively quickly by species including Soft Rush, Bulbous Rush, Bramble and grass species including Purple Moor-grass and Yorkshire Fog. Revegetative cover is estimated to be >80% on most of the peat deposits from Flaggy Bridge to Lough Cutra.

Fish (Brown Trout) were recorded feeding on fly life along the river as far upstream as the confluence of the Owendallulleegh at Derrybrien East. Otters are active along the entire length of the river but especially around the townland of Inchamore - Grid square 56 99.

There is little evidence of the peat slip on the lower sections of the river apart from the occasional small peat deposit along the banks that have been colonised by vegetation. All the fords crossing the river are now clear of peat however some low lying areas do still contain peat due to the fact that it is trapped behind a physical structure such as a bank of earth.

4 CONCLUSION

4.1 Windfarm Site to Flaggy Bridge

There have been few changes in the ecology of the areas affected by the peat slide within the past 6 months. As predicted the areas that appear slowest to re-vegetate are those comprising saturated 'black peat'. The bare peat areas at higher altitudes are re-vegetating at a slower rate than at lower altitudes, this is thought to be a result of harsher climatic conditions.

Large peat deposits remain up-stream of the boulder dams within the study area. These peat deposits may act as a source of further pollution of the Owendallulleegh River, it is recommended that the peat be removed from the stream channel. It may be necessary to divert the streams when this work is undertaken, consultation with the fisheries authorities should take place prior to any of this work commencing however. Vegetation has been slow to establish along the course of the newly formed streams in the upper areas of the peat slide.

4.2 Flaggy Bridge to Lough Cutra

The area from Flaggy Bridge to the confluence of the Owendallulleegh is an area of the river that experienced a lot of physical damage and deposition. From the findings of this monitoring survey it is clear that this area is revegetating and rehabilitating well with >80% cover already achieved in most areas.
There is good re-vegetation of bare peat areas locally along the length of the Owendallulleegh River also; it is thought that these areas will continue to be re-vegetated at a faster rate as pioneer species have become established.

Along the entire length of the river the peat deposits have dried out considerably and been vegetated more so than further up the peat slip area. Presently any peat deposits along the river appear stable and pose little threat to the future ecological status of the river particularly because the finer peat sediment has mostly been washed downstream previously. As the riparian vegetation has become re-established the buffer that this provides will aid the recovery of the in-stream ecology.

It is felt that in time the revegetation of the survey area will be total and will revert to the original habitats found before the peat slip event.

REFERENCES

Curtis, T.G.F. and McGough, H.N. (1988). *The Irish Red Data Book. 1 Vascular Plants*. The Stationery Office, Dublin.

EPA (1995). *Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)*. Environmental Protection Agency, Wexford

EPA (2002). *Guidelines on the information to be contained in Environmental Impact Statements*. Environmental Protection Agency, Wexford.

Foss, P., O'Connell, C.A. and Crushell, P. (2001). *Bogs and Fens of Ireland Conservation Plan 2005*. IPCC, Dublin.

Fossitt, J.A. (2000). *A Guide to Habitats in Ireland*. The Heritage Council. Ireland.

IEA (Institute of Environmental Assessment) (1995). *Guidelines for Baseline Ecological Assessment.* E & FN Spon, London, UK.

IEEM (2002). *Guidelines for Ecological Evaluation and Assessment. Institute of Ecological and Environmental Management*, Draft Report.

Inis Environmental Services (2004). Ecological Impact Assessment Of Emergency And Stabilisation Works At Derrybrien Bog Slide Area.

JNCC (Joint Nature Conservation Committee) (1993). *Handbook for Phase 1 Habitat Survey*. Joint Nature Conservation Committee, Peterborough, UK.

JNCC (Joint Nature Conservation Committee) (1995). *Guidelines for Selection of Biological SSSIs*. Joint Nature Conservation Committee, Peterborough, UK.

Lindsey, R. (1995). *Bogs: The Ecology, Classification and Conservation of Ombrotrophic Mires*. Scottish Natural Heritage, Edinburgh.

MacDonald, A., Stevens, P., Armstrong, H., Immirzi, P. and Reynolds, P. *A Guide to Upland Habitats*. Scottish Natural Heritage, Edinburgh.

NPWS (1993). *National ASI Survey Guidelines for Ecologists.* Unpublished Working Document, National Parks and Wildlife Service, Dublin.

Scottish Natural Heritage (2001). *Guidelines on the Environmental Impacts of Windfarms and Small Scale Hydroelectric Schemes*. Scottish Natural Heritage, Edinburgh.

Stoneman R. and Brooks, S. (Eds.) (1997). *Conserving Bogs. The Management Handbook.* The Stationary Office, Edinburgh.

Webb, D.A., Parnell, J. and Doogue, D. (1996). *An Irish Flora* (7th edn). Dundalgan Press, Dundalk.

APPENDIX I

Scientific Names of Species Mentioned in Text

Table A1.1 Scientific Names of plants species mentioned in the text

Common English Name	Scientific Name
Bent Grass	*Agrostis stolonifera*
Bilberry	*Vaccinium myrtilus*
Bog Asphodel	*Narthecium ossifragum*
Bog Rosemary	*Andromeda polifolia*
Bracken	*Pteridium aquilinum*
Bramble	*Rubus fruiticosus agg.*
Bulbous Rush	*Juncus bulbosus*
Carnation sedge	*Carex panicea*
Common Cotton-grass	*Eriophorum angustifolium*
Common Reedmace	*Typha latifolia*
Cranberry	*Vaccinium oxycoccus*
Creeping Buttercup	*Ranunculus repens*
Cross-leaved Heath	*Erica Tetralix*
Crowberry	*Empetrum nigrum*
Deer-grass	*Scirpus caespitosus*
Dock	*Rumex spp.*
Moss	*Eurhynchium praelongum*
Hare's-tail Cotton-grass	*Eriophorum vaginatum*
Ling Heather	*Calluna vulgaris*
Lodge Pole Pine	*Pinus contorta*
Purple Moor-grass	*Molinia caerulea*
Moss	*Racomitrium lanuginosum*
Sitka Spruce	*Picea sitchensis*
Soft Rush	*Juncus effusus*
Bog Moss	*Sphagnum auriculatum*
Bog Moss	*Sphagnum capillifolium*
Bog Moss	*Sphagnum cuspidatum*
Bog Moss	*Sphagnum magellanicum*
Bog Moss	*Sphagnum papillosum*
Bog Moss	*Sphagnum subnitens*
Feather Moss	*Thuidium tamariscinum*
Tormentil	*Potentilla erecta*
Willowherb	*Epilobium sp.*
Yorkshire Fog	*Holcus lanatus*

APPENDIX II

Upstream of Flaggy Bridge
AREA I

Plate 1 (Feb 2004): In vicinity of windfarm site, high proportion of area comprises displaced surface peat when compared with further down slope.

Plate 2 (Oct 2004): Bare peat areas remain saturated and little vegetation has become established, Note the Purple Moor-grass spreading out from the surface brown peat clumps in the area.

Plate 3 (Feb 2004): North of main boulder dam, mostly bare mineral soil and patches of bare 'black' peat. Only a few clumps of 'brown' surface peat deposited in area.

Plate 4 (Oct 04): Same area as in Plate 3. Note the clumps of vegetation that have developed since February 2004 (mostly Purple Moor-grass and Bulbous Rush). The peat in this area has dried out somewhat and become firm.

AREA II

Plate 5 (Feb 2004 above) & 6 (Oct 2004 below). The vegetation has re-established extremely well in this area. South of the Main Boulder Dam.

AREA III

Plate 7 (Feb 2004 above) & 8 (Oct 2004 below): Peat deposition on lands just North of Black Bridge. The areas of black peat have re-vegetated well.

AREA IV

Plate 9 (Feb 04 above) & 10 (Oct 04 below): Peat deposition at 1st dam between Black Bridge and Flaggy Bridge. Note some of the mature conifers appear to have died as a result of the peat deposits. The deep peat deposit remains saturated and has a sparse cover of Bulbous Rush vegetation.

Plate 11: North of Flaggy Bridge (looking upstream, Oct 04). Note re-vegetation of the river banks in this area.

Plate 12: Photo illustrating the gradual colonisation of bare peat areas by Bulbous rush in Area I (Oct 04).

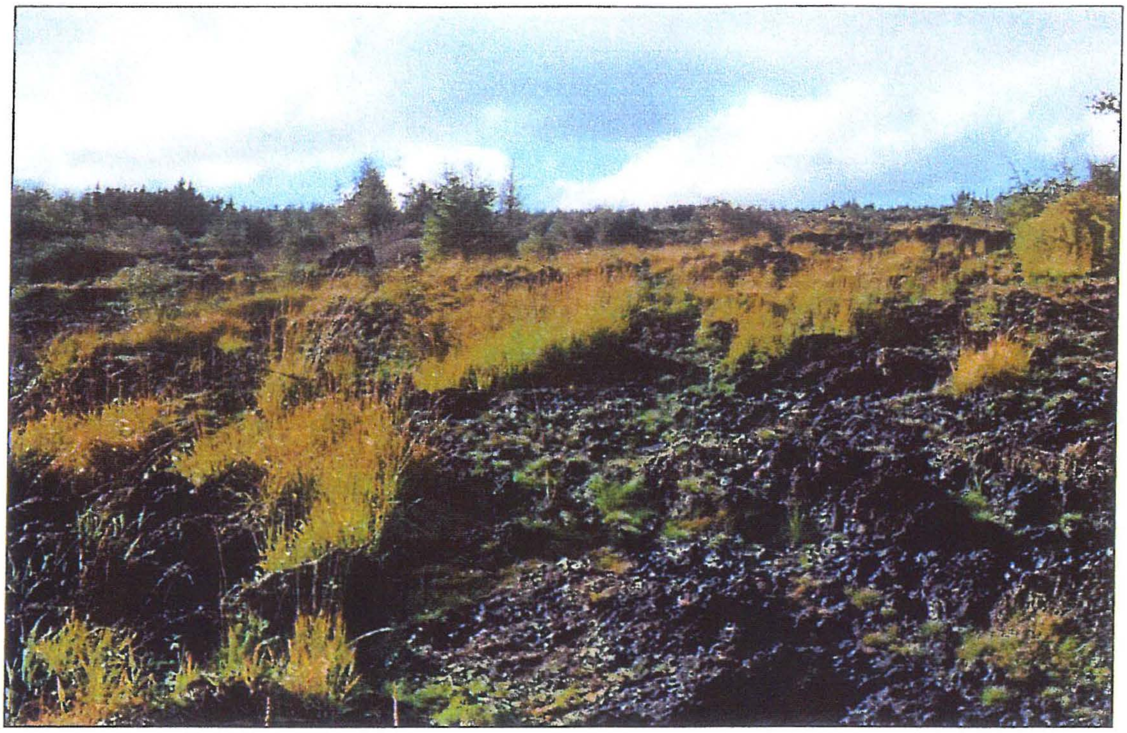


Plate 13: Illustrating the gradual colonisation of bare peat areas in Area II. It can be seen that vegetation comprising mainly Purple Moor-grass is spreading from the surface brow peat deposited in the area and other species including Bulbous Rush are vegetating the black peat areas in-between (Oct 04).

Downstream of Flaggy Bridge

Plate 14 (November 2003 above) & 15 (Sept. 2004 below): The photo ~~above~~ BELOW shows the vegetation recovery along the banks of the Owendallulleegh River at Grid ref. M612 014. The same stretch of river is shown ~~below~~ ABOVE shortly after the occurrence of the peat slip.

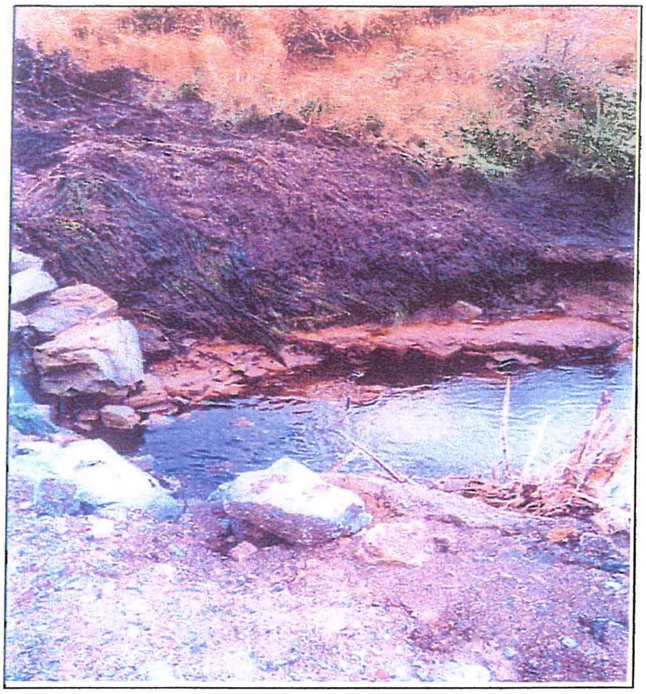


Plate 16 (November 2003 above) & 17 (Sept. 2004 below): Another 'before and after' shot of a site (173 metres south of Flaggy Bridge). Note the > 80% revegetation.

Plates 18 and 19: Flaggy Bridge downstream – right hand side bank. Large clumps of peat lying in field. The smaller fractions of organic peat have been washed away by precipitation leaving these root masses behind (Oct 04).

Plate 26: Confluence of Owendallulleegh River at Derrybrien East. Good numbers of Brown Trout were seen feeding on fly life here (Oct 04).

Plate 27: Grid ref. M 614 015 – This site recorded some of the largest peat deposits of the episode last year. This peat is revegetating slowly. There remains a significant depth of peat here (Oct 04).

Plates 24 and 25: Confluence of Owendallulleegh River at Derrybrien East. Some peat remains – the area to the immediate left of photo was under a significant amount of peat during December 2003. All that now remains is clumps that will take time to break down (Oct 04).

Plate 22: Photo showing that even larger masses of material are being revegetated at R574 997 (Oct 04).

Plate 23: R562 996. Photo showing that what remains after high precipitation and time is these clumps. These will break down in time. The smaller fractions of peat that made up the largest mass of material during the episode are not in evidence any more (Oct 04).

Plate 20: A peat clump, with all the fine sediment washed through, being overgrown with Bramble R614 018 (Oct 04).

Plate 21: Plants growing on peat sod R614 018 (Oct 04).

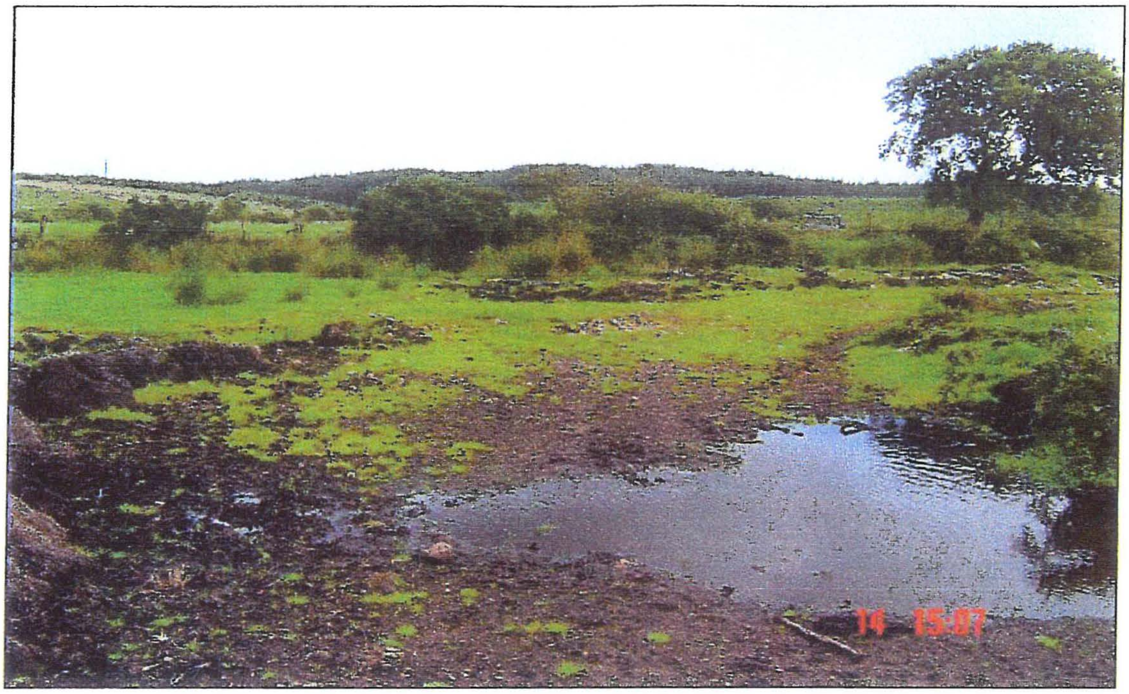
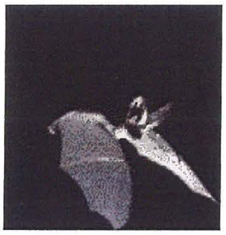


Plate 28: A ford on the banks of the Owendallulleegh River. This ford had a large quantity of peat deposited here during the peat slip event - it is now gone with the exception of clumps (Oct 04).

Summer assessment of the lesser horseshoe bat roost at Lough Cutra demesne

Inis Environmental Services, Edenvale, Ennis, County Clare.



September 2004

Introduction

A late winter assessment of the lesser horseshoe bat population of the Lough Cutra demesne was undertaken to identify the feeding activity of the bats and to confirm that the winter hibernaculum was still viable along the lake shore.

It became apparent from research on the bat fauna of the estate that no recent evidence was available relating to the summertime presence of the bats and that this was a major gap in the knowledge of the lesser horseshoe bats here.

The basis of this follow-up assessment is to examine the demesne for evidence of lesser horseshoe bats during the summer and if present to determine whether there is feeding associated with the lake.

Further to this, it is an aim of the study to examine all other bat activity upon the demesne and around the lake to provide evidence of any obvious disparity in bat feeding activity here in comparison with other water bodies and woodland examined formerly and in the current year by the author.

The presence of a number of bat species and of feeding activity especially close to the lake would assist in evaluating whether there is an unusually suppressed level of bat utilisation of the site.

This in turn would assist in interpreting whether there is reduced insect abundance of species of benefit to bat fauna associated with the land slide at Derrybrien.

This study deals only with the presence and activity of bats and does not address insect fauna directly.

Materials and Methods

Field equipment

QMC Mini3 ultrasonic heterodyne detector

Tranquility Transect Time expansion and heterodyne bat detector

Sony MiniDisc Recorder MZ-R700 and cable

Samsung Digimax 230 Digital Camera

Analysis equipment and editing software

Toshiba S2410-304 laptop computer

"Batsound" sound analysis software

Microsoft Picture It! Photo 7

An assessment to provide information on the summer bat fauna on the shores of Lough Cutra was carried out in August 2004. This is a period when bat activity is intense and bat numbers are high due to the recruitment of the year's offspring.

This is an ideal period to identify any severely negative effects upon the breeding success of bats in the immediate area of Lough Cutra.

A bat detector assessment of the Lough Cutra demesne was undertaken between August 8th and August 10th 2004. This involved a nighttime examination of all buildings upon the estate with special emphasis on the castle as this is the known site of the winter hibernaculum of the lesser horseshoe bat that is a central feature of the SAC.

Bat activity was monitored around the courtyard, stables, lodges and castle at a period when bats emerge from the roost (i.e. from approximately thirty minutes after sunset).

The farther shore of the lake was also examined for bat activity where access was possible to determine whether there was activity here also.

The whereabouts of the lesser horseshoe bat population in the summer period (i.e. the breeding site) was not known for several years prior to this study and one of the central investigations for this study was to determine if the bats were availing of the demesne throughout the year.

The castle was examined during the daytime and at night to check the basement, wine cellar, clock tower and all other accessible sites for evidence of or the presence of bats.

Residents and staff were questioned regarding any knowledge of bat roosts upon the estate.

Bat activity along the lakeshore and along paths through the woodland and forestry was assessed using bat detectors. All bats encountered were identified to species level and roosts were sought both by following the bats towards roosts and by examining buildings in the period prior to sunrise (a period of one and a half hours).

Roosts were not directly counted but an estimate of numbers of bats present was made for some of the roosts.

A final visit to count the lesser horseshoe bats present was undertaken on Saturday September 4th 2004.

Results

Species of bat present in Lough Cutra demesne

Lesser horseshoe bat	*Rhinolophus hipposideros*
Soprano pipistrelle	*Pipistrellus pygmaeus*
Common pipistrelle	*P. pipistrellus*
Leisler's bat	*Nyctalus leisleri*
Natterer's bat	*Myotis nattereri*
Daubenton's bat	*Myotis daubentoni*
Whiskered bat	*Myotis mystacinus*
Brown long-eared bat	*Plecotus auritus*

A spectrogram depicting ultrasonic signals of some of the species present upon the demesne is shown in Figure 1.

Lesser horseshoe bats were noted to be present upon the estate during the period of study. The bats were present in the boiler room up a chimney close to the boiler (see Figure 2). An attempt to count the bats at emergence time proved impossible as the bats repeatedly flew in and out of the windows, doorway and into the clock tower. It is probable that bats also emerged through a small gap surrounding the pipes where they entered from the clock tower (see Figure 3) as they were seen to return through this gap.

A visual examination of the chimney during daytime yielded an estimate of fifty bats approximately including a number of juvenile bats (offspring from this summer). At least fifteen young bats were present. A further eleven bats were present in the basement, one of the winter sites for this species. This brings an estimated total of sixty bats in summer. This population is most probably predominantly females and their young (a single offspring for each reproductive female that successfully bred).

A subsequent count on September 4th revealed that 46 lesser horseshoe bats were hanging up in the boiler house itself. None were in the chimney. The basement was not checked as it was too intrusive a procedure at this time for the residents.

Lesser horseshoe bats were noted feeding along the lakeshore in vegetation to the southeast and southwest of the castle and along an inlet of the lake to the southwest. Earlier studies in March 2004 also indicated that bats feed along the woodland paths and in the woods themselves. No lesser horseshoe bats were seen or heard feeding from two hours after emergence until a period one hour from return to the roost when bats were seen and heard along the northern side of the pheasantry and flying along vegetation lines towards the walled garden area prior to return.

Activity along the lakeshore and over the lake was most intense on the night of August 8th 2004. During observations in the area of the lake behind the castle, soprano pipistrelles, common pipistrelles, Daubenton's bats and Leisler's bats were all active at the same time over the lake.

Natterer's bats were heard and seen in the boiler room, emerging later than the lesser horseshoe bats and flying around outside the boiler room. Brown long-eared bats also flew in the same area of the boiler house in the area where the windows are absent (see the bottom of the tower as shown in Figure 3).

Natterer's bats were heard and seen returning before dawn towards a roost in the vicinity of the southern gate lodge (a café cum guest house). An examination of this building prior to sunrise on August 10th provided evidence that the lodge tower was the site of a Natterer's roost (of more than ten bats) and of a soprano pipistrelle roost (within the same tower, see Figure 4). Natterer's bats had returned to the roost before 5.35 am while some lesser horseshoe bats were still flying and perching in the boiler house at 6.00 am.

An approximate figure for Natterer's bats in the gate lodge would be between ten and twenty individuals. Bat squeaks were heard occasionally from the tower from bats that had already returned. Soprano pipistrelles were not counted as it was intended to note any other gate lodge with bats before bat activity ceased and observations at this gate lodge were interrupted prior to all bats having re-entered. It is likely that in excess of twenty soprano pipistrelles returned to this roost.

One soprano pipistrelle was seen to return to the northern gate close to sunrise (see Figure 5 (b)). This may have been the last of a number of bats and it is likely that there is a greater number present.

A bat was seen to emerge from the lodge late on the first night of observations. This was despite the tenant's assertion that bats had never been seen or heard in the lodge.

Soprano and common pipistrelle activity was present in and around the courtyard and stable yard and sustained social calls were heard here throughout the night.
Feeding was also noted in the stable yard by pipistrelles, Natterer's and by one whiskered bat. The majority of activity was of pipistrelles.

Pipistrelles were very active in the path leading from the southern gate lodge (on the Scariff Road) and were seen feeding in woodland around mature broadleaves (including a Spanish chestnut). Activity around this tree suggested that the bat was returning to a crevice in one branch but the bat did not land, either because it is not a roost or due to the disturbance caused by the observer. A Leisler's bat availed of a mature tree close to the courtyard as a mating roost and calls were audible (both to the unaided ear and to the bat detector) here for up to two hours on each night.

Leisler's bats were heard feeding over the lake, feeding over pasture and along woodland edge. No roosts of this species were found around the castle but this species may commute over a considerable distance and may also use trees more frequently than species like the pipistrelles.

Daubenton's bats could be seen and heard feeding directly over the lake surface. Activity levels were typical of a lake of the size and shelter of Lough Cutra. While watching bats, it was very clear that insects were abundant in the vicinity of the lake especially where there was vegetation to provide shelter towards the lakeshore.

Bat activity on the farther shores of the lake (to the east) was not observed over as long a period and thus only two species were noted here (pipistrelles).

There was an abundance of these species and it is unlikely that there was any difference in activity levels between the two shorelines examined. Bat activity (pipistrelle) was noted at a bridge over the River Owendalulleegh close to where it enters into Lough Cutra).

In summary, bat activity, diversity and abundance was high in the Lough Cutra estate and on Lough Cutra in August 2004.

Discussion

The Lough Cutra demesne provides a summer breeding site and winter hibernation site for lesser horseshoe bats and is thus one of the most significant sites for bats in Ireland. The actual number of the summer population of this species remains unclear due to the difficulty in counting the bats as they emerge or counting them within the roost without creating considerable disturbance. However, the number is likely to be greater than or equal to sixty bats (including offspring).

These bats benefit from the heat available in the boiler house during the summer period to rear their young and from the constant temperature of the basement and wine cellar to enter the deep winter torpor, termed hibernation. This is a highly desirable set of features within one site for a species of bat that has undergone worldwide decline up until very recently. Thus it would be of great concern if the feeding potential for this area were affected by the land slippage attributed to operations to establish a wind farm at Derrybrien.

The difficulty in identifying impacts upon the bats lies in the absence of previous data on the bats here in the summer period and on bat activity in the winter period.

What is clear from this study is that lesser horseshoe bats do avail of the site year-round, are present in 2004 and have bred successfully in 2004. This would imply that the bats have reached an appropriate body condition to allow pregnancy to occur and to progress to the birth of young and furthermore for young to advance to a stage when they can fly and feed for themselves.

Reproduction has thus not been prevented by any effects upon the lake by the accidental introduction of peat. It is unclear as to whether any diminution in reproductive success, population size (or mean body mass etc.) has taken place.

An earlier concern relating to the absence of Daubenton's bat was allayed by repeated observations of this species on the main body of the lake and on a small inlet southwest of the castle. As has been noted in the **Results** section, bat activity on the lake was especially noteworthy on the night of August 8th.

It is clear from this second short examination of the site that bats are abundant upon the demesne. It is probable that most of the species for which roosts have been identified have bred here. The lesser horseshoe bats had certainly bred.

Given that any waterborne peat entered into the lake at the opposite side via the River Owendalulleegh, it is improbable that there has been any significant impact upon the invertebrate fauna that would constitute the prey items of the bat species of the castle and lodges.

All of the indications from this examination would suggest that the bat fauna is in a healthy state in the area where the lesser horseshoe bats roost. The bats may feed over a wide area (as far away as 7 kilometres but more likely in the range of 3 to 5 kilometres). Feeding activity for the lesser horseshoe bats will encompass both the lakeshore and woodland interior and woodland paths.

One of the residents of the castle noted the presence of a barn owl (referred to as an "owl that screeched rather than hooted") in the clock tower in the days leading up to the study. The presence of this predator may provide an explanation for the lesser horseshoe bats' avoidance of the more exposed shoreline in favour of vegetation that would interfere both with their visibility to predators and with efforts catch them in flight.

It is concluded by the author that there is no measurable impact upon the bat fauna of Lough Cutra but that any effort to quantify potential impacts is hampered by lack of data for bats in the years prior to the land slippage.

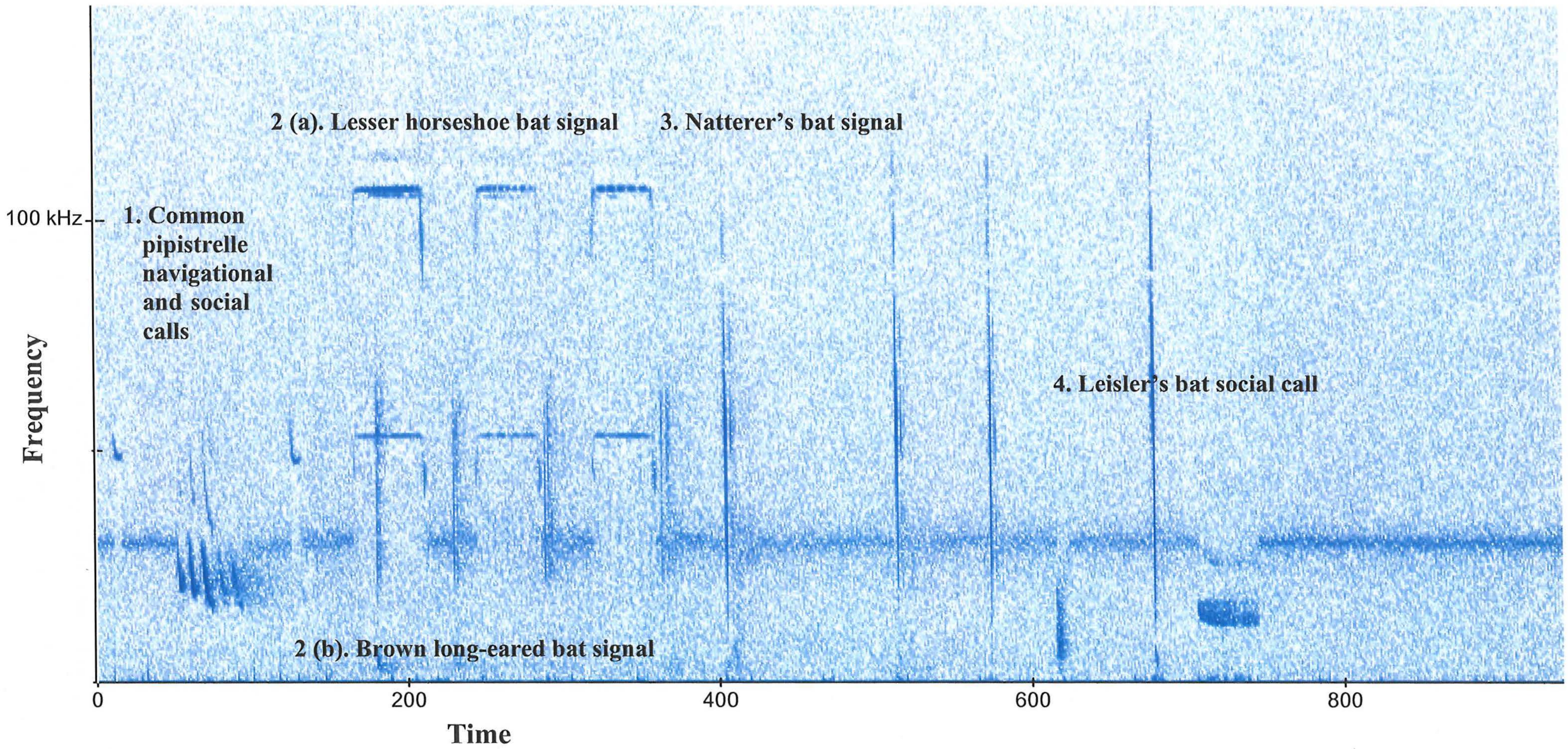


Figure 1: Spectrogram of some of the bat fauna of the Lough Cutra estate including common pipistrelle (1), lesser horseshoe bat and brown long-eared bat (2), Natterer's bat (3) and Leisler's bat (4).

Figure 2: Site of the lesser horseshoe bat maternity roost.
The bats are within the hot boiler room up the chimney. The bats fly in and out of the windows and door on emergence. The pile of droppings can be seen in the fireplace.

Figure 3: Exit and entry point used by bats in the boiler house.
At least one lesser horseshoe bat was seen to return through the hole around the pipe and two Natterer's bats exited through the aperture. The lesser horseshoe bat in the photo is one of two bats that flew around in the clock tower at emergence time.

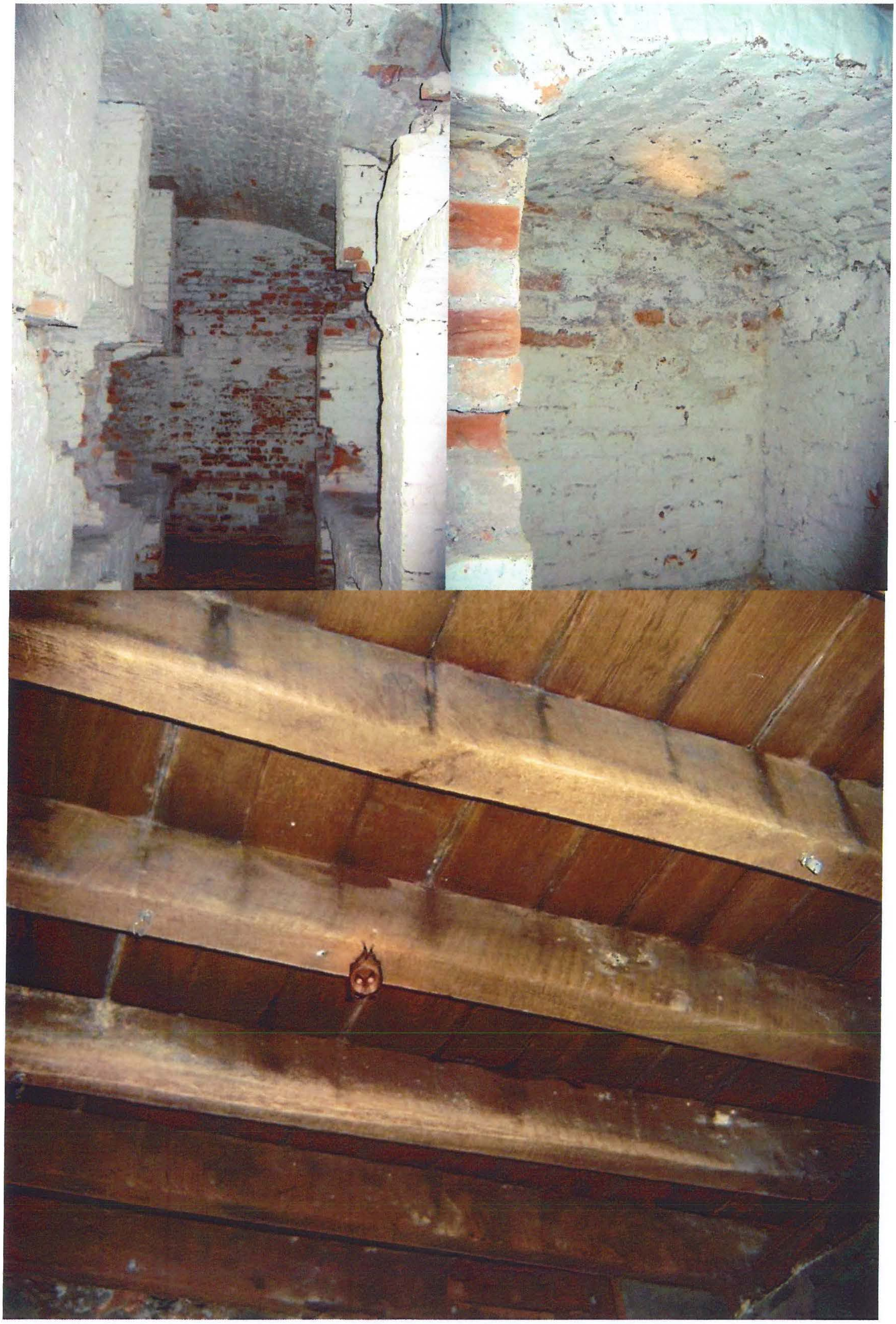


Figure 4: Wine cellar whereat lesser horseshoe bats roost in winter.
The lower picture shows the basement wherein bats roost both in winter and summer. A lesser horseshoe bat is shown in the centre of the picture.

Figure 5: Site of Natterer's bat roost (a) and soprano pipistrelle (a and **b) roosts.**
(a) is the gate lodge along the Scarriff Road and is open to guests.
(b) is the entrance gateway to the Lough Cutra demesne.
(c) Yard whereat soprano pipistrelles were active and emitting social calls.

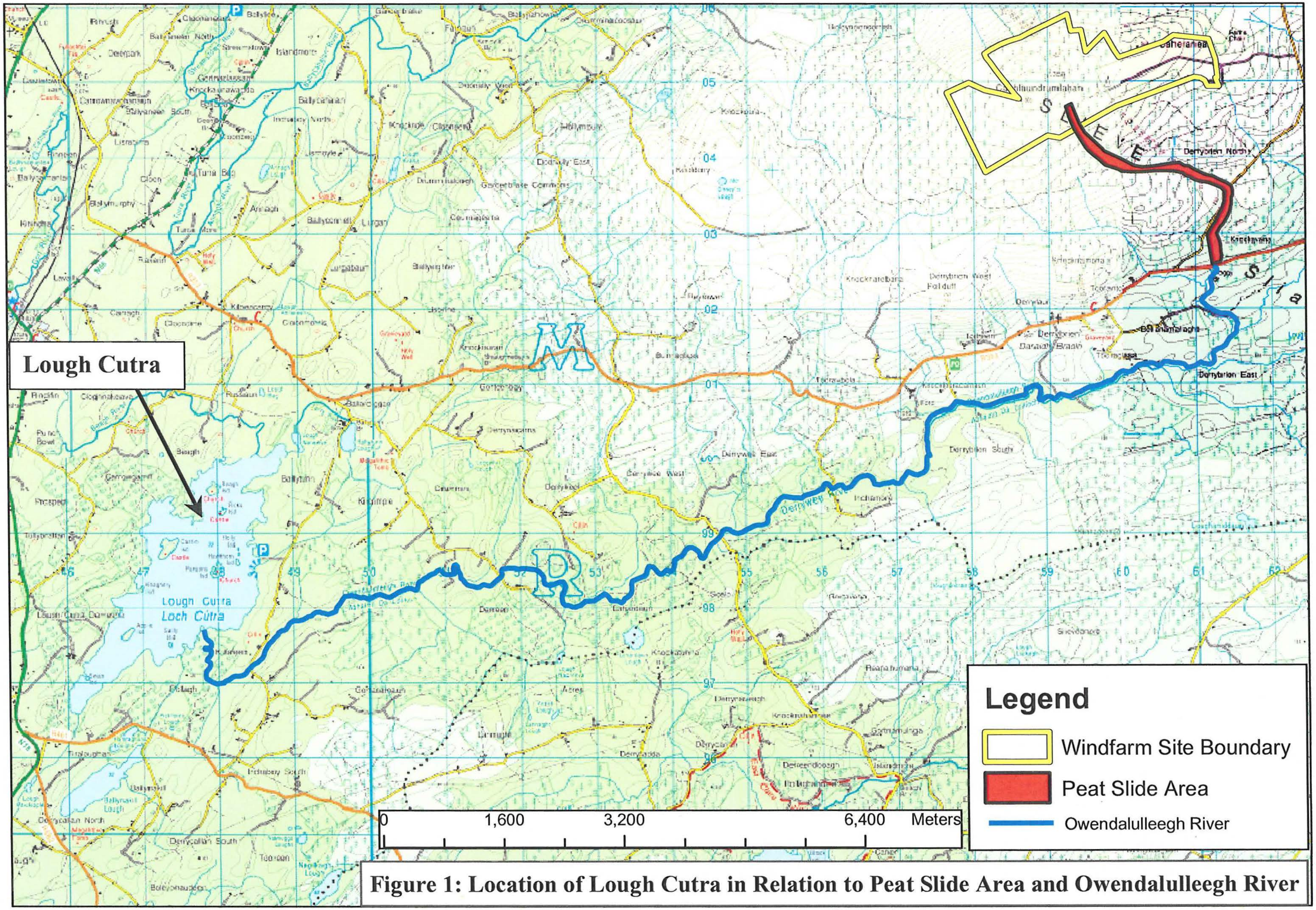


Figure 1: Location of Lough Cutra in Relation to Peat Slide Area and Owendalulleegh River

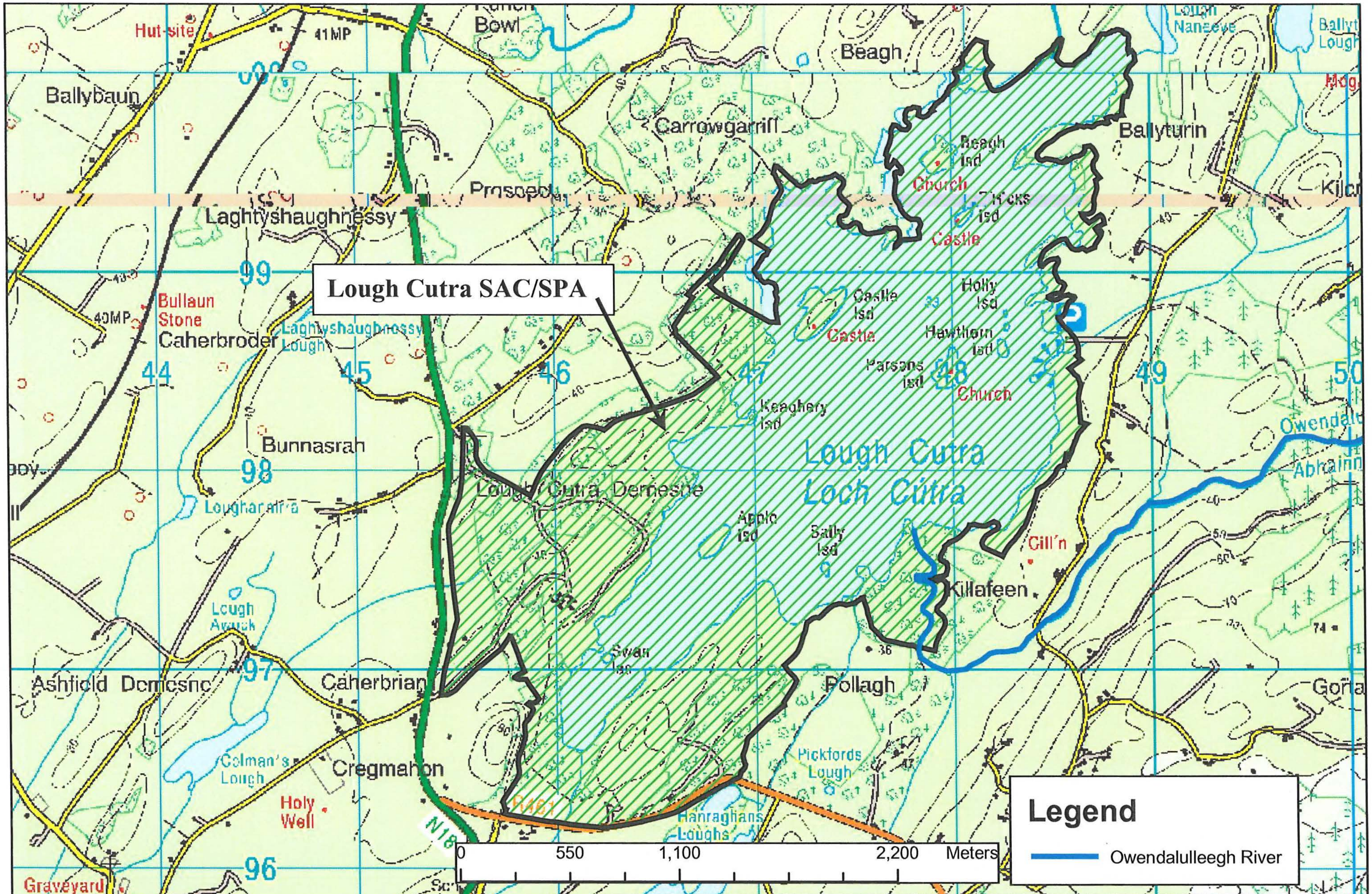


Figure 2: Lough Cutra Special Area of Conservation (SAC) Boundary.

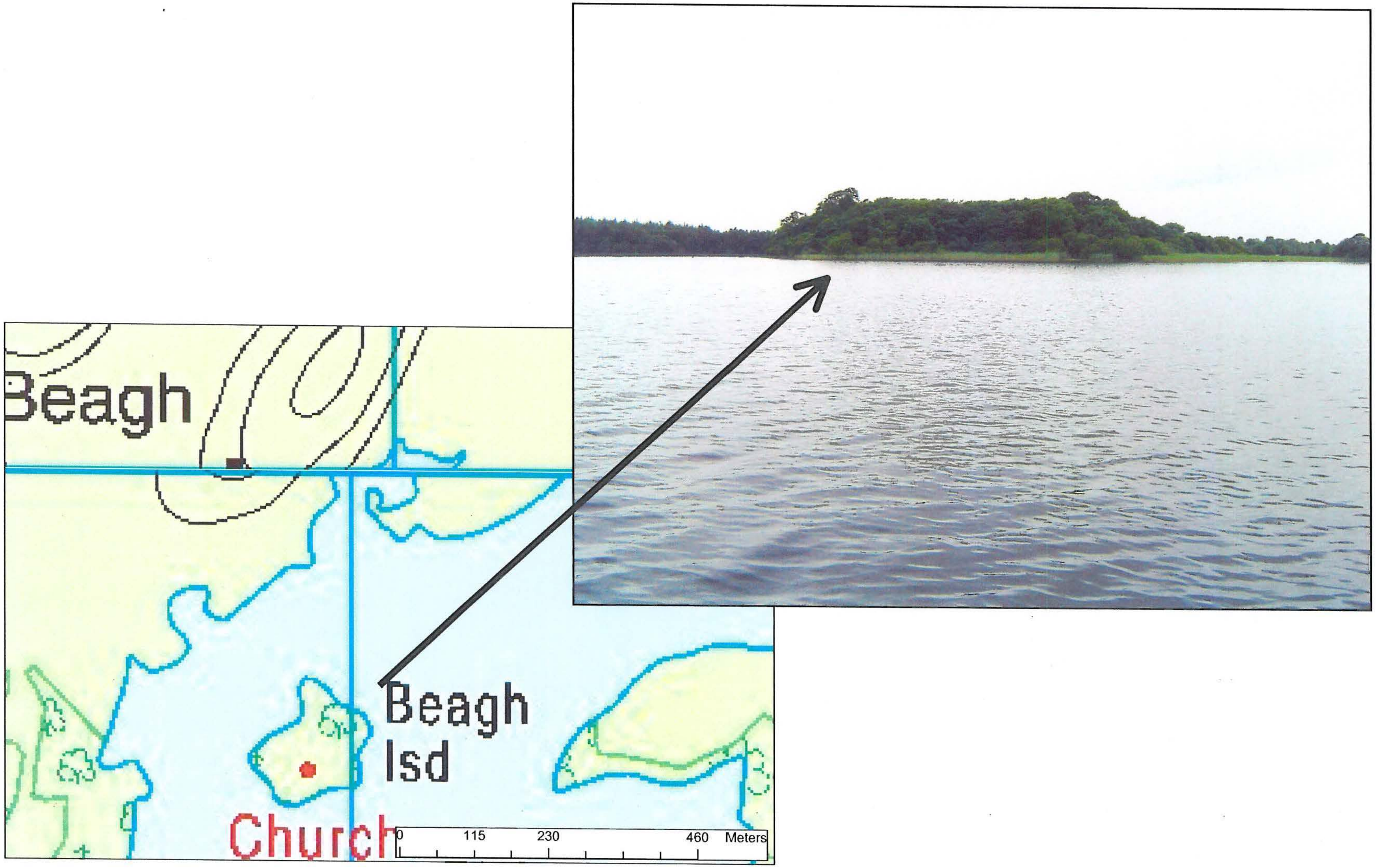


Figure 3(a) and 3(b): Beagh Island, the former Cormorant colony used to breed at this site.

Figure 4: Location of bats within the Lough Cutra demesne showing the cellars within the bats roost in winter. The entrance/ exits (yellow oval and close-up) used by the bats open out towards the lake.

Figure 5: Movements of lesser horseshoe bats on emergence from the cellar roost. Bats flew along the edge of the castle to the clock tower prior to dispersal along the avenue and along either side of the pheasantry.

Figure 6(a): Bats flew along the edge of the pheasantry towards woodland.

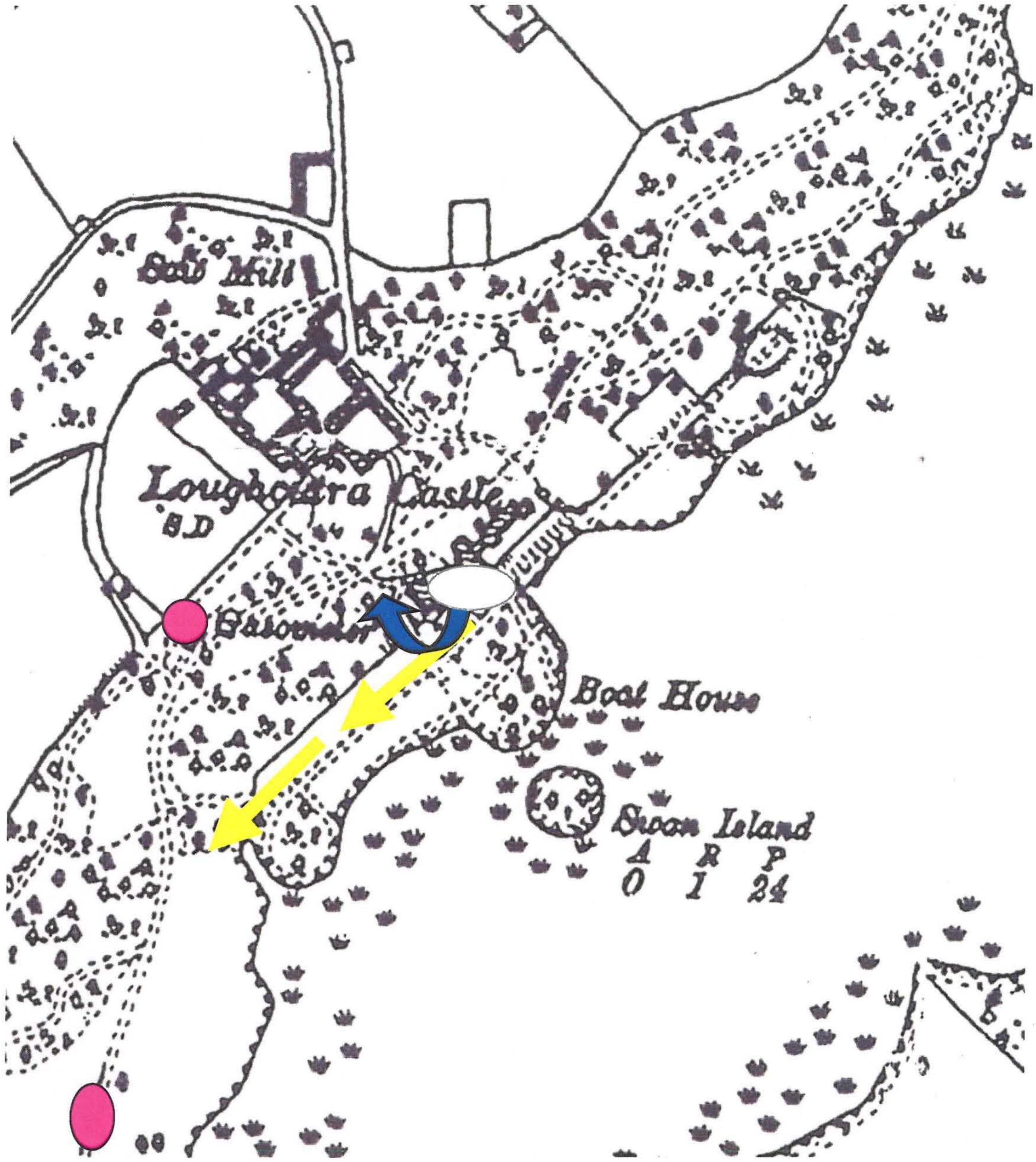


Figure 6 (b) Bat activity at Lough Cutra. The grey oval indicates the roost location. The yellow and blue lines indicate the movements of bats from the castle towards feeding areas. The pink ovals denote sites at which lesser horseshoe bats were noted during the night assessment.

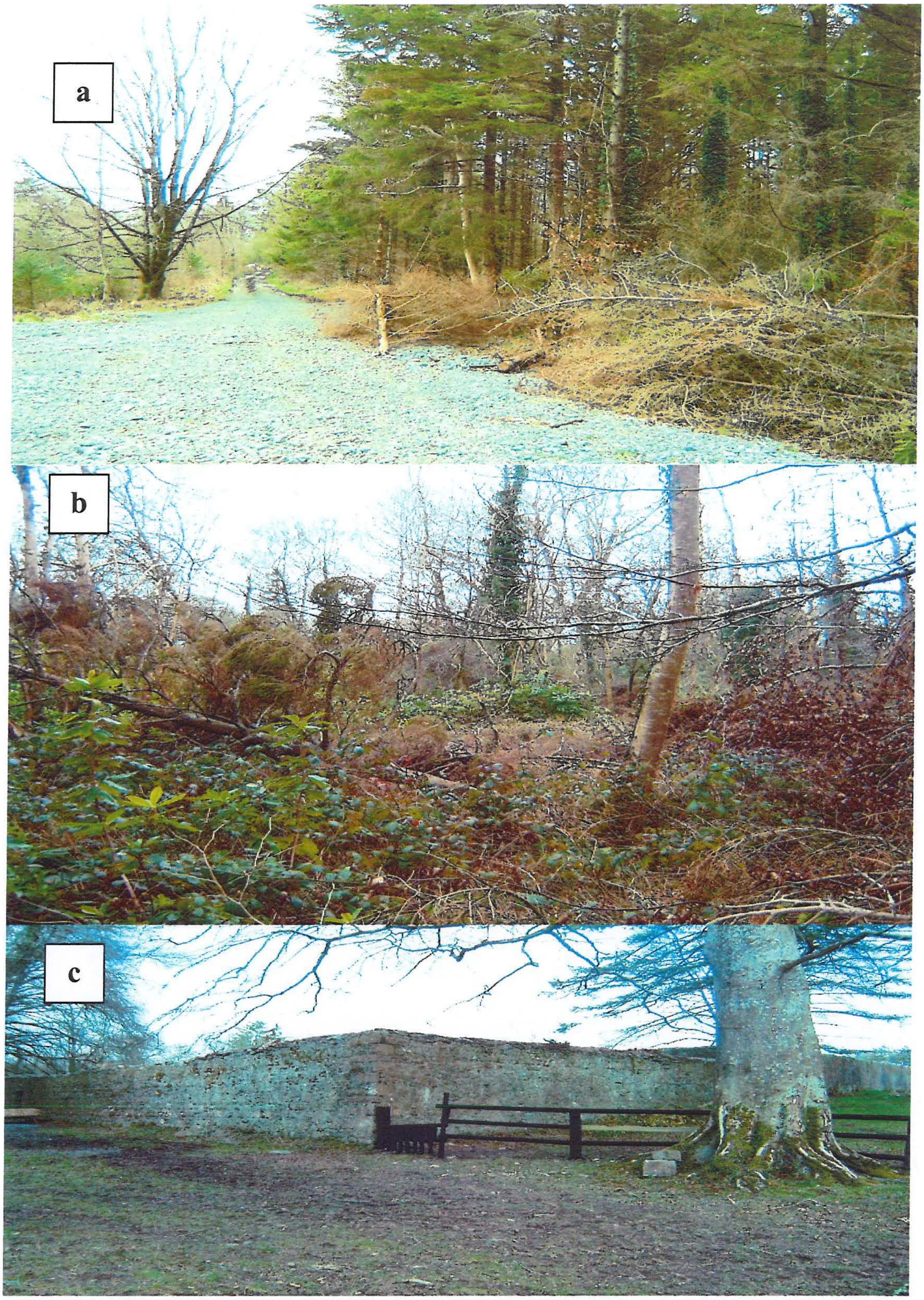


Figure 7: Feeding site of lesser horseshoe bat along woodland track. The bat was noted both on the track (a) and within the woodland (b).
(c) Feeding site of lesser horseshoe bat at walled garden.

Figure 8: Likely feeding sites for bats. A lesser horseshoe bat was noted at the stagnant water in the first photograph.

Figure 9: Potential feeding areas along woodland tracks and along the shoreline of Lough Cutra.

Figure 10: Trees with high potential as bat roosts. Such sites are only occasionally used by species such as the lesser horseshoe bat but are important for other species.

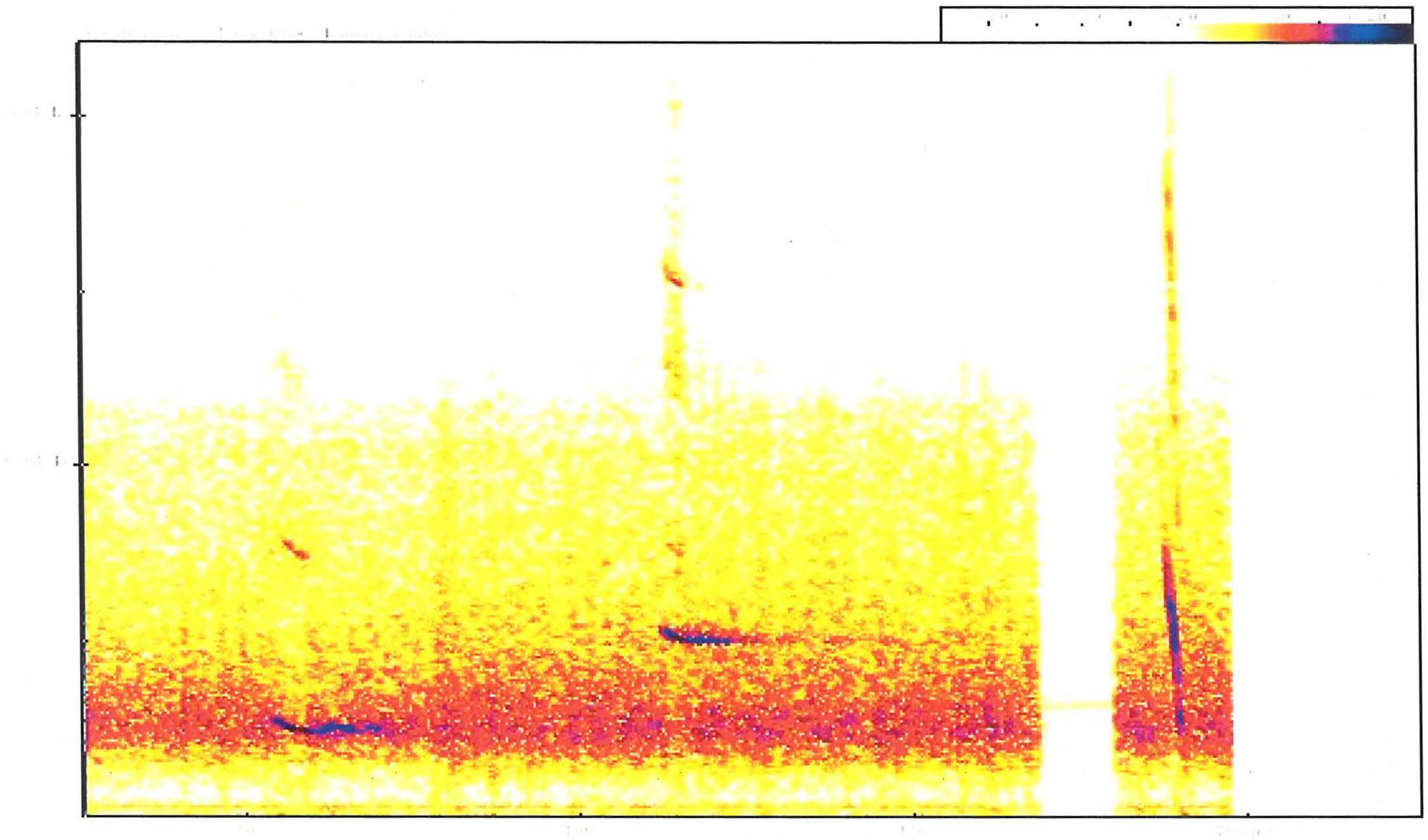


Figure 11: Sonogram showing three of the bat species present along the shoreline of Lough Cutra. From left Leisler's bat, soprano pipistrelle and Natterer's bat respectively.

Figure 12: River Owendalulleegh. The water of this river would be subjected to increased peat levels whenever the level is raised by heavy rainfall.

IMPACT ASSESSMENT OF DERRYBRIEN PEAT SLIDE ON HABITATS, CORMORANTS AND BAT FAUNA OF LOUGH CUTRA, CO. GALWAY

AUGUST 2004

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CONTENTS

LIST OF APPENDICES

1 INTRODUCTION

Inis Environmental Services have been commissioned by Hibernian Wind Energy Ltd. to assess the impacts of a peat slide on the ecology of Lough Cutra, County Galway. The peat slide occurred upstream of Lough Cutra on an area of mainly afforested blanket peat in the Slieve Aughty Mountains during Autumn 2003. There is currently a windfarm being constructed in the area adjacent to where the peat slide occurred.

As a result of the peat slide, an estimated 6000 m^3 of peat entered the upper reaches of the Owendallulleegh River (ESBI, unpublished data) and flowed along its length to Lough Cutra (approximately 21km upstream). A visible plume was observed at the confluence of the Owendallulleegh River with Lough Cutra.Concerns over the possible impacts of the peat slide on the ecology of Lough Cutra have led to this study being carried out.

Lough Cutra is a large freshwater lake that occurs on an area of limestone but the water quality is influenced mainly by the sediment washed into the lake from the sandstone mountains nearby. This lake is situated about 4 km southeast of Gort, Co. Galway.

The lake is recognized as being of international ecological importance based on the quality of wildlife habitats present, the presence of Lesser Horseshoe Bats and the occurrence of a regionally important population of cormorants (in the past). This site has been designated as a candidate Special Area of Conservation (SAC) because of the presence of Lesser Horseshoe Bats, a species listed on Annex II of the EU Habitats Directive. The site is also designated as a Special Protection Area because of the population of breeding Cormorants.

This aim of the study was to determine whether there have been significant impacts on the ecology of Lough Cutra in particular on the internationally important population of Lesser Horseshoe Bats, on the internationally important Fen Habitats that occur around the lake and on the regionally important population of Cormorants that have been recorded at the site in the past.

Unfortunately there was not a similar study carried out prior to the occurrence of the peat slide and therefore it is difficult to compare the results of this study to the situation prior to the peat slide. There have been, however, some surveys carried out in the past including:

- NHA survey of the site.
- An Environmental Impact Statement on the Abstraction of Water from Lough Cutra (2003).

Reports of these studies have been referred to in an attempt to determine possible impacts resulting from the peat slide. The report has been prepared in accordance with the published EPA guidelines (EPA 2002). Scientific names of plants and animals are included in the text.

1.1 Site Location

Figure 1 shows the location of Lough Cutra in relation to Peat Slide Area. The Owendalulleegh River is also highlighted, it can be seen that the river enters Lough Cutra on the Eastern shore and rises in the area where the peat slide occurred.

2 LEGISLATION AND STATUTORY CONTEXT

2.1 Habitats

The Habitats Directive was transposed into national law through the European Communities (Natural Habitats) Regulations 1997 (S.I. 94/97). There are a number of habitats listed in Annex I of the Habitats Directive that are rare in Western Europe and are listed for protection throughout the European Union. Sites selected for protection under the EU Habitats Directive in Ireland are known as Special Areas of Conservation and form part of a European network of sites. Lough Cutra is now designated as a candidate Special Area of Conservation (cSAC).

2.2 Birds

All birds are protected under Irish law and the Wildlife Act of 1976. The Third Schedule to the Wildlife Act 1976, was amended on the 6th December 1985, when the minister, in compliance with the European Communities Council Directive of 2 April, 1979 (No. 79/409/EEC), made regulations entitled the European Communities (Wildlife Act, 1976)(Amendment) Regulations, 1985 (No. 397 of 1985) removing the remaining twelve unprotected species from that schedule. As a consequence all wild birds are now protected throughout the state.

Under Article 4 of the Birds Directive it is required that the State must *strive to 'avoid pollution or deterioration of habitats'* of all wild birds, including species listed in Annex I of the Directive. Lough Cutra is designated as a Special Protection Area for Birds (SPA) on the basis of the population of breeding Cormorants.

2.3 Bats

Legal protection is given to almost all Irish mammal species under national (Wildlife Act, 1976 and Wildlife (Amendment) Act, 2000) and European (Habitats Directive via S.I. 94 of 1997) legislation. Of Ireland's mammals, greatest protection is afforded to species included in Annex II of the Habitat's Directive. This includes lesser horseshoe bats, *Rhinolophus hipposideros*. This species has a very restricted distribution on the island and is confined to the six western and southern counties of Mayo, Galway, Clare, Limerick, Cork and Kerry. The population of bats within this range is calculated to be in the region of 9,000 to 10,000 individuals, making this the second-most important population of this species in the world after Wales and England.

2.4 Designated Conservation Areas

Sites of national importance in the Republic of Ireland are termed proposed Natural Heritage Areas (pNHA's). While the Wildlife (Amendment) Act 2000 has been passed into law, pNHA's will not have legal backing until consultative process with landowners has been completed; this process is currently underway for many proposed sites. To date the only sites that have gone through the designation process are a number of Raised Bogs, mainly in the midlands.

Special Areas of Conservation (SAC's) are sites of international importance because of the presence of listed habitats or species that are of European importance.

Special Protection Areas (SPA's) for Birds, are designated based on the presence of internationally significant populations of listed bird species.

Legal backing for the protection of candidate SPA's and SAC's in Ireland is provided by the EU Directive on the Conservation of Natural Habitats and of Wild Flora and Fauna (92/43/EEC; commonly known as the 'Habitats Directive').

Table 1 gives details of the designations relevant to Lough Cutra. Figure 2 shows the boundary of the designated site.

TABLE 1 Lough Cutra NHA/SAC/SPA (Source: Dúchas, 2003).

Name	Site Code	Designation	Notes	Distance and direction from river survey area
Lough Cutra	000299	pNHA SAC SPA	Lough Cutra is an oligo/mesotrophic freshwater lake lying on limestone. The main habitats of this site are; aquatic lake vegetation, reed beds confined to sheltered bays and mixed woodland. The site is internationally important for it's breeding and wintering population of Cormorants (166 pairs in 1985 and max 300 individuals in winter) (Information compiled in 1987). The Cormorants use the offshore islands for breeding purposes. The internationally important populations of Cormorants and Lesser Horseshoe Bats should be especially protected. Lough Cutra is an important site with its diverse habitat types and the presence of both calcicole and calcifuge floras.	0km Includes and adjacent to river mouth

3 METHODOLOGY

3.1 Desktop Review
A desktop review was carried out to identify features of ecological importance within the study area. Literature sources consulted are included in the text and listed at the rear of the document.

3.2 Field Survey Work

3.2.1 Flora and Habitat Survey
The aims of the habitat survey were:
- To describe the various habitats that occur at Lough Cutra.
- To record any areas where peat deposits may have affected the ecology of the particular habitat in question.

Lough Cutra and adjacent habitats were surveyed using Phase 1 habitat survey methodology (JNCC, 1993). A walk-about and boat survey of the area was conducted on 15 July 2004. Habitats were identified and target notes were made on all semi-natural habitats encountered during the survey including notes on dominant vegetation, qualitative assessment of plant species diversity, vegetation structure, topography, disturbance and management. The habitats encountered on the site visit were classified in accordance with Fossitt 2000 as recommended by the Heritage Council.

3.2.2 Bird Survey
The aims of the Bird Survey were:
- To assess the breeding Cormorant, *Phalacrocorax carbo*, colony.
- To determine if any peat deposition took place on the breeding island.
- To assess impacts, if any, on the colony as a result of peat deposition.

The survey area consisted of only one island, Beagh Island, at the northern tip of Lough Cutra (see Figure 3(a) and 3(b)). This is a small island approximately 40 metres in length and 25 metres in width.

The survey was carried out on 15th July 2004. A boat was used to access Beagh Island. Three personnel, including a boatman, were needed to carry out this assessment. Weather conditions were fair but water levels were extremely low due to low precipitation in the area over a long period. Bathymetry charts were used to navigate the lake.

The following bodies provided information for this report (via publicly available documents):

- ESB International (ESBI)
- Environmental Protection Agency (EPA)
- Galway County Council
- National Parks and Wildlife Service (NPWS)
- Geological Survey of Ireland (GSI)

Cormorant Survey Techniques

Cormorants nest high up in mature trees when nesting on islands within freshwater lakes. They construct a large rough nest made of sticks and twigs and lined with grass and sometimes moss. These nests are easily discernible from a long distance as they are added to each year by the returning pair of Cormorants.

The foliage around the nests is denuded due to the acidic nature of the Cormorants faeces. This denudation of the foliage further assists the observer when counting nests and assessing numbers of breeding pairs.

3.2.3 Bat Survey

The aims of the Bat survey:

- To record the presence and activity of bats in and around Lough Cutra Demesne paying particular attention to Lesser Horseshoe Bats.

Equipment

QMC Mini 3 heterodyne bat detector
Eco Tranquillity time expansion and heterodyne bat detector
Sony Recording Minidisc Walkman MZ-R700 and cable
"Batsound" sound analysis software and Toshiba Satellite laptop computer
Exide handlamp and Petzl headlamp

Survey Methodology

The Lough Cutra demesne was examined for the presence and activity of bats on March 22nd, March 25th, 26th and 27th, 2004. This assessment concentrated on lesser horseshoe bats but any incidental bat species were also recorded where present.

The number of bats hibernating within the basement of Lough Cutra castle was counted in the initial visit of March 22nd to determine the level of usage of the site within the winter of 2003-2004. Advice on the location of the roosting bats was provided by the estate manager, Mr. Edward Somerville as the Conservation Ranger, Ms. Ciara O' Mahony was unavailable during this period for consultation. It is possible following discussions with Ms. O' Mahony that this count is an underestimate as the wine cellars were not checked on the guidance of Mr. Somerville. Bats are also known to roost within the wine cellars. (Two lesser horseshoe bats were noted by the author on April 11th 2000).

Bat activity within the area was low on the night of March 22nd and the observations on feeding are taken from subsequent examination of March 25th to March 27th.

Emergence activity was observed from 7.00 pm and the direction of emerging bats was noted. The second night of study provided a better viewing point for determining the general routes of emergence of the bats and the likely feeding areas accessed from these commuting corridors.

Feeding activity was sought and observed until bat activity ceased during the night. A second phase of observation was then initiated prior to final return at or near to sunrise. This second bout of feeding was restricted to a small number of the original emerging population. The demesne was walked during the daytime on March 26th and 27th to identify potentially good feeding areas, roost sites and any potential commuting routes for bats through the estate and in and around Lough Cutra lake.

Staff on the estate was questioned in relation to any observations of bats in buildings or other built structures. Trees were not considered in this assessment as it is rare for lesser horseshoe bats to avail of trees as hibernation sites.

The area within which the landslide occurred at Derrybrien was visited to determine whether there were any visible effects to the suitability of the River Owendalulleegh for macro-invertebrates that would form a component of the lesser horseshoe bat diet and to appreciate the historical alterations to the river prior to the assessment by the incursion of the considerable quantity of peaty soil.

4 EXISTING ENVIRONMENT

4.1 Designated Sites

As detailed above Lough Cutra is designated as a Natural Heritage Area, Special Area of Conservation and a Special Protection Area for birds. The boundaries of the designated sites are illustrated in Figure 2.

4.2 Habitats and Vegetation

Following the Phase 1 habitat survey of the site and surrounding area the different habitat types (as classified according to Fossitt 2000) were identified. The following is a description of the various habitats found in and around Lough Cutra The habitat code according to Fossitt is in brackets after the habitat name. Habitats that are likely to have been affected by the peat slide were surveyed and are described, agricultural land that may occur within the designated site were not surveyed nor were other habitats that occur above the high water level.

4.2.1 Limestone Lake (FL3)

The site is difficult to classify in accordance with Fossitt although the site occurs on Limestone and has a number of calcicole elements the source of much of the water is from the surrounding sandstone mountains and Blanket Bog areas. As a result the water is acidic and brown in colour, as a result there is an abundance of plants that are usually recorded from acid base-poor conditions. Much of the lake is fringed with reed and tall sedge vegetation (described 4.2.2 below). Bulbous Rush (*Juncus Bulbosus*), Shoreweed (*Littorella uniflora*) and Alternate Water-milfoil (*Myriophyllum alternifolium*) are abundant in the shallow shore waters. Stoneworts (*Chara spp.*) were recorded occasionally. Pondweeds (*Potamogeton spp.*) are abundant in the deeper areas. This unusually diverse habitat could correspond to either of the Annex I habitat types '*Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.*' or '*oligo- to mesotrophic standing waters with Littorella uniflora*' depending on the area of lake in question. From areas that were surveyed it there was no evidence of damage caused to this habitat type as a result of the additional peat sediment in the lake resulting from the slide. It was no possible to carry out a comprehensive survey of this habitat type and it is recommended because of the conservation importance of the habitat type that a more comprehensive survey be carried out to determine whether this habitat type has been impacted upon.

4.2.2 Reed and Large Sedge Swamp (FS1)

Reed and sedge habitats are common around the shores of the lake and are distributed throughout in shallow water. The stands are typically dominated by single species, either Common Reed (*Phragmites australis*) or Common Club-rush (*Schoenoplectus lacustris*). There is no evidence of the peat slide having damaged this habitat in any discernable way.

4.2.3 Rich Fen (PF1) and Freshwater Marsh (GM1)

There are small pockets of fen and marsh habitat distributed around the lake shore. On wet peaty areas fen vegetation includes Black Bog-rush (*Schoenus nigricans*), Saw *Sedge (Cladium mariscus*) and a range of associated sedges (*Carex* spp.) and fen mosses. Other Species present included Jointed Rush (*Juncus articulatus*) and Soft Rush (*J. effuses*), Devil's-bit Scabious (*Succisa pratensis*), Water Mint (*Mentha aquatica*), Marsh Cinquefoil (*Potentilla palustris*), Horsetail (*Equisetum fluviatile*), Marsh Willowherb (*Epilobium palustre*), Bogbean (*Menyanthes trifoliate*), Tormentil (*Potentilla erecta*).

Other areas around the lake support a fen vegetation. Other areas where the substrate is mineral soil and there is a more fluctuating water table the species are more typical of freshwater marsh with species such as Common Spike-rush (*Eleocharis palustris*), Common Marsh-bedstraw (*Galium palustre*), Purple-loosestrife (*Lythrum salicaria*).

While the winter water levels were almost certainly above some of these areas no significant areas of peat deposit were located and no discernable damage was recorded as a result of the peat slide.

4.2.4 Wet Woodland (WN 6)

There are a few restricted areas where this habitat is present. The woodland is dominated by Willow (*Salix spp.*) with an abundance of Alder and Holly present. Species in the understory include Creeping Buttercup (*Ranunculus repens*), Meadowsweet (*Filipendula ulmaria*) and Creeping Bent (*Agrostis stolonifera*). An area adjacent to the mouth of the Owendalulleegh River was surveyed and there was no discernable impacts recorded as a result of the peat slide, there was no evidence of peat deposits within the wooded area. There was evidence of deer using the area.

4.2.5 Exposed calcareous rock (ER2) and Exposed sand

Much of the lake shore comprises areas of either exposed calcareous rock or sand, the habitats are species poor.

There was no evidence of peat deposits along the shoreline although during the winter much of the area was covered in a peat deposit (E. Somerville, *pers. comm.*).

4.3 Cormorants

Historical Data
In 1986, 166 pairs of Cormorants were recorded breeding on Beagh Island at the northern tip of Lough Cutra. These numbers were internationally important. However these numbers have been declining over time and only 21 pairs were recorded in 1997.

Numbers of Cormorant do not over winter at the site but single birds may be seen from time to time.

Cormorant Survey Results
The results of this investigation show that there are no longer any breeding Cormorant, *Phalacrocorax carbo*, present at Lough Cutra. No nests were recorded on Beagh Island nor were any Cormorants seen. No peat deposition was recorded at Beagh Island or any of the other islands on the lake.

It is clear that the absence of Cormorants is not due to the peat slip event as NPWS staff have indicated that there was little to no breeding activity at this location for the past few years.

A further survey of lakes in the general area of south Galway/North Clare shows a large colony of breeding Cormorant has established itself on Illaunmore at Muckanagh Lough, ten kilometres southwest of Lough Cutra. It is felt that these birds have relocated to this area from Lough Cutra.

4.4 Bats

Population in National Context
The lesser horseshoe bat has been in decline for a considerable period and its numbers in Ireland may also be less than historically and the above figure is at least 2,000 lower than a figure estimated for this species by the National Parks and Wildlife Service in the 1990's.

The species has a more restricted choice of roost as it requires a space through which it may fly to reach a hanging perch. Unlike all other Irish species, it does not avail of gaps or crevices in stone or wood or between slate/ tile and felt as many house-dwelling bat species may. Nor are there many trees of suitable girth to provide roosting opportunities for this bat.

The restricted distribution for this species is not fully understood and it is presumed that winter conditions on the southern and western region are the limiting factors. This species is the most typically recorded cave-dweller of all of our bat species. Limestone caves account for most winter records of this species.

Lesser horseshoe bats may also be found in cellars of houses, castles or abbeys and it is just such a case for the bat population of the Lough Cutra demesne.

Bats have been recorded annually within the basement of the castle and this population affords the status of Special Area of Conservation for this species.

Roosting bats at Lough Cutra

There was only one site shown to the author within the castle where bats over-winter and hence the number is incomplete but indicative of the number of bats utilising the particular site at this time of year.

45 bats were noted within the cellars of the castle on March 22nd 2004. This is similar to a count by Dúchas Conservation Ranger, Ciara O' Mahony in January 1999 in this section (46 on 17th January 1999). The farm manager had asserted that no other sites were used and the wine cellar and other sites were not accessed.

Counts for the estate have reached a total of 93 in January 2001 (17th January 2001) and have been as low as 75 in January 2002 (24th January 2002).

The bats were predominantly in a relatively deep torpor during the initial observation and bat activity within the area was low on the night of the study. Little or no flying insects were apparent during observations by the author.

The bats roost within the castle basement/ cellar and wine cellar and emerge from the castle on the side facing towards Lough Cutra. Access is readily available to the under-floor space via four barred windows (see Figure 4).

Commuting route from Lough Cutra Castle (see Figure 5, 6(a), 6(b))

All bats that emerged from the castle flew along the edge of the castle to the tower. Most bats then flew up the path leading from the castle towards the pasture to the southwest and west with some possible movements to the north following on the edge of the castle. One or two bats flew along a line of yew trees flanking the pheasantry close to the house.

Clearly the number of bats emerging was less than the total population present and it is reasonable to estimate that as few as twenty emerged on any night of observations.

The majority of bats either flew along the pathway to a midway point whereat they flew over the wall and down along the line of the pheasantry on the western side.

No bats flew in the opposite direction away to the northeast of the castle directly from the roost. This may be due to a greater exposure (i.e. less vegetation) in the initial section of the lake flanking the house.

Feeding bats (see Figure 7, 8, 9)
Feeding activity was difficult to fully assess within a short assessment as bats may commute over a considerable distance. Lesser horseshoe bats emit a weak, highly directional ultrasonic signal that may be undetected even within close range.

Observations on feeding can only provide a very basic evaluation of the likely feeding territory of these bats as a full study based on the radiotracking of a number of individual bats was not deemed necessary in the current examination.

Lesser horseshoe bats were noted to feed along woodland tracks and within the vegetation adjoining the tracks and along the walled garden. Bat activity was not restricted to the lakeshore. Indeed lesser horseshoe bats were only noted at one site at the lakeside; a still water body that lies close to the pheasantry. Bats did not remain to feed here and it served only as a feeding site during commuting.

Feeding by lesser horseshoe bats is very often associated with broadleaf woodland but this species has also been observed by the author to feed on the shoreline of lakes and turloughs in the Gort area. While this bat is typically associated with lines of good vegetation cover, they may also cross small open areas either commuting or feeding.

Thus, lesser horseshoe bats may feed over lake sites and potentially even commute to and from roosts across open water as has been reported from radio-tracking studies of lesser horseshoe bats roosting on an island in Bavaria, Germany.

Feeding may be spread over a number of kilometres and has been reported to be concentrated within approximately 3 kilometres of maternity roosts within areas of good feeding potential (e.g. Dromore Wood, Ruan, county Clare, Sinéad Biggane NUIG *pers. comm.*) up to a distance of 9 kilometres in Wales at the largest roost sites (Maurice Webber, Robert Stebbings Consultancy, *pers. comm.*).

Within such a distance from the roost, there is considerable variety of habitat types. However, bat species are most associated with riparian and other watery habitats with good vegetation cover.

Lesser horseshoe bats are known to feed within each fortnightly period throughout winter and have been reported to commute several kilometres even during this the least active part of the year for bats (Carol Williams, Irish Bat Conference, May 2003).

Species of bat noted in Lough Cutra demesne (see Figure 10, 11)

Lesser horseshoe bat	*Rhinolophus hipposideros*
Soprano pipistrelle	*Pipistrellus pygmaeus*
Common pipistrelle	*P. pipistrellus*
Leisler's bat	*Nyctalus leisleri*
Natterer's bat	*Myotis nattereri*

It was not intended that a full assessment of the bat fauna of this site be undertaken and the above list is an incidental rather than an exhaustive list of the bat species present. It is likely that most Irish bat species are present within this site. Suitable roost sites for these species are included in the figures simply to illustrate that this demesne has great potential for a wide range of bats.

There are a number of buildings on the estate that would offer roosting opportunities for lesser horseshoe bats. These range from the various areas of the castle itself to the stable yard and gate lodges. A considerable pile of lesser horseshoe bat droppings in the cellar around an old boiler indicates that bats roost here in large numbers. No bats were in this area during this assessment.

Buildings such as the icehouse would also have high potential as bat roosts given some greater cover from disturbance.

5 IMPACTS

5.1 Habitats

There was no evidence of damage caused to habitats in or around Lough Cutra as a result of the peat slide.

5.2 Cormorants

There has been no impact on breeding Cormorant at Lough Cutra as they no longer breed at this location.

5.3 Bats

Potential Loss of feeding from the peat slide at Derrybrien (see Figure 12)

The importance of aquatic invertebrates to most bat species is indisputable whether through the direct ingestion of such prey while hatching over water or through the consumption of prey that had hatched previously from the water but were flying in woodland, wetland or were perched on a plant or other substrate.

Lesser horseshoe bats consume a variety of prey including crane fly, caddis flies, moths, lacewings and even small midges. Waterside vegetation is one of the most likely sites to encounter this bat.

Observations upon the bats during this assessment have shown that the bats returned to their winter site in 2003-2004 and were still present here in late March (towards the end of the hibernatory period). Feeding activity was noted during this period in the woodland and vegetation close to but not at the lakeside.

No sustained feeding was noted at the lakeshore. However, it would be inappropriate to draw conclusions on any negative effects on the foraging potential of the lake for bats based on such a small window of observation. Feeding activity over the lake would have been indicative that food was available to bats. The absence of bats may simply indicate that bats have identified more fruitful feeding areas.

To fully appreciate the feeding activity at Lough Cutra, it would be necessary to follow the entire feeding activity of a number of bats over a large distance for a number of nights. Avoidance of the lake (typically a good feeding site for bats) by the resident bats may offer an indication that insect availability is considerably less than would be expected for such a site.

The absence of any information on the feeding and commuting routes of the bats prior to the landslide impairs the ability to compare the "before" and "after" situations. For example, if it could be shown that bats emerging from the castle had formerly flown towards the lake in both directions and now only approached the lake where vegetation was dense, it may indicate that the lake is less beneficial as a feeding site than formerly (or there may be a need to examine other possibilities, e.g. predation in the more open terrain).

The population of bats within Lough Cutra are possibly resident throughout the year although this has not been the subject of assessment to date. Lesser horseshoe bats may use the same building for summer and winter roosting once the requirements of the two roost types is met.

Should the bats be present in summer, there would also be a potential for impact upon these bats and their offspring. There is clearly a gap in the knowledge regarding the bats upon the demesne that may have great significance in interpreting the effects of the landslide.

6 RECOMMENDATIONS

- Due to access difficulties it was not possible to carry out a comprehensive survey of the sub-littoral plant communities of Lough Cutra. It is recommended that the Eastern Shore of the Lough be walked and the habitat and vegetation communities described to determine whether the habitat has been impacted upon from the deposition of peat. Preliminary surveying undertaken to date indicate that there is no evidence of major peat deposition within this habitat.
- The invertebrate fauna of Lough Cutra and the River Owendallulleegh should be examined to provide a more accurate evaluation of the potential effects of the landslide upon this aspect and the consequent potential for feeding reduction for insectivorous vertebrates including the Lesser Horshoe Bat population at Lough Cutra.
- Where there is evidence that the water quality is incapable of supporting invertebrate diversity, immediate measures should be taken to improve the quality.
- A visit to the Lough Cutra demesne to determine whether lesser horseshoe bats are present in summer and breeding here should be undertaken.

REFERENCES

Altmann, J. (1974). *Observational study of behavior: sampling methods.* Cambridge University Press. pp 33 –34.

Bibby, C.J.; Burgess, N.D. and Hill, D.A. 1993. *Bird Census techniques*. pp 56 –59.

Brown R., Ferguson J., Lawrence M. and Lees D. (2002). Tracks and Signs of the Birds of Britain and Europe. 2nd edition. Helm Press.

Curtis, T.G.F. and McGough, H.N. (1988). *The Irish Red Data Book. 1 Vascular Plants*. The Stationery Office, Dublin.

Dúchas (2001). *Dúchas Data – Natura 2000.* 7 Ely Place, Dublin.

EPA (1995). *Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)*. Environmental Protection Agency, Wexford

EPA (2002). *Guidelines on the information to be contained in Environmental Impact Statements*. Environmental Protection Agency, Wexford.

Foss, P., O'Connell, C.A. and Crushell, P. (2001). *Bogs and Fens of Ireland Conservatuion Plan 2005*. IPCC, Dublin.

Fossit, J.A. (2000). *A Guide to Habitats in Ireland*. The Heritage Council. Ireland.

Hayden, T. & Harrington, R. (2002). Exploring Irish Mammals. Dúchas, The Heritage Service. Town House Dublin.

IEA (Institute of Environmental Assessment) (1995). *Guidelines for Baseline Ecological Assessment.* E & FN Spon, London, UK.

IEEM (2002). *Guidelines for Ecological Evaluation and Assessment. Institute of Ecological and Environmental Management*, Draft Report.

JNCC (Joint Nature Conservation Committee) (1993). *Handbook for Phase 1 Habitat Survey*. Joint Nature Conservation Committee, Peterborough, UK.

JNCC (Joint Nature Conservation Committee) (1995). *Guidelines for Selection of Biological SSSIs*. Joint Nature Conservation Committee, Peterborough, UK.

Mead, C. (2000). The state of the nation's birds. Chris Mead 2000. Whittet Books.

Mullarney, Svensson, Zetterstrom and Grant (2001). The most complete field guide to the birds of Britain and Europe. Collins.

NPWS (1993). *National ASI Survey Guidelines for Ecologists.* Unpublished Working Document, National Parks and Wildlife Service, Dublin.

Sharrock, JTR. (2002).The Atlas of Breeding Birds in Britain and Ireland. British Trust of Ornithology/Irish Wildbird Conservancy.

Webb, D.A., Parnell, J. and Doogue, D. (1996). *An Irish Flora* (7th edn). Dundalgan Press, Dundalk.

NPWS SITE DESCRIPTION

SITE NAME: LOUGH CUTRA

SITE CODE: 000299

Lough Cutra is a large oligo/mesotrophic freshwater lake lying on limestone but with much sediment washed down from the sandstone hills above. This lake is situated about 4 km south-east of Gort, Co. Galway.

This site is a candidate SAC selected for alkaline fen, a habitat listed on Annex I of the EU Habitats Directive, and for Lesser Horseshoe Bats, a species listed on Annex II of the EU Habitats Directive.

The vegetation around the lake is diverse, with reedbeds confined to sheltered bays, marshes and fens on sandy and peaty ground and natural and planted woodlands. Shallow water communities include species such as Jointed Rush (*Juncus articulatus*), Bulbous Rush (*J. bulbosus*), Alternate Water-milfoil (*Myriophyllum alternifolium*), Water-plantain (*Alisma plantago-aquatica*), Floating Club-rush (*Scirpus fluitans*), Lesser Water-plantain (*Baldellia ranunculoides*), Water Lobelia (*Lobelia dortmanna*) and Shoreweed (*Littorella uniflora*). Winter flooded areas support marsh vegetation with Common Spike-rush (*Eleocharis palustris*), Common Marsh-bedstraw (*Galium palustre*), Purple-loosestrife (*Lythrum salicaria*), amongst others, and with notable species such as Lesser Meadow-rue (*Thalictrum minus*), Northern Bedstraw (*Galium boreale*) and Blue-eyed-grass (*Sisyrinchium bermudiana*). On wet peaty areas fen vegetation includes Black Bog-rush (*Schoenus nigricans*), Saw *Sedge (Cladium mariscus*) and a range of associated sedges (*Carex* spp.) and fen mosses.

Woodland occurs around much of the lakeshore, as well as on a number of islands in the lake. Wet woodland on peat is dominated by Willow (*Salix cinerea*) and Alder (*Alnus glutinosa*). An old record of Irish Spurge (*Euphorbia hybernica*) probably comes from drier woodland which occurs in the Lough Cutra Demesne.

These woodlands provide feeding grounds for a summer roost of Lesser Horseshoe Bats. Between 1999 and 2001 up to 93 bats have been recorded in hibernation at Lough Cutra Castle and it is thought likely that a summer nursery roost also occurs here.

The lake is a regionally/locally important site for waterfowl. Monthly counts between November 1995 and March 1996, as part of an intensive study on flooding in the catchment, gave the following numbers: Whooper Swan (18), Mallard (101), Teal (69), Tufted Duck (83) and Goldeneye (58). The latter also use the nearly Ballynakill Lough. The lake has a long-established breeding colony of cormorants, with 34 nests in 1996. Higher numbers (166 pairs, 1985) have been recorded in the past. Small numbers also winter on the lake. In recent years there have been no records of Greenland White-fronted Geese from the lake, although in the past flocks of 60-80 birds were regular and were considered to be birds from the Rahasane or Creganna population.

The lake is used for fishing and tourism. Precautions should be taken to ensure the lake and its surrounding area is protected from damaging operations such as application of artificial fertilisers, development close to the lakeshore, drainage and felling of woodland areas.

Lough Cutra is of conservation interest for the range of wetland habitat types it contains, particularly alkaline fen, a habitat listed on Annex I of the E.U. Habitats Directive. The presence of an internationally important colony of Lesser Horseshoe Bats, a species listed on Annex II of the Habitats Directive, and a regionally important population of Cormorants add further interest to the site.

20.03.2003

DERRYBRIEN WINDFARM

PEAT SLIP

ENVIRONMENTAL IMPACT ASSESSMENT

ON

THE OWENDALLULEEGH RIVER

MARCH 2004

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1.0 INTRODUCTION

A landslide occurred near the southern boundary of the Derrybrien Wind Farm on the evening of 16th October 2003. The slide involved disturbance and partial displacement of approximately 450,000m^3 of peat. On 17th October, the limit of the displaced peat was measured at approximately 100m from the Black Road Bridge, a distance of approximately 2.45 km from the head of the slide. On 29th/30th October, following heavy rain, the slip mass re-mobilised before the emergency stabilisation measures were substantially underway, and solid peat entered the watercourse downstream of Black Road Bridge. The flow of solid peat continued for approximately 24 hours.

As a result of the landslide, an estimated 6000 m^3 of peat entered the upper reaches of the Owendallulleegh River (ESBI, unpublished data) and flowed along its length to Lough Cutra. This watercourse is of ecological and fisheries importance. A visible plume was observed at the confluence of the Owendallulleegh River with Lough Cutra (aerial photo and observations made by Shannon Regional Fisheries Board – Preliminary Assessment Report)

Inis Environmental Services was appointed by ESBI to undertake a joint survey with ESBI and the Shannon Regional Fisheries Board to assess the extent of impact of the peat slip on the Owendallulleegh river system.

The current report provides an assessment of the integrity of aquatic habitats in the river and provides information of the extent of peat deposition in the main stem corridor. It reports the results of a walkover type survey, carried out in December 2003, and a desk appraisal. The key aims of the study were as follows: -

- To assess the extent of peat deposition along the river;
- to determine the habitat integrity of aquatic and riparian areas;
- to provide a preliminary assessment of the potential impact of the land slide on the river;
- to suggest mitigation measures to assist the rehabilitation of the river, and,
- to recommend further survey work, where necessary, to assess fish stocks and other ecological indicators.

This study was undertaken by Inis Environmental Services on behalf of ESB International (ESBI). Field work was carried out by Inis Environmental Services in association with ESBI and the Shannon Regional Fisheries Board (ShRFB).

2.0 METHODOLOGY

2.1 Survey area

The survey area comprised of the entire length of the main stem Owendallulleegh River from Flaggy Bridge (NOS Grid Reference M61161 62512) to the mouth of the river, where it enters Lough Cutra, (NOS Grid Reference R47811 97721). This represents a study length of approximately 22 kilometres. The study area was divided into eleven sections. The overall area is shown in figure 1 and the eleven sections of river assessed are shown in figures A1.1 to A1.11 in appendix 1.

The survey was carried out over a two-week period comprising a team of

- Inis Environmental - (two persons);
- Shannon Regional Fisheries Board – (Three to five persons).
- ESBI (three persons).

Weather conditions were good and water level was low facilitating the survey. The survey comprised a walk down of the entire river main stem with recording of observations. A Health and Safety Induction course was held on the first morning of the survey to advise all survey members of the potential hazards and work methodology to be followed.

The survey was completed within a two-week period (9^{th} – 22^{nd} December 2003). The following maps, provided by ESBI under Licence from GSI, were utilised for the assessment:

- Ordnance Survey of Ireland, Discovery Series 1:50,000. Sheets 52.
- Ordinance Survey of Ireland, local 1:5000 sheets.

2.2 Aquatic Habitat Assessment

The aquatic habitats present in the eleven study sections were defined with reference to the habitat classification scheme published by the Heritage Council in *A Guide to Habitats in Ireland (*Fossitt, 2000). Codes such as FW1, refers to habitat types of eroding upland rivers, as defined in this publication. The diversity (species richness) of aquatic/riparian fauna is primarily a function of the integrity and physical diversity of the aquatic habitats. The more diverse the aquatic habitat is in terms of substrate, depth, riparian vegetation, etc. the richer the biological community is likely to be. Salmonid fish (trout and salmon) in particular have specific habitat requirements and the presence and abundance of these fish has been shown to be strongly correlated with key physical habitat variables (Haury, 1999). Habitat considerations for juvenile salmonids in streams and rivers include stream size and flow (Hatfield & Bruce 2000), depth and gradient (Kennedy & Strange 1986), substrate (Greenberg & Dahl 1998), and canopy (O'Grady, 1993). Physical habitat assessments were undertaken at intervals along the river. These sites were assessed in terms of: -

- Wetted width (m)
- Depth (m)
- Bank height (m)
- Riffle (%)
- Glide (%)
- Pool (%)
- Bedrock (%)
- Cobble (%)
- Gravel (%)
- Boulder (%)
- Sand/Silt (%)

Aquatic Flora Assessment

Qualitative assessments of instream vegetation were undertaken during the habitat assessment study. The species present were identified and the percentage cover of riparian and instream vegetation was estimated visually. An impact on vegetation was recorded where vegetation had been eroded, or covered by peat to a depth likely to affect growth. As the survey was carried out mid-winter, plants were identified from overwintering parts and were not always identifiable to species level. Similarly, cover of emergent aquatic species is lower in winter than at the peak of the growing season (summer). A list of aquatic and riparian plant species for the 10km grid squares containing the Owendallulleegh River was also extracted from the CD ROM of Preston, C. D., Pearman, D. A. and Dines, T. D., eds (2002). *New Atlas of the British and Irish Flora*. Oxford University Press, Oxford.

3.0 EXISTING ENVIRONMENT

3.1 General

The Owendallulleegh River within the study area is described and evaluated on the basis of aquatic and riparian habitats. The presence of protected aquatic species is also considered. The areas investigated are described below.

3.2 Designated Areas

The National Parks and Wildlife Service (NPWS) is responsible for natural heritage conservation in Ireland. It is responsible for the designation of the following areas of statutory protection:

- *Special Areas of Conservation (SACs)* - These were established under the 1992 Habitats Directive of the Council of the EU for the conservation of natural and semi-natural habitats and species of flora and fauna.
- *Special Protection Areas (SPAs)* – These areas are designated for the protection of birds, and were established under the Birds Directive of the EU in 1979.
- *Natural Heritage Areas (NHAs)* – These are nationally important protection areas and were established under Irish law.
- *Statutory Nature Reserves* - These are relatively small land areas, very often forest or previously afforested areas that are maintained as protected nature reserves.

The Owendallulleegh River is not on or within a site designated or being considered for designation for statutory nature conservation. However, it flows into Lough Cutra, which is a candidate Special Area of Conservation (cSAC) and a designated Special Protection Area (SPA) under the EU Birds Directive. Gortacarnaun Wood, a designated SAC, is also adjacent to the river. In table 1, these and other designated areas adjacent to the study area are described. The location of these sites in relation to the Owendallulleegh River is shown in figures 2 and 3. Additional information on Lough Cutra (Site code 00299) and Lough Coy (002117) are provided in appendix 2. No information on the Newhall site (002293) was available at the time of preparing this report. Under Article 6 of the Habitats Directive the onus is on the developer to assess the indirect impacts on any designated sites (Special Areas of Conservation –SACs or Special Protected Areas SPAs) as a result of a plan or project.

3.3 Hydrology of the area

The study area is located in the Owendallulleegh River (or Derrywee River) river system (EPA code 29/O/01). This is an undrained river system located in EPA hydrometric area 29. The Owendallulleegh is an upland spate river that rises in the Slieve Aughty Mountains in south County Galway. It flows west through the townlands of Derrybrien, Inchamore, Lahardaun, Derreen, and Kilafeen to enter the southern end of Lough Cutra. It has a main channel length of 22.5km (McGarrigle *et al*, 2002). The catchment area is approximately 40km^2 and includes extensive areas of cutover bog and coniferous forestry. Lough Cutra is an oligo/mesotrophic landlocked lake, which has a surface area of 3.9km^2. Catchment details and selected physical characteristics of the Owendallulleegh River (from source to Lough Cutra) are provided in tables 2 and 3 respectively.

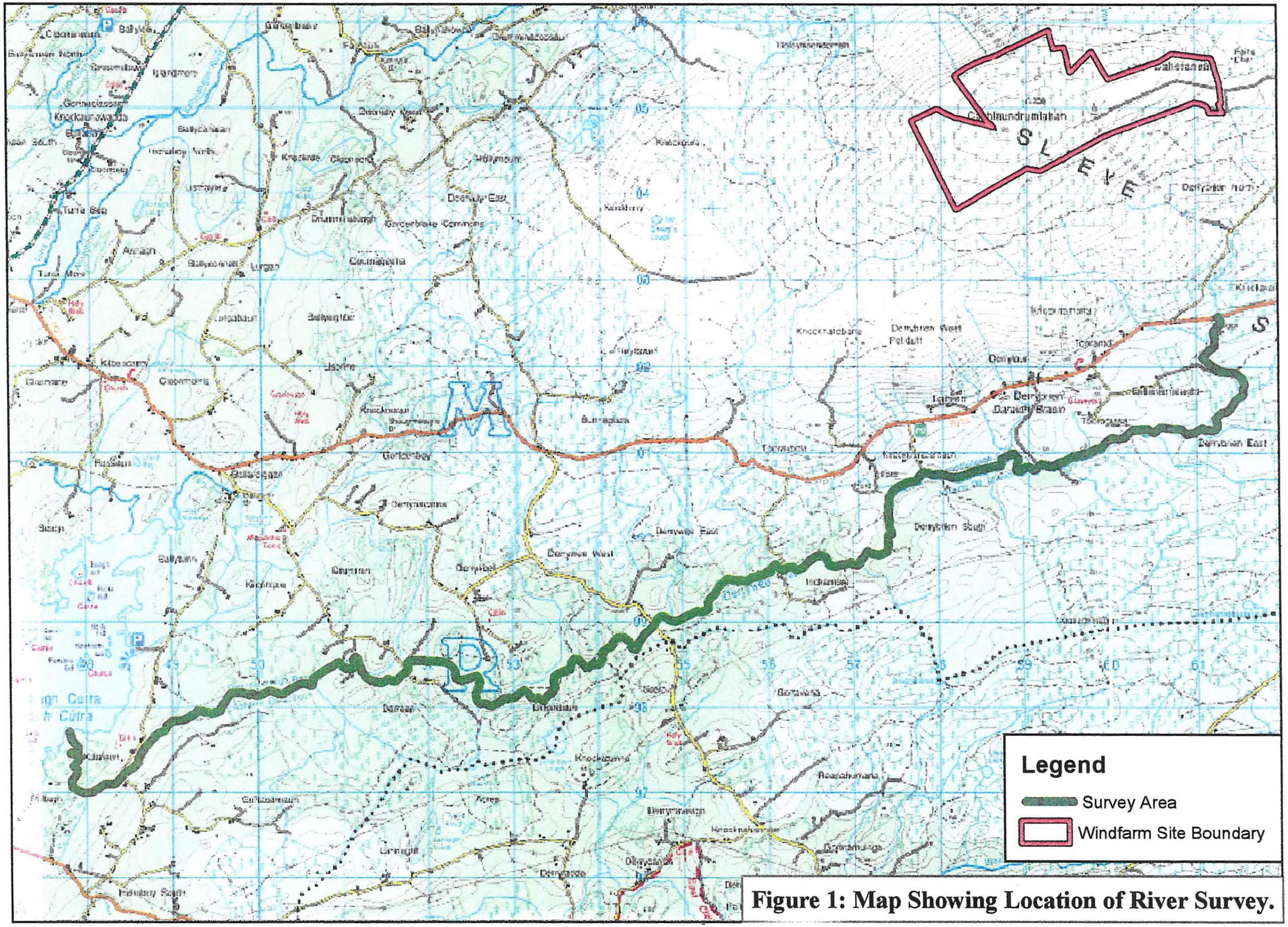

Figure 1: Map Showing Location of River Survey.

The Owendallulleegh River flows for a distance of approximately 22 km and flows into Lough Cutra. The outlet of Lough Cutra forms the Beagh river, which sinks at the Punch Bowl and remerges as the Cannahowna river (Gort River and Castletown river), where water is abstracted for the Gort Water supply. It then disappears underground again and re-emerges into Lough Coole and feeding into the turlough system at Coole – Garryland. Ultimately it is thought to discharge to the sea at Kinvarra.

Table 1 Designated sites surrounding river survey area (Source: NPWS).

Name	Site Code	Designation	Notes	Distance and direction from river survey area
Lough Cutra	000299	pNHA SAC SPA	Lough Cutra is an oligo/mesotrophic freshwater lake lying on limestone. The main habitats of this site are; aquatic lake vegetation, reedbeds confined to sheltered bays and mixed woodland. The site is internationally important for its breeding and wintering population of Cormorants (166 pairs in 1985 and max 300 individuals in winter) (Information compiled in 1987). The Cormorants use the off-shore islands for breeding purposes. The internationally important populations of Cormorants and Lesser Horseshoe Bats should be especially protected. Lough Cutra is an important site with its diverse habitat types and the presence of both calcicole and calcifuge floras.	0km Includes and adjacent to river mouth
Gortacarnaun Wood	002180	SAC	Old oak woodlands are scarce in Ireland and the habitat is of particular conservation importance as it is listed on Annex I of the EU Habitats Directive.	0km Adjacent to south bank river
Drummin Wood	002181	SAC	Drummin Wood is of considerable conservation significance as it conforms to a woodland habitat type that is scarce in Ireland and one that is listed on Annex I of the EU Habitats Directive. The occurrence of Red Data Book plant and animal species adds to the importance of the site.	0.2km North
Lough Coy	002117	SAC	The site consists of a small permanent lake in the middle of an almost circular turlough basin. Lough Coy is an excellent example of a 'riverine' type of turlough, and is in essence the floodplain of an underground river. The entire site consists of turlough habitat, an EU Habitats Directive Annex I priority habitat. Of particular note is the occurrence of three Red Data Book plant species at this site - these are Mudwort (*Limosella aquatica*), Fen Violet (*Viola persicifolia*) and Northern Yellow-cress (*Rorippa islandica*). Lough Coy is an excellent example of a eutrophic (nutrient-rich) turlough. The extreme water fluctuation supports a distinctive zonation of vegetation and provides many niches for specialist plants. It is an important site for wintering waterfowl.	7.7km North
Newhall	002293	SAC	No synopsis available	7.8km North North-west
Coole-Garryland	000252	SAC	Turloughs and protected bird species are the qualifying interests of this designated area.	6km south

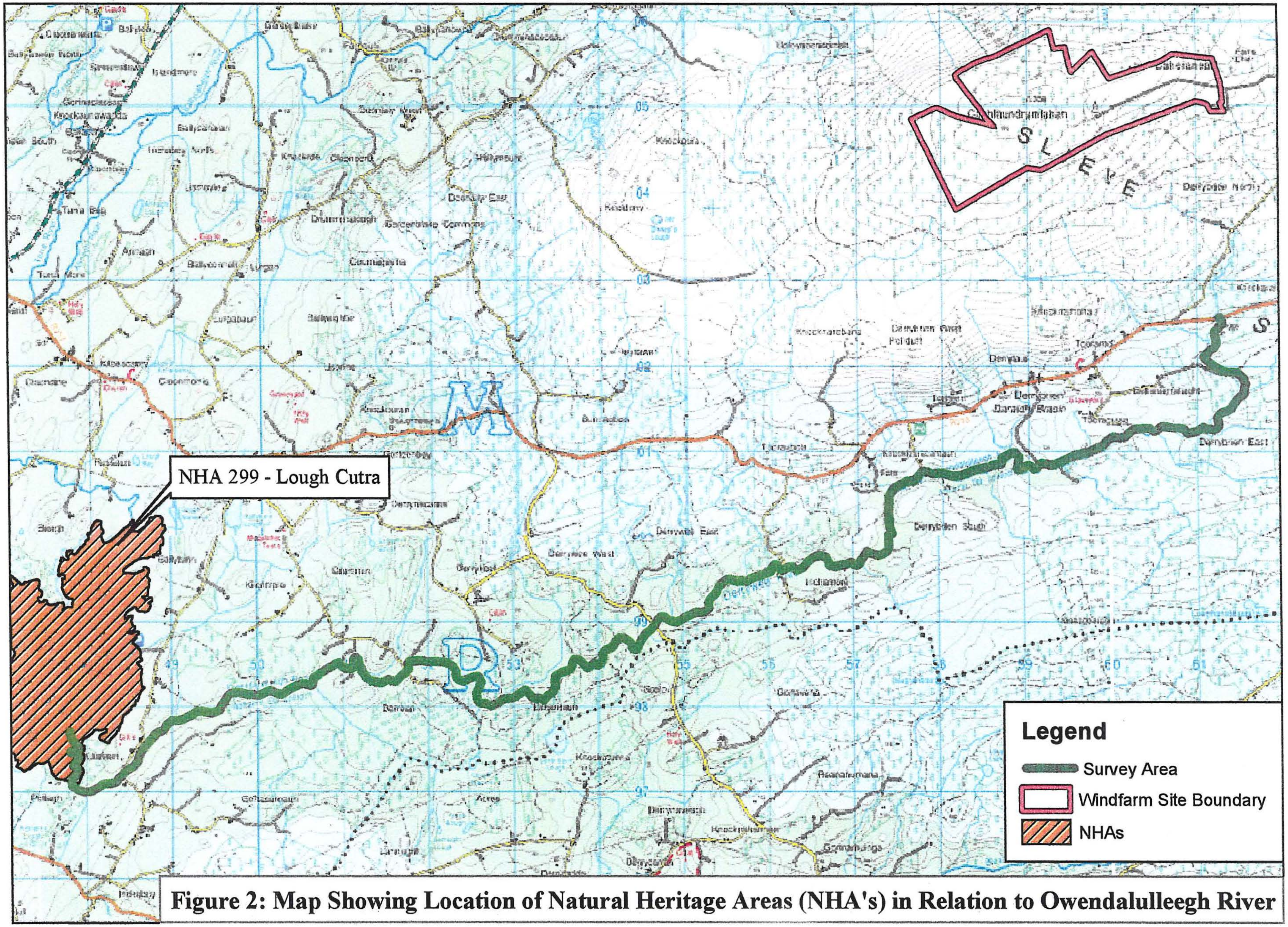

Figure 2: Map Showing Location of Natural Heritage Areas (NHA's) in Relation to Owendalulleegh River

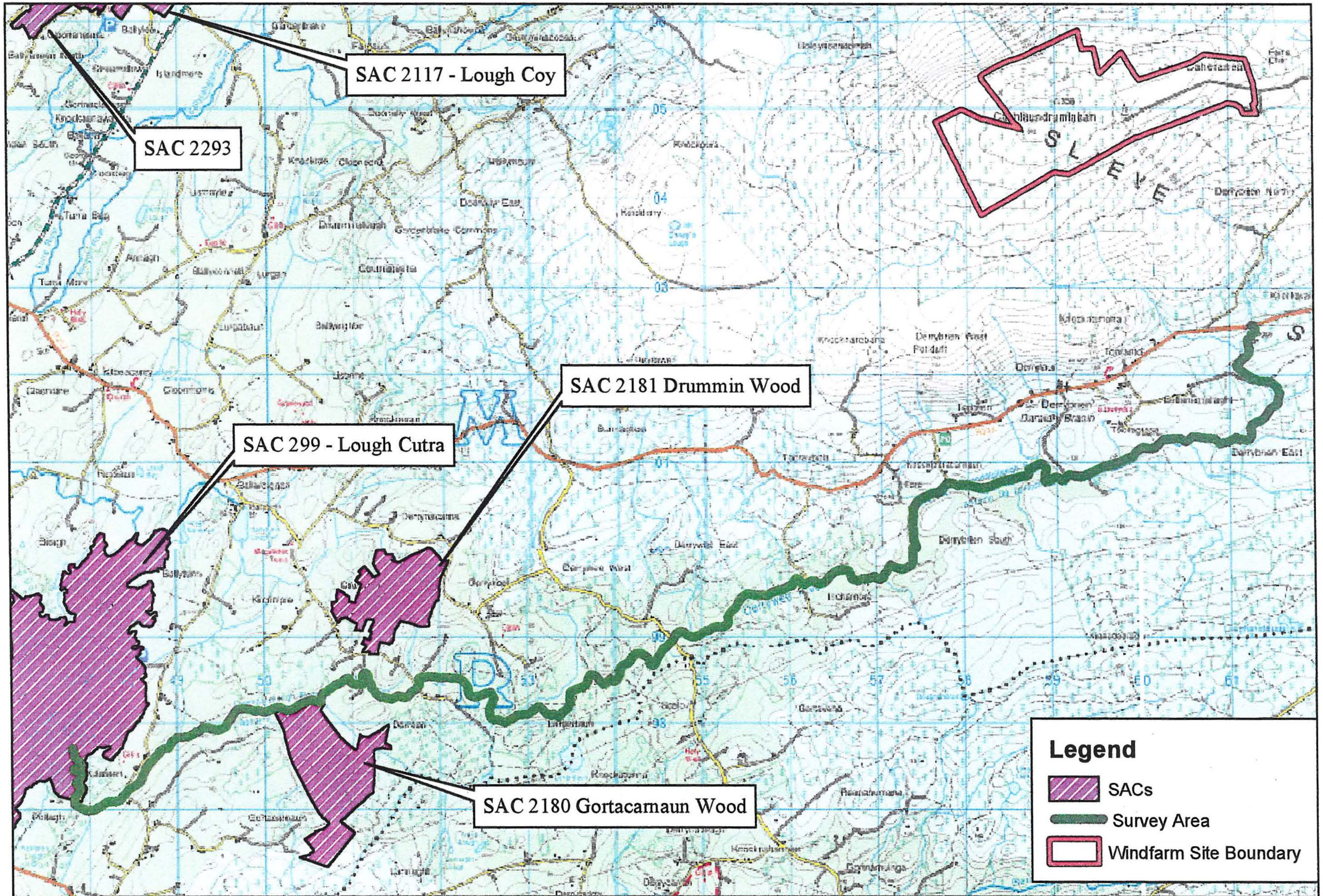

Figure 3: Map Showing Location of Special Areas of Conservation (SAC's) in Relation to Owendalulleegh River

Table 2 Catchment details of the Owendallulleegh River (from source to Lough Cutra). Adapted from McGarrigle *et al* (2002).

Detail	Value
EPA Code	29/O/01
OS Catchment number	146
NOS Grid Reference	R 478 976
Hydrometric area	29
Tributary of	Lough Cutra

Table 3 Physical characteristics of the Owendallulleegh River (from source to Lough Cutra). Calculated from the features shown on the NOS Discovery Series Map 52 and information provided in McGarrigle *et al*, 2002).

Characteristic	Value
Catchment area (km^2)	40
Length (km)	22.5
Basin length (km) [1]	17.2
Basin surface storage (%) [2]	0.005
Drainage density [3]	1.09
Stream order	3rd
Beneficial uses	General amenity and angling
Status	Tributary of designated SAC

Stream order was calculated using the Strahler method (Strahler, 1964).

3.4 Previous studies

3.4.1 Fish and fisheries of the Lough Cutra catchment

The fish fauna of Ireland is not as diverse as other European countries due to the impact of glaciation. Most of the fish species present in Irish river catchments have colonized from the sea or have been artificially introduced. The fact that the Lough Cutra catchment is landlocked will further reduce the number of fish species present. Native fish species in the Lough Cutra catchment include brown trout *Salmo trutta* and one out of the three Irish lamprey species (brook lamprey *Lampetra planeri*). Brook lamprey are listed under the European Union Directive on the Conservation of Natural and Semi-Natural Habitats and of Wild Fauna and Flora (Habitats Directive, 92:43:EEC). The catadromous[4] European eel *Anguilla anguilla* is thought to access Lough Cutra via underground river channels. Introduced fish species in the catchment include northern pike *Esox lucius*, stone loach *Barbatula barbatula*, perch *Perca fluviatilis*, and gudgeon *Gobio gobio*. There have been reports that carp *Cyprinus carpio* has been introduced to the lake but the ShRFB has not confirmed this. A list of the fish species, which are known to occur in the Lough Cutra catchment, and the Owendallulleegh River, along with their distribution and conservation status, is given in table 4. Lough Cutra is a privately owned lake and coarse/mixed fishery.

[1] Basin length is the straight-line distance between the mouth of the basin (in this case the confluence with the Lough Cutra) and the drainage divide nearest the source of the main stream.
[2] Basin surface storage (%) is the percentage of the basin covered in lentic water bodies (i.e. lakes).
[3] Drainage density is an index of the length of stream per unit area of basin. It is calculated by dividing the catchment area by the total length of perennial streams in the catchment.
[4] A fish species which spends most of its life in freshwater but migrates to the sea to spawn.

Table 4 A list of fish species recorded from the Lough Cutra catchment, and Owendallulleegh River, indicating their distribution, protection status, and utilisation (compiled from a number of unpublished sources).

				Protection			*Exploitation*		
Common name	**Scientific name**	**Origin**	**Distribution**	**EU HD**	**Berne**	**RDB**	**Recreational**	**Commercial**	**Present in Owendallulleegh River**
Brown Trout	*Salmo trutta*	N	W				•		•
European Eel	*Anguilla anguilla*	N	W				•	•	•
Carp*	*Cyprinus carpio*	I	L				•		
Gudgeon	*Gobio gobio*	I	L						•
Northern Pike	*Esox lucius*	I	W				•		
Perch	*Perca fluviatilis*	I	W				•		•
Brook lamprey	*Lampetra planeri*	N	L	II	Annex III	I			•
Stone Loach	*Barbatula barbatula*	I	L						•

*Not confirmed.

N=Native, I=Indigenous, W=Widespread, L=Local, E=Extinct.
EU Habitats Directive (EU HD) - Annex II (Species whose conservation requires the designation of SACs), Annex V (Exploitation subject to management)
Berne Convention (Berne) - Annex II (Strictly Protected fauna species), Annex III (Protected fauna species).
Red Data Book (RDB) - Ex – Extinct, E - Endangered, V - Vulnerable, R - Rare, I – Indeterminate, II – Internationally Important

3.4.2 Plant records

The following rare species are recorded for the 10km squares between Flaggy Bridge and L. Cutra. As this data was recorded on a 10km-square basis, it is not possible to state definitively whether the plant record is from the Owendallulleegh River, or from other wetland/streams in the 10km square.
As can be seen from the descriptions of the species' preferred habitats, most of these species prefer slow-moving or standing water or damp ground, and may have been recorded from L. Cutra or other areas of standing water within the relevant 10km squares and thus are less likely to have been affected by the peat slip event. These are marked +.

Orange foxtail *Alopecurus aequalis* – grows in muddy, marshy areas,

Slender tufted-sedge *Carex acuta* – grows along rivers and in ditches and marshes

Water sedge *Carex aquatilis* – grows in swampy areas by rivers and marshes

+Rigid hornwort *Ceratophyllum demersum* – grows in ponds, ditches and slow rivers

+Mudwort *Limosella aquatica* – grows in wet sandy mud by ponds

+Lesser pondweed *Potamogeton pusillus* – grows in lakes, streams and ponds usually in base-rich water

+Northern yellow-cress *Rorippa islandica* – grows on pond sides and other damp places

+Marsh yellow-cress *Rorippa palustris* – grows in open damp ground

+Blue-eyed grass *Sisyrinchium bermudiana* – grows in wet meadows and stony ground by lakes

+Greater bladderwort *Utricularia vulgaris sens. lat.* – grows in base-rich still or slow-moving water

+Fen violet *Viola persicifolia* – grows in fens

3.4.3 Protected aquatic fauna

The status of fauna listed in the European Union Directive on the Conservation of Natural and Semi-Natural Habitats and of Wild Fauna and Flora (Habitats Directive, 92:43:EEC) in the Owendallulleegh catchment is presented as follows;

Common name	Scientific name	Lough Cutra	Owendallulleegh River
Brook lamprey	*Lampetra planeri*	Not known	Present
Eurasian Otter	*Lutra lutra*	Common	Common

3.4.3.1 Brook lamprey

The brook lamprey is the smallest of the three lamprey species native to Ireland and it is the only one of the three species that is non-parasitic and spends all its life in freshwater. Brook lamprey is listed in Annex II of the Habitats Directive (92:43:EEC) and Appendix III of the Bern Convention. The Shannon Regional Fisheries Board has recently recorded Brook lamprey in the Owendallulleegh catchment.

3.4.3.2 Eurasian Otter

The otter is a legally protected species under the Wildlife Act, 1976 (and Wildlife (Amendment) Act, 2000). It is listed under Annex II of the EU Habitats Directive and under Annex II[5] of the Berne Convention. It is found throughout Ireland where it has apparently avoided the population declines that have occurred in many other countries. During the survey, the signs of otters (spraints and tracks) were recorded from many areas in the study area and up as far as chainage 182.

3.5 On-site Investigations

3.5.1 Aquatic habitats

The principal habitat type surveyed is categorised as eroding/upland river (FW1, Fossit 2000). For the purposes of this study, this was subdivided into in-stream areas and riparian, or riverbank, areas. A full aquatic and riparian habitat evaluation is presented in tables 5, 6, 7 and 8. The results of the physical habitat survey are given in table 9. The river length has been divided into 100m chainage lengths for the purpose of assessment, commencing at chainage zero at the Lough Cutra confluence.

3.5.2 Vegetation

A list of plant species recorded during the walkover study is given in Appendix 3. Very little vegetation was recorded from the deeper pools. Pondweed *Potamogeton* sp. was recorded at a few locations. Shallow areas were found to support a limited number of species. These areas were dominated by aquatic mosses such as *Fontinalis* and *Racomitrium* spp. Alternate water-milfoil *Myriophyllum alterniflorum* was recorded as being locally abundant. Emergent, marginal-type vegetation was found along the banks, particularly where these were shelved rather than steep-sided, and on islands and elevated cobble/gravel areas in the channel. The principal species recorded were watercress *Rorippa nasturtium-aquaticum*, water dropwort *Oenanthe* sp., fool's water-cress *Apium nodiflorum* and bulbous rush *Juncus bulbosus*. Willowherbs *Epilobium* spp., floating sweet-grass *Glyceria fluitans*, lesser spearwort *Ranunculus flammula* and brooklime *Veronica beccabunga* were locally frequent. Liverworts were locally dominant or abundant on steep-sided, shaded or overhanging banks, where they were constantly damp but rarely submerged. The dominant riparian species recorded were willows *Salix* spp., ash *Fraxinus excelsior*, hazel *Corylus avellana* and rowan *Sorbus aucuparia*, with an abundant great wood-rush *Luzula sylvatica* ground layer. Gorse *Ulex europaeus*, blackthorn *Prunus spinosa*, hawthorn *Crataegus monogyna* and bramble *Rubus fruticosus* were locally dominant, while bilberry *Vaccinium myrtillus* and soft rush *Juncus effusus* were locally abundant. Sedges *Carex* spp. were locally frequent. Some sections were dominated by planted evergreens such as sitka spruce *Picea sitchensis*. Most of the riverbank above the influence of flood events was dominated by either woodland or heath/bog flora, with unimproved grassland found in a few areas.

3.5.3 Peat Deposition

Estimates of peat deposition were made on the basis of bank side surface area and depth of peat. In general depths of peat at some locations ranged form 0.1 m thickness up to 0.5 m thickness. Larger deposits tended to occur at river bends where peat mounding was observed and at fords used on the river by local farming communities. Areas where larger depths of peat were observed tended to be small in area and could easily be removed if required.

[5] Annex II Berne Convention: Strictly protected fauna species.

Table 5 Aquatic, riparian and fisheries habitat evaluation chainage section 169-200.

Chainage section	Description	Map number	Aquatic habitat appraisal	Fisheries habitat appraisal	Level of instream impact	Level of riparian impact	Comment	Mitigation
200 - 189	From Flaggy Bridge downstream. The start point of the survey. Steep banks and a narrow channel characterize this section. There are hillocks on the eastern edge of the river that rise to 140m asl. Liverworts grow where moisture seeps down to the river.	1	One of the most heavily impacted areas of the river – strong scouring and removal of all instream vegetation. Degree to which instream habitats were affected depended on their relative exposure to the flow of moving peat i.e. whether they were on the inside or outside of a bend. Marginal species are showing good recovery three weeks after the peat slip where peat cover is light.	Here there are large amounts of peat deposited on the margins of the river. Sand banks are evident at bends in the river. These should dissipate with precipitation over time. Instream the riverbed has been scoured gravels and rocks transported downstream. All fish would have been displaced or killed by this flow of material.	Profound Negative	Profound Negative	Physical nature of river has been significantly altered here.	Large areas of peat on the margins may require removal. Alternatively could be planted and stabilized. Damage directly above and around culvert at M 61137 02304. This dam (005) should be removed. The culvert size and gauge should be changed. Instream physical enhancements may be required.
189 – 169	The section from chainage 189 – 182 is still fast moving and narrow until it meets a distributary at 182. From 182 – 169 the river widens and slows.	2	Aquatic vegetation is minimal from 189 – 182. Large amounts of siltation evident. Again there is recovery evident where peat cover is light. From 182 – 169 not as much impact due to the increasing river width.	Area between chainages 189 – 182 has been severely impacted. However, not much scouring has occurred in this section. From 182 – 169 there is good habitat available with good pools and glides - but siltation is evident. The banks have not been eroded as in chainage 200 – 189.	Substantial - Profound Negative	Substantial - Profound Negative	Fish were seen moving upstream within chainage 183. Because the fractions of peat are now small the pools seem clear enough but silt is present. Otter activity was observed at chainage 177.	Areas of peat need to be removed from the margins. Trees and shrubs instream should be left, as removal would be deleterious to habitats and fish.

Table 6 Aquatic, riparian and fisheries habitat evaluation chainage section 169-111.

Chainage section	Description	Map number	Aquatic habitat appraisal	Fisheries habitat appraisal	Level of instream impact	Level of riparian impact	Comment	Mitigation
169 151	River structure consists of long pools with alternating glide/run habitat. River widths up to 12m	3	This section is less severely impacted. Deposition on the river margins is reduced and vegetation is intact at most locations. Cover is much reduced where cobbles and boulders have been turned and scoured. Sheltered areas in the bends of the river have more moderate cover.	Despite some physical impacts, much of the instream habitat along this stretch has been left intact. Areas suitable for salmonid spawning, nursery, rearing and foraging continue to occur.	Moderate – Substantial Negative	Moderate – Substantial Negative	Impacts predicted to be short-tem at this section. Banks are still intact and good habitat is evident in the majority of the length of this section.	No action needed here. Natural recovery processes would suffice.
151 – 129	Long wide sections of slow water with some extensive riffles. Some very wide sections here (up to 19m). Substrate consists of cobble and gravel.	4	Fluctuation in instream vegetation cover reflects variations in streambed disturbance. Cover is much reduced where cobbles and boulders have been turned and scoured. However this damage was not recorded frequently in this section.	No scouring evident. No serious instream damage evident. No peat deposits. There are good areas of gravel evident. Periphyton present on gravels. The majority of larger peat material has been 'sieved out' by the narrow nature and overhanging shrubs from 200-182 of the river	Slight Negative	Slight Negative	This section is physically unchanged from its original form. Banks are still intact and good habitat is evident in the majority of the length of this section. Impacts negligible. Otter activity evident in this section.	No action needed here
129 – 111	Some large pools along this stretch, three small distributaries and three fords characterize this section. Bank height rises here along this section. Fish (salmonids) were noted moving in the pools here. This section is for the most part slow moving with some good riffles evident at the fords.	5	Cover of peat on the margins here is very light except for small pockets. Liverwort flora, the most abundant riparian-type marginal vegetation, is undamaged. Instream vegetation is low and scouring damage is not evident.	Good spawning areas in this section with gravels intact. Also good holding pools and nursery areas available. Damage is limited to marginal areas where peat has deposited. No instream damage evident with the exception of some trees and shrubs that have been washed down. These will form extra habitat for fish in future.	Slight Negative	Slight Negative	This section seems largely undamaged to the eye. There is no evidence of scouring or of large movements of gravels and cobbles. Because the fractions of peat are now small the pools seem clear enough but silt is present in the interstitial spaces. Otter activity in the form of paw prints and anal jelly was observed.	No action needed here

Table 7 Aquatic, riparian and fisheries habitat evaluation chainage section 111-31.

Chainage section	Description	Map number	Aquatic habitat appraisal	Fisheries habitat appraisal	Level of instream impact	Level of riparian Impact	Comment	Mitigation
111- 91	Deep pools and large sections of bedrock characterize this section. There is good bankside vegetation and some good stands of mixed forestry line the edges of the river in places. Tunneling (trees) was observed at two locations.	6	Due to the depth of water in areas instream vegetation was low where it was possible to assess. Again liverworts were undamaged.	Large deep holding pools that are impossible to assess for benthic damage. However there are good areas of glide (50%) accessible and these seem untouched. Peat has not deposited instream with the exception of areas in the lee of trees in the river. Peat has deposited on the margins in some areas.	Slight Negative	Slight Negative	This section seems largely undamaged to the eye. Large numbers of deer are using this area. The only discernable difference is the peat that has deposited on the banks.	No action needed here
91 – 70	This entire section has deciduous woodland on the bankside. As a result shading occurs on most of the sections. Long pools are evident with no damage recorded.	7	Vegetation that was seen was intact. There is impoverished riparian flora as a result of shading. The instream flora is low where shading occurs but is relatively undisturbed. The lower areas 64-56 supports very good areas of instream vegetation and also seems undisturbed by then peat slip event.	Where possible to assess instream predictors no damage was recorded. Gravels were evident but on a whole deep areas and glides predominated. Siltation was observed. Peat has deposited on the margins in some areas.	Slight Negative	Slight Negative	This section was undamaged and instream vegetation was intact where noted. Areas of peat deposition were apparent.	No action needed here
70 – 50	Wide sections of river bordered on the northern bank by good improved agricultural grassland complexes. The river exhibits deep pools again with glides predominating.	8	Good sections of instream growth are evident at the lower end of this section. Again heavy shading by overhanging trees has stunted growth in some sections. All instream vegetation that was observed was undisturbed.	Where wading permitted inspection of the instream predictors these seemed undisturbed. Peat has deposited on the margins in places.	Slight Negative	Slight Negative	This section was undamaged and instream vegetation was intact where noted. Areas of peat deposition were apparent.	No action needed here
X 50 – 31 (SAC 2180 Gortacarnaun Wood)	Characterized by widening sections of river with good pool systems. Some nice fast water at chainage 45 with nice undisturbed gravels present. Between chainages 39 – 34 on the southern bank there is heavy woodland cover entailing observers to make use of the northern bank.	9	There have been no impacts on vegetation found in this section. Open unshaded areas support good instream vegetation.	Minimal impacts were observed in this section. Peat has deposited on the banks at various locations and overhanging trees bear the detritus of the deluge.	Imperceptible Negative	Imperceptible Negative	Fresh otter spraints were noted in this section. There is no perceptible damage in this section.	No action needed here

Table 8 Aquatic, riparian and fisheries habitat evaluation chainage section 31-1.

Chainage section	Description	Map number	Aquatic habitat appraisal	Fisheries habitat appraisal	Level of instream impact	Level of riparian impact	Comment	Mitigation
31 – 11	Extensive areas of riffle separate some long deep pools. Instream predictors were difficult to assess in places due to the depth of pools.	10	There have been no impacts on vegetation found in this section. Open unshaded areas support good instream vegetation.	No impacts recorded on this section. Some small amounts of peat have settled on the margins at certain points.	Slight Negative	Slight Negative	There is no perceptible damage in this section.	No action needed here
11 – 1	Due to the depth of this section the ShRFB surveyed this section in boats. This section leads onto the mouth of the river and a large sand bank is present at this mouth.	11	There have been no impacts on vegetation found in this section. Depth of channel made assessment of instream vegetation impossible.	Although no impacts were recorded on this section some peat may have settled at the mouth of this river. Some small amounts of peat have settled on the margins at certain points.	Slight Negative	Slight Negative	There is no perceptible damage in this section.	No action needed here

Table 9 Approximate amount of peat (m^3) deposition observed on the river margins. (Estimated by ESBI)

Chainage section	Amount of peat (m^3) deposition observed on the margins (approx.)
200 - 189	1260.1
189 – 169	936.59
169 – 151	102.35
151 – 129	51.25
129 – 111	45
111- 91	21.5
91 – 70	276.25
70 – 50	79.75
50 – 31	16.15
31 - 11	65.15
11 - 1	67

Table 10 Results of the physical habitat survey.

Site number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Grid co-ords.	M611 625	M611 624	M 6113 623	M611 272	M610 206	M 611 196	M 611 345	M611 121	M604 119	M 601 121	M 579 702	M 575 538	M 57371 125
Bank height range (m)		1 - 2m	1 - 2m	3 - 7m	.5 - 3.5	.4 - 3.5	.4 - 2	.2 - .6	.5 - 1.5	1.5 - 2	.1 - 2	.1 - 2	.1 - 1.2
River width range (m)		1 - 2m	.2 - 1.1m	2 - 4m	.3 - 1.5m	1 - 4m	.7 - 4m	2 - 4m	3 - 8m	5 - 10m	5 - 14m	7 - 15m	8 - 19m
Depth range (m)		.1 - .5	.1 - .5m	.5 - .75m	.1 - .5m	.1 - .75m	.1 - .8m	.1 - .7m	.1 - 1.5m	.1 - .75m	.1 - 8m	.1 - .8m	.2 - .6m
Riffle %		50	20	10		10	10	10	50	20	30	20	5
Glide %		40	10	30	10	20	80	80	40	70	50	5	75
Pool %		10	70	40	60	70	10	10	10	10	20	75	20
Bedrock %		90	60	85	30	30	50		10				
Cobble %				5	10	10	30	75	20	60	15	15	80
Gravel %		10	40	15	60	60		25	70		15	85	20
Boulder %							20			40	70		
Sand/Silt %													

Site number	**14**	**15**	**16**	**17**	**18**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Grid co-ords.	R572 997	R561 996	R557 994	R546 989	R517 984	R517 984	R510 984	R502 981	R484 971	R482 972	R480 972	R487 978	R487 978
Bank height range (m)	.1 - 2.5	.1 - 5	0.5 - 2	0.1 - 2	1-3m	1-3m	1 - 3m	1-15m	1-3m	.1-2	.5-2m	.1 - 2.5	.1 - 5
River width range (m)	10 - 19m	2 - 20m	2 - 8m	3 - 30m	2-17m	5-14m	2-12m	10-14m	6-12m	17-25m	16-30m	10 - 19m	2 - 20m
Depth range (m)	.1 - .75m	.1 - 1m	.1 - 1.5m	.1 - >2m	.1-3	.2-3.5	.1 - 2.5	.1 -4.5	.2->2m	.2 -.4m	.75-5m	.1 - .75m	.1 - 1m
Riffle %	25	25	10	20	10	10	20	5		10		25	25
Glide %	75	25	80	50	60	35	30	10	50	90		75	25
Pool %		50	10	30	30	55	50	85	50		100		50
Bedrock %	10	60		70	30	30	5	80	10			10	60
Cobble %	20			20	40	20						20	
Gravel %	70	10	20	10	10	10	90					70	10
Boulder %		30	80		20	40	5	20	30	5			30
Sand/Silt %									60	95	100		

4.0 IMPACT

4.1 Characteristics of the impact

The results of this preliminary investigation suggest that the peat, which entered the upper reaches of the Owendallulleegh River, had a significant impact on the aquatic habitats in the river. The impacts were related to (1) physical impacts of peat on the river (i.e. scouring, bed erosion, etc.) and (2) impacts on water quality through elevated suspended solids and other parameters.

4.1.1 Physical impacts

Evidence of physical impacts are particularly apparent in the upper reaches of the river where an acute slide of peat into the channel scoured the river bed and denuded it of deposited materials such as gravels and cobbles. Physical impacts on the middle section of the river were less significant where suspended peat was transported. Deposition along this stretch of river was confined primarily to river bends and islands. No evidence of scouring was apparent along this section.

On the lower section of river, evidence of impacts were much reduced due to the spatial and temporal dilution of peat flocs and the riparian deposition of peat in the upper and middle section of the river. Suspended peat was transported along this stretch by river flows and deposition was confined primarily to river bends, islands and areas of reduced flow. No evidence of scouring was apparent along this section.

4.4.2 Scale of the impact

The most severe impact occurred in the upper section of the river, from Flaggy Bridge to confluence at Derrybrien East. In this area, the energy of moving peat, water and debris was greatest, and resulted in the near total loss of vegetation and scouring of the riverbed in some parts. Heavy deposition of peat on the banks also occurred in this area. The impact on the remaining downstream section was less significant. The presence of a 'high water mark' of debris deposited along the entire length of channel from Derrybrien to Lough Cutra indicates the ultimate height to which the banks were affected. In most areas below Tooraglassa, this is limited to a light covering of twigs and plant debris.

The main physical impact of peat silt on instream and riparian habitats is to be found within 0.5km downstream of Flaggy Bridge, where heavy peat deposition and scouring of the river channel had a profound impact. In contrast with this, practically the entire remaining habitat, from Bellaghnamallaght to L. Cutra, shows low/no impact, with localised areas of moderate impact. Habitat quality and species composition in areas of low/no impact is as expected for this type of river, where low nutrient availability and a spate-type flood regime do not favour the growth of emergent aquatic plants. Low cover of instream vegetation in areas of low/no impact is coincident with areas of heavy shading or deep pools, both of which are unsuitable for the growth of the most instream species typical of upland rivers. Those areas where instream vegetation has suffered moderate/low damage would be expected to recover naturally over the next 2-3 years.

Areas of deposited peat will provide new habitat for colonisation by some emergent species that are tolerant of its low pH, e.g. lesser spearwort, over the coming growing season (spring/summer 2004). However most of these deposits will be moved or modified by spate floods and are generally unlikely to provide habitat beyond approximately two years, given the eroding nature of this type of river. Most of the instream species found on this river prefer a mineral- (rock) derived substrate for growing, as opposed to one derived from organic matter (e.g. peat) – that is why they are found in this eroding type of river. While some deposition of fine peat is evident in the streambed, this is not of sufficient quantity to significantly affect plant growth.

With regard to plants and habitats along most of the affected stretch of the Owendallulleegh River, no remedial action is necessary, or even desirable, as the communities present will regenerate naturally over the next 1-3 years. Peat deposits should not be removed except where they present a possible danger to humans/livestock, or a potential threat to fisheries. Accessing and removing deposits is more likely to cause harm to habitats and plants than if they are left to naturally recolonise and/or be eroded (assuming that heavy plant such as caterpillar-tracked vehicles would be used to carry out the work).

5.0 MITIGATION

Some remedial works are desirable in the upper section at Flaggy Bridge in order to stabilise denuded areas of river channel and prevent unnecessary release of sediment into the watercourse. The use of matting, geotextile or similar 'soft' engineering solution to stabilise the bank sides and allow natural regeneration to occur is preferable over the use of 'hard' engineering. As well as facilitating habitat restoration and quickly fitting in with the natural landscape, 'soft' solutions have long-term advantages of being better adapted than hard bank retention engineering to absorbing some of the energy of spate events. Planting of vegetation 'plugs' at intervals along the stabilization structure would accelerate recolonisation. Any plants used should be taken from a suitable nearby site and the use of native species is recommended.

The planting of trees to replace those damaged in the flood would help to stabilise adjacent areas. The most suitable species are those native species already found growing naturally in this area – ash, mountain ash and downy birch.

Remediation of instream vegetation is problematic as aquatic mosses are slow growing. Two options are available. The first,'do nothing', option will leave the channel to recover by itself with no interference. This will be a slow process (3+ years). Alternatively, a small number of medium-sized (football-sized) boulders with moss growth could be introduced from unaffected parts of the river, preferably from the closest point possible (to retain a species composition as close to the original as possible). Such boulders would create a more diverse flow regime and variety of instream microhabitats. It is recommended that this option be considered only when all other remediation and stabilisation works have been completed, at which stage the condition of the streambed in the worst affected area should be re-assessed. The possible introduction of such boulders should be discussed with ShRFB staff.

5.1 Proposed further work

It was not possible to assess the status of fish populations and other fauna in the river during the current survey. It is therefore recommended that a fish stock assessment coupled with a macroinvertebrate survey be undertaken. This survey should use standard quantitative methods (electrical fishing and serber sampling) and should be undertaken at 5-10 sites along the river corridor. The ideal time to undertake this survey would be during the period July-September when the maximum numbers of juvenile fish would be expected to be present in a stream of this nature. At this time detailed recommendations regarding instream physical mitigation work can be made.

REFERENCE

Greenberg, L.A. and Dahl, J. 1998. Effect of habitat type on growth and diet of brown trout (*Salmo trutta* L.) in stream enclosures. *Fisheries Management & Ecology* **5:** 331-348.

Haury, J, Ombredane, D, & Bagliniere, JL (1999) The habitat of the Brown Trout (*Salmo trutta* L.) in watercourses. *Biology and ecology of the brown and sea trout. 37-89. (1999).*

Hatfield, T. & Bruce, J. (2000) Predicting Salmonid Habitat–Flow Relationships for Streams from Western North America. *North American Journal of Fisheries Management* **20**:1005–1015, 2000

Kennedy, GJA & Strange, CD (1986) The effects of intra- and inter-specific competition on the distribution of stocked juvenile Atlantic salmon, Salmo salar L., in relation to depth and gradient in an upland trout, Salmo trutta L., stream. J. Fish. Biol., **29**(2):199-214.

O'Grady, M.F. (1993) Initial observations on the effects of varying levels of deciduous bankside vegetation on salmonid stocks in Irish waters. *Aquacult. Fish. Manage.*, **24**(4):563-573.

APPENDIX 1 SURVEY AREAS ON THE OWENDALLULLEEGH.

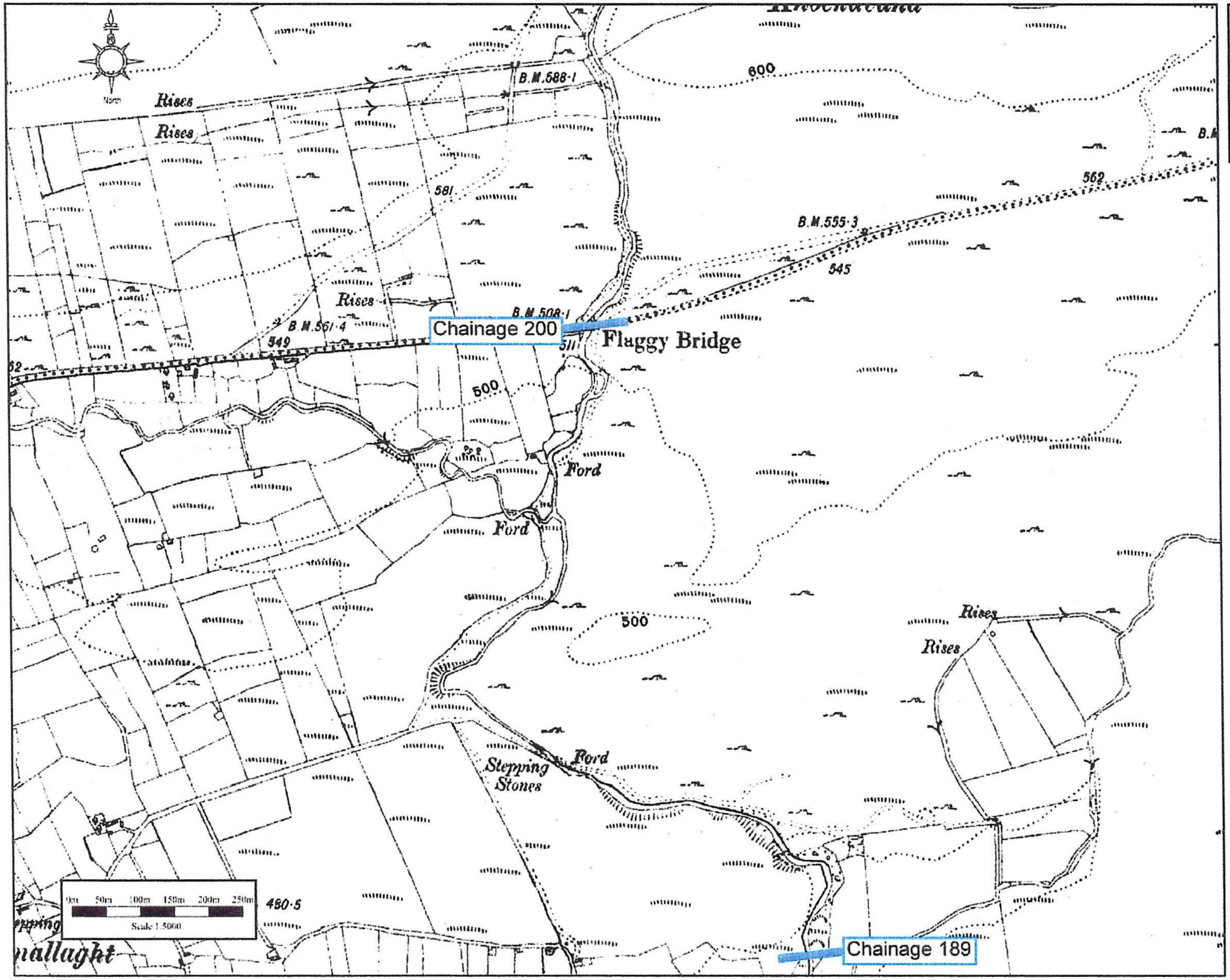

Figure A1.1
Section one was located downstream of Flaggy Bridge. Survey section was between chainages 200 - 189.

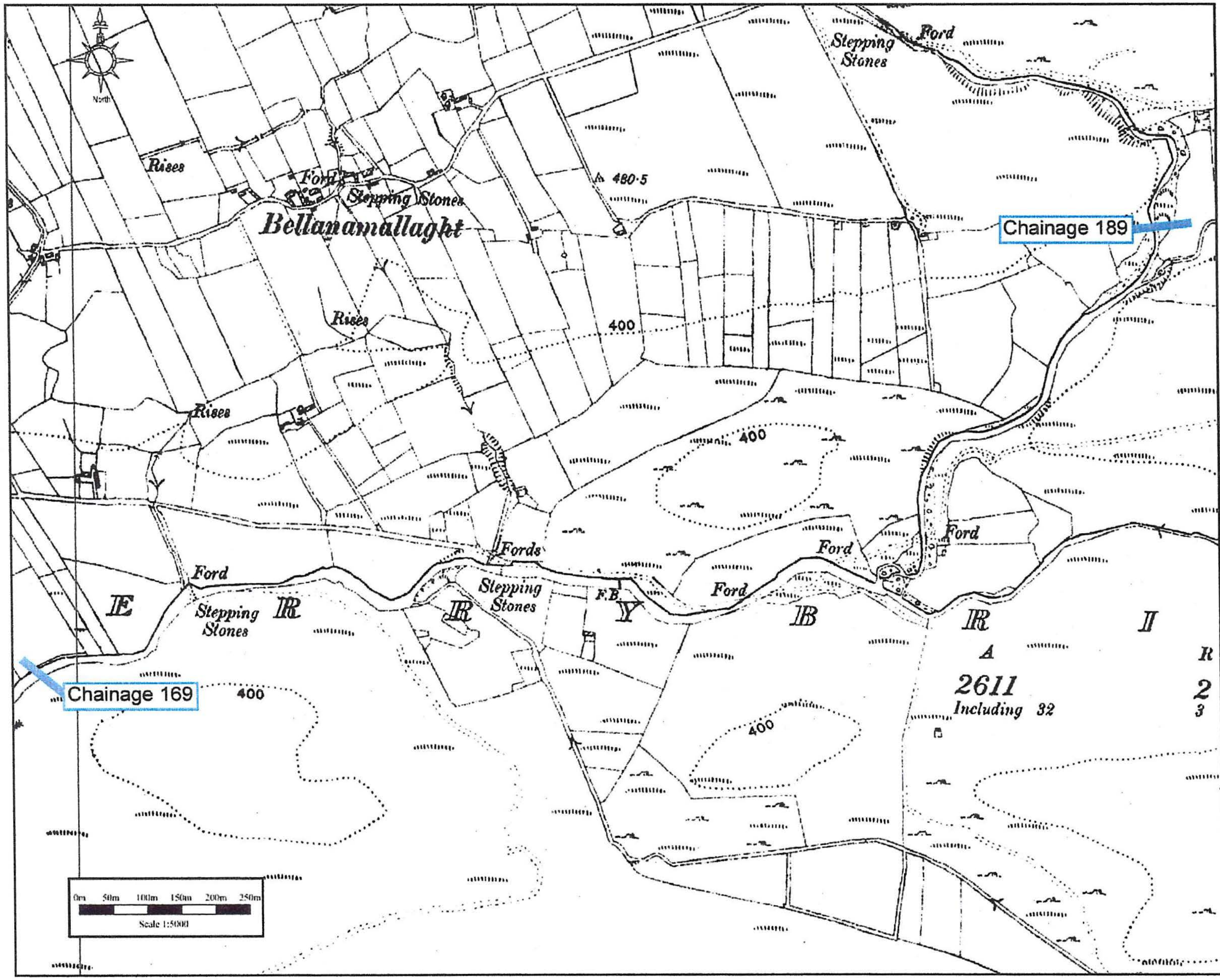

Figure A1.2
Section two was located on the second section down-stream of Flaggy Bridge. Survey section was between chainages 189 - 169.

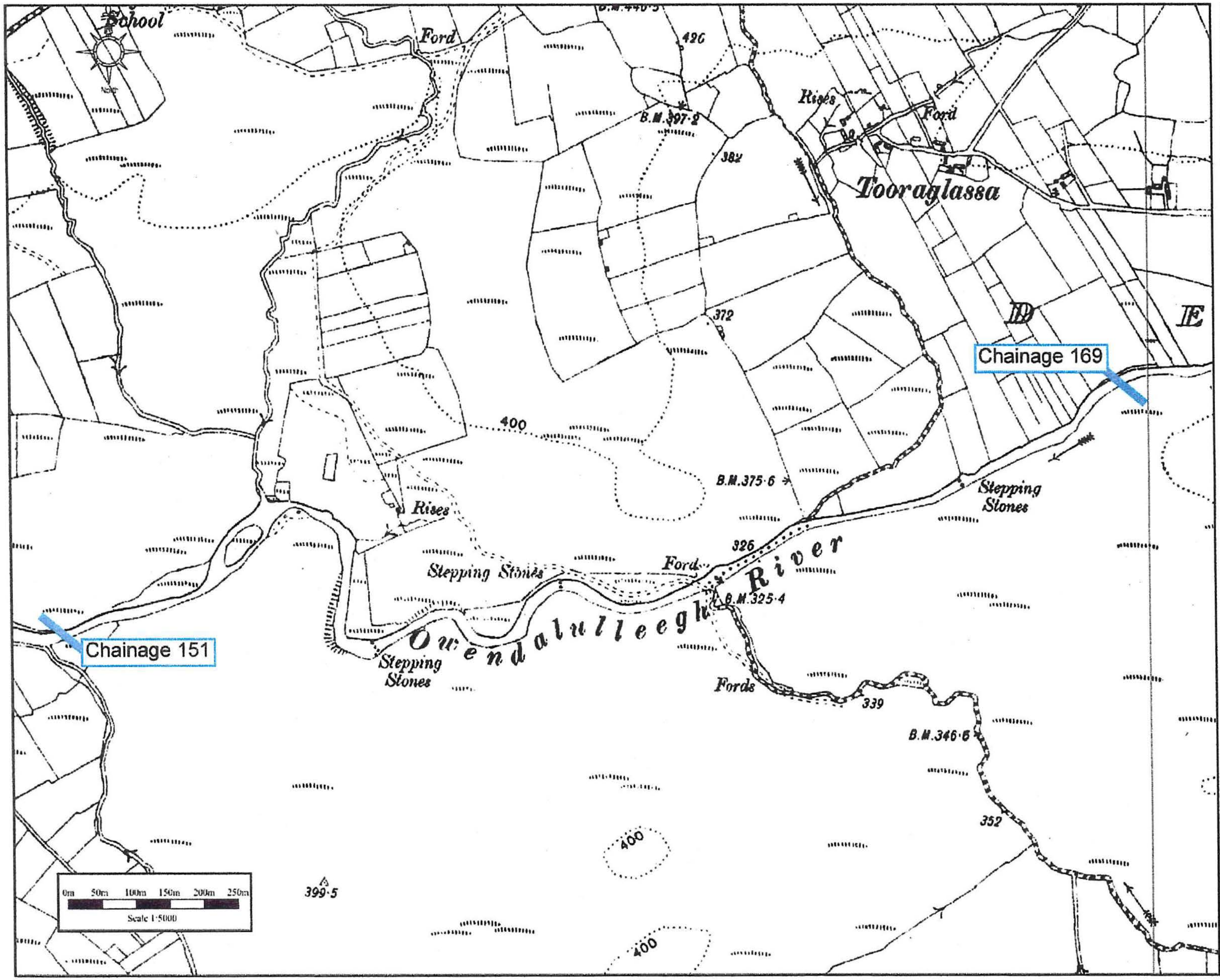

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Figure A1.3
Section three was located in the townland of Toorglassa. Survey section was between chainages 169 - 151.

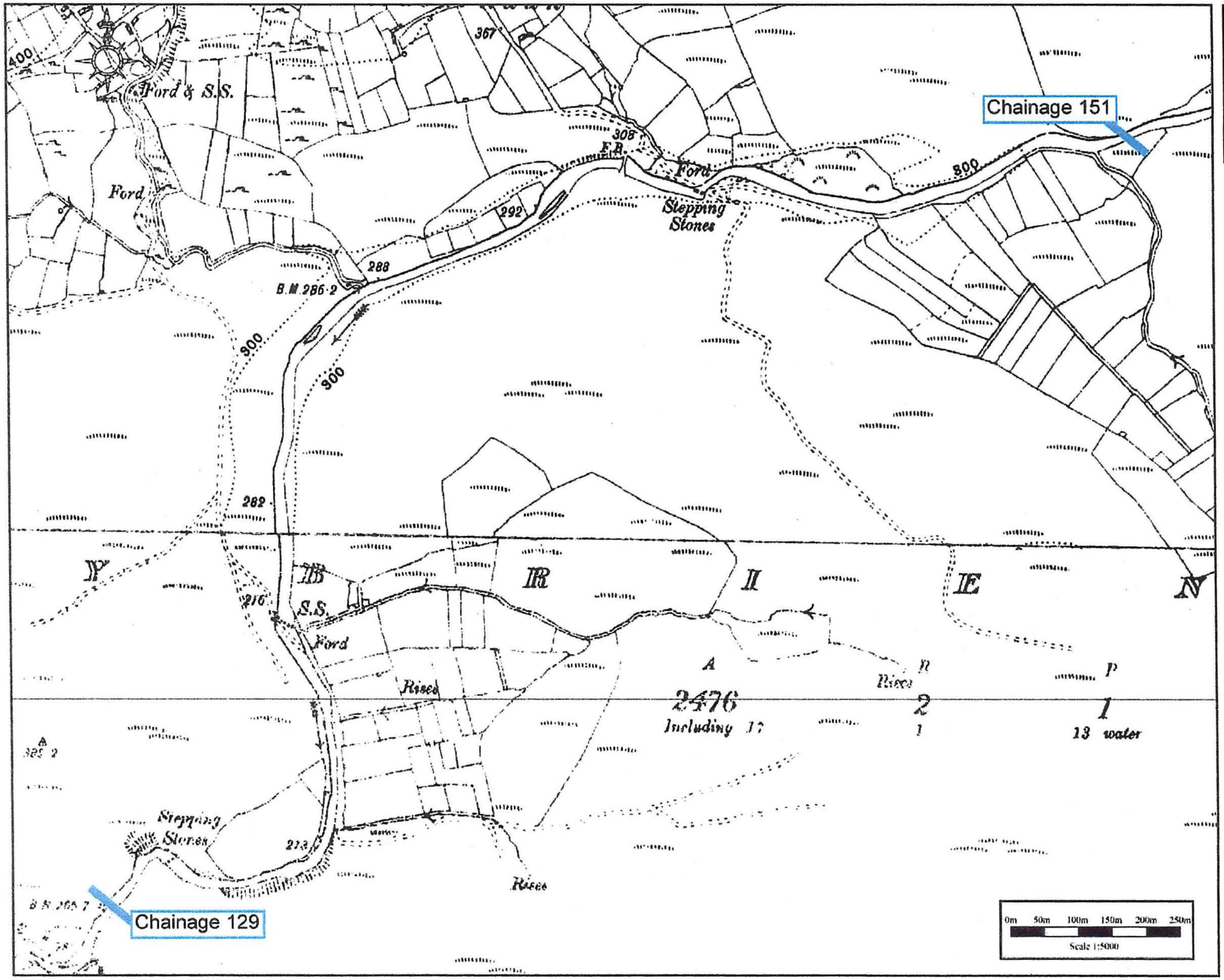

Figure A1.4
Section four was between chainages 151 and 129.

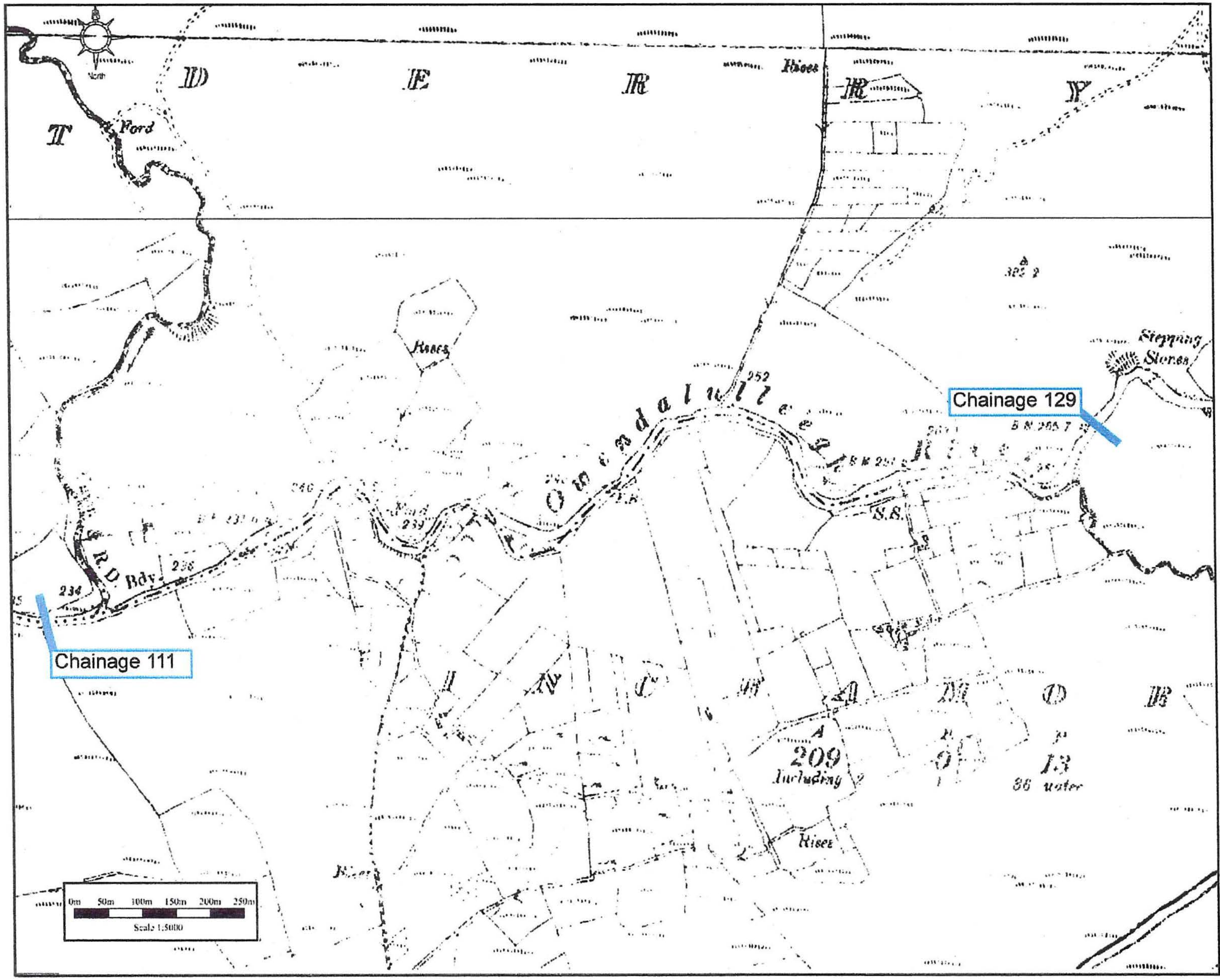

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Figure A1.5
Section five was between chainages 129 and 111.

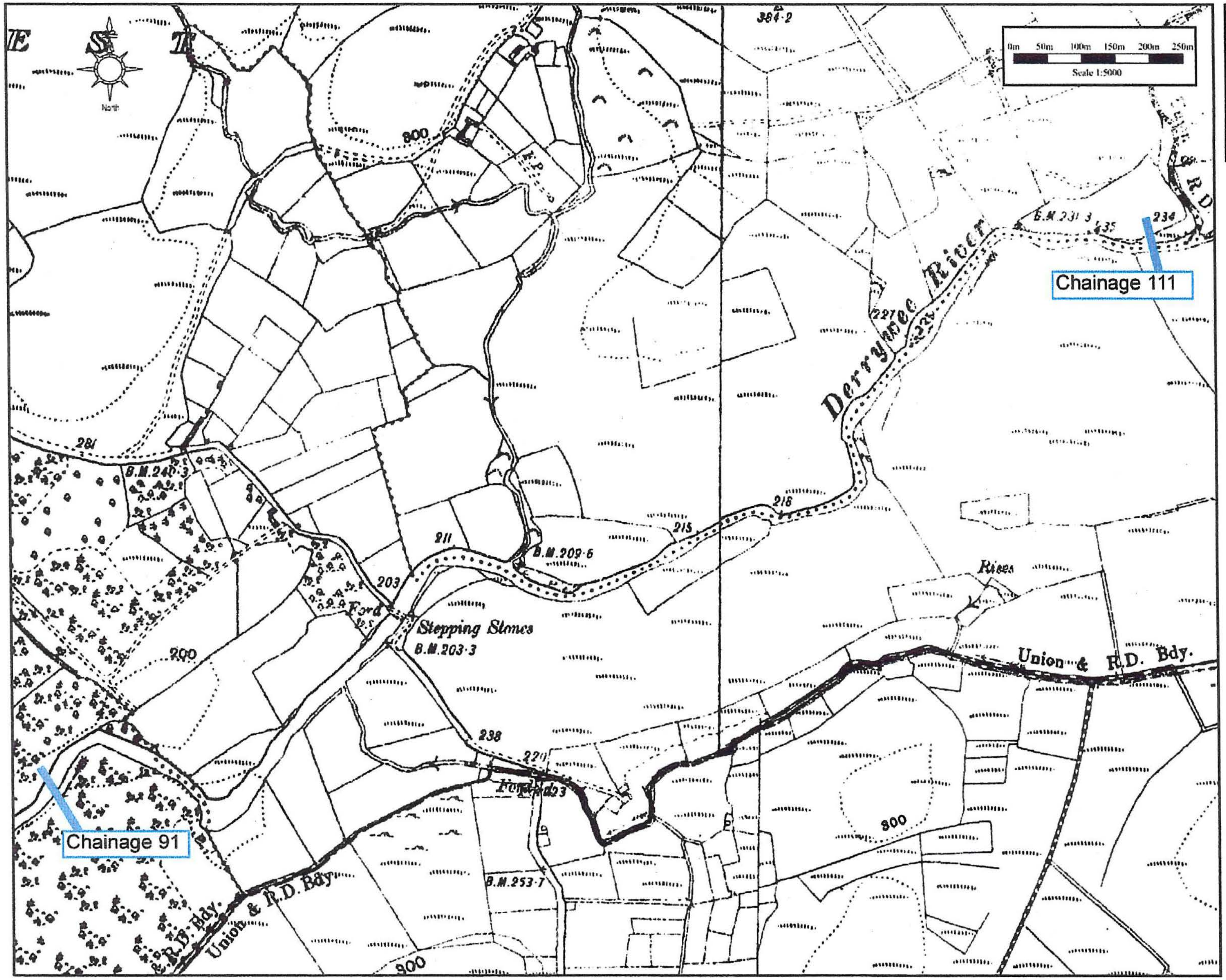

Figure A1.6
This figure shows the extent of survey section six.This section extended from chainage 111 to chainage 91.

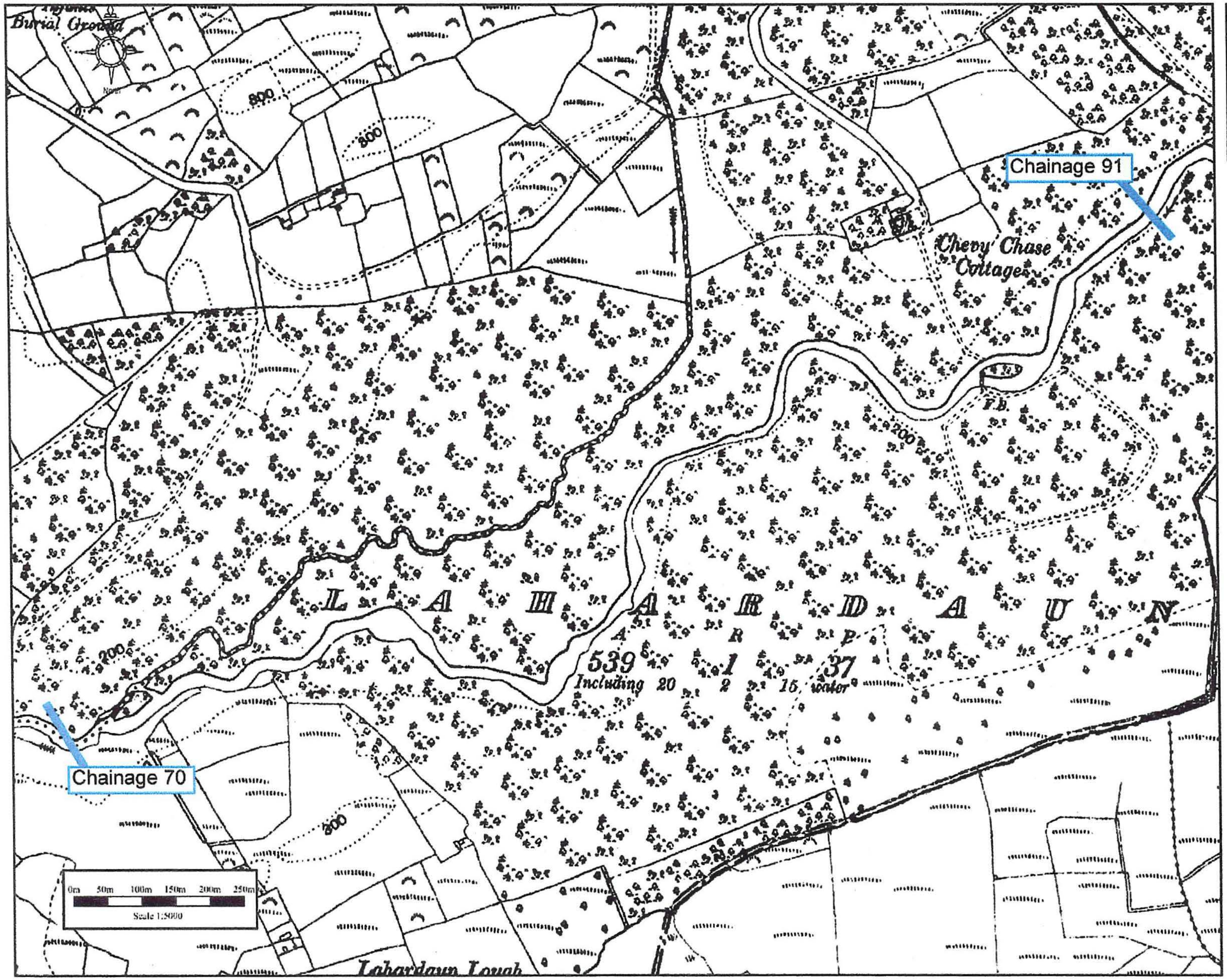

Figure A1.7
Section seven was located in the stretch of river near Chevy Chase cottage. Survey section was between chainages 91 - 70.

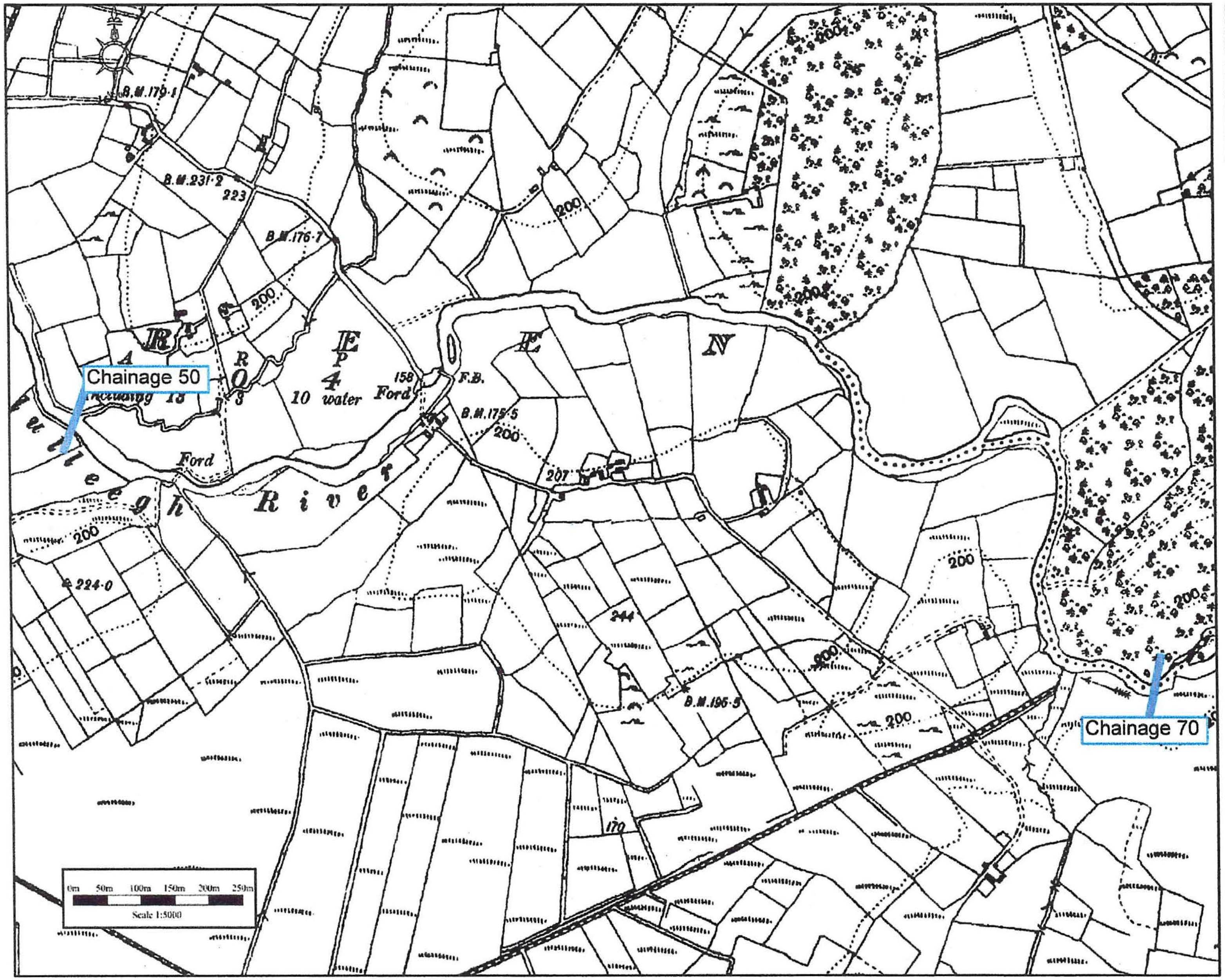

Figure A1.8
Section eight was located immediately downstream of the Chevy Chase cottage stretch and extended from chainage 70 to 50.

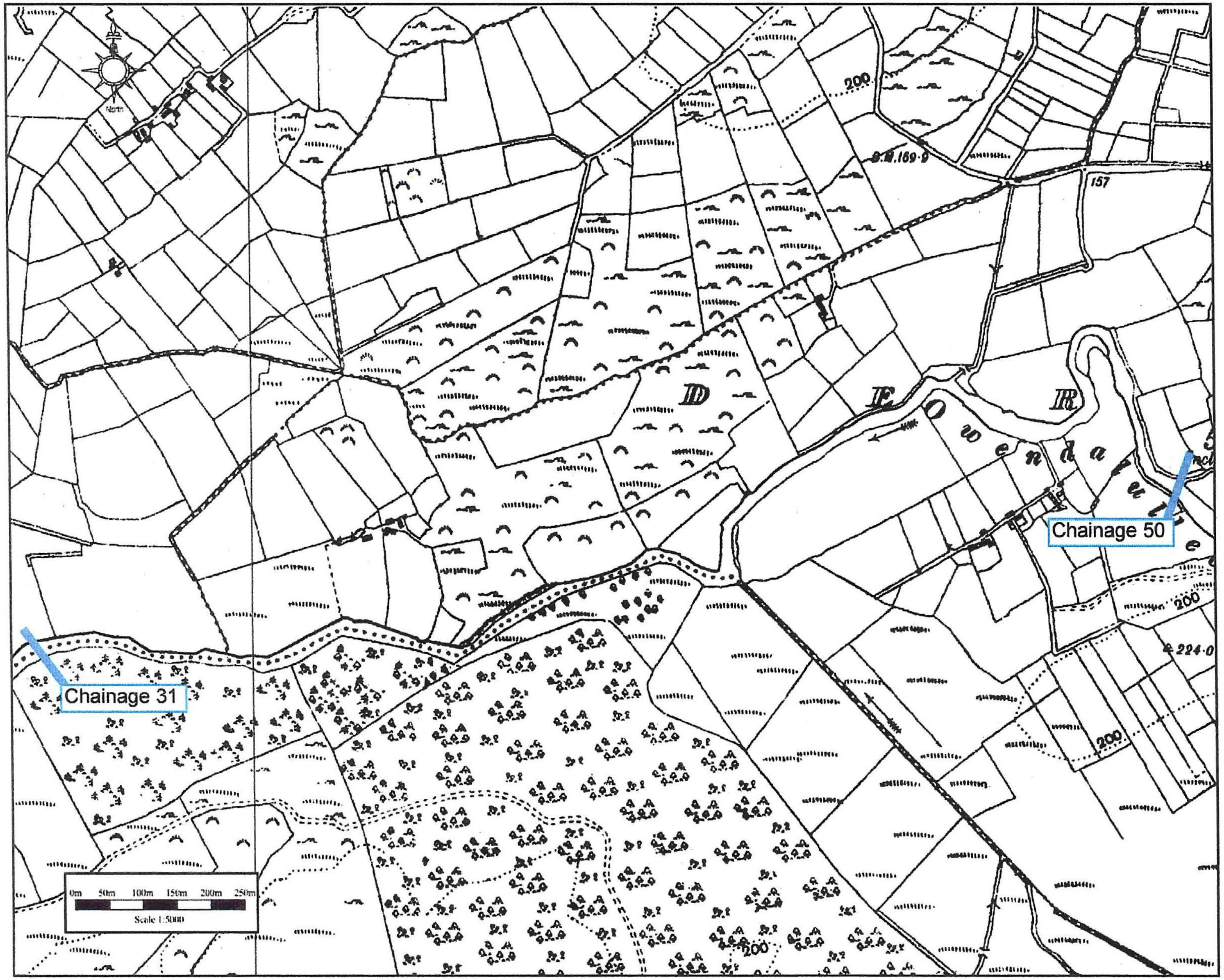

Figure A1.9
This figure shows the extent of survey section nine. This section extended from chainage 50 to chainage 31.

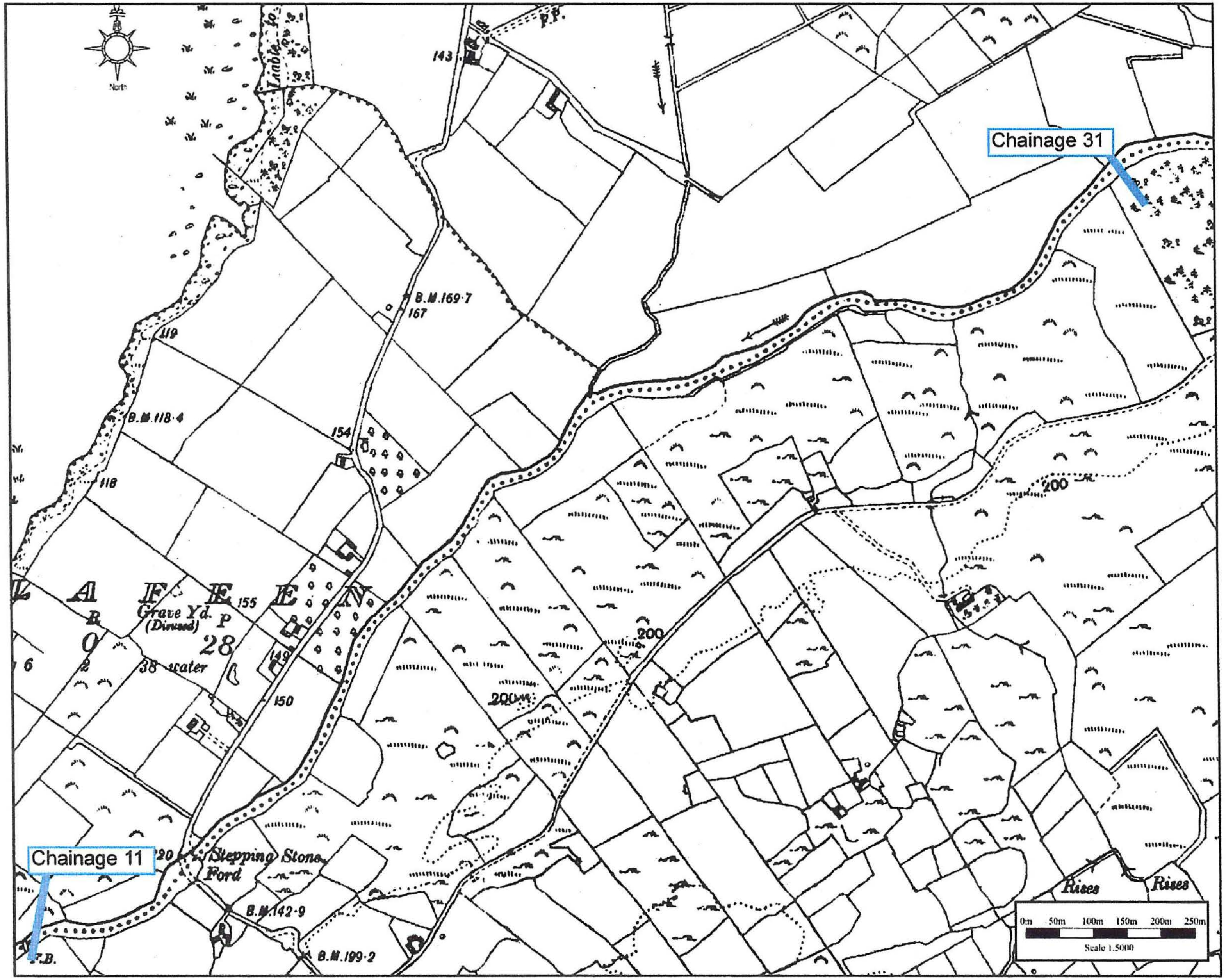

Figure A1.10
Section ten was located in the lower reaches of the river river. Survey section was between chainages 31 and 11.

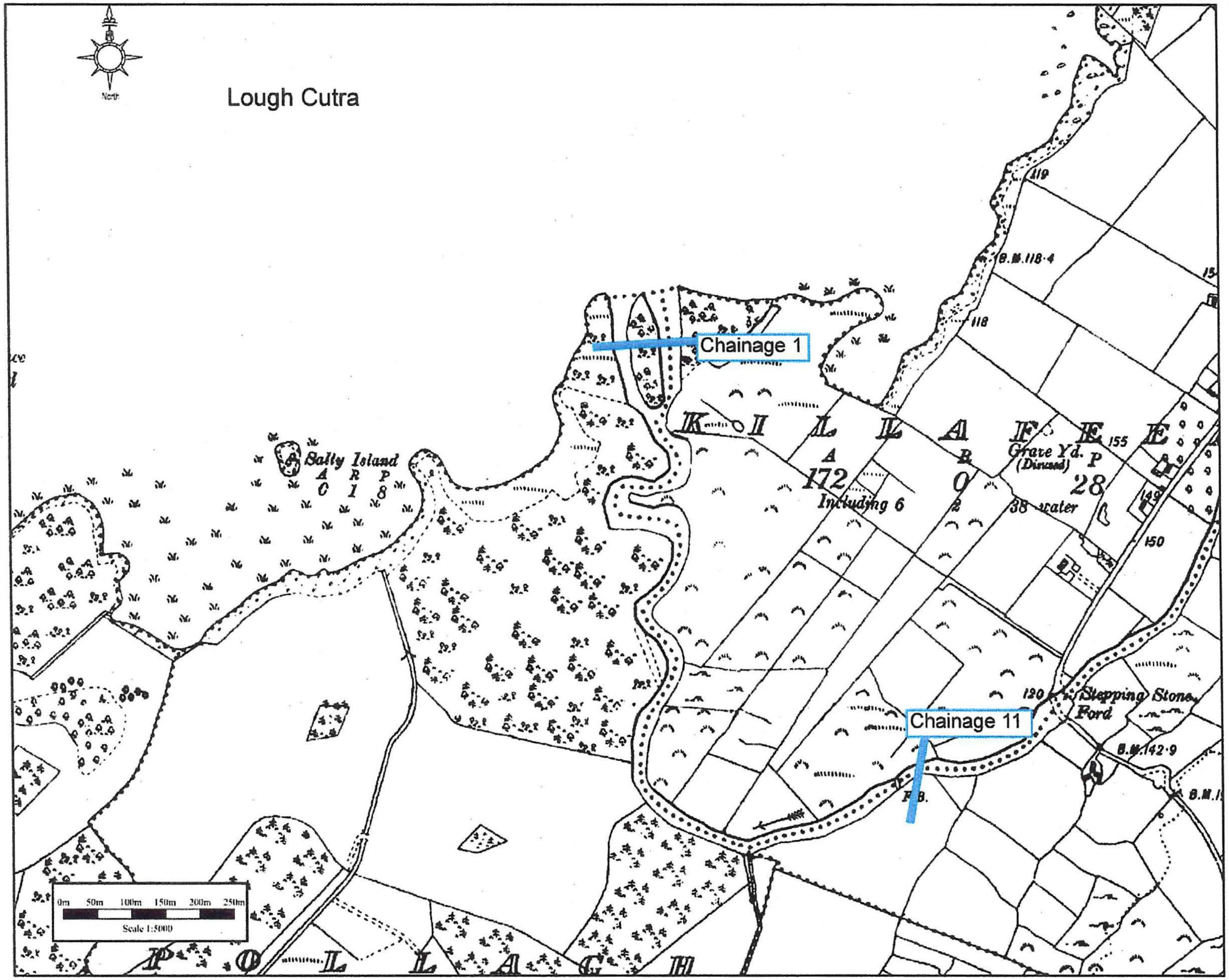

Figure A1.11
This section was the lower-most section of the river and extended from chainage 1 at the mouth of the river to chainage 11.

APPENDIX 2 NPWS SITE SYNOPSES

SITE NAME LOUGH CUTRA

SITE CODE 000299

Lough Cutra is an oligo/mesotrophic freshwater lake lying on limestone. This lake is located 4km south-east of Gort. The lake covers an area of 390 ha and has a catchment consisting of blanket bog and mineral soils.

The main habitats of this site are; aquatic lake vegetation, reedbeds confined to sheltered bays and mixed woodland. Reedbeds of Common Reed (*Phragmites australis*), Common Club-rush (*Scirpus lacustris*) and Great Fen-sedge (*Cladium mariscus*) exist. The flora shows a mixture of calcicole and calcifuge species with the Irish Spurge (*Euphorbia hyberna*) noted in the area. There is no information available on the status of the woodland habitats in this site.

The site is internationally important for its breeding and wintering population of Cormorants (166 pairs in 1985 and max 300 individuals in winter) (Information compiled in 1987). The Cormorants use the off-shore islands for breeding purposes.

The lake is used for fishing and tourism. Precautions should be taken to ensure the lake and its surrounding area is protected from damaging operations such as application of artificial fertilizers, development close to the lakeshore, drainage and felling of woodland areas. The internationally important populations of Cormorants and Lesser Horseshoe Bats should be especially protected.

Lough Cutra is an important site with its diverse habitat types and the presence of both calcicole and calcifuge floras. The site is also of interest as it has internationally important numbers of Cormorants on the Island.

SITE NAME: LOUGH COY

SITE CODE: 002117

Lough Coy is situated approximately 6.5 km north-east of Gort and lies close to the Slieve Aughty hills. The site consists of a small permanent lake in the middle of an almost circular turlough basin. There are drift deposits as well as outcropping rocks and boulders on the relatively steep side walls and small areas of scrub towards the top of the basin. The underlying soils consist of alluvial gleys and a gleyed rendzina-like soil.

A large swallowhole occurs at one side of the basin slightly above summer water level and water enters and leaves the turlough mostly through this. During the winter the fluctuation in levels is extreme and there are no emergent plants such as Common Club-rush (*Scirpus lacustris)* or Common Reed (*Phragmites australis)* in the lake. The turlough experiences a large throughput of water and is dependant on the flows in the tributaries of the Coole River. Lough Coy is an excellent example of a 'riverine' type of turlough, and is in essence the floodplain of an underground river.

Practically the entire site consists of turlough habitat, an EU Habitats Directive Annex I priority habitat. In summer the water area contracts to a degree depending on the prevailing weather and flat mud is exposed which splits into polygonal plates. This is the habitat for a variety of specialised plants such as Mudwort (*Limosella aquatica*), Needle Spike-rush (*Eleocharis acicularis*), Northern Yellow-cress (*Rorippa islandica*) and the liverwort *Riccia cavernosa*. The lakeshore itself has some of these species along with Knotgrass (*Polygonum aviculare*) and Redshank (*Polygonum persicaria*). Above this is a more continuous cover of the sedges *Carex nigra* and *C. hirta*, Reed Canary-grass (*Phalaris arundinacea*), Creeping Cinquefoil (*Potentilla reptans*), Corn Mint (*Mentha arvensis*) and Creeping Buttercup (*Ranunculus repens*). A vegetation characterised by Meadowsweet (*Filipendula ulmaria*), Northern Bedstraw (*Galium boreale*), Common Bird's-foot-trefoil (*Lotus corniculatus*) and Adder's-tongue (*Ophioglossum vulgare*) grows amongst the rocks and includes both Dog Violet (*Viola canina*) and Fen Violet (*V. persicifolia*). The limestone boulders on the upper slopes have a covering of the moss *Cinclidotus fontinaloides*. The fringe of scrub at the edge of the basin is mostly of Blackthorn (*Prunus spinosa*), Buckthorn (*Rhamnus catharticus*) and Ash (*Fraxinus excelsior*), with some Hazel (*Corylus avellana*).

Lough Coy is part of a complex of small sites (along with nearby Blackrock, Ballylee and Bullaunagh turloughs) which supports a nationally important population of Whooper Swans and regionally/locally important numbers of several duck and wader species. Maximum counts at Lough Coy in winter 1995/96 were as follows: Whooper Swan 78, Wigeon 285, Teal 283, Pochard 45, Lapwing 300, Dunlin 120 and Curlew 80. Birds move frequently between the various sites in response to water levels and disturbance. Lough Coy is often one of the few sites in the district which holds water in late summer and autumn and consequently is of importance for post-breeding birds and early autumn arrivals - 132 Mallard were counted in August 1996 and 149 Wigeon in September 1996.

Of particular note is the occurrence of three Red Data Book plant species at this site - these are Mudwort (*Limosella aquatica*), Fen Violet (*Viola persicifolia*) and Northern Yellow-cress (*Rorippa islandica*).

The main landuse within the site is cattle grazing which is quite heavy at the lake margins and on parts of the slopes. There is some removal of gravel from the drift deposits on the north western edge.

Lough Coy is an excellent example of an eutrophic (nutrient-rich) turlough. The extreme water fluctuation supports a distinctive zonation of vegetation and provides many niches for specialist plants. It is an important site for wintering waterfowl.

SITE NAME : COOLE-GARRYLAND COMPLEX

SITE CODE : 000252

The Coole-Garryland Complex is situated in a low-lying karstic limestone area west of Gort, County Galway. It contains a series of seasonal lakes (turloughs), which are fed by springs and a partly submerged river, surrounded by woodland, pasture and limestone heath. The more well-known turloughs present in the site include Lydacan, Crannagh North, Raheen, Crannagh South, Coole, Garryland, Newtown and Hawkhill.

Turloughs are listed as priority habitat on Annex I of the EU Habitats Directive, and the turloughs at Coole-Garryland are particularly good examples of this habitat type. Vegetation of the turloughs includes Shoreweed (*Littorella uniflora*), Spike-rush (*Eleocharis palustris*), Water-purslane (*Lythrum portula*) and Fen Violet (*Viola persicifolia*). A species of Starwort, *Callitriche palustris*, has recently been recorded from the site, its only known station in Ireland. The Coole river itself is of particular interest for the occurrence of a rare riverine habitat characterised by Trifid Bur-marigold (*Bidens tripartita*), Red Goosefoot (*Chenopodium rubrum*) and species of Knotgrass (*Polygonum* spp.).

The turloughs are fringed by a range of habitats on limestone pavement, including scrub communities containing Buckthorn (*Rhamnus catharticus*) and Hawthorn (*Crataegus monogyna*). In places, heath communities have developed over the limestone pavement, consisting of Ling Heather (*Calluna vulgaris*), Juniper (*Juniperus communis*), Blue Moor-grass (*Sesleria albicans*) and occasional Yew (*Taxus baccata*). In addition, the site contains good examples of smooth pavement and associated species-rich grasslands. Small areas of orchid-rich grassland occur at Coole-Garryland. The colourful array of orchids which can be found here include Pyramidal Orchid (*Anacamptis pyramidalis*), Spotted Orchids (*Dactylorhiza* spp.), Fragrant Orchid (*Gymnadenia conopsea*), Fly Orchid (*Ophrys insectifera*) and Greater Butterfly Orchid (*Platanthera chlorantha*).

A remarkable feature of the turloughs at Coole-Garryland is that they are closely associated with areas of woodland. Although substantial parts of the original deciduous forest have been converted to coniferous woodland composed of non-native species, stands of semi-natural deciduous woodland survive. Pedunculate Oak (*Quercus robur*) and Ash (*Fraxinus excelsior*) are the dominant species on deeper, more fertile soils, where there is also some Hazel (*Corylus avellana*), occasional Yew (*Taxus baccata*) and Elm (*Ulmus* spp.). There are also some unusual areas of dwarf Pedunculate Oak woodland growing on limestone pavement. This species of oak does not typically colonise this type of substrate.

Some of the deciduous woodlands have a mixture of native and non-native species. These mixed woodlands have a diverse shrub layer comprised of Spindle (*Euonymus europaeus*), Privet (*Ligustrum vulgare*), Burnet Rose (*Rosa pimpinellifolia*), Guelder Rose (*Viburnum opulus*), Blackthorn (*Prunus spinosa*), Pear (*Pyrus pyraster*) and Honeysuckle (*Lonicera periclymenum*). The ground flora is rich and includes Wood Anemone (*Anemone nemorosa*), Dog Violet (*Viola riviniana*), Shining Crane's-bill (*Geranium lucidum)*, Maidenhair Spleenwort (*Asplenium trichomanes*), Northern Bedstraw (*Galium boreale*), Biting Stonecrop (*Sedum acre*), Harebell (*Campanula rotundifolia*) and Bitter Vetch (*Lathyrus montanus*). The woodlands are notable for the presence of rare species of Myxomycete fungi, namely, *Licea idris, Licea marginata* and *Macbrideola decapillata,* the first-named in one of only three known sites for the species.

The nationally rare Mudwort (*Limosella aquatica*) and Dropwort (*Filipendula vulgaris*) also occur at this site. These two plant species are listed in the Irish Red Data Book.

The complex of habitats at Coole-Garryland provides habitat for a variety of mammal species, including Otter and Pine Marten. The otter is listed on Annex II of the EU Habitats Directive, while Pine Marten is considered to be threatened in Europe. The Coole-Garryland complex is also home to one of the most important and unique assemblages of insects in the country, including several notable species of beetles and flies.

The area is of importance for wintering waterfowl, especially Whooper Swan (mean peak of 324 in 1995/96 - 98/99), Bewick Swan (79 in winter 96/97), Wigeon (mean peak of 1044 in 1995/96 - 98/99), Mallard (mean peak of 330 in 1995/96 - 98/99), Pochard (mean peak of 176 in winter 1995/96 - 98/99), along with smaller numbers of Teal, Tufted Duck, Lapwing, Curlew and Dunlin.

In 1996 seven pairs of Lapwing bred at Newtown Turlough and two pairs of Common Sandpiper bred at Coole Lough.

A substantial portion of this site is in the ownership of the National Parks and Wildlife Service. It is a popular amenity area, and uncontrolled visitor access would pose a threat to sensitive animals. Other threats to the site may result from the intensification of agriculture (e.g. fertiliser application or pollution of water courses) outside the Nature Reserve.

The turlough system at Coole-Garryland is considered to be the most diverse in the country, for both its physiography and vegetation. It is unique in that it is so closely associated with woodland. The juxtaposition of these two distinct habitats, in addition to the presence of a variety of turloughs, has led to the development of uncommon communities, and rare species of insect and plant occur which are associated with both the turlough and the turlough/woodland transition. Overall, the range of good quality habitats at Coole-Garryland supports a high diversity of plant and animal species, rendering this site of prime importance for conservation.

APPENDIX 3 AQUATIC AND RIPARIAN PLANT SPECIES

Appendix 3.1 Plant species recorded

Common name	Botanical name
Instream species	
Alternate water milfoil	*Myriopyllum alternifolium*
Aquatic moss	*Fontinalis sp.*
Aquatic moss	*Racomitrium sp.*
Pondweed	*Potamogeton sp*
Emergent aquatic species	
Brooklime	Veronica beccabunga
Bulbous rush	Juncus bulbosus
Floating sweet-grass	Glyceria fluitans
Fool's water-cress	*Apium nodiflorum*
Lesser spearwort	*Ranunculus flammula*
Lesser water-parsnip	*Berula erecta*
Water dropwort	*Oenanthe* sp.
Water starwort	*Callitriche* sp.
Watercress	*Rorippa nasturtium-aquaticum*
Marginal species	
Ash	*Fraxinus excelsior*
Bilberry	*Vaccinium myrtillus*
Blackthorn	*Prunus spinosa*
Bog stitchwort	*Stellaria uliginosa*
Bracken	*Pteridium aquilinum*
Bramble	*Rubus fruticosus*
Common marsh bedstraw	*Galium palustre*
Creeping buttercup	*Ranunculus repens*
Downy birch	*Betula pubescens*
Gorse	*Ulex europaeus*
Great wood-rush	*Luzula sylvatica*
Hawthorn	*Crataegus monogyna*
Hazel	*Corylus avellana*
Horsetail	*Equisetum* sp.
Lady's smock	*Cardamine pratensis*
Liverworts	
Marsh ragwort	*Senecio aquaticus*
Rowan	*Sorbus aucuparia*
Sedges	*Carex* spp.
Sharp-flowered rush	*Juncus acutiflorus*
Sitka spruce	*Picea sitchensis*
Soft rush	*Juncus effusus*
Wild angelica	*Angelica sylvestris*
Willowherbs	*Epilobium* spp.
Willows	*Salix* spp

Appendix 3.2 Aquatic/riparian plant species recorded for the 10km-squares between Flaggy Bridge (Derrybrien) and Lough Cutra, as listed in the 'New Atlas of the British & Irish Flora (Preston, C. D., Pearman, D. A. and Dines, T. D., eds (2002). Oxford University Press, Oxford).

Species of limited distribution in Ireland are marked thus: *
Red data book species are marked thus: #
Flora Protection Order species are marked thus: !

Common name	Scientific name	Record	Status
Hemp agrimony	*Agrimonia eupatoria*	1987-1999	Native
Water plantain	*Alisma plantago-aquatica*	1987-1999	Native
!Orange foxtail	*Alopecurus aequalis*	1987-1999	Native
Marsh foxtail	*Alopecurus geniculatus*	1987-1999	Native
Wild angelica	*Angelica sylvestris*	987-1999	Native
Lesser marshwort	*Apium inundatum*	1987-1999	Native
Fool's water-cress	*Apium nodiflorum*	1987-1999	Native
Lesser water-plantain	*Baldellia ranunculoides*	1987-1999	Native
Lesser water-parsnip	*Berula erecta*	1987-1999	Native
Common water starwort	*Callitriche stagnalis sens. lat.*	1987-1999	Native
Marsh marigold	*Caltha palustris*	1987-1999	Native
Lady's smock	*Cardamine pratensis*	1987-1999	Native
*Slender tufted-sedge	*Carex acuta*	1987-1999	Native
Lesser pond-sedge	*Carex acutiformis*	Pre-1970	Native
*Water sedge	*Carex aquatilis*	1987-1999	Native
Lesser tussock-sedge	*Carex diandra*	Pre-1970	Native
Lesser tussock-sedge	*Carex diandra*	1987-1999	Native
Brown sedge	*Carex disticha*	Pre-1970	Native
Brown sedge	*Carex disticha*	1987-1999	Native
Tufted sedge	*Carex elata*	Pre-1970	Native
Tufted sedge	*Carex elata*	1987-1999	Native
Glaucous sedge	*Carex flacca*	1987-1999	Native
Hairy sedge	*Carex hirta*	1987-1999	Native
Slender sedge	*Carex lasiocarpa*	Pre-1970	Native
Slender sedge	*Carex lasiocarpa*	1987-1999	Native
Bog sedge	*Carex limosa*	1987-1999	Native
Common sedge	*Carex nigra*	1987-1999	Native
False fox-sedge	*Carex otrubae*	1987-1999	Native
Oval sedge	*Carex ovalis*	1987-1999	Native
Bottle sedge	*Carex rostrata*	1987-1999	Native
Bladder-sedge	*Carex vesicaria*	1987-1999	Native
Yellow-sedge subspecies	*Carex viridula subsp. brachyrrhyncha*	1987-1999	Native
Yellow-sedge subspecies	*Carex viridula subsp. viridula*	1987-1999	Native
*Rigid hornwort	*Ceratophyllum demersum*	1987-1999	Native
Great fen-sedge	*Cladium mariscus*	Pre-1970	Native
Great fen-sedge	*Cladium mariscus*	1987-1999	Native
Needle spike-rush	*Eleocharis acicularis*	1987-1999	Native
Many-stalked spike-rush	*Eleocharis multicaulis*	Pre-1970	Native
Many-stalked spike-rush	*Eleocharis multicaulis*	1987-1999	Native
Common spike-rush	*Eleocharis palustris*	Pre-1970	Native
Common spike-rush	*Eleocharis palustris*	1987-1999	Native

Floating club-rush	*Eleogiton fluitans*	1987-1999	Native

Common name	Scientific name	Record	Status
Canadian pondweed	*Elodea canadensis*	1987-1999	Alien
Marsh willowherb	*Epilobium palustre*	1987-1999	Native
Water horsetail	*Equisetum fluviatile*	1987-1999	Native
Marsh horsetail	*Equisetum palustre*	1987-1999	Native
Meadowsweet	*Filipendula ulmaria*	1987-1999	Native
Marsh bedstraw	*Galium palustre*	1987-1999	Native
Water avens	*Geum rivale*	1987-1999	Native
Small sweet-grass	*Glyceria declinata*	Pre-1970	Native
Small sweet-grass	*Glyceria declinata*	1987-1999	Native
Floating sweet-grass	*Glyceria fluitans*	1987-1999	Native
Marestail	*Hippuris vulgaris*	Pre-1970	Native
Marestail	*Hippuris vulgaris*	1987-1999	Native
Marsh pennywort	*Hydrocotyle vulgaris*	1987-1999	Native
Wild iris	*Iris pseudacorus*	1987-1999	Native
Slender club-rush	*Isolepis cernua*	1987-1999	Native
Sharp-flowered rush	*Juncus acutiflorus*	1987-1999	Native
Jointed rush	*Juncus articulatus*	1987-1999	Native
Bulbous rush	*Juncus bulbosus*	1987-1999	Native
Soft rush	*Juncus effusus*	1987-1999	Native
Hard rush	*Juncus inflexus*	1987-1999	Native
Duckweed	*Lemna minor*	1987-1999	Native
Ivy-leaved duckweed	*Lemna trisulca*	1987-1999	Native
#!Mudwort	*Limosella aquatica*	1987-1999	Native
Shoreweed	*Littorella uniflora*	1987-1999	Native
Yellow loosestrife	*Lysimachia vulgaris*	1987-1999	Native
Water purslane	*Lythrum portula*	1987-1999	Native
Purple loosestrife	*Lythrum salicaria*	1987-1999	Native
Water mint	*Mentha aquatica*	1987-1999	Native
Hybrid water mint	*Mentha aquatica x M. arvensis*	1987-1999	Native
Bog bean	*Menyanthes trifoliata*	1987-1999	Native
Blinks	*Montia fontana*	1987-1999	Native
Water forget-me-not	*Myosotis scorpioides*	1987-1999	Native
Alternate water-milfoil	*Myriophyllum alterniflorum*	1987-1999	Native
Yellow water-lily	*Nuphar lutea*	1987-1999	Native
White water-lily	*Nymphaea alba*	1970-1986	Native
White water-lily	*Nymphaea alba*	1987-1999	Native
Fine-leaved water-dropwort	*Oenanthe aquatica*	1987-1999	Native
Hemlock water-dropwort	*Oenanthe crocata*	1970-1986	Native
Hemnlock water-dropwort	*Oenanthe crocata*	1987-1999	Native
Water-pepper	*Persicaria hydropiper*	1987-1999	Native
Reed canary-grass	*Phalaris arundinacea*	1987-1999	Native
Common reed	*Phragmites australis*	1987-1999	Native
Small pondweed	*Potamogeton berchtoldii*	1987-1999	Native
Fen pondweed	*Potamogeton coloratus*	1987-1999	Native
Curled pondweed	*Potamogeton crispus*	1987-1999	Native
Various-leaved pondweed	*Potamogeton gramineus*	1987-1999	Native
Shining pondweed	*Potamogeton lucens*	1987-1999	Native
Broad-leaved pondweed	*Potamogeton natans*	1987-1999	Native
Fennel pondweed	*Potamogeton pectinatus*	1987-1999	Native

Perfoliate pondweed	*Potamogeton perfoliatus*	1987-1999	Native
Bog pondweed	*Potamogeton polygonifolius*	1987-1999	Native
Common name	**Scientific name**	**Record**	**Status**
*Lesser pondweed	*Potamogeton pusillus*	1987-1999	Native
Common water-crowfoot	*Ranunculus aquatilis*	Pre-1970	Native
Lesser celandine	*Ranunculus ficaria*	Pre-1970	Native
Lesser celandine	*Ranunculus ficaria*	1987-1999	Native
L. celandine subspecies	*Ranunculus ficaria subsp. bulbilifera*	1987-1999	Native
L. celandine subspecies	*Ranunculus ficaria subsp. ficaria*	1987-1999	Native
Lesser spearwort	*Ranunculus flammula*	1987-1999	Native
Ivy-leaved crowfoot	*Ranunculus hederaceus*	1987-1999	Native
Pond water-crowfoot	*Ranunculus peltatus*	1987-1999	Native
Celery-leaved buttercup	*Ranunculus sceleratus*	1987-1999	Native
Thread-leaved water-crowfoot	*Ranunculus trichophyllus*	1987-1999	Native
Great yellow-cress	*Rorippa amphibia*	1987-1999	Native
#Northern yellow-cress	*Rorippa islandica*	1987-1999	Native
Water-cress	*Rorippa nasturtium-aquaticum*	1987-1999	Native
Water-cress	*Rorippa nasturtium-aquaticum* agg.	1987-1999	Native
*Marsh yellow-cress	*Rorippa palustris*	1987-1999	Native
Eared willow	*Salix aurita*	1987-1999	Native
Goat willow	*Salix caprea*	1987-1999	Native
Olive willow	*Salix caprea x S. viminalis*	1987-1999	Native
Grey willow	*Salix cinerea*	1987-1999	Native
Sally	*Salix cinerea subsp. oleifolia*	1987-1999	Native
Crack willow	*Salix fragilis*	1987-1999	Alien
Creeping willow	*Salix repens*	1987-1999	Native
Osier willow	*Salix viminalis*	Pre-1970	Alien
Brookweed	*Samolus valerandi*	1987-1999	Native
Common club-rush	*Schoenoplectus lacustris*	1987-1999	Native
Water figwort	*Scrophularia auriculata*	1987-1999	Native
Common figwort	*Scrophularia nodosa*	1987-1999	Native
Lesser clubmoss	*Selaginella selaginoides*	1987-1999	Native
Marsh ragwort	*Senecio aquaticus*	1987-1999	Native
#Blue-eyed grass	*Sisyrinchium bermudiana*	Pre-1970	Native
Unbranched bur-reed	*Sparganium emersum*	1987-1999	Native
Branched bur-reed	*Sparganium erectum*	1987-1999	Native
Least bur-reed	*Sparganium natans*	Pre-1970	Native
Bog stitchwort	*Stellaria uliginosa*	1987-1999	Native
Comfrey	*Symphytum officinale*	1987-1999	Native
Meadow-rue	*Thalictrum flavum*	1987-1999	Native
Bulrush	*Typha latifolia*	1987-1999	Native
Intermediate bladderwort	*Utricularia intermedia sens. lat.*	Pre-1970	Native
Lesser bladderwort	*Utricularia minor*	Pre-1970	Native
Lesser bladderwort	*Utricularia minor*	1987-1999	Native
*Greater bladderwort	*Utricularia vulgaris sens. lat.*	Pre-1970	Native
Wild valerian	*Valeriana officinalis*	1987-1999	Native
Blue water-speedwell	*Veronica anagallis-aquatica*	1987-1999	Native
Brooklime	*Veronica beccabunga*	1987-1999	Native
Pink water-speedwell	*Veronica catenata*	1987-1999	Native
Viburnum	*Viburnum opulus*	1987-1999	Native
Marsh violet	*Viola palustris*	1987-1999	Native
#Fen violet	*Viola persicifolia*	1987-1999	Native

APPENDIX 4: SITE PHOTOS

Plate 1 Chainage 196 showing level to which peat slip material reached on this section of river. Bedrock is visible as a result of scouring by transported peat.

Plate 2 Chainage 198 showing silt deposition and level of peat on the banks.

Plate 3 Chainage 199. It is recommended that this blockage be removed. The left bank should be planted in high density formation with shrubs or trees that are ecologically similar to the surrounding flora.

Plate 4 Chainage 198-199 the gauge of the pipes here should be increased to assist flow through.

Plate 5 Chainage 199 – just south of Flaggy Bridge (chainage 200) showing peat deposition on the banks.

Plate 6 Scene of river from bridge (M 547 990) showing negligible impacts. This is the scenario for most of the lower sections of the river.

Plate 7 River showing some small light detritus on the banks

Plate 8 sand/silt washed down from the mountains. This photo was taken in the lower reaches of the river.

Plate 9 Section of river at confluence (chainage 182) exhibiting very little physical change. Gravels are still in situ here. River has widened considerably and accordingly the power of the slip has dissipated.

Plate 10 Fish were seen moving upstream in this section (Chainage 184)

DERRYBRIEN WINDFARM

PEAT SLIP

ENVIRONMENTAL IMPACT ASSESSMENT

ON

THE OWENDALLULEEGH RIVER

MARCH 2004

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1.0 INTRODUCTION

A landslide occurred near the southern boundary of the Derrybrien Wind Farm on the evening of 16th October 2003. The slide involved disturbance and partial displacement of approximately 450,000m^3 of peat. On 17th October, the limit of the displaced peat was measured at approximately 100m from the Black Road Bridge, a distance of approximately 2.45 km from the head of the slide. On 29th/30th October, following heavy rain, the slip mass re-mobilised before the emergency stabilisation measures were substantially underway, and solid peat entered the watercourse downstream of Black Road Bridge. The flow of solid peat continued for approximately 24 hours.

As a result of the landslide, an estimated 6000 m^3 of peat entered the upper reaches of the Owendallulleegh River (ESBI, unpublished data) and flowed along its length to Lough Cutra. This watercourse is of ecological and fisheries importance. A visible plume was observed at the confluence of the Owendallulleegh River with Lough Cutra (aerial photo and observations made by Shannon Regional Fisheries Board – Preliminary Assessment Report)

Inis Environmental Services was appointed by ESBI to undertake a joint survey with ESBI and the Shannon Regional Fisheries Board to assess the extent of impact of the peat slip on the Owendallulleegh river system.

The current report provides an assessment of the integrity of aquatic habitats in the river and provides information of the extent of peat deposition in the main stem corridor. It reports the results of a walkover type survey, carried out in December 2003, and a desk appraisal. The key aims of the study were as follows: -

- To assess the extent of peat deposition along the river;
- to determine the habitat integrity of aquatic and riparian areas;
- to provide a preliminary assessment of the potential impact of the land slide on the river;
- to suggest mitigation measures to assist the rehabilitation of the river, and,
- to recommend further survey work, where necessary, to assess fish stocks and other ecological indicators.

This study was undertaken by Inis Environmental Services on behalf of ESB International (ESBI). Field work was carried out by Inis Environmental Services in association with ESBI and the Shannon Regional Fisheries Board (ShRFB).

2.0 METHODOLOGY

2.1 Survey area

The survey area comprised of the entire length of the main stem Owendallulleegh River from Flaggy Bridge (NOS Grid Reference M61161 62512) to the mouth of the river, where it enters Lough Cutra, (NOS Grid Reference R47811 97721). This represents a study length of approximately 22 kilometres. The study area was divided into eleven sections. The overall area is shown in figure 1 and the eleven sections of river assessed are shown in figures A1.1 to A1.11 in appendix 1.

The survey was carried out over a two-week period comprising a team of

- Inis Environmental - (two persons);
- Shannon Regional Fisheries Board – (Three to five persons).
- ESBI (three persons).

Weather conditions were good and water level was low facilitating the survey. The survey comprised a walk down of the entire river main stem with recording of observations. A Health and Safety Induction course was held on the first morning of the survey to advise all survey members of the potential hazards and work methodology to be followed.

The survey was completed within a two-week period (9^{th} – 22^{nd} December 2003). The following maps, provided by ESBI under Licence from GSI, were utilised for the assessment:

- Ordnance Survey of Ireland, Discovery Series 1:50,000. Sheets 52.
- Ordinance Survey of Ireland, local 1:5000 sheets.

2.2 Aquatic Habitat Assessment

The aquatic habitats present in the eleven study sections were defined with reference to the habitat classification scheme published by the Heritage Council in *A Guide to Habitats in Ireland (*Fossitt, 2000). Codes such as FW1, refers to habitat types of eroding upland rivers, as defined in this publication. The diversity (species richness) of aquatic/riparian fauna is primarily a function of the integrity and physical diversity of the aquatic habitats. The more diverse the aquatic habitat is in terms of substrate, depth, riparian vegetation, etc. the richer the biological community is likely to be. Salmonid fish (trout and salmon) in particular have specific habitat requirements and the presence and abundance of these fish has been shown to be strongly correlated with key physical habitat variables (Haury, 1999). Habitat considerations for juvenile salmonids in streams and rivers include stream size and flow (Hatfield & Bruce 2000), depth and gradient (Kennedy & Strange 1986), substrate (Greenberg & Dahl 1998), and canopy (O'Grady, 1993). Physical habitat assessments were undertaken at intervals along the river. These sites were assessed in terms of: -

- Wetted width (m)
- Depth (m)
- Bank height (m)
- Riffle (%)
- Glide (%)
- Pool (%)
- Bedrock (%)
- Cobble (%)
- Gravel (%)
- Boulder (%)
- Sand/Silt (%)

Aquatic Flora Assessment

Qualitative assessments of instream vegetation were undertaken during the habitat assessment study. The species present were identified and the percentage cover of riparian and instream vegetation was estimated visually. An impact on vegetation was recorded where vegetation had been eroded, or covered by peat to a depth likely to affect growth. As the survey was carried out mid-winter, plants were identified from overwintering parts and were not always identifiable to species level. Similarly, cover of emergent aquatic species is lower in winter than at the peak of the growing season (summer). A list of aquatic and riparian plant species for the 10km grid squares containing the Owendallulleegh River was also extracted from the CD ROM of Preston, C. D., Pearman, D. A. and Dines, T. D., eds (2002). *New Atlas of the British and Irish Flora*. Oxford University Press, Oxford.

3.0 EXISTING ENVIRONMENT

3.1 General

The Owendallulleegh River within the study area is described and evaluated on the basis of aquatic and riparian habitats. The presence of protected aquatic species is also considered. The areas investigated are described below.

3.2 Designated Areas

The National Parks and Wildlife Service (NPWS) is responsible for natural heritage conservation in Ireland. It is responsible for the designation of the following areas of statutory protection:

- *Special Areas of Conservation (SACs)* - These were established under the 1992 Habitats Directive of the Council of the EU for the conservation of natural and semi-natural habitats and species of flora and fauna.

- *Special Protection Areas (SPAs)* – These areas are designated for the protection of birds, and were established under the Birds Directive of the EU in 1979.

- *Natural Heritage Areas (NHAs)* – These are nationally important protection areas and were established under Irish law.

- *Statutory Nature Reserves* - These are relatively small land areas, very often forest or previously afforested areas that are maintained as protected nature reserves.

The Owendallulleegh River is not on or within a site designated or being considered for designation for statutory nature conservation. However, it flows into Lough Cutra, which is a candidate Special Area of Conservation (cSAC) and a designated Special Protection Area (SPA) under the EU Birds Directive. Gortacarnaun Wood, a designated SAC, is also adjacent to the river. In table 1, these and other designated areas adjacent to the study area are described. The location of these sites in relation to the Owendallulleegh River is shown in figures 2 and 3. Additional information on Lough Cutra (Site code 00299) and Lough Coy (002117) are provided in appendix 2. No information on the Newhall site (002293) was available at the time of preparing this report. Under Article 6 of the Habitats Directive the onus is on the developer to assess the indirect impacts on any designated sites (Special Areas of Conservation –SACs or Special Protected Areas SPAs) as a result of a plan or project.

3.3 Hydrology of the area

The study area is located in the Owendallulleegh River (or Derrywee River) river system (EPA code 29/O/01). This is an undrained river system located in EPA hydrometric area 29. The Owendallulleegh is an upland spate river that rises in the Slieve Aughty Mountains in south County Galway. It flows west through the townlands of Derrybrien, Inchamore, Lahardaun, Derreen, and Kilafeen to enter the southern end of Lough Cutra. It has a main channel length of 22.5km (McGarrigle *et al*, 2002). The catchment area is approximately 40km^2 and includes extensive areas of cutover bog and coniferous forestry. Lough Cutra is an oligo/mesotrophic landlocked lake, which has a surface area of 3.9km^2. Catchment details and selected physical characteristics of the Owendallulleegh River (from source to Lough Cutra) are provided in tables 2 and 3 respectively.

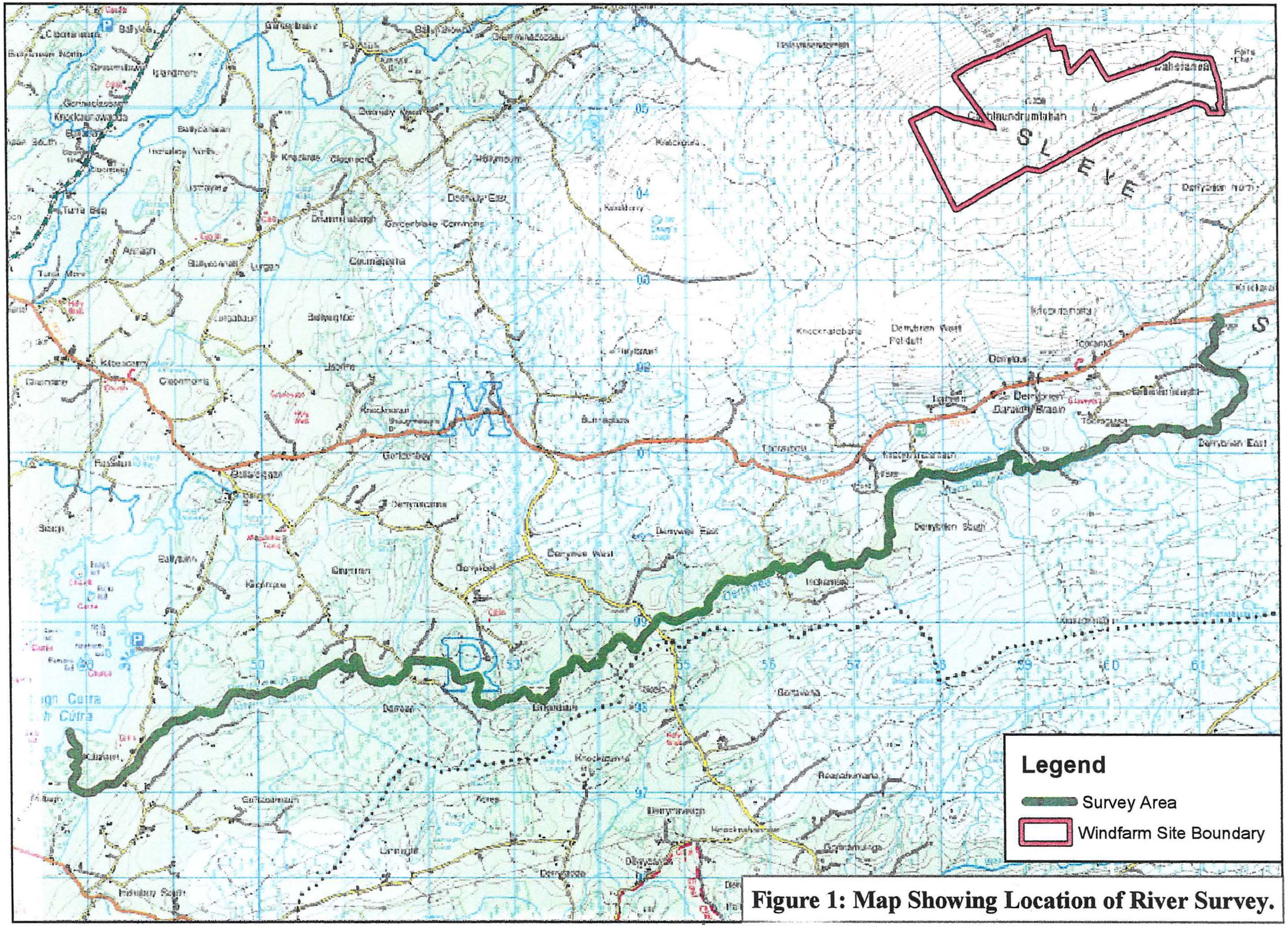

Figure 1: Map Showing Location of River Survey.

The Owendallulleegh River flows for a distance of approximately 22 km and flows into Lough Cutra. The outlet of Lough Cutra forms the Beagh river, which sinks at the Punch Bowl and remerges as the Cannahowna river (Gort River and Castletown river), where water is abstracted for the Gort Water supply. It then disappears underground again and re-emerges into Lough Coole and feeding into the turlough system at Coole – Garryland. Ultimately it is thought to discharge to the sea at Kinvarra.

Table 1 Designated sites surrounding river survey area (Source: NPWS).

Name	**Site Code**	**Designation**	**Notes**	**Distance and direction from river survey area**
Lough Cutra	000299	pNHA SAC SPA	Lough Cutra is an oligo/mesotrophic freshwater lake lying on limestone. The main habitats of this site are; aquatic lake vegetation, reedbeds confined to sheltered bays and mixed woodland. The site is internationally important for its breeding and wintering population of Cormorants (166 pairs in 1985 and max 300 individuals in winter) (Information compiled in 1987). The Cormorants use the off-shore islands for breeding purposes. The internationally important populations of Cormorants and Lesser Horseshoe Bats should be especially protected. Lough Cutra is an important site with its diverse habitat types and the presence of both calcicole and calcifuge floras.	0km Includes and adjacent to river mouth
Gortacarnaun Wood	002180	SAC	Old oak woodlands are scarce in Ireland and the habitat is of particular conservation importance as it is listed on Annex I of the EU Habitats Directive.	0km Adjacent to south bank river
Drummin Wood	002181	SAC	Drummin Wood is of considerable conservation significance as it conforms to a woodland habitat type that is scarce in Ireland and one that is listed on Annex I of the EU Habitats Directive. The occurrence of Red Data Book plant and animal species adds to the importance of the site.	0.2km North
Lough Coy	002117	SAC	The site consists of a small permanent lake in the middle of an almost circular turlough basin. Lough Coy is an excellent example of a 'riverine' type of turlough, and is in essence the floodplain of an underground river. The entire site consists of turlough habitat, an EU Habitats Directive Annex I priority habitat. Of particular note is the occurrence of three Red Data Book plant species at this site - these are Mudwort (*Limosella aquatica*), Fen Violet (*Viola persicifolia*) and Northern Yellow-cress (*Rorippa islandica*). Lough Coy is an excellent example of a eutrophic (nutrient-rich) turlough. The extreme water fluctuation supports a distinctive zonation of vegetation and provides many niches for specialist plants. It is an important site for wintering waterfowl.	7.7km North
Newhall	002293	SAC	No synopsis available	7.8km North North-west
Coole-Garryland	000252	SAC	Turloughs and protected bird species are the qualifying interests of this designated area.	6km south

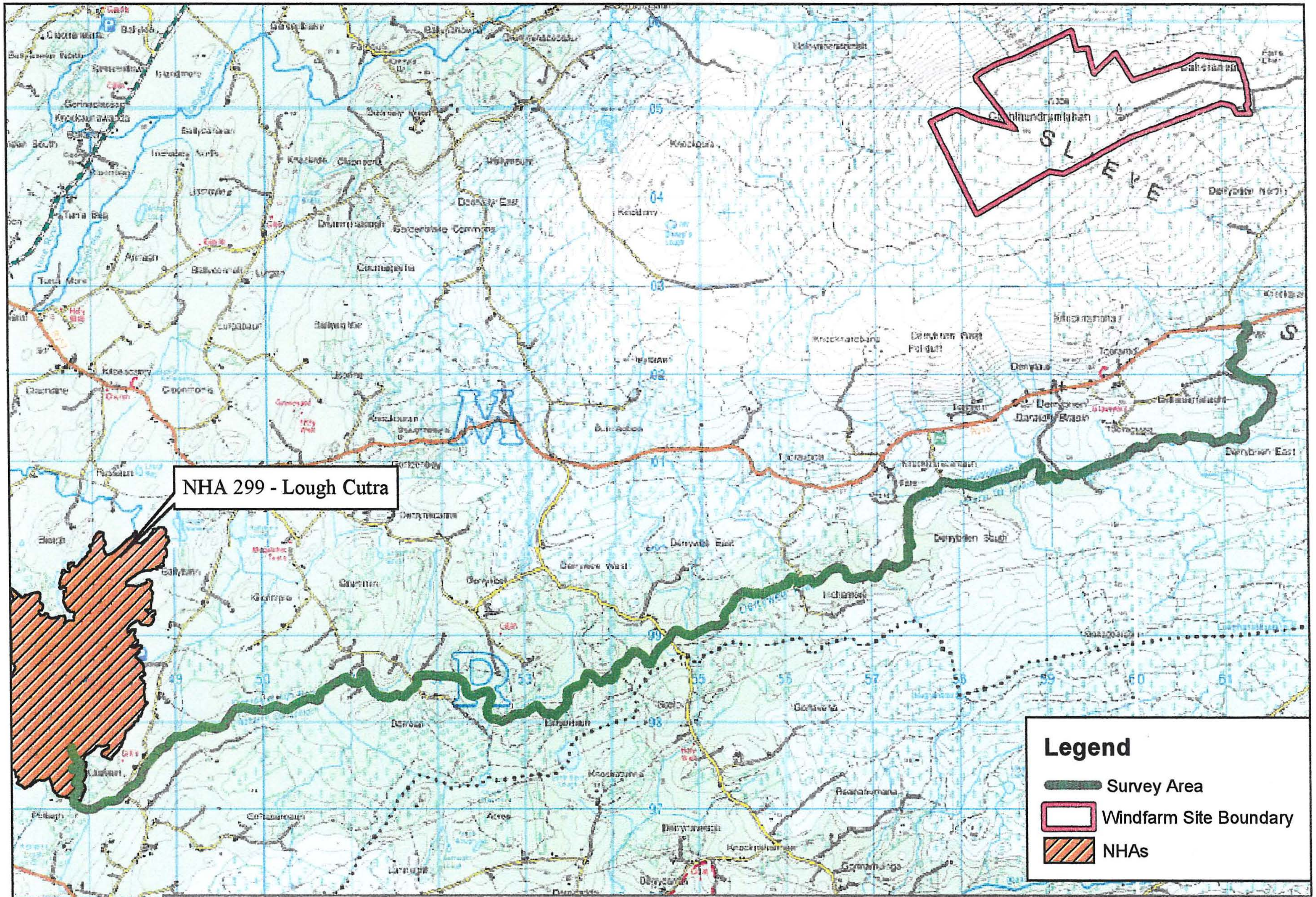

Figure 2: Map Showing Location of Natural Heritage Areas (NHA's) in Relation to Owendalulleegh River

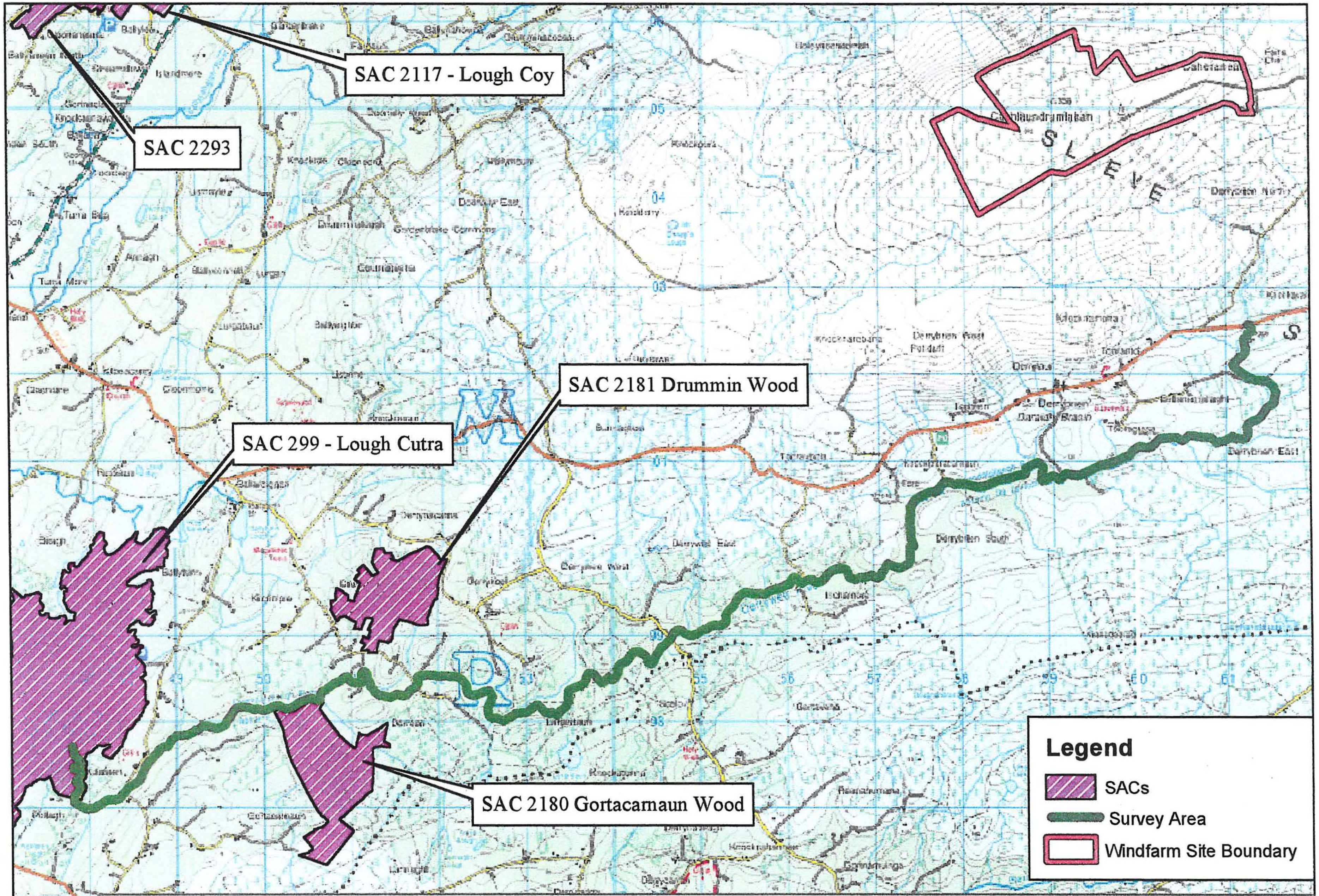

Figure 3: Map Showing Location of Special Areas of Conservation (SAC's) in Relation to Owendalulleegh River

Table 2 Catchment details of the Owendallulleegh River (from source to Lough Cutra). Adapted from McGarrigle *et al* (2002).

Detail	**Value**
EPA Code	29/O/01
OS Catchment number	146
NOS Grid Reference	R 478 976
Hydrometric area	29
Tributary of	Lough Cutra

Table 3 Physical characteristics of the Owendallulleegh River (from source to Lough Cutra). Calculated from the features shown on the NOS Discovery Series Map 52 and information provided in McGarrigle *et al*, 2002).

Characteristic	**Value**
Catchment area (km^2)	40
Length (km)	22.5
Basin length (km) [1]	17.2
Basin surface storage (%) [2]	0.005
Drainage density [3]	1.09
Stream order	3rd
Beneficial uses	General amenity and angling
Status	Tributary of designated SAC

Stream order was calculated using the Strahler method (Strahler, 1964).

3.4 Previous studies

3.4.1 Fish and fisheries of the Lough Cutra catchment

The fish fauna of Ireland is not as diverse as other European countries due to the impact of glaciation. Most of the fish species present in Irish river catchments have colonized from the sea or have been artificially introduced. The fact that the Lough Cutra catchment is landlocked will further reduce the number of fish species present. Native fish species in the Lough Cutra catchment include brown trout *Salmo trutta* and one out of the three Irish lamprey species (brook lamprey *Lampetra planeri*). Brook lamprey are listed under the European Union Directive on the Conservation of Natural and Semi-Natural Habitats and of Wild Fauna and Flora (Habitats Directive, 92:43:EEC). The catadromous[4] European eel *Anguilla anguilla* is thought to access Lough Cutra via underground river channels. Introduced fish species in the catchment include northern pike *Esox lucius*, stone loach *Barbatula barbatula*, perch *Perca fluviatilis*, and gudgeon *Gobio gobio*. There have been reports that carp *Cyprinus carpio* has been introduced to the lake but the ShRFB has not confirmed this. A list of the fish species, which are known to occur in the Lough Cutra catchment, and the Owendallulleegh River, along with their distribution and conservation status, is given in table 4. Lough Cutra is a privately owned lake and coarse/mixed fishery.

[1] Basin length is the straight-line distance between the mouth of the basin (in this case the confluence with the Lough Cutra) and the drainage divide nearest the source of the main stream.

[2] Basin surface storage (%) is the percentage of the basin covered in lentic water bodies (i.e. lakes).

[3] Drainage density is an index of the length of stream per unit area of basin. It is calculated by dividing the catchment area by the total length of perennial streams in the catchment.

[4] A fish species which spends most of its life in freshwater but migrates to the sea to spawn.

Table 4 A list of fish species recorded from the Lough Cutra catchment, and Owendallulleegh River, indicating their distribution, protection status, and utilisation (compiled from a number of unpublished sources).

				Protection			*Exploitation*		
Common name	**Scientific name**	**Origin**	**Distribution**	**EU HD**	**Berne**	**RDB**	**Recreational**	**Commercial**	**Present in Owendallulleegh River**
Brown Trout	*Salmo trutta*	N	W				•		•
European Eel	*Anguilla anguilla*	N	W				•	•	•
Carp*	*Cyprinus carpio*	I	L				•		
Gudgeon	*Gobio gobio*	I	L						•
Northern Pike	*Esox lucius*	I	W				•		
Perch	*Perca fluviatilis*	I	W				•		•
Brook lamprey	*Lampetra planeri*	N	L	II	Annex III	I			•
Stone Loach	*Barbatula barbatula*	I	L						•

*Not confirmed.

N=Native, I=Indigenous, W=Widespread, L=Local, E=Extinct.
EU Habitats Directive (EU HD) - Annex II (Species whose conservation requires the designation of SACs), Annex V (Exploitation subject to management)
Berne Convention (Berne) - Annex II (Strictly Protected fauna species), Annex III (Protected fauna species).
Red Data Book (RDB) - Ex – Extinct, E - Endangered, V - Vulnerable, R - Rare, I – Indeterminate, II – Internationally Important

3.4.2 Plant records

The following rare species are recorded for the 10km squares between Flaggy Bridge and L. Cutra. As this data was recorded on a 10km-square basis, it is not possible to state definitively whether the plant record is from the Owendallulleegh River, or from other wetland/streams in the 10km square.
As can be seen from the descriptions of the species' preferred habitats, most of these species prefer slow-moving or standing water or damp ground, and may have been recorded from L. Cutra or other areas of standing water within the relevant 10km squares and thus are less likely to have been affected by the peat slip event. These are marked +.

Orange foxtail *Alopecurus aequalis* – grows in muddy, marshy areas,

Slender tufted-sedge *Carex acuta* – grows along rivers and in ditches and marshes

Water sedge *Carex aquatilis* – grows in swampy areas by rivers and marshes

+Rigid hornwort *Ceratophyllum demersum* – grows in ponds, ditches and slow rivers

+Mudwort *Limosella aquatica* – grows in wet sandy mud by ponds

+Lesser pondweed *Potamogeton pusillus* – grows in lakes, streams and ponds usually in base-rich water

+Northern yellow-cress *Rorippa islandica* – grows on pond sides and other damp places

+Marsh yellow-cress *Rorippa palustris* – grows in open damp ground

+Blue-eyed grass *Sisyrinchium bermudiana* – grows in wet meadows and stony ground by lakes

+Greater bladderwort *Utricularia vulgaris sens. lat.* – grows in base-rich still or slow-moving water

+Fen violet *Viola persicifolia* – grows in fens

3.4.3 Protected aquatic fauna

The status of fauna listed in the European Union Directive on the Conservation of Natural and Semi-Natural Habitats and of Wild Fauna and Flora (Habitats Directive, 92:43:EEC) in the Owendallulleegh catchment is presented as follows;

Common name	Scientific name	Lough Cutra	Owendallulleegh River
Brook lamprey	*Lampetra planeri*	Not known	Present
Eurasian Otter	*Lutra lutra*	Common	Common

3.4.3.1 Brook lamprey

The brook lamprey is the smallest of the three lamprey species native to Ireland and it is the only one of the three species that is non-parasitic and spends all its life in freshwater. Brook lamprey is listed in Annex II of the Habitats Directive (92:43:EEC) and Appendix III of the Bern Convention. The Shannon Regional Fisheries Board has recently recorded Brook lamprey in the Owendallulleegh catchment.

3.4.3.2 Eurasian Otter

The otter is a legally protected species under the Wildlife Act, 1976 (and Wildlife (Amendment) Act, 2000). It is listed under Annex II of the EU Habitats Directive and under Annex II[5] of the Berne Convention. It is found throughout Ireland where it has apparently avoided the population declines that have occurred in many other countries. During the survey, the signs of otters (spraints and tracks) were recorded from many areas in the study area and up as far as chainage 182.

3.5 On-site Investigations

3.5.1 Aquatic habitats

The principal habitat type surveyed is categorised as eroding/upland river (FW1, Fossit 2000). For the purposes of this study, this was subdivided into in-stream areas and riparian, or riverbank, areas. A full aquatic and riparian habitat evaluation is presented in tables 5, 6, 7 and 8. The results of the physical habitat survey are given in table 9. The river length has been divided into 100m chainage lengths for the purpose of assessment, commencing at chainage zero at the Lough Cutra confluence.

3.5.2 Vegetation

A list of plant species recorded during the walkover study is given in Appendix 3. Very little vegetation was recorded from the deeper pools. Pondweed *Potamogeton* sp. was recorded at a few locations. Shallow areas were found to support a limited number of species. These areas were dominated by aquatic mosses such as *Fontinalis* and *Racomitrium* spp. Alternate water-milfoil *Myriophyllum alterniflorum* was recorded as being locally abundant. Emergent, marginal-type vegetation was found along the banks, particularly where these were shelved rather than steep-sided, and on islands and elevated cobble/gravel areas in the channel. The principal species recorded were watercress *Rorippa nasturtium-aquaticum*, water dropwort *Oenanthe* sp., fool's water-cress *Apium nodiflorum* and bulbous rush *Juncus bulbosus*. Willowherbs *Epilobium* spp., floating sweet-grass *Glyceria fluitans*, lesser spearwort *Ranunculus flammula* and brooklime *Veronica beccabunga* were locally frequent. Liverworts were locally dominant or abundant on steep-sided, shaded or overhanging banks, where they were constantly damp but rarely submerged. The dominant riparian species recorded were willows *Salix* spp., ash *Fraxinus excelsior*, hazel *Corylus avellana* and rowan *Sorbus aucuparia*, with an abundant great wood-rush *Luzula sylvatica* ground layer. Gorse *Ulex europaeus*, blackthorn *Prunus spinosa*, hawthorn *Crataegus monogyna* and bramble *Rubus fruticosus* were locally dominant, while bilberry *Vaccinium myrtillus* and soft rush *Juncus effusus* were locally abundant. Sedges *Carex* spp. were locally frequent. Some sections were dominated by planted evergreens such as sitka spruce *Picea sitchensis*. Most of the riverbank above the influence of flood events was dominated by either woodland or heath/bog flora, with unimproved grassland found in a few areas.

3.5.3 Peat Deposition

Estimates of peat deposition were made on the basis of bank side surface area and depth of peat. In general depths of peat at some locations ranged form 0.1 m thickness up to 0.5 m thickness. Larger deposits tended to occur at river bends where peat mounding was observed and at fords used on the river by local farming communities. Areas where larger depths of peat were observed tended to be small in area and could easily be removed if required.

[5] Annex II Berne Convention: Strictly protected fauna species.

Table 5 Aquatic, riparian and fisheries habitat evaluation chainage section 169-200.

Chainage section	Description	Map number	Aquatic habitat appraisal	Fisheries habitat appraisal	Level of instream impact	Level of riparian impact	Comment	Mitigation
200 - 189	From Flaggy Bridge downstream. The start point of the survey. Steep banks and a narrow channel characterize this section. There are hillocks on the eastern edge of the river that rise to 140m asl. Liverworts grow where moisture seeps down to the river.	1	One of the most heavily impacted areas of the river – strong scouring and removal of all instream vegetation. Degree to which instream habitats were affected depended on their relative exposure to the flow of moving peat i.e. whether they were on the inside or outside of a bend. Marginal species are showing good recovery three weeks after the peat slip where peat cover is light.	Here there are large amounts of peat deposited on the margins of the river. Sand banks are evident at bends in the river. These should dissipate with precipitation over time. Instream the riverbed has been scoured gravels and rocks transported downstream. All fish would have been displaced or killed by this flow of material.	Profound Negative	Profound Negative	Physical nature of river has been significantly altered here.	Large areas of peat on the margins may require removal. Alternatively could be planted and stabilized. Damage directly above and around culvert at M 61137 02304. This dam (005) should be removed. The culvert size and gauge should be changed. Instream physical enhancements may be required.
189 – 169	The section from chainage 189 – 182 is still fast moving and narrow until it meets a distributary at 182. From 182 – 169 the river widens and slows.	2	Aquatic vegetation is minimal from 189 – 182. Large amounts of siltation evident. Again there is recovery evident where peat cover is light. From 182 – 169 not as much impact due to the increasing river width.	Area between chainages 189 – 182 has been severely impacted. However, not much scouring has occurred in this section. From 182 – 169 there is good habitat available with good pools and glides - but siltation is evident. The banks have not been eroded as in chainage 200 – 189.	Substantial - Profound Negative	Substantial - Profound Negative	Fish were seen moving upstream within chainage 183. Because the fractions of peat are now small the pools seem clear enough but silt is present. Otter activity was observed at chainage 177.	Areas of peat need to be removed from the margins. Trees and shrubs instream should be left, as removal would be deleterious to habitats and fish.

Table 6 Aquatic, riparian and fisheries habitat evaluation chainage section 169-111.

Chainage section	Description	Map number	Aquatic habitat appraisal	Fisheries habitat appraisal	Level of instream impact	Level of riparian impact	Comment	Mitigation
169 151	River structure consists of long pools with alternating glide/run habitat. River widths up to 12m	3	This section is less severely impacted. Deposition on the river margins is reduced and vegetation is intact at most locations. Cover is much reduced where cobbles and boulders have been turned and scoured. Sheltered areas in the bends of the river have more moderate cover.	Despite some physical impacts, much of the instream habitat along this stretch has been left intact. Areas suitable for salmonid spawning, nursery, rearing and foraging continue to occur.	Moderate – Substantial Negative	Moderate – Substantial Negative	Impacts predicted to be short-tem at this section. Banks are still intact and good habitat is evident in the majority of the length of this section.	No action needed here. Natural recovery processes would suffice.
151 – 129	Long wide sections of slow water with some extensive riffles. Some very wide sections here (up to 19m). Substrate consists of cobble and gravel.	4	Fluctuation in instream vegetation cover reflects variations in streambed disturbance. Cover is much reduced where cobbles and boulders have been turned and scoured. However this damage was not recorded frequently in this section.	No scouring evident. No serious instream damage evident. No peat deposits. There are good areas of gravel evident. Periphyton present on gravels. The majority of larger peat material has been 'sieved out' by the narrow nature and overhanging shrubs from 200-182 of the river	Slight Negative	Slight Negative	This section is physically unchanged from its original form. Banks are still intact and good habitat is evident in the majority of the length of this section. Impacts negligible. Otter activity evident in this section.	No action needed here
129 – 111	Some large pools along this stretch, three small distributaries and three fords characterize this section. Bank height rises here along this section. Fish (salmonids) were noted moving in the pools here. This section is for the most part slow moving with some good riffles evident at the fords.	5	Cover of peat on the margins here is very light except for small pockets. Liverwort flora, the most abundant riparian-type marginal vegetation, is undamaged. Instream vegetation is low and scouring damage is not evident.	Good spawning areas in this section with gravels intact. Also good holding pools and nursery areas available. Damage is limited to marginal areas where peat has deposited. No instream damage evident with the exception of some trees and shrubs that have been washed down. These will form extra habitat for fish in future.	Slight Negative	Slight Negative	This section seems largely undamaged to the eye. There is no evidence of scouring or of large movements of gravels and cobbles. Because the fractions of peat are now small the pools seem clear enough but silt is present in the interstitial spaces. Otter activity in the form of paw prints and anal jelly was observed.	No action needed here

Table 7 Aquatic, riparian and fisheries habitat evaluation chainage section 111-31.

Chainage section	Description	Map number	Aquatic habitat appraisal	Fisheries habitat appraisal	Level of instream impact	Level of riparian Impact	Comment	Mitigation
111- 91	Deep pools and large sections of bedrock characterize this section. There is good bankside vegetation and some good stands of mixed forestry line the edges of the river in places. Tunneling (trees) was observed at two locations.	6	Due to the depth of water in areas instream vegetation was low where it was possible to assess. Again liverworts were undamaged.	Large deep holding pools that are impossible to assess for benthic damage. However there are good areas of glide (50%) accessible and these seem untouched. Peat has not deposited instream with the exception of areas in the lee of trees in the river. Peat has deposited on the margins in some areas.	Slight Negative	Slight Negative	This section seems largely undamaged to the eye. Large numbers of deer are using this area. The only discernable difference is the peat that has deposited on the banks.	No action needed here
91 – 70	This entire section has deciduous woodland on the bankside. As a result shading occurs on most of the sections. Long pools are evident with no damage recorded.	7	Vegetation that was seen was intact. There is impoverished riparian flora as a result of shading. The instream flora is low where shading occurs but is relatively undisturbed. The lower areas 64-56 supports very good areas of instream vegetation and also seems undisturbed by then peat slip event.	Where possible to assess instream predictors no damage was recorded. Gravels were evident but on a whole deep areas and glides predominated. Siltation was observed. Peat has deposited on the margins in some areas.	Slight Negative	Slight Negative	This section was undamaged and instream vegetation was intact where noted. Areas of peat deposition were apparent.	No action needed here
70 – 50	Wide sections of river bordered on the northern bank by good improved agricultural grassland complexes. The river exhibits deep pools again with glides predominating.	8	Good sections of instream growth are evident at the lower end of this section. Again heavy shading by overhanging trees has stunted growth in some sections. All instream vegetation that was observed was undisturbed.	Where wading permitted inspection of the instream predictors these seemed undisturbed. Peat has deposited on the margins in places.	Slight Negative	Slight Negative	This section was undamaged and instream vegetation was intact where noted. Areas of peat deposition were apparent.	No action needed here
50 – 3 (SAC 2180 Gortacarnaun Wood)	Characterized by widening sections of river with good pool systems. Some nice fast water at chainage 45 with nice undisturbed gravels present. Between chainages 39 – 34 on the southern bank there is heavy woodland cover entailing observers to make use of the northern bank.	9	There have been no impacts on vegetation found in this section. Open unshaded areas support good instream vegetation.	Minimal impacts were observed in this section. Peat has deposited on the banks at various locations and overhanging trees bear the detritus of the deluge.	Imperceptible Negative	Imperceptible Negative	Fresh otter spraints were noted in this section. There is no perceptible damage in this section.	No action needed here

Table 8 Aquatic, riparian and fisheries habitat evaluation chainage section 31-1.

Chainage section	Description	Map number	Aquatic habitat appraisal	Fisheries habitat appraisal	Level of instream impact	Level of riparian impact	Comment	Mitigation
31 – 11	Extensive areas of riffle separate some long deep pools. Instream predictors were difficult to assess in places due to the depth of pools.	10	There have been no impacts on vegetation found in this section. Open unshaded areas support good instream vegetation.	No impacts recorded on this section. Some small amounts of peat have settled on the margins at certain points.	Slight Negative	Slight Negative	There is no perceptible damage in this section.	No action needed here
11 – 1	Due to the depth of this section the ShRFB surveyed this section in boats. This section leads onto the mouth of the river and a large sand bank is present at this mouth.	11	There have been no impacts on vegetation found in this section. Depth of channel made assessment of instream vegetation impossible.	Although no impacts were recorded on this section some peat may have settled at the mouth of this river. Some small amounts of peat have settled on the margins at certain points.	Slight Negative	Slight Negative	There is no perceptible damage in this section.	No action needed here

Table 9 Approximate amount of peat (m^3) deposition observed on the river margins. (Estimated by ESBI)

Chainage section	Amount of peat (m^3) deposition observed on the margins (approx.)
200 - 189	1260.1
189 – 169	936.59
169 – 151	102.35
151 – 129	51.25
129 – 111	45
111- 91	21.5
91 – 70	276.25
70 – 50	79.75
50 – 31	16.15
31 - 11	65.15
11 - 1	67

Table 10 Results of the physical habitat survey.

Site number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Grid co-ords.	M611 625	M611 624	M 6113 623	M611 272	M610 206	M 611 196	M 611 345	M611 121	M604 119	M 601 121	M 579 702	M 575 538	M 57371 125
Bank height range (m)		1 - 2m	1 - 2m	3 - 7m	.5 - 3.5	.4 - 3.5	.4 - 2	.2 - .6	.5 - 1.5	1.5 - 2	.1 - 2	.1 - 2	.1 - 1.2
River width range (m)		1 - 2m	.2 - 1.1m	2 - 4m	.3 - 1.5m	1 - 4m	.7 - 4m	2 - 4m	3 - 8m	5 - 10m	5 - 14m	7 - 15m	8 - 19m
Depth range (m)		.1 - .5	.1 - .5m	.5 - .75m	.1 - .5m	.1 - .75m	.1 - .8m	.1 - .7m	.1 - 1.5m	.1 - .75m	.1 - 8m	.1 - .8m	.2 - .6m
Riffle %		50	20	10		10	10	10	50	20	30	20	5
Glide %		40	10	30	10	20	80	80	40	70	50	5	75
Pool %		10	70	40	60	70	10	10	10	10	20	75	20
Bedrock %		90	60	85	30	30	50		10				
Cobble %				5	10	10	30	75	20	60	15	15	80
Gravel %		10	40	15	60	60		25	70		15	85	20
Boulder %							20			40	70		
Sand/Silt %													

Site number	**14**	**15**	**16**	**17**	**18**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Grid co-ords.	R572 997	R561 996	R557 994	R546 989	R517 984	R517 984	R510 984	R502 981	R484 971	R482 972	R480 972	R487 978	R487 978
Bank height range (m)	.1 - 2.5	.1 - 5	0.5 - 2	0.1 - 2	1-3m	1-3m	1 - 3m	1-15m	1-3m	.1-2	.5-2m	.1 - 2.5	.1 - 5
River width range (m)	10 - 19m	2 - 20m	2 - 8m	3 - 30m	2-17m	5-14m	2-12m	10-14m	6-12m	17-25m	16-30m	10 - 19m	2 - 20m
Depth range (m)	.1 - .75m	.1 - 1m	.1 - 1.5m	.1 - >2m	.1-3	.2-3.5	.1 - 2.5	.1 -4.5	.2->2m	.2 -.4m	.75-5m	.1 - .75m	.1 - 1m
Riffle %	25	25	10	20	10	10	20	5		10		25	25
Glide %	75	25	80	50	60	35	30	10	50	90		75	25
Pool %		50	10	30	30	55	50	85	50		100		50
Bedrock %	10	60		70	30	30	5	80	10			10	60
Cobble %	20			20	40	20						20	
Gravel %	70	10	20	10	10	10	90					70	10
Boulder %		30	80		20	40	5	20	30	5			30
Sand/Silt %									60	95	100		

4.0 IMPACT

4.1 Characteristics of the impact

The results of this preliminary investigation suggest that the peat, which entered the upper reaches of the Owendallulleegh River, had a significant impact on the aquatic habitats in the river. The impacts were related to (1) physical impacts of peat on the river (i.e. scouring, bed erosion, etc.) and (2) impacts on water quality through elevated suspended solids and other parameters.

4.1.1 Physical impacts

Evidence of physical impacts are particularly apparent in the upper reaches of the river where an acute slide of peat into the channel scoured the river bed and denuded it of deposited materials such as gravels and cobbles. Physical impacts on the middle section of the river were less significant where suspended peat was transported. Deposition along this stretch of river was confined primarily to river bends and islands. No evidence of scouring was apparent along this section.

On the lower section of river, evidence of impacts were much reduced due to the spatial and temporal dilution of peat flocs and the riparian deposition of peat in the upper and middle section of the river. Suspended peat was transported along this stretch by river flows and deposition was confined primarily to river bends, islands and areas of reduced flow. No evidence of scouring was apparent along this section.

4.4.2 Scale of the impact

The most severe impact occurred in the upper section of the river, from Flaggy Bridge to confluence at Derrybrien East. In this area, the energy of moving peat, water and debris was greatest, and resulted in the near total loss of vegetation and scouring of the riverbed in some parts. Heavy deposition of peat on the banks also occurred in this area. The impact on the remaining downstream section was less significant. The presence of a 'high water mark' of debris deposited along the entire length of channel from Derrybrien to Lough Cutra indicates the ultimate height to which the banks were affected. In most areas below Tooraglassa, this is limited to a light covering of twigs and plant debris.

The main physical impact of peat silt on instream and riparian habitats is to be found within 0.5km downstream of Flaggy Bridge, where heavy peat deposition and scouring of the river channel had a profound impact. In contrast with this, practically the entire remaining habitat, from Bellaghnamallaght to L. Cutra, shows low/no impact, with localised areas of moderate impact. Habitat quality and species composition in areas of low/no impact is as expected for this type of river, where low nutrient availability and a spate-type flood regime do not favour the growth of emergent aquatic plants. Low cover of instream vegetation in areas of low/no impact is coincident with areas of heavy shading or deep pools, both of which are unsuitable for the growth of the most instream species typical of upland rivers. Those areas where instream vegetation has suffered moderate/low damage would be expected to recover naturally over the next 2-3 years.

Areas of deposited peat will provide new habitat for colonisation by some emergent species that are tolerant of its low pH, e.g. lesser spearwort, over the coming growing season (spring/summer 2004). However most of these deposits will be moved or modified by spate floods and are generally unlikely to provide habitat beyond approximately two years, given the eroding nature of this type of river. Most of the instream species found on this river prefer a mineral- (rock) derived substrate for growing, as opposed to one derived from organic matter (e.g. peat) – that is why they are found in this eroding type of river. While some deposition of fine peat is evident in the streambed, this is not of sufficient quantity to significantly affect plant growth.

With regard to plants and habitats along most of the affected stretch of the Owendallulleegh River, no remedial action is necessary, or even desirable, as the communities present will regenerate naturally over the next 1-3 years. Peat deposits should not be removed except where they present a possible danger to humans/livestock, or a potential threat to fisheries. Accessing and removing deposits is more likely to cause harm to habitats and plants than if they are left to naturally recolonise and/or be eroded (assuming that heavy plant such as caterpillar-tracked vehicles would be used to carry out the work).

5.0 MITIGATION

Some remedial works are desirable in the upper section at Flaggy Bridge in order to stabilise denuded areas of river channel and prevent unnecessary release of sediment into the watercourse. The use of matting, geotextile or similar 'soft' engineering solution to stabilise the bank sides and allow natural regeneration to occur is preferable over the use of 'hard' engineering. As well as facilitating habitat restoration and quickly fitting in with the natural landscape, 'soft' solutions have long-term advantages of being better adapted than hard bank retention engineering to absorbing some of the energy of spate events. Planting of vegetation 'plugs' at intervals along the stabilization structure would accelerate recolonisation. Any plants used should be taken from a suitable nearby site and the use of native species is recommended.

The planting of trees to replace those damaged in the flood would help to stabilise adjacent areas. The most suitable species are those native species already found growing naturally in this area – ash, mountain ash and downy birch.

Remediation of instream vegetation is problematic as aquatic mosses are slow growing. Two options are available. The first,'do nothing', option will leave the channel to recover by itself with no interference. This will be a slow process (3+ years). Alternatively, a small number of medium-sized (football-sized) boulders with moss growth could be introduced from unaffected parts of the river, preferably from the closest point possible (to retain a species composition as close to the original as possible). Such boulders would create a more diverse flow regime and variety of instream microhabitats. It is recommended that this option be considered only when all other remediation and stabilisation works have been completed, at which stage the condition of the streambed in the worst affected area should be re-assessed. The possible introduction of such boulders should be discussed with ShRFB staff.

5.1 Proposed further work

It was not possible to assess the status of fish populations and other fauna in the river during the current survey. It is therefore recommended that a fish stock assessment coupled with a macroinvertebrate survey be undertaken. This survey should use standard quantitative methods (electrical fishing and serber sampling) and should be undertaken at 5-10 sites along the river corridor. The ideal time to undertake this survey would be during the period July-September when the maximum numbers of juvenile fish would be expected to be present in a stream of this nature. At this time detailed recommendations regarding instream physical mitigation work can be made.

REFERENCE

Greenberg, L.A. and Dahl, J. 1998. Effect of habitat type on growth and diet of brown trout (*Salmo trutta* L.) in stream enclosures. *Fisheries Management & Ecology* **5:** 331-348.

Haury, J, Ombredane, D, & Bagliniere, JL (1999) The habitat of the Brown Trout (*Salmo trutta* L.) in watercourses. *Biology and ecology of the brown and sea trout. 37-89. (1999).*

Hatfield, T. & Bruce, J. (2000) Predicting Salmonid Habitat–Flow Relationships for Streams from Western North America. *North American Journal of Fisheries Management* **20**:1005–1015, 2000

Kennedy, GJA & Strange, CD (1986) The effects of intra- and inter-specific competition on the distribution of stocked juvenile Atlantic salmon, Salmo salar L., in relation to depth and gradient in an upland trout, Salmo trutta L., stream. J. Fish. Biol., **29**(2):199-214.

O'Grady, M.F. (1993) Initial observations on the effects of varying levels of deciduous bankside vegetation on salmonid stocks in Irish waters. *Aquacult. Fish. Manage.*, **24**(4):563-573.

APPENDIX 1 SURVEY AREAS ON THE OWENDALLULLEEGH.

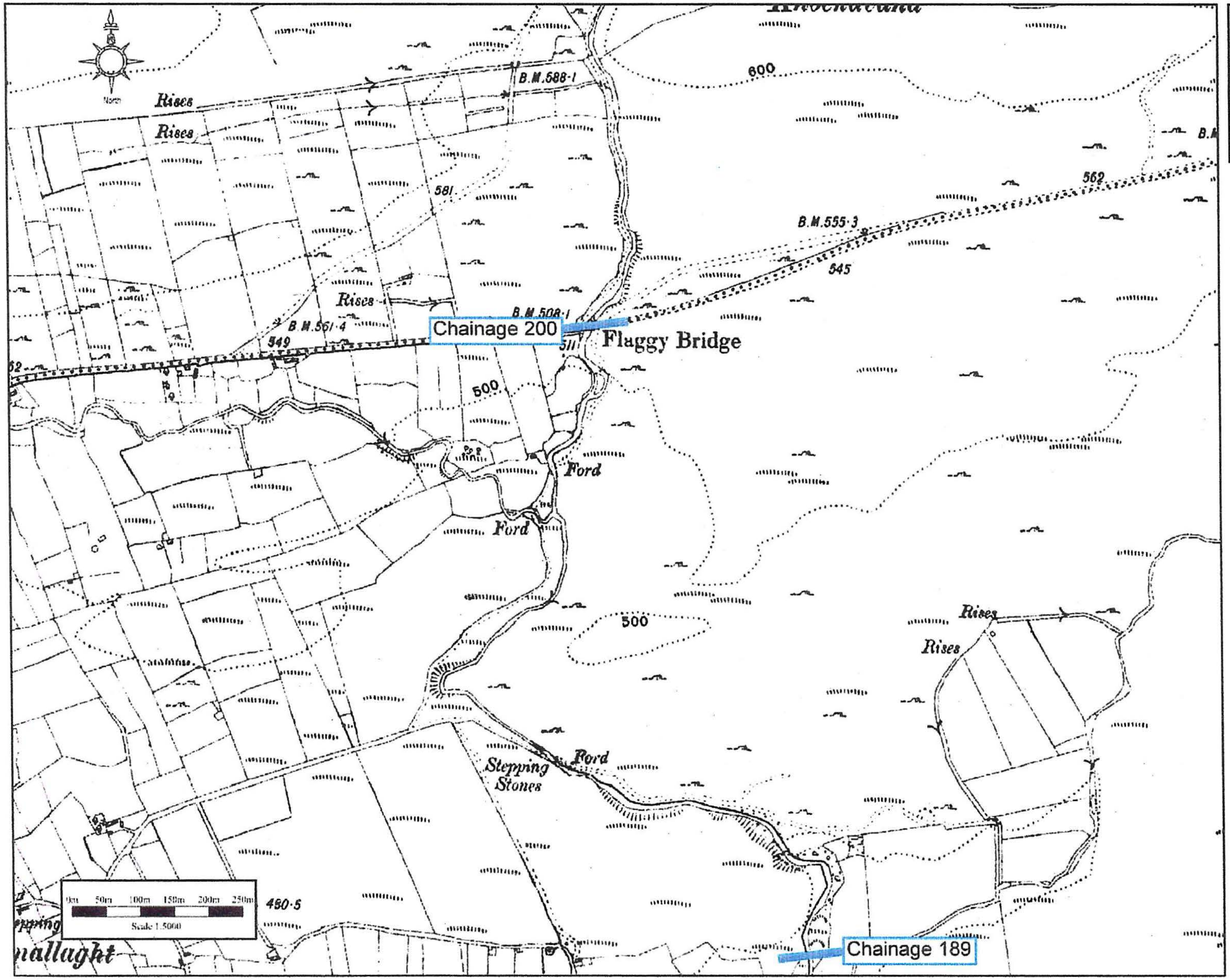

Figure A1.1
Section one was located downstream of Flaggy Bridge. Survey section was between chainages 200 - 189.

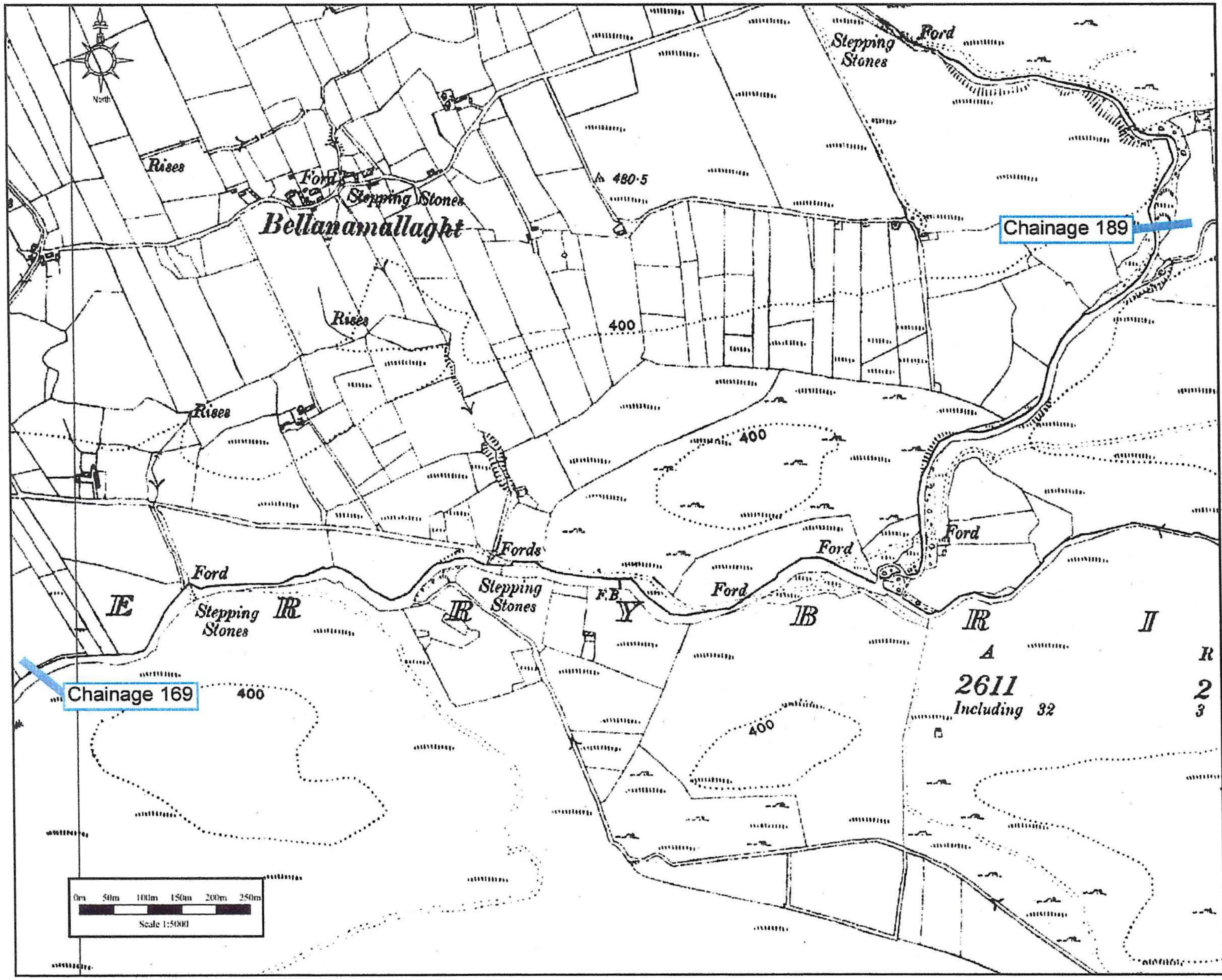

Figure A1.2
Section two was located on the second section down-stream of Flaggy Bridge. Survey section was between chainages 189 - 169.

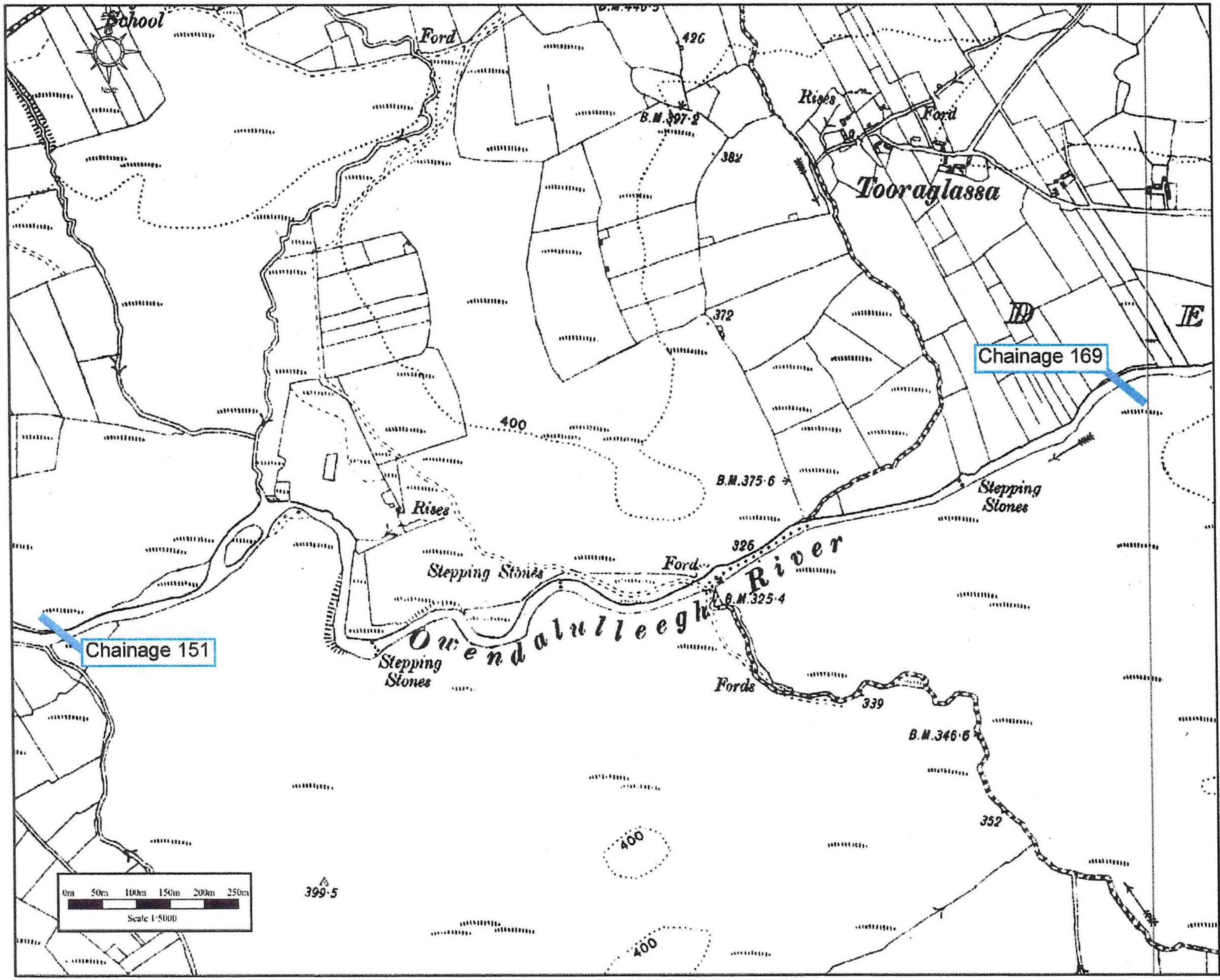

Figure A1.3
Section three was located in the townland of Toorglassa. Survey section was between chainages 169 - 151.

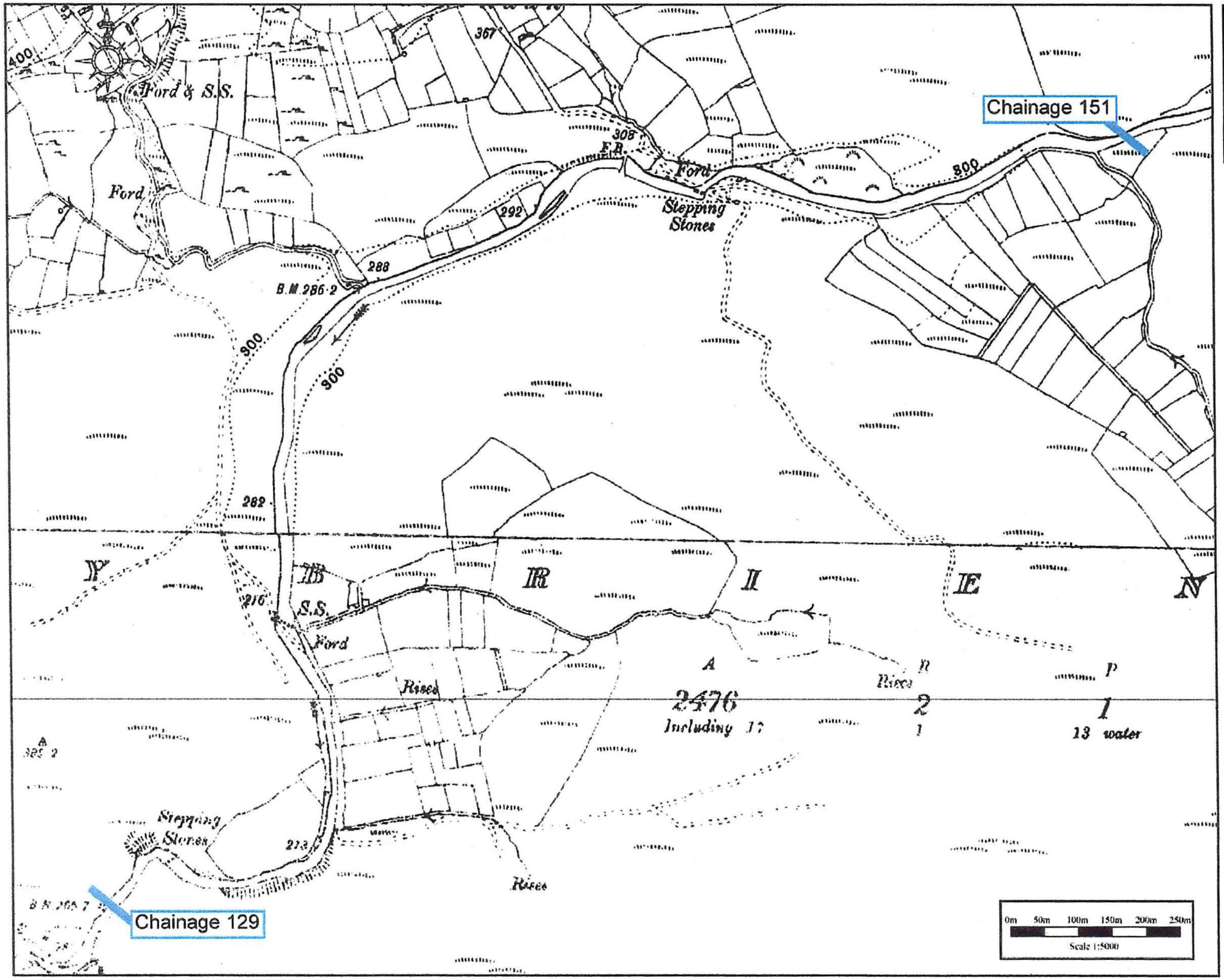

Figure A1.4
Section four was between chainages 151 and 129.

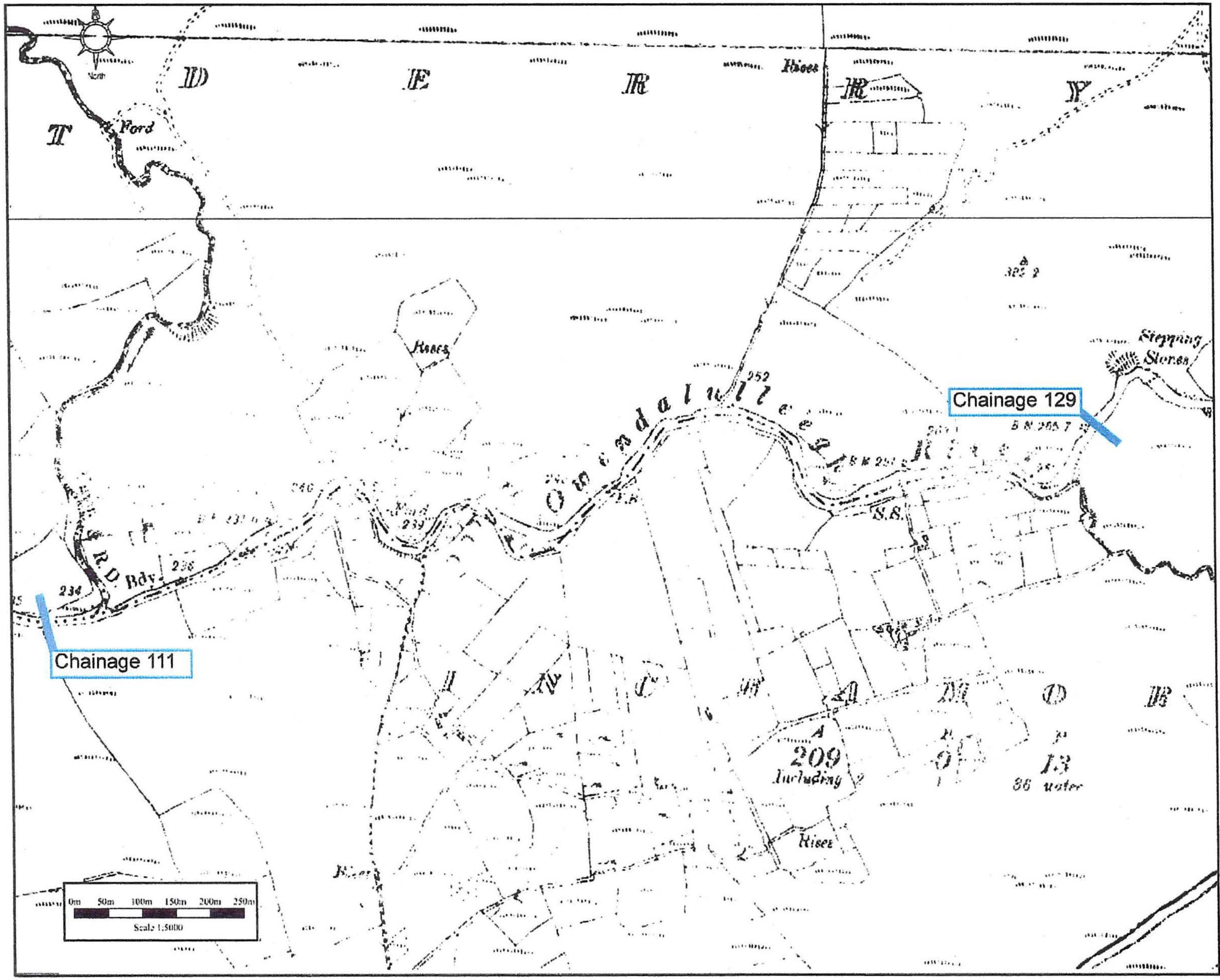

Figure A1.5
Section five was between chainages 129 and 111.

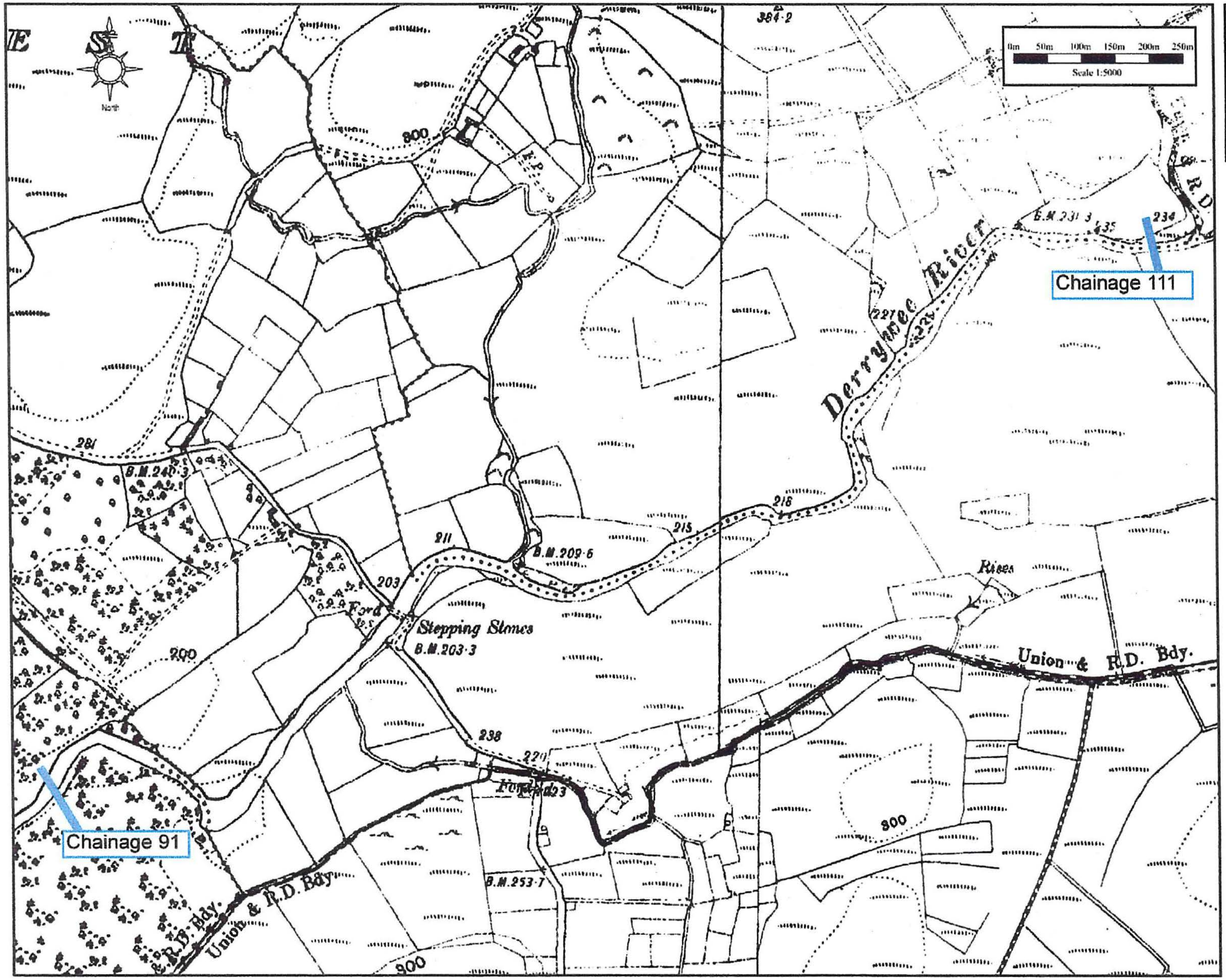

Figure A1.6
This figure shows the extent of survey section six. This section extended from chainage 111 to chainage 91.

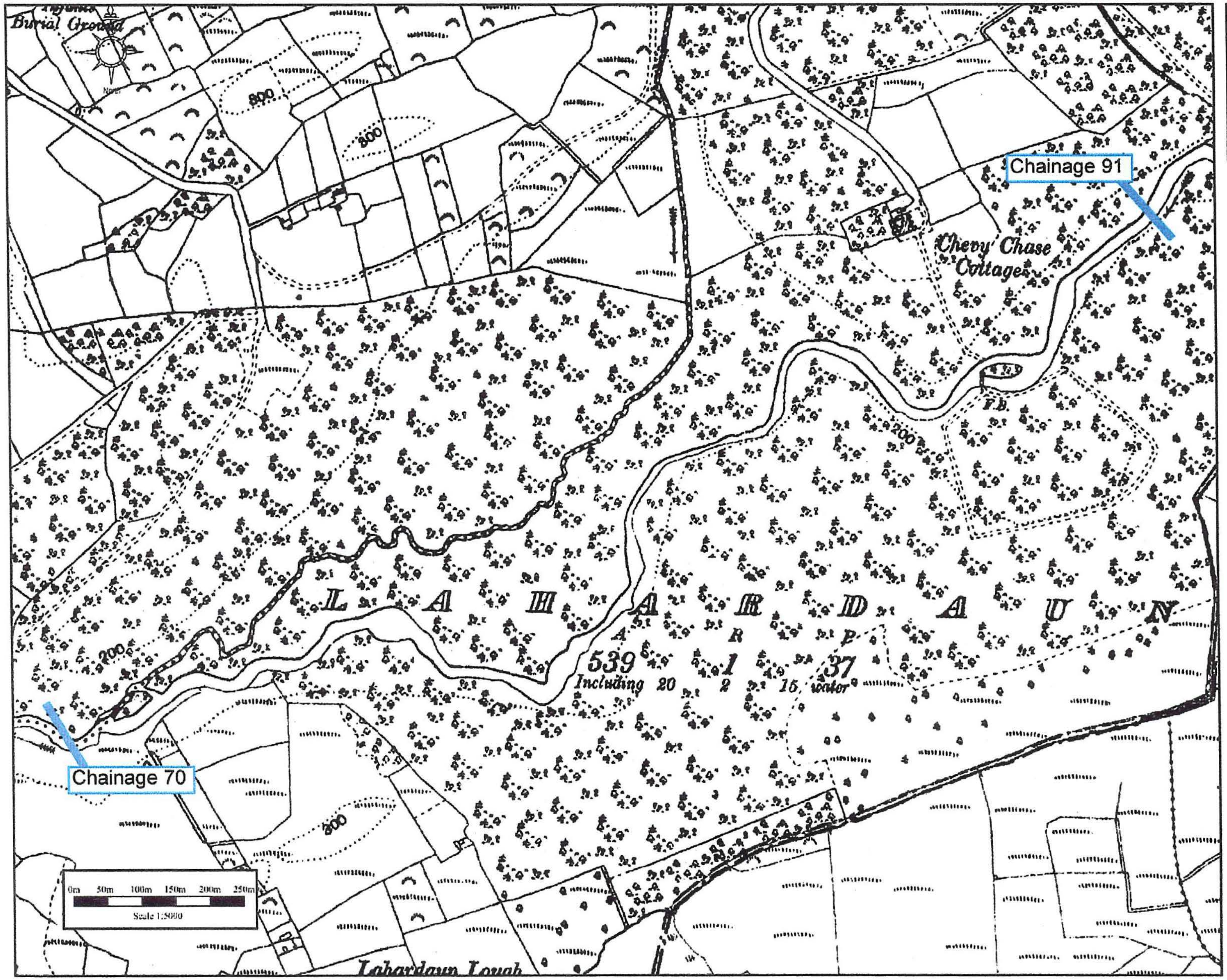

Figure A1.7
Section seven was located in the stretch of river near Chevy Chase cottage. Survey section was between chainages 91 - 70.

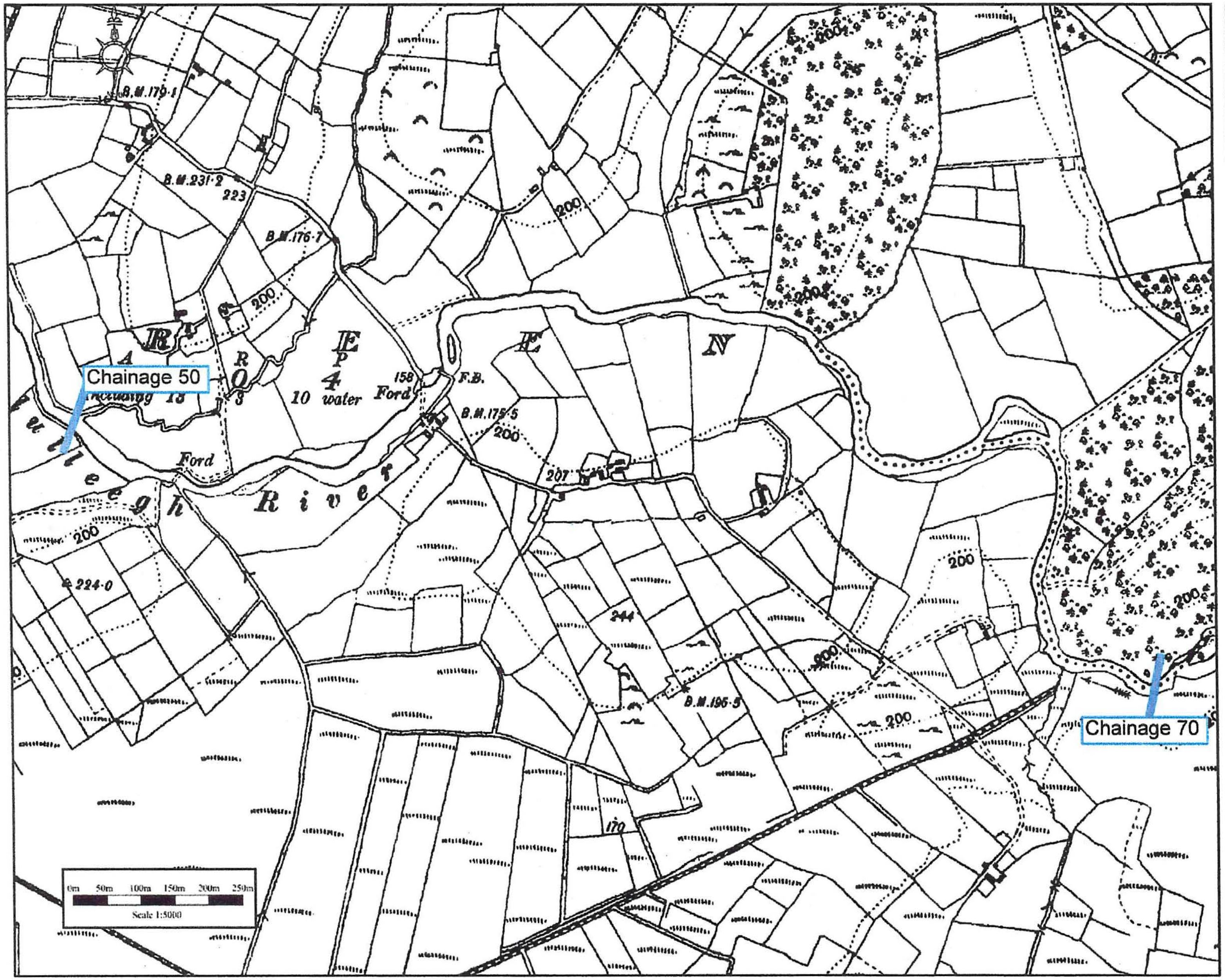

Figure A1.8
Section eight was located immediately downstream of the Chevy Chase cottage stretch and extended from chainage 70 to 50.

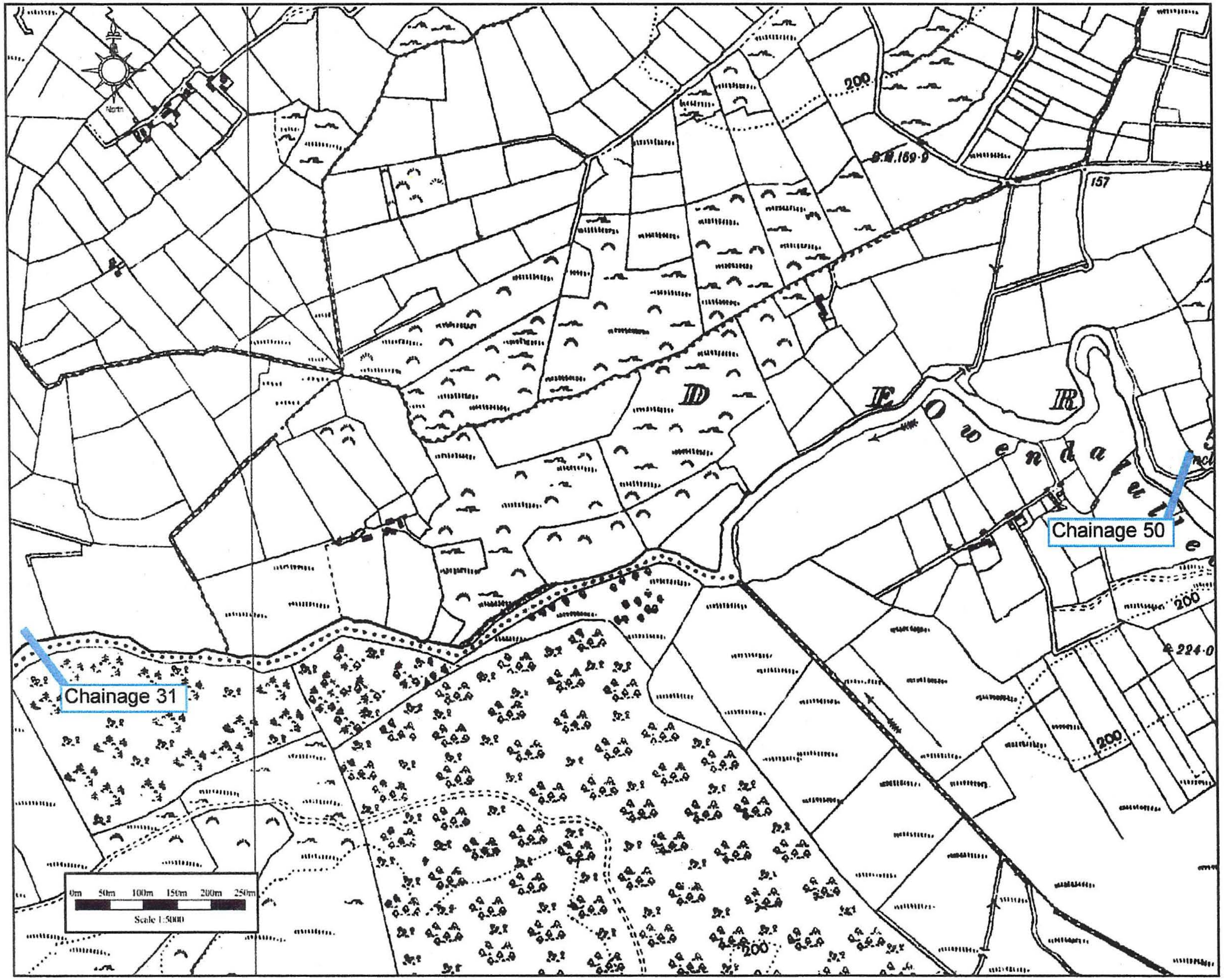

Figure A1.9
This figure shows the extent of survey section nine. This section extended from chainage 50 to chainage 31.

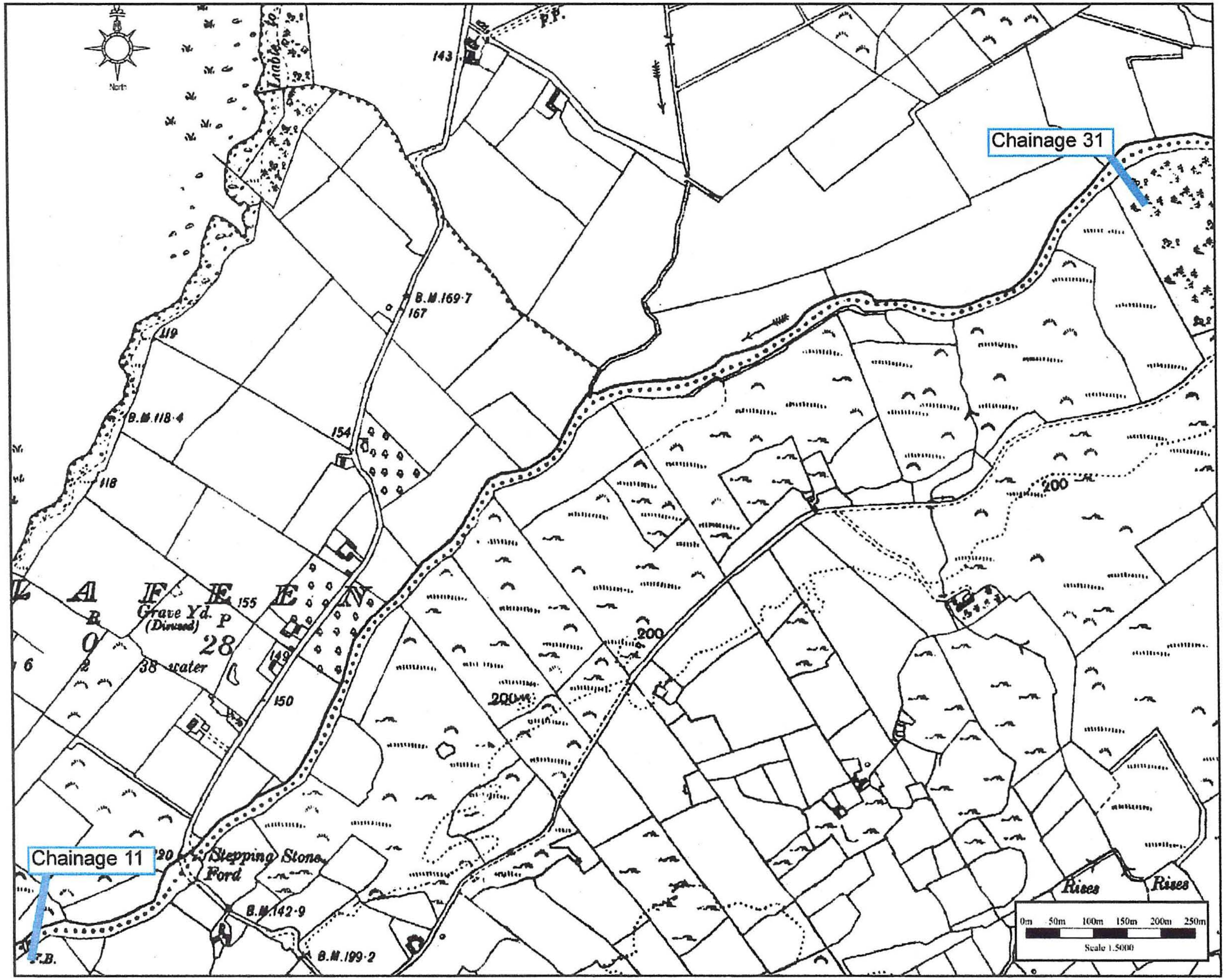

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Figure A1.10
Section ten was located in the lower reaches of the river river. Survey section was between chainages 31 and 11.

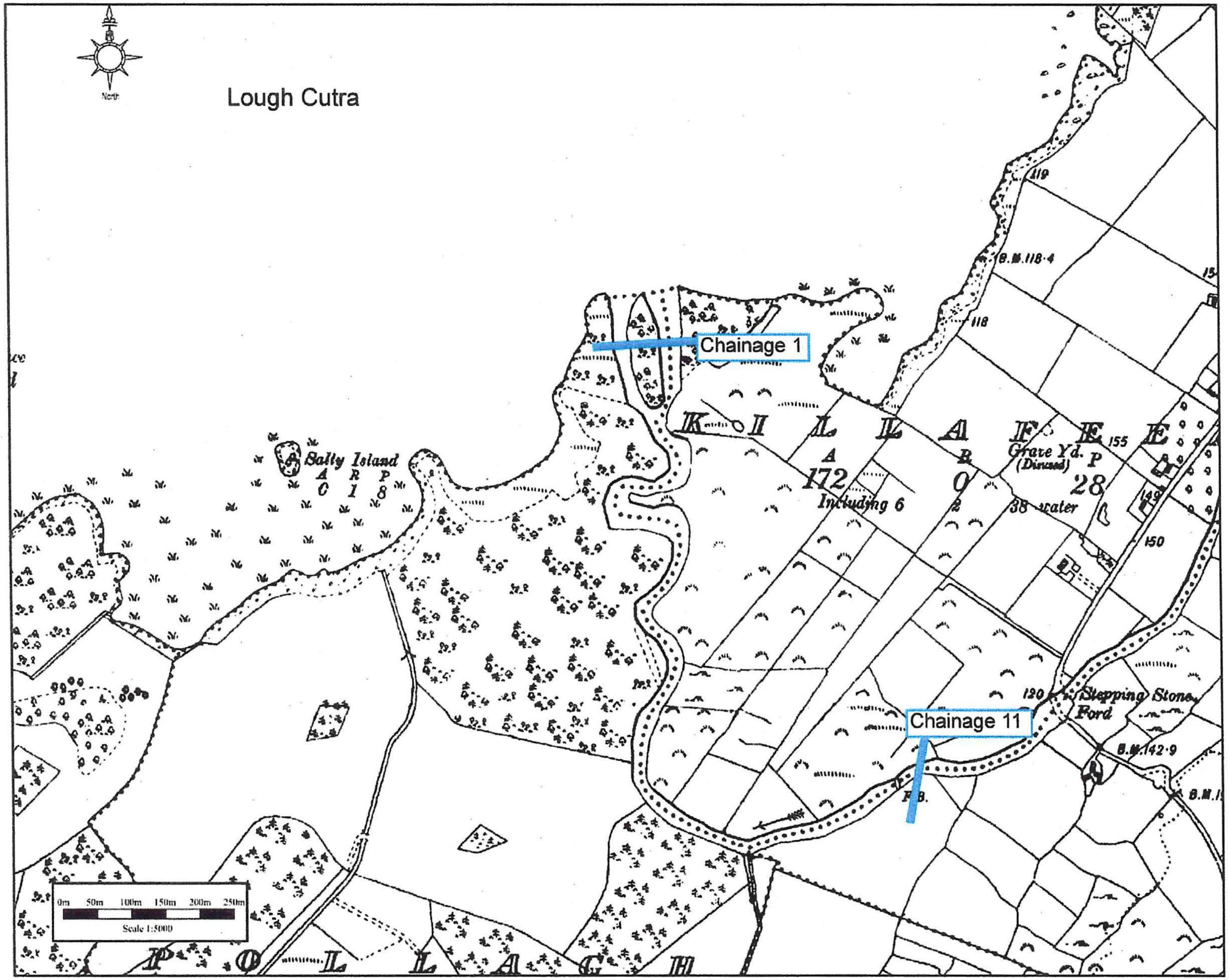

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Figure A1.11
This section was the lower-most section of the river and extended from chainage 1 at the mouth of the river to chainage 11.

APPENDIX 2 NPWS SITE SYNOPSES

SITE NAME LOUGH CUTRA

SITE CODE 000299

Lough Cutra is an oligo/mesotrophic freshwater lake lying on limestone. This lake is located 4km south-east of Gort. The lake covers an area of 390 ha and has a catchment consisting of blanket bog and mineral soils.

The main habitats of this site are; aquatic lake vegetation, reedbeds confined to sheltered bays and mixed woodland. Reedbeds of Common Reed (*Phragmites australis*), Common Club-rush (*Scirpus lacustris*) and Great Fen-sedge (*Cladium mariscus*) exist. The flora shows a mixture of calcicole and calcifuge species with the Irish Spurge (*Euphorbia hyberna*) noted in the area. There is no information available on the status of the woodland habitats in this site.

The site is internationally important for its breeding and wintering population of Cormorants (166 pairs in 1985 and max 300 individuals in winter) (Information compiled in 1987). The Cormorants use the off-shore islands for breeding purposes.

The lake is used for fishing and tourism. Precautions should be taken to ensure the lake and its surrounding area is protected from damaging operations such as application of artificial fertilizers, development close to the lakeshore, drainage and felling of woodland areas. The internationally important populations of Cormorants and Lesser Horseshoe Bats should be especially protected.

Lough Cutra is an important site with its diverse habitat types and the presence of both calcicole and calcifuge floras. The site is also of interest as it has internationally important numbers of Cormorants on the Island.

SITE NAME: LOUGH COY

SITE CODE: 002117

Lough Coy is situated approximately 6.5 km north-east of Gort and lies close to the Slieve Aughty hills. The site consists of a small permanent lake in the middle of an almost circular turlough basin. There are drift deposits as well as outcropping rocks and boulders on the relatively steep side walls and small areas of scrub towards the top of the basin. The underlying soils consist of alluvial gleys and a gleyed rendzina-like soil.

A large swallowhole occurs at one side of the basin slightly above summer water level and water enters and leaves the turlough mostly through this. During the winter the fluctuation in levels is extreme and there are no emergent plants such as Common Club-rush (*Scirpus lacustris)* or Common Reed (*Phragmites australis)* in the lake. The turlough experiences a large throughput of water and is dependant on the flows in the tributaries of the Coole River. Lough Coy is an excellent example of a 'riverine' type of turlough, and is in essence the floodplain of an underground river.

Practically the entire site consists of turlough habitat, an EU Habitats Directive Annex I priority habitat. In summer the water area contracts to a degree depending on the prevailing weather and flat mud is exposed which splits into polygonal plates. This is the habitat for a variety of specialised plants such as Mudwort (*Limosella aquatica*), Needle Spike-rush (*Eleocharis acicularis*), Northern Yellow-cress (*Rorippa islandica*) and the liverwort *Riccia cavernosa*. The lakeshore itself has some of these species along with Knotgrass (*Polygonum aviculare*) and Redshank (*Polygonum persicaria*). Above this is a more continuous cover of the sedges *Carex nigra* and *C. hirta*, Reed Canary-grass (*Phalaris arundinacea*), Creeping Cinquefoil (*Potentilla reptans*), Corn Mint (*Mentha arvensis*) and Creeping Buttercup (*Ranunculus repens*). A vegetation characterised by Meadowsweet (*Filipendula ulmaria*), Northern Bedstraw (*Galium boreale*), Common Bird's-foot-trefoil (*Lotus corniculatus*) and Adder's-tongue (*Ophioglossum vulgare*) grows amongst the rocks and includes both Dog Violet (*Viola canina*) and Fen Violet (*V. persicifolia*). The limestone boulders on the upper slopes have a covering of the moss *Cinclidotus fontinaloides*. The fringe of scrub at the edge of the basin is mostly of Blackthorn (*Prunus spinosa*), Buckthorn (*Rhamnus catharticus*) and Ash (*Fraxinus excelsior*), with some Hazel (*Corylus avellana*).

Lough Coy is part of a complex of small sites (along with nearby Blackrock, Ballylee and Bullaunagh turloughs) which supports a nationally important population of Whooper Swans and regionally/locally important numbers of several duck and wader species. Maximum counts at Lough Coy in winter 1995/96 were as follows: Whooper Swan 78, Wigeon 285, Teal 283, Pochard 45, Lapwing 300, Dunlin 120 and Curlew 80. Birds move frequently between the various sites in response to water levels and disturbance. Lough Coy is often one of the few sites in the district which holds water in late summer and autumn and consequently is of importance for post-breeding birds and early autumn arrivals - 132 Mallard were counted in August 1996 and 149 Wigeon in September 1996.

Of particular note is the occurrence of three Red Data Book plant species at this site - these are Mudwort (*Limosella aquatica*), Fen Violet (*Viola persicifolia*) and Northern Yellow-cress (*Rorippa islandica*).

The main landuse within the site is cattle grazing which is quite heavy at the lake margins and on parts of the slopes. There is some removal of gravel from the drift deposits on the north western edge.

Lough Coy is an excellent example of an eutrophic (nutrient-rich) turlough. The extreme water fluctuation supports a distinctive zonation of vegetation and provides many niches for specialist plants. It is an important site for wintering waterfowl.

SITE NAME : COOLE-GARRYLAND COMPLEX

SITE CODE : 000252

The Coole-Garryland Complex is situated in a low-lying karstic limestone area west of Gort, County Galway. It contains a series of seasonal lakes (turloughs), which are fed by springs and a partly submerged river, surrounded by woodland, pasture and limestone heath. The more well-known turloughs present in the site include Lydacan, Crannagh North, Raheen, Crannagh South, Coole, Garryland, Newtown and Hawkhill.

Turloughs are listed as priority habitat on Annex I of the EU Habitats Directive, and the turloughs at Coole-Garryland are particularly good examples of this habitat type. Vegetation of the turloughs includes Shoreweed (*Littorella uniflora*), Spike-rush (*Eleocharis palustris*), Water-purslane (*Lythrum portula*) and Fen Violet (*Viola persicifolia*). A species of Starwort, *Callitriche palustris*, has recently been recorded from the site, its only known station in Ireland. The Coole river itself is of particular interest for the occurrence of a rare riverine habitat characterised by Trifid Bur-marigold (*Bidens tripartita*), Red Goosefoot (*Chenopodium rubrum*) and species of Knotgrass (*Polygonum* spp.).

The turloughs are fringed by a range of habitats on limestone pavement, including scrub communities containing Buckthorn (*Rhamnus catharticus*) and Hawthorn (*Crataegus monogyna*). In places, heath communities have developed over the limestone pavement, consisting of Ling Heather (*Calluna vulgaris*), Juniper (*Juniperus communis*), Blue Moor-grass (*Sesleria albicans*) and occasional Yew (*Taxus baccata*). In addition, the site contains good examples of smooth pavement and associated species-rich grasslands. Small areas of orchid-rich grassland occur at Coole-Garryland. The colourful array of orchids which can be found here include Pyramidal Orchid (*Anacamptis pyramidalis*), Spotted Orchids (*Dactylorhiza* spp.), Fragrant Orchid (*Gymnadenia conopsea*), Fly Orchid (*Ophrys insectifera*) and Greater Butterfly Orchid (*Platanthera chlorantha*).

A remarkable feature of the turloughs at Coole-Garryland is that they are closely associated with areas of woodland. Although substantial parts of the original deciduous forest have been converted to coniferous woodland composed of non-native species, stands of semi-natural deciduous woodland survive. Pedunculate Oak (*Quercus robur*) and Ash (*Fraxinus excelsior*) are the dominant species on deeper, more fertile soils, where there is also some Hazel (*Corylus avellana*), occasional Yew (*Taxus baccata*) and Elm (*Ulmus* spp.). There are also some unusual areas of dwarf Pedunculate Oak woodland growing on limestone pavement. This species of oak does not typically colonise this type of substrate.

Some of the deciduous woodlands have a mixture of native and non-native species. These mixed woodlands have a diverse shrub layer comprised of Spindle (*Euonymus europaeus*), Privet (*Ligustrum vulgare*), Burnet Rose (*Rosa pimpinellifolia*), Guelder Rose (*Viburnum opulus*), Blackthorn (*Prunus spinosa*), Pear (*Pyrus pyraster*) and Honeysuckle (*Lonicera periclymenum*). The ground flora is rich and includes Wood Anemone (*Anemone nemorosa*), Dog Violet (*Viola riviniana*), Shining Crane's-bill (*Geranium lucidum*), Maidenhair Spleenwort (*Asplenium trichomanes*), Northern Bedstraw (*Galium boreale*), Biting Stonecrop (*Sedum acre*), Harebell (*Campanula rotundifolia*) and Bitter Vetch (*Lathyrus montanus*). The woodlands are notable for the presence of rare species of Myxomycete fungi, namely, *Licea idris*, *Licea marginata* and *Macbrideola decapillata*, the first-named in one of only three known sites for the species.

The nationally rare Mudwort (*Limosella aquatica*) and Dropwort (*Filipendula vulgaris*) also occur at this site. These two plant species are listed in the Irish Red Data Book.

The complex of habitats at Coole-Garryland provides habitat for a variety of mammal species, including Otter and Pine Marten. The otter is listed on Annex II of the EU Habitats Directive, while Pine Marten is considered to be threatened in Europe. The Coole-Garryland complex is also home to one of the most important and unique assemblages of insects in the country, including several notable species of beetles and flies.

The area is of importance for wintering waterfowl, especially Whooper Swan (mean peak of 324 in 1995/96 - 98/99), Bewick Swan (79 in winter 96/97), Wigeon (mean peak of 1044 in 1995/96 - 98/99), Mallard (mean peak of 330 in 1995/96 - 98/99), Pochard (mean peak of 176 in winter 1995/96 - 98/99), along with smaller numbers of Teal, Tufted Duck, Lapwing, Curlew and Dunlin.

In 1996 seven pairs of Lapwing bred at Newtown Turlough and two pairs of Common Sandpiper bred at Coole Lough.

A substantial portion of this site is in the ownership of the National Parks and Wildlife Service. It is a popular amenity area, and uncontrolled visitor access would pose a threat to sensitive animals. Other threats to the site may result from the intensification of agriculture (e.g. fertiliser application or pollution of water courses) outside the Nature Reserve.

The turlough system at Coole-Garryland is considered to be the most diverse in the country, for both its physiography and vegetation. It is unique in that it is so closely associated with woodland. The juxtaposition of these two distinct habitats, in addition to the presence of a variety of turloughs, has led to the development of uncommon communities, and rare species of insect and plant occur which are associated with both the turlough and the turlough/woodland transition. Overall, the range of good quality habitats at Coole-Garryland supports a high diversity of plant and animal species, rendering this site of prime importance for conservation.

APPENDIX 3 AQUATIC AND RIPARIAN PLANT SPECIES

Appendix 3.1 Plant species recorded

Common name	Botanical name
Instream species	
Alternate water milfoil	*Myriopyllum alternifolium*
Aquatic moss	*Fontinalis sp.*
Aquatic moss	*Racomitrium sp.*
Pondweed	*Potamogeton sp*
Emergent aquatic species	
Brooklime	Veronica beccabunga
Bulbous rush	Juncus bulbosus
Floating sweet-grass	Glyceria fluitans
Fool's water-cress	*Apium nodiflorum*
Lesser spearwort	*Ranunculus flammula*
Lesser water-parsnip	*Berula erecta*
Water dropwort	*Oenanthe* sp.
Water starwort	*Callitriche* sp.
Watercress	*Rorippa nasturtium-aquaticum*
Marginal species	
Ash	*Fraxinus excelsior*
Bilberry	*Vaccinium myrtillus*
Blackthorn	*Prunus spinosa*
Bog stitchwort	*Stellaria uliginosa*
Bracken	*Pteridium aquilinum*
Bramble	*Rubus fruticosus*
Common marsh bedstraw	*Galium palustre*
Creeping buttercup	*Ranunculus repens*
Downy birch	*Betula pubescens*
Gorse	*Ulex europaeus*
Great wood-rush	*Luzula sylvatica*
Hawthorn	*Crataegus monogyna*
Hazel	*Corylus avellana*
Horsetail	*Equisetum* sp.
Lady's smock	*Cardamine pratensis*
Liverworts	
Marsh ragwort	*Senecio aquaticus*
Rowan	*Sorbus aucuparia*
Sedges	*Carex* spp.
Sharp-flowered rush	*Juncus acutiflorus*
Sitka spruce	*Picea sitchensis*
Soft rush	*Juncus effusus*
Wild angelica	*Angelica sylvestris*
Willowherbs	*Epilobium* spp.
Willows	*Salix* spp

Appendix 3.2 Aquatic/riparian plant species recorded for the 10km-squares between Flaggy Bridge (Derrybrien) and Lough Cutra, as listed in the 'New Atlas of the British & Irish Flora (Preston, C. D., Pearman, D. A. and Dines, T. D., eds (2002). Oxford University Press, Oxford).

Species of limited distribution in Ireland are marked thus: *
Red data book species are marked thus: #
Flora Protection Order species are marked thus: !

Common name	Scientific name	Record	Status
Hemp agrimony	*Agrimonia eupatoria*	1987-1999	Native
Water plantain	*Alisma plantago-aquatica*	1987-1999	Native
!Orange foxtail	*Alopecurus aequalis*	1987-1999	Native
Marsh foxtail	*Alopecurus geniculatus*	1987-1999	Native
Wild angelica	*Angelica sylvestris*	987-1999	Native
Lesser marshwort	*Apium inundatum*	1987-1999	Native
Fool's water-cress	*Apium nodiflorum*	1987-1999	Native
Lesser water-plantain	*Baldellia ranunculoides*	1987-1999	Native
Lesser water-parsnip	*Berula erecta*	1987-1999	Native
Common water starwort	*Callitriche stagnalis sens. lat.*	1987-1999	Native
Marsh marigold	*Caltha palustris*	1987-1999	Native
Lady's smock	*Cardamine pratensis*	1987-1999	Native
*Slender tufted-sedge	*Carex acuta*	1987-1999	Native
Lesser pond-sedge	*Carex acutiformis*	Pre-1970	Native
*Water sedge	*Carex aquatilis*	1987-1999	Native
Lesser tussock-sedge	*Carex diandra*	Pre-1970	Native
Lesser tussock-sedge	*Carex diandra*	1987-1999	Native
Brown sedge	*Carex disticha*	Pre-1970	Native
Brown sedge	*Carex disticha*	1987-1999	Native
Tufted sedge	*Carex elata*	Pre-1970	Native
Tufted sedge	*Carex elata*	1987-1999	Native
Glaucous sedge	*Carex flacca*	1987-1999	Native
Hairy sedge	*Carex hirta*	1987-1999	Native
Slender sedge	*Carex lasiocarpa*	Pre-1970	Native
Slender sedge	*Carex lasiocarpa*	1987-1999	Native
Bog sedge	*Carex limosa*	1987-1999	Native
Common sedge	*Carex nigra*	1987-1999	Native
False fox-sedge	*Carex otrubae*	1987-1999	Native
Oval sedge	*Carex ovalis*	1987-1999	Native
Bottle sedge	*Carex rostrata*	1987-1999	Native
Bladder-sedge	*Carex vesicaria*	1987-1999	Native
Yellow-sedge subspecies	*Carex viridula subsp. brachyrrhyncha*	1987-1999	Native
Yellow-sedge subspecies	*Carex viridula subsp. viridula*	1987-1999	Native
*Rigid hornwort	*Ceratophyllum demersum*	1987-1999	Native
Great fen-sedge	*Cladium mariscus*	Pre-1970	Native
Great fen-sedge	*Cladium mariscus*	1987-1999	Native
Needle spike-rush	*Eleocharis acicularis*	1987-1999	Native
Many-stalked spike-rush	*Eleocharis multicaulis*	Pre-1970	Native
Many-stalked spike-rush	*Eleocharis multicaulis*	1987-1999	Native
Common spike-rush	*Eleocharis palustris*	Pre-1970	Native
Common spike-rush	*Eleocharis palustris*	1987-1999	Native

Floating club-rush	*Eleogiton fluitans*	1987-1999	Native

Common name	**Scientific name**	**Record**	**Status**
Canadian pondweed	*Elodea canadensis*	1987-1999	Alien
Marsh willowherb	*Epilobium palustre*	1987-1999	Native
Water horsetail	*Equisetum fluviatile*	1987-1999	Native
Marsh horsetail	*Equisetum palustre*	1987-1999	Native
Meadowsweet	*Filipendula ulmaria*	1987-1999	Native
Marsh bedstraw	*Galium palustre*	1987-1999	Native
Water avens	*Geum rivale*	1987-1999	Native
Small sweet-grass	*Glyceria declinata*	Pre-1970	Native
Small sweet-grass	*Glyceria declinata*	1987-1999	Native
Floating sweet-grass	*Glyceria fluitans*	1987-1999	Native
Marestail	*Hippuris vulgaris*	Pre-1970	Native
Marestail	*Hippuris vulgaris*	1987-1999	Native
Marsh pennywort	*Hydrocotyle vulgaris*	1987-1999	Native
Wild iris	*Iris pseudacorus*	1987-1999	Native
Slender club-rush	*Isolepis cernua*	1987-1999	Native
Sharp-flowered rush	*Juncus acutiflorus*	1987-1999	Native
Jointed rush	*Juncus articulatus*	1987-1999	Native
Bulbous rush	*Juncus bulbosus*	1987-1999	Native
Soft rush	*Juncus effusus*	1987-1999	Native
Hard rush	*Juncus inflexus*	1987-1999	Native
Duckweed	*Lemna minor*	1987-1999	Native
Ivy-leaved duckweed	*Lemna trisulca*	1987-1999	Native
#!Mudwort	*Limosella aquatica*	1987-1999	Native
Shoreweed	*Littorella uniflora*	1987-1999	Native
Yellow loosestrife	*Lysimachia vulgaris*	1987-1999	Native
Water purslane	*Lythrum portula*	1987-1999	Native
Purple loosestrife	*Lythrum salicaria*	1987-1999	Native
Water mint	*Mentha aquatica*	1987-1999	Native
Hybrid water mint	*Mentha aquatica x M. arvensis*	1987-1999	Native
Bog bean	*Menyanthes trifoliata*	1987-1999	Native
Blinks	*Montia fontana*	1987-1999	Native
Water forget-me-not	*Myosotis scorpioides*	1987-1999	Native
Alternate water-milfoil	*Myriophyllum alterniflorum*	1987-1999	Native
Yellow water-lily	*Nuphar lutea*	1987-1999	Native
White water-lily	*Nymphaea alba*	1970-1986	Native
White water-lily	*Nymphaea alba*	1987-1999	Native
Fine-leaved water-dropwort	*Oenanthe aquatica*	1987-1999	Native
Hemlock water-dropwort	*Oenanthe crocata*	1970-1986	Native
Hemnlock water-dropwort	*Oenanthe crocata*	1987-1999	Native
Water-pepper	*Persicaria hydropiper*	1987-1999	Native
Reed canary-grass	*Phalaris arundinacea*	1987-1999	Native
Common reed	*Phragmites australis*	1987-1999	Native
Small pondweed	*Potamogeton berchtoldii*	1987-1999	Native
Fen pondweed	*Potamogeton coloratus*	1987-1999	Native
Curled pondweed	*Potamogeton crispus*	1987-1999	Native
Various-leaved pondweed	*Potamogeton gramineus*	1987-1999	Native
Shining pondweed	*Potamogeton lucens*	1987-1999	Native
Broad-leaved pondweed	*Potamogeton natans*	1987-1999	Native
Fennel pondweed	*Potamogeton pectinatus*	1987-1999	Native

Perfoliate pondweed	*Potamogeton perfoliatus*	1987-1999	Native
Bog pondweed	*Potamogeton polygonifolius*	1987-1999	Native
Common name	**Scientific name**	**Record**	**Status**
*Lesser pondweed	*Potamogeton pusillus*	1987-1999	Native
Common water-crowfoot	*Ranunculus aquatilis*	Pre-1970	Native
Lesser celandine	*Ranunculus ficaria*	Pre-1970	Native
Lesser celandine	*Ranunculus ficaria*	1987-1999	Native
L. celandine subspecies	*Ranunculus ficaria subsp. bulbilifera*	1987-1999	Native
L. celandine subspecies	*Ranunculus ficaria subsp. ficaria*	1987-1999	Native
Lesser spearwort	*Ranunculus flammula*	1987-1999	Native
Ivy-leaved crowfoot	*Ranunculus hederaceus*	1987-1999	Native
Pond water-crowfoot	*Ranunculus peltatus*	1987-1999	Native
Celery-leaved buttercup	*Ranunculus sceleratus*	1987-1999	Native
Thread-leaved water-crowfoot	*Ranunculus trichophyllus*	1987-1999	Native
Great yellow-cress	*Rorippa amphibia*	1987-1999	Native
#Northern yellow-cress	*Rorippa islandica*	1987-1999	Native
Water-cress	*Rorippa nasturtium-aquaticum*	1987-1999	Native
Water-cress	*Rorippa nasturtium-aquaticum* agg.	1987-1999	Native
*Marsh yellow-cress	*Rorippa palustris*	1987-1999	Native
Eared willow	*Salix aurita*	1987-1999	Native
Goat willow	*Salix caprea*	1987-1999	Native
Olive willow	*Salix caprea x S. viminalis*	1987-1999	Native
Grey willow	*Salix cinerea*	1987-1999	Native
Sally	*Salix cinerea subsp. oleifolia*	1987-1999	Native
Crack willow	*Salix fragilis*	1987-1999	Alien
Creeping willow	*Salix repens*	1987-1999	Native
Osier willow	*Salix viminalis*	Pre-1970	Alien
Brookweed	*Samolus valerandi*	1987-1999	Native
Common club-rush	*Schoenoplectus lacustris*	1987-1999	Native
Water figwort	*Scrophularia auriculata*	1987-1999	Native
Common figwort	*Scrophularia nodosa*	1987-1999	Native
Lesser clubmoss	*Selaginella selaginoides*	1987-1999	Native
Marsh ragwort	*Senecio aquaticus*	1987-1999	Native
#Blue-eyed grass	*Sisyrinchium bermudiana*	Pre-1970	Native
Unbranched bur-reed	*Sparganium emersum*	1987-1999	Native
Branched bur-reed	*Sparganium erectum*	1987-1999	Native
Least bur-reed	*Sparganium natans*	Pre-1970	Native
Bog stitchwort	*Stellaria uliginosa*	1987-1999	Native
Comfrey	*Symphytum officinale*	1987-1999	Native
Meadow-rue	*Thalictrum flavum*	1987-1999	Native
Bulrush	*Typha latifolia*	1987-1999	Native
Intermediate bladderwort	*Utricularia intermedia sens. lat.*	Pre-1970	Native
Lesser bladderwort	*Utricularia minor*	Pre-1970	Native
Lesser bladderwort	*Utricularia minor*	1987-1999	Native
*Greater bladderwort	*Utricularia vulgaris sens. lat.*	Pre-1970	Native
Wild valerian	*Valeriana officinalis*	1987-1999	Native
Blue water-speedwell	*Veronica anagallis-aquatica*	1987-1999	Native
Brooklime	*Veronica beccabunga*	1987-1999	Native
Pink water-speedwell	*Veronica catenata*	1987-1999	Native
Viburnum	*Viburnum opulus*	1987-1999	Native
Marsh violet	*Viola palustris*	1987-1999	Native
#Fen violet	*Viola persicifolia*	1987-1999	Native

APPENDIX 4: SITE PHOTOS

Plate 1 Chainage 196 showing level to which peat slip material reached on this section of river. Bedrock is visible as a result of scouring by transported peat.

Plate 2 Chainage 198 showing silt deposition and level of peat on the banks.

Plate 3 Chainage 199. It is recommended that this blockage be removed. The left bank should be planted in high density formation with shrubs or trees that are ecologically similar to the surrounding flora.

Plate 4 Chainage 198-199 the gauge of the pipes here should be increased to assist flow through.

Plate 5 Chainage 199 – just south of Flaggy Bridge (chainage 200) showing peat deposition on the banks.

Plate 6 Scene of river from bridge (M 547 990) showing negligible impacts. This is the scenario for most of the lower sections of the river.

Plate 7 River showing some small light detritus on the banks

Plate 8 sand/silt washed down from the mountains. This photo was taken in the lower reaches of the river.

Plate 9 Section of river at confluence (chainage 182) exhibiting very little physical change. Gravels are still in situ here. River has widened considerably and accordingly the power of the slip has dissipated.

Plate 10 Fish were seen moving upstream in this section (Chainage 184)

DERRYBRIEN WIND FARM

DERRYBRIEN, SLIEVE AUGHTY MOUNTAINS, CO. GALWAY

BAT ASSESSMENT

February 2012

DRAFT REPORT

Faith Wilson Ecological Consultant BSc MIEEM CEnv
Kilnamanagh Farm, Kilnamanagh Beg, Glenealy, Co. Wicklow

DERRYBRIEN WIND FARM

DERRYBRIEN, SLIEVE AUGHTY MOUNTAINS, CO. GALWAY

BAT ASSESSMENT

Table of Contents

DERRYBRIEN WIND FARM

DERRYBRIEN, SLIEVE AUGHTY MOUNTAINS, CO. GALWAY

BAT ASSESSMENT

1. INTRODUCTION

1.1. Background

Faith Wilson Ecological Consultant and licensed bat specialist was commissioned by ESB International Consulting Engineers to carry out a study in relation to bats at the Derrybrien Windfarm, Slieve Aughty Mountains, Co. Galway. The Derrybrien Windfarm Project was acquired from Saorgus by ESB with full planning permission in 2003. There were no detailed bat surveys conducted as part of the planning process for the proposed wind farm at Derrybrien as part of the original Environmental Impact Assessment.

A peat slip occurred during construction in Oct 2003 during which peat/forestry debris was mobilised. After the peat slip remediation measures were put in place. These comprised barrages/boulder dams (4 of which remain) and some rerouting of drains. Following the peat slide in 2003 some surveys of the lesser horseshoe bats at Lough Cutra were conducted (Williams, 2004a & 2004b) to try and determine if the peat slide had any adverse impacts on the local populations.

The Department of Environment Community and Local Government have advised that a substitute consent application will have to be made for Derrybrien Windfarm and the remedial measures associated with 2003 peat slip. The objective of this report is to establish the impact of the peat slide and the existing wind farm on bats.

1.2. Legislation

<u>Note regarding the Substitute Consent Process</u>

The Planning and Development (Amendment) Act 2010 provides for a substitute consent process, in exceptional circumstances only, to allow for retrospective planning permission for development requiring EIA, or appropriate assessment under the Habitats Directive.

The Act provides that where a planning authority becomes aware that a final judgement of a court in the state or the EU Court of Justice has been made that a planning permission was in breach of the law, invalid or otherwise defective in a material respect it will require that an application for substitute consent is made to An Bord Pleanala to be accompanied by a remedial EIS and Natura Impact Statement.

The contents of a remedial EIS are as follows:

- A statement of significant effects, if any, on the environment, which have occurred or which can reasonably be expected to occur because of the development
- Details of any appropriate measures undertaken or proposed to remedy any significant adverse effects on the environment and the period of time within which any proposed remedial measures shall be carried out.

The contents of the remedial Natura Impact Statement are as follows:

- A statement of the significant effects, if any, on the environment, which have occurred or which are occurring or which can reasonably be expected to occur because of the development
- Details of any appropriate remedial measures undertaken or proposed to remedy any significant adverse effects on the environment and the period of time within which any proposed remedial measures shall be carried out
- Where the applicant wishes, a statement of imperative reasons of overriding public interest associated with the development or any compensatory measures being proposed by the applicant.

Legislation in relation to Bats

Wildlife Act 1976

In the Republic, under Schedule 5, of the Wildlife Act 1976, all bats, and their roosts, are protected by law. It is unlawful to disturb either without the appropriate licence. The Act was amended in 2000.

Bern and Bonn Convention

Ireland has also ratified two international wildlife laws pertaining to bats. These are known as the 'Bern' and 'Bonn' Conventions.

The Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1982), in relation to bats, exists to conserve all species and their habitats.

The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979, enacted 1983) was instigated to protect migrant species across all European boundaries.

EU Habitats and Species Directive

The EC Directive on the Conservation of Natural habitats and of Wild Fauna and Flora (Habitats Directive 1992), seeks to protect rare species, including bats, and their habitats and requires that appropriate monitoring of populations is undertaken. All bat species are protected under Annex IV of the EU Habitats Directive, while the lesser horseshoe bat (*Rhinolophus hipposideros*) is listed under Annex II. Member states are required to designate Special Areas of Conservation for all species listed under Annex II in order to protect them.

The current status and legal protection of the known bat species occurring in Ireland is given in **Table 1** below.

Table 1: Legal status and protection of the Irish bat fauna

Common and scientific name	Wildlife Act 1976 & Wildlife (Amendment) Act 2000	Irish Red List status	Habitats Directive	Bern & Bonn Conventions
Common pipistrelle *Pipistrellus pipistrellus*	Yes	Least Concern	Annex IV	Appendix II
Soprano pipistrelle *Pipistrellus pygmaeus*	Yes	Least Concern	Annex IV	Appendix II
Nathusius' pipistrelle *Pipistrellus nathusii*	Yes	Not referenced	Annex IV	Appendix II
Leisler's bat *Nyctalus leisleri*	Yes	Near Threatened	Annex IV	Appendix II
Brown long-eared bat *Plecotus auritus*	Yes	Least Concern	Annex IV	Appendix II
Lesser horseshoe bat *Rhinolophus hipposideros*	Yes	Least Concern	Annex II Annex IV	Appendix II
Daubenton's bat *Myotis daubentonii*	Yes	Least Concern	Annex IV	Appendix II
Natterer's bat *Myotis nattereri*	Yes	Least Concern	Annex IV	Appendix II
Whiskered bat *Myotis mystacinus*	Yes	Least Concern	Annex IV	Appendix II
Brandt's bat *Myotis brandtii*	Yes	Data Deficient	Annex IV	Appendix II

NB: Destruction, alteration or evacuation of a known bat roost is a notifiable action under current legislation and a derogation licence has to be obtained from the National Parks and Wildlife Service before works can commence.

2. METHODOLOGY

2.1. Desk Review

A review of the previous bat surveys conducted at Lough Cutra Castle by Williams (2004a & 2004b) following the peat slide was undertaken by Faith Wilson BSc CEnv MIEEM.

2.2. Consultations

A review of known bat roosts and bat activity within 10km of the windfarm was conducted using the Bat Conservation Ireland database. Monitoring data for the Lesser Horseshoe Roost at Lough Cutra Castle was provided by National Parks and Wildlife Service. Other bat specialists including members of Bat Conservation Ireland and the local Conservation Rangers from the National Parks and Wildlife Service (Raymond Stephens and Jacinta Murphy) were contacted regarding any surveys or detector work that they had carried out in the area.

2.3. Detector Survey

A bat activity survey across the operational wind farm and in the wider landscape was conducted using bat detectors. The surveys were conducted by Faith Wilson and Chris Peppiatt (both licensed bat specialists) on the 5th November 2011. During the survey each turbine was visited and bat activity was recorded using a variety of bat detectors (Heterodyne Bat Detector: Pettersson D100; Time Expansion Bat Detector: Pettersson D240; Frequency Division Bat Detector: Bat Box Duet). Time was spent at each turbine location during the survey and the networks of tracks between each turbine were also driven slowly with the bat box mounted on the window of each vehicle pointing upwards to record any bat passes. Bats were identified by their ultrasonic calls coupled with behavioural and flight observations.

2.4. Roost Survey

Initially it was proposed to resurvey the Lough Cutra Castle Lesser Horseshoe Roost as part of this study but following discussions with local National Parks and Wildlife Service staff this proposal was revised. The roost at Lough Cutra has had some recent works conducted to it and the roost is now counted by NPWS staff on a monthly basis. In order to reduce potential disturbance to the bats from additional counts it was agreed that this data would be made available to the study from NPWS and is presented below.

2.5. Survey constraints

Given the lack of baseline bat survey data for the wind farm site it is not possible to present the results of this study in a comparative way. However detailed roost information for the Lesser Horseshoe roost at Lough Cutra Castle is available from NPWS which will enable an indication of the fortunes of the roost to be examined.

Although the detector survey was carried out towards the end of the active bat season bats are currently still active and were recorded on both the wind farm site and at lower elevations.

3. RESULTS

3.1. Site Designations in the area for bats:

The closest designated Special Area of Conservation to the Derrybrien windfarm which lists lesser horseshoe bat as a qualifying interest is the Lough Cutra SAC (Site Code: 000299). This site is located approximately 12km to the south-west of the windfarm. The site synopsis for the site is presented in **Appendix 1**.

3.2. Rare and protected bat species known from the area

The wind farm is within the known range of the lesser horseshoe bat (*Rhinolophus hipposideros*) – this species is restricted in it's distribution to the west of Ireland and is found in Counties Mayo, Galway, Clare, Limerick, Kerry and Cork (Kelleher, 2004). This species is given additional protection under Annex II of the EU Habitats which requires member states to designate Special Areas of Conservation for the species.

There are a number of known lesser horseshoe roosts, all of which are located to the west of the wind farm as summarised below in **Table 2**. Two of these are located within 10km to the south-west of the site. Lough Cutra Castle, Gort which is located c.12km to the south-west of the site is also included in this table as the peat slide from Derrybrien entered the Owendallulleegh River ultimately entering Lough Cutra and there were concerns that the population of lesser horseshoe bats that roost there and form par t of the qualifying interest for the site may have been impacted.

Table 2. Known lesser horseshoe bat roosts within a 10km radius of the wind farm

Grid Ref	Name	Source	Species	Comment
R 47 98	Lough Cutra Castle, Gort, Co. Galway	NPWS Lesser Horseshoe Bat Database	*Rhinolophus hipposideros*	c.12km south west of the site

Grid Ref	Name	Source	Species	Comment
M 48 06	Thor Ballylee, Gort, Co. Galway	Bat Conservation Ireland Database	*Rhinolophus hipposideros*	c.9.3km to the west of the site
M 47 04	Cloonbeg, Gort, Co. Galway	Bat Conservation Ireland Database	*Rhinolophus hipposideros*	c.10km west of the site

The rare Nathusius' pipistrelle (*Pipistrellus nathusii*) was recorded from County Galway in 2007 (Bat Conservation Ireland database) but has not yet been recorded from Co. Clare.

All Irish species of bats are strictly protected under both the Wildlife Act (1976, amended 2000), the Bern and Bonn Convention and under Annex IV of the EU Habitats Directive.

3.3. Records of other bat roosts within a 10km radius of the wind farm.

There are no other known bat roosts within close proximity to the wind farm. There is a known roost of brown long-eared bats (*Plecotus auritus*) and soprano pipistrelle (*Pipistrellus pygmaeus*) and a second roost of brown long-eared bats and an unidentified *Myotis* sp. from a private residence and farm buildings at Ballynagar which is some 10km to the east of the wind farm.

Table 3. Previously known bat roosts within a 10km radius of the wind farm.

Grid Ref	Name	Source	Species	Comment
M 71 04	Private residence, Ballynagar, Co. Galway	Bat Conservation Ireland Database	*Plecotus auritus* *Pipistrellus pygmaeus*	10km east of the site
M 71 04	Farm Buildings, Ballynagar, Co. Galway	Bat Conservation Ireland Database	*Plecotus auritus* *Myotis sp.*	10km east of the site

3.4. Records of bat activity within a 10km radius of the wind farm.

Bats recorded from within a 10km radius of the wider study area are documented from a variety of data sources. These include reports prepared by licensed bat specialists and ecological consultants, records of activity recorded during Bat Conservation Ireland projects such as the BATLAS 2010 project and other records collated in the Bat Conservation Ireland Database.

The closest records of bats to the wind farm were made during the BATLAS 2010 Project recorded a good diversity of species from the general area. These include:

- Daubenton's bat (*Myotis daubentonii),* Leisler's bat (*Nyctalus leisleri*), soprano pipistrelle (*Pipistrellus pygmaeus*) and common pipistrelle (*Pipistrellus pipistrellus*) from Peterswell Turlough SAC which is located west of the N66,
- Leisler's bat (*Nyctalus leisleri*), soprano pipistrelle (*Pipistrellus pygmaeus*) and common pipistrelle (*Pipistrellus pipistrellus*) from Peterswell,
- An unidentified *Myotis* sp. and an unidentified bat from Kenny's Bridge, Farnaun,
- Leisler's bat (*Nyctalus leisleri*), soprano pipistrelle (*Pipistrellus pygmaeus*) and common pipistrelle (*Pipistrellus pipistrellus*) from Brockagh near Lough Atorick,
- An unidentified *Myotis* sp. and common pipistrelle (*Pipistrellus pipistrellus*) from Corlea Bridge on the Bleach River,
- Soprano pipistrelle (*Pipistrellus pygmaeus*) at Bleach Bridge on the east side of Lough Graney,
- Leisler's bat (*Nyctalus leisleri*) and common pipistrelle (*Pipistrellus pipistrellus*) from Speightspark on the west side of Lough Graney,
- Leisler's bat (*Nyctalus leisleri*) on the Clare Way,
- Soprano pipistrelle (*Pipistrellus pygmaeus*), an unidentified *Myotis* sp. and common pipistrelle (*Pipistrellus pipistrellus*) from Ballymanagh Crossroads,
- Daubenton's bat (*Myotis daubentonii),* soprano pipistrelle (*Pipistrellus pygmaeus*) and an unidentified *Myotis* sp. from Deerpark near Kilchreest,
- Soprano pipistrelle (*Pipistrellus pygmaeus*) from Clonoo East west of Loughrea,
- Soprano pipistrelle (*Pipistrellus pygmaeus*) from Leitrim More Castle.

The closest of these records was within 6km of the site. Other EIS studies in the area also recorded;

- soprano pipistrelle (*Pipistrellus pygmaeus*) at Ballynagar,
- common pipistrelle (*Pipistrellus pipistrellus*) at Ballaba.

The bat surveys conducted during 2004 by Howard Williams focused on bat activity in the Lough Cutra Castle Demesne. A spring survey conducted in March 2004 recorded 45 bats using the castle cellars for roosting purposes. In addition to the counts of lesser horseshoe bat the surveys also recorded:

- Soprano pipistrelle (*Pipistrellus pygmaeus*)
- Common pipistrelle (*P. pipistrellus*)
- Leisler's bat (*Nyctalus leisleri*)
- Natterer's bat (*Myotis nattereri*)

A summer survey was also conducted by Williams with counts in August and September 2004. This survey confirmed the presence of:

- Lesser horseshoe bat (*Rhinolophus hipposideros*)
- Soprano pipistrelle (*Pipistrellus pygmaeus*)
- Common pipistrelle (*P. pipistrellus*)
- Leisler's bat (*Nyctalus leisleri*)
- Natterer's bat (*Myotis nattereri*)
- Daubenton's bat (*Myotis daubentonii*)
- Whiskered bat (*Myotis mystacinus*)
- Brown long-eared bat (*Plecotus auritus*)

An estimate of 60 lesser horseshoe bats divided between the boiler house and the basement was made. A roost of Soprano pipistrelle and Natterer's bats was confirmed from a tower in the gate lodge in the estate (10 – 20 Natterers' bats and c.20 soprano pipistrelle).

3.5. Detector Survey

Weather conditions

Sunset 17:00 GMT, Cloud 5-10% at start (not much change during the approx. 3.5 hours), bright night with a waxing moon, wind light W (estimated Beaufort Scale 1), few flying insects seen. Temperatures – initial temperature was 8.5°C dropping to 5°C by the end of the survey.

Confirmed and potential roosts

No new roosts were confirmed during the detector survey but a number of buildings in the general area of the wind farm have potential both as maternity roosts and potential hibernation sites for bats. As these were private residences it was not possible to examine them in detail.

Areas of importance for foraging and commuting bats

The presence of bats using the wind farm for foraging purposes was confirmed during the detector survey of the site. Bat passes were recorded on two observations – a single pass of a distant unidentified bat was recorded near Turbine 40 with a similar observation of a single pass of an unidentified pipistrelle bat on the track between the junction of Turbines 56 and 57.

Details of the detector survey and the observations made are presented below in **Table 4** and coupled with the existing data held by Bat Conservation Ireland has allowed the status of bats in the study area to be determined (**Table 5**).

Table 4. Bat activity recorded using bat detectors within the wind farm site at Derrybrien with observations on features of interest to bats for foraging and commuting and assessment of potential collision risk with wind turbines.

Turbine Number	Easting	Northing	Time	Description	Observation	Distance from turbine base to adjoining vegetation likely to be used by bats (m)	Potential collision risk (H/M/L)
T1	157724	204779	19:19:00	Forestry on two sides, turbine is located in a corner	No bat activity recorded	29/35	H
T2	157942	204861	19:21:00	Forestry on two sides, turbine is located in a corner	No bat activity recorded	17/37	H
T3	157837	204545	19:17:00	Forestry on one side	No bat activity recorded	25	H
T4	158059	204646	19:27:00	Distant forestry	No bat activity recorded	93/122	M
T5	158247	204745	19:30:00	Almost encircled by forestry	No bat activity recorded	14/35	H
T6	157971	204362	19:14:00	Forestry on one side	No bat activity recorded	29	H
T7	158185	204433	19:37:00	Surrounded by wet grassland/clear fell	No bat activity recorded	131	M
T8	158427	204563	19:39:00	Some forestry adjoining	No bat activity recorded	35	H
T9	158573	204621	19:42:00	Some forestry adjoining	No bat activity recorded	50 – 70	M
T10	158793	204712	19:45:00	Surrounded by wet grassland/clearfell	No bat activity recorded	200	L
T11	158993	204794	19:49:00	Surrounded by wet grassland/clearfell	No bat activity recorded	225	L
T12	158083	204102	18:59:00	Forestry on one side	No bat activity recorded	45	H
T13	158298	204194	19:02:00	Surrounded by wet grassland/clearfell	No bat activity recorded	270	L
T14	158495	204317	19:04:00	Surrounded by wet grassland/clearfell	No bat activity recorded	290	L
T15	158685	204373	19:08:00	Surrounded by wet grassland/clearfell	No bat activity recorded	285	L

Turbine Number	Easting	Northing	Time	Description	Observation	Distance from turbine base to adjoining vegetation likely to be used by bats (m)	Potential collision risk (H/M/L)
T17	159116	204535	19:55:00	Low scattered conifers	No bat activity recorded	90	M
T18	158212	203857	18:57:00	Forestry on one side	No bat activity recorded	35	H
T19	158417	203937	18:53:00	Forestry on one side	No bat activity recorded	20	H
T20	158626	204045	18:50:00	Forestry on one side	No bat activity recorded	20	H
T21	158826	204148	18:46:00	Forestry on one side	No bat activity recorded	30	H
T22	159022	204237	18:42:00	Forestry on one side	No bat activity recorded	20	H
T23	159255	204307	18:38:00	Forestry on one side	No bat activity recorded	40	H
T24	159638	205083	20:14:00	Forestry at some distance to N and S	No bat activity recorded	130 - 140	L
T25	159739	204816	19:24:00	Forestry blocks to N and S	No bat activity recorded	40	H
T26	159905	204601	18:26:00	Forestry on two sides	No bat activity recorded	40 – 60	H
T27	159811	205250	21:07:00	Few small (to 5 metres) isolated self-sown saplings nearby, forestry 150-200 metres away to NE	No bat activity recorded	150 - 200	L
T28	159997	204938	19:37:00	Open – clearfell	No bat activity recorded	230	L
T29	160102	204702	18:35:00	Forestry to S	No bat activity recorded	30	H
T30	160034	205346	21:10:00	Forestry to N	No bat activity recorded	25	H
T31	160207	205042	19:50:00	Open	No bat activity recorded	135	L
T32	160281	204788	18:42:00	Forestry to S	No bat activity recorded	30	H
T33	160219	205422	21:14:00	Forestry to N, plus self-sown saplings nearby	No bat activity recorded	20	H
T34	160413	205125	19:58:00	Open	No bat activity recorded	280	L
T35	160459	204883	18:52:00	Forestry to S	No bat activity recorded	50	H
T36	160413	205505	21:17:00	Forestry to N	No bat activity recorded	20	H

Turbine Number	Easting	Northing	Time	Description	Observation	Distance from turbine base to adjoining vegetation likely to be used by bats (m)	Potential collision risk (H/M/L)
T37	160618	205216	20:05:00	Open	No bat activity recorded	260	L
T38	160636	204960	19:00:00	Forestry to S	No bat activity recorded	40	H
T39	160582	205579	21:20:00	Forestry to N, plus self-sown saplings nearby.	No bat activity recorded	25	H
T40	160789	205272	20:12:00	Open	21:18: one quick pass (seemed relatively distant) of unidentified Pipistrelle, not seen	230	L
T41	160801	205061	19:09:00	Forestry to S	No bat activity recorded	55	M
T42	160844	205609	21:25:00	Forestry to N, plus self-sown saplings nearby	No bat activity recorded	45	H
T43	160951	205159	20:38:00	Forestry to S	No bat activity recorded	140	L
T44	161041	205587	21:29:00	Forestry to N, plus self-sown saplings nearby	No bat activity recorded	45	H
T45	161146	205221	20:22:00	Open	No bat activity recorded	230	L
T46	161166	204961	20:31:00	Forestry to S	No bat activity recorded	90	M
T47	158301	205328	21:33:00	Forestry very close	No bat activity recorded	30	H
T48	158447	205411	21:36:00	Forestry on one side	No bat activity recorded	25	H
T49	158704	205512	21:40:00	Forestry on one side	No bat activity recorded	35	H
T50	158884	205610	21:47:00	Forestry on one side	No bat activity recorded	30	H
T51	159107	205713	21:51:00	Surrounded by wet grassland/clearfell, forestry to N	No bat activity recorded	60	M
T52	159301	205746	21:55:00	Surrounded by wet grassland/clearfell, forestry on both sides	No bat activity recorded	45 - 90	H

Turbine Number	Easting	Northing	Time	Description	Observation	Distance from turbine base to adjoining vegetation likely to be used by bats (m)	Potential collision risk (H/M/L)
T53	158482	205154	21:27:00	Forestry on one side, clearfell on the other	No bat activity recorded	35	H
T54	158655	205235	21:24:00	Forestry on both sides, 10 - 12m tall	No bat activity recorded	30	H
T55	158822	205317	21:21:00	Forestry close by	No bat activity recorded	30	H
T56	158985	205397	21:18:00	Surrounded by wet grassland/clearfell	Unidentified pipistrelle bat recorded between here and turbine 57, single pass only, foraging in amongst self sown conifers/scrub	90	M
T57	159249	205553	21:56:00	Forestry blocks all around	No bat activity recorded	57	M
T58	159447	205569	21:09:00	Some conifers adjoining on two sides	No bat activity recorded	60	M
T59	158565	204910	20:27:00	Surrounded by wet grassland/clearfell, forestry to S	No bat activity recorded	140	L
T60	158778	204988	20:30:00	Surrounded by wet grassland/clearfell, forestry to N	No bat activity recorded	45	H
T61	158961	205080	20:33:00	Surrounded by wet grassland/clearfell, forestry to W	No bat activity recorded	80	M
T62	159206	205247	20:37:00	Forestry on both sides N and S	No bat activity recorded	65	M
T63	159408	205269	20:40:00	Surrounded by wet grassland/clearfell and several blocks forestry	No bat activity recorded	50	H
T64	159588	205374	20:43:00	Surrounded by wet grassland/clearfell, forestry to S	No bat activity recorded	50	H
T65	159822	205461	21:37:00	Forestry to N and E	No bat activity recorded	40	H

Turbine Number	Easting	Northing	Time	Description	Observation	Distance from turbine base to adjoining vegetation likely to be used by bats (m)	Potential collision risk (H/M/L)
T66	159205	204891	20:19:00	Surrounded by wet grassland/clearfell	No bat activity recorded	125	L
T67	159395	204989	20:16:00	Forestry close by to S	No bat activity recorded	50	H
T68	159294	204643	17:20:00	Youngish forestry on one side	No bat activity recorded	10	H
T69	159521	204745	17:25:00	Forestry on both sides	No bat activity recorded	45	H
T70	159515	204408	18:36:00	Forestry on both sides	No bat activity recorded	30	H
T71	159711	204495	18:30:00	Forestry nearby on two sides	No bat activity recorded	25 – 30	H

Table 5. Adjudged status of Irish bat species within the study area.

Common name	Scientific name	Occurrence	Confirmed Roosts	Source
Common pipistrelle	*Pipistrellus pipistrellus*	Present – unidentified pipistrelle recorded in site	Yes	BCI database and field survey
Soprano pipistrelle	*Pipistrellus pygmaeus*	Likely – unidentified pipistrelle recorded	Yes	BCI database and field survey
Nathusius' pipistrelle	*Pipistrellus nathusii*	Potential – recorded from the county	No	BCI database
Leisler's	*Nyctalus leisleri*	Present	No	BCI database
Brown long-eared	*Plecotus auritus*	Present	Yes	BCI database
Lesser horseshoe	*Rhinolophus hipposideros*	Present	Yes	BCI database and field survey
Daubenton's	*Myotis daubentonii*	Present	No	BCI database
Natterer's	*Myotis nattereri*	Potential	No	BCI database
Whiskered	*Myotis mystacinus*	Potential	No	BCI database
Brandt's	*Myotis brandtii*	Potential – rare	No	BCI database

Bat activity was noted at lower elevations on leaving the site. At lower elevations two soprano pipistrelles and the other 4 unidentified pipistrelles were recorded on the minor road between the wind farm entrance and the R353. Five soprano pipistrelles were recorded on the minor road from the wind farm entrance to Killeenadeema.

3.6. Lesser horseshoe roost at Lough Cutra

The lesser horseshoe roost at Lough Cutra has been monitored over a number of years by National Parks and Wildlife Service staff and this data from the NPWS lesser horseshoe roost database is presented below in **Table 6**.

Table 6. NPWS counts conducted at the Lough Cutra roost.

Date	No. of bats present	Count Type	Droppings present	Bat Activity
21/07/1987	60		No	
14/01/1988	39		No	
17/01/2001	93		No	
19/04/2000	2		No	
Winter 1999/2000	49		No	
23/02/2006	84	Visual	Yes	Semi-active
13/06/2006	5		No	
23/01/2008	78	Visual	No	
20/08/2008	30	Heterodyne	No	
09/01/2009	97	Internal count	No	Torpid
17/06/2009	84	Internal count	No	Semi-active
03/07/2009	0	Internal count	No	
06/08/2009	1	Internal count	No	Semi-active
09/09/2009	31	Internal count	No	Semi-active
02/12/2009	139	Internal count	No	Semi-active
11/01/2010	142	Internal count	No	Torpid
12/02/2010	132	Internal count	No	Torpid

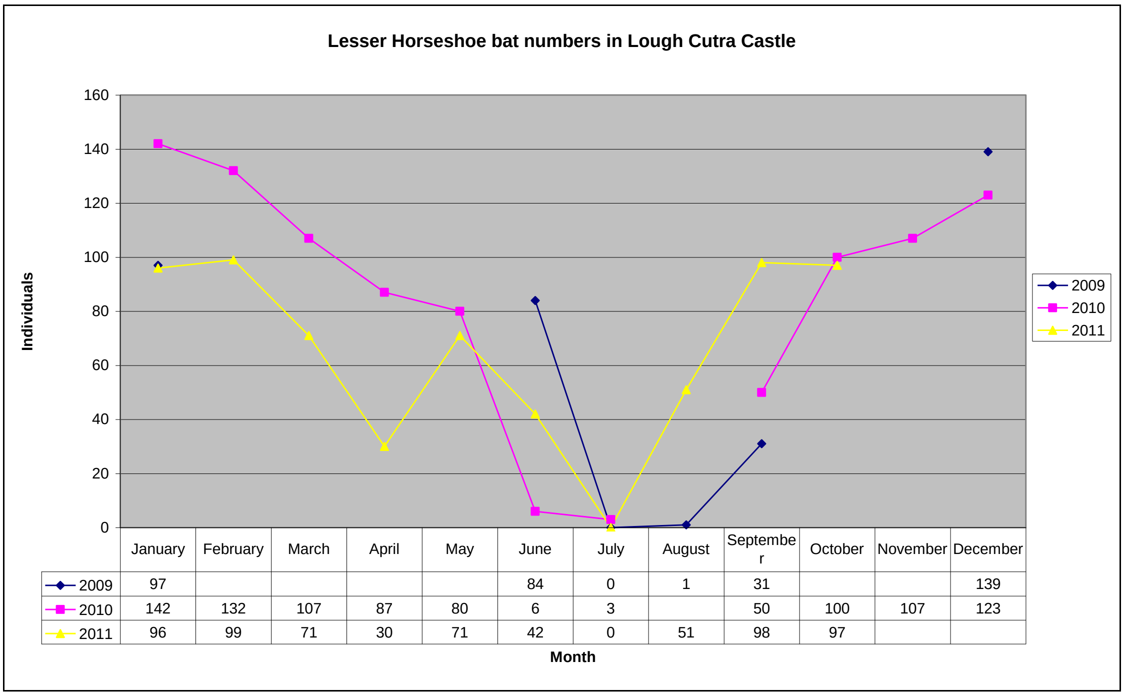
Since works to the roost took place in 2008 the roost has been monitored on a monthly basis by the local conservation staff. A summary of those counts is presented below in **Table 7**.

Table 7. Monthly monitoring counts of the roost conducted by NPWS staff following renovation works.

Month	2009	2010	2011
January	97	142	96
February		132	99
March		107	71
April		87	30
May		80	71
June	84	6	42
July	0	3	0
August	1		51
September	31	50	98
October		100	97
November		107	
December	139	123	
Average per year	***90***	***85***	***65***

These monthly counts are presented below in **Figure 1** and in general bat numbers at the roost have either increased or remained stable since the roost was first counted in 1987 when 60 bats were present indicating that the local population of lesser horseshoe bats are in favourable conservation status which is the same as the national population.

Figure 1. Lesser horseshoe bat numbers in Lough Cutra Castle 2009 – 2011.



4. DISCUSSION AND IMPACT ASSESSMENT

4.1. Assessment of potential impacts of the peat slide in relation to bats

The peat slide which occurred in 2003, whilst causing a fish kill and degradation of water quality in the Owendalulleegh River is unlikely to have impacted on local bat populations in particular the lesser horseshoe bats in Lough Cutra Castle. The main habitats used by lesser horseshoe bats for foraging identified by NPWS (2007) include:

- Riparian
- Scrub woodland
- Deciduous woodland
- Mixed woodland
- Hazel woodland
- Lake
- Grassland
- Conifer plantation
- Limestone pavement
- Coastal
- Pasture
- Parkland
- Turlough
- Caves (sea and non-marine)
- Artificial underground habitats

Those habitats within the foraging range of the roost would have been unaffected by the peat slide at Derrybrien with the exception of Lough Cutra itself. The principal foraging habitat for lesser horseshoe bats has been shown through radio tracking studies to be woodlands with some use of pasture and wetlands, rarely foraging over open water (Biggane (2004a, 2004b, , Bontadina *et. al.* (2002)).

Given that the Lough Cutra Castle population has ultimately remained stable and in some years has increased there would appear to be no negative impacts on this population from the peat slide and subsequent pollution event.

4.2. Assessment of potential impacts of the operational wind farm in relation to bats

Bats and Windfarms

Over the past decade an increasing body of evidence has emerged to indicate that many operational wind farms are having a negative impact on bats. These include studies from Europe, Australia and North America, which has documented a number of cases where bat mortalities have been recorded. These fatalities are thought to have occurred due to collisions with wind turbines but recent research has found that many of the bats had suffered barotraumas[1] (Baerwald *et. al.* (2008)). The study found that 90% of bat fatalities involved internal haemorrhaging consistent with barotrauma, and that direct contact with turbine blades only accounted for about half of the fatalities.

Four main potential negative impacts on bats by wind farms have been identified (Bach & Rahmel 2004):

- Collision with turbine blades
- Loss of foraging habitat
- Blocking of commuting or migration routes
- Ultrasound emission by wind turbines

4.2.1. Collision with turbine blades

To date most bat mortalities that have been documented have occurred during late summer or early autumn (Brinkman 2004, Dürr and Bach 2004), particularly during the period mid-July to September, which has suggested that migratory bats may be at high risk. However, recent data from Germany show that significant numbers of bat collisions have occurred at some sites before mid July and that resident bats such as Pipistrelles, also appear to be affected (Brinkmann *et al*. 2006).

The foraging behaviour and habitat preferences of British bats has been well researched (see Altringham 2003; Walsh and Harris 1996a, b) and these observations would be expected to be replicated in Ireland given the species present and landscape similarities. At present however very little is known about bat activity within collision envelope heights and indeed activity levels of bats at elevated locations in Ireland which are typically selected for wind farm/turbine developments.

Guidance on this has been developed by Natural England in Bats and Onshore Wind Turbines: Interim Guidance (Natural England 2009). This document provides guidance on

[1] Barotrauma involves tissue damage to air-containing structures caused by rapid or excessive pressure change; pulmonary barotrauma is lung damage due to expansion of air in the lungs that is not accommodated by exhalation).

assessing the risk posed by wind turbines on various bat species by taking into account various factors including habitat preference and flight behaviour. An assessment of the risk of collision fatalities affecting bat populations was also conducted in this document. These assessments are presented below in **Tables 8** and **9**.

Table 8. Assessing risk posed by turbines by taking account of various factors including habitat preference and flight behaviour (Source: Natural England (2009))

Factor	Low Risk	Medium Risk	High Risk
Habitat preference	Bats preferring cluttered habitat	Bats able to exploit background cluttered space	Bats preferring to use open habitat
Echolocation characteristics	Short range High frequency Low intensity Detection distance ~15m	Intermediate – more plastic in their echolocation	Long range Low frequency High intensity Detection distance ~80m
Weight	Lightest	Medium	Heaviest
Wing shape	Low wing loading Low aspect ratio Broadest wings	Intermediate	High wing loading High aspect ratio Narrow wings
Flight speed	Slow	Intermediate	Fast
Flight behaviour and use of landscape	Manoeuvre well will travel in cluttered habitat Keeps close to vegetation Gaps may be avoided	Some flexibility	Less able to manoeuvre May avoid cluttered habitat Can get away from unsuitable habitat quickly Commute across open landscape
Hunting techniques	Hunt close to vegetation Exploit richer food sources in cluttered habitat Gleaners	Hunt in edge and gap habitat Aerial hawkers	Less able to exploit insect abundance in cluttered habitat Aerial hawker Feed in open
Migration	Local or regional movements	Regional migrant in some parts of range	Long-range migrant in some parts of range

Factor	Low Risk	Medium Risk	High Risk
Conclusion	*Myotis* (most species) Long eared-bats Horseshoe bats	Common pipistrelle Soprano pipistrelle *Serotine *Barbastelle	*Noctule Leisler's bat Nathusius' pipistrelle

* These bat species are not present in Ireland.

Table 9. Risk of Collision Fatalities Affecting Bat Populations, (Source: Natural England (2009), modified to only show Irish Bat Species).

Bat species	Scientific Name	Relative population size and status	Risk of collision^	Population Threat
Common pipistrelle	*Pipistrellus pipistrellus*	Common/Least Concern	Medium	Low
Soprano pipistrelle	*Pipistrellus pygmaeus*	Common/Least Concern	Medium	Low
Brown long eared bat	*Plecotus auritus*	Common/Least Concern	Low	Low
Daubenton's bat	*Myotis daubentonii*	Common/Least Concern	Low	Low
Natterer's Bat	*Myotis nattereri*	Fairly Common/Least Concern	Low	Low
Whiskered Bat	*Myotis mystacinus*	Locally distributed/Least Concern	Low	Low
Brandt's bat	*Myotis brandtii*	Data deficient	Low	Low
Leisler's Bat	*Nyctalus leisleri*	Common/ Near Threatened	High	High
Nathusius's Pipistrelle	*Pipistrellus nathusii*	Rare/Least Concern	High	High
Lesser Horseshoe	*Rhinolophus hipposideros*	Rare/Least Concern	Low	Low

** Based on Known Distribution and ranking in Irish Red Data Book – Terrestrial Mammals.
^ Risk of collision is based on what we currently know about bat behaviour.

There is currently insufficient information available on if and how bats migrate in the Irish/British environment. Leisler's, Nathusius pipistrelle and soprano pipistrelle bats can all migrate over considerable distances. Work conducted under the study team of Professor Altringham has also shown that bats may migrate over 60 miles to swarming sites during the autumn months (Rivers *et. al.* (2006)). However, it is not known if similar long-distance migrations take place in Ireland. Bats in Ireland may migrate only short distances (several kilometres) between summer roosts and winter hibernacula. However bats could still be at risk of collision and baro-trauma during such migrations depending upon the habitats and terrain present and the location of any wind turbines.

4.2.2. Habitat use by bats

In general bats tend to favour areas of broadleaf woodland and water in preference to areas such as open arable fields, improved grassland, and open moorland (Walsh and Harris 1996a, 1996b). Linear features through the landscape such as hedgerows, treelines, watercourses and woodland margins, are of importance for commuting and feeding bats, often providing ecological corridors for movement between isolated habitats. In general the direct loss of habitat associated with the erection of wind turbines and associated infrastructure, i.e. turbine foundations, access tracks and electrical sub-stations, is typically small although the wind farm itself may cover a large area of ground as at Derrybrien.

It is therefore unlikely that direct habitat loss at Derrybrien formed a significant issue for bats although on some sites this could be exacerbated if for example a small local pond used by Daubenton's was lost or works resulted in the drainage of wetland habitats.

The main potential impact in terms of habitat use by bats caused by a turbine/wind farm arises from fragmentation of habitats and the loss of or interference to commuting or migrating routes. These impacts may arise either directly through the removal of a section of hedgerow to facilitate an access track or general avoidance of the area. A study of Serotine bats in Germany found that the bats increasingly avoided a site on which a wind farm was located over a four year period, although they had previously used the area. Such avoidance may also be a species specific reaction as at the same location pipistrelle bats only altered their behaviour depending upon the position of the turbines (Bach (2002)).

Bat abundance has been positively related to the presence of woodland habitat (Walsh and Harris 1996a, 1996b), so it is perhaps not surprising that some researchers have found that bat mortalities appear to be higher in or near forests (Arnett *et al* 2004; Brinkman 2004). Research carried out in Germany has suggested that bats may be at greater risk of collision with wind turbines that have been sited in highly structured landscapes, such as forests (Brinkman 2004; Brinkman *et al* 2006).

4.2.3. Baroutrauma

Bats may also be killed by lung damage due to pressure changes around a rotating rotor blade ("barotrauma") and hence there is no necessity for bats to make contact with a rotor to be killed by its movement.

4.2.4. Disturbance due to ultrasound emission

At present it is unknown how bats react to the ultrasound emissions produced by wind turbines. In a number of cases it has been shown that bats do react to ultrasounds when the intensity/frequency is in the same range as their own sonar calls (Bach & Rahmel (2004)). However with the exception of a few single observations, the way bats react to turbine ultrasounds is completely unknown.

4.2.5. Other Considerations

Grid connections

The power lines connecting wind farms to the national grid can also have impacts on bats in the wider landscape through loss of hedgerows, severance of habitats, etc. but can also create new foraging habitat especially through dense conifer plantations in the landscape.

Site Lighting

Lighting may interfere with bat activity, as it not only can deter some species from foraging in an area but should areas around or near turbines be illuminated this could actually attract other species of bats to the area as they will come to forage on the insects which accumulate below the lights.

Bridge Upgrades

Local bridges which have roosting potential for bats often require strengthening works, pressure grouting, etc. in order to accommodate the construction traffic for the wind farm. This can result in the entombment of bats and loss of roosts.

4.2.6. Operational Impacts

The principal operational impacts on bats arising from operation of any wind farm, is a risk of collision. Recent collision studies conducted at German wind farm sites have shown a significant correlation between rates of collision and extensively forested sites; however, Brinkmann & Schauer-Weisshahn (2006) cautioned that the evaluation of each potential wind farm site on other factors besides forestation is needed. Current evidence largely, but not entirely, suggests that bat mortality in the USA appears to be highest in or near forests (especially forests along ridge tops), more moderate in open areas close to forest, and lowest in open grassland or farmland away from forests (Arnett 2005).

5. RECOMMENDATIONS AND MITIGATION OPTIONS

5.1. Detailed Bat Survey

No baseline surveys of bats were undertaken in advance of the construction of the wind farm at Derrybrien and there has been no monitoring of the operational impacts of the turbines on local populations. The presence of bats using the wind farm site at Derrybrien was confirmed during the recent detector survey on site.

Given the time of year in which this survey was conducted, which is approaching the hibernation period for bats, it is thought that this is an under-representation of the importance of the site for bats. It is therefore recommended that a detailed bat survey is conducted across the active bat season in line with the Bat Conservation Ireland Guidelines for bat surveys of Terrestrial Turbines and Wind Farms in Ireland.

Following this survey work the true significance and importance of the site for local bat populations can be assessed and suitable mitigation measures can then be designed and implemented as appropriate to ensure that the operating wind farm at Derrybrien is not negatively impacting these protected species. Potential mitigation measures are outlined below.

5.2. Collision risk mitigation

Vegetation buffer distance

One of the main mitigation measures recommended to reduce collision risk is that the layout of each turbine is buffered (from the blade tip) a minimum of 50m away from all linear habitat features (e.g. hedgerows, tree-lines, and woodland edges). This buffer distance conforms to the linear feature buffer recommended by Natural England (Mitchell-Jones & Carlin (2008)). This measure generally requires the removal of vegetation within this area to reduce its foraging suitability for bats and will also reduce turbulence for the turbines.

Clearance of such vegetation should take place during the winter months (November – February) which will also avoid the bird breeding season (March – August inclusive). The vegetation in these cleared areas will then need to be removed on an ongoing basis to reduce their attractiveness to bats.

As detailed above in **Table 4** a number of turbines are located in very close proximity to forestry edges (typically within 50m) and thus pose a risk to foraging and commuting bats. Vegetation (principally the conifer plantation) surrounding some of these turbines may need to be cut back depending on bat activity levels in the area. These are summarised below in **Table10**.

Table 10. Buffer zones required for existing turbines at Derrybrien.

Turbine Number	Observation	Distance from adjoining vegetation likely to be used by bats (m)	Potential risk (H/M/L)	Expand buffer zone to vegetation to >50m
T1	No bat activity recorded	29/35	H	Y
T2	No bat activity recorded	17/37	H	Y
T3	No bat activity recorded	25	H	Y
T4	No bat activity recorded	93/122	M	N
T5	No bat activity recorded	14/35	H	Y
T6	No bat activity recorded	29	H	Y
T7	No bat activity recorded	131	M	N
T8	No bat activity recorded	35	H	Y
T9	No bat activity recorded	50 – 70	M	Y
T10	No bat activity recorded	200	L	N
T11	No bat activity recorded	225	L	N
T12	No bat activity recorded	45	H	Y
T13	No bat activity recorded	270	L	N
T14	No bat activity recorded	290	L	N
T15	No bat activity recorded	285	L	N
T17	No bat activity recorded	90	M	N
T18	No bat activity recorded	35	H	Y
T19	No bat activity recorded	20	H	Y
T20	No bat activity recorded	20	H	Y
T21	No bat activity recorded	30	H	Y
T22	No bat activity recorded	20	H	Y
T23	No bat activity recorded	40	H	Y
T24	No bat activity recorded	130 - 140	L	N
T25	No bat activity recorded	40	H	Y
T26	No bat activity recorded	40 – 60	H	Y
T27	No bat activity recorded	150 - 200	L	N
T28	No bat activity recorded	230	L	N
T29	No bat activity recorded	30	H	Y
T30	No bat activity recorded	25	H	Y
T31	No bat activity recorded	135	L	N
T32	No bat activity recorded	30	H	Y
T33	No bat activity recorded	20	H	Y
T34	No bat activity recorded	280	L	N
T35	No bat activity recorded	50	H	Y
T36	No bat activity recorded	20	H	Y
T37	No bat activity recorded	260	L	N
T38	No bat activity recorded	40	H	Y

Turbine Number	Observation	Distance from adjoining vegetation likely to be used by bats (m)	Potential risk (H/M/L)	Expand buffer zone to vegetation to >50m
T39	No bat activity recorded	25	H	Y
T40	21:18: one quick pass (seemed relatively distant) of unidentified Pipistrelle, not seen.	230	L	N
T41	No bat activity recorded	55	M	N
T42	No bat activity recorded	45	H	Y
T43	No bat activity recorded	140	L	N
T44	No bat activity recorded	45	H	Y
T45	No bat activity recorded	230	L	N
T46	No bat activity recorded	90	M	N
T47	No bat activity recorded	30	H	Y
T48	No bat activity recorded	25	H	Y
T49	No bat activity recorded	35	H	Y
T50	No bat activity recorded	30	H	Y
T51	No bat activity recorded	60	M	N
T52	No bat activity recorded	45 - 90	H	Y
T53	No bat activity recorded	35	H	Y
T54	No bat activity recorded	30	H	Y
T55	No bat activity recorded	30	H	Y
T56	Unidentified pipistrelle bat recorded between here and turbine 57, single pass only, foraging in amongst self sown conifers/scrub	90	M	N
T57	No bat activity recorded	57	M	N
T58	No bat activity recorded	60	M	N
T59	No bat activity recorded	140	L	N
T60	No bat activity recorded	45	H	Y
T61	No bat activity recorded	80	M	N
T62	No bat activity recorded	65	M	N
T63	No bat activity recorded	50	H	Y
T64	No bat activity recorded	50	H	Y
T65	No bat activity recorded	40	H	Y
T66	No bat activity recorded	125	L	N
T67	No bat activity recorded	50	H	Y
T68	No bat activity recorded	10	H	Y
T69	No bat activity recorded	45	H	Y
T70	No bat activity recorded	30	H	Y
T71	No bat activity recorded	25 – 30	H	Y

Operational curtailment

Should the creation of a buffer zone not have the required outcome and bat fatalities are still occurring another option is that of operational curtailment of turbines at low wind speeds as this is when bats are most likely to be foraging in close proximity to the turbines. Operational curtailment refers to selected, short-term periods when turbine rotor blades are intentionally kept from rotating. For bats, the most cost-effective type of operational curtailment appears to be a modest increase in cut-in speed, the lowest wind speed at which the rotor blades spin and generate electricity for the grid. Recent, cutting-edge research at wind farms in Canada, Germany, and the United States shows that increasing the cut-in speed from the usual 3.5–4.0 meters/second to about 6 m/s reduces bat mortality by 50–75 percent, while reducing power generation by only about 1 percent (Arnett, (2010)). This mitigation method has been proven to reduce bat kills from 53 to 87% on any given night, averaging 73%, at turbines that were partially curtailed during low-wind nights compared to those that were fully operational, (Arnett, pers. comm.) Such curtailment measures may only need to be applied to specific turbines within the wind farm where collision risk is high as opposed to across the board.

5.3. Monitoring

It is recommended that a year round bat detector activity survey and three year bat corpse monitoring study of the Derrybrien wind farm is designed and implemented to address if the wind farm is currently having an impact on bat mortality and to assess if the mitigation measures outlined above are working. This is in line with the guidelines issued by EUROBATS (Rodrigues, (2008)).

On completion of the study the results should be made available to the statutory agencies with the understanding that the results will be made available to any interested parties to assess the impacts of wind farms on Irish bat species and populations and to inform future Environmental Impact Studies, Ecological Assessment, and Appropriate Assessment work.

6. CONCLUSION

It is not thought that the peat slide at Derrybrien has had any adverse impacts on the population of lesser horseshoe bats at Lough Cutra Castle as the population there remains in favourable conservation status and is unlikely to have been impacted by this event.

At present it is unknown if the operation of the Derrybrien wind farm is having a negative impact on other species of bats as there has been no baseline surveys conducted during optimum conditions beyond a limited survey which was conducted in November 2011. This is very late in the active bat season and does not present an accurate representation of how the site is being used by bats and the potential impacts of the wind farm.

It is therefore recommended that a year long bat detector activity survey and three year bat corpse monitoring study of the Derrybrien wind farm is designed and implemented to address if the wind farm is currently having an impact on bat mortality.

A number of possible mitigation measures have been detailed and such a survey will determine if these measures are either required, or once implemented, if they are working.

7. REFERENCES

Altringham, J. D. (1996) **Bats: Biology and Behaviour.** Oxford University Press.

Altringham, J. D. (2003) **British Bats.** HarperCollins Publishers.

Bat Conservation Trust (2007). *Bat Surveys – Good Practice Guidelines.* Bat Conservation Trust London.

Arnett E.B. (ed) (2005). Relationships between bats and wind turbines in Pennsylvania and West Virginia: an assessment of bat fatality search protocols, patterns of fatality, and behavioural interactions with wind turbines. Final report submitted to the Bats and Wind Energy Cooperative and Bat Conservation International. Austin, TX.

Arnett, E. B., M. M. P. Huso, J. P. Hayes, and M. Schirmacher (2010). Effectiveness of changing wind turbine cut-in speed to reduce bat fatalities at wind facilities. A final report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International. Austin, Texas, USA.

Baerwald, E. F., D'Amours, G. H., Klug B. J. and R. M.R. Barclay (2008). Barotrauma is a significant cause of bat fatalities at wind turbines. Current Biology, Volume 18, Issue 16, R695-R696, 26 August 2008.

Bach, L. (2002). Auswirkungen von Windenergieanlagen auf das Verhalten und die Raumnutzungen von Fledermäusen am Beispiel des Windparks „Hohe Geest", Midlum - Endbericht. – unpubl. Report for Instituts für angewandte Biologie, Freiburg/Niederelbe: 46 pp.

Bach, L. & U. Rahmel (2004). Summary of wind turbine impacts on bats – assessment of a conflict. – Bremer Beiträge für Naturkunde und Naturschutz Volume 7: 245-252.

Barratt, E. M., Deauville, R., Burland, T. M., Bruford, M. W., Jones, G., Racey, P. A., & Wayne, R. K. (1997). DNA *answers the call of pipistrelle bat species.* Nature 387: 138 - 139.

Biggane, S. (2004a). Investigation of the commuting routes and foraging activity of lesser horseshoe bats at four maternity roosts in Co. Clare. Unpublished report to NPWS.

Biggane, S. (2004b). Investigation of the commuting routes and foraging activity of a lesser horseshoe bat maternity roost (SAC 002314) at Corbett's Cottage, Rylane, Tulla, Co. Clare. Unpublished report to NPWS.

Biggane, S. (2005). Investigation of the winter diet of lesser horseshoe bats at two hibernation sites in Co. Clare and its use in predicting winter foraging sites. Unpublished report to NPWS.

Bontadina, F., Schofield, H. & Naef-Daenzer, B. (2002). Radio-tracking reveals that lesser horseshoe bats (*Rhinolophus hipposideros*) forage in woodland. J. Zool., Lond. 258: 281-290.

Brinkman, R. (2004). *How do wind turbines affect hunting and migrating bats in Baden-Wurttemburg?* Conference Paper of the Baden-Wurttemburg Academy for Nature and Environmental Conservation, Vol. **15**, "Are wind turbines a threat to birds and bats?"

Brinkmann, R., Schauer-Weisshahn, H. & Bontadina, F. (2006). *Survey of possible operational impacts on bats by wind facilities in Southern Germany.* Final report submitted by the Administrative District of Freiburg, Department of Conservation and Landscape management and supported by the foundation Naturschutzfonds Baden-Württemberg. Brinkmann Ecological Consultancy, Gundelfingen/Freiburg, Germany.

Carden, R., Aughney, T., Kelleher, C. and N. Roche (2010). *Irish Bat Monitoring Schemes - BATLAS Republic of Ireland Report for 2008-2009.* Bat Conservation Ireland.

Cook, J., McCarthy, A., Holloway, S. and G. Oliver (2008). *Survey Guidance for Assessing Bat Activity at Proposed On-Shore Wind Farms.* In Practice: 62.

Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) 1982.

Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) 1979.

Council of the European Communities (1992). *Council Directive of 21 May 1992 on The Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC)*. O. J. L 206/35, 22 July 1992.

Dürr, T. & Bach, L. (2004). Bat death and wind turbines – a review of current knowledge, and the information available in the database for Germany. Bremer Beitrage fur Naturkunde und Naturschutz, 7: 253 – 263.

Entwistle, A.C., et al (2001). Habitat Management for Bats – a guide for land managers, landowners and their advisors. JNCC, Peterborough.

Hayden, T. and Harrington, R. (2000). **Exploring Irish Mammals.** Town House, Dublin.

Institute of Ecology and Environmental Management (2006) Guidelines for Ecological Impact Assessment in the United Kingdom (version 7 July 2006). http://www.ieem.org.uk/ecia/index.html

Kelleher, C. (2004). Survey of lesser horseshoe bat commuting routes and foraging areas at Curraglass Wood and Glanlough, Kilgarvan, Co. Kerry. Unpublished report to NPWS.

Kelleher, C. (2004). Thirty years, six counties, one species – an update on the lesser horseshoe bat *Rhinolophus hipposideros* (Bechstein) in Ireland. Irish Naturalists Journal. Volume 27, No. 10.

Kelleher, C. and Marnell, F. (2006). Bat Mitigation Guidelines for Ireland. Irish Wildlife Manuals, No. 25. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

Kelleher, C. (2006b). Brandt's Bat *Myotis brandtii*, New Bat Species to Co. Tipperary. Irish Naturalists' Journal 28: 345.

Knight, T. (2006). The use of landscape features and habitat by the lesser horseshoe bat *Rhinolophus hipposideros*: implications for conservation management. Unpublished PhD thesis, University of Bristol, UK.

Marnell, F., Kingston, N. & Looney, D. (2009) Ireland Red List No. 3: Terrestrial Mammals, National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.

McAney, C.M. (1994). The lesser horseshoe bat in Ireland – Past, Present and Future. *Folia Zoologica.* 43 (4): 387-392.

McAney, K. (2006). A Conservation Plan for Irish Vesper Bats. Irish Wildlife Manuals, No. 20. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

Mitchell-Jones, A. J. and McLeish, A. P. (1999). The Bat Workers' Manual. 2nd Edition, JNCC.

Mitchell-Jones T. & C. Carlin. (2009). *Bats and onshore wind turbines. Natural England Technical Information Note TIN051.*

NPWS (2007). *Rhinolophus hipposideros* (1303) Conservation Status Assessment Report. Background to the conservation assessment of lesser horseshoe bat (*Rhinolophus hipposideros*) (Bechstein) in Ireland. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

NRA (2009). Guidelines for Assessment of Ecological Impacts of National Road Schemes. National Roads Authority.

NRA (2006). Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes. National Roads Authority. www.nra.ie

NRA (2006). Guidelines for the Treatment of Bats Prior to the Construction of National Road Schemes. National Roads Authority. www.nra.ie

O'Sullivan, P. (1994). Bats in Ireland. Special supplement to the Irish Naturalists' Journal.

Richardson, P. (2000). Distribution Atlas of Bats in Britain and Ireland 1980 - 1999. The Bat Conservation Trust, London, UK.

Rivers, N.M., Butlin, R.K. and J.D. Altringham. (2006). *Autumn swarming behaviour of Natterer's bats in the UK: population size, catchment area and dispersal.* Biol. Conserv. **172**, 215-226.

Rodrigues, L., L. Bach, M.-J. Dubourg-Savage, J. Goodwin & C. Harbusch (2008): *Guidelines for consideration of bats in wind farm projects.* EUROBATS Publication Series No. 3 (English version). UNEP/EUROBATS Secretariat, Bonn, Germany, 51 pp.

Russ, J. (1999). *The bats of Britain and Ireland – Echolocation Calls, Sound Analysis and Species Identification.* Alana Books.

Schofield, H., Messenger, J., Birks, J. & Jermyn, D. (2002). Foraging and roosting behaviour of lesser horseshoes at Cilia, Radnor. VWT report.

Walsh, A.L. and Harris, S. (1996a). Foraging habitat preferences of vespertilionid bats in Britain. Journal of Applied Ecology, 33, 508-518.

Walsh, A.L and Harris, S. (1996b). Factors determining the abundance of vespertilionid bats in Britain: geographical, land class and local habitat relationships. Journal of Applied Ecology, 33, 519-529.

Warren, R.D. and Witter, M.S. (2002). Monitoring trends in bat populations through roost surveys: methods and data from *Rhinolophus hipposideros. Biol. Cons*. 105: 255-261

Whilde, T. (1993). Threatened Mammals, Birds, Amphibians and Fish in Ireland. Irish Red Data Book 2: Vertebrates. HMSO, Belfast.

Wildlife Act (1976). Government of Ireland.

Wildlife (Amendment) Act (2000). Government of Ireland.

8. APPENDIX 1. SITE SYNOPSIS FOR LOUGH CUTRA SAC.

SITE SYNOPSIS

SITE NAME: LOUGH CUTRA

SITE CODE: 000299

Lough Cutra is a large oligo/mesotrophic freshwater lake lying on limestone but with much sediment washed down from the sandstone hills above. This lake is situated about 4 km south-east of Gort, Co. Galway.

This site is a candidate SAC selected for alkaline fen, a habitat listed on Annex I of the EU Habitats Directive, and for Lesser Horseshoe Bat, a species listed on Annex II of the EU Habitats Directive. A series of connected woodlands on the western side of the lake has been included as foraging habitat for these bats.

The vegetation around the lake is diverse, with reedbeds confined to sheltered bays, marshes and fens on sandy and peaty ground and natural and planted woodlands. Shallow water communities include species such as Jointed Rush (*Juncus articulatus*), Bulbous Rush (*J. bulbosus*), Alternate Water-milfoil (*Myriophyllum alternifolium*), Water-plantain (*Alisma plantago-aquatica*), Floating Club-rush (*Scirpus fluitans*), Lesser Water-plantain (*Baldellia ranunculoides*), Water Lobelia (*Lobelia dortmanna*) and Shoreweed (*Littorella uniflora*). Winter flooded areas support marsh vegetation with Common Spike-rush (*Eleocharis palustris*), Common Marsh-bedstraw (*Galium palustre*), Purple-loosestrife (*Lythrum salicaria*), amongst others, and with notable species such as Lesser Meadow-rue (*Thalictrum minus*), Northern Bedstraw (*Galium boreale*) and Blue-eyed-grass (*Sisyrinchium bermudiana*). On wet peaty areas fen vegetation includes Black Bog-rush (*Schoenus nigricans*), Saw *Sedge (Cladium mariscus*) and a range of associated sedges (*Carex* spp.) and fen mosses.

Included in the site is a small (*c.* 3 ha.) turlough, very small areas of alkaline fen and occasional fields with affinities to *Molinia* meadow. A relatively large poor fen is present in the north of the site, adjoining the lake. The mouth of the Owendalulleegh River has formed an unusual delta where a good quality old willow (*Salix cinerea*)-dominated wet woodland has developed behind vegetated sand bars.

Woodland occurs around much of the lakeshore, as well as on a number of islands in the lake. Wet woodland on peat is dominated by Willow (*Salix cinerea*) and Alder (*Alnus glutinosa*). An old record of Irish Spurge (*Euphorbia hybernica*) probably comes from drier woodland which occurs in the Lough Cutra Demesne.

These woodlands provide feeding grounds for Lesser Horseshoe Bats. Between 1999 and 2001 up to 93 bats have been recorded in hibernation at Lough Cutra Castle and it is thought likely that a summer nursery roost also occurs here.

The lake is a regionally/locally important site for waterfowl. Monthly counts between November 1995 and March 1996, as part of an intensive study on flooding in the catchment, gave the following numbers: Whooper Swan (18), Mallard (101), Teal (69), Tufted Duck (83) and Goldeneye (58). The latter also use the nearly Ballynakill Lough. The lake has a long-established breeding colony of cormorants, with 34 nests in 1996. Higher numbers (166 pairs, 1985) have been recorded in the past. Small numbers also winter on the lake. In recent years there have been no records of Greenland White-fronted Geese from the lake, although in the past flocks of 60-80 birds were regular and were considered to be birds from the Rahasane or Creganna population.

The lake is used for fishing and tourism. Precautions should be taken to ensure the lake and its surrounding area is protected from damaging operations such as application of artificial fertilisers, development close to the lakeshore, drainage and felling of woodland areas.

Lough Cutra is of conservation interest for the range of wetland habitat types it contains, particularly alkaline fen, a habitat listed on Annex I of the E.U. Habitats Directive. The presence of an internationally important colony of Lesser Horseshoe Bats, a species listed on Annex II of the Habitats Directive, and a regionally important population of Cormorants add further interest to the site.

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