

# **Chapter 4:**

## **Flora & Fauna**

## 4.1 Introduction

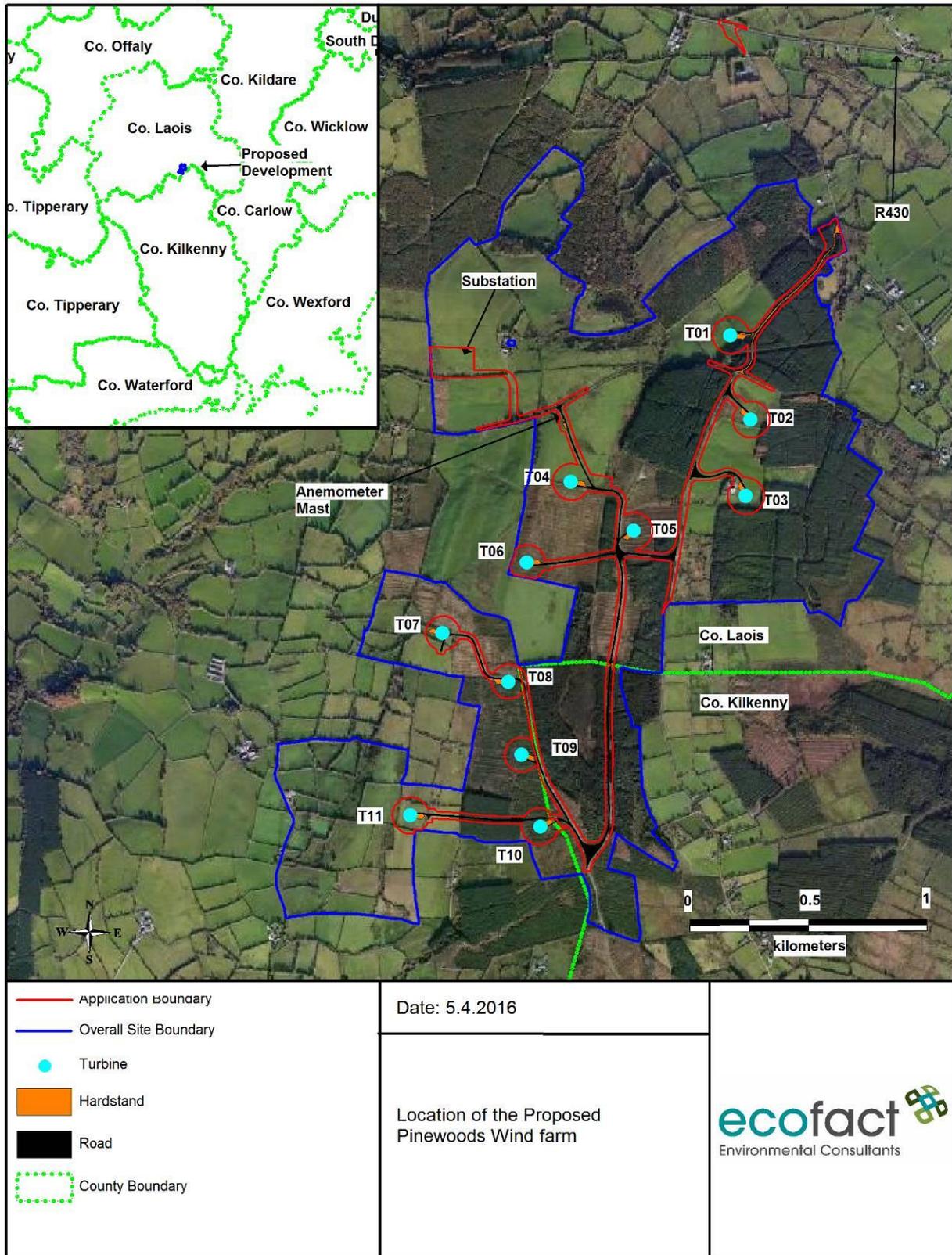
This chapter assesses the potential impacts of the proposed development on terrestrial and aquatic ecology. Areas designated for nature conservation are also considered, although a standalone Natura Impact Statement (NIS) has also been prepared.

The proposed development site lies approximately 3km east of Ballinakill, or approximately 8km south east of Abbeyleix in Co. Laois. The proposed development will consist of 11 no. wind turbines up to maximum tip height of 136.5m and all associated and ancillary works. A full description of the proposed development is provided in Chapter 2.

The subject site is located in an upland setting where coniferous plantation and agricultural grassland bordered by hedgerows dominate the landscape. The proposed development is within the River Nore catchment. There are two streams within the proposed development site, both tributaries of the Owenbeg River, a watercourse also known as the Owveg River which flows into the River Nore and also part of the River Barrow and River Nore SAC. At its closest, the River Barrow and River Nore SAC (Site Code: 002162) is located approximately 0.7km to the north of the main body of the proposed development (or 1.43 km overland hydrological distance). A proposed junction upgrade is located approximately 40m to the south of this designated site. The site synopsis for the River Barrow and River Nore SAC is provided in **Appendix 4.1**. The location of the proposed development site is presented in **Figure 4.1**.

The aim of this chapter is to identify features of ecological interest within the study area and specify the mitigation measures that will be used to ensure that significant impacts on these features do not occur. An evaluation is made of the scientific or conservation value of the sites identified and the potential for adverse impacts affecting designated sites following the implementation of appropriate mitigation. The objectives of this assessment were:

- To carry out a desktop study in order to determine the known ecology of the proposed development site and surrounding area;
- To carry out a baseline ecological survey of the proposed wind farm site to assess the status and importance of ecological interests present within the site;
- To predict the potential direct, indirect and cumulative likely significant impacts of the proposed development on designated conservation sites, flora and habitats and on fauna;
- To propose mitigation measures to inform the design, construction and operation of the wind farm so as to minimise potential impacts on ecology.



**Figure 4.1: Site location map showing the boundary of the proposed development site near the Co. Laois/Co. Kilkenny border**

## 4.2 Methodology

### 4.2.1 Guidelines and legislative context

The current assessment has been prepared taking account of the Environmental Protection Agency's (EPA) 'Guidelines on the Information to be contained in Environmental Impact Statements' (EPA, 2002) and 'Advice Notes on Current Practice (in the Preparation of Environmental Impact Statements)' (EPA, 2003) and also the 'Guidelines for Ecological Impact Assessment' (Institute of Ecology and Environmental Management, 2006). The Heritage Council publication 'Best Practice Guidance for Habitat Survey & Mapping' (Smith *et al.*, 2011) was also referenced for habitat mapping.

Cognisance of the European Communities (Environmental Impact Assessment) Regulations, 1989 (S.I. No. 349 of 1989) and subsequent amendments, as well as the European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009 (S.I. 296 of 2009) and the European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. 272 of 2009) were taken into account when preparing this assessment.

Under the Fisheries (Consolidation) Act, 1959, it is an offence to disturb the bed of a river. Under Section 3 of the Local Government (Water Pollution) Act, 1977 (as amended by Sections 3 and 24 of the 1990 Act) it is an offence to cause or permit any polluting matter to enter waters. Section 171 of the Fisheries (Consolidation) Act 1959 creates the offence of throwing, emptying, permitting or causing to fall onto any waters deleterious matter. Deleterious matter is defined as any substance that is liable to injure fish; to damage their spawning grounds; or the food of any fish; or to injure fish in their value as human food; or to impair the usefulness of the bed and soil of any waters as spawning grounds or other capacity to produce the food of fish.

A diversity of flora and fauna, rare at a national level, are protected under the provisions of the Wildlife Act, 1976 and Wildlife (Amendment) Act, 2000; which includes the Flora Protection Order (1999). The Habitats Directive 1992 has been transposed into Irish legislation as the European Union (EU) (Natural Habitats) Regulations SI 94/1997 and amended in 1998 and 2005. It is the responsibility of each Member State to designate Special Protection Areas (SPAs) and Special Areas of Conservation (SACs), both of which form part of the Natura 2000, a network of protected areas throughout the European Community. The Habitat Regulations have been updated in 2011 as the European Communities (Birds and Natural Habitats) Regulations 2011 to bring the Irish transposition of these regulations into line with the requirements of the EU Habitats Directive (1992). Article 6 paragraphs 3 and 4 of the EU Habitats Directive (1992) state that:

- 6(3) *Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public.*
- 6(4) *If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, the Member State shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted.*

*Where the site concerned hosts a priority natural habitat type and/or a priority species, the only considerations which may be raised are those relating to human health or public safety, to beneficial*

*consequences of primary importance for the environment or, further to an opinion from the Commission, to other imperative reasons of overriding public interest.*

#### 4.2.2 Desktop Review

A desktop review was carried out to identify features of ecological importance within the study area and surrounding region. The ecological assessment included designated and sensitive areas in the vicinity of the study area, to enable sufficient assessment to identify and quantify any significant impacts on the habitats, flora and fauna likely to arise from the construction and operation of the proposed development. Potential sites of conservation interest were identified prior to the field survey by an examination of Ordnance Survey (OS) aerial photography and OS maps (1:50,000, 1:10,560 or 6" and 1:2500 scale).

SACs, SPAs and Natural Heritage Areas and proposed NHAs (pNHAs) in the vicinity of the proposed development site were identified. This information was collated by accessing the website of the National Parks and Wildlife Service (NPWS) of the Department of Arts, Heritage and the Gaeltacht (DAHG).

The digital database of the New Atlas of the British and Irish Flora (Preston *et al.*, 2002) was consulted to assess the presence of rare plant species recorded from the 10km square in which the site is located. The online database hosted by the Irish National Biodiversity Data Centre (NBDC) ([www.biodiversityireland.ie](http://www.biodiversityireland.ie)) was also utilised to assess the importance of the study area for mammals; likewise, '*Exploring Irish Mammals*' (Hayden and Harrington, 2000) was consulted.

The NPWS publication '*Otter Survey of Ireland: 2004/2005*' (Bailey & Rochford 2007) was reviewed, as were the COFORD publications '*The Irish Squirrel Survey 2007*' (Carey *et al.* 2007) and the '*National Pine Marten Survey of Ireland 2005*' (O' Mahony *et al.* 2006). A desk study of bat records from the study area was undertaken. Sources accessed included The Bat Conservation Trust's report '*Distribution Atlas of Bats in Britain and Ireland 1980-1999*' (Richardson, 2000). The '*Irish Red Data Book 2: Vertebrates - Threatened Mammals, Birds, Amphibians and Fish in Ireland*' (Whilde 1993) and the updated '*Irish Red List No. 3: Terrestrial Mammals*' (Marnell *et al.* 2009) and '*Irish Red List No. 5: Fish, Reptiles and Amphibians*' (King *et al.* 2011) were also reviewed.

The current chapter also draws extensively on an ecology assessment prepared as part of a previous EIS for a proposed wind farm on the subject site (IWCM, 2012). This included a previous 12-month bird survey of the site completed during the period October 2010 and September 2011 (Moran 2012, presented in **Appendix 4.2**) and a detailed bat survey completed during the period May 2012 to October 2012 (Woodrow & Nicholas 2012, presented in **Appendix 4.3**).

#### 4.2.3 Field Survey Work

An updated habitat survey of the proposed development site was undertaken during July 2014. Information was recorded in relation to the primary habitats and land take to be directly affected by the proposed development, at a level corresponding with the Heritage Council publication '*Best Practice Guidance for Habitat Surveying and Mapping*' (Smith *et al.*, 2011). Habitat mapping was aided by aerial photography and habitats recorded were classified according to Fossitt '*A Guide to Habitats in Ireland*' (2000). A list of the dominant and notable plant species was taken for each habitat type. Plant species nomenclature follows Stace '*New Flora of the British Isles*' (1997). While emphasis was placed on the habitats within the immediate area of the proposed development, habitats recorded from the overall study area (land boundary) were also considered as a potential impact zone.

Mammal surveys for protected species including badger and otter was undertaken during the period July to September 2014. Mammal surveys were undertaken to assess the locations of features such as badger setts and to propose appropriate mitigation measures for the protection where necessary. Mammal surveys were undertaken during the daytime and the site was walked and evidence of mammal activity (burrows, tracks, trails, footprints, hair etc.) was searched for. The surveys followed

standard methodology as outlined in '*Best Practice Guidance - Badger Surveys*' by Scottish Natural Heritage (2003) and other guidance, including the book '*How to find and identify mammals*' by Muir *et al* (2013).

The current assessment follows on from a previous bat survey of the site which was completed during 2012 (See **Appendix 4.3**). An updated bat survey was also undertaken as part of the current assessment during the months of June, July, August, September and October 2014 (daytime assessments, 5 nights' activity surveys with 2 observers). The surveys were completed with regard to the 'Bat Mitigation Guidelines for Ireland' by Kelleher & Marnell (2006), and the '*Wind Turbine/Wind Farm Development Bat Survey Guidelines*' prepared by Bat Conservation Ireland (2012). The level of survey effort and the survey techniques employed were designed to allow a comprehensive understanding of the use of the site by bats. The survey included assessments of potential roost locations (including trees, buildings and bridges), and also bat activity surveys. The activity surveys included walkover transect surveys on the site itself hand held bat detectors. Surveying commenced approximately 30 minutes before dusk each night, and continued until 3 hours after dusk. The activity surveys (with the exception of the October survey) were all undertaken during warm dry nights and were considered to be optimal survey periods.

A general extensive breeding bird survey of the site was carried out over four days between May and July 2014, to update the previous 12-month survey of the site (See **Appendix 4.2**). The survey approach took the Scottish Natural Heritage (2013) guidelines '*Recommended bird survey methods to inform impact assessment of onshore wind farms*' into account, and provides an inventory of the species present on the site. A crepuscular (evening) ornithological survey of the site was carried out in late June 2014. The method used was based on Brown & Shepherd (1993). Transects used in the previous EIS survey were replicated to allow comparisons of results. Additional observations regarding birds were also made during other ecological surveys of the site which were completed as part of the overall ecological assessment of the site. All surveys were undertaken under ideal survey conditions, with dry, bright and calm conditions prevailing.

All watercourses/water bodies which could be affected directly (i.e. within the site) or indirectly (i.e. lie within 500 m of the site boundary) were assessed as part of the current assessment. Aquatic habitat assessments in relation to fish and aquatic ecological interests were carried out using the methodology given in the Environment Agency's '*River Habitat Survey in Britain and Ireland Field Survey Guidance Manual*' (EA, 2003) and the Irish Heritage Council's '*A Guide to Habitats in Ireland*' (Fossitt, 2000). **Table 1** presents the watercourses surveyed as part of the current assessment of the proposed development study area. All the potentially affected watercourses were assessed in terms of:

- Stream width and depth and other physical characteristics;
- Substrate type, listing substrate fractions in order of dominance, i.e. large rocks, cobble, gravel, sand, mud etc;
- Flow type, listing percentage of riffle, glide and pool in the sampling area;
- Instream vegetation, listing plant species occurring and their percentage coverage of the stream bottom at the sampling site (as applicable) and on the bankside and
- Estimated cover by bankside vegetation, giving percentage shade of the sampling site.

The results of the physical habitat study were used in conjunction with the leaflet '*The Evaluation of habitat for Salmon and Trout*' to assess habitat suitability for salmonids. This leaflet (Advisory leaflet No. 1) was produced by the Department of Agriculture for Northern Ireland Fisheries Division and was designed for use in the EU salmonid enhancement programme.

Electrical fishing assessments were then carried out at selected sites under authorisation from the Department of Communication, Energy and Natural Resources under Section 14 of the Fisheries Act

(1980). The purpose of this survey was to provide information on the presence of Annex II listed fish species (i.e. lampreys and salmon) and other fish (i.e. brown trout and eels) present at the selected sites. Sites were surveyed following the methodology outlined in the CFB guidance '*Methods for the Water Framework Directive - Electric fishing in wadable reaches*'. A portable electrical fishing unit (GFT backpack) was used during the assessment. A 20 minute semi-quantitative survey was carried out at Site 6 on the Owenbeg (Owveg) River. Five minute semi-quantitative surveys were carried out at the remainder of the sites (where feasible). Electrical fishing was not carried out at Site 3, Site 5, Site 8 and Site 9 given the nearly dry state and small size of these streams during September 2014.

Survey Site	NOS Grid Reference	Watercourse
1	S50191 79591	Moneycleare River (Ironmills River)
2	S49083 81403	Knockardagur Stream
3	S49829 82293	Knockardagur Stream
4	S51339 83633	Graiguenahown Stream
5	S51291 82312	Graiguenahown Stream
6	S51889 83704	Owenbeg River
7	S52092 82792	Knockbawn Stream
8	S52044 82173	Knockbawn Stream
9	S51947 79419	1 <sup>st</sup> order un-named tributary (EPA segment code 15_1085) of the Loan River

**Table 4.1: Locations of the sites examined for the proposed development site during September 2014**

Quantitative sampling of benthic (or bottom dwelling) aquatic macroinvertebrates was undertaken at Sites 2, 4 and 6 in **Table 4.1** using kick-sampling (Toner *et al.*, 2005). The Quality Rating (Q) System (Toner *et al.*, 2005) was used to obtain a water quality rating for each site. The Small Streams Risk Score (SSRS; Walsh, 2005) was also utilised for smaller watercourses. Searches for White-clawed crayfish and Freshwater Pearl Mussel (FPM) were carried out using a bathyscope. General assessments of terrestrial invertebrates were undertaken, with a focus on screening habitats present for their suitability to support any rare or notable species.

No specific reptiles and amphibian survey was undertaken. However, suitable habitats and activity for these groups were recorded during the course of the site walkover and mammal / fisheries investigations.

#### 4.2.4 Consultations

Preparation of this section included consultation, either directly or through publicly-available information, with:

- National Parks and Wildlife Service (NPWS);
- Inland Fisheries Ireland (IFI);
- Irish Peatland Conservation Council (IPCC);
- Geological Survey of Ireland (GSI);
- Botanical Society of the British Isles (BSBI);
- Birdwatch Ireland;

- Bat Conservation Ireland (BCI);
- British Trust for Ornithology (BTO)
- Environmental Protection Agency (EPA);
- National Biodiversity Data Centre (NBDC);
- Butterfly Ireland.

In response to the proposed development, the Development Applications Unit (DAU) of the National Parks and Wildlife Service of the Department of Department of Arts, Heritage and the Gaeltacht replied on the 31<sup>st</sup> May 2010 (Ref: G2010/152) with the following recommendations for the EIS:

- An ecological survey on the proposed development site carried out at appropriate times depending on the species being surveyed;
- An assessment of the impact of the development on flora, fauna and habitats, and in particular habitats listed on Annex I of the Habitats Directive, on areas important for birds, on species protected under the wildlife Acts of 1976 and 2000, on species listed on Annexes II and IV of the EC Habitats Directive (92/42/EEC) and on birds listed on Annex I of the EC Birds Directive (Council Directive 79/409 EEC);
- Suitable mitigation measures must be given where negative impacts are identified;
- Include mention of invasive alien species and methods required to ensure they are not accidentally introduced or spread during construction;
- An assessment of the impact on Natura 2000 sites and any other sites designated for nature conservation and appropriate mitigation measures if necessary with particular reference to the River Barrow and River Nore cSAC;
- Assessment of cumulative impacts with other plans or projects if applicable.

These recommendations have been recognised and addressed in this report. In addition, relevant documents recommended by the DAU in preparing this report have been used (e.g. Smith *et al.*, 2010). The DAU also recommended an Appropriate Assessment (AA) screening and if necessary AA be carried out for the proposed development. A separate AA has been prepared which considers effects of the proposed development on the Natura 2000 network.

The former Southern Regional Fisheries Board (now merged with other regional fisheries boards to form Inland Fisheries Ireland) replied in May 2010 with regard to the proposed development. The SRFB response included the following observations and comments:

- The waters in fisheries terms likely to be impacted act primarily as contributories to downstream habitat for juvenile salmonids and other species as well as macrophytes, algae and macroinvertebrates which a drift form a significant part of the food supply to the downstream fisheries of the Owenbeg catchment (Owenbeg catchment). They also, in the context of the proposed works have the potential to convey deleterious matter from those works such as concrete, silt, fuel, lubricating and hydraulic oils from construction plant and equipment downstream unless proper safeguards are in place;
- Stream structures should not damage fish habitat or create blockages to fish and macroinvertebrate passage;
- Pre-cast concrete should be used whenever possible, to eliminate the risk to all forms of aquatic life. When cast-in-place concrete is required, all work must be done in the dry and effectively isolated from any water that may enter the drainage network for a period sufficient to cure the concrete;

- Silt traps should be constructed at locations that will intercept run-off to the drainage network and should not be constructed immediately adjacent to watercourses. A buffer zone should remain between the silt trap and the watercourse with natural vegetation left intact so as to assist silt interception. All natural watercourses which have to be traversed during site development and road construction works should be effectively bridged prior to commencement;
- During the construction process and operation phase, natural flow paths should not be interrupted or diverted so as to give rise to create potential for erosion. Furthermore, excavation and installation of roads/access tracks should be undertaken so as not to result in the creation of preferential flow paths that may result in erosion;
- Where imported materials are used in road construction, these should be such as not to be liable to become crushed by vehicular movement, and lead to discharge of fine particles to downstream receiving waters;
- All oils and fuels should be stored in secure bunded areas, and particular care and attention should be taken during refuelling and maintenance operations on plant equipment. Where site works involve the discharge of drainage water to receiving rivers and streams, temporary oil interceptor facilities should be installed and maintained.

The observations and recommendations outlined by IFI have been acknowledged and have been incorporated into the mitigation measures to protect fish and fish habitats in watercourses draining the proposed development site.

#### 4.2.5 Evaluation

The impact significance is a combined function of the value of the affected feature (its ecological importance), the type of impact and the magnitude of the impact. It is necessary to identify the value of ecological features within the study area in order to evaluate the significance and magnitude of possible impacts. The ecological field survey and impact assessment has been prepared in line with the following guidelines:

- Guidelines on the information to be contained in Environmental Impact Statements (EPA 2002);
- Advice Notes on current practice in the preparation of Environmental Impact Statements (EPA, 2003);
- Institute of Ecology and Environmental Management Guidelines for Ecological Impact Assessment in the United Kingdom (IEEM 2006).

Ecological survey results were evaluated to determine the significance of identified features located in the study area on an importance scale ranging from international-national-county-local. The local scale is approximately equivalent to one 10km square but can be operationally defined to reflect the character of the area of interest. Because most sites will fall within the local scale, this is sub-divided into three categories: high local importance - local importance - local value. The criteria used are shown in **Table 4.2**.

The sensitivity of birds at the proposed development site was determined using a scheme developed by Percival (2003). The sensitivity of a bird species can be defined as its ecological importance and nature conservation interest at the site being assessed. The sensitivity of birds was evaluated using determining factors set out in **Table 4.3**.

Importance	Criteria
International Importance	<p>'European Site' including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA) or proposed Special Area of Conservation.</p> <p>Proposed Special Protection Area (pSPA). Site that fulfils the criteria for designation as a 'European Site' (see Annex III of the Habitats Directive, as amended).</p> <p>Features essential to maintaining the coherence of the Natura 2000 Network</p> <p>Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive.</p> <p>Resident or regularly occurring populations (assessed to be important at the national level) of the following:</p> <ul style="list-style-type: none"> <li>• Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or</li> <li>• Species of animal and plants listed in Annex II and/or IV of the Habitats Directive.</li> <li>• Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971).</li> <li>• World Heritage Site (Convention for the Protection of World Cultural &amp; Natural Heritage, 1972).</li> <li>• Biosphere Reserve (UNESCO Man &amp; The Biosphere Programme)</li> <li>• Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979).</li> <li>• Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979).</li> <li>• Biogenetic Reserve under the Council of Europe.</li> <li>• European Diploma Site under the Council of Europe.</li> <li>• Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988).</li> </ul>
National Importance	<p>Site designated or proposed as a Natural Heritage Area (NHA).</p> <p>Statutory Nature Reserve. Refuge for Fauna and Flora protected under the Wildlife Acts.</p> <p>National Park.</p> <p>Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA); Statutory Nature Reserve; Refuge for Fauna and Flora protected under the Wildlife Act; and/or a National Park. Resident or regularly occurring populations (assessed to be important at the national level) of the following:</p> <ul style="list-style-type: none"> <li>• Species protected under the Wildlife Acts; and/or</li> <li>• Species listed on the relevant Red Data list.</li> <li>• Site containing 'viable areas' of the habitat types listed in Annex I of the Habitats Directive.</li> </ul>
County Importance	<p>Area of Special Amenity. Area subject to a Tree Preservation Order.</p> <p>Area of High Amenity, or equivalent, designated under the County Development Plan.</p> <p>Resident or regularly occurring populations (assessed to be important at the County level) of the following:</p> <ul style="list-style-type: none"> <li>• Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;</li> <li>• Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;</li> <li>• Species protected under the Wildlife Acts; and/or</li> <li>• Species listed on the relevant Red Data list.</li> </ul> <p>Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National</p>

<i>Importance</i>	<i>Criteria</i>
	<p>importance.</p> <p>County important populations of species; or viable areas of semi-natural habitats; or natural heritage features identified in the National or Local BAP; if this has been prepared.</p> <p>Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county.</p> <p>Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.</p>
Local Importance (higher value)	<p>Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared;</p> <p>Resident or regularly occurring populations (assessed to be important at the Local level) of the following:</p> <ul style="list-style-type: none"> <li>• Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;</li> <li>• Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;</li> <li>• Species protected under the Wildlife Acts; and/or</li> <li>• Species listed on the relevant Red Data list.</li> <li>• Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality;</li> <li>• Sites or features containing common or lower value habitats, including naturalised species that are essential in maintaining links and ecological corridors between features of higher ecological value.</li> </ul>
Local Importance (lower value)	<p>Sites containing small areas of semi-natural habitat that are of some local importance for wildlife;</p> <p>Sites or features containing non-native species that are of some importance in maintaining habitat links.</p>

**Table 4.2: Criteria used to determine the value of ecological resources (taken from NRA, 2009)**

<i>Sensitivity</i>	<i>Determining Factor</i>
Very high	Species that form the cited interest of SPA's and other statutorily protected Nature conservation areas.
High	<p>Species that contribute to the integrity of an SPA but which are not cited as species for which the site is designated</p> <p>Ecologically sensitive species including: Divers, Common Scoter, Hen Harrier, Golden Eagle, Red-necked Phalarope, Roseate Tern and Chough</p> <p>Species present in nationally important numbers (&gt;1% of Irish population).</p>
Medium	<p>Species on Annex I of the EC Birds Directive</p> <p>Species present in regionally important numbers (&gt;1% regional (county)population</p> <p>Species on Bird Watch Ireland's red list of Birds of Conservation Concern</p>
Low	<p>Any other species of conservation interest, including species on Bird Watch Ireland's</p> <p>amber list of Birds of Conservation Concern not covered above</p>

**Table 4.3: Determination of sensitivity of birds (from Percival, 2003)**

#### 4.2.6 Assessment of Impact Type and Magnitude

Impact assessment takes account of both construction and operational impacts with reference to the potential for direct, indirect and synergistic impacts. The characterisation of impacts reflects the ecological structure and function upon which the key receptors depend. Detailed impact assessment takes into account the magnitude of impacts affecting populations or habitat extent. Identification of key receptors and the duration and timing of potential impacts is included. **Table 4.4** sets out the criteria for assessing impact magnitude. Impact types can be characterised as follows:

- Cumulative Impact: The addition of many small impacts to create one larger, more significant impact;
- ‘Do-Nothing Impact’: The environment as it would be in the future should no development of any kind be carried out;
- Indeterminable Impact: When the full consequences of a change in the environment cannot be described;
- Irreversible Impact: When the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost;
- Residual Impact: The degree of environmental change (impacts on integrity and conservation status of each of the key ecological receptors) that will occur after the proposed mitigation measures have taken effect. Account for uncertainty of mitigation;
- Synergistic Impact: Where the resultant impact is of greater significance than the sum of its constituents;
- ‘Worst Case’ Impact: The impacts arising from a development in the case where mitigation measures substantially fail.

<i>Impact magnitude</i>	<i>Definition</i>
No change:	No discernible change in the ecology of the affected feature.
Imperceptible Impact:	An impact capable of measurement but without noticeable consequences.
Slight Impact:	An impact which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate Impact:	An impact that alters the character of the environment that is consistent with existing and emerging trends.
Significant Impact:	An impact which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Profound Impact:	An impact which obliterates sensitive characteristics.

**Table 4.4: Criteria for assessing impact magnitude (NRA, 2009)**

The following terms are defined when quantifying duration:

- Temporary: up to 1 year;
- Short-term: from 1-7 years;
- Medium-term: 7-15 years;
- Long-term: 15-60 years;
- Permanent: over 60 years.

The magnitude of the possible impacts on birds that may occur on those species/populations recorded during the field surveys was determined by criteria in **Table 4.5**. The methodology

addresses this issue by quantifying the effect as far as possible, and expressing the size of that effect in relation to the existing baseline conditions. The assessments of magnitude and sensitivity lastly need to be brought together in order to determine the significance of the potential impact, and hence their acceptability in a planning context. The methodology achieves this by cross-tabulating the magnitude and sensitivity, using **Table 4.6** below, to give a prediction of the significance of each potential impact.

<i>Magnitude</i>	<i>Description</i>
Very high	Total loss or very major alteration to key elements/ features of the baseline conditions such that the post development character/ composition/ attributes will be fundamentally changed and may be lost from the site altogether. Guide: < 20% of population/habitat remains
High	Major loss or major alteration to key elements/ features of the baseline (pre-development) conditions such that post development character/ composition/ attributes will be fundamentally changed. Guide: 20-80% of population/ habitat lost
Medium	Loss or alteration to one or more key elements/features of the baseline conditions such that post development character/composition/attributes of baseline will be partially changed. Guide: 5-20% of population/ habitat lost
Low	Minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible but underlying character/composition/attributes of baseline condition will be similar to pre-development circumstances/patterns. Guide: 1-5% of population/ habitat lost
Negligible	Very slight change from baseline condition. Change barely distinguishable, approximating to the “no change” situation. Guide: < 1% population/ habitat lost

**Table 4.5: Determination of magnitude of effects on birds (from Percival, 2003)**

<i>Significance</i>		<i>Sensitivity</i>			
		<i>Very high</i>	<i>High</i>	<i>Medium</i>	<i>Low</i>
Magnitude	Very high	Very high	Very high	High	Medium
	High	Very high	Very high	Medium	Low
	Medium	Very high	High	Low	Very low
	Low	Medium	Low	Low	Very low
	Negligible	Low	Very low	Very low	Very low

**Table 4.6: Significance matrix: combining magnitude and sensitivity to assess significance**

#### 4.2.7 Limitations of the current assessment

The preparation of the current assessment did not encounter any limitations with respect to the timing of survey or seasonality restrictions. Areas of dense scrub and conifer plantation were impenetrable and difficult to survey and the precise extent of drainage channels may not be fully illustrated in the habitat mapping. However, this was not thought to have comprised the survey or assessment.

Results of a 12-month bird survey of the site completed during the period October 2010 and September 2011 and a bat survey completed during the period May 2012 to October 2012 were used to prepare the current chapter. These baseline surveys were based on a similar site layout so the extent of these surveys was deemed relevant to the current plan. As noted in EPA (2002), the

environment is an extremely complex combination of natural and human factors, many of which are constantly changing. To this end, additional bird and bat surveys were completed in 2014 to augment to the former studies. It is noted that there was little change in the habitats and results between the initial survey in 2012 and the subsequent survey in 2014. The combination of these surveys is considered to provide an adequate description of the existing environment against which future changes can be measured.

### 4.3 Description of the Existing Environment

#### 4.3.1 Designated Areas

Designated sites of ecological importance within 15km of the proposed development site are considered, including candidate Special Areas of Conservation (cSAC) and (SPAs) designated within the Natura 2000 network; as well as Natural Heritage Areas (NHA's). Enforcement of the protection of SPA's and SAC's in Ireland is provided by the transposition of the EU Habitats Directive (92/43/EEC) into Irish law, as the EC (Birds and Natural Habitats) Regulations (2011). Natura 2000 sites are also assessed in the accompanying Natura Impact Statement (NIS).

##### 4.3.1.1 Designated Natura 2000 sites

SAC's are designated sites of international importance because of the presence of habitats or species that are of European importance, listed on the EU Habitats Directive (1992). SPA's for birds are designated based on the presence of internationally significant populations of bird species, listed in Annex I of the EU Birds Directive (1979), amended by the Birds Directive (2009/147/EC) which was adopted to clarify the suite of amendments which had been required to the original 1979 Directive. Both of these regulations have been superseded by the EC (Birds and Natural Habitats) Regulations (2011).

The designated Natura 2000 sites within the study area are summarised below. **Figure 4.2** presents the location of the proposed development and the locations of the designated Natura 2000 sites within 15km of the study area for SACs and SPAs. The Natura 2000 sites within a 15km radius are:

- River Barrow and River Nore SAC (Site Code: 002162);
- Ballyprior Grassland SAC (Site Code: 2256);
- Lisbigney Bog SAC (Site Code: 000869);
- River Nore SPA (Site Code: 004233).

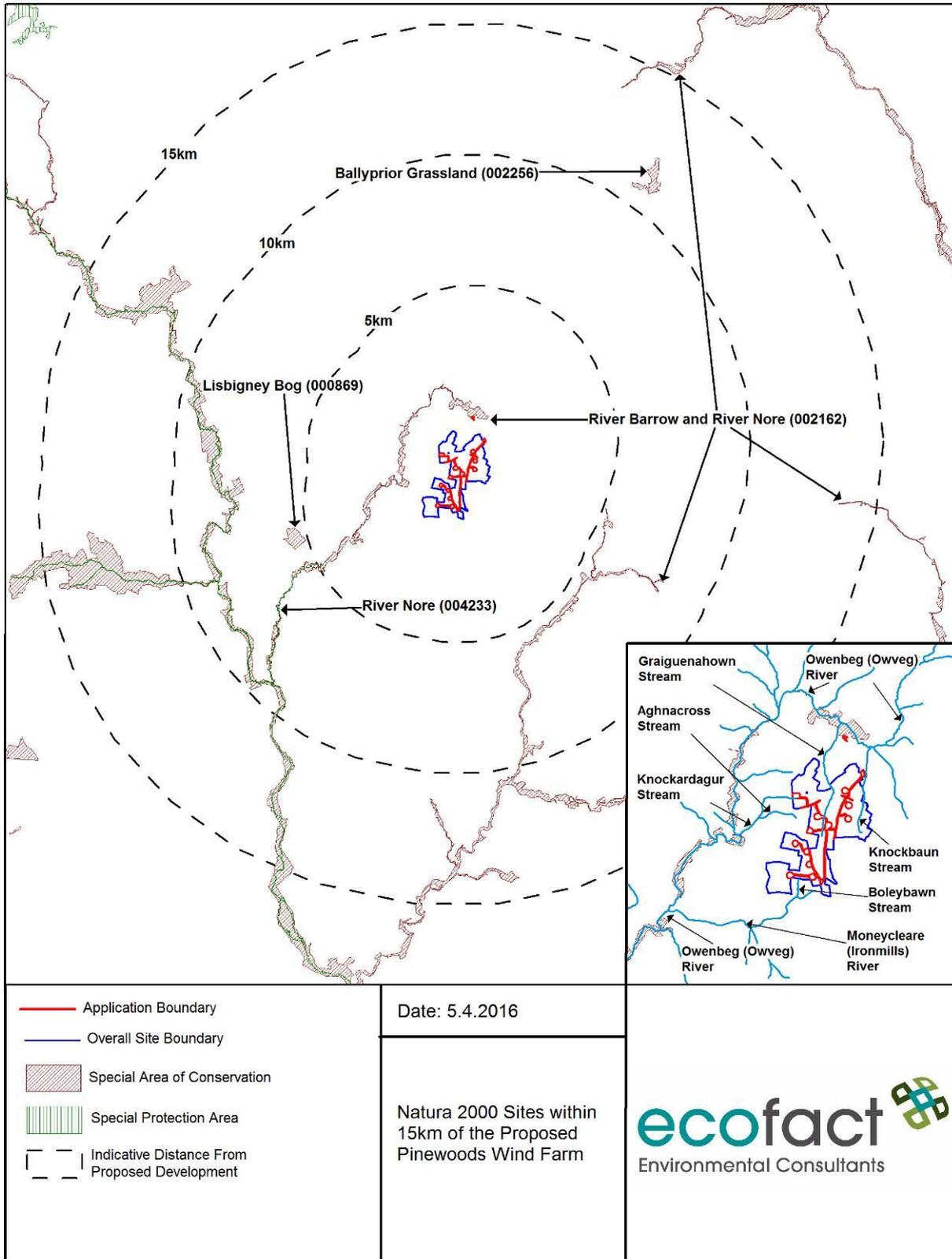
Sites lying outside of a 15km radius were assessed and no pathways or connections between the proposed development and these additional designated sites were identified with regard to this EIS. A more detailed evaluation of the designated Natura 2000 sites within a 15km radius of the proposed development is provided in the separate NIS.

##### ***River Barrow and River Nore SAC (Site Code: 002162)***

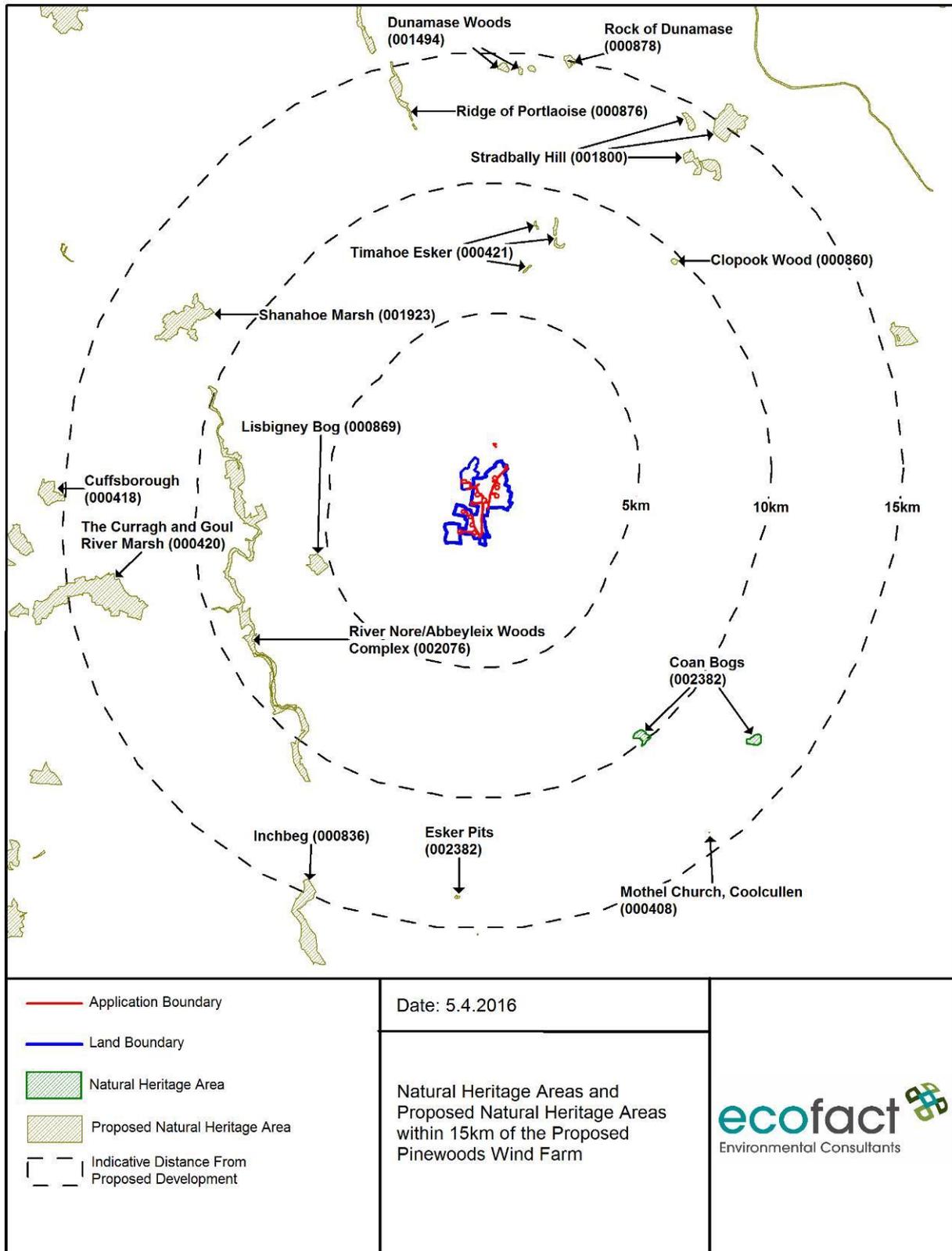
At its closest, the proposed development (junction upgrade) is located approximately 40m to the south of the River Barrow and River Nore SAC. This minor component of the proposed development is located ca. 130m to the east of the lower reach of the Graiguenahown Stream and ca. 180m south west of the Owenbeg River within the designation.

The principal component of the proposed development (turbines, hardstands, etc.) lies ca. 770m to the south of the River Barrow and River Nore SAC (or 1.43 km hydrological distance), where the Owenbeg River is part of the designation. The proposed development is also located ca. 1.14km to the east and 5.5km to the west of the River Barrow and River Nore cSAC, but the latter distance refers to a part of the Dinin (north) River within the designation, a subcatchment of the River Nore that would not be affected by the proposal. The Graiguenahown Stream and the Knockbaun Stream are two first order watercourses which rise within the proposed development boundary and flow

north into the Owenbeg River. The Knockardagur Stream, another tributary of the Owenbeg River drains the western component of the proposed development. The southern extent of the site is upslope of the Moneyclare River (also known as the Ironmills River) which also flows into the Owenbeg River. The site synopsis for the River Barrow and River Nore SAC is provided in **Appendix 4.1**.



**Figure 4.2: Map showing the Special Areas of Conservation and Special Protection Areas within 15km of the proposed Pinewoods Wind Farm site**



**Figure 4.3: Map showing the Natural Heritage Areas and Proposed Natural Heritage Areas within 15km of the proposed Pinewoods Wind Farm site**

The River Barrow and River Nore SAC (Site Code: 002162) is selected for alluvial wet woodlands and petrifying springs, priority habitats on Annex I of the E.U. Habitats Directive, 1992. The site is also selected as a SAC for old oak woodlands, floating river vegetation, estuary, tidal mudflats, *Salicornia* mudflats, Atlantic salt meadows, Mediterranean salt meadows, dry heath and eutrophic tall herbs, all habitats listed on Annex I of the Habitats Directive. As well as habitats, the SAC has been selected due to the presence of invertebrate, fish and mammal species which are listed under Annex II of the EU Habitats Directive, including freshwater pearl mussel (*Margaritifera margaritifera* and its hardwater form *M. durrovensis*), freshwater crayfish (*Austropotamobius pallipes*), Atlantic salmon (*Salmo salar*), twaite shad (*Alosa fallax fallax*), the three Irish Lamprey species - sea (*Petromyzon marinus*), brook (*Lampetra planeri*) and river (*Lampetra fluviatilis*), the Desmoulin's whorl snail *Vertigo moulinsiana* and Eurasian otter (*Lutra lutra*). The qualifying interests of the River Barrow and Nore SAC are presented in **Table 4.2** and are discussed individually below. The NPWS details the conservation objectives of the River Barrow and River Nore SAC (NPWS, 2011).

*Evaluation:* The River Barrow and River Nore SAC is evaluated as being of International Importance for the conservation of habitats and species listed on Annex II of the EU Habitats Directive.

#### **Ballyprior Grassland SAC (Site Code: 002256)**

Ballyprior Grassland SAC is located approximately 11.1km north east of the proposed development site. There are no overland hydrological connections between this designated site and the proposed development site. Ballyprior Grassland SAC consists of a limestone plateau supporting open calcareous grassland with occasional rocky scarps and valleys, but with little surface water and no streams. An estimated 35 hectares, 45% of the site area, consists of the Annex 1 priority habitat, orchid-rich calcareous grassland, which supports a rich diversity of both calcicole and calcifuge species, the latter occurring on mineral poor drift. The site has an exceptionally rich mycoflora and this is a better indication of grassland quality (in terms of continuity, lack of disturbance and low nutrient status) than the vascular flora. The Irish Hare, *Lepus timidus hibernicus* recorded as occurring in the site. This sub-species is listed in Annex III of the Bern Convention and in the Red Data Book as Internationally Important. It is legally protected by the Wildlife Act (1976).

*Evaluation:* Ballyprior Grassland SAC is evaluated as being of International Importance.

#### **Lisbigney Bog SAC (Site Code: 000869)**

Lisbigney Bog SAC comprises a small wetland situated c.5 km north-east of Durrow. The principal habitat is fen, with reed swamp, wet grassland, pools and scrub also occurring. At present, the site is not used for any particular activity other than light grazing. The site supports a population of the Annex II snail *Vertigo moulinsiana*. The site contains a small though significant example of *Cladium mariscus* fen. Similar habitat in this part of the country is scarce. All recently surveyed sites with confirmed populations of this species are considered important.

*Evaluation:* Lisbigney Bog SAC is evaluated as being of International Importance for the conservation of habitats and species listed on Annex I of the EU Habitats Directive.

#### **River Nore SPA (Site Code: 004233)**

The River Nore SPA is a long linear site located approximately 4km south-west of the proposed development. It includes the following river sections: the lower reaches of the Owenbeg River, the River Nore from the bridge at Townparks, (north-west of Borris-in-Ossory) to Coolnamuck (approximately 3km south of Inistioge) in Co. Kilkenny; the Delour River from its junction with the River Nore to Derrynaseera Bridge (west of Castletown) in Co. Laois; the Erkina River from its junction with the River Nore at Durrow Mills to Boston Bridge in Co. Laois; a 1.5 km stretch of the River Goul upstream of its junction with the Erkina River; the Kings River from its junction with the River Nore to a bridge at Mill Island Co. Kilkenny. The site includes the river channel and marginal vegetation. The

River Nore support nationally important numbers of Kingfisher *Alcedo atthis*. Other species which occur within the site include *Cygnus olor*, *Anas platyrhynchos*, *Phalacrocorax carbo*, *Ardea cinerea*, *Gallinula chloropus*, *Gallinago gallinago* and *Riparia riparia*.

*Evaluation:* The River Nore SPA is evaluated as being of International Importance.

#### 4.3.1.2 Natural Heritage Areas and Proposed Natural Heritage Areas

Sites of national ecological importance in the Republic of Ireland are designated as Natural Heritage Areas (NHA's) or proposed Natural Heritage Areas (pNHA's). NHA and pNHA sites within a 15km radius of the proposed development site have been identified. The locations of these sites are shown in **Figure 4.3**. The NHA and pNHA sites include:

- Lisbigney Bog pNHA (Site Code: 000869) located approximately 5.1km west of the proposed development site;
- Timahoe Esker pNHA (Site Code: 000421) located approximately 6.5km north of the proposed development site;
- River Nore/Abbeyleix Woods Complex pNHA (Site Code: 002076) located approximately 7km west of the proposed development site;
- Coan Bogs NHA (Site Code: 002382) located approximately 9km south east of the proposed development site;
- Shanahoe Marsh pNHA (Site Code: 001923) located approximately 11.5km north west of the proposed development site;
- The Curragh and Goul River Marsh pNHA (Site Code: 000420) located approximately 12 km west of the proposed development site;
- Stradbally Hill pNHA (Site Code: 001800) located approximately 12.5km north east of the proposed development site;
- Ridge of Portlaoise pNHA (Site Code: 000876) located approximately 12.5km north of the proposed development site;
- Esker Pits pNHA (Site Code: 002382) located approximately 13km south of the proposed development site;
- Inchbeg pNHA (Site Code: 000836) located approximately 14km south west of the proposed development site;
- Mothel Church pNHA (Site Code: 000408) located approximately 14km south east of the proposed development site;
- Cuffsborough pNHA (Site Code: 00418) located approximately 15km west of the proposed development site;
- Dumanase Woods pNHA (Site Code: 001494) located approximately 14.5km north of the proposed development site.

The only site which lies within 5km of the proposed development is Lisbigney Bog pNHA. This site is designated for the presence of fen, reed swamp, wet grassland, pools and scrub. The site is also co-designated within Lisbigney Bog cSAC. The other NHA/pNHA sites are considered to lie outside of the potential impact zone of the proposed development and no pathways or connections between the proposed development site and these designations are identified.

*Evaluation:* All NHA and pNHA sites are evaluated as being of National Importance.

### 4.3.2 Flora

The different habitat types (as classified according to Fossitt, 2000) recorded from within the proposed development site are listed in **Table 4.5** and described individually below. The habitat code according to Fossitt (2000) is in brackets after the habitat name. A list of plant species recorded by habitat is provided in each habitat description. Habitat survey and mapping followed the Heritage Council guidelines (Smith *et al.*, 2011). The evaluation of the ecological importance of the habitats recorded from the site follows the NRA (2009) guidelines. A list of plant species by habitat is provided in **Appendix 4.5, Table A5.1**. Habitats identified as key ecological receptors recorded from within the study area are presented in **Table 4.6**. Habitat mapping for the proposed development site is presented in **Figures 4.4a and 4.4b**.

The general proposed development area can be described as elevated, and rated as 'marginal' from an agricultural point of view. The proposed development site is dominated by commercially planted coniferous forestry and agricultural grassland; habitats which are evaluated as being of Local Importance, Lower Value with respect to botanical diversity. The field survey included an assessment of the overall site and the proposed turbines and associated infrastructure. Proposed turbines T05, T06, T08, T09 and T10 would be located in commercial forestry, the latter three alongside existing tracks. The remainder of the proposed turbines would be located in grassland habitats and some adjacent to commercial forestry/hedgerows.

<i>Habitat Code</i>	<i>Habitat name</i>
WD4	Conifer plantation
WD5	Scattered Trees & Parkland
WL1	Hedgerows
WL2	Treelines
WS1	Scrub
GA1	Improved agricultural grassland
GS4	Wet grassland
FW1	Eroding / Upland watercourse
FW4	Drainage Ditch
BL2	Earth Banks
BL3	Buildings & Artificial Surfaces
ED2	Spoil & Bare Ground

**Table 4.5: List of the habitat types recorded from the proposed Pinewoods Wind Farm site (according to Fossitt, 2000) with corresponding Annex I habitats identified**

#### 4.3.2.1 Conifer plantation (WD4)

The proposed development site is predominantly under commercial conifer plantation, where approximately 2km<sup>2</sup> of the proposed development site has been planted. These areas of non-native trees were found to be dominated by Sitka Spruce *Picea sitchensis*, Lodgepole Pine *Pinus contorta*, with Larch *Larix* spp. also recorded. Within the forestry patches of Ling *Calluna vulgaris* and Hare's-tail Cottongrass *Eriophorum vaginatum* were found in areas where there had been peatland habitat prior to afforestation. Plants more typical of mineral soils such as Oxeye Daisy *Leucanthemum vulgare*, Common Knapweed *Centaurea nigra* and Creeping Buttercup *Ranunculus repens* were found in drier areas. Ditches and wet ground had Rushes *Juncus* sp. while there were broad-leaved native trees also such as Hawthorn *Crataegus monogyna*, Rowan *Sorbus aucuparia* and Willow *Salix*

sp. Areas of more recently planted woodland had a larger broad-leaved component than older stands.

*Evaluation:* The coniferous plantations within the study area are evaluated as being of low local importance with regard to ecological interests, as they are species poor with relatively poor understory vegetation and they also are too wet on the ground to support badger or other ground dwelling mammals. This habitat is rated as Local Importance, Lower Value with regard to botanical and habitat diversity.

#### 4.3.2.2 Improved agricultural grassland (GA1)

This habitat was recorded from the northern portion of the study area where agricultural intensity was low, and also from the south western extent of the site where this habitat dominates. Much of the improved grassland within the study area was on shallow soils with poor drainage. Most of these fields are used for cattle grazing. Plant species present included Timothy *Phleum pratense*, Sweet-vern Grass *Anthoxanthum odoratum*, Meadow Fox-tail *Alopecurus geniculatus*, Yorkshire fog *Holcus lanatus*, and soft rush *Juncus effusus* frequent in wetter areas.

*Evaluation:* This habitat type is common in the surrounding countryside; species that occur are all common in the wider countryside. The habitat is managed to varying degree within the study area. Intensive agricultural grasslands are of low biodiversity value due to high nutrient inputs and low species diversity. Overall, this habitat is rated as being of Local Importance, Lower Value only.

#### 4.3.2.3 Wet grassland (GS4)

Abandoned agricultural pasture and lands where there is low level maintenance occur within the study area was classified as wet grassland. These areas are dominated by soft rush with gorse also encroaching occurring. Occasional Cuckoo-flower *Cardamine pratensis*, Lesser Spearwort *Ranunculus acris* and Meadowsweet *Filipendula ulmaria*. In one very small area, on the brow of a hill to the north, an emergent heath vegetation is apparent, with Ling, Lousewort *Pedicularis sylvatica* and Tormentil *Potentilla erecta*.

*Evaluation:* Overall, this habitat is also rated as being of Local Importance, Lower Value only.

#### 4.3.2.3 Hedgerows (WL1)

Hedgerows occur at various locations within the site, and were more frequently associated with the improved agricultural landscape at the south western extent of the site. Hedgerow habitats were found to be dominated by Willow scrub and Hawthorn *Crataegus monogyna*, with Blackthorn (*Prunus spinosa*), Gorse *Ulex europaeus* and Bramble *Rubus fruticosus* agg. also occurring. Vegetation along the base of the hedgerows can be dense and diverse, with the community of Bilberry *Vaccinium myrtillus*, Common Haircap *Polytrichum commune* and Wood-sorrel *Oxalis acetosella* being particularly characteristic at this elevation.

*Evaluation:* Hedgerow habitats can act as wildlife corridors for bird and mammal species. Hedgerows are evaluated as being of Local Importance, Higher Value with respect to wildlife connectivity; however, hedgerow habitats within the study area are poorly connected.

#### 4.3.2.4 Treelines (WL2)

Treelines were infrequently recorded from within the study area as field boundaries greater than 5m in height. A few isolated treelines occur at the south western extent of the site and were dominated by Ash *Fraxinus excelsior*, Rowan *Sorbus aucuparia* with Oak *Quercus* sp. occasional. Treelines to the north of the site were dominated by mature Sycamore *Acer pseudoplatanus* and Horse chestnut *Aesculus hippocastanum*.

*Evaluation:* Treelines of native species including ash may be of some use to birdlife for feeding and nesting purposes and also for mammal species, due to the insect diversity associated with the

understory vegetation. Treelines are of Local Importance, Higher Value with respect to wildlife connectivity; however, within the proposed development site treelines were infrequent.

#### 4.3.2.5 Scrub (WS1)

Small areas of scrub dominated by Gorse *Ulex europaeus* or Brambles *Rubus fruticosus* agg. occur throughout the site. Scrub is a form of transitional woodland and while it can have a low diversity of plant species it can be of value as cover for mammals and birds. Scrub of willow was frequently recorded along the riparian corridors of the minor watercourses draining the site and is of value for protecting the riparian zone, although excessive cattle access has diminished this somewhat. Scrub also occurred in open areas within the conifer plantation and along the roadside verges within the site.

*Evaluation:* This habitat is rated as being of Local Importance, Higher Value in respect of the botanical diversity within the habitat. However, it provides important forage and cover for both breeding bird species and mammalian fauna.

#### 4.3.2.6 Eroding upland watercourses (FW1)

The Graiguenahown Stream and the Knockbaun Stream are two first order watercourses which rise within the proposed development boundary and flow north into the Owenbeg River. These minor first order high gradient watercourses correspond with eroding upland watercourse habitat (FW1). These streams drain areas predominantly under coniferous forestry and are generally heavily shaded. Though the riparian corridors of these streams are generally affected by coniferous plantations they still retain semi-natural scrub habitat. The substrate in these watercourses is mostly of rock. Extensive areas of cattle poaching could be seen along the Graiguenahown Stream within the proposed development site where open grassland and scrub bordered the stream. The proposed development site is within parts of the Owenbeg, Ironmills (Moneyclare) and Dinin sub-catchments and all watercourses draining the proposed development site flow ultimately into the River Nore. Water levels in these watercourses fluctuate greatly according to season and rainfall events. When seen in September 2014, both the Graiguenahown Stream and the Knockbaun Stream were dry within the proposed development site boundary. Water levels in the Moneyclare River were very low at this time.

*Evaluation:* Watercourses within the proposed development site was found to be impacted and are not suitable for brown trout. Within the site, this habitat is evaluated as being of Local Importance, Lower Value. Further downstream and outside of the proposed development site, the lower reaches of the Graiguenahown Stream and the Knockbaun Streams support salmonids and are rated as being of Local Importance, Higher Value. The Owenbeg River drains the northern portion of the site and is designated within the River Barrow and River Nore SAC downstream of the site, this watercourse is therefore of International Importance downstream of the proposed development site.

#### 4.3.2.7 Drainage Ditches (FW4)

This category includes linear water bodies or wet channels that are entirely artificial in origin, and some sections of natural watercourses that have been excavated or modified to enhance drainage and control the flow of water. Drainage ditches occur along field boundaries, between stands of commercial forestry and within blocks of commercial forestry (not mapped). Water levels in many of the drainage ditches within the study area are considered to fluctuate and were found to be dry during the current field surveys.

*Evaluation:* This habitat is of Local Importance, Lower Value with regard to botanical and habitat diversity.

#### 4.3.2.8 Earth Banks (BL2)

Earth banks are a common type of field boundary in the Ballinakill area. Within the proposed development site, this habitat is constructed from local materials including earth, stone and peat to a

lesser degree. Some of these earth banks are bordered by drainage ditches. Species composition varied according to drainage and included patches of Ling *Calluna vulgaris* and Hare's-tail Cottongrass *Eriophorum vaginatum* (peat based habitat) to Oxeye Daisy *Leucanthemum vulgare*, Common Knapweed *Centaurea nigra* and Creeping Buttercup *Ranunculus repens*, plants more typical of mineral soils.

*Evaluation:* This habitat is of Local Importance, Lower Value with regard to botanical and habitat diversity.

#### **4.3.2.9 Buildings & Artificial Surfaces (BL3)**

Buildings and areas of land that are covered with artificial surfaces including roads, yards and driveways within the study area correspond to the habitat 'buildings and artificial surfaces'.

*Evaluation:* This habitat is of Local Importance, Lower Value with regard to botanical and habitat diversity.

#### **4.3.2.10 Spoil & Bare Ground (ED2)**

This category includes areas of bare ground that are either very transient in nature, or persist for longer periods of time because of ongoing disturbance or maintenance. Such conditions occur on tracks used to access conifer plantation vegetation where vegetative cover does not exceed 50%.

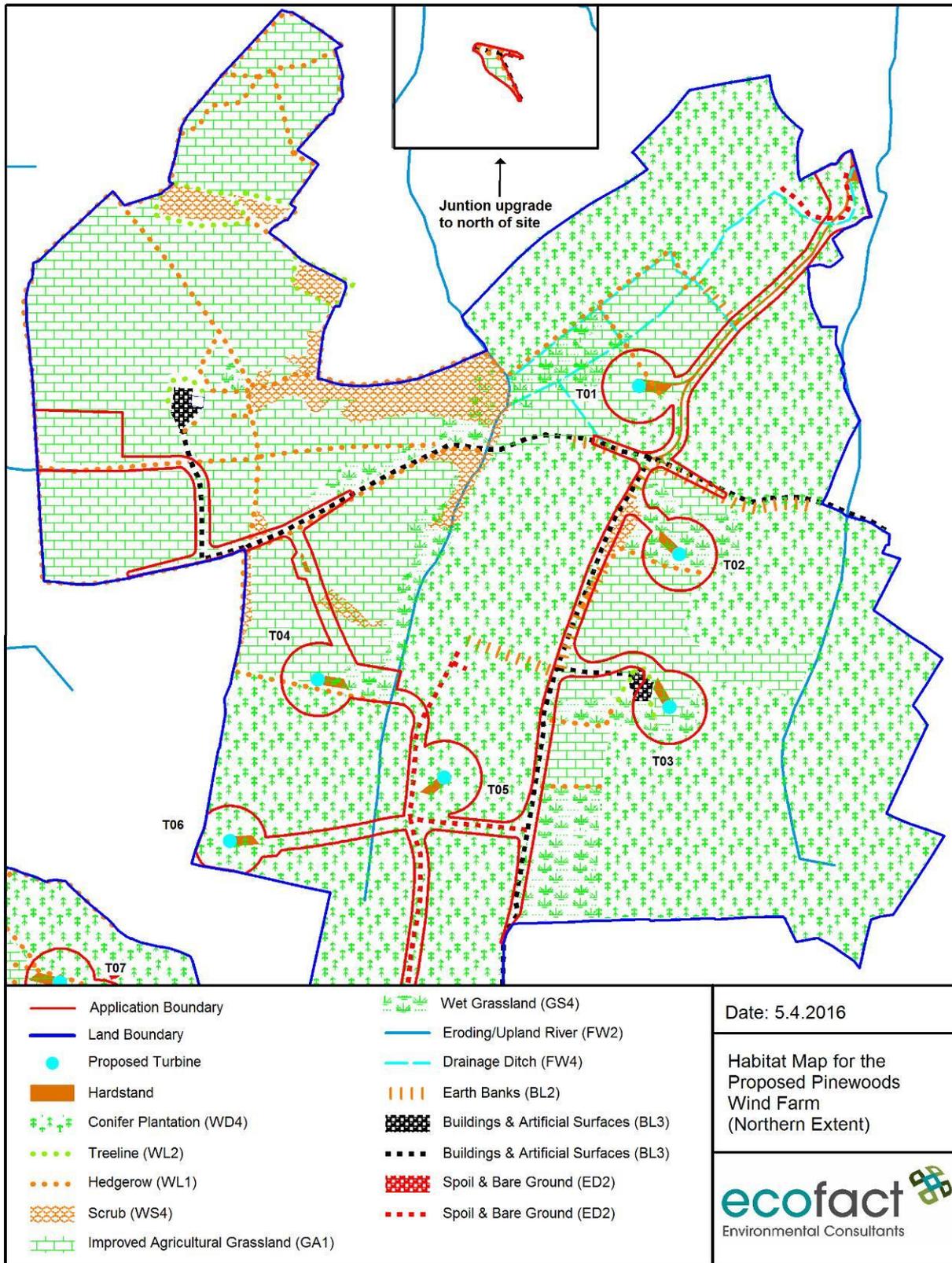
*Evaluation:* This habitat is of Local Importance, Lower Value with regard to botanical and habitat diversity.

#### **4.3.2.11 Rare plant species**

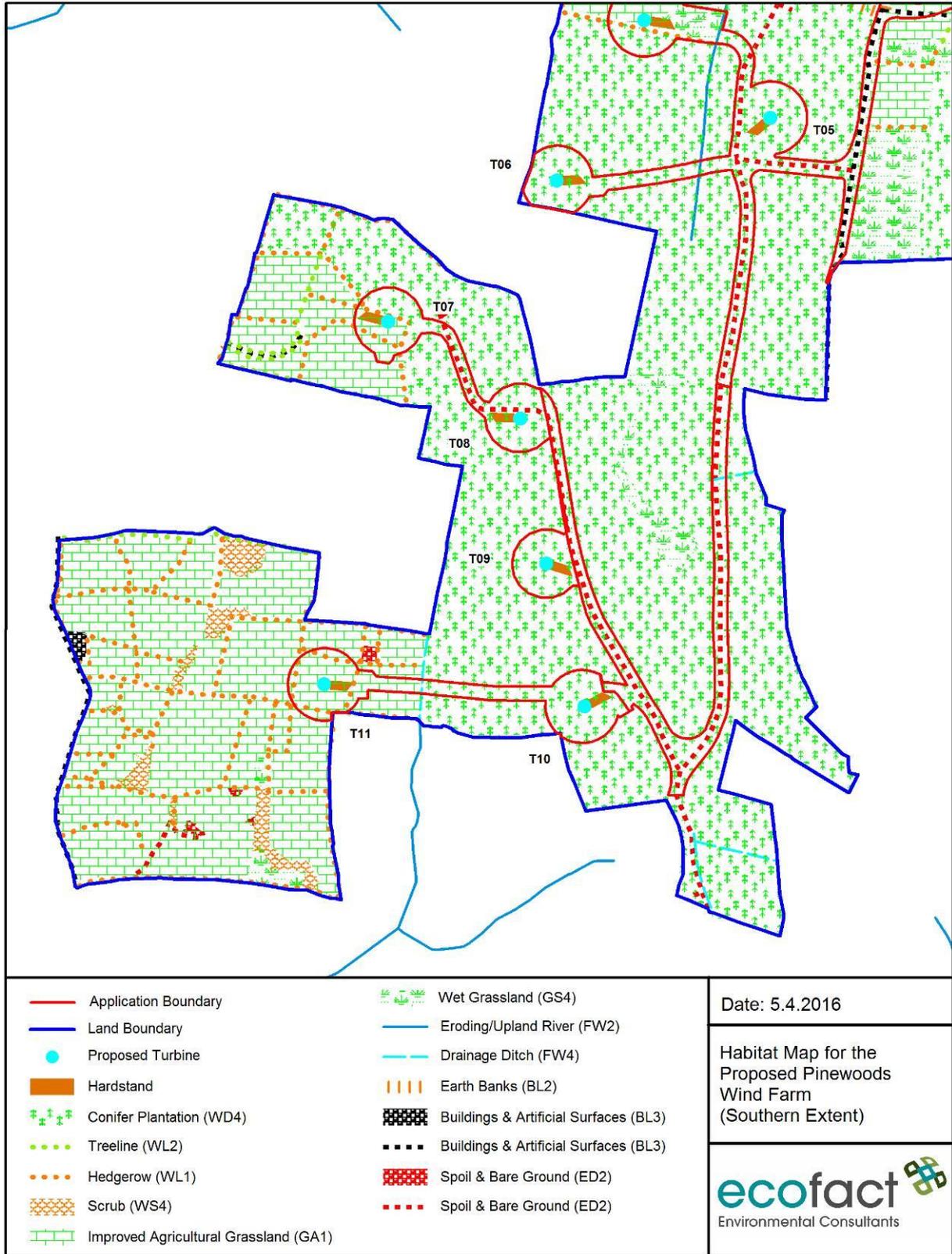
Common plant species recorded during the field survey are detailed in the habitat descriptions above. During the field survey, the habitats were also assessed with respect to their potential suitability for rare plants. The proposed development site lies within the 10km grid squares S48 and S58. Records of rare flora for this grid square within the NPWS online database and the Irish Biodiversity Data Centre online database. No rare flora species protected under the Flora (Protection) Order of 1999 or included in the Irish Red Data Book (Curtis and McGough, 1988) were recorded for the 10km grid squares covering the proposed development site and no protected flora were recorded from within the study area during the current survey.

#### **4.3.2.12 Non-native invasive flora**

During the course of the current assessment no non-native, invasive flora were recorded from within the Pinewoods Wind Farm site. Cherry laurel *Prunus laurocerasus*, New Zealand Pygmy weed *Crassula helmsii*, Canadian waterweed *Elodea canadensis*, Japanese knotweed *Fallopia japonica*, Least duckweed *Lemna minuta*, Rhododendron *Rhododendron ponticum* and Pitcherplant *Sarracenia purpurea* are non-native plant species recorded in the 10km grid squares S48 and S58 which collectively cover the proposed development site.



**Figure 4.4a: Habitat map showing the northern section of the proposed development site**



**Figure 4.4b:** Habitat map showing the southern section of the proposed development site

### 4.3.3 Fauna

Detailed field surveys were carried out within the study area of the proposed development site. **Table 4.7** presents a summary description and evaluation of the fauna recorded or considered likely to occur within the study area.

The proposed development site is elevated and highly modified, and dominated by habitats of low ecological value such as coniferous plantation and agricultural grassland. This reduces the importance of the site for both non-volant mammals and bats. The streams on the site are small, and subject to drying out. This reduces their ecological importance; however these streams are in the River Nore catchment and therefore drain into the Natura 2000 network and, using a precautionary approach and conservative methodology, hydro-connectivity between the site and that network has been assumed for the basis of this EIS. Atlantic salmon occur within the main stem of the Owenbeg River downstream of the proposed development site. The site is not of significant importance to amphibians; however the protected Common Frog *Rana temporaria* does occur on the site. The fauna of the site are discussed and evaluated below.

Habitat/site	Description	Evaluation
Eroding/upland watercourses (FW1)	The minor watercourses draining the northern portion of the study area are tributaries of the Owenbeg River.	The watercourses draining the Pinewoods Wind Farm site are evaluated as being of high local importance downstream of the site.  The Owenbeg River drains the northern portion of the site and is designated within the River Barrow and River Nore cSAC downstream of the site, this watercourses is therefore of International Importance. The lower reaches of the Graiguenahown Stream are also within this cSAC so warrant the same importance.
Scrub (WS1), hedgerows (WL1) and treelines (WL2)	These habitats were found to be limited to river corridors and along field boundaries and residential boundaries.	These habitats are of Local importance (Higher Value) as they provide an ecological function as wildlife corridors for fauna and also for local flora.

**Table 4.6: Habitats of ecological importance identified as key ecological receptors within the proposed development site (watercourses downslope also included)**

#### 4.3.3.1 Non-volant mammals

The Wildlife Act (1976) and the Wildlife (Amendment) Act (2000) protect most of our native mammals. **Table 4.8** presents a list of protected mammals recorded or expected to occur within the 10km grid squares (S48 and S58). This table has been adapted from information presented in NPWS (2008), the NBDC and recent national survey data for Red Squirrel *Sciurus vulgaris*, Pine Marten *Martes martes* and Otter *Lutra lutra*. Overall, a total of 21 mammal species have been recorded, in the 20km<sup>2</sup> covered by 10km grid squares S48 and S58, most which could use the proposed development site to one degree or another.

The mammal survey involved pre-identification of suitable mammal habitats using aerial photography. Important features of ecological interest in relation to non-volant mammals within the study area are annotated on **Figure 4.5**.

<i>Fauna species</i>	<i>Description</i>	<i>Evaluation</i>
Non-volant mammals	Non-volant mammal species recorded within the study area were found to comprise species common in the Irish countryside including rabbit and hedgehog. The site was dominated by coniferous plantation with a large proportion of grassland habitats. Limited habitat was recorded for species listed on the Irish Red Data List and the Irish Wildlife Act (1976 and 2000) including badger and Irish hare.	Mammal species recorded are evaluated as being of low local to high local importance, with limited suitable habitat within the study area. Badger and Irish hare occurring within the site are identified as being of high local importance.
Bats	Four bat species were recorded during the current assessment – Soprano Pipistrelle, Common Pipistrelle, Leisler's bat and Natterer's bat. These species had sparse distribution within the study site. The coniferous forestry which is the dominant habitat type present within the proposed development area is unsuitable for bat roosting. The habitats in this area are suboptimal for bat foraging.	Bat species within the Pinewoods Wind Farm site were found to occur in numbers of low local importance; however, due to their protection status all bats are evaluated as being of high ecological value.
Birds	The only Red listed species found in this study were Woodcock and Meadow Pipit. Meadow Pipit is a widespread and common passerine found in grassland in Ireland. The study area is suboptimal for woodcock given the low density of woodland and only one bird was recorded. Thirteen Amber Listed species were also recorded. The only raptors that were recorded on or near the study site were Sparrowhawk and Kestrel.	Scrub, hedgerow and wet grassland within the Pinewoods Wind Farm site are habitats evaluated as being of local importance (higher value) for avifauna. Other habitats are evaluated as being of local importance (lower value).
Fish communities	The proposed development site is located on elevated ground around the watershed of sub-catchments of the River Nore. The minor 1 <sup>st</sup> order watercourses within the Pinewoods Wind Farm site were found to be insignificant in terms of salmonid production as they were unsuitable for the spawning and nursery requirements of salmonids and were almost dried out during the summer of 2014.  Larger watercourses such as the Owenbeg River downslope of the site support brown trout and salmon where suitable nursery and rearing areas occur. European eel, minnow, stone loach and three-spined stickleback are also expected to occur in	Atlantic salmon is listed on Annex II of the EU Habitats Directive and occurs within the Owenbeg River within the River Barrow and River Nore cSAC designation downstream of the Pinewoods Wind Farm site.  This watercourse is evaluated as being Internationally Important. Salmon can be expected to occur upstream of the cSAC designation, but downstream of the proposed development site boundary. Brown trout and European eel are evaluated as being of high local importance within the study area.

<i>Fauna species</i>	<i>Description</i>	<i>Evaluation</i>
	larger watercourses downstream of the site.	Watercourses within the proposed development are evaluated as being of local importance (lower value) with regard to fish communities.
Reptiles and amphibians	Amphibians recorded within the study are limited to frogs. Suitable habitat for the smooth newt does not occur. The common lizard may potentially occur although it was not recorded during the field survey.	The common frog was recorded from the Pinewoods Wind Farm site and is evaluated as being of high local importance.
Invertebrates	<p>Aquatic macroinvertebrate diversity within the study area was found to be representative of small upland watercourses with background impacts identified with regard to biological water quality. No protected aquatic macroinvertebrates were recorded from within the study area.</p> <p>Terrestrial invertebrates characteristic of wet grassland, scrub and hedgerow habitats were recorded.</p>	<p>Aquatic macroinvertebrates within the study area are evaluated as being of low local importance.</p> <p>Terrestrial invertebrates within the study area are evaluated as being of low local importance.</p>

**Table 4.7: Evaluation of fauna within the study area and features at national/county/local scale**

<i>Species</i>	<i>Indication of population</i>	<i>Level of Protection</i>	<i>Occurrence within the proposed wind farm site.</i>
Badger <i>Meles meles</i>	Found throughout Ireland	Wildlife Act, 1976, though exceptions are written into the Act.	Evidence of foraging within the site and inactive setts recorded.
Hedgehog <i>Erinaceus europaeus</i>	Found throughout Ireland;	Appendix III of the Bern Convention	Occurs within the site
Irish stoat <i>Mustela arminea</i>	Found throughout Ireland	Appendix III of the Bern Convention	Likely to occur within the site
Pygmy shrew <i>Sorex minutus</i>	Found throughout Ireland	Appendix III of the Bern Convention	Occurs within the site
Otter <i>Lutra lutra</i>	Found throughout Ireland;	Annex II and IV of Habitats Directive Appendix III of the Bern Convention.	Occurs within the watercourses downstream of the site e.g. Owenbeg River.
Irish hare <i>Lepus timidus hibernicus</i>	Found throughout Ireland	Irish Red Data Book 'Internationally Important'. Annex V of the Habitats Directive. Appendix III Bern Convention.	Recorded from within the site.
Pine marten <i>Martes martes</i>	Restricted to woodland or scrub;	Wildlife Act, Annex V and IV of Habitats Directive (European interest), Appendix III of the Bern Convention.	May occasionally use the proposed development site.
Red squirrel	Distributed widely	Protected under the Wildlife Act;	Not recorded from the

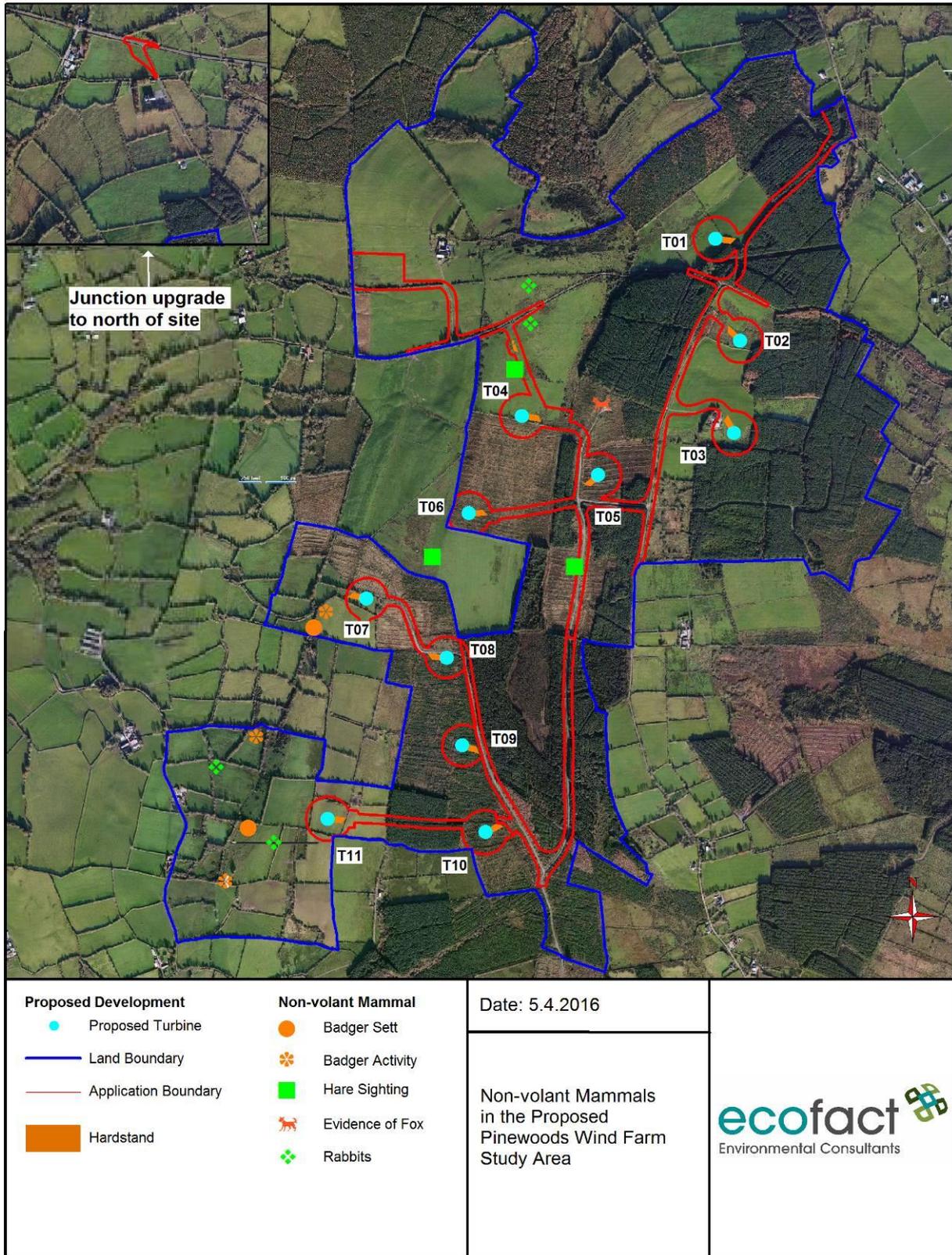
<i>Species</i>	<i>Indication of population</i>	<i>Level of Protection</i>	<i>Occurrence within the proposed wind farm site.</i>
<i>Sciurus vulgaris</i>	through Ireland;	classified as near threatened in a global context in the 2000 IUCN Red List of Threatened Species.	site but may occur.
Natterer's Bat <i>Myotis nattereri</i>	Distributed widely through Ireland	Annex IV of the EU Habitats Directive and Appendix II of the Bern Convention.	Could possibly occur in the site.
Daubenton's bat <i>Myotis daubentonii</i>	Distributed widely through Ireland	Irish Red Data Book 'Internationally important', Annex IV of the EU Habitats Directive and Appendix II of the Bern Convention.	Unlikely to occur within the study area due to lack of suitable waterbodies and suitable roost habitat.
Common pipistrelle <i>Pipistrellus pipistrellus</i>	Found throughout Ireland	Irish Red Data Book 'Internationally important', Annex IV of the EU Habitats Directive and Appendix II if the Bern Convention.	Recorded from within the site.
Soprano pipistrelle <i>Pipistrellus pygmaeus</i>	Found throughout Ireland.	Irish Red Data Book 'Internationally important', Annex IV of the EU Habitats Directive and Appendix II if the Bern Convention.	Recorded from within the site.
Fallow deer <i>Dama dama</i>	Distributed widely through Ireland.	Wildlife Act, 1976.	Likely to occur within the site.
Wood Mouse <i>Apodemus sylvaticus</i>	Distributed widely through Ireland.		Likely to occur within the site.
Bank Vole <i>Myodes glareolus</i>	Found throughout Ireland.	Invasive Species: Invasive Species. Medium Impact Invasive Species	Likely to occur within the site.
Lesser Noctule <i>Nyctalus leisleri</i>	Found throughout Ireland	Protected Species: EU Habitats Directive, Annex IV, Protected Species: Wildlife Acts	Forages / commutes within the site.
European Rabbit <i>Oryctolagus cuniculus</i>	Distributed throughout Ireland.	Invasive Species: Invasive Species, Medium Impact Invasive Species	Present on the site.
Red Fox <i>Vulpes vulpes</i>	Found throughout Ireland		Likely to occur within the site.
Brown Rat <i>Rattus norvegicus</i>	Distributed throughout Ireland.	Invasive Species: Invasive Species, High Impact Invasive Species	Likely to occur on the site.
Eastern Grey Squirrel <i>Sciurus carolinensis</i>	Found throughout Ireland.	Invasive Species: Invasive Species, High Impact Invasive Species	Likely to occur on the site
Red Squirrel <i>Sciurus vulgaris</i>	Found in throughout Ireland.	Protected Species: Wildlife Acts	Likely to occur on the site

**Table 4.8: Protected mammal species expected to occur within the 10km grid squares of the current study area (R48 and R58), based on NBDC**

The badger (*Meles meles*) is protected in Ireland under the Wildlife Acts (1976) and (2000). Badgers use the proposed development site and there was evidence of moderate activity on the southern portion of the site. In the south-western corner of the site, there was evidence of low level activity (snuffle holes, wood scraping) along with two inactive subsidiary setts. It was considered that that these setts had not been used recently and there was evidence of former gorse removal/ disturbance that may have caused the badgers to leave these setts. In the mid-western area of the site moderate levels of badger activity (snuffle holes) was recorded, and one inactive sett with two entrances was recorded. This sett was, however, recently active, but since there was no bedding it was deemed that this was probably a subsidiary sett. Again there was evidence of disturbance here (land drainage) which may have caused the badgers to leave this dwelling. It is noted that these setts could become active again at any time, and have the same level of protection as active setts. No other badger dwellings were recorded. There was access issues in relation to coniferous forestry, however there was no evidence (i.e. trails, footprints) that badgers were entering the areas that could not be accessed.

The site is also used by Irish Hare *Lepus timidus hibernicus*, Rabbit *Oryctolagus cuniculus*, Fox *Vulpes vulpes*, Hedgehog *Erinaceus europaeus* and Pygmy Shrew *Sorex minutus*. The Irish Hare is protected under the Wildlife Acts (1976) and (2000) and is listed as Internationally Important in the Irish Red Data Book (Marnell, 2009). Hedgehogs and Shrews are also protected under the Wildlife Acts. Pine marten *Martes martes* may also be present in the forestry areas (although no signs of this species were recorded). Irish stoat (*Mustela erminea hibernica*), again a protected species under the Wildlife Acts, it is likely to be present within the study area, considering the availability of prey items (rabbits) in the study area. Evidence of the presence of this species was not recorded during the field survey however. Otter (*Lutra lutra*) is a widespread Irish species and occurs frequently along river corridors and lakes. The otter is listed in Annex II of the EU Habitats Directive and is protected under the Irish Wildlife Act 1976 (Amendment 2000). Otter were not recorded within the proposed development site nor would this species be expected to occur, taking account of the absence of suitable watercourses or wetlands. The fish populations in the main channels of the Owenbeg, Moneyclare and Dinin Rivers downstream of the proposed development site are considered suitable to support otter.

Other mammal species expected to be present at the proposed development site include Field Mouse *Apodemus sylvaticus* Fallow deer *Dama dama* have been recorded previously from within the study area (NBDC database) and are considered likely to occur in the elevated habitat of the proposed development site. Sika deer may also potentially occur, having been previously recorded from within the 10km grid squares. However, no signs of these species were recorded during the current survey. Both Fallow and Sika deer are protected under the Wildlife Acts (1979 and 2000), but are also a quarry species, subject to hunting and culling.



*Figure 4.5: Non-volant mammals in the proposed development site study area.*

### 4.3.3.2 Bats

Existing bat records show that common pipistrelle *Pipistrellus pipistrellus*, Soprano pipistrelle *Pipistrellus pygmaeus*, Leisler's bat *Nyctalus leisleri*, Daubenton's bat *Myotis daubentonii* and Natterer's Bat *Myotis nattereri* were previously recorded from the two 10km grid squares covering the proposed development site (BCI, NBDC). In NPWS (2008), which gives the status and current distributions of EU protected species in Ireland; the following bats were also indicated to occur in the study area: brown long-eared bat *Plecotus auritus* and Whiskered bat *Myotis mystacinus* / Brandt's bat *Myotis brandtii*.

The National Biodiversity Data Centre (NBDC) maps landscape suitability bats based on Lundy *et al* (2011). The maps are a visualisation of the results of the analyses based on a 'habitat suitability' index. The index ranges from 0 to 100 with 0 being least favourable and 100 most favourable for bats. **Table 4.9** gives the suitability of the study area for the bat species found in Ireland (based on NBDC) along with their Irish Red List Status (from Marnell *et al*, 2009).

It is noted that the bat suitability index for the proposed development site is only 27.33 which is low. The suitability index for Leisler's bats is given as 30-37 in the biodiversity maps which is also considered to be relatively low. It is noted that the bat suitability index is calculated on a broad geographical scale and the site itself is thought to be of lower importance than is indicated on the biodiversity maps (which take in adjoining areas of countryside which are of higher importance and then provides a mean suitability index range). The important issue here is that the site is not located in an area which is a "core" area for any bat species. On the biodiversity maps there are two level ratings of importance (38-46 and 47-71) above the rating giving to the area where this proposed wind farm site is located. The site is therefore rated as being just average for bats, and even this rating may have been overestimated.

Common name	Scientific name	Suitability index	Irish red list status
All bats	-	27.33	
Common pipistrelle	<i>Pipistrellus pipistrellus</i>	49	Least Concern
Soprano pipistrelle	<i>Pipistrellus pygmaeus</i>	37	Least Concern
Lesser horseshoe bat	<i>Rhinolophus hipposideros</i>	1	Least Concern
Daubenton's bat	<i>Myotis daubentonii</i>	23	Least Concern
Brown long-eared bat	<i>Plecotus auritus</i>	37	Least Concern
Leisler's bat	<i>Nyctalus leisleri</i>	37	Near Threatened
Natterer's bat	<i>Myotis nattereri</i>	33	Least Concern
Whiskered bat	<i>Myotis mystacinus</i>	28	Least Concern
Nathusius' pipistrelle	<i>Pipistrellus nathusii</i>	1	Least Concern

**Table 4.9: Bat suitability index for the study area of the proposed pinewoods wind farm site**

Detailed bat habitat and activity surveys were undertaken during the months of June, July, August, September and October in 2014 to update the surveys completed during 2012 (see **Appendix 4.3**). Common Pipistrelle was the most frequent bat recorded on the site during the currents surveys. Soprano pipistrelle, Leisler's bat and *Myotis* species (thought to include Natterer's bat) were also recorded. A brief account of the individual bat detector surveys are provided below.

Surveying focussed on potential roosting areas at dusk and also included activity surveys along potential commuting/foraging routes. Surveying commenced approximately 30 minutes before dusk each night, and continued until 3 hours after dusk. Surveying conditions at the time of the surveys was deemed ideal with little/no wind and slightly overcast. Insect activity, mostly comprising midges, was high as would be expected in a forested area during calm conditions. Though bat calls were frequently recorded during the current surveys, the level of activity was considered low. On the clear

nights when surveying was carried out, it could be seen that a single bat can register multiple detections as an individual bat can move back and forth along a feeding corridor while feeding. Overall, the species diversity was found to be low and bat activity levels were considered low.

Based on the daytime surveys, the proposed development site is generally considered sub-optimal for bats and there are no bat roosts on the site. Bats roost in places where there is adequate shelter and safety which vary according to season. Roosts include man-made structures such as houses, churches, outhouses, stone bridges, stables, sheds as well as trees and caves. There are no buildings on site which could be used by bats. There are a few buildings outside of the proposed development. These may be used to some degree by roosting bats but these areas would not be affected by the proposed development. Indeed, there is an occupied farmhouse in the townland of Crutt approximately 170m to east of the site boundary which is a minor pipistrelle roost. This roost was active in 2012 (see **Appendix 4.3**) and was found to be used by no more than 5 common pipistrelle bats in the current survey. This roost is located in excess of 600m from the closest proposed turbine (T05 located to the northwest). There are no other buildings or other structures on the proposed development site that could potentially be used by roosting bats however. Some large coniferous trees could potentially be used as night/day roosts during the summer months. Any roosting in such locations would be in an intermittent basis only, as coniferous trees are generally sub-optimal for this purpose. The roost habitat provided by such trees (Sitka spruce) would be unsuitable as maternity or hibernation roosts. There are no mature deciduous trees near the proposed turbine locations, and no exceptional deciduous trees anywhere on the site. The site is rated as offering very poor roosting opportunities for bats.

The primary habitats on the proposed development site are coniferous plantation and grassland. Potential commuting in the coniferous forestry result from breaks in the plantation continuum, mainly where access roads and firebreaks occur. In relation to the area of the proposed development site, the proportion of potential bat commuting corridors is considered low, especially with regard to the hedgerow networks that surround small fields at lower elevations in the region. Coniferous woodland is deemed physically unsuitable for bats as the trees are planted too close together and branches would limit access during flight. Even the most agile species of bats would probably be discouraged from hunting in these restricted conditions. Overall, the proposed development site comprises sub-optimal habitat for bat foraging.

The proposed development site is used by small numbers of bats and is not considered an important bat foraging and commuting area. Watercourses are usually focal points for bats as they provide an abundance of insect life on which bats can feed. The watercourses within the site are deemed too small to be of noteworthy value to bats however, and were dry during the summer of 2014.

As with the 2012 survey, Common Pipistrelle was the most frequent bat recorded on the site during the current survey. Soprano pipistrelle, Leisler's bat and Myotis bats (thought to include Natterer's bat) were also recorded during the current survey. However, the levels of activity recorded during the current (2014) were lower than those indicated by the 2012 survey. When bats were recorded at any given location, they were recorded only briefly – no feeding bouts were recorded at any particular part of the site. This pattern of activity indicates that the proposed development site is not an important foraging area and that parts of the site are used by commuting bats.

Leisler's bats are at risk from wind turbines due to their high flying height. Only 1-2 individual Leisler's bats were recorded during on any given evening/night during the course of the current surveys which were carried out during ideal weather conditions. It is noted that levels of activity were much lower than recorded in the 2012 survey. Despite being a species that emerges early, it was up to an hour after dusk when Leisler's bats were recorded which shows that they were not roosting on the site. This conclusion is supported by a consideration of the poverty of the habitat on the site for the species. The general countryside to the west of the site would be far more suitable for this species, and indeed other bats species.

Most of the recorded pipistrelle bat activity was associated with forest edge and hedgerows. The Leisler's bats were recorded most often in the middle of the site, and in the south-western part of the site. Bats at the site were recorded both feeding and commuting, and the area of young commercial forestry was found to yield significant insect production. Forestry edges and hedgerows are the most important features for bats on the site, acting as foraging/commuting vectors.

Leisler's bats are of significant conservation importance in Ireland and as they are a high flying species they are at risk from wind turbines. There is a difficulty in mitigating for Leisler's bats as they fly high and don't generally follow linear features. The proposed development site, however, was not found to be particularly important for Leisler's bats owing to the infrequency with which it is over-flown and the lack of suitable roosting habitat. What few Leisler's bats are on site will therefore be occasional and erratic visitors. There will be Leisler's bats over any part of the countryside in this part of Ireland during the summer months, and other areas of adjoining countryside are far more suitable for this and other bat species. It is possible that the previous 2012 study overestimated the numbers of bats using the site, by counting multiple passes of the same bat for example. The results of the bat survey are presented in **Figure 4.7**, where the most important bat feeding / commuting routes are illustrated. The 2012 bat survey results are presented in **Appendix 4.3**.

<i>Bat species recorded</i>	<i>3<sup>rd</sup> June</i>	<i>24<sup>th</sup> July</i>	<i>14<sup>th</sup> August</i>	<i>17<sup>th</sup> September</i>	<i>16<sup>th</sup> October</i>
Common pipistrelle	**	**	**	**	*
Soprano pipistrelle	**	*	**	*	
Leisler's bat	*	*	*		
Myotis sp. bat			*		

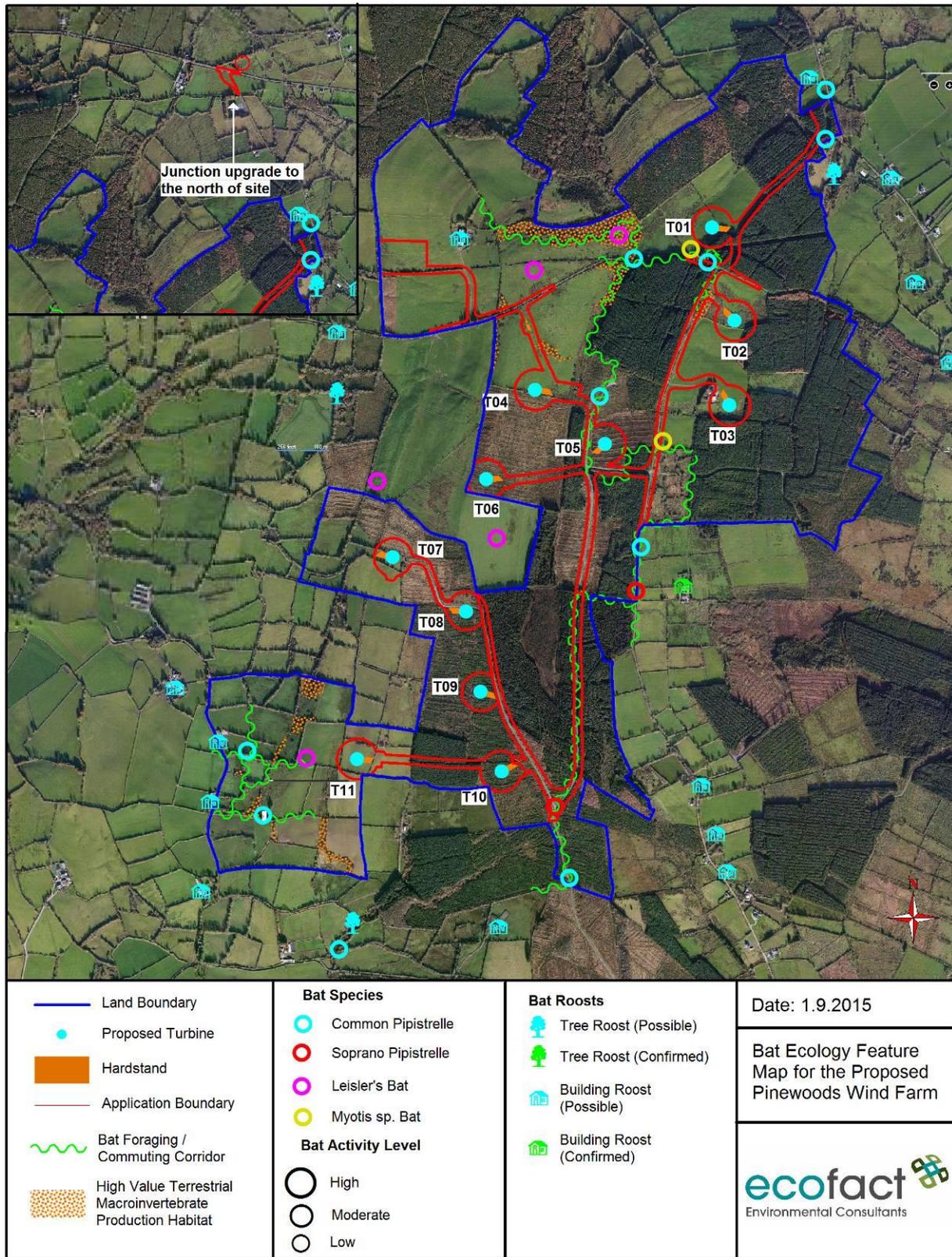
*\*Low activity, \*\*Moderate activity, \*\*\*High activity*

**Table 4.10: Bat records from surveys carried out at the proposed development site from June to October 2014**

This bat detector survey on 3<sup>rd</sup> June 2014 commenced at the northern boundary of the proposed development site in the environs of the Graiguenahown Stream. The corridor of the Graiguenahown Stream was walked towards the center of the site and a pair of common pipistrelles was recorded along the forestry edge to the north east of Turbine 4. This pair of bats could be seen at times they were heard and foraged briefly along the verge of the coniferous woodland. A Leisler's bat was recorded in the large field at the north west of the proposed development site. The portion of the site to the north of the local Knockardagur road was also surveyed on this evening/night.

A single common pipistrelle was recorded foraging along the roadway and flew off along the road to the east. A single Leisler's bat and a soprano pipistrelle were recorded over an area of scrub to the west of Turbine 1. No bat activity was recorded in the field containing proposed turbine Turbine 1. A single common pipistrelle was recorded at two locations on the north-eastern boundary of the site next to stands of commercial forestry.

The focus of the bat detector survey on 24<sup>th</sup> July 2014 was on the grassland hedgerow landscape and commercial forestry at the south western portion of the proposed development site in the environs of Turbines 7, 8, 9, 10 and 11. The hedgerow network to the west of Turbine 11 was found to be most important with regard to bat feeding. Both common pipistrelle and soprano pipistrelle were recorded foraging along hedgerows in this area but activity levels were low. It was considered that these bats may have been roosting in farm buildings immediately west of the site as they were detected at dusk. Areas of scrub in agricultural fields not intensively managed appeared to be favoured by foraging pipistrelle bats. A single Leisler's bat was also recorded around mid-night. This bat foraged briefly over fields to the west of Turbine 11. A Leisler's bat was also detected over a field to the north of Turbine 7.



**Figure 4.7: Bat ecology feature map for the proposed development site illustrating the most important bat feeding/commuting routes are illustrated**

Four species of bats were recorded during the bat detector survey on 14<sup>th</sup> August 2014 which focussed on the north-eastern portion of the site in the environs of Turbines 2, 3, and 5, and the south eastern extent of the site around Turbines 8, 9 and 10. This survey commenced at the minor building roost confirmed in 2012, to the east of the Turbine 8 and to the east of the proposed

development site. This roost was found to be in use by no more than five Common pipistrelle bats. Low level common pipistrelle foraging was recorded along coniferous forestry edges with no more than 2 bats occurring together. The highest concentration of activity was where linear features intersected. Most activity during this survey was recorded where the local road meets forestry edges between Turbine 1 and 2. A Myotis sp. bat was recorded at this location and also along the northern boundary of a wet grassland field with scrub (between Turbine 3 and 5). Low level soprano pipistrelle activity was recorded along the roadway to the south-east of Turbine 5. Low level common pipistrelle activity was recorded along the track within the proposed development site, with sporadic individual bats being recorded. It is considered that this activity was relayed by a single bat.

The entire track within the proposed development site and roadways within near the site were surveyed in the bat detector survey on the evening/night 17<sup>th</sup> September 2014. The only bat species recorded were common and soprano pipistrelle bats. Activity levels were low and confined to forestry rides and verges.

The bat detector survey of 16<sup>th</sup> October 2014 involved walking all the proposed tracks of the proposed development, some of which included existing tracks. Bat activity levels were considered slightly decreased compared to previous surveys undertaken in 2014, intermittent misty conditions perhaps influencing bat activity. In this final October survey, the only bat species recorded was common pipistrelle. Activity was confined to forestry rides and verges.

#### 4.3.3.3 Birds

Overall, a total of 56 bird species were recorded using the site (See **Table 4.11**). A total of 43 species were recorded in the previous EIS study (Moran, 2012 - presented in **Appendix 4.2**), which included a wintering and breeding bird surveys (2010 -2012). A raptor survey was also undertaken during the previous EIS study from March to September 2011. The current study of the site included both a wintering (2014 – 2015) and breeding bird survey (2014) of the site, a total of 52 species were recorded during the current study.

##### **Wintering Bird Survey 2010 – 2011**

A total of 29 species of bird were recorded from within the general survey area and surrounding countryside during the winter surveys carried out between October 2010 – February 2011 (Moran, 2012 - see **Appendix 4.2**). These included red listed golden plover *Pluvialis apricaria* and amber listed Hen Harrier *Circus cyaneus*, Kestrel *Falco tinnunculus* and Starling *Sturnus vulgaris*. It is important to note here that Golden Plover are listed on both the Red (for breeding) and Amber (for over-wintering) list of the BoCCI list. Here, they are listed as Red, as it is their highest categorisation of concern with regard to the precautionary principal. It should be noted that Golden Plover were not noted breeding at this site over the October 2010 – February 2011.

##### **Breeding Bird Surveys Mar 2011 – Sept 2011**

There were 39 species recorded in the survey area during breeding surveys (March – September 2011), including 6 amber and 1 red-listed species. Of these, there was evidence that the vast majority were breeding within the site or in the immediate vicinity. During raptor surveys, two species were detected between April – September 2011, Kestrel and Sparrowhawk *Accipiter nisus*, both of which were observed hunting in the vicinity of the site. **Table 4.11** summarises the results of the winter, breeding and raptor surveys undertaken in the October 2010 – September 2011 period.

##### **Breeding Bird Survey May 2014 – June 2014**

A breeding bird survey was carried out between May and June 2014. A full list of the 47 species recorded in this study is presented in **Table 4.11** below. This list is similar to that found in the previous study (Moran 2011). Additions to the species list for the site, resulting from this study, are Woodcock *Scolopax rusticola*, Lesser Black-backed Gull *Larus fuscus*, Common Swift *Apus apus*, Stonechat *Saxicola torquata*, Lesser Redpoll *Acanthis cabaret* and Common Crossbill *Loxia*

*curvirostra*. The only Red listed species found in this study were Woodcock *Scolopax rusticola* and Meadow Pipit. Thirteen Amber Listed species were also recorded. The only raptors that were recorded on or near the study site were Sparrowhawk and Kestrel Falcon *Falco tinnunculus*. There were no waders recorded on the semi-improved grassland. The only wader recorded was one Woodcock.

### **Wintering Bird Survey 2014 – 2015**

A wintering bird survey was carried out at the site with monthly visits between October 2014 and March 2015. There were a number of additions to the species list for the site, and overall a total of 36 species were recorded in this study. This is an increase on the 29 species recorded in the wintering bird survey carried out in 2010-11 with Sparrowhawk, Snipe *Gallinago gallinago*, Dunnock *Prunella modularis*, Grey Wagtail *Motacilla cinerea*, Linnet *Carduelis cannabina*, Lesser Redpoll and Common Crossbill being added to the wintering bird list. The most important species which was recorded in 2011 but not in 2012 or 2014/15 was Hen Harrier. In the 2011 report, it refers to a juvenile Hen Harrier seen on two occasions during the winter surveys at a distance of up to 1 km, and was likely passing through the area.

The species list recorded is in line with what would be expected from these habitats in Ireland in winter. From an ornithological point of view, the main habitats in the study area are young second rotation coniferous forestry, mature forestry and semi-improved grassland. The study site is long and narrow, running roughly north to south. Most of the young forestry is to the south. The mature stands of forestry run from the centre to the north of the site. At the north-west corner there is an area of semi-improved grassland.

Three species on the red list of BOCCI were recorded. The Meadow Pipit is a widespread and common passerine found in grassland in Ireland. It was put on the red list because of large declines in its Irish breeding population following the two severe winters of 2009/10 and 2010/11. The Grey Wagtail is a widespread and common bird found on rivers and streams and it too suffered serious declines during the two severe winters of 2009/10 and 2010/11. There are already signs of recovery in both these populations (Crowe et al, 2014). The third species on the BOCCI red list is Golden Plover. A flock of 400 Golden Plover was seen flying at about 200m near the test mast at the northern end of the site on the 15<sup>th</sup> of December 2012. No Golden Plover were seen during the other visits. Flocks of 70 and 55 were recorded in the previous survey, also flying over the site at 200m to 300m. Numbers of Golden Plover in Ireland peak in January (Crowe, 2005) and flocks can occur at considerable distances from wetlands (Boland & Crowe, 2012). Flocks of Golden Plover may pass over the site occasionally but there is very little suitable foraging habitat available to them on this site. In general, the winter relative abundance map in the latest atlas (Balmer et al, 2013) shows most Golden Plover around the coast and across the midlands. They are relatively scarce in the centre of the south-east of Ireland.

The previous report mentioned a juvenile Hen Harrier, likely to be passing through the area during wintering bird surveys. There were no sightings of Hen Harrier in December 2012, December 2014 or January 2015. There was a general paucity of raptors in the area, no Buzzards, Peregrines or Merlins. Only a single Kestrel was seen on a regular basis. A Sparrowhawk was seen briefly during the January visit.

In general, the site is very poor for birds in winter. There were no large flocks of thrushes, finches, pipits, tits or waders using the site. There are no berries for winter thrushes, there are no wetlands for winter waders, there is very little rank grass to support small mammal prey for raptors, there is very little seed for finches. The numbers of common birds present on the site in winter is very low and would not be attractive to hunting Hen Harriers. The December survey continued until sunset and there was no sign of any Hen Harrier roost on the site.

### ***Curlew issue (raised by Birdwatch Ireland)***

Birdwatch Ireland raised concerns about Curlew in the vicinity of the proposed development during consultation. It is understood that they were referring to 2007-2011 atlas data. The subject site is at the junction of four 10km squares S47, S48, S57 and S58. The site falls within the three tetrads S57E, S58A and S58B. There are no breeding records for Curlew in S47, S48 or S57. In the 10km square S58, there are two tetrads with Curlew during the breeding season. In S58W has a record of Curlew being in a territory for over 1 week and in S58X there is a record of Curlew visiting a probable nest site. These two tetrads are at the other side of the 10km square from proposed development site, at least 6km away. It is noted that Curlew was not recorded during any of the surveys and it is not considered likely that they would ever use this proposed development site as it is not suitable as a habitat for nesting or foraging.

### ***Evaluation of birds in the study area***

Overall the site holds a bird community which would be typical of the habitats such as young second rotation coniferous forestry, mature forestry and semi-improved grassland which occur on the site. The site is not of particular importance to birds, with the species present also likely to be similar that that occurring in the adjoining areas of the Co. Laois countryside. The list of bird species recorded in this study and the previous study is consistent with a large scale Irish study of breeding birds in second-rotation plantations (Sweeney *et al*, 2010). In that study the presence of summer migrants in younger forestry was noted. Linnet and Grasshopper Warbler were the only species of Conservation Concern (both on the amber list at the time) found in that study.

Utilising the method outlined in Percival (2003), the sensitivity of bird species recorded regularly using the habitat at the proposed site during surveys is low. Five species of increased sensitivity – Black-Headed Gull, Golden Plover, Hen Harrier, Woodcock and Meadow Pipit were observed on a small number of occasions, in the general vicinity of the site, but were merely passing through. It is noted than Hen harrier was not recorded during the 2014 survey. The site is not a significant site for the foraging, nesting or passage of any significant population of any species of conservation concern.

<i>Scientific name</i>	<i>Common name</i>	<i>BoCCI listing</i>	<i>Winter survey (Oct 2014 – March 2015)</i>	<i>Breeding Survey (May – June 2014)</i>	<i>Winter survey (Oct 2010 – Feb 2011)</i>	<i>Breeding survey (Mar – Sept 2011)</i>	<i>Raptor survey (Mar – Sept 2011)</i>
<i>Accipiter nisus</i>	Sparrowhawk	Amber	✓	✓	✓	✓	Hunting only
<i>Acrocephalus schoenobaenus</i>	Sedge Warbler	Green		✓			
<i>Aegithalos caudatus</i>	Long-tailed Tit	Green	✓	✓	✓		
<i>Alauda arvensis</i>	Skylark	Amber		✓		✓	
<i>Anthus pratensis</i>	Meadow pipit	Red	✓	✓	✓	✓	
<i>Apus apus</i>	Common Swift	Amber		✓			
<i>Carduelis cabaret</i>	Lesser Redpoll	Green	✓	✓			
<i>Carduelis</i>	Linnet	Amber	✓	✓			

Scientific name	Common name	BoCCI listing	Winter survey (Oct 2014 – March 2015)	Breeding Survey (May – June 2014)	Winter survey (Oct 2010 – Feb 2011)	Breeding survey (Mar – Sept 2011)	Raptor survey (Mar – Sept 2011)
<i>cannabina</i>							
<i>Carduelis carduelis</i>	Goldfinch	Green	✓	✓			
<i>Carduelis chloris</i>	Greenfinch	Green		✓		✓	
<i>Carduelis spinus</i>	Siskin	Green	✓	✓	✓		
<i>Circus cyaneus</i>	Hen Harrier	Amber			✓		
<i>Columba palumbus</i>	Wood Pigeon	Green	✓	✓	✓	✓	
<i>Corvus corax</i>	Raven	Green	✓	✓	✓	✓	
<i>Corvus cornix</i>	Hooded Crow	Green	✓	✓	✓	✓	
<i>Corvus frugilegus</i>	Rook	Green		✓	✓	✓	
<i>Corvus monedula</i>	Jackdaw	Green	✓	✓	✓	✓	
<i>Cuculus canorus</i>	Cuckoo	Green		✓		✓	
<i>Delichon urbicum</i>	House Martin	Amber		✓		✓	
<i>Emberiza schoeniclus</i>	Reed Bunting	Green	✓	✓		✓	
<i>Erithacus rubecula</i>	Robin	Amber	✓	✓	✓	✓	
<i>Falco tinnunculus</i>	Kestrel	Amber	✓	✓			Hunting only
<i>Fringilla coelebs</i>	Chaffinch	Green	✓	✓	✓	✓	
<i>Gallinago gallinago</i>	Snipe	Green	✓				
<i>Garrulus glandarius</i>	Jay	Green	✓	✓	✓	✓	
<i>Hirundo rustica</i>	Swallow	Amber		✓		✓	
<i>Larus fuscus</i>	Lesser Black-backed Gull	Amber		✓			
<i>Larus ridibundus</i>	Black Headed Gull	Red				✓	
<i>Locustella naevia</i>	Common Grasshopper Warbler	Green					

Scientific name	Common name	BoCCI listing	Winter survey (Oct 2014 – March 2015)	Breeding Survey (May – June 2014)	Winter survey (Oct 2010 – Feb 2011)	Breeding survey (Mar – Sept 2011)	Raptor survey (Mar – Sept 2011)
<i>Locustella naevia</i>	Grasshopper warbler	Amber		✓		✓	
<i>Loxia curvirostra</i>	Common Crossbill	Green	✓	✓			
<i>Motacilla alba</i>	Pied Wagtail	Green	✓	✓	✓	✓	
<i>Motacilla cinerea</i>	Grey Wagtail	Red	✓				
<i>Oenanthe oenanthe</i>	Wheatear	Amber				✓	
<i>Parus ater</i>	Coal Tit	Green	✓	✓	✓	✓	
<i>Parus caeruleus</i>	Blue Tit	Green	✓	✓	✓	✓	
<i>Parus major</i>	Great Tit	Green	✓	✓	✓	✓	
<i>Phasianus colchicus</i>	Pheasant	Green	✓		✓	✓	
<i>Phylloscopus collybita</i>	Chifchaff	Green		✓		✓	
<i>Phylloscopus trochilus</i>	Willow warbler	Green		✓		✓	
<i>Pica pica</i>	Magpie	Green	✓	✓	✓	✓	
<i>Pluvialis apricaria</i>	Golden Plover	Red	✓		✓		
<i>Prunella modularis</i>	Dunnock	Green	✓	✓		✓	
<i>Pyrrhula pyrrhula</i>	Bullfinch	Green	✓	✓	✓	✓	
<i>Regulus regulus</i>	Goldcrest	Amber	✓	✓	✓	✓	
<i>Saxicola torquata</i>	Stonechat	Amber		✓			
<i>Scolopax rusticola</i>	Woodcock	Red		✓			
<i>Sturnus vulgaris</i>	Starling	Amber	✓	✓	✓		
<i>Sylvia atricapilla</i>	Blackcap	Green		✓		✓	
<i>Sylvia communis</i>	Whitethroat	Green		✓		✓	
<i>Troglodytes troglodytes</i>	Wren	Green	✓	✓	✓	✓	
<i>Turdus iliacus</i>	Redwing	Green	✓		✓	✓	
<i>Turdus merula</i>	Blackbird	Green	✓	✓	✓	✓	

Scientific name	Common name	BoCCI listing	Winter survey (Oct 2014 – March 2015)	Breeding Survey (May – June 2014)	Winter survey (Oct 2010 – Feb 2011)	Breeding survey (Mar – Sept 2011)	Raptor survey (Mar – Sept 2011)
<i>Turdus philomelos</i>	Song Thrush	Green	✓	✓	✓	✓	
<i>Turdus pilaris</i>	Fieldfare	Green	✓		✓		
<i>Turdus viscivorus</i>	Mistle Thrush	Amber	✓	✓	✓	✓	

**Table 4.11: Birds recorded during the winter, breeding and raptor surveys undertaken in the October 2010 - September 2011 period (from Moran, 2012), and in 2014, showing BoCCI status according to Colhoun & Cummins (2013).**

#### 4.3.3.4 Fish

The proposed development site is located on the Co. Laois/Co. Kilkenny border in the River Nore catchment. Runoff from the area on which the proposed development would be located is to the Owenbeg sub-catchment on the northern and western portions of the site and the Dinin sub-catchment on the south eastern side. The fisheries value of the watercourses draining the proposed development area is related to stream size, physical characteristics and water quality. It can be seen from the catchment descriptions below that the watercourses within the proposed development area are unsuitable with respect to fish production due to their small size. Indeed the streams on the site itself were dry or partially dry during the summer of 2014. It is noted, however, that these streams are likely to carry water in wetter years/seasonally, and have the potential to carry pollutants to downstream areas.

A hydrological overview of the sub-catchments is given below with a focus on the watercourses potentially affected by the proposed development. This is followed by a discussion on the existing fisheries information in the study area and the findings of the on-site assessments.

#### **Nore catchment**

The River Nore is located in Hydrometric area 15 (EPA Code 15N01) and is in the South Eastern River Basin District (SERBD). The Nore rises on the eastern slopes of the Devil's Bit Mountain in County Tipperary. It then flows south-eastwards to County Laois and County Kilkenny before joining the River Barrow just north of New Ross. The river passes near Durrow, County Laois then through Ballyragget, the city of Kilkenny and then the villages of Bennettsbridge and Thomastown. The primary tributaries of the River Nore are the Dinin, Mountrath, Breaghagh, King's, Little Arrigle and Black Water Rivers have a total length of 118km, a catchment area of 2,359km<sup>2</sup>, and an annual mean discharge of 40m<sup>3</sup> sec<sup>-1</sup> (Lucey, 1998; McGarrigle, 2002). The Nore, for a large part of its course, traverses limestone planes of Carboniferous age and then Old Red Sandstone below Thomastown and before joining the Barrow, runs over Ordovician shales. Using the EPA Hydrotool which returns flow duration curves for most rivers in Ireland, the River Nore has a 95%ile flow and mean flow of 1.844m<sup>3</sup>/s and 0.21095m<sup>3</sup>/s just upstream of the Owenbeg River confluence. Here, mean flow was taken as the 30%ile river flow, as in MacCarthaigh (1997).

#### **Owenbeg sub-catchment**

The Owenbeg River (EPA Code: 15/O/01) rises approximately 5km to the north east of the proposed development site. It is also known as the Owveg River. It generally flows in a south westerly direction for approximately 28km to meet the River Nore between Durrow and Ballyragget. Approximately 6km from source, the 2<sup>nd</sup> order Owenbeg River flows within 0.5km to the north of the proposed

development site. It is fed from the south by the two first order streams which rise within the proposed development site, the Knockbaun Stream (EPA segment code 15\_387) and Graiguenahown Stream (EPA code 15G29). Using the EPA Hydrotool, the Owenbeg River has respective estimated 95<sup>th</sup>ile and mean flows of 0.012m<sup>3</sup>/s and 0.338m<sup>3</sup>/s just upstream of the Graiguenahown Stream confluence.

The Knockbaun Stream and Graiguenahown Stream have channel lengths of 2.2km and 3km respectively and are within the NoreMain\_Owenbeg\_Upper sub-basin. Based on flows returned by the EPA Hydrotool for the Owenbeg River, and proportional catchment areas, the 95<sup>th</sup>ile flow and mean flow of the Graiguenahown and Knockbaun Streams at the northern boundary of the proposed development site are estimated as 0.0008m<sup>3</sup>/s and 0.023m<sup>3</sup>/s respectively, these flows are an indication of how small these watercourses are.

The Knockardagur Stream (EPA code 15K26) drains the north western portion of the proposed development site. The Knockardagur Stream is indicated as rising approximately 0.3km west of the proposed development site. It flows west for ca. 1.3km before being joined by the Aghnacross Stream (EPA segment code 115\_767), another 1<sup>st</sup> order watercourse which is also indicated as rising approximately 0.3km west of the proposed development site. After the confluence of the Aghnacross Stream, the 2<sup>nd</sup> order Knockardagur Stream flows west for 0.6km into the 3<sup>rd</sup> order Owenbeg River.

The southern portion of the proposed development site is drained by the Moneyclare River (EPA code 15M24). The Moneyclare River rises ca. 100m south of the proposed development site and flows west for ca. 0.3km before being fed from the north by another 1<sup>st</sup> order stream that rises at the southern boundary of the site (Ironmills sub-catchment). The Moneyclare River flows west for ca. 1.5km and is met from the south by the 2<sup>nd</sup> order Cill Rois River (EPA code 15C74). After the confluence of the Moneyclare and Cill Rois Rivers, the 3<sup>rd</sup> order Moneyclare (Ironmills) River flows for 2.2km before flowing into the Owenbeg River. Thereafter, the Owenbeg flows south west for ca. 10km before discharging to the 6<sup>th</sup> order River Nore, where it is fed by the 2<sup>nd</sup> order Ballymaddock Stream (EPA code 15B14) and the 2<sup>nd</sup> order Loughill River (EPA code 15L13).

#### **Dinin sub-catchment**

A small proportion of the proposed development site is located in the Dinin (north) catchment (EPA Code: 15D07). It is noted that there are no turbines proposed in this catchment however. The Loan Stream (EPA Segment Code: 15\_1085) rises approximately 0.5km south of the proposed development. It flows south for ca. 1.7km until it is met by another 1<sup>st</sup> order watercourse of length 1km that rises ca. 0.35km south east of the proposed development site. A further 5km downstream, the 2<sup>nd</sup> order Loan Stream flows into the 4<sup>th</sup> order Dinin (north) River.

#### **Fish - Existing information**

The River Nore is designated a salmonid water under the EU Freshwater Fish Directive. O'Reilly (2004) points out that the Owenbeg River is a fast flowing gravel stream that fishes well for trout on the wet fly in high water.

One site was electric fished on the Dinin River as part of the WFD surveillance monitoring programme in rivers 2012. The survey site was located downstream of the N77 Dinin Bridge, approximately 7.5km northwest of Kilkenny City, Co. Kilkenny. Three electric-fishing passes were conducted along a 43m length of channel. Glide dominated the habitat, while the substrate consisted mostly of cobble. A total of five fish species were recorded. Atlantic salmon *Salmo salar* was the most abundant species, followed by Brown trout *S. trutta*, minnow *Phoxinus phoxinus*, stone loach *Barbatula barbatula* and European eel *Anguilla anguilla*. See **Table 4.12** for more detailed results.

All three species of lamprey (River lamprey *Lampetra fluviatilis*, Brook lamprey *L. planeri* and Sea lamprey *Petromyzon marinus*,) are listed in Appendix III of the Bern Convention. All three lamprey species have been recorded from the Nore catchment (Kurtz & Costello 1999). Taking into account

the distance from the sea, it is unlikely that any lamprey species other than the brook lamprey is present in the Owenbeg River and its tributaries.

<i>Scientific name</i>	<i>Common name</i>	<i>0+</i>	<i>1+ &amp; older</i>	<i>Total minimum density</i>
<i>Salmo salar</i>	Salmon	0.202	0.037	0.240
<i>Salmo trutta fario</i>	Brown trout	0.015	0.031	0.046
<i>Phoxinus phoxinus</i>	Minnow	-	-	0.042
<i>Barbatula barbatula</i>	Stone loach	-	-	0.003
<i>Anguilla anguilla</i>	Eel	-	-	0.001

**Table 4.12: Density of each fish species (no./m<sup>2</sup>) captured on the Dinin River in September 2012.**  
Source: Sampling fish for the WFD, Rivers 2012, SERBD.

### Results of on-site assessments

Electrical fishing surveys were carried out on watercourses draining the proposed development site under licence from the Department of Communications, Energy and Natural Resources (Section 14 licence). The fish survey was undertaken during September 2014. Water levels in all watercourses were low, with the watercourses on the site itself mainly dry. **Figure 4.9** gives the aquatic ecological survey locations examined in detail during the current assessment and the results of the fisheries and aquatic biological assessments. **Table 4.13** gives physical characteristics of the aquatic survey sites draining the proposed development site. **Tables 4.14 and 4.15** gives results of the electrical fishing carried out on the selected watercourses during September 2014.

<i>Parameter</i>	<i>Site</i>								
	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>9</i>
Wetted width (m)	0.5	1	0	0.3	0.4	3.7	0.2	0.15	0.3
Mean depth (cm)	5	35	0	2	10	30	7	4	3
Maximum depth (cm)	20	50	0	3	15	50	13	12	9
Riffle (%)	90	0	0	90	50	5	100	60	80
Glide (%)	0	100	0	10	50	90	0	40	20
Pool (%)	10	0	0	0	0	5	0	0	0
Rock (%)	10	5	5	30	5	5	20	0	0
Cobble (%)	80	45	20	30	30	80	80	50	20
Gravel (%)	10	40	70	40	65	10	0	50	80
Fine (%)	0	10	5	0	0	5	0	0	0
Shade (%)	20	80	75	85	88	0	40	100	90
Bank cover (%)	100	100	80	40	50	60	90	100	80
Bank height (m)	0.40	1.5	0.6	0.5	1.3	0.7	0.3	2.9	2
Bank slope (°)	40	85	75	90	80	65	30	90	90
Instream vegetation (%)	0	20	0	0	0	0	0	0	0

**Table 4.13: Physical characteristics of the aquatic survey sites examined for the proposed Pinewoods wind farm during September 2014.**

Of the nine survey locations examined as part of the current assessment, fish were recorded only at Site 6. Site 6 was located on the Owenbeg River at the R430 Bridge to the north of the proposed development site. This part of the river had a wetted width of c.3.7m and mean depth of c.30cm. This part of the river was characterised by riffle glide pool sequences with a substrate dominated by cobble. This part of the river was considered an important spawning and nursery area for brown trout and salmon. A total of five fish species were recorded at Site 6: Brown trout (N=11), Atlantic

salmon (N=2), minnow (N=28) and Three-spined stickleback *Gasterosteus aculeatus* (N=14). Site 1, Site 2, Site 3, Site 4, Site 5, Site 8 and Site 9 were almost completely dried out and flow was negligible. These stream stretches were deemed unsuitable for salmonids at the time of the current survey and fish would not be expected to occur at these locations. Electrical fishing was not carried out at Site 3, Site 5, Site 8 and Site 9 given the nearly dry state and small size of these streams. In wetter years/months, these streams could support small populations of juvenile trout and the lower reaches of these streams could possibly be used by spawning salmonids and as salmonid nursery areas.

Many of the streams in the study area were found to be physically impacted by cattle. For example, instream areas at Site 5 on the Graiguenahown Stream and riparian areas at Site 7 on the Knockbaun Stream were considerably poached, reducing the habitat quality with respect to fish. The aforementioned watercourses are the only streams that occur within the proposed development site and the reaches within the site are unsuitable for salmonids taking account of their small size and tendency to dry out during prolonged dry periods. It is noted that no lampreys were recorded during the current assessment and it is highly unlikely that this species occur within the proposed development boundary.

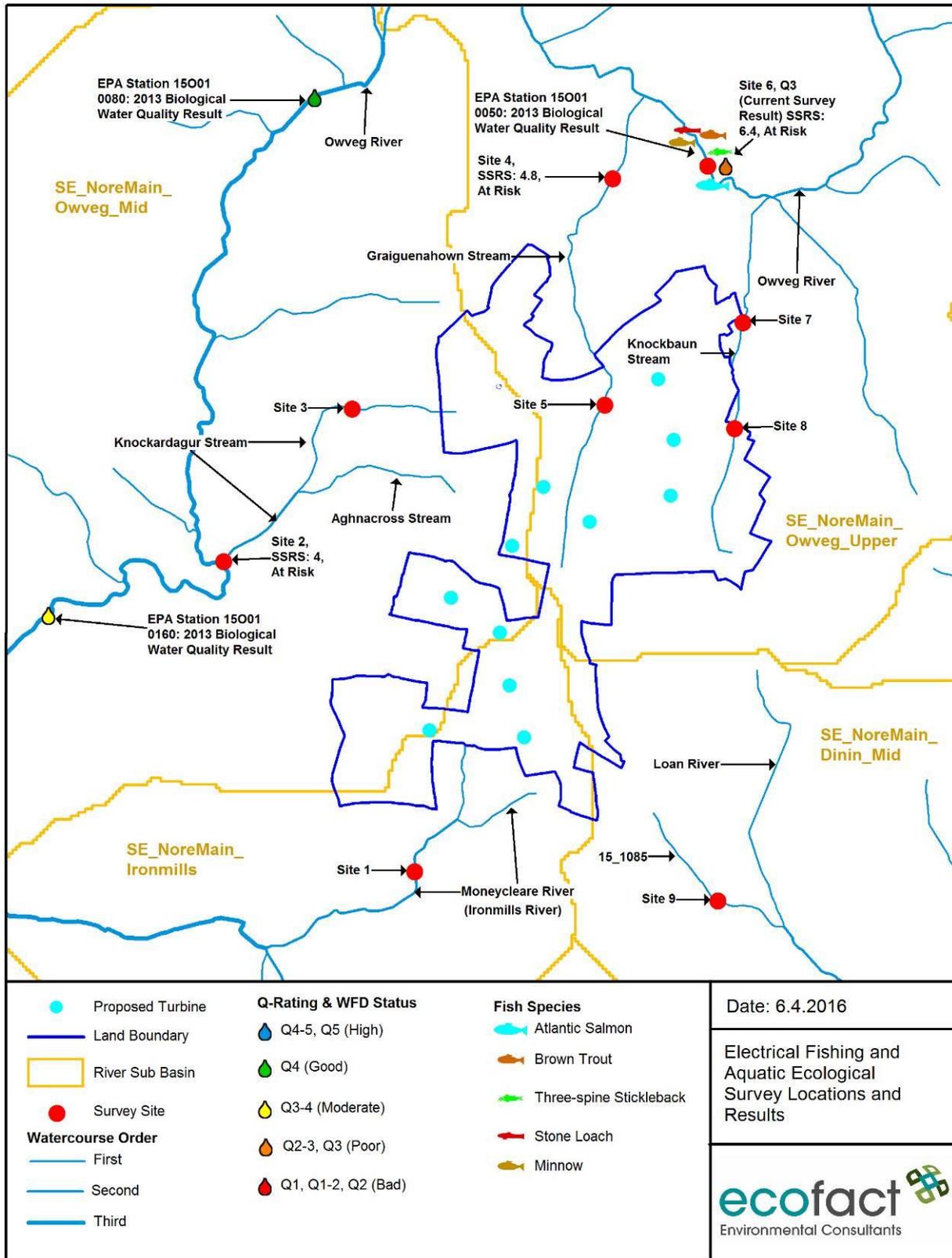
Site	Watercourse	Fish species	N	Mean	Min	Max	St. Dev.
6	Owenbeg River	Brown trout	11	9.7	8	11.1	0.99
		Atlantic salmon	2	9.25	9.2	9.3	0.07
		Stone loach	2	8.9	8.8	9	0.14
		Minnow	28	5.5	5	6.5	0.46
		Three-spined Stickleback	14	3.15	3	3.5	0.16

**Table 4.14: Summary statistics for lengths of fish caught at Site 6 during the electrical fishing survey of watercourses draining the proposed Pinewoods Wind farm site during September 2014.**

**Note: Fish recorded only at Site 6.**

Site	Watercourse	Fishing time (mins)	Area Fished (m <sup>2</sup> )	Brown trout			Atlantic salmon			Stone loach			Minnow			Three-spined stickleback		
				N	Fish/min	Fish/m <sup>2</sup>	N	Fish/min	Fish/m <sup>2</sup>	N	Fish/min	Fish/m <sup>2</sup>	N	Fish/min	Fish/m <sup>2</sup>	N	Fish/min	Fish/m <sup>2</sup>
1	Moneyclare	5	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Knockardagur Stream	5	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	Graiguenahown Stream	5	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	Owenbeg River	20	70	1	0.5	0.1	2	0.1	0.3	2	0.1	0.3	2	1.4	0.4	1	0.7	0.2
7	Knockbaun Stream	5	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

**Table 4.15: Results of the electrical fishing survey of selected watercourses draining the proposed Pinewoods Wind Farm site during September 2014.**



**Figure 4.9: Electrical fishing and aquatic ecological survey locations and results for the proposed development site.**

### **Reptiles and Amphibians**

The common frog (*Rana temporaria*) was recorded within the study area in wet grassland habitat at the northern extent of the proposed development site. The smooth newt (*Lissotriton vulgaris*) has been previously recorded from the study area and but was not recorded during the current survey. It is unlikely that this species occurs within the proposed development area given the lack of suitable habitat i.e. ponds and deep drainage ditches. The breeding sites of both frogs and newts are protected under the Wildlife Act (1979, Amendment 2000); however no areas suitable for breeding were recorded. The common lizard (*Zootoca vivipara*) has been previously recorded in the study area (NBDC database) and could potentially occur on the site.

### **Aquatic macroinvertebrates**

**White-clawed crayfish:** The white-clawed crayfish *Austropotamobius pallipes* is the only freshwater crayfish recorded in Ireland. It is classified as vulnerable and rare in the IUCN Red List and is protected in Ireland under the schedules of the Wildlife Act 1976. It is also listed in Appendices II and V of the Habitats Directive (92/43/EEC). It is generally considered to be widespread in lowland lakes and rivers which are underlain by Carboniferous limestone, or its derivative - glacial drift (Reynolds, 1998). The current study area is within the known range and distribution of White-clawed crayfish (NBDC & NPWS, 2008). This species would not occur within the proposed development site taking account of the unsuitable aquatic habitats. This species may occur in the Owenbeg and Dinin Rivers downstream of the proposed development. However, white-clawed crayfish was not recorded during kick sampling or hand searching in the watercourses examined during the current surveys.

**Freshwater Pearl mussel:** The Freshwater Pearl Mussel (FPM) *Margaritifera margaritifera* is listed under Annex II and V of the Habitats Directive (92/43/EEC). It is legally protected in Ireland under Statutory Instruments No. 112, 1990 and No. 94, 1997. The species is also protected under the Convention on the Conservation of European Wildlife and Natural Habitats. It is listed as 'Endangered' on the International Union for Conservation of Nature and Natural Resources (IUCN) Red Data List. It is also protected under the Wildlife Act 1976 and Wildlife Amendment Act 2000. The European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009 (S. I. 296 of 2009) have been developed to support the achievement of favourable conservation status for freshwater pearl mussels. These regulations set environmental quality objectives for the habitats of the freshwater pearl mussel populations within the boundaries of a site notified in a candidate list of European sites, or designated as a Special Area of Conservation, require the production of sub-basin management plans with programmes of measures to achieve these objectives, as well as setting out the duties of public authorities in respect of the sub-basin management plans and programmes of measures.

To date, 19 cSACs have been designated for *M. margaritifera* in Ireland, including the River Nore (as part of the River Barrow and River Nore cSAC). The River Nore also supports *Margaritifera margaritifera durrovensis*, classified as a separate hardwater species endemic to the Nore. This species does not occur within the proposed development site and was not recorded during the current aquatic assessments. High water quality is demanded of the Nore Freshwater Pearl Mussel which requires an 'ecological quality ratio' of 0.9 (European Communities Environmental Objectives (Surface Water) Regulations 2009 (S.I. No. 272 of 2009)). This is equivalent to a biological Q-value of Q4-5 (Lucy, 2009). These mussels are present along a 15km stretch of the River Nore from Poorman's bridge to just north of Ballyragget, Co. Kilkenny. Since the Owenbeg River joins the Nore along this stretch, the proposed development is within this FPM catchment. The FPM requires very high quality rivers with clean river beds and waters with very low levels of nutrients. Water quality in the streams draining the proposed development site was found to be unsatisfactory with respect to FPM requirements, a plume of silt visible upon disturbance of the substrate and excessive filamentous growth at some locations.

### **Results of the on-site investigations**

**Table 4.A2.2** gives the list of macroinvertebrates recorded while biological sampling at the survey sites during the current assessment. The macroinvertebrates recorded were typically those associated with impacted eroding upland watercourses. The species recorded would be expected to occur in most watercourses in the Laois/Kilkenny region. The extent of forestry and cattle poaching in the study area was expected to influence to some degree the macroinvertebrate assemblages, these factors likely to be adversely affecting macroinvertebrate habitat and therefore macroinvertebrate diversity). Biological sampling could only be carried out at three locations (Site 2, Site 4, and Site 6) given the low water levels and unsuitability for kick sampling at the other locations. **Table 4.16** gives family richness and biotic index results for the sites examined during the biological sampling. The results for the surveyed sites are given below.

#### **Site 2, Site 3 (Knockardagur Stream)**

Site 2 was located on the lower reach of the Knockardagur Stream, less than 100m upstream of the Owenbeg River confluence. This site was approximately 2km west of the proposed development site. This part of the stream had a wetted width of ca. 1m. The substrate comprised ca. 5% rock (including some bedrock), ca. 45% cobble, ca. 50% gravel and ca. 10% fine material. A total of 10 macroinvertebrate families were recorded at this location. Pollution tolerant freshwater shrimp *Gammarus duebeni* and larvae of Blackfly (Simuliidae) were the most abundant macroinvertebrates. Less sensitive (Group B) larvae of *Leuctra* sp. were common. River limpet *Ancylus fluviatilis*, aquatic earthworm (Lumbricidae) and beetles (*Elmis* sp., Helodidae) were also recorded at this site. This site scored 4 using the SSRS scheme so is in the 'at risk' category.

Site 3 was located ca. 1km west of the proposed development site. This part of the stream was almost dried out with only a trickle of water in the stream. Aquatic macroinvertebrates were not recorded here.

#### **Site 4, Site 5 (Graiguenahown Stream)**

Site 4 and Site 5 were located on the Graiguenahown Stream. Site 5 was located within the proposed development site and could not be sampled - this part of the watercourse had obviously diminished in size. The wetted width of the stream at Site 5 was ca. 0.4m while it could be seen that this part of the stream would have a wetted width of greater than 1m during normal flows (based on the amount of fluvial substrate not covered by water). The wetted width of the stream at Site 4, approximately 1km downstream of the proposed development site was ca. 0.3m and the mean depth was ca. 10cm. A macroinvertebrate family diversity of 7 was recorded at this location. Larvae of *Leuctra* sp. and the caseless caddisfly *Polycentropus* sp. were both common. *G. duebeni* was numerous and was the only crustacean recorded at this site. The leeches *Glossiphonia* sp. and *Hemiclepsis marginata* were also recorded at this site. This site attained an SSRS of 4.8 so is in the 'at risk' category.

#### **Site 6**

Site 6 was located on the main channel of the Owenbeg River, approximately 1km north of the proposed development site. The substrate at this location mostly comprised cobble. Luxuriant filamentous algal growth was recorded in this stream, indicating organic enrichment. Siltation of the substrate in this watercourse was considerable.

A macroinvertebrate family richness of 11 was recorded at this location. Green chironomid larvae were numerous. Other Dipteran larvae recorded were *Tipula* sp., *Limnophora* sp. and Ceratopogonidae. Larvae of the cased caddisfly *Potamophylax* sp. And caseless Trichopteran larvae were scarce. No pollution sensitive indicators were recorded at this site. Using the EPA freshwater biological monitoring scheme (Toner *et al*, 2005), this site was rated Q3, Moderately polluted, equivalent to Water Framework Directive (WFD) 'Poor Status'.

Site	Family diversity	Q-value	Water Framework Directive (WFD) status	Small Streams Risk (SSRS)*	Streams Score	SSRS category
2	13	4-5	high	-	-	-
4	9	4	good	7.2		Probably at risk
7	13	5	high	4.8		At risk

\*SSRS for 1<sup>st</sup> and 2<sup>nd</sup> order streams only.

**Table 4.16: Family richness and biotic index results for the sites examined during the biological sampling undertaken on the watercourses within the Pinewoods wind farm during September 2014.**

The results of the on-site chemical water quality investigations are presented in Table A5.3. Conductivity was in the range 143.8  $\mu\text{S cm}^{-1}$  (Site 4) to 546  $\mu\text{S cm}^{-1}$  (Site 6). Dissolved Oxygen (D.O.) varied from 83.1% to 113.5%. The pH range at the study sites was 8.2 (Site 7) to 8.7 (Site 6).

### Terrestrial invertebrates

There are records of the Annex II listed Desmoulin's whorl snail *Vertigo moulinsiana* from the 10km grid square S48 (Source: NBDC). Desmoulin's whorl snail is a climbing species in emergent vegetation, living over a large vertical range at different times of year. Desmoulin's whorl snail lives in permanently wet, usually calcareous, swamps, fens and marshes bordering rivers, lakes and ponds, or in river floodplains. It is most often found in open situations (Killeen, 2003). Based on the habitat requirements for this species, the proposed development site is highly unlikely to harbour this species.

NBDC indicates a record of the hymenopteran *Lasioglossum lativentre* (Schenck, 1853) in the 10km grid square S58 which covers part of the eastern extent of the proposed development site. This is a threatened species and is IUCN listed as critically endangered. One currently known population of the bee *Lasioglossum lativentre* (Schenck, 1853) is known in Ireland however. This species was known from 12 locations pre 1978 at which point it was not recorded again until 2005 when it was found at Kilcarrig Bridge in Co. Carlow (Fitzpatrick & Byrne, 2006). This location is in excess of 30km east of the current study area however, and this species is unlikely to occur on the site.

The Marsh Fritillary butterfly is a species associated with wet grassland and heath habitat in Ireland. It is listed in Annex II of the EU Habitats Directive (1992). The food plant of the caterpillar larvae of this species is known as Devil's-bit Scabious *Succisa pratensis* (DBS). During the current survey Devil's-bit scabious was not recorded so the marsh fritillary butterfly is unlikely to occur in the study area.

### Results of the on-site investigations

The site does not have the potential to contain any protected terrestrial invertebrate species. The Narrow-bordered Bee Hawk-moth *Hemaris tityus* was recorded in the south of the site during June 2014, and this is a scarce but not protected species. Overall the habitats on the site (i.e. Coniferous forestry and grassland) support a generalised terrestrial invertebrate community.

Some of the terrestrial invertebrates recorded during the walkover surveys included the large black slug *Arion ater* was found on the open grassland habitats. Red ants were recorded in borders of grassland habitats at the south western side of the site with field Slug *Deroceras reticulatum* being recorded in the grassland areas. Common rough woodlice *Porcellio scaber* was recorded in dead wood throughout the site but was more abundant outside of areas under coniferous plantation such as on hedgerow borders of fields. Opiliones of Coeloptera as well as ground beetles (Carabidae) were also recorded. Again this group was more abundant outside areas under coniferous forestry. The forest-associated beetle species *Abax parallelepipedus* was recorded within the forestry areas. Spider species from family Linyphiidae were also recorded. The terrestrial macroinvertebrate communities

within the forested areas were of low species richness as would be typical of non-native coniferous plantations. Butterflies were recorded in the south western portion of the proposed development site in grassland habitats. Species recorded Orange tip *Anthocharis cardamines*, Ringlet *Aphantopus hyperantus*, Peacock *Inachis io*, Green-veined white *Pieris napi*, Small tortoiseshell *Aglais urticae* and Speckled wood *Pararge aegeria*. Terrestrial true flies (Diptera) recorded were Cleg fly *Haematopota pluvialis*, blow fly *Calliphora vomitora* and *Tipula paludosa*. The terrestrials species recorded are commonly found in comparable habitats in Ireland. No rare or protected species were recorded during the field surveys.

#### 4.3.3.5 Key ecological receptors

The key ecological receptors identified from the ecological interests including designated sites, habitats, flora and fauna recorded within the proposed development site study area are presented in **Table 4.17**.

<i>Ecological receptors within the zone of influence</i>	<i>Summary description of the ecological receptors</i>	<i>Evaluation of the ecological receptors</i>
River Barrow and River Nore cSAC	Site selected for alluvial wet woodlands and petrifying springs, priority habitats on Annex I of the E.U. Habitats Directive. The cSAC has been selected due to the presence of invertebrate, fish and mammal species which are listed under Annex II of the EU Habitats Directive, including freshwater pearl mussel and its hardwater form <i>M. durrovensis</i> , freshwater crayfish, Atlantic salmon, twaite shad, the three Irish Lamprey species - sea, brook and river, the Desmoulin's whorl snail <i>Vertigo moulinsiana</i> and Eurasian otter. The proposed development site is located approximately 0.6km to the south of the River Barrow and River Nore cSAC (or 1.43 km hydrological distance).	The River Barrow and River Nore cSAC is evaluated as being of International Importance for the conservation of habitats and species listed on Annex II of the EU Habitats Directive
Eroding /upland watercourses (FW1)	Eroding / upland watercourses within the study area provide aquatic habitat for salmonids. The Owenbeg River is designated within the River Barrow and River Nore cSAC downstream of the Pinewoods Wind Farm site. Minor eroding watercourses within site do not support salmonids.	The Owenbeg River downstream of the Pinewoods Wind Farm site is evaluated as Internationally important being part of the River Barrow and River Nore cSAC. It contains salmonids and salmonid spawning and nursery habitats. Watercourses within the proposed development site are evaluated as being of local importance, lower value.
Scrub (WS1), hedgerows (WL1) and treelines (WL2)	These habitats were found throughout the site along field boundaries Scrub also formed linear pockets along watercourse corridors and unmanaged areas of land.	These habitats are of high local importance as they provide an ecological function as wildlife corridors for fauna and also for local flora.

<i>Ecological receptors within the zone of influence</i>	<i>Summary description of the ecological receptors</i>	<i>Evaluation of the ecological receptors</i>
Non-volant mammals	Non-volant mammal species recorded within the study area were found to comprise species common in the Irish countryside. Irish Hare and Badger listed on the Irish Wildlife Act (1979, 2000) were recorded from within the site. Other species such as stoat, pine marten and deer may occur within the site and environs. Otter is likely to occur in the Owenbeg River downstream of the proposed development site.	Mammal species protected under the Wildlife Act occurring within the site are identified as being of high local importance; this includes badger and Irish hare.
Bats	Bats were recorded within the study area, including within the proposed development site	Soprano and Common pipistrelles, Leisler's bat and Natterer's bat within the Pinewoods Wind Farm site are evaluated as being of high local importance.
Birds	The only Red listed species found in this study were Woodcock and Meadow Pipit. Meadow Pipit is a widespread and common passerine found in grassland in Ireland. The study area is suboptimal for woodcock given the low density of woodland and only one bird was recorded. Thirteen Amber Listed species were also recorded. The only raptors that were recorded on or near the study site were Sparrowhawk and Kestrel.	Scrub, hedgerow and wet grassland within the Pinewoods Wind Farm site are habitats evaluated as being of local importance (higher value) for avifauna. Other habitats are evaluated as being of local importance (lower value).
Fish communities	The proposed development site is located on elevated ground around the watershed of sub-catchments of the River Nore. The minor 1 <sup>st</sup> order watercourses within the Pinewoods Wind Farm site were found to be insignificant in terms of salmonid production as they were unsuitable for the spawning and nursery requirements of salmonids and were almost dried out during the summer of 2014. Larger watercourses such as the Owenbeg River downslope of the site support brown trout and salmon where suitable nursery and rearing areas occur. European eel, minnow, stone loach and three-spined stickleback are also expected to occur in larger watercourses downstream of the site.	Atlantic salmon is listed on Annex II of the EU Habitats Directive and occurs within the Owenbeg River within the River Barrow and River Nore cSAC designation downstream of the Pinewoods Wind Farm site. This watercourse is evaluated as being Internationally Important. Salmon can be expected to occur upstream of the cSAC designation, but downstream of the proposed development site boundary. Brown trout and European eel are evaluated as being of high local importance within the study area. Watercourses within the proposed development are evaluated as being of local

<i>Ecological receptors within the zone of influence</i>	<i>Summary description of the ecological receptors</i>	<i>Evaluation of the ecological receptors</i>
		importance (lower value) with regard to fish communities.
Reptiles and amphibians	Amphibians recorded within the study are limited to frogs. Suitable habitat for the smooth newt does not occur. The common lizard may potentially occur although it was not recorded during the field survey.	The common frog was recorded from the Pinewoods Wind Farm site and is evaluated as being of high local importance.

***Table 4.17: Identification of key ecological receptors within the Pinewoods Wind Farm zone of impact (based on NRA 2009).***

## 4.4 Description of the Likely Impacts

### 4.4.1 Impact assessment methodology

It is necessary to ensure that any assessment of impact takes account of impacts associated with construction and operation of the proposed development including direct, indirect, secondary, cumulative, short, medium and long-term, permanent, temporary, reversible and irreversible, positive and negative effects as well as impact interactions. Criteria for assessing impact type and magnitude are presented in **Tables 4.18 and 4.19** respectively. In line with the NRA guidelines (2009) and EPA guidelines (2002), the following terms are defined when quantifying duration: Temporary: up to 1 year; Short-term: from 1-7 years; Medium-term: 7-15 years; Long-term: 15-60 years; Permanent: over 60 years.

When characterising impacts, wherever possible reference should be made to the following parameters:

- Magnitude relates to the quantum of an impact, for example the number of individuals affected by an activity;
- Extent should also be predicted in a quantified manner and relates to the area over which the impact occurs;
- Duration is intended to refer to the time during which the impact is predicted to continue, until recovery or re-instatement;
- Reversibility should be addressed by identifying whether an impact is ecologically reversible either spontaneously or through specific action;
- Timing/Frequency of impacts in relation to important seasonal and/or life-cycle constraints should be evaluated. Similarly, the frequency with which activities (and concomitant impacts) would take place can be an important determinant of the impact on receptors.

<i>Impact type</i>	<i>Criteria</i>
Positive impact:	A change which improves the quality of the environment (for example by increasing species diversity; or improving the reproductive capacity of an ecosystem; or removing nuisances; or improving amenities).
Neutral	A change which does not affect the quality of the environment.
Negative impact:	A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem, or damaging health or property or by causing nuisance).

**Table 4.18: Criteria for assessing impact type**

Localised impacts on rivers are loosely defined as impacts measurable no more than 250m from the impact source. Extensive impacts on rivers are defined as impacts measurable more than 250m from the impact source. Any impact on salmonid spawning habitat, or nursery habitat where it is in short supply, would be regarded as an extensive impact as it is likely to have an impact on the salmonid population beyond the immediate vicinity of the impact source. Criteria for assessing impact magnitude in relation to aquatic sites and watercourses are presented in **Table 4.20** below.

<i>Impact magnitude</i>	<i>Definition</i>
No change:	No discernible change in the ecology of the affected feature.
Imperceptible Impact:	An impact capable of measurement but without noticeable consequences.
Slight Impact:	An impact which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate Impact:	An impact that alters the character of the environment that is consistent with existing and emerging trends.
Significant Impact:	An impact which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Profound Impact:	An impact which obliterates sensitive characteristics.

**Table 4.19: Criteria for assessing impact magnitude**

Localised impacts on rivers are loosely defined as impacts measurable no more than 250m from the impact source. Extensive impacts on rivers are defined as impacts measurable more than 250m from the impact source. Any impact on salmonid spawning habitat, or nursery habitat where it is in short supply, would be regarded as an extensive impact as it is likely to have an impact on the salmonid population beyond the immediate vicinity of the impact source. Criteria for assessing impact magnitude in relation to aquatic sites and watercourses are presented in **Table 4.20** below.

<i>Sites of International Importance</i>	<i>Impacts</i>	<i>Temporary</i>	<i>Short-term</i>	<i>Medium-term</i>	<i>Long-term</i>
	Extensive	Major	Severe	Severe	Severe
	Localised	Major	Major	Severe	Severe
<i>Sites of National Importance</i>		<i>Temporary</i>	<i>Short-term</i>	<i>Medium-term</i>	<i>Long-term</i>
	Extensive	Major	Major	Severe	Severe
	Localised	Moderate	Moderate	Major	Major
<i>Sites of County Importance</i>		<i>Temporary</i>	<i>Short-term</i>	<i>Medium-term</i>	<i>Long-term</i>
	Extensive	Moderate	Moderate	Major	Major
	Localised	slight	Moderate	Moderate	Moderate
<i>Sites of High local importance</i>		<i>Temporary</i>	<i>Short-term</i>	<i>Medium-term</i>	<i>Long-term</i>
	Extensive	Slight	Slight	Moderate	Moderate
	Localised	Not significant	Slight	Slight	Slight
<i>Sites of Low local importance</i>		<i>Temporary</i>	<i>Short-term</i>	<i>Medium-term</i>	<i>Long-term</i>
	Extensive	Not significant	Not significant	Slight	Slight
	Localised	Not significant	Not significant	Not significant	Not significant

**Table 4.20: Criteria for assessing impact significance on aquatic sites**

#### 4.4.2 'Do nothing' impact

It is considered that the integrity of the existing environment within the zone of influence of the proposed development would continue in line with existing trends, where the site would continue to be utilised for commercial forestry. Agricultural activities and peat cutting in the townlands in the study area would exert small scale impacts on the landscape and ecological interests in isolation from the proposed development.

#### 4.4.3 Potential Impacts affecting designated areas

The potential impacts affecting designated conservation sites has been evaluated in this current assessment in relation to internationally important Natura 2000 sites and sites of national importance (NHAs). The only site identified as being potentially affected by the proposed development is the River Barrow and River Nore SAC, located approximately 0.7km to the north (1.43 km hydrological distance), where the Owenbeg River and the lower reach of the Graiguenahown and Knockbaun Streams are part of the designated area. A more detailed assessment of the designated Natura 2000 sites within a 15km radius of the proposed development site is provided in the separate NIS report.

##### 4.4.3.1 Construction phase impacts affecting designated areas

###### ***Construction phase impacts affecting the River Barrow and River Nore cSAC***

The proposed development does not lie within or directly adjacent to any SAC site and there will be no direct impacts arising from the proposed development affecting SACs.

All drainage from the proposed development site is to the River Nore via the Graiguenahown and Knockbaun Streams at the north, the Knockardagur Stream to the west of the site and the Moneycleare and Loan Rivers to the south. There would be two crossings of the upper reaches of the Graiguenahown Stream and a crossing of a drainage ditch connected to the Boleybawn Stream, a 1<sup>st</sup> order tributary of the Moneycleare River.

The junction upgrade to the north of the proposed wind farm site is the closest element of the proposed development to the River Barrow and River Nore SAC. Works at this component of the development will be limited to the environs of the existing public roadway. Works at this location are not expected to result in significant water quality related impacts in the Graiguenahown Stream or the Owenbeg River due to distance and extent of the works. The shortest overland hydrological distance from the main component of the proposed development site to the River Barrow and River Nore cSAC is 1.43km, via the Graiguenahown Stream. The Graiguenahown Stream rises within the 'NoreMain\_Owenbeg\_Upper' sub-basin where and the lower reaches of this stream are designated within the SAC. The distance from the confluence of Graiguenahown Stream with the Owenbeg River to the River Nore is approximately 19.8km. The total distance from the northern boundary of the site to the River Nore by the Graiguenahown and Owenbeg River pathway is 21.5km. The proposed development includes two crossings of the Graiguenahown Stream where roadways are proposed to access T04 and T06. The crossings for the proposed roadways to Turbine 4 and Turbine 6 are located 2.25km and 2.53km upstream of the River Barrow and River Nore SAC, or 22.38km and 22.66km upstream of the River Nore respectively. There are no roadways crossings proposed for any other stream within the proposed development boundary i.e. the Knockbawn Stream within the 'NoreMain\_Owenbeg\_Upper' sub-basin, which is the only other watercourse within the proposed development site. There are three proposed turbines (Turbines 9, 10 and 11) within the 'NoreMain\_Dinin\_Mid' sub-basin. The nearest surface water to a turbine in this sub-basin is the Boleybawn Stream which rises approximately 150m to the south east of Turbine 11.

Since the proposed development site includes tributaries of the Owenbeg River, there is potential for indirect impacts arising from the proposed development affecting the River Barrow and River Nore SAC. It is considered that the Loan River within the 'NoreMain\_Dinin\_Mid sub-basin' would not be affected by the proposed development given that there are no turbines or access roads planned in

this portion of the site i.e. south eastern extent. The proposed development has the potential for indirect emissions to the SAC as a result of impacts affecting water quality within the Owenbeg River catchment. These indirect impacts may arise through pollutant discharges or increases in siltation or suspended solids to the Graiguenahown and Knockbaun Streams, where the headwaters of these minor Owenbeg River tributaries lie within the proposed development site. This potential impact is assessed as a major negative impact and is likely to be limited in extent to the Owenbeg River. Indirect impacts on water quality in the Owenbeg River are not envisaged by pollution of the Knockardagur Stream and its tributary the Aghnacross Stream, or the Moneyclare River taking into account low hydraulic connectivity and distance from the Owenbeg River. For example, the Knockardagur Stream and Aghnacross Stream are 655m and 455m from proposed Turbines 4 and 6 in that order. It is noted that all streams within the proposed development site boundary are very small 1<sup>st</sup> order streams and were partially dry during the summer of 2014. All watercourses within the proposed development site were found to be dried out in September 2014.

The most likely potential indirect impact of the proposed development on receiving watercourses and aquatic habitats during the construction phase is suspended solids contamination. This could have potential adverse effects on the migration of salmon or siltation of spawning habitats downstream within the Owenbeg River. Elevated suspended solids levels could arise from construction activities such as excavations, site clearance and road building where surface waters could transport soils and debris to the Graiguenahown Stream, in particular. There would be two crossings of the Graiguenahown stream and these works which take place in the close proximity to this stream, or perhaps within the stream and have the potential for increasing suspended solids concentrations and the loadings to the River Barrow and River Nore SAC. It is noted that the carrying capacity of the Graiguenahown Stream is small taking into account its size and that that the overland distance from other elements of the proposed development to other watercourses is of such distance that the potential for conveyance of pollutants to the River Barrow and River Nore SAC is low. Any significant pollution events, although unlikely, may potentially indirectly affect salmon and otter populations within the SAC downstream of the development site. This potential impact is assessed as major negative.

The proposed development will not require any direct resource requirements within the SAC i.e. water abstraction, alteration of hydrology, impacts on fish passage. Transportation requirements for the proposed development may require crossing of the SAC at existing crossing points downstream of the wind farm site and these are not considered to be a significant impact, where the conservation interests of the site in inland locations are predominantly Annex II aquatic species which occur within the main channel of the Owenbeg River within 10km of the proposed development.

The proposed development does not include elements which would result in likely direct impacts affecting excavation requirements or transportation requirements which may affect the SAC.

Other potential impacts on water quality during the construction phase could occur as a result of accidental spillage of cement or oil stored on site, water contact with uncured concrete and subsequent mobilisation of lime/cement and transport to watercourses. Any engineering works which cause runoff of sediments can also increase the levels of nutrients in receiving streams. The removal of commercial forestry and grassland in advance of road construction for example would leave previously vegetated areas prone to soil erosion and brash/woody debris can be a significant source of nutrients. This can potentially result in the enrichment or eutrophication of the affected streams and catchment areas further downstream of the development within the SAC, and a possible change in overall water quality status. Road access to the site already exists but a number of the existing onsite roads will need to be upgraded, along with the construction of some new roads to facilitate access. In the current case, the construction of the proposed development is not expected to significantly affect the drainage regime on the site, the extent of areas affected will be limited to the footprint of the proposed roads, hardstands and turbine bases, minimising the potential impacts on water quality.

Cumulative impacts of the proposed development affecting the River Barrow and River Nore SAC are identified with regard to potential water quality impacts affecting the Owenbeg River catchment, in combination with ongoing commercial forestry, drainage works and agricultural inputs. Any further pressures with regard to fish passage and changes in hydrology would have the potential to cumulatively affect Freshwater Pearl Mussel and Annex II Atlantic salmon populations within the catchment.

#### ***Construction phase impacts affecting Ballyprior Grassland SAC***

The proposed development site is located approximately 11.1km south west of the Ballyprior Grassland SAC. There are no overland hydrological connections between this designated site and the proposed development site. There are no pathways identified from the proposed development that could affect the habitats (fen, with reed swamp, wet grassland, pools and scrub) or species (*Vertigo moulinsiana*) of this site.

#### ***Construction phase impacts affecting Lisbigney Bog SAC***

There are no construction phase impacts identified affecting Lisbigney Bog SAC; where the proposed development is located approximately 4.5km directly east of this site with no pathways for impacts either directly or indirectly affecting the peatland habitats for which this bog is designated.

#### ***Construction phase impacts affecting the River Nore SPA***

The River Nore SPA includes the river channel and marginal vegetation of the River Nore and the lower reaches of the Owenbeg River. This site is located approximately 4km south west of the proposed development site, or 13km downstream from the southern boundary of the site via the Boleybawn Stream. The River Nore SPA supports nationally important numbers of Kingfisher *Alcedo atthis*. The prey items of this species in watercourses downstream of the proposed development could be indirectly affected by the proposed development by water pollution through suspended solids and other mechanisms analogous to impacts on the River Barrow and River Nore SAC. Deterioration of water quality and knock-on impacts on water quality dependent fish that are required to sustain kingfisher could reduce prey availability. This potential impact is assessed as a significant negative impact.

#### ***Construction phase impacts affecting Natural Heritage Areas and proposed Natural Heritage Areas***

The only site which lies within 5km of the proposed development is Lisbigney Bog pNHA, located approximately 4.5km to the west. This site is designated for the presence of fen, reed swamp, wet grassland, pools and scrub. The site is also co-designated within Lisbigney Bog. There are no construction phase impacts identified affecting Lisbigney Bog.

There are numerous other proposed Natural Heritage Areas within 15km of the proposed development including Coan Bogs (Site Code: 002382), Esker Pits and Shanahoe marsh (Site Code: 001923) but none would be affected by the proposed development taking into account distance and/or weak hydrological connectivity.

#### ***4.4.3.2 Operational phase impacts affecting designated sites***

##### ***Operational phase impacts affecting the River Barrow and River Nore SAC***

There are no direct impacts affecting the River Barrow and River Nore SAC arising from the proposed development during the operational phase. Potential indirect impacts may include increased surface water run-off or increased traffic activity on any newly created access roads, which would have the potential for indirect water quality impacts on the minor watercourses within the Owenbeg catchment. Mitigation measures for the control of surface run-off and the protection of fisheries interests within the affected watercourses will negate any long term operational impacts affecting River Barrow and River Nore SAC downstream. A Surface Water Management Plan will be drawn up for the site to include the operational and decommissioning phase. This will include all aspects of the

proposed development, but will not be responsible for the ongoing commercial forestry activity within the site.

#### ***Operational phase impacts affecting Ballyprior Grassland SAC***

There are no direct impacts affecting Ballyprior Grassland SAC arising from the proposed development during the operational phase.

#### ***Operational phase impacts affecting Lisbigney Bog SAC***

There are no direct, indirect or cumulative impacts affecting this site identified for the operational phase of the proposed development.

#### ***Operational phase impacts affecting the River Nore SPA***

Operational phase impacts of the proposed development on the River Nore SPA relate to water quality deterioration and indirect impacts on the food source of kingfisher. This potential impact is, however unlikely, but is assessed as a potential moderate negative impact.

#### ***Operational phase impacts affecting Natural Heritage Areas and proposed Natural Heritage Areas***

No operational phase impacts are identified for the Natural Heritage Areas and proposed Natural Heritage Areas.

#### ***4.4.3.3 Cumulative impacts affecting designated sites***

Human activities in the River Nore catchment can have a significant effect on water quality through the addition of chemicals whether onto the land or directly into watercourses and by the alteration of catchments by land use changes. Fertilisers, mainly nitrogen, phosphorus and potassium are applied to land, especially in the case of arable crops since nutrients are removed when the crops are harvested. Pesticides, fungicides, herbicides and insecticides sprayed onto lands can reach watercourses and affect instream flora and fauna at all trophic levels, thereby affecting river habitats and water quality dependent species in the Owenbeg River and River Nore.

Tillage and cultivation operations at local and regional level are likely to alter the movement and distribution of soil water. Ploughing increases lateral flow in topsoil, thereby increasing soil erosion and mobilisation of soil particles which can eventually reach watercourses. This can result in elevated suspended solids and nutrient concentrations in the watercourses supporting species of conservation concern in the River Barrow and River Nore SAC and River Nore SPA.

Increasing demand for water and increasing sources of pollution (amounts and types) means greater potential for aquatic environmental damage. Climate change may lead to longer summer periods of low flow in rivers which will reduce the dilution of pollutants.

The Nore Main Water Management Unit Action Plan (SERBD, 2010) covers the River Nore catchment from Ballinakill to Thomastown and includes the Owenbeg River catchment. This action plan lists pressures / risks to water quality in the current study area which are considered potential cumulative impacts on water quality in the River Nore. The WMU action plan for the Nore main WMU identifies that Total Phosphorus (TP) sources are mostly diffuse (60%) and mainly from agriculture (48%) and unsewered properties (6%). 39% of Total Phosphorus originates from waste water treatment plants, with 7 point pressures highlighted: Ballyhale-Knocktopher, Ballyraggett, Bennettsbridge, Freshford, Kilkenny, Thomastown and Ballinakill WWTPs. Additional point pressures include a dairy processing plant and a quarry which are licensed to discharge to surface waters.

#### ***4.4.3.4 Potential Impacts affecting flora***

##### ***Construction phase impacts affecting flora***

During the construction phase of the proposed development, the most significant direct impacts will arise during ground clearance works for the construction of the wind turbines, hard stands and access roads to the site. There will be a direct loss of habitat within the footprint of the proposed

wind turbines, hard stands and access roads. **Table 4.21** lists the habitats directly affected by various elements of the proposed development.

The proposed development site is dominated by two habitats: coniferous plantation (WD4) and improved agricultural grassland (GA1). Both of these habitat types have been identified as being of low ecological importance within a local context and impacts affecting these habitats are evaluated as being imperceptible negative with regard to the botanical communities they support. Neither coniferous plantation nor improved agricultural grassland habitats are classified as key ecological receptors. The magnitude of impact on these habitats is assessed as slight negative. Most of the turbines, hardstands and roadways at the proposed development would incur the loss of conifer plantation, with Turbines 5, 6, 7, 8, 9 and 10 and ancillary development occurring in this habitat type.

Code	Habitat name	Evaluation	Proposed turbine and hard stand											Access road
			1	2	3	4	5	6	7	8	9	10	11	
WD4	Conifer plantation	Local importance, lower value			✓	✓	✓	✓	✓	✓	✓	✓		✓
GA1	Improved agricultural grassland	Local importance, lower value	✓	✓	✓	✓			✓				✓	✓
WL1	Hedgerows	Local importance, higher value	✓	✓		✓			✓				✓	✓
WL2	Treelines	Local importance, higher value												
WS1	Scrub	Local importance, higher value												
GS4	Wet grassland	Local importance, lower value		✓	✓									
FW1	Eroding / Upland watercourse	Local importance, lower value*												✓
FW4	Drainage Ditch	Local importance, lower value												✓
BL2	Earth Banks	Local importance, lower value												
BL3	Buildings & Artificial Surfaces	Local importance, lower value												
ED2	Spoil & Bare Ground	Local importance, lower value								✓	✓	✓		✓

\*watercourses within the proposed development site

**Table 4.21: Habitats directly affected by proposed turbines and associated hard stands, and by proposed access roads in the proposed Pinewoods wind farm site.**

Land take impacts affecting hedgerows which exist as linear features within the agricultural landscape of the study area and along the riparian corridor of the Graiguenahown Stream within the site are evaluated as being slight to moderate negative in the local context. Only short sections of these linear features are within the application boundary where they occur near proposed turbines 1, 4, 7 and 11. Impacts to these habitats will be limited to within the footprint of the proposed development and will not result in the loss of these entire habitats. The only location where treeline habitat would be affected is near Turbine 3 where the southern end of a row of trees would be felled.

During construction phase, the potential exists for direct and indirect impacts on watercourses within the Owenbeg catchment which drains all but a small portion of the south eastern portion of the site. In particular, the physical characteristics of the Graiguenahown Stream could be altered at crossing points where there is currently no access from existing tracks to proposed turbine locations. There are two crossings of the Graiguenahown Stream where roadways are proposed to access Turbine 4 and 6. The crossings for the proposed roadways to Turbines 4 and 6 are located 2.58km and 2.88km upstream of the Owenbeg River in that order. It is noted that the carrying capacity of the Graiguenahown Stream is small taking account of its small size and propensity to drying out. Indeed, this stream was found to be dried out when examined in September 2014.

Likewise, the Knockbaun Stream was dry within the proposed development site at this time. The potential for impacts on important aquatic areas like the Owenbeg River are considered low and especially in the case of pollutants delivered via the Knockbaun Stream as turbines are not located near this watercourse and no crossings of this watercourse are planned. The distance between the Graiguenahown Stream and the nearest proposed turbine in the associated sub-catchment (NoreMain\_Owenbeg\_Upper) is 270m, with T05 being located to the east of the Graiguenahown Stream sub-catchment. Also located within this sub-basin, the Knockbaun Stream is 240m east of T03, the turbine in closest proximity to this stream.

At the western side of the proposed development site, the nearest surface water to a proposed turbine is 850m, where the Aghnacross Stream source is to the northwest within the NoreMain\_Owenbeg\_Mid sub-basin. At the southern portion of the site in the NoreMain\_Ironmills sub-basin, proposed Turbine 11 is closest to a watercourse, where it is located approximately 150m northwest of the source of the Boleybawn Stream. Both the Aghnacross and Boleybawn Streams rise outside of the proposed development site. The fact that these streams are located away from the proposed development reduces to negligible the risk of water quality impacts in downstream areas via these streams.

The only noteworthy surface water transport vector to important aquatic areas, namely the lower reaches of the Graiguenahown Stream, the Owenbeg River and the River Nore is the Graiguenahown Stream. This minor watercourse however has limited potential for transport of pollutants with regard to its small size. At the northern boundary of the proposed development site, this stream was found to be dry in September 2014. The distance from the northern boundary of the proposed development site to the Owenbeg River is 1.76km and the distance from the northern boundary of the proposed development site to the River Nore is 21.5km. Based on estimated flows (which are related to catchment size), the contribution of the Graiguenahown Stream to flows in the Owenbeg and Nore Rivers is very small. For example, the catchment area of the Graiguenahown Stream within the proposed development boundary is approximately 1km<sup>2</sup> and the catchment area of the Owenbeg River upstream of the Graiguenahown Stream confluence is 14.5km<sup>2</sup>, where the 95%ile and mean flow is 0.012m<sup>3</sup>/s and 0.338m<sup>3</sup>/s in that order. These flows are small but compared to the respective 95%ile and mean flow is 0.0008m<sup>3</sup>/s and 0.023m<sup>3</sup>/s flow in the Graiguenahown Stream at the northern boundary of the proposed development site, they are significant. The corresponding theoretical dilution of the Graiguenahown Stream at the northern boundary of the proposed development site by the Owenbeg River at the junction of the Graiguenahown Stream is approximately 14 at both 95%ile and mean flow. It is estimated that hypothetical dilution of water in the Graiguenahown Stream at the northern boundary of the site by the Owenbeg River just upstream of the River Nore would be in the order of 250 at 95%ile flow and 57 at mean flow. The much larger flow of the River Nore would dilute water in the Graiguenahown Stream at the northern boundary of the site by over 2265 times at 95%ile flow and 900 at mean flow. It can be seen that dilution is greater at 95%ile flow, or at times when flow is equalled or exceeded 95%ile of the time i.e. periods of low flow. This corresponds to times when surface waters are most vulnerable to pollution. The reason for this scenario is likely to result from relatively larger base flows in watercourses at lower elevations during prolonged dry periods, when smaller streams at higher elevations reach very low

levels due to dropping water tables. This principle further reduces the potential for impacts on watercourses downstream of the proposed development site.

Construction impacts on the lower reaches of the Graiguenahown Stream, Owenbeg River and River Nore may include increased siltation or pollution of water courses by oil, lubricants, petrol / diesel or accidental spillages associated with construction machinery. Overall, the Graiguenahown Stream, as well as other watercourses draining the proposed development site is not considered significant vectors of pollutants to important downstream areas owing to size, distance and small carrying capacity and dilution rates provided by receiving waters. The magnitude of potential direct impacts on watercourses within the site boundary is evaluated as slight negative, but as these watercourses are of local value, higher importance downstream, the significance of potential impacts are greater and evaluated as moderate negative upstream of the River Barrow and River Nore SAC, and potential major negative within the SAC. Appropriate mitigations are addressed in relation to aquatic ecology and also in the hydrology assessment.

There is the potential for the importation of invasive, non-native species into the site during the construction phase, evaluated as an indirect impact. This may occur either through the utilisation of machinery which has previously been operating on a contaminated site, or through the importation of fill material or spoil which has been contaminated. Proper screening of any material brought into the site and mitigation measures including the washing of machinery will effectively reduce this potential impact. No non-native, invasive species were recorded from the site during the current assessment however.

The cumulative impact of the proposed development with regard to flora and habitats within the proposed development site is assessed with regard to the ongoing commercial forestry operations and agricultural land management within the site. It is considered that micro-siting of the proposed wind turbines would result in a significant reduction in any cumulative impacts affecting the loss of intact habitats of high local importance within the study area.

#### *Operation phase impacts affecting habitats and flora*

There are no ongoing operational impacts expected affecting habitats and flora arising from the proposed development other than the direct loss of these habitats during the construction phase. No indirect or cumulative impacts affecting habitats or flora are identified.

#### **4.4.3.5 Potential impacts affecting fauna**

##### ***Construction phase impacts affecting fauna***

###### *Non-volant mammals*

The construction phase of the proposed development gives rise to the potential for both direct and indirect impacts affecting mammals. Populations of mammals protected under the EU Habitats Directive and other European legislation are rated as being of International Importance (i.e. bat species). No non-volant mammals of international importance were recorded during the current survey nor are any considered to occur within the proposed development site.

Populations of species protected under Irish legislation (i.e. Wildlife Acts) are rated as being of National Importance (i.e. badger, stoat, Irish hare). All of the impacts to mammals in the current situation will, however, be at a local level and will have no bearing on the affected populations on either a county, national or international level. The potential impacts affecting mammals are outlined below.

There are two inactive badger setts within the proposed development site in the townland of Boleybawn but these historical dwellings are to the west of any component of the proposed development. The south-western most sett is nearest proposed Turbine 11 and is approximately 360m to the west of this turbine. Proposed Turbine 7 is located approximately 200m to the east of the inactive sett at the west of the proposed development. Neither of these inactive setts would be

directly impacted by the proposed development due to geographical separation. At construction stage, the proposed development could reduce the chance of these setts being re-occupied by badgers. This potential impact is assessed as Slight negative.

Impacts to badger, hares, hedgehogs and additional non-protected mammal species will include the direct loss of habitat and the fragmentation of existing habitat due to turbine, hard stand and access road construction in conjunction with increased activity on the site. The footprint of the proposed development including access roads potentially affecting hedgerows and scrub habitat may have a localised slight negative impact on habitat connectivity for mammal species including badger. These impacts would be limited to the local context where habitual commuting routes along hedgerows may be affected. The potential impact on hare, hedgehog and other non-volant mammals is assessed as imperceptible negative. The mobility of mammal species and the availability of suitable habitat, including forage and cover within the vicinity of the wind farm development reduces the potential impact of the proposed development.

Any commercial forestry activities on the site currently constitute disturbance impacts to mammals within the study area, with associated access roads and ground clearance. This leads to the conclusion that impacts affecting these mammal species arising from the proposed development are potentially slight negative in significance, taking cognisance of the potential for cumulative impacts.

The proposed development site includes the upper reaches two 1<sup>st</sup> order tributaries of the Owenbeg River; with otter identified within the larger watercourses downstream of the site. The proposed development has the potential for indirect impacts affecting the water quality and fish communities in watercourses draining the proposed development site. Water quality impacts therefore could potentially indirectly affect the foraging ability of otter within the Owenbeg River. This potential impact is evaluated as being slight to moderate negative in a local context.

#### *Bats*

The bat species recorded from within the proposed development site were Common pipistrelle (*Pipistrellus pipistrellus*), Soprano pipistrelle (*Pipistrellus pygmaeus*), Leisler's bat and a *Myotis* species thought to be a Natterer's bat. Overall, the species diversity of bats was found to be low and bat activity levels were considered low. Both pipistrelle species are identified as the most common species occurring in the Irish countryside. Though bat calls were frequently recorded during the current surveys, the level of activity was considered low. On the clear nights when surveying was carried out, it could be seen that a single bat can register multiple detections, as an individual bat can move back and forth along a feeding corridor while feeding.

No roost sites were recorded from the proposed development site and the proposed development would not incur any direct impacts on bat roosts. A single roost that was active in 2012 was found to be used by no more than 5 pipistrelle bats. This roost is located in the townland of Graiguenahown approximately 170m to the east of the site and in excess of 600m from the closest proposed turbine (Turbine 5 located to the northwest). No known roost sites of greater significance have been identified in the wider study area.

The bats occurring within the current study area are associated with minor local roosts and are likely to be dominated by young dispersing males. These bats were found to utilise the coniferous forestry access roads, and forestry edges and hedgerows within and surrounding the proposed development site. In general, bat activity within the proposed development site was found to be low, with little/no roost potential identified within the proposed development zone and low roosting potential in the surrounding landscape. The proposed development site is regarded as poor in terms of insect production and therefore bat foraging due to the dominance of habitats of low ecological value, and unimportant with respect to bat roosting considering the absence of buildings and lack of mature native trees. Overall, the proposed development site is suboptimal for bats.

Linear margins of conifer plantations and existing access roads and tracks within the treeline corridor are identified as being of some importance for commuting bats. The proposed development works will occur largely on green field agricultural lands and coniferous commercial forestry requiring minimal removal of conifer plantation edge or hedgerow habitats which are used by insignificant numbers of bats as commuting corridors. The impact of severing/fragmentation of these linear features are evaluated as slight negative in the local context, however these impacts would be in line with current operations on the land such as clear felling of forestry. Direct impacts on bats are assessed as none. Positive impacts include habitat creation in the medium to long term, in the creation of treelines and the installation of bat boxes to encourage roosting. Habitat creation including planting of treelines along the newly created access roads will be of some benefit to bats and is likely to result in a slight positive impact on bats in the medium to long-term.

### *Birds*

During the current study, the only Red listed species found was an individual Woodcock (the only wader recorded) and Meadow Pipit. The only raptors that were recorded on or near the study site were Sparrowhawk and Kestrel. The majority of the proposed turbine locations, hard stands and access roads are located within intensively managed and low ecological value commercial forestry and areas of improved agricultural grassland.

Of the other species of conservation concern which bred or were found in breeding habitat at the site in 2014, none, including the thirteen amber listed species recorded are considered likely to be significantly affected by this proposed development during the construction phase. Using the significance matrix, the significance of this development falls into the category of “very low concern”.

There will be some loss or alteration to one or more key elements/features of the baseline condition such that the post-development character/composition/attributes will be partially changed from baseline condition owing to the removal of sections of scrub and conifer plantation. The birds recorded regularly utilising the habitats occurring at the site fall into the category of low sensitivity. This development, therefore, should not be of concern, although normal design care and habitat management should be exercised to minimise impacts.

There will be unavoidable, temporary disturbance impacts during construction, which must be carried out outside of the breeding season (March 1<sup>st</sup> – August 31<sup>st</sup>), but there is ample alternative habitat to temporarily accommodate the displaced birds within several hundred metres of the site.

Any impacts on birds and avifaunal habitats including hedgerows and scrub are evaluated as slight negative and localised.

### *Fish*

The potential impacts on fish from the construction phase are primarily related to water quality impacts (see Section 4.4.3.1 and section 4.4.3.5 above). Site excavations such as foundations for proposed Turbines 1 to 11 and excavations for associated hardstands can result in sediment input to streams draining the proposed development site. The nearest proposed turbine to a watercourse at the proposed development site, however, is Turbine 11, which is located 150m northwest of the source of the Boleybawn Stream. Installation, upgrading and/or extension of the internal site road network on the proposed development site could also result in increased silt runoff. There are only two watercourse crossings associated with the proposed development, however, where the upper reaches of the Graiguenahown Stream would be crossed by proposed roads to Turbines 4 and 6. Suspended solids even in quite small quantities could have a serious effect on the spawning sites of salmonids in the Owenbeg River. Releases of suspended solids would be expected to be limited to the construction phase of the proposed wind farm development. Special care and techniques are required in the design and construction of the proposed development to ensure that there will be no siltation or negative impact on the watercourses downstream of the site (Owenbeg and Nore Rivers).

The construction roadways within the site and any adjacent swales could affect site drainage and potentially result in increased erosion of local streams and may result in lower water levels in dry weather, which will reduce the habitat available to fish.

This potential impact, however, is considered to be limited to the Graiguenahown Stream for reasons linked with stream size. Any operations which result in loss of sediment can also result in increased nutrients being released from the soil. This can potentially cause eutrophication of streams, which lowers the capacity of the streams to support fish and invertebrate fauna. In areas where forestry development has occurred and associated artificial fertilisation, such as a large proportion of the lands between the Graiguenahown and Knockardagur Streams, the effect of soil losses to surface waters can be particularly significant. Watercourses within the proposed development site are limited to minor headwaters of 1<sup>st</sup> order streams feeding into the Owenbeg River however, namely the Graiguenahown and Knockardagur Streams. Within the proposed development site, these watercourses do not support fish, owing to their small size and lack of suitable habitat for fish, in particular, salmonids. The principal impacts affecting aquatic ecology is identified in relation to water quality impacts. The potential impacts of the proposed development affecting aquatic ecological interests including fish and their food (macroinvertebrates) in the aquatic environment within the proposed development site would be slight negative at most as these streams are of low ecological value, taking account of ongoing background impacts arising from commercial forestry, agriculture and cattle poaching.

Downstream areas including the lower reaches of the Graiguenahown and Knockbaun Streams which flow out of the site to the north, the Knockardagur Stream which rises to the west of the site, the Moneyclare River which drains the southern extent of the site, and the Owenbeg River into which these streams discharge can be expected to support fish communities. Potential impacts on these sections of watercourses range in magnitude from moderate negative (upstream of designated stretches) to major negative where waters are within the River Barrow and River Nore SAC. The Owenbeg River contains suitable salmonid habitats and 1.43km downstream of the site boundary this watercourse is designated within the River Barrow and River Nore SAC.

Potential impacts of the proposed development on aquatic biota and habitats arising during the construction phase may include:

- Pollution of streams/rivers with suspended solids due to runoff of soil from construction areas, or due to disturbance of fine subsurface substrates in the course of instream construction and excavation during watercourse crossings;
- Pollution of streams/rivers with other substances such as fuels, lubricants, waste concrete, waste water from site toilet and wash facilities, etc.;
- Permanent loss of habitat where access roads are constructed over or in close proximity to streams/rivers or where streams/rivers are permanently diverted to new channels to facilitate access roads. This may lead to the obstruction to upstream movement of fish due to construction of culverts;
- Changes in hydrology, peak and minimum flow rates, etc. arising from the alteration of peatland habitats within the site.

As with any construction site, there is a risk that machinery or materials imported into the site could act as a vector for introducing or dispersing non-native invasive species. Of particular risk to fisheries waters would be the introduction of riparian invasive plants such as Japanese Knotweed *Fallopia japonica*, Himalayan balsam *Impatiens glandulifera*, or Rhododendron *Rhododendron ponticum* which can block light to fisheries channels reducing the carrying capacity for fish. The risk of introducing aquatic invasive species (i.e. zebra mussels *Dreissena polymorpha*, fairy moss *Azolla filiculoides*) to upland oligotrophic streams is thought to be low however.

Modern drainage and water treatment systems (e.g. SUDS) would be included in the proposed development and incorporated into a Surface Water Management Plan for the site and these could result in moderate beneficial impacts for the affected watercourses once the development is operational.

Pollution by substances associated with the construction process would be a potential problem at all points where the proposed development, including associated ancillary works, is constructed close to or over watercourses, particularly where this involves instream works, construction of culverts or river diversion. There would be two crossings of the upper reaches of the Graiguenahown Stream within the proposed development. In the event of failure of the mitigation measures, a significant pollution event in any of this watercourse would be considered the worst-case scenario potential impact that may result from the proposed development; with potential downstream impacts affecting the River Barrow and River Nore SAC.

However, it is important to note that with effective mitigation water quality impacts and habitat enhancement measures would allow for significant mitigation of impacts especially in relation to the Owenbeg River. With the mitigation measures proposed for fisheries in relation to the protection of water quality, the impact on aquatic macroinvertebrates would be imperceptible negative at most in the local context.

#### *Reptiles and Amphibians*

The common frog was recorded from within the wet grassland habitat within the proposed development site. This species utilises the wet ground and standing water associated with the wet grassland and possibly within borders of conifer plantations on the site. No newts or reptiles were recorded during the current study within the study area. The potential impact of the proposed development is deemed to be imperceptible to slight negative in the local context with regard to frogs; with the potential for direct and indirect impacts affecting this species. Ongoing commercial forestry operations within the site are considered to give rise to imperceptible to slight cumulative impacts.

Although no reptiles were encountered during any of the surveys, the common lizard may occur and disruption of habitat utilised by these species would be imperceptible to slight negative impact in the local context.

#### *Invertebrates*

The potential impacts on aquatic macroinvertebrates the proposed development are again primarily related to water quality impacts and follow on from the fisheries impacts. Suspended solids or sediment affecting the watercourses within the study area is also a major concern and can have serious negative impacts on aquatic invertebrate and plant life. The proposed development gives rise to the potential for direct and indirect impacts affecting aquatic macroinvertebrates and the potential for cumulative impacts affecting water quality within the study area with regard to commercial forestry is also identified.

The land take of the proposed development will result in a reduction in habitat for butterflies and other insects, but in terms of the availability of these habitats in the local area this would constitute a small fraction of similar and readily available habitat; resulting in an imperceptible to slight negative impact in the local context.

### ***Operational phase impacts affecting fauna***

#### *Non-volant mammals*

During the operation of the proposed development, it is anticipated that impacts affecting mammals including otter and Irish hare, identified as key ecological receptors occurring within the study area would be limited to imperceptible to slight negative in the local context, arising from the localised

loss of foraging habitats and impacts arising from ongoing disturbance during maintenance; taking account of the existing commercial forestry works within the site.

Indirect and cumulative impacts affecting mammals with regard to operational site maintenance visits in conjunction with ongoing commercial forestry operations and peat cutting are evaluated as having the potential for imperceptible negative to slight negative impacts on mammals in the local context.

### *Bats*

Research in the US and in other European countries indicates that wind turbines have a detrimental effect on some bat species such as tree roosting bats, aerial feeding bats and particularly migratory bat species (Natural England Technical Information Note: TIN051, rev. 2). Studies to date in Europe and the U.S.A. (Kunz *et al.*, 2007, Arnett *et al.*, 2008) have shown that bat mortality due to wind turbines is a serious issue. A recent study (Baerwald *et al.*, 2008) has shown that bats do not have to make contact with the turbine to be killed as the change in atmospheric pressure resulting from the rotating rotor causes bats' lungs to haemorrhage leading to the animals' death. Baerwald *et al.*, (2008) found that 90% of bat fatalities associated with American wind farms involved internal haemorrhaging consistent with barotraumas.

The following factors are identified by Natural England to aid predicting the risk posed by turbines on bats (from Natural England Technical Information Note: TIN051, rev. 2):

- whether populations of bats migrate (autumn migration has been identified as the peak risk period in US and European studies);
- how high bats fly (when or where) and how bats use air space at higher altitudes whether foraging, echo locating, commuting or migrating;
- how far bats travel from their roosts;
- the extent of bat mortality at wind turbine sites (which species are affected and in which habitats and whether the pattern of use of sites has been altered by the installation of the turbines); and
- how bats behave in the vicinity of turbines.

The proposed development site is not an important flyway for bats. The proposed development site is not an area between a roost site or a foraging area for bats. These characteristics of the proposed development site coupled with the low numbers of bats recorded diminish the chances of significant impacts of proposed development on bats.

Bat use of the landscape is linked to roost and food availability and is influenced by need, tradition and opportunism. Each bat species has specific habitat requirements, but the key factors that influence bat distribution are roost availability and presence of suitable foraging sites (Bihari, 2004). Most bat species are unlikely to come into contact with the blades during their normal movements, because, to the best of our knowledge, these bats do not fly at high altitude and rarely fly at heights that intersect with the blades. Most species of bats, including the most commonly recorded bat species during the current assessment (Common and Soprano pipistrelles) have echolocation calls with a useful range of only a few metres and so prefer to fly close to habitat features such as hedgerows, woodlands, walls, rivers, and within and just above the tree canopy. These low flying species and would not be affected by the installation of wind turbines within the proposed development site. Indeed, Brandt *et al.*, (2007) note that common and soprano pipistrelle bats significantly preferred greater hedge and woodland edge linear features over lower, mechanically cut hedgerows and open grassland field areas as commuting aids and foraging areas. Common and soprano pipistrelle bats emit peak frequencies in the range 42 kHz - 62kHz, frequencies conducive to hunting at close range to prey. All turbine blades will be a distance significantly higher than the preferred foraging habitat of pipistrelle bats. Pipistrelle bats typically fly 5-10m above ground level

(Russ, 1999). The same holds true for *Myotis* sp. bats (a single *Myotis* sp. Bat deemed to be a Natterer's bat was recorded in the current field surveys.) Proposed turbines within the wind farm will have no operational impact on these bats continuing to utilise the coniferous woodland edges, hedgerows or access roads within the site. The potential impact on pipistrelle and *Myotis* sp. bat is evaluated as not significant.

Some species of bats, particularly those with strong echolocation calls, will exploit open habitats and are more likely to be at risk from collision with turbines. The only species of bat in Ireland with such a strong echolocation call is Leisler's bat. Small numbers of this species are known to use the proposed development site but this usage is characterised as occasional, opportunistic and erratic visits rather than the concentrated, sustained and frequent flights associated with roost and prey rich environments. This bat emits frequencies in the range 21kHz - 36kHz. These relatively low frequencies (resulting in longer waves) allow increased transmission of sound and hence this bat can detect prey at greater distances than other bat species in Ireland. Leisler's bats usually fly 10-70m above ground level (Russ, 1999). Since Leisler's bats regularly fly at turbine rotor heights, they are therefore potentially at risk from direct collision and barotrauma. Bat echolocation and collision mortality studies suggest that only a small fraction of detected bat passes near turbines results in collisions (Johnson *et al.*, 2002). Jen and McCarthy (1978) have shown that captive hoary bats are able to avoid colliding with moving objects more successfully than stationary ones. Overall, the impact of the proposed development on Leisler's bats is evaluated as slight-moderate negative in the long term taking account of the above literature and low level and type of Leisler's bat activity at the site during optimal conditions for surveying during the summer of 2014.

There are no anticipated operational impacts identified with regard to lighting on the site which would have the potential to affect bats. Bats are vulnerable to the loss of roost sites and any change/loss of habitat that results in a reduction in the availability of its prey. Pesticides are also a threat to bats, due to not only the detrimental impact they can have on its insect prey population but also due to the potential contamination of prey with fatal toxins. In relation to these threats and other threats to bats such as powerlines, disease and starvation, the impact of the proposed development is considered to pose an insignificant risk to bat populations in the region.

### *Birds*

The operational phase of the proposed development has the potential to give rise to collisions, disturbance and displacement of birds. Bird collisions and mortalities could also arise from electrocution, should associated structures such as overhead power lines that would transport energy from the wind farm. As is the case with the proposed development site, the risk of collision is reduced considerably when birds are absent or present in small numbers only. The proposed development site largely comprises habitats of low ecological value for birds and the few birds use the site. Likewise the site is not on regular flyway and very few events of birds flying over the site have been observed. It is important to note also that birds are less likely to fly during periods of high wind and would be expected to fly at lower heights during windy conditions. This would decrease the chances of bird collisions with moving turbine rotors.

A single Red listed Woodcock and Meadow Pipit were recorded at the proposed development site. These species usually fly low to the ground and there is a negligible risk of collision with turbine rotors. Sparrowhawk and Kestrel were the only raptors recorded and are amber listed in Ireland. Recent studies (Pearce-Higgins *et al.* 2009, Madders & Whitfield. 2006) suggest that Kestrels show low levels of avoidance of turbines. Sparrowhawk is a low flying species that forages along treelines and hedgerows, ambushing prey encountered during flight. This species would not be expected to fly at rotor height so would not be affected at operation stage. A large proportion of the bird community recorded at the proposed development site comprised passerines. Pearce-Higgins *et al.* (2009) states that there is little evidence of any effect of wind turbine proximity on passerines; although direct reductions in breeding birds were observed within a 500m buffer zone (Pearce-Higgins *et al.*, 2009).

Following years of research into the impacts of wind turbines on avifauna, there is now a wealth of evidence to support the view that while a range of bird species do occasionally collide with wind turbines, overall, collision events are uncommon or rare (Still et al., 1996, Langston and Pullan 2003, Drewitt and Langston 2006) and in fact, the majority of birds actively avoid flying into moving turbines. None of the regularly occurring species observed in and around the survey area are considered to be at high risk of collision with turbines.

It is highly unlikely that there will be any significant disturbance effects during the operation of the wind farm, and breeding birds will return to the remaining suitable habitat. Therefore, this development should not be of concern with regard to long-term disturbance of breeding birds providing appropriate habitat is retained intact where its removal is not necessary for the development.

The operational phase of the proposed development on birds is evaluated as slight negative.

#### *Fish*

The operation of wind farms would not normally be considered to have the potential to have significant impacts on the aquatic environment and fish. The main potential impact on water quality and fisheries associated with the operational phase of the proposed development would be the indirect pollution of the watercourses within the study area arising from ongoing run-off from the required access roads or due to long term soil subsidence caused during the construction phase. These operational impacts are evaluated as potentially ranging from slight to moderate negative in the absence of mitigation. The scale of impacts affecting the watercourses and fish communities will depend on the implementation of effective mitigation measures and the management of surface water within the development site.

The potential exists for the leakage of oils and lubricants from the turbines or maintenance areas giving rise to a risk of water pollution. However, the likelihood of this occurring is very low and this impact would be fully avoided on a well managed site.

With the mitigation measures proposed for fisheries in relation to the protection of water quality during the operational phase, the impact on aquatic macroinvertebrates would be imperceptible negative at most.

#### *Reptiles and Amphibians*

The operational impact of the proposed development in relation to the common frog is evaluated as imperceptible negative in the local context. No operational impacts affecting reptiles are identified.

#### *Invertebrates*

With the mitigation measures proposed for fisheries in relation to the protection of water quality during the operational phase, the impact on aquatic macroinvertebrates would be imperceptible negative at most.

Operational impacts affecting terrestrial invertebrates are identified as being in line with existing trends, where ongoing disturbance currently exists within the site associated with commercial forestry operations i.e. a moderate impact. No protected invertebrates were recorded or are likely to occur within the site.

#### **4.4.4 Decommissioning phase impact**

Decommissioning of the proposed development site would bring with it many of the same potential impacts as can be realised during the construction phase, although the magnitude of the impact of decommissioning a site would normally be much less than the construction phase impacts. With suitable planning and provision of adequate mitigation any significant potential impacts of decommissioning on the receiving aquatic environment could be avoided.

#### 4.4.5 Impact assessment for the key ecological receptors

The impact assessment and significance of impacts during both construction and operational phase has been summarised with respect to the key ecological receptors identified within the zone of impact with respect to the proposed development. These results are summarised in **Table 4.22**.

<i>Key ecological receptor</i>	<i>Construction phase impacts</i>	<i>Operational Impacts</i>	<i>Ecological significance</i>
River Barrow and River Nore SAC	Water quality impacts, siltation and spread of invasive species	Surface water run-off	Potential major negative impacts via indirect impacts on water quality and conservation interests if unmitigated as there is overland connectivity between the proposed development site and the Owenbeg River, the Owenbeg River within the designation.
Eroding /upland watercourses (FW1)	Possible access road construction, hydrological changes, siltation. Spread of invasive species	Surface water run-off and potential pollution events.	Potential impacts affecting the Owenbeg River and lower reaches of the Graiguenahown and Knockbaun Streams are evaluated as major negative in the absence of mitigation as these areas are within the River Barrow and River Nore SAC. Impacts on the Graiguenahown and Knockbaun Streams within and downstream of the site range from slight negative to moderate negative.
Scrub (WS1), hedgerows (WL1) and treelines (WL2)	Habitat loss of hedgerow habitat due to construction footprint and access road construction.	No further operational impacts expected.	Slight to moderate in the local context. Impacts are considered to be likely given that the proposed development will require limited removal.
Non-volant mammals	Disturbance and displacement during construction. Potential indirect impacts affecting water quality will impact on otter	No operational impacts identified.	In the absence of mitigation measures impacts affecting mammals within the proposed development site, particularly badger and Irish hare are evaluated as potentially slight negative in the local context.
Bats	The proposed development will require limited removal of forestry habitats and linear habitats within the development site.	Overall, operational impacts affecting bats are slight negative.	In the absence of mitigation measures impacts affecting bats are evaluated as potentially being slight negative.
Birds	Potentially slight negative impacts from construction disturbance and habitat loss	Potentially slight negative impacts due to disturbance and displacement	Not Significant to Slight negative impacts due to disturbance and displacement
Fish	Impacts to water quality:	Operational impacts limited to	Water quality impacts arising during the construction or operational phase

<i>Key ecological receptor</i>	<i>Construction phase impacts</i>	<i>Operational Impacts</i>	<i>Ecological significance</i>
	(Pollutants/ suspended solids) and loss of instream habitat in the lower reaches of the Graiguenahown and Knockbaun Streams, and in the Owenbeg River.	potential for pollution and the failure of surface water run-off mitigations.	may potentially result in major negative impacts on fish populations in the Owenbeg River and moderate negative in the Graiguenahown and Knockbaun Streams upstream of the River Barrow and River Nore SAC. No impacts on fish are envisaged for watercourses within the proposed development site boundary.
Freshwater Pearl Mussel	Impacts to water quality: (Pollutants/ suspended solids) and loss of instream habitat in the River Nore	As for fish	Risk of damage to a population of a critically endangered species and / or degradation of habitat. Very low probability however considering distance between proposed development and nearest FPM population. The River Nore FPM population is at least 14km via the Moneyclare River and in excess of 20km via other surface water features, so there is weak connectivity between the proposed development and FPM.
Reptiles and amphibians	Habitat loss, direct disturbance and direct mortality	No operational phase impacts identified	Impacts affecting common frogs are identified as being imperceptible to slight in the local context.

**Table 4.22: Impact characterisation for key ecological receptors (based on NRA, 2009)**

## 4.5 Mitigation & Monitoring Measures

### 4.5.1 Designated areas

The only designated area requiring protection is the River Barrow and River Nore SAC.

#### 4.5.1.1 Mitigation measures during construction phase

All mitigation recommendations have been developed in the context of national and international legislative guidance for the protection and management of flora, habitats of conservation importance, fauna and aquatic ecological interest. The description of mitigation measures is provided in terms of mitigation by avoidance, reduction and remediation. The remedial measures highlighted for the flora and fauna sections below will be sufficient for the designated areas within the study area.

Particular care is required with regard to the Owenbeg River and the lower reaches of the Graiguenahown and Knockbaun Streams which are designated within the River Barrow and River Nore SAC downstream of the proposed development site. Additional mitigation measures to protect water quality during the construction phase are detailed in **Chapters 5 and 6**. The implementation of comprehensive Surface Water Management Plan (SWMP) will be designed and will be aimed at preventing any incidences of surface water pollution and will protect water quality in sensitive aquatic areas downstream, including the lower reaches of the Graiguenahown Stream and the Owenbeg River within the River Barrow and River Nore SAC.

Generally accepted best practice pollution control measures, as outlined below, will be employed during the construction phase when working in or near the minor watercourses in the study area to prevent the transport of deleterious substances to the River Barrow and River Nore SAC:

- Release of suspended solids to all surface waters will be controlled by interception (e.g. silt traps) and management of site run-off. To this end, any surface water run-off shall be treated to ensure that Suspended Solids (SS) and other polluting materials are not above background levels. SS background levels are those concentrations that exist under normal conditions i.e. outside of times when commercial forestry is being felled or in the short-term thereafter, during construction, etc. SS levels are known to increase at times of higher than normal stream discharge, especially following a dry period. There will therefore be a requirement for water quality monitoring in advance of any construction activities at the site to establish background water quality parameter levels. The *Cullenagh* judgement (ruling by the Commercial Court regarding an 18 turbine development on Cullenagh Mountain) sets a precedent that development need only maintain the status quo of a site and not to further deteriorate a protected habitat;
- Silty water shall be treated using silt trays/settlement ponds and temporary interceptors and traps will be installed until such time as permanent facilities are constructed. Straw bales or silt fences shall be appropriately located near watercourses to further help prevent untreated surface water run-off entering any watercourse;
- All fuels, lubricants and hydraulic fluids will be kept in secure bunded areas away from watercourses. The bunded area will accommodate 110% of the total capacity of the containers within it. Containers will be properly secured to prevent unauthorised access and misuse. An effective spillage procedure will be put in place with all staff properly briefed. Any waste oils or hydraulic fluids will be collected, stored in appropriate containers and disposed of offsite in an appropriate manner;
- Fuelling and lubrication will be conducted off-site where possible. If on-site fuelling or lubrication is required, it will not be conducted outside of a secure, bunded hard-standing area. Appropriately trained staff will be used to undertake all fuelling and lubrication and spillkits available in the case of any accidental spillage;

- Storage areas, machinery depots and site offices will not be located within 100m of watercourses;
- Foul effluent from the site temporary offices and facilities will be properly treated and removed to a suitable treatment facility;
- Spill kits will be made available close to streams and all staff will be properly trained on correct use;
- Disposal of raw or uncured waste concrete will be controlled to ensure that watercourses or other sensitive areas will not be impacted. All work will be done in dry weather and effectively isolated from any water that may enter the drainage network for a period sufficient to cure the concrete;
- Attenuation ponds and a constructed wetland shall be designed, allowing 24 hour settlement before discharge of any run-off into the surrounding watercourses.

Works adjacent to or over watercourses within the proposed development site will be carried out outside of the salmonid spawning season and the times that early life stages of salmonid fish will be present. Overall, no instream work will be undertaken during the period October to April. The publication '*Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites*' by Murphy (2004) and the NRA's '*Guidelines for the crossing of watercourses during the construction of national road schemes*' (NRA, 2005) will be followed during the construction of new access roads or instream works.

It is imperative that no significant impacts (direct, indirect or cumulative) occur on the streams downstream of the proposed development or the downstream catchment areas. The Total Suspended Solids limit value given for surface waters in the Salmonid Water Regulations is 25mg/l. This standard is expressed as an average concentration over a period of 12 months and does not apply to suspended solids with harmful chemical properties. It is considered that background levels in watercourses draining the site would be below this concentration most of the time and with appropriate and robust mitigation measures proposed, this value will not be exceeded at anytime during construction/operations.

Any plant or equipment that may have worked in environments where invasive species are present (including but not restricted to zebra mussel *Dreissena polymorpha*, curly waterweed *Lagarosiphon major*, Japanese knotweed *Fallopia japonica* (and other members of the Knotweed family), Indian balsam *Impatiens glandulifera*, giant hogweed *Heracleum mantegazzianum*, rhododendron *Rhododendron ponticum*, New Zealand flatworm *Arthurdendyus triangulata*), shall be suitably cleaned by a high pressure hose before being used on site to prevent the colonisation and spread of invasive species to the proposed development site and potentially to the River Barrow and River Nore SAC. Water used for this washing process shall always be intercepted and prevented from draining back into watercourses.

#### 4.5.1.2 Mitigation measures during operational phase

Water quality impacts potentially arising during the operational phase of the proposed wind farm are considered to be limited to indirect impacts which may result in low level siltation or pollution impacts on the minor watercourses within the Owenbeg River and the lower reaches of the Graiguenahown and Knockbaun Streams. This would therefore give rise to indirect and cumulative impacts on water quality within the SAC. The potential for ongoing operational water quality impacts affecting the River Barrow and River Nore SAC will be effectively mitigated in the required SWMP taking particular account of the requirements for land slide and erosion controls.

#### 4.5.1.3 Monitoring

Monitoring of the proposed development with regard to the potential impacts and proposed mitigations for their reduction, remediation and avoidance will be required to be undertaken by a

qualified ecologist, contracted to independently assess the success and efficacy of the mitigations proposed and implemented on the site. This will include the implementation of the SWMP for the site.

#### **4.5.1.4 Reinstatement**

Reinstatement of all affected areas will be undertaken to the satisfaction of NPWS and IFI. The loss of habitat for conservation interests in the River Barrow and River Nore SAC or impacts affecting the aquatic habitats and qualifying interests of the River Barrow and River Nore SAC will require reinstatement in consultation with these statutory bodies.

### **4.5.2 Habitats and flora**

#### **4.5.2.1 Mitigation measures during construction phase**

The existing commercial forestry divisions and firebreaks and existing tracks within the proposed development site have been considered at design stage. This measured approach has reduced the scale of potential impacts on habitats. It is considered that there is further scope for micro-siting of the wind turbine locations and associated hardstands to avoid hedgerow habitat and areas of scrub (though removal of large areas of scrub is not anticipated).

During the construction of the proposed development, waste materials may be generated such as excavated spoil/rubble during the works phase. This material will not be placed/stored on/near surface water features, scrub or hedgerow habitats occurring within the study area; disposal of any waste material at any location will require a waste permit.

Appropriate measures will be taken to ensure that machinery does not facilitate the establishment and spread of non-native invasive species into the proposed development area. Refuelling of machinery will be undertaken away from the watercourses. Temporary toilet facilities will be provided and there will be no discharges to ground from this unit. Site management procedures will include provisions for removing rubbish generated by on-site staff.

Land clearance and soil stripping within the footprint of the works will be limited to the works area, with habitats outside of the required works or access requirements left intact. Disturbed areas within the footprint of the works will be allowed to regenerate naturally i.e. no reseeding/replanting to be carried out. The required works footprint for the proposed development, including turbine locations, access roads etc will be clearly defined and sited to reduce land take impacts affecting habitats. Fencing of the works area during construction will minimise impacts on adjoining habitats.

Replanting mitigations for loss of hedgerow and any scrub habitats will ensure that there is no net loss of these locally important habitats within the study area. Any planting to be carried out will utilise native species only and will take cognisance of the varying habitat structure within the local landscape. Prescriptions for landscape planting will be prepared by a qualified landscape architect with input from a qualified ecologist, making reference to the baseline habitats and ecological conditions; i.e. scrub, hedgerows and treelines. The development of a Habitat and Species management Plan (HSMP) in consultation with the NPWS will be required at detailed design stage to ensure native species are used. This plan will be drawn up with reference to the extent of habitats disturbed, fencing and plant species.

To protect the habitat 'eroding upland rivers' which comprise the Graiguenahown Stream and the Knockbaun Streams within the proposed development site, guidance in Murphy (2004) and NRA (2005) will be followed during the construction of new access roads over the Graiguenahown Stream and during any instream works. A SWMP would be considered appropriate to mitigate for site drainage which will be planned to control of surface water run-off. This plan will be designed by an engineer/hydrologist to protect water quality in all eroding watercourses draining the proposed development site.

#### **4.5.2.2 Mitigation measures during operational phase**

No further habitat or flora mitigations are required during the operational phase of the proposed development.

#### 4.5.2.3 Monitoring

During the construction phase of the project the works will be monitored by an independent ecologist to ensure that the measures to protect water quality and terrestrial ecology are fully implemented by the contractor. Monitoring of mitigation measures implemented will be required during the operational phase to ensure success and implementation. Direct consultation and discussion with the NPWS will be carried out by the site ecologist to ensure compliance with all nature conservation legislation, to the satisfaction of all statutory bodies and the correct management of the site to best ecological standards.

#### 4.5.2.4 Reinstatement

Reinstatement of all affected areas will be undertaken to the satisfaction of NPWS and Inland Fisheries Ireland (IFI). Any loss of habitats evaluated as being of high local value within the development site will be addressed and compensated for following the provision of detailed designs, in consultation with the NPWS.

### 4.5.3 Fauna

#### 4.5.3.1 Mitigation measures during construction phase

##### **Non-volant Mammals**

There will need to be a pre-construction badger survey on the site and a derogation licence will be required to work within 50m of any setts, should new setts be established prior to construction stage. However, overall terrestrial mammals will not be a significant constraint here and again will benefit from the HSMP.

Temporary fencing (paling with 25 mm mesh) will be erected around the required site works to delineate and restrict the works area and to minimise the potential for disturbance impacts outside of the works area. As no otter holts, or indeed any mammal dwellings, were identified within the impact area of the proposed development, there is no specific mitigation required for the protection of mammals in relation to relocation / construction of artificial dwellings.

The retention of areas of habitats of high conservation interest and linear features such as treelines, hedgerows and areas of scrub will reduce impacts on many common mammal species within the site, where badger and deer possibly occur within the study area. It is recommended that hedgerow removal, if required will be carried out slowly to ensure that any stoats present can escape. Ongoing monitoring for protected species within the development site including Irish hare, badger and stoats will be undertaken by the site ecologist.

##### **Bats**

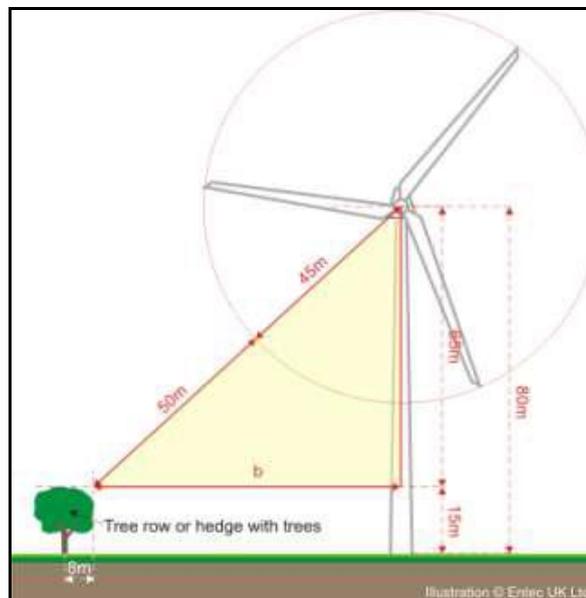
The bat survey carried out as part of the current assessment identified the proposed development site to be of low importance in terms of bat activity in the local context. This infers a limited importance for linear habitats in relation to bat species. The elevated nature of study area, dominated by wet grassland and conifer forestry habitats are considered to limit the bat potential. Landscaping or design to keep turbines away from the forestry edges and hedgerows has already informed site design/layout and will be further addressed in the HSMP, however. This will reduce the risk of bat collisions with turbine rotors and barotrauma. Natural *England Interim Guidance on Bats and Onshore Wind Turbines* (Carlin and Mitchell-Jones, 2009) suggest a minimum distance between features (such as forest or woodland edge) of 50 metres to reduce risk of impact. The Natural England guidance suggests that the following formula is used in order to ensure that a distance of 50 metres or more can be ensured between the blade tip and a potential feeding feature at the nearest

point:  $\sqrt{[(50 + bl)^2 - (hh - fh)^2]}$  where  $bl$  = blade length,  $hh$  = hub height,  $fh$  = feature height. For the example shown below in Figure 4.10,  $b = 69.3m$ .

Considering the anticipated dimensions of the turbines, and the likely maximum height of sitka spruce (for example 15 metres at 20 year felling age), the distance that the turbine would have to be from forest edge ( $b$ ) in order to comply with Natural England Guidelines would be c.55 metres. For turbines in the vicinity of hedgerows, it means that turbines need to be placed a minimum of 36 metres from them (assuming a maximum feature height of 5 metres). Where this is not physically feasible (e.g. due to small field sizes or other constraints) hedgerows need to be removed within the 36 metre radius from the turbine and re-planted in order to maintain the hedgerow network and habitat availability.

General mitigation measures for bats will follow the National Road Authority's 'Guidelines for the Treatment of Bats during the Construction of National Road Schemes' (Kelliher and Marnell, 2006). This document outlines the requirements that should be met in the pre-construction (site clearance) and construction phases of any development to minimise negative impacts on roosting bats, or prevent avoidable impacts resulting from significant alterations to the immediate landscape. The avoidance of hedgerows by proposed turbines and hardstands during construction stage as recommended in mitigation for habitats (section 4.5.2.1) will also reduce impacts on bat commuting /feeding corridors. There are no bat roosts within the proposed development site. Nonetheless, any felled mature trees with ivy should be left to lie on the ground for 24 hours to allow bats that may have been roosting in them to escape.

The above mitigation measures, including recommended distances between turbines and linear features will be set out in the HSMP. Progress on the implementation of the measures for bats will be reported to NPWS. Post-construction monitoring of bats will be required in order to establish the effectiveness of the measures that have been put in place.



**Figure 4.10: Illustration for formula for ensuring a minimum distance of 50 metres from blade tip to habitat (potential feeding) feature. From Carlin and Mitchell-Jones (2009)**

### Birds

Any clearance or removal of semi-natural habitats, scrub or vegetation should not be undertaken during the bird breeding season as detailed under Section 40 of the 1976 Wildlife Act, as amended by Section 46 of the Wildlife Amendment Act (2000), whereby it is forbidden to cut or remove trees or other semi-natural vegetation during the bird nesting season, from the 1<sup>st</sup> of March to the 31<sup>st</sup> of August. This includes riparian vegetation along river corridors (i.e. reeds and marginal vegetation)

which could be used by water birds subject to marginal exemptions for the maintenance of roads, farms and the clearing of sites for development. Micro-siting of turbines away from hedgerows as recommended in section 4.5.2.1 will reduce the impact of site clearance on birds. In the event that turbines cannot be relocated, replanting will be carried out as per mitigation for habitats which would result in re-establishment of hedgerows around turbines and associated hardstands.

Care will be taken to ensure that disturbance will be restricted to the required foot-print of the development infrastructure to ensure that the surrounding habitats are not disturbed.

### ***Fish***

The protection of fish relates to the protection of water quality and habitat for fish. Any construction works taking place in the immediate vicinity of watercourses has the potential to generate and release suspended solids and other pollutants and this applies to the Graiguenahown Stream in particular in the current case. The potential for release to watercourses is greatest during wet weather, for example during a period of rainfall after vegetation clearance or excavations near the Graiguenahown Stream. Generally accepted best practice pollution control measures, as outlined for the protection of the River Barrow and River Nore SAC are also relevant in relation to the fish, and will be employed and strictly observed during the construction phase when working in or near the minor watercourses in the study. Additional mitigation measures to protect water quality during the construction phase are detailed in the Soil and Water chapters.

Plans in relation to water quality should be incorporated into the design and working schedule of the wind farm. This plan will include preparatory works on the site, including installation of silt fences and bunds. To this end, a detailed Surface Water Management Plan (SWMP) for the control of silt-laden water and other pollutants within the site is required. The IFI and the NPWS will be consulted and supplied with a detailed method statement outlining the proposed methodology for the undertaking of works within and affecting the watercourses within the proposed development site. The implementation of the SWMP will be monitored by an independent environmental consultant, reporting directly to the IFI and NPWS. The independent environmental consultant will carry out visual examinations of watercourses receiving flows from the proposed development during the construction phase and regular water samples will be taken.

The implementation of comprehensive SWMP designed with to drainage awareness and aimed at retaining of soils and reducing the incidence of surface water pollution within the boundary of the proposed development will help protect water quality in sensitive aquatic areas downstream, including the lower reaches of the Graiguenahown Stream and the Owenbeg River. The surface runoff attenuation design strategy will be implemented to protect the minor watercourses within the study area, limited to the Graiguenahown and Knockbaun Streams and a drainage ditch connected to a 1<sup>st</sup> order tributary of the Moneyclare River. A fundamental aim of the SWMP will be to intercept silt laden waters and remove sediment prior to release into the watercourse. Measures such as those outlined in Altmüller & Dettmer (2006) in particular are recommended whereby sediment trapping can be accomplished by constructing ponds or wetlands within the proposed development site prior to construction and directing runoff to these retention areas prior to waters entering surface waters that flow out of the site. These attenuation ponds/wetlands will be constructed with vegetated depressions and will act as sand, coarse silt and suspended solids sinks. Existing drains along the roads will be integrated into the SWMP where appropriate by installing check dams. Each silt control feature will be given a reference number and an on-site quality system of maintenance and monitoring of each trap will be implemented. Any wetland features built during construction should be left in place to include post decommission stage, as such features will continue to provide a positive ecological function.

Where haul roads pass close to watercourses, silt fencing will be used to protect the streams. These fences will be secured into the ground and divert water into silt traps. Silt traps should be constructed at locations that will intercept run-off to the drainage network and should not be

constructed immediately adjacent to watercourses. A buffer zone should remain between the silt trap and the watercourse with natural vegetation left intact so as to assist silt interception. All natural watercourses which have to be traversed during site development and road construction works should be effectively bridged prior to commencement. Additional silt fencing will be kept on site for the ongoing maintenance of the structures provided. Again, maintenance and monitoring of such silt fences will be subject to an on-site quality management system. Wheel washing facilities will be provided at the site entrance draining to silt traps. Spoil heaps from the excavations for the turbine bases will be covered and surrounded by silt fences to filter sediment from the surface water run-off from excavated material. Berms will be covered with a pre-seeded matting to expedite the vegetation cover. The berms will be surrounded by silt fencing until the vegetation has been established.

The construction of swales for access road drainage will follow the natural flow paths on site where possible. Existing overland flow channels will be maintained and cross-drains provided in the access roads to allow continuity of flow. Interceptor drains will be constructed upslope where there are no existing channels with cross-drains provided at 50m intervals. The roadside swales will therefore only carry the access road run-off and so avoid carrying large volumes of water and concentrating flows. Where swales are laid at slopes greater than 2%, check dams will be provided. This will reduce effective slope, run-off velocities and any consequent potential for erosion. Furthermore, excavation and installation of roads / access tracks should be undertaken so as not to result in the creation of preferential flow paths that may result in erosion. During the construction process and operation phase, natural flow paths should not be interrupted or diverted so as to give rise to create potential for erosion.

Cross-drains will be provided for drainage crossings and conveying flows from existing and proposed drains across the access tracks. Sub-surface drains will be installed if a water ponding problem is likely to develop, this will be taken into account in the detailed design. New culverts may be required for the crossings of the Graiguenahown Stream - these will be sized appropriately. Where imported materials are used in road construction, these should be such as not to be liable to become crushed by vehicular movement, and lead to discharge of fine particles to downstream receiving waters.

The contractor shall ensure that erosion control and attenuation facilities, namely sediment/silt traps, swales and ponds are regularly maintained during the construction phase and will review same on a regular basis and maintain a log of issues/maintenance and any remediation completed. The contractor shall ensure that all personnel working on site are trained in pollution incident control response. In addition, appropriate signage should be placed on site outlining the spillage response procedure and a contingency plan to contain silt. The operation of machinery within watercourses affected by the proposed development and any instream works will be minimised through strategic scheduling. All of the construction machinery operating in or near these watercourses will be systematically checked in order to avoid leaks of oils, hydraulic fluids and fuels. All oils and fuels should be stored in secure bunded areas, and particular care and attention should be taken during refuelling and maintenance operations on plant equipment. Where site works involve the discharge of drainage water to receiving rivers and streams, temporary oil interceptor facilities should be installed and maintained. Adequate security should be provided on site to prevent spillage as a result of vandalism.

Standing water in the excavations will contain an increased concentration of suspended solids. The excavations will be pumped into temporary settlement basins which will be lined and which will drain into existing or proposed drainage channels on site following settlement of suspended solids. The settlement basins will be constructed in advance of any excavations for the turbine bases.

Cables will be installed in trenches underneath and directly adjacent to access tracks as far as possible. Trenches will be excavated during dry periods where possible in short sections and left open for minimal periods to avoid acting as a conduit for surface water flows. Clay bunds will be

constructed within the cable trench at intervals. Pre-cast concrete should be used whenever possible, to eliminate the risk to all forms of aquatic life. When cast-in-place concrete is required, all work must be done in periods of dry weather and effectively isolated from any water that may enter the drainage network for a period sufficient to cure the concrete. A risk assessment will be prepared prior to any wet concrete operations being carried out and will only be conducted where sufficient periods of dry weather are forecast.

Stream structures should not damage fish habitat or create blockages to fish and macroinvertebrate passage. A method statement for stream crossings (if required) will be agreed in advance with NPWS and the fisheries authorities. IFI is charged under the Fisheries Act (1980) with the responsibility to protect and conserve all freshwater fisheries within its area of jurisdiction. This is not expected to represent an issue, as the reaches of the Graiguenahown and Knockbaun Streams within the site are too small to support fish.

Any diesel or fuel oils stored on site will be banded to 110 % of the capacity of the storage tank. Such facilities will not be located near any drain or watercourse. Design and installation of fuel tanks will be in accordance with best practice guidelines. Refuelling of plant during construction will be carried out on a designated concrete pad, away from watercourses, draining to an oil interceptor. Drip trays and spill kits will be kept available on site. Only emergency breakdown maintenance will be carried out on site. Appropriate containment facilities will be provided to ensure that any spills from the vehicle are contained and removed off site.

Direct crossings of watercourses and any required diversions will be carried out outside of the salmonid spawning season and the times that early life stages of salmonid fish will be present. Overall, no instream work will be undertaken during the period October to April inclusive following agreement with Inland Fisheries Ireland (IFI). The publication '*Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites*' by Murphy (2004) and the NRA's '*Guidelines for the crossing of watercourses during the construction of national road schemes*' (NRA, 2008) will be followed during the construction works. Work on the site will be timed to occur outside periods where very heavy rainfall would be expected (i.e. the winter months).

The construction period will also not coincide with major forestry operations. Portaloos will be used to provide temporary toilet facilities for site personnel. Sanitary waste will be removed from site via a licensed waste disposal contractor.

A regular review of weather forecasts of heavy rainfall will be required and the contractor is required to prepare a contingency plan for before and after such events in relation to pre-cast concrete use, in-stream work or work in proximity to any watercourse.

### ***Reptiles and amphibians***

Should any areas that could potentially be used by frogs for spawning require disturbance between the months of February to June, the area should be inspected by an ecologist to ensure that no spawn or froglets are present. A derogation license from the NPWS will be required if frogs are to be interfered with and frogs will be relocated to a suitable habitat in the locality.

### ***Invertebrates***

No protected macroinvertebrates were recorded within the study area. Mitigations to protect water quality and fisheries will protect aquatic macroinvertebrates within the aquatic habitats and watercourses potentially affected by the proposed development.

#### ***4.5.3.2 Mitigation measures during operational phase***

Site specific mitigations will be provided at detailed design phase for implementation during the operational phase of the proposed development. A review of the ecological mitigation measures may be required during the operational phase, where further measures are identified with respect to faunal conservation measures required.

Access to the site will be limited using a gate to prevent illegal dumping on the site, use of off road vehicles etc. which has been found to occur within the forestry site currently.

It is not envisaged that the operational phase of the wind farm development will involve any significant impacts on the fish or aquatic ecological interests of the study area. Further, the maintenance of the wind farm will include the activities associated with keeping the drainage system operating effectively. The developer will have the responsibility for maintaining the drainage system at the site. The maintenance regime will include the mowing of swales; inspecting cross-drains for any blockages; inspecting outfalls to watercourses; inspecting the existing channels for any obstructions; inspecting the ponds and testing the water quality at the outfalls periodically. Maintenance shall be in accordance with CIRIA C697 SuDS and Maintenance Manual.

#### 4.5.3.3 Monitoring

Retention of vegetative corridors, instream works, culverts, installation of bat boxes and replanting will be monitored by a suitably qualified ecologist to determine the efficiency of the mitigation measures. The implementation of the HSMP and SWMP for the site will be monitored by a qualified ecologist will also be undertaken.

Most mammal fauna are highly mobile, as are bird populations within the study area; it is therefore recommended that further surveying of the proposed development site should be undertaken, immediately prior to the construction phase in the event that a breeding season elapses between the current survey season, the completion of detailed designs and the commencement of construction works at the site. Any necessary modifications to the proposed mitigation measures should be made to accommodate any changes in the populations of protected species within the site. These changes should be agreed in advance with the local NPWS ranger. Details of construction and operational phase monitoring will need to be agreed with NPWS at the pre-construction phase.

#### 4.5.3.4 Reinstatement

Reinstatement of stream banks and riparian vegetation will be required, where the watercourses within the site will be affected by the access road construction. Reinstatement of the aquatic environment where instream works are required must be carried out under the supervision of a qualified aquatic ecologist and must be agreed with the NPWS and IFI prior to completion of works.

There is a requirement for landscape reinstatement to make provision for foraging and commuting routes for fauna along riparian corridors where these are affected.

## 4.6 Residual Impacts

### 4.6.1 Overview

The predicted residual impacts of the proposed development are those impacts that remain after implementation of the mitigation measures described above. The key ecological receptors including designated sites, habitats, flora and fauna have been assessed with respect to the potential impacts identified at the current design stage. In **Table 4.23**, a summary of the residual impact assessment is provided.

The key findings of the current assessment are as follows:

- The proposed development site is not of significant ecological value, due to its generally degraded nature as a result of agricultural activities and extent of conifer plantation;
- The site is not located within or adjacent to any site designated for nature conservation;
- The site is of no particular importance for mammals, including badger and bats;
- The site does not contain any watercourses that support protected macroinvertebrates or fish;

- The site is not on any migration path or regular flyover for any bird species of conservation importance.

Impacts of the proposed development on ecology are assessed as being slight to moderate negative, with these being reduced down to slight at most with the provision of mitigation.

The main mitigation measures that have been employed are as follows:

- The design of the site has resulted in it being located from any designated site. The site has poor hydrological linkage with important watercourses downslope. This reduces/eliminates the risk of landslides or severe water quality impacts;
- A Surface Water Management Plan (SWMP) will be drawn up to ensure that there are no significant impacts on water quality affecting the watercourses draining the site.
- A Habitat and Species Management Plan (HSMP) for the site will be drawn up to ensure that the ecological value of the site improves following development. This is very achievable due to the current degraded status of the site in terms of ecological interests. This plan will be drawn up and implemented following consultation with Inland Fisheries Ireland and National Parks and Wildlife Service staff.
- Ecological monitoring will be undertaken pre-construction, during construction and post construction, to ensure that all the mitigation measures committed to are fully implemented.

The residual impacts on the key ecological receptors including designated sites, habitats, flora and fauna are outlined below. The proposal will bring ecological benefits to the site, and also improve the monition of regional bird populations as part of the proposed ecological monitoring that will be completed.

#### 4.6.2 Designated sites

A standalone Natura Impact Statement has been prepared for the proposed development and this assessment has concluded that the integrity and conservation interests of the River Barrow and River Nore SAC would not be affected by the proposed development.

#### 4.6.2 Habitats and flora

The habitats under the footprint of the proposed development (access roads and turbine hard-standings) would be transformed to 'buildings and artificial surfaces (BL3)' habitat. With implementation of the mitigation measures, other habitats altered within the proposed development site would revert to pre-construction condition. Once the proposed development has been completed and habitats disturbed by construction activities have revegetated, areas surrounding turbines would not be disturbed in the manner that they currently are by agricultural and forestry activities. The overall residual impact on habitats would be slight positive taking account of loss of habitat and improvements (stability in the vicinity of the proposed turbines, replanting of trees) and implementation of the HSMP.

#### 4.6.3 Fauna

##### 4.6.3.1 Mammals

###### **Non-volant mammals**

Impacts on non-volant mammals would be slight negative during the construction phase, due to disturbance on the site and possible disturbance to a secondary inactive badger sett. However, in the medium term there would be a positive impact on all mammals with the implementation of the HSMP.

###### **Bats**

Impacts on bats would be slight negative during the construction phase, due to disturbance. With replanting to promote bat commuting, and installation of bat boxes, as part of the HSMP, the value of proposed development site would improve for feeding and commuting/foraging bats. The risk of Leisler's bat collision with turbine rotors cannot be eliminated. Overall, the residual impact at operational stage is assessed as neutral.

### **Birds**

Avoidance of the bird nesting season during construction would ensure that there would be no significant effects on local bird populations. There will be no significant habitat loss for species of conservation concern.

Considering that the proposed development site is not an important flyway for birds and that the risk of collisions is low, the impact of the proposed wind farm on birds is deemed imperceptible.

### **Fish**

Water quality and aquatic ecology in the Graiguenahown and Knockbaun Streams and in the Owenbeg River would be protected with the mitigation proposed for water quality, including a SWMP. Fish movements, community structure and compositions in the Owenbeg River would not change with the mitigation measures outlined for water quality protection.

The overall residual impact on fish and aquatic ecology is expected to be not significant during construction phase, with potential for slight positive impacts with the implementation of the HSMP.

### **Reptiles and Amphibians**

Wetland areas used for attenuation of water if left in place, as well as new drainage ditches would be of benefit to Common Frog and aquatic macroinvertebrates. This would be a positive impact for these fauna.

### **Invertebrates**

Water quality and aquatic ecology in the Graiguenahown and Knockbaun Streams and in the Owenbeg River would be protected with the mitigation proposed for water quality, including a Surface Water Quality Management Plan. Macroinvertebrate assemblages would not change adversely with the mitigation measures outlined for water quality protection.

<i>Ecological receptors within the zone of influence</i>	<i>Ecological significance if unmitigated</i>	<i>Mitigation measures</i>	<i>Residual impact</i>
River Barrow and River Nore cSAC	Major negative impacts	Water quality protection, avoidance, invasive species management, monitoring.	Not significant
Eroding /upland watercourses (FW1)	Impacts affecting the Owenbeg River and lower reaches of the Graiguenahown and Knockbaun Streams are evaluated as major negative.  Impacts on the Graiguenahown and	Water quality protection, SWMP, avoidance, monitoring.	Impacts affecting the Owenbeg River and the Graiguenahown and Knockbaun Streams are evaluated as not significant.

<i>Ecological receptors within the zone of influence</i>	<i>Ecological significance if unmitigated</i>	<i>Mitigation measures</i>	<i>Residual impact</i>
	Knockbaun Streams within and downstream of the site range from slight negative to moderate negative.		
Scrub (WS1), hedgerows (WL1) and treelines (WL2)	Slight to moderate in the local context.	HSMP, micro-siting, minimising work area.	Neutral to Slight positive
Non-volant mammals	Potentially slight negative in the local context.	HSMP, minimising work area and disturbance, monitoring, protection of water quality.	Slight negative during construction phase only. Potential for positive impacts with HSMP.
Bats	Impacts affecting bats are evaluated as being slight negative.	HSMP, minimising work area and disturbance, bat boxes.	Slight negative during the construction phase, neutral at operation stage
Birds	Not significant to slight negative impacts due to disturbance and displacement	HSMP, minimising work area and disturbance, protection of water quality, avoidance of bird nesting season, monitoring.	Slight negative during construction phase. Potential for positive impacts with HSMP. Imperceptible negative during operational phase.
Fish communities	Major negative impacts on fish populations in the Owenbeg River and moderate negative in the Graiguenahown and Knockbaun Streams upstream of the River Barrow and River Nore cSAC.  No impacts on fish are envisaged for watercourses within the proposed development site boundary.	Water quality protection, avoidance of salmonid spawning season, HSMP, monitoring.	Potential for slight positive impacts with HSMP.
Reptiles and amphibians	Impacts affecting common frogs are identified as being imperceptible to slight in the local context.	Water quality protection, HSMP.	Slight negative during construction phase only. Potential for slight positive impacts with HSMP.

**Table 4.23: Residual impact characterisation for key ecological receptors (based on NRA, 2009)**

#### **4.7 Environmental Commitments**

All design and operating protocols should be agreed with the relevant statutory authorities (IFI, NPWS) and included in the developer's method statements. The developer should ensure that all sub-contractors and site supervisors are aware of the various environmental commitments made in relation to the proposed development. Responsible personnel and communication lines should be established and documented prior to the commencement of on-site works. Where feasible, site meetings may be appropriate to review construction activities.

Works other than those agreed at the design stage should not be undertaken unless there is a written agreement between the relevant statutory authority and the developer's project management team. A site inspection should be undertaken on completion of site works to assess and confirm the implementation of the agreed mitigation measures. In addition, as part of periodic post-construction structure inspections, measures should be assessed for continued effectiveness.

There is a commitment made in this EIS for the preparation of a HSMP and a SWMP. These shall be drawn up at the advance design stage and prior to construction. These plans shall be agreed with NPWS, IFI and the local authority. The HSMP shall also be drawn up in consultation with local BirdWatch Ireland staff.

An Operational Phase Environmental Management Plan (EMP) will also be drawn up and implemented and will be agreed with the relevant statutory bodies. Monitoring of wildlife and efficacy of the mitigation measures will be undertaken during and post construction.

Decommissioning of a wind farm site would bring with it many of the same potential impacts as can be realised during the construction phase except in reverse, although the magnitude of the impact of decommissioning a site would normally be much less than the construction phase impacts. With suitable planning and provision of adequate mitigation any significant potential impacts of decommissioning on the receiving aquatic environment could be avoided. A Decommissioning Plan will be prepared at the end of the lifetime of the wind farm and agreed with the relevant statutory authorities.

## References:

- Altmüller R. & Dettmer, R. 2006. Successful species protection measures for the Freshwater Pearl Mussel (*Margaritifera margaritifera*) through the reduction of unnaturally high loading of silt and sand in running waters – Experiences within the scope of the Lutterproject.
- Arnett, E.B., Brown, W.K., Erickson, W.P., Fiedler, J.K., Hamilton, B.L., Henry, T.H., Jain, A., Johnson, G.D., Kerns, J., Koford, R.R., Nicholson, C.P., O’Connell, T.J., Piorkowski, M.D. and Tankersley, Jr., R.D. 2008 Patterns of bat fatalities at wind energy facilities in North America. *Journal of Wildlife Management* 72 (1): 61 – 78.
- Baerwald, E.F., D’Amours, G.H., Klug, J.B. and Barclay, R.M.R. 2008 Barotrauma is a significant cause of bat fatalities at wind turbines. *Current Biology* 18: No. 16, 695 - 696.
- Balmer, D. Gillings, S. Caffrey, B.J. Swann, R.L. Downie, I.S. 7 Fuller, R.J. 2013. Bird Atlas 2007-2011: the breeding and wintering birds of Britain and Ireland. BTO Books, Thetford.
- Barbour, M.T. and Stribling, J.B. (1991) Use of Habitat Assessment in Evaluating the Biological Integrity of Stream Communities. In: Methods in Stream Ecology (Eds. Hauer, F.R. and Lamberti, G.A. Academic Press.
- Bat Conservation Trust (2012). Bat Surveys: Good Practice Guidelines, 2nd Edition. Bat Conservation Trust, London
- Bat Conservation Ireland (2012) Wind Turbine/Wind Farm Development Bat Survey Guidelines. Version No. 2.8, December 2012.
- Bihari Z. (2004). The roost preference of *Nyctalus noctula* (Chiroptera, Vespertilionidae) in summer and the ecological background of their urbanisation. *Mammalia*, 68: 329-336.
- Bibby, CJ, Burgess, ND, Hill DA and Mustoe SH (2005) Bird Census Techniques (2nd Edn), Academic Press, London, UK.
- Brandt, G., Blows, L., Linton, D., Paling N and Prescott, C. (2007) Habitat associations of British bat species on lowland farmland within the Upper Thames catchment area. Centre for Wildlife Assessment & Conservation E-Journal (2007) 1: 10-19.
- Boland, H Crowe, O. 2012. Irish Wetland bird Survey: Waterbird Status and Distribution 2001/02 to 2008/09. BirdWatch Ireland.
- BTO, 2010. Bird Atlas 2007-2011. Accessed online:  
<http://blx1.bto.org/atlasresults/allocmayo.html>
- Carlin, C. and Mitchell-Jones, T. (2009) Bats and Onshore Wind Turbines – Interim Guidance (1st Edition – 11th February), Technical Information Note TIN051. Natural England, Peterborough, UK
- CFB (2008) *Methods for the Water Framework Directive - Electric fishing in wadable reaches*. Central Fisheries Board, now Inland Fisheries Ireland, Swords, Dublin.
- Chandler, J.R. (1970) A Biological Approach to water Quality Management. *Water Poll. Cont.* 69:415-421.
- Colhoun, K. Cummins, S. 2013. Birds of Conservation Concern in Ireland 2014-2019. *Irish Birds* 9: 523-544.
- Crowe, O. Coombes, R.H. O’Halloran, J. (2014) Estimates and trends of common breeding birds in the Republic of Ireland. *Irish Birds* 10: p23-32.
- Crowe, O. (2005) Ireland’s Wetlands and their Waterbirds: Status and Distribution. BirdWatch Ireland, Newcastle, Co. Wicklow.

- Curtis, T.G.F. & McGough, H.N. (1988) 1 Vascular plants. *The Irish Red Data Book*. The Stationery Office, Dublin.
- Drewitt, A and Langston R (2006). Assessing the impacts of windfarms on birds. In *Wind, Fire and Water: Renewable energy and birds*. Ibis, 148 (Supp 1), pp 29 – 42.
- EA (2003) River Habitat Survey in Britain and Ireland: Field Survey Guidance Manual. River Habitat Survey Manual: 2003 version, Environment Agency, Peterborough.
- EC (2011) *Guidance Document: Wind Energy Development and Natura 2000*. Publication office of the European Union, 2011.
- EPA (2002) Guidelines on the Information to be contained in Environmental Impact Statements. Environmental Protection Agency, Wexford.
- Fitter, R., Fitter, A. & Blamey, M. (1985) *Wild flowers of Britain and Northern Europe*. Collins, London.
- Fitter, R., Fitter, A., & Farrer, A. (1984) *Grasses, sedges, rushes and ferns of Britain and Northern Europe*. HarperCollins, London.
- Fitzpatrick, U., T.E. Murray, R.J. Paxton & M.J.F. Brown (2006). Building on IUCN National Red Lists to produce national lists of conservation priorities – a model using Irish bees (submitted to Conservation Biology).
- Flora (Protection) Order 1999. Statutory Instrument No. 94 of 1999. The Stationery Office, Dublin.
- Flosi, G, and Reynolds, F. L. (1994) California salmonid stream habitat restoration manual. California Department of Fish and Game, Technical Report, Sacramento.
- Fossitt, J. (2000). A guide to habitats in Ireland. The Heritage Council, Kilkenny.
- Hardy J, Crick H, Wernham C, Riley H, Etheridge B and Thompson D (2009). Raptors a field guide for surveys and monitoring. Scottish Natural Heritage, Edinburgh, Scotland.
- Harris, S., Cresswell, P. & Jefferies, D. (1989) Surveying for badgers. Occasional *Publication of the Mammal Society No. 9*. Mammal Society, Bristol.
- Hayden and Harrington (2000) *Exploring Irish Mammals*. Duchas. The Heritage Service.
- IWCM (2012) Pinewoods Wind Farm. Environmental Impact Statement, 2012.
- Jen, P.H.S., and McCarty, J.K. (1978). Bats avoid moving objects more successfully than stationary ones. *Nature* 275, 743–744.
- Johnson, G.D. *et al.* (2002) Bat interactions with wind turbines at the Buffalo Ridge, Minnesota wind resource area: 2001 field season. Electric Power Research Institute, Palo Alto, California.
- Joint Nature Conservation Committee (1993) Handbook for Phase 1 habitat survey – a technique for environmental audit. JNCC, Peterborough.
- Kelleher, C. & 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.
- Killeen I,J (2003). Ecology of Desmoulin’s Whorl Snail. *Conserving Natura 2000 Rivers Ecology Series No. 6*. English Nature, Peterborough.
- King, J.L., Marnell, F., Kingston, N., Rosell, R., Boylan, P., Caffrey, J.M., FitzPatrick, Ú., Gargan, P.G., Kelly, F.L., O’Grady, M.F., Poole, R., Roche, W.K. & Cassidy, D. (2011) *Ireland Red List No. 5: Amphibians, Reptiles & Freshwater Fish*. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

- Kurtz, I. and Costello, M. J. (1999). An outline of the biology, distribution and conservation of lampreys in Ireland. *Irish Wildlife Manuals* No. 5. Dúchas, the Heritage Service, Dublin.
- Langston R and Pullan J (2003). Wind farms and birds: an analysis of the effects of wind farms on birds and Guidance on Environmental Assessment Criteria and Site Selection Issues. Report by Birdlife International on behalf of the Bern Convention.
- Lynas, P., Newton, S.F. & Robinson, J.A. (2009) The status of birds in Ireland: an analysis of conservation concern 2008-2013. *Irish Birds*, 8(2): 149-166
- MacCarthaigh (1997) Hydrological data. A listing of water recorders and summary statistics at selected gauging stations. Environmental Protection Agency, Ireland.
- 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.
- McGinnity, P., Gargan, P., Roche W., Mills, P., and McGarrigle M. 2003. Quantification of the freshwater salmon habitat asset in Ireland using data interpreted in a GIS platform. *Irish Freshwater Fisheries Ecology and Management Series*, Central Fisheries Board, Dublin, 3. 131 pp.
- Moorkens, E. A. (1999) Conservation Management of the Freshwater Pearl Mussel *Margaritifera margaritifera*. Part 1: Biology of the species and its present situation in Ireland. *Irish Wildlife Manuals*, No. 8.
- Moran, P. (2012) Proposed Pinewoods Wind-farm Ornithological Assessment. Report by Forest, Environmental Research and Services Ltd.
- NPWS (2008). *The Status of EU Protected Habitats and Species in Ireland*. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin.
- NPWS (2010). Threat Response Plan Kerry Slug *Geomalacus maculosus*. Department of the Environment, Heritage and Local Government.
- NRA (2008) Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes. National Roads Authority, Dublin.
- (NRA 2008) Ecological surveying techniques for protected flora and fauna during the planning of National Road Schemes. National Roads Authority, Dublin, Ireland.
- NRA (2009) Guidelines for Assessment of Ecological Impacts of National Road Schemes: Rev. 2. National Roads Authority, Dublin
- Muir, G., Morris, P.A. Troughton, G., Strachan, R., Wroot, S., Beer, A.J., Savery, J. (2013) How to Find and Identify Mammals [Revised Edition]. Published by the Mammal Society. 74pp.
- O' Reilly, P. (2004) Rivers of Ireland – A fly fisher's guide. 6<sup>th</sup> Ed. Merlin Unwin Books.
- O'Connor, W. (2003) Biology and Management of European Eel (*Anguilla anguilla*, L.) in the Shannon Estuary, Ireland. Unpublished PhD thesis, National University of Ireland.
- O'Connor W. (2006) A baseline survey of juvenile lamprey populations in the River Feale catchment. *Irish Wildlife Manuals*, No. 22. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.
- O' Reilly, P. (2004) Rivers of Ireland – A fly fisher's guide 6<sup>th</sup> Ed. Merlin Unwin Books.
- Pearce-Higgins, J. Stephen, L. Langston, R. Bainbridge, I. Bullman, R. (2009) The distribution of breeding birds around upland wind farms. *Journal of Applied Ecology*, 46, 1323-1331.
- Percival, SM (2003) Birds and Wind Farms in Ireland: A Review of Potential Issues and Impact Assessment, Sustainable Energy Ireland.

- Preston, C. D., Pearman, D. A. and Dines, T. D., eds (2002). *New Atlas of the British and Irish Flora*. Oxford University Press, Oxford
- Roche N. and Aughney T. (2008). The car-based bat monitoring scheme for Ireland: Report for 2007. Department of the Environment, Heritage and Local Government, Dublin
- Russ, J. 1999. The bats of Britain and Ireland. Echolocation calls, sound analysis, and species identification. Alana Ecology Books, Belfast, 104 pp.
- Sargent, G. & Morris, P. (1997) How to Find and Identify Mammals. The Mammal Society, London.
- SERBD (2010) River Basin Management Plans 2009 - 2015: Nore Main Water Management Unit Action Plan :
- [http://www.wfdireland.ie/docs/1\\_River%20Basin%20Management%20Plans%202009%20-%202015/SERBD%20RBMP%202010/Water%20Management%20Unit%20Action%20Plans/Nore%20Main%20WMU%20Mar%202010.pdf](http://www.wfdireland.ie/docs/1_River%20Basin%20Management%20Plans%202009%20-%202015/SERBD%20RBMP%202010/Water%20Management%20Unit%20Action%20Plans/Nore%20Main%20WMU%20Mar%202010.pdf)
- SEPA (Scottish Environmental Protection Agency) (1996) Guidelines for Water Pollution Prevention from Civil Engineering Contracts. *Scottish Environmental Protection Agency*.
- Scottish Executive (2000) River Crossings and Migratory Fish: Design Guidance. *A Consultation Paper. April 2000*.
- Scottish Natural Heritage (2005). Survey Methods for Use in Assessing the Impacts of Onshore Wind farms on Bird Communities, Scottish Natural Heritage (SNH) Guidance Document, 2005.
- Scottish Natural Heritage (2003). Best Practice Guidance - Badger Surveys. Inverness Badger Survey 2003. Commissioned Report No. 096.
- Still D, Little B and Lawrence S (1996). The effect of wind turbines on the bird population at Blyth Harbour, Northumberland. ETSU W/13/00394/REP, Energy Technology Support Unit, UK department of Trade and Industry.
- Smith, G.F., O'Donoghue, P., O'Hora, K. and Delaney, E. (2011) Best practice guidance for habitat survey and mapping. The Heritage Council, Kilkenny.
- Stace, C. (1997) *New flora of the British Isles*. Cambridge University Press, London.
- Toner, P., Bowman, K., Clabby, K., Lucey, J., McGarrigle, M, Concannon, C., Clenaghan, C., Cunningham, P., Delaney, J., O'Boyle, S., MaCarthaigh, M., Craig, M., and Quinn, R. 2005. *Water Quality in Ireland 2001-2003*. Environmental Protection Agency, Wexford.
- Turnpenney A.W.H. & Williams R. (1980) The effects of sedimentation on the gravels of an Industrial River. *J. Fish. Biol.*, **17**(6), 681-693.
- Webb, D. A., Parnell, J. & Doogue, D. (1996) *An Irish Flora*. Dundalgan Press, Dundalk
- Whilde, A. (1993) Threatened mammals, birds, Amphibians and fish in Ireland, Irish Red data book 2: *Vertebrates*. Belfast, HMSO.
- Whitfield, P. Bullman, R. Band, B. (2005), revised December 2010) Survey methods for use in assessing the impacts of onshore windfarms on bird communities. Scottish Natural Heritage
- Woodrow, W. & McNicholas, D. (2012) Bat Survey and Impact Statement. Pinewoods Wind Farm.

## PLATES - Habitats



*Plate 4.1: Plate looking west from the south-western site (July 2014). Fields comprising the habitat 'improved agricultural grassland' and bordered by hedgerows are typical features of the south western extent of the proposed development site*



*Plate 4.2: Much of the proposed development site comprises commercial coniferous forestry - 'conifer plantation' (WD4)*



*Plate 4.3: Ongoing forestry operations, January 2015*



*Plate 4.4: Proposed development site, January 2015*



*Plate 4.5: Part of the northern portion of the proposed development site (May 2014) - Some parts of the site have been denuded of vegetation owing to cattle trampling. These areas were classified as 'spoil and bare ground' habitat*



*Plate 4.6: The south western extent of the proposed development site comprises agricultural land, hedgerows (WL1) and some rows of mature trees (treeline WL2). Tracks within the site correspond to 'buildings and artificial surfaces habitat*



*Plate 4.7: The Graiguenahown Stream (15G29) rises within the proposed development site and flows north in into the Owenbeg (or Owenbeg) River (15O01) (Nore tributary). This watercourse corresponds to eroding / upland river habitat and has been impacted by cattle poaching. Wet grassland (GS4) and scrub (WS1) occur along the verge of this stream*

#### PLATES - Mammals



*Plate 4.8: Bat activity survey being carried out in the proposed development site in July 2014 - Anabat and heterodyne detectors were used during the bat activity surveys*



*Plate 4.9: Irish Hare occurs within the proposed development site*



*Plate 4.10: Badger snuffle holes were recorded over much of the southern end of the site*



*Plate 4.11: A recently active badger sett found at S50219 81083. These recently active setts can become active again at any time*



*Plate 4.12: Another entrance to the above badger sett*



*Plate 4.13: Droppings deemed to be those of a fox were recorded adjacent to a track near the centre of the proposed development site*

#### PLATES - Birds



*Plate 4.14: Meadow pipits recorded in a hedgerow during the 2014 breeding bird survey*



*Plate 4.15: Whitethroat recorded during the 2014 breeding bird survey*



*Plate 4.16: Sedge warblers recorded during the 2014 breeding bird survey*



*Plate 4.17: Reed bunting recorded during the 2014 breeding bird survey of the proposed development site*



*Plate 4.18: Willow warblers recorded during the 2014 breeding bird survey*



*Plate 4.19: Coal tit on the proposed development site, December 2014*

### PLATES - Aquatic Ecology



*Plate 4.20: Electrofishing at site 6 on the Owenbeg River - Atlantic salmon, brown trout, minnow, stone loach and three-spined stickleback were recorded at this site*



*Plate 4.21: Kick-sampling for aquatic macroinvertebrates in the Owenbeg River*



*Plate 4.22: Hand-searching for crayfish at site 6. Underwater visual assessment carried out with a bathyscope enables a clear view of the river substrate as reflection/glare is eliminated*



*Plate 4.23: Site 1 was located on the Moneyclare River to the south of the proposed development site*



*Plate 4.24: Site 2 was located on the lower reach of the Knockardagur Stream, just upstream of the Owenbeg River confluence*



*Plate 4.25: Site 3 on the Knockardagur Stream ca. 1km to the west of the proposed development site*



*Plate 4.26: The Graiguenahown Stream at Site 4 ca. 1.2km downstream of the proposed development site*



*Plate 4.27: Site 5 was located on the Graiguenahown Stream within the proposed development site*



*Plate 4.28: Site 6 on the Owenbeg River. This part of the river is within the River Barrow and River Nore SAC.*



*Plate 4.29: Site 7 was located on the Knockbaun Stream at the north eastern border of the proposed development site*



*Plate 4.30: Site 8 was located on the Knockbaun Stream ca. 1km from source on the eastern border of the proposed development site*



**Plate 4.31:** Site 9 was located on a 1<sup>st</sup> order un-named tributary (EPA segment code 15\_1085) of the Loan River



**Plate 4.32:** Juvenile Salmon *Salmo salar* recorded at Site 6



**Plate 4.33:** Larvae of the pollution tolerant caseless caddisfly *Rhyacophila dorsalis* was recorded at Site 6



*Plate 4.34: Larvae of pollution tolerant Sumilidae were recorded at Site 2*



*Plate 4.35: The only Crustacean recorded during the current assessment was Gammarus duebeni, being found at the two sites examined on the River Clydagh (Sites 2 and 4)*



*Plate 4.36: Narrow bordered bee hawk moth. No rare or protected terrestrial macroinvertebrates were recorded during the early summer survey*

## Appendix 4.1: NPWS Site Synopsis

SITE NAME: RIVER BARROW AND RIVER NORE

SITE CODE: 002162

This site consists of the freshwater stretches of the Barrow/Nore River catchments as far upstream as the Slieve Bloom Mountains and it also includes the tidal elements and estuary as far downstream as Creadun Head in Waterford. The site passes through eight counties – Offaly, Kildare, Laois, Carlow, Kilkenny, Tipperary, Wexford and Waterford. Major towns along the edge of the site include Mountmellick, Portarlinton, Monasterevin, Stradbally, Athy, Carlow, Leighlinbridge, Graiguenamanagh, New Ross, Inistioge, Thomastown, Callan, Bennettsbridge, Kilkenny and Durrow. The larger of the many tributaries include the Lerr, Fushoge, Mountain, Aughavaud, Owenass, Boherbaun and Stradbally Rivers of the Barrow and the Delour, Dinin, Erkina, Owenbeg, Munster, Arrigle and King’s Rivers on the Nore. Both rivers rise in the Old Red Sandstone of the Slieve Bloom Mountains before passing through a band of Carboniferous shales and sandstones. The Nore, for a large part of its course, traverses limestone plains and then Old Red Sandstone for a short stretch below Thomastown. Before joining the Barrow it runs over intrusive rocks poor in silica. The upper reaches of the Barrow also runs through limestone. The middle reaches and many of the eastern tributaries, sourced in the Blackstairs Mountains, run through Leinster Granite. The southern end, like the Nore runs over intrusive rocks poor in silica. Waterford Harbour is a deep valley excavated by glacial floodwaters when the sea level was lower than today. The coast shelves quite rapidly along much of the shore.

The site is a candidate SAC selected for alluvial wet woodlands and petrifying springs, priority habitats on Annex I of the E.U. Habitats Directive. The site is also selected as a candidate CSAC for old oak woodlands, floating river vegetation, estuary, tidal mudflats, *Salicornia* mudflats, Atlantic salt meadows, Mediterranean salt meadows, dry heath and eutrophic tall herbs, all habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for the following species listed on Annex II of the same directive – Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Nore Freshwater Pearl Mussel, Crayfish, Twaite Shad, Atlantic Salmon, Otter, *Vertigo moulinsiana* and the plant Killarney Fern.

Good examples of Alluvial Forest are seen at Rathsnagadan, Murphy’s of the River, in Abbeyleix estate and along other shorter stretches of both the tidal and freshwater elements of the site. Typical species seen include Almond Willow (*Salix triandra*), White Willow (*S. alba*), Grey Willow (*S. cinerea*), Crack Willow (*S. fragilis*), Osier (*S. viminalis*), with Iris (*Iris pseudacorus*), Hemlock Water-dropwort (*Oenanthe crocata*), Angelica (*Angelica sylvestris*), Thin-spiked Wood-sedge (*Carex strigosa*), Pendulous Sedge (*C. pendula*), Meadowsweet (*Filipendula ulmaria*), Valerian (*Valeriana officinalis*) and the Red Data Book species Nettle-leaved Bellflower (*Campanula trachelium*). Three rare invertebrates have been recorded in this habitat at Murphy’s of the River. These are: *Neoascia obliqua* (Diptera: Syrphidae), *Tetanocera freyi* (Diptera: Sciomyzidae) and *Dictya umbrarum* (Diptera: Sciomyzidae).

A good example of petrifying springs with tufa formations occurs at Dysart Wood along the Nore. This is a rare habitat in Ireland and one listed with priority status on Annex I of the EU Habitats Directive. These hard water springs are characterised by lime encrustations, often associated with small waterfalls. A rich bryophyte flora is typical of the habitat and two diagnostic species, *Cratoneuron commutatum* var. *commutatum* and *Eucladium verticillatum*, have been recorded.

The best examples of old Oak woodlands are seen in the ancient Park Hill woodland in the estate at Abbeyleix; at Kyleadohir, on the Delour, Forest Wood House, Kylecorragh and Brownstown Woods on the Nore; and at Cloghristic Wood, Drummond Wood and Borris Demesne on the Barrow, though other patches occur throughout the site. Abbeyleix Woods is a large tract of mixed deciduous woodland which is one of the only remaining true ancient woodlands in Ireland. Historical records show that Park Hill has been continuously wooded since the sixteenth century and has the most complete written record of any woodland in the country. It supports a variety of woodland habitats and an exceptional diversity of species including 22 native trees, 44 bryophytes and 92 lichens. It also contains eight indicator species of ancient woodlands. Park Hill is also the site of two rare plants, Nettle-leaved Bellflower and the moss *Leucodon sciuroides*. It has a typical bird fauna including Jay, Long-eared Owl and Raven. A rare invertebrate, *Mitostoma chrysomelas*, occurs in Abbeyleix and only two other sites in the country. Two flies *Chrysogaster virescens* and *Hybomitra muhlfeldi* also occur. The rare Myxomycete fungus, *Licea minima* has been recorded from woodland at Abbeyleix.

Oak woodland covers parts of the valley side south of Woodstock and is well developed at Brownsford where the Nore takes several sharp bends. The steep valley side is covered by Oak (*Quercus* spp.), Holly (*Ilex aquifolium*), Hazel (*Corylus avellana*) and Birch (*Betula pubescens*) with some Beech (*Fagus sylvatica*) and Ash (*Fraxinus excelsior*). All the trees are regenerating through a cover of Bramble (*Rubus fruticosus* agg.), Foxglove (*Digitalis purpurea*) Wood Rush (*Luzula sylvatica*) and Broad Buckler-fern (*Dryopteris dilatata*).

On the steeply sloping banks of the River Nore about 5 km west of New Ross, in County Kilkenny, Kylecorragh Woods form a prominent feature in the landscape. This is an excellent example of a relatively undisturbed, relict Oak woodland with a very good tree canopy. The wood is quite damp and there is a rich and varied ground flora. At Brownstown a small, mature Oak-dominant woodland occurs on a steep slope. There is younger woodland to the north and east of it. Regeneration throughout is evident. The understorey is similar to the woods at Brownsford. The ground flora of this woodland is developed on acidic, brown earth type soil and comprises a thick carpet of Bilberry (*Vaccinium myrtillus*), Heather (*Calluna vulgaris*), Hard Fern (*Blechnum spicant*), Cowwheat (*Melampyrum* spp.) and Bracken (*Pteridium aquilinum*).

Borris Demesne contains a very good example of a semi-natural broad-leaved woodland in very good condition. There is quite a high degree of natural re-generation of Oak and Ash through the woodland. At the northern end of the estate Oak species predominate. Drummond Wood, also on the Barrow, consists of three blocks of deciduous woods situated on steep slopes above the river. The deciduous trees are mostly Oak species. The woods have a well established understorey of Holly (*Ilex aquifolium*), and the herb layer is varied, with Brambles abundant. Whitebeam (*Sorbus devoniensis*) has also been recorded.

Eutrophic tall herb vegetation occurs in association with the various areas of alluvial forest and elsewhere where the flood-plain of the river is intact. Characteristic species of the habitat include Meadowsweet (*Filipendula ulmaria*), Purple Loosestrife (*Lythrum salicaria*), Marsh Ragwort (*Senecio aquaticus*), Ground Ivy (*Glechoma hederacea*) and Hedge Bindweed (*Calystegia sepium*). Indian Balsam (*Impatiens glandulifera*), an introduced and invasive species, is abundant in places. Floating River Vegetation is well represented in the Barrow and in the many tributaries of the site. In the Barrow the species found include Water Starworts (*Callitriche* spp.), Canadian Pondweed (*Elodea canadensis*), Bulbous Rush (*Juncus bulbosus*), Milfoil (*Myriophyllum* spp.), *Potamogeton x nitens*, Broad-leaved Pondweed (*P. natans*), Fennel Pondweed (*P. pectinatus*), Perfoliated Pondweed (*P. perfoliatus*) and Crowfoots (*Ranunculus* spp.). The water quality of the Barrow has improved since the vegetation survey was carried out (EPA, 1996).

Dry Heath at the site occurs in pockets along the steep valley sides of the rivers especially in the Barrow Valley and along the Barrow tributaries where they occur in the foothills of the Blackstairs Mountains. The dry heath vegetation along the slopes of the river bank consists of Bracken (*Pteridium aquilinum*) and Gorse (*Ulex europaeus*) species with patches of acidic grassland vegetation. Additional typical species include Heath Bedstraw (*Galium saxatile*), Foxglove (*Digitalis purpurea*), Common Sorrel (*Rumex acetosa*) and Bent Grass (*Agrostis stolonifera*). On the steep slopes above New Ross the Red Data Book species Greater Broomrape (*Orobanche rapum-genistae*) has been recorded. Where rocky outcrops are shown on the maps Bilberry (*Vaccinium myrtillus*) and Wood Rush (*Luzula sylvatica*) are present. At Ballyhack a small area of dry heath is interspersed with patches of lowland dry grassland. These support a number of Clover species including the legally protected Clustered Clover (*Trifolium glomeratum*) – a species known from only one other site in Ireland. This grassland community is especially well developed on the west side of the mud-capped walls by the road. On the east of the cliffs a group of rock-dwelling species occur, i.e. English Stonecrop (*Sedum anglicum*), Sheep's-bit (*Jasione montana*) and Wild Madder (*Rubia peregrina*). These rocks also support good lichen and moss assemblages with *Ramalina subfarinacea* and *Hedwigia ciliata*.

Dry Heath at the site generally grades into wet woodland or wet swamp vegetation lower down the slopes on the river bank. Close to the Blackstairs Mountains, in the foothills associated with the Aughnabrisky, Aughavaud and Mountain Rivers there are small patches of wet heath dominated by Purple Moor-grass (*Molinia caerulea*) with Heather (*Calluna vulgaris*), Tormentil (*Potentilla erecta*), Carnation Sedge (*Carex panicea*) and Bell Heather (*Erica cinerea*).

Saltmeadows occur at the southern section of the site in old meadows where the embankment has been breached, along the tidal stretches of in-flowing rivers below Stokestown House, in a narrow band on the channel side of Common Reed (*Phragmites*) beds and in narrow fragmented strips along the open shoreline. In the larger areas of salt meadow, notably at Carrickcloney, Ballinlaw Ferry and Rochestown on the west bank; Fisherstown, Alderton and Great Island to Dunbrody on the east bank, the Atlantic and Mediterranean sub types are generally intermixed. At the upper edge of the salt meadow in the narrow ecotonal areas bordering the grasslands where there is significant percolation of salt water, the legally protected species Borrer's Saltmarsh-grass (*Puccinellia fasciculata*) and Meadow Barley (*Hordeum secalinum*) (Flora Protection Order, 1987) are found. The very rare Divided Sedge (*Carex divisa*) is also found. Sea Rush (*Juncus maritimus*) is also present. Other plants recorded and associated with salt meadows include Sea Aster (*Aster tripolium*), Sea Thrift (*Armeria maritima*), Sea Couch (*Elymus pycnanthus*), Spear-leaved Orache (*Atriplex prostrata*), Lesser Sea-spurrey (*Spergularia marina*), Sea Arrowgrass (*Triglochin maritima*) and Sea Plantain (*Plantago maritima*).

*Salicornia* and other annuals colonising mud and sand are found in the creeks of the saltmarshes and at the seaward edges of them. The habitat also occurs in small amounts on some stretches of the shore free of stones.

The estuary and the other Habitats Directive Annex I habitats within it form a large component of the site. Extensive areas of intertidal flats, comprised of substrates ranging from fine, silty mud to coarse sand with pebbles/stones are present. Good quality intertidal sand and mudflats have developed on a linear shelf on the western side of Waterford Harbour, extending for over 6 km from north to south between Passage East and Creadaun Head, and in places are over 1 km wide. The sediments are mostly firm sands, though grade into muddy sands towards the upper shore. They have a typical macro-invertebrate fauna, characterised by polychaetes and bivalves. Common species include *Arenicola marina*, *Nephtys hombergii*, *Scoloplos armiger*, *Lanice conchilega* and *Cerastoderma edule*.

The western shore of the harbour is generally stony and backed by low cliffs of glacial drift. At Woodstown there is a sandy beach, now much influenced by recreation pressure and erosion. Behind it a lagoonal marsh has been impounded which runs westwards from Gaultiere Lodge along the course of a slow stream. An extensive reedbed occurs here. At the edges is a tall fen dominated by sedges (*Carex* spp.), Meadowsweet, Willowherb (*Epilobium* spp.) and rushes (*Juncus* spp.). Wet woodland also occurs. This area supports populations of typical waterbirds including Mallard, Snipe, Sedge Warbler and Water Rail.

The dunes which fringe the strand at Duncannon are dominated by Marram grass (*Ammophila arenaria*) towards the sea. Other species present include Wild Sage (*Salvia verbenaca*), a rare Red Data Book species. The rocks around Duncannon ford have a rich flora of seaweeds typical of a moderately exposed shore and the cliffs themselves support a number of coastal species on ledges, including Thrift (*Armeria maritima*), Rock Samphire (*Crithmum maritimum*) and Buck's-horn Plantain (*Plantago coronopus*).

Other habitats which occur throughout the site include wet grassland, marsh, reed swamp, improved grassland, arable land, quarries, coniferous plantations, deciduous woodland, scrub and ponds.

Seventeen Red Data Book plant species have been recorded within the site, most in the recent past. These are Killarney Fern (*Trichomanes speciosum*), Divided Sedge (*Carex divisa*), Clustered Clover (*Trifolium glomeratum*), Basil Thyme (*Acinos arvensis*), Hemp nettle (*Galeopsis angustifolia*), Borrer's Saltmarsh Grass (*Puccinellia fasciculata*), Meadow Barley (*Hordeum secalinum*), Opposite-leaved Pondweed (*Groenlandia densa*), Autumn Crocus (*Colchicum autumnale*), Wild Sage (*Salvia verbenaca*), Nettle-leaved Bellflower (*Campanula trachelium*), Saw-wort (*Serratula tinctoria*), Bird Cherry (*Prunus padus*), Blue Fleabane (*Erigeron acer*), Fly Orchid (*Ophrys insectifera*), Broomrape (*Orobanche hederæ*) and Greater Broomrape (*Orobanche rapum-genistæ*). Of these the first nine are protected under the Flora Protection Order 1999. Divided Sedge (*Carex divisa*) was thought to be extinct but has been found in a few locations in the site since 1990. In addition plants which do not have a very wide distribution in the country are found in the site including Thin-spiked Wood-sedge (*Carex strigosa*), Field Garlic (*Allium oleraceum*) and Summer Snowflake (*Leucojum aestivum*). Six rare lichens, indicators of ancient woodland, are found including *Lobaria laetevirens* and *L. pulmonaria*. The rare moss *Leucodon sciuroides* also occurs.

The site is very important for the presence of a number of EU Habitats Directive Annex II animal species including Freshwater Pearl Mussel (*Margaritifera margaritifera* and *M. m. durrovensis*), Freshwater Crayfish (*Austropotamobius pallipes*), Salmon (*Salmo salar*), Twaite Shad (*Alosa fallax fallax*), three Lamprey species - Sea (*Petromyzon marinus*), Brook (*Lampetra planeri*) and River (*Lampetra fluviatilis*), the marsh snail *Vertigo moulinsiana* and Otter (*Lutra lutra*). This is the only site in the world for the hard water form of the Pearl Mussel *M. m. durrovensis* and one of only a handful of spawning grounds in the country for Twaite Shad. The freshwater stretches of the River Nore main channel is a designated salmonid river. The Barrow/Nore is mainly a grilse fishery though spring salmon fishing is good in the vicinity of Thomastown and Inistioge on the Nore. The upper stretches of the Barrow and Nore, particularly the Owenass River, are very important for spawning.

The site supports many other important animal species. Those which are listed in the Irish Red Data Book include Daubenton's Bat (*Myotis daubentoni*), Badger (*Meles meles*), Irish Hare (*Lepus timidus hibernicus*) and Frog (*Rana temporaria*). The rare Red Data Book fish species Smelt (*Osmerus eperlanus*) occurs in estuarine stretches of the site. In addition to the Freshwater Pearl Mussel, the site also supports two other freshwater Mussel species, *Anodonta anatina* and *A. cygnea*.

The site is of ornithological importance for a number of E.U. Birds Directive Annex I species including Greenland White-fronted Goose, Whooper Swan, Bewick's Swan, Bartailed Godwit, Peregrine and Kingfisher. Nationally important numbers of Golden Plover and Bar-tailed Godwit are found during the winter. Wintering flocks of migratory birds are seen in Shanahoe Marsh and the Curragh and

Goul Marsh, both in Co. Laois and also along the Barrow Estuary in Waterford Harbour. There is also an extensive autumnal roosting site in the reedbeds of the Barrow Estuary used by Swallows before they leave the country.

Landuse at the site consists mainly of agricultural activities – many intensive, principally grazing and silage production. Slurry is spread over much of this area. Arable crops are also grown. The spreading of slurry and fertiliser poses a threat to the water quality of the salmonid river and to the populations of Habitats Directive Annex II animal species within the site. Many of the woodlands along the rivers belong to old estates and support many non-native species. Little active woodland management occurs.

Fishing is a main tourist attraction along stretches of the main rivers and their tributaries and there are a number of Angler Associations, some with a number of beats. Fishing stands and styles have been erected in places. Both commercial and leisure fishing takes place on the rivers. There is net fishing in the estuary and a mussel bed also. Other recreational activities such as boating, golfing and walking, particularly along the Barrow towpath are also popular. There is a golf course on the banks of the Nore at Mount Juliet and GAA pitches on the banks at Inistioge and Thomastown. There are active and disused sand and gravel pits throughout the site. Several industrial developments, which discharge into the river, border the site. New Ross is an important shipping port. Shipping to and from Waterford and Belview ports also passes through the estuary.

The main threats to the site and current damaging activities include high inputs of nutrients into the river system from agricultural run-off and several sewage plants, overgrazing within the woodland areas, and invasion by non-native species, for example Cherry Laurel and Rhododendron (*Rhododendron ponticum*). The water quality of the site remains vulnerable. Good quality water is necessary to maintain the populations of the Annex II animal species listed above. Good quality is dependent on controlling fertilisation of the grasslands, particularly along the Nore. It also requires that sewage be properly treated before discharge. Drainage activities in the catchment can lead to flash floods which can damage the many Annex II species present. Capital and maintenance dredging within the lower reaches of the system pose a threat to migrating fish species such as lamprey and shad. Land reclamation also poses a threat to the salt meadows and the populations of legally protected species therein.

Overall, the site is of considerable conservation significance for the occurrence of good examples of habitats and of populations of plant and animal species that are listed on Annexes I and II of the E.U. Habitats Directive respectively. Furthermore it is of high conservation value for the populations of bird species that use it. The occurrence of several Red Data Book plant species including three rare plants in the salt meadows and the population of the hard water form of the Pearl Mussel which is limited to a 10 km stretch of the Nore, add further interest to this site.

## Appendix 4.2: 2010-2011 Bird Survey Report

Proposed Pinewoods Wind-farm: Ornithological Assessment  
REVISED LAYOUT 2013



INITIAL REPORT PREPARED NOVEMBER 2011 BY:



FERS Ltd.  
Silloge  
Kilberry  
Navan  
Co. Meath  
087 7573121  
dr\_patmoran@eircom.net  
OSI Licence No.:EN0064509

## Summary

*Galetech Energy Developments Ltd. is proposing to develop a wind farm known as Pinewoods Wind Farm, at landholdings in the town-lands of Boleybawn, Knockardagur, Graiguenahown, Ironmills, Kilrush and Crutt in counties Laois and Kilkenny. This development will consist of 8 no. 3MW wind turbines and all associated development. This report assesses the distribution of avifauna dependant on the area immediately within the development site, and the local avifaunal resource in a wider context. Surveys were carried out over a 12 month period between October 2010 and September 2011 in order to comprehensively identify those species of avifauna utilising the site and environs.*

*This report concludes that a wind-farm of the scale discussed is not likely to have a significant negative impact on the utilisation of the survey site or wider area by avifauna for breeding or foraging purposes, provided appropriate habitat management and mitigation measures are put in place. All field surveys were carried out by Dr Patrick Moran and Dr Emma Reeves.*

## Table of Contents

1	Introduction .....	1
1.1	Wind as a renewable energy source in Ireland.....	1
1.2	Potential impacts of wind energy – an overview .....	1
2	The proposed development.....	2
2.1	Background information .....	2
2.2	Description of proposed development .....	2
2.3	The existing environment .....	5
2.3.1	Designated areas within and adjacent to the proposed site .....	5
2.3.2	General habitat characteristics .....	5
3	Policy and Guidance.....	7
3.1	Background .....	7
3.2	Habitats Directive.....	7
3.3	Birds Directive .....	9
3.4	Wildlife act (1976), Wildlife (Amendment) Act (2000) .....	9
3.5	BWI/RSPB NI guidance .....	9
3.6	General.....	10
4	Objectives of the Ornithological Impact Assessment .....	11
5	Survey Assessment Methods .....	12
5.1	Consultations and Desk Study.....	12
5.2	Field surveys.....	12
5.2.1	Winter surveys .....	13
5.2.2	Breeding surveys.....	14
5.2.3	Raptor surveys .....	15
5.3	GIS work and Maps .....	15
6	Results.....	17
6.1	General information with regard to immediate development site .....	17
6.2	Desk study .....	17
6.3	Winter Surveys.....	17
6.4	Spring/summer breeding surveys .....	18
6.5	Raptor surveys .....	19
7	Evaluation of Bird Resource .....	21
7.1	Overview of Legislation.....	21

7.2	Birds of conservation concern/enhanced protection within the study area.....	22
7.2.1	Skylark, <i>Alauda arvensis</i> . BoCCI status: Amber, Birds Directive Annex I: No .....	22
7.2.2	Hen Harrier, <i>Circus cyaneus</i> . BoCCI status: Amber, Birds Directive Annex I: YES .....	23
7.2.3	House Martin, <i>Delichon urbicum</i> . BoCCI status: Amber, Birds Directive Annex I: No. .	23
7.2.4	Kestrel, <i>Falco tinnunculus</i> , BoCCI status: Amber, Birds Directive Annex I: No.....	23
7.2.5	Swallow, <i>Hirundo rustica</i> . BoCCI Status: Amber, Birds Directive Annex I: No.....	23
7.2.6	Black-headed Gull, <i>Larus ridibundus</i> . BoCCI status: Red, Birds Directive Annex I: No.	23
7.2.7	Grasshopper Warbler, <i>Locustella naevia</i> . BoCCI status: Amber, Birds Directive Annex I: No	24
7.2.8	Wheatear, <i>Oenanthe oenanthe</i> . BoCCI status: Amber, Birds Directive Annex I: NO ....	24
7.2.9	Golden Plover, <i>Pluvialis apricaria</i> . BoCCI status: Red, Birds Directive Annex I: YES .....	24
7.2.10	Starling, <i>Sturnus vulgaris</i> . BoCCI status: Amber, Birds Directive Annex I: No .....	24
7.3	Key habitat evaluation with regard to avifauna.....	25
7.3.1	Natura 2000 sites within 15 km of proposed development.....	25
8	Assessment of Impacts.....	31
8.1	Scope of Impacts.....	31
8.2	Assessment of impacts.....	32
8.3	Significance of potential impacts during construction – direct habitat loss and disturbance	35
8.4	Significance of potential impacts during the operation of wind turbines .....	35
8.4.1	Direct Habitat Loss .....	36
8.4.2	Collision Risk.....	36
8.4.3	Disturbance .....	36
8.4.4	Decommissioning of the wind farm .....	37
8.5	Cumulative impacts.....	37
9	Mitigation Measures .....	38
9.1	General Recommendations .....	38
9.1.1	Preparation of an NIS .....	38
9.1.2	Timing of works.....	38
9.1.3	Site Environmental Management Procedures .....	38
9.1.4	Fulfilment of ecological requirements during construction and operation .....	39
9.2	Construction phase mitigation.....	39
9.2.1	Direct habitat loss .....	39
9.2.2	Disturbance impacts.....	39

9.3	Operational phase mitigation .....	39
9.3.1	Collision mortality .....	39
9.3.2	Habitat loss/Disturbance .....	40
9.3.3	Post construction monitoring .....	40
10	Conclusion and Recommendations.....	41
11	Appendix I: Viewsheds of vantage points used in raptor surveys .....	42
12	Appendix II Raptor movements recorded during surveys .....	44

## 1 Introduction

### 1.1 Wind as a renewable energy source in Ireland

Wind power has been used commercially to produce energy since the early 1980's. The development of alternative energy sources is now seen as a priority at international, European and domestic levels for economic, environmental and energy policy requirements. It is now generally accepted that Ireland's wind-resource is among the best in Europe and indeed the world relative to the energy demands of the country. Sustainable Energy Authority of Ireland have carried out resource studies indicating that the potential for wind as a renewable energy source is an order of magnitude greater than the potential provided by other renewables and in fact, is larger than all other renewable energy resources combined.

### 1.2 Potential impacts of wind energy – an overview

Ireland being such a small, yet ecologically rich island, it is often the case that sites which are suitable for wind farms are also areas of considerable ecological significance – often particularly so for avifauna. One of the central issues which has resulted in opposition to wind farms regards the perceived impacts of wind turbines on avifauna, primarily through collisions with turbines. Following years of research into the impacts of wind turbines on avifauna, there is now a wealth of evidence to support the view that while a range of bird species do occasionally collide with wind turbines, overall, collision events are uncommon or rare (Still et al 1996, Langston and Pullan 2003, Drewitt and Langston 2006) and in fact, the majority of birds actively avoid flying into moving turbines. A recent multi-site and multi-species analysis of the impacts of wind farms on bird populations (Pearse-Higgins *et al* 2012) indicates that there is a greater impact on bird populations during construction than during operation. This study also found that there was little evidence to suggest consistent post-construction population declines in any species.

## 2 The proposed development

### 2.1 Background information

GED is proposing to develop a wind farm known as Pinewoods Wind Farm, located 10 km south east of Abbeyleix, on the Laois-Kilkenny border. The proposed development will consist of 8 no. 3MW wind turbines and all associated development in town-lands of Boleybawn, Knockardagur, Graiguenahown, Ironmills, Kilrush and Crutt (see Figure 1). In September 2010, FERS Ltd. was engaged to carry out a comprehensive survey of the avifaunal resource existing at the proposed development site, and environs. FERS Ltd. has been conducting ecological surveys since the company's inception in 2005. Previous work has included surveys within and adjacent to Natura 2000 sites. Clients have included NPWS, Meath County Council, the Heritage Council, Inland Waterways Association of Ireland, the OPW, Coillte and Drogheda Port Company in addition to private individuals and companies. Dr Moran, the senior ecologist with FERS, has in excess of 15 years of experience in carrying out ecological surveys, in both an academic and professional capacity. Dr Moran has a 1st class honours degree in Environmental

Biology (UCD), a Ph.D. in Ecology (UCD), a Diploma in EIA and SEA management (UCD) and has recently been awarded a M.Sc. in GIS (University of Ulster Coleraine). He has carried out many ornithological surveys for various types of projects, and numerous ornithological assessments for proposed wind farm developments.

## 2.2 Description of proposed development.

The proposed development will consist of 8 no. 3MW wind turbines and all associated development in town-lands of Boleybawn, Knockardagur, Graiguenahown, Ironmills, Kilrush and Crutt. The proposed wind farm is located approximately 10 km south east of Abbexleix.

The land-use within the general area is predominantly farmland and forestry. The development will consist of 8 Enercon E82 3.0MW turbines. Each proposed turbine has a rated power output capacity of up to 3 MW. The typical dimensions of this turbine type are as follows:

- Hub height: 85m
- Rotor Diameter: 100m
- Height not exceeding: 135m (ground to blade tip)
- Blade Clearance height: 35m

The turbine blades rotate clockwise when viewed upwind and varies 6 to 18.5 revolutions per minute depending on wind speed. The turbine has a cut-in wind speed of 2 m/s, and a cut-out speed of 28 m/s. At the cut-out speed the turbine would automatically shut down. A full description of the proposed development is provided elsewhere in the EIS.

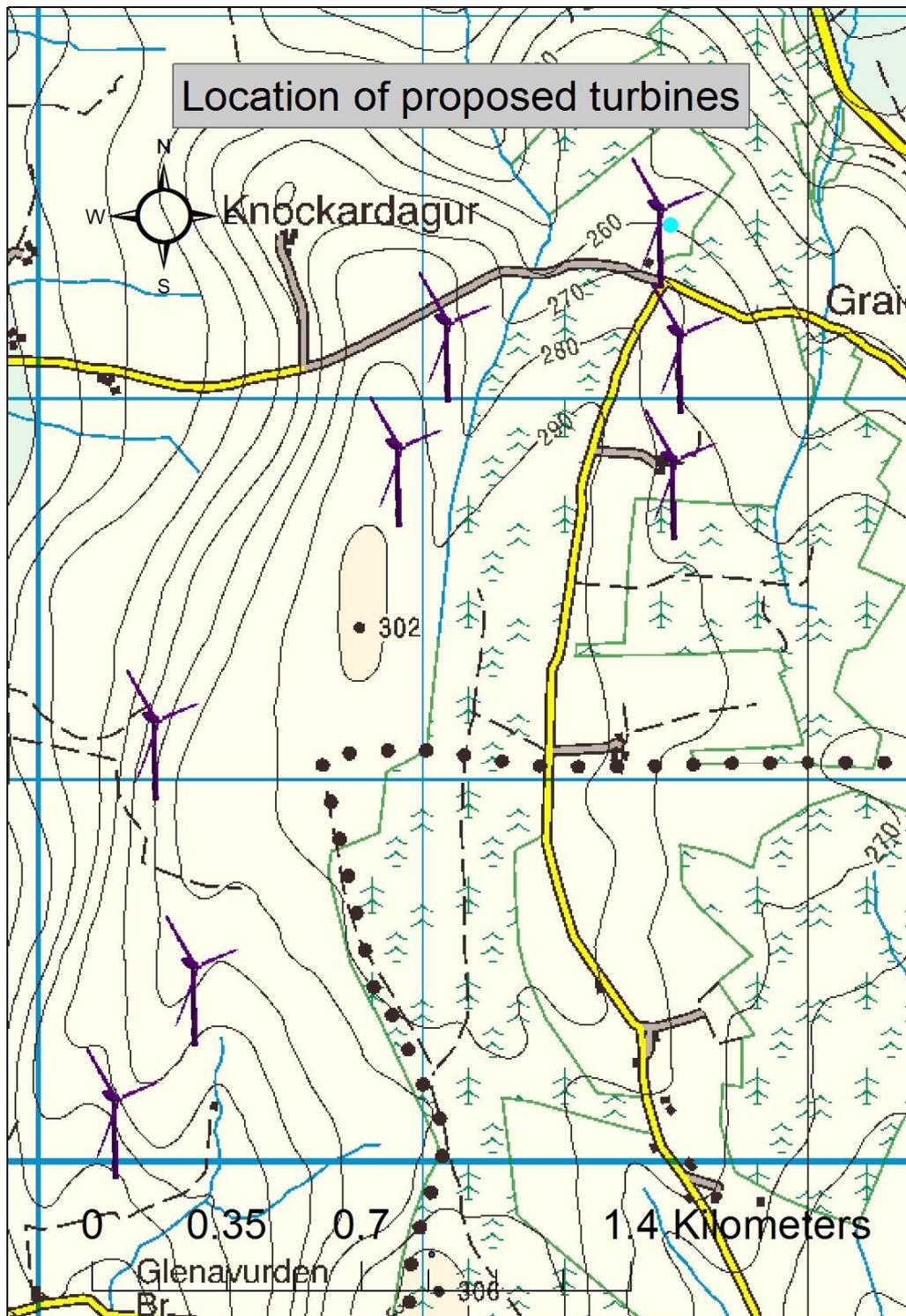


Figure 1: Map of locality illustrating location of proposed wind turbines (note turbines not to scale)

## 2.3 The existing environment

### 2.3.1 Designated areas within and adjacent to the proposed site

A desk study of the general area identified that while there are no Special Areas of Conservation or Special Protection Areas within the boundaries of the proposed development, there are several Natura 2000 sites in the general vicinity (see Table 1).

Table 1: Natura 2000 sites occurring within a 15 km buffer zone around the proposed turbines

Designated Area	Designation	Site Code	Distance to nearest turbine
River Barrow and River Nore	SAC	002162	2.35 km
Ballyprior Grassland	SAC	002256	24 km
Lisbigney Bog	SAC	000869	9.7 km
River Nore	SPA	004233	4.2 km

### 2.3.2 General habitat characteristics

The land-use in the general area is predominantly farmland and forestry. The proposed turbines are located in an area comprised primarily conifer plantations of various ages. An aerial photograph of the general vicinity is shown in Figure 2.



Figure 2: Aerial photograph illustrating the general habitat types in the vicinity of the proposed wind farm

While Fossitt (2000) categorises all ages of conifer plantations as WD4, it is important to note that there is a wide range of ages of conifers within this classification. In areas in which the trees are young (less than 10 years), there is a considerable quantity of Scrub (WS1) habitat associated with the young trees.

### 3 Policy and Guidance

#### 3.1 Background

The potential impact of wind farms on birds has been an issue with many recent proposals world-wide and in Ireland. In order to help address this issue, Dr. Steve Percival drafted the document “Birds and wind farms in Ireland: A review of potential issues and impact assessment” for the purpose of presenting a methodology, the key aims of which was to establish a process by which wind farm developers and conservation agencies could work together to:

- Ensure that wind farm development does not occur in inappropriate locations where important bird populations may be affected.
- Ensure that bird issues do not hinder the development of wind farms at sites where they are not significant.
- Identify where appropriate mitigation measures should be undertaken and where developments may be able to deliver a conservation gain to the area’s ornithological interest.

#### 3.2 Habitats Directive

The “Habitats Directive” (Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna) is the main legislative instrument for the protection and conservation of biodiversity within the European Union and lists certain habitats and species that must be protected within wildlife conservation areas, considered to be important at a European as well as at a national level. A “Special Conservation Area” or SAC is a designation under the Habitats Directive. The Habitats Directive sets out the protocol for the protection and management of SACs. The Directive sets out key elements of the system of protection including the requirement for “*Appropriate Assessment*” of plans and projects. The requirements for an Appropriate Assessment are set out in the EU Habitats Directive. Articles 6(3) and 6(4) of the Directive state:

- (3) *“Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site’s conservation objectives. In the light of the conclusions of the assessment of*

*the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public.”*

*(4) “If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of over-riding public interest, including those of social or economic nature, the Member State shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted.”*

Avoiding impacts of any project on Natura 2000 sites is also of paramount importance. The maintenance of habitats and species within individual Natura 2000 sites at favourable conservation condition contributes to the overall maintenance of favourable conservation status of those habitats and species at a national level. It is therefore necessary to identify any potential impacts of the proposed development on the conservation status of Natura 2000 sites.

The National Parks and Wildlife Service deem that the favourable conservation status of a habitat is achieved when:

- Its natural range, and area it covers within that range, is stable or increasing.
- The ecological factors that are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future.
- The conservation status of its typical species is favourable.

The National Parks and Wildlife Service deem that the favourable conservation status of a species is achieved when:

- Population data on the species concerned indicate that it is maintaining itself.
- The natural range of the species is neither being reduced, or likely to be reduced in the foreseeable future.
- There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

### 3.3 Birds Directive

The “Birds Directive” (Council Directive 2009/147/EC on the Conservation of Wild Birds) provides for a network of sites in all member states to protect birds at their breeding, feeding, roosting and wintering areas. This directive identifies species that are rare, in danger of extinction or vulnerable to changes in habitat and which need protection (Annex I species). Appendix I indicates Annex I bird species as listed on the Birds Directive. A “Special Protection Area” or SPA, is a designation under The Birds Directive.

Special Areas of Conservation and Special Protection Areas form a pan-European network of protected sites known as Natura 2000 sites and any plan or project that has the potential to impact upon a Natura 2000 site requires appropriate assessment.

### 3.4 Wildlife act (1976), Wildlife (Amendment) Act (2000)

The primary domestic legislation providing for the protection of wildlife in general, and the control of some activities adversely impacting upon wildlife is the Wildlife Act of 1976. The aims of the wildlife act according to the National Parks and Wildlife Service are “... to provide for the protection and conservation of wild fauna and flora, to conserve a representative sample of important ecosystems, to provide for the development and protection of game resources and to regulate their exploitation, and to provide the services necessary to accomplish such aims.” All bird species are protected under the act. The Wildlife (Amendment) Act of 2000 amended the original Act to improve the effectiveness of the Act to achieve its aims. In September 2011, the Wildlife Act was further enhanced by the European Community (Birds and Natural Habitats) Regulations.

### 3.5 BWI/RSPB NI guidance

Bird Watch Ireland and the RSPB NI have agreed a list of priority bird species for conservation action on the island of Ireland. These Birds of Conservation Concern in Ireland are published in a list known as the BoCCI List. In this BoCCI List, birds are classified into three separate lists (Red, Amber and Green), based on the conservation status of the bird and hence conservation priority. The Red List birds are of high conservation concern, the Amber List birds are of medium conservation concern and the Green List birds are not considered threatened. Specific criteria are used to classify a bird into one of these three categories.

Species are red-listed if:

- Their population range has declined dramatically in recent years.
- Their breeding population has undergone large and widespread declines since 1800.
- They are of global conservation concern.

Species are amber-listed if:

- Their population or range has declined moderately in recent years.
- They are rare breeders.
- Their breeding or wintering population is localised or of internationally important numbers.
- They have unfavourable conservation status in Europe.

Species are green-listed if they do not meet Red or Amber-listing criteria.

### 3.6 General

With regard to the impact of developments on avifauna, it is important that significant negative impacts on “Important” species be avoided. These important species are defined as:

- Species listed on Annex I of the EU Birds Directive (Directive 2009/147/EC on the conservation of wild birds).
- Species listed on Bird Watch Ireland’s current Birds of Conservation Concern list with a

conservation status of red or amber

- Rare or vulnerable regularly occurring migratory species, or those migrants warranting special consideration owing to the proximity of migration routes, breeding, moulting, wintering or staging areas in relation to the proposed wind farm
- Species occurring at the site in regionally or nationally important numbers
- Species occurring in special concentrations or which for other reasons may be at an exceptional risk of impact.

## 4 Objectives of the Ornithological Impact Assessment

The principal objectives of this impact assessment are as follows:

- To describe baseline conditions of the birds on site through detailed field surveys.
- To determine the nature conservation value and status of sites or bird species potentially affected by the proposed development.
- To consider the range of potential impacts to ornithological receptors and assess their significance.
- To identify any species potentially at risk and to quantify any potential risks.
- To recommend mitigation measures to avoid, minimise or offset any impacts of significance, as well as reasonable measures by which the ecological value of the area could be enhanced as a consequence of the proposed development.
- To assess the significance of any residual impacts, after the adoption of agreed mitigation/habitat enhancement measures.

## 5 Survey Assessment Methods

### 5.1 Consultations and Desk Study

The consultations and desk study carried out with regard to this survey are outlined below:

- The proposed site was visited in order to gain an understanding of the study area with regard to avifauna.
- A review of the aerial photographs and maps for the area was carried out. Possible important habitats for birds within and adjacent to the survey area were identified from photos and maps, and these areas targeted for the field study.
- A review of the National Parks and Wildlife Service (NPWS) on-line database, relating to designated sites within or near to the survey sites was carried out with particular attention to any sites containing species at nationally and regionally important numbers.
- The information available regarding previous records for avifauna within the survey area from the BTO on-line database was reviewed, with particular attention paid to whether there were any:
  - Annex I species recorded at/near the survey area;
  - Particularly ecologically sensitive species recorded at or near the survey site;
  - Species on the red or amber lists of birds of conservation concern (Birdwatch Ireland) occurring at or near the survey site.
- A review of wetland sites of interest with regard to this survey occurring within 10km of the survey area.

- Correspondence with Birdwatch Ireland.

The results of the initial consultations and desk study indicated that in-depth field studies were required in order to comprehensively assess the bird species present in the vicinity of the proposed development, and any potential impacts of the proposed development on the avifauna of the immediate and surrounding area.

## 5.2 Field surveys

The desk study yielded evidence of the possibility of numerous “important” species utilising the habitats in the vicinity of the proposed development, including both large water fowl such as Whooper Swan and Greylag Geese, and several raptor species. As such, a 12-month baseline ornithological survey of the area, with the aim of quantifying the use of the proposed wind farm development site by breeding and non-breeding birds, and to allow a determination of the likelihood of bird displacement and disturbance on site, and collision with turbines. Surveying followed the guidance published in “Bird Census Techniques” (Bibby *et al* 2005) and “Raptors, a field guide for surveys and monitoring” 2<sup>nd</sup> Edn (Hardy *et al* 2009) with techniques modified to suit terrain and survey objectives. Surveys were divided into three main sections:

- Winter surveys.
- Breeding Surveys.
- Raptor Surveys.

### 5.2.1 Winter surveys

During the period October 2010 – February 2011, winter bird surveys were carried out, primarily to determine if the area of the proposed turbines was utilised by any winter migrants that might be impacted upon by the proposed development. The site was visited twice a month and a transect route walked/driven (see figure 3), stopping at eight set observation points for a period of 10 minutes, taking approximately 3 hours in total. Utilising a tripod-mounted Opticron GS665 GA spotting scope (fitted with a HDF 16 – 48 X Zoom) and Opticron DBA Oasis 10X42 binoculars all birds observed were noted.



Figure 3: Transect route walked (red line)/driven (orange line) and observation points (green dots) used during winter surveys

### 5.2.2 Breeding surveys

During the period March – September 2011, bird surveys were carried out twice a month in order to establish those species of birds present within this area during this important time of year during which breeding and the replenishing of species occurs. The same route-transect and observation points as utilised for winter surveys (figure 3) was employed for breeding surveys. All species observed were noted and recorded. A Long-eared Owl survey was carried out on the 4<sup>th</sup> of August, commencing 90 minutes after sunset and lasting approximately 1 hour in order to listen for evidence of Long-eared Owl (*Asio otis*). A parabolic microphone and digital recorder were utilised to enhance and record bird calls (LiSN Parabolic Microphone LS370 with Edirol digital recorder and Sennheiser earphones).

The objective of the breeding surveys was to:

- Identify all breeding bird species present within the boundaries of the site and surrounding habitat.
- To record any priority species and assess their status within the site.
- To identify any areas of habitat of particular interest with regard to biodiversity.

Birds were considered to be breeding if they appeared to be holding a territory, giving alarm calls, observed to be carrying nesting material or food items or if nests/young birds were seen or heard. Given the terrain in question over much of the site (young conifer plantation with very thick scrub growth), the majority of identifications were based on bird calls.

### 5.2.3 Raptor surveys

Given the habitat type and the relative proximity (approximately 20 km) of the proposed site to the Slieve Bloom Mountains SPA (site code 004160), which is considered a stronghold for Hen Harrier (*Circus cyaneus*) and which also holds breeding territories of Peregrine Falcon (*Falco peregrinus*) and Merlin (*Falco columbarius*), raptor surveys were carried out in order to determine if the area of the site was part of the territory of any of these species. Having surveyed the site for suitable breeding habitat for Hen Harrier, an appropriate vantage point was chosen using GIS, which would give optimal views over suitable habitat. This vantage point was visited twice a month, between April and September for a time period of 3 hours per visit (between the hours of 8 am and 3 pm). The position of the vantage point relative to the surrounding landscape and view-sheds of the vantage point based on flight heights of 35 m and 100m are shown in Appendix I.

## 5.3 GIS work and Maps

ArcGIS 9.3 was utilised in the production of all maps by standard methods. For the production of view-sheds, 50 metre spot-point elevation data, provided by GED, was imported into ArcMap and was utilised to generate a digital elevation map of the study area using the interpolate to raster (inverse distance weighted) function. Having imported vantage point co-ordinate data into the database, a view-shed of the vantage point utilised during raptor surveys was created, based on an observer height of 2 m and a flight height of 35 m or 100 m (OFFSETA = 2, OFFSETB = 35/100).

# 6 Results

## 6.1 General information with regard to immediate development site

For a description of the impacts upon general flora, fauna and habitats, please see Chapter 7 of the EIS – “Flora and Fauna”.

## 6.2 Desk study

The results of the desk study indicated the presence of several designated areas in the vicinity of the study area and the possibility that several “important” bird species might occur within the vicinity of the

proposed development. The results of the desk study indicated that at minimum, a twelve-month baseline ornithological survey of the study area was required in order to comprehensively assess any impacts of the proposed development on the avifauna of the immediate and surrounding area.

### 6.3 Winter Surveys

A total of 29 species of bird were recorded from within the general survey area and surrounding countryside over the winter surveys. Four of these qualify as “important” species as defined in section 1.2. These species are listed in Table 2 in addition to their corresponding colour according to the 2008 – 2013 BoCCI List. It is important to note here that Golden Plover are listed on both the Red (for breeding) and Amber (for over-wintering) list of the BoCCI list. Here, they are listed as Red, as it is their highest categorisation of concern with regard to the precautionary principal. It should be noted that Golden Plover were not noted breeding at this site.

Table 2: Bird species recorded during winter surveys

Latin name	Common name
<i>Aegithalos caudatus</i>	Long-tailed Tit
<i>Anthus pratensis</i>	Meadow pipit
<i>Carduelis spinus</i>	Siskin
<i>Circus cyaneus</i>	Hen Harrier
<i>Columba palumbus</i>	Wood Pigeon
<i>Corvus corax</i>	Raven
<i>Corvus cornix</i>	Hooded Crow
<i>Corvus frugilegus</i>	Rook
<i>Corvus monedula</i>	Jackdaw
Latin name	Common name
<i>Erithacus rubecula</i>	Robin
<i>Falco tinnunculus</i>	Kestrel
<i>Fringilla coelebs</i>	Chaffinch
<i>Garrulus glandarius</i>	Jay
<i>Motacilla alba</i>	Pied Wagtail
<i>Parus ater</i>	Coal Tit
<i>Parus caeruleus</i>	Blue Tit
<i>Parus major</i>	Great Tit
<i>Phasianus colchicus</i>	Pheasant
<i>Pica pica</i>	Magpie
<i>Pluvialis apricaria</i>	Golden Plover
<i>Pyrrhula pyrrhula</i>	Bullfinch
<i>Regulus regulus</i>	Goldcrest
<i>Sturnus vulgaris</i>	Starling
<i>Troglodytes troglodytes</i>	Wren
<i>Turdus pilaris</i>	Fieldfare
<i>Turdus iliacus</i>	Redwing
<i>Turdus merula</i>	Blackbird
<i>Turdus philomelos</i>	Song Thrush
<i>Turdus viscivorus</i>	Mistle Thrush

#### 6.4 Spring/summer breeding surveys

There were 39 species recorded in the survey area during breeding surveys, including 6 amber and 1 red-listed species. Of these, there was evidence that the vast majority were breeding within the site or in the immediate vicinity (see Table 3).

Table 3: Species recorded during surveys carried out between March and September 2011

Latin name	Common name	Evidence of Breeding
<i>Accipiter nisus</i>	Sparrowhawk	Yes
<i>Alauda arvensis</i>	Skylark	Yes
<i>Anthus pratensis</i>	Meadow Pipit	Yes
<i>Carduelis carduelis</i>	Goldfinch	Yes
<i>Carduelis chloris</i>	Greenfinch	Yes
<i>Carduelis spinus</i>	Siskin	Yes
<i>Columba palumbus</i>	Wood Pigeon	Yes
<i>Corvus corax</i>	Raven	Yes
Latin name	Common name	Evidence of Breeding
<i>Corvus cornix</i>	Hooded Crow	Yes
<i>Corvus frugilegus</i>	Rook	Yes
<i>Corvus monedula</i>	Jackdaw	Yes
<i>Cuculus canorus</i>	Cuckoo	Yes
<i>Delichon urbicum</i>	House Martin	No
<i>Emberiza schoeniclus</i>	Reed Bunting	Yes
<i>Erithacus rubecula</i>	Robin	Yes
<i>Falco tinnunculus</i>	Kestrel	Yes
<i>Fringilla coelebs</i>	Chaffinch	Yes
<i>Garrulus glandarius</i>	Jay	Yes
<i>Hirundo rustica</i>	Swallow	No
<i>Larus ridibundus</i>	Black Headed Gull	No
<i>Locustella naevia</i>	Grasshopper warbler	Yes
<i>Motacilla alba</i>	Pied Wagtail	Yes
<i>Oenanthe oenanthe</i>	Wheatear	Yes
<i>Parus ater</i>	Coal Tit	Yes
<i>Parus caeruleus</i>	Blue tit	Yes
<i>Parus major</i>	Great Tit	Yes
<i>Phasianus colchicus</i>	Pheasant	Yes
<i>Phylloscopus collybita</i>	Chifchaff	Yes
<i>Phylloscopus trochilus</i>	Willow warbler	Yes
<i>Pica pica</i>	Magpie	Yes
<i>Prunella modularis</i>	Dunnock	Yes
<i>Pyrrhula pyrrhula</i>	Bullfinch	Yes
<i>Regulus regulus</i>	Goldcrest	Yes
<i>Sylvia atricapella</i>	Blackcap	Yes
<i>Sylvia communis</i>	Whitethroat	Yes
<i>Troglodytes troglodytes</i>	Wren	Yes
<i>Turdus merula</i>	Blackbird	Yes
<i>Turdus philomelos</i>	Song thrush	Yes
<i>Turdus viscivorus</i>	Mistle Thrush	Yes

## 6.5 Raptor surveys

The results of vantage point surveys carried are indicated in Table 4. During raptor surveys, two species were detected, Kestrel and Sparrowhawk, both of which were observed hunting in the vicinity of the site. These are the most common raptors in the country and are likely to be observed at any site with suitable habitat. Detailed maps of raptor activity observed are presented in Appendix III.

Table 4: Observations recorded during raptor surveys, indicating date of survey, start time, species and activity observed

Date	Start time	Weather	Species	Activity
10/04/11	10:00	Clear visibility, sunny, light wind (F1)	Sparrowhawk	Hunting
			Kestrel	Hunting
26/04/11	09:00	Clear visibility, overcast, breezy (F3)	Sparrowhawk	Hunting
			Kestrel	Hunting
19/05/11	09:00	Clear visibility, overcast, light wind (F1 – 2)	Sparrowhawk	Hunting
24/05/11	11:00	Clear visibility, overcast, light wind (F1)	None	
20/06/11	10:00	Clear visibility, sunny, breezy (F3)	Kestrel	Hunting
30/06/11	10:00	Clear visibility, sunny, calm	Kestrel	Hunting
15/07/11	09:30	Clear visibility, overcast, light wind (F1)	Sparrowhawk	Passing over
25/07/11	09:30	Clear visibility, 50% cloud, breezy (F2)	Kestrel	Hunting
09/08/11	10:30	Clear visibility, sunny, calm	Kestrel	Hunting
17/08/11	09:30	Clear visibility, sunny, light wind (F1)	Sparrowhawk	Hunting
			Kestrel	Hunting
19/09/11	10:00	Clear visibility, intermittent light rain, calm	Kestrel	Hunting
28/09/11	11:30	Clear visibility, overcast, breezy (F3)	Sparrowhawk	Hunting

## 7 Evaluation of Bird Resource

### 7.1 Overview of Legislation

Within Europe, the European Union (EU) adopts legislation in the form of Directives and Regulations. With regard to wildlife and nature conservation, member states of the EU have adopted two Directives in response to their obligations under the Bern Convention: Council Directive 79/409/EEC (The Birds Directive), and Council Directive 92/43/EEC (The Species and Habitats Directive). These directives, in combination with the EIA Directive (85/337/EEV) and the Wildlife Act (1976/2000) provide for the protection of animal species of importance and the habitats that support them. The most important of these pieces of legislation with regard to this, ornithological survey, is the Birds Directive, the primary provisions of which are:

- The maintenance of favourable conservation status of all wild birds across their distributional range.
- The identification of and classification of Special Protection Areas (SPA's) for rare or vulnerable species listed on Annex I of the Directive and regularly occurring migratory species – paying particular importance to the protection of wetlands of international importance.
- The establishment of a general scheme of protection for all wild birds.
- Restrictions on the sale and keeping of wild birds.
- Specification of the conditions under which hunting and falconry can be undertaken.

- The prohibition of large-scale, non-selective means of bird-killing.
- Conditions under which permission may be sought to carry out otherwise prohibited activities.
- The encouragement and support of relevant research.
- Requirements to ensure that the introduction of non-native birds does not threaten biodiversity.

The maintenance of habitats and species within individual Natura 2000 sites at favourable conservation condition contributes to the overall maintenance of favourable conservation status of those habitats and species at a national level. It is therefore necessary to identify any potential impacts of the proposed development on the conservation status of Natura 2000 sites.

The National Parks and Wildlife Service deem that the favourable conservation status of a habitat is achieved when:

- Its natural range, and area it covers within that range, is stable or increasing.
- The ecological factors that are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future.
- The conservation status of its typical species is favourable.

The National Parks and Wildlife Service deem that the favourable conservation status of a species is achieved when:

- Population data on the species concerned indicate that it is maintaining itself.
- The natural range of the species is neither being reduced, or likely to be reduced in the foreseeable future.
- There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

## 7.2 Birds of conservation concern/enhanced protection within the study area

A total of 10 species of conservation concern were observed in the vicinity of the proposed development and surrounding countryside. The following are brief descriptions of the species of conservation concern observed during all surveys, with information regarding their conservation status (BoCCI list status, presence on Annex I of the Birds Directive) and information as to where they were observed. These species, apart from the Hen Harrier, were observed within 500 m of the nearest turbine.

### 7.2.1 Skylark, *Alauda arvensis*. BoCCI status: Amber, Birds Directive Annex I: No

The commonest and most widespread lark of the Palearctic, measuring 18 – 19 cm with a wingspan of 30 – 36 cm. Prefers open surfaces on firm soils, well clothed with grasses/cereals or low herbage. Decreases in populations reported from almost all countries of western and northern Europe, likely owing to intensification of agricultural practices. Generally no more than local movements recorded in Ireland, although resident numbers may be added to by migrants. Plant and animal food are important year-round, but especially dependent on invertebrates during the breeding season. This species was heard throughout the site during the breeding season.

#### 7.2.2 Hen Harrier, *Circus cyaneus*. BoCCI status: Amber, Birds Directive Annex I: YES

A large raptor, typically measuring 44 – 52 cm, with a wing-span of 100 – 120 cm. Most often observed quartering the ground hunting at a relatively low altitude with characteristic mode of flight with gliding interspersed by 5 – 10 wing beats. Habitat selection is largely governed by availability of preferred prey items but tending to avoid areas intensively utilised by humans, most commonly occurring in upland areas of bog and heath. Eggs are laid in April/May in a nest on the ground, in short, thick vegetation. The Slieve Bloom Mountain SPA is a known stronghold of this raptor. A juvenile was observed on two occasions during winter surveys at a distance of up to 1 km, and was likely passing through the area.

#### 7.2.3 House Martin, *Delichon urbicum*. BoCCI status: Amber, Birds Directive Annex I: No.

A medium sized, bull-headed hirundine with a distinctly forked tail measuring approximately 12.5 cm with a wing span of 26 – 29 cm. A migratory species, most of those arriving in Ireland having departed from Africa. This species, like the Swallow feeds almost entirely upon flying insects, caught on the wing. This species is more likely to be encountered in built-up urban areas than the Common Swallow, and most frequently nests on the outer walls of buildings, but also natural sites on cliffs and outcrops. This species was observed occasionally during breeding surveys foraging directly over the proposed site.

#### 7.2.4 Kestrel, *Falco tinnunculus*, BoCCI status: Amber, Birds Directive Annex I: No.

A relatively small falcon, measuring 32 – 35 cm with a wing span of 71 – 80 cm with a long tail most commonly observed in modern Ireland hunting above the verges adjacent to motorways with typical hovering action. The Kestrel is the commonest diurnal raptor in much of the Palearctic. Occupies a wide range of habitats throughout the whole of Ireland. Local, slight decreases in populations in Ireland have been reported recently. The primary food of Kestrels consists of small mammals, with other birds being secondary, but will also feed on insects. Kestrels were routinely observed hunting during raptor surveys, indicating that there is a nest in the vicinity.

#### 7.2.5 Swallow, *Hirundo rustica*. BoCCI Status: Amber, Birds Directive Annex I: No.

A medium sized hirundine with a characteristic long, forked tail, measuring 17 – 19 cm with a wingspan of 32 – 34.5 cm. Breeds across the west Palearctic from subarctic through boreal, temperate, steppe and Mediterranean zones in both continental and oceanic climates. Migratory, primarily spending the winter months in Africa, although increasingly in Spain also. Entirely dependent on a constant supply of small flying insects during both breeding and winter season. Preferred habitat open pasture grazed by animals, meadows and farm-crops where invertebrate prey is plentiful. Avoids heavily wooded areas and dense centres of human population, although preferred nest sites are accessible, open, man-made structures. Swallows were observed regularly during breeding surveys hunting over the survey site.

#### 7.2.6 Black-headed Gull, *Larus ridibundus*. BoCCI status: Red, Birds Directive Annex I: No.

A small, agile gull, measuring approximately 34 – 37 cm with a wingspan of 100 – 110 cm. Breeds across middle latitudes of the western Palearctic, primarily in lowland or lower uplands, always near shallow calm water. Outside of the breeding season can shift to inland waters, and increasingly frequenting refuse dumps, parks and city streets in addition to traditional feeding grounds of freshly ploughed fields. The range of this species has greatly expanded since the 19<sup>th</sup> century, although there is evidence for recent loss of colonies in the north-west of Ireland. Food consists primarily of animal material, particularly earthworms and insects, supplemented with plant material, although increasingly becoming a scavenger of human settlements. Small numbers observed flying over site during breeding surveys.

#### 7.2.7 Grasshopper Warbler, *Locustella naevia*. BoCCI status: Amber, Birds Directive Annex I: No

A rather small, indistinct warbler, measuring 12.5 – 13.5 cm with a wing span of 15 – 19 cm. Difficult to observe directly owing to skulking behaviour and preference for low, tangled ground-cover this species is often only identified by the distinctive call of the male, similar to a grasshopper, or an anglers reel. Young plantations and scrub are favoured habitats, feeding primarily on insects. A migratory species, but not well studied, likely overwintering in west Africa arriving in Ireland around May. Males of this species were heard throughout the site in suitable habitat.

### 7.2.8 Wheatear, *Oenanthe oenanthe*. BoCCI status: Amber, Birds Directive Annex I: NO

A bold, bouncy, ground-loving chat, measuring 14.5 – 15.5 cm with a wing span of 26 – 32 cm. A migratory species, wintering in tropical Africa, but one of the first passerines to return in spring, often as early as March. The Wheatear is primarily insectivorous, supplemented with some plant material. The Wheatear has a characteristic mode of foraging, often running along on the ground, stopping to scan the surroundings and pick up prey items. Eggs are typically laid from mid-April, often on the ground, but also in holes. Foraging birds were seen on several occasions during breeding surveys.

### 7.2.9 Golden Plover, *Pluvialis apricaria*. BoCCI status: Red, Birds Directive Annex I: YES.

A relatively small wader, measuring approximately 26 - 29 cm with a wing span of 67 – 76 cm. In Ireland breeds primarily on upland heath and bogs. While only a small number breed in Ireland (typically in the region of several hundred pairs), numbers increase dramatically in winter with migrants, where they forage at the coast and inland at open agricultural land, often roosting at inland lakes. Food consists primarily of invertebrates, with some plant material. Substantial flocks (consisting of 70 and 55 individuals) of Golden Plover were observed flying over the area at a height of approximately 200 – 300 m during early winter surveys.

### 7.2.10 Starling, *Sturnus vulgaris*. BoCCI status: Amber, Birds Directive Annex I: No.

A medium sized passerine with distinctive triangular wings and a short, square tail measuring 21.5 cm with a wing span of 37 – 42 cm. Flight is swift with a distinctive flying style, especially when occurring in flocks. An adaptable species, breeding wherever suitable conditions are found, often associated with human dwellings in both breeding and winter season. There have been recent declines in this species in Ireland. The resident population is swelled in winter due to the arrival of migrants, and huge flocks gather in suitable roosting areas such as reed beds. Omnivorous, with both animal and plant material consumed throughout the year, but a marked increase in the proportion of animal material during the breeding season. Flocks of starling were observed during winter surveys, generally while passing through the site.

## 7.3 Key habitat evaluation with regard to avifauna.

### 7.3.1 Natura 2000 sites within 15 km of proposed development

There are three Special Areas of Conservation (see Figure 4) within 15 km of the proposed development, the River Barrow and River Nore SAC (site code 002162), Ballyprior Grassland SAC (site code 002256) and Lisbigney Bog SAC (site code 000869). There is one Special Protection Area (see Figure 5) within 15 km of the proposed development.

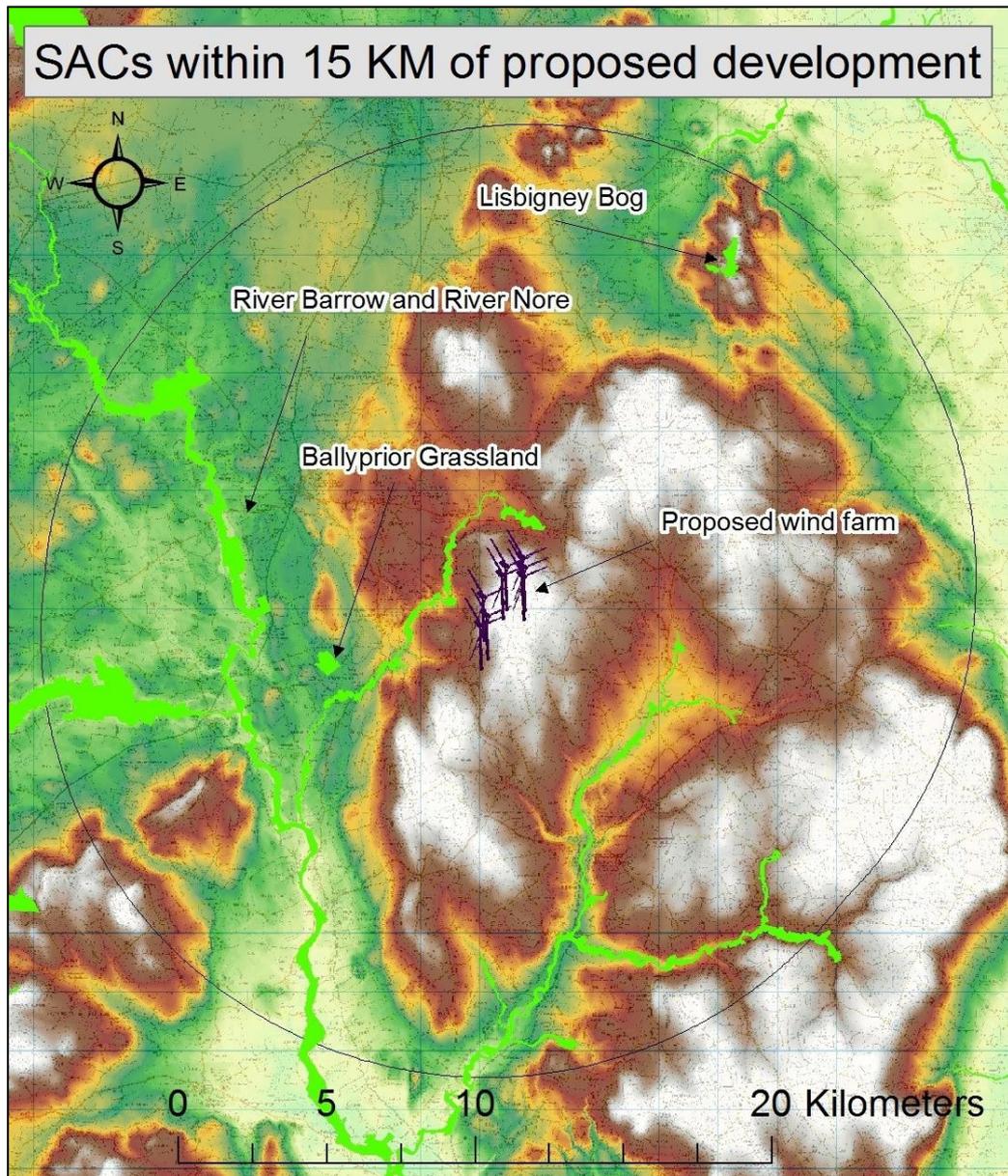


Figure 4: Map illustrating location of proposed development relative to SACs within a 15 km buffer zone

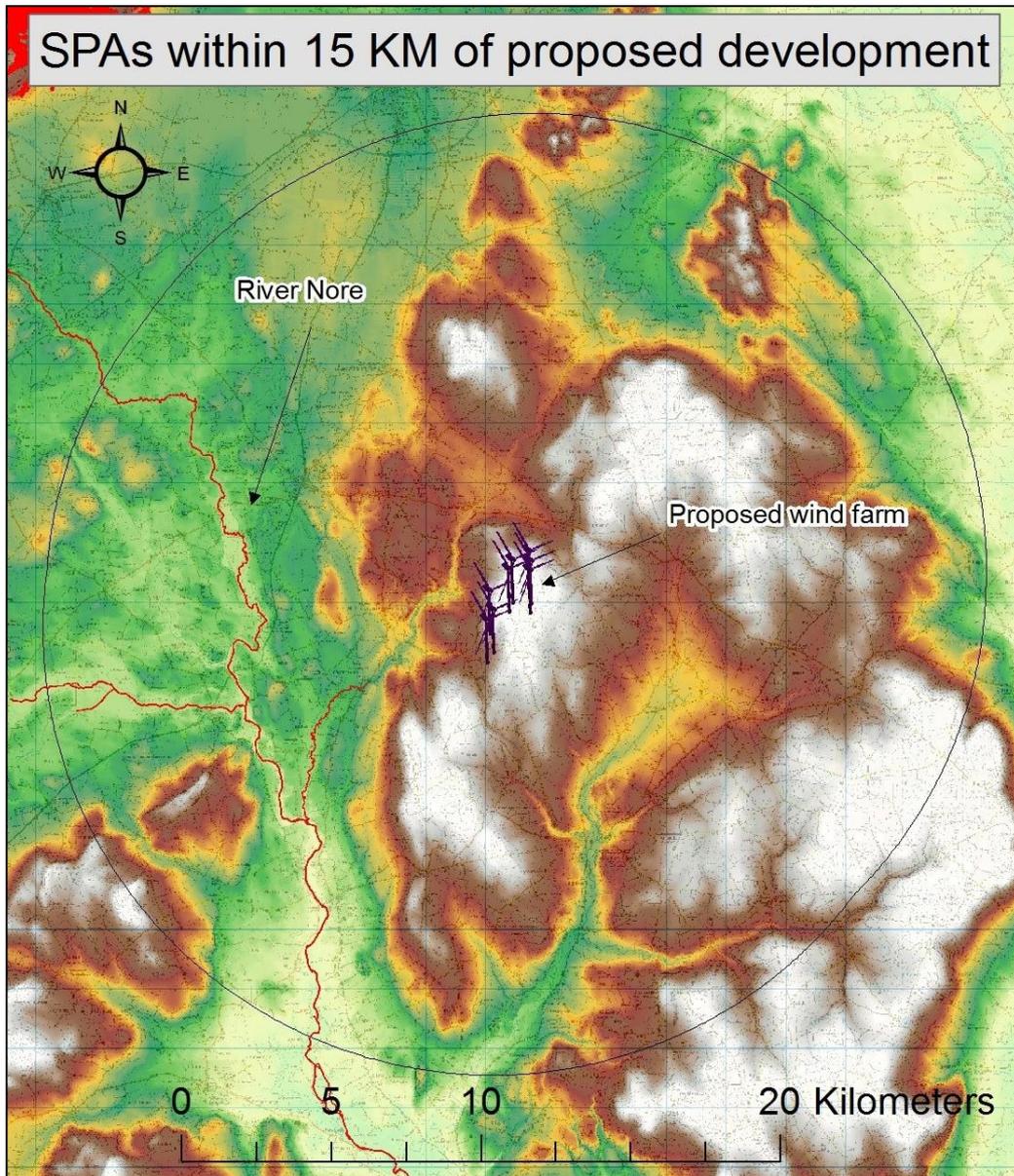


Figure 5: Map illustrating location of proposed development relative to SPAs within a 15 km buffer zone

### 7.3.1.1 River Barrow and River Nore SAC.

This site consists of most of the freshwater stretches of the Barrow/Nore River catchments. The Barrow is tidal as far upriver as Graiguenamanagh while the Nore is tidal as far upriver as Inishtioige. The site also includes the extreme lower reaches of the River Suir and all of the estuarine component of Waterford Harbour extending to Creadan Head. The larger of the many tributaries include the Lerr, Fushoge, Mountain, Aughavaud, Owenass, Boherbaun and Stradbally Rivers of the Barrow and the Delour, Dinin, Erkina, Owveg, Munster, Arrigle and King's Rivers on the Nore. Both rivers rise in the Old Red Sandstone of the Slieve Bloom Mountains. They traverse limestone bedrock for a good proportion of their routes, though the middle reaches of the Barrow and many of the eastern tributaries run through Leinster Granite. A wide range of habitats associated with the rivers are included within the site, including substantial areas of woodland (deciduous, mixed), dry heath, wet grassland, swamp and marsh vegetation, salt marshes, a small dune system and intertidal sand and mud flats. Areas of improved grassland, arable land and coniferous plantations are included in the site for water quality reasons. The site supports many Annexed habitats including the priority habitats of alluvial woodland and petrifying springs. Quality of habitat is generally good. The site also supports a number of Annex II animal species - *Salmo salar*, *Margaritifera margaritifera*, *M.m. durrovensis*, *Alosa fallax fallax*, *Austropotamobius pallipes*, *Petromyzon marinus*, *Lutra lutra*, *Lampetra fluviatilis* and *L. planeri*. Annex I Bird species include *Anser albifrons flavirostris*, *Falco peregrinus*, *Cygnus cygnus*, *Cygnus columbianus bewickii*, *Limosa lapponica*, *Pluvialis apricaria* and *Alcedo atthis*. A range of rare plants and invertebrates are found in the woods along these rivers and rare plants are also associated with the saltmarsh.

30% of the site consists of water: 10% freshwater and 20% of estuarine and tidal stretches. The Annex II species listed in Section 4.2 are dependent on the quality of these waters. Much of the site along the water courses is under threat from pollution caused by increased fertiliser application, sewage and industrial waste. There is also loss of saltmeadow habitat with two legally protected species and a rare sedge, as a result of infilling and agricultural intensification. *Alosa fallax* may be vulnerable to angling pressure. Aquaculture occurs in Waterford Harbour and may be causing some disturbance to the intertidal sediments and wintering birds - intensification of aquaculture is a threat.

The conservation objective of the River Barrow and River Nore SAC is to maintain or restore the favourable conservation condition of the Annex I habitat(s) and or Annex II species for which the SAC has been designated:

- Desmoulin's whorl snail *Vertigo moulinsiana*.
- Freshwater pearl mussel *Margaritifera margaritifera*.
- White-clawed crayfish *Austropotamobius pallipes*.
- Sea lamprey *Petromyzon marinus*.
- Brook lamprey *Lampetra planeri*.

- River lamprey *Lampetra fluviatilis*.
- Twaite shad *Alosa fallax*.
- Atlantic salmon (*Salmo salar*) (only in fresh water).
- Estuaries.
- Mudflats and sandflats not covered by seawater at low tide.
- *Salicornia* and other annuals colonizing mud and sand.
- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*).
- Otter *Lutra lutra*.
- Mediterranean salt meadows (*Juncetalia maritimi*).
- Killarney fern *Trichomanes speciosum*.
- Nore freshwater pearl mussel *Margaritifera durrovensis*.
- Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitriche-Batrachion* vegetation.
- European dry heaths.
- Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels.
- Petrifying springs with tufa formation (*Cratoneurion*).
- Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles.
- Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*).

### 7.3.1.2 Ballyprior Grassland SAC

Ballyprior Grassland is located 4 km south of Stradbally in Co. Laois and is located at the north end of the Castlecomer Plateau. The site consists of a limestone plateau supporting open calcareous grassland with occasional rocky scarps and valleys, but with little surface water and no streams. Soils are thin on the plateau, but deeper with local drift in low areas and valley bottom. Scrub of *Crataegus monogyna*, *Prunus spinosa*, *Rubus fruticosus* with bracken, *Pteridium aquilinum*, or Gorse Scrub of *Ulex europaea* is frequent in the east and north of the site. Scrub woodland of predominantly *Corylus avellana* with *Fraxinus excelsior* and a well-developed ground flora, occurs in the extreme west of the site. There are also a few ponds scattered within the site. The site contains orchid-rich calcareous grassland, a priority habitat listed on Annex I of the EU Habitats Directive. The site also hosts an exceptionally diverse mycoflora. An estimated 35 hectares, 45% of the site area, consists of the Annex I Priority Habitat, orchid-rich calcareous grassland, which supports a rich diversity of both calcicole and calcifuge species, the latter occurring on mineral poor drift. The site has an exceptionally rich mycoflora and this is a better indication of grassland quality (in terms of continuity, lack of disturbance and low nutrient status) than the vascular flora. The Irish Hare, *Lepus timidus hibernicus* recorded as occurring in the site. This sub-species is listed in Annex III of the Bern Convention and in the Red Data Book as Internationally Important. It is legally protected by the Wildlife Act (1976).

Due to recent division of the lands between seven new owners, the site is vulnerable to habitat damage (clearance of scrub, surface rock, soil and vegetation disturbance) and subsequent improvement by harrowing, re-seeding and fertilising. Such efforts at 'improvement' are already occurring within and around the site. Adjacent grassland habitat has been lost also to afforestation in recent years, to the south. Appropriate grazing management is essential for conservation of this habitat; the site flora is therefore vulnerable to adverse changes in the grazing regime and also to encroachment by scrub and bracken.

The conservation objective of the Ballyprior Grassland SAC is to maintain or restore the favourable conservation condition of the Annex I habitat(s) and or Annex II species for which the SAC has been

designated:

- Semi-natural dry grasslands and scrubland facies on calcareous substrates.

#### 7.3.1.3 Lisbigney Bog SAC

Lisbigney Bog is situated approximately 5km north-east of Durrow, Co. Laois. This complex wetland site has developed from a valley raised bog, which was partially cut, and now supports a variety of wetland vegetation types on underlying bog peat. These include raised bog, cut-over bog, wet grassland, freshwater marsh, reed and large sedge swamp, wet willow-alder-ash woodland and scrub, in addition to the priority habitat, calcareous fen. The principal habitat is fen, with reed swamp, wet grassland, pools and scrub also occurring. At present, the site is not used for any particular activity other than light grazing. Calcareous fen occupies nearly one third of the site. The site represents 0.1% of the national total of calcareous fen with *Cladium mariscus*, but occurs in a region where fen habitat is scarce. The site supports a population of the Annex II snail *Vertigo moulinsiana*. The site contains a small though significant example of *Cladium mariscus* fen. Similar habitat in this part of the country is scarce. All recently surveyed sites with confirmed populations of this species are considered important. The site is privately owned and the principal threat is drainage. Some burning occurs in most years and if severe can be damaging.

The conservation objective of the Lisbigney Bog SAC is to maintain or restore the favourable conservation condition of the Annex I habitat(s) and or Annex II species for which the SAC has been designated:

- Calcareous fen with *Cladium mariscus* and species of the *Caricion davallianae* (30 % area of the site).
- *Vertigo moulinsiana*.

#### 7.3.1.4 River Nore SPA

The River Nore SPA is a long linear site that includes the following river sections: the River Nore from the bridge at Townparks, (north-west of Borris in Ossory) to Coolnamuck (approximately 3 km south of Inistioge) in Co. Kilkenny; the Delour River from its junction with the River Nore to Derrynaseera bridge (west of Castletown) in Co Laois; the Erkina River from its junction with the River Nore at Durrow Mills to Boston Bridge in Co. Laois; a 1.5 km stretch of the River Goul upstream of its junction with the Erkina River; the Kings River from its junction with the River Nore to a bridge at Mill Island Co. Kilkenny. The site includes the river channel and marginal vegetation. The River Nore support nationally important numbers of *Alcedo atthis*. Other species which occur within the site include *Cygnus olor*, *Anas platyrhynchos*, *Phalacrocorax carbo*, *Ardea cinerea*, *Gallinula chloropus*, *Gallinago gallinago* and *Riparia riparia*. There are no known threats to the conservation objectives of this site.

The conservation objective of this site is to maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA:

- *Alcedo atthis* [breeding]

## 8 Assessment of Impacts

### 8.1 Scope of Impacts

The potential impacts consist of those that could take place during the construction phase of the development and the operation lifetime of the development.

The following activities may occur during the construction phase and could give rise to impacts on the ornithological interest at the site:

- Removal of scrub, dwarf shrub and tree cover.
- Construction of new access roads and upgrades to existing roads.
- Construction of wind turbine foundations and ancillary.
- Excavation of cable trenches.
- Construction of sub-stations and other permanent buildings.
- Temporary lay-down areas associated with construction.
- Temporary site office construction and ancillary.

During the operational lifetime of the development the following may give rise to impacts on the ornithological interest at the site:

- Potential collision risk with turbine blades.
- Disturbance through human activity and vehicular access to the site owing to regular maintenance of turbines.
- Background noise at the site due to the operation of wind turbines and the presence of man-made objects.
- Habitat restoration and management work following the construction phase.
- Human access on site owing to monitoring activities.

### 8.2 Assessment of impacts

The assessment of the impacts of wind farms on birds in Ireland has been investigated by Dr. Steve M. Percival and a methodology developed to identify potential issues and impact assessment. This method involves assessing potential impacts through evaluating the sensitivity of species affected and the magnitude of effects and combining these to produce a Significance Matrix. These are outlined in Table 5, Table 6 and Table 7.

Table 5: Determination of sensitivity

Sensitivity	Determining Factor
VERY HIGH	Species that form the cited interest of SPA's and other statutorily protected nature conservation areas.

HIGH	Species that contribute to the integrity of an SPA but which are not cited as species for which the site is designated Ecologically sensitive species including: Divers, Common Scoter, Hen Harrier, Golden Eagle, Red-necked Phalarope, Roseate Tern and Chough Species present in nationally important numbers (>1% of Irish population)
MEDIUM	Species on Annex I of the EC Birds Directive Species present in regionally important numbers (>1% regional (county)population) Species on Bird Watch Ireland's red list of Birds of Conservation Concern
LOW	Any other species of conservation interest, including species on Bird Watch Ireland's amber list of Birds of Conservation Concern not covered above

Table 6: Determination of magnitude

Magnitude	Description
VERY HIGH	Total loss or very major alteration to key elements/features of the baseline condition such that the post development character/composition/attributes will be fundamentally changed and may be lost from the site altogether <i>Guide: &lt;20% of population/habitat remains</i>
HIGH	Major loss or major alteration to key elements/features of the baseline condition such that post-development character/composition/attributes will be fundamentally changed <i>Guide: 20 - 80% of population/habitat lost</i>
MEDIUM	Loss or alteration to one or more key elements/features of the baseline condition such that the post-development character/composition/attributes will be partially changed <i>Guide: 5 - 10% of population/habitat lost</i>
LOW	Minor shift away from baseline condition. Change arising from the loss/alteration will be discernible but underlying character/composition/attributes of baseline condition will be similar to pre-development circumstances/patterns <i>Guide: 1 - 5% of population/habitat lost</i>
NEGLIGIBLE	Very slight change from baseline condition. Change barely distinguishable, approximating to the "no change" situation <i>Guide: &lt;1% population/habitat lost</i>

Table 7: Combining magnitude and sensitivity to assess significance

SIGNIFICANCE		SENSITIVITY			
		VERY HIGH	HIGH	MEDIUM	LOW
MAGNITUDE	VERY HIGH	<i>VERY HIGH</i>	<i>VERY HIGH</i>	<i>HIGH</i>	<i>MEDIUM</i>
	HIGH	<i>VERY HIGH</i>	<i>VERY HIGH</i>	<i>MEDIUM</i>	<i>LOW</i>
	MEDIUM	<i>VERY HIGH</i>	<i>HIGH</i>	<i>LOW</i>	<i>VERY LOW</i>
	LOW	<i>MEDIUM</i>	<i>LOW</i>	<i>LOW</i>	<i>VERY LOW</i>
	NEGLIGIBLE	<i>LOW</i>	<i>VERY LOW</i>	<i>VERY LOW</i>	<i>VERY LOW</i>

This significance is then utilised to determine whether a predicted impact is acceptable or not. The methodology suggests the following interpretation of significance ratings:

Very low and low – should not normally be of concern, though normal design care should be exercised to minimise impacts.

Very high and high – represent a highly significant impact on bird populations and would warrant refusal of a planning permission.

Medium – represents a potentially significant impact that requires careful individual assessment. Such an impact could warrant planning refusal, but it may be of a scale that can be resolved by revised design or appropriate mitigation.

### 8.3 Significance of potential impacts during construction – direct habitat loss and disturbance

Utilising the method outlined in the previous section, the sensitivity of bird species recorded regularly using the habitat at the proposed site during surveys is generally low. Three species of increased sensitivity – Black-headed Gull, Golden Plover and Hen Harrier were observed on a small number of occasions, in the general vicinity of the site, but were merely passing through. The magnitude of impacts, with appropriate habitat management and mitigation measures will be medium, with some loss or alteration to one or more key elements/features of the baseline condition such that the post-development character/composition/attributes will be partially changed from baseline condition. Much of this change will be as a result of the felling of trees within conifer plantations. As a rough guide, up to 10% of population/habitat lost. The majority of the site area is composed of improved agricultural grassland and conifer plantations of various ages. The loss of a small portion of this habitat for turbine bases/access road will not have a long-term detrimental impact on local avifauna.

Using the significance matrix, the significance of this development falls into the category of “very low

concern". This development, therefore, should not be of concern – although normal design care and habitat management should be exercised to minimise impacts. Where disturbance/removal of any scrub habitat is necessary, the works must be carried out outside of the breeding season (March 1st – August 31st) in accordance with section 46 of the Wildlife (Amendment) Act 2000.

#### 8.4 Significance of potential impacts during the operation of wind turbines

There are three primary means through which a wind farm development can affect bird populations:

- (1) Direct habitat loss.
- (2) Collision.
- (3) Disturbance.

##### 8.4.1 Direct Habitat Loss

The magnitude of this effect can be determined by the extent of loss of particular habitats in the context of the development and the habitats surrounding the development. The primary habitat of concern with regard to this development is the scrub associated with young areas of conifer plantation, which is heavily utilised during the breeding season by a plethora of species. There will be some loss or alteration to one or more key elements/features of the baseline condition such that the post-development character/composition/attributes will be partially changed from baseline condition owing to the removal of sections of scrub and conifer plantation. The birds recorded regularly utilising the habitats occurring at the site fall into the category of low sensitivity. This would indicate that the significance of this impact should be categorised as very low. This development, therefore, given appropriate mitigation measures, should not be of concern – although normal design care and habitat management should be exercised to minimise impacts.

##### 8.4.2 Collision Risk

One of the greatest controversies involving the erection of wind-farm developments has been the bird collisions with wind turbines, with significant mortality being recorded at some sites (typically sites established early in the short history of wind-farms, such as at the Straits of Gibraltar, in the path of migratory raptors). Following years of research into the impacts of wind turbines on avifauna, there is now a wealth of evidence to support the view that while a range of bird species do occasionally collide with wind turbines, overall, collision events are uncommon or rare (Still et al 1996, Langston and Pullan 2003, Drewitt and Langston 2006) and in fact, the majority of birds actively avoid flying into moving turbines. None of the regularly occurring species observed in and around the survey area are considered to be at high risk of collision with turbines.

##### 8.4.3 Disturbance

The presence of wind turbines themselves, in addition to the increased human presence associated with the wind farm could potentially deter some birds from using the site and its surrounds, resulting in a disturbance impact. The majority of the habitat type to be affected by this development is conifer

plantation and scrub, heavily utilised by local avifauna during the breeding season. There will be unavoidable, temporary disturbance impacts during construction, which must be carried out outside of the breeding season (March 1<sup>st</sup> – August 31<sup>st</sup>), but there is ample alternative habitat to temporarily accommodate the displaced birds within several hundred metres of the site. It is highly unlikely that there will be any significant disturbance effects during the operation of the wind farm, and breeding birds will return to the remaining suitable habitat. Therefore, this development should not be of concern with regard to long-term disturbance of breeding birds providing appropriate habitat is retained intact where its removal is not necessary for the development.

#### 8.4.4 Decommissioning of the wind farm

The decommissioning of the wind farm has the potential to have a negative impact on the bird resource of the study site. The magnitude of these potential impacts will depend on the methods, timescale and timing of decommissioning, and although it is difficult to predict the significance of these impacts – mitigation will be possible.

#### 8.5 Cumulative impacts

The cumulative impacts of the proposed development will be dealt with in the Natura Impact Statement.

## 9 Mitigation Measures

### 9.1 General Recommendations

#### 9.1.1 Preparation of an NIS

The proposed development is proximate to a number of Natura 2000 sites and is of a nature that may impact upon these sites. The proposed development therefore requires Appropriate Assessment and the preparation of an NIS according to sections 6(3) and 6(4) of the EU Habitats Directive.

#### 9.1.2 Timing of works

According to section 46 of the Wildlife (Amendment) Act 2000, it is an offence to cut, grub or otherwise destroy any vegetation growing in any hedge or ditch during the period beginning on March 1<sup>st</sup> and ending on August 31<sup>st</sup> inclusive owing to the impact upon breeding birds. If there is to be disturbance/clearance of any areas of scrub/hedges/trees during works, works must be carried out outside of this period.

#### 9.1.3 Site Environmental Management Procedures

A Site Environmental Management Procedures (SEMP) should be put in place during the construction and operational phases of the development in order to avoid any preventable impacts on the ornithological resource of the study area. This procedure should include:

- An emergency procedure for site-workers to follow in the case of active nest sites being

encountered during works (in the case of unusually early or late breeding). The basis of this procedure is that in the case of an event such as this, all work must be brought to a halt and specialist advice sought with regard to buffer areas etc. If this procedure is in place before such an event happens, it will significantly reduce any delays associated with such an event.

- A procedure must be put in place such that all site workers are aware of the Site Environmental Management Procedures inducted in the importance of adherence to the SEMP.

#### 9.1.4 Fulfilment of ecological requirements during construction and operation

A procedure should be put in place to ensure that due consideration is given to ecological requirements throughout the construction and operation of the wind farm. The site should be visited on a minimum of two occasions by a suitably qualified ecologist (with a minimum qualification of a degree in an ecological discipline) to monitor progress and to ensure that the work is carried out in an ecologically sensitive manner.

### 9.2 Construction phase mitigation

#### 9.2.1 Direct habitat loss

The primary habitat present at the site of ecological concern with regard to avifauna is the scrub and rough wet grassland (GSi4) associated with areas of young conifer trees. This habitat type is utilised by many of the breeding species present at the site. The retention of as much of this habitat type as is possible will provide breeding habitat for these birds. Mitigation measures during construction should be directed toward minimising any impacts on breeding birds. All construction works involving the disturbance or removal of habitat must be restricted to the period September 1<sup>st</sup> – February 28<sup>th</sup>, thus avoiding the breeding season.

#### 9.2.2 Disturbance impacts

The primary disturbance impacts in this case will likely be on breeding birds. Again, therefore, it is recommended that all construction works be restricted to the period September 1<sup>st</sup> – February 28<sup>th</sup>, thus avoiding the breeding season. Many of the species present are relatively tolerant of disturbance owing to the nature of the habitat in which they breed, which provides significant shelter from any potential disturbance.

### 9.3 Operational phase mitigation

#### 9.3.1 Collision mortality

Collision mortality potential is probably the single most contentious aspect of most proposed wind farms. There is now a wealth of evidence to support the view that while a range of bird species do

occasionally collide with wind turbines, overall, collision events are uncommon or rare (Still et al 1996, Langston and Pullan 2003, Drewitt and Langston 2006) and in fact, the majority of birds actively avoid flying into moving turbines. No birds of particular risk from collision, such as Whooper Swan, were observed flying through the subject site.

Raptors regularly occurring within the immediate area of the site (Kestrel and Sparrowhawk) were observed to hunt primarily over the young plantations surrounding the site. A juvenile Hen Harrier was observed on two consecutive survey visits in December 2010 (16/12/10 and 28/12/10) hunting over farmland north of the proposed development at a distance of approximately 1 – 2 km from the site. It is likely that given the prevailing weather conditions in December of 2010, this individual was passing through the area, and Hen Harrier were not observed in the vicinity again. It is likely that the presence of this individual was an anomaly, and it is unlikely that the area would maintain a population of Hen Harrier owing to a lack of suitable habitat.

It is not envisaged that collision mortality will be an issue at this site.

### 9.3.2 Habitat loss/Disturbance

The impacts due to habitat loss and disturbance have been categorised as very low, but it is possible nevertheless to mitigate against these impacts through the retention of as much scrub habitat as possible. Assuming the retention of this habitat, disturbance and habitat loss during the operational phase of the wind farm are not expected to have a significant negative impact on avifauna at the site.

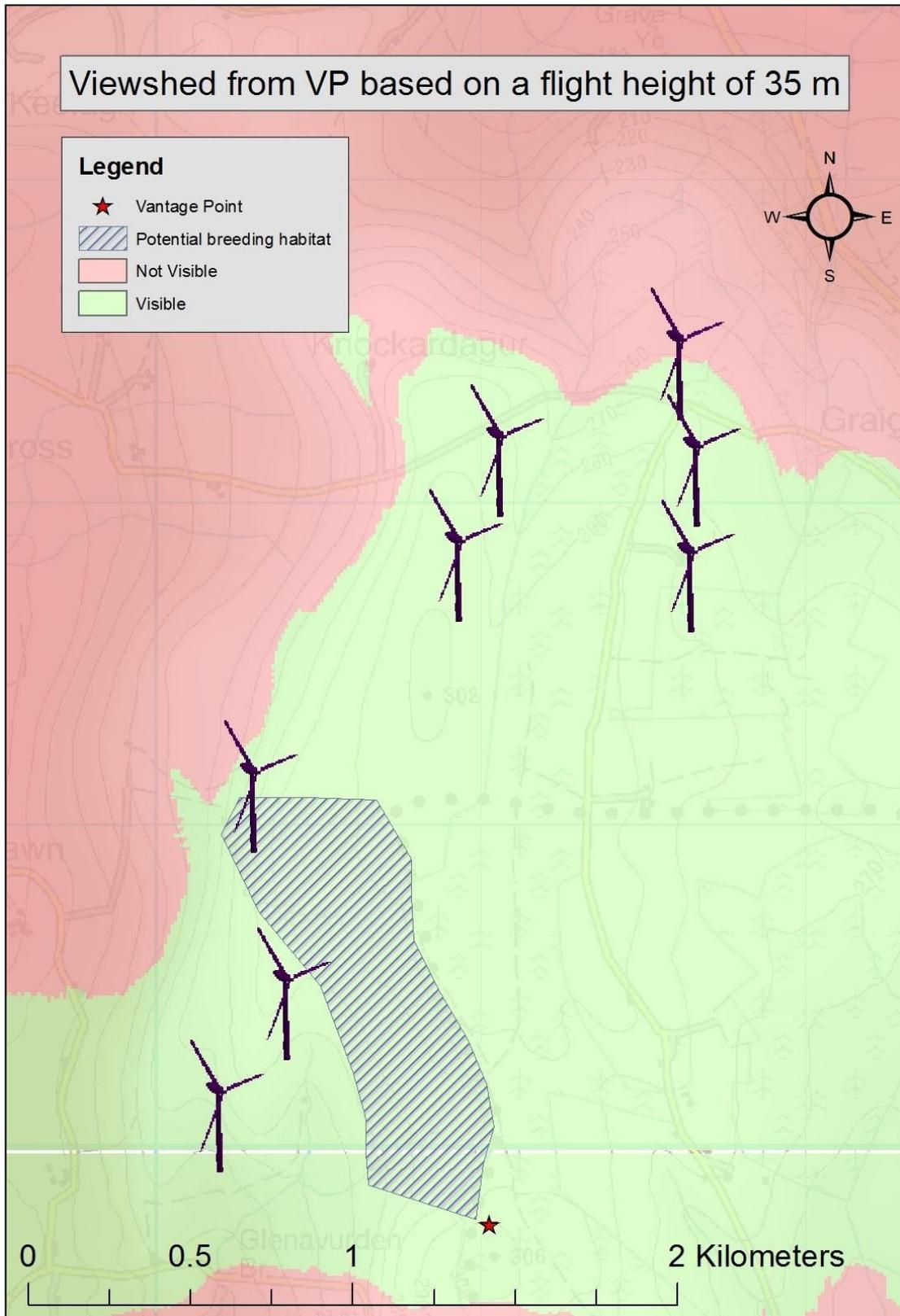
### 9.3.3 Post construction monitoring

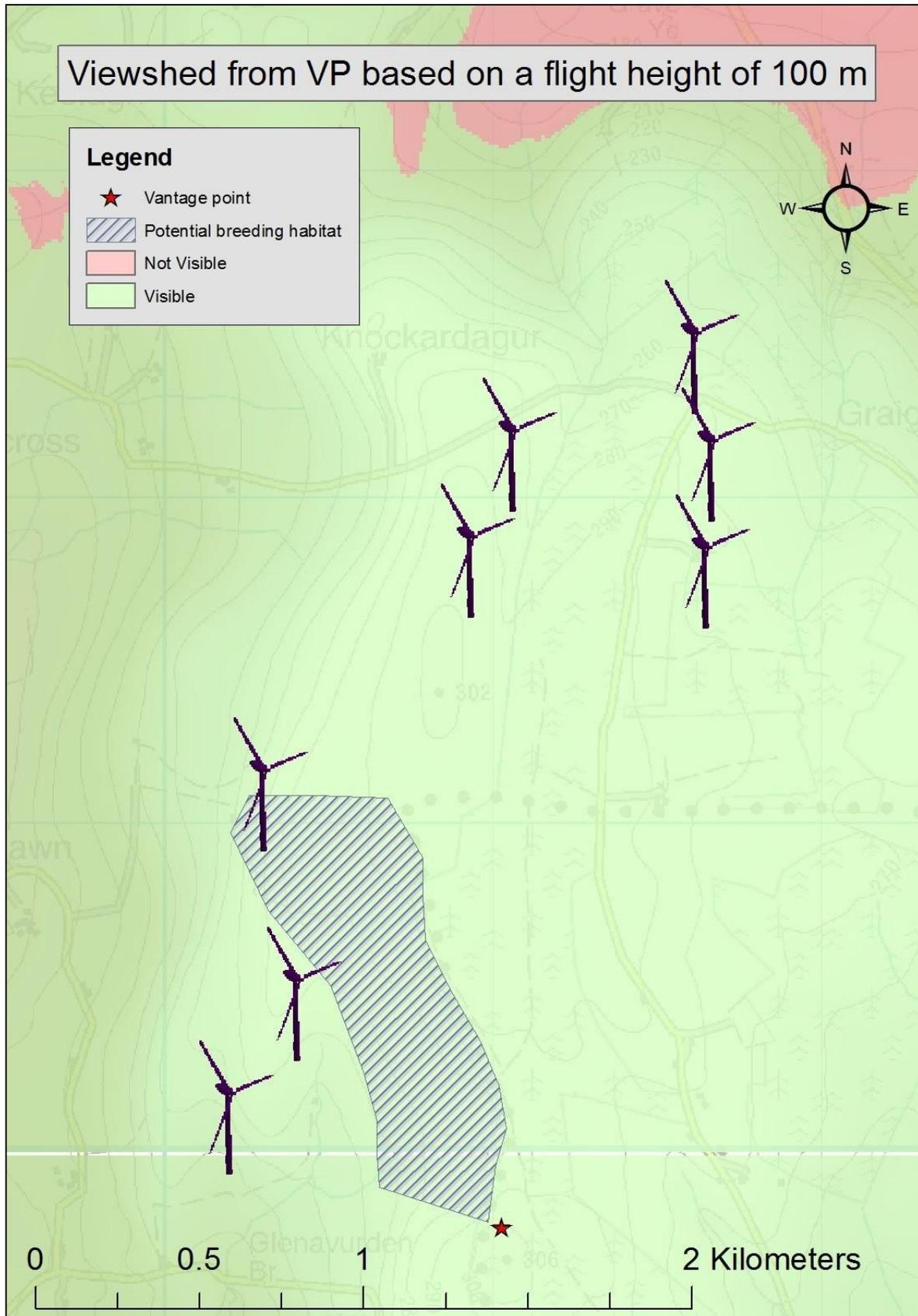
Owing to the nature of the habitat, and the unique assemblage of breeding species known to utilise this habitat type, it is recommended to put in place a monitoring protocol to examine the impact of the proposed development on the local avifauna. It is recommended that breeding bird surveys be carried out at this site at 5 and 15 year intervals post construction in order to monitor avifaunal activity.

## 10 Conclusion and Recommendations

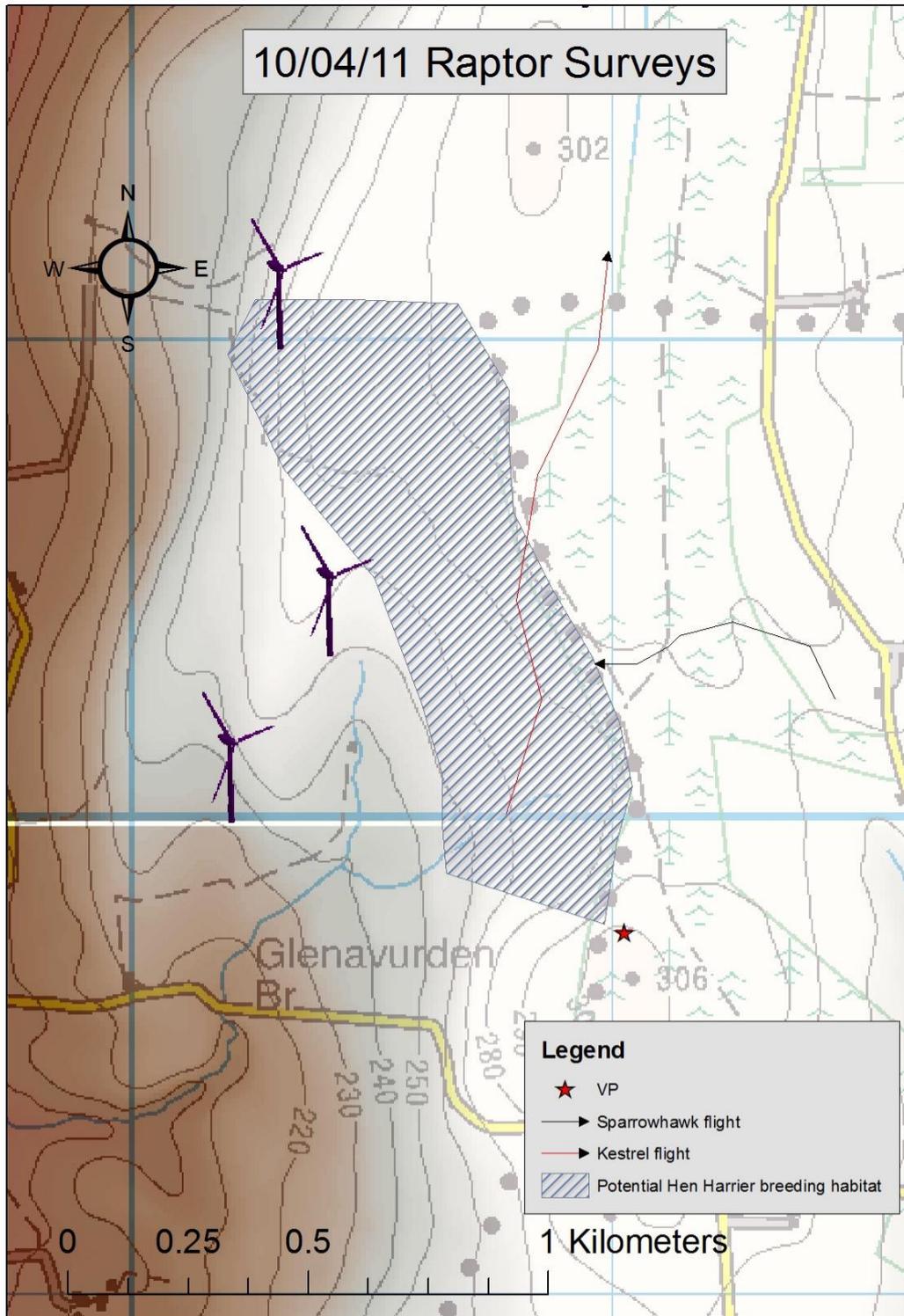
- The proposed development of Pinewoods Wind farm holds no statutory designations within the site, but does occur within 15 km of 3 Natura 2000 sites.
- Desk and field studies have identified :
  - 10 species of conservation concern occurring within and around the proposed development site.
- Given appropriate mitigation measures, and the retention of the maximum possible amount of scrub habitat, it is predicted that a wind farm of the scale described will result in a significance of low impact.

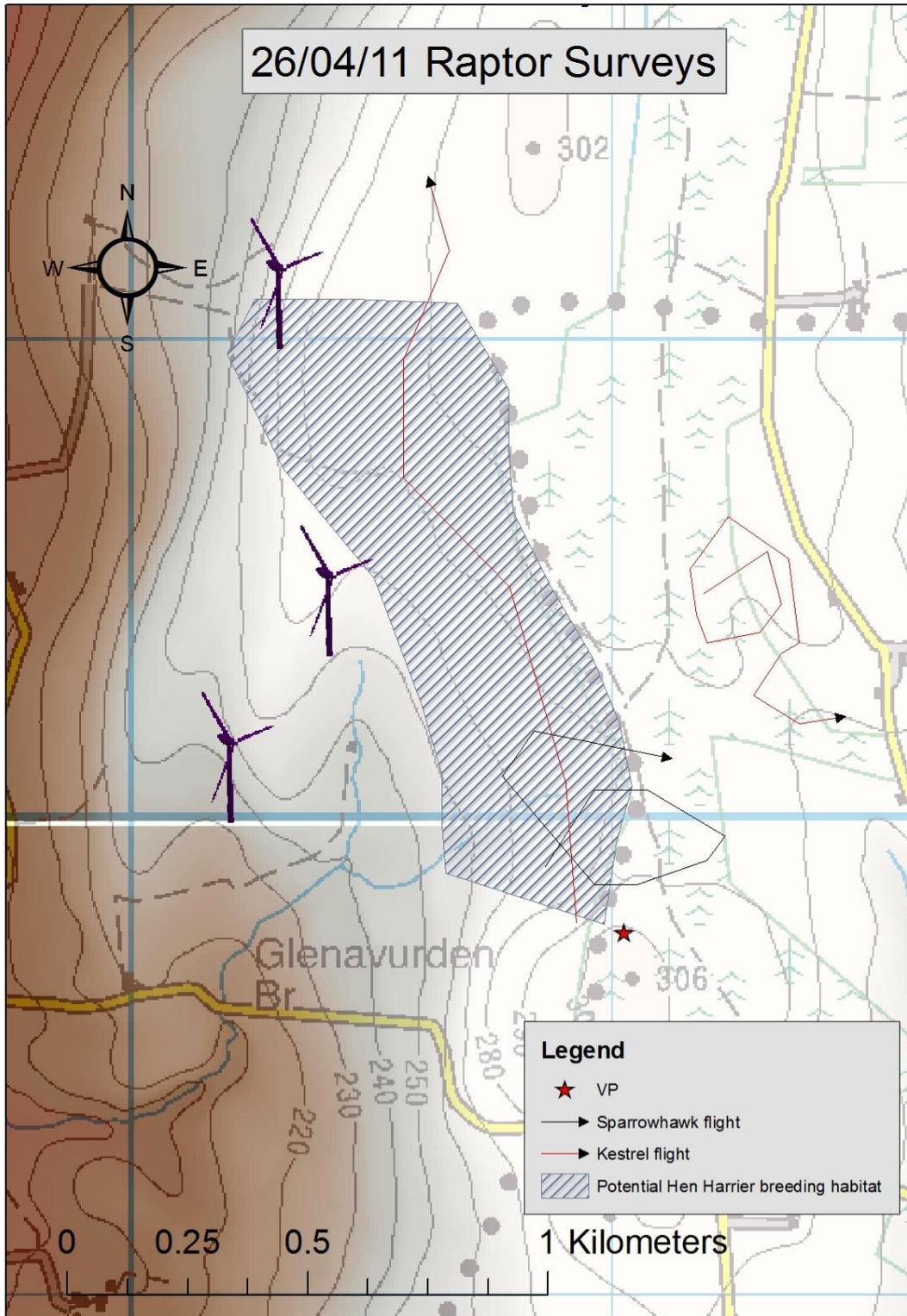
### 11 Appendix I: Viewsheds of vantage points used in raptor surveys

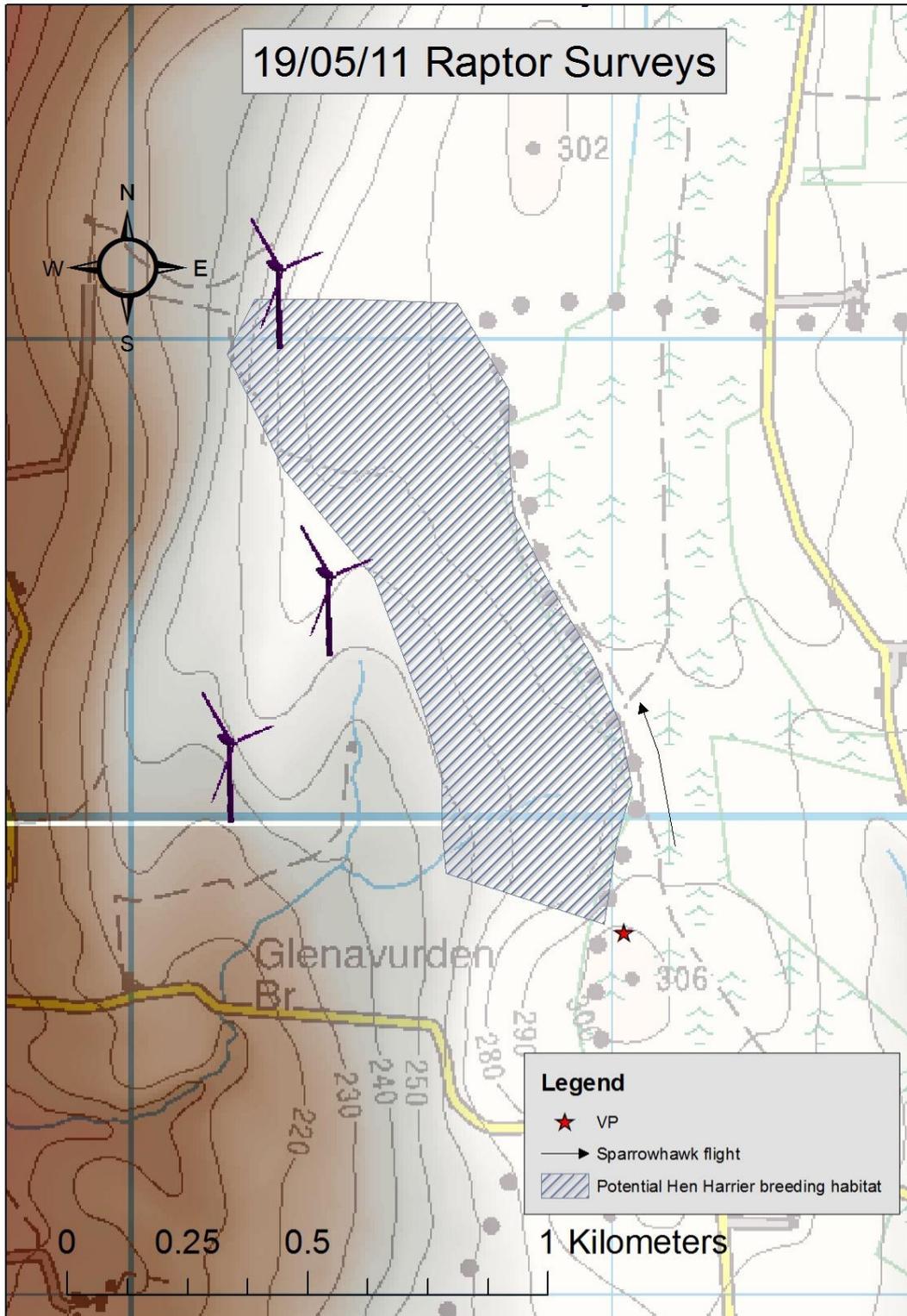


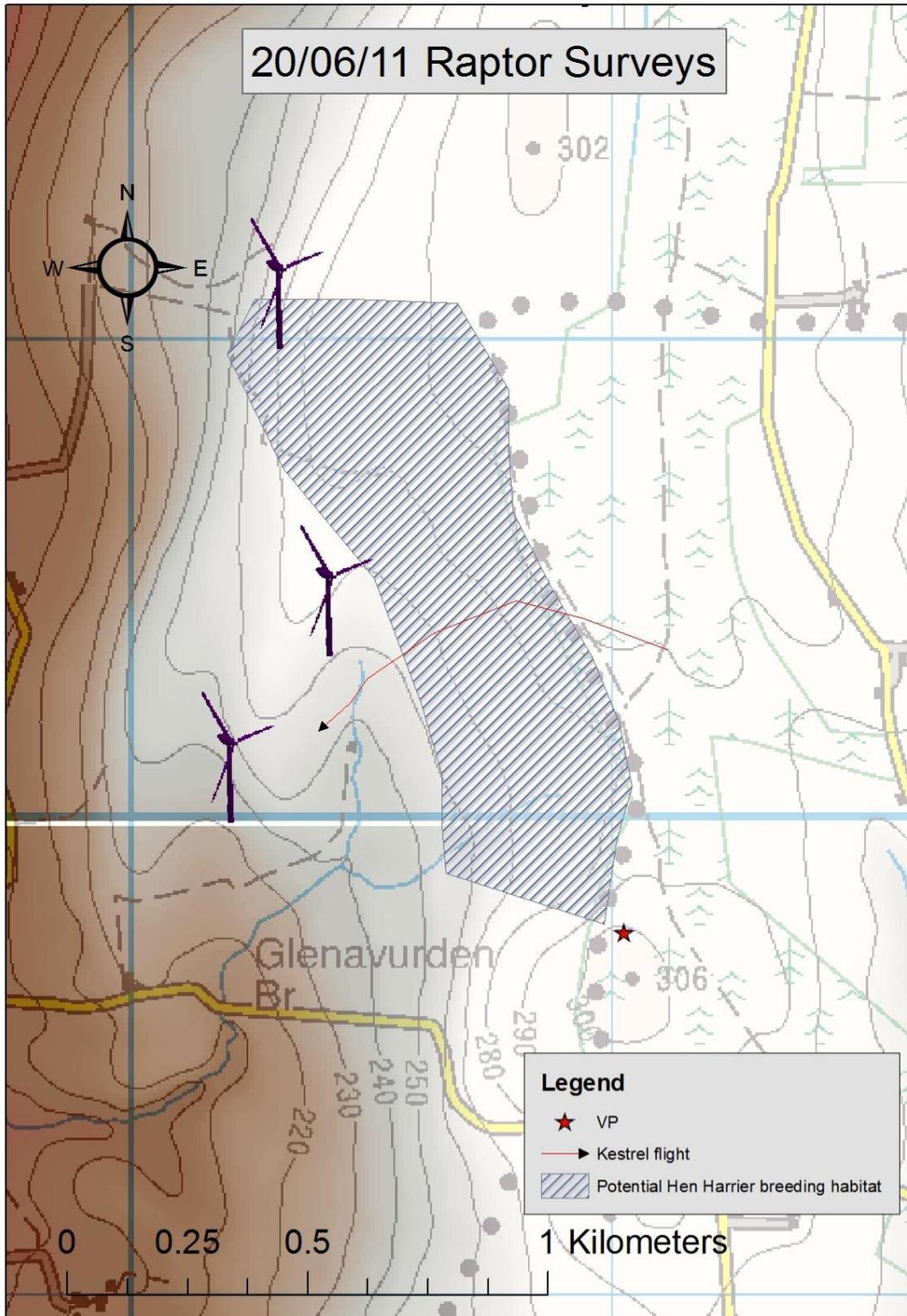


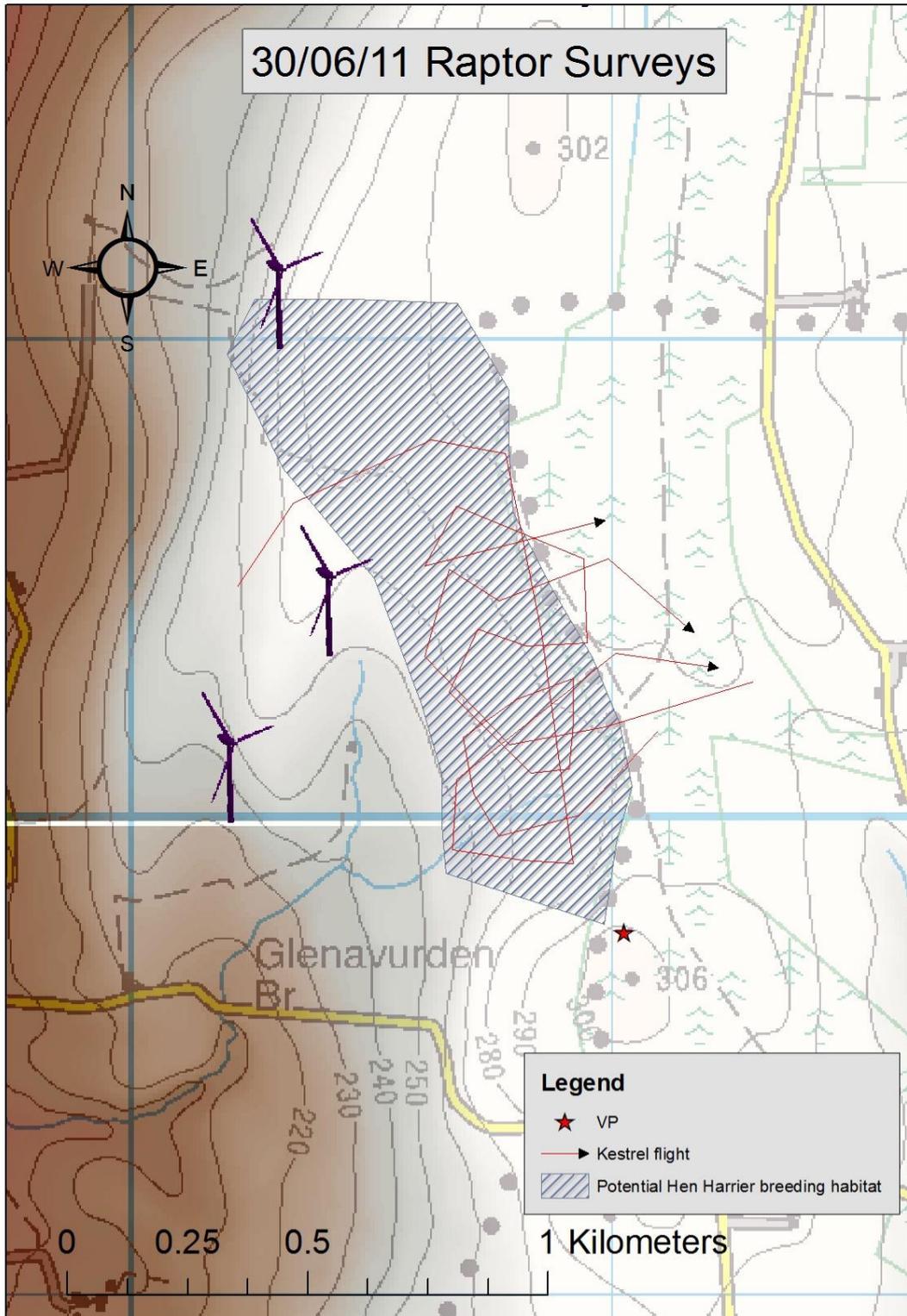
## 12 Appendix II Raptor movements recorded during surveys

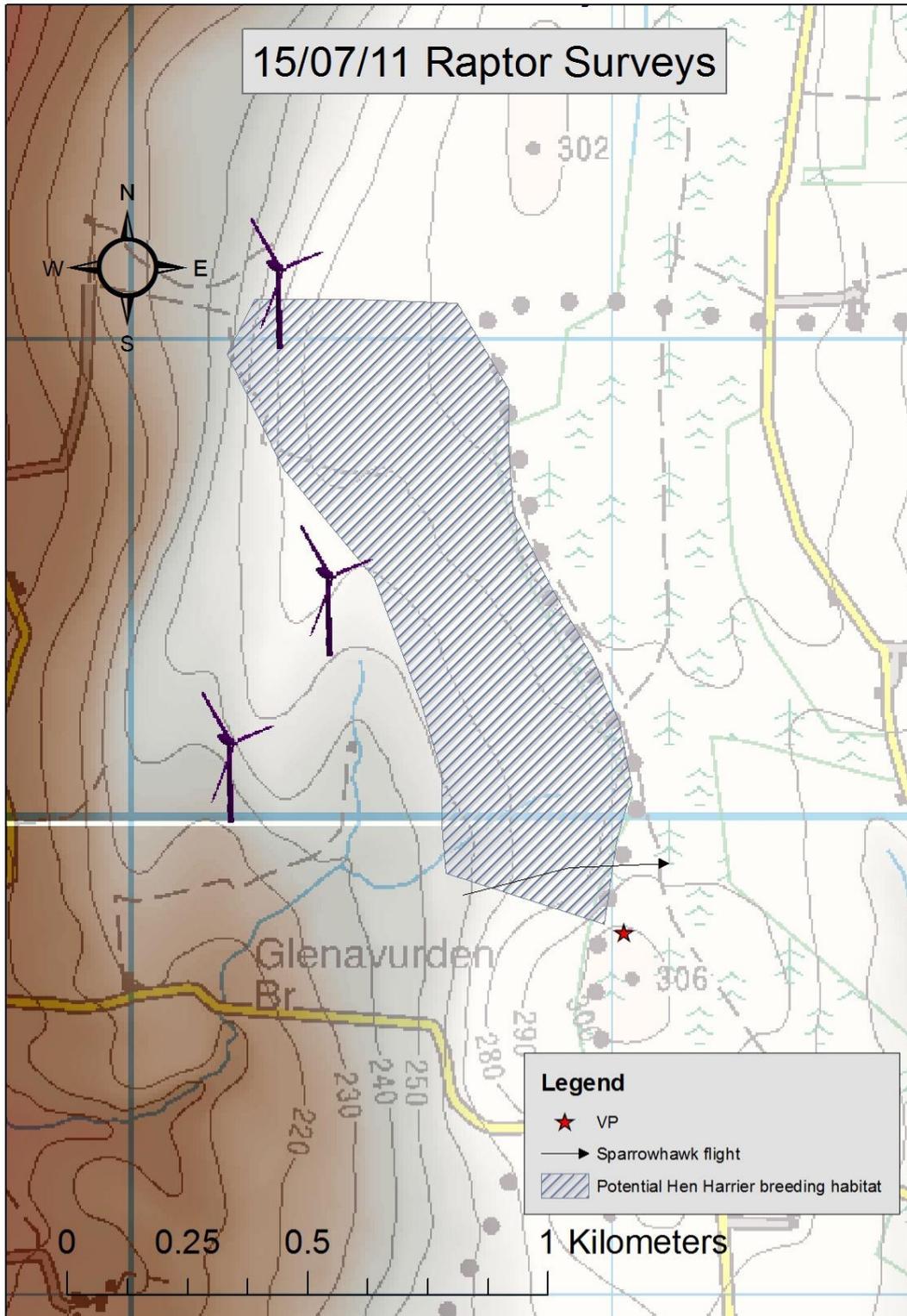


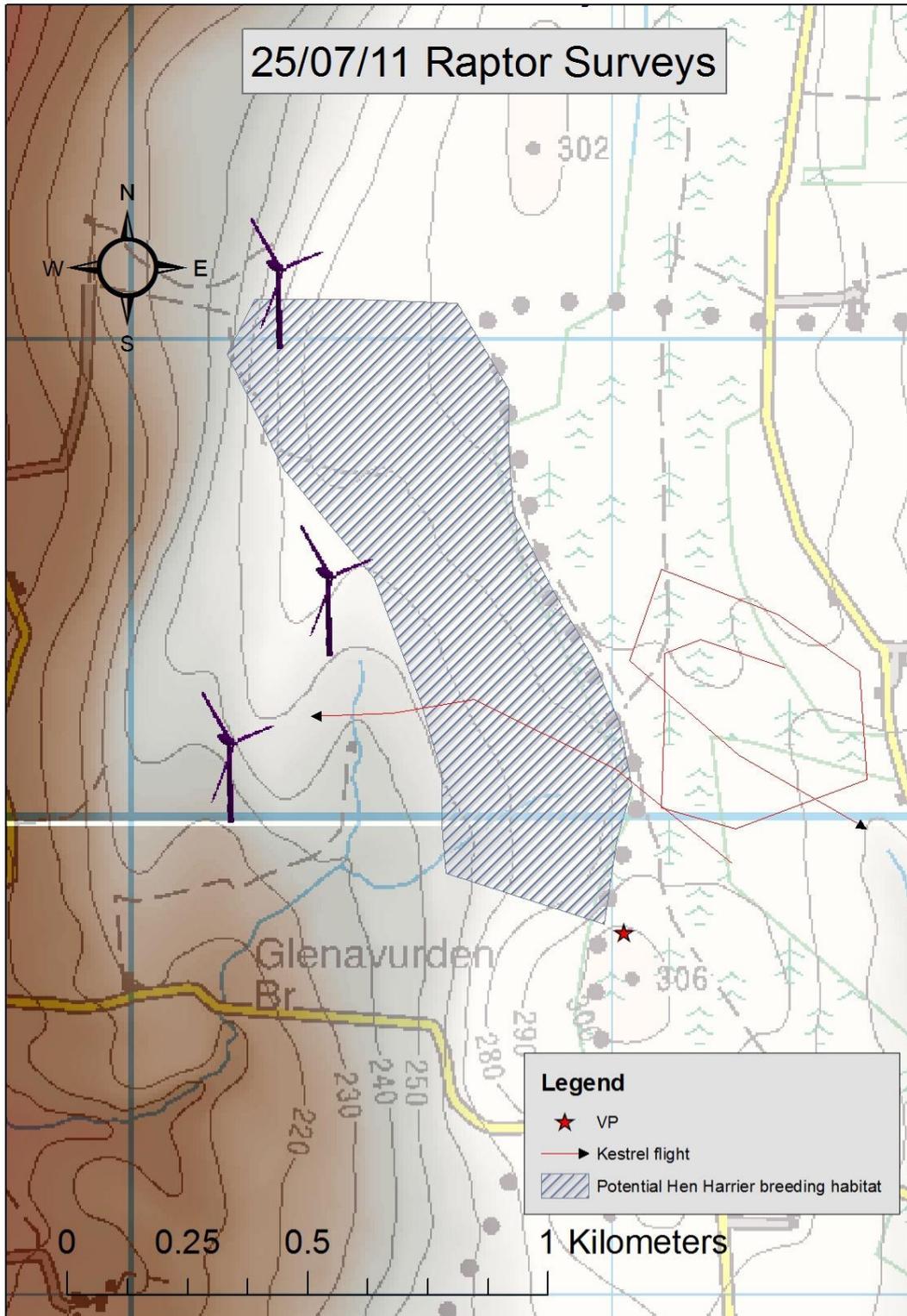


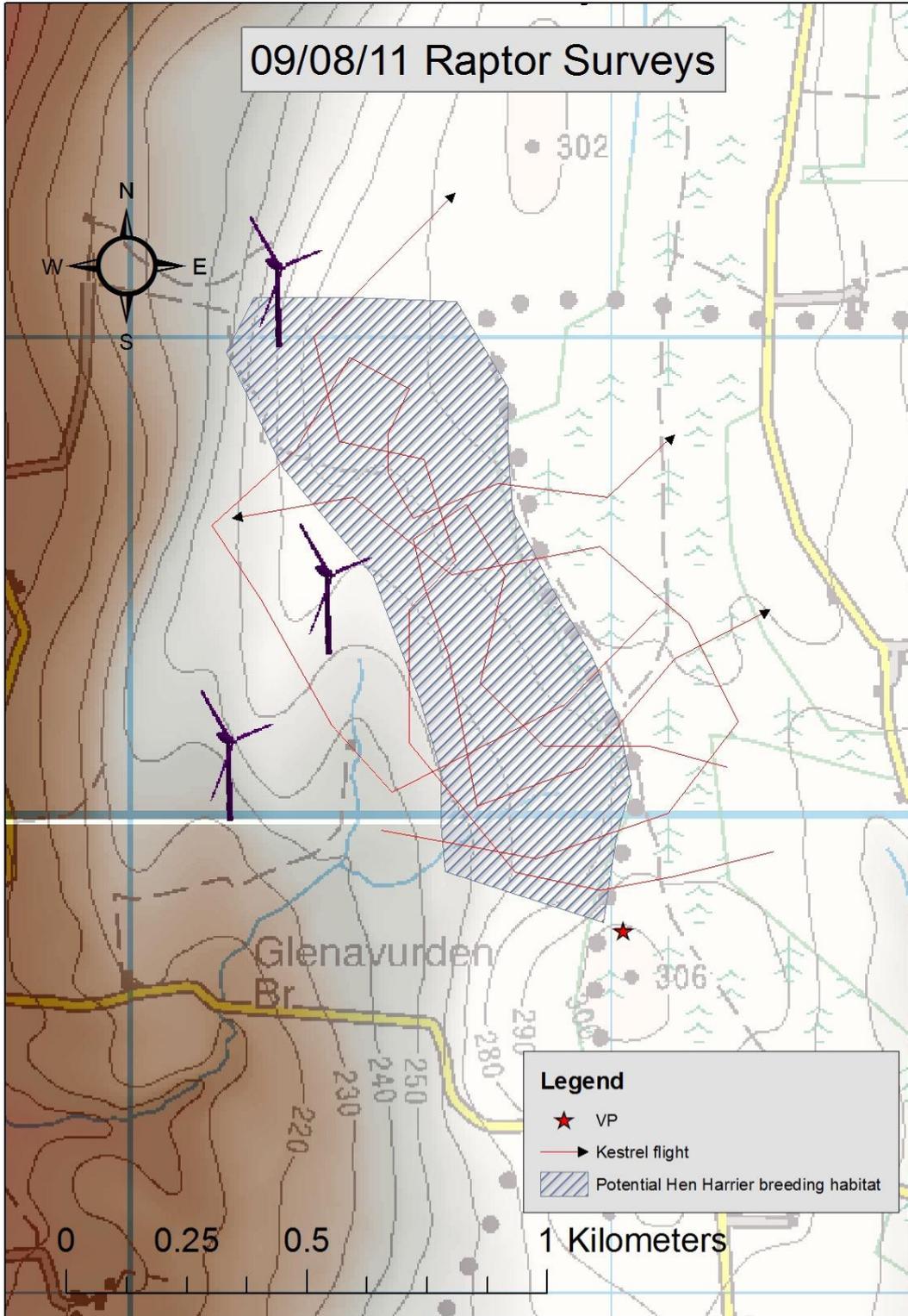


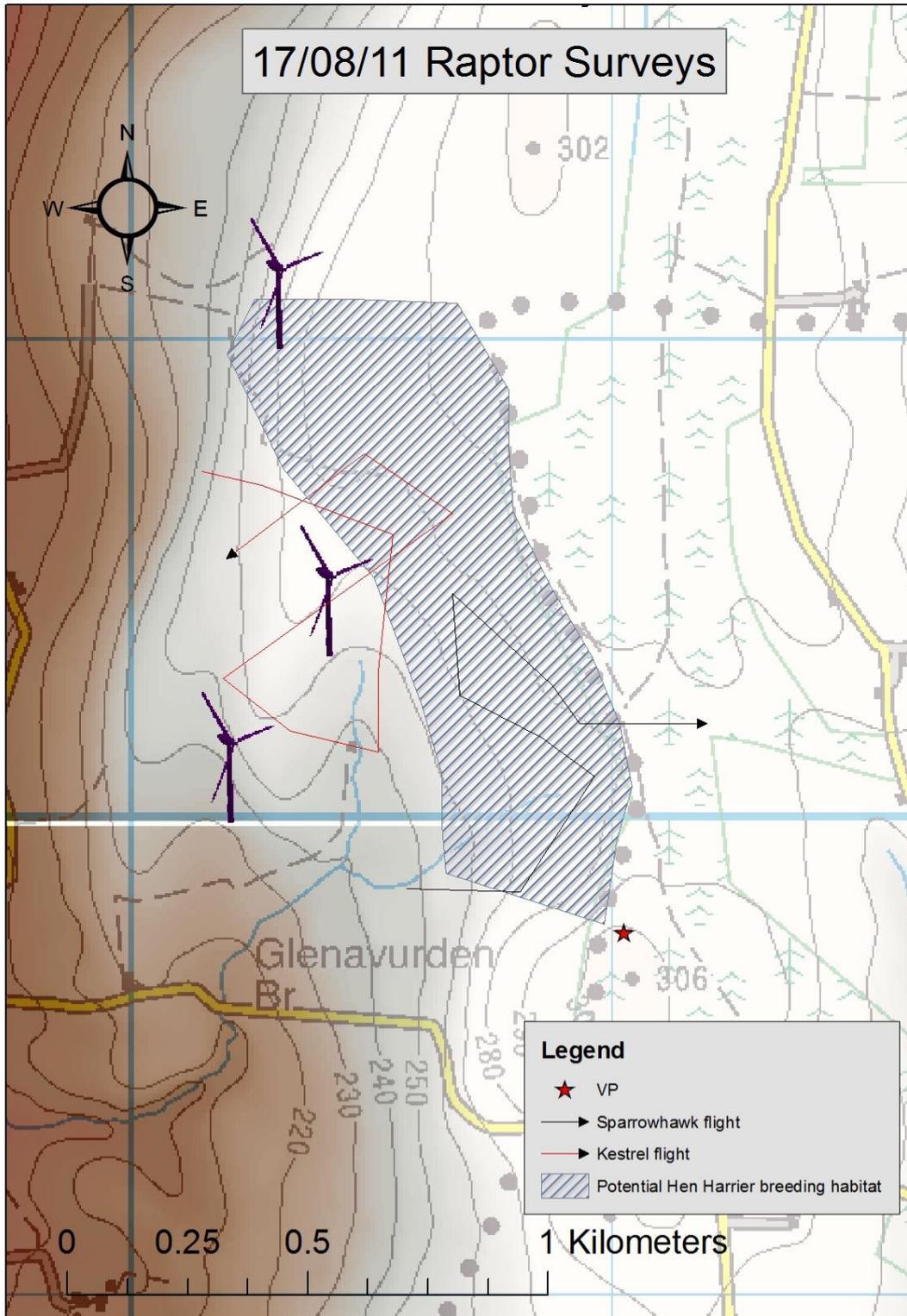




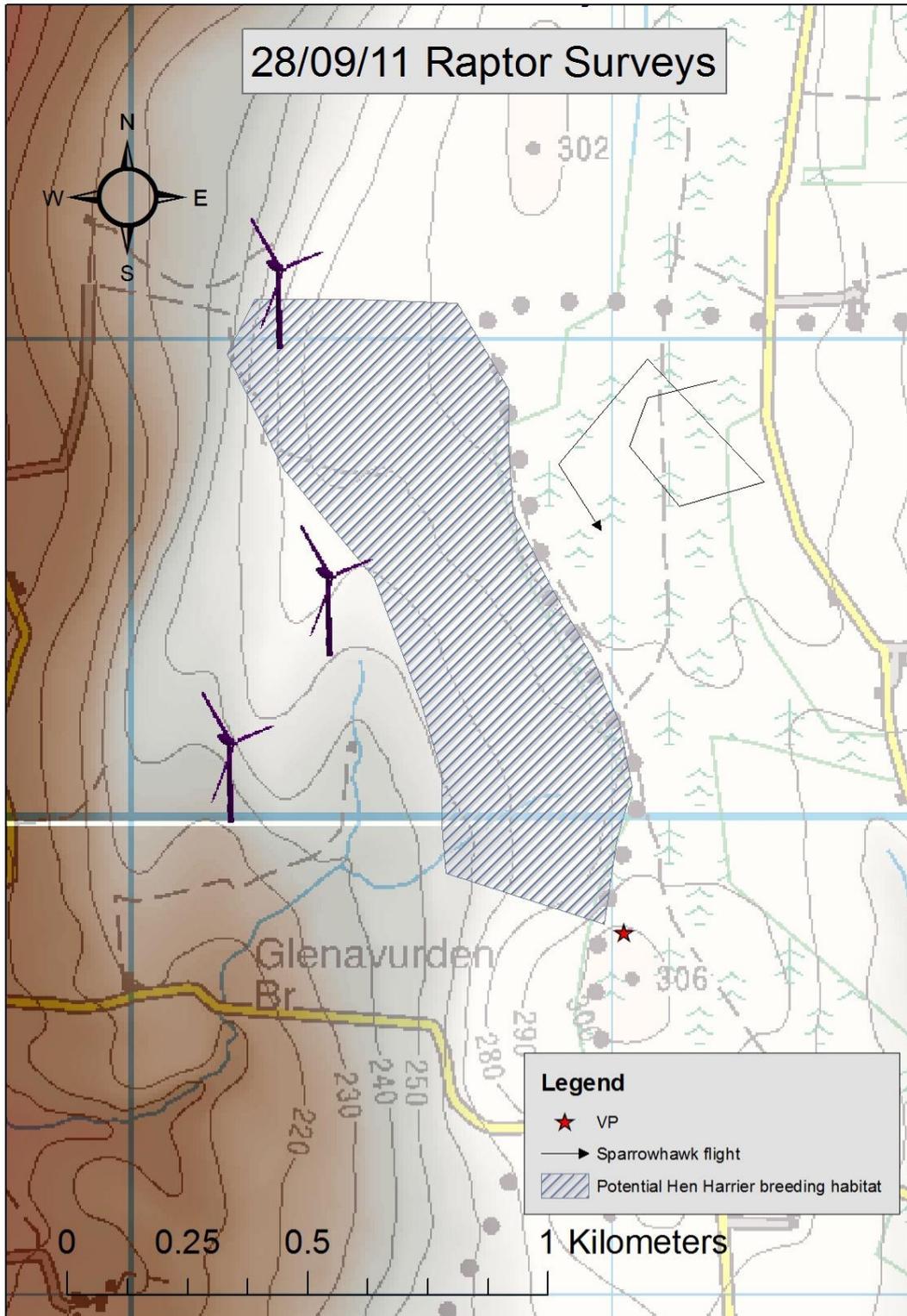












## References and Bibliography

Baines D and Andrew M (2003). Marking of deer fences to reduce frequency of collisions by woodland grouse. *Biological Conservation*, 110, pp 169 – 176.

Bibby, CJ, Burgess, ND, Hill DA and Mustoe SH (2005) *Bird Census Techniques* (2<sup>nd</sup> Edn), Academic Press, London, UK.

Bird Watch Ireland: Birds of Conservation Concern in Ireland 2008 – 2013.

Bracken F, McMahon B and Whelan J (2008). Breeding bird populations of Irish peatlands: Capsule Peatlands are very important habitats for birds despite low species diversity. *Bird Study*, 55(2), pp 169 – 178.

DEHLG (2009) *Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities*. DEHLG.

De Lucas, M, Jans GFE and Ferrer, M (Editors) (2007) *Birds and Wind Farms, Risk Assessment and Mitigation*, Quercus.

Douglas JT, Bellamy P, Pearse-Higgins JW (2011). Changes in the abundance and distribution of upland breeding birds at an operational wind farm. *Bird Study*, 58(1), pp 37 – 43.

Drewitt A and Langston R (2006). Assessing the impacts of windfarms on birds. In *Wind, Fire and Water: Renewable energy and birds*. *Ibis*, 148 (Supp 1), pp 29 – 42.

Environmental Protection Agency (1995) *Advice notes on current practice in the preparation of Environmental Impact Statements*. EPA, Wexford, Ireland.

Environmental Protection Agency (1997) *Draft Guidelines to be contained in the information to be contained in Environmental Impact Statements*. EPA, Wexford, Ireland.

European Commission (2000) *Managing Natura 2000 Sites: The provisions of Article 6 of the 'Habitats' Directive*. Luxembourg: Office for Official Publications of the European Communities

European Commission (2002) *Assessment of plans and projects significantly affecting Natura 2000 sites. Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC*. Luxembourg: Office for Official Publications of the European Communities.

European Commission (2007) *European Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC; Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence, opinion of the Commission*.

Fossitt, J. (2001) *A Guideline to Habitats in Ireland*. The Heritage Council, Kilkenny, Ireland.

Hardy J, Crick H, Wernham C, Riley H, Etheridge B and Thompson D (2009). *Raptors a field guide for surveys and monitoring*. Scottish Natural Heritage, Edinburgh, Scotland.

Langston R and Pullan J (2003). Wind farms and birds: an analysis of the effects of wind farms on birds and Guidance on Environmental Assessment Criteria and Site Selection Issues. Report by Birdlife International on behalf of the Bern Convention.

Larsen JK and Clausen (2002) Potential Wind Park Impacts on Whooper Swans in Winter: The Risk of Collision. *Waterbirds: The International Journal of Waterbird Biology*, Vol. 25, Special Publication 1: Proceedings of the Fourth International Swan Symposium 2001 (2002), pp. 327- 330. Waterbird Society.

Mougeot F, Redpath S, Moss R, Matthiopolous J and Hudson P (2003). Territorial behaviour and population dynamics in Red Grouse *Lagopus lagopus scoticus* (I) Population experiments. *Journal of Animal Ecology*, 72, pp 1073 – 1082.

Pearse-Higgins J, Stephen L, Langston R, Bainbridge I and Bullman R (2009). The distribution of breeding birds around upland wind farms. *Journal of Applied Ecology*, 46, pp 1323 – 1331.

Percival, SM (2003) Birds and Wind Farms in Ireland: A Review of Potential Issues and Impact Assessment, Sustainable Energy Ireland.

Still D, Little B and Lawrence S (1996). The effect of wind turbines on the bird population at Blyth Harbour, Northumberland. ETSU W/13/00394/REP, Energy Technology Support Unit, UK department of Trade and Industry.

[www.npws.ie](http://www.npws.ie) – website of the National Parks and Wildlife Service

[www.europa.eu](http://www.europa.eu) – official website of the European Union

## Appendix 4.3: 2012 Bat survey Report

# APPENDIX

## BAT SURVEY AND IMPACT ASSESSMENT

APPENDIX .....	1
BAT SURVEY AND IMPACT ASSESSMENT .....	1
1 STATEMENT OF AUTHORITY .....	1
2 INTRODUCTION.....	1
2.1 Background.....	1
2.2 Relevant Legislation .....	1
3 METHODOLOGY .....	2
3.1 Desk Study and Site Investigations .....	2
3.2 Impact Assessment methodology.....	11
4 RESULTS.....	15
4.1 Overviews.....	15
4.1.1.....Roost Surveys	15
4.1.2..... Transect Surveys	15
4.1.3.....Static detector surveys	16
4.2 Individual Roost Survey Reports .....	16
4.3 Individual Transect Survey reports .....	19
4.3.1.....Visit 1 (Site visited on 3 <sup>rd</sup> May 2012)	19
4.3.3.....Visit 3 (Site visited on 19 <sup>th</sup> July 2012)	25
4.3.4.....Visit 4 (Site visited on 9 <sup>th</sup> August 2012)	28
4.3.5.....Visit 5 (Site visited on 2 <sup>nd</sup> September 2012)	31
4.3.6.....Visit 6 (Site visited on 11 <sup>th</sup> October 2012)	34
4.3.7 Summary of bat activity recorded during transect surveys .....	36
4.4 Individual Static Monitor Survey Reports .....	37
4.4.1..... Static monitoring results for 3 <sup>rd</sup> May 2012	37
4.4.2..... Static monitoring results for 11-20 <sup>th</sup> June 2012	41
4.4.3..... Static monitoring results for 13-20 <sup>th</sup> July 2012	46
4.4.4..... Static monitoring results for 9-16 <sup>th</sup> August 2012	51

4.4.5. Static monitoring results for 2- 8 <sup>th</sup> /11 <sup>th</sup> September 2012	60
4.6 Association of bat passes with habitat features .....	67
4.7 Summary and discussion of results .....	68
4.6 Survey issues and limitations.....	69
5 POTENTIAL IMPACTS OF THE DEVELOPMENT .....	70
5.1 Bat roosts .....	70
5.2 Collision and barotrauma.....	70
5.2.1..... Leisler’s Bat	71
5.2.2..... Pipistrelle Species	74
5.2.3..... <i>Myotis</i> species	74
5.3 Loss or fragmentation of habitat.....	75
5.4 Displacement or disturbance of bats .....	75
6 MITIGATION AND ENHANCEMENT .....	76
8 SUMMARY AND CONCLUSION .....	82
9 REFERENCES.....	83

## **1 STATEMENT OF AUTHORITY**

The bat surveys were led by Will Woodrow, MSc., MIEEM and David McNicholas Grad IEEM. Will Woodrow is an experienced environmental fieldworker and ecologist with a career spanning over 25 years. A full member of the Institute of Ecology and Environmental Management (IEEM), Will has been carrying out bat fieldwork for over five years and has undertaken training on two separate occasions in bat survey design and appropriate mitigation as well as specific training on designing, undertaking and interpreting bat surveys for wind farm proposals and in advanced bat sonogram analysis. Will is a licenced bat worker, holding NPWS licences for roost disturbance and bat handling. David McNicholas MSc undertook the surveys with Will Woodrow. David has assisted with and led on many bat surveys over the past two years, has undertaken a thesis into the impact of wind turbines on bats and has undertaken training on bat survey methods, design and appropriate mitigation. David has also experience in interpreting bat survey data for wind farm proposals. David is a Graduate Member of the Institute of Ecology and Environmental Management.

## **2 INTRODUCTION**

### **2.1 Background**

A bat survey and impact assessment of the proposed wind farm at Pinewoods, near Abbeyleix Co. Laois was carried out by Woodrow Sustainable Solutions. The assessments were undertaken in order to assess the potential adverse effects of wind turbines on bats. Monthly surveys were undertaken from May to October 2012. The results of these surveys have informed this assessment study.

This chapter complements the Ecology Chapter (Chapter 6) of the EIA and all assessment conclusions and mitigation proposals from this report form part of the overall ecological assessment and proposed mitigation for the scheme.

### **2.2 Relevant Legislation**

#### *Wildlife Act 1976*

Schedule 5 of the Wildlife Act 1976 gives protection to all bats and their roosts in the Republic of Ireland. It is unlawful to disturb them without an appropriate licence from NPWS. The Act was amended in 2000.

*EU Habitat Directive 1992 and EC (Birds and Natural Habitats) Regulations 2011*

The EU Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (Habitats Directive 1992), provides protection to particular species and their habitats across Europe. All species of bats recorded in Ireland are listed on Annex IV of the Directive, while the lesser horseshoe bat (*Rhinolophus hipposideros*) is listed under Annex II (species subject to special conservation measures, including designation of SACs). The Habitats Directive is transposed into Irish law through the EC (Birds and Natural Habitats) Regulations 2011.

*Bern and Bonn Convention*

Ireland has ratified two international conventions, which afford protection to bats amongst other fauna. These are known as the 'Bern' and 'Bonn' Conventions. The Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1982) exists to conserve all species and their habitats, including bats. 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, which covers certain species of bat.

### **3 METHODOLOGY**

In order to comply with the requirements of the EU Habitats Directive and the EC Habitats Regulations, wind farm applications in Ireland need to have bat surveys undertaken as part of their ecological assessment. Bat Conservation Ireland has provided draft guidelines on what would be expected in the approach and content of a bat survey and ecological assessment (although these are currently under review and not publicly available).

#### **3.1 Desk Study and Site Investigations**

The survey and assessment of bat activities at the Pinewoods site and the impact assessment were carried out by combining the results of the desktop research with the results of the field surveys. Reference was also made to a variety of best practice documents for wind farm bat surveys in Ireland and Europe. These are referenced at the end of the report.

Bat Conservation Ireland is currently drawing up Wind Turbine / Wind Farm Development Bat Survey Guidelines. While these are not yet available in a completed format, a previous draft version prescribes the following key recommendations:

- A combination of survey methods should be used – these include manual activity surveys,

driven transects, static detector surveys of activity at ground level, static detector surveys of activity at height, the identification of potential roosts, surveys of known roosts and other detailed survey work such as radio-tracking, infra-red, etc.

- On-site activity surveys should include both post emergence activity surveys (from approximately thirty minutes before sunset and for a minimum of 120 minutes) and dawn surveys (from a minimum of 90 minutes prior to sunrise). These surveys should determine the approximate numbers and species of bats present within the site, areas used for foraging, commuting routes to and from roosts and any changes in mid to late summer activity levels. The approximate flying height and direction taken by bats should be estimated and detailed if possible.
- Manual activity surveys should be designed as timed walked transects to ensure that all areas and main features of the site are sampled within the time period of 30 minutes before dusk to 2-3 hours after sunset. Pre-dawn to dawn surveys commencing a minimum of 90 minutes before sunrise should also be carried out. Transects should be walked in different directions and at different starting points across the bat season so that variations in emergence times of different species of bats and bat activity across the site are recorded. Pre-dawn surveys can assist in determining if any roosts are present on or within a 200 metre radius of the site.
- Environmental conditions across the transect should be recorded at regular intervals to determine if there is a change in bat activity attributable to exposure/rainfall/wind speed, etc.
- Should a potential roost (tree/structure/building, etc.) be present on-site it should be adequately inspected to determine its use by bats. If the structure or tree contains a *known* roost a derogation licence may be required to allow internal inspection.
- Where a known roost is present or within 200 metres of the site, the survey should identify how bats from that roost are using the site, i.e. key commuting routes from that roost and the main foraging areas used by the bats. Two dusk and dawn surveys per roost should be carried out as a minimum per season. Depending on the proximity of the roost to turbines, the species present and the significance of the roost further surveys focusing on this location may be required.
- The survey area should not only focus on the turbine locations but should encompass the entire site area and extend to a minimum distance of 200m beyond the site boundary. Surveys well outside the site boundaries may also be required if significant features occur. During the surveys, features such as hedgerows, and tree lines and topographical features such as valleys and water courses should be observed for potential roost sites, foraging areas and commuting

routes. Such a survey can take place early in the planned development and its findings can be considered when determining the turbine locations at a pre-application stage.

- Static bat detectors/recorders should be set up to record for longer periods (8+ nights, all night) for at least one period each month. Recordings should be made at proposed turbine locations but also other features on and around the site for comparison.
- Driven transects may provide useful information on the wider landscape from the perspective of bats, in the vicinity of the proposed development site.
- Additional aspects of the wind farm/turbine development such as access tracks/haul roads, transmission stations, construction compounds, transmission lines, towers etc. should also be assessed for potential negative impacts on bats.
- Any opportunity to survey at height and over extended periods of time using unattended detectors should be taken although it should be noted that use of such detectors alone is not satisfactory and these should be combined with walked transects, car-based transects, point counts, etc.

Taking account of the above, the survey approach for the site was as follows:

An initial daylight survey of the site was undertaken to establish potential roost sites and to look for signs of roost activity (droppings). During this initial visit, survey transects were walked in daylight and marked onto a handheld GPS, taking account of potential roost and foraging features and commuting routes. Transects were designed to provide the best coverage across the site as a whole, provide good representative coverage of all habitats and suitable features, and cover the areas of proposed infrastructure. Where appropriate, transects were undertaken away from the proposed infrastructure. An equally important issue considered in the setting up of transects was health and safety, considering that the site is somewhat remote and that routes would be walked in darkness.

The large size of the site meant that it required monthly survey visits by two independently working surveyors, using two-way radio systems for health and safety reasons, to provide an appropriate level of coverage throughout the site. Figure 1 below shows all transects walked.

Transects were walked using professional Wildlife Acoustics EM3 bat detectors. Temperature and wind speed was measured at intervals throughout the survey using a Silva hand held weather meter. Field records were made of bat species encountered, number of bat passes, activity where known (e.g. foraging, commuting, advertising), travelling direction and approximate height (where known). Analysis of sound recordings was undertaken using Analook and Batsound software to confirm species and exact number of bat passes for survey sections (or genus for *Myotis* species).

A total of seven survey visits were made to the site during the months May to October, six of these surveys were post-dusk surveys, three included emergence surveys and one visit was a dual survey visit incorporating a dusk emergence survey and pre-dawn transect survey.

Details of these surveys, including weather conditions are provided below in Table 1.

In addition to the transect surveys, static monitors were employed monthly at the site at various points. These monitors were placed strategically within the site in order to get a representative coverage of potential bat feeding features and turbine positions. Dates and positions of static detectors are given in Table 2 and Figure 2. Two static monitors were also placed at the met mast location in order to gain information on the comparative use of the site at ground level and near the rotor swept area. This involved use of an IWCM trained climber to locate separate microphones on the met mast at 4 metres and at 45 metres altitude, and monitoring bat activity over time.

All aspects such as weather conditions and, where possible, height, direction and behaviour of bats were recorded in line with the Bat Conservation Ireland guidelines.

For health and safety reasons, Woodrow Sustainable Solutions undertakes night time field work with 2 fieldworkers present on site at all times. Where two surveyors are undertaking separate transects, they remain in touch on two-way radio systems.

**Table 1: Survey dates, timing and weather conditions**

<b>Date</b>	<b>Activity</b>	<b>Time</b>	<b>Weather Conditions</b>
<b>3 May 2012</b>	Dusk Transect Survey	21:33 – 23:14 (Two surveyors working concurrently on different transects)	Wind – Force 0-1. Cloud cover 6/8 Dry Temp. 9.2-12.2°C
<b>11 June 2012</b>	Roost emergence survey & Dusk Transect Survey	22:08 – 00:24	Wind – Force 0. Cloud cover 8/8. Mainly dry with a little drizzle at the end. Temp 10.2-14.5°C
<b>20 June 2012</b>	Roost emergence	21:30 – 23:17	Wind – Force 1. Cloud cover 8/8 Light rain Temp. 14.3-15°C
<b>19 July 2012</b>	Roost emergence survey & Dusk Transect Survey	22:31 - 00:21	Wind - Force 0-1 (Light Westerly) Cloud cover 7/8 Temp: 14.3°C. Dry
<b>9 August 2012</b>	Roost emergence survey & Dusk Transect Survey	22:40 - 23:59 (Two surveyors working concurrently on different transects)	Wind - Force 0-1: (Light Southerly) Cloud cover 2/8 Dry Temp 19.4 - 14°C
<b>1 &amp; 2 September 2012</b>	Dusk roost emergence survey & (01/09/2012) & Dawn Transect Survey (02/09/2012)	19:48 – 21:20  04:53 - 06:22	Wind -Force 0 Dry Cloud cover 0/8 Temp: 9.3- 10.5°C
<b>11 October 2012</b>	Dusk Transect Survey	19:21 – 20:25 (Two surveyors working concurrently on different transects)	Wind - Force 1 W Dry Cloud cover 4/8 Temp: 8.5-9.5°C

Figure 1 – Main transect route within and around the site

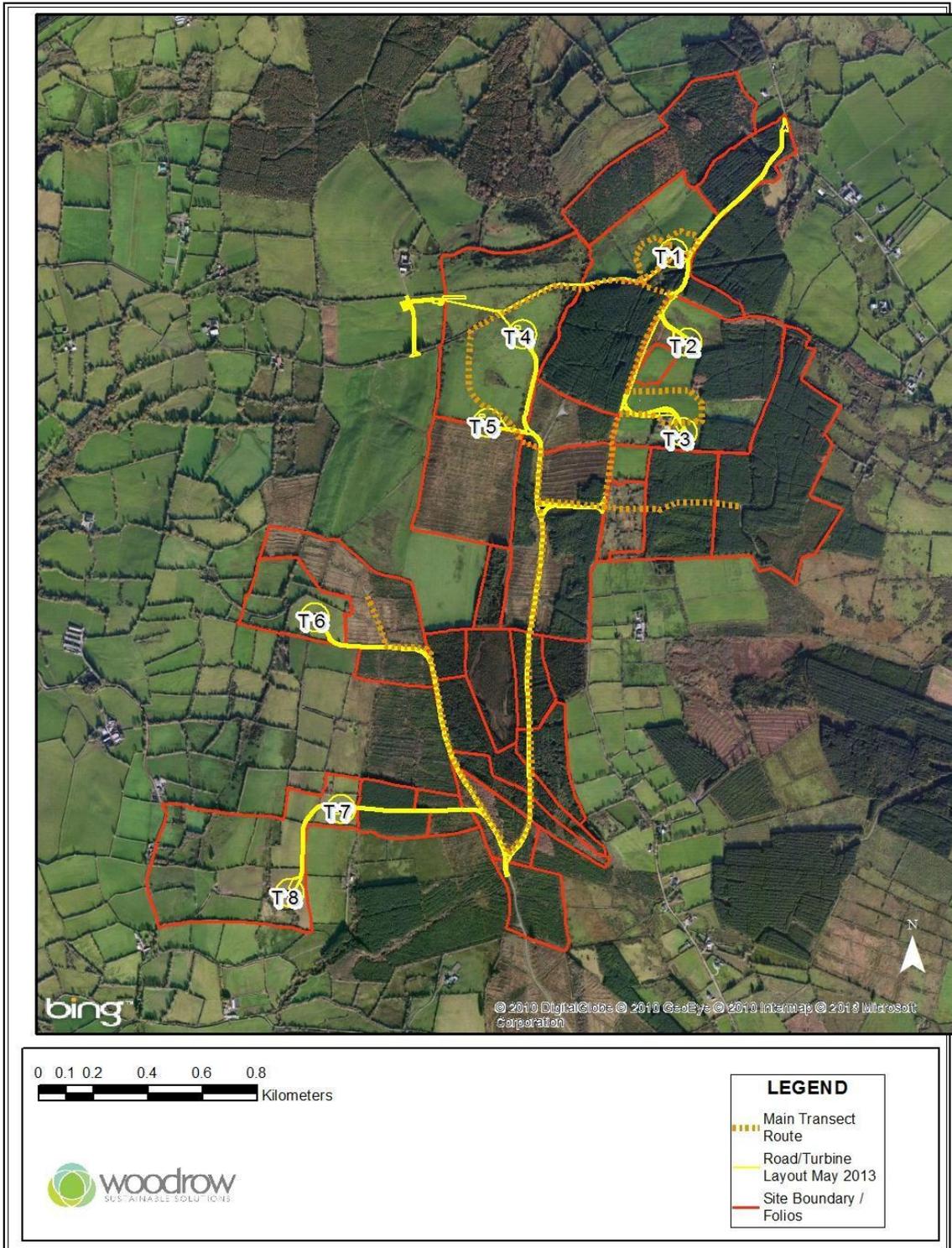
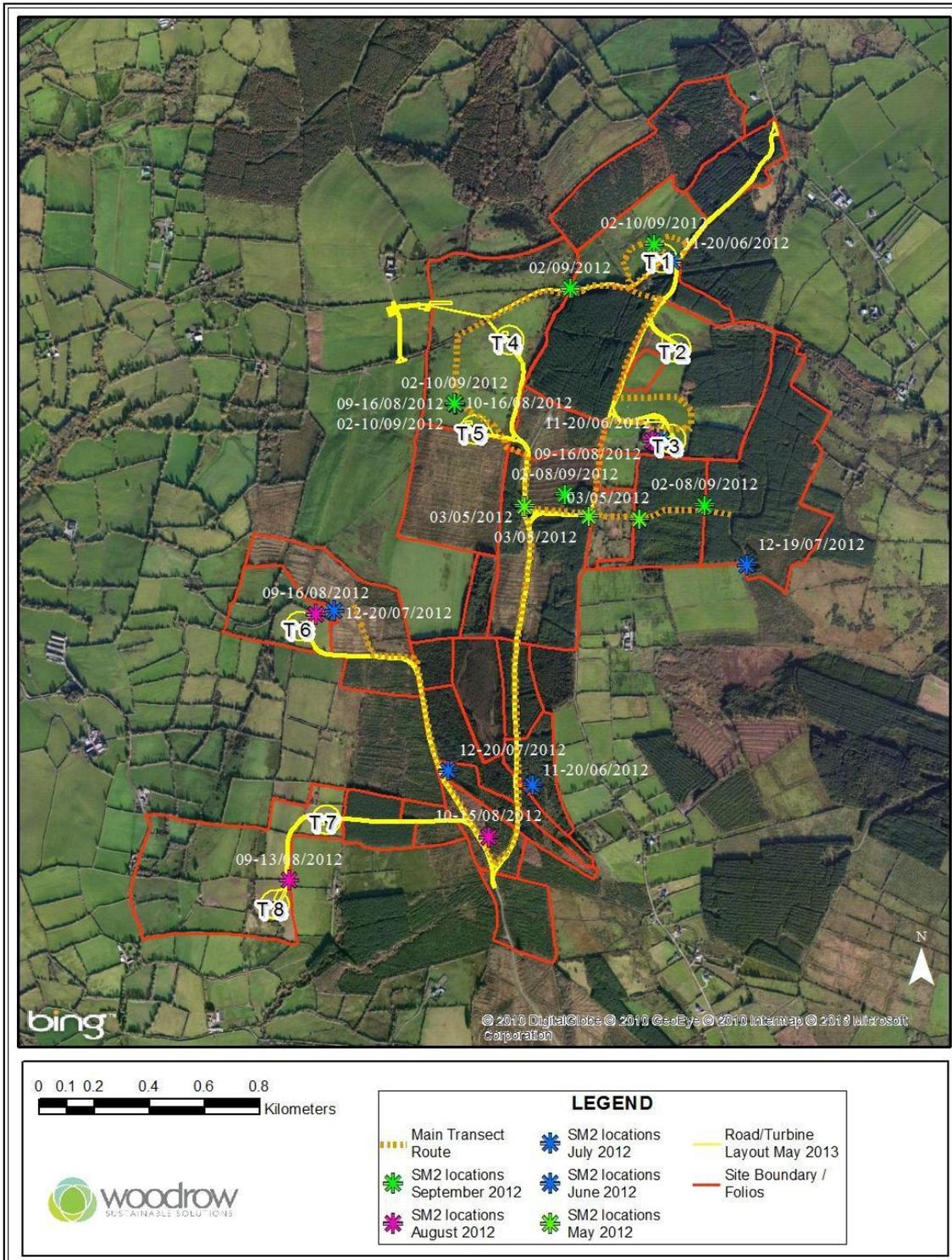


Table 2: Survey dates and features covered for static bat detectors

Date	Detector type	Unit N°	N° Nights Surveyed	Features / Turbine positions covered
3 May 2012	Song Meter SM	2	1	Forestry edge
		3	1	Forestry edge
		4	1	Forestry edge
11-20 June 2012	Song Meter SM	2	7	Farm buildings near T3.
		4	7	Open pasture north of T5 (met mast)
		6	7	Coniferous woodland.
12 – 18 July 2012	Song Meter SM 2	1	6	Forestry edge / forestry ride.
		2	6	Young forestry edge and open pasture near T6.
		4	6	Forest ride & edge habitat.
		3	6	Open pasture north of T5 (met mast) – at 4m altitude
9 – 16 August 2012	Song Meter SM 2	1	7	Farm buildings and pasture near T3
		2	7	Hedgerow near T6.
		4	7	Hedgerow near T8.
		6	7	Forestry edge.
		3	7	Open pasture north of T5 (met mast) – at 4m altitude
		5	7	Open pasture north of T5 (met mast) – at 45m altitude
2 – 10 September 2012	Song Meter SM 2	1	8	Forestry ride close to proposed turbine location.
		2	8	Mature forestry edge & young forestry. Close to proposed turbine location.
		5	8	Hedgerow near T1.
		6	8	River to the north.
2 - 11 September 2012	Song Meter SM	3	9	Open pasture north of T5 (met mast) – at 4m altitude
		5	9	Open pasture north of T5 (met mast) – at 45m altitude
11 September – 11 October	Song Meter SM	3	30	Open pasture north of T5 (met mast) – at 4m altitude
		5	30	Open pasture north of T5 (met mast) – at 45m altitude

Figure 2 – Location of SM2 static bat detectors and dates of deployment



### 3.2 Impact Assessment methodology

In order to undertake an assessment of the potential impact of the proposal on bats, it is necessary not only to have carried out surveys to ascertain what bat species and numbers are present on the site, but also how susceptible those species are to impacts from wind farms and how susceptible the Irish populations are to impacts. The following sources have been used to determine the potential for impact on the different species of bat encountered at Pinewoods.

The most appropriate work on this has been put forward by Natural England in *Bats and Onshore Wind Turbines: Interim Guidance* (Natural England 2009). This guidance document outlines the species that are most at risk from wind turbines. The assessment of risk in the guidance document was carried out on attributes and behaviour of the bat taken from a number of sources. Applicability of these behavioural attributes to the Irish context is considered likely. Table 3 below shows the risk associated with the species that are found in Ireland. Those recorded at Pinewoods are shown in bold.

**Table 3 - Irish bat species likely to be at risk from wind turbines<sup>1</sup>**

Low risk	Medium risk	High risk
<b>Myotis species</b>	<b>Common pipistrelle</b>	<b>Leisler's bat</b>
Brown long-eared bat	<b>Soprano pipistrelle</b>	Nathusius' pipistrelle

In addition, it is important to ascertain which *populations* may be threatened due to impacts of wind turbines. Information from the *Irish Mammals Red Data List* (Marnell *et al*, 2009)<sup>2</sup> and provides help on this. Table 4 below gives status of different bat species in Ireland.

Those species recorded at Pinewoods are in bold (all *Myotis* species are highlighted since the total number of *Myotis* species recorded at Pinewoods is unknown).

**Table 4 – Bat species in Ireland according to their status (from Marnell *et al*. 2009)**

Species	Near threatened	Least Concern	Data Deficient
<b>Leisler's bat <i>Nyctalus leisleri</i></b>	?		
<b>Daubenton's bat <i>Myotis daubentonii</i></b>		?	
<b>Whiskered bat <i>Myotis mystacinus</i></b>		?	
<b>Natterer's bat <i>Myotis nattereri</i></b>		?	
Brown long-eared bat <i>Plecotus auritus</i>		?	
Nathusius' pipistrelle <i>Pipistrellus nathusii</i>		?	
<b>Common pipistrelle <i>Pipistrellus pipistrellus</i></b>		?	
<b>Soprano pipistrelle <i>Pipistrellus pygmaeus</i></b>		?	
Lesser horseshoe bat <i>Rhinolophus hipposideros</i>		?	
Brandt's bat <i>Myotis brandtii</i>			?

---

1 Natural England (2009) *Bats and Onshore Wind Turbines: Interim Guidance*

2 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.

Leisler's bat, soprano pipistrelle, common pipistrelle and *Myotis* species were recorded at the site.

It can be seen from table 4 above that Leisler's bat is listed as *Near Threatened* in the *Irish Mammals red Data List*. The reasons for this listing given in the report is the fact that Ireland is a world stronghold for the species, holding an estimated 20-25% of the global population of the species. Leisler's bats have a strong echolocation call that allows them to feed by aerial hawking a considerable distance from habitat features. They are frequently observed feeding at height. It is this feeding habit that puts them in the *High Risk* category with respect to impacts from wind turbines. Pipistrelle species, such as soprano pipistrelle, tend to be more closely associated with habitat features such as forest edge and so are less likely to be flying in the open at turbine height, hence the conclusion of *Medium* risk for this species in table 3.

Having identified the importance of different bat species in Ireland and their general susceptibility to impacts from wind turbines, it is necessary to undertake an impact assessment through an appropriate methodology. The methodology applied is from the IEEM Guidance (2006)<sup>3</sup>. The general approach was to assess the magnitude / extent and probability of occurrence of impacts and relating them to the value of the receptor as outlined above. Definitions of these are provided below.

### **Impact Magnitude**

The magnitude of an impact depends upon the nature and sensitivity of a receptor and the range of potential effects arising from the construction and operation of a proposed development. For the purposes of this assessment the impact magnitude is influenced by the intensity, duration, frequency and reversibility of a potential impact and is categorised as follows:

- High magnitude impact: that which results in harmful effects to the conservation

status of a site, habitat or species and is likely to threaten the long-term integrity of the system.

- Moderate magnitude impact: that which results in harmful effects to the conservation status of a site, habitat or species, but does not have an adverse impact on the integrity of the system.

---

3 IEEM (2006) Guidelines For Ecological Impact Assessment in the UK

- Low magnitude impact: that which has a noticeable effect but is either sufficiently small or of short duration to cause no harm to the conservation status of the site, habitat or species.
- Imperceptible: that which has no perceptible impact.
- Positive: that which has a net positive impact for the conservation status of a site, habitat or species.

### **Nature Conservation Value**

The nature conservation value of a receptor is based upon a geographic hierarchy of importance. The following spatial categories are used during the assessment of impacts:

- International: sites, habitats and species populations of importance in a European context;
- National: sites, habitats and species populations of importance in an national context;
- Regional: sites, habitats and species populations of importance in a county context;
- Local: sites, habitats and species populations of importance in a parish and district context; and
- Low: habitats and species populations of less than local importance but of some value.

### **Impact Significance**

The significance of impacts is determined by evaluating the nature conservation value of the site, habitat or species concerned together with the magnitude of the impacts affecting the system. The more ecologically valuable a receptor and the greater the magnitude of the impact, the higher the significance of that impact is likely to be. Table 5 below outlines the levels of impact significance to be used during the assessment of impacts. The probability of occurrence as outlined above will also be used when defining the significance of impacts.

Table 5 – Impact significance matrix

		Magnitude of Potential Impact			
		High	Moderate	Low	Imperceptible
Nature Conservation Value	International	Severe	Major	Moderate	Minor
	National	Severe	Major	Moderate	Minor
	Regional	Major	Moderate	Minor	Minor
	Local	Moderate	Minor	Minor	Negligible
	Low	Minor	Negligible	Negligible	Negligible

### Impact probability

The likelihood that an impact will occur is categorised to be:

- Certain/near certain – probability of occurrence estimated at 95% chance or higher;
- Probable – probability of occurrence estimated above 50% but below 95%;
- Unlikely – probability of occurrence estimated above 5% but less than 50%; and
- Extremely unlikely – probability of occurrence estimated at less than 5%.

## 4 RESULTS

### 4.1 Overviews

#### 4.1.1 Roost Surveys

Internal and / or external inspections were undertaken of all buildings within a reasonable proximity to the site, and for which access could be gained, for evidence of roosting bats. Field signs can include droppings, butterfly feeding remains, scratch marks/smoothed surfaces around entrance points, oil staining from fur.

Emergence surveys of buildings within and in the vicinity of the site boundary revealed no active roosts within the site and one small pipistrelle roost (comprising 3 roosting bats) at a dwelling located approximately 450 metres from the proposal boundary. Roost surveys of farm buildings within the site boundary did show some level of use of them by feeding bats.

### 4.1.2 Transect Surveys

Recorded bat activity during transect surveys varied considerably over the season with a significantly lower level of activity in the second half of the season. Table 6 below shows the total number of bat passes and bat passes per hour for each monthly visit. The October visit in particular had very low levels of bat activity. The use of ‘bat passes per hour’ as a unit of measurement is important since it provides an indication of the level of bat activity having taken account of the amount of time spent surveying.

A minimum of 4 species of bat were recorded during the transect surveys, comprising soprano and common pipistrelle, Leisler’s bat and *Myotis* species. The majority of the recorded activity was close to habitat features such as forest edge, hedgerows and within forestry rides.

**Table 6 – Bat passes per hour recorded during transect surveys**

Bat passes per hour by visit		
	Total bat passes	Total bat passes per hour
3 May 2012	127	40.31
11 June 2012	145	66.92
19 July 2012	80	47.05
9 August 2012	26	13.44
2 September 2012	22	14.66
11 October 2012	8	3.75

### 4.1.3 Static detector surveys

Static detector surveys enhanced the transect surveys in a number of ways. Firstly, they showed activity within the site later in the night after standard transect survey timings. This notably showed more *Myotis* species activity within the site than had been recorded during transects. Secondly they showed how relatively high activity on one night a given spot can be followed by very low activity or no activity at all the next night at the same spot, and how activity at a habitat feature can be high on one night while activity at a similar habitat feature elsewhere in the site on the same night can be low. In all likelihood these variations in activity are linked to variations in weather conditions and prey availability.

A minimum of 4 species of bat were recorded during the static detector surveys, comprising soprano and common pipistrelle, Leisler’s bat and *Myotis* species.

Static detectors were also used in order to undertake a survey of the extent to which bats were active 'at height' at the site, providing an insight into the extent to which they fly in proximity to the rotor swept area of the turbines. Results showed that, although there was some activity at 45 metres, activity levels were considerably lower (or even absent for some species) compared to activity at 4 metres.

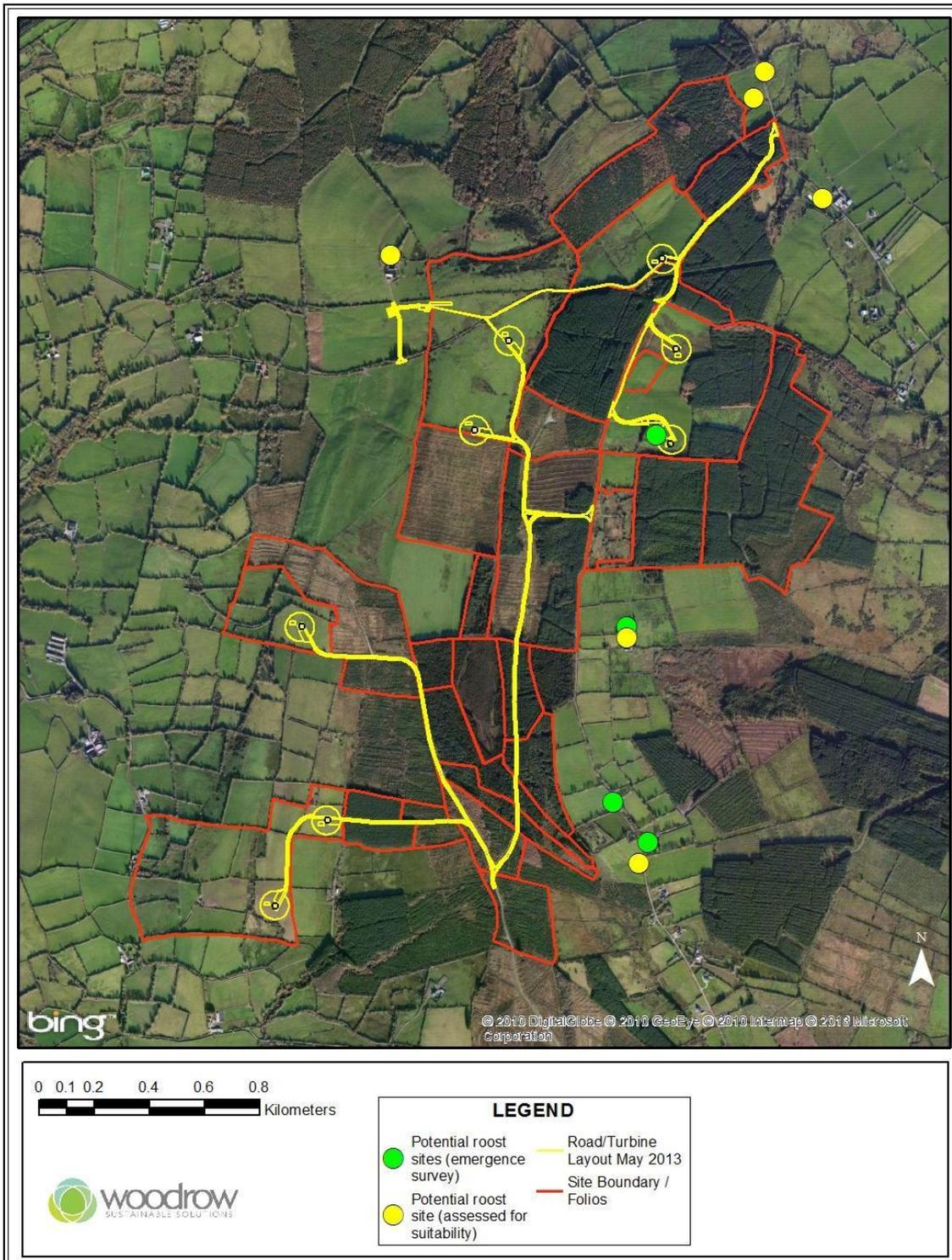
## **4.2 Individual Roost Survey Reports**

Results of surveys of potential roosts are provided in Table 7 below. Emergence surveys of potential roosts were undertaken at buildings in reasonable proximity to the site where there was considered to be potential for them to hold a bat roost. No active roosts were recorded within the site; however, at one dwelling house outside the site 2 common pipistrelles and 1 soprano pipistrelle emerged from under lead flashing around the chimney. Bat droppings were also recorded under the soffit at the front of the house. This soffit also has potential to hold roosting bats but no bats were seen to emerge from the building during the survey on the 2<sup>nd</sup> September 2012.

**Table 7 – Roost potential of buildings in the vicinity of the proposal and emergence surveys undertaken**

<b>Roost Potential</b>	<b>Location</b>	<b>Building Type</b>	<b>Irish Grid Location</b>	<b>Nearest Turbine</b>	<b>Emergence Survey</b>	<b>Emergence Survey Date</b>	<b>Survey Result</b>
Low	Within the site boundary	Farm buildings	IS 51629 81827	48m to the NW	Yes - Dusk	20/ 06/ 2012	No bat roost recorded, but bats were recorded feeding within the large open farm building during a period of rainfall.
High	Outside boundary	Occupied farm house	IS 51449 81148	495m to the NE	Yes - Dusk	02/ 09/ 2012	1 soprano pipistrelle and 2 common pipistrelles emerged from under lead flashing around the chimney. Bat droppings also recorded under soffit that has potential to hold roosting bats.
Low	Outside boundary	Occupied farm house and farm buildings	S 51441 81105	541m to the NE	No	N/A	No signs of potential roosting bats or suitable features to facilitate bats to warrant emergence survey.
Low	Outside boundary	Two old farm stone buildings.	S 51399 80507	497m to the west	Yes - Dusk	09/ 08/ 2012	No bats emerged from buildings but bats recorded using the hedgerows around the buildings.
Low	Outside boundary	Old vacant dwelling house with farm buildings.	S 51522 80362	614m to the west	Yes - Dusk	19/ 07/ 2012	No bats recorded emerging from the building but some bats recorded in the surrounding area.
Low		Occupied new dwelling house with limited roosting potential.	S 51543 80074	595m to the west	No	N/A	No signs of potential roosting bats or suitable features to facilitate bats to warrant emergence survey.

Figure 3: Potential roost sites surveyed 2012



## 4.3 Individual Transect Survey reports

### 4.3.1 Visit 1 (Site visited on 3<sup>rd</sup> May 2012)

A total of 127 bat passes were recorded during this visit from a likely four species. One of the passes was from an unidentified pipistrelle species. The other bat passes were from Leisler's bat, soprano pipistrelle, common pipistrelle and *Myotis* species.

The Leisler's bat activity was largely associated with forestry edge habitat with smaller numbers associated with clear-felled forestry, young second rotation forestry, forestry rides and a small number occurring within more open habitat along the track to the north of the site.

Common pipistrelles were found to be most strongly associated with forestry edge habitat, followed by forestry rides and hedgerow features. Soprano pipistrelles, like common pipistrelles, were also found to be most closely associated with forestry edge habitat, followed by forestry rides, enclosed mixed woodland and farm buildings. The single unidentified pipistrelle was associated with hedgerow habitat to the north of the site.

Only two *Myotis* species bats were recorded during this survey and were found to be associated with enclosed mixed woodland to the north of the site. Figure 4 below shows the recorded distribution of all bat activity within the site for this visit.

Table 8 below shows the total number of bat passes recorded for the visit and the number of bat passes per hour. The number of bat passes per hour can be assessed in totality, by species or by time spent near to specific habitat features. This gives a clear picture of the value of the site and different features within it for bats of different species in different conditions.

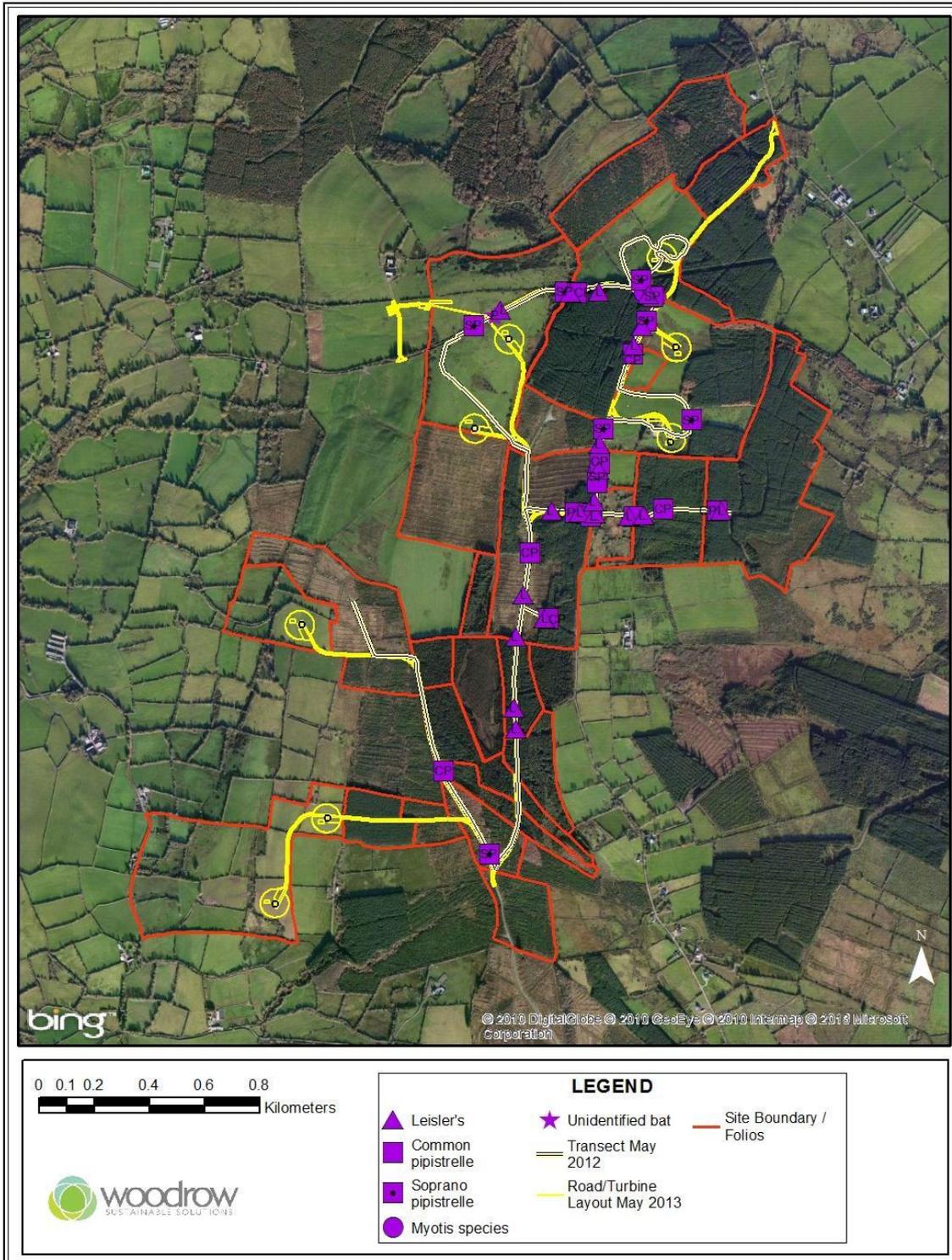
Table 8: Bat passes per hour from visit 1

Date: 03/05/2011 – Dusk Transect		
Time Spent in field – 189 minutes		
	Total bat passes	Total bat passes per hour
Soprano pipistrelle	14	4.44
Common pipistrelle	50	15.87
Pipistrelle sp.	1	0.31
Unidentified Bat	0	0
Leisler's bat	57	18.09
<i>Myotis</i> sp.	5	1.58
<b>All bats</b>	<b>127</b>	<b>40.31</b>

### Bat numbers

Bat numbers have been estimated based on an understanding gained in the field of whether bat passes are recurring individuals or not. This can be difficult to estimate. It is considered that a reasonable minimum of 10 (and maximum of 16-18) Leisler's bat, 2 *Myotis* sp. and up to a maximum of 15 common pipistrelles and 9 soprano pipistrelles were recorded during this visit.

Figure 4: Bat transect records for visit 1 on 3<sup>rd</sup> May 2012



### **4.3.2 Visit 2 (Site visited on 11th June 2012)**

A total of 145 bat passes were recorded during 130 minutes of surveying on this occasion. A likely three species were recorded. Five of the bat passes were from unidentified pipistrelle species. The other bat passes were from Leisler's bat, soprano pipistrelle and common pipistrelle. No *Myotis* species were recorded during the survey. The total number of bat passes per species recorded for this visit is given in table 9 below.

Leisler's bat activity was largely associated with open habitat to the north of the site and smaller numbers associated with forest edge habitat. Three Leisler's bat passes were observed to the north of the site over open pasture and bats were estimated to be at heights varying between 8-30m.

Common pipistrelles were found throughout the site and were mostly strongly associated with forestry edge habitat, followed by farm buildings, enclosed mixed woodland, clear-felled forestry and hedgerow features.

Soprano pipistrelles, were found throughout the site and were most strongly associated with forestry edge habitat, followed by enclosed mixed woodland with smaller numbers recorded near hedgerow habitat and clear-felled forestry. The two unidentified pipistrelles were associated with forestry edge and hedgerow habitat features to the east of the site along the main road. No *Myotis* sp. bats were recorded during this survey.

The position of all bats recorded in relation to proposed infrastructure on this survey can be seen in Figure 5 below. Table 9 below shows the total number of bat passes recorded for the visit and the number of bat passes per hour.

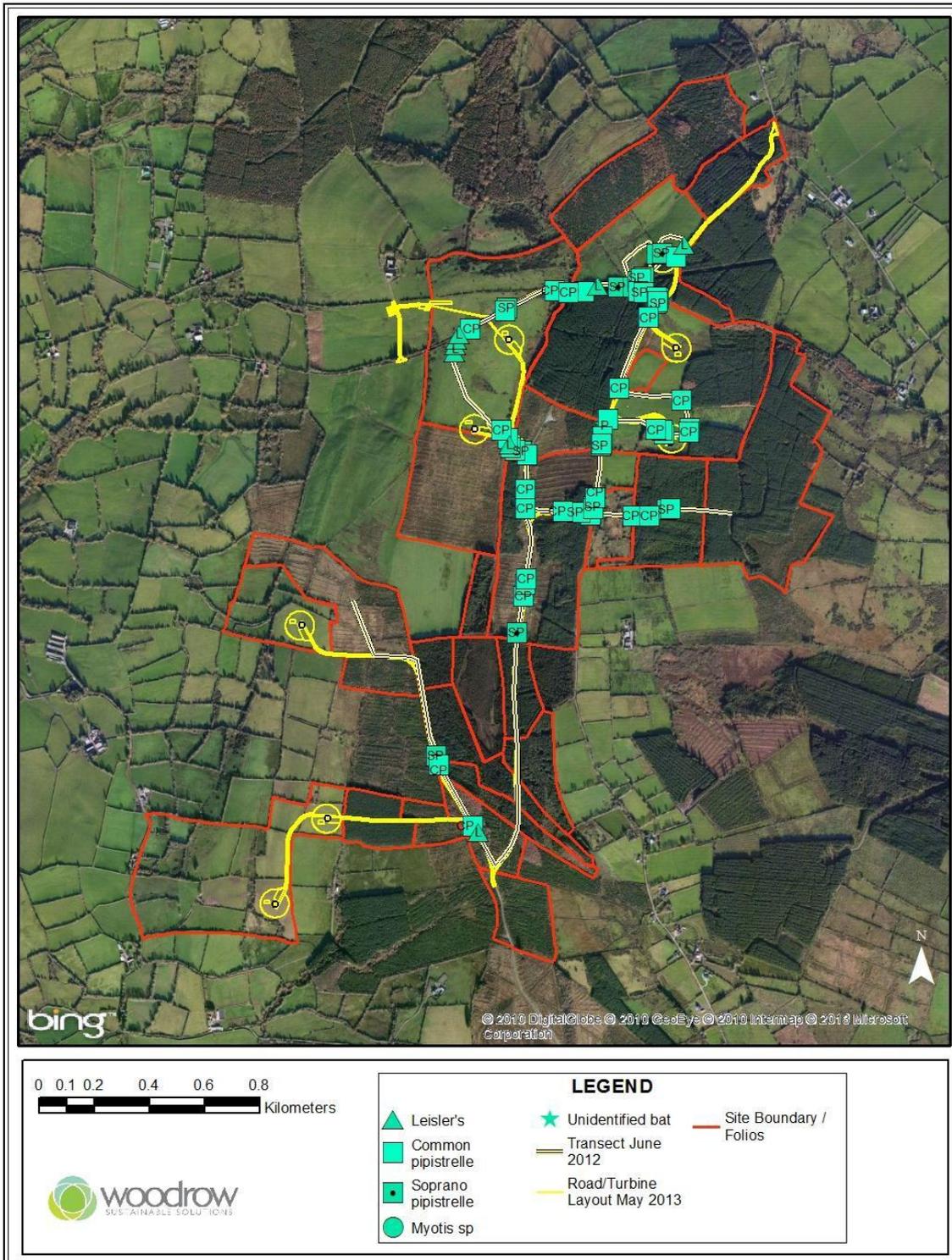
Table 9: Bat passes per hour from visit 2

Date: 11/06/2012 – Dusk Transect		
Time Spent in field – 130 minutes		
	Total bat passes	Total bat passes per hour
Soprano pipistrelle	37	17.07
Common pipistrelle	79	36.46
Pipistrelle sp.	5	2.30
Unidentified Bat	0	0
Leisler's bat	24	11.07
<i>Myotis</i> sp.	0	0
<b>All bats</b>	<b>145</b>	<b>66.92</b>

### Bat numbers

It is estimated that between 3 and 6 Leisler's bat, 0 *Myotis* species, a reasonable minimum of 20 (and maximum of 34) common pipistrelles, a reasonable minimum of 10 (and maximum of 17) soprano pipistrelles were recorded during this visit.

Figure 5: Bat transect records for visit 2 on 11<sup>th</sup> June 2012



### 4.3.3 Visit 3 (Site visited on 19<sup>th</sup> July 2012)

A total of 80 bat passes were recorded during 102 minutes of surveying. This was generally consistent with bat activity level recorded during previous visits. Three species of bat were recorded at the site during this visit. This comprised common pipistrelle, soprano pipistrelle and Leisler's bat. No *Myotis* species were recorded during the survey. The total number of bat passes per species recorded for this visit is given in table 10 below.

Leisler's bat activity was found to be largely associated with forest edge habitat followed by open pasture with smaller numbers associated with forestry rides.

Common pipistrelles were found throughout the site and were most strongly associated with forestry edge habitat followed by hedgerow features and forestry rides with smaller numbers recorded among enclosed mixed woodland and open pasture.

Soprano pipistrelles were found throughout the northern half of the site and were most strongly associated with forestry edge and hedgerow habitat. The two unidentified pipistrelles were associated with hedgerow habitat features and open pasture. No *Myotis* bats were recorded during this survey.

The position of all bats recorded in relation to proposed infrastructure is shown in Figure 6 below.

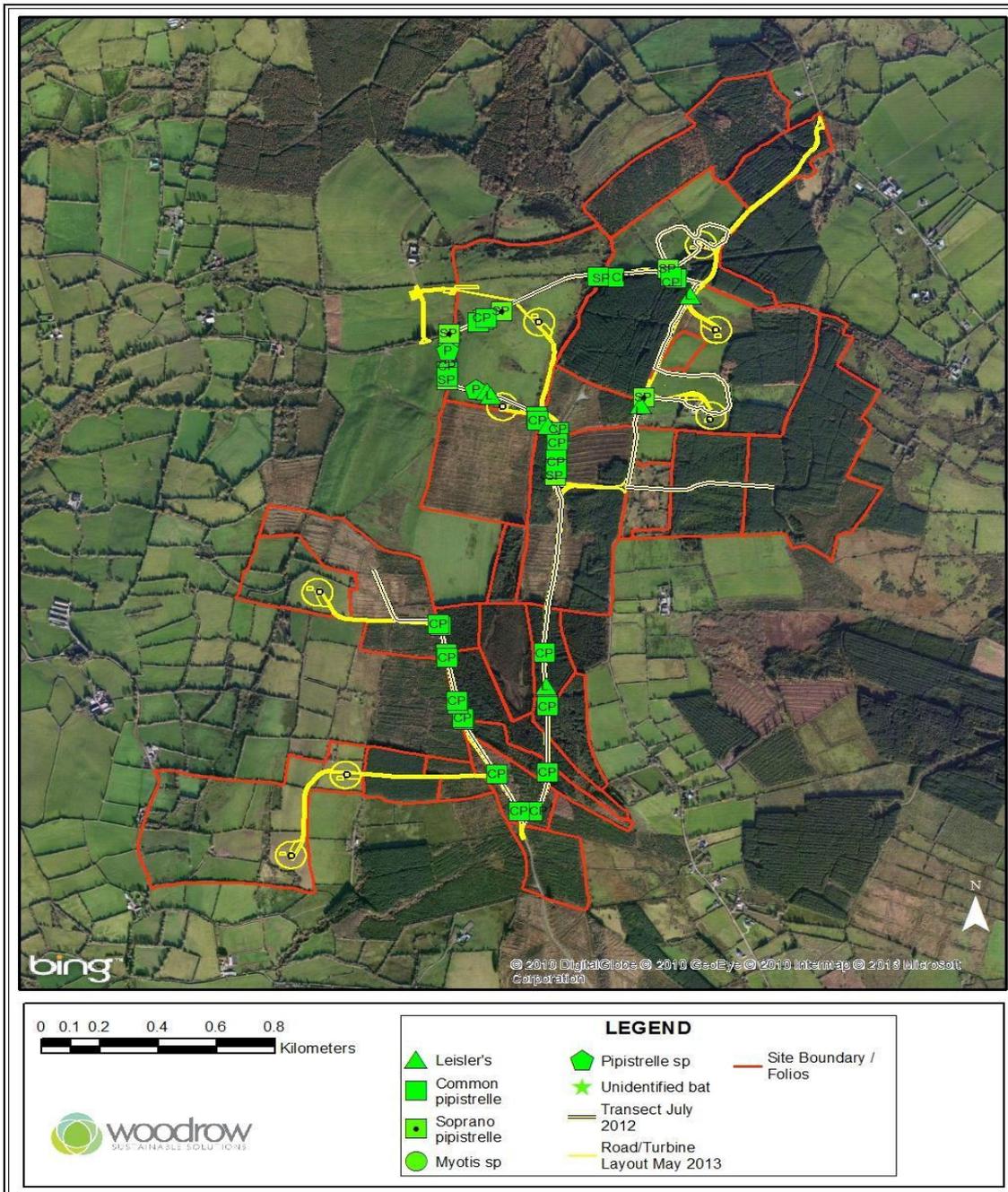
**Table 10 Bat passes per hour from visit 3**

Date: 19/07/2011 – Emergence and Dusk Transect		
Time Spent in field – 102 minutes		
	Total bat passes	Total bat passes per hour
Soprano pipistrelle	6	3.52
Common pipistrelle	61	35.8
Pipistrelle sp.	5	2.94
Unidentified Bat	0	0
Leisler's bat	8	4.70
<i>Myotis</i> sp.	0	0
<b>All bats</b>	<b>80</b>	<b>47.05</b>

**Bat numbers**

It is estimated that a maximum of 6 Leisler’s bat, 0 *Myotis* species, a reasonable minimum of 16 (and maximum of 24) common pipistrelles, a maximum of 7 soprano pipistrelles and a maximum of 2 unidentified pipistrelles were recorded during this visit.

**Figure 6: Bat transect records for visit 3 on 19<sup>th</sup> July 2012**



#### 4.3.4 Visit 4 (Site visited on 9<sup>th</sup> August 2012)

During this visit, a total of 26 bat passes were recorded during 116 minutes of surveying. This is a considerably lower level of bat activity than was recorded during previous visits. Three species of bat were recorded within the site with two additional bats recorded that could not be identified down to species due to poor quality recording. The three species that were identified during this survey were common pipistrelle, soprano pipistrelle and Leisler's bat. No *Myotis* species were recorded during the survey. The total number of bat passes per species recorded for this visit is given in table 11 below.

On this occasion, Leisler's bat activity was found to be largely associated with forest rides and clear-felled forestry habitat.

Common pipistrelles were found throughout the site and were most strongly associated with forestry edge habitat followed by clear felled forestry and farm buildings to the east with smaller numbers associated with enclosed mixed woodland, forestry rides and hedgerow features. Soprano pipistrelles were found throughout the northern half of the site and were most strongly associated with forestry edge and forestry rides. The two unidentified bats were associated with forestry edge and hedgerow habitat features. No *Myotis* bats were recorded during this survey.

The position of all bat activity recorded in relation to proposed infrastructure is shown in Figure 7 below.

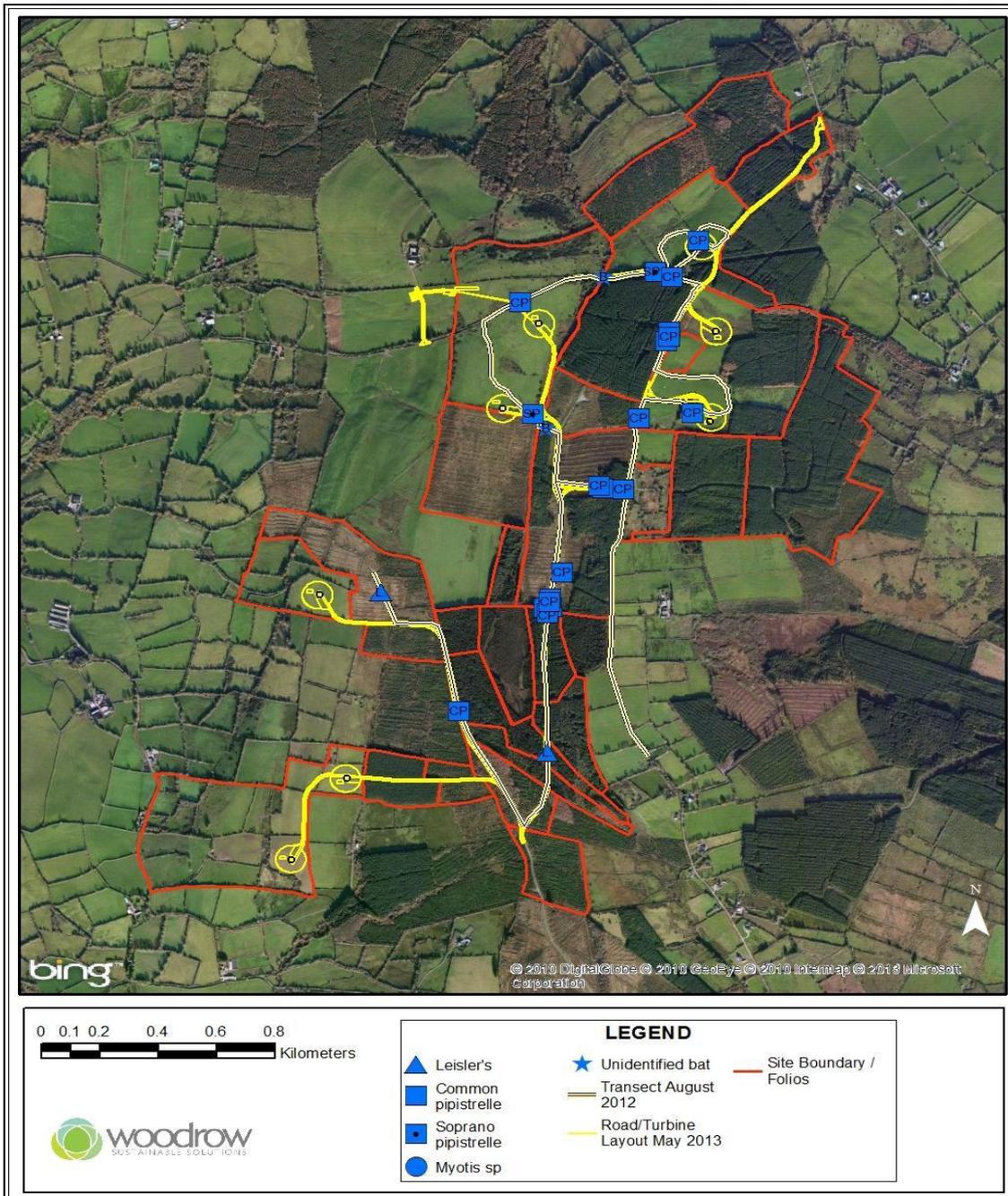
**Table 11: Bat passes per hour from visit 4**

Date: 9/08/2012 - Dusk Transect		
Time Spent in field – 116 minutes		
	Total bat passes	Total bat passes per hour
Soprano pipistrelle	6	3.1
Common pipistrelle	16	8.27
Pipistrelle sp.	0	0
Unidentified Bat	1	1.03
Leisler's bat	2	1.03
<i>Myotis</i> sp.	0	0
All bats	26	13.44

**Bat Numbers**

It is estimated that 2 Leisler’s bats, 0 *Myotis* species, a reasonable minimum of 10 (and maximum of 14) common pipistrelles, a reasonable minimum of 5 (and maximum of 6) soprano pipistrelles and 2 unidentified bat species were recorded during this visit.

**Figure 7: Bat transect records for visit 4 on 9<sup>th</sup> August 2012**



#### 4.3.5 Visit 5 (Site visited on 2<sup>nd</sup> September 2012)

This survey was undertaken as a pre-dawn transect. In general terms, this visit was similar to that recorded in July in terms of bat passes. A total of 22 bat passes were recorded during 90 minutes of surveying. Three species of bat were recorded within the site with one additional bats recorded that could not be identified down to species due to poor quality recording of the call. The three species that were identified during this survey were again common pipistrelle, soprano pipistrelle and Leisler's bat. No *Myotis* species were recorded during the survey. The total number of bat passes per species recorded for this visit is given in table 12 below.

During this survey Leisler's bat activity was found to be largely associated with forest edge habitat and between the open pasture and hedgerow around the farm buildings to the east of the site.

Common pipistrelles were found throughout the site and were most strongly associated with forestry edge habitat and to a lesser extent enclosed mixed woodland to the north of the site.

Soprano pipistrelles were found throughout the site and were most strongly associated with forestry edge habitat and to a lesser extent forestry rides. One unidentified pipistrelle species was also recorded along forestry edge habitat to the southwest of the site. The recording was not detailed enough to determine the exact species in this case. No *Myotis* bats were recorded during this survey.

The position of all bats recorded in relation to proposed infrastructure is shown in Figure 8 below.

**Table 12: Bat passes per hour from visit 5 (pre-dawn transect surveys)**

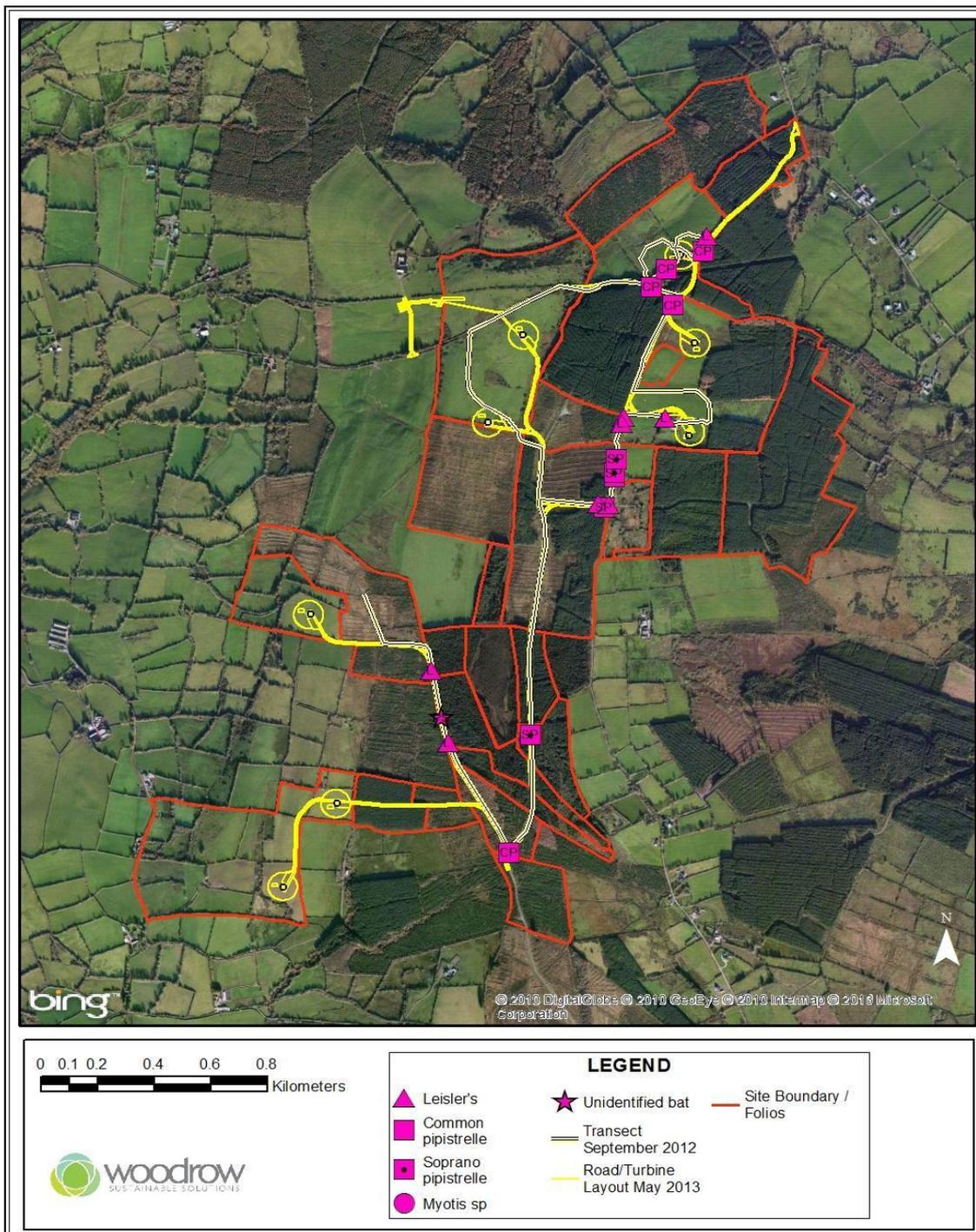
Date: 2/09/2012 – Pre -dawn Transect		
Time Spent in field – 90 minutes		
	Total bat passes	Total bat passes per hour
Soprano pipistrelle	4	2.66
Common pipistrelle	11	7.33
Pipistrelle sp.	0	0

Unidentified Bat	1	0.66
Leisler's bat	6	4
<i>Myotis</i> sp.	0	0
All bats	22	14.66

**Bat Numbers**

It is estimated that a reasonable minimum of 4 (and maximum of 8) Leisler's bat, 0 *Myotis* species, a reasonable minimum of 3 (and maximum of 5) common pipistrelles, a reasonable minimum of 4 (and maximum of 5) soprano pipistrelles and 1 unidentified pipistrelle species were recorded during this visit.

**Figure 8: Bat transect records for visit 5 on 2<sup>nd</sup> September 2012**



#### 4.3.6 Visit 6 (Site visited on 11<sup>th</sup> October 2012)

Bat activity during this visit was the lowest recorded over the course of the season, with total of 9 bat pass were recorded during 124 minutes of surveying. Only two species of bat were recorded within the site during this survey. This comprised of both common pipistrelle and soprano pipistrelle. No Leisler's bat or Myotis species were recorded during the survey. The total number of bat passes per species recorded for this visit is given in table 13 below.

Both common and soprano pipistrelles were found to be most strongly associated with forestry edge habitat. It is also likely that the individuals encountered during this survey were using these habitat types as shelter from the prevailing wind as all bat activity was recorded either along or within mature forestry edge.

The position of all bats recorded in relation to proposed infrastructure is shown in **Figure 9** below.

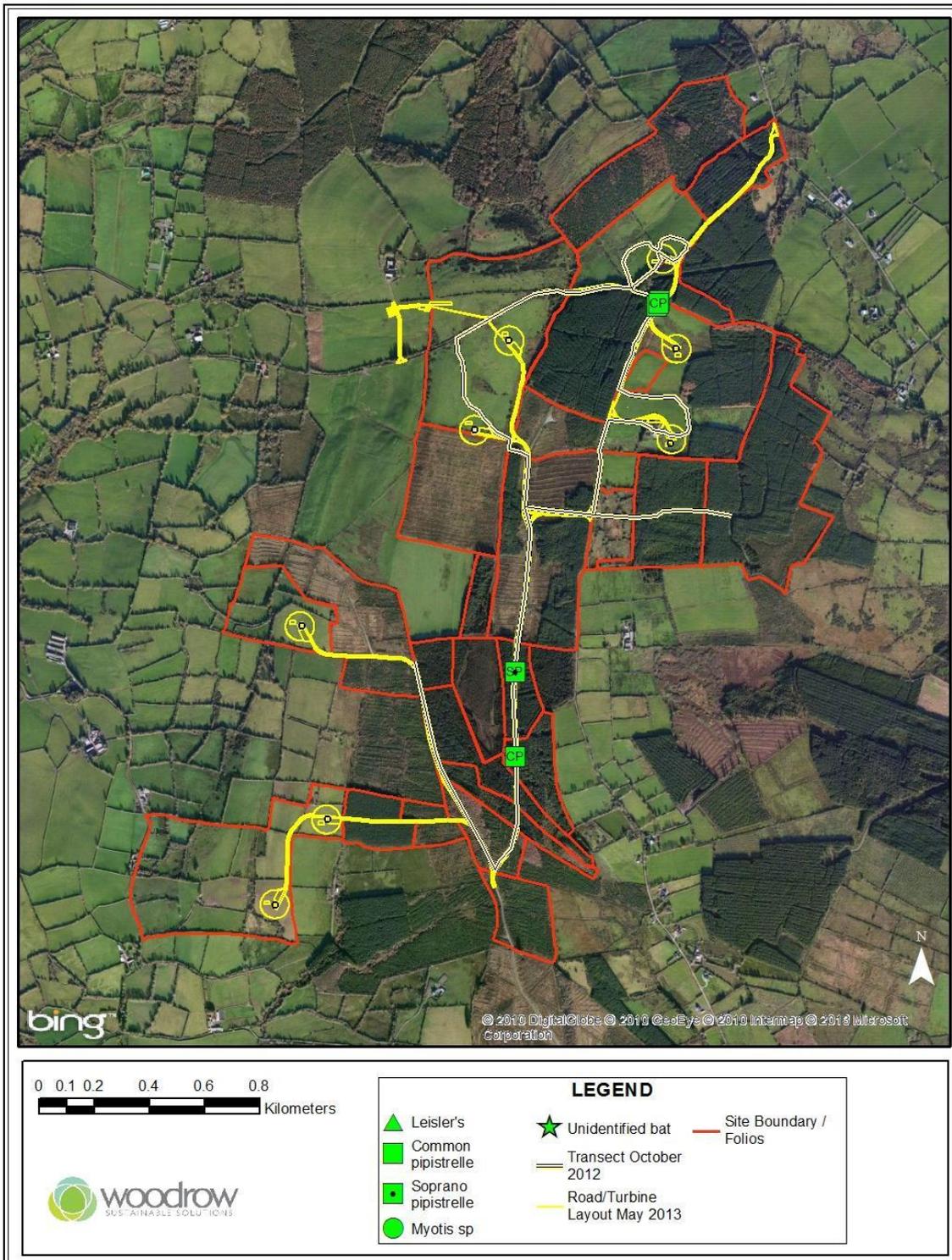
**Table 13: Bat passes per hour from visit 6 (Dusk transect survey)**

Date: 11/10/2012 – Dusk Transect		
Time Spent in field – 124 minutes		
	Total bat passes	Total bat passes per hour
Soprano pipistrelle	5	2.4
Common pipistrelle	4	1.9
Pipistrelle sp.	0	0
Unidentified Bat	0	0
Leisler's bat	0	0
Myotis sp.	0	0
All bats	9	4.35

#### Bat Numbers

It is estimated that a maximum of 5 individual bats were recorded during this visit. This comprised 3 common pipistrelles and 2 soprano pipistrelles.

Figure 9: Bat transect records for visit 6 on 11<sup>th</sup> October 2012



### 4.3.7 Summary of bat activity recorded during transect surveys

The greatest amount of bat activity in terms of bat passes per hour recorded during the transects was during the months of May, June and July with a peak of 66.9 bat passes per hour recorded during the June visit. Much lower levels of bat activity were recorded later in the season, with the lowest activity of 4.35 bat passes per hour occurring during the October dusk transect. This is a fairly typical pattern to usage of sites such as Pinewoods. Such sites, although well connected to the surrounding countryside by habitat features such as hedgerows, are still fairly exposed to wind and other weather factors. They are also likely to cool more quickly than lowland areas after dusk. Such issues make sites like Pinewoods more likely to be used by bats during the most temperate times of the active bat season.

A minimum of four species were recorded during transect surveys, comprising common pipistrelle, soprano pipistrelle, Leisler's bat and a minimum of one species of *Myotis* bat. *Myotis* bats are not reliably identified to species level on recordings of calls and their status (commonly held across all *Myotis* species except Brandt's bat) as being of *low risk* from wind turbines and being of *least concern* in conservation terms (see tables 3 and 4) provides little justification for speculation on which *Myotis* species may be present.

The most commonly encountered species on the site was common pipistrelle, followed by Leisler's bat and soprano pipistrelle, with a more limited number of *Myotis* bats recorded. It was noted during the surveys that most recorded activity appeared to be associated with features such as forest edge and hedgerows, with a small group of bats often recorded feeding together along a defined habitat feature. Where flying height was observed it was largely between 2 and 8 metres. There is likely to be a bias to this, however, since bats at higher altitudes would be harder to see and may have resulted in no heights being recorded for them.

Bats at the site were recorded both feeding and commuting. On a number of occasions bat passes from commuting individuals were noted along features such as forestry rides and small numbers of bats recorded feeding elsewhere in the site later. This suggests that bats use the habitat features on the site both for commuting and for feeding.

## **4.4 Individual Static Monitor Survey Reports**

Static monitors were set out at the site at a number of locations and at times during the survey season, with static monitor surveys in May, June, July, August and September 2012. Two individual units were also attached to the met mast on site for a number of weeks in August, September and October. One unit was set to record at a height of 4m and the other at 45m. This was to allow for a comparison of bat activity at ground level and close to the rotor sweep area of the proposed turbines.

Results of static monitoring sessions cannot be viewed in the same way as for transect surveys. The nature of the monitoring means that maps are not relevant beyond placement of detector units and tables of bat passes per hour would be considered as only indicative of activity, since a single bat feeding near to a static detector for an hour, for example, could result in hundreds of logged bat passes. The best way to view the results is by activity over time. This is presented in bar charts for each static unit per month. The intention is that such activity at one location is compared to that at another location during the same time period. In this way, the use of different locations and, importantly different features, by bats can be assessed comparatively, providing a better understanding of the relative importance of different features at the sites for bats.

It is difficult to gauge the distance that bats were from the static bat detector when their calls were recorded by it. In fact detection distance for bats is extremely variable, being affected by atmospheric attenuation, the frequency of the bat call, the loudness of the bat and the direction of the bat call itself. The microphone used in the SM2 static detector is omnidirectional so there is nothing that can be deduced in terms of which direction a call came from by its strength and the direction that the microphone was facing.

### **4.4.1 Static monitoring results for 3<sup>rd</sup> May 2012**

Static surveys were carried out over the duration of the transect survey on this visit in order to gain a better short term understanding of bat activity at a number of habitat features within the site. This data cannot be directly compared to more long term monitoring undertaken between June and September 2012, but does give a good indication of short term bat activity

at three different features during the short period surveyed. Three detectors were placed at different features within the site. The location of each static detector is shown in Figure 10 below.

**Static detector 1 – Located within forestry edge habitat**

Static detector 1 was positioned along forestry edge habitat, at grid reference IS 51372 81519, in the centre of the site. This static detector recorded for a total of 77 minutes and recorded a total of 722 bat passes (equivalent to 562.6 bat passes/ hour). Although this seems to be a considerably high amount of bat activity for this location, the data analysis revealed that the majority of this activity was likely to be produced by a small number of bats (possibly two to three common pipistrelles) continually feeding in close proximity to the detector. For example, a single common pipistrelle was recorded up to 12 times in one minute and two common pipistrelles were also recorded up to 9 times per minute. It should also be noted that this location also provides shelter from the prevailing winds as it has forestry edge habitat to the west, north and south. The main road is also within recording distance of the detector and may also provide a commuting corridor for bats. These features may contribute to the high level of bat activity recorded on at this location. The total bat passes per species is given in Table 14 below.

**Table 14: Total bat passes recorded for unit static detector 1 on the 3/06/2012**

	Soprano pipistrelle	Common pipistrelle	Pipistrelle sp.	Myotis species	Leisler's Bat	Bat s p.	Total bat passes
<b>Total bat passes/sp.</b>	0	695	0	0	27	0	722

**Static detector 2 – Located within forestry ride habitat**

Static detector 2 was positioned within a forestry ride to the east of the site at grid reference IS 51144 81542. This static detector recorded for a total of 68 minutes and recorded a total of 64 bat passes (equivalent to 56.5 bat passes/ hour). 14 Leisler’s bat passes were recorded. These passes showed open call characteristics, possibly indicating that these bats were commuting above treetop level as opposed to within the forestry ride. Analysis of the

recordings shows that at least three individual bats were recorded within range of the static detector at any one time. This consisted of common and soprano pipistrelles and a Leisler’s bat. The total bat passes per species is given in Table 15 below.

**Table 15: Total bat passes recorded for unit static detector 2 on 3/06/2012**

	Soprano pipistrelle	Common pipistrelle	Pipistrelle sp.	Myotis species	Leisler's Bat	Bat s p.	Total bat passes
<b>Total bat passes/sp.</b>	6	44	0	0	14	0	64

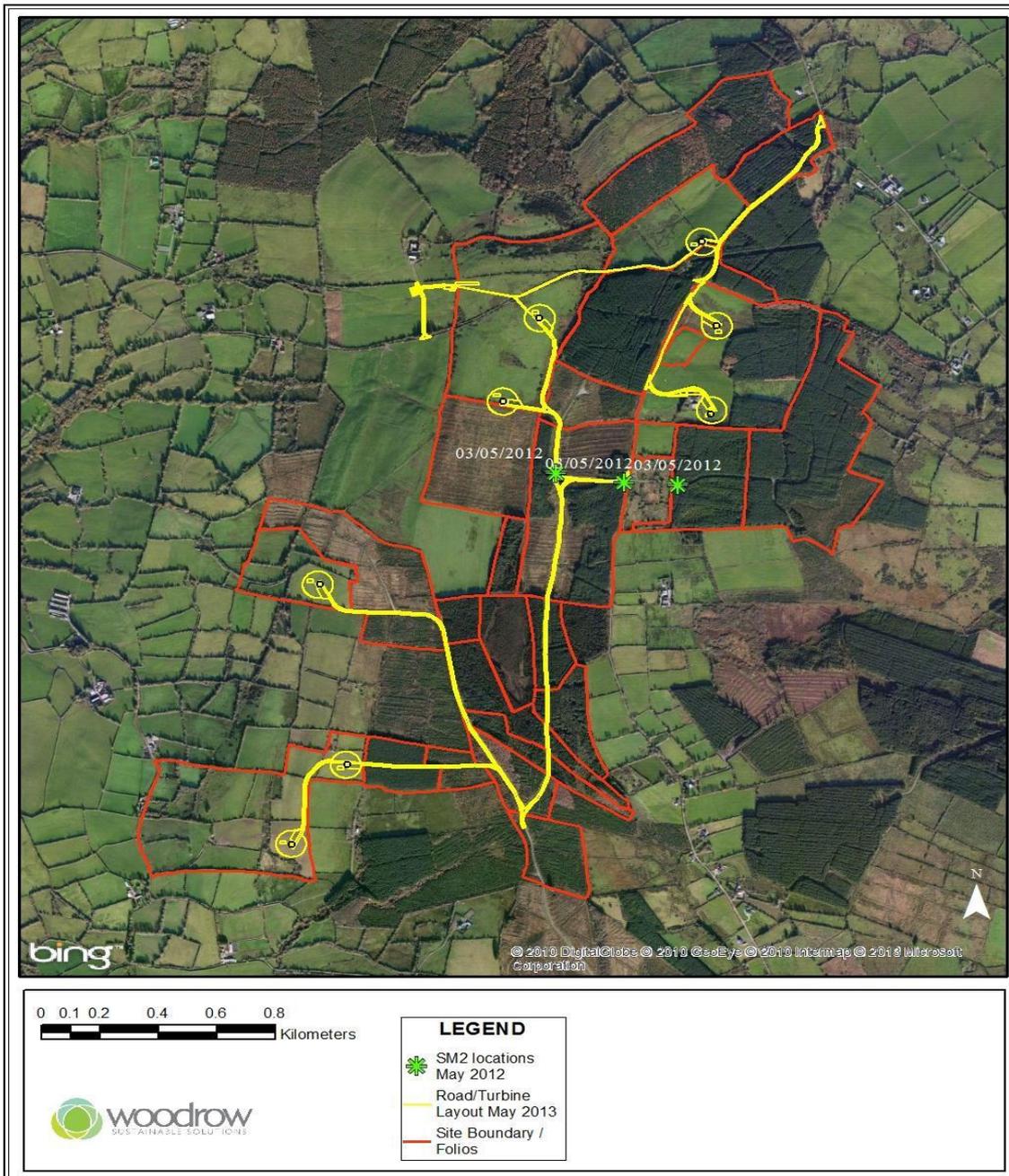
**Static detector 3 – Located along forestry edge habitat, forestry track and young plantation forestry**

Static detector 3 was positioned along forestry edge habitat, forestry track and young plantation forestry in the middle of the site at grid reference IS 51540 81507. This static detector recorded for a total of 85 minutes and recorded a total of 258 bat passes (equivalent to 182.1 bat passes/ hour). Detailed analysis of the recordings show that at least 13 Leisler’s bat and 26 common pipistrelle passes were recorded within a six minutes period and that all Leisler’s calls were recorded at the same time as common pipistrelle activity, possibly indicating that at least two bats were continuously feeding over this period for an extended period. The high level of activity at this location may be due to the use of forestry edge habitat as a feature for feeding and commuting bats in the area.

**Table 16: Total bat passes recorded for unit static detector 3 on 3/06/2012**

	Soprano pipistrelle	Common pipistrelle	Pipistrelle sp.	Myotis species	Leisler's Bat	Bat s p.	Total bat passes
<b>Total bat passes/sp.</b>	4	181	0	0	73	0	258

Figure 10: Location of static detectors May 2012

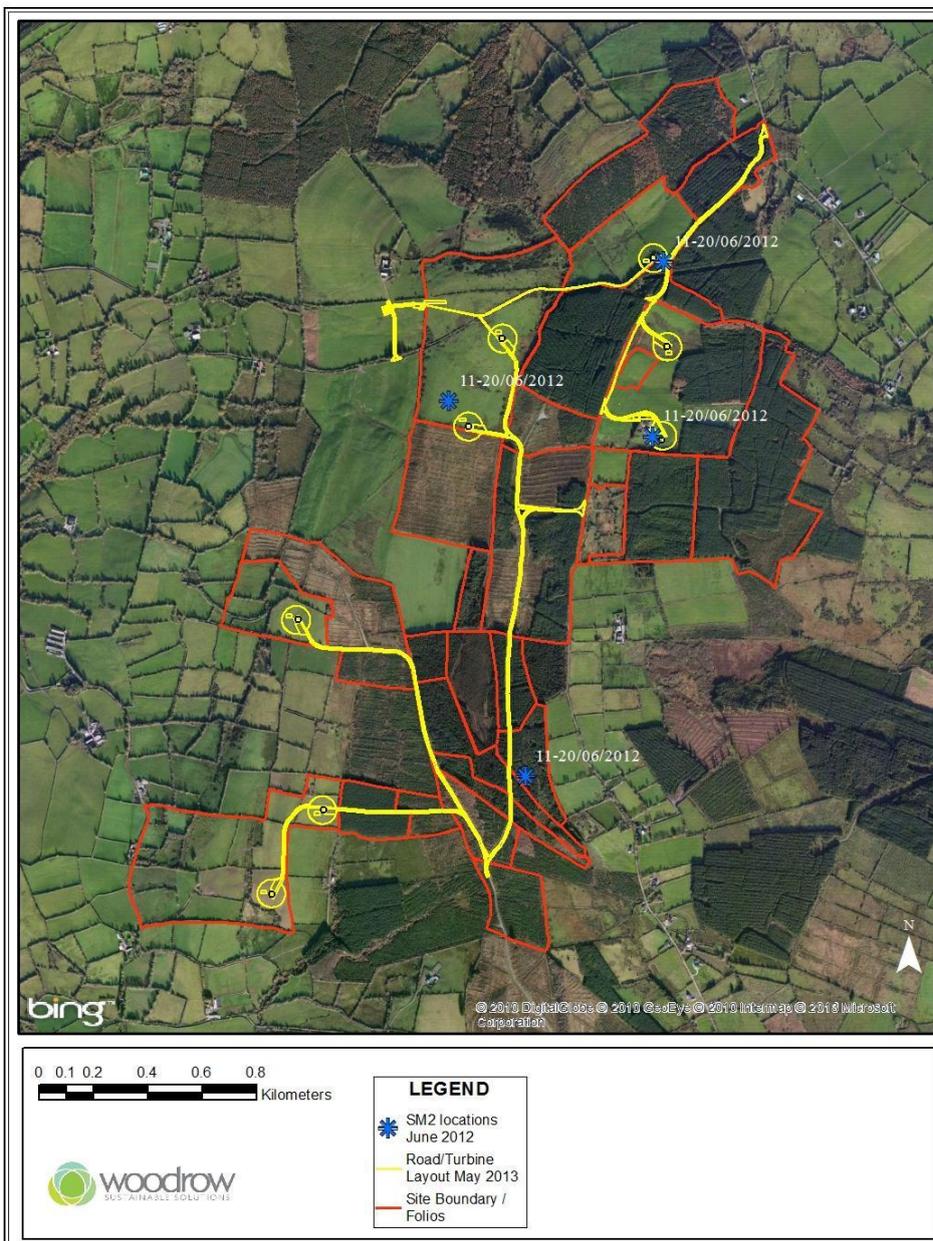


### 4.4.2 Static monitoring results for 11-20<sup>th</sup> June 2012

This survey was carried out over a total of 8 nights from 11-20<sup>th</sup> June 2012. Four detectors were used and placed at different features to enable a comparison of bat usage at different habitat features across the site. The location of each static detector is shown in Figure 11 below.

The level of activity over time for each detector is presented in figures 12 to 15 below.

Figure 11: Location of static detectors June 2012



**Static detector 1- Open pasture north of T5**

Static detector 1 was positioned on the met mast over open pasture north of T5.

In general terms activity was low. The greatest amount of the bat activity was recorded on the night of 11-12/06/2012 with a total of 1 Leisler’s bat pass and 3 common pipistrelle passes. As can be seen from figure 12 below, activity was very low for the remainder of the survey period with no more than 3 bat passes on any night. Bat species recorded were common pipistrelle, Leisler’s bat and *Myotis* species.

**Table 17: Total bat passes recorded for unit static detector 1 between the 11 -20/06/2012**

	Soprano pipistrelle	Common pipistrelle	Pipistrelle sp.	Myotis species	Leisler's Bat	Bat s p.	Total bat passes
<b>Total bat passes/sp.</b>	0	9	0	1	2	0	12

**Static detector 2- Farm buildings near T3**

Static detector 2 was positioned close to the farm buildings to the east of the site close to a proposed turbine location (T3). This location had a comparatively higher level of bat activity, with bat passes (largely common pipistrelle with some *Myotis* species) being recorded on most nights. This higher level of activity is likely to be associated with the use of farm building and nearby hedgerow and scrub habitats features.

**Table 18: Total bat passes recorded for unit static detector 2 between the 11 -20/06/2012**

	Soprano pipistrelle	Common pipistrelle	Pipistrelle sp.	Myotis species	Leisler's Bat	Bat s p.	Total bat passes
<b>Total bat passes/sp.</b>	3	60	0	6	0	0	69

**Static detector 3 - Forest edge adjoining open pasture near T1**

Static detector 3 was positioned near ‘edge’ habitat, with open pasture to the west and hedgerow / mature forestry to the south and east. This unit was also close to a proposed turbine location (T1). In general terms activity was comparatively low over the period with no bat activity between the 13<sup>th</sup> & 17<sup>th</sup> of June. The level of activity over time for static detector static detector 3 is presented in figure 14 below.

**Table 19: Total bat passes recorded for unit static detector 3 between the 11-20/06/2012**

	Soprano pipistrelle	Common pipistrelle	Pipistrelle sp.	Myotis species	Leisler's Bat	Bat s p.	Total bat passes
<b>Total bat passes/sp.</b>	1	19	0	2	0	0	22

**Static detector 4- Felled and windblown forestry clearing**

Static detector 4 was positioned within the coniferous plantation to the south of the site in an area where the planting was not dense and the habitat could be considered to mimic a natural forestry clearing. This location had the highest level of activity, with a total of 139 bat passes recorded over the period and bat activity recorded on all nights. A minimum of four species of bat were recorded at the site, as can be seen in table 20 below.

**Table 20: Total bat passes recorded for unit static detector 4 between the 11-20/06/2012**

	Soprano pipistrelle	Common pipistrelle	Pipistrelle sp.	Myotis species	Leisler's Bat	Bat s p.	Total bat passes
<b>Total bat passes/sp.</b>	4	119	0	12	4	0	139

**Summary**

The results above suggest an affinity for proximity to features by bats at the site during the survey period, with the highest number of bats recorded within forestry clearing habitat and the lowest in open habitat. It was noted, however, that activity levels varied between detectors placed in forest edge habitat. This may be due to such factors as prevailing wind directions and the relative shelter provided from it.

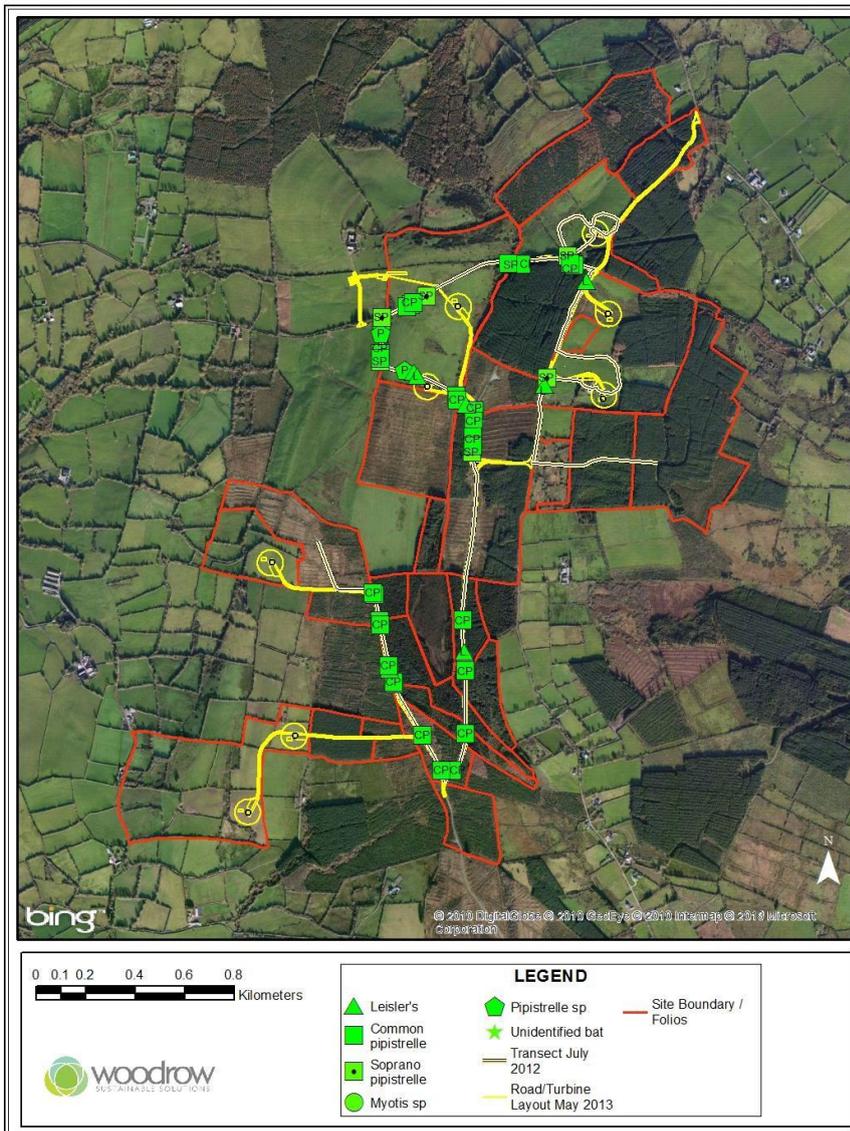




### 4.4.3 Static monitoring results for 13-20<sup>th</sup> July 2012

This survey was carried out over a total of 7 nights from 13-20<sup>th</sup> July 2012. Four detectors were used and placed at different features to enable a comparison of bat usage at different habitat features across the site. The location of each static detector is shown in Figure 16 below. The level of activity over time for each detector is also presented.

Figure 16: Location of static detectors July 2012



### Static detector 1- Forestry edge and ride

Static detector 1 was positioned in a forestry ride, with open pasture c. 10m to the west at grid reference IS 51937 81337. This unit was positioned some 150-200m from a proposed turbine location (T5) further to the northeast in similar habitat. In general terms activity was low. The unit recorded from the 13-20<sup>th</sup> of July with bats only recorded on the nights of the 14-15<sup>th</sup> July and 15-16<sup>th</sup> July. A single Leisler's bat was recorded on the 14<sup>th</sup> of July. No bat passes were recorded after the morning of the 16<sup>th</sup> of July.

**Table 21: Total bat passes recorded for unit static detector 1 between the 12 -20/07/2012**

	Soprano pipistrelle	Common pipistrelle	Pipistrelle sp.	Myotis species	Leisler's Bat	Bat sp.	Total bat passes
<b>Total bat passes/sp.</b>	0	33	0	3	1	0	<b>37</b>

### Static detector 2 - Forestry edge adjoining open pasture

Static detector 2 was positioned in the west of the site in forest edge habitat with open pasture to the west and young forestry to the east, at grid reference IS 50446 81173. The detector was positioned within 95m of a proposed turbine location (T6).

This location had a greater level of bat activity than detector 1 with a total of 118 bat passes recorded. This may be due to such factors as wind direction suiting feeding conditions at this location during the period.

Thirteen Leisler's bats were recorded at this location with individuals detected on each night between the 13-18<sup>th</sup> of July. No bat activity was recorded after 02:00 on the 18<sup>th</sup> of July even though the detectors were recording until the 20<sup>th</sup> of July.

**Table 22: Total bat passes recorded for unit static detector 2 between the 13-20/07/2012**

	Soprano pipistrelle	Common pipistrelle	Pipistrelle sp.	Myotis species	Leisler's Bat	Bat s p.	Total bat passes
<b>Total bat passes/sp.</b>	9	94	0	2	13	0	<b>118</b>

**Static detector 3 – Open pasture**

Static detector 1 was positioned on the met mast over open pasture north of T5.

In general terms activity was very low with a total of only 3 bat passes recorded during the survey period. This comprised 2 Leisler’s bat passes and a single common pipistrelle bat pass.

**Table 23: Total bat passes recorded for unit static detector 6 between the 13-20/06/2012**

	Soprano pipistrelle	Common pipistrelle	Pipistrelle sp.	Myotis species	Leisler's Bat	Bat s p.	Total bat passes
<b>Total bat passes/sp.</b>	0	1	0	0	2	0	3

**Static detector 4 - Forestry edge and ride**

Static detector 4 was positioned in forestry edge / forest ride habitat with mature conifers to the east and young plantation forestry to the west separated by a forestry track. The unit was located at grid reference IS 50857 80584. In general terms activity was low over the period with only two clear periods of activity. Eleven common pipistrelle passes and one Leisler’s bat pass were recorded on the 13<sup>th</sup> of July with another single period of common pipistrelle activity (9 passes) recorded on the 16<sup>th</sup> of July. The level of activity over time for static detector static detector 4 is presented in figure 20 below.

**Table 24: Total bat passes recorded for unit static detector 4 between the 13-20/07/2012**

	Soprano pipistrelle	Common pi pistrelle	Pipistrelle sp.	Myotis species	Leisler's Bat	Bat s p.	Total bat passes
<b>Total bat passes/sp.</b>	0	20	0	0	1	0	21

**Summary**

As with the June data, the results above suggest an affinity for proximity to features by bats at the site during the survey period, with the highest number of bats recorded within forest edge habitat and the lowest in open pasture. Again it was noted that activity levels varied between detectors placed in forest edge habitat at different parts of the site.

Figure 17: Bat passes by species and hour for static detector 1 - Coniferous forest edge and ride

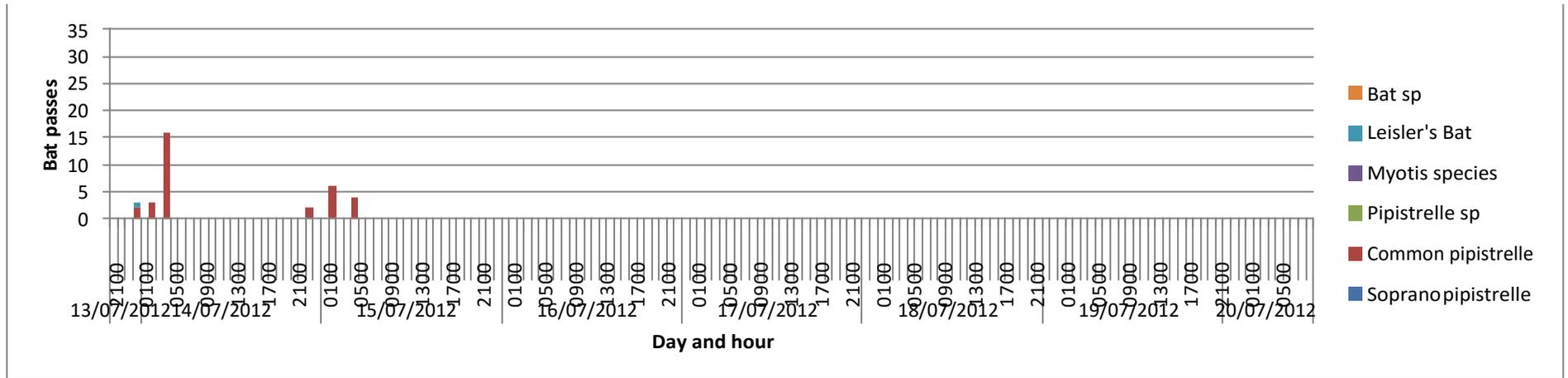


Figure 18: Bat passes by species and hour for static detector 2- Forestry edge adjoining open pasture

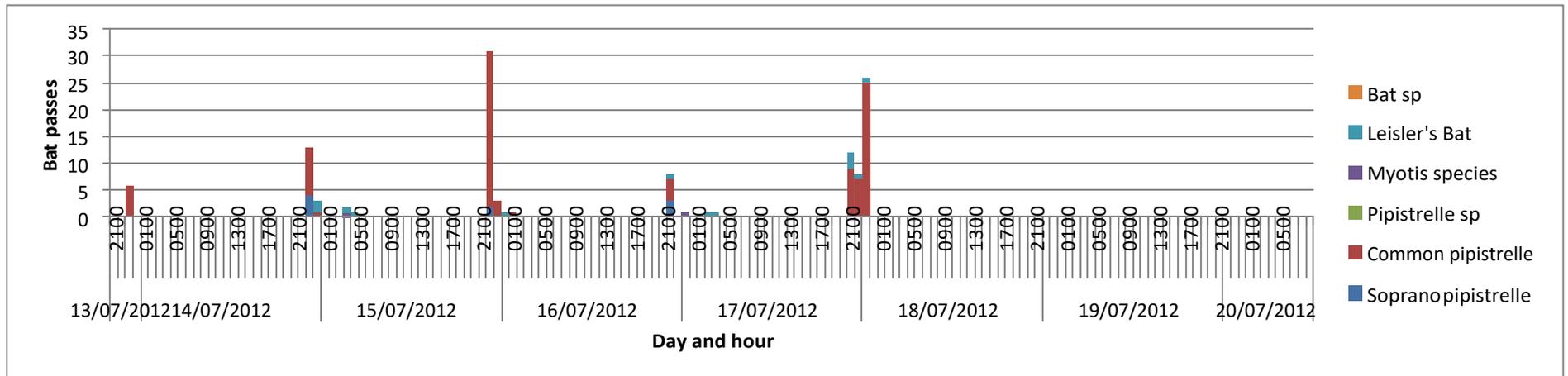
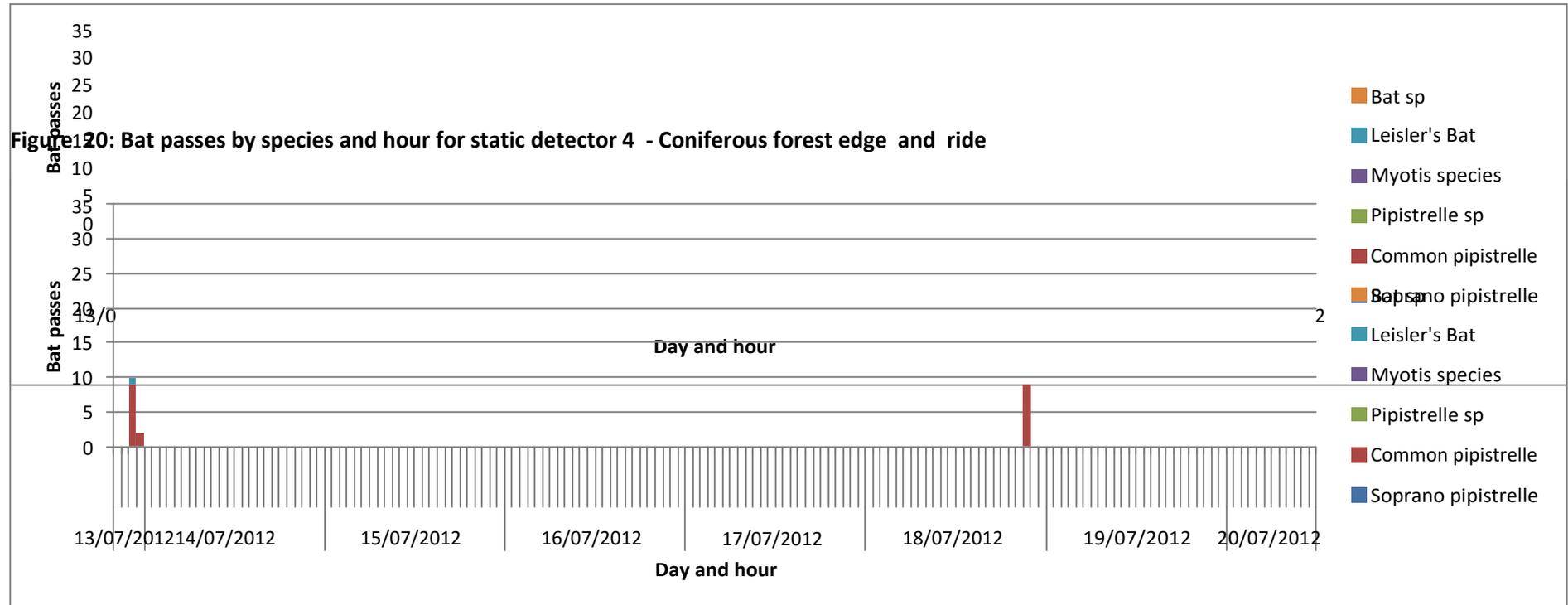


Figure 19: Bat passes by species and hour for static detector 3 - Open pasture

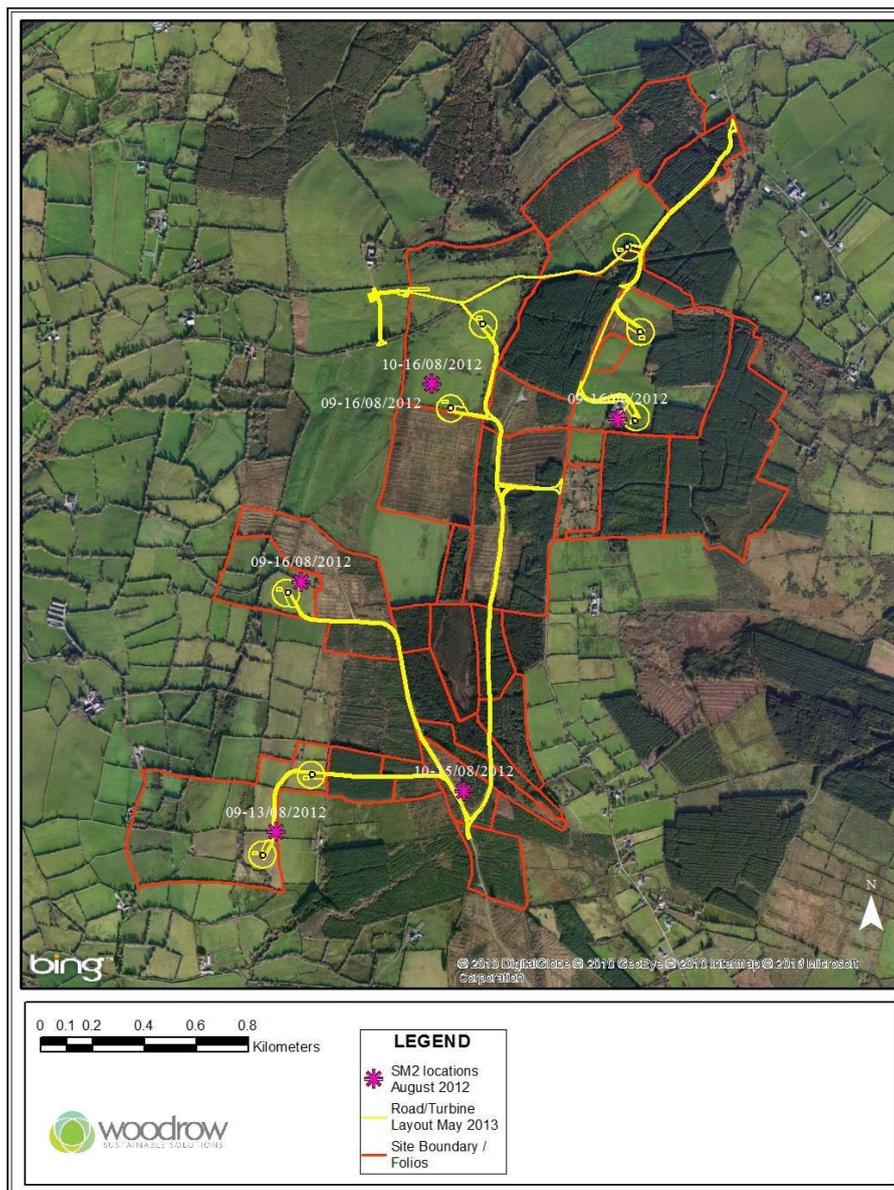


2100 0100 0500 0900 1300 1700 2100 0100 0500 0900 1300 1700 2100 0100 0500 0900 1300 1700 2100 0100 0500 0900 1300 1700 2100 0100 0500 0900 1300 1700 2100 0100 0500 0900 1300 1700 2100 0100 0500

#### 4.4.4 Static monitoring results for 9-16<sup>th</sup> August 2012

This survey was carried out over a total of 7 nights from 9-16<sup>th</sup> August 2012. Six static detectors were used on site, with four detectors placed at different features around the site, to enable a comparison of bat usage at different habitat features. Two units were placed on the met mast (one at a height of 4m and the other at 45m) to allow for comparison between bat activity at height (within/close to the rotor swept area) and that near ground level. The location of each static detector is shown in Figure 21 below. The level of activity over time for each detector is presented in figures 22 to 27 below.

**Figure 21: Location of static detectors for August 2012**



**Static detector 1: 9-16<sup>th</sup> August 2012 – Farm Buildings near T4**

Static detector 1 was positioned beside the farm buildings to the east of the site at grid reference IS 51602 81791. The unit is within around 50 metres of the proposed location of turbine T3. In general terms activity was low and when compared to the same location surveyed in June, there was considerably less activity. In June, a total of 69 bat passes were recorded over nine nights, compared with a total of 12 bat passes over seven nights in August.

The greatest amount of the bat activity was recorded on the night of 10-11/08/2012 with activity consisting of 5 Leisler’s bat passes, 6 *Myotis* species, 32 common pipistrelles, 4 soprano pipistrelles and 1 pipistrelle species bat pass. The only other significant amount of activity recorded was on the night of the 9-10/08/2012 with a total of 39 bat passes recorded, 2 of which were Leisler’s. 5 *Myotis* species bat passes were also recorded on this night. Figure 22 below shows activity over time at the location.

**Table 25: Total bat passes recorded for unit static detector 1 between the 9-16/08/2012**

	Soprano pipistrelle	Common pipistrelle	Pipistrelle sp.	Myotis species	Leisler's Bat	Bat s p.	Total bat passes
<b>Total bat passes/sp.</b>	0	9	0	1	2	0	12

**Static detector 2: 9-16<sup>th</sup> August 2012 – Hedgerow near T6**

Static detector 2 was positioned along a hedgerow to the west of the site at grid reference IS 50381 81160. The unit was also positioned in close proximity to the proposed location of turbine T6. In general terms activity was higher at this location in comparison to other static detectors deployed at the same time.

Bats were recorded on six of the seven nights with the greatest amount of activity recorded on the night of the 9-10/08/2012. During the course of the night a total of 94 bat passes were recorded. A total of 63 common pipistrelle, 26 soprano pipistrelle, 1 pipistrelle species and 4 *Myotis* species bat passes were recorded on this night. No Leisler’s bat activity was recorded on this unit. As can be seen from figure 23 below, activity was variable for the

remainder of the survey period with a second peak of bat activity on the night of the 13-14/08/2012.

**Table 26: Total bat passes recorded for unit static detector 2 between the 9-16/08/2012**

	Soprano pipistrelle	Common pipistrelle	Pipistrelle sp.	Myotis species	Leisler's Bat	Bat s p.	Total bat passes
<b>Total bat passes/sp.</b>	69	154	7	7	0	0	237

**Static detector 3: 9-13<sup>th</sup> August 2012 – Hedgerow near T8**

Static detector 3 was positioned within hedgerow habitat to the southwest of the site, near T8, at grid reference IS 50287 80191. In general terms activity was low for this habitat type. It should however be noted that this part of the site is exposed to the west which may reduce bat activity during windy conditions.

Bats were recorded on two of the four nights surveyed with 19 bat passes recorded on the night of the 10-11/08/2012 and only one *Myotis* species bat pass recorded on the night of the 12-13/08/2012.

Common pipistrelles were found to be the most numerous species at this location, with 16 passes recorded on the night of 10-11/08/2012. All bat activity on this night occurred between the hours of 21:00 and 02:00. Two common pipistrelles and one *Myotis* sp. were also recorded on this night.

Activity over time for this location can be seen in Figure 24 below.

**Table 27: Total bat passes recorded for unit static detector 3 between the 9-13/08/2012**

	Soprano pipistrelle	Common pipistrelle	Pipistrelle sp.	Myotis species	Leisler's Bat	Bat s p.	Total bat passes
<b>Total bat passes/sp.</b>	2	16	0	2	0	0	20

**Static detector 4: 10-15/08/2012 – Coniferous forest edge near T12**

Static detector 4 was positioned within coniferous forestry close to edge habitat, at grid

reference IS 51010 80327. Bats were recorded on four of the five nights. In general terms bat activity at this location was low. The greatest amount of the bat activity was recorded on the night of 14-15/08/2012 with a total of 13 bat passes. This consisted of 6 Leisler’s, 4 common pipistrelle, 2 soprano pipistrelle bat passes, and 1 pipistrelle bat pass. Figure 25 below shows bat activity over time for this location.

**Table 28: Total bat passes recorded for unit static detector 4 between the 10-15/08/2012**

	Soprano pipistrelle	Common pipistrelle	Pipistrelle sp.	Myotis species	Leisler's Bat	Bat s p.	Total bat passes
<b>Total bat passes/sp.</b>	7	16	1	1	6	0	31

**Static detector 5 – Open pasture near T5 (at 45m high)**

Static detector 5 was positioned on the met mast, at a height of 45m, north of T5. Bat activity was extremely low, with a single Leisler’s bat pass recorded on the 10/08/2012. This was the only bat activity recorded over a total of six nights surveying at a height of 45m. Data analysis from microphone recordings from both 45 metres and 4 metres suggest that this individual was commuting in the vicinity of 45 metres and then dropped lower as it approached the mast, as the call was also recorded on the bottom microphone a short time later. This record of a single bat pass over a period of 6 survey nights shows that although Leisler’s bats were recorded travelling at height, it was an unusual occurrence at this time and within open pasture habitat. The greatest number of Leisler’s bat passes for this month were found to be more closely associated with forestry edge habitat.

**Table 29: Total bat passes recorded for unit static detector 5 between the 10-16/08/2012**

	Soprano pipistrelle	Common pipistrelle	Pipistrelle sp.	Myotis species	Leisler's Bat	Bat s p.	Total bat passes
<b>Total bat passes/sp.</b>	0	0	0	0	1	0	1

### Static detector 6 – Open pasture near T5 (at 4m high)

Static detector 6 was positioned on the met mast, at a height of 4m, north of T5. In general terms activity was low, with a total of 12 bat passes recorded over a total of seven nights surveyed.

The greatest amount of bat activity was recorded on the night of 9-10/08/2012. This consisted of a total of 9 common pipistrelle and 1 unidentified bat passes, with the remaining 2 Leisler's bat passes recorded on the night of 10-11/08/2012.

**Table 30: Total bat passes recorded for unit static detector 6 between the 9-16/08/2012**

	Soprano pipistrelle	Common pipistrelle	Pipistrelle sp.	Myotis species	Leisler's Bat	Bat s p.	Total bat passes
<b>Total bat passes/sp.</b>	0	9	0	0	2	1	12

### Summary

The results above show an interesting picture of bat usage of the site. Again, there is a general affinity with habitat features shown. However, there is a distinct variation in the comparative use of similar features within the site, notably with two detectors placed near to hedgerow habitat in the south west of the site showing very different results. It is quite possible that the weather conditions, notably rain, would have reduced the potential for bats to forage deeper into the site due to such factors as distance from roost sites. General weather data for the same period is shown in Figure 28<sup>4</sup>.

---

<sup>4</sup> Wind and temperature data gathered from IW CM met mast on site at 50.7 metres. Precipitation data gathered from Laois Weather Online. Recorded at Durrow and therefore only indicative of actual precipitation at the site. Available online at <http://www.laoisweather.com/>

Figure 22: Bat passes by species and hour for static detector 1 - Farm Buildings near T3

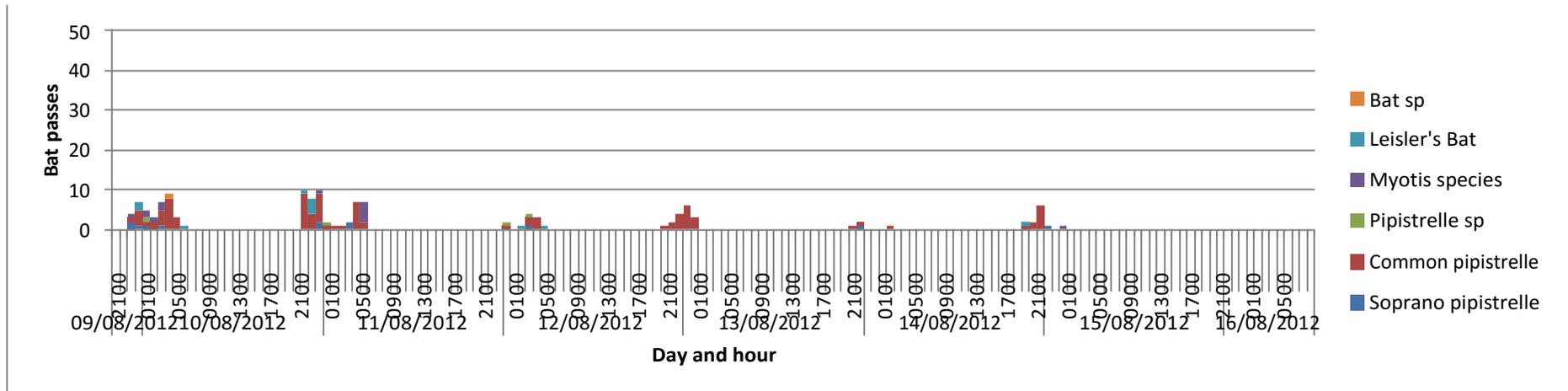


Figure 23: Bat passes by species and hour for static detector 2 - Hedgerow near T6

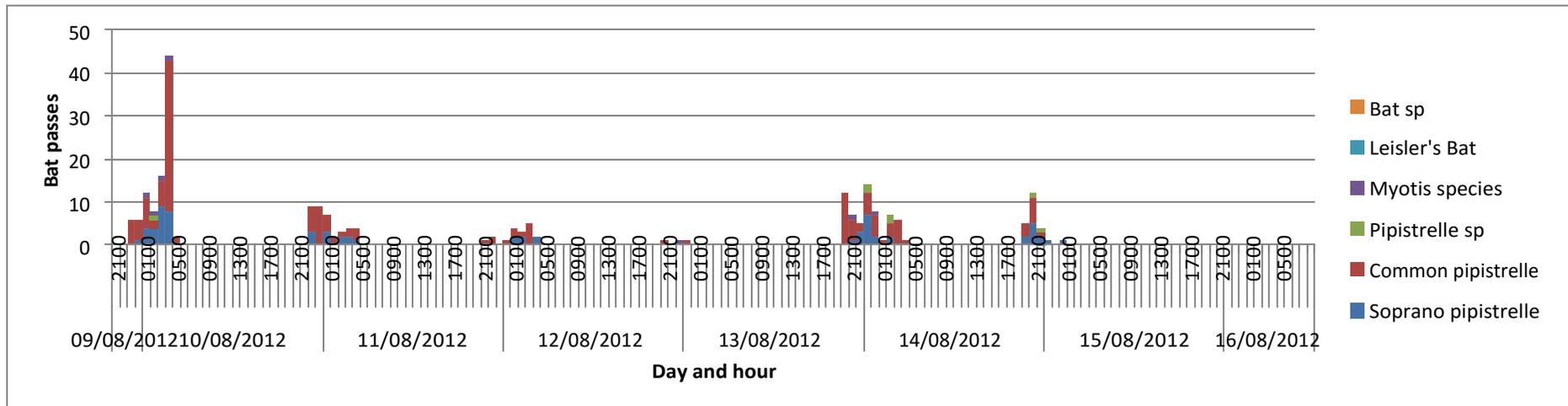


Figure 24: Bat passes by species and hour for static detector 3 - Hedgerow near T8

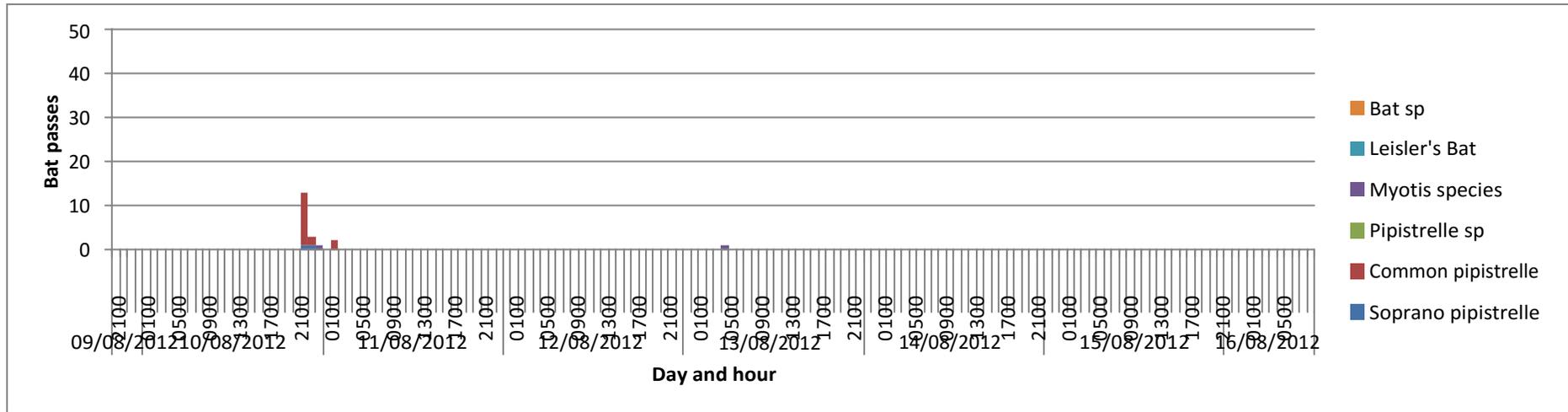
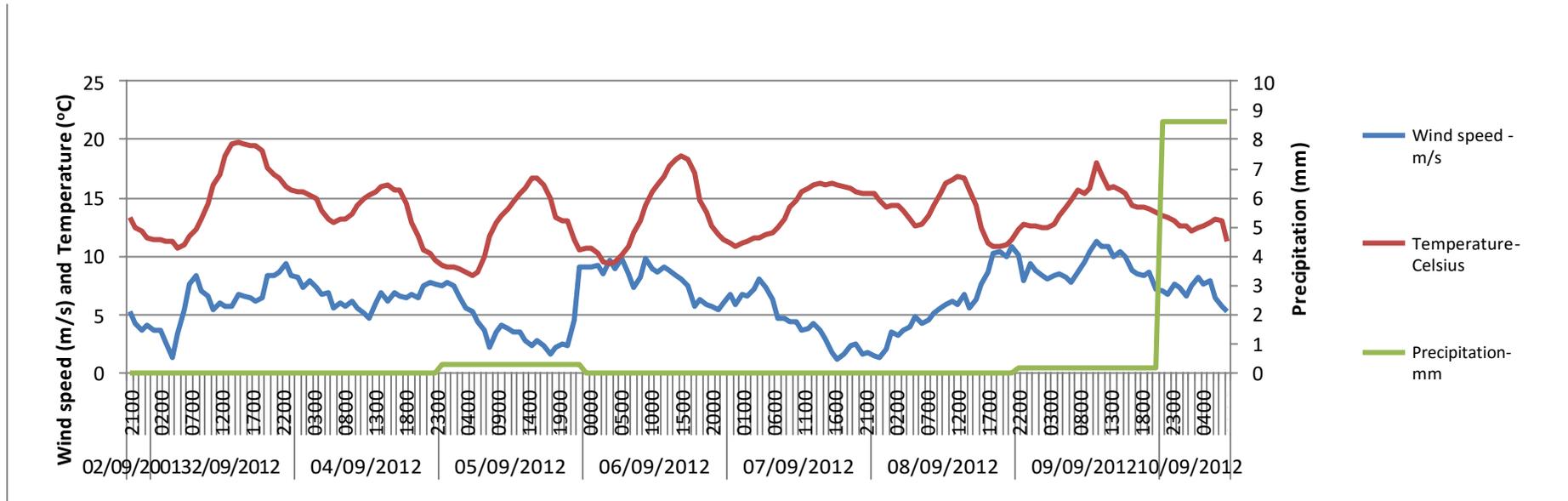




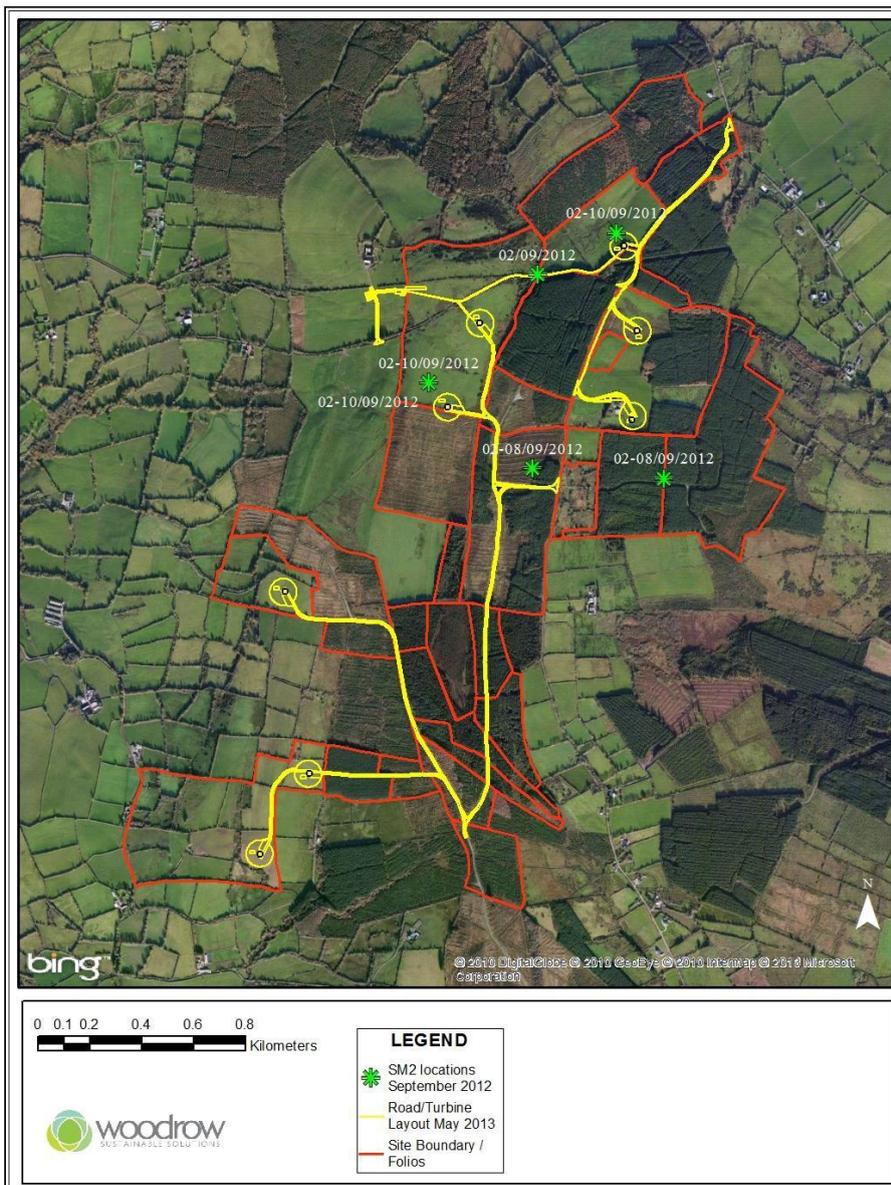
Figure 28: Temperature, wind speed and precipitation, 2<sup>nd</sup> – 10<sup>th</sup> August 2012



### 4.4.5 Static monitoring results for 2- 8<sup>th</sup>/11<sup>th</sup> September 2012

This survey was carried out over a total of six nights between the 2-8<sup>th</sup> September 2012 (detectors at the met mast recorded until 11<sup>th</sup> September). Six static detectors were used on site with four detectors placed at different features around the site, to enable a comparison of bat usage at different habitat features. Two static detectors were placed on the mast (one at a height of 4m and the other at 45m) to allow for comparisons between bat activity at height versus low down. The location of each static detector is shown in Figure 29 below. The level of activity over time for each detector is presented in figures 30 to 34 below.

**Figure 29: Location of static detectors for September 2012**



### Static detector 1: Forestry edge and ride

Static detector 1 was positioned within an enclosed coniferous forestry ride to the east of the site at grid reference IS 51795 81548. Bats were recorded on all nights with a maximum of 68 bat passes recorded on the night of the 02-03/09/2012. This consisted of 58 common pipistrelle passes (with 29 passes occurring between the hours of 22:00 & 23:00 and therefore may be attributed to a single or small number of bats feeding in the area), 6 Leisler's bat passes (5 of which occurred between the hours of 03:00 & 04:00), 3 soprano pipistrelle passes and 1 *Myotis* sp. bat pass. Figure 30 below shows bat activity over time for this location.

**Table 31: Total bat passes recorded for unit static detector 1 between the 2-8/09/2012**

	Soprano pipistrelle	Common pipistrelle	Pipistrelle sp.	Myotis species	Leisler's Bat	Bat s p.	Total bat passes
<b>Total bat passes/sp.</b>	17	151	0	13	15	1	197

### Static detector 2: Mature forestry edge and young forestry

Static detector 2 was positioned within the middle of the site along mature forestry edge habitat to the west with young 1.5m high second rotation forestry to the west.

Bat activity was recorded on all nights from this detector with a minimum of 4 species recorded. A minimum of 3 species were recorded on each night. Common pipistrelle and soprano pipistrelle were recorded on all nights, with *Myotis* species recorded on 5 of the 6 nights and Leisler's on 4 of the 6 nights. There was a peak in Leisler's activity on the last night, with a total of 28 passes, recorded throughout the night.

Figure 31 below shows bat activity over time for this location.

**Table 32: Total bat passes recorded for unit static detector 2 between the 2-8/09/2012**

	Soprano pipistrelle	Common pipistrelle	Pipistrelle sp.	Myotis species	Leisler's Bat	Bat s p.	Total bat passes
<b>Total bat passes/sp.</b>	46	93	0	14	40	0	193

### Static detector 3: Hedgerow near T1

Static detector 3 was positioned along hedgerow habitat with open pasture either side. This was located to the north of the site near T1 at grid reference IS 51608 82506.

Activity during the survey period at this location was the highest of any static monitoring undertaken at the site during the year. There was a high number of bat passes from soprano and common pipistrelles on 4 of the 6 nights, with a total of 568 passes from the two species on the night of 6<sup>th</sup> – 7<sup>th</sup> September. Lower numbers, although still significant, of *Myotis* species and Leisler’s bat passes were recorded during the survey period. Interestingly there was no activity recorded on the final night of surveying for this location despite activity being recorded at other locations.

Figure 32 below shows bat activity over time for this location.

**Table 33: Total bat passes recorded for unit static detector 5 between the 2 -8/09/2012**

	Soprano pipistrelle	Common pipistrelle	Pipistrelle sp.	Myotis species	Leisler's Bat	Bat s p.	Total bat passes
<b>Total bat passes/sp.</b>	688	551	98	30	20	0	<b>1387</b>

**Static detector 4 – Open pasture (Mast at 4m altitude): 2-11<sup>th</sup> September 2012**

Static detector 4 was positioned on the mast (at a height of 4m) over open pasture to the northwest of the site. Although activity was relatively low at this location in comparison to other static detectors (as would be expected since this detector was not placed near habitat features) there was some level of activity recorded on most nights. This is useful since it provides a reasonable baseline of activity at ground level against which to make a comparative assessment of activity at height versus activity at ground level. Three species of bat were recorded, Leisler’s bat, soprano pipistrelle and common pipistrelle. This was the only location and period during which Leisler’s bat was the most numerous in terms of bat passes, reinforcing the understanding that the species is more likely to be active away from habitat features than other species.

Figure 33 below shows bat activity over time for this location.

**Table 34: Total bat passes recorded for unit static detector 3 between the 02 -11/09/2012**

	Soprano pipistrelle	Common pipistrelle	Pipistrelle sp.	Myotis species	Leisler's Bat	Bat s p.	Total bat passes

<b>Total bat passes/sp.</b>	10	27	0	0	31	0	<b>68</b>
-----------------------------	----	----	---	---	----	---	-----------

**Static detector 5 – Open pasture (Mast at 45m altitude ): 2-11<sup>th</sup> September 2012**

Static detector 5 was positioned on the mast (at a height of 45m) over open pasture to the northwest of the site. There was generally a very low level of activity recorded with a total of 2 (and possibly 3) species recorded. The most notable issues with these results actually relate to comparisons with static detector 4 since both units were recording at the same location but at different heights. The results show that both common pipistrelle and Leisler’s bats were flying at heights closer to the microphone at 45 metres than the one at 4 metres, since calls were recorded on the former microphone that were not recorded on the latter one. The results from this survey period show that, while both common pipistrelle and Leisler’s bat were recorded flying at or near rotor blade height, it was a rare occurrence, with 4 passes recorded at 45 metres within a total of 72 passes recorded at the two microphones combined.

Figure 34 below shows bat activity over time for this location.

**Table 35: Total bat passes recorded for unit static detector 4 between the 02-11/09/2012**

	<b>Soprano pipistrelle</b>	<b>Common pipistrelle</b>	<b>Pipistrelle sp.</b>	<b>Myotis species</b>	<b>Leisler's Bat</b>	<b>Bat s p.</b>	<b>Total bat passes</b>
<b>Total bat passes/sp.</b>	0	2	1	0	1	0	<b>4</b>

**Summary**

Again, the results show a general affinity with habitat features on the site. With a significantly higher amount of activity recorded by static detector 3, located at a hedgerow in the northern part of the site. The level of activity recorded by static detectors in a forestry ride and at mature forest edge were very similar overall. The detectors placed on the mast (which were left to record longer than other units) showed some interesting results, with a sufficient of activity at ground level to enable a realistic comparison of activity at ground level and at height. The results showed a significantly higher level of activity at ground level, but showed that activity at 45 metres did occur, albeit at very low levels.

There was no obvious weather correlation with activity at 45 metres, with bat passes recorded at wind speeds of 4.5, 5.7, 7.5 and 7.7 m/s and at air temperatures of 10.2°C and above, against a background of wind speeds that dropped as low as 1.3 m/s, night time temperatures that were largely above 10°C and, for the most part, fairly dry conditions. General weather data for the same

period is shown in Figure 35<sup>5</sup>.

---

<sup>5</sup> Wind and temperature data gathered from IW CM met mast on site at 50.7 metres. Precipitation data gathered from Laois Weather Online. Recorded at Durrow and therefore only indicative of actual precipitation at the site. Available online at <http://www.laoisweather.com/>

Figure 30: Bat passes by species and hour for static detector 1- Forestry edge and ride

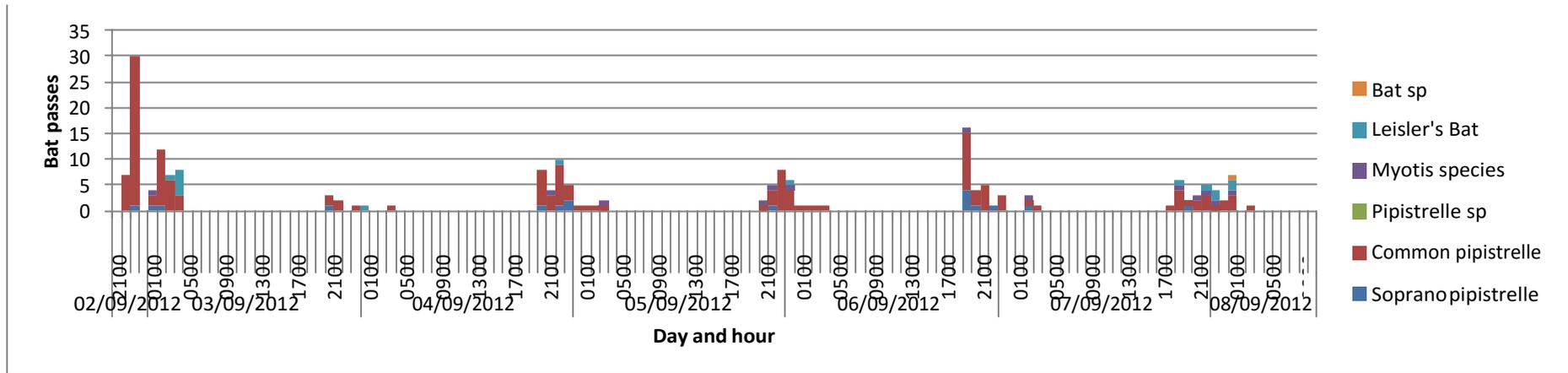


Figure 31: Bat passes by species and hour for static detector 2 - Mature forestry edge and young forestry

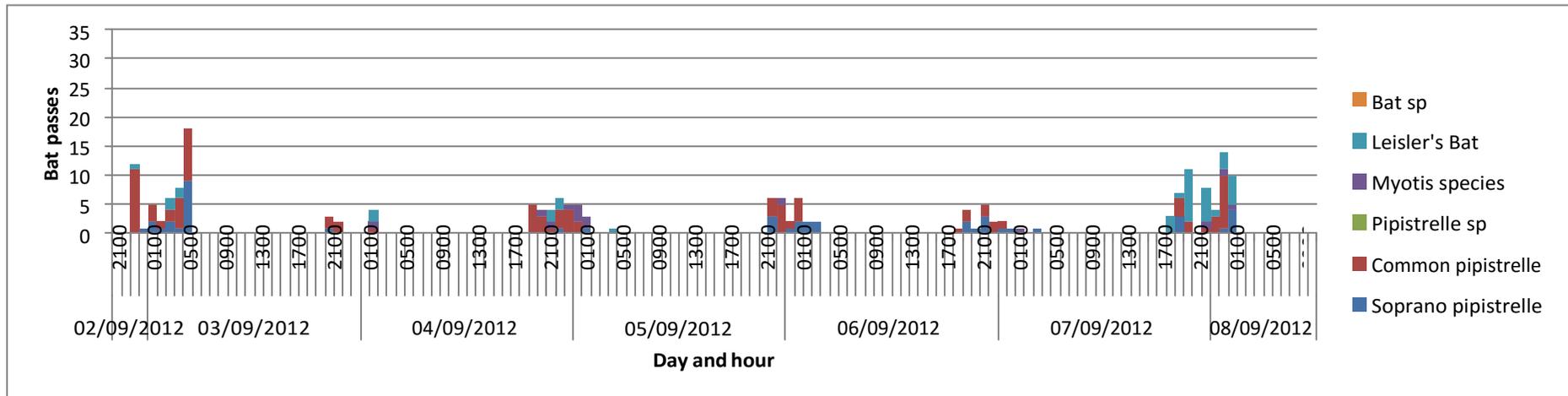


Figure 32: Bat passes by species and hour for static detector - 3 – Hedgerow (note x-axis units changed due to higher number of bat passes)

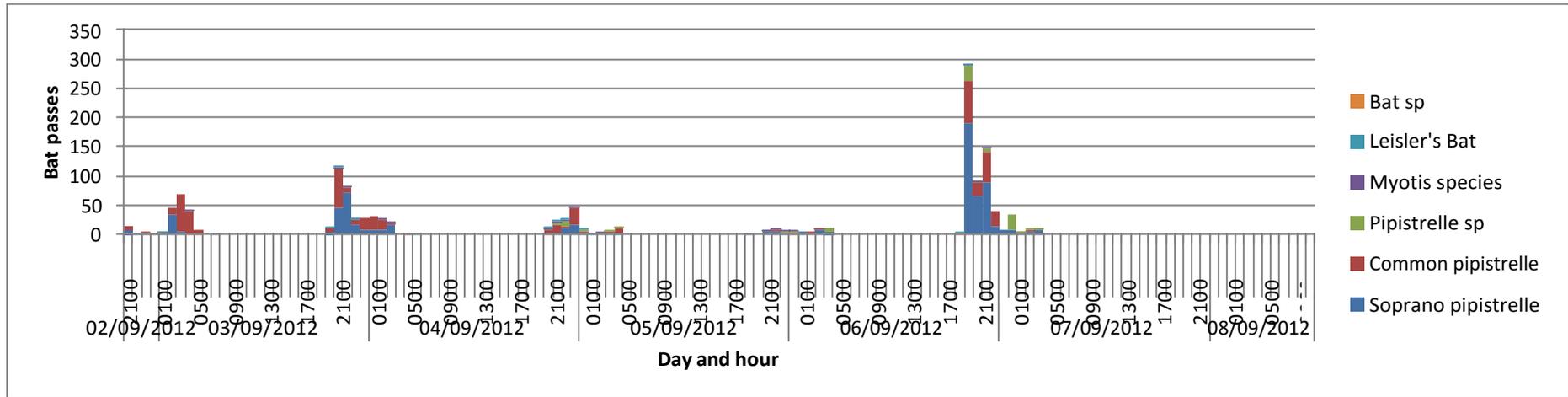


Figure 33: Bat passes by species and hour for static detector 4 - Open pasture (Mast at 4m altitude)

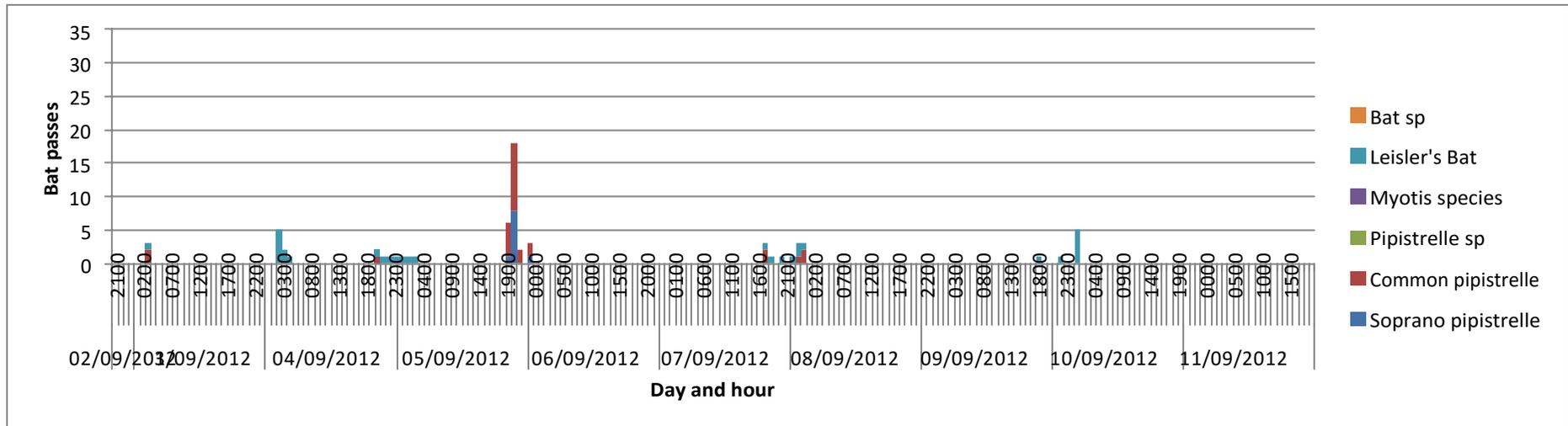


Figure 34: Bat passes by species and hour for static detector 5 - Open pasture (Mast at 45m altitude)

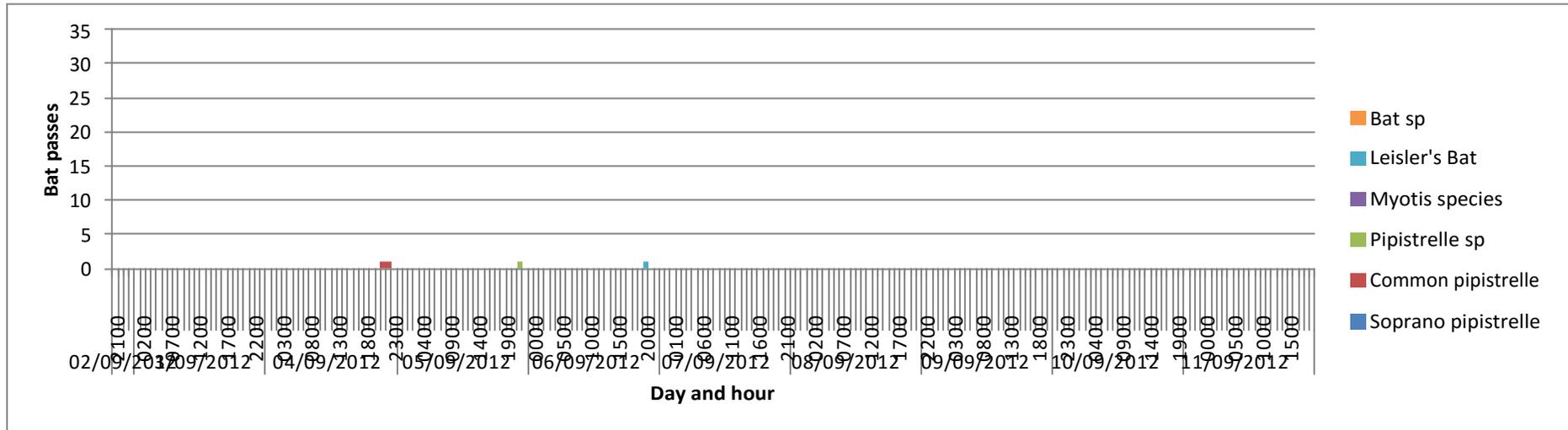
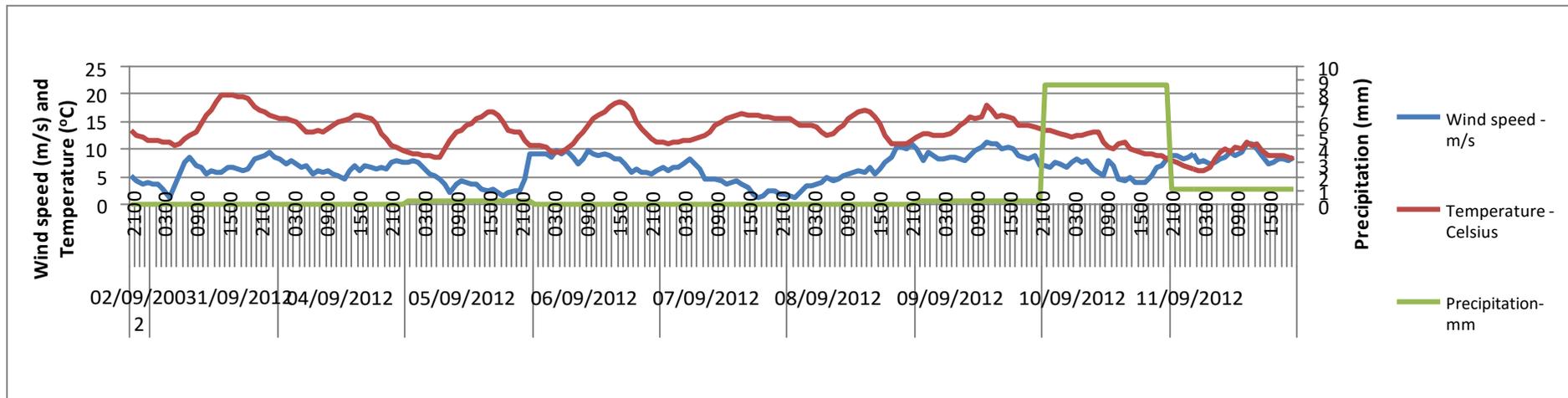


Figure 35: Wind Speed and Temperature data



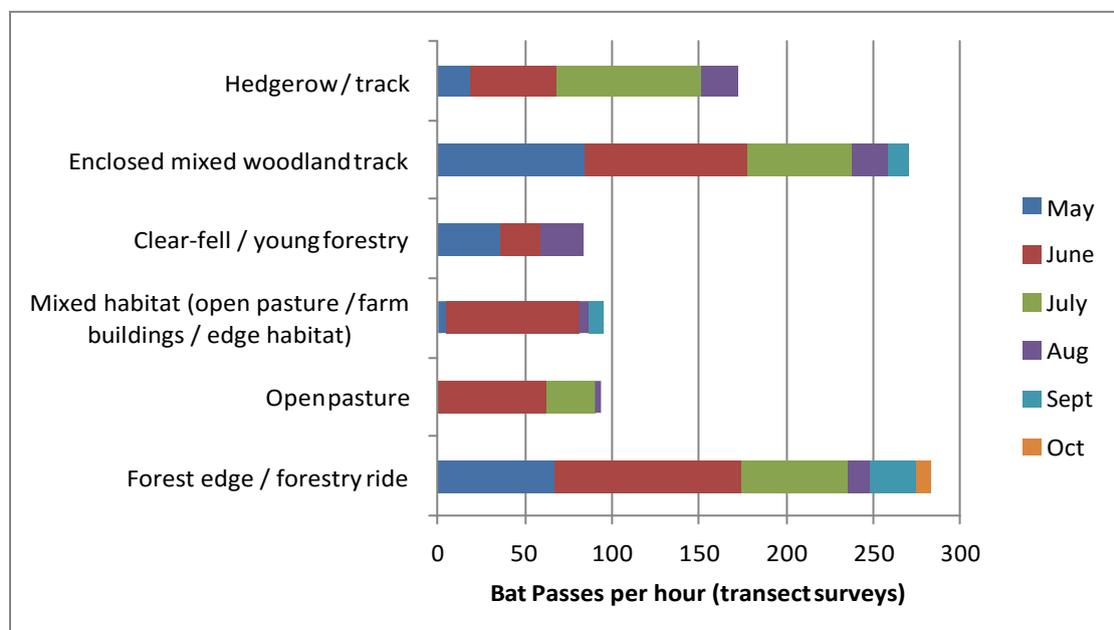
### 4.6 Association of bat passes with habitat features

Sections 4.3 and 4.4 above have commented on the association of recorded bat passes with habitat features during both transect surveys and static detector surveys. The overall picture is that bat activity recorded during the survey season was largely associated with habitat features such as hedgerows and forest edge. This is typified by the results for the May transect visit. The transect route was separated into different sections reflecting different habitat types. The number of bat passes per hour for these different sections for the all transect surveys is presented in Figure 36 below. This shows an affinity of bat activity with features, notably forest edge.

If looking at the overall values, it may be surprising that a similar number of bat passes per hour were recorded in open pasture as were recorded in mixed habitat and clear-felled forestry. However, it is notable that the majority of activity over open pasture was recorded in June and July, possibly when better weather conditions reduced the need to use the lee of features for foraging and when species such as dung flies would be at their greatest numbers.

Excepting the June transect results, there is an extremely strong bias towards hedgerow / track, enclosed mixed woodland track, and forest edge / forestry ride.

Figure 36: Bat passes per hour by habitat type – all transect surveys



## 4.7 Summary and discussion of results

Taking an overview of the results, there are a number of issues that stand out, notably:

1. The site has a variable level of bat activity throughout the year with a noticeably higher level of activity recorded during transects in the first half of the active bat season.
2. The level of bat activity varied considerably from visit to visit. While this may relate to seasonal variations, the data from static bat detectors suggests that it may relate equally to weather conditions on individual nights, notably precipitation levels.
3. Comparative studies of the use of habitat features over the same period showed variations in bat use. This suggests bat activity may be concentrated in different parts of the site at any one time, possibly depending on factors such as prevailing wind direction, invertebrate prey availability and proximity of different areas to bat roost sites.
4. A single bat roost was recorded in the vicinity of the proposal. This supported very small numbers of soprano and common pipistrelle at the time of the survey. The roost is situated approximately 170 metres outside the site boundary, and almost 600 metres from the nearest turbine base.
5. Leisler's bats were the only high risk species recorded at the site. The species was recorded throughout the site, but with a generally higher concentration in the centre and north of the site. In particular there was a higher concentration of activity associated with an east facing section of forestry edge along the minor road that runs north / south through the site.
6. Bat usage of the site is weighted towards habitat features, with forest edge, hedgerow, wooded tracks and the vicinity of buildings associated with the greatest amount of bat activity. The weighting towards such features was strongest either side of the core summer months, possibly related to the need to use the lee of features at certain times of the year or the difference in invertebrate productivity in different habitats over the year. Such features are distributed fairly evenly throughout the site.
7. Comparative studies of use of the site (over open pasture) at ground level and at height (45 metres) by bats showed some limited use at a higher altitude but with most activity recorded at ground level. For example between 12<sup>th</sup> and 19<sup>th</sup> August there were 12 bat passes at ground level and 1 bat pass at 45 metres, and between 2<sup>nd</sup> and 10<sup>th</sup> September there were 68 bat passes at ground level and 4 bat passes at 45 metres.

## 4.6 Survey issues and limitations

All surveys have limitations. In the case of bat surveys, those limitations often relate to weather conditions at the time of the survey. In this case, survey conditions were fair to good for all surveys, with only the later (October) survey being partly undertaken in temperatures likely to be somewhat low for significant levels of bat activity. However, this is considered to be fully representative of the time of year when bats are more likely to respond to increasingly short periods of suitable weather for foraging.

Good survey conditions for static monitoring sessions are harder to guarantee since weather forecasts can change dramatically over the few nights that static detectors are left out. However, this mirrors real situations in sites such as Pinewoods and can produce some insight into the sporadic and opportunistic use of these upland sites by bats. The reduced amount of activity during periods of high precipitation was notable.

In general terms, it is considered that the survey approach and coverage was sufficient in order to gain an insight into the use of the site by bats and assess any potential impacts of the proposed wind farm development on populations.

## 5 POTENTIAL IMPACTS OF THE DEVELOPMENT

### 5.1 Bat roosts

A single bat roost was located in the vicinity of the site. This is located east of the centre of the site, some 175 metres outside the site boundary and 600 metres from the nearest turbine base. There were no bat roosts recorded within the site. Considering the lack of bat roosts within the site, the absence of any works in the vicinity of the roost and the distance of the roost from the proposal, there is not considered to be any potential impact on bat roosts resulting from the proposal.

### 5.2 Collision and barotrauma

Both direct collision with rotor blades and barotrauma resulting from close contact with rotor blades have been found to be an issue with bats and wind farms notably in the US (e.g. Cryan *et al* 2009) and mainland Europe. The evaluation of susceptibility of bat species likely to be at risk of impacts from wind turbines detailed in Section 3.2 above is partly associated with the likelihood of different species flying at rotor blade height in an open landscape.

The hub height and blade diameter of the proposed turbines is 100 and 51.5 metres respectively, giving a rotor swept area between 48.5 and 151.5 metres above the ground. As detailed in Section 3.2, Leisler's bats are potentially most at risk from impacts from turbines due to their habit of flying and feeding directly at height, at speed, and having a reduced ability for manoeuvre to avoid collision. Noting the above, it is important to understand the extent to which Leisler's bats feed at height at the site. The Leisler's bat passes at Pinewoods, where height was ascertained, varied from around 5 metres to upwards of 20 metres during transect surveys. The use of the area by bats at height was monitored by a comparison of static recorders placed at ground level and at 45 metres on the meteorological mast on the site. Monitoring at height can be technically difficult. However some reliable data was collected during the period that the monitoring was undertaken. In particular, the period from the 2<sup>nd</sup> to the 11<sup>th</sup> September 2012 resulted in reliable recordings from both microphones. This 9 night monitoring period resulted in a total of 31 bat passes from Leisler's bat at the ground microphone and 1 single pass from the species at the 45 metre microphone. The same monitoring period produced 10 and 27 passes respectively for soprano pipistrelle and common pipistrelle at ground level but no passes for soprano pipistrelle and 2 passes for common pipistrelle (plus a single unidentified pipistrelle species) at 45 metres.

While it is clear that there was significantly less activity at height during this period at this location, there is an important issue to consider in the interpretation of these results. Much of the monitoring at the mast location produced little or no bat activity. This is not surprising since the mast is located within an area of improved pasture, a habitat with limited interest for feeding bats. The location of the mast next to a feeding feature would be likely to result in two effects. Firstly it would result in more bats being recorded generally since the habitat feature would attract them. Secondly it would result in an increase in activity at height since bats would be attracted to the top of the feature in search of prey items.

### **5.2.1 Leisler's Bat**

Leisler's bats were recorded in varying numbers during transect surveys, with by far the largest number during the May visit. The species was recorded throughout the site, but with a generally higher concentration in the centre and north of the site. In particular there was a higher concentration of activity associated with an east facing section of forestry edge west of turbines 2 and 3 (though not generally in proximity to those turbine locations).

As detailed previously, Leisler's activity during the transect surveys was relatively high in the May and June visits but was low to extremely low or absent during other months. Static

detector surveys showed a relatively high level of activity for the species in May and September and, to a lesser extent, July. The relatively high level of recorded activity in September coincided with monitoring being undertaken at both 45 metres high and at ground level at the mast location. Data from this month showed a total of 31 Leisler's bat passes at 4 metres above the ground and one single Leisler's bat pass at 45 metres above the ground at the same location. This shows that Leisler's bats flying at or near the lower end of wind turbine rotor height, but that was not typical of the behaviour of the species at this location during this monitoring period.

Observations during transect surveys suggest that much Leisler's activity on the site relates to small numbers of bats foraging along features, notably forestry edge. Where numbers of bat passes are recorded at a single location, these can often relate to 2 or 3 individuals repeatedly foraging over the same spot. Taking account of this, it is considered that the highest number of Leisler's bats recorded using the site at any one time was between 10 and 18 individuals. This was during the May visit. There are two turbines (T1 and T5) that are located close to forestry edge.

In assessing the potential impact of such occasional contact during peaks of activity, it is necessary to consider the conservation status of the species and the potential impact of occasional collisions on the population. As detailed in section 3.2, Leisler's bats are considered to be *Near Threatened* in the Irish Mammals Red Data List and at *High Risk* with respect to collision risk with wind turbines. It is also important to consider that bats have a maximum of one young per year and so recruitment in bat populations is generally low. The impact of turbine collisions or barotrauma on a relatively low number of individual Leisler's bats therefore has the potential for significant impact on a population in any given area.

Taking account of the occasional peaks of activity within the site and the numbers of Leisler's bat recorded, it is considered that the population should be considered as of Regional importance. Considering the high susceptibility of Leisler's bats to collision risk or barotrauma, the generally low number of bats recorded on site but with recorded peaks in continued activity on occasion, the observed association of peaks in activity with feeding close to features, and the results of surveying at height on the site, it is concluded that without mitigation there is the potential for a worst case scenario of a negative impact of moderate magnitude on a Regionally important population, suggesting a negative impact of moderate significance without mitigation (see table 5). This level of potential impact and the need for a

precautionary approach suggests the need for appropriately targeted mitigation.

The recorded general affinity of Leisler's bat with habitat features such as forest edge during surveys is an important issue to consider in assessing potential impact of wind turbines on them at this site. There are two turbines that are located close to forestry edge (T1 and T5). The forestry at these locations will continue to mature, thus bringing the habitat feature (tree top) closer to the turbine swept area. The affinity of Leisler's bats with such features means that there is a potential increase in the likelihood of bats coming into direct contact with turbines.

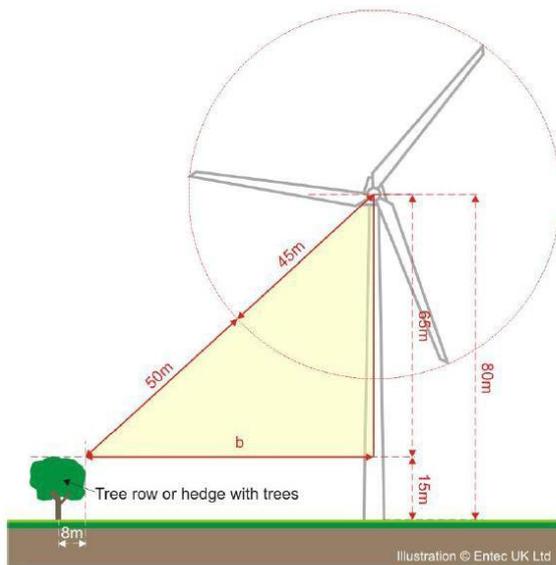
The consideration of appropriate mitigation must take account of the way in which Leisler's bats have been recorded using the site during the 2012 survey. The species was largely recorded in association with features such as forestry edge habitat, although there were also some records of individuals over open habitat. Information gained by recording at height showed little bat activity at 45 metres above ground level. However, it is likely that an increase in height of features that bats use (such as forest edge) will result in an increase in foraging height relative to that in open habitat. Appropriate mitigation, therefore is considered to be that which ensures a distance between habitat features and the swept rotor area of turbines. For turbines adjacent to forestry areas or other habitat features this is likely to mean the re-location of turbines away from key features (such as hedgerows) or felling of trees within a distance of the turbines if such relocation is not feasible for other reasons.

Natural England Interim Guidance on Bats and Onshore Wind Turbines (NE 2009) suggest a minimum distance between features (such as forest or woodland edge) of 50 metres to reduce risk of impact, while Eurobats suggest a minimum distance of 200 metres (Eurobats 2008).

There is no official adopted approach to minimum distance in Ireland. However it is noted that the Northern Ireland Environment Agency (NIEA) who work with potential impacts on the same species that occur at Pinewoods, have adopted the Natural England Guidance. The Natural England guidance suggests that the formula below is used in order to ensure that a distance of 50 metres or more can be ensured between the blade tip and a potential feeding feature at the nearest point.

**Figure 37: Formula for ensuring a minimum distance of 50 metres from blade tip to habitat (potential feeding) feature. Source NE (2009)**

$$b = \sqrt{(50 + b)^2 - (hh - fh)^2}$$



where: bl = blade length, hh = hub height , fh = feature height (all in metres). For the example above, b = 69.3 m.

Considering the dimensions of the turbines (hub height 100 metres and blade length 51.5 metres), and the likely maximum height of sitka spruce (for example 15 metres at 20 year felling age), the distance that the turbine would have to be from forest edge (b) in order to comply with Natural England Guidelines would be 55 metres. The proposed mitigation in line with this standard is set out in section 6.

## 5.2.2 Pipistrelle Species

Pipistrelle bats are considered as being at medium risk of impact from wind turbines in terms of the likelihood of barotrauma or collision risk based on species behaviour and foraging techniques (see Section 3.2). As with Leisler's bats, recorded pipistrelle activity on transect surveys was significantly higher in the first half of the survey season. The results of static survey results, however, showed fairly consistent activity throughout the season near to habitat features. Noticeably, there was significantly more common pipistrelle activity at the site than soprano pipistrelle. The survey results show a distinct affinity of pipistrelle species to habitat features such as forestry edge, forestry rides, hedgerows and farm buildings. The highest numbers of pipistrelle bats were recorded during the June visit, when a reasonable minimum of 22 (and maximum of 36) common pipistrelles and a reasonable minimum of 11 (and maximum of 17) soprano pipistrelles were recorded at the site.

As with Leisler's bats, the affinity of pipistrelle species to habitat features such as forest edge is likely to result in an increased risk of collision and / or barotrauma at turbines close to such

features.

Taking account of the level of recorded site usage by pipistrelle species, their affinity for keeping to habitat features (notably with many recorded individuals being observed at less than 10 metres above the ground during the surveys) and their being at *medium* risk of impact from wind turbines in terms of the likelihood of barotrauma or collision risk based on species behaviour and foraging techniques, it is considered that there is the potential for a worst case scenario of a negative impact of moderate magnitude on a Locally to Regionally important population resulting in a negative impact of *moderate* significance. The survey data (notably with many recorded individuals being observed at less than 10 metres above the ground during the surveys) suggest that the probability of impact will be less where turbines are located away from habitat features. It is therefore considered that there is a need for appropriate mitigation to ensure that turbines and habitat features are a minimum distance apart. The proposed mitigation in line with this is set out in section 6.

### **5.2.3 *Myotis* species**

A number of *Myotis* bats were recorded within the site. *Myotis* bats typically have relatively weak echolocation calls compared to species such as Leisler's bats and need to be in close proximity to the ground or other features in order to navigate. For this reason they are considered to be at a low risk from wind turbine impacts, notably since they are not likely to be flying at rotor blade height. *Myotis* bats are not considered to be at risk from turbine collision risk or barotrauma from this proposal.

### **5.3 Loss or fragmentation of habitat**

It is stated in Chapter 6 (Ecology) that up to 50 metres of linear hedgerow will be lost at the site as a result of wind farm infrastructure. Such losses will be in individual sections of 5-10 metres and are not considered likely to have a greater impact on bat populations than the *minor* negative impact attributed to it in general ecology terms in Chapter 6.

It should be noted that where there is a requirement to ensure a minimum distance between turbine blades and bat foraging features (such as hedgerows) and where constraints mean that there is no further potential for movement of the turbine, mitigation in the form of feature removal will be required in order to ensure there is no impact on bat populations. Such a situation will require that hedgerows are re-planted in a suitable area. This is detailed in section 6 below.

## **5.4 Displacement or disturbance of bats**

As detailed above, no bat roosts were recorded in the vicinity of the site (with a single roost recorded 175 metres outside the site boundary) and no buildings holding potential for bat roosts will be affected by the proposal. It is considered, therefore, that there is no potential for displacement or disturbance of bat roosts as a result of the proposal.

The impact of active wind turbines on displacement or disturbance of bats is unknown at this time. Infra-red monitoring of bat activity around turbines in the United States anecdotally shows bats interacting with stationary turbines and flying adjacent to operational turbines. This suggests that they may not be displaced by turbines. However, it is unknown as to whether that is true of species in Ireland. The species that may be most affected in such a way would be likely to be Leisler's bats since it is the species most likely to fly at active turbine height. Any likelihood of displacement of Leisler's bats by active turbines would result in a loss of feeding area. However it would equally decrease or remove the risk of collision or barotrauma.

## **6 MITIGATION AND ENHANCEMENT**

Section 5.2 highlighted that, without mitigation, there is considered to be a potential moderate negative impact on local Leisler's bat populations and a moderate negative impact on Pipistrelle species as a result of potential collision risk and / or barotrauma. It is suggested that there is a need for mitigation in both instances.

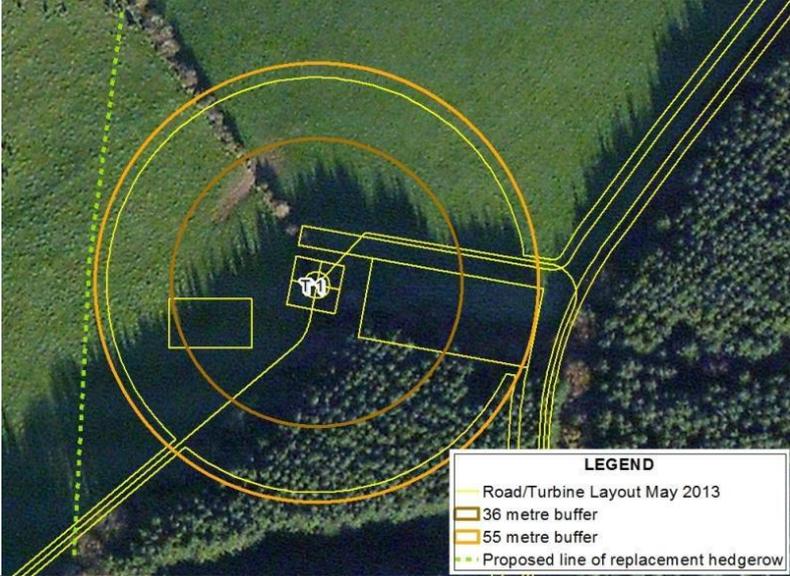
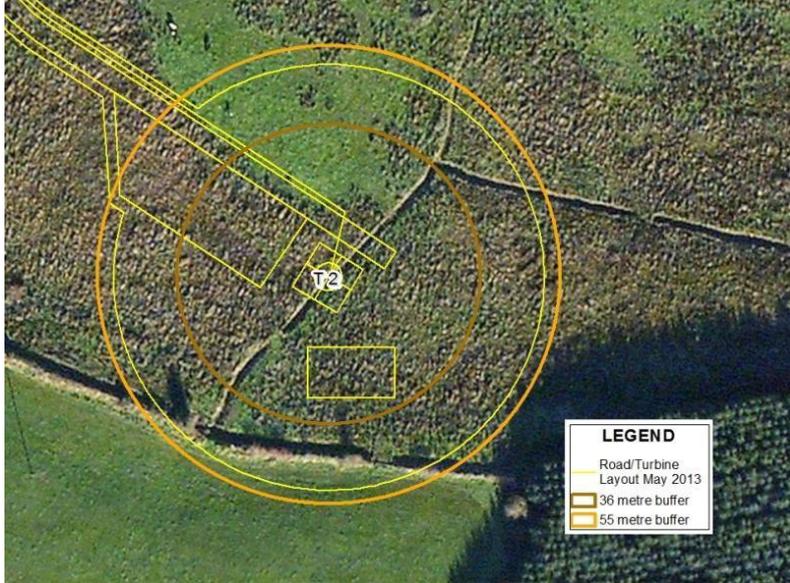
Mitigation proposed with respect to potential impact on both species is the set-back of turbines from potential feeding features by a minimum of 50 metres (blade tip to top of feature) in line with Natural England Guidance. This effectively means that forestry needs to be felled within a 55 metre radius around turbines that are to be placed adjacent to the forestry area. For turbines in the vicinity of hedgerows, it means that turbines need to be placed a minimum of 36 metres from them (assuming a maximum feature height of 5 metres). Where this is not physically feasible (eg due to small field sizes or other constraints) hedgerows need to be removed within the 36 metre radius from the turbine and re-planted in order to maintain the hedgerow network.

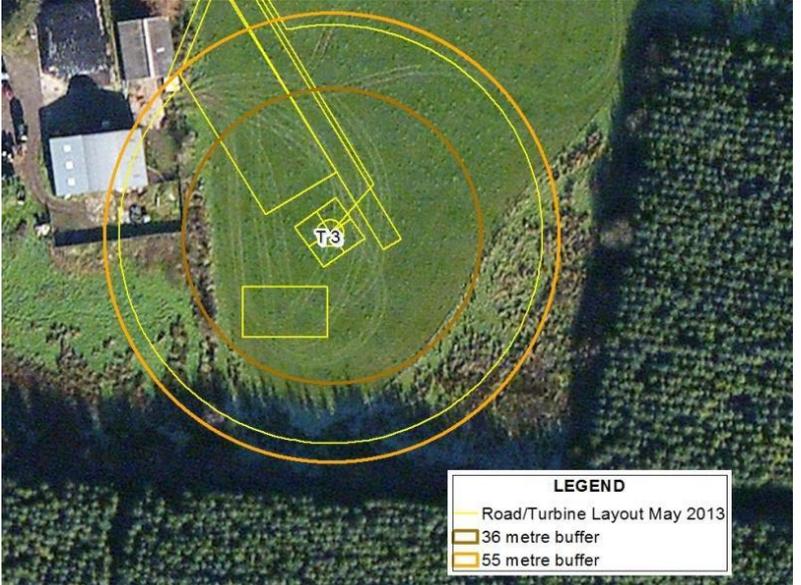
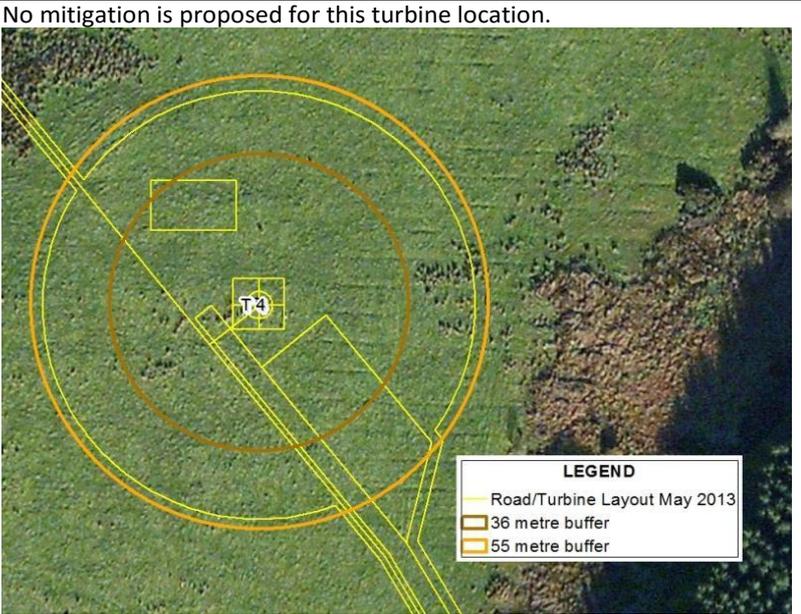
Specific mitigation proposals by turbine location are set out in the table below. It is considered that the application of the mitigation measures below will result in the likelihood

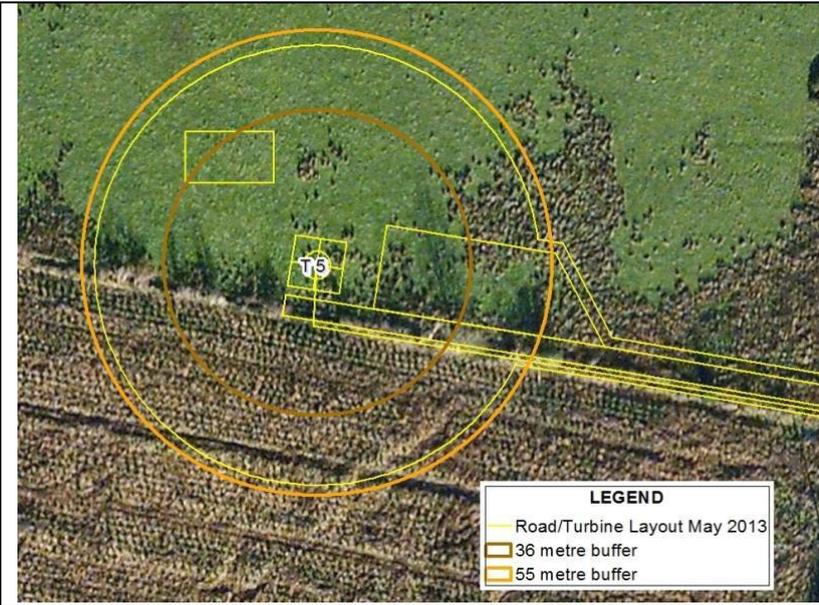
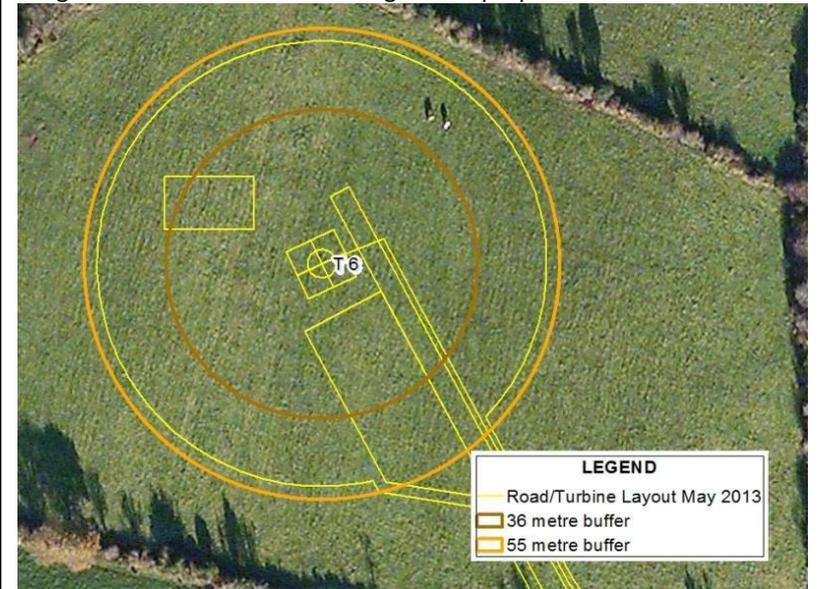
*Pinewoods Wind Farm*

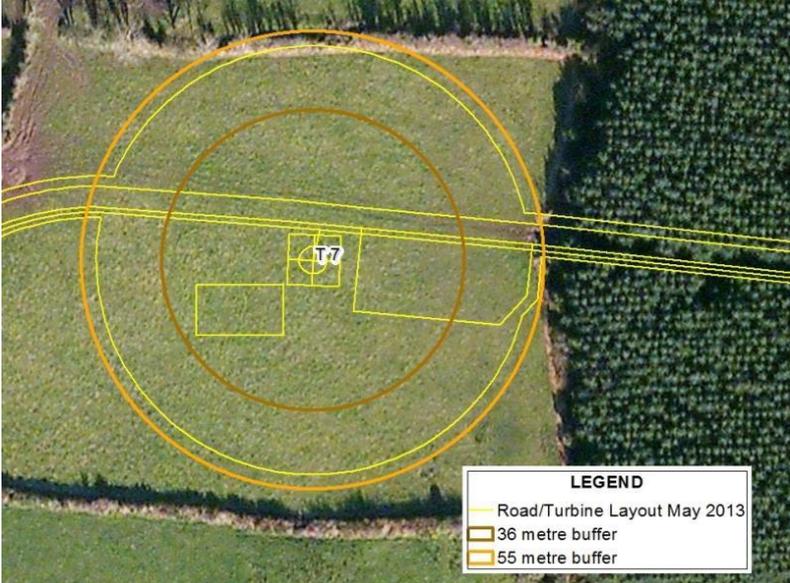
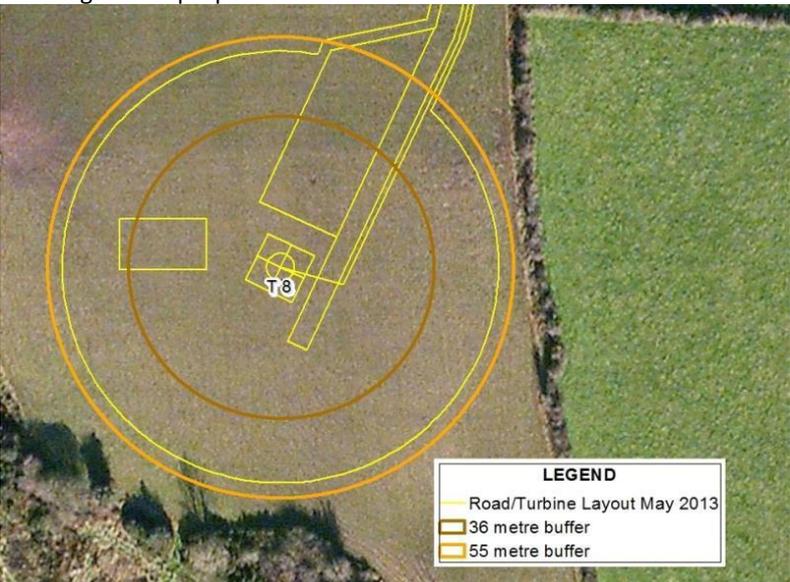


of bats coming into contact with turbines and will consequently reduce the potential *moderate negative* impact on Leisler's bat and common and soprano pipistrelle populations to a *minor negative* impact.

Turbine and description of issues	Proposed mitigation
<p><b>T1</b> The turbine lies at a point where a hedgerow meets existing forestry. There was a relatively high amount of activity around this turbine position comprising a minimum of four species of bat. A particularly high level of activity was recorded during the static detector survey in September. An enhanced buffer distance between this turbine and any habitat features should be applied.</p>	<p>There is no realistic option for moving this turbine position. The adjoining forestry will be felled to facilitate the turbine construction and operation. It is recommended that a minimum lateral distance of 55 metres around this turbine is cleared of forestry and other habitat features including hedgerows. Replacement hedgerows, replicating the species mix of the existing hedgerow, must be replanted as mitigation. The 55 metre buffer and the proposed route of the re-planted hedgerow are shown in the figure below.</p>  <p><b>LEGEND</b>                      Road/Turbine Layout May 2013                      36 metre buffer                      55 metre buffer                      Proposed line of replacement hedgerow</p>
<p><b>T2</b> The turbine lies within an area of unimproved pasture and not close to any features considered to be routinely used by feeding or commuting bats.</p>	<p>No mitigation is proposed for this turbine location.</p>  <p><b>LEGEND</b>                      Road/Turbine Layout May 2013                      36 metre buffer                      55 metre buffer</p>
<p><b>T3</b> The turbine lies within an area of improved pasture and is bounded on the west by farm buildings and on the east and south by forestry edge. The wider area had a recorded medium level of usage by bats during surveys.</p>	<p>Iterative design resulted in the proposed location of the turbine being moved to ensure a minimum 36 metres from farm buildings and 55 metres from forestry edge. No further mitigation is proposed for this turbine.</p>

<p>minimum buffer distance between this turbine and habitat features (including forestry and farm buildings) should be applied.</p>	
<p><b>T4</b> The turbine lies within an area of semi-improved pasture and not close to any features considered to be routinely used by feeding or commuting bats.</p>	<p>No mitigation is proposed for this turbine location.</p> 
<p><b>T5</b> The turbine lies within an area of semi-improved pasture but in close proximity to forest edge habitat. An appropriate buffer distance between this turbine and forest edge habitat should be applied.</p>	<p>It is recommended that a minimum lateral distance of 55 metres around this turbine is cleared of forestry to avoid impacts. The 55 metre buffer is shown in the figure below.</p>

	 <p><b>LEGEND</b></p> <ul style="list-style-type: none"> <li>— Road/Turbine Layout May 2013</li> <li>○ 36 metre buffer</li> <li>○ 55 metre buffer</li> </ul>
<p><b>T6</b></p> <p>The turbine lies within an area of improved pasture. The wider area had a recorded medium level of usage by bats during surveys. A minimum buffer distance between this turbine and habitat features (hedgerows) has been applied.</p>	<p>Iterative design resulted in the proposed location of the turbine being moved southwards to ensure a minimum 55 metres from the nearest hedgerow habitat. No further mitigation is proposed for this turbine.</p>  <p><b>LEGEND</b></p> <ul style="list-style-type: none"> <li>— Road/Turbine Layout May 2013</li> <li>○ 36 metre buffer</li> <li>○ 55 metre buffer</li> </ul>

<p><b>T7</b>                  The turbine lies within an area of improved pasture near hedgerow and forestry habitat. The wider area had a recorded medium level of usage bay bats during surveys. A minimum buffer distance between this turbine and habitat features (hedgerows and forestry) has been be applied.</p>	<p>Iterative design resulted in the proposed location of the turbine being moved to ensure a minimum 36 metres from the nearest hedgerow habitat and 55 metres from forestry. No further mitigation is proposed for this turbine.</p> 
<p><b>T8</b>                  The turbine lies within an area of improved pasture and hedgerow habitat. The wider area had a recorded medium level of usage bay bats during surveys. A minimum buffer distance between this turbine and habitat features (hedgerows and treelines) has been be applied.</p>	<p>No mitigation is proposed for this turbine.</p> 

## 7 MONITORING

The mitigation programme proposed above is a precautionary one based on knowledge of the use of the site by bats and current knowledge on bats and wind farms. It is considered that the implementation of the above mitigation measures is likely to result in the likelihood of collision and / or barotrauma impacts on bats to be reduced to a very low level. However, it is noted that there are no recommended buffer distances for use in the Republic of Ireland and those adopted are as used in Northern Ireland. In addition it is acknowledged that at certain times of the year and in certain parts of the site, there was an enhanced amount of bat activity, notably by Leisler's bats. It is also noted that bat activity can change with time at any given site and, with that, potential impact levels can change.

For this reason a monitoring programme is proposed for the site that is intended to ascertain any change to the use of the site by bats after construction, to confirm the effectiveness of the adopted buffer zones in this setting and to further inform future assessments of the potential impact of wind farm proposals on bats.

The monitoring programme should include post construction surveys at a selection of turbine locations where a substantial amount of activity has been recorded and where buffer zones to different feature types can be monitored. Monitoring should be undertaken using paired static detectors with one located at the wind turbine and the other paired detector located at the nearest habitat feature in order to gather comparative data on the usage of both areas.

The monitoring programme should also include the use of static detectors at height in order to monitor any changes in the use of the site by bats flying at rotor height.

It is proposed that monitoring, using paired detectors, is undertaken at turbine T1. This is because of the relatively high level of activity recorded in the vicinity and to monitor the effectiveness of hedgerow set-back mitigation. It is recommended that comparative monitoring at ground level and at height is undertaken either at the met mast north of T5 or, preferably, from a turbine on site.

The monitoring should be undertaken for a period of 3 years following construction, or otherwise in line with guidelines current at the time of construction, with results provided to the Planning Authority for review at the end of this period. In the event

of significant changes in the use of the site by bats (notably in the event of high levels of activity in the close vicinity of turbines and evidence of bats flying at rotor blade height), targeted corpse searches and may need to be employed to monitor any impacts on the local bat population and appropriate mitigation measures may be required based on the findings of such searches.

## **8 SUMMARY AND CONCLUSION**

The survey at Pinewoods, undertaken as transect visits and the use of static bat detectors between May and October inclusive, provides a valuable understanding of bat usage of the site. The surveys showed that there is a variable level of usage of the site by bats and that bat usage of the site is generally associated with habitat features such as forestry edge and hedgerows. Comparative surveys at 4 metres and at 45 metres in altitude at the same location (away from habitat features) showed a very strong bias towards activity near the ground, with little or no activity for different species recorded at 45 metres.

Iterative design and proposed mitigation has resulted in the movement of proposed turbine positions away from features or the setting back of features from turbines where this was not feasible. Taking account of mitigation proposals, it is considered that the proposal will result in a worst case minor negative impact on bat populations at the site.

It is recognised that bat populations can change over time at sites and that there has been little monitoring on the success of buffer zones around wind turbines for bats. For this reason a monitoring programme has been proposed to be undertaken for 3 years following construction of the wind farm, with a potential for further mitigation should surveys show a significant change in bat use of the area.

## 9 REFERENCES

- Bat Conservation Ireland (in prep). *Bat Conservation Ireland Draft Turbine/Wind Farm Guidelines*. In preparation.
- Entwistle, A.C., et al (2001). *Habitat Management for Bats – a guide for land managers, landowners and their advisors*. JNCC, Peterborough.
- 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. and F. Marnell (2006). *Bat Mitigation Measures for Ireland*. Irish Wildlife Manuals. No. 25. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.
- 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.
- Mitchell-Jones, A.J. & McLeish, A.P. (2004). *Bat workers' manual*. Joint Nature Conservation Committee, Peterborough. Third Edition.
- Mitchell-Jones, A.J. (2004). *Bat mitigation guidelines*. English Nature.
- Mitchell-Jones T. & C. Carlin. (2009). *Bats and onshore wind turbines. Natural England Technical Information Note TIN051*.
- NIEA (2010). Bat survey - specific requirements for windfarm proposals
- Richardson, P. (2000). *Distribution atlas of bats in Britain and Ireland 1980 - 1999*. The Bat Conservation Trust, London, UK.
- 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.
- Shiel, C.B., Shiel, R.E., Fairley, J.S. (1999). *Seasonal changes in the foraging behaviour of Leisler's Bats (Nycatlus Leisleri) in Ireland as revealed by radio- telemetry*. Journal of Zoology of London. 249, 347-158.
- Whilde A. (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.

## Appendix 4.4: Consultation letters



## Southern Regional Fisheries Board

Bord Iascaigh Réigiúnach an Deiscirt

14<sup>th</sup> May 2010.

Ms. Catherine Keogan,  
IWCM Ltd.,  
Unit 1 Cootehill Enterprise Centre,  
Cootehill,  
Co. Cavan.



### PROPOSED WIND FARM AT KNOCKNARDAGUR BY GALETECH ENERGY DEVELOPMENTS LTD.

Dear Ms. Keogan,

I refer to your letter dated 9th March 2010 to the Eastern Regional Fisheries Board. Kindly note the proposed development site is situated within the functional area of this Board.

As you may be aware, the Southern Regional Fisheries Board is charged with the protection, conservation and promotion of fisheries within our functional area. Board policy is aimed at maintaining a sustainable fisheries resource through preserving the productive capacity of fish habitat by avoiding habitat loss, or mitigating harmful alteration to habitat. Projects such as proposed have the potential to impact on downstream fisheries resources if they are not carried out in an environmentally sensitive manner.

The following observations and comments are of necessity of a general nature, as construction proposals and method statements are not as yet available. While they apply to the proposed development in general, the waters in fisheries terms likely to be impacted act primarily as contributories to downstream habitat for juvenile salmonids and other species as well as macrophytes, algae and macroinvertebrates which as drift form a significant part of the food supply to the downstream fisheries of the Owenbeg Catchment. They also, in the context of the proposed works, have the potential to convey deleterious matter from those works such as concrete, silt, fuel, lubricating and hydraulic oils from construction plant and equipment downstream unless proper safeguards are in place.

Stream size can be misleading in regard to fish presence. A significant amount of fish rearing occurs in very small channels and seasonal streams. These streams may not be recognised as fish or macroinvertebrate habitat and their importance to fisheries sometimes overlooked.



The Southern Regional  
Fisheries Board  
Anglesea Street  
Clonmel  
Co. Tipperary  
T: (052) 6180055  
F: (052) 6123971  
E: enquiries@srfb.ie  
www.srfb.ie

Stream crossings structures should not damage fish habitat or create blockages to fish and macroinvertebrate passage. Design and choice of structure is up to the engineer or qualified person who must make a decision based on the technical and economic feasibility of the structure to pass fish and macroinvertebrates (and the requirement to protect critical fish habitats e.g. fish spawning and over wintering areas) and prevention of erosion and sedimentation. In the case of the proposed development, noting the location of the proposed turbines, it is unclear as to whether a crossing or crossings of the Owenbeg River headwaters will not be required.

Uncured concrete can kill fish and macroinvertebrates by altering the pH of the water. Pre-cast concrete should be used whenever possible, to eliminate the risk to all forms of aquatic life. When cast-in-place concrete is required, all work must be done in the dry and effectively isolated from any water that may enter the drainage network for a period sufficient to cure the concrete.

One of the potential impacts of the proposed development is the discharge of silt-laden waters to fisheries streams from newly developed sites at which earth moving and excavation works are ongoing. Silt can clog salmonid spawning beds, and juvenile salmonids are particularly sensitive to siltation of gill structures. Similarly, plant and macroinvertebrate communities can literally be blanketed over, and this can lead to loss or degradation of valuable habitat. It is important to incorporate best practices into construction methods and strategies to minimise discharges of silt/suspended solids to waters.

Silt traps should be constructed at locations that will intercept run-off to the drainage network. Traps should not be constructed immediately adjacent to natural watercourses. A buffer zone should remain between the silt trap and the watercourse with natural vegetation left intact so as to assist silt interception. All natural watercourses which have to be traversed during site development and road construction works should be effectively bridged prior to commencement. The crossing of watercourses at fords is unacceptable because of the amount of uncontrolled sedimentation that can be generated by their use.

All oils and fuels should be stored in secure bunded areas, and particular care and attention should be taken during refuelling and maintenance operations on plant and equipment. Where site works involve the discharges of drainage water to receiving rivers and streams, temporary oil interceptor facilities should be installed and maintained.

Additionally, we would request that in terms of stability both during the construction and operational phases, the developers assess and critically review the soil type and structure at the proposed turbine locations, and along the route of any proposed access track(s)/road(s) including areas where temporary or permanent stock piling of excavated material takes place. This is particularly important if the areas concerned contain peat soils.

During the construction process and operational phase, natural flow paths should not be interrupted or diverted so as to give rise to or create potential for erosion. Furthermore, excavation and installation of road(s)/access track(s) should be undertaken so as not to result in the creation of preferential flow paths that may result in erosion. Where imported materials are used in road construction, these should be such as not to be liable to become

crushed by vehicular movement, and lead to discharge of fine particulates to downstream receiving waters.

I trust these preliminary observations will be of assistance, and would be obliged to receive more detailed information, particularly as regards the proposed location of temporary and permanent access tracks/routes, as soon as same is available.

Yours sincerely,



Patrick Kilfeather,  
Senior Fisheries Environmental Officer.



**Comhshaol, Oidhreacht agus Rialtas Áitiúil**  
Environment, Heritage and Local Government

31<sup>st</sup> May 2010

Ms. Catherine Keogan,  
Environmental Manager,  
IWCM Ltd.,  
Cootchill Enterprise Centre,  
Cootchill,  
Co. Cavan,  
Ireland.

**Our Ref: G2010/152**  
**Your Ref:**

**Re: Proposed Windfarm Development at Knockardagur, Co. Laois**



A Chara,

With reference to the above mentioned proposed Windfarm please find below the nature conservation recommendations of the Dept. of the Environment, Heritage and Local Government.

With regard to any EIS for this proposed development an ecological survey should be carried out on the proposed development site to survey the habitats and species present. Such surveys should be carried out at an appropriate time of the year depending on the species being surveyed for. The EIS should include the results of the surveys. The impact of the development on the flora, fauna and habitats present should be assessed, and in particular the impact of the proposed development should be assessed on habitats listed on annex I of the Habitats Directive, on areas important for birds, on species protected under the Wildlife Acts of 1976 and 2000, on species listed on Annexes II and IV of the EC Habitats Directive (92/42/EEC) and on birds listed on Annex I of the EC Birds Directive (Council Directive 79/409 EEC). Where negative impacts are identified suitable mitigation measures must be detailed if appropriate. The impact on any flight paths of animals such as bird and bat species should also be included in the EIS. Should the survey work show that the wind turbines would impact on flight paths, such as migratory routes or routes from roosts to feeding areas, there will be a need for further consultation with the National Parks and Wildlife Service of this Dept. The EIS should also include mention of invasive alien species and the methods required to ensure they are not accidentally introduced or spread during construction.

The EIS should assess the impact on Natura 2000 sites and any other sites designated for nature conservation. In particular it should assess the impact on the habitats and species listed by NPWS as

being within such sites and any other protected species which may be present. Where negative impacts are identified suitable mitigation measures must be detailed if appropriate. This proposed development is within 2 km of the River Barrow River Nore candidate Special Area of Conservation (cSAC) (site code 002162) designated under the Habitats Directive (Council Directive 92/43/EEC). The project should be screened for appropriate assessment (AA) and if necessary subject to appropriate assessment. The EIS and AA should also assess cumulative impacts with other plans or projects if applicable.

In addition we refer you to the documents listed below which may be of use to you.

The final draft EU Guidance on Wind Energy Developments and Natura 2000 which can be downloaded from  
[http://circa.europa.eu/Public/irc/env/wind\\_nature/library?l=/final\\_draft\\_guide/guide\\_march\\_2010doc/EN\\_1.0\\_&a=d](http://circa.europa.eu/Public/irc/env/wind_nature/library?l=/final_draft_guide/guide_march_2010doc/EN_1.0_&a=d)

The Departmental Wind Energy Planning Guidelines which can be downloaded from  
<http://www.environ.ie/en/Publications/DevelopmentandHousing/Planning/FileDownload.1633.en.pdf>

Windfarms on Peatland (2008-2010) Mires and Peat volume 4 which can be found on  
<http://www.mires-and-peat.net/mpj3.html>

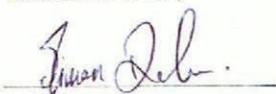
Best Practice guidance for Habitat Survey and Mapping (pre-publication version) by George F Smith, Paul O'Donoghue, Katie O'Hora and Eamon Delaney, January 2010, The Heritage Council, which can be downloaded from  
[http://www.heritagecouncil.ie/fileadmin/user\\_upload/Publications/Wildlife/HabitatMappingPre-Pub.pdf](http://www.heritagecouncil.ie/fileadmin/user_upload/Publications/Wildlife/HabitatMappingPre-Pub.pdf)

The Departmental guidance document on Appropriate Assessment available on the NPWS web site [www.npws.ie](http://www.npws.ie) under the section entitled Wildlife Planning and the Law

The EU Commission guidance entitled "Assessment of plans and projects significantly affecting Natura 2000 sites. Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC"

Finally, this recommendation is based on the papers submitted to this Department on a pre-planning basis and is made without prejudice to any decision the Minister may take upon sight of a former planning application or the submission of an Environmental Impact Statement.

Is mise le meas,



Simon Dolan  
Development Applications Unit  
Phone No.: 053 9117377  
[Simon.Dolan@environ.ie](mailto:Simon.Dolan@environ.ie)



**BirdWatchIreland**  
protecting birds and biodiversity

Unit 20 Block D  
Bullford Business  
Campus  
Kilcoole

t: +353 1 281 9878  
e: info@birdwatchireland.ie  
w: birdwatchireland.ie

Patron  
Michael D.  
Higgins  
President of

Éarlamh  
Micheál D Ó hUiginn  
Uachtarán Na  
hÉireann

Catherine Keogan,  
IWCM Ltd.,  
Clondargan,  
Stradone,  
Co. Cavan

**Your Ref:**

**Our Ref:** 28.01.15LS

13-03-15

**Re:** Proposed Wind Farm Development in North Kilkenny and South Co. Laois

Dear Ms. Keogan,

Thank you for your consultation regarding this proposed wind farm development. BirdWatch Ireland is supportive of the development of low carbon energy sources in Ireland, in particular wind energy and is working in a proactive way in order to ensure energy targets can be met, in addition to obligations to protect and enhance important areas for wildlife under the EU Nature Directives<sup>1</sup>. Given the potential for wind farms to have direct, indirect and cumulative impacts on bird populations, BirdWatch Ireland would have concerns over any developments which were not ecologically sustainable, specifically developments with potential for significant impacts on bird populations within designated sites and in the wider countryside. We would have particular concern for priority species<sup>2</sup>.

We have significant concerns regarding the construction of a wind farm at the location indicated in your scoping letter, as recent records show the possible presence of breeding Curlew within this area. Curlew are a red listed species in the Birds of Conservation Concern in Ireland 2014-2019 report and the breeding Curlew population in Ireland has suffered serious declines (82%) since 1987<sup>2</sup>. Curlew are known to be particularly sensitive to disturbance and displacement from wind infrastructure<sup>3</sup>, in addition Curlew densities have been shown to decrease significantly during wind farm construction with populations showing no recovery post-construction<sup>4</sup>.

<sup>1</sup> EU Nature Directives [Birds Directive (79/409/EEC) & Habitats Directive (92/43/EEC), Environmental Impact Assessment (EIA) Directive (85/337/EEC as amended by 97/11/EC), and Strategic Environmental Assessment (SEA) Directive (Directive 2001/42/EC).

<sup>2</sup> Colhoun K. & Cummins, S. 2013 Birds of Conservation Concern in Ireland 2014-19. *Irish Birds* 9:523-544

<sup>3</sup> 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.

<sup>4</sup> 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



Directors: K O'Byrne (Chairman), B Lavery, JB Peart, Seamus Bridgeman, Gerry Lyons, Margaret Stephens, David Fay. Registered charity no. 5703. BirdWatch Ireland is the trading name of the



**BirdWatchIreland**  
*protecting birds and biodiversity*

Unit 20 Block D	t: +353 1 281 9878	Patron	Éarlamh
Bullford Business	e: <a href="mailto:info@birdwatchireland.ie">info@birdwatchireland.ie</a>	Michael D.	Micheál D Ó hUiginn
Campus	w: <a href="http://birdwatchireland.ie">birdwatchireland.ie</a>	Higgins	Uachtarán Na
Kilcoole		President of	hÉireann

We would recommend that a detailed review is undertaken concerning the potential impacts of wind farms on the bird species relevant to this site and its surrounding areas, in addition to appropriate surveys to determine species utilization of the area, including flight-lines. Potential impacts of the proposed development alone should be considered in addition to the potential cumulative impacts from existing, approved and/or proposed developments in the area. Furthermore, should the development go ahead we would recommend post construction monitoring to include vantage point surveys and fatality monitoring.

We would appreciate if you could let us know if or when this proposal enters the planning process and if you would forward us a copy of the survey results and the Ecological Impact Assessment reports for this proposed wind farm when they become available. Digital copies are welcomed (Email: [casework@birdwatchireland.ie](mailto:casework@birdwatchireland.ie)).

Yours sincerely,

Karen Carrigy  
Policy & Advocacy Team



Directors: K O'Byrne (Chairman), B Lavery, JB Peart, Seamus Bridgeman, Gerry Lyons, Margaret Stephens, David Fay. Registered charity no. 5703. BirdWatch Ireland is the trading name of the

## Appendix 4.5: Ecological field survey data

**Table 4.A5.1** Flora species list by habitat.

		Conifer Plantatio n	Grasslan d	Earth bank	Treeline (WL2)	Hedgero w (WL1)	Scrub (WS1)
<i>Acer pseudoplatanus</i>	Sycamore	✓		✓	✓		
<i>Achillea millefolium</i>	Yarrow			✓			
<i>Aesculus hippocastanum</i>	Horse-chestnut				✓		
<i>Agrostis capillaris</i>	Common Bent			✓			
<i>Ajuga reptans</i>	Bugle	✓		✓			
<i>Alliaria petiolata</i>	Garlic Mustard	✓					
<i>Alnus glutinosa</i>	Alder	✓					
<i>Alopecurus geniculatus</i>	Marsh Foxtail		✓				
<i>Angelica sylvestris</i>	Wild Angelica			✓			
<i>Anthoxanthum odoratum</i>	Sweet Vernal -grass	✓	✓	✓			
<i>Anthriscus sylvestris</i>	Cow Parsley			✓	✓		
<i>Bellis perennis</i>	Daisy	✓	✓	✓			
<i>Betula pubescens</i>	Downy Birch	✓				✓	
<i>Blechnum spicant</i>	Hard-fern	✓		✓			
<i>Brachythecium rutabulum</i>	Rough-stalked Feather-moss			✓			
<i>Calliergonella cuspidata</i>	Pointed Spear-moss			✓			
<i>Calluna vulgaris</i>	Heather	✓	✓				
<i>Campylopus introflexus</i>	Heath Star-moss	✓					
<i>Cardamine flexuosa</i>	Wavy Bitter-cress				✓		
<i>Cardamine hirsuta</i>	Hairy Bitter-cress		✓				
<i>Cardamine pratensis</i>	Cuckooflower		✓				
<i>Carex nigra</i>	Common Sedge	✓	✓				
<i>Centaurea nigra</i>	Common Knapweed	✓					
<i>Chamerion angustifolium</i>	Rosebay Willowherb	✓					✓
<i>Chrysosplenium oppositifolium</i>	Opposite-leaved Golden-saxi frage			✓			
<i>Cirsium palustre</i>	Marsh Thistle		✓			✓	
<i>Conopodium majus</i>	Pignut					✓	
<i>Corylus avellana</i>	Hazel					✓	

		Conifer Plantatio n	Grasslan d	Earth bank	Treeline (WL2)	Hedgero w (WL1)	Scrub (WS1)
<i>Cotoneaster sp.</i>	Cotoneaster				✓		
<i>Crataegus monogyna</i>	Hawthorn			✓	✓	✓	✓
<i>Cynosurus cristatus</i>	Crested Dog's -tail		✓				
<i>Dactylis glomerata</i>	Cock's-foot			✓			
<i>Deschampsia cespitosa</i>	Tufted Hair-grass	✓					
<i>Digitalis purpurea</i>	Foxglove			✓		✓	
<i>Equisetum arvense</i>	Field Horsetail	✓					
<i>Equisetum telmateia</i>	Great Horsetail			✓			
<i>Eriophorum vaginatum</i>	Hare's-tail Cottongrass	✓					
<i>Ficaria verna</i>	Lesser Celandine	✓				✓	
<i>Filipendula ulmaria</i>	Meadowsweet		✓				
<i>Fraxinus excelsior</i>	Ash				✓	✓	✓
<i>Galium aparine</i>	Cleavers			✓		✓	
<i>Geranium robertianum</i>	Herb-Robert	✓			✓		
<i>Hedera helix</i>	Common Ivy	✓		✓	✓	✓	✓
<i>Holcus lanatus</i>	Yorkshire-fog			✓			
<i>Hyacinthoides non-scripta</i>	Bluebell			✓		✓	
<i>Hypericum perforatum</i>	Perforate St. John's-wort			✓			
<i>Hypericum tetrapterum</i>	Square-stalked St. John's wort	✓		✓			
<i>Hypochoeris radicata</i>	Cat's-ear						
<i>Ilex aquifolium</i>	Holly	✓		✓	✓	✓	
<i>Juncus articulatus</i>	Jointed Rush	✓					
<i>Juncus effusus</i>	Soft-Rush	✓	✓				
<i>Kindbergia praelonga</i>	Common Feather-moss					✓	
<i>Larix decidua</i>	European Larch	✓					
<i>Leucanthemum vulgare</i>	Oxeye Daisy	✓					
<i>Lonicera periclymenum</i>	Honeysuckle			✓		✓	
<i>Lotus pedunculatus</i>	Greater Bird's-foot-trefoil			✓			
<i>Luzula campestris</i>	Field Wood-rush		✓				
<i>Luzula sylvatica</i>	Great Wood-rush	✓		✓		✓	
<i>Medicago lupulina</i>	Black Medick	✓					

		Conifer Plantatio n	Grasslan d	Earth bank	Treeline (WL2)	Hedgero w (WL1)	Scrub (WS1)
<i>Odontites vernus</i>	Red Bartsia	✓					
<i>Orchis mascula</i>	Early-purple Orchid	✓					
<i>Oxalis acetosella</i>	Wood-sorrel	✓		✓		✓	
<i>Pedicularis sylvatica</i>	Lousewort		✓				
<i>Phleum pratense</i>	Timothy		✓				
<i>Phragmites australis</i>	Common Reed						✓
<i>Picea sitchensis</i>	Sitka Spruce	✓					
<i>Pinus contorta</i>	Lodgepole Pine	✓					
<i>Plantago lanceolata</i>	Ribwort Plantain			✓			
<i>Polypodium vulgare</i>	Polypody				✓		
<i>Polystichum setiferum</i>	Soft Shield-fern				✓		
<i>Polytrichum commune</i>	Common Haircap			✓		✓	
<i>Potentilla erecta</i>	Tormentil		✓				
<i>Potentilla sterilis</i>	Barren Strawberry			✓			
<i>Primula vulgaris</i>	Primrose	✓					
<i>Prunus laurocerasus</i>	Cherry Laurel				✓		
<i>Prunus spinosa</i>	Blackthorn	✓		✓		✓	✓
<i>Pteridium aquilinum</i>	Bracken			✓			
<i>Quercus</i> sp.	Oak				✓		
<i>Ranunculus acris</i>	Meadow Buttercup		✓				
<i>Ranunculus flammula</i>	Lesser Spearwort		✓				
<i>Ranunculus repens</i>	Creeping Buttercup	✓					
<i>Rhytidiadelphus squarrosus</i>	Springy Turf-moss	✓		✓			
<i>Rhytidiadelphus triquetrus</i>	Big shaggy-moss				✓	✓	
<i>Rosa</i> sp.	Roses						
<i>Rubus fruticosus</i> agg.	Brambles			✓	✓	✓	✓
<i>Rumex obtusifolius</i>	Broad-leaved Dock		✓				
<i>Salix</i> sp.	Willow	✓					✓
<i>Sambucus nigra</i>	Elder	✓			✓	✓	
<i>Scleroderma citrinum</i>	Common Earth-ball				✓		
<i>Senecio jacobaea</i>	Common Ragwort	✓					

		Conifer Plantatio n	Grasslan d	Earth bank	Treeline (WL2)	Hedgero w (WL1)	Scrub (WS1)
<i>Smyrniolum olusatrum</i>	Alexanders				✓		
<i>Sorbus aucuparia</i>	Rowan	✓		✓			
<i>Sphagnum cuspidatum</i>	Feathery Bog-moss	✓					
<i>Sphagnum</i> sp.	Bog mosses		✓				
<i>Stellaria graminea</i>	Lesser Stitchwort	✓					
<i>Stellaria holostea</i>	Greater Stitchwort	✓					
<i>Stellaria media</i>	Common Chickweed		✓				
<i>Symphoricarpos albus</i>	Snowberry	✓			✓		
<i>Taraxacum</i> sp.	Dandelions			✓			
<i>Thuidium tamariscinum</i>	Common Tamarisk-moss	✓		✓	✓		
<i>Trifolium repens</i>	White Clover		✓				
<i>Tussilago farafara</i>	Colt's-foot	✓					
<i>Typha latifolia</i>	Bulrush	✓					
<i>Ulex europaeus</i>	Gorse	✓		✓		✓	✓
<i>Urtica dioica</i>	Common Nettle			✓		✓	
<i>Vaccinium myrtillus</i>	Bilberry	✓		✓		✓	
<i>Veronica chamaedrys</i>	Germander Speedwell			✓			
<i>Vicia sepium</i>	Bush Vetch			✓			
<i>Viola riviniana</i>	Common Dog-violet			✓	✓	✓	

**Table 4.A5.2: Macroinvertebrates recorded during the kick sampling surveys undertaken for the proposed development site during September 2014.**

	Pollution sensitivity group	Functional feeding group	Relative abundance		
			Site 2	Site 4	Site 6
<b>STONEFLIES</b> (Order Plecoptera)					
Needleflies (Leuctridae)					
<i>Leuctra</i> sp.	B	Shredder	*****	*****	****
<b>CASED CADDIS FLIES</b> (Tricoptera)					
Northern caddisflies (Limnephilidae)					
<i>Potamophylax</i> sp.	B	Shredder			**
<b>CASELESS CADDIS FLIES</b> (Trichoptera)					
Grey flags (Hydropsychidae)					
<i>Hydropsyche</i> sp.	C	Filtering collector			**
Rhyacophilidae					
The sandfly <i>Rhyacophila dorsalis</i>	C	Predator			**
Trumpet-net caddisflies (Polycentropodidae)					
<i>Polycentropus</i> sp.	C	Filtering collector	**	*****	
<b>TRUE FLIES</b> (Diptera)					
Blackfly (Simuliidae)	C	Filtering collector	*****		
Craneflies (Tipulidae)	C	Shredder			
<i>Tipula</i> sp.	C	Shredder			*
Family Chironomidae					
Green chironomid	C	Filtering collector	****		*****
House/Stable flies (Muscidae)					
<i>Limnophora</i> sp.	C				**
Biting Midge (Ceratopogonidae)	C				*
<b>BETLES</b> (Coleoptera)					
Riffle Beetle larvae (Elmidae)					
<i>Elmis</i> sp.	C	Predator	**		
Marsh beetles (Helodidae)	C	Predator	*	*	**

Water Scavenger Beetle					
<i>Hydrophilidae</i>		Predator			*
<b>SNAILS</b> (Mollusca, Gastropoda)					
Family Ancyliidae					
River limpet <i>Ancylus fluviatilis</i>	C	Scraper	****	***	
<b>CRUSTACEANS</b> (Crustacea)					
Amphipods (Amphipoda, Gammaridae)					
Freshwater shrimp <i>Gammarus duebeni</i>	C	Shredder	*****	*****	
<b>LEECHES</b> (Hirudinae)					
Glossiphonidae					
<i>Glossiphonia</i> sp.	D	Predator		**	
<i>Hemiclepsis marginata</i>	D	Predator		*	
<b>BUGS</b> (Hemiptera)					
Gerridae					
<i>Gerris</i> sp.	D	Predator	*		
<b>SEGMENTED WORMS</b> (Annelida, Clitellata)					
Aquatic earthworm (Lumbriculidae)	D	Collector	**	***	*
<b>No. of different families</b>			<b>10</b>	<b>7</b>	<b>11</b>
<b>Q-value</b>			<b>n/a</b>	<b>n/a</b>	<b>3</b>
<b>SSRS</b>			<b>4</b>	<b>4.8</b>	<b>6.4</b>
<b>SSRS category</b>			<b>At risk</b>	<b>At risk</b>	<b>At risk</b>

\*Present (1 or 2 individuals), \*\*Scarce/Few (<1%), \*\*\*Small Numbers (<5%), \*\*\*\*Fair Numbers (5-10%), \*\*\*\*\*Common (10-20%), \*\*\*\*\*Numerous (25-50%), \*\*\*\*\*Dominant (50-75%), \*\*\*\*\*Excessive (>75%).

**Table 4.A5.3: Selected chemical water quality characteristics of the aquatic survey sites examined downslope of the proposed development site**

<i>Site</i>	<i>Temperature (°C)</i>	<i>Dissolved Oxygen (%)</i>	<i>Dissolved Oxygen (mg O<sub>2</sub>l<sup>-1</sup>)</i>	<i>Conductivity (µS cm<sup>-1</sup>)</i>	<i>pH</i>
2	15.5	91.6	9	350	8.5
4	14.1	84.4	8.86	143.8	8.3
6	14.1	113.5	11.65	546	8.7
7	14.6	83.1	8.31	198.2	8.2