ENVIRONMENTAL BALANCE IN DESIGN AND CONSTRUCTION

# ELEMENT POWER IRELAND LTD.

# ENVIRONMENTAL IMPACT STATEMENT FOR THE PROPOSED MAIGHNE WIND FARM IN COUNTY KILDARE AND COUNTY MEATH

## VOLUME 2 – MAIN EIS

## CHAPTER 7 – ECOLOGY

## MARCH 2015

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# 7 ECOLOGY

## 7.1 Introduction

The ecological appraisal for the proposed Maighne Wind Farm was carried out by Fehily Timoney & Company (FTC) between December 2012 and February 2015. A series of ecological surveys were carried out at the site, including habitat and botanical surveys, bird surveys, and mammal (excluding bats) surveys. Bat surveys were carried out by Mr. Conor Kelleher. In addition, Ecofact Environmental Consultants Ltd. carried out an evaluation of the impact of the proposed development on aquatic habitats, aquatic ecological communities, and individual aquatic species. Based on the results of these various studies, FTC considered potential direct, indirect and cumulative impacts of the proposed development on the existing ecological receptors both outside and within the site and proposed appropriate mitigation measures to minimise these potential impacts.

The purpose of this evaluation was to:

- Undertake a desktop review of available ecological data for the site and area, including a review of designated sites within 15 km of Maighne Wind Farm
- Undertake ecological field surveys of the site and surrounding lands and where required on proposed cable routes, turbine delivery routes and grid connection routes
- Identify flora and fauna present on the site and adjacent lands and where required on all elements of the wind farm.
- Evaluate the ecological significance of the site
- Assess the potential impacts of the proposed wind farm development on the ecology of the site and surrounding areas including met masts, proposed cable routes, turbine delivery routes and grid connection route
- Consider measures to mitigate the potential negative impact(s) of the proposed wind farm on the ecology of the site and surrounding land.

### 7.1.1 Study Area

The site boundary for the proposed Maighne Wind Farm encloses an area of approximately 1200ha as illustrated in Figure 2.1 which is included in the Figures and Drawings Volume 2a of this EIS. The proposed development consists of the erection of up to 47 no. wind turbines with a tip height of up to 169m, access tracks, a sub-station, a permanent meteorological mast, borrow pits and associated works, temporary compounds as well as temporary minor alterations to the public road for the delivery of turbines to the site (turbine delivery route). The turbines are arranged in five wind farm clusters. The clusters are Ballynakill (10 turbines), Windmill (3 turbines), Drehid-Hortland (21 turbines), Derrybrennan (2 turbines) and Cloncumber (11 turbines). All clusters are connected via associated underground medium voltage (MV) cables which run predominately along the public road network linking back to a proposed sub-station on-site at Drehid. Here the power will be converted to AC up to a maximum voltage of 220kV for export to the Irish national grid via high voltage (HV) underground cables to either one of two existing substations located at Woodland, Co. Meath or Maynooth, Co. Kildare.

Whether the connection point to the national electricity transmission grid will be located at the Woodland or Maynooth substations will be determined by EirGrid plc, which is the statutory Transmission System Operator. Accordingly, the documentation submitted with this application for permission identified and evaluates 2 no. HV grid connection routes (which will operate at a voltage up to 220kV). The 2 no. HV grid connection cable routes included in this application will connect the proposed Maighne Wind Farm substation at Drehid to either one of two existing substations located at Woodland, Co. Meath or Maynooth, Co. Kildare. However, only one of these routes will be constructed following the identification of the preferred connection point by the Transmission System Operator.

Note that the study area for various elements of surveys undertaken may vary; this is further detailed in section 7.2.

## 7.2 Methodology

### 7.2.1 Relevant Guidance

The methodology for this assessment has been devised in consideration of the following relevant guidance published by the Environmental Protection Agency (EPA) including '*Guidelines on the information to be contained in Environmental Impact Statements* [1]' and '*Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)* [2]'.

Additional guidance available from the EU such as '*Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment'* [3] has also been considered. The assessment also takes account of '*Guidelines for Ecological Impact Assessment in the United Kingdom* [4]', published by the Chartered Institute of Ecology and Environmental Management (CIEEM). The Heritage Council publication '*Best Practice Guidance for Habitat Survey & Mapping'* [5] is also referenced.

Relevant guidance published by the National Roads Authority (NRA) such as 'Guidelines for Assessment of Ecological Impacts of National Road Schemes [6]', '*Guidelines for Assessment of Ecological Impacts of National Road Schemes, Revision 1* [7]', '*Environmental Impact Assessment of National Road Schemes – A practical guide*' [8] and '*Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes*' [9] have also been followed.

Relevant guidance from Scottish Natural Heritage (SNH) in relation to birds such as '*Recommended Bird Survey Methods to inform Impact Assessment of Onshore Wind farms* [10]','*Survey Methods for use in assessing the impacts of onshore wind farms on bird communities* [11]' and '*Assessing the cumulative impact of onshore wind energy developments* [12]' has also been utilised.

Documentation and guidance available from Meath County Council (MCC) such as '*The County Meath Biodiversity Action Plan: 2008-2012* [13]' and the '*Meath County Development Plan 2013-2019* [14]' have been referenced as have documents and guidance from Kildare County Council such as the '*Kildare County Development Plan 2011-2017* [15]' and the '*County Kildare Biodiversity Plan'* [16].

In addition, to comprehensively research and so understand the existing behaviour of bats within the study areas the approach detailed in the following guidelines were followed:

- *Bat Surveys: Best Practice Guidelines* (2nd edition) [17];
- *Wind Turbine/Wind Farm Development Bat Survey Guidelines* [18] ;
- *Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes* [19]*;*
- *Bat Surveys: Best Practice Guidelines* (2nd edition [20];
- *Bats and Onshore Wind Turbines – Interim Guidance (2nd Edition)* [21];
- *Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes* [22];
- *Guidelines for the Treatment of Bats during the Construction of National Road Schemes* [23];
- *Bat survey – specific requirements for wind farm proposals* [24];
- *Guidelines for Consideration of Bats in Wind Farm Projects* [25].

### 7.2.2 Consultation

The scope for this evaluation has been informed by consultation with An Bord Pleanála, statutory consultees, bodies with environmental responsibility and other interested parties as summarised in Chapter 4 EIA Scoping, Consultation and Key Issues. Full details, including scoping report response are available in Chapter 4 of this EIS.

### 7.2.3 Desk Study

The desk top study involved an examination of ecological aspects from sources of information including information on the National Parks and Wildlife Service (hereafter referred to as NPWS) webpage, metadata available online from the National Parks and Wildlife Service mapping system (http://webgis.npws.ie/npwsviewer/), and the National Biodiversity Data Centre (hereafter referred to as NDBC) mapping system (http://maps.biodiversityireland.ie/#/Home).

Additional sources of information such as natural heritage datasets (county surveys) commissioned by MCC, which have been made available, including a Tree, Woodland and Hedgerow Survey, a Wetlands and Coastal Habitats Survey and a County Geological Heritage Survey have also been reviewed.

### 7.2.4 Field Assessment

The following describes the individual methods employed on a taxa-specific basis.

#### *7.2.4.1 Avifauna*

*Target Species*
The following criteria has been utilised to select target species for the current study. Scottish Natural Heritage (SNH) guidance [10] on the assessment of the effects of wind farms on ornithological interests suggests that there are three important species lists from which target species be drawn, as follows:

- Species listed on Annex 1 of the Birds Directive [26]
- Red-listed birds of Conservation Concern [27]
- Schedule 1 of the Wildlife and Countryside Act 1981 (not applicable in Ireland) and;
- Regularly occurring migratory species.

In addition to the above, consideration should be given to species identified locally as of conservation concern, regionally as of conservation concern or those particularly susceptible to impact from wind farm development. Note that not all species on the above lists would be categorised as target species, e.g. most passerine species and general lowland farmland birds are not considered to be particularly susceptible to impacts from wind farms [10].

In the Irish context, it has been suggested that target species should be taken from species of conservation concern in Ireland (BOCCI [27]), those likely to occur within the vicinity of the proposed wind farm, and those most at risk from particular impacts such as disturbance and displacement [28].

'Birds of Conservation Concern in Ireland' (BoCCI) are classified into three separate lists; red, amber and green. *Red-listed* species are of high conservation concern, *Amber-listed* species are of medium conservation concern and *Green-listed* species are considered to be of no conservation concern [27].

To date three BoCCI lists have been published with the current list by Colhoun & Cummins (2014) [27] superseding the two former lists by Lynas *et al.* (2007) [29] and Newton *et al.* (1999) [30]. The conservation status of bird species found in this study was assessed using the most recent (2014) BoCCI List [27].

Additionally, a review of the bird species listed on Annex I on the EU Birds Directive (2009/147/EC) was undertaken in assessing the conservation status of birds. Annex I species are often afforded additional protection through the designation of Special Protection Areas (SPAs) throughout EU countries in addition to existing National legislation.

The following table details the species identified as target species prior to commencement of studies, based on occurrence within the study area, known sensitivies to development and conservation status:

**Table 7.1: Target Species identified for Avifauna Surveys**

| Common Name | Species | Annex I Status (18) | BoCCI status (19) |
|---|---|---|---|
| Golden Plover | *Pluvialis apricaria* | Yes | Red |
| Kingfisher | *Alcedo atthis* | Yes | Amber |
| Merlin | *Falco columbarius* | Yes | Amber |

| Common Name | Species | Annex I Status (18) | BoCCI status (19) |
|---|---|---|---|
| Whooper Swan | *Cygnus* | Yes | Amber |
| Peregrine | *Falco peregrinus* | Yes | Green |
| Greenland White Fronted Goose | *Anser albifrons* | Yes | Amber |
| Hen Harrier | *Circus cyaneus* | Yes | Amber |
| Black-headed Gull | *Larus ridibundus* | No | Red |
| Curlew | *Numenius arquata* | No | Red |
| Lapwing | *Vanellus* | No | Red |
| Woodcock | *Scolopax rusticola* | No | Red |
| Redshank | *Tringa totanus* | No | Red |
| Barn Owl | *Tyto alba* | No | Red |
| Yellowhammer | *Emberiza citronella* | No | Red |
| Common Gull | *Larus canus* | No | Amber |
| Kestrel | *Falco tinnunculus* | No | Amber |
| Lesser Black-backed Gull | *Larus fuscus* | No | Amber |
| Mute Swan | *Cygnus olor* | No | Amber |
| Snipe | *Gallinago* | No | Amber |
| Buzzard | *Buteo* | No | Green |

*Overview of Methods*

Winter season surveys were carried out from December 2012 to March 2014 inclusive. The main components were a winter walkover survey, a flight activity survey and dedicated Hen Harrier and Red Grouse surveys. Breeding season surveys were carried out from April 2013 to August 2013, with additional surveys in April 2014 to June 2014. In addition to best practice methods for surveying birds such as the Countryside Bird Survey (CBS) and breeding wader surveys following established guidance [31], surveys to address target species such as breeding Barn Owl and Merlin were also implemented following recent best practice guidance in Ireland [32] [33]. All surveys were carried out by competent field ornithologists.

*Winter Walkover Survey*

A winter walkover survey based on the previously published method in Brown and Shepherd 1993 [34] was utilised to sample general winter bird numbers and levels of activity on site. This method was utilised for winter walkover surveys as it can be easily adapted or modified to sample general birds within different habitat types in the landscape, i.e. rather than targeting wading species as per the original method it can be modified to record all species. This method is recommended in published guidance on surveys to be used when carrying out impact assessments of wind farms on birds [11]. The study area for this survey was the proposed land folio footprint.

Three walking surveys of the entire wind farm land folio footprint were conducted. On each visit individual land folios were walked using routes selected to sample the different habitats present. Routes utilised were varied across visits as were surveyors and timing of walks to avoid bias. Vantage point watches to sample levels of flight activity and to record species not easily recorded when walking (such as raptors) were incorporated, as per the published method [34], into the surveys. The direction and duration of each walking survey (including watch effort) was recorded on each visit; flight lines of note were also recorded.

Birds present within the various habitats were recorded and totals of each species per visit noted. Flight activity of target species was recorded as duration in seconds and flight lines of note recorded on maps. Target notes were made on the presence of key species such as Whooper Swan (i.e. location, habitat, behaviour) as well as additional species such as mammals and or potentially important habitats.

The subject site was walked on three separate occasions during the winter period (defined as October to March inclusive); site visits were conducted in October/November 2012 (Visit 1), January 2013 (Visit 2) and March 2013 (Visit 3) (see Appendix F1 for survey dates and times of surveys). All walkover surveys were carried out with landowner consent.

*Flight Activity Survey*

Flight activity surveys, based on observations of flight activity at pre-defined height bands (selected to match predicted rotor envelopes) are typically collated and used to establish a number of key metrics such as [35]:

1. The time each target species spends flying over a defined survey area
2. The relative use of different parts of the survey area by each target species
3. The proportion of flying time each target species spends at turbine rotor height.

The study area for this survey was the turbine clusters of Cloncumber and Derrybrennan as well as lands to the south of Derrybrennan including Lullymore Heritage Park (identified as a possible roost for Swans).

Vantage point effort following SNH guidance were carried out over the winter of 2013/2014 at these locations (Lullymore Heritage Park Ponds/Cloncumber cluster) where Whooper Swan activity had been noted close by in the winter of 2012/2013 (i.e. feeding or roosting swans had been recorded during walkover or other surveys); the Cloncumber cluster was surveyed from an elevated vantage point to the south which afforded views of the site and towards Lullymore, whilst the Lullymore Heritage Park Ponds was surveyed from an elevated point to the west of the park which allowed views both of the pond itself and also northwards towards the proposed turbine locations at Derrybrennan. Thirty-six hours of vantage point effort was carried out at each vantage point within the period October 2013 to March 2014. Spring passage in April 2014 was also surveyed.

**Table 7.2: Vantage Point Locations**

| Vantage Point number | Townland | Grid Reference |
|---|---|---|
| 1 | Lullymore | N69680 29664 |
| 2 | Cloncumber | N71545/21732 |

Following SNH guidance [10] and the results of consultation with NPWS, watches were conducted from one hour before sunrise to two hours after (total duration 180 minutes) and from two hours before sunset to one hour after, thereby sampling diurnal, crepuscular and nocturnal activity of target species.

With regard to the equipment utilised for vantage point surveys, binoculars were the primary equipment used to scan for target species. Dictaphones were utilised to dictate bird heights whilst tracking flight events. Flight heights were estimated visually within the target height bands (<50m, 50-170m,>170m) as allowed for in published guidance (SNH 2014). Flight height estimation using a clinometer or rangefinder is accepted as one means of determining flight height however this is often not practicable (equipment may be clumsy and birds may be lost from view whilst trying to focus additional equipment on a target species rapidly moving out of sight); it should be noted that in practice many flocks of swans would not fly close enough to a surveyor for a rangefinder to be used, resulting in most flights heights being estimated in any case. As is often the case an experienced observer will be able to record accurate observations at a higher frequency resulting in a larger dataset for analysis.

*Countryside Bird Survey*

For general breeding birds the method utilised was based on the existing British Trust for Ornithology (BTO) Breeding Bird Survey (BBS or CBS) [42]. The study area for this survey comprised a total of 7 no. 1 kilometre squares which were selected and centred on different habitats present within the subject site (see Figure 7.5, Volume 2a of this EIS).

For each square birds were counted over two visits, each timed to coincide with the early part of the breeding season (April to mid-May 2013) and later part of the season (mid- May to late June 2013) with visits at least four weeks apart. Pre-selected walking routes or transects (two in number) were used to walk the area within the square. Surveyors recorded all birds seen or heard as they walked methodically along their transect routes. Birds were noted in four distance categories, measured at right angles to the transect line (within 25m, between 25m-100m and over 100m from the transect line) and those seen in flight only. Recording birds in distance bands gives a measure of bird detectability and allows relative population densities to be estimated if required [42].

SNH guidance on recommended bird survey methods to inform impact assessment of onshore wind farms states:

> *"Surveys of farmland passerines especially on more intensive arable habitat are generally not required".* [10]

Countryside bird surveys were therefore carried out during one summer only as it is generally considered that passerine species are not significantly impacted by wind farms [10]; in addition variation in numbers between years is not expected to differ significantly.

*Breeding Waders*

Species of waders breeding at the Maighne Wind Farm site were surveyed within the 500m envelope around each proposed turbine location. A number of methods were combined from published literature [31] [43] and best practice guidance [10] to estimate numbers of target species breeding within this envelope. Note; unless specified otherwise the term '500m envelope' will refer to the envelope of the relevant cluster being discussed, references to individual turbines or individual turbine envelopes will be further detailed.

Methods utilised were grouped into 2 categories; those for breeding Lapwing *Vanellus* and those for other species such as Curlew *Numenius arquata*, Common Snipe *Gallinago*, Redshank *Tringa totanus*, Woodcock *Scolopax rusticola*, Common Sandpiper *Actitis hypoleucos* and Ringed Plover *Charadrius hiaticula.* For each species, a pre-defined matrix of suitable habitats was created and used to select target habitats for survey.

**Table 7.3: Target Species and Associated Suitable Breeding Habitat**

| Target Species | Suitable Breeding Habitat |
|---|---|
| Lapwing | Lowland wet grassland, arable farmland, cutover bog with pools and wet grassland |
| Snipe | Wet pastures, marsh, bogs (intact and cutover) and fens |
| Redshank | Bog |
| Curlew | Bog |
| Common Sandpiper | Streams/rivers in bog |
| Woodcock | Woodland, bog woodland |
| Ringed Plover | Cutover bog, milled peat with exposed gravel |

Survey methods for Lapwing followed those in Bibby *et al.* 2000 [31] wherein the primary count unit for breeding birds is defined as an incubating female; in addition displaying birds, birds standing guard near nests or distraction displays were also recorded as indications of occupied territories. Extensive areas of open ground were covered from roads, farm tracks or roadsides (where possible); larger areas of open ground not visible from easily accessible vantage points were walked using transects.

Surveys were carried out during the time periods recommended in Bibby *et al.* 2000 [31] although territorial behaviour noted outside these periods was also utilised in the assessment. For all additional species of wader the employed method was essentially the same and utilised transects walked through suitable habitat within 3 hours of dawn or dusk. Count units (see Table 7.5) were predefined for each target species and included in the method statement provided to surveyors.

All suitable habitats for waders were visited, at four week intervals, during the months of April, May and June 2013. Observations from each visit were annotated onto maps (locations of territories or breeding attempts) and a final, summary map produced at the end of the survey season using ArcGIS Desktop 10.1. Breeding wader summary sheets were also compiled at the end of the breeding season, indicating in each case the minimum number of breeding pairs/occupied territories known to occur (see Appendix F2: Bird Survey Data 2).

### Table 7.4 Count Units for each Wading Species

| Species | Count Unit |
|---|---|
| Lapwing | Incubating Bird |
| Common Snipe | Drumming or Chipping Bird |
| Redshank | Alarming Bird |
| Woodcock | Displaying Male |
| Ringed Plover | Presence or Absence/ Fledged Young late in season |
| Common Sandpiper | Presence or Absence/ Fledged young late in season |
| Curlew | Territorial Activity |

Due to design layout changes, any lacunae in coverage of the predicted 500m envelope were surveyed in April, May, and June 2014, following methods used previously.

*Barn Owl*

Barn Owl survey methods were designed in conjunction with Dr. John Lusby of BirdWatch Ireland and followed best practice as utilised in recent Barn Owl surveys in Ireland [44] [32]. The method employed was an occupancy search of suitable breeding or nesting sites. The method was designed not only to record Barn Owl presence or absence within the subject site hinterland, but also to provide a comparable baseline on the relative percentage occupancy of suitable sites, thereby allowing comparison with known densities in other areas. This was predicated on the low degree of availability of baseline information on this species within the study area.

The designated search area was set as a 1.5km hinterland around the proposed turbine locations. Within this area all potentially suitable sites (for which access permission was granted) were cold searched for occupancy by Barn Owl. For each location visited the grid reference was noted and the site scored on the following metrics: Suitability (four categories), Nesting Opportunities Present (nine categories) and Activity (three categories). Any additional species present were also noted.

Locations of all suitable sites (occupied or unoccupied) were recorded using a GPS and mapped with ArcGIS Desktop 10.1.

*Merlin*

Merlin surveys were centred on suitable habitat for the species and methods used were based on previous surveys in Ireland [33] [45]; developed in association with Dr. John Lusby of BirdWatch Ireland and agreed with NPWS. Areas of potentially suitable habitat for Merlin, as defined in previous surveys [45] [33], exists within or adjacent to the clusters which comprise the Maighne Wind Farm site. The study area for Merlin was defined as a 1km square centrally placed on the available suitable habitat (illustrated in Figure 7.5.0, Volume 2a of this EIS). A total of 3 no. 1 km squares were surveyed for Merlin presence.

Three visits were undertaken to the study square, each at 4-week intervals and timed to coincide with periods of Merlin activity (April to mid-May 2013, mid-May to late June 2013, and July to mid-August 2013). Prior to the first visit, all areas within the square identified as not suitable for Merlin (open water, urban areas, farmland, enclosed pastures and areas above 700m) were excluded from the target search area.

The remaining habitat was walked using parallel transects 120m apart and intensively searched for evidence of Merlin. Features such as suitable nest sites (old corvid nests) and suitable perches (posts, hummocks, boulders, remnant peat stands and root mats) were noted and the grid reference recorded. Transect locations were recorded on ortho-photographs of the study square.

Recorded information/evidence was defined in the form of secondary Merlin evidence (whitewash, pellets, feathers), prey remains (feather spots, moth wings, prey remains etc.), nests (possible or occupied) and direct observations (calling birds, displaying birds, hunting birds, inter-specific aggression etc.).

Locations of collected evidence or observations were recorded for subsequent visits and prey remains and pellets were collected, placed in a bag and labelled with the date, site and location (for subsequent analysis). Additional raptor species such as Kestrel, Sparrowhawk or Buzzard were noted. Evidence of species such as Long-Eared Owl (in the form of pellets) was also collected if recorded.

*Hen Harrier*

Hen Harrier surveys, following methods used in the Irish Hen Harrier Winter Roost Survey (IHHWS [46]) were carried out at known roosts or areas with potential for roosts, within the study area. This focussed on two historically utilised roosts whose locations were provided from NPWS following consultation. Numbers of birds utilising these roosts, in addition to access routes to and from roosts and other flight activity was recorded over 2 winters (October 2012 to March 2014). Note: the location of any roosting activity by Hen Harrier was agreed to be kept confidential following consultation with NPWS.

*Red Grouse*

Red Grouse surveys were carried out at 2 (Windmill and Drehid-Hortland) of the 5 clusters which comprise the Maighne Wind Farm site. The method employed followed published best practice utilised in the recent National Red Grouse survey [47]. Transects were walked through suitable habitat for this species and a tape lure of a calling male Red Grouse was played at set intervals. Any responses were noted. The use of a tape lure was carried out under license.

#### *7.2.4.2 Terrestrial Mammals (excluding Bats)*

Mammal surveys were carried out in tandem with winter walkover surveys over the winter period 2012/2013. Any sightings, tracks or signs (including droppings, resting places, burrows and setts) of mammals occurring within, or in the vicinity, of the site were recorded using field notes and/or hand held GPS units. All evidence of note in regard to mammals was recorded as target notes and subsequently digitised using ArcGIS Desktop 10.1.

In the case of Otter proposed access track water course crossings were visited in November and December 2014 when internal road layouts had been finalised to check for breeding sites or resting places. In addition watercourse crossings on the proposed MV cable route and Grid Connection route were surveyed for evidence of Otter.

In the case of the proposed wind farm, the proposed locations of the wind turbines are primarily away from Otter habitat, given the precautionary buffer imposed on water features such as streams, rivers and lakes. The likely impact therefore is disturbance to any resting places or breeding sites, potentially affected by bridge works, the building or placement of new bridges and trenchless techniques at off road crossings of rivers and streams along the proposed cable route or indirect impacts on water quality which may affect Otter habitat and prey. The zone of influence for trenchless crossings at bridges was deemed to be low, due to the largely non-invasive nature of the works and diurnal timing. In that case surveyors walked 100m either side of the proposed bridge or structure crossing, to check for evidence in the form of Spraints, Tracks, Feeding Remains, Slides and Holts. Locations of evidence were recorded and holts or possible holt locations recorded with a handheld GPS.

### *7.2.4.3 Terrestrial Mammals (Bats)*

*Introduction*

Bats utilise treeline and hedgerow boundaries of agricultural grasslands, sheltered minor roads and lanes, scrub and woodland edge habitats as foraging areas and commuting routes and large-scale development in such areas may adversely affect bats in a number of ways such as vegetation removal or new tracks which may impact bats through the creation of open space barriers that bats may be unwilling to cross. Bat roosts in trees or buildings may be lost if they have to be removed. The removal of hedgerows and treelines and the loss of mature trees, draining of wet areas and provision of artificial lighting all affect the availability of invertebrate prey and feeding areas. It is essential therefore that a comprehensive study of bat activity at affected sites be undertaken (as was for the current appraisal) to identify any conflict zones and hence to avoid or reduce impacts through mitigation to safeguard these animals.

Previously referenced guidelines recommend that the potential impacts of a proposed development on bats are assessed over several seasons in order to take into consideration the affect the planned development may have on the nightly and seasonal behaviour of bats including:

- Post hibernation spring re-emergence
- Peak summer activity
- Autumnal mating behaviour and, where necessary
- Winter hibernation.

Each method of surveying bats has its own specific merit in observing and identifying the different species, their occurrence and landscape use (roosts, flight paths, hunting areas). However, each method is selective. The best approach, therefore, is through using a strategic combination of techniques. As outlined below in Table 7.5.

**Table 7.5: Bat Survey Timing Maighne Wind Farm**

| Month | May 2013 | June 2013 | September 2013 | December 2013 | December 2014 |
|---|---|---|---|---|---|
| Survey Type | Spring<br>Detector surveys | Summer Detector Surveys, onsite structure surveys and roost assessment | Autumn Identification of Leisler's Bats Lekking areas, other mating sites | Winter Assessment of known hibernation sites and access of potential hibernacula if required | Structure Survey along proposed cable routes |

*Desktop Study*

A desk study of extant bat records in the vicinity of the study area was also undertaken by evaluation of relevant literature and a review of *Bat Conservation Ireland's* National Bat Records Database and the *National Parks and Wildlife Service's* National Lesser Horseshoe Bat Roost Database.

Areas likely to be of interest for bats within Maighne Wind Farn site and in the wider landscape were identified and selected from mapping and ortho-photography before being assessed on the ground as the nature and type of habitats present are indicative of the species likely to be present. During site visits, landowners were also questioned in relation to bat observations within their farmyards, dwellings and outbuildings.

*Field Methods*

Habitats on each site were assessed for their favourability for bats and where possible, structures were surveyed for bat presence either externally via bat detector, internally by visual inspection or by a combination of both. All accessible areas of such structures were inspected for bats and/or their signs using powerful torches. The presence of bats is often shown by grease staining, droppings, urine marks, corpses, feeding signs such as invertebrate prey remains and/or the presence of bat fly *Nycteribiidae* pupae, although direct observations are also occasionally made. Bat droppings are often identifiable to species-level based on their size, shape and content and those of certain species, for example brown long-eared *Plecotus auritus* and lesser horseshoe *Rhinolophus hipposideros* bats, are very distinctive and unmistakable.

An assessment of potential bat roosts in trees will be undertaken at pre-construction stage when impacted trees are known. A survey of trees to be removed is best undertaken as near as possible to felling as bats are highly mobile animals that can move into affected trees between their survey and their removal if the period is a long one.

The winter 2013/2014 assessment of bat hibernation sites within or adjacent to the study areas found that veteran and mature trees, older buildings, bridges, farm outbuildings and derelict structures have potential for use as winter roosting sites in which bats can hibernate however no such hibernation site is currently known in the local area and none was identified during the assessment. In winter, bats can secrete themselves deep within such structures and so can be present without being visible. The exception is the lesser horseshoe bat which hangs in the open within structures and is easily seen but this species is absent from the Midlands [(48)]. Bats in Ireland as elsewhere, are known to hibernate in natural caves especially in limestone areas but there are no known natural caves in Co. Kildare or Co. Meath (Drew 2004). Apart from natural underground features, manmade prehistoric underground structures - souterrains - are also known to be used by these animals and one potential such prehistoric site is present within the townland of Drehid (ref.: www.archaeology.ie) however the feature is buried and therefore not accessible to bats.

Transects through bat favourable habitats were walked in each of the planned development areas during which bat activity was recorded using heterodyne/frequency division (*BatBox Duet - BatBox Electronics*) and heterodyne/frequency division/time expansion (*Echometer EM3+ - Wildlife Acoustics*) detectors while the wider area of the proposed development was surveyed from a vehicle driven at 20kph with a detector mounted on the hedge-side of the vehicle. Bats were identified by their ultrasonic calls coupled with behavioural and flight observations and on computer by sound analysis of recorded echolocation and social calls with dedicated software (*Kaleidoscope Viewer - Wildlife Acoustics*).

Nocturnal bat activity is mainly bi-modal taking advantage of increased insect numbers on the wing in the periods after dusk and before dawn, with a lull in activity in the middle of the night. This is particularly true of 'hawking' species – i.e. bats which capture prey in the open air. However, 'gleaning' species remain active throughout the night as prey is available on foliage for longer periods. The prime periods for detecting bat activity especially flight paths and commuting routes, therefore, are two hours after dusk and again for a shorter period before dawn.

Bat activity is governed by the activity of their insect prey and insect abundance is in turn governed by weather conditions and climate. Insects, and therefore bats, are unlikely to be abroad at temperatures below 6°C or during periods of strong winds or heavy rainfall so survey in such conditions is not possible.

All field surveys were undertaken within the active bat seasons and during good weather conditions.

Due to an iterative design layout process, some areas surveyed in 2013 are now no longer within the scheme.

*Survey Constraints*

There were no climatic or seasonal constraints to the onsite assessments as each was undertaken during optimal conditions (for survey) ; at a seasonal level the prolonged winter of 2012/2013 and very cold spring of 2013 resulted in decreased numbers or indeed an absence of flying insects up to the end of May which affected bat activity. In 2013, the Irish bat fauna experienced a second consecutive winter and spring of exceptionally low temperatures. In 2012, bat activity throughout the country was noticeably affected by the severely cold temperatures with bats remaining in hibernation far longer than usual. Some species remained underground until mid-May (pers. obs.); unlike, in 'normal' years, when bats are usually active from mid-March onwards.

The prolonged and record rainfall in the summer of 2012 which followed the long winter of 2011/2012 noticeably affected a range of animal species including bees, butterflies and moths and resulted in far fewer numbers of these invertebrates being on the wing than in other years. The reduction in prey items affected bat activity and would certainly have lead to malnourised animals entering hibernation. Any young born late in the summer of 2012 would likely have perished during the following winter having had less time for feeding and, consequently, low fat reserves. The negative impacts of the spring and summer weather were then exacerbated by a second prolonged winter which lasted until the end of May 2013 with night temperatures throughout the month of only 2°C to 6°C which is certain to have resulted in greater mortality of juveniles.

The prolonged winter of 2012/2013 also resulted in staggered and late birth of young, abandonment of pups, roost absence and poor foraging activity in 2013 and to compound matters further, the bats which survived the extended winter and finally emerged from hibernation two months later than usual at the end of May had only four to five hours of darkness in which to feed compared to eight or nine hours of darkness had they emerged from hibernation in mid-March as the nights in May are far shorter.

As a result of the weather conditions during 2012 and early 2013 as outlined above, bat activity and numbers across the country were noticeably lower in the summer and autumn of 2013 than in previous years with activity being especially poor through the month of June until temperatures rose sufficiently and stabilised. There were no seasonal or climatic constraints to survey in 2014.

#### *7.2.4.4 Habitats*

*Field Survey*

A walkover survey to identify habitats was carried out at the study site during July 2013. Habitats were visited and classified according to Fossitt (2000) [49] and following best practice as in Smith *et al*. 2011 [5].

Ortho-photographs of the subject site were annotated in the field to delineate each habitat type identified. Target notes were recorded for each habitat polygon. The minimum size of habitats mapped was 400m² for polygons, or 20m for linear habitats, in line with recommended guidance [5]. The position of notable small habitats and features of interest (e.g. springs) was marked using a GPS, and recorded as points of interest. The main plant species in each habitat type were recorded on a tick list, thereby enabling a full species list for each site to be compiled (see Appendix F4). Any areas of habitat which were identified as having potential to be of Annex I quality were highlighted for further survey to confirm the Annex status.

*Marsh Fritillary Habitat Assessment*
Due to the Maighne Wind Farm being located within the potential dispersal zone of known populations of Marsh Fritillary; a habitat appraisal methodology was specifically designed or this species following consultation and training with Butterfly Conservation Ireland (BCI). Appraisal criteria was based on a number of factors such as percentage cover of food plant, aspect, slope etc. as advised by BCI. The survey sheet used for habitat appraisal for this species is included in Appendix F3. This enabled potential habitats for this species to be identified even if not currently being utilised.

#### *7.2.4.5 Aquatic Ecology*

Field survey work to inform the current ecological appraisal was undertaken during the period August to October 2013. Plate 7.1 gives the location of the five clusters of the proposed Maighne Wind Farm and with respect to water regions (Hydrometric Area and catchment).

*Legislative Context*

A diversity of flora and fauna, rare at a national level, are protected under the provisions of the Wildlife Acts, 1976 [50] and 2000 [51]; and the secondary legislation made thereunder, including the Flora Protection Order 1999 (S.I. No. 94 of 1999) [52]. The Habitats Directive 1992 is now transposed into Irish law by way of, *inter alia*, the European Communities (Birds and Natural Habitats) Regulations (2011 to 2013).

Under the Fisheries (Consolidation) Act, 1959, it is an offence to disturb the bed of a river; and written permission from Inland Fisheries Ireland is required to proceed with works in any areas where disturbance to the spawning and nursery areas of both salmonids and lampreys is predicted. Salmon, all lamprey species and their habitats are further protected under the EU Habitats Directive, 1992.

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. Suspended solids would be a key parameter here. Likewise any visual evidence of oil/fuel in the river would constitute an offence.

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 not only as any substance that is liable to injure fish but is also liable 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.

*Selection of Watercourses for Assessment*

All watercourses/water bodies which could be affected directly (i.e. within the Maighne Wind Farm development) or indirectly (i.e. within 500 m of the site boundary) were considered as part of the current appraisal. Some of the sites assessed are located greater than 500 m from the site boundary.

Generally only streams and other watercourses shown on the 1:50,000 Discovery Series Maps were examined, as watercourses smaller than this are not normally of fisheries or aquatic ecological significance.

A total of 10 sites were selected for detailed evaluation. The sites selected for assessment are given in Table 7.6 and the location of these sites is shown in Plate 7.2.

The surveys completed at each site were at a level required to make an evaluation of biological water quality, fisheries value, aquatic habitat value, and presence of rare/protected/notable aquatic species at each site. Due to land access restrictions sampling could only be undertaken at sites within the land option areas. However, watercourses downslope of the proposed development were observed from public roads and this allowed such watercourses to be adequately evaluated for the purpose of the current appraisal.

*Aquatic Habitat Appraisal*

Habitat appraisal was carried out at the rivers/streams on, and in the vicinity of, the site using the methodology given in the Environment Agency's '*River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003'* [53] and the Irish Heritage Council's *'A Guide to Habitats in Ireland'* [54]. All the affected watercourses were evaluated 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
- In stream vegetation, listing plant species occurring and their percentage coverage of the stream bottom at the sampling site (as applicable) and on the bankside
- 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*' (DANI Advisory leaflet No. 1) to assess habitat suitability for salmonids. Stream order is described using the classification system given in Strahler (1957) [55] which defines stream size based on a hierarchy of tributaries (with I$^{st}$ order streams being the smallest).

The Water Framework Directive status of waterbodies in the study area was estimated with reference to the manual *'European waters — assessment of status and pressures'* by the European Environmental Agency (2012) [56].

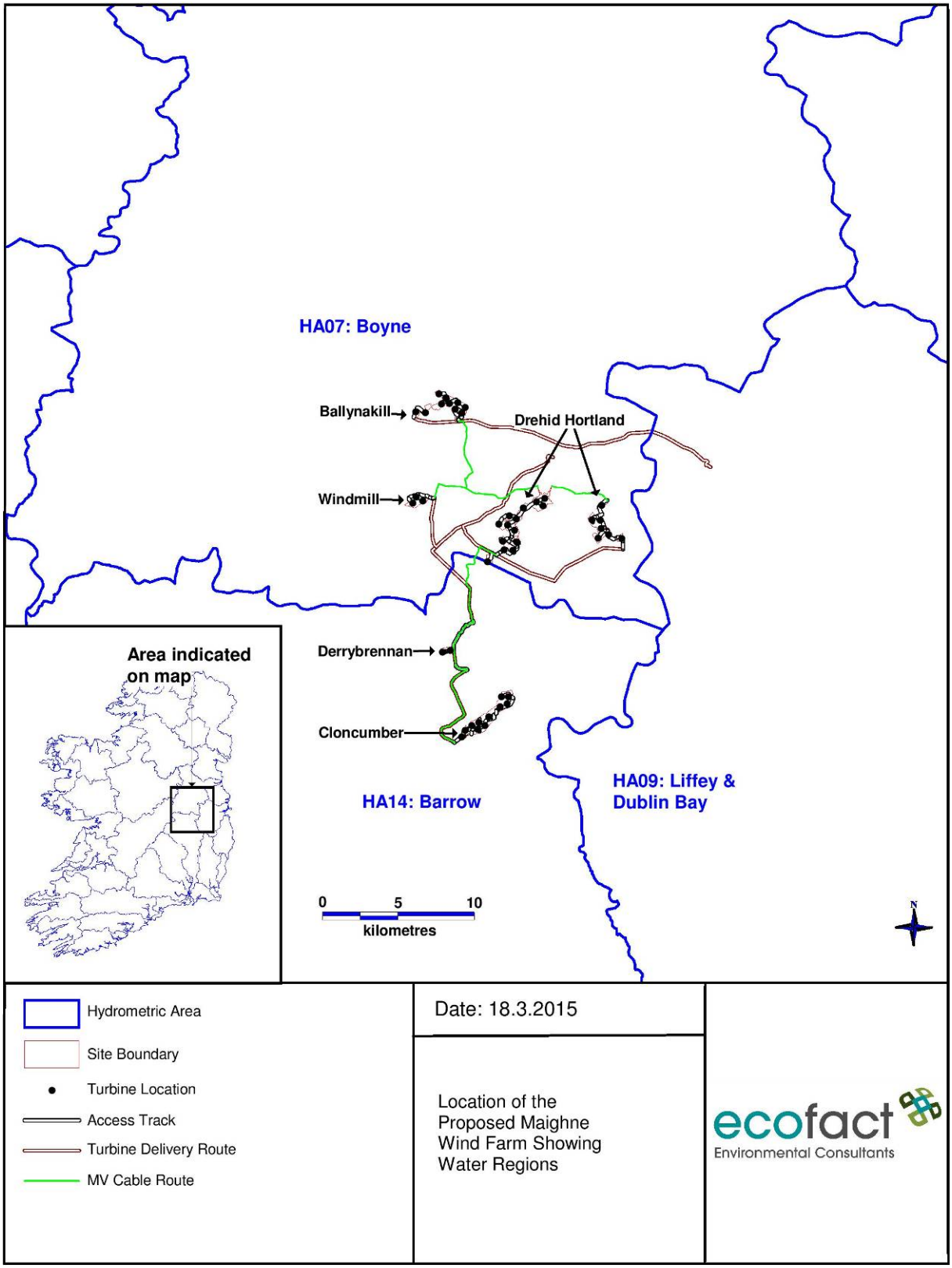



**Plate 7.1: Water Regions within five Clusters of the Proposed Maighne**

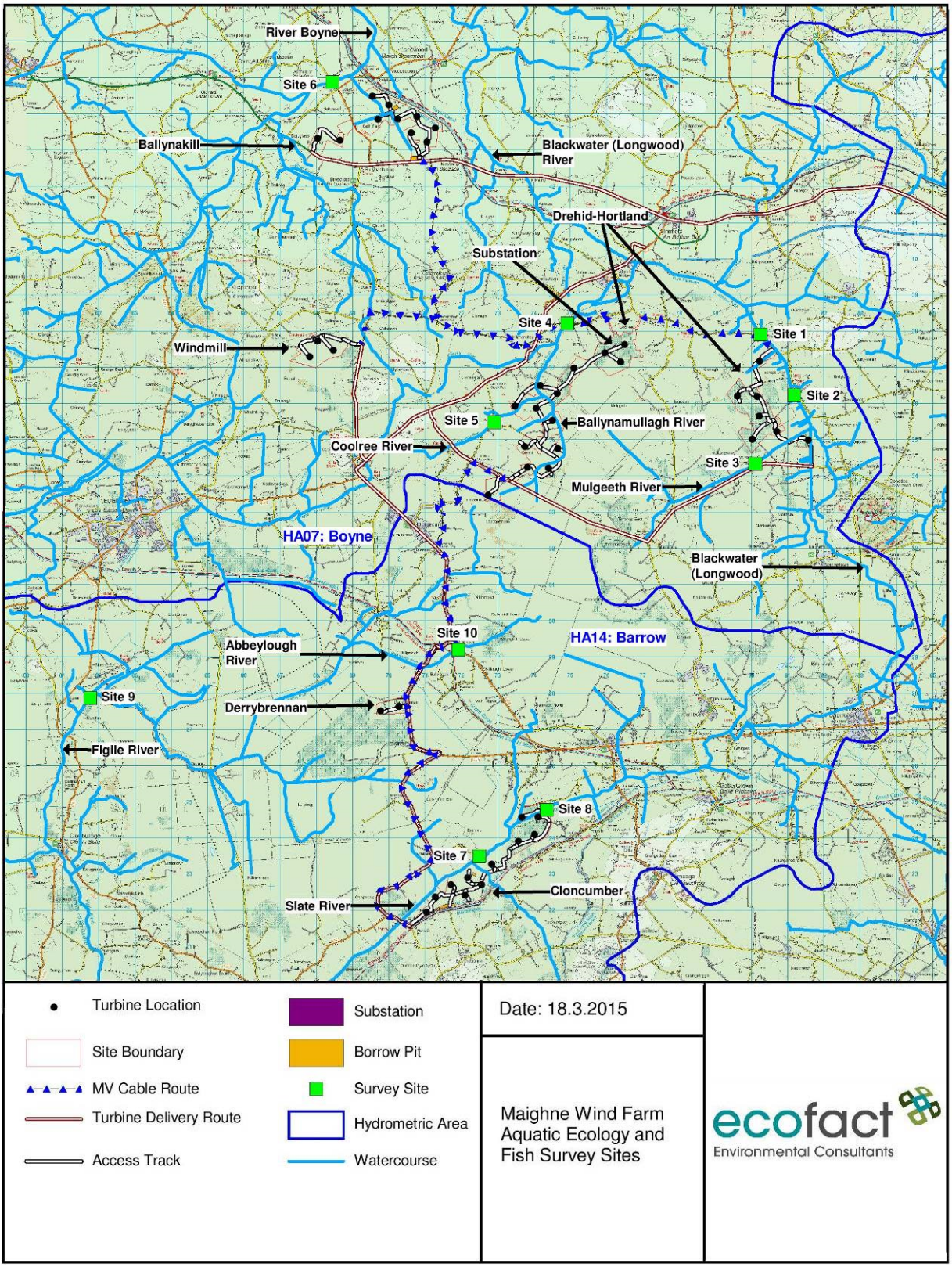



**Plate 7.2: Maighne Wind Farm Aquatic Ecology and Fisheries Survey Sites**

**Table 7.6: Location of the Aquatic Ecology and Fisheries Survey Sites August/October 2013 Survey.**

| Site No. | Catchment | Relevant component of wind farm | Sub-catchment | River | Tributary | Water-course Name | Segment code | EPA code |
|---|---|---|---|---|---|---|---|---|
| 1 | Boyne | Drehid-Hortland | Blackwater (Longwood) | Blackwater (Longwood) | | Blackwater (Longwood) | 07_925 | 07B02 |
| 2 | Boyne | Drehid-Hortland | Blackwater (Longwood) | Blackwater (Longwood) | | Blackwater (Longwood) | 07_1043 | 07H03 |
| 3 | Boyne | Drehid-Hortland | Blackwater (Longwood) | Blackwater (Longwood) | Mulgeeth | Mulgeeth | 07_1720 | 07M54 |
| 4 | Boyne | Drehid-Hortland | Blackwater (Longwood) | Blackwater (Longwood) | Coolree 07 | Coolree 07 | 07_1848 | 07C23 |
| 5 | Boyne | Drehid-Hortland | Blackwater (Longwood) | Blackwater (Longwood) | Coolree 07 | Coolree 07 | 07_1230 | 07C23 |
| 6 | Boyne | Ballynakill, Windmill | Boyne | Boyne | | Boyne | 07_951 | 07B04 |
| 7 | Barrow | Cloncumber | Figile | Slate | | Slate | 14_1574 | 14S01 |
| 8 | Barrow | Cloncumber | Figile | Slate | | Slate | 14_235 | 14S01 |
| 9 | Barrow | Derrybrennan | Figile | Figile | | Figile | 14_553 | 14F01 |
| 10 | Barrow | Derrybrennan | Figile | Figile | Abbeylough | Abbeylough | 14_1678 | 14A01 |

*Aquatic macroinvertebrate surveys*

Kick sampling

Qualitative sampling of benthic (or bottom dwelling) macroinvertebrates was undertaken at selected (index) sites using kick-sampling (Toner *et al.*, 2005) [(57)]. This procedure involved the use of a 'D' shaped hand net (mesh size 0.5mm; 350mm diameter) which was submerged on the river bed with its mouth directed upstream. The substrate upstream of the net was then kicked for one minute in order to dislodge invertebrates, which were subsequently caught in the net. This procedure was undertaken at three points along/across the watercourse. Stone washings and vegetation sweeps were also undertaken to ensure a representative sample of the fauna present at each site was collected.

All samples of invertebrates were combined for each site and live sorted on the river bank and identified to the level required to assign a Q-rating or Small Stream Risk Score (SSRS) score. Samples were also collected and fixed in ethanol for subsequent laboratory identification.

Biological water quality

The Quality Rating (Q) System (Toner *et al*, 2005 [(57)]) and the SSRS were used to obtain a water quality rating / risk assessment for each site.

The Quality Rating System (Q-Value) is based on the well-established sensitivities, abundance and diversity of macroinvertebrates and their relation to water quality. The changes brought about by organic pollution in the bottom dwelling (benthic) macroinvertebrate community in rivers are particularly well documented. These changes are due to the varying sensitivities of the different components of the community to the stresses caused by pollution. It is well documented that community diversity declines in the presence of pollution and that more tolerant forms progressively replace sensitive species as the level of pollution increases. The same basic Quality Rating System (Q-Value) has been used to assess the water quality of Irish rivers since 1971. It has provided the primary basis for mapping long-term trends of water quality in Irish rivers by the EPA. For the purposes of the Irish assessment procedure, benthic macroinvertebrates are divided into five indicator groups ranging from the most disturbance sensitive taxa to the most insensitive taxa as follows:

- Group A, the sensitive forms
- Group B, the less sensitive forms
- Group C, the tolerant forms

- Group D, the very tolerant forms
- Group E, the most tolerant forms.

The Q-Value assigned to a site depends on inter alia, the degree of departure of the river fauna's taxonomic composition, diversity and abundance from its reference condition at close to natural, undisturbed conditions. A Q-Value of Q5 indicates that conditions are close to reference conditions whereas a Q-Value of Q1 indicates the presence of serious pollution. The Q-Value employs the ratio of disturbance sensitive to insensitive taxa to indicate the degree or extent of change from the natural reference conditions at a site.

The Quality Rating System (Q-Value) has been intercalibrated at European level in both the Northern Geographical Intercalibration Group (NGIG) and the Central/Baltic Geographical Intercalibration Group (CBGIG). The relationship between Q-Value and Ecological Status for macroinvertebrates is as shown in Table 7.7.

### Table 7.7: Relationship between Q-Value and Ecological Status for Macroinvertebrates

| Q Value* | WFD Status | Pollution Status | Condition** |
|---|---|---|---|
| Q5, Q4-5 | High | Unpolluted | Satisfactory |
| Q4 | Good | Unpolluted | Satisfactory |
| Q3-4 | Moderate | Slightly polluted | Unsatisfactory |
| Q3, Q2-3 | Poor | Moderately polluted | Unsatisfactory |
| Q2, Q1-2, Q1 | Bad | Seriously polluted | Unsatisfactory |

** These values are based primarily on the relative proportions of pollution sensitive to tolerant macroinvertebrates (the young stages of insects primarily but also snails, worms, shrimps etc.) resident at a river site.*
*** "Condition" refers to the likelihood of interference with beneficial or potential beneficial uses*

#### Protected aquatic invertebrates

An assessment of the occurrence of rare protected species (e.g. white-clawed crayfish, freshwater pearl mussels) at sampling sites was assessed by underwater visual observation using bathyscopes.

*Fisheries assessments*

#### Visual surveys

Many of the streams on the proposed wind farm site were small first order streams or field drains that could be assessed visually and categorised as watercourses of insignificant fisheries importance that contained no fish. Other areas where access could not be provided (i.e. outside the option lands areas) were also assessed visually from publically accessible areas.

#### Dip netting surveys

Qualitative netting with a 'D' shaped dip net (35cm diameter, 2mm mesh) was carried out at selected sites to check for the presence/absence of small fish. This method was generally employed in drains and very small watercourses. The net was used in a circular motion to intercept small fish sheltering in instream vegetation stands and under the bank vegetation overhang.

#### Electrofishing surveys

An electrical fishing assessment was carried out at Site 9 on the Figile River under authorisation from the DCENR 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) at 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 (Smith Root-LR 24 backpack or Marine Electrics Safari Researcher 660D) was used during the assessment. Fishing was carried out continuously for 5 minutes at each site and captured fish were collected into a container of river water. Captured fish were then anaesthetised using a solution of 2-phenoxyethanol and measured to the nearest mm using a measuring board. Subsequent to this the fish were allowed to recover in a container of river water. All fish were released alive and spread evenly over the sampling area. Following completion of the fishing the dimensions and physical habitat characteristics of each site were recorded.

The evaluation criteria used in the current assessment follows the '*Guidelines for the Assessment of Ecological Impacts of National Realignments – Revision 2*' [58]. The evaluation of 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 therefore necessary to identify the value of ecological features within the study area in order to evaluate the significance and magnitude of possible impacts.

Following the guidance set out by the NRA (2009 [6]) the study area for the proposed development has been evaluated based on an identified zone of influence with regard to the potential for pathways for impacts affecting ecological features of interest (habitats, flora and fauna).

Ecological features are assessed on a scale ranging from international-national-county-local. The local scale is taken as corresponding to the zone of influence of the development and extending to a parish area. The evaluation criteria are presented below. Watercourses, evaluated following the NRA (2009 [6]) criteria were evaluated on the basis of a number of characteristics and features defined as follows:

- Aquatic habitat refers to the in-water conditions of any watercourse; including substrate and stream structure (i.e. proportion of riffles, runs and pools)
- The fisheries value of a watercourse refers to its suitability for fish, primarily salmonids (salmon and trout), and to the associated value for recreational angling purposes
- Annex II species are those that are listed under the EU Habitats Directive (92/43/EEC)
- Annex I habitats are those that are listed under the EU Habitats Directive, including Priority Habitats
- The evaluation of water quality uses a five-point biotic index (Q-value) based on the presence and relative abundance of various invertebrates using the Environmental Protection Agency's (EPA) standard technique.

#### *7.2.4.6 Other Taxa Investigations*

Particular attention was given to Lepidoptera (butterflies and moths), Odonata (dragonflies and damselflies) and any other taxa occurring at or near the site, whilst conducting various surveys. Observations of note were recorded as target notes and locations recorded using a hand held GPS.

The conservation status of other taxa was assessed by checking if any are listed in one or more of the following: Wildlife Acts (1976-2012 [59]), the Irish Red Data List [48], the EU Habitats Directive [60] and other relevant sources.

### 7.2.5 Evaluation Criteria for Ecological Assessment

It is important to establish, on a project by project basis the receiving environment wherein a development is going to occur and any changes likely to result [6]. Ecological 'resources' such as sites, habitats, features, assemblages, species or individuals, which occur in the vicinity of a project require to be assessed. The term 'ecological receptor' is used to describe an ecological resource once a predicted impact is likely [6].

#### *7.2.5.1 Ecological Resource Evaluation*

The value of the ecological resources/receptors at the subject site was evaluated using the ecological evaluation guidance given in the National Roads Authority (NRA) guidance on assessment of ecological impacts of National Road Schemes [6].

This guidance provides ratings for resources based primarily on geographic context and allows for resources at International, National, County and Local (higher and lower value) levels. Key ecological receptors (for assessment) are those deemed to be above the 'Local Importance (lower value) evaluation. Evaluation criteria are outlined below in Table 7.8.

### Table 7.8: Ecological Resource Evaluation Criteria (from NRA (2009) [6])

| Resource Evaluation | Defining Criteria |
|---|---|
| International Importance | 'European Site' including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA) or proposed Special Area of Conservation.<br>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). Features essential to maintaining the coherence of the Natura 2000 Network.<br>Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive.<br>Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or Species of animal and plants listed in Annex II and/or IV of the Habitats Directive.<br>Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971). World Heritage Site (Convention for the Protection of World Cultural & Natural Heritage, 1972).<br>Biosphere Reserve (UNESCO Man & The Biosphere Programme). Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979).<br>Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979).<br>Biogenetic Reserve under the Council of Europe. European Diploma Site under the Council of Europe.<br>Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988). |
| National Importance | Site designated or proposed as a Natural Heritage Area (NHA).<br>Statutory Nature Reserve.<br>Refuge for Fauna and Flora protected under the Wildlife Acts.<br>National Park.<br>Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA);<br>Statutory Nature Reserve; |

| Resource Evaluation | Defining Criteria |
|---|---|
| | Refuge for Fauna and Flora protected under the Wildlife Act; and/or a National Park.<br>Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. Site containing 'viable areas' of the habitat types listed in Annex I of the Habitats Directive. |
| County Importance | Area of Special Amenity.<br>Area subject to a Tree Preservation Order.<br>Area of High Amenity, or equivalent, designated under the County Development Plan.<br>Resident or regularly occurring populations (assessed to be important at the County level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; Species of animal and plants listed in Annex II and/or IV of the Habitats Directive; Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list.<br>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 importance.<br>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.<br>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.<br>Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level. |
| Local Importance (Higher Value) | Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared;<br>Resident or regularly occurring populations (assessed to be important at the Local level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; Species of animal and plants listed in Annex II and/or IV of the Habitats Directive; Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list.<br>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;<br>Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value. |
| Local Importance (Lower Value) | Sites containing small areas of semi natural habitat that are of some local importance for wildlife;<br>Sites or features containing non native species that are of some importance in maintaining habitat links. |

### *7.2.5.2 Avifauna Receptor Evaluation*

Avifauna resources are to be initially evaluated as to whether or not they constitute key receptors for the assessment following NRA guidance as outlined in Table 7.8, previously. For the purposes of impact assessment a receptor 'importance value' or sensitivity, following published guidance as in Percival 2007 [61], SNH 2006 and literature review of published information on birds and wind farms [62] [63] [64] [65] [66] is to be calculated. Where provided receptor values from Percival 2007 are below those recommended in guidance within the Irish context [6]; then the evaluation has been increased in line with the recommended Irish evaluation as a precautionary principle. Table 7.9, illustrates the combined receptor evaluation criteria used to assign sensitivity levels to key receptors.

## Table 7.9: Avian Resource Evaluation Criteria

| Sensitivity of key receptor | Percival 2007 criteria | NRA Resource Evaluation | NRA Criteria | Combined Criteria |
|---|---|---|---|---|
| Very High. | Species is cited interest of SPA.<br><br>Species present in Internationally important numbers. | International Importance. | Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive | Species is cited interest of SPA.<br><br>Species present in Internationally important numbers.<br><br>Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive |
| High | Other non-cited species which contribute to integrity of SPA.<br><br>Ecologically sensitive species (<300 breeding pairs in UK) and less common birds of prey.<br><br>Species listed on Annex 1 of the EU Birds Directive.<br><br>Regularly occurring relevant migratory species which are rare or vulnerable | National Importance | Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list | Other non-cited species which contribute to integrity of SPA.<br><br>Ecologically sensitive species (<300 breeding pairs nationally) and less common birds of prey.<br><br>Species listed on Annex 1 of the EU Birds Directive.<br><br>Regularly occurring relevant migratory species which are rare or vulnerable<br>Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species protected under the Wildlife Acts; and/or Species listed on the |

| Sensitivity of key receptor | Percival 2007 criteria | NRA Resource Evaluation | NRA Criteria | Combined Criteria |
|---|---|---|---|---|
| | | | | relevant Red Data list (in this case BOCCI Red list). |
| Medium | Species present in regionally important numbers (>1% of regional population).<br><br>Species occurring within SPA's but not crucial to the integrity of the site.<br><br>Species listed as priority species in the UK BAP subject to special conservation measures | County Importance | Resident or regularly occurring populations (assessed to be important at the County level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;<br>County important populations of species.<br>Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level. | Species present in regionally important numbers (>1% of regional population).<br><br>Species occurring within SPA's but not crucial to the integrity of the site.<br>Resident or regularly occurring populations (assessed to be important at the County level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;<br><br>County important populations of species.<br><br>Species that are rare or are undergoing a decline in quality or extent at a national level. |
| Low | Species covered above which are present very infrequently or in very low numbers.<br><br>Any other species of conservation interest not covered above, e.g. species listed on the red or amber lists of the BoCC. | Local Importance (High Value) | Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared;<br>Resident or regularly occurring populations (assessed to be important at the Local level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. | Locally important populations of priority species identified in the Local BAP, if this has been prepared;<br>Resident or regularly occurring populations (assessed to be important at the Local level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list.<br><br>Amber listed species. |
| Negligible | Species that remain common and widespread | Local Importance (Low Value) | n/a | Species that remain common and widespread<br><br>Green Listed Species. |

## 7.3 Existing Environment

### 7.3.1 Overall Site in Context

The proposed Maighne Wind Farm lies primarily within North Kildare (2 proposed turbine locations are in South County Meath). The landscape of north Kildare is strongly influenced by the Bog of Allen resulting in a mosaic of various habitats from improved agricultural farmland to raised bog, cutover bog and forestry in various stages of its lifecycle. The subject site consists of 5 clusters of proposed turbines. Of these clusters, two are located at the northern and southern extremity of the overall site in improved agricultural land, with the remaining clusters situated within or on the periphery of historical or existing raised bog basins. The majority of these basins have been exploited for resources such as peat extraction or forestry and this is reflected in the habitats within which the proposed turbines are to be placed.

The area is drained by a number of river catchments, primarily the Rivers Boyne and Blackwater (north) which drain the northern clusters of the proposed Wind Farm site whilst the River Slate and Figile (via the Cushaling and Crabtree Rivers) drain the southern clusters. Two canals, the Royal and the Grand transect the proposed development area. The M4 motorway also transects the greater area south of the northernmost cluster of proposed turbines which abuts the county boundary with Meath.

### 7.3.2 Designated Nature Conservation Sites

In total, there are 34 designated sites or proposed designated sites within 15km of the proposed development (see Table 7.10). Ten of these are Natura 2000 or 'European' sites. Of these 10 European sites, nine are candidate Special Areas of Conservation (cSACs) and one is designated as a Special Protected Area (SPA). It should be noted that a number of the cSAC sites are also designated as a Natural Heritage Areas (NHA). There are 20 proposed Natural Heritage Areas (pNHAs) and four additional, designated Natural Heritage Areas (NHAs). Table 7.10, overleaf, details the designated sites located within 15km of the proposed development, including their qualifying interests as well as the distances of these sites from the study area. Figure 7.1, Volume 2a of this EIS, shows the location and extent of the designated nature conservation sites within 15km of the study area. The NPWS sites synopses for natura sites and available information on proposed and designated Natural Heritage Areas can be viewed on www.npws.ie [67].

The River Boyne and River Blackwater cSAC (site code: 002299) is located c.800m from the proposed development at its closest point (adjacent to the Ballinakill cluster). The cSAC is designated for aquatic species such as otter (*Lutra lutra*), river lamprey (*Lampetra fluviatilis*) and salmon (*Salmo salar*), as well alkaline ferns and alluvial forest. Some of the grassland areas along the Boyne and Blackwater are used by a nationally important winter flock of Whooper Swan (*Cygnus cygnus)*; although this species is not one for which the site has been selected for designation. Under the NRA site evaluation criteria [6] this site would be rated as of 'International Importance' and is therefore a key receptor for the current assessment.

The River Boyne and River Blackwater SPA (site code: 004232) is located is located c.840m from the proposed development at its closest (adjacent to the Ballinakill cluster). The SPA is of high ornithological importance as it supports a nationally important population of kingfisher, a species that is listed on Annex I of the EU Birds Directive [26]. Under the NRA site evaluation criteria [6] this site would be rated as of 'International Importance' and is therefore a key receptor for the current assessment.

Ballynafagh Bog cSAC (site code 000391) is located 6.19km from the proposed development. The site is a raised bog situated c.1km west of Prosperous, Co. Kildare. The site contains the priority habitat active raised bog and also supports breeding Merlin. Under the NRA site evaluation criteria [6] this site would be rated as of 'International Importance' and is therefore a key receptor for the current assessment.

Pollardstown Fen cSAC (site code 000396) is located 6.74km from the proposed development. Pollardstown Fen is situated on the northern margin of the Curragh of Kildare, approximately 3 km north-west of Newbridge. It lies in a shallow depression, running in a north-west/south-east direction. About 40 springs provide a continuous supply of water to the fen. These rise chiefly at its margins, along distinct seepage areas of mineral ground above the fen level. The continual inflow of calcium-rich water from the Curragh, and from the limestone ground to the north, creates waterlogged conditions which lead to peat formation. There are layers of calcareous marl in this peat, reflecting inundation by calcium-rich water. This peat-marl deposit reaches some 6m at its deepest point and is underlain by clay. The site contains a number of habitats/species listed on Annex I/II of the EU Habitats Directive, including the priority habitat *Cladium* Fens [7210].

The site supports important invertebrate species and is the only site in Ireland to support all three *Vertigo* snail species. Under the NRA site evaluation criteria [6] this site would be rated as of 'International Importance' and is therefore a key receptor for the current assessment.

Ballynafagh Lake cSAC (site code 001387) is located 5.45km from the proposed development. Ballynafagh Lake is located about 2km north-west of Prosperous in Co. Kildare. It is a shallow alkaline lake with some emergent vegetation. The Blackwood Feeder, which connects Ballynafagh Lake to the Grand Canal, is also included in the site. The site contains the Annex habitat Alkaline fens [7230]. Under the NRA site evaluation criteria [6] this site would be rated as of 'International Importance' and is therefore a key receptor for the current assessment.

Rye Water Valley/Carton cSAC (site code 001398) is located 13.61km from the proposed development. Rye Water Valley/Carton SAC is located between Leixlip and Maynooth, in Counties Meath and Kildare, and extends along the Rye Water, a tributary of the River Liffey. The site is designated for a number of habitats and/or species listed on Annex I/II of the EU Habitats Directive including the priority habitat [7220] Petrifying Springs. Under the NRA site evaluation criteria [6] this site would be rated as of 'International Importance' and is therefore a key receptor for the current assessment.

The River Barrow and River Nore cSAC (site code 002162) is located 13.5km from the proposed development. This site consists of the freshwater stretches of the Barrow and 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, Portarlington, 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, Owveg, Munster, Arrigle and King's Rivers on the Nore. Within the context of the proposed wind farm connectivity exists with the River Barrow via the Slate River which flows southwestwards from the Cloncumber cluster and joins with the River Figile; connecting to the River Barrow further south. 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. 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 Freshwater Pearl Mussel, which is limited to a 10km stretch of the Nore, add further interest to this site. Under the NRA site evaluation criteria [6] this site would be rated as of 'International Importance' and is therefore a key receptor for the current assessment.

Mouds Bog cSAC (site code 002331) is located 5.4km from the proposed development. Mouds Bog is located about 3km north-west of Newbridge in Co. Kildare, close to the Hill of Allen, and includes amongst others, the townlands of Grangehiggin, Barretstown and Hawkfield. The site comprises a raised bog that includes both areas of high bog and cutover bog. Much of the margins of the site are bounded by trackways. Under the NRA site evaluation criteria [6] this site would be rated as of 'International Importance' and is therefore a key receptor for the current assessment.

Mount Hevey Bog cSAC (site code 002342) is located 5.4km from the proposed development. Mount Hevey Bog is situated approximately 4km north-east of Kinnegad, in the townlands of Cloncrave, White Island, Aghamore, Kilwarden and Kilnagalliagh. The Meath-Westmeath County boundary runs through the centre of the bog. The site comprises a raised bog that includes both areas of high bog and cutover bog. The Dublin-Sligo railway runs through the northern part of the bog isolating two northern lobes. The northern lobes are adjacent to the Royal Canal. The site contains the priority Annex Habitat [7110] Active Raised Bog. Mount Hevey Bog is a site of considerable conservation significance as it comprises a raised bog, a rare habitat in the E.U. and one that is becoming increasingly scarce and under threat in Ireland. The site supports a good diversity of raised bog microhabitats, including hummock/hollow complexes, pools, flushes and regenerating cutover, as well as a number of scarce plant species. Active raised bog is listed as a priority habitat on Annex I of the E.U. Habitats Directive. Priority status is given to habitats and species that are threatened throughout the E.U. Ireland has a high proportion of the total E.U. resource of this habitat type (over 60%) and so has a special responsibility for its conservation at an international level. Under the NRA site evaluation criteria [6] this site would be rated as of 'International Importance' and is therefore a key receptor for the current assessment.

The Long Derries, Edenderry cSAC (site code 000925) is located 3.09km from the proposed development.

The Long Derries is located approximately 5km south-east of Edenderry in Co. Offaly and is part of a low esker ridge running from Edenderry to Rathdangan. It consists primarily of glacial gravels interspersed with loam and peat soil. The site contains the priority Annex I habitat [6210] Orchid-rich Calcareous Grassland. Under the NRA site evaluation criteria [6] this site would be rated as of 'International Importance' and is therefore a key receptor for the current assessment.

Ballina Bog pNHA (site code 000390) is located 940m from the proposed development. Ballina Bog is situated about 8km west of Enfield and just south-west of Moyvalley in an elongated valley in Co. Kildare. Much of the surface is of good quality and quite wet in spite of the presence of many drains. The drains cross the bog in a north-east to south-west direction and also a few run east-west. The former are shallow and of long standing. Many have been filled in by bog moss (*Sphagnum* spp.) growth but retain moving water towards the edges of the bog. Two much deeper drains were inserted in the early 1980s and may cause more long-term damage to the bog.

The vegetation and structure of the surface is well developed, especially in the southern half. Substantial areas of hummock and hollow topography exist, with pools and active *Sphagnum* growth. Much of the *Sphagnum* is *S. magellanicum*. Heather (*Calluna vulgaris*) and cottongrasses (*Eriophorum vaginatum* and *E. angustifolium*) are frequent on the surface. A large part of the bog has remained unburned for 20-30 years and contains an abundance of the lichen *Cladonia impexa*. Marginal peat cutting has been carried out at the northern and eastern ends of the bog. Despite the presence of many drains, the condition of the vegetation and surface makes this bog of considerable scientific importance. It is one of the most easterly raised bogs which are relatively intact. Under the NRA site evaluation criteria [6] this site would be rated as of 'National Importance' and is therefore a key receptor for the current assessment.

Ballynafagh Bog pNHA (site code 00391) is located 6.19km from the proposed development. The site is a raised bog situated c.1km west of Prosperous, Co. Kildare. The site contains the priority habitat active raised bog and also supports breeding Merlin. Under the NRA site evaluation criteria [6] this site would be rated as of 'National Importance' and is therefore a key receptor for the current assessment.

Curragh (Kildare) pNHA (site code 000392) is located 7.35km from the proposed development. The Curragh is an extensive open plain which lies about 3km south west of Newbridge in Co. Kildare. It is bisected by the M7/N7 motorway and a railway line. The Curragh Camp and Curragh Racecourse are located within the plain. The site extends for some 10km in a north-west/south-east direction and is approximately 5km at its widest. The town and most of the racecourse are not included in the site.

The solid geology of the area consists of limestone bedrocks. Overlying this are quaternary deposits. Glacial and glaciofluvial (glacial meltwater) deposits are generally very thick in the Curragh, usually 20-70m. This over-burden forms part of what is known as the Mid-Kildare or Curragh Aquifer. In addition to groundwater flow from the aquifer, the principal surface discharges includes the River Liffey, the Tully Stream, the wetlands east of Monasterevin and the Milltown Feeder which supplies both Pollardstown Fen and the Grand Canal. Under the NRA site evaluation criteria [6] this site would be rated as of 'National Importance' and is therefore a key receptor for the current assessment.

Mouds Bog pNHA (site code 00395) is located 5.4km from the proposed development. Mouds Bog is located about 3km north-west of Newbridge in Co. Kildare, close to the Hill of Allen, and includes amongst others, the townlands of Grangehiggin, Barretstown and Hawkfield. The site comprises a raised bog that includes both areas of high bog and cutover bog. Much of the margins of the site are bounded by trackways. Under the NRA site evaluation criteria [6] this site would be rated as of 'National Importance' and is therefore a key receptor for the current assessment.

Pollardstown Fen pNHA (site code 000396) is located 6.78km from the proposed development. Pollardstown Fen is situated on the northern margin of the Curragh of Kildare, approximately 3km north-west of Newbridge. It lies in a shallow depression, running in a north-west/south-east direction. About 40 springs provide a continuous supply of water to the fen. These rise chiefly at its margins, along distinct seepage areas of mineral ground above the fen level. The continual inflow of calcium-rich water from the Curragh, and from the limestone ground to the north, creates waterlogged conditions which lead to peat formation. There are layers of calcareous marl in this peat, reflecting inundation by calcium-rich water. This peat-marl deposit reaches some 6 m at its deepest point and is underlain by clay. The site contains a number of habitats/species listed on Annex I/II of the EU Habitats Directive, including the priority habitat *Cladium* Fens [7210]. The site supports important invertebrate species and is the only site in Ireland to support all three *Vertigo* snail species. Under the NRA site evaluation criteria [6] this site would be rated as of 'National Importance' and is therefore a key receptor for the current assessment.

Rathmoylan Esker pNHA (site code 000557) is located 9.6km from the proposed development. Rathmoylan Esker is a Natural Heritage Area comprising several segments on a series of north-west to south-east trending eskers located 7km south of Trim near the village of Rathmoylan in Co. Meath. Several parts of these eskers have been colonised by semi-natural deciduous and mixed woodland. Due to extensive quarrying operations, only three intact areas of wooded esker now remain. The most natural and undisturbed portion of woodland has developed on a narrow esker ridge surrounded by pasture on three sides and an abandoned quarry on the other. Ash (*Fraxinus excelsior*) is the dominant tree in the canopy with frequent Beech (*Fagus sylvatica*) present, particularly in the drier soils near the summit of the esker.

There is also a rich association of other tree species including Hawthorn (*Crataegus monogyna*), Hazel (*Corylus avellana*), Sycamore (*Acer psuedoplatanus*), Horsechestnut (*Aesculus hippocastanum*), birch (*Betula* spp.) and occasional oak (*Quercus* spp.) and a diverse shrub and herbaceous layer including Dog-rose (*Rosa canina*) and Elder (*Sambucus nigra*). A lot of rotting wood occurs on the woodland floor and there is a good byrophyte cover in many places. Rathmoylan Esker is an excellent example of this habitat type in an undisturbed and ungrazed state. It has good species diversity, a varied age structure and has retained its natural character. Under the NRA site evaluation criteria [6] this site would be rated as of 'National Importance' and is therefore a key receptor for the current assessment.

The Long Derries, Edenderry pNHA (site code 000925) is located 3.09km from the proposed development. The Long Derries is located approximately 5 km south-east of Edenderry in Co. Offaly and is part of a low esker ridge running from Edenderry to Rathdangan. It consists primarily of glacial gravels interspersed with loam and peat soil. The site contains the priority Annex I habitat [6210] Orchid-rich Calcareous Grassland. Under the NRA site evaluation criteria [6] this site would be rated as of 'National Importance' and is therefore a key receptor for the current assessment.

Ballynafagh Lake pNHA (site code 001387) is located 5.5km from the proposed development. Ballynafagh Lake is located about 2km north-west of Prosperous in Co. Kildare. It is a shallow alkaline lake with some emergent vegetation. The Blackwood Feeder, which connects Ballynafagh Lake to the Grand Canal, is also included in the site. The site contains the Annex habitat Alkaline fens [7230]. Under the NRA site evaluation criteria [6] this site would be rated as of 'National Importance' and is therefore a key receptor for the current assessment.

Donadea Wood pNHA (site code 001391) is located 1.99km from the proposed development. This site is located about 6km north of Prosperous in Co. Kildare. It is the old demesne woodland of Donadea Castle, and is now owned by Coillte. The soil of the area is glacial drift. The entire site has been planted with a mix of deciduous and coniferous trees. Ash (*Fraxinus excelsior*) is the predominant deciduous species, with some cherry (*Prunus*
spp.), oak (*Quercus* spp.), Beech (*Fagus sylvatica*) and Sycamore (*Acer pseudoplatanus*). Occasional patches of Elder (*Sambucus nigra*), Hazel (*Corylus avellana*) and Hawthorn (*Crataegus monogyna*) are found. The site is notable for the presence of two rare species of Myxomycete fungus, namely *Diderma chondrioderma* and *Licea testudinacea*, the latter in one of only two known Irish sites. Under the NRA site evaluation criteria [6] this site would be rated as of 'National Importance' and is therefore a key receptor for the current assessment.

Liffey at Oberstown pNHA (site code 001395) is located 13.28km from the proposed development. This site is located about 2km north-west of Naas, on the east bank of the River Liffey. The site, which was surveyed in 1976, is on a steep bank of about 10m in height. It is formed of a wet boulder-clay surface covered by mosses, willow (*Salix* spp.) scrub and some herbaceous species. The main plant of interest at the site was Dark-leaved Willow (*Salix myrsinifolia*), a rare plant in Ireland. By 1983 this site had been cleared of woodland and no Dark-leaved Willow was found. This site represented a good example of riverside vegetation, with two scarce plants.

Although cleared of woodland in 1983, remnants may remain or regeneration may have occurred. Under the NRA site evaluation criteria [6] this site would be rated as of 'National Importance' and is therefore a key receptor for the current assessment.

Liffey Bank above Athgarvan pNHA (site code 001396) is located 14.92km from the proposed development. This site is located on the River Liffey about 3km north-west of Kilcullen in Co. Kildare. On one of the meanders above Athgarvan, the Liffey has cut into a very sandy patch of boulder clay, steepening its banks beyond the point where continuous vegetation can exist. The resulting unstable sandy slope faces south and is colonised by an interesting flora characteristic of unstable soil.

Beds of harder rock boulder clay make small cliffs in places and the grassland above these is of Red Fescue (*Festuca rubra*) with Wild Garden (*Thymus polytrichus*), Oxeye Daisy (*Leucanthemum vulgare*),Carline Thistle (*Carlina vulgaris*) and Spring-sedge (*Carex caryophyllea*). Under the NRA site evaluation criteria [6] this site would be rated as of 'National Importance' and is therefore a key receptor for the current assessment.

Rye Water Valley/Carton pNHA (site code 001398) is located 13.62km from the proposed development. Rye Water Valley/Carton pNHA is located between Leixlip and Maynooth, in Counties Meath and Kildare, and extends along the Rye Water, a tributary of the River Liffey. The site is designated for a number of habitats and/or species listed on Annex I/II of the EU Habitats Directive including the priority habitat [7220] Petrifying Springs. Under the NRA site evaluation criteria [6] this site would be rated as of 'National Importance' and is therefore a key receptor for the current assessment.

Ballynabarny Fen pNHA (site code 001573) is located 1.52km from the proposed development. This fen lies in a small, deep, artificially-created valley between the embankments of the Royal Canal and the nearby railway, and is situated about 3km west-north-west of Longwood in Co. Meath. Ballynabarny Fen contains a good floral representation of a fen community. This habitat is relatively uncommon and the presence of Variegated Horsetail is a bonus.

The adjacent canal adds habitat diversity to the site. Under the NRA site evaluation criteria [6] this site would be rated as of 'National Importance' and is therefore a key receptor for the current assessment.

Mount Hevey Bog pNHA (site code 001584) is located 5.4km from the proposed development. Mount Hevey Bog is situated approximately 4km north-east of Kinnegad, in the townlands of Cloncrave, White Island, Aghamore, Kilwarden and Kilnagalliagh. The Meath-Westmeath County boundary runs through the centre of the bog. The site comprises a raised bog that includes both areas of high bog and cutover bog. The Dublin-Sligo railway runs through the northern part of the bog isolating two northern lobes. The northern lobes are adjacent to the Royal Canal. The site contains the priority Annex Habitat [7110] Active Raised Bog. Mount Hevey Bog is a site of considerable conservation significance as it comprises a raised bog, a rare habitat in the E.U. and one that is becoming increasingly scarce and under threat in Ireland. The site supports a good diversity of raised bog microhabitats, including hummock/hollow complexes, pools, flushes and regenerating cutover, as well as a number of scarce plant species. Active raised bog is listed as a priority habitat on Annex I of the E.U. Habitats Directive. Priority status is given to habitats and species that are threatened throughout the E.U. Ireland has a high proportion of the total E.U. resource of this habitat type (over 60%) and so has a special responsibility for its conservation at an international level. Under the NRA site evaluation criteria [6] this site would be rated as of 'National Importance' and is therefore a key receptor for the current assessment.

The Royal Canal pNHA (site code 002103) is located immediately adjacent to the proposed development at its closest (the proposed cable route to Woodland will pass underneath the canal). The Royal Canal is a man-made waterway linking the River Liffey at Dublin to the River Shannon near Termonbarry Co. Longford. The canal has been designated as an NHA which is generally comprised of the central channel and the banks on either side of it. Under the NRA site evaluation criteria [6] this site would be rated as of 'National Importance' and is therefore a key receptor for the current assessment.

Grand Canal pNHA (site code 002104) is located immediately adjacent to the proposed development at its closest. The Grand Canal is a man-made waterway linking the River Liffey at Dublin with the Shannon at Shannon Harbour and the Barrow at Athy Otter spraints are found along the towpath, particularly where the canal passes over a river or stream. The Common Newt breeds in the ponds on the bank at Gollierstown in Co. Dublin. The Rare and legally protected Opposite-leaved Pondweed (*Groenlandia densa*) (Flora Protection Order 1999 [52]) is present at a number of sites in the eastern section of the Main Line. The ecological value of the canal lies more in the diversity of species it supports along its linear habitats than in the presence of rare species. Under the NRA site evaluation criteria [6] this site would be rated as of 'National Importance' and is therefore a key receptor for the current assessment.

Molerick Bog NHA (site code001582) is located 2.94km from the proposed development. Molerick Bog NHA is situated approximately 4 km south-west of Longwood in the townlands of Molerick, Anneville and Blackshade Co. Meath. The site comprises a raised bog that includes both areas of high bog and cutover bog. The site is bounded by the Dublin-Sligo railway line to the north and local roads to the east.

The site consists of a small basin bog with a dry surface. Cutover is found all around the site, there is broadleaved woodland located to the south-west, wet woodland is located to the north-west, scrub to the east, humid grassland to the south, a flush/fen area to the west and humid grassland on mineral soil to the north-west. Under the NRA site evaluation criteria [6] this site would be rated as of 'National Importance' and is therefore a key receptor for the current assessment.

Black Castle Bog NHA (site code 000570) is locate 8.42km form the proposed development. Black Castle Bog NHA is situated approximately 8 km north-west of Edenderry, mainly in the townlands of Clonmore, Ballyheashill and Ballymacwilliam in County Meath. The site comprises a raised bog that includes both areas of high bog and cutover bog. The north-western margins of the site are bounded by roads and those on the south-east are bounded mainly by scrub and woodland. The site consists of one crescent-shaped lobe, which is quite flat. There is an absence of permanent pools on the high bog. The raised bog is of particular interest as it is one of the most easterly remaining raised bogs in the country. The peripheral area of abandoned cutover bog has developed into a range of different habitats. Under the NRA site evaluation criteria [6] this site would be rated as of 'National Importance' and is therefore a key receptor for the current assessment.

Carbury Bog NHA (site code 001388) is located 1.43km from the proposed development. Carbury Bog NHA is situated 4 km north of Carbury, almost entirely within the townlands of Ardkill, Carbury and Knockcor, County Kildare. Carbury Hill, which rises to 142 m, lies directly south of the bog. This site originally consisted of two lobes but much of the large north-west lobe is actively cutover and has been excluded from the site.

The site consists of four sections separated by the old Edenderry railway line and the Carbury- Broadford road. Overall the southern section is quite wet with good hummock/hollow development. There is some marginal scrub woodland along the margins of the small western section. A narrow strip of deciduous woodland cuts through the main section in line with the old railway. Much of the high bog has vegetation typical of a Midland Raised Bog with Ling Heather (Calluna vulgaris) and Cottongrass (Eriophorum spp.). Other species present include Bog-rosemary (Andromeda polifolia) and Cranberry (Vaccinium oxycoccos). Under the NRA site evaluation criteria [6] this site would be rated as of 'National Importance' and is therefore a key receptor for the current assessment.

Hodgestown Bog NHA (site code 001393) is located 3.67km from the proposed development. Hodgestown Bog NHA is located 4 km north-west of Prosperous, mostly in the townlands of Hodgestown, Coolearagh East and Garvoge in Co. Kildare. The site comprises a raised bog that includes both areas of high bog and cutover bog.

This raised bog was originally part of a much larger area of bog that has now been cutover and reclaimed for forestry and agriculture. Hodgestown Bog is separated by a mineral ridge from Ballynafagh SAC (391) and together these are two of the bogs at the eastern extreme of the range of raised bogs in Ireland. Although Hodgestown bog has no pools there are hummocks throughout the high bog and there is also a small hummock/hollow complex. Cutover is found all around the high bog. Under the NRA site evaluation criteria [6] this site would be rated as of 'National Importance' and is therefore a key receptor for the current assessment.

The Liffey Valley pNHA is located 7.8km from the proposed development. The main terrestrial habitat included within the site is mixed deciduous woodland on fertile, limey alluvium and boulder clay, in which Beech (*Fagus sylvatica)* is dominant in some areas. A wet marsh occurs on the strip of land between the Mill Race and the river east of the metal bridge and west of the paint factory.

Kilteel Wood pNHA is located 13.3km from the proposed development. This site is located about 10km north-east of Naas and immediately east of the village of Kilteel. The wood is situated on a hill which rises to 248m. The site is a small heathy wood mostly of oak (Quercus spp.) and Downy Birch (Betula pubescens). Other trees present include Beech (Fagus sylvatica), Sycamore (Acer pseudoplatanus), Ash (Fraxinus excelsior) and Scots Pine (Pinus sylvestris).

Slade of Saggart and Crooksling Glen pNHA is located 14km from the proposed development. This site is located in the south-west of Co. Dublin and stretches from Brittas northwards to approximately 2km south of Saggart. The northern half of the site comprises a river valley with steep tree-covered sides, while the southern side is flatter and contains two small lakes, the Brittas Ponds.

## Table 7.10: Designated sites within 15km of the Proposed Development

| Site | Code | Features of Interest | Summary Description | Distance to Development |
|---|---|---|---|---|
| River Boyne and River Blackwater cSAC | 002299 | River lamprey (*Lampetra fluviatilis*) [1099]<br>Salmon (*Salmo salar*) [1106]<br>Otter (*Lutra lutra*) [1355]<br>Alkaline fens [7230]<br>Alluvial forests with *Alnus glutinosa* and Fraxinus excelsior (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0] | This site comprises most of the freshwater element of the River Boyne from upriver of the Boyne Aqueduct at Drogheda, the Blackwater River as far as Lough Ramor and the principal Boyne tributaries, notably the Deel, Stoneyford and Tremblestown Rivers. The rivers flow through a landscape dominated by intensive agriculture, mostly of improved grassland but also cereals. Much of the river channels were subject to arterial drainage schemes in the past. Natural flood-plains now exist along only limited stretches of river, though often there is a fringe of reed swamp, freshwater marsh, wet grassland or deciduous wet woodland. Along some parts, notably between Drogheda and Slane, are stands of tall, mature mixed woodland. Substantial areas of improved grassland and arable land are included in site for water quality reasons.<br><br>The main channel of the Boyne contains a good example of alluvial woodland of the *Salicetum albo-fragilis* type which has developed on three alluvium islands. Alkaline fen vegetation is well represented at Lough Shesk, where there is a very fine example of habitat succession from open water to raised bog. The Boyne and its tributaries is one of Ireland's premier game fisheries and offers a wide range of angling, from fishing for spring salmon and grilse to sea trout fishing and extensive brown trout fishing. The site is one of the most important in eastern Ireland for Salmon (*Salmo salar*) and has very extensive spawning grounds. The site also has an important population of River Lamprey (*Lampetra fluviatilis*), though the distribution or abundance of this species is not well known. Otter (*Lutra lutra*) is widespread throughout the site. Some of the grassland areas along the Boyne and Blackwater are used by a nationally important winter flock of Whooper Swan (*Cygnus Cygnus*).<br><br>Several Red Data Book plants occur within the site, with *Pyrola rotundifolia, Poa palustris* and *Juncus compressus*. Also occurring are a number of Red Data Book animals, notably Badger (*Meles meles*), Pine Marten *(Martes martes*) and *Rana temporaria*. The River Boyne is a designated Salmonid Water under the EU Freshwater Fish Directive. | 0.80km |

| Site | Code | Features of Interest | Summary Description | Distance to Development |
|---|---|---|---|---|
| | | | | |
| River Boyne and River Blackwater SPA | 004232 | Kingfisher (*Alcedo atthis*) [A229] | The River Boyne and River Blackwater SPA is a long, linear site that comprises stretches of the River Boyne and several of its tributaries; most of the site is in County Meath, but it extends also into Counties Cavan, Louth and Westmeath.<br><br>It includes the following river sections: the River Boyne from the M1 motorway bridge, west of Drogheda, to the junction with the Royal Canal, west of Longwood, County Meath; the River Blackwater from its junction with the River Boyne in Navan to the junction with Lough Ramor in County Cavan; the Tremblestown River/Athboy River from the junction with the River Boyne at Kilnagross Bridge west of Trim to the bridge in Athboy, County Meath; the Stoneyford River from its junction with the River Boyne to Stonestown Bridge in County Westmeath; the River Deel from its junction with the River Boyne to Cummer Bridge, County Westmeath. The site includes the river channel and marginal vegetation.<br><br>The site is a Special Protection Area (SPA) under the EU Birds Directive [26] of special conservation interest for the following species: Kingfisher (*Alcedo atthis*). | 0.84km |
| Ballynafagh Bog cSAC | 000391 | [7110] Raised Bog (Active)*<br>[7120] Degraded Raised Bog<br>[7150] Rhynchosporion Vegetation | The site is a raised bog situated c.1km west of Prosperous, Co. Kildare. The site contains the priority habitat active raised bog and also supports breeding Merlin. | 6.19km |
| Pollardstown Fen cSAC | 000396 | [7210] *Cladium* Fens*<br>[7220] Petrifying Springs*<br>[7230] Alkaline Fens<br>[1013] Geyer's Whorl Snail (*Vertigo geyeri*)<br>[1014] Narrow-mouthed Whorl Snail (*Vertigo angustior*)<br>[1016] Desmoulin's Whorl Snail (*Vertigo moulinsiana*) | Pollardstown Fen is situated on the northern margin of the Curragh of Kildare, approximately 3 km north-west of Newbridge. It lies in a shallow depression, running in a north-west/south-east direction. About 40 springs provide a continuous supply of water to the fen. These rise chiefly at its margins, along distinct seepage areas of mineral ground above the fen level. The continual inflow of calcium-rich water from the Curragh, and from the limestone ground to the north, creates waterlogged conditions which lead to peat formation. There are layers of calcareous marl in this peat, reflecting inundation by calcium-rich water. This peat-marl deposit reaches some 6 m at its deepest point and is underlain by clay. The site contains a number of habitats/species | 6.74km |

| Site | Code | Features of Interest | Summary Description | Distance to Development |
|---|---|---|---|---|
| | | | listed on Annex I/II of the EU Habitats Directive, including the priority habitat *Cladium* Fens [7210]. | |
| Ballynafagh Lake cSAC | 001387 | [7230] Alkaline Fens<br>[1016] Desmoulin's Whorl Snail (*Vertigo moulinsiana*)<br>[1065] Marsh Fritillary (*Euphydryas aurinia*) | Ballynafagh Lake is located about 2 km north-west of Prosperous in Co. Kildare. It is a shallow alkaline lake with some emergent vegetation. The Blackwood Feeder, which connects Ballynafagh Lake to the Grand Canal, is also included in the site. The site contains the Annex habitat Alkaline fens [7230]. | 5.45Km |
| Rye Water Valley/ Carton cSAC | 001398 | [7220] Petrifying Springs*<br>[1014] Narrow-mouthed Whorl Snail (*Vertigo angustior*)<br>[1016] Desmoulin's Whorl Snail (*Vertigo moulinsiana*) | Rye Water Valley/Carton SAC is located between Leixlip and Maynooth, in Counties Meath and Kildare, and extends along the Rye Water, a tributary of the River Liffey. The site is designated for a number of habitats and/or species listed on Annex I/II of the EU Habitats Directive including the priority habitat [7220] Petrifying Springs | 13.61km |
| The River Barrow and River Nore cSAC | 002162 | [1130] Estuaries<br>[1140] Tidal Mudflats and Sandflats<br>[1310] *Salicornia* Mud<br>[1330] Atlantic Salt Meadows<br>[1410] Mediterranean Salt Meadows<br>[3260] Floating River Vegetation<br>[4030] Dry Heath<br>[6430] Hydrophilous Tall Herb Communities<br>[7220] Petrifying Springs*<br>[91A0] Old Oak Woodlands<br>[91E0] Alluvial Forests*<br>[1016] Desmoulin's Whorl Snail (*Vertigo moulinsiana*)<br>[1029] Freshwater Pearl Mussel (*Margaritifera margaritifera*)<br>[1092] White-clawed Crayfish (*Austropotamobius pallipes*)<br>[1095] Sea Lamprey (*Petromyzon marinus*)<br>[1096] Brook Lamprey (*Lampetra planeri*) | This site consists of the freshwater stretches of the Barrow and 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, Portarlington, 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, Owveg, Munster, Arrigle and King's Rivers on the Nore. Within the context of the proposed wind farm connectivity exists with the River Barrow via the Slate River which flows southwestwards from the Cloncumber cluster of proposed turbines and joins with the River Figile; further connecting to the River Barrow further south.<br><br>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. 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 Freshwater Pearl | 13.5km |

| Site | Code | Features of Interest | Summary Description | Distance to Development |
|---|---|---|---|---|
| | | [1099] River Lamprey (*Lampetra fluviatilis*)<br>[1103] Twaite Shad (*Alosa fallax*)<br>[1106] Atlantic Salmon (*Salmo salar*)<br>[1355] Otter (*Lutra lutra*)<br>[1421] Killarney Fern (*Trichomanes speciosum*)<br>[1990] Nore Freshwater Pearl Mussel (*Margaritifera durrovensis*) | Mussel, which is limited to a 10 km stretch of the Nore, add further interest to this site. | |
| Mouds Bog cSAC | 002331 | [7110] Raised Bog (Active)*<br>[7120] Degraded Raised Bog<br>[7150] Rhynchosporion Vegetation | Mouds Bog is located about 3 km north-west of Newbridge in Co. Kildare, close to the Hill of Allen, and includes amongst others, the townlands of Grangehiggin, Barretstown and Hawkfield. The site comprises a raised bog that includes both areas of high bog and cutover bog. Much of the margins of the site are bounded by trackways | 5.4km |
| Mount Hevey Bog cSAC | 002342 | [7110] Raised Bog (Active)*<br>[7120] Degraded Raised Bog<br>[7150] Rhynchosporion Vegetation | The site comprises a raised bog that includes both areas of high bog and cutover bog. The site contains the priority Annex Habitat [7110] Active Raised Bog. Mount Hevey Bog is a site of considerable conservation significance as it comprises a raised bog, a rare habitat in the E.U. and one that is becoming increasingly scarce and under threat in Ireland. | 5.4km |
| The Long Derries cSAC | 000925 | [6210] Orchid-rich Calcareous Grassland* | The Long Derries is located approximately 5 km south-east of Edenderry in Co. Offaly and is part of a low esker ridge running from Edenderry to Rathdangan. It consists primarily of glacial gravels interspersed with loam and peat soil. | 3.09km |
| Ballina Bog pNHA | 000390 | Raised Bog Habitat | Ballina Bog is situated about 8km west of Enfield and just south-west of Moyvalley in an elongated valley in Co. Kildare. Much of the surface is of good quality and quite wet in spite of the presence of many drains. | 0.94km |
| Ballynafagh Bog pNHA | 00391 | Raised Bog Habitat | The site is a raised bog situated c.1km west of Prosperous, Co. Kildare. The site contains the priority habitat active raised bog and also supports breeding Merlin. | 6.19km |
| Curragh (kildare) pNHA | 000392 | Limestone Geology | The Curragh is an extensive open plain which lies about 3km south west of Newbridge in Co. Kildare. It is bisected by the M7/N7 motorway and a railway line. The Curragh Camp and Curragh Racecourse are located within the plain. | 7.35km |
| Mouds Bog pNHA | 00395 | Raised Bog Habitat | Mouds Bog is located about 3 km north-west of Newbridge in Co. Kildare, close to the Hill of Allen, and includes amongst others, the | 5.4km |

| Site | Code | Features of Interest | Summary Description | Distance to Development |
|---|---|---|---|---|
| | | | townlands of Grangehiggin, Barretstown and Hawkfield. The site comprises a raised bog that includes both areas of high bog and cutover bog. Much of the margins of the site are bounded by trackways | |
| Pollardstown Fen pNHA | 000396 | [7210] *Cladium* Fens | Pollardstown Fen is situated on the northern margin of the Curragh of Kildare, approximately 3 km north-west of Newbridge. It lies in a shallow depression, running in a north-west/south-east direction. About 40 springs provide a continuous supply of water to the fen. These rise chiefly at its margins, along distinct seepage areas of mineral ground above the fen level. The continual inflow of calcium-rich water from the Curragh, and from the limestone ground to the north, creates waterlogged conditions which lead to peat formation. There are layers of calcareous marl in this peat, reflecting inundation by calcium-rich water. This peat-marl deposit reaches some 6 m at its deepest point and is underlain by clay. The site contains a number of habitats/species listed on Annex I/II of the EU Habitats Directive, including the priority habitat *Cladium* Fens [7210]. | 6.78km |
| Rathmoylan Esker pNHA | 000557 | Semi-natural deciduous and Mixed Woodland | Rathmoylan Esker is a Natural Heritage Area comprising several segments on a series of north-west to south-east trending eskers located 7km south of Trim near the village of Rathmoylan in Co. Meath. Several parts of these eskers have been colonised by semi-natural deciduous and mixed woodland. | 9.6km |
| The Long Derries, Edenderry pNHA | 000925 | [6210] Orchid-rich Calcareous Grassland* | The Long Derries is located approximately 5 km south-east of Edenderry in Co. Offaly and is part of a low esker ridge running from Edenderry to Rathdangan. It consists primarily of glacial gravels interspersed with loam and peat soil. | 3.09km |
| Ballynafagh Lake pNHA | 001387 | Shallow alkaline lake with emergent vegetation | Ballynafagh Lake is located about 2 km north-west of Prosperous in Co. Kildare. It is a shallow alkaline lake with some emergent vegetation. The Blackwood Feeder, which connects Ballynafagh Lake to the Grand Canal, is also included in the site. The site contains the Annex habitat Alkaline fens [7230]. | 5.5km |
| Donedea Wood pNHA | 001391 | Two rare species of Myxomycete fungus and woodland | This site is located about 6km north of Prosperous in Co. Kildare. The entire site has been planted with a mix of deciduous and coniferous trees. The site is notable for the presence of two rare species of Myxomycete fungus, namely *Diderma chondrioderma* and *Licea testudinacea*, the latter in one of only two known Irish sites | 1.99km |

| Site | Code | Features of Interest | Summary Description | Distance to Development |
|---|---|---|---|---|
| Liffey at Oberstown pNHA | 001395 | Riverside Vegetation | This site represented a good example of riverside vegetation, with two scarce plants. Although cleared of woodland in 1983, remnants may remain or regeneration may have occurred. | 13.28km |
| Liffey Bank above Athgarvan pNHA | 001396 | Flora of unstable soils | This site is located on the River Liffey about 3km north-west of Kilcullen in Co. Kildare. On one of the meanders above Athgarvan, the Liffey has cut into a very sandy patch of boulder clay, steepening its banks beyond the point where continuous vegetation can exist. The resulting unstable sandy slope faces south and is colonised by an interesting flora characteristic of unstable soil. | 14.92km |
| Rye Water Valley/Carton pNHA | 001398 | [7220] Petrifying Springs*<br>[1014] Narrow-mouthed Whorl Snail (*Vertigo angustior*)<br>[1016] Desmoulin's Whorl Snail (*Vertigo moulinsiana*) | Rye Water Valley/Carton SAC is located between Leixlip and Maynooth, in Counties Meath and Kildare, and extends along the Rye Water, a tributary of the River Liffey. The site is designated for a number of habitats and/or species listed on Annex I/II of the EU Habitats Directive including the priority habitat [7220] Petrifying Springs | 13.62km |
| Ballynabarny Fen pNHA | 001573 | Fen Community | This fen lies in a small, deep, artificially-created valley between the embankments of the Royal Canal and the nearby railway, and is situated about 3km west-north-west of Longwood in Co. Meath. Ballynabarny Fen contains a good floral representation of a fen community. | 1.52km |
| Mount Hevey Bog pNHA | 001584 | [7110] Raised Bog (Active)*<br>[7120] Degraded Raised Bog<br>[7150] Rhynchosporion Vegetation | The site comprises a raised bog that includes both areas of high bog and cutover bog. The site contains the priority Annex Habitat [7110] Active Raised Bog. Mount Hevey Bog is a site of considerable conservation significance as it comprises a raised bog, a rare habitat in the E.U. and one that is becoming increasingly scarce and under threat in Ireland. | 5.4km |
| Royal Canal pNHA | 002103 | Aquatic Flora and Fauna, Corridor value | The Royal Canal is a man-made waterway linking the River Liffey at Dublin to the River Shannon near Termonbarry Co. Longford. The canal has been designated as an NHA which is generally comprised of the central channel and the banks on either side of it. | 0km |
| Grand Canal pNHA | 002104 | Diversity of species, corridor value, Flora Protection Order Species | The Rare and legally protected Opposite-leaved Pondweed (*Groenlandia densa*) (Flora Protection Order 1999 [52]) is present at a number of sites in the eastern section of the Main Line. The ecological value of the canal lies more in the diversity of species it supports along its linear habitats than in the presence of rare species. | 0km |
| Molerick Bog NHA | 001582 | Raised Bog Habitat | The site comprises a raised bog that includes both areas of high bog and cutover bog. | 2.94km |

| Site | Code | Features of Interest | Summary Description | Distance to Development |
|---|---|---|---|---|
| Black Castle Bog NHA | 000570 | Raised Bog Habitat | The site comprises a raised bog that includes both areas of high bog and cutover bog. The north-western margins of the site are bounded by roads and those on the south-east are bounded mainly by scrub and woodland. | 8.42km |
| Carbury Bog NHA | 001388 | Raised Bog Habitat | The site consists of four sections separated by the old Edenderry railway line and the Carbury- Broadford road. A narrow strip of deciduous woodland cuts through the main section in line with the old railway. Much of the high bog has vegetation typical of a Midland Raised Bog. | 1.43km |
| Hodgetown Bog NHA | 001393 | Raised Bog Habitat | The site comprises a raised bog that includes both areas of high bog and cutover bog. | 3.67km |
| Kilteel Wood pNHA | 001394 | Deciduous Woodland | This site is located about 10km north-east of Naas and immediately east of the village of Kilteel. The wood is situated on a hill which rises to 248m. The site is a small heathy wood mostly of oak (Quercus spp.) and Downy Birch (Betula pubescens). Other trees present include Beech (Fagus sylvatica), Sycamore (Acer pseudoplatanus), Ash (Fraxinus excelsior) and Scots Pine (Pinus sylvestris). In a clearing gorse (Ulex europaeus, U. gallii) and Heather (Calluna vulgaris) occur. | 13.3km |
| Slade of Saggart and Crooksling Glen pNHA | 000211 | Woodlands and Wetlands | This site is located in the south-west of Co. Dublin and stretches from Brittas northwards to approximately 2km south of Saggart. The northern half of the site comprises a river valley with steep tree-covered sides, while the southern side is flatter and contains two small lakes, the Brittas Ponds. | 14km |
| Liffey Valley pNHA | 000128 | Aquatic and Terrestrial Habitats | The main terrestrial habitat included within the site is mixed deciduous woodland on fertile, limey alluvium and boulder clay, in which Beech (*Fagus sylvatica)* is dominant in some areas. A wet marsh occurs on the strip of land between the Mill Race and the river east of the metal bridge and west of the paint factory. | 7.8km |

## 7.3.3 Ballinakill

The Ballinakill cluster is located north of the village of Broadford, Co. Kildare and south west of the town of Longwood, County Meath. The Kildare/Meath County boundary runs through the site and therefore two of the proposed 10 turbines (T1 and T2) are located in Co. Meath. The remainder are in Co. Kildare. Note existing environment data on Aquatic Ecology and Bats are presented seperately.

### *7.3.3.1 Habitats*

#### *Turbine Land Folios*

Habitat mapping was carried out at the subject site on July 5, 2013 following methods previously outlined. Habitat types identified within the study area are illustrated in Figure 7.13.7: Habitat Map, Volume 2a, and described below.

*Arable Crops (BC1)* - A number of fields within the Ballinakill cluster are planted with cereal crops such as Barley or Wheat. Under the NRA site evaluation scheme [6], this habitat would be rated as Local Importance (lower value), as it is a highly modified habitat with low species diversity.

*Drainage Ditches (FW4)* - This classification refers to a drainage channel which leads towards the River Boyne in the northern half of the cluster. The channel is managed in places and the width varies from 2-2.5m on average. The channel has a gravel substrate and aquatic vegetation includes *Apium nodiflorum* and *Sparganium erectum.* Under the NRA site evaluation scheme, this habitat would be rated as Local Importance (Lower value).

*Improved agricultural grassland (GA1)* - A number of fields of improved agricultural grassland exist within the site boundary. Typically this habitat is dominated by *Lolium perenne.* Other species include *Poa annua*, *Ranunculus repens*, *Trifolium* spp. And *Rumex* spp. Under the NRA site evaluation scheme [6], this habitat would be rated as Local Importance (lower value), as it is a highly modified habitat with low species diversity.

*Dry Calcareous and Neutral Grassland (GS1)* - Improved dry calcareous and Neutral grassland occurs throughout the site. Grasses recorded included *Cynosausus cristatus, Phleum pratense, Alopecuris pratensis, Holcus lanatus, Lolium perenne, Agrostis stolonifera, Dactylis glomerate, Poa annua*. Herbs recorded included *Ranunculus repens, Ranunculus acris, Plantago spp., Leontodon autumnalis, Cerastium fontanum, Taraxacum spp., Rumex spp. ,Cirsium arvense.*In some places *Rhinanthus minor*, *Odontites vernus* are present. Some areas have a wet grassland influence with species such as *Potentilla anserina* and abundant *Ranculus repens*. No sedges or rushes are present in these sections however. Due to improved habitat quality is assessed as low. Under the NRA site evaluation scheme [6], this habitat would be rated as Local Importance (lower value), as it is a highly modified habitat with low species diversity.

*Wet grassland (GS4)* - This classification refers to species rich wet grassland which occurs within the site. This habitat type is underlain with a substrate of peaty soil. Two variations of this habitat type were recorded with varying degrees of improvement. A field immediately east of the proposed T5 location includes a discete area which contained species associated with a remnant flush type habitat e.g. *Eriophorium augustifolium, Menyanthes trifoliate, Hydrocotyle vulgaris*. However there was no Sphagnum moss present. Other wet grassland species recorded included *Agrostus stolonifera, Agrostis canina, Holcus lanatus, Succisa preatensis, Mentha aquatic, Juncus effuses, Juncus inflexus, Juncus conglomerate, Ranunculus repens, Juncus articulates, Juncus acutiflorus, Potentilla erecta, Cirsium palustre, Prunella vulgaris, Centaurea nigra, Anthoxanthum odoratum.* This field, due to its increased diversity and slightly high value for invertebrate fauna would be classified as local importance (higher value) under the NRA classification scheme. No turbines or development are proposed for this field.

Another field of more improved GS4 exists between the proposed locations of T6 and T7. This was found to be similar to that already described but included higher cover of species indicative of improvement such as *Holcus lanatus, Agrostis stolonifera, Ranunculus repens* etc. Due to improvement habitat quality is assessed as low. Under the NRA site evaluation scheme [6], this habitat would be rated as Local Importance (lower value), as it is a highly modified habitat with low species diversity.

*Treelines (WL2)* - The predominant field boundary within this cluster is treelines. These consist of *Fraxinus excelsior, Crataegus monogyna, Corylus avellana, Prunus spinosa* and *Sambucus nigra*. Due to its corridor value under the NRA site evaluation scheme, this habitat would be rated as Local Importance (higher value) as habitats of local importance for wildlife.

*M4 Motorway Crossing*

Due to its proximity to Ballinakill (c.500m south of the cluster boundary) the proposed M4 Motorway crossing at Moyvalley is included here. Habitats within 100m of either side of the likely crossing were mapped even though it is likely that the crossing will be undertaken with minimal habitat loss. Habitats present here, many of which reflect a high level of modification (e.g. amenity grassland, buildings and artificial surfaces and ornamental or non-native planting) and not already described include the following:

*Buildings and Artificial surfaces (BL3)* - Under the NRA site evaluation scheme, this habitat would be rated as Local Importance (lower value) as habitats of local importance for wildlife.

*Amenity grassland (GA2)* - Under the NRA site evaluation scheme, this habitat would be rated as Local Importance (lower value) as habitats of local importance for wildlife.

*Ornamental/Non-native shrub (WS3* - Under the NRA site evaluation scheme, this habitat would be rated as Local Importance (lower value) as habitats of local importance for wildlife.

*Dry Meadows and Grassy Verges (GS2)* - Under the NRA site evaluation scheme, this habitat would be rated as Local Importance (higher value) as habitats of local importance for wildlife.

*Immature woodland (WS2)* - Under the NRA site evaluation scheme, this habitat would be rated as Local Importance (higher value) as habitats of local importance for wildlife.

*Bog Woodland (WN7)* - Under the NRA site evaluation scheme, this habitat would be rated as Local Importance (higher value) as habitats of local importance for wildlife.

### *7.3.3.2 Botanical Species*

A full list of botanical species recorded within the subject site is detailed in Appendix F4. No FPO (Flora Protection Species) were noted within the cluster boundary. No invasive species were recorded.

### *7.3.3.3 Terrestrial Mammals*

In addition to the designated Otter (*Lutra lutra*) and Badger (*Meles meles*) surveys, the following data incorporates casual terrestrial mammal observations from other ecological surveys undertaken within the subject area. Desktop review of information available from the National Biodiversity Data Centre (NDBC) suggests species such as Badger, Irish Hare, Red Fox, Otter, Irish Stoat, American Mink, West European Hedgehog and Red Squirrel are all present within the 10km squares (N64,N74) within which the subject cluster is located. Of these only Badger evidence was recorded within the Ballinakill cluster. Given the habitats present Irish Stoat, Irish Hare, Red Fox and Hedgehog are all likely to be present at the cluster. Otter and American Mink were not recorded however are likely to be present on the nearby River Boyne. Red Deer and Pine Marten, recorded in the 10km square N74, are unlikely to be present at the cluster due to lack of suitable habitat.

All terrestrial mammal species recorded from the Ballynakill cluster are of 'Least Concern' on Ireland's Red List of terrestrial mammals [48]. Badger (*Meles meles*), Red Deer (*Cervus elaphus*), Pine Marten (*Martes martes*) and Irish Hare (*Lepus timidus hibernicus*) are protected under the Wildlife Acts (1976-2012) [68] .

*Badger*

Evidence of Badger was recorded from three locations within the cluster. Two Badger setts, of which one was confirmed to be active, were recorded within the environs of the cluster (see Figure 7.18: Mammal Sightings, Volume 2a of this EIS). Locations of all recorded badger evidence are provided in Table 7.11, over.

## Table 7.11: Locations of Badger Evidence Recorded during Ecological Field Surveys – Ballynakill Cluster

| Species | Date | Nearest Turbine - Ballynakill | Description | Grid Reference |
|---|---|---|---|---|
| Badger | 09/01/2013 | T1 | outlier sett | 69149 44971 |
| Badger | 28/02/2013 | T4 | Tracks | - |
| Badger | 18/04/2013 | T1&T10 | Large active badger sett | 69332 45033 |

*Other Mammals*

While not recorded during the current survey, species such as House Mouse (*Mus musculus domesticus*), Hedgehog (*Erinaceus eruopaeus*) and Wood Mouse (*Apodemus sylvaticus*) have a widespread distribution in Ireland are likely to be found within the cluster [48].Pygmy Shrew (*Sorex minutus*) is likely to be present throughout the cluster.

### *7.3.3.4 Avifauna*

There were no records of the following target species from surveys carries out at the Ballinakill cluster: Whooper Swan, Golden Plover, Kingfisher, Whinchat, Greenland White-Fronted Goose, Hen Harrier, Black-Headed Gull, Common Gull, Curlew, Redshank, Lapwing, Woodcock, Lesser Black backed Gull or Mute Swan.

#### *Peregrine*

A single observation of this species was noted during winter walkover surveys (09/01/2013). No further sightings were recorded. No suitable breeding habitat exists within Ballinakill cluster. Peregrine breeding distribution in Ireland has increased by 276% in the period 1968-72 to 2007-11 [69]. The recorded flight height for the single observation was 30m.

#### *Barn Owl*

No observation was made of Barn Owl during the entire survey period.

Following the methods outlined previously, nine locations within 1.5km of the Ballinakill cluster were identified as having potential for breeding Barn Owls and were examined as part of the Breeding Barn Owl surveys. Of these, no site was confirmed to contain Breeding Barn Owl. Three of these locations were classified in the highest category for suitability (occupied or highly suitable) for breeding Barn Owl (*Tyto alba*) with multiple opportunities for nesting and/or roosting. These consisted of an abandoned kiln, a two storey house and an 18th century mill building.

In addition, there were two suitable breeding Barn Owl nest and/or roosting sites recorded within 1.5km of the Ballinakill cluster, which were classified as having limited access and/or limited number of nest and/or roost locations. No evidence of nesting and/or roosting was recorded within these sites. A further site were investigated which can be classified as suitable for roosting Barn Owl only. Three sites were investigated which were appraised as completely unsuitable for breeding Barn Owl, and as having no potential as a roosting and/or nest location.

The findings of the current study, in particular the low occupancy of highly suitable nest sites, reflect the current status of the species in Ireland, which has undergone a 47% decline in breeding distribution during the period 1968-72 to 2007-11 [69].

*Yellowhammer*

This species was recorded in low numbers from the early season CBS (Countryside Bird Survey) visit. It is likely to breed in low numbers at the Ballinakill cluster in suitable habitat.

*Kestrel*

Kestrel was recorded twice over the course of winter surveys. Individual birds were noted on two separate winter visits. No breeding was confirmed on site at Ballinakill. This species was also not noted at locations suitable for breeding Barn Owls (often additionally utilised by kestrel).

*Snipe*

No occupied territories of the amber listed [27] species Snipe (*Gallinago*) were recorded in April to June 2013. A single bird was flushed from wet grassland during the April breeding waders visit however this was a passage migrant as no further evidence was noted at the location on subsequent visits. Snipe was recorded on four occasions during winter surveys, including a peak of 22 recorded in January 2013. These, wintering birds, were flushed from wet grassland between the two westernmost turbines in the cluster (turbine T4 and turbine T5). This reflects the habitat requirements of the species which favours habitats such as wetlands, bogs and wet tussocky grassland [69]. No further breeding was recorded within areas of the 500m envelope re-surveyed in 2014 (i.e additional habitats within 500m of the proposed envelope as a result of design layout changes).

*Buzzard*

Common Buzzard was recorded on two occasions during winter surveys. Single birds were noted in January and February 2013. No breeding was recorded within the cluster.

*General winter birds*

The general assemblage of wintering birds recorded from the cluster reflects the managed nature of most of the farmland present.

A total of 38 species were recorded at the Ballinakill cluster during the modified Brown and Shepherd surveys (n=2) conducted during the defined winter period and are listed in Table 7.12 below. Of these, none are on the Birds of Conservation Concern in Ireland (BoCCI) red list [27] and 8 are on the BoCCI amber list [27]. All other species recorded, apart from Pheasant which is not considered for BOCCI, are on the BoCCI green list [27] (least conservation concern). A single Annex I species **[3]** (Peregrine) was recorded during the modified Brown and Shepherd surveys winter season 2013. Species which occurred in the highest abundance were Rook, Woodpigeon, Redwing, Fieldfare, and Starling; all reflective of general and widespread farmland birds in winter. Snipe, an Amber listed species was recorded in relatively high numbers (n=22) given the size of the cluster however this reflects the quality of the wet grassland within which birds were located.

## Table 7.12: Bird species recorded at Ballinakill Winters 2012/13 and 2013/2014

| Species | | Code | Visit 1 | Visit 2 | Total | BoCCI status | Annex I |
|---|---|---|---|---|---|---|---|
| Blackbird | *Turdus merula* | B | 20 | 41 | 61 | Green | No |
| Blue Tit | *Cyanistes caeruleus* | BT | 1 | 1 | 2 | Green | No |
| Bullfinch | *Pyrrhula* | BF | 0 | 1 | 1 | Green | No |
| Buzzard | *Buteo* | BZ | 2 | 2 | 4 | Green | No |
| Chaffinch | *Fringilla coelebs* | CH | 10 | 20 | 30 | Green | No |
| Coal Tit | *Periparus ater* | CT | 1 | 3 | 4 | Green | No |
| Dunnock | *Prunella modularis* | D | 1 | 3 | 4 | Green | No |

| Species | | Code | Visit 1 | Visit 2 | Total | BoCCI status | Annex I |
|---|---|---|---|---|---|---|---|
| Fieldfare | *Turdus pilaris* | FF | 26 | 47 | 73 | Green | No |
| Goldcrest | *Regulus* | GC | 4 | 12 | 16 | Amber | No |
| Goldfinch | *Carduelis* | GO | 3 | 0 | 3 | Green | No |
| Great Tit | *Parus major* | GT | 14 | 9 | 23 | Green | No |
| Greenfinch | *Carduelis chloris* | GR | 0 | 1 | 1 | Green | No |
| Hooded Crow | *Corvus cornix* | HC | 2 | 6 | 8 | Green | No |
| House Sparrow | *Passer domesticus* | HS | 0 | 7 | 7 | Amber | No |
| Jackdaw | *Corvus monedula* | JD | 10 | 37 | 47 | Green | No |
| Jay | *Garrulus glandarius* | J | 1 | 1 | 2 | Green | No |
| Kestrel | *Falco tinnunculus* | K | 1 | 1 | 2 | Amber | No |
| Lesser Redpoll | *Carduelis cabaret* | LR | 18 | 0 | 18 | Green | No |
| Linnet | *Carduelis cannabina* | Li | 3 | 0 | 3 | Amber | No |
| Long-tailed Tit | *Aegithalus caudatus* | LT | 100 | 0 | 100 | Green | No |
| Magpie | *Pica* | MG | 12 | 5 | 17 | Green | No |
| Meadow Pipit | *Anthus pratensis* | MP | 4 | 0 | 4 | Green | No |
| Mistle Thrush | *Turdus viscivorus* | M | 1 | 2 | 3 | Green | No |
| Moorhen | *Gallinula chloropus* | MH | 0 | 1 | 1 | Green | No |
| Peregrine | *Falco peregrinus* | PE | 1 | 0 | 1 | Green | Yes |
| Pied Wagtail | *Montacilla alba* | PW | 2 | 2 | 4 | Green | No |
| Redwing | *Turdus iliacus* | RE | 8 | 101 | 109 | Green | No |
| Reed Bunting | *Acrocephalus scirpaceus* | RB | 8 | 0 | 8 | Green | No |
| Robin | *Erithacus rubecula* | R | 28 | 27 | 55 | Amber | No |
| Rook | *Corvus frugilegus* | RO | 125 | 178 | 303 | Green | No |
| Siskin | *Carduelis spinus* | SK | 5 | 0 | 5 | Green | No |
| Skylark | *Alauda arvensis* | S | 0 | 2 | 2 | Amber | No |
| Snipe | *Gallinago* | SN | 22 | 5 | 27 | Amber | No |
| Song Thrush | *Turdus philomelos* | ST | 0 | 7 | 7 | Green | No |
| Sparrrowhawk | *Accipiter nisus* | SH | 0 | 1 | 1 | Green | No |
| Starling | *Sturnus vulgaris* | SG | 3 | 357 | 360 | Amber | No |
| Woodpigeon | *Columba palumbus* | WP | 115 | 157 | 272 | Green | No |
| Wren | *Troglodytes* | WR | 40 | 23 | 63 | Green | No |

### *General Breeding Birds*

The results of the CBS survey are presented in Table 7.13, below. As outlined previously, a 1km square was selected to sample the relevant habitats within the Ballinakill cluster. In this instance the square was located in the north west of the cluster in the townlands of Calf's Field and Roe's Bridge. This included areas of improved agricultural grassland, hedgerows, treelines, drains, scrub and a portion of the canal which runs adjacent to the north east. The relevant square was orientated as illustrated in Figure 7.13.3 Survey Squares, Volume 2a of this EIS.

Early season visits (Early April to mid-May) recorded the expected assemblage of general countryside birds. Species such as Robin, Blackbird, Wren, Chaffinch, Woodpigeon, Jackdaw, and Willow Warbler occurred in the greatest numbers with the most dominant species being Robin (n=20); (Table 7.13).

Late season visits (mid-May to late June) reflected similar assemblages with the additional of migrant species such as Swallow, although not in great densities (n=2). A total of 24 avian species were recorded during the CBS surveys conducted between April and June 2013 (Table 7.13). Of these, one red listed species of conservation concern in Ireland (Yellowhammer) and four amber listed species (Robin, Swallow, Goldcrest and House Sparrow) of medium conservation concern were recorded [27] . No Annex 1 [26] species were recorded on the site during the CBS surveys.

A small Sand Martin (Amber) colony was noted south of the survey square during winter walkover surveys (Grid Reference 669149 744971); this was likely to be occupied although Sand Martins were not recorded during surveys.

### Table 7.13: Bird Species recorded at Ballinakill during CBS surveys (Early and Late season visits)

| Species Name | | Code | Early | Late | Total | BoCCI status | Annex I |
|---|---|---|---|---|---|---|---|
| Swallow | *Hirundo rustica* | SL | 0 | 2 | 2 | Amber | No |
| Goldfinch | *Carduelis* | GO | 0 | 3 | 3 | Green | No |
| Hooded Crow | *Corvus cornix* | HC | 1 | 0 | 1 | Green | No |
| House Sparrow | *Passer domesticus* | SW | 1 | 0 | 1 | Amber | No |
| Yellowhammer | *Emberiza citronella* | Y | 1 | 0 | 1 | Red | No |
| Dunnock | *Prunella modularis* | D | 1 | 7 | 8 | Green | No |
| Bullfinch | *Pyrrhula* | BF | 2 | 0 | 2 | Green | No |
| Pheasant | *Phasianus colchicus* | PH | 2 | 0 | 2 | n/a | No |
| Magpie | *Pica* | MG | 2 | 3 | 5 | Green | No |
| Song Thrush | *Turdus philomelos* | ST | 2 | 6 | 8 | Green | No |
| Rook | *Corvus frugilegus* | RO | 2 | 8 | 10 | Green | No |
| Reed Bunting | *Acrocephalus scirpaceus* | RB | 3 | 0 | 3 | Green | No |
| Blue Tit | *Cyanistes caeruleus* | BT | 3 | 1 | 4 | Green | No |
| Great Tit | *Parus major* | GT | 3 | 1 | 4 | Green | No |
| Goldcrest | *Regulus* | GC | 3 | 4 | 7 | Amber | No |
| Coal Tit | *Periparus ater* | CT | 5 | 2 | 7 | Green | No |
| Chiffchaff | *Phylloscopus collybita* | CC | 5 | 3 | 8 | Green | No |
| Willow Warbler | *Phylloscopus trochilus* | WW | 12 | 9 | 21 | Green | No |
| Jackdaw | *Corvus monedula* | JD | 13 | 0 | 13 | Green | No |
| Woodpigeon | *Columba palumbus* | WP | 14 | 15 | 29 | Green | No |
| Chaffinch | *Fringilla coelebs* | CH | 15 | 5 | 20 | Green | No |
| Wren | *Troglodytes* | WR | 17 | 9 | 26 | Green | No |
| Blackbird | *Turdus merula* | B | 18 | 5 | 23 | Green | No |
| Robin | *Erithacus rubecula* | R | 20 | 3 | 23 | Amber | No |

#### *7.3.3.5 Other Taxa*

No other taxa of note such as species of Lepidoptera (butterflies and moths) were recorded from the subject site. Both Common Frog and Common Lizard are protected by the Wildlife Acts (1976-2012) [59]. Common Frog is likely to be present throughout the site. Common Lizard, though not recorded, is likely present in suitable habitat.

## 7.3.4 Windmill Cluster

The Windmill cluster is located c.2km north of Carbury village in the townlands of Nurney and Ballinderry. Three turbines are proposed; which are to be located in an area of cutover bog under active commercial extraction. Note existing environment data on Aquatic Ecology and Bats are presented seperately.

### *7.3.4.1 Habitats*

Habitat mapping was carried out at the subject site on July 3, 2013 following methods previously outlined. Habitat types identified within the study area are illustrated in Figure 7.14.7: Habitat Map, Volume 2a of this EIS and detailed below:

*Cutover Bog (PB4)* - This classification refers to the main body of machine milled peat within which the three proposed turbines T24, T25 and T26 are to be located. As a commercially worked bog, no vegetation is present. Numerous drains are present throughout and along the edges. A drain, c.2.5m wide and 3m deep seperates this section from the area of intact 'high bog' immediately adjacent to the south and outside the cluster site boundary. Under the NRA site evaluation scheme [6], this habitat would be rated as Local Importance (lower value), as it is a highly modified habitat with low species diversity.

*Bog Woodland (WN7)* - Bog woodland exists along the periphery of the cutover bog section of the site. Downy birch *Betula pubescens* and Scots Pine *Pinus sylvestris* predominate. Under the NRA site evaluation scheme [6], this habitat would be rated as Local Importance (Higher Value).

*Built Surfaces (BL3)* – This habitat includes the roadway into the peat milling site, currently existing buildings and storage areas for peat. Under the NRA site evaluation scheme [6], this habitat would be rated as Local Importance (lower value), as it is a highly modified habitat with low species diversity.

*Scrub (WS1)* – An area of scrub exists adjacent to the proposed site entrance. . Under the NRA site evaluation scheme [6], this habitat would be rated as Local Importance (Higher Value).

*Raised Bog (PB1)* - An area of raised bog exists to the south of the proposed wind farm cluster. This has been historically cut along its eastern margin with resultant drains in this area. Overall the surface of the bog is intact however the bog is only slightly wet underfoot. There are no extensive hummocks or hollow formations and the only pools present are dried out. Species present include *Calluna vulgaris, Erica tetralis, Eriophrum augustofulium, Eriophrium vaginatum, Tricophorum caespitosum*, *Narthecium ossifragum, Drasera rotundifolia, Cladonia portentosa, Cladonia floerkeana, Sphagnum spp., Hypnum jutlandicum.*

Due to its potential conformity with Annex Habitats such as active raised bog (Active Raised Bog 7110) or degraded raised bog (7120), this portion of bog adjacent to the proposed development site (within which no development is proposed and which is outside the cluster boundary) was further surveyd by a peatland specialist. The full results of this survey are presented in Appendix F5. A synopsis is presented below.

*Windmill Bog – Raised Bog Site Report Synopsis*

The site comprises an intact section of raised bog habitat located on a flat, low lying area that slopes gently to the east. The dominant vegetation recorded throughout the site comprises *Calluna vulgaris, Eriophorum vaginatum*, and *Narthecium ossifragum.* Other frequently encountered species include *Cladonia portentosa* and *Sphagnum* mosses. The high bog supports a small area (c 0.1ha) of active peat forming communities in the northeastern part of the site. This active area support sub-central ecotope dominated by *Sphagnum* mosses and *Eriophorum vaginatum* .There is a good cover of *Sphagnum* mosses (over 45%) including *Sphagnum magellanicum, Sphagnum papillosum, Sphagnum capillifolium, Sphagnum cuspidatum,* and *Sphagnum subnitens* Substrate conditions are soft underfoot. The microtopography is relatively well developed with low hummocks. Conditions are progressively drier towards the edge of the bog, with marginal ecotope occurring throughout.

The report concluded that the bog is a remnant area of raised bog that has been severely impacted by long term peat extraction and associated drainage. The site continues to support a small area of active raised bog, a habitat that is rare throughout Ireland.

The site is deemed to be of high conservation value due to the presence of Active Raised Bog, a priority habitat listed on Annex I of the EU Habitats Directive. The site is also of value for range, being one of the most eastern examples of the habitat in Ireland.

#### *7.3.4.2 Botanical Species*

A full list of botanical species recorded within the subject site is detailed in Appendix F4. No FPO (Flora Protection Species) were noted within the Windmill cluster. Details of species identified from the Peatland survey of the adjacent high bog are detailed in the relevant appendix of said report. The invasive species *Rhodendron Ponticum* was noted on the high bog to the south however this is c.1km from the nearest proposed turbine location.

#### *7.3.4.3 Terrestrial Mammals*

As to be expected from the habitats on site, very little evidence of terrestrial mammals was recorded. However, Badger tracks were noted in a milled peat area in April 2014. Irish Hare is present on the adjacent high bog within the cluster. Table 7.14, details the recorded Badger evidence.

### Table 7.14: Locations of Badger Evidence Recorded During Ecological Field Surveys – Windmill Cluster

| Species | Date | Nearest Turbine | Description | Grid Reference |
|---|---|---|---|---|
| Badger | 17/04/2013 | T24 | Tracks | N68647 37441 |

#### *7.3.4.4 Avifauna*

There were no records of the following target species from surveys carried out at the Windmill cluster: Whooper Swan, Kingfisher, Peregrine, Whinchat, Greenland White-Fronted Goose, Hen Harrier, Black-Headed Gull, Common Gull, Curlew, Redshank, Lapwing or Mute Swan.

#### *Golden Plover*

Golden Plover (an Annex I species [26] were noted on two occasions in or near the cluster boundary. Table 7.15, below details the two observations. Both were in October 2012 and only one observation involved birds within the cluster. Small numbers of wintering Golden Plover may occasionally perch on the milled peat present during daylight hours however due to the ongoing disturbance from commercial activities this is unlikely to constitute a regular roost or location which sees a high frequency of occurrence of Golden Plover.

### Table 7.15: Golden Plover Observations - Windmill Cluster

| Site Name | Survey Type | Visit Number | Date | Start Time | End Time | Species | Number | Bird Notes |
|---|---|---|---|---|---|---|---|---|
| Windmill | B & S Winter | 1 | 25/10/2012 | 10.22 | 11.4 | Golden Plover_GP | 3 | |
| Windmill | B & S Winter | 1 | 25/10/2012 | 10.22 | 11.4 | Golden Plover_GP | 200 | Circling N of site (off site) |

*Merlin*

No Merlin were recorded within the Windmill cluster site boundary during winter surveys. Following methods outlined previously the 1km square N6736 was selected as the breeding Merlin survey square for Windmill due to its habitat content including both foraging (open bog) and nesting habitat (conifer edge). The location of the survey square and digitised transect routes used to search for Merlin evidence are detailed in Figure 7.14.5 Merlin Survey Results, Volume 2a of this EIS.

On the basis of the collected information, no usage of the selected habitat by Merlin could be extrapolated. Pellets and whitewash (droppings), attributed to Kestrel and Barn Owl (based on size and contents) were located. Buzzard was alo noted in woodland to the south of the area of high bog adjoining the site. Results of Merlin surveys are outlined below in Table 7.16 and illustrated in Figure 7.14.5 Merlin Survey Results of Volume 2a of this EIS.

### Table 7.16: Results of Merlin Surveys

| Visit Number | Date | Sighting / Structure / Sighting Grid Reference | sign / evidence type | No. Of prey items | Age of prey / evidence | Bird Notes |
|---|---|---|---|---|---|---|
| 1 | 06/05/2013 | 67840/36820 | P | 1 | <3weeks | Barn owl pellet |
| 1 | 06/05/2013 | 67840/36820 | P | 2 | <3weeks | 2 Kestrel pellets and Kestrel observed |
| 1 | 06/05/2013 | 67840/36820 | | 2 | <3weeks | 2 Kestrel feathers |
| 1 | 06/05/2013 | 67763/36655 | PL | 8 | <3weeks | White feathers in Birch tree |
| 1 | 06/05/2013 | 68052/37043 | PL | 1 | <3weeks | Pellet on bog along margain with cutaway bog, Buzzard observed. |
| 1 | 06/05/2013 | 67980/36980 | W | 1 | <3weeks | Barn owl white wash under marking post |
| 1 | 06/05/2013 | 68635/36882 | P | 1 | <3weeks | Barn owl pellet under fence post |
| 2 | 04/06/2013 | | | | | No pellets or plucked items at any of previous locations or elsewhere in square |
| 2 | 04/06/2013 | | | | | Cuckoo x2 flying W to E |
| 3 | 15/08/2013 | | | | | No signs recorded |

### *Red Grouse*

A Red Grouse survey, following methods previously outlined, was carried out at the Windmill cluster on 27/3/2013. The results suggest that no Grouse may be present in suitable habitat on the high bog adjacent to the Windmill cluster. This reflects a general reduction in the breeding range of the species in Ireland which has contracted by 66% in the time period since 1968-72 [69].

Losses in the raised bogs of the midlands are mainly associated with factors such as habitat loss due to afforestation, large scale peat extraction and inappropriate burning [69].

### *Woodcock*

There were two occupied breeding territories, of the red listed [27] Woodcock (*Scolopax rusticola*) recorded within or near the 500m turbine envelope (see Figure 7.14.4 Breeding Wader Results of Volume 2a of this EIS). A single male was recorded roding (in territorial display) on the edge of the 500m envelope to the southwest of the proposed turbine T26 in May 2013 (date of visit 6/5/2013 and 13/5/2013). A further male was recorded roding in June to the south east, outside the predicted 500m turbine envelope. Woodcock is Red listed on the BoCCCI list [27].

### *Barn Owl*

No observation was made of Barn Owl during the entire survey period. Evidence of Barn Owl vis-à-vis pellets and feathers were found during Merlin surveys indicating that the area is utilised for foraging by at least one bird. (see Figure 7.14.6 of Volume 2a of this EIS).

Following the methods outlined previously, 8 locations within 3km of the Ballinakill cluster were identified as having potential for breeding Barn Owls and were examined as part of the Breeding Barn Owl surveys. An additional location was unsurveyable due to access restrictions. Of these, no site was confirmed to contain Breeding Barn Owl. Two of the surveyed locations were classified in the highest category for suitability (occupied or highly suitable) for breeding Barn Owl (*Tyto alba*) with multiple opportunities for nesting and/or roosting. These consisted of an old barn and Carbury Castle which is located c.2km south of the proposed development. In addition, there were 2 suitable breeding Barn Owl nest and/or roosting sites recorded within 1.5km of the Maighne Wind Farm subject site, which were classified as having limited access and/or limited number of nest and/or roost locations. No evidence of nesting and/or roosting was recorded within these sites. A number of other suitable buildings/trees exist in the greater hinterland and it may be that these contain birds which sporadically utilise the subject site for foraging.

The findings of the current study, in particular the low occupancy of highly suitable nest sites, reflect the current status of the species in Ireland, which has undergone a 47% decline in breeding distribution during the period 1968-72 to 2007-11 [69]. Barn Owl is Red listed on the BoCCCI list [27].

### *Kestrel*

This species was recorded during the Merlin survey visit in May 2013. A bird was noted to the southeast of the Windmill cluster and additional evidence in the form of pellets and feathers were collected. Due to the unvegetated nature of most of the Windmill cluster, this species is unlikely to actively forage within the proposed turbine envelope.

### *Lesser Black-backed gull*

A single flock of 16 birds was noted overflying the Windmill cluster in October 2012 during the first winter B&S visit.

### *Snipe*

A single Snipe was recorded within the Windmill cluster during winter surveys (see Appendix F1). A peak of 21 birds were noted on the raised bog to the south on 18/1/2013. This reflects the habitat requirements of the species which favours habitats such as wetlands, bogs and wet tussocky grassland [69]. No breeding was noted during breeding wader surveys as very little breeding habitat exists within the 500m envelope. Snipe is Amber listed on the BoCCCI list [27].

### *Buzzard*

Two Buzzards were noted in October 2012 during winter B&S surveys (recorded flight height was 10-50m). An additional sighting was observed to the southwest of the proposed Windmill cluster (outside the boundary) during breeding Merlin surveys on 6/5/2013.

### *General winter birds*

A total of 25 species were recorded at the Ballinakill cluster during the Brown and Shepherd surveys conducted during the defined winter period and are listed in Table 7.17, below. Of these, three (Golden Plover, Grey Wagtail and Meadow Pipit) are on the Birds of Conservation Concern in Ireland (BoCCI) red list [27] and six (Robin, Goldcrest, Snipe, Sparrowhawk, Lesser Black-Backed Gull and Starling) are on the BoCCI Amber list [27]. All other species recorded are on the BoCCI green list [27] (least conservation concern). No Annex I species [3] was recorded within the cluster during the modified Brown and Shepherd surveys.

Abundance of those species recorded is typically low, reflecting the nature of the habitats present. As most of the site is bare peat, birdlife is mainly confined to the bog woodland fringing the cluster. Many of the species recorded in higher densities (e.g. Golden Plover, Redwing) were recorded outside the cluster boundary.

## Table 7.17: Bird species Recorded during Winter 2012/13 – Windmill Cluster

| Species | | Code | Visit 1 | Visit 2 | Visit 3 | Total | BoCCI status | Annex I |
|---|---|---|---|---|---|---|---|---|
| Chaffinch | *Fringilla coelebs* | CH | 11 | 7 | 3 | 21 | Green | No |
| Blackbird | *Turdus merula* | B | 4 | 0 | 8 | 12 | Green | No |
| Woodpigeon | *Columba palumbus* | WP | 10 | 0 | 2 | 12 | Green | No |
| Hooded Crow | *Corvus cornix* | HC | 4 | 0 | 0 | 4 | Green | No |
| Robin | *Erithacus rubecula* | R | 9 | 1 | 2 | 12 | Amber | No |
| Raven | *Corvus corax* | RN | 4 | 0 | 0 | 4 | Green | No |
| Meadow Pipit | *Anthus pratensis* | MP | 2 | 0 | 0 | 2 | Red | No |
| Goldcrest | *Regulus* | GC | 4 | 5 | 1 | 10 | Amber | No |
| Buzzard | *Buteo* | BZ | 2 | 0 | 0 | 2 | Green | No |
| Snipe | *Gallinago* | SN | 2 | 0 | 0 | 2 | Amber | No |
| Golden Plover | *Pluvialis apricaria* | GP | 203 | 0 | 0 | 203 | Red | Yes |
| Wren | *Troglodytes* | WR | 7 | 4 | 4 | 15 | Green | No |
| Sparrowhawk | *Accipiter nisus* | SH | 1 | 0 | 0 | 1 | Amber | No |
| Grey Wagtail | *Motacilla cinerea* | GL | 1 | 0 | 0 | 1 | Red | No |
| Lesser Redpoll | *Carduelis cabaret* | LR | 7 | 1 | 0 | 8 | Green | No |
| Blue Tit | *Cyanistes caeruleus* | BT | 1 | 1 | 1 | 3 | Green | No |
| Mallard | *Anas platyrhynchos* | MA | 4 | 0 | 0 | 4 | Green | No |

| Species | | Code | Visit 1 | Visit 2 | Visit 3 | Total | BoCCI status | Annex I |
|---|---|---|---|---|---|---|---|---|
| Lesser Black-backed Gull | *Larus fuscus* | LB | 16 | 0 | 0 | 16 | Amber | No |
| Dunnock | *Prunella modularis* | D | 0 | 1 | 0 | 1 | Green | No |
| Redwing | *Turdus iliacus* | RE | 0 | 33 | 23 | 56 | Green | No |
| Great Tit | *Parus major* | GT | 0 | 0 | 2 | 2 | Green | No |
| Coal Tit | *Periparus ater* | CT | 0 | 0 | 1 | 1 | Green | No |
| Starling | *Sturnus vulgaris* | SG | 0 | 0 | 12 | 12 | Amber | No |
| Jackdaw | *Corvus monedula* | JD | 0 | 0 | 1 | 1 | Green | No |
| Magpie | *Pica* | MG | 0 | 0 | 1 | 1 | Green | No |

### *General Breeding Birds*

The results of the CBS survey are presented in Table 7.18, below. As outlined previously, a 1km square was selected to sample the relevant habitats within the Ballinakill cluster. In this instance the square (N6837) overlays the majority of the eastern portion of the cluster in the townland of Ballinderry. Two transects, orientated broadly east to west were utilised to sample breeding bird distribution and activity. The northern transect followed an existing track along the edge of the fringing woodland on the northern side of the cluster and the southern transect approximately follows the existing facebank thereby sampling the adjacent high bog in addition to the proposed folio within which the proposed turbines are to be located. The relevant square is illustrated in Figure 7.15.3 Survey Squares of Volume 2a of this EIS.

A total of 25 avian species were recorded during the CBS surveys conducted between April and June 2013 (Table 7.18). Of these, one red listed species of high conservation concern in Ireland (Meadow Pipit) and six amber listed species (Goldcrest, Linnet, Mistle Thrush, Robin, Skylark and Swallow) of medium conservation concern were recorded [27] . No Annex 1 [26] species were recorded on the site during the CBS surveys. Typical woodland species such as Willow Warbler, Coal Tit and Chaffinch were found in good numbers on the northern transect, reflecting the woodland habitat adjoining. Meadow pipit and Skylark, both recorded on the southern transect of the square; were recorded exclusively from the high bog adjacent to the south of the cluster. No breeding habitat for these species exists within the proposed red line boundary for the Windmill cluster.

### Table 7.18: Bird Species Recorded during CBS surveys (Early and Late Season Visits) – Windmill Cluster

| CBS | | Code | Early | Late | Total | BoCCI status | Annex I |
|---|---|---|---|---|---|---|---|
| Blackbird | Turdus merula | B | 12 | 6 | 18 | Green | No |
| Blue Tit | Cyanistes caeruleus | BT | 1 | 3 | 4 | Green | No |
| Bullfinch | Pyrrhula | BF | 1 | 0 | 1 | Green | No |
| Chaffinch | Fringilla coelebs | CH | 11 | 4 | 15 | Green | No |
| Chiffchaff | Phylloscopus collybita | CC | 0 | 1 | 1 | Green | No |
| Coal Tit | Periparus ater | CT | 2 | 14 | 16 | Green | No |
| Cuckoo | Cuculus canorus | CK | 3 | 2 | 5 | Green | No |
| Goldcrest | Regulus | GC | 0 | 1 | 1 | Amber | No |
| Great Tit | Parus major | GT | 3 | 0 | 3 | Green | No |
| Jackdaw | Corvus monedula | JD | 5 | 4 | 9 | Green | No |
| Lesser Redpoll | Carduelis cabaret | LR | 0 | 5 | 5 | Green | No |
| Linnet | Carduelis cannabina | LI | 7 | 2 | 9 | Amber | No |

| CBS | | Code | Early | Late | Total | BoCCI status | Annex I |
|---|---|---|---|---|---|---|---|
| Meadow Pipit | Anthus pratensis | MP | 22 | 17 | 39 | Red | No |
| Mistle Thrush | Turdus viscivorus | M | 2 | 1 | 3 | Amber | No |
| Pied Wagtail | Montacilla alba | PW | 2 | 1 | 3 | Green | No |
| Robin | Erithacus rubecula | R | 5 | 2 | 7 | Amber | No |
| Rook | Corvus frugilegus | RO | 5 | 2 | 7 | Green | No |
| Skylark | Alauda arvensis | S | 12 | 6 | 18 | Amber | No |
| Song Thrush | Turdus philomelos | ST | 3 | 2 | 5 | Green | No |
| Swallow | Hirundo rustica | SL | 3 | 3 | 6 | Amber | No |
| Whitethroat | Sylvia communis | WH | 2 | 0 | 2 | Green | No |
| Willow Warbler | Phylloscopus trochilus | WW | 13 | 4 | 17 | Green | No |
| Woodpigeon | Columba palumbus | WP | 6 | 4 | 10 | Green | No |
| Wren | Troglodytes | WR | 13 | 6 | 19 | Green | No |

#### *7.3.4.5 Other Taxa*

No other taxa of note such as species of Lepidoptera (butterflies and moths) were recorded from the subject site. Both Common Frog and Common Lizard are protected by the Wildlife Acts (1976-2012) [59]. Common Frog is likely to be present throughout the site and was recorded on the adjacent high bog during surveys. Common Lizard, though not recorded, is likely present in suitable habitat.

### 7.3.5 Drehid-Hortland

The proposed Drehid-Hortland cluster is located east and south of Kilshanchoe Village, Co. Kildare.

The two portions of Drehid-Hortland cluster will be dealt with individually within the following sections by turbine number. Note existing environment data on Aquatic Ecology and Bats are presented seperately.

#### *7.3.5.1 Habitats*

***Drehid (Turbines 11-23, 47)***

Habitat mapping was carried out at the subject site on July 9, 2013 following methods previously outlined. Habitat types identified within the study area are illustrated in Figure 7-16: Habitat Map, Volume 2a of this EIS, and described below. Further Annex I surveys, of habitat identified as having the potential to conform to a type on Annex I of the Habitats directive was carried out on August 22, 2013.

*Depositing/Lowland Rivers (FW2)* - This habitat refers to two rivers which flow through the proposed development area for Turbines T11-23. The first is the Coolree River, which is a tributary of the River Blackwater and drains the southwestern portion of the cluster. Within the area recorded it is approximately 2m wide and 0.5m deep with a gravel or cobble substrate. The banks are steep in places. The river is treelined and contains limited aquatic vegetation.

The Ballynamullagh River which flows through the site rises in Parsonstown and flows northeastwards and then north to join with the Coolree to form the Fear English River. This river is 2-3m wide, with 2.5m high banks. Vegetation present includes *Sparganium erectum* and *Equisetum* spp.

Due to their high connectivity/corridor value, under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Higher Value).

*Improved Agricultural Grassland (GA1)* - This habitat type predominates in the southwestern portion of the cluster in the townlands of Drehid and Parsonstown.

Some areas are very species poor with only *Lolium perenne* present. Other, more species rich fields also occur however even in these cases *Lolium* is still the dominant grass. Some areas of disturbed grassland contain wet grassland species due to poor drainage however the dominant habitat is still improved agricultural grassland. Species recorded include *Lolium perenne, Poa annua, Agrostis stolenifera, Agrostis canina, Holcu lanatus, Cynosurus cristatus, Phleum pratense, Alopecurus pratensis, Alopecurus geniculatus, Ranunculus repens*, *Trifolium* spp., *Plantago* spp., *Cirsium arvense* and *Urtica dioica*. In places *Juncus effusus* and *Juncus inflexus* are present. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Lower value).

*Improved Agricultural Grassland/Wet Grassland mosaic (GA1/GS4)* - This refers to improved agricultural grassland which grades into wet grassland; located south of the proposed location of turbine T17.

Species present include *Lolium perenne, Agrostis stolonifera, Ranunculus repens, Ranculus acris* and abundant rushes such as *Juncus effuses, Juncus inflexus, Juncus articulates* and also *Trifolium* spp. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Higher value).

*Raised Bog (PB1)*
An area of raised bog exists to the south of the proposed locations of turbine T12 and turbine T13. Surrounded by plantation forestry and degraded cutover bog (PB4); this area does contain a smaller area of active raised bog which has sphagnum cover of approximately 80% within a discrete area. Overall the ground underfoot is quite dry however there are shallow pools with *Sphagnum cuspidatum* and hummocks. The ground is very sturdy and there is no quaking or significantly wet areas. Species present include *Calluna vulgaris* and *Erica tetralix* in equal abundance. *Eriophrum augustifolium* and *Eriophorum vaginatum, Narthecium ossifragum*, *Trichophorum cespetisum, Rhynchospara alba, Drosera rotundifolia, Vaccinium oxycoccos, Andromeda polofolia, Cladonia portentosa, Cladonia floerkeana, Dicranum scoparium* and *Racometrium languginosum*. Sphagnum species include *Sphagnum magellanicium*, *Sphagnum capillifolium* and *Sphagnum papillosum*.
Due to the presence of active raised bog, a priority Annex I habitat under the NRA site evaluation scheme [6], this habitat would be rated as of International Importance. As such an Annex assessment of the bog was carried out by a peatland specialist.

*Cutover bog (PB4)*
This area of bog contains a number of large deep drains (1.5m wide and 3-4m deep) and is dominated by cutover. The area has begun to regenerate and contains predominantly *Calluna vulgaris*, *Trichophorum caespitosum*, *Eriophorum vaginatum*, *Narthecium ossifragus*, *Molinia caerulea* and *Cladonia* spp. There is little if any sphagnum present. *Juncus effusus* is present in places.

The drains contain *Sphagnum cuspidatum*, *Potentilla palustris*, *Potamogetan* spp., *Hydrocotyle vulgaris*, *Osmunda regalis*, *Menyanthes trialiata*. Woodland on the bog comprises *Betula punscens*, *Pinus sylvestris* and *Salix* spp. Due to the extent of rengeneration and proximity to intact raised bog, under the NRA site evaluation scheme [6], this habitat would be rated as of County Importance.

*Cutover Bog/Dry calcareous grassland (PB4/GS1)*
Northeast of turbine T15 is a small area (approximately 10mx10m) containing both acid and calcareous flora. The orchid *Gymnadenia conopsea* and helleborine *Epipactus palustris*, both indicative of calcareous grassland/fen are present in this location in large numbers. Other species include *Molinea caerulea, Briza media, Luzula multiflora*, *Juncus squarrosus, Juncus effuses, Juncus acutiflorus, Eriophorum augustifolium, Carex panacea, Carex nigra, Carex binervis, Succisia pratensis* and *Centaurea nigra*. Due to the profusion of orchids, under the NRA site evaluation scheme [6], this habitat would be rated as of County Importance.

*Other artificial lakes and ponds (FL8)*
This refers to a large area of open water which includes emergent vegetation such as *Typha latifolia* and *Juncus bulbosus*. Aquatic species such as *Hydrocotyle vulgaris, Sparganium erectum* are also found. On the edge of the pond *Molinia caerula, Eriophorum vaginatum, Juncus effuses* and some Sphagnum species are found. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Higher value).

*(Mixed) broadleaved woodland (WD1)* - This consists of a broadleaf plantation of Fraxinus excelsior, with the height of trees above 5m. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Higher value).

*Conifer plantation (WD4)* - Conifer plantation exists at the Drehid portion of the Drehid-Hortland portion in varying age classes although mature stands predominate.

The dominant species is *Pucea sitchensis* although *Pinus sylvestrus* is also present. Broadleaved species have been planted along the edges of tracks and include *Fraxinus excelsior, Betula pubescens, Fagus sylvatica, Ilex aquifolium, Quercus petraea* and *Salix cinerea.* Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Lower value).

*Treelines (WL2)*
Treelines occur at the site and mainly contain *Fraxinus excelsior, Crataegus monogyna, Salix* spp., *Pinus sylvestris* and *Corylus avellana.* Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Higher value) due to its value as a corridor for wildlife.

*Scrub (WS1)*
Recolonising areas of scrub exist where clearfelled forestry has not been replanted. Tree species present include *Picea sitchensis, Betula pubescens* and *Salix* spp. Shrubs include *Sambucus nigra, Chanerion augustofolium, Epilobium hirsutum, Cirsium* spp., *Geranium robertianum* and *Taraxacum* spp. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Higher value).

## Hortland (Turbines T40-T46)

Habitat mapping was carried out at the subject site on July 10, 2013 following methods previously outlined. Habitat types identified within the study area are illustrated in Figure 7.15.7 Habitat Map, Volume 2a of this EIS, and described below. Further Peatland surveys, of habitat identified as having the potential to conform to a type on Annex I of the Habitats directive was carried out on December 12, 2013.

*Tilled Land (BC3)* - A single, recently tilled field was recorded during habitat surveys. This was located in open farmland to the east of the proposed location of T43. Due to its highly modified nature, under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Lower Value).

*Depositing/ Lowland Rivers (FW2)* - This habitat classification pertains to the River Blackwater which flows adjacent to the site along the eastern edge of the proposed T40 land folio/forestry compartment. Although technically outside the site boundary this is considered in the current assessment due to its close proximity. The river at this stage is narrow and obscured by trees in places with limited aquatic vegetation. Aquatic vegetation recorded includes *Lemna minor*, *Phalaris arundinacea* and *Nasturtium officinale*. Due to its high connectivity/corridor value, under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Higher Value).

*Drainage ditches (FW4)* - Drainage ditches exist throughout the site, around most fields and forestry compartments. They often replace hedgerows as boundaries. This habitat would be rated as Local Importance (Lower value) as many exhibit signs of enrichment.

*Improved agricultural grassland (GA1)* - Improved agricultural grassland is found at the proposed location for T41. This improved and primarily grazed by sheep at the location in question. A full species list of the species present is included in the appended Botanical Species list (see Appendix F4). Due to its highly modified nature, under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Lower Value).

*Wet Grassland (GS4)* - Referring to a field of wet grassland to the east of the proposed Turbine (T49) at Mucklon, this is a field dominated by rushes and species such as *Potentilla anserina, Filipendula ulmaris*, *Mentha aquatica*, *Juncus effusus* and *Veronica beccabunga*. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Higher Value).

*Cutover Bog (PB4)* - Some small pockets of historically cutover bog exist within the main forestry compartments containing the proposed turbines T42-45. These are now succeeding to scrub with areas of bracken also. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Higher Value).

*Conifer Plantation (WD4)* - Conifer planatation dominated by *Picea sitchensis.* Due to low diversity under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Lower Value).

*Hedgerows (WL1)* - Hedgerows within the Hortland section (of Drehid-Hortland) are primarily comprised of *Crataegus monogyna* (Hawthorn), poor growing in many places and younger hedges of this species also occur. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Higher Value).

*Treelines (WL2)* - Hedgerows exist along main road boundaries, forest edges and bordering some drains within the site. Some very mature *Salix* spp. Are present. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Higher Value).

*Bog Woodlands (WN7*) - Bog woodland, primarily Birch stands dominated by *Betula pendula,* exists as buffers between unplanted forestry compartments within the main grouping of turbines T41-45. Some windblown areas of forestry have also succeeded to this habitat type. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Higher Value).

*Recently Felled Woodland (WS5)* - This refers to recently clearfelled areas of forestry. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Lower Value).

*Buildings and Artificial Surfaces/ Dry Meadows and Grassy Verges (BL3/GS2)* - This classification refers to forestry tracks internal to the main area of commercial forestry within the Hortland portion of the Drehid-Hortland cluster. Many tracks have a corresponding linear grassy verge which is best considered as the latter habitat type above i.e. Dry Meadows and Grassy Verges. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Lower Value).

*Conifer Plantation/ Mixed Broadleaf and Conifer Plantation (WD4/WD2)* - This classification refers to the specific forestry compartment within which the proposed turbine T42 is to be located. In portions of this compartment a broadleaf component exists where existing Birch (*Petula* spp.) has not been thinned out resulting in a mosaic, dominated by WD4 but which smaller areas could be classified as WD2 due to the presence of Birch stands. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Lower Value).

*Conifer Plantation/ Immature Woodland (WD4/WS2)* – This classification refers to an area of replanted forestry east of the proposed location of turbine T43. Previously regenerating with native species such as Birch and Willow, the proposed compartment has now been replanted with commercial conifers. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Lower Value).

*Conifer Plantation/ Cutover Bog (WD4/PB4)* - This habitat classification refers to Spruce (*Picea sitchensis*) planted on cutover bog. Due to the age of this young, first rotation forestry, resulting visible strata of young trees and rank heather are present. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Lower Value).

*Raised Bog (PB1)* - Although not present within the cluster boundary, an area of high bog exists immediately adjacent to the west. Due to the possibility of this corresponding with an Annex I habitat, dedicated peatland surveys by a specialist ecologist were undertaken to investigate the potential for impact. The results of the survey, including illustrations of the locations of Active Raised Bog, carried out in December 2013, are appended in Appendix F5: Peatland Survey Reports.

The site comprises an intact section of raised bog habitat located on a flat low lying area surrounded by cutover bog and conifer forestry. The dominant vegetation recorded throughout the site comprises *Calluna vulgaris, Eriophorum vaginatum, Trichophorum cespitosum*, and *Narthecium ossifragum.* Other abundant species include *Cladonia portentosa* and *Sphagnum* mosses. The high bog supports two discrete areas of active peat forming communities in the south-western part of the bog. Active areas contain sub-central ecotope dominated by *Sphagnum* mosses. The sub-central ecotope (active peat forming areas) are typically dominated by *Eriophorum vaginatum and Rhynchospora alba* together with a good diversity of *Sphagnum* mosses including *Sphagnum magellanicum, Sphagnum papillosum, Sphagnum capillifolium, Sphagnum cuspidatum, Sphagnum subnitens* and *Sphagnum fallax*. Areas supporting this ecotope type comprise 50-60% *Sphagnum* moss cover. Substrate is soft underfoot. The microtopography is relatively well developed and comprises low hummocks, S*phagnum* lawns, and occasional pools. The formation of active peat forming areas is likely to be attributed to secondary re-wetting of the high bog caused by subsidence due to drainage and peat extraction activities. In addition, the site supports three other ecotope types that conform to degraded raised bog (face bank, marginal and sub-marginal).

Conditions are progressively drier towards the edge of the bog, with sub-marginal and marginal ecotopes prominent. The site is of conservation value for the presence of the priority EU Annex I habitat 'Active raised bog 7110'. Past drainage of the high bog is evident by the presence of functional drainage ditches in the southern part of the site.

The southern margins of the high bog comprise actively cut face banks that are progressively intruding into the high bog. An extensive area of industrially cutaway bog adjoins the western part of the site. Active cutting is no longer occurring along northern and eastern margins.

The bog is a remnant area of raised bog that has been severely impacted by long term peat extraction and associated drainage. The site surveyed continues to support a small area of active raised bog, a habitat that is rare throughout Ireland. The site is deemed to be of high conservation value due to the presence of 'Active Raised Bog (7110)', a priority habitat listed on Annex I of the EU Habitats Directive.

#### *7.3.5.2 Annex I Appraisal Assessment*

An Annex I assessment of the raised bog south of the proposed location of turbine T12, turbine T13 was carried out on 22/8/2014. Two relives were undertaken to record in detail Flora species and respective cover of each present. In summary this assessment found that the high bog present at the location is a remnant of a more extensive degraded/cutover raised bog which still has active raised bog (sphagnum cover >50%). The edge of the high bog is not defined by a face bank and the high bog surface has no drains; therefore it corresponds to the Annex I priority habitat "Active Raised Bog [7110]". This habitat, located outside the proposed development boundary, is of high conservation value.

#### *7.3.5.3 Botanical Species*

Lists of botanical species recorded within the Drehid-Hortland cluster are provided in Appendix F4. No FPO (Flora Protection Species) were noted within the cluster. Details of species identified from the Peatland survey of the adjacent high bog within the Hortland portion of the cluster are detailed in the relevant appendix of said report (see Appendix F5). *Rhododendron Ponticum* was the only invasive species recorded; this species is found at the forestry entrance to the site at N79873/35724 (see Figure 7.15.7, Volume 2a of this EIS for exact location).

#### *7.3.5.4 Terrestrial Mammals*

*Badger*
Evidence of Badger was noted at 3 locations within the proposed Drehid portion (T11-T23, T47) of the Drehid-Hortland cluster. An active sett with a single entrance was located in Parsonstown and Badger tracks were noted both on bog south of the proposed turbine T13 and also proximal to the proposed locations for Turbines 20 and 22. Locations of evidence are illustrated in Figure 7.15.9, Volume 2a of this EIS and detailed below in Table 7.19. No evidence of Badger was recorded within the proposed T40-T46 at Hortland.

### Table 7.19: Badger Records for Drehid-Hortland

| Date | Site | Species | Badger Signs | Turbine No./Folio/Location | Grid ref |
|---|---|---|---|---|---|
| 22/04/2013 | Drehid | Badger | Badger tracks throughout bog near T13. | Between T20 and T22 | Badger sett 674815 734449 |

*Otter*

Otter evidence (spraints) was noted along drains on the bog adjacent to the red line boundary between T14 and T15. An Otter holt with recent evidence of usage was located along a drainage ditch located to the south of the proposed location of T40.

## Table 7.20: Recorded Otter Evidence Drehid-Hortland

| Date | Site | Species | Otter signs | Turbine No./Folio/Location | Grid ref |
|---|---|---|---|---|---|
| 22/04/2013 | Drehid | Otter | Otter spraints along drains on bog close to T14 and T15 | T14/T15 | N674957 736247 |
| 25/02/2015 | Hortland | Otter | Holt; Active | T40 | N681407 734727 |

*Other Mammals*
Irish Hare is present at the site. Wood mouse remains were found in raptor pellets collected during Merlin surveys. Deer species are also present. Red Fox is present.

### *7.3.5.5 Avifauna*

There were no records of the following target species from surveys carried out at the Drehid-Hortland cluster: Greenland White fronted Goose, Kingfisher, Redshank, Black-Headed Gull or Common Gull.

### Drehid (Turbines T11-T23, T47)

#### *Whooper Swan*

*Occurrence within subject site winters 2012-2014*
A single bird was noted in flight over the Drehid portion of Drehid-Hortland on the 18/3/2013, during winter B&S surveys. This bird traversed the site northwest to southeast, due east of the proposed location of T21 (see Figure 7.15.0. B&S Flightlines of Note). The flight height of the observed bird was 50m; total flight duration was 51s.

#### *Golden Plover*

Golden Plover (an Annex I species [26]) were noted on six occasions in or near the Drehid portion of Drehid-Hortland. All observations were during the winter period. Table 7.21, below details the six observations. For observations for which flight height was recorded (n=5) three of the five observations involved flight activity within the predicted rotor envelope (50-170m). The recorded peak of 220 birds involved a flock off site to the northwest of Parsonstown at Coonagh.

## Table 7.21: Golden Plover Observations Drehid-Hortland Turbines T11-T23, T47

| Site Name | Survey Type | Visit Number | Date | Start Time | End Time | Species | Number | Bird Notes |
|---|---|---|---|---|---|---|---|---|
| Drehid | B & S Winter | 1 | 25/10/2012 | 12.38 | 13.45 | Golden Plover_GP | 2 | Flying 10-100m |
| Drehid | B & S Winter | 2 | 15/01/2013 | 10.00 | 15.45 | Golden Plover_GP | 52 | |
| Drehid | B & S Winter | 2 | 15/01/2013 | 10.00 | 15.45 | Golden Plover_GP | 20 | Flew E at 15-20m |
| Drehid | B & S Winter | 2 | 15/01/2013 | 10.00 | 15.45 | Golden Plover_GP | 24 | Flew S at 10-15m |

| Site Name | Survey Type | Visit Number | Date | Start Time | End Time | Species | Number | Bird Notes |
|---|---|---|---|---|---|---|---|---|
| Drehid | B & S Winter | 2 | 15/01/2013 | 10.30 | | Golden Plover_GP | 18 | Flying c.100m then <60m. Landed briefly. |
| Drehid | B & S Winter | 3 | 18/03/2013 | 08.55 | 16.00 | Golden Plover_GP | 220 | 120->180m |

*Merlin*

No Merlin were recorded within the Drehid portion of Drehid-Hortland during winter surveys. Following methods outlined previously the 1km square N7536 was selected as the breeding Merlin survey square for Drehid due to its habitat content including both foraging (bog) and nesting habitat (conifer edge). The location of the survey square and digitised transect routes used to search for Merlin evidence are detailed in Figure 7.15.3 Survey squares.

On the basis of the collected information, no usage of the selected habitat by Merlin could be extrapolated. A single pellet, found in May is most likely Kestrel given that Kestrel was recorded in the vicinity during winter B&S surveys. Passerine feathers, found underneath a tree along a ditch is typical evidence from Sparrowhawk (also recorded at the site during winter surveys) and therefore unlikely to be Merlin. Insufficient evidence of the quantity and type expected at a Merlin site were located to consider the surveyed square as containing breeding Merlin or being part of a Merlin territory. Results of Merlin surveys are outlined below in Table 7.22 and illustrated in Figure 7.15.5, Volume 2a of this EIS.

### Table 7.22: Results of Merlin Surveys N7536 – Drehid-Hortland Cluster

| Visit Number | Date | Sighting / Structure / Sighting Grid Reference | sign / evidence type | No. Of prey items | Age of prey / evidence | Bird Notes |
|---|---|---|---|---|---|---|
| 1 | 07/05/2013 | 74981/36105 | P | 1 | >3weeks | Possible Kestrel Pellet |
| 1 | 07/05/2013 | 75452/36105 | | | | Snipe x1 |
| 1 | 07/05/2013 | 75619/35533 | | | | Mallard x1 |
| 2 | 07/06/2013 | | | | | No signs recorded |
| 3 | 09/08/2013 | 675323/736879 | Pl | 15 | <3weeks | Passerine feathers found under a birch tree along ditch |
| 3 | 09/08/2013 | | | | | Jay x2: pair in forestry |

*Hen Harrier*

No Hen Harriers were recorded from surveys carried out at the Drehid portion of Drehid-Hortland.

*Lapwing*

A flock of 19 wintering Lapwing were recorded during winter B&S surveys. These were noted SE of the proposed location of T14 on cutaway bog, outside the cluster boundary. Investigations during the 2013 breeding season (April to June) found no occupied territories within the 500 envelope (500m around each proposed turbine location).

*Woodcock*

There were two occupied breeding territories, of the red listed [27] Woodcock (*Scolopax rusticola*) recorded within or near the 500m turbine envelope (see Figure 7.15.4: Breeding Wader Results, Volume 2a of this EIS). A single bird was recorded roding (in territorial display) within the 500m envelope, to the southeast of the proposed location of T14 in April 2013 (date of visit 22/4/2013 and 23/4/2013). A further bird was recorded roding in June to the east of the proposed location of T20, also within the predicted 500m turbine envelope.

*Snipe*

Three confirmed occupied territories (based on drumming or displaying males) and one possible territory (bird recorded in flight only) were noted during breeding wader surveys carried out in April-June 2013 (see Figure 7.15.4: Breeding Wader Results). The locations of birds exhibiting territorial behaviour in 2013 was exclusively outside the proposed 500m turbine envelope, and centred on the habitats fringing the large expanse of bog to the east of the cluster. An occupied territory (see Figure 7.15.4: Breeding Wader Results) was verified on the 29th April, 2014 when another male was noted drumming south of the proposed location of turbine T13. This is assumed to be a separate territory to those recorded in 2013, and was within the proposed 500m turbine envelope.

**Table 7.23: Snipe Breeding Observations Turbines T11-T23, T47 Drehid-Hortland Cluster**

| Species | Number | Total pairs | Breeding Status | Sighting / Structure / Sighting Grid Reference | Bird Notes |
|---|---|---|---|---|---|
| Snipe_SN | 1 | 1 | OT | 675236 736232 | Drumming |
| Snipe_SN | 1 | 1 | OT | 675494 735591 | Possible breeder, flying no drumming |
| Snipe_SN | 2 | 2 | 2OT | 674964 733884 | 2 Drumming |
| Snipe_SN | 1 | 1 | OT | 765 368 | One drumming; 2014 visits to cover envelope changes |

*Barn Owl*

No observation was made of Barn Owl during the entire survey period.

Following the methods outlined previously, 10 locations within 1.5km of the wind farm site were identified as having potential for breeding Barn Owls and were examined for evidence of Barn Owl. Of these, no site was confirmed to contain Breeding Barn Owl.

Two of the surveyed locations were classified in the highest category for suitability (occupied or highly suitable) for breeding Barn Owl (*Tyto alba*) with multiple opportunities for nesting and/or roosting. In addition, there were four suitable Barn Owl sites recorded within 1.5km of the subject site, which were classified as having limited access and/or limited number of nest and/or roost locations, an additional 2 sites were classified as suitable for roosting only. No evidence of nesting and/or roosting was recorded within these sites.

Two sites were completely unsuitable for either roosting or breeding. The findings of the current study, in particular the low occupancy of highly suitable nest sites, reflect the current status of the species in Ireland, which has undergone a 47% decline in breeding distribution during the period 1968-72 to 2007-11 [69]. Barn Owl is Red listed on the BoCCCI list [27].

### *Yellowhammer*

This species, which is red listed in Ireland was recorded both during winter and breeding season surveys. All observations were from the southwest portion of the site, in particular the townlands of Drehid and Parsonstown. During winter a peak of eight birds were recorded in northern area of the cluster within which proposed turbines T11, T12 and T13 are to be located. Birds were also noted in this area during CBS (breeding season) surveys indicating that birds are present year round in suitable habitat.

### *Whinchat*

No records of this species which has undergone a 76% range contraction in Ireland (most of which in the midlands) in the time period 1968-72 to present [69].

### *Kestrel*

Kestrel was noted on two occasions during winter B&S surveys. Dates of observations were 25/10/2012 and 18/3/2013. On the latter date a bird was recorded in flight at 30m. No sightings were recorded during breeding season surveys however a single pellet found during Merlin surveys is attributable to Kestrel and points to resident birds outside the Drehid portion of Drehid-Hortland boundary.

### *Mute Swan*

Two adults were recorded in flight over the Drehid portion of Drehid-Hortland on 18/3/2013 during winter B&S surveys. Observed flight height was 40m and flight duration was 68s.The birds were flying northeast to southwest between the proposed locations of T17 and T18.

### *Buzzard*

There were three observations of this species during winter 2012/13 B&S surveys. Two observations involved single birds (in flight at 10-50m and 30m respectively) and the third, in March 2013 involved a pair in display over suitable breeding habitat east of the proposed location of T20 (see Figure 7.15.0 B&S Flightlines of Note, Volume 2a of this EIS). This involved flight heights of up to 100m. There were no further observations during the breeding season.

### *General Wintering Birds*

A total of 53 species were recorded from the site over the course of winter season B&S surveys. Of these, five species (Yellowhammer, Meadow Pipit, Grey Wagtail, Lapwing and Golden Plover) are on the BoCCI Red List [27], 11 species (Goldcrest, Robin, House Sparrow, Kestrel, Linnet, Mistle Thrush, Mute Swan, Tree Sparrow, Teal, Whooper Swan and Starling) are Amber listed; whilst the remaining species recorded are all Green listed.

Three species listed on Annex I of the EU Habitats Directive (Golden Plover, Little Egret and Whooper Swan) were recorded. Table 7.24, over details the species recorded.

## Table 7.24: B&S Bird Survey Results - Drehid-Hortland Cluster Turbines T11-T23, T47

| B&S | | Code | Visit 1 | Visit 2 | Visit 3 | Total | BoCCI status | EU habitats Directive Annex I |
|---|---|---|---|---|---|---|---|---|
| Blackbird | *Turdus merula* | B | 26 | 85 | 60 | 171 | Green | No |
| Blue Tit | *Cyanistes caeruleus* | BT | 8 | 7 | 7 | 22 | Green | No |
| Bullfinch | *Pyrrhula pyrrhula* | BF | 1 | 1 | 1 | 3 | Green | No |
| Buzzard | *Buteo buteo* | BZ | 3 | 1 | 3 | 7 | Green | No |
| Chaffinch | *Fringilla coelebs* | CH | 25 | 23 | 79 | 127 | Green | No |
| Coal Tit | *Periparus ater* | CT | 6 | 31 | 15 | 52 | Green | No |
| Collared Dove | *Streptopelia decaocto* | CD | 0 | 0 | 3 | 3 | Green | No |
| Common Crossbill | *Loxia curvirostra* | CR | 0 | 1 | 5 | 6 | Green | No |
| Dunnock | *Prunella modularis* | D | 2 | 11 | 8 | 21 | Green | No |
| Feral Pigeon | *Columba livia* | FP | 0 | 0 | 5 | 5 | Green | No |
| Fieldfare | *Turdus pilaris* | FF | 108 | 121 | 5 | 234 | Green | No |
| Goldcrest | *Regulus regulus* | GC | 15 | 19 | 14 | 48 | Amber | No |
| Golden Plover | *Pluvialis apricaria* | GP | 2 | 114 | 220 | 336 | Red | Yes |
| Goldfinch | *Carduelis carduelis* | GO | 53 | 0 | 0 | 53 | Green | No |
| Great Tit | *Parus major* | GT | 22 | 3 | 9 | 34 | Green | No |
| Green Sandpiper | *Tringa ochropus* | GE | 0 | 0 | 2 | 2 | Green | No |
| Grey Heron | *Ardea cinerea* | H | 0 | 0 | 1 | 1 | Green | No |
| Grey Wagtail | *Motacilla cinerea* | GL | 2 | 0 | 0 | 2 | Red | No |
| Hooded Crow | *Corvus cornix* | HC | 10 | 18 | 31 | 59 | Green | No |
| House Sparrow | *Passer domesticus* | HS | 26 | 0 | 3 | 29 | Amber | No |
| Jackdaw | *Corvus monedula* | JD | 3 | 10 | 6 | 19 | Green | No |
| Jay | *Garrulus glandarius* | J | 6 | 4 | 4 | 14 | Green | No |
| Kestrel | *Falco tinnunculus* | K | 1 | 0 | 1 | 2 | Amber | No |
| Lapwing | *Vanellus vanellus* | L | 19 | 0 | 0 | 19 | Red | No |
| Lesser Redpoll | *Carduelis cabaret* | LR | 50 | 3 | 25 | 78 | Green | No |
| Linnet | *Carduelis cannabina* | Li | 18 | 11 | 0 | 29 | Amber | No |
| Little Egret | *Egretta garzetta* | ET | 0 | 1 | 0 | 1 | Green | Yes |
| Long-tailed Tit | *Aegithalus caudatus* | LT | 2 | 9 | 3 | 14 | Green | No |
| Magpie | *Pica pica* | MG | 6 | 10 | 4 | 20 | Green | No |
| Mallard | *Anas platyrhynchos* | MA | 22 | 2 | 4 | 28 | Green | No |
| Meadow Pipit | *Anthus pratensis* | MP | 12 | 4 | 24 | 40 | Red | No |
| Mistle Thrush | *Turdus viscivorus* | M | 18 | 0 | 12 | 30 | Amber | No |
| Mute Swan | *Cygnus olor* | MS | 0 | 0 | 2 | 2 | Amber | No |
| Pheasant | *Phasianus colchicus* | PH | 14 | 0 | 5 | 19 | Not assessed | No |
| Pied Wagtail | *Montacilla alba* | PW | 2 | 1 | 5 | 8 | Green | No |
| Raven | *Corvus corax* | RN | 3 | 4 | 1 | 8 | Green | No |
| Redwing | *Turdus iliacus* | RE | 164 | 136 | 129 | 429 | Green | No |

| B&S | | Code | Visit 1 | Visit 2 | Visit 3 | Total | BoCCI status | EU habitats Directive Annex I |
|---|---|---|---|---|---|---|---|---|
| Reed Bunting | *Acrocephalus scirpaceus* | RB | 6 | 0 | 1 | 7 | Green | No |
| Robin | *Erithacus rubecula* | R | 45 | 24 | 33 | 102 | Amber | No |
| Rook | *Corvus frugilegus* | RO | 61 | 114 | 61 | 236 | Green | No |
| Siskin | *Carduelis spinus* | SK | 43 | 0 | 0 | 43 | Green | No |
| Snipe | *Gallinago gallinago* | SN | 5 | 9 | 0 | 14 | Amber | No |
| Song Thrush | *Turdus philomelos* | ST | 1 | 4 | 13 | 18 | Green | No |
| Sparrrowhawk | *Accipiter nisus* | SH | 1 | 0 | 1 | 2 | Green | No |
| Starling | *Sturnus vulgaris* | SG | 1 | 533 | 1406 | 1940 | Amber | No |
| Stonechat | *Saxicola torquata* | SC | 0 | 1 | 0 | 1 | Green | No |
| Teal | *Anas crecca* | TE | 0 | 16 | 21 | 37 | Amber | No |
| Tree Sparrow | *Passer montanus* | TS | 0 | 0 | 22 | 22 | Amber | No |
| Treecreeper | *Certhia familiaris* | TC | 0 | 1 | 4 | 5 | Green | No |
| Whooper Swan | *Cygnus cygnus* | WS | 0 | 0 | 1 | 1 | Amber | Yes |
| Woodpigeon | *Columba palumbus* | WP | 185 | 20 | 154 | 359 | Green | No |
| Wren | *Troglodytes troglodytes* | WR | 33 | 24 | 25 | 82 | Green | No |
| Yellowhammer | *Emberiza citronella* | Y | 0 | 1 | 8 | 9 | Red | No |

### *General Breeding Birds*

Table 7.25 details the species recorded on both early and late season CBS (Countryside Bird Survey) visits. Following methods outlined previously, two 1km squares (illustrated in Figure 7.5.0 Survey Squares, Volume 2a of this EIS) were selected to sample breeding bird activity within the cluster. The northernmost square (N7436) was selected to sample agricultural habitats and forestry in different stages of its lifecycle and the southernmost square (N73 335) sampled agricultural lands. Species recorded included general countryside birds. Yellowhammer, which is Red listed was recorded. Migrant species recorded included, Blackcap, Willow Warbler, Chiffchaff, Whitethroat and Swallow. Cuckoo (n=3) was recorded during the early season visit to N7335. In total 1 red, 6 amber and 30 green listed species were recorded.

### Table 7.25: CBS Survey Results N7436 – Drehid Hortland Cluster T11-T23, T47

| CBS | | Code | Early | Late | BoCCI status | EU Habitats Directive Annex I |
|---|---|---|---|---|---|---|
| Blackbird | *Turdus merula* | B | 42 | 30 | Green | No |
| Blackcap | *Sylvia atricapilla* | BC | 3 | 1 | Green | No |
| Blue Tit | *Cyanistes caeruleus* | BT | 8 | 3 | Green | No |
| Bullfinch | *Pyrrhula* | BF | 0 | 3 | Green | No |
| Chaffinch | *Fringilla coelebs* | CH | 39 | 34 | Green | No |
| Chiffchaff | *Phylloscopus collybita* | CC | 5 | 5 | Green | No |
| Coal Tit | *Periparus ater* | CT | 13 | 8 | Green | No |
| Collared Dove | *Streptopelia decaocto* | CD | 4 | 0 | Green | No |
| Cuckoo | *Cuculus canorus* | CK | 3 | 0 | Green | No |

| CBS | | Code | Early | Late | BoCCI status | EU Habitats Directive Annex I |
|---|---|---|---|---|---|---|
| Dunnock | *Prunella modularis* | D | 3 | 8 | Green | No |
| Goldcrest | *Regulus regulus* | GC | 16 | 16 | Green | No |
| Goldfinch | *Carduelis carduelis* | GO | 5 | 5 | Green | No |
| Great Tit | *Parus major* | GT | 10 | 2 | Green | No |
| Greenfinch | *Carduelis chloris* | GR | 1 | 6 | Green | No |
| Hooded Crow | *Corvus cornix* | HC | 4 | 0 | Green | No |
| House Sparrow | *Passer domesticus* | HS | 8 | 2 | Amber | No |
| Jackdaw | *Corvus monedula* | JD | 0 | 2 | Green | No |
| Jay | *Garrulus glandarius* | J | 1 | 0 | Green | No |
| Lesser Redpoll | *Carduelis cabaret* | LR | 8 | 0 | Green | No |
| Long-tailed Tit | *Aegithalus caudatus* | LT | 4 | 5 | Green | No |
| Magpie | *Pica pica* | MG | 0 | 1 | Green | No |
| Mallard | *Anas platyrhynchos* | MA | 1 | 1 | Green | No |
| Mistle Thrush | *Turdus viscivorus* | M | 2 | 7 | Green | No |
| Moorhen | *Gallinula chloropus* | MH | 1 | 0 | Green | No |
| Pied Wagtail | *Montacilla alba* | PW | 1 | 2 | Green | No |
| Raven | *Corvus corax* | RN | 2 | 0 | Green | No |
| Robin | *Erithacus rubecula* | R | 21 | 8 | Amber | No |
| Rook | *Corvus frugilegus* | RO | 49 | 4 | Green | No |
| Song Thrush | *Turdus philomelos* | ST | 17 | 12 | Green | No |
| Starling | *Sturnus vulgaris* | SG | 0 | 7 | Amber | No |
| Swallow | *Hirundo rustica* | SL | 13 | 12 | Amber | No |
| Treecreeper | *Certhia familiaris* | TC | 1 | 0 | Green | No |
| Whitethroat | *Sylvia communis* | WH | 5 | 4 | Green | No |
| Willow Warbler | *Phylloscopus trochilus* | WW | 11 | 9 | Green | No |
| Woodpigeon | *Columba palumbus* | WP | 18 | 16 | Green | No |
| Wren | *Troglodytes troglodytes* | WR | 51 | 46 | Green | No |
| Yellowhammer | *Emberiza citronella* | Y | 7 | 4 | Red | No |

## Hortland (Turbines T40 - T46)

### *Whooper Swan*

No observations were made of this species within the study period.

### *Golden Plover*

Golden Plover (an Annex I species [26]) were noted on a single occasion in or near the cluster boundary during the winter period. Table 7.26, details the observation. For observations for which flight height was recorded (n=1) none involved flight activity within the predicted rotor envelope.

### Table 7.26: Golden Plover observations - Drehid-Hortland Turbines (T40-T46)

| Site Name | Survey Type | Date | Species | Number | Duration (s) | <30 | <50 | 30-170 | 50-170 | >170 |
|---|---|---|---|---|---|---|---|---|---|---|
| Hortland | B & S Winter | 25/01/2013 | Golden Plover_GP | 438 | 600 | 0 | 600 | 600 | | |

*Merlin*

No Merlin were recorded during winter surveys. Following methods outlined previously the 1km square N7935 (see Figure 7.15.3 Survey Squares, Volume 2a of this EIS) was selected as the breeding Merlin survey square for the Hortland portion of the Drehid-Hortland cluster due to its habitat content including both foraging (bog) and nesting habitat (conifer edge).

### Table 7.27: Results of Merlin Surveys N7935 – Drehid- Hortland Cluster (T40-T46)

| Visit Number | Date | Sighting / Structure / Sighting Grid Reference | sign / evidence type | No. Of prey items | Age of prey / evidence | Bird Notes |
|---|---|---|---|---|---|---|
| 1 | 11/04/2013 | N79372 35481 | Pellets, Plucked item | 2 | >/<3weeks | frog, bird |
| 1 | 11/04/2013 | N79356 35500 | Pellets, Plucked item | 1 | <3weeks | frog |
| 1 | 11/04/2013 | N79347 35507 | Plucked item | 2 | >/<3weeks | frog, bird |
| 1 | 11/04/2013 | N79200 35164 | Plucked item | 1 | <3weeks | frog |
| 1 | 11/04/2013 | | Hen Harrier x1 | | | male, hunting/flying. Mobbed by hooded crows |
| 1 | 11/04/2013 | | Buzzard x1 | | | |
| 1 | 11/04/2013 | | Kestrel x2 | | | male and female |
| 2 | 04/06/2013 | N79369 35482 | Plucked item | 1 | <3weeks | bird |
| 2 | 04/06/2013 | N79364 35493 | Pellets | | >3weeks | |
| 2 | 04/06/2013 | N79356 35501 | Plucked item | | >3weeks | |
| 2 | 04/06/2013 | N79352 35508 | Plucked item | 2 | <3weeks | bird and mammal |
| 2 | 04/06/2013 | N78882 35407 | Plucked item, pellets | 1 | >3weeks | feather |

| Visit Number | Date | Sighting / Structure / Sighting Grid Reference | sign / evidence type | No. Of prey items | Age of prey / evidence | Bird Notes |
|---|---|---|---|---|---|---|
| 2 | 04/06/2013 | N79202 35168 | Moth Wings | 1 | previous season | dragon fly wings |
| 3 | 10/07/2013 | N7928 3567 | | | | |

Results of the analysis of collected prey remains and pellets is presented below in Table 7.28. Where possible, all species discovered were identified to the specific level.

A number of assumptions have been made, as follows: (1) all small passerines up to the size of thrush species (Song Thrush, Redwing and Blackbird), and Snipe, are considered potential Merlin prey where feather 'scatters' were discovered (note that where remains of small passerines were found in pellets, then the nature of the pellet is considered before assigning it to Merlin or another bird of prey species); (2) small mammal remains found in pellets have not been assigned to Merlin, as all such pellets were identifiable as belonging to Kestrel or Long-eared Owl; (3) Frog remains found in pellets (or otherwise) have not been assigned to Merlin either (although see *Irish Birds* 9: 510-511), pellets containing Frog are assigned to Kestrel; although studies suggest that Frogs are not a common feature of Kestrel diet; (4) Frogs appear to be more often taken by Kestrels than by Merlins ;Table 7.28, below shows the results of the pellet analysis for N7935.

### Table 7.28: Prey Item / Pellet Analysis N7935 Merlin Square

| Site Name | Date Collected | Grid Reference | Contents | Refers to Merlin Presence Y / N |
|---|---|---|---|---|
| Hortland N7935 | 11-Apr-13 | N79372 35489 | Meadow Pipit feathers | Yes |
| | | | LEO pellet (44x22): Wood Mouse (2) | No |
| Hortland | 11-Apr-13 | N79356 35500 | Kestrel pellet (23x11): Pygmy Shrew | No |
| Hortland | 11-Apr-13 | N79347 35507 | Meadow Pipit feathers | Yes |
| Hortland | 05-Jun-13 | N79364 35493 | Kestrel pellet (33x14.5): Wood Mouse & Pygmy Shrew | No |
| Hortland | 05-Jun-13 | N79352 35508 | Passerine feathers, possibly Chaffinch | No |
| Hortland | 05-Jun-13 | N79369 35482 | Siskin; possibly Greenfinch | Yes |
| Hortland | 05-Jun-13 | N79202 35168 | Dragonfly | Yes |
| Hortland | 05-Jun-13 | N78882 35407 | Linnet or Redpoll feathers | Yes |
| | | | Kestrel/Merlin pellet (38x18); small passerine, possibly Linnet | No |
| | | | Kestrel pellet: very small pellet, mammal fur, but no bone | No |
| Hortland | 05-Jun-13 | N79356 35501 | Frog/Lizard backbone | Possibly |

On the basis of the collected information, the subject square does show evidence of potential usage by Merlin and consequently may form part of a territory. Many of the prey items can be attributed to Merlin and therefore on a precautionary basis the square is assigned as showing evidence of occupancy by Merlin. It should be noted that no observations where made of birds, and no suitable nest sites (such as old corvid nests) were recorded; however research shows that this does not preclude the presence of Merlin. Nonetheless one might expect that if breeding were occurring in the square which was surveyed (or in the area of the square closest to the proposed turbines) some observations of territorial behaviour such as mobbing the observer, mobbing other birds of prey etc. might have been recorded. It should be noted that the area was also surveyed three times for breeding waders, with no observations of Merlin. Kestrel, Hen Harrier and Buzzard however, were observed in the same square over the same survey period. Results of Merlin surveys are outlined below in Table 7.15 and illustrated in Figure 7.15.5, Volume 2a of this EIS.

### *Red Grouse*

A Red Grouse survey, following methods outlined previously was carried out at the subject site in late March 2013 (date: 27/3/2013). An east-west transect through suitable habitat (high bog west of the proposed development) was walked and a tape lure simulating the territorial call of a male Red Grouse was played. No responses were received and it is therefore assumed that no Red Grouse are present on the high bog surveyed.

### *Hen Harrier*

A single Hen Harrier was observed during Merlin surveys on April 11, 2013. The sighting involved a male bird which was noted hunting and interacting with Hooded Crows before flying out of sight to the west (see Figure 7.15.4 Merlin Transects and Additional Sightings, Volume 2a of this EIS). As the subject site is outside the current range of breeding Hen Harrier in Ireland [70], this is assumed to have been a late wintering bird possibly en route to one of the known roosts located to the south of the site (see 7.3.6.5).

### *Curlew*

A single record of five birds during winter B&S surveys on 21/1/2013. No further sightings during winter visits and no evidence of breeding.

### *Lapwing*

No Lapwing were recorded on site during breeding wader surveys carried out in April, May and June 2013. Lapwing were recorded on site during winter B&S surveys carried out in winter 2012/13. Birds were noted on two days in the vicinity of the proposed location of T46, in the townland of Bishop's Chair. Recorded flight activity and numbers are detailed in Table 7.29, below.

**Table 7.29: Lapwing Observations Drehid-Hortland Turbines T40-T46**

| Site Name | Survey Type | Visit Number | Date | Species | Number | Duration (s) | <50 | 50-170 | >170 |
|---|---|---|---|---|---|---|---|---|---|
| Hortland | B & S Winter | 1 | 01/11/2012 | Lapwing_L. | 58 | | 0 | 0 | 0 |
| Hortland | B & S Winter | 2 | 24/01/2013 | Lapwing_L. | 110 | 250 | 250 | 0 | 0 |
| Hortland | B & S Winter | 2 | 24/01/2013 | Lapwing_L. | 105 | 350 | 350 | 0 | 0 |
| Hortland | B & S Winter | 2 | 25/01/2013 | Lapwing_L. | 105 | 330 | 0 | 330 | 0 |

Total recorded flight duration was 930s of which all was below the predicted rotor envelope of 50-170m. A further breakdown finds that 600s was at heights less than 20m, whilst 330s was at 50m. Birds were also noted in this area on the first B&S visit in lower numbers (n=58). The maximum number recorded on site was 110, noted on January 21, 2013.

*Woodcock*

No woodcock were recorded during winter surveys.

There were four occupied breeding territories, of the red listed [27] Woodcock (*Scolopax rusticola*) recorded within or near the 500m turbine envelope (see Figure 7.15.4: Breeding Wader Results, Volume 2a of this EIS). Surveys were carried out during the time period April-June 2013, following methods outlined previously. Dates of surveys were April 11, 24 and 27; May 23 and 24 and June 19 and 25. Results of surveys are detailed below in Table 7.30, and illustrated in Figure 7.15.4 Breeding waders survey results, Volume 2a of this EIS.

### Table 7.30: Breeding Woodcock Territories - Drehid / Hortland Turbines T40-T46

| Site Name | Survey Type | Species | Number | Breeding Status | Grid Reference | Bird Notes |
|---|---|---|---|---|---|---|
| Hortland | Breeding wader | Woodcock_WK | 1 | CBA | N800 356 | Roding and flushed 27/04/2013 |
| Hortland | Breeding wader | Woodcock_WK | 1 | CBA | N801 348 | Roding |
| Hortland | Breeding wader | Woodcock_WK | 2 | CBA | N804 351 | Roding |
| Hortland | Breeding wader | Woodcock_WK | 1 | CBA | N805 357 | Roding |

*Snipe*

Four occupied territories (based on drumming or chipping birds), including one confirmed breeding attempt, were noted during breeding wader surveys carried out in April-June 2013 (see Figure 7.15.5: Breeding Wader Results, Volume 2a of this EIS). Three of these were outside the 500m turbine envelope on high bog adjacent to the west whilst the remaining territory was within the 500m boundary line to the south east of the proposed T40 location. In total, four pairs of Snipe are thought to have bred or held territory close to the proposed windfarm, all but one outside the proposed turbine envelope.

### Table 7.31: Locations of Snipe Breeding Observations Hortland Turbines T40- T46

| Survey Type | Species | Number | Breeding Status | Sighting / Structure / Sighting Grid Reference | Bird Notes |
|---|---|---|---|---|---|
| Breeding wader | Snipe_SN | 1 | OT | N795 356 | Chipping |
| Breeding wader | Snipe_SN | 1 | OT | N793 357 | Chipping |
| Breeding wader | Snipe_SN | 2 | CBA | N818 347 | Drumming both visits |
| Breeding wader | Snipe_SN | 1 | OT | N789 352 | Chipping |

### *Barn Owl*

No observation was made of Barn Owl during the entire survey period. Following the methods outlined previously, 21 locations within 1.5km of the wind farm site were identified as having potential for breeding Barn Owls and were examined for evidence of Barn Owl.

Of these, no site was confirmed to contain Breeding Barn Owl. Three of the surveyed locations were classified in the highest category for suitability (occupied or highly suitable) for breeding Barn Owl (*Tyto alba*) with multiple opportunities for nesting and/or roosting. In addition, there were 11 suitable Barn Owl sites recorded within 1.5km of turbines T40-46, which were classified as having limited access and/or limited number of nest and/or roost locations, an additional five sites were classified as suitable for roosting only. No evidence of nesting and/or roosting was recorded within these sites. Two sites were completely unsuitable for either roosting or breeding. The findings of the current study, in particular the low occupancy of highly suitable nest sites, reflect the current status of the species in Ireland, which has undergone a 47% decline in breeding distribution during the period 1968-72 to 2007-11 [69]. Barn Owl is Red listed on the BoCCCI list [27].

### *Yellowhammer*

This species, which is red listed in Ireland, was not recorded from the Hortland portion of Drehid-Hortland cluster during winter and breeding season surveys.

### *Whinchat*

This species which has undergone a 76% range contraction in Ireland (most of which in the midlands) in the time period 1968-72 to present [69]. A breeding pair was noted on June 19, 2013; west of the proposed turbine T40 location. Both male and female birds were noted in wet grassland habitat, located outside the proposed development boundary.

### *Kestrel*

Kestrel was noted on two occasions during winter B&S surveys. Dates of observations were 01/11/2012 and 24/1/2013. One of these occasions was a female commuting through the site at a flight height of 30m. Observations during the summer months included a pair in April, noted hunting the high bog and forest edge west of the proposed location of T42. Single sightings were also noted close to this location in May indicating a potential breeding territory. However, no occupied nests or proof of breeding was recorded within the Hortland portion of Drehid-Hortland.

### *Lesser Black-backed gull*

A single observation during winter months. A flock of 5 was noted on 22/3/2013 during winter B&S surveys.

### *Buzzard*

There were six observations of this species during surveys within the Hortland portion of the Drehid-Hortland cluster. Four observations, of up to two birds were noted during winter surveys. Birds were also observed in the area of forestry south west of the proposed location of turbine T44 in April and May 2013. This included birds perched and sightings of more than one individual, indicating a possibly occupied territory. A potential nest site may have been located at N801 363 however this was not investigated so as to avoid disturbing breeding birds if present. Observed flight heights ranged from 10m to 100m.

### *General Wintering Birds*

A total of 44 species were recorded from the site over the course of winter season B&S surveys. Of these, four species (Curlew, Meadow Pipit, Lapwing and Golden Plover) are on the BoCCI Red List [27], 10 species (Goldcrest, Sparrowhawk, Robin, House Sparrow, Kestrel, Linnet, Mistle Thrush, Lesser Black Backed Gull,

Snipe and Starling) are Amber listed; whilst the remaining species recorded are all Green listed. One species listed on Annex I of the EU habitats directive (Golden Plover) was recorded. Table 7.32, below details the species recorded.

### Table 7.32: Bird Species Recorded during Winter B&S surveys Hortland T40-T46

| B&S | | Code | Visit 1 | Visit 2 | Visit 3 | BoCCI status | EU habitats Directive Annex I |
|---|---|---|---|---|---|---|---|
| Blackbird | *Turdus merula* | B | 19 | 14 | 12 | Green | No |
| Blue Tit | *Cyanistes caeruleus* | BT | 3 | 23 | 1 | Green | No |
| Bullfinch | *Pyrrhula pyrrhula* | BF | 4 | 6 | 0 | Green | No |
| Buzzard | *Buteo buteo* | BZ | 5 | 1 | 0 | Green | No |
| Chaffinch | *Fringilla coelebs* | CH | 24 | 20 | 4 | Green | No |
| Coal Tit | *Periparus ater* | CT | 9 | 4 | 3 | Green | No |
| Common Crossbill | *Loxia curvirostra* | CR | 8 | 0 | 0 | Green | No |
| Curlew | *Numenius arquata* | CU | 0 | 5 | 0 | Red | No |
| Dunnock | *Prunella modularis* | D | 2 | 82 | 0 | Green | No |
| Fieldfare | *Turdus pilaris* | FF | 2 | 40 | 3 | Green | No |
| Goldcrest | *Regulus regulus* | GC | 7 | 25 | 5 | Amber | No |
| Golden Plover | *Pluvialis apricaria* | GP | 0 | 438 | 0 | Red | Yes |
| Goldfinch | *Carduelis carduelis* | GO | 3 | 28 | 0 | Green | No |
| Great Tit | *Parus major* | GT | 5 | 5 | 1 | Green | No |
| Greenfinch | *Carduelis chloris* | GR | 0 | 3 | 0 | Green | No |
| Grey Heron | *Ardea cinerea* | H | 1 | 0 | 0 | Green | No |
| Hooded Crow | *Corvus cornix* | HC | 9 | 2 | 3 | Green | No |
| House Sparrow | *Passer domesticus* | HS | 3 | 8 | 0 | Amber | No |
| Jackdaw | *Corvus monedula* | JD | 65 | 58 | 4 | Green | No |
| Jay | *Garrulus glandarius* | J | 0 | 2 | 0 | Green | No |
| Kestrel | *Falco tinnunculus* | K | 1 | 11 | 0 | Amber | No |
| Lapwing | *Vanellus vanellus* | L | 58 | 111 | 0 | Red | No |
| Lesser Black-backed Gull | *Larus fuscus* | LB | 0 | 0 | 5 | Amber | No |
| Lesser Redpoll | *Carduelis cabaret* | LR | 1 | 45 | 1 | Green | No |
| Linnet | *Carduelis cannabina* | LI | 0 | 35 | 0 | Amber | No |
| Long-tailed Tit | *Aegithalus caudatus* | LT | 7 | 1 | 0 | Green | No |
| Magpie | *Pica pica* | MG | 2 | 6 | 1 | Green | No |
| Meadow Pipit | *Anthus pratensis* | MP | 1 | 1 | 0 | Red | No |
| Mistle Thrush | *Turdus viscivorus* | M | 2 | 2 | 2 | Amber | No |
| Pheasant | *Phasianus colchicus* | PH | 1 | 1 | 0 | N/A | No |
| Pied Wagtail | *Montacilla alba* | PW | 2 | 2 | 0 | Green | No |
| Raven | *Corvus corax* | RN | 2 | 0 | 1 | Green | No |
| Redwing | *Turdus iliacus* | RE | 7 | 1 | 40 | Green | No |
| Reed Bunting | *Acrocephalus scirpaceus* | RB | 2 | 4 | 0 | Green | No |
| Robin | *Erithacus rubecula* | R | 22 | 27 | 3 | Amber | No |

| B&S | | Code | Visit 1 | Visit 2 | Visit 3 | BoCCI status | EU habitats Directive Annex I |
|---|---|---|---|---|---|---|---|
| Rook | *Corvus frugilegus* | RO | 49 | 80 | 15 | Green | No |
| Siskin | *Carduelis spinus* | SK | 2 | 3 | 0 | Green | No |
| Snipe | *Gallinago gallinago* | SN | 1 | 1 | 0 | Amber | No |
| Song Thrush | *Turdus philomelos* | ST | 1 | 0 | 0 | Green | No |
| Sparrrowhawk | *Accipiter nisus* | SH | 1 | 105 | 1 | Amber | No |
| Starling | *Sturnus vulgaris* | SG | 235 | 0 | 0 | Amber | No |
| Treecreeper | *Certhia familiaris* | TC | 2 | 1 | 0 | Green | No |
| Woodpigeon | *Columba palumbus* | WP | 22 | 49 | 7 | Green | No |
| Wren | *Troglodytes troglodytes* | WR | 12 | 4 | 5 | Green | No |

### *General Breeding Birds*

Table 7.33, below, details the species recorded on both early and late season CBS (Countryside Bird Survey) visits. Following methods outlined previously, a 1km square (illustrated in Figure 7.15.2, Survey Squares, Volume 2a of this EIS) was selected to sample breeding bird activity. The selected square (N7835) was selected to sample agricultural habitats, forestry and raised bog habitats. Species recorded included general countryside birds for the most part. Some late wintering Redwing were recorded on the early season (April to mid-May visit). Meadow Pipit, which is Red listed was recorded on high bog sections of the square although it should be noted that no development is proposed on high bog. Migrant species recorded included, Blackcap, Willow Warbler, Wheatear and Swallow. In total one red, seven amber and 22 green listed species were recorded.

### Table 7.33: CBS Results N7835 Drehid-Hortland Cluster

| Species | | Code | Early | Late | BoCCI status | EU habitats Directive Annex I |
|---|---|---|---|---|---|---|
| Blackbird | Turdus merula | B | 10 | 16 | Green | No |
| Blackcap | Sylvia atricapilla | BC | 0 | 1 | Green | No |
| Bullfinch | Pyrrhula pyrrhula | BF | 1 | 0 | Green | No |
| Chaffinch | Fringilla coelebs | CH | 12 | 3 | Green | No |
| Coal Tit | Periparus ater | CT | 2 | 0 | Green | No |
| Goldcrest | Regulus regulus | GC | 1 | 0 | Amber | No |
| Goldfinch | Carduelis carduelis | GO | 0 | 6 | Green | No |
| Great Tit | Parus major | GT | 1 | 0 | Green | No |
| Hooded Crow | Corvus cornix | HC | 5 | 1 | Green | No |
| Jackdaw | Corvus monedula | JD | 0 | 5 | Green | No |
| Long-tailed Tit | Aegithalus caudatus | LT | 0 | 1 | Green | No |
| Magpie | Pica pica | MG | 0 | 2 | Green | No |
| Mallard | Anas platyrhynchos | MA | 5 | 0 | Green | No |
| Meadow Pipit | Anthus pratensis | MP | 10 | 19 | Red | No |
| Mistle Thrush | Turdus viscivorus | M | 0 | 1 | Amber | No |
| Pheasant | Phasianus colchicus | PH | 2 | 1 | n/a | No |

| Species | | Code | Early | Late | BoCCI status | EU habitats Directive Annex I |
|---|---|---|---|---|---|---|
| Pied Wagtail | Montacilla alba | PW | 1 | 0 | Green | No |
| Raven | Corvus corax | RN | 0 | 1 | Green | No |
| Redwing | Turdus iliacus | RE | 7 | 0 | Green | No |
| Robin | Erithacus rubecula | R | 11 | 7 | Green | No |
| Rook | Corvus frugilegus | RO | 0 | 6 | Green | No |
| Skylark | Alauda arvensis | S | 2 | 3 | Amber | No |
| Snipe | Gallinago gallinago | SN | 1 | 0 | Amber | No |
| Song Thrush | Turdus philomelos | ST | 3 | 2 | Green | No |
| Starling | Sturnus vulgaris | SG | 0 | 1 | Amber | No |
| Swallow | Hirundo rustica | SL | 1 | 3 | Amber | No |
| Wheatear | Oenanthe oenanthe | W | 0 | 1 | Amber | No |
| Willow Warbler | Phylloscopus trochilus | WW | 1 | 7 | Green | No |
| Woodpigeon | Columba palumbus | WP | 5 | 4 | Green | No |
| Wren | Troglodytes troglodytes | WR | 8 | 7 | Green | No |

#### *7.3.5.6 Other Taxa*

Both Common Frog and Common Lizard are protected by the Wildlife Acts (1976-2012) [59]. Common Frog is likely to be present throughout the site in suitable habitat. Common Lizard, though not recorded, is likely present in suitable habitat. In addition, the following species of Lepidoptera (Butterflies) were recorded.

*Lepidoptera*
Small Tortoiseshell (*Aglais urticae*)
Peacock (*Inachis io*)
Speckled wood (*Pararge aegeria*)
Meadow Brown *Maniola jurtina*
Ringlet *Aphantopus hyperantus*
Green-veined White *Pieris napi*
Large Heath *Coenonympha tullia*

*Odonota*
Brown Hawker *Aeshna grandis*
Ruddy Darter *Sympetrum sanguineum*
Four-spotted chaser *Libellula quadrimaculata*
Banded demoiselle *Calopteryx splendens*
Large Red Damselfly *Pyrrhosoma nymphula*

### 7.3.6 Derrybrennan

The Derrybrennan cluster comprises two turbines (numbered T27-T28). These are proposed to be located on the south side of the R403 and the Grand Canal c.5km northwest of Allenwood, Co. Kildare. The two turbines are located in the townland of Derrybrennan. Note existing environment data on Aquatic Ecology and Bats are presented seperately.

### *7.3.6.1 Habitats*

#### *Proposed Turbine Folios*

Habitat mapping was carried out at the proposed turbine locations on July 8, 2013 and July 12, 2013. Habitat types identified within the study area are illustrated in Figure 7.16.20: Habitat Map, Volume 2a of this EIS, and described below.

*Arable Crops BC1* - This designation refers to the habitat within which the northernmost of the cluster. This comprises a number of fields used for arable crops, namely Barley or Wheat. Under the NRA site evaluation scheme [(6)], this habitat would be rated as of Local Importance (Lower Value).

*Improved Agricultural Grassland GA1* - The southernmost of the cluster is to be located in improved agricultural grassland. This is currently grazed by cattle. Species present include *Taraxacum* spp*., Lolium perenne* (dominant), *Alopecurus pratensis, Poa annua, Holcus lanatus, Agrostis stolonifera, Ranunculus repens, Potentilla anserine*, *Trifolium* spp., *Rumex crispus, Rumex obtusifolius, Ranunculus acris, Festuca* spp. Under the NRA site evaluation scheme [(6)], this habitat would be rated as of Local Importance (Lower Value).

*Conifer Plantation WD4* - This comprises Sitka spruce (2-4m high) with some broadleaf trees around the edges mainly *Salix cinerea*, *Alnus glutinosa*, *Betula* spp. Under the NRA site evaluation scheme [(6)], this habitat would be rated as of Local Importance (Lower Value).

*Mixed Conifer woodland WD3* - This refers to small stands of Scots Pine *Pinus sylvestris* with scattered Cyprus *Cupressus* species. Under the NRA site evaluation scheme [(6)], this habitat would be rated as of Local Importance (Higher Value).

*Treelines WL2* - A treeline comprising Scots Pine *Pinus sylvestris* and Willow *Salix* spp. forms a field boundary in the southern half of the land folio. Tree lines are also found on either side of the canal to the north of the cluster. Under the NRA site evaluation scheme [(6)], this habitat would be rated as of Local Importance (Higher Value).

*Dry Calcareous and Neutral Grassland GS1* - A small area of dry calcareous neutral grassland exists in the southeastern corner of the land folio. Species include *Holcus lanatus, Cynosurus cristatus, Phleum pratense, Anthaxanthum odoratum, Alopecurus pratensis, Trifolium* spp*., Prunella vulgaris, Lotus corniculatus, Leucanthemum vulgare, Plantago* spp*., Dactylorhiza fuchsia.* Under the NRA site evaluation scheme [(6)], this habitat would be rated as of Local Importance (Higher Value).

*Hedgerows WL1* - The eastern boundary of the cluster is comprised of Hawthorn *Crataegus monogyna* hedgerow. Under the NRA site evaluation scheme [(6)], this habitat would be rated as of Local Importance (Higher Value).

*(Mixed) Broadleaf Woodland WD1* - A narrow band (c.30m) of this habitat has been planted in the north west of the cluster. Trees present include *Fraxinus excelsior, Picea sylvestris, Picea sitchensis, Crataegus monogyna.* Under the NRA site evaluation scheme [(6)], this habitat would be rated as of Local Importance (Higher Value).

*Farm Buildings BL3* - A number of farm buildings exist in the northeastern corner of the land folio. Under the NRA site evaluation scheme [(6)], this habitat would be rated as of Local Importance (Lower Value).

#### *Proposed Canal Crossing*

In addition to the above, the lands on either side of the canal crossing along the access road into the proposed Derrybrennan cluster was mapped in November 2014 (illustrated in Figure 7.16.20, Volume 2a of this EIS). Habitats of interest here mainly refer to those fringing the canal on either side of the proposed crossing. In particular treelines which may require modification for the widening of the existing bridge/works to facilitate access. Habitats found at this location, not already described are as follows:

*Canals (FW3)* - As the canal is an NHA under the NRA site evaluation scheme [(6)], this habitat would be rated as of National Importance.

*Amenity Grassland (GA2)* - Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Lower Value).

*Immature woodland (WS3)* - Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Higher Value).

#### *7.3.6.2 Annex Assessment*

No Annex assessment was required for the Derrybrennan cluster as no habitats likely to conform with those listed on Annex I were found to occur.

#### *7.3.6.3 Botanical Species*

A full list of Botanical species recorded in included in Appendix F4. No Flora Protection Order (FPO) or invasive species were recorded from the subject site.

#### *7.3.6.4 Terrestrial Mammals*

*Badger*
No badger evidence was recorded within the proposed Derrybrennan cluster.

*Otter*
Otter spraint was located at the south west corner of the cluster in January 2013. The evidence was at the insection point of a perimeter drain and small stream that runs north to south outside the cluster boundary.

### Table 7.34: Otter Sighting/Evidence Information – Derrybrennan Cluster

| Species | Latin Name | Date | Mammal notes | Grid ref |
|---|---|---|---|---|
| Otter | Lutra lutra | 28/01/2013 | Spraint on ditch at stream/drain junction | N 69521 27263 |

*Other Mammals* - Pine Marten is present within the cluster; an individual was observed in woodland to the south. Fox evidence in the form of scat was noted on a number of occasions. Deer are present in surrounding woodland. Irish Hare evidence was also noted on site in January 2013.

#### *7.3.6.5 Avifauna*

There were no observations of the following target species during surveys carried out at the Derrybrennan cluster, Kingfisher, Merlin, Red Grouse, Black Headed Gull, Curlew, Redshank, Whinchat, Common Gull, Lesser Black Backed Gull or Mute Swan.

#### *Whooper Swan*

*Occurrence within subject site winters 2012-2014*
There were no records of this Annex I species within the cluster boundary. A small family party of three birds was noted to the southwest, c.1km from turbine T28, on 22/11/2012. These were birds feeding in stubble. Birds may occasionally utilise the existing water feature at Lullymore Heritage Park, c.2.5km from T28, during the winter months however the frequency of occurrence is low as is the frequency of occurrence in fields within the hinterland of the same location.

*Flight Activity Winter 2013/14*
Following the occurrence of birds in the winter of 2012/13 in close proximity to the proposed turbine locations; a flight activity survey was undertaken in winter 2013/2014.

A vantage point (Grid Reference N69680 29664) was selected to the southwest at Lullymore which enabled views of the proposed turbine locations (T27 and T28) to the north but also the lake at Lullymore Heritage Park which was identified as a possible roost.

Watches each of three hours duration, were carried out at dawn and dusk during the period November 2013 to April 2014. A total of 36hrs of effort was undertaken. The dates, times and results of each watch are detailed in Appendix F2, Survey Data 2.

During this period, there were no observations of Whooper Swan flight activity within the proposed rotor envelope. Other species recorded included Peregrine, Golden Plover and Hen Harrier. Flightlines recorded during vantage point surveys at Lullymore are illustrated in Figure7.16.1-7.17.5, Volume 2a of this EIS.

*Golden Plover*

There were no records of this Annex I species within the site boundary. Birds do use the hinterland of the Derrybrennan cluster and were observed on two occasions from VP watches conducted at Lullybeg (c.2.5km south). This included flight activity of birds within 1km of the proposed turbines T27 and T28. All recorded flight activity was below the predicted rotor envelope of 50-170m. See Table 7.35, below for flight activity records. The lowest recorded flight activity was at 20m.

### Table 7.35: Golden Plover Records - Derrybrennan Cluster (T27 & T28)

| Survey Type | Date | Species | Number | Obs. Time | Duration (s) | <50m | 50-170m | >170m |
|---|---|---|---|---|---|---|---|---|
| Winter Dusk VP | 22/11/2014 | Golden Plover_GP | 8 | 16.00 | 27 | 27 | 0 | 0 |
| Spring VP | 04/04/2014 | Golden Plover_GP | 43 | 07.01 | 55 | 55 | 0 | 0 |

*Hen Harrier*

Individual Hen harriers were recorded on four occasions during dawn watches at Lullymore over the course of Winter 2013/2014. These sightings most likely refer to birds commuting from a nearby known roost. Recorded flight activity was all <20m or below the predicted rotor envelope of 50-170m. Details of observations are provided in Table 7.36, below. Note, none of these sightings are within the proposed turbine T27, or turbine T28, 500m envelope.

### Table 7.36: Hen Harrier Observations – Derrybrennan Cluster (T27 & T28)

| Date | Species | No. | VP Grid Ref | Obs Time | Duration (s) | <50 | 50-170 | >170 | Bird Notes |
|---|---|---|---|---|---|---|---|---|---|
| 27/11/2013 | Hen Harrier_HH | 1 | N69340/24450 | 09.39 | 104 | 104 | 0 | 0 | female |
| 23/12/2012 | Hen Harrier_HH | 1 | N69680 29664 | 09.58 | 25 | 25 | 0 | 0 | juv |
| 22/12/2013 | Hen Harrier_HH | 1 | N69680 29664 | 10.03 | 78 | 78 | 0 | 0 | juv |
| 18/02/2014 | Hen Harrier_HH | 1 | N69680 29664 | 07.37 | 25 | 25 | 0 | 0 | Female type from north; |

Observations at dawn are attributed to birds dispersing from roosts in the greater hinterland (5-10km) of the proposed Derrybrennan cluster. These roosts are further dealt with subsequently. In addition to the above observations, a female Hen Harrier was seen in stubble fields' c.1km south of the proposed turbine folio on 30/10/2013. This bird was noted hunting stubble mid-afternoon.

*Roosts*

Information on two known winter roosts in the hinterland of the proposed Derrybrennan cluster was provided by Dr. Barry O Donoghue, NPWS. The locations of these roosts was agreed to be kept confidential. For the purpose of this assessment the roosts are referred to as Roost A and Roost B.

Following identification of roosting locations, surveys, following the Irish Hen Harrier Winter Roost Survey methodology [46] were undertaken to determine levels of Hen Harrier numbers and respective flight activity. Particular note was made to directions of arrival and departure to and from roosts; as this may indicate preferred foraging areas during daytime and heights utilised during commuting flights to and from same.

- Roost A - Roost A is located c.5km from Derrybrennan cluster. A total of 14 watches, each of two hours duration were carried out at this roost over winters 2012/13 and 2013/14. There were four observations of Hen Harrier, either of birds flying to or from the known roost location, or birds loafing in the area having left the roost. Watches were conducted at either dawn or dusk. Within separate winters, two observations were noted from six watches over the winter period 2012/13 (January to March); whilst two observations were also noted from eight watches during the winter period 2013/14 (October to April inclusive). Observations included a wing tagged individual.
- Roost B - Roost B is located 6-10km from the Derrybrennan cluster. A total of 10 watches, each of two hours duration were carried out following methods as outlined previously. There were three observations of Hen Harrier, including an adult male, and a wing tagged individual different to the previously mentioned.

From those observations (n=6) where flight duration was recorded, a total of 290s of Hen Harrier flight activity was noted. All flight activity was below the predicted rotor envelope (the highest recorded height was 20m). Recorded flight activity is provided in Table 7.37, overleaf.

## Table 7.37: Hen Harrier Observations at Winter Roosts A and B (locations confidential)

| Date | Species | Number | VP Name | Obs. Time | Height | Duration (s) | <50 | 50-170 | >170 | Bird Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 30/01/2013 | Hen Harrier_HH | 1 | Roost A | 07.58 | 10m | 140 | 140 | 0 | 0 | |
| 30/01/2013 | Hen Harrier_HH | 1 | Roost A | 17.10 | 10m | 60 | 60 | 0 | 0 | Flying NW |
| 27/11/2013 | Hen Harrier_HH | 1 | Roost B | 15.08 | <10m | 10 | 10 | 0 | 0 | Perched and flys N through trees, wing tagged-white tag on left wing, yellow tag on right wing |
| 27/11/2013 | Hen Harrier_HH | 1 | Roost B | 16.35 | <10 | 24 | 24 | 0 | 0 | In from N East settled at 16.35, dropping to roost. Settling location N 808/287. Wing tagged-white tag on left wing, yellow tag on right wing |
| 13/12/2013 | Hen Harrier_HH | 1 | Roost A | 08.22 | 10 | 25 | 25 | 0 | 0 | In from SE, flew through. Wing tags-white on left wing, probably blue on right wing |
| 17/01/2014 | Hen Harrier_HH | 1 | Roost B | 08.02 | | | | | | Circling up and away. Pale adult male bird |
| 17/10/2013 | Hen Harrier_HH | 1 | Roost A | 09.10 | 20 | | | | | Flew SW, perched in tree-NB not a roost. Ringtail |
| 15/03/2014 | Hen Harrier_HH | 1 | Roost B | 18.39 | 0-10 | 31 | 31 | 0 | 0 | Flew into roost |

*Peregrine*

A total of two observations of this Annex I species was noted during Winter and/or Spring migration surveys in 2014. Recorded flight activity (t=53s) was outside the predicted rotor envelope of 50-170m. Peregrine breeding distribution in Ireland has increased by 276% in the period 1968-72 to 2007-11 [69]. No breeding was recorded on site.

### Table 7.38: Peregrine Observations – Derrybrennan Cluster (T27 & T28)

| Date | Species | Number | Obs Time | Height | Duration (s) | <50 | 50-170 | >170 | Bird Notes |
|---|---|---|---|---|---|---|---|---|---|
| 02/01/2014 | Peregrine | 1 | 09.57 | 0-30 | 35 | 35 | 0 | 0 | One immature bird, hunting woodpigeon |
| 12/04/2014 | Peregrine | 1 | 19.26 | 10-20 | 18 | 18 | 0 | 0 | |

*Lapwing*

One observation during the winter period of birds within the Derrybrennan cluster. A flock of 17 was recorded on November 2, 2013 when birds were flushed from a ploughed field adjacent to turbine T27. Birds were noted on a number of occasions in stubble field to the southwest and a maximum of 40 was recorded in March 2013.

Investigations during the 2013 breeding season (April to June) found no occupied territories within the target envelope (500m around each proposed turbine - T27 and T28). A number of occupied territories were located in stubble fields to the south west, c.1.5km from the Derrybrennan cluster.

*Woodcock*

There were no breeding territories, of the red listed [27] Woodcock (*Scolopax rusticola*) recorded within the 500m turbine envelope at Derrybrennan during breeding wader surveys carried out in April-June 2013 (see Figure 7.16.9: Breeding Wader Results, Volume 2a of this EIS). An occupied territory was noted to the southeast, outside the cluster boundary.

*Snipe*

There were no confirmed occupied territories (based on drumming or displaying males) recorded within the proposed turbine 500m envelope, during breeding wader surveys carried out in April-June 2013 (see Figure 7.16.9: Breeding Wader Results, Volume 2a of this EIS). An occupied territory, based on a drumming bird was located just outside the 500m envelope (and cluster boundary) to the southeast of the two proposed turbines T27 & T28).

*Barn Owl*

No observation was made of Barn Owl during the entire survey period. Results of breeding Barn Owl surveys are illustrated in Fig 7.16.12 Barn Owl Survey Results, Volume 2a of this EIS.

Following the methods outlined previously, locations within 1.5km of the Derrybrennan cluster that were identified as having potential for breeding Barn Owls were further examined for evidence. Of these, no site was confirmed to contain Breeding Barn Owl. None of the surveyed locations were classified in the highest category for suitability (occupied or highly suitable) for breeding Barn Owl (*Tyto alba*) with multiple opportunities for nesting and/or roosting.

Due to the expansive nature of the surrounding peatlands very few older houses or structures exist which could be utilised by Barn Owl.

There was a single suitable Barn Owl sites recorded within 1.5km of the subject site, which was classified as having limited access and/or limited number of nest and/or roost locations, an additional site was classified as suitable for roosting only. No evidence of nesting and/or roosting was recorded within these sites. The findings of the current study, in particular the low occupancy of highly suitable nest sites, reflect the current status of the species in Ireland, which has undergone a 47% decline in breeding distribution during the period 1968-72 to 2007-11 [69]. Barn Owl is Red listed on the BoCCCI list [27].

### *Yellowhammer*

This species, which is red listed in Ireland was recorded during breeding season surveys. A single bird was recorded in the late season CBS visit from the square centred on the location of the proposed turbines T27 and T28.

### *Kestrel*

A pair of Kestrel nested at N670530 727780; this location is outside the cluster boundary in a treeline of Scots Pine located across the road from farm buildings in the north east corner of the cluster. Birds were noted in this location, alarm calling, and observed using a nearby plucking post suggesting breeding took place.

A total of 12 observations were made involving flight activity by Kestrel. These include observations both within and without the Derrybrennan cluster. Observations from vantage point surveys at Lullymore, targeted at Whooper Swan, are included as they provide information on typical flight heights utilised by the species. Total duration recorded was 473s, of which 100% was below the predicted rotor envelope (50-170m). Apart from one observation, all recorded flight height was at 20m or less. Table 7.39, below provides detail on the observations.

**Table 7.39: Kestrel Flight Activity Observations – Derrybrennan Cluster (T27 & T28)**

| Date | Species | No. | Obs Time | Height (m) | Duration (s) | <50 | 50-170 | >170 | Bird Notes |
|---|---|---|---|---|---|---|---|---|---|
| 30/01/2013 | Kestrel_K. | 1 | 10.06 | 10-12 | 32 | 32 | 0 | 0 | Flying 1-3m above road then moved over forestry flying 10-12m. Hovered over bog for 24 secs |
| 26/03/2013 | Kestrel_K. | 1 | 13.35 | 0-10 | 111 | 111 | 0 | 0 | Male max 10m. Landed. |
| 22/11/2013 | Kestrel_K. | 1 | 15.50 | 0-10 | 32 | 32 | 0 | 0 | |
| 27/11/2013 | Kestrel_K. | 1 | 09.14 | 10-0 | 5 | 5 | 0 | 0 | |
| 27/11/2013 | Kestrel_K. | 1 | 09.28 | 0-10 | 8 | 8 | 0 | 0 | |
| 23/12/2013 | Kestrel_K. | 1 | 14.13 | <10 | 16 | 16 | 0 | 0 | |
| 23/12/2013 | Kestrel_K. | 1 | 15.40 | <10 | 42 | 42 | 0 | 0 | |
| 23/12/2013 | Kestrel_K. | 1 | 16.07 | <10 | 27 | 27 | 0 | 0 | |
| 18/02/2014 | Kestrel_K. | 1 | 16.37 | 20 | 20 | 20 | 0 | 0 | |
| 18/02/2014 | Kestrel_K. | 1 | 17.25 | 40 | 180 | 180 | 0 | 0 | SN x2 drumming after sunset at VP. |

*Buzzard*

Buzzard was observed within the study area on one occasion during winter B&S surveys when an individual was noted feeding in stubble (presumably on earthworms- a known behaviour) close to the northernmost proposed turbine location (turbine T27). The date of the observation was January 28, 2013 and the bird was observed feeding in this manner for 21 minutes.

Flight activity by Buzzard was also noted, both from winter walkover surveys of proposed turbine locations T27 and T28 and also from vantage point effort as described previously. Observations from vantage point surveys at Lullymore, targeted at Whooper swan, are included as they provide information on typical flight heights utilised by the species however it should be noted that some of the recorded flight activity was outside the proposed cluster boundary.

Total recorded flight duration was 504s of which 63.5% (t=320s) was below the predicted rotor envelope (50-170m). Remaining flight activity (t=184s) was within the predicted rotor envelope (50-170m). Table 7.40, below shows all recorded flight activity.

### Table 7.40: Buzzard Flight Activity - Derrybrennan Cluster T27 & T28

| Date | Species | No. | Obs Time | Height | Duration (s) | <50 | 50-170 | >170 | Bird Notes |
|---|---|---|---|---|---|---|---|---|---|
| 28/01/2013 | Buzzard | 1 | 10.27-10.48 | | | | | | Mostly in field eating invertebrates (worms?) |
| 30/01/2013 | Buzzard | 1 | | | | | | | Out of forestry, circling & calling. |
| 26/03/2013 | Buzzard | 2 | | | | | | | Pair of BZ flew N to S into WD4 |
| 09/05/2013 | Buzzard | | | | | | | | |
| 22/11/2013 | Buzzard | | | | | | | | On ground, never seen in flight |
| 23/12/2013 | Buzzard | 2 | 10.37 | 0-30 | 122 | 122 | 0 | 0 | 105s@10-20m, 17s@20-30m |
| 18/02/2014 | Buzzard | 1 | 15.40 | 25 | 60 | 60 | 0 | 0 | |
| 18/02/2014 | Buzzard | 1 | 15.49 | 20 | 30 | 30 | 0 | 0 | Interacting with HC |
| 20/03/2014 | Buzzard | 2 | 17.12 | | 231 | 47 | 184 | 0 | Pair soaring or displaying |
| 12/04/2014 | Buzzard | 1 | 19.11 | 20-40 | 61 | 61 | 0 | 0 | |

*General Winter Birds*

A total of 37 species were recorded from the Derrybrennan cluster from winter season B&S surveys. Of these, nine species (Goldcrest, Robin, Mistle Thrush, Kestrel, Linnet, Skylark, Sparrowhawk, Starling) are Amber listed; three are Red Listed (Lapwing, Meadow pipit and Woodcock) whilst the remaining species recorded are all Green listed. No species listed on Annex I of the EU habitats directive were recorded within the site boundary. Table 7.41, overleaf, details the species recorded.

## Table 7.41: Winter Bird Survey Results – Derrybrennan Cluster (T27 & T28)

| B&S | | Code | Visit 1 | Visit 2 | Visit 3 | BoCCI status | EU habitats Directive Annex I |
|---|---|---|---|---|---|---|---|
| Blackbird | *Turdus merula* | B | 6 | 11 | 9 | Green | No |
| Blue Tit | *Cyanistes caeruleus* | BT | 4 | 6 | 1 | Green | No |
| Bullfinch | *Pyrrhula pyrrhula* | BF | 4 | 2 | 0 | Green | No |
| Buzzard | *Buteo buteo* | BZ | 0 | 2 | 2 | Green | No |
| Chaffinch | *Fringilla coelebs* | CH | 52 | 87 | 32 | Green | No |
| Coal Tit | *Periparus ater* | CT | 5 | 9 | 3 | Green | No |
| Common Crossbill | *Loxia curvirostra* | CR | 1 | 0 | 0 | Green | No |
| Dunnock | *Prunella modularis* | D | 4 | 0 | 0 | Green | No |
| Fieldfare | *Turdus pilaris* | FF | 0 | 156 | 49 | Green | No |
| Goldcrest | *Regulus regulus* | GC | 10 | 15 | 8 | Amber | No |
| Great Tit | *Parus major* | GT | 4 | 0 | 0 | Green | No |
| Hooded Crow | *Corvus cornix* | HC | 5 | 3 | 0 | Green | No |
| Jay | *Garrulus glandarius* | J | 1 | 6 | 2 | Green | No |
| Kestrel | *Falco tinnunculus* | K | 1 | 2 | 1 | Amber | No |
| Lapwing | *Vanellus vanellus* | L | 17 | 0 | 40 | Red | No |
| Lesser Redpoll | *Carduelis cabaret* | LR | 2 | 1 | 0 | Green | No |
| Linnet | *Carduelis cannabina* | Li | 0 | 12 | 0 | Amber | No |
| Long-tailed Tit | *Aegithalus caudatus* | LT | 9 | 0 | 8 | Green | No |
| Magpie | *Pica pica* | MG | 5 | 9 | 0 | Green | No |
| Meadow Pipit | *Anthus pratensis* | MP | 0 | 26 | 1 | Red | No |
| Mistle Thrush | *Turdus viscivorus* | M | 1 | 15 | 9 | Amber | No |
| Pheasant | *Phasianus colchicus* | PH | 5 | 3 | 0 | N/A | No |
| Pied Wagtail | *Montacilla alba* | PW | 6 | 3 | 0 | Green | No |
| Raven | *Corvus corax* | RN | 1 | 0 | 0 | Green | No |
| Redwing | *Turdus iliacus* | RE | 2 | 32 | 47 | Green | No |
| Reed Bunting | *Acrocephalus scirpaceus* | RB | 2 | 3 | 2 | Green | No |
| Robin | *Erithacus rubecula* | R | 21 | 6 | 4 | Amber | No |
| Rook | *Corvus frugilegus* | RO | 68 | 130 | 5 | Green | No |
| Siskin | *Carduelis spinus* | SK | 16 | 0 | 0 | Green | No |
| Skylark | *Alauda arvensis* | S | 0 | 18 | 9 | Amber | No |
| Snipe | *Gallinago gallinago* | SN | 0 | 2 | 0 | Amber | No |
| Song Thrush | *Turdus philomelos* | ST | 0 | 5 | 0 | Green | No |
| Sparrrowhawk | *Accipiter nisus* | SH | 3 | 2 | 0 | Amber | No |
| Starling | *Sturnus vulgaris* | SG | 623 | 7 | 0 | Amber | No |
| Woodcock | *Scolopax rusticola* | WK | 0 | 1 | 0 | Red | No |
| Woodpigeon | *Columba palumbus* | WP | 273 | 42 | 2 | Green | No |
| Wren | *Troglodytes troglodytes* | WR | 15 | 8 | 3 | Green | No |

*Breeding Birds*

The survey square undertaken to sample breeding birds is illustrated in Figure 7.5 Survey Squares, Volume 2a of this EIS. This illustrates transects walked through the cluster, which was surveyed following methods outlined previously. A total of 36 species were recorded. Of these, one was a red listed species (Yellowhammer). Eight Amber listed species (Goldcrest, House Sparrow, Linnet, Mistle Thrush, Robin, Sparrowhawk, Starling and Swallow) were recorded. All remaining species recorded are Green listed.

### Table 7.42: CBS Survey Square Results – Derrybrennan Cluster (T27 & T28)

| CBS | | Code | Early | Late | BoCCI status | EU habitats Directive Annex I |
|---|---|---|---|---|---|---|
| Blackbird | *Turdus merula* | B | 23 | 10 | Green | No |
| Blue Tit | *Cyanistes caeruleus* | BT | 3 | 0 | Green | No |
| Bullfinch | *Pyrrhula pyrrhula* | BF | 0 | 2 | Green | No |
| Buzzard | *Buteo buteo* | BZ | 1 | 0 | Green | No |
| Chaffinch | *Fringilla coelebs* | CH | 41 | 14 | Green | No |
| Chiffchaff | *Phylloscopus collybita* | CC | 0 | 1 | Green | No |
| Coal Tit | *Periparus ater* | CT | 3 | 4 | Green | No |
| Cuckoo | *Cuculus canorus* | CK | 1 | 0 | Green | No |
| Dunnock | *Prunella modularis* | D | 2 | 0 | Green | No |
| Goldcrest | *Regulus regulus* | GC | 7 | 12 | Amber | No |
| Goldfinch | *Carduelis carduelis* | GO | 9 | 6 | Green | No |
| Great Tit | *Parus major* | GT | 4 | 1 | Green | No |
| Greenfinch | *Carduelis chloris* | GR | 0 | 5 | Green | No |
| Hooded Crow | *Corvus cornix* | HC | 1 | 0 | Green | No |
| House Sparrow | *Passer domesticus* | SW | 2 | 11 | Amber | No |
| Lesser Redpoll | *Carduelis cabaret* | LR | 5 | 0 | Green | No |
| Linnet | *Carduelis cannabina* | LI | 0 | 4 | Amber | No |
| Long-tailed Tit | *Aegithalus caudatus* | LT | 2 | 0 | Green | No |
| Magpie | *Pica pica* | MG | 3 | 0 | Green | No |
| Mallard | *Anas platyrhynchos* | MA | 0 | 2 | Green | No |
| Mistle Thrush | *Turdus viscivorus* | M | 7 | 5 | Amber | No |
| Pheasant | *Phasianus colchicus* | PH | 1 | 0 | n/a | No |
| Pied Wagtail | *Montacilla alba* | PW | 3 | 3 | Green | No |
| Reed Bunting | *Acrocephalus scirpaceus* | RB | 2 | 2 | Green | No |
| Robin | *Erithacus rubecula* | R | 6 | 7 | Amber | No |
| Rook | *Corvus frugilegus* | RO | 6 | 2 | Green | No |
| Siskin | *Carduelis spinus* | SK | 6 | 0 | Green | No |
| Song Thrush | *Turdus philomelos* | ST | 1 | 2 | Green | No |
| Sparrrowhawk | *Accipiter nisus* | SH | 0 | 1 | Amber | No |
| Starling | *Sturnus vulgaris* | SG | 0 | 3 | Amber | No |
| Swallow | *Hirundo rustica* | SL | 9 | 19 | Amber | No |
| Whitethroat | *Sylvia communis* | WH | 9 | 5 | Green | No |

| CBS | | Code | Early | Late | BoCCI status | EU habitats Directive Annex I |
|---|---|---|---|---|---|---|
| Willow Warbler | *Phylloscopus trochilus* | WW | 10 | 5 | Green | No |
| Woodpigeon | *Columba palumbus* | WP | 5 | 13 | Green | No |
| Wren | *Troglodytes troglodytes* | WR | 16 | 22 | Green | No |
| Yellowhammer | *Emberiza citronella* | Y | 0 | 1 | Red | No |

#### *7.3.6.6 Other Taxa*

The following species of Lepidoptera were recorded; note this includes observations from outside the red-line boundary from areas which, due to design layout changes, are no longer included. This includes turbines which were removed from the proposed layout due to their proximity to important butterfly habitats.

Lepidoptera:
Meadow Brown *Maniola jurtina*
Ringlet *Aphantopus hyperantus*
Green-Veined White *Pieris napi*
Large White *Pieris brassicae*
Brimstone *Gonepteryx rhamni*
Speckled Wood *Pararge aegeria*

Odonota:
Azure Damselfly *Coenagrion puella*
Blue-tailed damselfly *Ischnura elegans*
Large Red Damselfly *Pyrrhosoma nymphula*
Brown Hawker *Aeshna grandis*
Common Hawker *Aeshna junca*
Four Spotted Chaser *Libellula quadrimaculata*

In addition to the above Marsh Fritillary was noted off site at known locations such as at the Lullymore West IPCC (Irish Peatland Conservation Council) reserve and the Butterfly Conservation Ireland reserve at Lullymore. None were observed within the proposed development land folio and no suitable habitat is present.

### 7.3.7 Cloncumber

The proposed Cloncumber cluster lies to the south west of Allenwood village and approximately 3km northwest of the Hill of Allen. It is bordered on its south side by the Barrow Line of the Grand Canal. The Slate River forms the northern boundary of the cluster. Note existing environment data on Aquatic Ecology and Bats are presented seperately.

#### *7.3.7.1 Habitats*

Habitat mapping was carried out at the subject site on July 17, 2013 following methods previously outlined. Habitat types identified within the cluster are illustrated in Figure 7.17.13: Habitat Map, Volume 2a of this EIS, and described below:

| | |
|---|---|
| BC1 | Arable crops |
| BC3 | Tilled land |
| FW2 | Depositing/lowland rivers |
| FW3 | Canals |
| FW4 | Drainage ditches |
| GA1 | Improved agricultural grassland |

| | |
|---|---|
| WD1 | (Mixed) broadleaved woodland |
| WD4 | Conifer plantation |
| WL2 | Treelines |
| GA1/GS4 | Improved agricultural grassland/ Wet grassland |
| GS4/GS1 | Wet grassland/ Dry calcareous and neutral grassland |

*Arable Crops BC1*
Some fields of arable crops are found within the cluster; these primarily consist of Wheat and Barley. Other species recorded include *Poa annua, Papaver rhoem, Matricaria discoidea*. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Lower Value).

*Tilled Land BC3*
Some unplanted tilled land was present on site at the time of survey. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Lower Value).

*Depositing/Lowland Rivers FW2*
A river, c.5-6m wide broadly splits the cluster in two from east to west. This feature which flows into the River Slate at the northern side of the cluster has banks c.3m high and is slow flowing. Banks are vertical. Instream vegetation includes *Schoenoplectus lacustris, Glyceria fluitans, Sparganium emersum, Rancunculus flammula, Apium nodiflorum, Phragmites australis, Phalaris arundinacea, Glyceria maxima, Iris Pseudacorus, Lemna* spp. Bankside vegetation includes *Epilobium hirsutum, Arrhenatherum elaticus, Dactylis glomerata, Filipendula ulmaria, Potentilla anserine, Equisetum* spp*., Cirsium arvense, Centaurea nigra, Anthriscus sylvestris.* Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Higher Value).

*Drainage Ditches FW4*
Drainage ditches run throughout the site between fields. Typical species recorded include *Phalaris arundinacea, Phragmites australis, Arrhenatherum elatius, Mentha aquatic, Succisa pratens, Centaurea nigra*, *Cirsium* sp, *Apium nodiflorum, Viccia cracca, Equisetum sp., Molinia caerulea, Galium verium, Hypericum perforatum, Menyanthes trifoliate, Iris pseudacorus*. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Lower Value).

*Improved Agricultural Grassland GA1*
Improved agricultural grassland is present on site. Species present include *Lolium perenne* (dominant), *Poa annua, Plantago major, Ranunculus repens, Trifolium* spp., *Cirsium vulgare, Ranunculus Acris, Taraxacum spp., Juncus effusus* (occasional). Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Lower Value).

*(Mixed) Broadleaf Woodland (WD1)*
A small stand of deciduous trees composed of mature Beech *Fagus sylvatica, Sambucus nigra, Crataegus monogyna* and *Picea sitchensis*, is locate centrally in the cluster on the location of a ringfort or historical enclosure (indicated on Discovery series maps). Another small group of deciduous trees exists to the southwest within the existing field complex. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Higher Value).

*Conifer Plantation WD4*
The eastern portion of the cluster contains significant cover of Conifer plantation. Dominant species are Sitka Spruce, Scots Pine in patches. There are broadleaf trees on the outside edges of forestry compartments in places. These include Silver Birch and *Salix* spp. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Higher Value).

*Treelines WL2*
Field boundaries in the majority of the cluster comprise mainly treelines. Species include *Fraxinus excelsior* (dominant), *Crataegus monogyna, Salix* spp., *Acer Pseudoplatanus, Pinus sylvestruis*. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Higher Value).

*Improved Agricultural/Wet Grassland GA1/GS4*
Improved grassland grading into wet grassland. Species include *Juncus acutiflorus, Juncus Effusus, Potentilla anserine, Ranunculus repens, Ranunculus flammula, Agrostis stolonifera, Lolium perenne, Carex panacea, Holcus lanatus, Prunella vulgaris.* Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Higher Value).

*Wet/ Dry Calcaerous and Neutral Grassland GS4/GS1*
This classification refers to a number of fields of Wet Grassland grading into neutral grassland. Species present include *Lolium perenne, Holcus lanatus, Anthoxanthum odoratum, Agrostis capillaris, Agrostis stolonifera, Alopecurus geniculatus, Phleum pratense, Poa annua, Cynosurus cristatus, Ranuculus repens, Potentilla anserine, Ranunculus acris, Juncus inflexus, Juncus effuses and Achillea millefolium.* Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Higher Value).

#### *7.3.7.2 Annex Assessment*

No habitats were identified within the cluster that had the potential to conform with Annex habitats.

#### *7.3.7.3 Botanical Species*

A full list of Botancal species recorded is provided in Appendix F4: Botanical Species. No Flora Protection Order species was recorded from the cluster. No invasive species were recorded.

#### *7.3.7.4 Terrestrial Mammals*

*Badger*
A badger sett was located in woodland in the northeastern portion of the cluster. This constituted an outlier sett (occasionally used single entrance setts). Additional evidence was also noted in two separate locations and included tracks and evidence of foraging. Locations of Badger evidence are illustrated in Figure 7.17.22 Mammal Observations, Volume 2a of this EIS. Further detail on Badger observations is provided below in Table 7.43.

### Table 7.43: Badger Observations – Cloncumber Cluster

| Species | Latin Name | Description | Grid Reference |
|---|---|---|---|
| Badger | Meles meles | Outlier badger sett | N73235 23752 |
| Badger | Meles meles | Badger foraging | N71690 22788 |
| Badger | Meles meles | Badger tracks | N72513 23118 |

*Otter*
Otter evidence in the form of spraints, slides was noted at a number of locations throughout the site. Locations of recorded evidence was primarily along river/stream banks (Slate and Cloncumber) but also along the adjacent canal. An individual was observed along the Slate River on February 1, 2013. A suitable holt location was located in the wooded copse to the southwest of turbine T33 however no evidence of occupancy by Otter was present (indicating Fox may be an alternative).

## Table 7.44: Otter Observations – Cloncumber Cluster

| Species | Latin Name | Otter signs | Grid Reference |
|---|---|---|---|
| Otter | Lutra lutra | Tracks at river | |
| Otter | Lutra lutra | Otter slide | N72021 22102 |
| Otter | Lutra lutra | Otter seen along Slate River; Spraints and tracks. | N73204 24007 |
| Otter | Lutra lutra | Evidence of otter at river | |
| Otter | Lutra lutra | Slides | N 72021 22102 |
| Otter | Lutra lutra | Spraint & slides at bridge. | N 72546 23463 |
| Otter | Lutra lutra | Spraint widespread small bridges | |
| Otter | Lutra lutra | Signs widespread | |

*Other Mammals*
Evidence of American Mink was noted along both internal rivers and the adjacent canal. Red Fox is present and evidence (scat) was noted within the cluster and along the adjacent canal (including a possible den).

### *7.3.7.5 Avifauna*

There were no observations or records of the following target species from the proposed Cloncumber cluster, Hen Harrier, Merlin, Red Grouse, Black Headed Gull, Redshank, Whinchat, Common Gull or Lesser Black Backed Gull.

#### *Whooper Swan*

There were six observations in total of this Annex 1 species from surveys conducted at the Cloncumber cluster. Two involved small groups of 2-4 birds *in situ* feeding on improved agricultural grassland. Both of these observations involved birds at the south western end of the proposed cluster. Locations were birds noted are illustrated in Figure 7.3 Whooper Swan Feeding and Roosting Sites, Volume 2a of this EIS.

There were four observations of flying birds; two of which were birds flying in to roost at Lullymore Heritage Park Ponds in November 2013. Flightpaths are illustrated in Figure 7.16.1-7.17.5, Volume 2a of this EIS. A vantage point at N71550/21740 was utilised over the winter period October 2013 to April 2014 to sample levels of flight activity within the cluster. Total hours of watch was 36hrs. Recorded flight activity was 690s, from three No. observations. Of this, 68.5% (t=490s) was below the predicted rotor envelope (50-170m). Remaining flight activity (31.4% of overall or 217s) was at the predicted rotor height.

#### *Golden Plover*

There were ten observations of this Annex I species within or near the Cloncumber cluster. All observations were within the period November to April (therefore wintering birds only). No suitable breeding habitat exists at Cloncumber for this species. For those observations where flight activity was recorded (n=9), a total of 1314s of flight activity was noted, including both on and off site records. Of the recorded total flight duration 63% (t=827s) was within the predicted rotor envelope; 29% (t=379s) was below the predicted rotor envelope and 8% (t=108s) was above the predicted rotor envelope. The maximum flock size recorded was 180 birds (on January 24, 2014); average flock size recorded from all observations was 47 birds (range = 1-180). Locations of recorded flight activity are illustrated in Figures 7.16.1-7.17.5 Volume 2a of this EIS.

The details of all Golden Plover observations at the subject site are outlined below in Table 7.45 over.

## Table 7.45: Golden Plover Observations Cloncumber

| Survey Type | Date | Number | Duration (s) | <50m | 50-170m | >170 m | Bird Notes |
|---|---|---|---|---|---|---|---|
| B & S Winter | 02/11/2012 | 1 | | | | | Over |
| B & S Winter | 21/03/2013 | 4 | 72 | 72 | 0 | 0 | 20m |
| Winter Dusk VP | 18/11/2013 | 6 | 148 | 148 | 0 | 0 | 122s@ 60-120m, 6s@60-10m, 20s@10-0m |
| Winter Dawn VP | 10/12/2013 | 90 | 34 | 0 | 34 | 0 | |
| Winter Dusk VP | 10/12/2013 | 7 | 10 | 10 | 0 | 0 | |
| Winter Dawn VP | 24/01/2014 | 180 | 59 | 14 | 45 | 0 | |
| Winter Dawn VP | 07/02/2014 | 125 | 728 | 15 | 605 | 108 | Constantly changing height over fields. Climbs higher as they fly west |
| Spring VP | 16/04/2014 | 50 | 129.00 | 12.00 | 117.0 | 0 | |
| Spring VP | 16/04/2014 | 1 | 9.00 | 9.00 | 0 | 0 | |
| Spring VP | 17/04/2014 | 10 | 125.00 | 99.00 | 26.00 | 0 | |

### *Kingfisher*

No Kingfisher were recorded from Cloncumber cluster during breeding season surveys. Two observations of single birds were noted during winter season surveys. The first was of a bird along the Slate River on 21/3/2013; the second observation was of a bird at the canal bridge to the north east of the Griffith Aqueduct on November 18, 2013.

### *Peregrine*

Two observations were noted of this Annex I species was noted during surveys in 2013. All records were during the winter months (January 2013 and November 2013). Both observations involved brief views of birds outside the cluster boundary, to the north and south respectively. Total flight duration recorded was 16s of which 100% was below the predicted rotor envelope (50-170m) at 10-20m. Peregrine breeding distribution in Ireland has increased by 276% in the period 1968-72 to 2007-11 [69].

### *Curlew*

No Curlew were recorded from the Cloncumber cluster during winter surveys. A number of birds were recorded overflying the site in June during the late season CBS survey. Over the course of the survey small groups ranging from 1-5 birds flew over the site heading towards the northwest. No suitable breeding habitat or evidence of breeding was found within the proposed turbine envelope (T29 – T39) and these sightings are attributed to non-breeding birds.

Curlew have been recorded breeding at Lodge Bog at Lullymore East, c.2.5km northwest of the proposed Cloncumber cluster.

### *Lapwing*

*Winter*
Lapwing were recorded from the cluster during both winter and breeding season surveys. The first observation of this species was on November 2, 2012 when a bird was present in fields where turbines T34- T37 are proposed to be situated. Further to this Lapwing were observed on six more occasions during winter surveys. Birds were present in March and showing signs of territorial behaviour such as display and mobbing of predators. Total flight activity recorded from five observations during the winter period (Oct-March) was 425s of which 100% was below the predicted rotor envelope (50-170m). Table 7.46 below further details winter season observations of this species.

**Table 7.46: Cloncumber Lapwing Observations Winter – Cloncumber Cluster**

| Survey Type | Date | No. | Height | Duration (s) | <50 | 50-170 | >170 | Bird Notes |
|---|---|---|---|---|---|---|---|---|
| B & S Winter | 02/11/2012 | 1 | | | | | | |
| B & S Winter | 21/03/2013 | 12 | | | | | | Including 2 displaying. All subsequently flushed but none left area, circled calling= breeding. |
| Winter Dusk VP | 18/11/2013 | 105 | 30-40 | 52 | 52 | 0 | 0 | |
| Winter Dusk VP | 18/11/2013 | 30 | 0-10 | 84 | 84 | 0 | 0 | |
| Winter Dawn VP | 22/11/2013 | 7 | 20-40m | 65 | 65 | 0 | 0 | 23s@30-40m, 42s@20-30m |
| Winter Dawn VP | 22/11/2013 | 29 | 0-20m | 46 | 46 | 0 | 0 | |
| Winter Dawn VP | 22/11/2013 | 29 | 0-40m | 178 | 178 | 0 | 0 | 116s@0-20m, 62s@20-40m |

*Breeding Season*
An occupied territory was identified in arable farmland c.300m to the northwest of the proposed location of T33. Birds were noted in this location on all three breeding wader survey visit dates (27/4/2013, 27-28/5/2013 and 27-29/6/2013). Recorded behaviour included birds in active territorial display (April) and alarm calling and agitated behaviour in May and June respectively. Breeding was not proved but the agitated behaviour in the latter stages of the breeding season suggests breeding may have taken place. Figure 7.17.9 Breeding Wader Survey Results, Volume 2a of this EIS, shows the location of the occupied territory. No further breeding was recorded within areas of the 500m envelope re-surveyed in 2014 (i.e additional habitats within 500m of the proposed envelope as a result of design layout changes). Potentially suitable wet grassland for breeding waders does exist to the south east of the proposed location of turbine T31, within the adjacent pNHA, however this area had no breeding waders present on survey dates in 2014 (25/4/14, 30/5/14, 24/6/14). This is attributed to the heavy regime of grazing by cattle and horses which renders the area currently unsuitable.

### *Woodcock*

There was one breeding territory, of the red listed [27] Woodcock (*Scolopax rusticola*) recorded within the 500m turbine envelope (T29-39) during breeding wader surveys carried out in April-June 2013 (see Figure 7.17.9: Breeding Wader Results, Volume 2a of this EIS). Evidence of occupied territories in the form of a roding or displaying male was noted in May (27-28/5/2013) within the boundary of the cluster (to the west of the proposed location of T32) but also outside in adjacent bog woodland.

Locations of occupied territories/recorded display is illustrated in Fig 7.17.9 Breeding Wader Results, Volume 2a. It is likely that breeding may have occurred outside the site in adjacent bog woodland.

No further breeding was recorded within areas of the entire 500m envelope re-surveyed in 2014 (i.e additional habitats within 500m of the proposed envelope as a result of design layout changes).

### *Snipe*

There was one confirmed occupied territory (based on drumming or displaying males) recorded within the proposed turbine 500m envelope, during breeding wader surveys carried out in April-June 2014 (see Figure 7.17.9: Breeding Wader Results, Volume 2a). This was based on a drumming or displaying bird to the southwest of the proposed location of T29, recorded in May 2013. No further breeding was recorded within areas of the entire 500m envelope re-surveyed in 2014 (i.e additional habitats within 500m of the proposed envelope as a result of design layout changes). Potentially suitable wet grassland does exist to the SE of the proposed location of T31, within the adjacent pNHA, however this area had no breeding waders present on survey dates in 2014 (25/4/14, 30/5/14, 24/6/14). This is attributed to the heavy regime of grazing by cattle and horses which renders the area currently unsuitable.

### *Barn Owl*

No observation was made of Barn Owl during the entire survey period. Results of breeding Barn Owl surveys are illustrated in Fig 7.17.12 Barn Owl Survey Results, Volume 2a.

Following the methods outlined previously, 13 locations within 1.5km of the wind farm site were identified as having potential for breeding Barn Owls were further examined for evidence. Of these, no site was confirmed to contain Breeding Barn Owl. None of the surveyed locations were classified in the highest category for suitability (occupied or highly suitable) for breeding Barn Owl (*Tyto alba*) with multiple opportunities for nesting and/or roosting.

There were 11 suitable Barn Owl sites classified as having limited access and/or limited number of nest and/or roost locations. No additional sites were classified as suitable for roosting only. No evidence of nesting and/or roosting was recorded within these sites. The findings of the current study, in particular the low occupancy of suitable nest sites of any type, reflect the current status of the species in Ireland, which has undergone a 47% decline in breeding distribution during the period 1968-72 to 2007-11 [(69)]. Barn Owl is Red listed on the BoCCCI list [(27)].

### *Yellowhammer*

This species, which is red listed in Ireland was recorded on seven occasions within the winter season survey period. Birds were noted in stubble fields and a peak of 30 was present on24/1/2014. Birds also breed in suitable habitat within the clusTer and were recorded from both early and late season CBS surveys.

### *Kestrel*

There were three observations of Kestrel within the cluster, all during the period November to February. Proof of breeding was not obtained within the cluster. Recorded flight activity (t=34s) was all the <20m height band.

### *Mute Swan*

There were four observations of this species during surveys at the Cloncumber cluster. Birds were recorded from the River Slate on two occasions during winter walkover surveys. In addition a pair was recorded from the adjacent canal on both early and late season CBS surveys.

*Buzzard*

Buzzard was observed within the study area on 23 occasions in total. Observations included birds both onsite and offsite.

Winter season sightings predominate (n=22) however flight activity in March (n=11) which is effectively winter season is often courtship or territorial flight in the case of Buzzard which breeds early compared to other species. Part of the cluster is assessed as being within the territory of a breeding pair of Buzzard however no evidence of breeding on site was noted and only a single observation was recorded during the breeding season. Sightings involved 1-3 birds and recorded behaviour included birds foraging on the ground (including scavenging dead sheep) as well as soaring and a display indicative of birds holding territory. Total recorded flight duration was 3,678s of which 84.5% (t=3108s) was below the predicted rotor envelope (50-170m). Remaining flight activity (t=570s) was within the predicted rotor envelope (50-170m). Table 7.47, below details the recorded flight activity. Flightlines are illustrated in Figures 7.16.1 to 7.17.5 of Volume 2a of the EIS.

## Table 7.47: Buzzard Flight Activity – Cloncumber Cluster

| Date | No. | Obs Time | Height | Duration (s) | <50 | 50-170 | >170 | Bird Notes |
|---|---|---|---|---|---|---|---|---|
| 21/03/2013 | 1 | 11.34 | 30 | 10 | 10 | 0 | 0 | 30m |
| 21/03/2013 | 2 | 12.03 | 20-30 | 2200 | 2200 | 0 | 0 | Soaring and calling together at 25m then 1 off hunting at 12.08. Both together soaring 12.09 - 12.43 at 30m |
| 24/01/2014 | 1 | 17.26 | 10-30 | 65 | 65 | 0 | 0 | |
| 07/02/2014 | 1 | 9.05 | 10-20 | 54 | 54 | 0 | 0 | |
| 07/02/2014 | 3 | 15.23 | 0-60 | 230 | 188 | 42 | 0 | Scavenging on dead sheep |
| 07/02/2014 | 1 | 15.46 | 0-10 | 27 | 27 | 0 | 0 | |
| 07/02/2014 | 1 | 16.3 | 0-10 | 16 | 16 | 0 | 0 | |
| 07/02/2014 | 2 | 17.27 | 10-30 | 117 | 117 | 0 | 0 | |
| 16/04/2014 | 1 | 18.43 | | 133.00 | 3.00 | 130 | 0 | |
| 31/03/2014 | 1 | 8.19 | | 158.00 | 37.00 | 121 | 0 | |
| 31/03/2014 | 1 | 18.48 | | 25.00 | 25.00 | 0 | 0 | |
| 05/03/2014 | 1 | 7.17 | | 94.00 | 94.00 | 0 | 0 | |
| 05/03/2014 | 1 | 7.32 | | 17.00 | 17.00 | 0 | 0 | |
| 05/03/2014 | 1 | 7.44 | | 72.00 | 72.00 | 0 | 0 | |
| 05/03/2014 | 1 | 7.51 | | 16.00 | 16.00 | 0 | 0 | |
| 05/03/2014 | 2 | 8.29 | | 18.00 | 18.00 | 0 | 0 | Considered a pair; in close association |
| 05/03/2014 | 1 | 17.08 | | 38.00 | 38.00 | 0 | 0 | |
| 05/03/2014 | 1 | 17.57 | | 113.00 | 23.00 | 90 | 0 | |
| 05/03/2014 | 3 | 18.08 | | 275.00 | 88.00 | 187 | 0 | |

*General Winter Birds*

A total of 53 species were recorded from the cluster from winter season B&S surveys. Of these, 14 species (Goldcrest, Robin, Mistle Thrush, Merlin, Skylark, Starling, House Sparrow, Tree Sparrow, Kingfisher, Kestrel, Sparrowhawk, Snipe, Teal, Whooper Swan) are Amber listed; five are Red Listed (Golden Plover, Meadow pipit, Lapwing, Woodcock and Yellowhammer) whilst the remaining species recorded are all Green listed.

Four species listed on Annex I of the EU Habitats Directive were recorded (Kingfisher, Whooper Swan, Peregrine and Golden Plover) although it should be noted that Peregrine and Kingfisher were recorded off site. Table 7.48, below, detail the species recorded.

### Table 7.48: Modified B&S Survey Results – Cloncumber Cluster

| B&S | | Code | Visit 1 | Visit 2 | Visit 3 | BoCCI status | EU habitats Directive Annex I |
|---|---|---|---|---|---|---|---|
| Blackbird | *Turdus merula* | B | 33 | 15 | 9 | Green | No |
| Blue Tit | *Cyanistes caeruleus* | BT | 33 | 10 | 3 | Green | No |
| Bullfinch | *Pyrrhula pyrrhula* | BF | 2 | 0 | 2 | Green | No |
| Buzzard | *Buteo buteo* | BZ | 2 | 3 | 3 | Green | No |
| Chaffinch | *Fringilla coelebs* | CH | 33 | 6 | 4 | Green | No |
| Coal Tit | *Periparus ater* | CT | 18 | 14 | 4 | Green | No |
| Common Crossbill | *Loxia curvirostra* | CR | 0 | 2 | 0 | Green | No |
| Dunnock | *Prunella modularis* | D | 2 | 7 | 1 | Green | No |
| Fieldfare | *Turdus pilaris* | FF | 90 | 155 | 93 | Green | No |
| Goldcrest | *Regulus regulus* | GC | 13 | 34 | 17 | Amber | No |
| Golden Plover | *Pluvialis apricaria* | GP | 1 | 0 | 4 | Red | Yes |
| Goldfinch | *Carduelis carduelis* | GO | 4 | 0 | 0 | Green | No |
| Great Tit | *Parus major* | GT | 11 | 5 | 1 | Green | No |
| Grey Heron | *Ardea cinerea* | H | 0 | 0 | 1 | Green | No |
| Grey Wagtail | *Motacilla cinerea* | GL | 0 | 1 | 0 | Green | No |
| Hooded Crow | *Corvus cornix* | HC | 6 | 15 | 10 | Green | No |
| House Sparrow | *Passer domesticus* | HS | 20 | 7 | 0 | Amber | No |
| Jackdaw | *Corvus monedula* | JD | 0 | 5 | 9 | Green | No |
| Jay | *Garrulus glandarius* | J | 2 | 2 | 0 | Green | No |
| Kestrel | *Falco tinnunculus* | K | 1 | 1 | 0 | Amber | No |
| Kingfisher | *Alcedo atthis* | KF | 0 | 0 | 11 | Amber | Yes |
| Lapwing | *Vanellus vanellus* | L | 1 | 0 | 12 | Red | No |
| Lesser Redpoll | *Carduelis cabaret* | LR | 3 | 0 | 0 | Green | No |
| Long-tailed Tit | *Aegithalus caudatus* | LT | 8 | 32 | 7 | Green | No |
| Magpie | *Pica pica* | MG | 0 | 4 | 3 | Green | No |
| Mallard | *Anas platyrhynchos* | MA | 0 | 0 | 2 | Green | No |
| Meadow Pipit | *Anthus pratensis* | MP | 20 | 20 | 40 | Red | No |
| Mistle Thrush | *Turdus viscivorus* | M | 9 | 5 | 3 | Amber | No |
| Moorhen | *Gallinula chloropus* | MH | 0 | 1 | 0 | Green | No |
| Mute Swan | *Cygnus olor* | MS | 0 | 2 | 1 | Amber | No |
| Peregrine | *Falco peregrinus* | PE | 0 | 1 | 0 | Green | Yes |

| B&S | | Code | Visit 1 | Visit 2 | Visit 3 | BoCCI status | EU habitats Directive Annex I |
|---|---|---|---|---|---|---|---|
| Pheasant | *Phasianus colchicus* | PH | 0 | 1 | 1 | N/A | No |
| Pied Wagtail | *Montacilla alba* | PW | 0 | 2 | 2 | Green | No |
| Raven | *Corvus corax* | RN | 1 | 0 | 0 | Green | No |
| Redwing | *Turdus iliacus* | RE | 222 | 81 | 119 | Green | No |
| Reed Bunting | *Acrocephalus scirpaceus* | RB | 3 | 6 | 0 | Green | No |
| Robin | *Erithacus rubecula* | R | 14 | 29 | 5 | Amber | No |
| Rook | *Corvus frugilegus* | RO | 30 | 65 | 16 | Green | No |
| Siskin | *Carduelis spinus* | SK | 2 | 0 | 0 | Green | No |
| Skylark | *Alauda arvensis* | S | 53 | 13 | 5 | Amber | No |
| Snipe | *Gallinago gallinago* | SN | 12 | 5 | 5 | Amber | No |
| Song Thrush | *Turdus philomelos* | ST | 2 | 21 | 3 | Green | No |
| Sparrrowhawk | *Accipiter nisus* | SH | 2 | 4 | 0 | Amber | No |
| Starling | *Sturnus vulgaris* | SG | 276 | 439 | 200 | Amber | No |
| Stonechat | *Saxicola torquata* | SC | 1 | 0 | 0 | Green | No |
| Teal | *Anas crecca* | TS | 1 | 0 | 5 | Amber | No |
| Tree Sparrow | *Passer montanus* | TS | 7 | 0 | 0 | Amber | No |
| Treecreeper | *Certhia familiaris* | TC | 1 | 1 | 0 | Green | No |
| Whooper Swan | *Cygnus cygnus* | WS | 2 | 0 | 0 | Amber | Yes |
| Woodcock | *Scolopax rusticola* | WK | 0 | 1 | 0 | Red | No |
| Woodpigeon | *Columba palumbus* | WP | 37 | 29 | 13 | Green | No |
| Wren | *Troglodytes troglodytes* | WR | 28 | 11 | 4 | Green | No |
| Yellowhammer | *Emberiza citronella* | Y | 13 | 1 | 4 | Red | No |

### *General Breeding Birds*

A total of 39 species were recorded from breeding season CBS surveys, carried out as previously outlined. Of these, four are Red listed (Curlew, Lapwing, Meadow Pipit and Yellowhammer). Ten Amber listed species were recorded (Goldcrest, House Sparrow, Mistle Thrush, Mute Swan, Robin, Swallow, Sand Martin, Skylark, Starling, Wheatear). All remaining species are Green listed. It should be noted that Curlew and Wheatear were recorded as non-breeding or passage birds only as no breeding habitat for these species exists within the cluster.

## Table 7.49: CBS Square N7222 Results – Cloncumber Cluster

| CBS | | Code | Early | Late | BoCCI status | EU habitats Directive Annex I |
|---|---|---|---|---|---|---|
| Blackbird | *Turdus merula* | B | 27 | 2 | Green | No |
| Blue Tit | *Cyanistes caeruleus* | BT | 0 | 1 | Green | No |
| Buzzard | *Buteo buteo* | BZ | 0 | 1 | Green | No |
| Chaffinch | *Fringilla coelebs* | CH | 14 | 7 | Green | No |
| Chiffchaff | *Phylloscopus collybita* | CC | 1 | 0 | Green | No |
| Coal Tit | *Periparus ater* | CT | 1 | 5 | Green | No |
| Common Crossbill | *Loxia curvirostra* | CR | 1 | 0 | Green | No |
| Cuckoo | *Cuculus canorus* | CK | 1 | 0 | Green | No |
| Curlew | *Numenius arquata* | CU | 0 | 13 | Red | No |
| Dunnock | *Prunella modularis* | D | 1 | 2 | Green | No |
| Goldcrest | *Regulus regulus* | GC | 2 | 2 | Amber | No |
| Goldfinch | *Carduelis carduelis* | GO | 0 | 3 | Green | No |
| Great Tit | *Parus major* | GT | 2 | 0 | Green | No |
| Greenfinch | *Carduelis chloris* | GR | 0 | 3 | Green | No |
| Grey Heron | *Ardea cinerea* | H | 1 | 0 | Green | No |
| Hooded Crow | *Corvus cornix* | HC | 1 | 6 | Green | No |
| House Sparrow | *Passer domesticus* | SW | 6 | 3 | Amber | No |
| Jackdaw | *Corvus monedula* | JD | 1 | 1 | Green | No |
| Lapwing | *Vanellus vanellus* | L | 1 | 2 | Red | No |
| Magpie | *Pica pica* | MG | 1 | 3 | Green | No |
| Mallard | *Anas platyrhynchos* | MA | 4 | 0 | Green | No |
| Meadow Pipit | *Anthus pratensis* | MP | 2 | 8 | Red | No |
| Mistle Thrush | *Turdus viscivorus* | M | 6 | 0 | Amber | No |
| Mute Swan | *Cygnus olor* | MS | 2 | 2 | Amber | No |
| Pied Wagtail | *Montacilla alba* | PW | 1 | 0 | Green | No |
| Reed Bunting | *Acrocephalus scirpaceus* | RB | 1 | 1 | Green | No |
| Robin | *Erithacus rubecula* | R | 9 | 4 | Amber | No |
| Rook | *Corvus frugilegus* | RO | 1 | 123 | Green | No |
| Sand Martin | *Riparia riparia* | SM | 0 | 7 | Amber | No |
| Sedge Warbler | *Acrocephalus schoenobaenus* | SW | 1 | 0 | Green | No |
| Skylark | *Alauda arvensis* | S | 3 | 6 | Amber | No |
| Song Thrush | *Turdus philomelos* | ST | 4 | 2 | Green | No |
| Starling | *Sturnus vulgaris* | SG | 0 | 3 | Amber | No |
| Swallow | *Hirundo rustica* | SL | 17 | 14 | Amber | No |
| Wheatear | *Oenanthe oenanthe* | W | 10 | 0 | Amber | No |
| Willow Warbler | *Phylloscopus trochilus* | WW | 6 | 9 | Green | No |
| Woodpigeon | *Columba palumbus* | WP | 5 | 8 | Green | No |
| Wren | *Troglodytes troglodytes* | WR | 13 | 9 | Green | No |
| Yellowhammer | *Emberiza citronella* | Y | 8 | 3 | Red | No |

#### *7.3.7.6 Other Taxa*

The following species of Lepidoptera (butterflies) were recorded:

- Lepidoptera:
- Small Tortoiseshell *Aglais urticae*
- Peacock *Inachis io*
- Small white *Pieris rapae*
- Wall Brown *Lasiommata megera*

### 7.3.8 Aquatic Ecology

The study area is described below in terms of

- affected catchments
- designated sites with aquatic dependant key conservation interests
- waterbody types in the study area
- protected aquatic flora and fauna
- fish communities and fisheries
- aquatic macroinvertebrates
- biological water quality and
- aquatic plant communities

Each of the above are discussed in relation to the Ballynakill, Drehid-Hortland, Windmill, Derrybrennan and Cloncumber clusters of the proposed Maighne Wind Farm development.

#### *7.3.8.1 Affected catchments*

A brief overview of the two Hydrometric Areas (or part of) affected by the proposed Maighne Wind Farm is given below.

##### *Hydrometric Area 07 Boyne*

Hydrometric Area 07 consists of the River Boyne catchment. The River Boyne main channel rises near Edenderry on the borders of Counties Offaly and Kildare and flows in a north-easterly direction for 112 km before entering the Irish Sea at Drogheda. Together with its tributaries, it drains a catchment of approximately 2,500 km$^2$. The River Boyne corridor together with its tributary the Kells Blackwater River are designated as a Special Area of Conservation (SAC) (SAC Code 002299). In addition, the River Boyne main channel is also a designated salmonid river under the EU Freshwater Fish Directive (78/659/EEC).

The Boyne has eleven major tributary sub-catchments. The watercourses in the Boyne catchment affected by the proposed Maighne Wind Farm are the Boyne River and Glash River (Ballynakill), the Balrinnet and Glash Rivers (Windmill), and the Coolree, Ballynamullagh, Mulgeeth and Longwood Blackwater Rivers (Drehid-Hortland), where the names in parenthesis are components of the proposed development in the various sub-catchments.

Most of the Boyne catchment is underlain by limestone-based glacial till (O'Grady 1998 [71]). The Boyne catchment drains a mainly lowland area, and consequently all sub-catchments are fed by percolating ground water to a greater extent rather than by runoff. Farming practices in the catchment include dairy, beef production and tillage. There are many large towns in the catchment, including Slane, Navan, Kells, Trim, Athboy and Ballivor.

O'Grady (1998) reported that three major ecological impacts on the Boyne catchment have occurred in 'recent' times. These are (1) excavation of peat lands in the headwater area of the catchment to fuel power stations, (2) the 1980's arterial drainage scheme which affected virtually the entire catchment, and (3) the onset of serious eutrophication problems on Lough Ramor in the Kells Blackwater sub catchment.

The excavation of the peat bogs in headwater areas led to a runoff of fine peat silt particles causing siltation of the headwater tributaries and excessive growth of reeds on these lateral silt beds. This led to a narrowing and deepening of the stream channels; particularly in the catchment area above Trim (O'Grady 1998). The second major event to impinge on the system was the implementation of an arterial drainage programme throughout the catchment. This programme commenced in 1969 and continued until 1985 (O'Grady 1998). The only major section of this catchment which was not drained was the lower reaches of the main Boyne channel - from Navan downstream, and a section of the Kells Blackwater.

The Ballynakill, Drehid-Hortland and Windmill cluster of the proposed Maighne Wind Farm are within the Boyne catchment and watercourses draining these areas are discussed below.

Drehid-Hortland

The Drehid-Hortland cluster is drained by the Blackwater (Longwood) River (EPA code 07B02). The western extent of the Drehid-Hortland cluster is drained by the Coolree River (EPA code 07C23). This river rises to the east of the site and flows into the 4$^{th}$ order Blackwater (Longwood) from the south as a 3$^{rd}$ order watercourse. The 3$^{rd}$ order Ballynamullagh River rises within the Drehid-Hortland site and flows into the Coolree River from the south. The Mulgeeth River (EPA code 07M54) rises within the southern extent of the Drehid-Hortland cluster of the proposed development. It has a channel length of c. 8km and flows east into the Blackwater (Longwood) River a 2$^{nd}$ order watercourse.

Ballynakill

The Ballynakill cluster is located to the southwest of Longwood. This cluster is drained by the River Boyne (EPA code 07B04, segment code 07_951) to the north, the Boolykeagh River (EPA code 07B44) and the Glash River (EPA code 07G02) to the west. The River Boyne within the study area is a large drained 5$^{th}$ order river with little physical variation. The Boolykeagh River is a 2$^{nd}$ order watercourse that is formed by the joining of two 1$^{st}$ order streams that are within the Ballynakill cluster. These streams join and the Boolykeagh River flows north for approximately 2km before flowing into the River Boyne. The Glash River is a 4$^{th}$ order watercourse that is formed by numerous tributaries to the south west of the site. A 1$^{st}$ order stream of c. 1.5km in length (Mulphedder Stream, EPA code 07M18) within the Glash River sub-catchment flows approximately 0.5km to the west of the site. The Ashfield Stream (EPA code 07A14) drains the north eastern portion of the site. This 1$^{st}$ order watercourse has a channel length of c. 2km and flows into the River Boyne approximately 1km downstream of the Royal Canal crossing.

Windmill

The Windmill cluster is located in the Glash River sub-catchment where the lands are drained by the 2$^{nd}$ order Balrinnet River (EPA code 07B26). The Balrinnet River is formed by two 1$^{st}$ order streams that rise approximately 1km north and 1.5km south-east of the Windmill cluster (Glash Stream to the south east). The Balrinnet River flows into the Kilrainy River (EPA code 07K22) to form the Glash River which flows into the River Boyne. The headwaters of the Glash Stream flow within 0.2km from the cluster. The overland hydrological distance from the proposed Windmill cluster to the River Boyne is approximately 8.5km.

### *Hydrometric Area 14 Barrow*

Hydrometric Area 14 is the Barrow catchment, which is one of the largest river catchments in Ireland. The River Barrow itself is 192kmlong and drains a catchment of 2,983km$^2$. It rises on sandstones in the Slieve Bloom Mountains at an elevation of 580m to flow south to confluence with the River Suir estuary at Waterford Harbour. The River Barrow corridor (together with the adjacent River Nore) is a SAC (SAC Code 002162).

The Barrow has eleven major tributary sub-catchments. The main tributaries, on the left bank, are the Cushina, Figile and Slate, all of which form one tributary at Monasterevin, the Greese, Lerr, Burren, Mountain and Pollmounty; those on the right bank are the Owenass, Triogue, Stradbally, Douglas, Fushoge, Gowran, Powerstown and Duiske. The current proposed development affects the Cushina, Figile, Slate, Stadbally and Triogue River sub-catchments. A number of other minor sub-catchments draining directly into the main channel of the River Barrow are also affected.

The River Barrow has been the subject of an arterial drainage scheme (1926 – 1934) with 210km of main rivers and tributaries and 175km of smaller drains deepened and widened, to improve conveyance, in the course of the works programme. The extent of the drainage programme was largely confined to the catchment upstream of Athy and included the extensive Figile-Slate systems.

There are extensive areas of peat in the catchment, bogland having an area in excess of 159 $km^2$ in the catchment. The Cushina – Philipstown – Figile – Slate system in particular drains extensive areas of flat land with large-scale commercial peat workings present. The Cloncumber, Derrybrennan, Drehid-Timahoe clusters are located in this sub-catchment where these areas are drained by the Slate and Abbeylough Rivers.

To accommodate navigation, as well as providing hydropower to a number of industrial units, the River Barrow was regulated by a number of major weirs, creating a series of very low gradient reaches between each weir.

Navigation at each weir was accommodated through a network of 23 lock gates. Downstream of Athy, the Grand Canal – Barrow Line navigation switches from being an exclusively canal-like channel to one where navigation takes place within the riverine channel.

The Cloncumber and Derrybrennan clusters rm are within the Barrow catchment and watercourses draining these areas are discussed below.

Cloncumber

The Cloncumber cluster is located in the Slate River (EPA code 14S01) sub-catchment within the Barrow catchment. Much of the northern boundary of the this cluster, a stretch of approximately 4km is defined by the stretch of the 3rd order Slate River upstream of Agar Bridge. An external road is proposed to access the proposed Cloncumber cluster from the north which would involve a crossing of the Slate River. The Cloncumber Stream (EPA code 14C17) flows north through proposed Cloncumber cluster of the proposed development to meet the Slate River from the south. The Cloncumber Stream is a highly modified low gradient 2nd order channel. The 3rd order Slate River joins the 4th order Figile River approximately 12km downstream of the Cloncumber cluster. Approximately 1km downstream, the Figile River is fed from the west by the 3rd order Cushina River (EPA code 13C04). A further 7km or so downstream the Figile River flows into the River Barrow (EPA code 14B01).

Derrybrennan

The Figile River (EPA code 14F01) drains the Derrybrennan cluster. The Abbeylough River (EPA code 14A01) is a 1st order watercourse of approximately 6km long. This watercourse flows in an easterly direction and to within 1.2km north of the proposed Derrybrennan cluster. It flows into the 2nd order Figile River approximately 2km north west of the proposed development site. The 3rd order Slate River joins the 4th order Figile River.

### *7.3.8.2 Designated Sites*

#### *SACs designated for aquatic interests*

There are two Natura 2000 river systems in the study area. These are the River Barrow and River Nore cSAC (Site Code 002162) and the River Boyne and River Blackwater cSAC (Site Code 002299). These two Natura 2000 are discussed hereunder with reference to the Drehid-Hortland, Ballynakill and Windmill clusters of the proposed Maighne Wind Farm in Hydrometric Area 04 and with reference to the Cloncumber and Derrybrennan clusters of the site in Hydrometric Area 14.

#### *River Boyne and the River Blackwater cSAC*

Drehid-Hortland

The Drehid-Hortland cluster of the proposed development is within the Blackwater (Longwood) River sub-basin and approximately 10km to the southeast at its closest. The Blackwater (Longwood) River flows into River Boyne and the River Blackwater SAC.

The shortest pathway between the Drehid-Hortland cluster and the River Boyne and the River Blackwater SAC is approximately 18.9km where the overland hydrological distance from the eastern portion of the Drehid-Hortland cluster and the River Boyne and the River Blackwater SAC is approximately 18.9km via the Blackwater (Longwood) River.

The distance from the western portion of the proposed development site to the River Boyne within the cSAC is approximately 19km where the Coolree River drains the western extent of the site and flows into the Blackwater (Longwood) River before discharging to the River Boyne.

Ballinakill

The upper limit of the River Boyne and River Blackwater cSAC on the main channel of the River Boyne is approximately 2km west of Longwood where the royal Canal crosses the River Boyne. The Ballynakill cluster lies approximately 1km due south of this part of the River Boyne and River Blackwater cSAC.

This part of the cSAC is a receptor for Ballynakill cluster as the Boolykeagh River flows from the Ballynakill site into the River Boyne. The western extent of the Ballynakill site also drains into the River Boyne and River Blackwater cSAC via the Glash River.

Windmill

The Windmill cluster is located in the Glash River sub-catchment which discharges to the River Boyne approximately 1.5km upstream of the designation. The closest watercourse to the Windmill cluster of the proposed development is a 1st order tributary of the Balrinnet River which flows approximately 0.2km to the east of the proposed development site. This stream would be crossed by the proposed MV cable. The distance from this location to the River Boyne and River Blackwater cSAC is approximately 11km via the Balrinnet River which flows into the Glash River before meeting the River Boyne.

*River Barrow and the River Nore cSAC*

Cloncumber

The Cloncumber cluster is in the Slate River catchment so the River Barrow within the River Barrow and River Nore cSAC is receiving water for this part of the proposed Maighne Wind Farm. The Cloncumber cluster is located approximately 18km to the north west of the River Barrow cSAC where the main channel of the Rive Barrow is within the designation. The closest part of the proposed Cloncumber cluster of the proposed development to the River Barrow and River Nore cSAC hydrologically is where the MV cable route crosses the Slate River. This crossing location is approximately 18km upstream of the River Barrow and River Nore cSAC where the lower reach of the Figile River is part of the designation.

Derrybrennan

The Derrybrennan cluster is within the Figile River sub-catchment. At its closest, the Derrybrennan component of the proposed development is located 17.5km to the north east of the River Barrow and River Nore cSAC. The proposed MV cable would cross the Abbeylough River and the Lullymore East Stream, these stream crossings located approximately 34km via watercourse pathways.

### *7.3.8.3 Designated salmonid waters*

*Boyne catchment*

The River Boyne main channel is a designated Salmonid Water under the European Communities (Quality of Salmonid Waters) Regulations, 1988 (S.I. No. 293/1988).

Ballinakill

The River Boyne is located approximately 1km north of the proposed Ballynakill cluster of the proposed development. The Boolykeagh River flows from the northern boundary of the proposed development site to the River Boyne. The Glash River system to the west of the proposed development which drains part of the site also flows into the main channel of the River Boyne.

Windmill

The Windmill cluster of the proposed development is located in the Glash River sub-catchment and is located approximately 9.5km upstream of the main channel of the River Boyne.

Drehid-Hortland

The Drehid-Hortland cluster is drained by the Blackwater (Longwood) River. The Blackwater (Longwood) River flows into River Boyne approximately 18.9km downstream of this cluster.

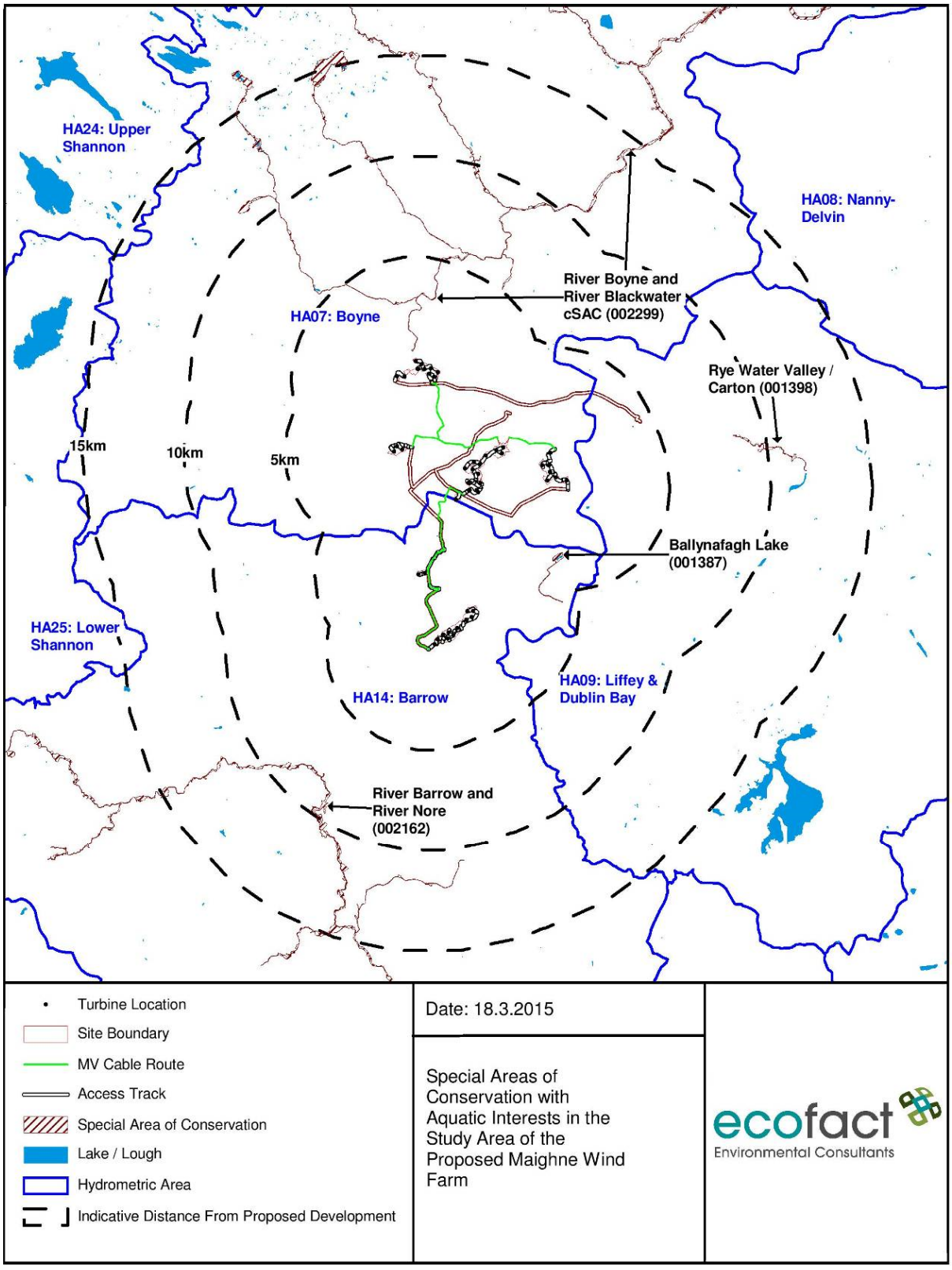



**Plate 7.3: Proposed wind farm in relation to Natura 2000 river sites and Special Areas of Conservation with aquatic interests**

*Barrow catchment*

There are no designated Salmonid Waters in the Barrow catchment.

### *7.3.8.4 Waterbody types*

Plate 7.2 shows the principal watercourses in the study area for the proposed Maighne Wind Farm. These water features correspond with rivers and streams shown on the EPA map viewer where spatial data such as watercourse locations can be downloaded from the EPA geoportal website. These watercourses are also indicated on the 1:50,0000 scale Discovery Series maps. Watercourses in the study area are discussed below under drains (FW4) and depositing/lowland rivers (FW2). These are the only habitat types in the study area following the classifications given in Fossitt (2000 [49]). A significant proportion of 1st order watercourses in the region correspond to the habitat drainage ditch owing to the low gradient topography of the study area. Indeed, there is no clear delineation between Hydrometric Area 7 (Barrow) and Hydrometric Area 14 (Barrow) with respect to surface water features, some 1st order streams crossing from one of these water regions to another. For example, the Clonkeen Stream (EPA code 07C36) rises within the Barrow catchment and flows north into the River Boyne approximately 2km east of Edenderry.

*Drains (FW4)*

There are a number of highly modified waterbodies within the proposed Maighne Wind Farm corresponding to the habitat 'Drainage ditch (FW4)'. These waterbodies include drainage ditches, field drains and channelised streams. The drainage ditch and depositing lowland river habitats in the study areas of the Drehid-Hortland, Ballynakill and Windmill clusters within the Boyne catchment, and the Cloncumber and Derrybrennan clusters within the Barrow catchment are discussed below.

Typical characteristics of waterbodies classified as drains are evidence of significant, and modification including deepening and straightening, absence of any visible flow, dominance of mud or silt substrate, and choking by aquatic vegetation. This category of waterbody is highly modified and generally not of any significant aquatic ecological importance, and rarely of any fisheries importance. These watercourses usually contain populations of three-spined stickleback (*Gasterosteous aculeatus)* however. This fish species can be expected to occur in most of the watercourses in the proposed Maighne Wind Farm. The land drainage network in the proposed Maighne Wind Farm has many drainage ditches that are not indicated by the EPA i.e. watercourses smaller than 1st order.

Drainage ditches in the proposed clusters are evaluated as being of Local Importance (lower value). It is noted that these waterbodies can be of importance to amphibians (i.e. frogs and newts) and the presence of frogs and/or newts would raise their overall ecological value. It is also possible that whorl snails (*Vertigo moulinsiana*) could use these habitats in some limited areas. Small drains can also occasionally be used by white-clayed crayfish (*Austropotamobius* pallipes); however this species was not found in the current study. However, most of the drains assessed during the current study were physically degraded and organically enriched.

<u>Drehid-Hortland</u>

The Mulgeeth River at southern extent of the Drehid-Hortland cluster is a sluggish watercourse of trapezoidal cross section. It flows into the Blackwater (Longwood) River.

<u>Ballinakill</u>

Two 1st order watercourses within the Ballynakill cluster are channelised and deepened and classified as a drainage ditches.

Windmill

Two 1st order streams that rise approximately 1km north and 1.5km south-east of the proposed Windmill cluster and join to form the Balrinnet River are classified as drainage ditches. These linear watercourses drain predominantly peaty soils and are slowing flowing.

Cloncumber

There are three minor 1st order tributaries within / adjoining the proposed Cloncumber cluster that flows into the Slate River from the north of the Slate River and fall into the habitat category 'drainage ditch. The longest of these has a channel length of c. 4km.

Derrybrennan

The Abbeylough River which drains the Derrybrennan clustert and the Lullymore Stream to the south are classified as drainage ditches, being artificial /deeply drained linear channels.

*Depositing/lowland rivers (FW2)*

Larger watercourses in the proposed Maighne Wind Farm are low gradient with deposits of fine sediments on the river bed with slow water flow. All watercourses in the study area have been modified to one degree or another, with many channels subjected to severe modifications in part as a result of the OPW arterial drainage schemes. Such reaches of these watercourses would typically hold populations of small fish such as Minnow, Stone loach, Pike, perch and brown trout. Atlantic salmon *Salmo salar*, Brook lamprey *Lampetra planeri* and White-clawed crayfish could also potentially be present in these stretches. The lowland depositing rivers in the study area are evaluated as being of Local Importance (higher value).

Drehid-Hortland

The Drehid-Hortland cluster is drained by the Blackwater (Longwood) River which corresponds to the habitat lowland/depositing river. This watercourse has a trapezoidal cross section and banks of up to 2m high.

Ballinakill

The Boolykeagh and Glash Rivers downstream of the proposed Ballynakill clsuter are lowland/depositing rivers, having been drained/highly modified in the past.

Windmill

The Balrinnet, Boolykeagh and Glash Rivers downstream of the proposed Ballynakill cluster are lowland/depositing rivers that have been drained/highly modified in the past.

Cloncumber

The Slate River and the Cloncumber Stream correspond to the habitat lowland/depositing river. The Slate River has encroaching marginal vegetation and large stands of instream club rush. The Cloncumber Stream is artificially deepened and widened and has a large proportion of instream emergent vegetation.

Derrybrennan

The Figile River which is the receiving water for the Derrybrennan cluster corresponds to the habitat lowland/depositing river.

#### *7.3.8.5 Protected aquatic flora and fauna*

The proposed Maighne Wind Farm is within the 10km Grid squares N62, N63, N64, N72, N73 and N83. Every six years, Member States of the European Union are required to report on the conservation status of all habitats and species listed on the annexes of the Habitats Directive as required under Article 17 of the Directive. Following a period of public consultation Ireland submitted these status assessments to the European Commission in June 2013.

Table 7.50 shows the current distribution of protected aquatic fauna in the 10km grid squares relevant to the Drehid-Hortland, Ballynakill, Windmill, Cloncumber and Derrybrennan cluster based on the 2013 Article 17 Assessments.

### Table 7.50: Distribution of Protected Aquatic Species

| | Component of windfarm and Relevant 10km grid square(s) | | | | |
|---|---|---|---|---|---|
| | **Drehid-Hortland (N73, N83)** | **Ballynakill (N64, N74)** | **Windmill (N63)** | **Cloncumber (N72)** | **Derrybrennan (N62, N72)** |
| Atlantic salmon (1106) | ✓ | ✓ | ✓ | ✓ | ✓ |
| Freshwater pearl mussel (1029) | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded |
| White-clawed crayfish (1092) | ✓* | ✓ | ✓ | ✓ | ✓ |
| Brook lamprey | ✓ (N83 only) | ✓ (N74 only) | ✓ | | |
| River lamprey | ✓ (N83 only) | ✓ (N74 only) | ✓ | | |
| Sea lamprey | | | | | |

*Indicated as occurring by NBDC.
Table based on NPWS (2013) Article 17 Assessments

#### *Atlantic salmon*

The Atlantic salmon is listed under Annexes II and V of the EU Habitats Directive and Appendix III of the Bern Convention. It is an economically important species and salmon recreational and commercial fisheries occur throughout Ireland. Atlantic salmon are present in the main river channels and tributaries of the Boyne and Barrow catchments. Atlantic salmon are an anadromous species, meaning they are spawned in freshwater habitats and then migrate to the sea. Salmon habitats are usually fast flowing riffle and glide habitats with cobble or gravel substrates. Salmon angling areas are usually located on main river channels or small rivers in deep glides of 1.5m depth or more.

Crisp (2000 [72]) notes that salmon spawning site selection is governed by a complex of environmental factors including intra-gravel flow, gravel size, water depth as well as stream velocity and cover, which are all essential for successful spawning, egg survival and hatching. One of the most important factors for salmon egg survival is oxygen supply, which is dependent upon dissolved oxygen concentration and inter-gravel flow. High concentrations of suspended solids in the river are undesirable as they are likely to result in infilling of the gravel pores with fine material (Cowx and Fraser, 2003 [73]).

Watercourses in the study area including the Boyne, Blackwater (Longwood), Slate and Figile Rivers are unsuitable/suboptimal with regard to salmonid spawning considering the lack of gravel substrates, poor aeration due to sluggish flows and degree of siltation. It is noted that many of these watercourses drain the Bog of Allen and that the substrate in many watercourses in the study area have artificially high levels of suspended solids during flood events and peaty deposits on the river beds. These conditions do not coincide with the habitat requirements of salmon spawning.

McGinnity *et al.* (2003 [74]) give the distribution of salmon in watercourses in Ireland and indicate that the species is present in all rivers of equal or greater than 2nd order in both the Boyne and Barrow catchments (with the exception of the upper reaches of the Owenass River in the upper Barrow catchment).

Within the study area these waters include the Blackwood (Longwood), and the lower reaches of the Glash, Coolree and Mulgeeth Rivers in the Boyne catchment and the in the Barrow catchment. The Figile, Abbeylough, Lullymore and Slate Rivers and Cloncumber Stream area within the Barrow catchment are also indicated as supporting salmon.

Atlantic salmon populations in Ireland have been recently assessed as being 'unfavourable - inadequate' by NPWS in the 2013 Article 17 Conservation Status Assessments (2013) [75].

Boyne Catchment

Atlantic salmon are widely distributed in the Boyne catchment and main tributaries, and the Boyne is subject to famous folklore stories about the great warrior Fionn mac Cumhaill and the mythical "*salmon of Knowledge*" that was caught on the River Boyne. Unfortunately as it is put in the book '*A celebration of salmon rivers*' published by NASF (2007 [76]) "*the salmon is no longer an image associated with the Boyne, nor is wisdom a quality to be associated with the management of this natural resource*".

The main problem currently facing salmon in the Boyne catchment is water quality which is addressed further in Chapter 10 – Water Quality of this EIS. The catchment was also significantly affected in the past by a major extended OPW arterial drainage scheme that involved deepening and channelisation works affecting almost every channel in the catchment above Navan. O'Grady (1998) argued that this drainage scheme may have inadvertently improved salmonid production in the catchment. He concluded that this was due to (a) the restoration of a natural river form in the middle reaches of the main channel as a result of the removal of a series of large weirs and (b) the post-drainage fishery enhancement programmes. However, few anglers in the Boyne catchment would agree with this hypothesis, and it is clear that the scheme had a devastating effect on the physical ecological diversity of the river corridors in this catchment. The lower reaches of the main Boyne channel, from Navan to Drogheda, was not subject to arterial drainage and this coupled with the lengthy nature (17 years) of the drainage scheme was also probably advantageous in terms of maintaining salmonid production (O'Grady 1998 [71]). However, the delay in this scheme was apparently due to budgetary constraints rather than a mitigation measure and does not take into account other ecological impacts. O'Grady (1998 [71]) reported that spawning sites for both salmon (and trout) in the Boyne catchment are confined principally to the tributaries as there are very limited gravel deposits in the main channel. He also noted that sub-tributaries in the catchment are generally not of importance in fisheries terms; probably a legacy of the arterial drainage scheme. O'Grady (1998 [71]) states that the tributaries function as nursery areas for salmonids and the larger of these channels, and the main Boyne channel, support substantial populations of salmon parr (and adult brown trout). According to Inland Fisheries Ireland the River Boyne catchment contains 5.93% of the accessible juvenile salmon habitat in Ireland, comprising 6.69 million $m^2$ of suitable juvenile salmon habitat. Salmon angling areas in the River Boyne are largely limited to the main Boyne downstream of Navan and the lower reaches of the Kells Blackwater. Adult salmon seldom move upstream of this point in the channel until late in the year, after the angling season (O'Grady 1998 [71]; O'Reilly 2002 [77]).

Barrow Catchment

The Barrow is a highly modified river with the lower and middle reaches of the river canalised for navigation. The river still has a good run of salmon which spawn downstream of the weirs on the main channel, and also run into the tributaries. Most of the tributaries have been subjected to arterial drainage schemes and water quality is a significant pressure in the catchment. It is a river that has had recurring serious water pollution problems in recent times, and fish kills have occurred. Despite this salmon stocks are improving according to Inland Fisheries Ireland. A catchment wide electrofishing survey of juvenile salmon abundance was undertaken on the River Barrow during summer 2011 by Inland Fisheries Ireland.

The mean catch in 2011 at 79 sites was 24.75 salmon fry per 5 minute fishing which is considered a high abundance level. The mean catch over the four years sampled was 15.35 salmon fry per five minute fishing. It is clear that all the 2nd order and larger streams in the study area of the proposed wind farm site have salmon populations. According to Inland Fisheries Ireland the River Barrow catchment contains 5.75% of the accessible juvenile salmon habitat in Ireland, comprising 6.49 million $m^2$ of suitable juvenile salmon habitat. The salmon fishing in the River Barrow is generally regarded as poor, and what fish are taken are mostly grilse, taken either during the summer or late in the season. The salmon fisheries on the River Barrow are located well downstream of the study area.

### *Freshwater Pearl Mussel*

The freshwater pearl mussel (*Margaritifera margaritifera* (L.)) is a large bivalve species found in oligotrophic, soft to neutral waters of rivers and, occasionally, in lakes. In Ireland, the species is concentrated along the western sea-board, but also occurs in the south and east where geology allows. However, the Freshwater Pearl Mussel does not occur in the study area or in downstream areas.

The biology and ecology of the species are particularly notable in that individuals can grow to very large sizes relative to other freshwater molluscs, building up thick calcareous valves, in rivers with relatively soft water and low levels of calcium.

Their shell building is consequently very slow, and individuals in natural conditions live to over a hundred years of age.

In Ireland, a total of 27 populations have been designated within 19 SAC areas for *Margaritifera margaritifera.* NPWS (2013 [75]) note that the freshwater pearl mussel (FPM) is found in 162 rivers in 104 catchments/sub-catchments across 14 counties (Carlow, Cavan, Clare, Cork, Donegal, Galway, Kerry, Limerick, Mayo, Sligo, Tipperary, Waterford, Wexford and Wicklow). The Freshwater Pearl Mussel does not occur in the study area or in downstream areas. Freshwater Pearl Mussel populations in Ireland have been recently assessed as being 'unfavourable - bad' by NPWS in the 2013 Article 17 Conservation Status Assessments (2013 [75]).

#### Boyne Catchment

The Drehid-Hortland, Ballynakill and Windmill clusters are located within the Boyne catchment. The Drehid-Hortland and Windmill clusters are located in Co. Kildare as is the bulk of the Ballynakill cluster. A small portion of the northern extent of the Ballynakill cluster is located in Co. Meath. There are no records of FPM in these counties and the species does not occur in the study area. The Article 17 report (NPWS, 2013) which shows the current distribution of FPM shows the Boyne catchment to be outside the known distribution of FPM in Ireland.

#### Barrow Catchment

The Cloncumber and Derrybrennan clusters are located within the Barrow catchment in Co. Kildare. Co. Kildare is not listed in NPWS (2013 [78]) as an area where FPM is found and the study area is not indicated within the current distribution of FPM.

Lucey (1993 [79]) gives the distribution of *Margaritifera margaritifera* in southern Irish rivers and streams. This study area encompassed Hydrometric Areas 11 to 24. The distribution of FPM given in Lucey (1993 [79]) for the River Barrow is within the distribution given in NPWS (2013 [78]). Again, the proposed development is outside of this distribution range.

Tributaries of the Barrow, Nore and Suir River were examined for freshwater pearl mussels *Margaritifera margaritifera* and *M. m. Durrovensis* from June to August 1991 (Moorkens *et al.,* 1992 [80]). Rivers surveyed included the Figile, Cushina, Lerr and Greese in the upper Barrow catchment. Of the 79 rivers surveyed, only four were found to have living freshwater pearl mussels. Two of these rivers were in the Barrow catchment: the Mountain River and the Ballymurphy River. In the 1991 study (Moorkens *et al.,* 1992 [80]), mussels were found in sandy gravel towards the river banks, and under overhanging trees. It is noted in Moorkens *et al.* (1992 [80]) that alteration in a river's flow regime, such as that caused by drainage for forestry or agriculture, may result in summer flows being insufficient to support Freshwater Pearl Mussel. The same can be said of drainage carried out for harvesting of peat.

A large proportion of rivers in the study area have soft substrates deemed unsuitable for FPM, beds of these rivers thought to be influenced by peat runoff from peat harvesting, suspended solids from ploughed lands and diffuse enrichment from agricultural activities, all known pressures on FPM (Moorkens, 1999 [81]).

There are three *Margaritifera margaritifera* populations in the Barrow catchment within the River Barrow and River Nore cSAC (002162). These mussels are present in the Mountain, Ballymurphy and Aughavaud Rivers and are in excess of 65km to the south of the Cloncumber cluster.

### *White-clawed crayfish*

The white-clawed crayfish is the only freshwater crayfish recorded in Ireland. Populations of the species in the rest of Europe have declined dramatically and Ireland is seen as a unique stronghold for this species in a European context (Reynolds 1998 [82]). The white-clawed crayfish is protected under both European and Irish legislation. It is protected by the Wildlife Act, 1976 and has been classified as endangered in the IUCN Red List. It is also listed under Appendix III of the Bern Convention and Annexes II and V of the EU Habitats Directive (1992). The white-clawed crayfish is Ireland's only crayfish species. Ireland is understood to hold some of the best European stocks of this species, under least threat from external factors. Irish stocks are therefore of substantial conservation importance (Reynolds, 1998 [82]).

Throughout its natural range across Western Europe, the distribution and abundance of white-clawed crayfish has been dramatically reduced in the last 150 years due to human disturbances such as overfishing, habitat destruction, pollution and the introduction of foreign crayfish species (Reynolds, 1998 [82]). In Britain, the North American signal crayfish (*Pacifastacus leniusculus*) was introduced for aquaculture and subsequently escaped into the wild, where it has had a devastating effect on white-clawed crayfish populations. While this species has not been recorded in Ireland, there is a real threat that this alien crayfish species will reach this country. The crayfish plague, which was transmitted by introduced crayfish species and is caused by the fungus *Aphanomyces astaci*, has been found in Ireland since the late 1980s.

White-clawed crayfish is widespread in areas which are underlain by Carboniferous limestone, or its derivative - glacial drift (Reynolds, 1998 [82]). Demers *et al.* (2005 [83]) reported that white-clawed crayfish are still widespread in the rivers of the Irish midlands, where the geology is predominantly limestone. However, these authors also report that the distribution of white-clawed crayfish in rivers has been restricted since the mid-1980s. This was attributed in part to an outbreak of the crayfish plague. Recent data from the EPA suggests a decline in crayfish populations in the north midlands (Reynolds, 2006 [84]). According to Reynolds (1998), the main threats to the white-clawed crayfish in Ireland are stream drainage, pollution and the introduction of predators, competitors or diseases. Ongoing drainage maintenance on arterially drained rivers in Ireland has also been identified as having a significant adverse effect of this species (O'Connor & McDonnell, 2008 [85]). The overall Article 17 assessment for white-clawed crayfish is Unfavourable-Inadequate (NPWS, 2013).

Boyne Catchment

White-clawed crayfish is generally considered to be widespread in lowland rivers such as the River Boyne and tributaries (e.g. Lucey and McGarrigle, 1987 [86]). Demers *et al*. (2005 [83]) also reported that crayfish populations in the lakes and rivers of the Boyne catchment were likely to have been affected by crayfish plague, but are currently recuperating, according to Reynolds (2007). However, this effect is geographically isolated (Gallagher *et al.*, 2006 [87]). All components of the proposed development within the Boyne catchment are located within 10km grid squares within the current distribution of White-clawed crayfish (as in Table 7.53). This species can be expected to occur in the watercourses draining the Drehid-Hortland, Ballynakill and Windmill clusters.

Barrow Catchment

All components of the proposed development within the Barrow catchment are located within 10km grid squares within the current distribution of White-clawed crayfish (see Table 7.53). This species can be expected to occur in the watercourses draining the Cloncumber and Derrybrennan clsuters.

*Brook lamprey*

The brook lamprey is the smallest of the three lampreys native to Ireland and it is the only one of the three species that is non-parasitic and spends all its life in freshwater (Maitland & Campbell 1992 [88]). Brook lamprey is listed in Annex II of the EU Habitats Directive (92:43:EEC) and in Appendix III of the Bern Convention. Brook lampreys are the most common and widespread of the three Irish lamprey species (Kurtz & Costello, 1999 [89]). They are found in most 2nd order and larger streams and rivers throughout the study area. Brook lampreys live for up to five years burrowed into silt deposits in rivers. They metamorphose into adults and spawn in the early spring in fast flowing streams with gravel substrates. Unlike the other two Irish lamprey species they are not parasitic as adults, and undertake only localised migrations.

Lampreys show a preference for gravel-dominated substratum for spawning, and mainly silt and sand-dominated substratum for nursery habitat (Harvey & Cowx, 2003 [90]). The spawning season of brook lampreys starts when the water temperatures reach 10–11ºC (Maitland, 2003 [91]). This usually occurs in March/April.

Although still common in Ireland they are under significant threat from drainage and navigation maintenance works and also from water quality deterioration. Brook lampreys are also doing less well across the rest of European Union. In this regard Irish populations of Brook lampreys are of International Importance. Ireland has failed to protect lampreys with a close season for instream works during their spawning season so they are vulnerable due to the lack of this type of protection. Responsibility for protecting lampreys in Ireland falls within the remit of Inland Fisheries Ireland; although there are none and never have been any fisheries for this species in Ireland. Brook lamprey populations in Ireland have been recently assessed as being 'favourable' by NPWS in the 2013 Article 17 Conservation Status Assessments (2013 [92]).

Boyne Catchment

During a survey of juvenile lamprey populations in the Boyne Catchment (O'Connor, 2006 [93]), brook lampreys were found to be widely distributed in the catchment. Lampreys were present at 70 out of the 91 sites investigated (77%). Mean minimum densities of river/brook juveniles recorded was 5.16 ± 2.43 juvenile lampreys per $m^2$, which was considered high in the context of Irish rivers. These were considered to be primarily brook lampreys, although river lampreys were also likely to be represented in samples taken from the lower reaches of the Boyne main channel.

*Drehid Hortland*
During the O'Connor (2006 [93]) survey of juvenile lampreys in the River Boyne catchment, juvenile lampreys were recorded in the Blackwater (Longwood) River. This species can be expected to occur in the Mulgeeth and Coolree Rivers which drain the Drehid-Hortland cluster.

*Ballinakill*
Juvenile lampreys occurred in the main channel of the Boyne upstream and downstream of the Boolykeagh River confluence when surveyed in 2005 (O'Connor, 2006 [93]).

*Windmill*
The main channel of the River Boyne was found to have suitable habitat for lampreys at surveyed locations both upstream and downstream of the Glash River confluence, the watercourse draining the Windmill cluster. This species can be expected to occur in the Glash River also.

Barrow Catchment

King (2006 [94]) gives the distribution of the three species of lampreys in the River Barrow cSAC and found brook lampreys to be widely distributed in the main channel of the River Barrow. Taking into account the spawning requirements of the brook lamprey, this species can be expected to occur in only low densities within the study area, the lack of suitable spawning areas considered a limiting factor. Drained rivers such as those in the study area have a much reduced lateral heterogeneity and a lower availability of flow refugia and backwater habitats than un-drained rivers and this can be expected to restrict lamprey production.

*Cloncumber*
The Abbeylough, Cloncumber and Slate Rivers are likely to support brook lamprey in low densities. These watercourses are regarded as suboptimal for this species however with consideration for the spawning requirements.

*Derrybrennan*
The Figile and Lullymore Rivers may support small populations of brook lampreys. These watercourses are regarded as suboptimal for this species however with regard to the spawning requirements of the species. These watercourses generally have soft substrates and little gravelly substrates, the latter essential for successful spawning.

### *River lamprey*

The river lamprey is larger in size than the brook lamprey and exhibits an anadromous life cycle. River lamprey is listed in Annex II and IV of the Habitats Directive (92:43:EEC), and also in Appendix III of the Bern Convention. River lampreys are poor swimmers and climbers and are confined to the lower reaches of the Boyne catchment - well downstream of the study area of the proposed Maighne Wind Farm. King (2006 [94]) notes the presence of river/brook lampreys in the Barrow upstream of Portarlington. It is considered that these lampreys were most likely brook lampreys, taking account of the distance from the tide and the number of weirs on the river.

River lamprey populations in Ireland have been recently assessed as being 'favourable' by NPWS in the 2013 Article 17 Conservation Status Assessments (2013). However, this has been based on the fact that they have been grouped together with Brook lamprey populations due to identification difficulties.

### *Sea lamprey*

The sea lamprey is the largest of the Irish lamprey species and again has an anadromous life cycle. They are also listed in Annex II of the Habitats Directive and Appendix III of the Bern Convention. In the NPWS Irish Wildlife Manuals No. 21 (King, 2006 [94]), the sea lamprey is indicated as occurring as far upstream as Carlow on the main channel of the River Barrow. Although more capable than river lampreys, sea lampreys are again poor swimmers and climbers would be confined to the lower reaches of the Boyne and Barrow Rivers, if present - well downstream of the study area of the currently proposed wind energy development. Indeed, NPWS (2013) notes that in several sea lamprey rivers, (e.g. the Mulkear, the Feale, the Fergus, the Barrow) severe barriers to passage occur at the upstream end of the tidal freshwater and that this does not represent a favourable situation. Sea lamprey populations in Ireland have been recently assessed as being 'unfavourable' by NPWS in the 2013 Article 17 Conservation Status Assessments (2013 [95]).

### *Floating river vegetation*

The plants characteristic of this habitat include a number of *Ranunculus* species and all *Callitriche* species, including other submerged aquatic plants. The community Callitricho–Batrachion includes species of the *Ranunculus* subgenus *Batrachium* and two species of *Callitriche*, *C. hamulata* and *C. platycarpa* as diagnostic species. There are few published records for descriptions of this habitat in Ireland and no comprehensive island-wide descriptions. According to NPWS (2013 [96]) the EU definition of this habitat is very broad, especially when the presence of aquatic mosses is taken into account. Using this broad definition the habitat will be found in most watercourses in Ireland. There is to date no satisfactory definition of the habitat and its sub-types or their distribution in Ireland. Consequently there is a lack of relevant monitoring data concerning the habitat. What is clear is that the habitat can occur over a wide range of physical conditions, from acid, oligotrophic, flashy upland streams dominated by bryophytes to more eutrophic, slow flowing streams dominated by Ranunculus and Callitriche species. While the former will be sensitive to diffuse pollution the latter, especially in shallow streams, will be relatively more resistant. Flora associated with the Annex I habitat 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation' (3260) includes *Ranunculus saniculifolius, Ranunculus trichophyllus, Ranunculus fluitans, Ranunculus penicillatus ssp. penicillatus, Ranunculus penicillatus* ssp. *Pseudofluitantis, Ranunculus aquatilis, Myriophyllum* spp., Callitriche spp., *Sium erectum* (or *Berula erecta*), *Zannichellia palustris, Potamogeton* spp., and the moss *Fontinalis antipyretica*. *Groenlandia densa* (Opposite leaved pondweed) is also included in the list. The flowering rush *Butomus umbellatus* may be present as part of the bank flora where floating river vegetation has been identified. The habitat 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation' in Ireland has been recently assessed as being 'inadequate' by NPWS in the 2013 Article 17 Conservation Status Assessments (2013 [96]).

### *7.3.8.6 Fish Communities and Fisheries*

This section includes results of desk studies carried out for fish surveys in the Boyne and Barrow catchments as well as results of the field assessments carried out specifically for the proposed development. Table 7.51 presents the results of the physical habitat assessments at the aquatic ecology and fisheries survey sites, Table 7.52 presents the results of the River Habitat Survey (RHS) assessments, Table 7.53 presents the results of the fisheries habitat assessments and Table 7.54 presents the biological water quality and WFD status at the aquatic ecology and fisheries survey sites examined during the current field survey work. The results of the aquatic ecology and fisheries survey are also presented on Figure 7.4.

#### *Boyne catchment*

A single site was surveyed in the River Boyne catchment within the Eastern River Basin District as part of WFD fish surveillance monitoring in 2010 (Kelly *et al, 2011* [97]). This site was located close to the river's source, approximately 1.5km north of Edenderry. This location is approximately 18km upstream of the Fear English River confluence with the River Boyne, the Fear English River draining the Drehid-Hortland clsuter. A total wetted area of 936m$^2$ was surveyed at Boyne Bridge by IFI in 2010 (117m m long channel of wetted width 8m). Emergent macrophyte vegetation was abundant throughout this stretch, while submerged and floating species were also present. Three fish species were recorded in the River Boyne at Boyne Bridge: brown trout (0.05/m$^2$), three-spined stickleback (0.004/m$^2$) and minnow (0.002/m$^2$). It is noted that the stretch of the River Boyne surveyed during 2010 (Kelley *et al*, 2010 [97]) was drained, corresponding to channel characteristics of some watercourses in the current survey area.

#### *Barrow Catchment*

During the current assessment, electrical fishing was carried out at Site 9 on the Figile River in July 2014. A total of three fish species were recorded at this location: brown trout, European eel and pike.

A site on the main channel of the River Barrow was surveyed in the River Barrow catchment within the Eastern River Basin District as part of WFD fish surveillance monitoring in 2009 (Kelly *et al., 2010* [97]), so data from this site was also considered in the current assessment. This site was located at Pass Bridge in Monasterevin, Co. Kildare, approximately 10km downstream of the Figile-Slate confluence, or approximately 22km downstream of Cloncumber, the nearest cluster (Cloncumber). One electric-fishing pass was conducted using four boat-based electric-fishing units on the 6$^{th}$ of July 2009 along a 426m length of channel. The mean wetted width of the surveyed stretch was 25.6m and the mean depth was 96.0cm. Riffle and glide dominated the habitat, while the substrate was a mixture of cobble, gravel and sand. Macrophyte vegetation consisted mostly of riparian grasses but some submerged species were also present. A total wetted area of 10906m$^2$ was surveyed. A total of eleven fish species were recorded in the River Barrow (Pass Bridge) site (as well as roach x bream hybrids). Gudgeon *Gobio gobio* was the most abundant species (0.0037/m$^2$), followed by roach *Rutilus rutilus*(0.0031/m$^2$), salmon *Salmo salar* (0.0031/m$^2$), perch *Perca fluviatilis* (0.0026/m$^2$), pike *Esox lucius* (0.0024/m$^2$), minnow *Phoxinus phoxinus* (0.0013/m$^2$), brown trout *Salmo trutta* (0.0009/m$^2$), stone loach *Barbatula barbatula* (0.0007/m$^2$), European eel *Anguilla anguilla* (0.0006/m$^2$), dace *Leuciscus leuciscus* (0.0006/m$^2$), roach x bream hybrids *Rutilus rutilus* x *Abramis brama* (0.0004/m$^2$) and bream *A. Brama* (0.0001/m$^2$).

Gudgeon ranged in length from 8.2cm to 12.0cm (Fig. 4.12). Roach ranged in length from 5.5cm to 25.0cm. Four age classes (2+, 3+, 4+ and 5+) were present, accounting for approximately 14.7%, 35.3%, 29.4% and 17.6% of the total roach catch respectively. Salmon ranged in length from 9.0cm to 14.0cm. All individuals were aged 1+. Perch ranged in length from 10.6cm to 36.0cm. Six age classes (1+, 2+, 3+, 4+, 5+ and 8+) were present. Pike ranged in length from 17.5cm to 59.0cm. Three age classes (1+, 2+ and 3+) were present, accounting for approximately 77%, 8% and 15% of the total pike catch respectively. Brown trout ranged in length from 12.0cm to 38.5cm. Three age classes (1+, 2+ and 3+) were present, accounting for approximately 20%, 70% and 10% of the total brown trout catch respectively. Mean brown trout L1, L2 and L3 were 10.6cm, 18.3cm and 19.4cm respectively, indicating a fast rate of growth for brown trout in this river site according to the classification scheme of Kennedy and Fitzmaurice (1971 [98]). Eels ranged in length from 46.0cm to 58.0cm.

### *Salmonid habitats and fisheries*

Atlantic salmon are discussed in detail in Section 7.3.8.5. As well as salmon, brown trout also occur in the study area. Arterial drainage programmes dating from the 19th and first half of the 20th century impacted on many catchments throughout Ireland. Brown trout occur in virtually every catchment in Ireland with suitable water quality and spawning grounds, and are one of the most common and recognisable fish species in Ireland. Indeed, they have less protection in Ireland from anglers than non-native invasive cyprinid fish species such as the dace and roach, presumably due to their abundance. Brown trout occur as resident 'brown trout' and also as an anadromous form, the 'sea trout'. In many catchments throughout Ireland trout make extensive migrations between spawning grounds in streams and feeding grounds in lakes or larger rivers.

The Boyne catchment was severely affected by these schemes which degraded habitats for species such as trout. In many cases trout populations were more affected than salmon, with the removal of features such as undercut banks, large woody debris etc. from these channels. The larger river channels in the study area are still considered to be important trout fisheries, i.e. the Boyne, Blackwater (Longwood), Slate and Figile are all still noted for the quality and size of brown trout that they produce (O'Reilly, 2004 (77)).

### *Coarse fish habitats and fisheries*

Coarse fish are essentially any freshwater fish other than salmon and trout and generally include members of the cyprinidae family (i.e. roach, dace, rudd, bream, tench), pike and perch. The term coarse fishing originated in the United Kingdom in the early 19th century. Prior to that time, recreational fishing was a sport of the gentry, who angled for salmon and trout which they called game fish. Other fish were disdained as coarse fish.

Almost all coarse fish in Ireland are considered to be non-native species. However, there is recent evidence that pike may be native to Ireland (Pedreschi *et al*, 2013 (99)). Coarse fish in Ireland are afforded a higher level of protection in Ireland than native brown trout, with strict limits on the number and sizes of these fish that can be killed by anglers. Coarse fisheries are of significant economic value in Ireland, particularly for tourist anglers. Coarse fisheries and coarse fish spawning areas are generally located in large lowland rivers and lakes. The main channel of Moynalty is important in this regard.

### *Eel habitats*

The European eel *Anguilla anguilla* is a native fish of significant ecological importance. In recent decades, this species has undergone a dramatic decline throughout its range. In response to the decline in European eel populations European Council Regulation 1100/2007 “Establishing measures for the recovery of the stock of European eel” has now been adopted in member states. European eel is listed as ‘Critically endangered’ and is now ‘Red Listed’ according to the recently published ‘Red List No. 5: Amphibians, Reptiles & Freshwater Fish’ (King *et al*., 2011 (100)).

Eels are considered present throughout the proposed wind farm site, but are generally only found in larger watercourses, rivers and lakes. Eels have a catadromous life cycle, which means they spawn in the sea and migrate into freshwater to feed and grow. This is opposite of the life cycle of the salmon, for example. The upstream migration of eels in rivers is restricted by weirs and their obstacles. However unlike lampreys they are able to climb over weirs. Despite the international decline in this species, they are still common in the main rivers in the study area.

### *Lamprey habitats*

The most common lamprey species in the study area is Brook lamprey and they are generally common and widespread in the study area in 2nd order and larger streams and rivers.

### *Others*

The majority of the watercourses within the proposed wind farm site are small fish populations dominated by species such as the three-spined stickleback, nine-spined stickleback, minnow and stone loach.

These small fish communities are not of significant ecological or economic importance. These small fish populations, and particularly ones dominated by sticklebacks, can be present in even small drains that have permanent water.

#### *7.3.8.7 Aquatic macroinvertebrates*

##### *Macroinvertebrate communities*

The aquatic macroinvertebrate community in Ireland is impoverished due to glaciation with many species not reaching Ireland following the retreat of the ice and sea level changes. Macroinvertebrate assemblages were recorded from Site 2 on the Longwood Blackwater in the Boyne catchment, and Site 8 on the Slate River and Site 9 on the Figile River in the Barrow catchment as indicated on Figure 7.4. The macronivertebrates recorded at these locations are provided in Table 7.55.

The macroinvertebrate communities in the study area were typically associated with slow flowing watercourses. Pollution tolerant macroinvertebrates were found to dominate the macroinvertebrate assemblage at these sites. Watercourse morphology including physical characteristics such as depth and wetted width, as well as gradient, substrate conditions and instream/emergent vegetation coupled with water quality all dictate the macroinvertebrate families and relative abundance at the sites surveyed. The macroinvertebrate community assemblages recorded on the Longwood Blackwater, Slate River and Figile River are considered to be representative of the watercourses in the study area at large. Owing to their large size, these sites probably support the richest aquatic macroinvertebrate communities in the study area, as the smaller watercourses (drainage ditches) in the study area are prone to fluctuations and have less diverse structural diversity. The only protected macroinvertebrate in the study area is white clawed crayfish (see Section 7.3.8.5). This species was not recorded during the current assessment but is likely to occur.

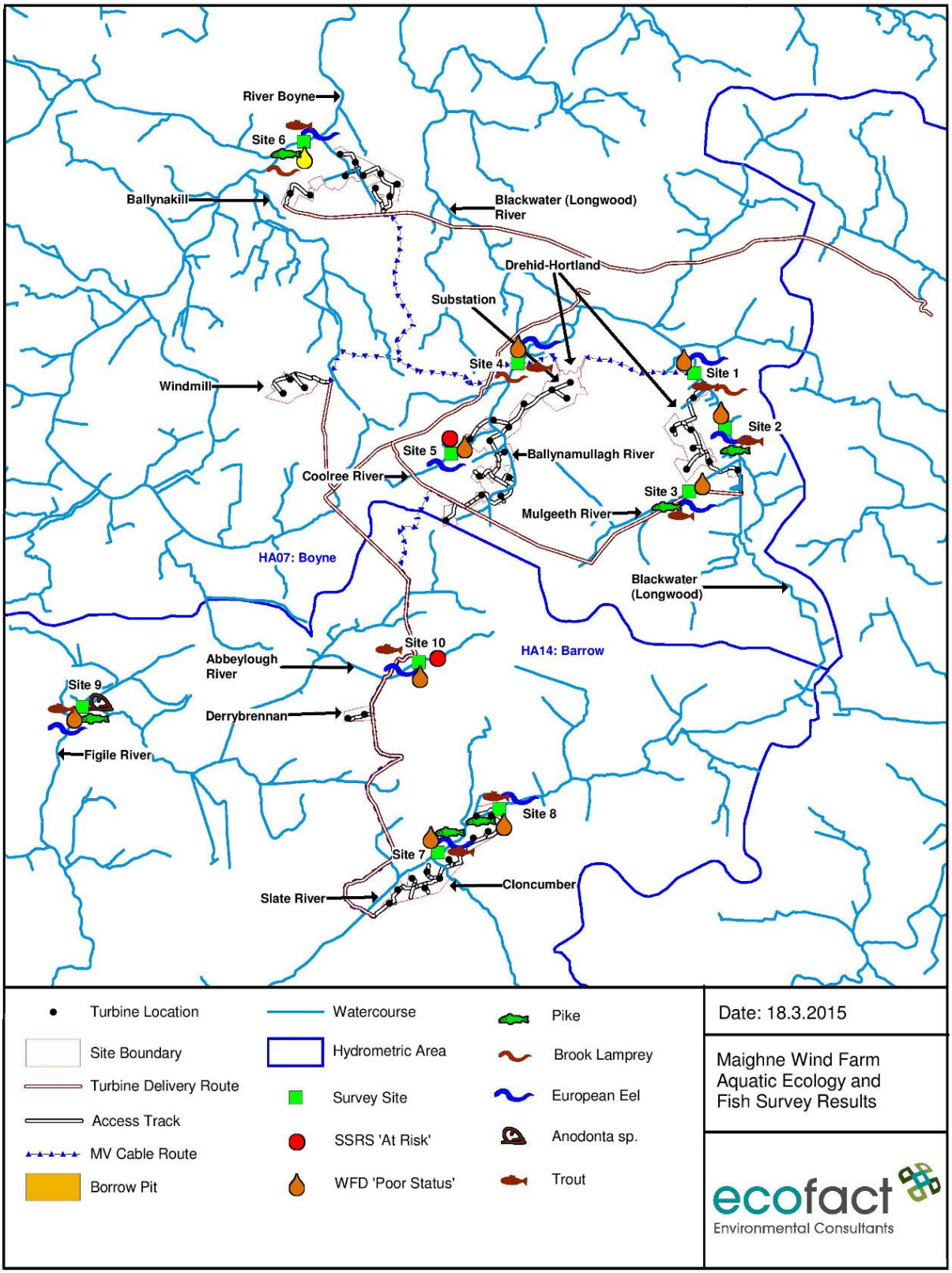



**Plate 7.4: Aquatic Ecology and Fisheries Survey Sites and Results**

### *Boyne Catchment*

Drehid-Hortland

Site 2 (as indicate on Plate 7.4) was located on the Blackwater (Longwood) River in the Boyne catchment to the east of the proposed Drehid-Hortland cluster. A macroinvertebrate family diversity of eight was recorded at this site. The pollution tolerant crustaceans *Gammarus deubeni* and *Asellus aquaticus*, as well as the snail *Bithynia tentaculata* were common. The snail *Lymnaea peregra* and beetles *Potamonectes depressus elegans* and *Stictotarsus duodecimpustulatus* were also recorded. The only Trichopteran recorded was *Hydropsyche sp.* (common).

### *Barrow catchment*

Cloncumber

Site 8 was located on the Slate River at the eastern extent of the proposed Cloncumber cluster. Macroinvertebrates in 10 families were recorded here. The only Ephemeropteran recorded was larval *Baetis rhodani*, a pollution tolerant indicator. Fair numbers and small numbers of *A. Aquaticus* and *Gammarus duebeni* were recorded respectively. The non-native snail *Potamopyrgus jenkinsi* was numerous. The leeches *Glossiphonia complanata* and the fish parasite *Piscicola geometra* as well as Aquatic worm (Lumbriculidae) were present at this site.

Derrybrennan

Site 9 was located on the Figile River downstream of the Derrybrennan cluster. The macroinvertebrate family diveristy at this location was 16. Trivhopterans were well represented with cased larvae of Group (less sensitive) *Phryganea sp.* (scarce) and caseless larvae of *Hydropsyche sp.* (fair numbers) and *Polycentropus* sp. (scarce). Larvae of the banded jewelwing damselfly *Agrion splendens* the true fly *Dicranota* sp. were recorded in small numbers. Molluscs were the most diverse group with the following recorded: *Planorbis carinatus, P. Jenkinsi, Lymnaea stagnalis* and freshwater duck mussel *Anodonta anatina.*

*A. anatina* has been previously recorded from the Figile River (based on distribution maps in Byrne *et al,* 2009 [101]). Its habitat in Ireland is lowland lake, slow moving rivers and canals. Microhabitat for this species in Ireland comprises muddy or silty beds in areas of still or slow flow. The Slate River is also considered to support this species. There are a total of 31 Irish non-marine molluscan species that either have a threat status or with important Irish populations (Moorkens, 2006 (96)), including Duck Mussel. The IUCN status of *A. anatina* is 'Vulnerable' (Byrne *et al,* 2009 [101]) and its threat status is 'Vulnerable' (Moorkens, 2006 (96)).

### *7.3.8.8 Biological water quality*

Water quality has been monitored in the River Boyne and Barrow main stem and in selected tributaries by the Environmental Protection Agency (EPA) and its predecessors since 1971. As part of its rollover monitoring programme, biological sampling is carried out periodically by the EPA. Below is an account of biological water quality in the study area based on EPA data. Table 7.56 gives the biological water quality ratings of watercourses assessed in August / September 2013. Plate 7.5 gives the most EPA Biological Water Quality Results for Watercourses Draining the Proposed Maighne Wind Farm.

### *Hydrometric Area 07 (Boyne)*

Drehid-Hortland

The Drehid-Hortland cluster is drained by the Blackwater (Longwood) River and was most recently monitored by the EPA in 2012. The uppermost EPA biological survey location on this river in 2012 is at the bridge south of Hortland (07B02 60), to the east of the proposed development. Biological water quality at this location was rated Q3 at this time, equivalent to WFD poor status. Biological water quality at the bridge at Johnstown was rated Q3-4 in 2012, equivalent to WFD moderate status.

The following is the most recent EPA assessment of the Blackwater (Longwood) River based on the 2012 results: *the dominance of pollution tolerant and paucity of pollution sensitive macroinvertebrate taxa indicated unsatisfactory ecological conditions at all sites surveyed on the Blackwater (Longwood) River in September 2012. Enriched conditions were evident with enhanced macrophyte growth noted downstream of Johnstown at Longwood (0300) and in the lower reaches (0600).*

Ballinakill

A stretch of the River Boyne between the EPA biological monitoring station at Ashfield Bridge (07B04 600) and Inchamore Bridge (07B04 800) lies approximately 1km north of the Ballynakill component of the proposed development site. At the upstream location (Ashfield Bridge), biological water quality was rated Q3-4 in 2012, corresponding to WFD moderate status. At the downstream location (Inchamore Bridge), biological water quality was rated Q4 in 2012, corresponding to WFD good status. The following is the most recent EPA assessment of the Blackwater (Longwood) River based on the 2012 results: *the majority of the fifteen stations surveyed on the Boyne River remain in an unsatisfactory ecological condition in 2012. The macroinvertebrate fauna indicated satisfactory ecological conditions at six of the stations examined. An unwelcome decline in ecological status was noted at three stations. The macroinvertebrate fauna indicated a decline from good to moderate ecological conditions in the upper reaches at Boyne Bridge (0200) and at Scarriff Bridge (0900) and a decline from high to good ecological conditions at Inchamore Bridge (0800). A welcome improvement from moderate to good ecological conditions was noted downstream of Broadboyne Bridge (2010). Unsatisfactory ecological conditions continue downstream of Edenderry (0300), at Ashfield Bridge downstream of the Glash River confluence (0600), downstream of the Blackwater (Longwood) confluence (0900), at Trim and downstream (1200, 1400), at Bective Bridge downstream of the Knightsbrook and Boycetown confluences (1500), Kilcarn Old Bridge, downstream of the Clady and Skane river confluences (1700) and at Obelisk Bridge, upstream of Drogheda (2200).*

The Mulphedder Stream drains the western extent of the proposed development site and flows in to the Glash River upstream of Bunglass Bridge (07G02 600). Biological water quality at this site was rated Q3-4 in 2012, corresponding to WFD moderate status.

Windmill

The Windmill cluster is drained by the Glash River system River which most recently monitored by the EPA in 2012. Biological monitoring is carried out at four locations within this sub-basin. The uppermost location is at the bridge NW of Calfstown (07G02 200) which is ca. 1km to the northeast of the proposed development site. Biological water quality at all locations surveyed by the EPA in 2012 were rated Q3, equivalent to WFD poor status.

The following is the most recent EPA assessment of the Glash River based on the 2012 results: *the dominance of pollution tolerant macroinvertebrate taxa, complete lack of pollution sensitive taxa and excessive instream siltation continues to indicate unsatisfactory poor ecological conditions at all stations surveyed on the Glash River in 2012. Excessive peat siltation of the instream substratum was noted in particular near Calfstown (0200) and at Clonuff Bridge (0400).*

### *Hydrometric Area 14 Barrow*

Cloncumber

The Cloncumber cluster is drained by the Slate River and the Cloncumber Stream and these watercourses were most recently monitored by the EPA in 2011.

The Slate River is monitored at Ford Bridge (14S01 50) upstream of the proposed development and at Agar Bridge (14S01 100) downstream. Biological water quality at both of these locations were rated Q3-4 in 2011, equivalent to WFD moderate status.

The following is the most recent EPA assessment of the Slate River based on the 2011 results: *Only one of the six stations surveyed on the Slate River was in a satisfactory ecological condition in 2011. Poor ecological conditions persist downstream of Prosperous (0020) and Allenwood (0050). A slight improvement from poor to moderate ecological conditions was noted at Agar Bridge (0100) and downstream of Rathangan (0210).*

*The increased diversity of sensitive macroinvertebrate fauna indicated a welcome improvement in the lower reaches (0300) however signs of enrichment (heavy siltation, enhanced instream algal growth, elevated dissolved oxygen and pH readings) were still evident*.

Only a single site is monitored on the Cloncumber Stream, at Old River Bridge (14C17 0200), c. 3km upstream of the proposed development site. Biological water quality at this site was rated Q3-4 in 2011, equivalent to WFD moderate status. The following is the most recent EPA assessment of the Cloncumber Stream based on the 2011 results: *the macroinvertebrate fauna continues to indicate unsatisfactory moderate ecological conditions on the Cloncumber Stream at Old River Bridge (0200) when surveyed in May 2011.*

Derrybrennan

The Derrybrennan cluster is drained by the Figile River and was most recently monitored by the EPA in 2011. The Slate River is assessed by the EPA both upstream and downstream of the proposed development: at Ticknevin Bridge (14F01 200) and Cushaling Bridge (14F01 100) respectively. In 2011, biological water quality was rated Q, equivalent to WFD poor status at Ticknevin Bridge, and Q3-4, equivalent to WFD moderate status at Cushaling Bridge.

The following is the most recent EPA assessment of the Figile River based on the 2011 results: *The dominance of pollution tolerant macroinvertebrate species, enhanced instream plant and algal growth and excessive siltation indicated continued unsatisfactory ecological conditions in the upper reaches (0050, 0100, 0200) of the Figile River in May 2011. The increased diversity and abundance of sensitive macroinvertebrate species indicated good ecological conditions at Clonbulloge (0300), Derrygarran (0400) and Andra Bridge (0500) although the enhanced macrophyte and algal growth continues to indicate some enrichment.*

#### *7.3.8.9 Aquatic plant communities*

Plants recorded during the current surveys consisted of *Sparganium erectum*, *Apium nodiflorum*, *Rorippa nasturtium-aquaticum*, *Glyceria maxima*, *Phalaris arundinacea, Mentha aquatica*, *Myosotis scorpioides, Iris pseudacorus, Schloenoplectus lacustris, Nuphar lutea, Callitriche* spp., *Lemna* spp. and *Potamegeton* sp. The moss *Fontinalis antipyretica* is widespread the Boyne catchment while the filamentous green algae *Cladophora glomerata* is common in both the Boyne and Barrow catchments, especially in the enriched lower reaches of rivers and some tributaries within the study area.

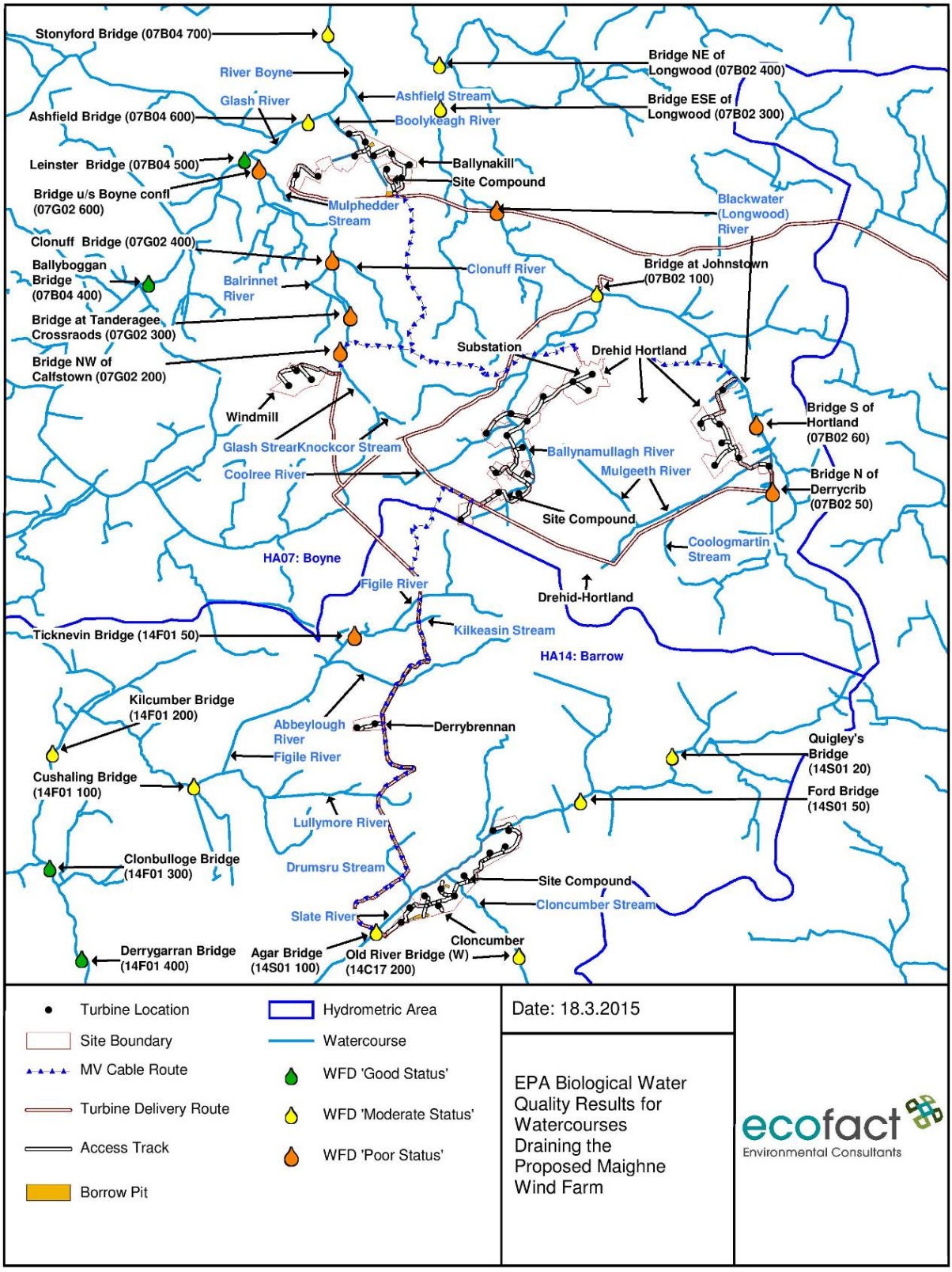



**Plate 7.5: EPA Biological Water Quality Results for Watercourses Draining Proposed Maighne Wind Farm**

## Table 7.51: Results of the Physical Habitat Assessments* of Aquatic Ecology and Fisheries Survey Sites

| Site | Watercourse Name | Wetted width (m) | Mean Depth (cm) | Max Depth (cm) | Instream vegetation (%) | Bank Height (m) | Bank slope (°) | Bank Cover (%) | Canopy Cover (%) | Riffle (%) | Glide (%) | Pool (%) | Flow Velocity (m/s) | Rock (%) | Cobble (%) | Gravel (%) | Fine (%) | Shade (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Blackwater (Longwood) | 3 | 30 | 50 | 40 | 4 | 45 | 100 | 85 | 0 | 100 | 0 | 0.2 | 20 | 20 | 20 | 40 | 50 |
| 2 | Blackwater (Longwood) | 2.5 | 30 | 40 | 20 | 0.5 | 45 | 100 | 20 | 0 | 100 | 0 | 0.02 | 0 | 0 | 0 | 100 | 20 |
| 3 | Mulgeeth | 2.5 | 30 | 40 | 20 | 0.5 | 45 | 100 | 20 | 0 | 100 | 0 | 0.02 | 0 | 0 | 0 | 100 | 20 |
| 4 | Coolree 07 | 2 | 15 | 20 | 40 | 1 | 90 | 100 | 40 | 20 | 80 | 0 | 0.3 | 20 | 20 | 10 | 50 | 40 |
| 5 | Coolree 07 | 0.5 | 5 | 20 | 0 | 1.5 | 80 | 95 | 95 | 30 | 40 | 30 | 0.2 | 0 | 30 | 40 | 30 | 95 |
| 6 | Boyne | 6 | 1 | 1.8 | 8 | 2 | 20 | 100 | 0 | 0 | 50 | 50 | 0.2 | 0 | 5 | 70 | 25 | 0 |
| 7 | Slate | 1.2 | 40 | 50 | 80 | 2.5 | 75 | 100 | 0 | 0 | 100 | 0 | 0.03 | 0 | 0 | 20 | 80 | 0 |
| 8 | Slate | 2.5 | 30 | 40 | 20 | 0.5 | 45 | 100 | 20 | 0 | 100 | 0 | 0.02 | 0 | 0 | 0 | 100 | 20 |
| 9 | Figile | 6 | 50 | 100 | 40 | 1.8 | 75 | 100 | 0 | 0 | 100 | 0 | 0.02 | 0 | 10 | 80 | 10 | 0 |
| 10 | Abbeylough | 1.5 | 15 | 20 | 40 | 1 | 80 | 100 | 70 | 0 | 100 | 0 | 0.01 | 10 | 40 | 40 | 10 | 70 |

**Assessment follows Environment Agency (2003) River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003*

## Table 7.52: Results of the River Corridor Survey (RHS) Assessments of Survey Sites

| Site | Watercourse Name | EPA code | Drained | Wetted width (m) | Gradient (Low/Med/High)* | Siltation (Heavy/Moderate/Normal/Free)* | Filamentous algae (Y/N) | Eroding banks (Y/N) | Braided channel (Y/N) | Artificial features (Y/N) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Blackwater (Longwood) | 07B02 | Yes | 3 | L | H | N | N | N | Y |
| 2 | Blackwater (Longwood) | 07H03 | Yes | 2.5 | L | H | N | N | N | Y |
| 3 | Mulgeeth | 07M54 | Yes | 2.5 | L | H | N | N | N | Y |
| 4 | Coolree 07 | 07C23 | Yes | 2 | L | H | N | N | N | Y |
| 5 | Coolree 07 | 07C23 | Yes | 0.5 | L | M | Y | N | N | Y |
| 6 | Boyne | 07B04 | Yes | 6 | L | M | Y | N | N | Y |
| 7 | Slate | 14S01 | Yes | 1.2 | L | M | Y | N | N | N |
| 8 | Slate | 14S01 | Yes | 2.5 | L | H | N | N | N | Y |
| 9 | Figile | 14F01 | Yes | 6 | L | N | N | N | N | Y |
| 10 | Abbeylough | 14A01 | Yes | 1.5 | L | M | N | N | N | Y |

**Visual assessment*.

## Table 7.53: Results of the Fisheries Habitat Assessments of Survey Sites

| Site | Water-course Name | Salmonid nursery (Y/N) | Salmonid fishery (Y/N) | Coarse nursery (Y/N) | Coarse fishery (Y/N) | Salmon (P/A) | Trout (P/A) | Coarse fish (P/A) | Eel (P/A) | Lamprey Habitat (P/A) | Lamprey (P/A) | Cray-fish (P/A) | FWPM (P/A) | Floating river vegetation (Y/N) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Blackwater (Longwood) | N | N | N | N | A | P | A | L | P | L | A | A | N |
| 2 | Blackwater (Longwood) | N | N | N | N | A | L | L | L | A | A | A | A | N |
| 3 | Mulgeeth | N | N | N | N | A | L | L | L | A | A | A | A | N |
| 4 | Coolree 07 | Y | N | N | N | A | L | A | L | P | L | A | A | N |
| 5 | Coolree 07 | N | N | N | N | A | A | A | L | A | A | A | A | N |
| 6 | Boyne | Y | Y | Y | Y | P | P | P | P | P | P | P | A | Y |
| 7 | Slate | Y | N | Y | N | P | P | P | P | A | A | A | A | N |
| 8 | Slate | N | N | N | N | A | L | L | L | A | A | A | A | N |
| 9 | Figile | Y | Y | Y | N | A | A | P | A | A | A | A | A | N |
| 10 | Abbeylough | Y | N | N | N | A | P | P | P | A | A | A | A | N |

*Y = Yes, N= No, P = Present, A = Absent, L = not recorded but likely to occur in the waterbody*

## Table 7.54: Biological Water Quality and WFD Status at the Aquatic Ecology and Fisheries Survey Sites

| Site | Watercourse Name | EPA code | EPA Q-value | ECOFACT Q-value | ECOFACT SSRS | WFD status | Morphological status* (High / Good / Moderate / Poor / Bad) | Biological status* (High / Good / Moderate / Poor / Bad) | Fisheries status* (High / Good / Moderate / Poor / Bad) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Blackwater (Longwood) | 06B02 | N/A | Q3 | N/A | Poor | P | M | M |
| 2 | Blackwater (Longwood) | 06B02 | Q3/Q3-4 | Q3 | N/A | Poor/Moderate | P | P | P |
| 3 | Mulgeeth | 07M54 | N/A | Q3 | N/A | Poor | P | P | P |
| 4 | Coolree 07 | 07C23 | N/A | Q3 | N/A | Poor | P | P | P |
| 5 | Coolree 07 | 07C23 | N/A | Q3 | Bad | Poor | P | P | P |
| 6 | Boyne | 07B04 | Q3-4 | Q3-4 | N/A | Moderate | P | M/G | M/G |
| 7 | Slate | 14S01 | Q3-4 | Q3 | N/A | Poor/Moderate | P | P | G |
| 8 | Slate | 14S01 | N/A | Q3 | N/A | Poor | P | P | P |
| 9 | Figile | 14F01 | N/A | Q3 | N/A | Poor | G | G | G |
| 10 | Abbeylough | 14A01 | N/A | Q3 | Bad | Poor | P | P | P |

**categories follow EEA (2012).*

## Table 7.55: Macroinvertebrates Recorded during the Biological Surveys

| | Pollution sensitivity group | Functional group | Site 2- Longwood Blackwater | Site 8 Slate River | Site 9 Figile River |
|---|---|---|---|---|---|
| **MAYFLIES** (Uniramia, Ephemeroptera) | | | | | |
| *Large dark olive Baetis rhodani* | C | Scraper & gathering collector | | **** | |
| **CASED CADDIS FLIES** (Trichoptera) | | | | | |
| Northern caddisflies (Limnephilidae) | | | | ** | |
| Phryganeidae | | | | | |
| *Phryganea sp.* | B | Shredder | | | ** |
| **CASELESS CADDIS FLIES** (Trichoptera) | | | | | |
| Grey flags (Hydropsychidae) | | | | | |
| *Hydropsyche sp.* | C | Filtering Collector | ***** | **** | **** |
| Trumpet-net caddisflies (Polycentopodidae) | | | | | |
| *Polycentropus sp.* | C | Filtering collector | | | ** |
| **DAMSELFLIES** (Odonata, Zygoptera ) | | | | | |
| Jewelwings/Demoiselles (Agriidae) | | | | | |
| Banded jewelwing *Agrion splendens* | B | Predator | | | *** |
| **TRUE FLIES** (Diptera) | | | | | |
| Craneflies (Tipulidae) | C | Shredder | | | |
| *Dicronata sp.* | C | Shredder | | | *** |
| Family Chironomidae | | | | | |
| **BEETLES** (Coeloptera) | | | | | |
| Gyrinidae | | | | | |
| Whirligig beetle larvae (Gyrinidae) | | | | | |
| Common whirligig beetle *Gyrinus sp.* | C | Predator | | | ** |
| *Haliplidae* | C | Predator | | | |
| Diving beetles (Dytiscidae) | | | | | |
| Sub family Hydroporinae | | | | | |
| *Stictotarsus duodecimpustulatus* | C | Predator | *** | | |
| *Potamonectes depressus elegans* | C | Predator | ** | | |
| **SNAILS** (Mollusca, Gastropoda) | | | | | |
| Family Lymnaeidae | | | | | |
| Wandering Snail *Lymnaea peregra* | D | Shredder | ** | | |
| Great Pond Snail *Lymnaea stagnalis* | C | Shredder | | | ** |
| Family Planorbiidae | | | | | |
| Keeled Ramshorn Snail *Planorbis carinatus* | C | Scraper | | | ***** |
| Hydrobiidae | | | | | |
| *Bithynia tentaculata* | C | Shredder | ***** | | |
| Jenkins spire shell *Potamopyrgus jenkinsi* | C | Grazer | | ****** | ***** |

| | Pollution sensitivity group | Functional group | Site 2- Longwood Blackwater | Site 8 Slate River | Site 9 Figile River |
|---|---|---|---|---|---|
| Family Ancylidae | | | | | |
| River limpet *Ancylus fluviatilis* | C | | **** | ** | |
| **MUSSELS** (Mollucsa, Lamellibranchiata) | | | | | |
| *Duck mussel Anodonta anatina* | | | | | * |
| Orb/Pea Mussels (Family Sphaeridae) | D | Filtering Collector | ** | | |
| **CRUSTACEANS** (Crustacea) | | | | | |
| Amphipods (Amphipoda, Gammaridae) | | | | | |
| Freshwater shrimp *Gammarus sp* | C | Shredder | ***** | *** | ** |
| Isopods, Asellidae | | | | | |
| Hog louse *Asellus aquaticus* | D | Shredder | ***** | **** | *** |
| **LEECHES** (Hirudinae) | | | | | |
| Piscicolidae | | | | | |
| *Piscicola geometra* | C | Predator | | * | * |
| Glossiphonidae | | | | | |
| *Glossiphonia complanata* | D | Predator | | * | |
| **BUGS** (Hemiptera) | | | | | |
| Lesser Water Boatmen (Corixidae) | | Predator | | | ** |
| *Notonectidae* | | | | | |
| *Notonecta* sp. | C | Predator | | | * |
| **ALDERFLIES** (Megaloptera) | | | | | |
| Alderfly larvae (Sialidae) | | | | | * |
| **OLIGOCHAETAE** | | | | | |
| Aquatic worm (Lumbriculidae) | D | Collector | | * | |

**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 7.56: Biological Water Quality Results**

| Site | Catchment | Relevant component of wind farm | Sub-catchment | River | Watercourse | Q-value | WFD Status | SSRS |
|---|---|---|---|---|---|---|---|---|
| 1 | Boyne | Drehid-Hortland | Blackwater (Longwood) | Blackwater (Longwood) | Blackwater (Longwood) | Q3 | Poor | - |
| 2 | Boyne | Drehid-Hortland | Blackwater (Longwood) | Blackwater (Longwood) | Hortland | Q3 | Poor | - |
| 3 | Boyne | Drehid-Hortland | Blackwater (Longwood) | Blackwater (Longwood) | Mulgeeth | Q3 | Poor | - |
| 4 | Boyne | Drehid-Hortland | Blackwater (Longwood) | Blackwater (Longwood) | Coolree 07 | Q3 | Poor | - |
| 5 | Boyne | Drehid-Hortland | Blackwater (Longwood) | Blackwater (Longwood) | Coolree 07 | Q3 | Poor | Bad |
| 6 | Boyne | Ballynakill, Windmill | Boyne | Boyne | Boyne | Q3-4 | Moderate | - |
| 7 | Barrow | Cloncumber | Figile | Slate | Slate | Q3 | Poor | - |
| 8 | Barrow | Cloncumber | Figile | Slate | Slate | Q3 | Poor | - |
| 9 | Barrow | Derrybrennan | Figile | Figile | Figile | Q3 | Poor | - |
| 10 | Barrow | Derrybrennan | Figile | Figile | Abbeylough | Q3 | Poor | - |

### 7.3.9 Bats

#### *7.3.9.1 Desktop Review*

A review of existing bat records within 30km and 10km of the study areas (sourced from BCIreland's National Bat Records Database) reveals that, currently, eight of the ten known Irish species have been observed within a 30km radius. These include common, soprano and Nathusius' pipistrelles, Leisler's, brown long-eared, Daubenton's *Myotis daubentonii,* whiskered *M. mystacinus* and Natterer's *M. nattereri* bats as shown in Tables 7.57 to 7.68 below. Roosts of several of these species, as shown in the tables, have also been identified within these radii but none are within or immediately adjacent to any of the study areas.

The two remaining Irish species; lesser horseshoe and Brandt's *M. brandtii* bats have not been recorded in the local area to date. Of these, the lesser horseshoe bat is not known to occur in either county as the species' distribution range is confined to the west of Ireland and only a single confirmed specimen of Brandt's bat has been found in Ireland (Mullen 2007 [102]). Further information on the Irish bat species is given in Appendix 1 and 2 of the standalone Bat Survey Report, appended to this EIS (see Appendix F6 of Volume 3).

Tables 7.57 to 7.68 below outline the adjudged status of each bat species within a 30km and a 10km radius of each of the respective clusters indicated.

## Table 7.57: Adjudged status of Irish bat species within a 30km radius of the Ballynakill Cluster

| Common name | Scientific name | 30km radius | Known roosts | Source |
|---|---|---|---|---|
| Common pipistrelle | *Pipistrellus pipistrellus* | Present | 12 known | BCIreland/Pers. Obs. |
| Soprano pipistrelle | *Pipistrellus pygmaeus* | Present | 22 known | BCIreland/Pers. Obs. |
| Nathusius' pipistrelle | *Pipistrellus nathusii* | Present | 0 known | BCIreland |
| Unknown pipistrelle | *Pipistrellus* spp. | | 12 known | BCIreland |
| Leisler's bat | *Nyctalus leisleri* | Present | 10 known | BCIreland/Pers. Obs. |
| Brown long-eared bat | *Plecotus auritus* | Present | 23 known | BCIreland/Pers. Obs. |
| Daubenton's bat | *Myotis daubentonii* | Present | 3 known | BCIreland/Pers. Obs. |
| Natterer's bat | *Myotis nattereri* | Present | 1 known | BCIreland/Pers. Obs. |
| Whiskered bat | *Myotis mystacinus* | Present | 1 known | BCIreland |
| Lesser horseshoe bat | *Rhinolophus hipposideros* | Absent | 0 known | BCIreland/NPWS |
| Brandt's bat | *Myotis brandtii* | Potential – rare | 0 known | BCIreland |
| Unknown species | | | 18 known | BCIreland |

## Table 7.58: Adjudged status of Irish bat species within a 10km radius of the Ballynakill Cluster

| Common name | Scientific name | 10km radius | Known roosts | Source |
|---|---|---|---|---|
| Common pipistrelle | *Pipistrellus pipistrellus* | Present | 1 known | BCIreland/Pers. Obs. |
| Soprano pipistrelle | *Pipistrellus pygmaeus* | Present | 2 known | BCIreland/Pers. Obs. |
| Nathusius' pipistrelle | *Pipistrellus nathusii* | Potential | 0 known | BCIreland |
| Unknown pipistrelle | *Pipistrellus* spp. | | 3 known | BCIreland |
| Leisler's bat | *Nyctalus leisleri* | Present | 4 known | BCIreland/Pers. Obs. |
| Brown long-eared bat | *Plecotus auritus* | Present | 4 known | BCIreland/Pers. Obs. |
| Daubenton's bat | *Myotis daubentonii* | Present | 0 known | BCIreland/Pers. Obs. |
| Natterer's bat | *Myotis nattereri* | Potential | 0 known | BCIreland/Pers. Obs. |
| Whiskered bat | *Myotis mystacinus* | Potential | 1 known | BCIreland |
| Lesser horseshoe bat | *Rhinolophus hipposideros* | Absent | 0 known | BCIreland/NPWS |
| Brandt's bat | *Myotis brandtii* | Potential – rare | 0 known | BCIreland |

## Table 7.59: Adjudged status of Irish bat species within a 30km radius of the Windmill Cluster

| Common name | Scientific name | 30km radius | Known roosts | Source |
|---|---|---|---|---|
| Common pipistrelle | *Pipistrellus pipistrellus* | Present | 10 known | BCIreland/Pers. Obs. |
| Soprano pipistrelle | *Pipistrellus pygmaeus* | Present | 17 known | BCIreland/Pers. Obs. |
| Nathusius' pipistrelle | *Pipistrellus nathusii* | Present | 0 known | BCIreland |
| Unknown pipistrelle | *Pipistrellus* spp. | | 10 known | BCIreland |
| Leisler's bat | *Nyctalus leisleri* | Present | 8 known | BCIreland/Pers. Obs. |
| Brown long-eared bat | *Plecotus auritus* | Present | 25 known | BCIreland/Pers. Obs. |
| Daubenton's bat | *Myotis daubentonii* | Present | 4 known | BCIreland/Pers. Obs. |
| Natterer's bat | *Myotis nattereri* | Present | 0 known | BCIreland/Pers. Obs. |
| Whiskered bat | *Myotis mystacinus* | Present | 1 known | BCIreland |
| Lesser horseshoe bat | *Rhinolophus hipposideros* | Absent | 0 known | BCIreland/NPWS |
| Brandt's bat | *Myotis brandtii* | Potential – rare | 0 known | BCIreland |
| Unknown species | | | 17 known | BCIreland |

## Table 7.60: Adjudged status of Irish bat species within a 10km radius of the Windmill Cluster

| Common name | Scientific name | 10km radius | Known roosts | Source |
|---|---|---|---|---|
| Common pipistrelle | *Pipistrellus pipistrellus* | Present | 10 known | BCIreland/Pers. Obs. |
| Soprano pipistrelle | *Pipistrellus pygmaeus* | Present | 17 known | BCIreland/Pers. Obs. |
| Nathusius' pipistrelle | *Pipistrellus nathusii* | Potential | 0 known | BCIreland |
| Unknown pipistrelle | *Pipistrellus* spp. | | 10 known | BCIreland |
| Leisler's bat | *Nyctalus leisleri* | Present | 3 known | BCIreland/Pers. Obs. |
| Brown long-eared bat | *Plecotus auritus* | Present | 3 known | BCIreland/Pers. Obs. |
| Daubenton's bat | *Myotis daubentonii* | Present | 0 known | BCIreland/Pers. Obs. |
| Natterer's bat | *Myotis nattereri* | Present | 0 known | BCIreland/Pers. Obs. |
| Whiskered bat | *Myotis mystacinus* | Present | 1 known | BCIreland |
| Lesser horseshoe bat | *Rhinolophus hipposideros* | Absent | 0 known | BCIreland/NPWS |
| Brandt's bat | *Myotis brandtii* | Potential – rare | 0 known | BCIreland |
| Unknown species | | | 2 known | BCIreland |

### Table 7.61: Adjudged status of Irish bat species within a 30km radius of the Drehid Cluster

| Common name | Scientific name | 30km radius | Known roosts | Source |
|---|---|---|---|---|
| Common pipistrelle | *Pipistrellus pipistrellus* | Present | 14 known | BCIreland/Pers. Obs. |
| Soprano pipistrelle | *Pipistrellus pygmaeus* | Present | 20 known | BCIreland/Pers. Obs. |
| Nathusius' pipistrelle | *Pipistrellus nathusii* | Present | 0 known | BCIreland |
| Unknown pipistrelle | *Pipistrellus* spp. | | 20 known | BCIreland |
| Leisler's bat | *Nyctalus leisleri* | Present | 12 known | BCIreland/Pers. Obs. |
| Brown long-eared bat | *Plecotus auritus* | Present | 32 known | BCIreland/Pers. Obs. |
| Daubenton's bat | *Myotis daubentonii* | Present | 3 known | BCIreland/Pers. Obs. |
| Natterer's bat | *Myotis nattereri* | Present | 3 known | BCIreland/Pers. Obs. |
| Whiskered bat | *Myotis mystacinus* | Present | 2 known | BCIreland |
| Lesser horseshoe bat | *Rhinolophus hipposideros* | Absent | 0 known | BCIreland/NPWS |
| Brandt's bat | *Myotis brandtii* | Potential – rare | 0 known | BCIreland |
| Unknown species | | | 20 known | BCIreland |

### Table 7.62: Adjudged status of Irish bat species within a 10km radius of the Drehid Cluster

| Common name | Scientific name | 10km radius | Known roosts | Source |
|---|---|---|---|---|
| Common pipistrelle | *Pipistrellus* | Present | 1 known | BCIreland/Pers. Obs. |
| Soprano pipistrelle | *Pipistrellus pygmaeus* | Present | 1 known | BCIreland/Pers. Obs. |
| Nathusius' pipistrelle | *Pipistrellus nathusii* | Potential | 0 known | BCIreland |
| Unknown pipistrelle | *Pipistrellus* spp. | | 3 known | BCIreland |
| Leisler's bat | *Nyctalus leisleri* | Present | 2 known | BCIreland/Pers. Obs. |
| Brown long-eared bat | *Plecotus auritus* | Present | 3 known | BCIreland/Pers. Obs. |
| Daubenton's bat | *Myotis daubentonii* | Present | 0 known | BCIreland/Pers. Obs. |
| Natterer's bat | *Myotis nattereri* | Potential | 0 known | BCIreland/Pers. Obs. |
| Whiskered bat | *Myotis mystacinus* | Potential | 0 known | BCIreland |
| Lesser horseshoe bat | *Rhinolophus hipposideros* | Absent | 0 known | BCIreland/NPWS |
| Brandt's bat | *Myotis brandtii* | Potential – rare | 0 known | BCIreland |

## Table 7.63: Adjudged status of Irish bat species within a 30km radius of the Hortland Cluster

| Common name | Scientific name | 30km radius | Known roosts | Source |
|---|---|---|---|---|
| Common pipistrelle | *Pipistrellus pipistrellus* | Present | 18 known | BCIreland/Pers. Obs. |
| Soprano pipistrelle | *Pipistrellus pygmaeus* | Present | 18 known | BCIreland/Pers. Obs. |
| Nathusius' pipistrelle | *Pipistrellus nathusii* | Present | 0 known | BCIreland |
| Unknown pipistrelle | *Pipistrelle* spp. | | 18 known | BCIreland |
| Leisler's bat | *Nyctalus leisleri* | Present | 27 known | BCIreland/Pers. Obs. |
| Brown long-eared bat | *Plecotus auritus* | Present | 35 known | BCIreland/Pers. Obs. |
| Daubenton's bat | *Myotis daubentonii* | Present | 4 known | BCIreland/Pers. Obs. |
| Natterer's bat | *Myotis nattereri* | Present | 4 known | BCIreland/Pers. Obs. |
| Whiskered bat | *Myotis mystacinus* | Present | 2 known | BCIreland |
| Lesser horseshoe bat | *Rhinolophus hipposideros* | Absent | 0 known | BCIreland/NPWS |
| Brandt's bat | *Myotis brandtii* | Potential – rare | 0 known | BCIreland |
| Unknown species | | | 21 known | BCIreland |

## Table 7.64: Adjudged status of Irish bat species within a 10km radius of the Hortland Cluster

| Common name | Scientific name | 10km radius | Known roosts | Source |
|---|---|---|---|---|
| Common pipistrelle | *Pipistrellus pipistrellus* | Present | 2 known | BCIreland/Pers. Obs. |
| Soprano pipistrelle | *Pipistrellus pygmaeus* | Present | 3 known | BCIreland/Pers. Obs. |
| Nathusius' pipistrelle | *Pipistrellus nathusii* | Potential | 0 known | BCIreland |
| Unknown pipistrelle | *Pipistrellus* spp. | | 2 known | BCIreland |
| Leisler's bat | *Nyctalus leisleri* | Present | 2 known | BCIreland/Pers. Obs. |
| Brown long-eared bat | *Plecotus auritus* | Present | 2 known | BCIreland/Pers. Obs. |
| Daubenton's bat | *Myotis daubentonii* | Present | 0 known | BCIreland/Pers. Obs. |
| Natterer's bat | *Myotis nattereri* | Potential | 0 known | BCIreland/Pers. Obs. |
| Whiskered bat | *Myotis mystacinus* | Potential | 0 known | BCIreland |
| Lesser horseshoe bat | *Rhinolophus hipposideros* | Absent | 0 known | BCIreland/NPWS |
| Brandt's bat | *Myotis brandtii* | Potential – rare | 0 known | BCIreland |
| Unknown species | | | 1 known | BCIreland |

## Table 7.65: Adjudged status of Irish bat species within a 30km radius of the Derrybrennan Cluster

| Common name | Scientific name | 30km radius | Known roosts | Source |
|---|---|---|---|---|
| Common pipistrelle | *Pipistrellus pipistrellus* | Present | 1 known | BCIreland/Pers. Obs. |
| Soprano pipistrelle | *Pipistrellus pygmaeus* | Present | 23 known | BCIreland/Pers. Obs. |
| Nathusius' pipistrelle | *Pipistrellus nathusii* | Present | 0 known | BCIreland |
| Unknown pipistrelle | *Pipistrelle* spp. | | 11 known | BCIreland |
| Leisler's bat | *Nyctalus leisleri* | Present | 11 known | BCIreland/Pers. Obs. |
| Brown long-eared bat | *Plecotus auritus* | Present | 26 known | BCIreland/Pers. Obs. |
| Daubenton's bat | *Myotis daubentonii* | Present | 3 known | BCIreland/Pers. Obs. |
| Natterer's bat | *Myotis nattereri* | Present | 0 known | BCIreland/Pers. Obs. |
| Whiskered bat | *Myotis mystacinus* | Present | 1 known | BCIreland |
| Lesser horseshoe bat | *Rhinolophus hipposideros* | Absent | 0 known | BCIreland/NPWS |
| Brandt's bat | *Myotis brandtii* | Potential – rare | 0 known | BCIreland |
| Unknown species | | | 19 known | BCIreland |

## Table 7.66: Adjudged status of Irish bat species within a 10km radius of the Derrybrennan Cluster

| Common name | Scientific name | 10km radius | Known roosts | Source |
|---|---|---|---|---|
| Common pipistrelle | *Pipistrellus pipistrellus* | Present | 1 known | BCIreland/Pers. Obs. |
| Soprano pipistrelle | *Pipistrellus pygmaeus* | Present | 0 known | BCIreland/Pers. Obs. |
| Nathusius' pipistrelle | *Pipistrellus nathusii* | Potential | 0 known | BCIreland |
| Unknown pipistrelle | *Pipistrellus* spp. | | 1 known | BCIreland |
| Leisler's bat | *Nyctalus leisleri* | Present | 3 known | BCIreland/Pers. Obs. |
| Brown long-eared bat | *Plecotus auritus* | Present | 5 known | BCIreland/Pers. Obs. |
| Daubenton's bat | *Myotis daubentonii* | Present | 0 known | BCIreland/Pers. Obs. |
| Natterer's bat | *Myotis nattereri* | Potential | 0 known | BCIreland/Pers. Obs. |
| Whiskered bat | *Myotis mystacinus* | Present | 1 known | BCIreland |
| Lesser horseshoe bat | *Rhinolophus hipposideros* | Absent | 0 known | BCIreland/NPWS |
| Brandt's bat | *Myotis brandtii* | Potential – rare | 0 known | BCIreland |
| Unknown species | | | 1 known | BCIreland |

**Table 7.67: Adjudged status of Irish bat species within a 30km radius of the Cloncumber Cluster**

| Common name | Scientific name | 30km radius | Known roosts | Source |
|---|---|---|---|---|
| Common pipistrelle | *Pipistrellus pipistrellus* | Present | 17 known | BCIreland/Pers. Obs. |
| Soprano pipistrelle | *Pipistrellus pygmaeus* | Present | 24 known | BCIreland/Pers. Obs. |
| Nathusius' pipistrelle | *Pipistrellus nathusii* | Present | 0 known | BCIreland |
| Unknown pipistrelle | *Pipistrellus* spp. | | 1 known | BCIreland |
| Leisler's bat | *Nyctalus leisleri* | Present | 3 known | BCIreland/Pers. Obs. |
| Brown long-eared bat | *Plecotus auritus* | Present | 32 known | BCIreland/Pers. Obs. |
| Daubenton's bat | *Myotis daubentonii* | Present | 2 known | BCIreland/Pers. Obs. |
| Natterer's bat | *Myotis nattereri* | Present | 4 known | BCIreland/Pers. Obs. |
| Whiskered bat | *Myotis mystacinus* | Present | 3 known | BCIreland |
| Lesser horseshoe bat | *Rhinolophus hipposideros* | Absent | 0 known | BCIreland/NPWS |
| Brandt's bat | *Myotis brandtii* | Potential – rare | 0 known | BCIreland |
| Unknown species | | | 21 known | BCIreland |

**Table 7.68: Adjudged status of Irish bat species within a 10km radius of the Cloncumber Cluster**

| Common name | Scientific name | 10km radius | Known roosts | Source |
|---|---|---|---|---|
| Common pipistrelle | *Pipistrellus pipistrellus* | Present | 0 known | BCIreland/Pers. Obs. |
| Soprano pipistrelle | *Pipistrellus pygmaeus* | Present | 0 known | BCIreland/Pers. Obs. |
| Nathusius' pipistrelle | *Pipistrellus nathusii* | Potential | 0 known | BCIreland |
| Leisler's bat | *Nyctalus leisleri* | Present | 0 known | BCIreland/Pers. Obs. |
| Brown long-eared bat | *Plecotus auritus* | Present | 3 known | BCIreland/Pers. Obs. |
| Daubenton's bat | *Myotis daubentonii* | Present | 0 known | BCIreland/Pers. Obs. |
| Natterer's bat | *Myotis nattereri* | Present | 0 known | BCIreland/Pers. Obs. |
| Whiskered bat | *Myotis mystacinus* | Potential | 0 known | BCIreland |
| Lesser horseshoe bat | *Rhinolophus hipposideros* | Absent | 0 known | BCIreland/NPWS |
| Brandt's bat | *Myotis brandtii* | Potential – rare | 0 known | BCIreland |
| Unknown species | | | 2 known | BCIreland |

#### *7.3.9.2 Field Study Findings*

In 2013, onsite bat activity surveys were undertaken during the spring, summer and autumn seasons in May, June and September. A total of 21 nights of onsite survey were undertaken which identified five bat species; common and soprano pipistrelle, Leisler's, brown long-eared and Daubenton's bat.

*Bat Activity Survey Findings*

The key locations of importance for bats in the local area include water bodies, watercourses, woodlands, treelines and hedgerows. Additional habitats include scrub and scattered trees. The bat fauna present onsite is typical of the habitats present, with the predominantly pasture grassland landscape providing a limited range of habitats. Faunal diversity is greater in areas dominated by semi-natural vegetation.

Common and soprano pipistrelles were the most commonly recorded species onsite and were ubiquitous along hedgerows, treelines and the edges of forests throughout the area.

Brown long-eared bat was encountered in several areas but this species may be present without being detected as it is a very quiet species and sometimes hunts without echolocating.

Leisler's bat, which forages over agricultural landscapes, scrub and woodland as well as urban areas, was widespread across the area.

Daubenton's bat, which forages over open water, was observed on the Grand Canal adjacent to the Cloncumber cluster and one of the larger rivers in the area. This species travels over considerable distances along watercourses and is also found on smaller water bodies such as ponds and pools. It often roosts beneath stone masonry bridges, taking advantage of cracks and crevices. In such locations, roosts are vulnerable through infilling of fissures during maintenance works, impacts of lighting etc.

The bat observations recorded at the proposed locations of each turbine of Maighne Wind Farm are shown in Table 7.69 below.

### Table 7.69: Bat Observations at Proposed Turbine Locations

| Turbine number | Habitat Code | Bat species | Comments |
|---|---|---|---|
| 1 | GA1, WL1 | Common pipistrelle | Low activity |
| 2 | GA1, WL1 | Common pipistrelle | Low activity |
| 3 | GA1, WL1 | Common pipistrelle<br>Soprano pipistrelle<br>Brown long-eared | Low activity |
| 4 | GA1, WL1 | Common pipistrelle<br>Soprano pipistrelle<br>Brown long-eared<br>Leisler's | Low activity |
| 5 | GA1, WL1 | Common pipistrelle<br>Leisler's | Low activity |
| 6 | GA1, WL1 | Common pipistrelle<br>Soprano pipistrelle<br>Leisler's | Low activity |
| 7 | GA1, WL1 | Common pipistrelle<br>Soprano pipistrelle | Low activity |
| 8 | GA1, WL1 | Common pipistrelle<br>Soprano pipistrelle<br>Leisler's | Low activity |
| 9 | GA1, WL1 | Common pipistrelle<br>Soprano pipistrelle | Low activity |

| Turbine number | Habitat Code | Bat species | Comments |
|---|---|---|---|
| 10 | GA1, WL1 | Common pipistrelle<br>Soprano pipistrelle<br>Leisler's | Low activity |
| 11 | WD4 | Common pipistrelle<br>Soprano pipistrelle | High activity |
| 12 | WD4 | Common pipistrelle<br>Soprano pipistrelle<br>Leisler's | High activity |
| 13 | WS1 | Common pipistrelle<br>Soprano pipistrelle | Low activity |
| 14 | WS1 | Soprano pipistrelle<br>Leisler's | Low activity |
| 15 | WS1 | Common pipistrelle<br>Soprano pipistrelle | Low activity |
| 16 | WS4, WL1 | Common pipistrelle<br>Soprano pipistrelle | Low activity |
| 17 | GA1, WL1 | Common pipistrelle<br>Soprano pipistrelle<br>Leisler's | Low activity |
| 18 | GA1, WL1 | Common pipistrelle<br>Soprano pipistrelle | Low activity |
| 19 | GA1, WL1 | Common pipistrelle<br>Soprano pipistrelle | Low activity |
| 20 | GA1, WL1 | Common pipistrelle<br>Soprano pipistrelle | Low activity |
| 21 | GA1, WL1 | Common pipistrelle | Low activity |
| 22 | GA1, WL1 | Common pipistrelle<br>Soprano pipistrelle | Low activity |
| 23 | GA1, WL1 | Common pipistrelle<br>Soprano pipistrelle | Low activity |
| 24 | PB4 | Common pipistrelle<br>Soprano pipistrelle | Low activity |
| 25 | PB4 | Common pipistrelle<br>Soprano pipistrelle | Low activity |
| 26 | PB4 | Common pipistrelle<br>Leisler's | Low activity |
| 27 | GA1 | Common pipistrelle<br>Leisler's | Low activity |
| 28 | WD4 | Common pipistrelle | Low activity |
| 29 | WD4 | Common pipistrelle<br>Soprano pipistrelle<br>Leisler's | Low activity |

| Turbine number | Habitat Code | Bat species | Comments |
|---|---|---|---|
| 30 | WD4 | Common pipistrelle<br>Soprano pipistrelle<br>Leisler's | Low activity |
| 31 | WD4 | Common pipistrelle<br>Soprano pipistrelle | Low activity |
| 32 | WD4 | Common pipistrelle<br>Leisler's | Low activity |
| 33 | GA1 | Common pipistrelle<br>Soprano pipistrelle | Low activity |
| 34 | GA1, WL1 | Common pipistrelle<br>Soprano pipistrelle<br>Leisler's | High activity |
| 35 | GA1, WL1 | Common pipistrelle<br>Soprano pipistrelle<br>Leisler's | Low activity |
| 36 | GA1 | Common pipistrelle<br>Soprano pipistrelle | Low activity |
| 37 | GA1 | Common pipistrelle<br>Soprano pipistrelle<br>Leisler's bat | Low activity |
| 38 | GA1 | Soprano pipistrelle | Low activity |
| 39 | GA1 | Common pipistrelle<br>Soprano pipistrelle | Low activity |
| 40 | WD4 | Common pipistrelle<br>Soprano pipistrelle<br>Leisler's | Low activity |
| 41 | GA1 | Common pipistrelle<br>Soprano pipistrelle<br>Leisler's | Low activity |
| 42 | WD4 | Common pipistrelle<br>Soprano pipistrelle<br>Leisler's | High activity |
| 43 | WD4 | Common pipistrelle<br>Soprano pipistrelle<br>Leisler's | High activity |
| 44 | WD4 | Common pipistrelle<br>Soprano pipistrelle | Low activity |
| 45 | WD4 | Common pipistrelle | Low activity |
| 46 | GA1 | Common pipistrelle | Low activity |
| 47 | GA1, WL1 | Common pipistrelle<br>Soprano pipistrelle | Low activity |

*Roost Survey Findings*

During survey, a soprano pipistrelle roost was identified in a waste water treatment plant to the west of Longwood village but this is outside the study area.

*High and Medium Voltage Cable Routes Structure Survey Findings*

Several structures along the proposed HV and MV cable routes were inspected for their potential to harbour bat roosts. These included 24 culverts and 20 bridges as shown in Table 7.70 below with their adjudged potential to be used by bats.

The structures varied in their favourability for use by bats. Some have been completely sealed by concrete which prevents bat use while others have crevices between stonework in which bats can secrete themselves.

Three culverts and seven bridges have uncluttered access for bats, are high enough to off-set the risks of predation and complete inundation and have crevices that are favourable for bat use.

**Table 7.70: Bat Roost Potential within Impacted Structures along the HV and MV Cable Routes**

| Structure | Bat potential | Location | Comments |
|---|---|---|---|
| Bridge | Nil | N705 215 | Low, prone to predation and flooding |
| Bridge | Nil | N703 216 | Sealed – no available crevices for bat-use |
| Culvert | Nil | N710 384 | Low, prone to predation and flooding |
| Culvert | Nil | N711 233 | Low, prone to predation and flooding |
| Culvert | Nil | N708 242 | Low, prone to predation and flooding |
| Culvert | Nil | N704 255 | Low, prone to predation and flooding |
| Culvert | Nil | N706 266 | Low, prone to predation and flooding |
| Bridge | Potential | N710 287 | Some crevices present |
| Bridge | Potential | N716 293 | Some crevices present |
| Bridge | Low | N719 293 | Low, prone to predation and flooding |
| Culvert | Low | N715 305 | Low, prone to predation and flooding |
| Culvert | Low | N715 313 | Low, prone to predation and flooding |
| Culvert | Low | N734 377 | Low, prone to predation and flooding |
| Culvert | Nil | N736 336 | Low, prone to predation and flooding |
| Bridge | Potential | N747 383 | Some crevices present |
| Bridge | Low | N872 338 | Low, prone to predation and flooding |
| Bridge | Low | N764 394 | Low, prone to predation and flooding |
| Bridge | Low | N766 392 | Low, prone to predation and flooding |
| Bridge | Low | N766 398 | Low, prone to predation and flooding |
| Bridge | Potential | N921 342 | Some crevices present |
| Culvert | Nil | N895 342 | Low, prone to predation and flooding |

| Structure | Bat potential | Location | Comments |
|---|---|---|---|
| Culvert | Nil | N885 340 | Low, prone to predation and flooding |
| Culvert | Nil | N877 337 | Low, prone to predation and flooding |
| Culvert | Nil | N851 332 | Low, prone to predation and flooding |
| Culvert | Limited | N827 342 | Low, prone to predation and flooding |
| Culvert | Nil | N824 348 | Low, prone to predation and flooding |
| Culvert | Nil | N816 357 | Low, prone to predation and flooding |
| Bridge | Potential | N807 374 | Some crevices present |
| Culvert | Nil | N795 379 | Low, prone to predation and flooding |
| Culvert | Nil | N857 363 | Low, prone to predation and flooding |
| Bridge | Potential | N876 404 | Some crevices present |
| Bridge | Potential | N881 405 | Some crevices present |
| Culvert | Nil | N939 452 | Low, prone to predation and flooding |
| Culvert | Nil | N946 463 | Low, prone to predation and flooding |
| Culvert | Nil | N949 467 | Low, prone to predation and flooding |
| Bridge | Low | N802 413 | Low, prone to predation and flooding |
| Culvert | Nil | N843 417 | Low, prone to predation and flooding |
| Culvert | Nil | N871 404 | Low, prone to predation and flooding |
| Bridge | Low | N893 420 | Low, prone to predation and flooding |
| Culvert | Nil | N896 432 | Low, prone to predation and flooding |
| Bridge | Low | N917 453 | Low, prone to predation and flooding |
| Bridge | Low | N939 452 | Low, prone to predation and flooding |
| Bridge | Low | N947 463 | Low, prone to predation and flooding |
| Bridge | Low | N950 468 | Low, prone to predation and flooding |

There are no known bat hibernation sites within the study areas or along the proposed cable routes. Minor hibernation sites certainly occur but these are of single specimens or small numbers of bats that find winter refugia in older stone structures, trees and unheated modern buildings where they over-winter beneath slates, lead flashing and ridge tiles or within cavity walls etc. No hibernation site was identified during the present assessments.

#### *7.3.9.3 Overall Assessment of Scientific Interest of Area for Bats*

The habitats in the area of the proposed Maighne Wind Farm may be considered in terms of extent, diversity, naturalness, rarity, fragility, typicalness, recorded history, position, potential value and intrinsic appeal (Regini, 2000 [103]). The potential of these habitats for bat fauna is considered in this framework also.

The area may be considered in terms of the principal habitats or land use zones present and the principal areas of ecological interest in relation to bats present on or near the study areas include:

1. Deciduous woodlands, treelines, hedgerows and scrub provide potential roosting, foraging and commuting opportunities for bats. Considered as of high local value.

2. Coniferous woodlands, although non-native, provide shelter belts for foraging and commuting bats and are considered to have low local value.
3. The Boyne, Slate and Blackwater rivers and their tributaries provide foraging habitat and commuting routes across the area for bats. Such watercourses are considered as of high local or national value.

*Agricultural Areas and Associated Hedgerows and Treelines*

Most of the agricultural areas may be considered as of low or negligible interest from a bat perspective. The habitats onsite are low-grade and widespread. However, many of the onsite hedgerows are relatively diverse and therefore of moderate local value being used for both commuting and foraging.

*Woodland and Scrub*

Deciduous woodland and scrub habitats provide areas where insect prey can accumulate for bat foraging and are considered as of high local value in relation to bats. Coniferous woodland is much poorer being non-native and mono-cultural and so is considered as of moderate value.

*Blanket Bog*

Being an open habitat, blanket bog is poor for bats unless taller scrub is present in places to act as shelter for insect swarms. These are considered as of low value in relation to bats.

*Rivers, Canals, Streams and Drains*

Rivers and streams and their associated riparian habitat provide important wildlife corridors for a number of mammalian (including bats), avian and invertebrate species of conservation interest and their quality should be maintained.

### 7.3.10 MV Cable / Grid Connection Routes

Proposed MV cable routes and the proposed HV cable options were surveyed in November and December 2014. It should be noted that cables are proposed to be placed underneath public roads. The primary target therefore for these studies was the structures along the proposed routes (in terms of Otter and Bats) and habitats at proposed crossings underneath canals and motorways where off-line works are anticipated. Bats have been dealt with in section 7.3.9. Structures surveyed are illustrated in Figure 7.11, Volume 2a of this EIS.

*Structure Surveys for Otter*

A total of 55 structures (results are illustrated in Figure 7.11, Volume 2a of this EIS) were surveyed in November (26/11/14) and December (3/12/14) for evidence of Otter. Additional target notes on other ecological items of note such as Dipper, Kingfisher, Invasive species etc. was also recorded. In addition to structures on cable routes as described a number of structures or proposed internal river crossings (where new bridges are proposed) were surveyed for completeness.

Otter evidence (in the form of Spraints, runs or slides) was found at 17 structures. A suitable holt location was found at Structure 8 (ST8) at N71333/37909 however no evidence of occupation by Otter was present. Another suitable holt location was located at structure 26 (ST26) however again, no evidence of usage was present. All other structures had no evidence of Otter in close proximity.

No invasive flora species were noted.

American Mink, an invasive mammal species was noted at structures ST8, ST29 and ST30.

Evidence of Dipper (droppings on rocks) was noted at structure ST31 and the habitat present is suitable for the species.

### *Habitat mapping along proposed Cable route and TDR*

Habitat mapping of the crossing points at Canals and Motorways, including both MV and HV grid options, was also carried out.

Two canal crossings and two motorway crossings, where off-road trenchless techniques are proposed to be utilised were mapped. All but the proposed crossing of the M4 motorway near Enfield were mapped in the field; the former was mapped from desktop. Nodes along the proposed turbine delivery route where landtake is proposed were also mapped from desktop orthophotography. Habitats are mapped in Figures 7.16A.1, 7.20.1 of Volume 2a of this EIS. Habitats at the M4 crossing south of the Ballinakill cluster and the canal crossing on the access road to the Derrybrennan cluster are addressed in their respective cluster sections. Habitats at the canal crossing proximal to Kilcock and the M4 crossing proximal to Enfield are addressed here.

Canal crossing at Kilcock/Motorway crossing at Enfield
Habitats recorded at the proposed crossings are illustrated in 7.16A.1, 7.20.1, Appendix 7 and described as follows:

*Buildings and Artificial Surfaces (BL3)*
This refers to roadways, rail lines and buildings present at both crossing locations. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Lower Value).

*Flower Beds and Borders (BC4)*
This refers to planted borders proximal to the proposed canal crossing at Kilcock. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Lower Value).

*Treelines (WL2)*
Treelines are present on the western side of the canal at Kilcock and form field boundaries at the proposed Enfield Crossing. Treelines also exist along motorway embankments. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Higher Value).

*Scrub (WS1)*
Scrub is present in a number of locations, especially where the canal goes under the R148. A small area of scrub is also located close to the proposed Enfield motorway crossing. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Higher Value).

*Improved agricultural Grassland (GA1)*
Occurs in fields surrounding the crossing locations. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Lower Value).

*Hedgerows (WL1)*
Occurs as field boundaries in fields surrounding the crossing locations. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Higher Value).

*Dry Meadows and Grassy Verges (GS2)*
Found as fringing habitat along roadsides and also at the rear of a house adjacent to the canal at Kilcock. At the Enfield crossing this habitat occurs as fringing habitat along the motorway. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Higher Value).

*Canal (FW3)*
Refers to the royal canal. As a proposed Natural Heritage Area, under the NRA site evaluation scheme [6], this habitat would be rated as of National Importance.

*Amenity Grassland (GA2)*
Occurs both as gardens and also amenity grassland adjacent to the canal near Kilcock. This habitat also occurs as a roadside habitat at the overpass adjacent to the proposed motorway crossing at Enfield. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Lower Value).

*Ornamental and non-Native Shrub (WS3)*
This habitat occurs on the northern side of the R148, to the east of the canal at Kilcock. This habitat is also Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Lower Value).

*Stone Walls (BL1)*
Stone walls occur where the R148 passes over the Royal Canal to the west of Kilcock. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Lower Value).

*Immature Woodland (WS2)*
This habitat is found on the sloping embankment and roadside verge along the overpass at the proposed motorway crossing near Enfield. A field to the south of the proposed route is also planted with young deciduous trees which best fits this classification. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Higher Value).

*(Mixed) Deciduous Woodland (WD1)*
This habitat is found immediately southeast of the proposed crossing route of the M4 near Enfield. Existing more mature trees intergrade into younger deciduous trees planted along the sloping embankment of the motorway overpass. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Higher Value).

*Wet Grassland (GS4)*
A large field of this habitat is found to the east of the proposed cable route underneath the M4 near Enfield. This is currently separated from the proposed route by a buffer comprising the existing overpass and associated planting. Under the NRA site evaluation scheme [6], this habitat would be rated as of Local Importance (Higher Value).

### Table 7.71: Structure Otter Survey Results – MV & HV Cable Routes

| Revised Structure Number | STRUCTURE GRID REFERENCES | Otter Evidence (Yes / No / Possible) | TARGET NOTES |
|---|---|---|---|
| ST1 | N69974/43979 | No | |
| ST2 | N71371/41644 | No | |
| ST3 | N71294/41350 | No | No structure under road but one either side of road here. |
| ST4 | N71203/40864 | No | No structure under road but two adjacent structures on west side of road here. To south of location marked on map. |
| ST5 | N71212/40765 | No | Old hole in bank considered likely to be mink |
| ST6 | N71233/40603 | No | Larger structure under road not mapped |
| ST7 | N71241/40380 | No | Hole beside bridge considered old mink or even rat hole |
| ST8 | N71333/37909 | Possible | Old hole of otter or mink 1.5m from bridge, no fresh trails, no spraints |
| ST9 | N71359/37420 | No | |
| ST10 | N71045/36211 | No | Under road |
| ST11 | N71039/36183 | No | West side of road |
| ST12 | N69292/38281 | No | |
| ST13 | N71784/34835 | No | |
| ST14 | N72649/34237 | No | |
| ST15 | N73620/33680 | No | Wrong location on map |
| ST16 | N74082/33460 | No | |
| ST17 | N75013/32972 | No | Level crossing, no stream here. |
| ST18 | N77016/32230 | No | |

| Revised Structure Number | STRUCTURE GRID REFERENCES | Otter Evidence (Yes/No/Possible) | TARGET NOTES |
|---|---|---|---|
| ST19 | N77848/33273 | Yes | Run & slip at N77792/33302; run, slide & spraints at N77867/33280 close to bridge |
| ST20 | N81636/34258 | Yes | Runs south of bridge |
| ST21 | N70327/21678 | No | |
| ST22 | N72100/26244 | No | No water here. |
| ST23 | N71903/29213 | No | |
| ST24 | N70897/28706 | Yes | Spraints on top of concrete culvert and runs to river both sides of track |
| ST25 | N71530/30513 | No | No structure, no water |
| ST26 | N71567/31222 | Yes | Original stone bridge filled in and dry - west side: spraints at entrance & within bridge on stones used to block it up. Holt possible within these stones. Runs both sides of bridge. East side: suitable entrance but no spraints. |
| ST27 | N74525/35972 | Yes | Spraints on west bank, runs and slides, remnants of small bird on small rock with spraint. Footprints downstream c. 100m |
| ST28 | N95045/46799 | No | Small spraints on rocks on river considered mink |
| ST29 | N94788/46271 | Yes | Single otter spraint. Several mink spraints & tracks. Droppings on rocks considered from Dipper, very suitable stream. |
| ST30 | N93946/45180 | Yes | Otter tracks and runs. Also mink present |
| ST31 | N91750/45311 | Yes | Otter spraint c.300m up stream. Suspect Dipper may use this stream here with several droppings on rocks. Structure not strictly on route but adjacent to road. |
| ST32 | N89686/43162 | No | |
| ST33 | N89231/42190 | No | |
| ST34 | N88428/40770 | No | |
| ST35 | N88081/40612. | Yes | Otter spraints, runs & slides |
| ST36 | N87670/39163 | No | |
| ST37 | N87005/39266 | No | No structure under road. Stream runs from grid ref' east adjacent to road with small residential entrance structures along road. |
| ST38 | N83944/38374 | No | No structure under road here |
| ST39 | N80764/37355 | Yes | Otter spraints and tracks. Also lots of mink tracks. |
| ST40 | N80641/37457 | No | |
| ST41 | N80384/37725 | Yes | Small otter print nearer structure but spraints and tracks at Blackwater River close by. |
| ST42 | N79428/37970 | No | |
| ST43 | N92125/34589 | No | |
| ST44 | N89415/34180 | No | |
| ST45 | N88596/34020 | No | |
| ST46 | N87902/33720 | No | |
| ST47 | N85051/33133 | Yes | Otter spraint on top of pipe under the bridge and on rock downstream. |

| Revised Structure Number | STRUCTURE GRID REFERENCES | Otter Evidence (Yes/No/Possible) | TARGET NOTES |
|---|---|---|---|
| ST48 | N82370/34880 | No | |
| ST49 | N81651/35685 | No | |
| ST50 | N81200/36496 | No | Grey Wagtail - 1 |
| ST51 | N81041/37175 | No | |
| ST52 | N73292/29794 | Yes | Single spraint, several runs and slides |
| ST53 | N72862/29541 | Yes | Distinct otter runs, must be very active. |
| ST54 | N72837/29339 | Yes | Less obvious activity here |
| ST55 | N72772/29181 | Yes | Runs and slides |

### 7.3.11 Habitat Evaluation

*Habitat Evaluation Summary*

The following summary table outlines the ecological resources in the form of habitat types found at the subject site (within the proposed red line boundary for all 5 clusters). Key receptors as per NRA guidance [6], for which impact assessment is to be carried out, are also indicated.

The most dominant habitats at the subject site are Improved Agricultural Grassland (GA1) and commercial forestry (WD4) which together account for 61% of the habitats present.

Note: for area calculations of linear features such as Hedgerows, treelines and mosaics of both, an average hedgerow width of 2.2m has been assumed. This follows published mean hedgerow widths [104].

**Table 7.72: Summary of Habitat Evaluations, Habitats by Area and Key Receptors**

| Fossitt Code | Area in Hectares (ha) | % of Total Area | Evaluation | Key Receptor |
|---|---|---|---|---|
| BC1: Arable crops | 57 | 4.58 | Local Importance (Lower Value) | No |
| BC3: Tilled land | 5 | 0.38 | Local Importance (Lower Value) | No |
| BL3: Buildings and artificial surfaces | 3 | 0.27 | Local Importance (Lower Value) | No |
| GA1: Improved agricultural grassland | 455 | 36.56 | Local Importance (Lower Value) | No |
| GA1/GS4: Mosaic | 28 | 2.29 | Local Importance (Higher Value) | Yes |
| GA2: Amenity grassland (improved) | 0 | 0.01 | Local Importance (Lower Value) | No |
| GS1: Dry calcareous and neutral grassland | 139 | 11.14 | Local Importance (Lower Value) | No |
| GS4: Wet grassland | 21 | 1.66 | Local Importance (Higher Value) | Yes |
| GS4/GS1: Mosaic | 11 | 0.90 | Local Importance (Higher Value) | Yes |
| PB1: Raised bog | 17 | 1.35 | International Importance | Yes |
| PB4: Cutover bog | 86 | 6.91 | Local Importance (Lower Value) | No |
| PB4/GS1: Mosaic | 0 | 0.00 | County Importance | Yes |
| Pond/FL8: Mosaic | 0 | 0.03 | Local Importance (Higher Value) | Yes |

| Fossitt Code | Area in Hectares (ha) | % of Total Area | Evaluation | Key Receptor |
|---|---|---|---|---|
| WD1: (Mixed) broadleaved woodland | 9 | 0.75 | Local Importance (Higher Value) | Yes |
| WD3: (Mixed) conifer woodland | 1 | 0.07 | Local Importance (Higher Value) | Yes |
| WD4: Conifer plantation | 304 | 24.45 | Local Importance (Lower Value) | No |
| WD4/PB4: Mosaic | 1 | 0.08 | Local Importance (Lower Value) | No |
| WD4/WD2: Mosaic | 16 | 1.27 | Local Importance (Lower Value) | No |
| WN7: Bog woodland | 33 | 2.64 | Local Importance (Higher Value) | Yes |
| WS1: Scrub | 13 | 1.03 | Local Importance (Higher Value) | Yes |
| WD4/WS2: Mosaic | 7 | 0.58 | Local Importance (Lower Value) | No |
| WS5: Recently-felled woodland | 28 | 2.22 | Local Importance (Lower Value) | No |
| BL3/GS2: Mosaic | 0 | 0.01 | Local Importance (Lower Value) | No |
| FW2 : Depositing/lowland rivers | 1 | 0.06 | Local Importance (Higher Value) | Yes |
| FW4: Drainage ditches | 2 | 0.14 | Local Importance (Lower Value) | No |
| WL1: Hedgerows | 2 | 0.19 | Local Importance (Higher Value) | Yes |
| WL2: Treelines | 5 | 0.42 | Local Importance (Higher Value) | Yes |
| WL2/WL1: Mosaic | 0 | 0.01 | Local Importance (Higher Value) | Yes |

### 7.3.12 Terrestrial Fauna Evaluation

The basis of impact assessment should be a determination of which ecological resources within the zone of influence of the proposed development are of sufficient value to be material in decision making and therefore, included in the assessment [6], [4]. Table 7.73, below, outlines the key receptors selected for assessment and the rationale for same; taken from NRA guidance [6].

**Table 7.73: Evaluation of Fauna**

| Common name | Conservation Status | NRA Evaluation | Rationale | Key Ecological Receptor |
|---|---|---|---|---|
| Smooth Newt | Protected Species: Wildlife Acts [68] | National Importance | Present Historically | Yes |
| Common Frog | Protected Species: EU Habitats Directive Annex V [60]; Protected Species: Wildlife Acts [59] | National Importance | Recorded as present and assessed as likely to occur throughout in suitable habitat. | Yes |

| Common name | Conservation Status | NRA Evaluation | Rationale | Key Ecological Receptor |
|---|---|---|---|---|
| Common Lizard | Protected Species: Wildlife Acts [59] | National Importance | Recorded historically and assed as likely to occur in suitable habitat | Yes |
| West European Hedgehog | Protected Species: Wildlife Acts [59] | Local Importance (Higher Value) | Recorded historically and assessed as likely to occur throughout | Yes |
| European Otter | Protected Species: EU Habitats Directive Annex II[4]; Protected Species: EU Habitats Directive Annex IV[4]; Protected Species: Wildlife Acts [59] | National Importance | Recorded in suitable habitats. | Yes |
| Eurasian Red Squirrel | Protected Species: Wildlife Acts [59] | County Importance | Present in 4 of 7 10km squares within which proposed wind farm is to be located since 2010. | Yes |
| Eurasian Badger | Protected Species: Wildlife Acts [59] | County Importance | Recorded as present. A number of setts located including a main sett. | Yes |
| Pine Marten | Protected Species: EU Habitats Directive Annex V[4]; Protected Species: Wildlife Acts [59] | County Importance | One observation and likely to occur in suitable habitat throughout. | Yes |
| Irish Hare | Protected Species: Wildlife Acts [59] | National Importance | Assessed as present throughout site | Yes |
| Bats | Protected Species: EU Habitats Directive Annex IV[4]; Protected Species: Wildlife Acts [59] | National Importance | Legal status and ecological sensitivity | Yes |
| Marsh Fritillary | Protected Species: EU Habitats Directive Annex II[4]; | National Importance | Present during survey period proximal to Derrybrennan cluster study site overlaps known range in Ireland. | Yes |

### 7.3.13 Avifauna Evaluation

The basis of impact assessment should be a determination of which ecological resources within the zone of influence of the proposed development are of sufficient value to be material in decision making and therefore, included in the assessment [6], [4]. Table 7-74, below, outlines the key receptors selected for assessment and the rationale for same based on NRA guidance [6]; the overall importance or sensitivity evaluation for each key receptor, taken from guidance such as Percival 2007 [61] is also illustrated.

## Table 7.74: Avifauna Key Receptor Evaluation

| Common name | Conservation Status | NRA Evaluation | Rationale | Key Receptor | Receptor Evaluation for Impact Assessment (Sensitivity) |
|---|---|---|---|---|---|
| Whooper Swan | Protected Species: Wildlife Acts [59] Annex I [26], Amber Listed [27] | International Importance | Sporadically occurring population at low numbers within the site (max = 6); flight activity recorded. | Yes | Very High |
| Golden Plover | Protected Species: Wildlife Acts [59] Annex I [26], Red Listed [27] | County Importance | Recorded at 3/5 clusters during winter (max recorded flock size 438 ) | Yes | Medium |
| Kingfisher | Protected Species: Wildlife Acts [59] Annex I [26], Amber Listed [27] | National Importance | No proved breeding but likely to breed in suitable habitat in surrounding hinterland. One winter record Cloncumber. | Yes | High |
| Common Snipe | Protected Species: Wildlife Acts [59] ;Amber Listed [27] | Local Importance (Higher Value) | Recorded breeding inside 500m envelope at 2/5 clusters. Known sensitivity. | Yes | Medium due to published 34% decline in national breeding distribution since 1968-72 [69]. |
| Eurasian Curlew | Protected Species: Wildlife Acts [59] Annex II [26], Red Listed [27] | County Importance | Not recorded breeding within the proposed development 500m turbine envelope, but may breed nearby at Lodge Bog; included on a precautionary basis. | Yes | High |
| Lapwing | Protected Species: Wildlife Acts , Red Listed [27] | County Importance | Recorded breeding in low numbers (n=1 pair) at Cloncumber. Wintering at 3/5 clusters. | Yes | Medium |
| Peregrine | Protected Species: Wildlife Acts [59] Annex I [26], Green Listed [27] | County Importance | A number of observations of birds (n=5); no breeding recorded on site | Yes | High |
| Yellowhammer | Protected Species: Wildlife Acts , Red Listed [27] | County Importance | Recorded from CBS survey and suitable habitat throughout site; breeding at 4/5 clusters. | Yes | Medium |
| Merlin | Protected Species: Wildlife Acts ,Annex I Amber Listed [27] | Local Importance (Higher Value) | Occurs in winter in low numbers; possible occupied territory at Hortland. | Yes | High |
| Kestrel | Protected Species: Wildlife Acts , Amber Listed [27] | Local Importance (Higher Value) | Breeding in low numbers on or near site. Known sensitivity. | Yes | Low |

| Common name | Conservation Status | NRA Evaluation | Rationale | Key Receptor | Receptor Evaluation for Impact Assessment (Sensitivity) |
|---|---|---|---|---|---|
| Whinchat | Protected Species: Wildlife Acts , Red Listed (27) | County Importance | One pair located at Hortland outside site boundary. | Yes | Medium |
| Woodcock | Protected Species: Wildlife Acts , Red Listed (27) | Local Importance (Higher Value) | Breeding in 500m envelope at 3/5 clusters. Up to 9 territories recorded. | Yes | Medium |
| Buzzard | Protected Species: Wildlife Acts , Green Listed (27) | Local Importance (Higher Value) | Widespread throughout site. Recorded at 5/5 clusters. | Yes | Low |
| Barn Owl | Protected Species: Wildlife Acts , Red Listed (27) | National Importance | No breeding recorded or evidence of occupied sites. A single record of pellets within the Merlin square at Windmill ensures a precautionary approach given low national population. | Yes | High |
| Hen Harrier | Protected Species: Wildlife Acts ,Annex I Amber Listed (27) | National Importance | Winter Roost within hinterland of site; recorded foraging in winter & early Spring at 2 sites. No breeding. | Yes | High |

## 7.4 Do Nothing Scenario

If the proposed development does not proceed, the 'do nothing' scenario is that the existing environment and key receptors identified in Section 7.3 are likely to remain as described.

## 7.5 Potential Impacts

### 7.5.1 Introduction

Wind farm developments are large developments which may potentially impact on the environment throughout the different stages of their lifecycle. This section outlines the relevant impacts on ecological resources identified as key receptors during construction, operational and decommissioning phases of the proposed Maighne Wind Farm. Mitigation undertaken through avoidance and design is also discussed. Assessment of ecological impacts is required prior to development consent in order to identify the need for impact avoidance and mitigation and opportunities for enhancement [4]. Guidance on the assessment of the impacts [6] [4] of developments define impacts as "*those changes to the baseline conditions likely to arise from the project and the resulting ecological impacts*". Impacts should be evaluated as a project progresses to distinguish design changes which may be incorporated to avoid or reduce impacts as an integral part of project design (the unmitigated project) and those mitigation measures which are additional [6]. The current appraisal was carried out with the regard to the above criteria, and incorporated mitigation through avoidance and design as part of an iterative process, in line with published impact assessment guidance [4] [1].

### 7.5.2 Mitigation by Avoidance and design

The following measures were undertaken to reduce impacts on designated sites, flora and fauna through avoidance and design:

- The hard-standing area of the wind farm has been kept to the minimum necessary, including all site clearance works to minimise land take of habitats and flora
- Larger turbines have also been utilised to minimise the total rotor envelope of the proposed development
- Site design and layout deliberately avoided direct impacts on Natura 2000 sites. The placement of turbines in deciduous woodland has been avoided where possible. Internal road design has avoided hedgerow removal wherever possible. This in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds [64].
- All cabling for the project is to be placed underground; this significantly reduces collision risk to birds over the lifetime of the wind farm and is in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds [64]
- The HV grid connection routes have been selected to utilise public roads thereby minimising landtake of potentially sensitive habitats
- Care has been taken to ensure that sufficient buffers are in place between wind farm infrastructure and hydrological features such as rivers, lakes and streams. Access roads were the exception to the rule in that river crossings had to take place however, wherever possible, existing stream and river crossings have been utilised.
- Any works in or around watercourses will adhere to best practice as per NRA guidance where possible.
- Sensitive locations for Marsh Fritillary in the Lullymore area have been avoided by the removal of turbines and re-aligning of roads adjacent to IPCC and BCI reserves for this species
- Turbine and infrastructure layout has been modified as part of an iterative process to reduce impacts on ecological resources identified during the impact assessment process. This included the following:

    1. The movement of a road at Ballinakill to avoid a Sand Martin colony.
    2. The dropping of two turbines at Derrybrennan to avoid impacts on breeding Lapwing and Marsh Fritillary habitats at Lullymore.
    3. The movement of a turbine at Derrybrennan to avoid the possibility of flight risk to Whooper Swans potentially roosting at Lullymore.
    4. The movement of a substation at Drehid-Hortland to avoid indirect impacts on raised bog.

5. The movement of a turbine at Drehid Hortland to avoid impacts on raised bog.
6. The movement of a turbine at Drehid Hortland to avoid impacts on raised bog and breeding Merlin.

- The design of the proposed MV cable route and HV potential grid routes was also carried out with cognisance to ecological features. Cables are to be placed underneath public roads where possible to avoid impact to roadside hedgerows.

See Appendix C1: Site Selection Report of Volume 3 of the Appendices, for a full description of the design layout review process including alternatives considered.

### 7.5.3 Potential Impacts During Construction

#### *7.5.3.1 Potential Direct Impacts*

Potential Direct Impacts during construction on the following are addressed below:

- Designated Nature Conservation Sites
- Habitats and Flora
- Avifauna
- Mammals (excluding Bats)
- Aquatic Ecology and Fisheries
- Bats
- Other Taxa

#### *Designated Nature conservation sites*

In total, there are 34 designated sites or proposed designated sites within 15km of the proposed wind farm site (see Table 7.10).

Natura 2000 sites

There are no designated Natura 2000 sites within the proposed development area therefore no direct impacts are predicted during construction. An accompanying Natura Impact Statement (NIS) has been prepared for the proposed development and accompanies this EIS. The NIS addresses potential impacts on Natura 2000 sites resulting from the proposed development.

Natural Heritage Areas or Proposed Natural Heritage Areas

Of the previously identified NHA's or pNHA's a total of four are within close proximity and/or connected hydrogically and therefore potentially directly affected. These are as follows:

- **The Royal Canal pNHA**: This proposed grid connection route (Option 1) to Woodland, Co. Meath is scheduled to cut underneath this site. Although trenchless techniques are an inherently safe technology there is a slight potential for direct impacts in the event of an unlikely failure whilst undergoing a crossing of a canal.

- **The Grand Canal pNHA**: As with the Royal Canal, this canal is proposed to be crossed along the course of the access road to the Derrybrennan Cluster. The potential for direct impacts occurs here as a bridge will have to be re-inforced to facilitate access and cable laying; a small number of trees may also have to be removed to facilitate access. The proposed cable will be located in the bridge, in the newly constructed decking or may pass underneath the canal using trenchless techniques. Direct impacts in the form of pollution events may occur during the construction stage without mitigation.

  **Donedea Wood pNHA**: The proposed Grid Connection to Maynooth (Option 2) runs through the road adjacent to this site. As the cable is to be placed underneath the public road direct impacts on Donedea Wood can be avoided by selective placement of the cable (i.e. on the opposite side of the road).

- **Carbury Bog pNHA**: The proposed cluster at Windmill is adjacent to a portion of High Bog which forms the northern extent of the basin which includes Carbury Bog pNHA.

The proposed development area is removed from the pNHA and is currently extensively milled for peat extraction for commercial purposes. No direct impacts on Carbury Bog pNHA are predicted.

All other NHA's or pNHA's previously described are outside the proposed development area and therefore no direct impacts are predicted.

### *Habitats and flora*

Habitat types identified within the study area are illustrated in Figure 7.16: Habitat Map, Volume 2a of this EIS.

Construction of the wind farm will lead to some permanent loss of habitat**.** The habitat loss will be the total area covered by the roads plus the footprint of each of the proposed turbines and all other wind farm infrastructure. For clarity, associated infrastructure includes borrow pits, compounds, substations and distilling ponds (proposed). Landtake has also been calculated for modifications at junctions along the proposed turbine delivery route.

Tree or hedgerow trimming will also be required along cable routes and turbine delivery routes and also at sites entrances to facilitate delivery of turbines and traffic requirements (see Chapter 13: Traffic and Transportation of this EIS). This is not assessed as landtake. The habitat loss from habitat key receptors (see Table 7.75) due to during construction landtake (including the turbine delivery route) for the proposed development is further detailed below.

Total predicted habitat loss as a result of the proposed development is 97.94ha or 8% of the total area of the site; of this, 85% of the landtake is from habitats classified as of low ecological value.

It should be noted that not all landtake is permanent as borrowpits and modifications such as at roundabouts along the turbine delivery route will be reinstated.

Key Receptors

| | |
|---|---|
| GA1/GS4: Mosaic | Local Importance (Higher Value) |
| GS4: Wet grassland | Local Importance (Higher Value) |
| GS4/GS1: Mosaic | Local Importance (Higher Value) |
| PB1: Raised bog | International Importance |
| PB4/GS1: Mosaic | County Importance |
| Pond/FL8: Mosaic | Local Importance (Higher Value) |
| WD1: (Mixed) broadleaved woodland | Local Importance (Higher Value) |
| WD3: (Mixed) conifer woodland | Local Importance (Higher Value) |
| WN7: Bog woodland | Local Importance (Higher Value) |
| WS1: Scrub | Local Importance (Higher Value) |
| FW2 : Depositing/lowland rivers | Local Importance (Higher Value) |
| WL1: Hedgerows | Local Importance (Higher Value) |
| WL2: Treelines | Local Importance (Higher Value) |
| WL2/WL1: Mosaic | Local Importance (Higher Value) |

GA1/GS4; Magnitude of habitat loss (2.1ha or 7.6% of habitat type) is assessed as low. Duration permanent and irreversible. It is considered unlikely that the unmitigated impact will be significant.

GS4; Magnitude of habitat loss (1.8ha or 8.7% of habitat type) is assessed as low. Duration permanent and irreversible. It is considered unlikely that the unmitigated impact will be significant.

GS4/GS1; Magnitude of habitat loss (0.38ha or 3.38% of habitat type) is assessed as low. Duration permanent and irreversible. It is considered unlikely that the unmitigated impact will be significant.

PB1; No landtake therefore no impact is predicted.

PB4/GS1; No landtake therefore no impact is predicted.

Ponds/FL8; No landtake therefore no impact is predicted.

WD1; Magnitude of habitat loss (2.5ha or 26.9% of habitat type) is low; duration permanent and irreversible. It should be noted that much of this landtake is from a turbine located in a commercial Sycamore plantation. It is considered unlikely that the unmitigated impact will be significant.

WD3; No landtake therefore no impact is predicted.

WN7; Magnitude of habitat loss (5.73ha or 17.45% of habitat type) is low; duration permanent and irreversible. It is considered unlikely that the unmitigated impact will be significant.

WS1; Magnitude of habitat loss (1.13 or 8.84% of habitat type) is low; duration permanent and irreversible. It is considered unlikely that the unmitigated impact will be significant.

FW2: It is proposed to use clearspan bridges to cross these habitats if required. This will not necessitate landtake therefore no direct impact is predicted.

WL1/WL2/WL1+WL2: Hedgerows and treelines (Local Importance Higher Value); Magnitude of habitat loss is low (0.45ha or 14% of habitat type, also equating to 0.46% of total habitat area). Duration permanent for the majority of removed habitat however hedgerows will be re-instated where possible such as at junctions along cable or turbine delivery routes. Duration mostly permanent with some temporary loss. Some loss reversible. It is considered unlikely that the unmitigated impact will be significant.

## Table 7.75: Habitat Loss of Key Habitat receptors due to During Construction Landtake (including Turbine Delivery Route)

| Fossitt Code | Evaluation | Key Receptor | Area in Hectares (Ha) | % of Site | Landtake (Ha) | % of Habitat type | % of Total Landtake (97.94ha) |
|---|---|---|---|---|---|---|---|
| GA1/GS4: Mosaic | Local Importance (Higher Value) | Yes | 28.493 | 2.289 | 2.184 | 7.665 | 2.23 |
| GS4: Wet grassland | Local Importance (Higher Value) | Yes | 20.671 | 1.661 | 1.794 | 8.679 | 1.83 |
| GS4/GS1: Mosaic | Local Importance (Higher Value) | Yes | 11.228 | 0.902 | 0.380 | 3.385 | 0.39 |
| PB1: Raised bog | International Importance | Yes | 16.807 | 1.350 | 0.000 | 0.000 | 0.00 |
| PB4/GS1: Mosaic | County Importance | Yes | 0.043 | 0.003 | 0.000 | 0.000 | 0.00 |
| Pond/FL8: Mosaic | Local Importance (Higher Value) | Yes | 0.394 | 0.032 | 0.000 | 0.000 | 0.00 |
| WD1: (Mixed) broadleaved woodland | Local Importance (Higher Value) | Yes | 9.297 | 0.747 | 2.504 | 26.939 | 2.56 |
| WD3: (Mixed) conifer woodland | Local Importance (Higher Value) | Yes | 0.852 | 0.068 | 0.000 | 0.000 | 0.00 |
| WN7: Bog woodland | Local Importance (Higher Value) | Yes | 32.856 | 2.640 | 5.736 | 17.459 | 5.86 |
| WS1: Scrub | Local Importance (Higher Value) | Yes | 12.833 | 1.031 | 1.135 | 8.842 | 1.16 |
| FW2 : Depositing/lowland rivers | Local Importance (Higher Value) | Yes | 0.742 | 0.060 | 0.000 | 0.000 | 0.00 |
| WL1: Hedgerows | Local Importance (Higher Value) | Yes | 2.375 | 0.191 | 0.215 | 9.050 | 0.22 |
| WL2: Treelines | Local Importance (Higher Value) | Yes | 5.220 | 0.419 | 0.241 | 4.611 | 0.25 |
| WL2/WL1: Mosaic | Local Importance (Higher Value) | Yes | 0.162 | 0.013 | 0.001 | 0.681 | 0.00 |

*Avifauna*

The effects of infrastructure such as wind farms on birds are highly variable and depend on a wide range of factors including the specification of the development, the topography of the surrounding land, the habitat affected and the numbers and species of birds present [64].Developments such as wind farms in general have many effects on birds, including potential direct habitat loss and fragmentation, displacement due to disturbance, death and injury due to collisions, and disruption of local or migratory movements, with a consequent increase in energy expenditure [65]. However the principle concerns in terms of adverse effects on birds are (1) disturbance displacement, (2) collision, (3) habitat loss/change and (4) barriers to movement [106]. Of these only two are applicable during construction, 1) disturbance displacement and 2) habitat Loss/change. Habitat loss is the primary potential direct impact during constructions and although disturbance displacement could be viewed as effective habitat loss, it is essentially indirect and therefore covered under Indirect Impacts.

Habitat Loss/Change

Habitat loss can be direct through land take of breeding or foraging habitats for key species or indirect such as effective habitat loss through avoidance or disturbance due to the above factors. For direct impacts during construction land take of potential breeding or foraging habitat is the primary impact. This may constitute land stripping or vegetation removal affecting ground nesting birds, hedgerow removal or trimming if this takes place during the breeding season and loss of nesting or roosting sites such as trees. Some species may also be affected through material extraction (for example Sand Martin) requirements for construction purposes.

Positive impacts may also occur as a result of the construction process through the creation of habitats (e.g. balancing ponds) or through the provision of habitats [7] as enhancement measures.

Impacts on avifauna are to be assessed following guidance in Percival 2007 [61]. As outlined previously, key avian receptors have been assigned an evaluation of importance (or sensitivity) for assessment. Following this the significance of potential impacts are rated as a product of both the magnitude of the predicted effect and the importance value (sensitivity) of the key receptor affected, based on the probability of the likely impact occurring. The criteria for defining Magnitude, Probability of Impact and consequent significance as outlined in the above referenced guidance [61] are outlined in Appendix F8.

The following matrix outlines the assessment of direct impacts on key avifauna receptors during construction, based on the criteria previously outlined. Note: the criteria utilised in the current assessment to define duration were as follows, from published guidance [1]:

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

The current time period predicted for construction of the project is estimated at 23 months (see Chapter 2 for Project Construction details).

## Table 7.76: Impact assessment matrix for key avifauna receptors during construction direct impacts

| Key Receptor (Sensitivity) | Construction Direct Impact Character | Significance without mitigation |
|---|---|---|
| Whooper Swan (Very High) | Possible direct loss of foraging habitat should land take of turbine/hardstand areas overlap e.g. winter stubble or similar winter feeding habitat. Area of land take negligible in relation to alternative habitat available. Number of birds (maximum recorded =6) occurring very low in context of national or international thresholds. | Probability of temporary to short term impact **high**, magnitude assessed as **negligible**, overall impact **low.** |
| Golden Plover (High) | Possible direct loss of foraging/day roost habitat should land take of turbine/hardstand areas overlap e.g. winter stubble, milled peat (used for roosting) or similar winter feeding habitat in additional to improved grassland utilised for nocturnal foraging. Area of land take negligible in relation to alternative habitat available. | Probability of temporary to short term impact **high**, magnitude assessed as **negligible**, overall impact **very low.** |
| Kingfisher (High) | No direct loss of habitat predicted. | Probability of Impact **low**, Magnitude assessed as **negligible**, overall impact **very low**. |
| Peregrine (High) | No direct habitat loss due to no breeding sites being located within site boundary. | Probability of Impact **low**, Magnitude assessed as **negligible**, overall impact **very low**. |
| Merlin (High) | Possible habitat loss of nocturnal roosting sites for wintering birds such as trees due to land take. Possible land take of trees suitable for breeding (i.e. containing old corvid nests) at Hortland due to clearfelling for turbines. | Probability of Impact **medium**, Magnitude assessed as **medium**, overall impact **medium**. |
| Lapwing (Medium) | Possible habitat loss due to land take for hardstand areas should this overlap breeding fields (Cloncumber cluster). Likelihood medium given low recorded densities (N=1 breeding pair at Cloncumber). Alternative nesting habitat available in 500m envelope and immediate hinterland. | Probability of Impact **Medium**, Magnitude assessed as **High**, overall impact **low**. |
| Eurasian Curlew (High) | No direct loss of habitat as no breeding Curlew located within proposed development boundary. | Probability of impact **low**; magnitude assessed as **negligible**; overall impact **very low.** |
| Common Snipe (Medium) | Habitat loss at recorded breeding clusters of Drehid-Hortland and Cloncumber. Large amounts of foraging and breeding displacement habitat available at Drehid-Hortland and Cloncumber (Alternative nesting habitat available in 500m envelope and immediate hinterland). | Probability of Impact **Medium**, Magnitude assessed as **High**, overall impact **low**. |

| Key Receptor (Sensitivity) | Construction Direct Impact Character | Significance without mitigation |
|---|---|---|
| Woodcock (Medium) | Loss of habitat during construction due to land take of coniferous woodland. Though strongly associated with deciduous woodland in most studies, areas of pre-thicket forestry with dense ground vegetation may also support breeding birds [107]. At the subject site nine territories were located in suitable areas of breeding habitat. However multiple nesting opportunities exist in the area in conifer woodland, birch woodland and deciduous woodland. | Probability of temporary to short term impact **Medium.** Magnitude may be **High** if birds breeding at substation location. Overall significance is **low.** |
| Barn Owl (High) | Possible direct construction impact would be loss of nests sites due to demolition of buildings, removal of nesting trees, disturbance to nest sites. Densities in the area very low and a large number of suitable breeding sites are unoccupied. As a mainly nocturnal species disturbance is greatly reduced. | Probability of temporary to short term impacts **low**. Magnitude likely to be **high** should birds be nesting in e.g. a mature tree that requires removal. Overall significance assessed as **medium.** |
| Buzzard (Low) | Possible direct construction impact would be mainly loss of nest sites through tree removal. High breeding densities in the area. Large amount of displacement breeding habitat (trees) available. | Probability of temporary to short term impacts **medium.** Magnitude **high** should a nest site be lost. Overall significance **very low.** |
| Yellowhammer (Medium) | Loss of breeding habitat through land take of hedgerows, or foraging habitat. Direct habitat loss is the main effect through removal of hedgerows in which Yellowhammers breed. | Probability of temporary to short term impacts is **medium** as hedgerow removal will be avoided where possible. Magnitude assessed as **medium.** Overall significance assessed as **low**. |
| Kestrel (Low) | Possible loss of nest habitat should trees containing nests be removed. Low numbers recorded breeding or close to subject site (only one confirmed nest adjacent to site boundary at Derrybrennan cluster). | Probability of temporary to short term impacts **medium** as hedgerow/tree removal to be minimised through design. Magnitude assessed as **high** should nest site loss occur. Overall impact significance is **very low**. |
| Hen Harrier (High) | Possible loss of small amounts of foraging habitat for wintering birds due to landtake for turbines placed in pre-thicket forestry, wet grassland or bog habitats. Low numbers recorded within the context of the overall size of habitats available and ample displacement habitat for foraging available. | Probability of habitat loss of areas regularly utilised in winter **medium**; magnitude assessed as **low** given displacement habitat available relative to numbers recorded; overall impact **low.** |
| Whinchat (Medium) | No loss of habitat predicted as the recorded pair was outside the red line boundary. Species may benefit from clearfelling for hardstand areas as this may create suitable habitat. Additional birds may occur in suitable pre-thicket/wet grassland habitats dependant on population factors. | Probability of habitat loss low given **low** population and available habitat; magnitude assessed as **high** given low population; overall impact **low.** |

### *Mammals (excluding Bats)*

Several mammal species were found to be present on and in the vicinity of the site. Species recorded include American Mink, Otter, Pine Marten, Badger, Irish Hare and Fox. Red Squirrel has also been identified as occurring within the area (present in 4/7 10km squares within which the subject site is located – NBDC). While no evidence of breeding was confirmed for most of these species, it is likely that at least some of these species breed on the site. A number of badger setts, including at least one main sett, were located on site and suitable Otter Holt locations (although showing no evidence of occupation) was located along the proposed cable routes.

#### Badger

No recorded Badger setts will be directly affected by the proposed development.

The potential exists for additional setts, created between the original survey period and the commencement of construction, to be directly affected by any proposed hedgerow removal. Given the habitats present in the wider environment, most affected mammals will be able to move to other locations in the wider area until the disturbance has lessened. It is considered probable that any unmitigated impacts on Badger will be significant.

#### Pine Marten

The main substation at Drehid-Hortland is to be located in an area of clear felled forestry; suitable habitat for this species. In addition coniferous forestry at Cloncumber will also be lost to accommodate turbines. However as there are other areas of conifer plantation adjoining the proposed development area, affected or disturbed individuals should be able to move into nearby plantations and the larger expanses of Bord na Mona sites containing suitable habitat such as Drehid. Therefore it is felt that the permanent loss of a relatively small amount of conifer plantation is unlikely to impact negatively on the local Pine Marten community. There is still the possibility that Pine Marten breeding or resting sites may be disturbed during any clear felling operations. It is considered possible that any unmitigated impacts on Pine Marten will be significant.

#### Red Squirrel

No Red Squirrel was recorded form the site and are known to no longer occur in County Meath. The proposed substation at Drehid-Hortland is to be located in an area of clear felled forestry; suitable habitat for this species. In addition coniferous forestry at Cloncumber will also be lost to accommodate turbines. Although numbers are no doubt sparse, as the species seems to be re-colonising much of the area, a precautionary approach his being taken and it is assumed that they may occur in any woodland scheduled for clearfelling. There is therefore the possibility that Red Squirrel breeding or resting sites may be disturbed during any clear felling operations. It is considered possible that any unmitigated impacts on Red Squirrel may be significant.

#### Otter

Otter holts or couches may be directly impacted through construction works such as the construction of bridges and river crossings. It is considered probable that any unmitigated impacts on Otter during construction will be significant.

### *Bats*

The construction of the wind farm will involve some offsite widening of existing road carriageways to allow unimpeded haulage of the large turbine sections. This road widening will involve tree and hedgerow trimming /removal which may affect bats. Existing bridges and culverts which may be in use by bats may also require strengthening to cope with increased loads during turbine delivery. New access tracks will also need to be constructed resulting in the loss of vegetation which may be in use as flight path features by bats. Onsite construction activity may also has the potential to cause disturbance to these animals.

The potential impacts are as follows:

- Loss of commuting and foraging habitats
- Loss of roosts in trees
- Loss of roosts in bridges/culverts

*Aquatic Ecology and Fisheries*

Access tracks will be built/upgraded to access proposed turbine locations. The proposed works will also include trenching to facilitate the laying of MV cabling. Where these cables need to cross watercourses there will be the potential for direct impacts on the aquatic environment (disturbance and degradation of fluvial and riparian habitats). Where possible a trenchless crossing technique will be employed. Alternative trenchless techniques are also being considered and these over ground methods would have less significant potential direct impacts on watercourses (e.g. fixing of cables to bridges). The entire cable route is along existing roadways for example at Agar Bridge over the Slate River and the bride over the Coolree River.

There is potential for releases of suspended solids and other substances associated with upgrading, realigning and construction of access roads and trenching within the site and also during the excavation work associated with proposed borrow pits. Installation, upgrading and/or extension of an internal road network on a wind farm site and excavations can result in increased silt runoff. Suspended solids in even quite small quantities may have a serious effect on the spawning sites of salmonids (O'Connor & Andrew, 1998 [108]; Turnpenny & Williams, 1980 [109]; Shackle *et al*., 1999 [110]).

Engineering works in the vicinity of rivers/streams or at river/stream crossings can also impact directly on physical habitat, for example the spawning or nursery areas of fish. Permanent loss of aquatic habitats can also occur where access roads are constructed over or in close proximity to streams/rivers or where streams/rivers are permanently diverted to new channels. Obstruction to upstream movement of fish, particularly salmon and trout, due to construction of culverts can also potentially occur.

Site drainage can potentially result in increased erosion of nearby streams, and may result in lower water levels in dry weather, which will reduce the habitat available to fish. The construction of the wind farm is not expected to significantly affect the drainage regime of any cluster within the development lands however, all clusters located in catchments drained by sluggish lowland highly modified watercourses. Any operations which result in loss of sediment will also result in increased nutrients being released from the soil. This has the potential to cause eutrophication of streams thereby lowering the potential of the streams to support fish and invertebrate fauna.

*Other Taxa present on site*

Additional species such as Common Frog, Common Lizard and small mammals may be directly affected through habitat loss which may occur during construction though this is considered unlikely to be significant due to most of the habitats on site being unsuitable. Some invertebrate habitat will be directly lost through land take of hedgerows.

Marsh Fritillary

Marsh Fritillary is known to occur within the hinterland of the site. Known breeding populations exist in the Allenwood (Ballynafagh Bog/fen) and Lullymore area and are actively managed by both the IPCC (Irish Peatland Conservation Council) and BCI (Butterfly Conservation Ireland). Two clusters (Derrybrennan and Cloncumber) exist within the known breeding distribution of the species as per the latest available NPWS assessment. An additional cluster, Drehid-Hortland lies within the known range of the species although breeding has not been recorded in the relative 10km squares in recent years.

Although no Marsh Fritillaries were recorded within the proposed development boundary (limited habitat exists) the Marsh Fritillary has a meta-population structure [111] meaning that central populations have outlying colonies that are lost periodically and then re-occupied during periods of expansion.

Direct impacts on this species would be as follows:

- Loss of suitable habitat containing breeding colonies (through landtake)
- Damage to suitable habitat containing breeding colonies (e.g. through trampling).
- Mortality of adults when on the wing (mid-May to end of June) through antropogenic sources.

#### *7.5.3.2 Potential Indirect Impacts*

Potential Indirect Impacts during construction on the following are addressed below:

- Designated Nature Conservation Sites
- Habitats and Flora
- Avifauna
- Mammals (excluding Bats)
- Aquatic Ecology and Fisheries
- Bats
- Other Taxa

*Designated Nature Conservation Sites*

In total, there are 33 designated sites or proposed designated sites within 15km of the proposed wind farm site (see Table 7.10).

Natura 2000 sites

Natura 2000 sites hydrologically linked to the proposed development site have the potential to be indirectly impacted due to hydrological changes and impacts such as increased siltation, nutrient release and/or contaminated run-off through drainage channels and watercourses.

Hydrological impacts are more likely to occur during the construction phase but could also occur during the operational phase *e.g.*, run-off from hard-standing areas. A Natura Impact Statement (NIS) has been prepared for the proposed development and has been submitted with the application for permission.

Natural Heritage Areas or Proposed Natural Heritage Areas

Natural Heritage Areas or proposed Natural Heritage Areas with hydrological links to the proposed development site could have the potential to be indirectly impacted due to hydrological changes and impacts such as increased siltation, nutrient release and/or contaminated run-off through drainage channels and watercourses. This includes the following:

The Rye Water/Carton pNHA (001398) is located downstream of the proposed trenchless crossing of the River Rye Water and potential impacts are as follows:

1. Reduction in water quality (a key element of site) and consequent impacts on *Vertigo* snails within the Rye Water/Carton pNHA; reduction in water quality of portion of canal which is overlapped by site boundary.
2. Reduction in water quality (a key element of site) and consequent reduction in area or Petrifying springs habitat in Rye Water/Carton pNHA.

Indirect impacts via vibration may occur on both the Royal and Grand canals as a result of trenchless operations; this is assessed as short term in duration and low in magnitude, additional indirect impacts as a result of spillage of fuels, lubricating fluid etc. may also occur without mitigation. Pollution/sedimentation as a result of spillage along haul routes which cross over canal bridges may also occur.

Any modifications to canal bridges may result in impacts on Bats present, including general disturbance or loss of roost locations.

*Habitats and Flora*

Indirect impacts on habitats and flora include the spread of invasive species which may be distributed during construction works. Rhododendron was recorded within the proposed development site. This is a highly invasive plant species and are easily spread by human activities such as construction works. Therefore the proposed development could affect the existing environment by facilitating the indirect spread of these species. It is considered probable that any unmitigated impacts could be significant.

Indirect impacts on raised bog habitats

Areas of adjacent high bog have been identified at Windmill and Drehid-Hortland. These areas do include the priority internal habitat Active Raised Bog. No works are proposed in these habitats and both turbines and roads have been designed/re-located to mitigate through avoidance.

Recent literature suggests that increases in marginal drainage at the margin of specific bogs may result in the creation of a hydraulic connection between subsoil sub crops and marginal drains, thus lowering the regional groundwater table and hence resulting in water loss from the main bog body [112]. This is predicated in the documented instance (Clara Bog) on "*a succession of carboniferous limestone to relatively permeable glacial till deposits to low permeability lacustrine clay sediment is the predominant underlying geology of the bog. However there are areas where the glacial till protrudes through the lacustrine clay, which ordinarily isolates the high bog from underlying groundwater, thereby engendering a dependency on regional groundwater conditions"* [112]. It is of note that the study cited also states *"Such a connection appears to be unique to Clara Bog West as a result of prevailing geological conditions"* [112].

Although considered unlikely, should the raised bog present exhibit ground water dependency similar to that at Clara Bog, which could be affected through excavation works within high permeability strata at the periphery of the raised bog; then said excavations could affect the eco-hydrology of the bog present. It should be noted however that this would be dependent on a number of factors including the presence of artesian conditions within the adjacent high bog, gravel sub crops protruding through lacustrine clay and said sub crops containing groundwater possibly fed from higher elevations.

In addition, literature on wetlands ecology and management suggests that open ditches exhibit relatively small rates of drawdown at distances of >10m and closed ditches reveal much more modest drops in water table levels [113] suggesting drainage measures for the proposed development are unlikely to contribute additively to groundwater drawdown. Given the high degree of existing drainage proximal to the identified active raised bog areas, the drainage measures outlined for the current project during both construction and operational phases (see Chapter 9: Hydrology and Chapter 8: Soils and Geology) are not considered significant.

*Avifauna*

Disturbance Displacement

High levels of activity and disturbance during construction may cause birds to vacate territories close to works, especially in species vulnerable to disturbance. The displacement of birds from areas within and surrounding developments can effectively amount to habitat loss [64]. If a proposed location is therefore avoided as a result of the disturbance then effective habitat loss can occur. Examples of causes of disturbance during construction which may lead to displacement are vehicle and personnel movements, vibration and noise impacts from the construction process and visual intrusion [64].

Additional impacts may occur during the construction process due to road works along turbine delivery routes, the erection of cabling, the placement of underground cabling, re-working structures such as bridges along turbine delivery routes, and excavation of borrow pits or extraction of materials. Studies on both during construction [63] and during operational impacts of wind farms [62] have shown that certain species affected in particular by during construction impacts (in that they fail to recover to pre-construction densities) are large wading species.

Indirect effects may occur on species linked to aquatic habitats through pollution events, sediment laden runoff and dust deposition.

### Table 7.77: Avifauna during construction indirect Impact Assessment Matrix

| Key Receptor (Sensitivity) | Construction Indirect Impact Character | Significance without mitigation |
|---|---|---|
| Whooper Swan (Very High) | Possible disturbance from feeding sites if construction period overlaps wintering period (Oct-March) and availability of food resources (e.g. improved agricultural grassland). Literature suggests swans can become habituated to daily disturbance [114] and the presence of wind turbines in feeding areas [115] with little evidence of *permanent* post construction displacement [116]. Numbers recorded low. | Probability of some temporary to short-term disturbance **high** >50%; Magnitude **negligible** due to crop rotation levels published literature. Overall impact assessed as **Low.** |
| Golden Plover (High) | Possible disturbance during winter months from feeding or roosting locations during daytime hours during construction; feeding is mainly nocturnal and ample displacement habitat is available for during daylight hours. Numbers on site low. Literature suggests differences in densities pre and post construction of wind farms not significant [63] implying low levels of permanent displacement. | Probability of some temporary to short term disturbance to wintering birds **high,** magnitude **negligible** due to low numbers recorded on site and availability of alternative habitat. Impact assessed as **very low.** |
| Kingfisher (High) | Possible indirect impacts through pollution events, runoff etc. which may impact on water quality downstream from the site and thus affect prey availability / breeding success/ foraging ability. | Probability of temporary to short term indirect impacts occurring **medium,** magnitude assessed as **medium**, overall significance is **medium**. |
| Peregrine (High) | Possible disturbance to foraging birds through noise, visual intrusion. No displacement from foraging areas or breeding sites. Disturbance unlikely as the species adapts to disturbance prone habitats such as urban environments easily. | Probability of temporary to short term impact **low**; magnitude assessed as **negligible**; overall impact **very low.** |
| Merlin (High) | Possible noise/ visual intrusion disturbance to foraging wintering birds. Unlikely to be significant due to low densities. Noise and visual intrusion to possibly nesting or foraging birds at the Hortland cluster could occur if works overlap breeding season (April-July). | Probability of temporary to short term impacts on breeding birds **medium;** magnitude assessed as **Medium;** overall impact **medium.** |
| Lapwing (Medium) | Possible disturbance to birds during relevant breeding season. Literature suggests changes to densities during construction and differences in densities from pre to post construction are not significant [63]; studies on disturbance to nesting lapwing found that | Probability of temporary to short term impact **medium**, magnitude **low** based on literature. Overall impact significance **very low**. |

| Key Receptor (Sensitivity) | Construction Indirect Impact Character | Significance without mitigation |
|---|---|---|
| | increased disturbance did not reduce Lapwing clutch survival [117]. | |
| Common Snipe (Medium) | Possible disturbance to breeding birds during construction. Literature suggests significant declines in densities during construction [63] which may lead to previously published density declines post construction [62]. | Probability of temporary to short term impact **high**; magnitude assessed as **high** based on literature; overall impact assessed as **medium.** |
| Eurasian Curlew (High) | Possible disturbance during cable laying to breeding birds at Lodge bog is considered as the proposed cable route runs adjacent to Lodge Bog. No breeding evidence was recorded within the proposed development boundary. Studies show that high levels of activity and disturbance during construction are likely to cause birds to vacate territories close to turbine locations. Resultant consequences on breeding success may cause birds to seek other territories in subsequent years post construction [63] resulting in effective habitat loss. | Probability appraised as **medium** on a precautionary basis, even though works are proposed on an existing public road to which birds may be habituated; magnitude assessed as **high** should disturbance occur; overall impact is assessed as **Medium**. |
| Woodcock (Medium) | Disturbance during construction due to land take of coniferous woodland. Though strongly associated with deciduous woodland in most studies, areas of pre-thicket forestry with dense ground vegetation may also support breeding birds [107]. At the subject site nine territories were located and birds are likely to breed in scattered birch, areas of pre-thicket forestry or dense patches of naturally regenerating saplings. However multiple nesting opportunities exist in the area due to the large expanses of cutaway bogs nearby. Woodcock are unlikely to breed at turbine locations within mature conifers as understorey vegetation is limited. | Probability of temporary to short term impact **Medium.** Magnitude may be **High** if birds breeding at turbine locations. Overall significance is **low.** |
| Barn Owl (High) | Possible during construction impact would be disturbance to nest sites. Densities in the area very low and a large number of suitable breeding sites are unoccupied. As a mainly nocturnal species disturbance is greatly reduced. | Probability of temporary to short term impacts **low**. Magnitude likely to be **medium** should birds be nesting in e.g. a mature tree adjacent to works. Overall significance assessed as **low.** |
| Buzzard (Low) | Disturbance to this species is unlikely as they typically occur in high densities in open countryside and farming landscapes. | Probability of temporary to short term impacts **medium.** Magnitude **high** should a nest site be located close to works. Overall significance **very low.** |
| Yellowhammer (Medium) | Noise disturbance. Studies on the impacts of wind farms during both construction [63] and operation [62] have found little evidence of significant disturbance effects on passerine species; direct habitat loss is the main effect | Probability of temporary to short term impacts is **medium**. Magnitude assessed as **medium.** Overall significance assessed as **low**. |

| Key Receptor (Sensitivity) | Construction Indirect Impact Character | Significance without mitigation |
|---|---|---|
| | through removal of hedgerows in which Yellowhammers breed. | |
| Kestrel (Low) | Possible impacts include disturbance to breeding or foraging birds. Disturbance not likely are Kestrels are birds of open countryside and habituate to vehicle disturbance such as along motorways. | Probability of temporary to short term impacts **medium** as hedgerow/tree removal to be minimised through design. Magnitude assessed as **high** should nest site loss occur. Overall impact significance is **very low**. |
| Hen Harrier (High) | Possible indirect impacts would be disturbance to foraging birds. | Probability of impact **medium**; magnitude assessed as **low**; overall impact **low**. |
| Whinchat (Medium) | Indirect impacts would be hydrological impacts on habitats where a breeding pair was recorded due to during construction works which may affect the quality of the habitat. | Probability of impact **low**; magnitude assessed as **medium**; overall impact **very low**. |

*Mammals (excluding Bats)*

Badger
The potential exists for indirect impacts via both visual and noise disturbance, in particular should said works overlap with periods of activity by badger. Badgers may also be excluded from foraging areas due to screening/fencing erected during construction works. This is considered unlikely to be significant due to works only taking place in daylight hours.

Pine Marten
The potential exists for indirect impacts via both visual and noise disturbance, in particular should said works occur within coniferous areas of the subject site. Pine Marten may also be excluded from foraging areas due to screening/fencing erected during construction works. This is considered unlikely to be significant given the short duration of works.

Red Squirrel
The potential exists for indirect impacts via both visual and noise disturbance, in particular should said works occur within coniferous areas of the subject site. Red Squirrel may also be excluded from foraging areas due to screening/fencing erected during construction works. This is considered unlikely to be significant given the short duration of works.

Otter
Otters may be indirectly impacted through construction works which disturb an occupied breeding or resting sites. Additional indirect impacts include hydrological changes and impacts such as increased siltation, nutrient release and/or contaminated run-off through drainage channels and watercourses. Sediment and/or pollution entering streams and waterways could reduce water quality within areas where prey items occur, an increase in sediment could also lead to the smothering of spawning grounds if present thereby inducing longer term effects on prey availability.

Otter movements between foraging areas may also be impaired due to the placement of temporary screening or fencing during construction; loss of foraging areas may lead to a decline in breeding success and a diminution of Otter numbers in the locality. This is considered as possibly significant.

*Aquatic Ecology and Fisheries*

The most likely potential impact during the construction phase of the wind farm on receiving watercourses and aquatic habitats arises indirectly via impacts affecting water quality, such as accidental releases of silt laden runoff, as a result of accidental spillage of cement or hydrocarbons stored on site impacting upon water quality, or from effluent spillages from welfare facilities within the temporary construction compounds.

Indirect water quality impacts can potentially occur during trenching work. This would involve machines digging linear trenches and would result in excavated material being accumulated.

This material could be a source of contaminated runoff particularly if it were to be stockpiled near a sensitive watercourse during a period of wet weather. The trenching works could also generate a significant amount of waste material which is not suitable for backfilling and this would be a risk to adjoining watercourses if not stored and disposed of appropriately. Trenches can also become flooded (i.e. during a high rainfall event) and if this water was pumped into an adjoining sensitive watercourse then significant water quality impacts could be realised.

The proposed wind farm development poses a potential risk to watercourses in terms of alteration of drainage regimes, silt run-off and pollution events originating from site works which gives rise to the potential for impacts affecting fish and fisheries, as well as aquatic invertebrate communities within the study area.

Aquatic species listed on Annex II of the EU Habitats Directive (1992) within the study area include the Atlantic salmon and the white-clawed crayfish. Any engineering works which cause runoff of sediments can also increase the levels of nutrients in watercourses downslope. This can result in the enrichment or eutrophication of the affected streams, and possible changes in ecological status. Suspended solids or sediment in a river can have serious negative impacts on aquatic invertebrate and instream flora with knock-on impacts on higher organisms such as salmon and otter. Potential impacts affecting these species could occur as a result of water quality impacts from accidental pollution events including increased elevated suspended solids and consequent siltation effects.

There is a risk that machinery or materials imported onto the site could act as a vector for introducing or dispersing non-native invasive species. The introduction of non-native plants along watercourses can have serious negative impacts on riverbeds. For example, Japanese knotweed can result in bare banks prone to erosion outside of the growing season, as this plant suppresses / eliminates growth of native ground flora. Soils washed into rivers settle out and can cover over gravels beds used by spawning salmon and lampreys, constituting a reduction in area and quality of habitat used for reproductive purposes.

*Bats*

Potential indirect impacts which may occur during construction are as follows:

- Disturbance due to increased human activity

*Other Taxa*

Additional species such as Common Frog, Common Lizard, small mammals and invertebrates may be indirectly affected by disturbance which may occur during construction though this is considered unlikely to be significant. Common Frog may also be indirectly affected through sediment or pollution run off into waterbodies. It is considered possible that any unmitigated impacts on water quality could be significant.

<u>Marsh Fritillary</u>
Increased drainage or alteration to hydrological regimes in areas of suitable habitat containing this species may cause an indirect impact through a degradation in habitat however due to the absence of suitable habitat in close proximity to construction locations no significant impacts are predicted.

#### *7.5.3.3 Potential Cumulative Impacts*

Cumulative impacts have been defined as "Impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project [118]". In general within the EU there are environmental concerns over increasing numbers of developments and associated cumulative impacts on designated sites [3] . Individually a development, or indeed any action, may have minor effects on the environment, but collectively these effects may be significant and potentially greater than the sum of the individual parts acting alone (Masden *et al.* 2009[62]).

It is accepted that a difficulty lies in translating both direct effects and indirect effects, or cumulative effects, into their ultimate impacts. This assessment sets out to determine whether the proposed development and its resultant effects would result in cumulative impacts on the key receptors present within the vicinity of the subject site.

Other plans or projects identified to be considered in combination with the proposed wind farm development are as follows (from published guidance [12]).

- Mineral Extraction
- Built Development
- Power lines
- Telecommunications masts
- Forestry
- Road Schemes
- Recreational Pressure
- Existing land use Pressure

Potential Cumulative Impacts during construction on key receptors identified are addressed below:

- Designated Nature Conservation Sites
- Habitats and Flora
- Avifauna
- Mammals (excluding Bats)
- Aquatic Ecology and Fisheries
- Bats
- Other Taxa

*Designated Nature Conservation Sites*

As no direct impacts are predicted on Nature Conservation sites during construction of the proposed wind farm then no additive effects due to in combination direct impacts with other existing sources of direct impact are predicted. An accompanying Natura Impact Statement (NIS) has been prepared for the proposed development and accompanies this EIS. The NIS addresses potential impacts on Natura 2000 sites resulting from the proposed development.

*Habitats and Flora*

Potential direct impacts during construction have been identified as land take during construction of the wind farm (including turbine hardstands, met mast, compounds, substation, borrow pits, bridges, sections of new access roads and internal cabling), which will lead to some permanent loss of habitat. Other existing or planned sources of land take in the vicinity of the proposed wind farm may result in cumulative impacts.

Land take from built development in the area is not sufficient to result in an in combination significant effect.

Peat Extraction
The proposed development is also located in an area where significant quantities of peat are extracted from the Bog of Allen annually. Peat extraction and associated operations have the potential to adversely affecting drainage impacts on existing raised bogs, increasing the rate of habitat loss of both degraded raised bog and intact raised bog, where present. Peat extraction itself may contribute to water quality impacts through increasing sedimentation in surrounding water catchments which may be added to cumulatively by the proposed development.

Afforestation
Afforestation is ongoing within areas of the Maighne Wind Farm site and is likely to continue. Although proven to promote diversity in species such as birds during pre-thicket stages mature plantations may have less diversity than other semi-natural or natural habitats such as Bog Woodland or Raised Bog. Run-off from forestry may contribute to water quality impacts in the area which may be added to cumulatively by the proposed development.

Other Development
Cumulative or in-combination impacts may occur if there are effects which occur as the result of the likely effects of the proposed development interacting with the impacts of other plans or projects in the relevant locality. To inform the current appraisal, planning searches were carried out on the relevant planning authority webpages. Planning searches and a review of the IWEA webpage were also utilised to search for other wind farm developments in the area.

*Existing or Proposed Wind farms*
The following existing/planned wind farms within 15km of the proposed development were examined for potential cumulative impacts on water quality and avifauna with the proposed development (Emlagh wind farm is being considered following a request from NPWS for inclusion):

1. Crowinstown Wind Farm, a 3 turbine permitted wind farm at Delvin, Co. Westmeath
2. Dryderstown Wind Farm, a 1 turbine wind permitted farm at Delvin, Co. Westmeath
3. Mountlucas Wind Farm, a 28 turbine existing wind farm at Derrylesk, Co. Offaly
4. Yellowriver Wind Farm, a 32 turbine permitted wind farm at Rhode, co. Offaly.
5. Emlagh Wind Farm, a proposed 46 turbine wind farm near Kells County Meath (c.35km from the subject site)

The existing wind farms outlined above are not located within any of the same waterbody catchments as the proposed Maighne Wind Farm development. There is no potential cumulative impact on water quality therefore as there is no cumulative risk of an increase in sediment to waterbodies.

*Avifauna*

Direct impacts on avifauna during construction are primarily land take related, mainly due to loss of nesting habitats of key species. Other sources of land take as outlined above do have the potential to cumulatively impact on nesting or resident farmland or woodland species (the typical landscape characters) in addition to specialist species such as Woodcock (potentially affected by forestry operations). Species such as Yellowhammer may be affected cumulatively by further loss of hedgerows due to farming practices etc. Even though in combination land take is unlikely to result in range loss of any species which frequent the subject site, mitigation may be required to neutralise the effect of the proposed wind farm.

Disturbance or effective habitat loss indirectly is more difficult to quantify; especially as most species of birds may habituate to disturbance over time. Key Receptors in the case of the subject site such as Swans have been shown to exhibit habituation to human disturbance and the presence of turbines [115] [114] and Golden Plover have been shown also to become habituated to wind farms [120] [121] therefore the long term in combination impact is assessed as negligible.

*Mammals (excluding Bats)*

Mammal breeding or resting sites may be cumulatively impacted by other developments which either remove potential breeding sites (e.g. road construction) or farming or forestry activities which may for example remove Badger Setts, Pine Marten breeding sites, Red Squirrel Dreys etc. However with the implementation of best practice methods during construction in regard to mammals such as Otter, Badger and Red Squirrel it is considered unlikely that any cumulative impacts will be significant.

*Aquatic Ecology and Fisheries*

The area of the proposed site is subject to additional pressures on water quality and aquatic ecology, particularly in relation to agricultural activities.

Where wind farm construction and agricultural activities occur at the same time there is the potential for significant in-combination or cumulative impacts on local watercourses. The risk of such impacts would, for example, greatly increase if such works were taking place during the winter months or times of very high rainfall. In addition there are a number of waste facilities in the region that could result in in-combination impact on aquatic ecology. Chapter 10: Water Quality deals further with cumulative impacts on water quality due to in combination effects with other activities.

Within the River Boyne catchment, other cumulative impacts could occur in relation to the construction of the proposed Maighne wind farm. The proposed development is also located in an area where huge quantities of peat are extracted from the Bog of Allen annually. Peat extraction and associated operations have the potential or adversely affect water quality in the Slate, Figile and Blackwater (Longwood) Rivers.

*Bats*

Potential cumulative impacts on bats during construction would be as follows:

- Displacement of populations
- Abandonment of young
- Mortality

*Other Taxa*

Other taxa may be similarly affected by land take however given the large amount of displacement habitats available the overall in combination effect is assessed as negligible.

Marsh Fritillary
Cumulative impacts would be cumulative land take due to in combination effects with activates such as peat extraction, farming intensification, drainage etc. Corridor fragmentation between metapopulations as a result of increasing developments is also a potential indirect impact.

### 7.5.4 Potential Impacts During Operation

#### *7.5.4.1 Potential Direct Impacts*

Potential Direct Impacts during operation on the following are addressed below:

- Designated Nature Conservation Sites
- Habitats and Flora
- Avifauna
- Mammals (excluding Bats)
- Aquatic Ecology and Fisheries
- Bats

- Other Taxa

Natura 2000 sites

Natura Impact Statement (NIS) has been prepared for the proposed development and has been submitted with the application for permission. No direct impacts are predicted on Natura 2000 sites during operation.

Natural Heritage Areas or Proposed Natural Heritage Areas

There will be no direct impacts on Carbury Bog, the Royal Canal or Grand Canal during operation. Any maintenance of cables will not impact on these sites. This also applies to Donedea Woods which will have cables installed in the adjacent roadway. No other NHA's or pNHA's will be directly impacted.

*Habitats and Flora*

No further direct impacts on habitats and flora are predicted during the operational phase.

*Avifauna*

Studies on operational impacts of wind farms [62] have shown that certain species do exhibit levels of turbine avoidance during operational phases which may be extrapolated to reductions in breeding bird densities; however this may not be as significant as previously thought, certainly in comparison to impacts during construction [63]. It seems that there is little evidence for consistent post-construction population declines in any species, suggesting for the first time that wind farm construction can have greater impacts on birds than wind farm operation; this is supported in the literature [122]. A recent study on the effects of wind turbines on the distribution of wintering farmland birds [122] did not find any consistent patterns of turbine avoidance across the species groups studied (Corvids, seed-eaters, gamebirds and Skylark).

The primary cause of direct impact on birds during the operational phase of a development is Collision Risk.

Collision Risk

Not all bird species are equally susceptible to collision, and some species suffer proportionately high levels of collision mortality [65]. Morphology, physical flight characteristics and differences in vision are all influencing factors. Martin and Shaw, 2010 [123], suggest that it is the characteristics of the section of a birds visual field that projects forward and hence 'looks' that are the key factors. In some species the vertical extent of the forward binocular vision is reduced and therefore the bird is rendered blind if, whilst in the process of flying it undertakes behaviour such as the detection of conspecifics, remote food sources etc. [124] [123]. Other species have reduced fovea, are emmetropic (default focus is distant) or may contain blind spots in their field of vision (as an evolutionary trait) which may cause susceptibility to collision. Flight height or the flight heights which birds habitually use along either migration or local flight paths is also an influencing factor. Relative size and high wing loading (or low manoeuvrability) are influencing factors as larger birds with poor manoeuvrability are generally perceived as at greater risk of collision with structures (see Brown *et al.*, 1992 [125], quoted in Drewitt and Langston, 2006 [64]. Various species therefore exhibit different morphological and behavioural attributes which may contribute to collision risk.

Recent studies show that modern, larger multi-MW turbines show comparable fatality estimates with older generation models and expected increases in fatalities due to increases in rotor surface are not as expected, possibly due to increased altitude, increased distance between turbines and slower rotation speeds [121]. Appraisal of collision risk for the proposed development is based on a predicted rotor envelope of 50-170m (see Chapter 2, Section 2.3.2 of this EIS). Although considered unlikely to be significant, possible collision risk from guy wires associated with the proposed met mast is acknowledged and mitigation will be provided to further avoid any possible impacts. This will also benefit other species.

## Table 7.78: Direct Impact assessment matrix for key avifauna receptors during operation

| Key Receptor (Sensitivity) | Operational Direct Impact Character | Significance without Mitigation |
|---|---|---|
| Whooper Swan (Very High) | **Collision:**<br>Studies on wintering swans have found low levels of collision mortality, even in sites with a high degree of transit flights (n=1664 in one case) through the operational wind farm and relatively high numbers (>500) of birds regularly present [115]. In a review of swan and goose fatalities at wind farms only 2 whooper swans were recorded as fatalities from monitoring undertaken at 46 different wind farms across 8 countries [116]. Recommended avoidance rates from SNH are 98% [126], based on literature reviews of recorded fatalities; this suggests a high micro-avoidance of turbines. | **Collision:**<br>Probability of Impact **Low**, based on recorded flight activity, height of proposed envelope (50-170m), published best scientific knowledge and low frequency of occurrence at the site**,** Magnitude assessed as **negligible**, overall significance assessed as **low**. |
| Whooper Swan (contd.) | In relation to nocturnal flight activity recent studies utilising radar on both offshore and coastal wind farms in Europe have recorded macro-avoidance rates in wildfowl at least as high, or higher at night than during the day, implying that diurnal avoidance rates are comparable to those in periods of lower visibility [127]. Best scientific knowledge suggests comparable if not higher avoidance rates by wildfowl during perceived periods of poor visibility.<br>Best scientific knowledge therefore suggests overall a high avoidance rate and consequent low fatality estimate for wind turbines in relation to Whooper Swans both in relation to diurnal flight activity and activity in crepuscular and nocturnal periods.<br>In addition to this the indicative numbers of this species at the subject site further reduces collision risk estimates to a negligible level. | |
| Golden Plover (High) | **Collision:** Golden Plover have been recorded in low numbers as collision fatalities at wind farms [120] [128]; the published avoidance rate by SNH for collision risk modelling for the species is 98% [129] indicating a high micro avoidance rate in regard to collision with turbines. Numbers recorded at the subject site are low in relation to the published threshold for National Importance. A study in the Netherlands of three operational wind arms where Golden Plover were active both diurnally and nocturnally found no fatalities, supporting a high micro-avoidance rate [121]. | **Collision:**<br>Probability of collision **low** based on published avoidance rates and recorded fatalities; magnitude **low** based on numbers recorded from site; overall significance **very low.** |
| Kingfisher (High) | **Collision:** No operational collision risk due to buffer distances from rivers and height of rotor envelope. | **Collision:** Probability of longer term impact **low**: magnitude assessed as **negligible**; overall significance **very low.** |

| Key Receptor (Sensitivity) | Operational Direct Impact Character | Significance without Mitigation |
|---|---|---|
| Peregrine (High) | **Collision:** Evidence of collision fatality is low with only two birds recorded in published reviews of wind farm fatalities, up to 2004 [120]. Recommended avoidance rate (by SNH) for collision risk modelling is 98% suggesting high micro-avoidance capabilities. **L**ow levels of flight activity recorded within the proposed envelope results in a low collision risk estimate. | **Collision**: probability of long term collision risk is **medium** due to published avoidance rates magnitude assessed as **low**; overall significance is **low**. |
| Merlin (High) | **Collision:** Merlin mainly take prey from a perch, on the ground or in low flight [130]. Wintering birds have been shown to employ low flight attacks for over 64% of total hunts [131]. Occasionally birds fly upwards during a pursuit flight but this only represents 10.8% of total hunts [131], possibly due to increased energy expenditure. Recorded flight activity at the subject site exclusively below predicted rotor envelope (50-170m). Flight patterns during the breeding season are likely to be similar with documented hunting and commuting flight often 1-2m [132] . | **Collision:** Probability of impact **medium** due to published flight heights relative to height of proposed envelope (50-170m); magnitude assessed as **low**; overall significance **low**. |
| Lapwing (Medium) | **Collision:** Evidence of collision fatality is low with only 2 birds recorded in published reviews of wind farm fatalities, up to 2004 [120].During the breeding season Lapwing indulge in territorial display and interspecific behaviour which may bring them into the predicted rotor envelope. Low numbers recorded breeding within the 500m turbine envelope reduces magnitude. | **Collision:** probability of impact **medium**; magnitude assessed as **medium**; overall significance **low**. |
| Eurasian Curlew (High) | Collision Risk to birds breeding at Lodge Bog is considered. During the breeding season male birds mark their territory with an undulating display flight up to 1.5km from the territory centre.<br>Recorded fatalities of Curlew at operational wind farms are scarce with none recorded from a review of 46 wind farms across Europe [120] up to 2004; a single mortality was recorded from a study in Germany [133] published in 2013. Avoidance rate of turbines for the purposes of Collision Risk modelling is currently set at 98% [129]. | **Collision**: probability of impact **low** , based on distance from turbines to Lodge Bog , published avoidance and low fatality estimates; **Magnitude** assessed as **medium;** overall impact assessed as **low**. |
| Common Snipe (Medium) | **Collision:** Birds may be at risk of collision during breeding season as they display over territories; however typical heights are below 80m with alternating ascents and descents of c.20m. Low numbers breeding on site and height of predicted rotor envelope (50-170m) suggests any mortality not significant. Only a single fatality recorded in a review of bird collision victims across Europe [120]. | **Collision**: probability of impact **medium**; magnitude assessed as **low;** overall significance **very low**. |
| Woodcock (Medium) | **Collision:** Birds typically display over territories at heights of up to 30m above ground; up to 100ha can be covered by a displaying male with maximum durations recorded of 64 minutes per 24 hour period [134]. The predicted height of the rotor envelope will be above most flight activity at 50-170m. Wintering birds will also commute to foraging grounds at dusk. Recorded fatality rates low with only a single fatality from a review of 46 wind farms across Europe [120]. | **Collision**: Probability of collision **medium** due to height of proposed envelope (50-170m); magnitude **high** should collision occur; overall significance **low**. |

| Key Receptor (Sensitivity) | Operational Direct Impact Character | Significance without Mitigation |
|---|---|---|
| Barn Owl (High) | **Collision:**<br>No fatalities have been recorded on a European basis to date [120]; a single fatality has been record in the UK [135] [136] although this was at a domestic turbine rather than a commercial turbine. Barn Owls typically forage up to 3m above ground level and therefore collision risk is significantly reduced [136]. Evidence of Barn Owl located near a single cluster (Windmill) however the bare nature of the milled peat where turbines are located will not encourage birds to forage. | **Collision:** Probability of collision **low;** magnitude assessed as **medium** on a precautionary basis; overall significance **low.** |
| Buzzard (Low) | **Collision:**<br>Common Buzzard has been recorded as fatalities within the European Context with 27 recorded in a review of 46 wind farms up to 2004 [120]. However this is low in relation to the estimated European population of up to one million pairs [130] and best available knowledge suggests mortality due to wind farms is not sufficient to cause significant population declines. | **Collision**:<br>Probability of impact **high**, magnitude assessed as **medium to high**; overall impact **very low** to **low.** |
| Yellowhammer (Medium) | **Collision Risk:**<br>No significant collision risk due to height of rotor envelope. | **Collision**: probability of impact **low**; magnitude assessed as **negligible**; overall impact assessed as **very low**. |
| Kestrel (Low) | **Collision Risk:**<br>Recorded breeding proximal to Derybrennan and present during the breeding season at 3/5 clusters. Assumed to be present year round in the vicinity of all clusters.<br>100% of recorded flight activity was below the predicted rotor envelope (50-170m). Has been recorded as fatalities in Europe [120] but collision risk at subject site predicted to be lower due to increased height of predicted rotor envelope in relation to commonest hunting technique of hovering at 10-40m [130]. | **Collision**: probability of impact assessed as **medium** due to height of proposed envelope (50-170m); magnitude assessed as **medium**, overall impact **low**. |
| Hen Harrier (High) | **Collision Risk:**<br>Highest during winter months when winter birds may be present. Significantly reduced due to the absence of breeding as territorial display known as 'skydancing' often occurs at heights within the predicted rotor envelope. Documented as occasionally soaring or arriving at winter roosts 'at height' [137] however both documented roosts are >5km from the nearest respective turbine. All flight activity recorded at subject site (including at roosts) below predicted rotor envelope (50-170m). Literature suggests flying at low heights is a 'ubiquitous trait' supported by a number of studies [138]. The species has a high, published avoidance rate (>95%) [138] in relation to wind turbines. Low numbers recorded wintering at nearby known roosts (one during winter 2013/14; 4-5 individuals winter 2013/14) in respect of best available information on known wintering population (estimated at 269-349 wintering birds recently by NPWS). | **Collision:** Probability of impact assessed as **Low** due to height of proposed envelope (50-170m); magnitude **low** should it occur; overall impact assessed as **low**. |

| Key Receptor (Sensitivity) | Operational Direct Impact Character | Significance without Migitation |
|---|---|---|
| Whinchat (Medium) | **Collision Risk:**<br>No significant collision risk due to height of rotor envelope. | **Collision**: probability of impact **low**; magnitude assessed as **negligible**; overall impact assessed as **very low**. |

*Mammals (excluding Bats)*

Occasional vehicular traffic along access roads may result in fatalities; however this is expected not to be significant due to the mainly diurnal requirement for access and speed restrictions on internal roads. No further direct impact on mammals (excluding Bats) during operation is predicted.

*Aquatic Ecology and Fisheries*

Operational wind farms are not considered to have the potential to significantly impact on the aquatic environment. The main risk to watercourses is when oils and lubricants are used on the site. If such substances leaked from the turbines or maintenance areas in significant quantities or were disposed of inappropriately, there is of the potential for water pollution. However, the likelihood of this occurring is very low and the potential significance of this impact can be mitigated through proper management. Spills of any oil or fuels from site vehicles onto the access roads may find its way to the local stream network. However, this is unlikely to be a significant impact considering the low numbers of vehicles involved and the high quality standards that are implemented on a well-managed site.

*Bats*

Bat mortality due to collisions with wind turbines is well known and studies have further shown that bats may be killed without physically contacting turbine blades. The death of bats due to the presence of the operating turbines may reduce local bat populations especially if a turbine is sited near a roost. The wind farm is to be sited within an area which is over-flown by Leisler's bat and whose hedgerow, treeline and forest edge habitats are currently in use by at least four other bat species. Although, as yet, there are no published results of a study of bat mortality from Irish wind turbines, considering recent research from mainland Europe and North America, there is an increasing amount of detailed published evidence that wind turbines cause bat fatalities. However, many of these overseas turbine/bat mortality studies are at wind farms, with significantly large numbers of turbines, sited along known bat migration routes where many hundreds or even thousands of bats commute seasonally resulting in numerous deaths and injuries. There is currently no evidence that mortality of bats on the same scale occurs in Ireland. Although it is known that Nathusius' pipistrelle migrates from Scandinavia to Scotland and to the north of Ireland and back again (Russ *et al.* 2001 [139]), apart from this species, there is currently no evidence that internal or external bat migration routes of other bat species exist elsewhere in Ireland as no research has been undertaken. Nevertheless, risks to bats from wind turbines have to be acknowledged and it is possible that some bat mortality may occur due to the operation of the planned development therefore mitigation measures are recommended to reduce the likelihood of such fatalities. The foreseen potential impacts during operation are as follows.

- Death through collision with turbine blades
- Death through barotrauma– non-contact haemorrhaging of blood vessels in the lungs

Appraisal of collision risk for the proposed development is based on a predicted rotor envelope of 50-170m (see Chapter 2, Section 2.3.2 of this EIS).

*Other Taxa*

No direct impacts are predicted on other Taxa during the operational phase.

### *7.5.4.2 Potential Indirect Impacts*

Potential Indirect Impacts during operation on the following are addressed below:

- Designated Nature Conservation Sites
- Habitats and Flora
- Avifauna
- Mammals (excluding Bats)
- Aquatic Ecology and Fisheries
- Bats
- Other Taxa

*Designated Nature Conservation Sites*

Natura 2000 sites
A Natura Impact Statement (NIS) has been prepared for the proposed development. The NIS addresses potential impacts on Natura 2000 sites within 15km of the proposed development resulting from the proposed development.

Natural Heritage Areas or proposed Natural Heritage Areas
Natural Heritage Areas or proposed Natural Heritage Areas with hydrological links to the proposed development site have the potential to be indirectly impacted due to hydrological changes and impacts such as increased siltation, nutrient release and/or contaminated run-off through drainage channels and watercourses.

The Rye Water/Carton pNHA (001398) is located downstream of the proposed trenchless crossing of the River Rye Water and potential indirect impacts during operation are as follows:

1. Reduction in water quality (a key element of site) and consequent impacts on *Vertigo* snails within the Rye Water/Carton pNHA, and/or reduction in water quality of the portion of canal which is overlapped by site boundary, due to run-off from the operational wind farm.
2. Reduction in water quality (a key element of site) and consequent reduction in area or Petrifying springs habitat in Rye Water/Carton pNHA due to contaminants or run off from the operational wind farm.

*Habitats and Flora*
There is a potential impact (without mitigation) on water quality within the subject site, due to sediment erosion and runoff during the operational phase. No further impacts to habitats should occur during the operational phase of the wind farm.

*Avifauna*
Indirect impacts on avifauna during operation are Barrier Effect and ongoing Disturbance Displacement.

Disturbance

Habitat loss can be direct through land take of breeding or foraging habitats for key species or indirect such as effective habitat loss through avoidance or disturbance due to factors such as perceived collision risk. Birds may therefore avoid areas proximal to turbines until habituation takes place. There are examples in the literature of habituation in species such as geese and swans (see Fijn *et al.*, 2012 [115] and Madsen and Boertmann, 2008 [140]).

Barrier Effect

One of the potential operational impacts of wind farms is avoidance where the wind farm may act as a barrier to movements [66]. The effect of birds altering their migration flyways or local flight paths to avoid any infrastructure is a form of displacement [64]. The primary impact of barrier effect is increased energy expenditure when birds have to fly further to circumvent an obstacle.

Effects can be highly variable and range from slight 'checks' in flight direction, height or speed, through to larger diversions around objects. Studies have shown that birds on migration may show avoidance of wind farms [141] but the observed distances involved were trivial in regard to total migration distances, and hence energy expenditure.

In relation to nocturnal flight activity recent studies utilising radar on both offshore and coastal wind farms in Europe have recorded macro-avoidance rates in wildfowl at least as high, or higher at night than during the day, implying that diurnal avoidance rates are comparable to those in periods of lower visibility [127]. In the same study migrating flocks at night were recorded increasing their distance from individual turbines once inside the wind farm and also travelling in the corridors between turbines [127].

*Assessment of Impacts on Key Receptors*

The following matrix outlines the assessment of impacts on key avifauna receptors during wind farm operation, based on the criteria previously outlined. Note: the criteria utilised in the current assessment to define duration were as follows, from published guidance [1]:

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

The current time period predicted for operation of the project is 30 years (see Chapter 2 for planning and construction programme).

## Table 7.79: Indirect impact assessment matrix for key avifauna receptors during operation

| Key Receptor (Sensitivity) | Operational Indirect Impact Character | Significance without mitigation |
|---|---|---|
| Whooper Swan (Very High) | **Disturbance**: Possible disturbance from feeding areas during wintering period (Oct-March) dependant on availability of food resources (e.g. improved agricultural grassland/stubble). Literature suggests possible short term displacement of 200-400m [115] [142] followed by habituation [115] with little evidence of *permanent* post construction displacement [116]. Most of the wind farm is outside the known core range (5km) of wintering Whooper Swans from roost locations [143]. Numbers on site very low in context.<br><br>**Barrier Effect:** There are t wo types of barrier effect; those to migrating birds along migration routes and daily barrier effects due to placement of turbines between feeding and roosting sites. Barrier effect can be related to perceived collision risk [144]. Barrier effects along migration routes of wildfowl have been shown to cause only small effects on total migration distance [141].<br><br>Swans have been shown to exhibit horizontal avoidance as they fly past the outer edge of wind farms [115] and distances of up to 200m have been noted for whooper swans [142]. In the Netherlands, Bewicks Swans have been recorded adjusting their flight paths to the presence of turbines during both light and darkness, with no large deflections or panic reactions recorded and birds were recorded flying around and between rows of turbines [115].<br>Distances between turbines at the referenced site (300-400m) [115] are comparable to those at Maighne (350-500m).In relation to nocturnal flight activity recent studies utilising radar on both offshore and coastal wind farms in Europe have recorded macro-avoidance rates in wildfowl at least as high, or higher at night than during the day, implying that diurnal macro-avoidance rates are comparable to those in periods of lower visibility [127]. | **Disturbance:**<br>Probability of disturbance (short term) **high;** magnitude **negligible** due to crop rotation interval and published habituation; overall significance **Low.**<br><br>**Barrier Effect:**<br><br>Probability of some barrier effect **high**; magnitude to migrating birds in terms of energy expenditure assessed as **negligible**; magnitude of daily barrier effect assessed as **negligible** as literature suggests swans safely commute through turbines, the distance between turbines and clusters allows for micro-avoidance, and predicted height of rotor envelope in relation to recorded flight height diminishes perceived collision risk; overall significance assessed as **low.** |

| Key Receptor (Sensitivity) | Operational Indirect Impact Character | Significance without mitigation |
|---|---|---|
| Golden Plover (High) | **Disturbance**: Possible disturbance during winter months from feeding or roosting locations; feeding is mainly nocturnal and ample displacement habitat is available for during daylight hours. Numbers recorded on site are low in relation to National Threshold. Literature suggests differences in densities pre- and post-construction of wind farms not significant [63]; displacement not significant but may occur up to 175m [120].<br><br>**Barrier Effect:** Low published avoidance rates of wind farms [121] and changes in densities within wind farms post construction [63] suggest wind farms do not act as significant barriers to Golden Plover. | **Disturbance**: Probability of some disturbance **high;** low numbers recorded from site and literature review magnitude to be **low;** overall significance **low.**<br><br>**Barrier Effect:**<br>Probability of some barrier effect **medium**; magnitude to migrating birds in terms of energy expenditure assessed as **negligible**; magnitude of daily barrier effect assessed as **negligible** as the distance between turbines and clusters allows for micro-avoidance and relative numbers on site are low; overall significance assessed as **very low.** |
| Kingfisher (High) | **Disturbance**: No operational disturbance due to buffer distances from rivers.<br><br>**Barrier Effect**: No barrier effect due to buffer distances from rivers/streams. | Probability of longer term impact **low**: magnitude assessed as **negligible**; overall significance **very low.** |
| Peregrine (High) | **Disturbance:** Possible disturbance to foraging birds through noise, visual intrusion. No displacement from breeding sites due to none being recorded within the proposed site boundary [143].<br><br>**Barrier Effect:** Recorded flight activity suggests high proportion of flight activity below rotor height; the wind farm is unlikely to act as a significant barrier to a species such as Peregrine. | **Disturbance**: Probability of long term disturbance **low**; magnitude assessed as **low**; overall significance **very low**.<br><br>**Barrier Effect**: Probability of long term impact **low**; magnitude assessed as **medium**; overall significance **Low**. |
| Merlin (High) | **Disturbance:** possible disturbance to wintering birds due to operational maintenance etc. Possible disturbance to any birds holding territory at Hortland although turbine locations removed from<br><br>**Barrier Effect:** Barrier effect has been recorded in Europe [120] though this may relate mainly to large scale migration which is unlikely at the subject site. Numbers recorded on site low. | **Disturbance**: Probability of impact **medium**; magnitude assessed as **low**; overall significance **low**.<br><br>**Barrier Effect:** Probability of impact **high:** magnitude assessed as **low**; overall significance **low**. |

| Key Receptor (Sensitivity) | Operational Indirect Impact Character | Significance without mitigation |
|---|---|---|
| Eurasian Curlew (High) | **Disturbance** to birds breeding at Lodge Bog is considered here: Studies on the operational effects of wind farms have found Curlews can exhibit avoidance of up to 800m in respect of turbines [62]. However results of studies vary with some studies finding little or no evidence of disturbance [145]; suggesting impacts may vary from site to site dependant on factors such as habitat.<br><br>**Barrier Effect:** to birds breeding at Lodge Bog is considered here. Foraging during the breeding season has been recorded up to 1.5km from nest sites however as no turbines are proposed within this distance of Lodge bog, no significant daily impediment is expected. Barrier effect on migrating birds or birds undertaking larger scale movements is unlikely to be significant given minimum distances between both individual turbines and larger clusters. | **Disturbance:** Probability of Impact assessed as **low** as no proposed turbines are within 800m of Lodge Bog; magnitude assessed as **negligible;** overall impact assessed as **very low**.<br><br>**Barrier Effect**: Probability of Impact assessed as **Low**: magnitude assessed as **low**; overall impact **very low.** |
| Lapwing (Medium) | **Disturbance:** Although birds may be displaced by up to 100m by the presence of turbines [62] [145]; overall distribution and aggregations within wind farms are more influenced by habitat parameters such as the availability of preferred breeding habitat [145]. Additional literature suggests changes to densities from pre to post construction are not significant [63]. At the subject site the low density of breeding birds recorded in relation to available habitat implies any displacement of up to 100m will not be significant.<br><br>**Barrier Effect:** Barrier effect has been recorded in a number of studies however not at significant levels [120]. | **Disturbance:** probability of impact **high**; magnitude assessed as **low**; overall significance **low**.<br><br>**Barrier Effect:** probability of impact **medium**; magnitude assessed as **medium**; overall significance **low**. |
| Woodcock (Medium) | **Disturbance**: Disturbance and loss of habitat during operation minimal due to no further land take of woodland. As a nocturnal species unlikely to be effected by noise/visual intrusion.<br><br>**Barrier Effect:** Home ranges are small with birds recorded flying up to 1km from nests sites to forage [107]. No published evidence of barrier effect to migrating birds [120]. Wintering birds present in low numbers. | **Disturbance:** Probability of disturbance during operation **low**; magnitude assessed as **medium**; overall significance **very low**.<br><br>**Barrier Effect**: Probability of Barrier effect **low**; magnitude assessed as **medium**; overall significance **very low**. |

| Key Receptor (Sensitivity) | Operational Indirect Impact Character | Significance without mitigation |
|---|---|---|
| Barn Owl (High) | **Disturbance:** Possible disturbance would be noise or visual intrusion leading to effective habitat loss of e.g. foraging areas within the wind farm boundary. Barn Owls breeding success has shown no declines in areas of high disturbance levels in the UK, such as near to military activity [135]; it is unlikely that noise from turbines would significantly affect birds, if present. No sites suitable for Barn Owl within 1.5km of the site boundary were found to be occupied.<br><br>**Barrier Effect:**<br>Given the low population levels within both the immediate area and the wider regional context [69] avoidance of the proposed wind farm is unlikely to induce significant energetic expenditure on either daily patterns of birds or birds undertaking larger movements such as post fledging dispersal of juveniles. | **Disturbance:** Probability of disturbance is **low**; magnitude is assessed as **low**; overall significance is **very low.**<br><br>**Barrier Effect**: Probability of barrier effect **low**: magnitude assessed as **medium**; overall significance **low**. |
| Buzzard (Low) | **Disturbance:**<br>In a review of the published impacts of wind farms on Common Buzzard populations [120], it was found that overall, impacts on Buzzard populations post construction, across both winter and breeding season was not significant, Common Buzzards do show habituation to the presence of wind farms [120].<br><br>**Barrier Effect:**<br>Barrier Effect on either migration or regular flights of Common Buzzard has been shown at 2 of 6 studies to date (2004) in a European context [120]**;** overall barrier effect was not shown to be significant. | **Disturbance:** probability of impact **medium**, magnitude assessed as **low** due to habituation, overall impact assessed as **very low**.<br><br>**Barrier Effect**: probability of impact assessed as **medium**; magnitude assessed as **low**; overall impact **very low**. |
| Yellowhammer (Medium) | **Disturbance / Barrier Effect:**<br>Loss of breeding habitat through land take of hedgerows, or foraging habitat. Noise disturbance. Studies on the impacts of wind farms during both construction [63] and operation [62] have found little evidence of significant disturbance effects on passerine species; direct habitat loss is the main effect through removal of hedgerows in which Yellowhammers breed. | **Disturbance / Barrier Effect:** probability of impact assessed as **low**; magnitude assessed as **low**; overall impact very **low**. |

| Key Receptor (Sensitivity) | Operational Indirect Impact Character | Significance without mitigation |
|---|---|---|
| Kestrel (Low) | **Disturbance:**<br>Disturbance (in terms of minimal distance to wind farm) has been recorded in 14 studies on wind farms in Europe, however the maximum distance recorded was 150m [120].<br>This is unlikely to be significant. Habituation to wind farms has been recorded in Kestrel [120].<br><br>**Barrier Effect:**<br>Barrier effect has been shown to a degree in either migrating Kestrel or regular flight paths within the European context (3 of 5 studies) [120]. However as barrier effect is often related to perceived collision risk the higher predicted rotor envelope at the subject site should reduce any possible effects. | **Disturbance:**<br>Probability of impact **medium**; magnitude assessed as **high**; overall impact **very low**.<br><br>**Barrier Effect:**<br>Probability of Impact **medium**; magnitude assessed as **medium**; overall impact **very low**. |
| Hen Harrier (High) | **Disturbance:**<br>No breeding takes place within the subject site and it is not located within the breeding range of the species in Ireland; noise disturbance/visual intrusion unlikely to deter wintering birds from foraging as evidence suggests birds may continue to utilise wind farms post construction [146].<br><br>**Barrier Effect:**<br>Although barrier effect has been documented in at least one study in the European context; recent evidence suggests that birds continue to use wind farms post construction [138] [146] indicating wind farms may not be significant barriers. Large scale migration of this species doesn't occur at the subject site. Dispersed nature of clusters, predicted envelope height and distance to known roosts implies commuting routes to these sites unlikely to be significantly affected. | **Disturbance:**<br>Probability of impact assessed as **low**; magnitude **low**; overall impact **very low**.<br><br>**Barrier Effect:**<br>Probability of impact assessed as **low**; magnitude **low**; overall impact **very low**. |
| Whinchat (Medium) | **Disturbance:** Studies on the impacts of wind farms during both construction [63] and operation [62] have found little evidence of significant disturbance effects on passerine species;**:**<br><br>**Barrier Effect:** No predicted Barrier Effect due to height of proposed envelope and low densities of birds. | **Disturbance / Barrier Effect:** probability of impact assessed as **low**; magnitude assessed as **low**; overall impact very **low**. |

*Mammals (excluding Bats)*

The primary indirect operational impact on mammals will be increased noise due to rotation of the blades of the turbines, ongoing visual intrusion. This is considered as unlikely to be significant.

*Aquatic Ecology and Fisheries*

Upgrading of the site track/road network could allow increased public access to the site. This could potentially result in illegal dumping of domestic rubbish or possibly facilitate access of poachers to fish spawning areas. Provision of access to off road vehicles (including quad bikes) is also a potential impact. Such vehicles can cause direct damage to streams, particularly in the headwaters of catchments and indirect effects on aquatic sites such as erosion of soils.

*Bats*

No indirect impacts on Bats are envisaged.

*Other Taxa*

No operational impacts are predicted.

### *7.5.4.3 Potential Cumulative Impacts*

Potential Cumulative Impacts during operation on the following are addressed below:

- Designated Nature Conservation Sites
- Habitats and Flora
- Avifauna
- Mammals (excluding Bats)
- Aquatic Ecology and Fisheries
- Bats
- Other Taxa

*Designated Nature Conservation Sites*

As no direct impacts are predicted on Nature Conservation sites during operation of the proposed wind farm then no additive effects due to in combination direct impacts with other existing sources of direct impact are predicted. Indirect impacts predicted during operation periods due to impacts such as increased siltation, nutrient release and/or contaminated run-off through drainage channels and watercourses do have the potential to combine with other sources of impact such as runoff from farming or forestry practices, contamination events etc.

An accompanying Natura Impact Statement (NIS) has been prepared for the proposed development. The NIS addresses potential impacts on Natura 2000 sites resulting from the proposed development.

*Habitats and Flora*
No direct impacts on habitats and flora are predicted during the operational phase of the development. Indirect impacts predicted during construction due to hydrological changes and impacts such as increased siltation, nutrient release and/or contaminated run-off through drainage channels and watercourses do have the potential to combine with other sources of impact such as runoff from farming or forestry practices, contamination events etc. Mitigation is therefore required to neutralise any potential impact from the proposed wind farm.

*Avifauna*
Direct impacts on avifauna during operation which may be cumulatively added to by other existing pressures or proposed developments include collision related mortality, ongoing disturbance/displacement and barrier effect.

A planning search/search of the IWEA/Eirgrid databases was carried out to determine the number of wind farms either operational or in the planning process, within 30km of the proposed development (an additional proposed development in Co. Meath, greater than 30km, is included for completeness). The following wind farms or proposed wind farms were identified:

### Table 7.80: Existing Wind Farms within 30 km of the proposed development

| Wind Farm Name | Location | Number of Turbines | Status | Distance from Subject Site |
|---|---|---|---|---|
| Emlagh | Near Kells, County Meath | 46 | *Proposed* | 35km |
| Crowinstown | Crowinstown, Co. Westmeath | 3 | *Permitted* | 19.7km |
| Dryderstown | Delvin, Co. Westmeath | 1 | *Permitted* | 20.8km |
| Mount Lucas | Mount Lucas, Co. Offaly | 28 | *Operational* | 16.9km |
| Yellow River | Rhode, Co. Offaly | 32 | *In Planning* | 10.5km |

Flight height or the flight heights which birds habitually use along either migration or local flight paths is an influencing factor in determining whether the proposed development will combine with additional wind farms to produce additive, synergistic or antagonistic effects. These effects include increased Barrier Effect (potentially obstructing migratory flightpaths), increased collision risk (through combined mortality in species susceptible) and increased disturbance to birds utilising foraging grounds whilst on migration.

Collision Risk to Whooper Swans:

In a study of on the migration routes of Whooper Swans and geese in relation to wind farm footprints in the UK [147]; the mean recorded flight height for Whooper Swan migration over land was 80m ±134m, at ground speeds of 63kph ±16kph (n=226). Median flight height (i.e. the most frequently recorded altitude of flight) over land during migration was 40m in spring and 6m in autumn; 40m overall. Local movements are often likely to occur at lower heights depending on topography. This is reflected in the flight observations from the study site which recorded the highest proportion of flight activity at the <50m height interval. Predicted mortality rates (within a worst case scenario model) from the proposed Emlagh wind farm are c.1 bird per annum. It should be noted that this is located c.35km from the proposed Maighne wind farm.

In relation to nocturnal flight activity recent studies utilising radar on both offshore and coastal wind farms in Europe have recorded macro-avoidance rates in wildfowl at least as high, or higher at night than during the day, implying that diurnal avoidance rates are comparable to those in periods of lower visibility [127]. Best scientific knowledge therefore suggests comparable if not higher avoidance rates by wildfowl during perceived periods of poor visibility.

A population model has already been described for Whooper Swan in relation to predicting the population level effects of elevated mortality resulting from wind turbine collisions. This model, produced by SNH [148], is based on the same breeding population as the birds found in Ireland and is therefore comparable (note the population simulations were run on the assumption of survival rates for the Scottish population and a closed population model with no immigration or emigration). The model predicts that 4% of the population has to be removed annually to cause a population decline.

Applying this rate of population removal to the Irish wintering population (10520 birds [70]) results in 420 individuals having to be removed on an annual basis to cause population decline. Given the low frequency of occurrence of this species at the Maighne Wind Farm site and low numbers recorded, the predicted cumulative mortality from collision with turbines at both Emlagh and Maighne is unlikely to negatively affect the wintering population and hence the conservation status of the species.

In addition, in combination mortality with the proposed north south interconnector (c.18km from the nearest proposed turbine), or overhead wires in general in the area is highly unlikely to produce mortality of 420 individuals; resulting in no in combination impact on the overall conservation status of the species. Any in combination collision risk on Whooper Swans due to these wind farms is assessed as negligible given the distances from the proposed Maighne site, the high avoidance rates of wind farms and turbines by Whooper Swans and low numbers of birds utilising the Maighne site.

In Combination Barrier Effect:

The development does have the potential to combine with other wind farms in an additive manner although this is unlikely to be synergistic. Distance is important to note in this regard and the proposed Emlagh wind farm is c.35km from the proposed Maighne wind farm. The main effect of Barriers on birds is resulting energy expenditure (as a result of having to circumvent obstacles) and it has been suggested that multiple wind farms along migration routes may result in energy expenditure rates sufficient to affect breeding success (i.e. through loss of body condition) [66]. It should be noted, in relation to the energetic capacity of swans for example, that Whooper Swans can make the crossing from Ireland to Iceland, a distance of 800-1200km, in 1.5days [149]. Therefore the relative increase in energy expenditure and fuel loss through flying over or through an obstacle is important. In the case of the Maighne wind farm the dispersed nature of the clusters will serve to reduce energy expenditure through the provision of transit corridors and the broadly north south orientation is favourable to the passage of birds (it has been suggested that orientation of wind farms parallel to main flightpaths is likely to reduce collision risk, especially where there is large scale bird movement in a predominant axis [65]). This also applies to other species of migrating wildfowl such as Geese. Swans have been shown to exhibit both macro and micro avoidance of turbines; in one study in the Netherlands swans were noted flying through windfarms [115] suggesting that in instances where the predicted rotor envelope is above typical flight heights, swans are not deterred from commuting through wind farms.

Any in combination collision risk due to the barrier effect of these wind farms is assessed as negligible.

In Combination Disturbance/Displacement

Disturbance or effective habitat loss indirectly is more difficult to quantify; especially as most species of birds may habituate to disturbance over time. Key Receptors in the case of the subject site such as Swans have been shown to exhibit habituation to human disturbance and the presence of turbines [115] [114] and Golden Plover have been shown also to become habituated to wind farms [120] [121] therefore the long term in combination impact is assessed as negligible.

*Mammals (excluding Bats)*

Mammal breeding or resting sites may be cumulatively impacted by other developments which either remove potential breeding sites (e.g. road construction) or farming or forestry activities which may for example remove Badger Setts, Pine Marten or Red Squirrel breeding sites etc. However given that no landtake is predicted for the operational phase, no cumulative impact is predicted.

*Aquatic Ecology and Fisheries*

Operational wind farms are not normally considered to have the potential to significantly impact on the aquatic environment. The main risk to watercourses is when oils and lubricants are used on the site. If such substances leaked from the turbines or maintenance areas or were disposed of inappropriately, there is a risk of water pollution. However, the likelihood of this occurring is very low and the potential significance of this impact can be mitigated through proper management. Spills of any oil or fuels from site vehicles onto the access roads may find its way to the local stream network. However, this is unlikely to be a significant impact considering the low numbers of vehicles involved and the high quality standards that are implemented on a well-managed site.

Upgrading of the site track/road network could allow increased public access to the site. This could potentially result in illegal dumping of domestic rubbish or possibly facilitate access of poachers to fish spawning areas. Provision of access to off road vehicles (including quad bikes) is also a potential impact.

Such vehicles can cause direct damage to streams, particularly in the headwaters of catchments and indirect effects on aquatic sites such as erosion of soils. These have the potential to act in combination with additional pressures on Aquatic ecology should they occur during the operational phase of the project.

*Bats*

Potential Cumulative impacts on Bats during operation would be as follows:

- Mortality
- Reduction of local populations

*Other Taxa*

Other taxa may be similarly affected by landtake however given the large amount of displacement habitats available the overall in combination effect is assessed as negligible.

Marsh Fritillary:
Cumulative impacts during operation are not considered likely to be significant. The re instatement and landscaping which will occur post construction may result in positive impacts for butterflies in general.

## 7.5.5 Potential Impacts during Decommissioning

### *7.5.5.1 Potential Direct Impacts*

Potential Direct Impacts during decommissioning on the following are addressed below:

- Designated Nature Conservation Sites
- Habitats and Flora
- Avifauna
- Mammals (excluding Bats)
- Aquatic Ecology and Fisheries
- Bats
- Other Taxa

Natura 2000 sites

There are no designated Natura 2000 sites within the proposed development area therefore no direct impacts are predicted during decommissioning.

Natural Heritage Areas or Proposed Natural Heritage Areas

No direct impacts are predicted on NHAs s or proposed Natural Heritage Areas sites during decommissioning. A small number of trees at canal bridges may require trimming to facilitate turbine removal.

*Habitats and Flora*

The decommissioning of the wind farm may result in some temporary loss of habitat, primarily to hedgerows at access points which may require partial removal to facilitate exiting of turbine parts.

*Avifauna*

The following matrix outlines the assessment of direct impacts on key avifauna receptors during decommissioning, based on the criteria previously outlined. Note: the criteria utilised in the current assessment to define duration were as follows, from published guidance (1):

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

The current time period predicted for decommissioning of the project is 12-18 months (see Chapter 2 for planning and construction program).

**Table 7.81: Direct Impact assessment matrix for key avifauna receptors during decommissioning**

| Key Receptor (Sensitivity) | Decommissioning Direct Impact Character | Significance without mitigation |
|---|---|---|
| Whooper Swan (Very High) | No direct impacts predicted. | Probability of Impact **low**, Magnitude assessed as **Negligible**, overall impact **very low**. |
| Golden Plover (High) | No direct impacts predicted. | Probability of Impact **low**, Magnitude assessed as **Negligible**, overall impact **very low**. |
| Kingfisher (High) | No direct loss of habitat predicted. | Probability of Impact **low**, Magnitude assessed as **Negligible**, overall impact **very low**. |
| Peregrine (High) | No direct habitat loss due to no breeding sites being located within site boundary. | Probability of Impact **low**, Magnitude assessed as **Negligible**, overall impact **very low**. |
| Merlin (High) | No further landtake in areas proximal to occupied breeding territory; winter numbers low. | Probability of Impact **low**, Magnitude assessed as **Negligible**, overall impact **very low**. |
| Lapwing (Medium) | No direct impact predicted. | Probability of Impact **low**, Magnitude assessed as **low**, overall impact **very low**. |
| Eurasian Curlew (High) | Direct impacts on birds breeding at Lodge Bog is considered here: no direct impact is predicted. | Probability of Impact **low**, Magnitude assessed as **Negligible**, overall impact **very low**. |
| Common Snipe (Medium) | No direct impact predicted. | Probability of Impact **low**, Magnitude assessed as **low**, overall impact **very low**. |
| Woodcock (Medium) | No direct impact predicted. | Probability of Impact **low**, Magnitude assessed as **low**, overall impact **very low**. |
| Barn Owl (High) | Possible direct during decommissioning impact would be loss of nests sites due to removal of nesting trees. Densities | Probability of temporary to short term impacts **low**. Magnitude likely to be **high** should birds be nesting in e.g. a mature |

| Key Receptor (Sensitivity) | Decommissioning Direct Impact Character | Significance without mitigation |
|---|---|---|
| | in the area very low and a large number of suitable breeding sites are unoccupied. As a mainly nocturnal species disturbance is greatly reduced. | tree that requires removal. Overall significance assessed as **medium.** |
| Buzzard (Low) | Possible direct during decommissioning impact would be mainly loss of nest sites through tree removal. Disturbance unlikely. High breeding densities in the area. | Probability of temporary to short term impacts **medium.** Magnitude **high** should a nest site be lost. Overall significance **very low.** |
| Yellowhammer (Medium) | Loss of breeding habitat through land take of hedgerows, or foraging habitat. Direct habitat loss is the main effect through removal of hedgerows in which Yellowhammers breed. | Probability of temporary to short term impacts is **medium** as hedgerow removal will be avoided where possible. Magnitude assessed as **medium.** Overall significance assessed as **low**. |
| Kestrel (Low) | Possible loss of nest habitat should trees containing nests be removed. | Probability of temporary to short term impacts **medium** as hedgerow/tree removal to be minimised through design. Magnitude assessed as **high** should nest site loss occur. Overall impact significance is **very low.** |
| Hen Harrier (High) | No direct impacts predicted. | Probability of temporary to short term impacts low; magnitude low; overall impact **very low.** |
| Whinchat (Medium) | No direct impacts predicted. | Probability of temporary to short term impacts low; magnitude negligible; overall impact **very low.** |

*Mammals (excluding Bats)*

Vehicular traffic during decommissioning along access roads may result in fatalities; however this is expected not to be significant due to the mainly diurnal requirement for access and speed restrictions which will be in place. It is considered unlikely that direct impacts on Badger during the decommissioning process will be significant; as setts are unlikely to have become established in locations to be affected. There is still possibility that Pine Marten breeding or resting sites may be disturbed during any tree felling operations required to facilitate vehicular access etc. for the decommissioning process. It is considered unlikely that direct impacts on Pine Marten during the decommissioning process will be significant. It is considered unlikely that direct impacts on Red Squirrel during the decommissioning process will be significant. It is considered extremely unlikely that direct impacts on Otter during the decommissioning process will be significant.

*Aquatic Ecology and Fisheries*

The decommissioning phase of the proposed wind farm site gives rise to similar potential impacts as can be realised during the construction phase; although the magnitude of the impact of decommissioning is normally reduced as all infrastructure is already in place on the site and there would be no earthworks at this stage. With suitable planning and provision of adequate mitigation potential impacts on the receiving aquatic environment during decommissioning can be minimised.

It should be noted that there will be no removal of hardstandings or roads as part of decommissioning so no re-instatement earthworks will be required.

*Bats*

The possible impacts on bats during the decommissioning phase of the wind development are the same as those given for the construction phase of the project as similar activities which may affect bats will again be undertaken both on and offsite resulting in the potential

- loss of commuting and foraging habitats
- loss of roosts in trees
- loss of roosts in bridges/culverts

*Other Taxa*

Additional species such as Common Frog, Common Lizard, small mammals and invertebrates may be directly affected by land take which may occur during decommissioning though this is considered unlikely to be significant. No impacts are predicted in Marsh Fritillary populations during decommissioning.

### *7.5.5.2 Potential Indirect Impacts*

Potential Indirect Impacts during decommissioning on the following are addressed below:

- Designated Nature Conservation Sites
- Habitats and Flora
- Avifauna
- Mammals (excluding Bats)
- Aquatic Ecology and Fisheries
- Bats
- Other Taxa

*Designated Nature Conservation Sites*

Natura 2000 sites
An accompanying NIS has been prepared for the proposed development and accompanies this EIS. The NIS addresses potential impacts on Natura 2000 sites resulting from the proposed development.

Natural Heritage Areas or Proposed Natural Heritage Areas
NHAs or pNHAa with hydrological links to the proposed Maighne Wind Farm have the potential to be indirectly impacted due to hydrological changes and impacts such as increased siltation, nutrient release and/or contaminated run-off through drainage channels and watercourses. The Rye Water/Carton pNHA (001398) is located downstream of the proposed trenchless crossing of the River Rye Water and potential impacts are as follows:

1. Reduction in water quality (a key element of site) and consequent impacts on *Vertigo* snails within the Rye Water/Carton pNHA; reduction in water quality of portion of canal which is overlapped by site boundary.
2. Reduction in water quality (a key element of site) and consequent reduction in area or Petrifying springs habitat in Rye Water/Carton pNHA.

*Habitats and Flora*

Rhododendron was recorded within the proposed development site. This is a highly invasive plant species and is easily spread by human activities such as construction works. Therefore the proposed development could affect the existing environment by facilitating the indirect spread of these species during the decommissioning process. It is considered that indirect impacts on habitats and flora during the decommissioning process are possible; mitigation required.

*Avifauna*

The following matrix outlines the assessment of indirect impacts on key avifauna receptors during decommissioning, based on the criteria previously outlined. Note: the criteria utilised in the current assessment to define duration were as follows, from published guidance [1]:

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

The current time period predicted for decommissioning of the project is 12-18 months (see Chapter 2 for planning and construction programme).

### Table 7.82: Indirect Impact assessment matrix for key avifauna receptors during decommissioning

| Key Receptor (Sensitivity) | Decommissioning Indirect Impact Character | Significance without mitigation |
|---|---|---|
| Whooper Swan (Very High) | Possible disturbance from feeding sites if decommissioning period overlaps wintering period (Oct-March). Literature suggests swans can become habituated to daily disturbance [114] and the presence of decommissioning machinery/personnel will not result in significant disturbance. | Probability of some temporary to short-term disturbance **high** >50%; Magnitude **negligible** due to low numbers and habituation and evidence in literature. Overall impact assessed as **Low.** |
| Golden Plover (Medium) | Possible disturbance during winter months from feeding or roosting locations during daytime hours during decommissioning; feeding is mainly nocturnal and ample displacement habitat is available for during daylight hours. Numbers on site low. Literature suggests differences in densities pre and post construction of wind farms not significant [63]. | Probability of some temporary to short term disturbance to wintering birds **high,** magnitude **negligible** due to low numbers recorded on site and availability of alternative habitat. Impact assessed as **very low.** |
| Kingfisher (High) | Possible indirect impacts through pollution events, runoff etc. which may impact on water quality downstream from the site and thus affect prey availability / breeding success/ foraging ability. | Probability of temporary to short term indirect impacts occurring **medium,** magnitude assessed as **medium**, overall significance is **medium**. |
| Peregrine (High) | Possible disturbance to foraging birds through noise, visual intrusion. No displacement from foraging areas or breeding sites. Disturbance unlikely as the species adapts to urban environments easily and is unlikely to be disturbed by machinery/personnel. | Probability of temporary to short term impact **low**; magnitude assessed as **negligible**; overall impact **very low.** |
| Merlin (High) | Possible noise/ visual intrusion disturbance to foraging breeding birds if present at Hortland. Unlikely to be significant due to habituation over lifetime of windfarm. | Probability of temporary to short term impacts **low;** magnitude assessed as **negligible;** overall impact **very low.** |
| Lapwing (Medium) | Possible disturbance to breeding birds during relevant breeding season. Studies on | Probability of temporary to short term impact **medium**, magnitude |

| Key Receptor (Sensitivity) | Decommissioning Indirect Impact Character | Significance without mitigation |
|---|---|---|
| | disturbance to nesting lapwing found that increased nest visits (i.e. disturbance) did not reduce Lapwing clutch survival [117]. The level of disturbance associated with decommissioning will not be significant. | **low** based on literature. Overall impact significance **very low**. |
| Eurasian Curlew (High) | Breeding birds at Lodge Bog are considered here: No disturbance to birds during decommissioning as cables will remain *in situ* underneath public road adjacent to Lodge Bog. | Probability appraised as **low**; magnitude assessed as **negligible** should disturbance occur; overall impact is assessed as **very low**. |
| Common Snipe (Medium) | Possible disturbance to breeding birds during decommissioning; Literature suggests significant declines in densities during construction [63] which may lead to previously published density declines post construction; however decommissioning disturbance is not comparable to construction and no habitat alteration is foreseen. | Probability of temporary to short term impact **high**; magnitude assessed as **medium** due to reduced disturbance; overall impact assessed as **low.** |
| Woodcock (Medium) | Disturbance during decommissioning due to presence of machinery/personnel. Though strongly associated with deciduous woodland in most studies, areas of pre-thicket forestry with dense ground vegetation may also support breeding birds [107]. At the subject site 2 territories were located one of which overlaps the proposed substation location (located in pre-thicket second rotation forestry). However multiple nesting opportunities exist in the area in conifer woodland, birch woodland and deciduous woodland. | Probability of temporary to short term impact **Medium.** Magnitude may be **medium** if birds breeding at substation location. Overall significance is **low.** |
| Barn Owl (High) | Disturbance during decommissioning would be disturbance of nests sites due to presence of machinery/personnel should they occur adjacent to works. Densities in the area very low and a large number of suitable breeding sites are unoccupied. As a mainly nocturnal species disturbance is greatly reduced. | Probability of temporary to short term impacts **low**. Magnitude likely to be **low** even should birds be nesting in e.g. a mature tree proximal to works Overall significance assessed as **very low.** |
| Buzzard (Low) | Possible during decommissioning impact would disturbance to nest sites through noise/visual intrusion. Disturbance unlikely. High breeding densities in the area. | Probability of temporary to short term impacts **medium.** Magnitude **low** .Overall significance **very low.** |
| Yellowhammer (Medium) | Noise disturbance. Studies on the impacts of wind farms during both construction [63] and operation [62] have found little evidence of significant disturbance effects on passerine species; and this is likely to be less during decommissioning. | Probability of temporary to short term impacts is **low**. Magnitude assessed as **medium.** Overall significance assessed as **very low.** |
| Kestrel (Low) | Possible impacts include disturbance to breeding or foraging birds. Disturbance not likely are Kestrels are birds of open countryside and exhibit habituation to vehicle disturbance such as along motorways. | Probability of temporary to short term impacts **medium** as hedgerow/tree removal to be minimal/zero. Magnitude assessed as **high** should nest site loss occur. Overall impact significance is **very low**. |

| Key Receptor (Sensitivity) | Decommissioning Indirect Impact Character | Significance without mitigation |
|---|---|---|
| Hen Harrier (High) | Indirect impacts are not predicted. | Probability of impacts **low**; magnitude **low**; overall impact **low**. |
| Whinchat (Medium) | Indirect impacts are not predicted. | Probability of impacts **low**; magnitude **negligible**; overall impact **very low**. |

*Mammals (excluding Bats)*

The potential exists for indirect impacts via both visual and noise disturbance, in particular decommissioning works overlap with periods of activity by badger or Pine Marten. Badgers may also be excluded from foraging areas due to screening/fencing erected during works. Indirect impacts are therefore considered unlikely to be significant due to works primarily taking place in daylight hours. Pine Marten may also be excluded from foraging areas due to screening/fencing erected during works. Indirect impacts are therefore considered unlikely to be significant given the short duration of works. It is therefore considered that indirect impacts are extremely unlikely given the short duration of works.

Otter
Otters may be indirectly impacted through decommissioning works which disturb an occupied breeding or resting sites. This is considered unlikely due to roads and stream/river crossings already being in place.

Sediment and/or contaminated run-off entering streams and waterways could reduce water quality within areas where prey items occur, an increase in sediment could also lead to the smothering of spawning grounds if present thereby inducing longer term effects on prey availability; however this should be minimal during the decommissioning process. It is considered that indirect impacts on Otter are unlikely.

*Aquatic Ecology and Fisheries*

The decommissioning phase of the proposed wind farm site gives rise to similar potential impacts as can be realised during the construction phase; although the magnitude of the impact of decommissioning is normally reduced as all infrastructure is already in place on the site and no earthworks would take place. With suitable planning and provision of adequate mitigation potential impacts on the receiving aquatic environment during decommissioning can be minimised.

*Bats*

The possible impacts on bats during the decommissioning phase of the wind development are the same as those given for the construction phase of the project as similar activities which may affect bats will again be undertaken both on and offsite resulting in potential impacts as follows:

- disturbance due to increased human activity.

*Other Taxa*

Impacts on other taxa are considered extremely unlikely to be significant.

### *7.5.5.3 Potential Cumulative Impacts during Decommissioning*

Potential cumulative impacts during decommissioning on key receptors identified are addressed below:

- Designated Nature Conservation Sites
- Habitats and Flora
- Avifauna

- Mammals (excluding Bats)
- Aquatic Ecology and Fisheries
- Bats
- Other Taxa

*Designated Nature Conservation Sites*

As no direct impacts are predicted on designated nature conservation sites during decommissioning of the proposed wind farm then no additive effects due to in combination direct impacts with other existing sources of direct impact are predicted.

Indirect impacts predicted during decommissioning periods due to impacts such as increased siltation, nutrient release and/or contaminated run-off through drainage channels and watercourses do have the potential to combine with other sources of impact such as runoff from farming or forestry practices, contamination events etc. where hydrological links exist. An accompanying NIS has been prepared for the proposed development and accompanies the application for consent. The NIS addresses potential impacts on European sites resulting from the proposed development.

*Habitats and Flora*

No significant cumulative impacts on Habitats and Flora are predicted during the decommissioning process. Minimal amounts of land take may occur during the decommissioning process which may act cumulatively with any other projects ongoing at the time. There is potential for dispersion of invasive species which may act cumulatively with any other projects ongoing at the time. These may require mitigation to neutralize the predicted effect. It is considered possible that these may be significant.

*Avifauna*

A minimal amount of land take may be required during the decommissioning process in particular of hedgerows. Disturbance or effective habitat loss indirectly during decommissioning is more difficult to quantify; especially as most species of birds may habituate to disturbance over time. Key Receptors in the case of the subject site such as Swans have been shown to exhibit habituation to human disturbance and the presence of turbines [115] [114] and Golden Plover have been shown also to become habituated to wind farms [120] [121] therefore the long term in combination impact is assessed as negligible and unlikely to be significant.

*Mammals (excluding Bats)*

Mammal breeding or resting sites may be cumulatively impacted by other developments which either remove potential breeding sites (e.g. road construction) or farming or forestry activities which may for example remove Badger Setts, Pine Marten breeding sites etc. Mitigation may therefore be required to neutralise the effect of the proposed wind farm. However with the implementation of best practice methods during construction in regard to mammals such as Otter and Badger it is considered unlikely that any cumulative impacts will be significant.

*Aquatic Ecology and Fisheries*

The decommissioning phase of the proposed wind farm site gives rise to similar potential impacts as can be realised during the construction phase; although the magnitude of the impact of decommissioning is normally reduced as all infrastructure is already in place on the site and no earthworks would take place. With suitable planning and provision of adequate mitigation potential impacts on the receiving aquatic environment during decommissioning can be minimised.

*Bats*

The possible impacts on bats during the decommissioning phase of the wind development are the same as those given for the construction phase of the project as similar activities which may affect bats will again be undertaken both on and offsite.

## 7.6 Mitigation Measures

Any potential impacts will be minimised by implementing the following mitigation and enhancement measures, such that residual impacts associated with the proposed development will be acceptable.

A Project Ecologist will be appointed to oversee all works and mitigation measures during construction, operational and decommissioning phases.

### 7.6.1 Mitigation Measures during Construction

#### *7.6.1.1 Designated Nature conservation sites*

Implement mitigation measures outlined in Chapter 8 'Geology and Slope Stability', Chapter 9 'Hydrology' and Chapter 10 'Water Quality' of this EIS, in addition to the accompanying NIS and section 7.5.3.3, below, to minimise and prevent the identified indirect impacts on the River Boyne and River Blackwater cSAC, the River Boyne and River Blackwater SPA, the River Barrow and River Nore cSAC, the Rye Water/Carton cSAC and Ballynafagh Lake cSAC.

#### *7.6.1.2 Habitats*

A Habitat and Species Management Plan which will detail habitat restoration measures will be appropriately planned and designed to avoid/minimise any potential conflicts between the proposed development and the positive impacts of increasing habitat diversity in close vicinity to operational turbines. An appropriately qualified and experienced ecologist will review and, where required, amend the proposed Habitat and Species Management Plan and consult with NPWS to seek their views on the implementation of the proposed measures. Enhancement measures will include butterflies such as Marsh Fritillary.

Any re-instated habitats such as Hedgerows will utilise native species suitable for the area.

*Indirect impacts on Raised Bogs at Windmill and Drehid-Hortland*

In order to protect the existing raised bog and nearby groundwater wells from the effects of dewatering, if high permeability strata are encountered along with strong groundwater inflow within excavations, groundwater cut-off techniques (such as sheet piling) will be used in preference to lowering of the water table (dewatering). The precise technique to be used will be determined at detailed design stage following a full ground investigation. This will avoid the possibility of significant drainage of the adjacent peat bogs. It should also be noted that the majority of excavations close to peat bogs will not extend much deeper than the existing drainage network. Any dewatering will be temporary, during construction only and will not have time to cause drainage of the peat, which due to the low permeability of the peat would result in very slow drainage.

#### *7.6.1.3 Aquatic Ecology*

In advance of any works taking place, a method statement for protecting watercourses and waterbodies on the site will be prepared following further consultation with the IFI and NPWS and detailed in the final Construction Environmental Management Plan (CEMP). An outline Construction Environmental Management Plan has been prepared and is included in the Environmental Impact Statement (Appendix D).

The Construction Method Statement will be distributed and discussed with all parties involved in the construction of the wind farm site (including any sub-contractors) in order to protect aquatic conservation interests within the study area. The CEMP will set out measures to avoid siltation, erosion, surface water run-off and accidental pollution events which all have the potential to adversely affect water quality within the site during the construction phase.

The CEMP will detail preparatory works on the site, including installation of silt fences and bunds. The preparatory work including assessment of existing bridge crossings will be undertaken in advance of any excavations on the site. A sealed silt fence will be placed at both sides of the crossing points and to a minimum of 10m upstream and downstream of each crossing at both sides of the road. All measures provided for the protection of aquatic ecology and fisheries within the proposed development site, in addition to the mitigation measures for water quality protection to be detailed in the CEMP, will effectively protect aquatic ecological interests downstream of the proposed development.

All access tracks will be designed to minimise excavation on the site and reduce the risk of sediment runoff. Swales for turbine bases and hard standings will be constructed. It is not expected that overland flows will be obstructed to any great extent as a result of the layout of the wind farm, however where required, interceptor channels will collect overland flows on the upslope side of the access tracks and hard standing areas. The interceptor channels will cross the access tracks in cross-drains which will be provided at regular intervals

A buffer of 50 m from watercourses has been adopted. Where site tracks are existing rather than a new site track, this buffer will not apply.

All infrastructure will set back 50 m away from all streams within the site except for the main crossings and the entrance to the Hortland portion of Drehid-Hortland (near T40) which is <50m (although an existing track is partially utilised). An access road at Cloncumber is also <50m from a water feature. The contractor will also ensure that trafficking on site is kept to a minimum and the routes of haul roads are kept away from watercourses as far as possible.

Where haul roads pass close to watercourses, silt fencing will be used to protect the streams. Again, maintenance and monitoring of such silt fences will be subject to an on-site quality management system as set out in the CEMP.

Cross-drains will be provided for drainage crossings and conveying flows from existing and proposed drains across the access tracks. Any new or upgraded culverts will be sized appropriately.

A method statement for streams crossings (roads and cables) will be finalised following consultation with NPWS and IFI and will follow the guidelines set out in (Murphy, 2004 [150]) and the NRA (2008) [151] '*Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes*' and also the latest IFI guidelines. In relation to cable crossing, trenchless techniques will be used when other alternatives (i.e. placing cables on bridges, open cut techniques) are not practical. There are two options available:

i. Trenchless Technique #1

Horizontal direction drilling is a widely-used method of installing underground pipes and cables whereby a surface-launched drilling rig would be used to drill in an underground arc beneath the watercourse, with minimal impact on the surrounding area.

ii. Trenchless Technique #2

This would involve digging two pits, an entrance pit and a receiving pit, on either side of the watercourse. The two pits would then be connected by ducts underground, installed either by a drilling or pipe-ramming method, without disturbing the watercourse above.

The optimal construction technique will be selected on the basis of detailed site investigation at the crossing locations and following consultation with Kildare and Meath County Councils and statutory authorities including Inland Fisheries Ireland.

In the event that trenchless techniques utilise drilling; a biodegradable fluid such as CLEARBORE will be used rather than Bentonite.

In addition a contingency and resource protection plan to include the following will be prepared:

1. Drilling operations to be limited to daytime hours and conditions when low levels of rainfall are forecast.
2. Drilling fluid materials and their respective data sheets shall be included in the method statement for waterways or stream crossings.
3. Any site specific investigation results shall be disclosed. Investigations will include review of all available data from utility owners, site investigations, trial holes, ground penetrating radar as might be appropriate for the location.
4. Materials such as suitable biodegradable absorbent material, silt fencing and gravel bags (plastic, gravel filled bags) shall be kept at boring sites in sufficient quantities to contain any release of drilling fluid.
5. A visual inspection shall be undertaken of the planned bore path prior to the boring operation to ensure any or all utilities and substructures have been identified and test holes have been properly prepared.
6. At stream crossings with flowing water, water monitors will be placed upstream and downstream of the crossing point, access permitting.
7. Onsite training shall be provided for all monitors, and names and phone numbers provided to site supervisors.
8. Upon completion of each drill rod, the monitoring person/team will be provided with information in relation to position of entry and exit of drilling head, amount of fluid utilized or pumped, equipment breakdowns or repairs, any abnormal drilling pressures recorded and any change of drilling fluid contents.
9. A field response plan to minimize loss of returns of drilling fluid and actions to restore returns shall be provided.
10. Equipment required to clean up and contain any released drilling fluid will be available at the work site or at an offsite location at the temporary construction compounds.
11. In the event of a release of drilling fluid; works will stop immediately, the bore stem shall be pulled back to relieve pressure and the site supervisor notified to ensure adequate actions are taken and notifications made. In addition terrestrial releases shall be cleaned up using on site equipment and a terrestrial berm will be constructed around any terrestrial release.
12. Silt fences will be constructed around proposed work areas prior to commencement of works.
13. Refueling of equipment will take place at the temporary construction compounds or with a mobile bowser a minimum of 100 m from watercourse.
14. Pre-construction Ecological surveys shall take place at drilling sites to determine whether any sensitive species or species requiring derogations (such as Otter) are present.
15. Works will be monitored by the project ecologist.
16. Any dewatering of the pits will be pumped to land as far from the watercourse as possible to allow it to infiltrate through the field or to a stilling pond or alternative to a holding tank, tested and appropriately discharged under licence.

The contractor shall ensure that erosion control and attenuation facilities, namely silt fences and silt curtains are regularly maintained during the construction phase. Spoil heaps from the excavations for the turbine bases and trenches will be covered with geotextile and surrounded by silt fences to filter sediment from the surface water run-off from excavated material. Cable trenches within the wind farm clusters will be located 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 any cable trenches at intervals.

An Emergency Silt Control and Spillage Response Procedure will be included as a contingency in the CEMP which will detail the required measures for the Contractor to implement in the event of a ‘worst case’ scenario on the site. Timing of the proposed works will also take account of the fisheries constraints within the study area, where no works will be undertaken in the instream environment during the salmonid close season.

A risk assessment will be prepared prior to any wet concrete operations being carried out. All concreting works will be fully detailed in the Contractor's Construction Method Statement and will be minimised, particularly adjacent to the aquatic environment.

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

Wheel washing facilities will be provided at the site entrance draining to silt traps. These units will be self-contained and will filter the waste for ease of disposal. Waste will be removed from each unit and from site by a permitted contractor. Additional silt fencing will be kept on site for the ongoing maintenance of the structures provided. Portaloos will be used to provide toilet facilities for site personnel. Sanitary waste will be removed from site via a permitted waste contractor(s) and will not be discharged on site.

Any diesel or fuel oils stored on site will be bunded 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 at a number of dedicated refuelling station locations on site, typically at each compound or at least 100m from a watercourse using mobile bowsers. 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.

Appropriate preventative measures will be detailed within the CEMP, and are set out in the outline CEMP, so as to ensure that non-native aquatic/riparian species are not introduced into the site. These measures will follow as relevant the manual '*The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads'* by NRA (2010) [(152)].

The contractor 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 provisions within the CEMP for the site will effectively result in the control of erosion and siltation on the site. This is considered to be the key mitigation measure for the protection of aquatic species located in downstream receiving waters.

The works programme for the site will incorporate erosion and sediment control to be detailed in the CEMP including the installation of drainage and runoff controls before starting site clearance and earthworks; minimisation of the area of exposed ground; preventing runoff entering the site from adjacent ground; provision of appropriate control and containment measures on site; monitoring and maintenance of erosion and sediment controls throughout the project; and establishing vegetation as soon as practical on all areas where soil has been exposed. The design of all silt and erosion control measures on the site including silt traps and siltation ponds, culverts and cross-drains will be based on the peak flood flows determined using the procedure set out in CIRIA (2006) [(153)].

Due to the fact that the proposed site is located within the catchment areas of important salmonid rivers, effective water runoff protection methods will be integrated into the detailed CEMP and contractor's method statement. Chapter 10 - Water Quality of this EIS also provides run-off prevention measures that will be utilised in the CEMP for the proposed development. The implementation of the water quality protection measures will be incorporated into an Environmental Commitments audit checklist for the site.

There will no excavations in close proximity to riparian habitats or instream works during the salmonid close season (October–March annually) in order to protect spawning salmonids, incubating ova and emerging fry. Any upgraded bridges or culverts will be designed to be passable by fish.

#### *7.6.1.4 Flora*

The following methods will be implemented to ensure that invasive alien species are not accidentally introduced or spread during construction:

- Measures to be utilised to deal with invasive species will be included in the CEMP .These measures will follow as relevant the manual '

*The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads'* by NRA (2010) [152]; and cognisance will be made of '*The Best Practice Management Guidelines*' produced by Invasive Species Ireland (Maguire et al, 2008 [154]).

- Rhododendron was primarily located at the edge of the cluster boundary (forestry entrance at Hortland). Any new patches of Rhododendron that are located during construction and operation of the wind farm will be treated to prevent further spread of this plant. Where Rhododendron has established, such areas will be eradicated by a suitably qualified person prior to construction to prevent further spread of this highly invasive plant. For this location cutting and stump treatment with an appropriate herbicide is likely to be the most effective measure. Additional applications of herbicide of any regrowth will be required to achieve complete eradication.

Wheel washes draining to silt traps will be implemented at site entrances to prevent the possible spread of any invasive species.

#### *7.6.1.5 Birds*

Tree removal and clearance of any other vegetation likely to hold high numbers of nesting birds will take place outside of the bird breeding season *i.e.* not during the period of March to August inclusive where possible. This includes hedgerow and scrub removal in addition to hedgerow trimming along turbine delivery routes and proposed cable routes. This will help protect nesting birds. This in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds [64].

In relation to breeding Lapwing, although no turbines are proposed at located nests sites; all turbine locations in suitable breeding locations (Derrybrennan and Cloncumber) will be surveyed for breeding Lapwing should proposed works occur within the Lapwing Breeding Season (April to June). Should any be present at exact turbine locations, then no works shall be undertaken during the period April-June to allow breeding to progress. Any works required to be carried out during the breeding season close to these locations shall be supervised by the project ecologist with stop works authority (so as to minimise disturbance).

Construction operations will take place during the hours of daylight to minimise disturbances to roosting birds, or active nocturnal bird species. This in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds [64]. Limited operations such as concrete pours and turbine erection may require night-time operating hours; these will be detailed in the CEMP and supervised by the project ecologist.

Toolbox talks with construction staff on disturbance to key species during construction. This will help minimise disturbance. This in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds [64].

Sections of hedgerow scheduled for removal and/or trimming, and containing mature trees suitable for nesting Barn Owls will be surveyed prior to construction for occupancy by Owls. Should Owls be present then minimum protection zones as outlined in published guidance will be adhered to for the period of construction or until breeding has ceased [135].

Due to published impacts during construction on breeding Snipe and the assessment of significance, the following restrictions shall apply; areas known to have had breeding Snipe territories will be re-surveyed prior to the commencement of construction. An exclusion zone of 500m shall be placed around recorded nest sites April to June, to reduce possibility of disturbing birds during critical periods of breeding season, as per published literature [63]. The implementation of this measure will be monitored by the project ecologist.

Re-instated hedgerows will be planted with native species, locally sourced, this will result in habitat enhancement for local species of conservation importance such as Yellowhammer. This in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds [64].

Kingfisher: Implement mitigation measures outlined in Chapter 8 'Geology and Slope Stability', Chapter 9 'Hydrology' and Chapter 10 'Water Quality' of this EIS, and section 7.5.1.3, previous, to minimise and prevent the identified indirect impacts water quality.

Merlin:
Prior to scheduled commencement of construction; nest baskets suitable for Merlin will be placed in suitable locations (such as isolated trees on high bog or trees within forestry compartments which are in clearings) as these are often preferred nest locations. Locations chosen shall be >500m from proposed turbines; this is to encourage any birds scoping territories to take up nest sites suitably removed from turbines. This may also benefit birds not currently breeding (as breeding was not proved). This will occur at the Drehid-Hortland Cluster, within the 1km square identified (west of T32) and also at within the area identified as active raised bog (south of T13) (as an enhancement measure).

A pre-construction survey (March) will be conducted of the proposed turbine locations and adjacent high bog of the Hortland portion of Drehid-Hortland to assess any evidence of Merlin activity or taking up territories. Should Merlin be present then works at these locations will be restricted to outside the breeding season (April-July).

Curlew (Lodge Bog): Breeding Curlew at Lodge Bog will be surveyed prior to the commencement of construction to establish the location of occupied territories/breeding attempts. No construction works shall be undertaken within 1km of a Curlew breeding location during the period April to July.

All works will be monitored by the project ecologist.

#### *7.6.1.6 Mammals (excluding Bats)*

Construction operations will take place during the hours of daylight to minimise disturbances to faunal species at night. Limited operations such as concrete pours and turbine erection may require night-time operating hours; these will be detailed in the CEMP and supervised by the project ecologist.

Due to the time delays between initial surveys for terrestrial mammals and the likely construction date, a qualified ecologist will re-survey the hedgerow/woodland areas earmarked for development for Badger setts, Pine Marten dens or Red Squirrel dreys no more than 10–12 months prior to construction, with a further check immediately prior to vegetation clearance. In the event that a Badger sett is found, the NRA (2006) guidelines (contained in Appendix F8 for the treatment of Badgers will be followed. In addition the NPWS will be updated and consulted on the status of any Badger setts found. All works shall be overseen by the project ecologist.

All locations where river crossings are to occur and where construction of bridges or enhancement of existing bridges is required will be surveyed for Otter no more than 12-14 months prior to construction as per published guidance from the NRA. This will involve re-survey, by a qualified ecologist, of the locations in question for breeding or resting places of Otter. Survey methods will follow established best practice [155]. The location of the recorded Otter holt at Drehid-Hortland shall also be resurveyed no more than 12-14 months prior to construction as per published guidance from the NRA.

Should Otter breeding or resting sites be present then best practice guidance (NRA) in the treatment of Otters will be followed, under the terms of the obtained derogation. The NPWS will be updated on the status of any evidence found. All works shall be overseen by the project ecologist. In the event that the Otter holt recorded at Drehid-Hortland is active prior to construction commencing, mitigation measures such as the erection of screening, reduced timing of works, shall be implemented as per best practice guidance from the NRA, following consultation with NPWS. It should be noted that this holt is outside the red line boundary and unlikely to be affected.

At the Cloncumber cluster, in addition to the above screening shall be placed along the banks of the Cloncumber stream to prevent disturbance to Otters commuting between the Canal and the Slate River during the construction period.

Where possible tree felling of trees in forestry areas will be limited to time periods outside which Pine Martens may have young in dens (March and April). If this is unavoidable than areas to be clear felled will be surveyed in advance by a suitable qualified ecologist to determine whether any occupied Pine Marten dens are present. A necessary license under the wildlife act will be applied for should any sites have to be disturbed.

#### *7.6.1.7 Bats*

*Overview of impacts*

Risks to bats from wind turbines have to be acknowledged and it is possible that some bat mortality may occur due to the operation of the planned development therefore mitigation measures are recommended to reduce the likelihood of such fatalities.

*Assessment of conflict zones*

Standard mitigation measures, as would apply to any large-scale development, shall be adopted in the site clearance and construction of the turbines. These shall include limiting season of disturbance to trees and other vegetation so as to reduce impacts on breeding bird species and to implement measures to avoid and/or control pollution and sedimentation into watercourses. The following specific measures will be required to protect bats onsite.
The following mitigation measures are in line with the NRA guidelines on provisions for the conservation of bats during the planning and construction of roads (2006) (see Appendix F8). Reference is made to the NRA Guidelines (*Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes* and the *Guidelines for the Treatment of Bats during the Construction of National Road Schemes*).

Each of the proposed locations of the 47 turbines and sub-station was surveyed and the bat activity findings recorded have identified specific areas of conflict that are listed in Table 7.83 below along with recommended mitigation measures to prevent or reduce the potential negative impacts in these areas.

**Table 7.83: Assessment of potential turbine / sub-station / bat conflict zones**

| Turbine number | Nearest vegetation | Bat activity | Recommended mitigation measures and general comments |
|---|---|---|---|
| 1 | Hedgerow | Low | Survey veteran ash tree with bat roost potential |
| 2 | Hedgerow | Low | No mitigation required |
| 3 | Hedgerow | Low | No mitigation required |
| 4 | Hedgerow | Low | Remove hedgerow vegetation within 60m of the turbine shaft<br>Survey mature beech and horse chestnut trees with bat roost potential |
| 5 | Hedgerow | Low | Remove hedgerow vegetation within 60m of the turbine shaft |
| 6 | Hedgerow | Low | Survey mature beech trees with bat roost potential |
| 7 | Hedgerow | Low | No mitigation required |
| 8 | Hedgerow | Low | No mitigation required |
| 9 | Hedgerow | Low | No mitigation required |
| 10 | Hedgerow | Low | Survey mature beech trees with bat roost potential |
| 11 | In forestry | High | Remove all tree plantings within a 60m radius of the turbine shaft |
| 12 | In forestry | High | Remove all tree plantings within a 60m radius of the turbine shaft |
| 13 | Scrub | Low | Remove vegetation within 60m of the turbine shaft |
| 14 | Scrub | Low | Remove vegetation within 60m of the turbine shaft |
| 15 | Scrub | Low | Remove vegetation within 60m of the turbine shaft |
| 16 | Hedgerow | Low | Remove hedgerow vegetation within 60m of the turbine shaft |

| Turbine number | Nearest vegetation | Bat activity | Recommended mitigation measures and general comments |
|---|---|---|---|
| 17 | Hedgerow | Low | Remove hedgerow vegetation within 60m of the turbine shaft |
| 18 | Hedgerow | Low | Remove hedgerow vegetation within 60m of the turbine shaft |
| 19 | Hedgerow | Low | Remove hedgerow vegetation within 60m of the turbine shaft |
| 20 | Hedgerow | Low | No mitigation required |
| 21 | Hedgerow | Low | No mitigation required |
| 22 | Hedgerow | Low | No mitigation required |
| 23 | Hedgerow | Low | No mitigation required |
| 24 | N/A | Low | No mitigation required |
| 25 | N/A | Low | No mitigation required |
| 26 | N/A | Low | No mitigation required |
| 27 | N/A | Low | No mitigation required |
| 28 | In forestry | Low | No mitigation required |
| 29 | In forestry | Low | Remove all tree plantings within a 60m radius of the turbine shaft |
| 30 | In forestry | Low | Remove all tree plantings within a 60m radius of the turbine shaft |
| 31 | In forestry | Low | Remove all tree plantings within a 60m radius of the turbine shaft |
| 32 | In forestry | Low | Remove all tree plantings within a 60m radius of the turbine shaft |
| 33 | N/A | Low | No mitigation required |
| 34 | Hedgerow | High | Remove hedgerow vegetation within 60m of the turbine shaft |
| 35 | Hedgerow | Low | No mitigation required |
| 36 | N/A | Low | No mitigation required |
| 37 | N/A | Low | No mitigation required |
| 38 | N/A | Low | No mitigation required |
| 39 | N/A | Low | No mitigation required |
| 40 | In forestry | Low | Remove all tree plantings within a 60m radius of the turbine shaft |
| 41 | N/A | Low | No mitigation required |
| 42 | In forestry | High | Remove all tree plantings within a 60m radius of the turbine shaft |
| 43 | In forestry | High | Remove all tree plantings within a 60m radius of the turbine shaft |
| 44 | In forestry | Low | Remove all tree plantings within a 60m radius of the turbine shaft |
| 45 | In forestry | Low | Remove all tree plantings within a 60m radius of the turbine shaft |
| 46 | N/A | Low | No mitigation required |
| 47 | Hedgerow | Low | Remove hedgerow vegetation within 60m of the turbine shaft |

As shown in the previous table, apart from four sites needing pre-construction tree surveys, mitigation measures to protect bats are required at 22 of the 47 proposed turbine locations. In all cases it is recommended that existing vegetation is cleared to provide a vegetation-free buffer zone around the turbine. This includes turbines T31 and T32 at Cloncumber which are within a *Coillte*-owned, set-aside biodiversity area. This area mainly consists of non-native coniferous woodland and removing such within a 60m radius of both turbines will not impact on the biodiversity value of the site as tree clearance should encourage the growth of ground-cover native bog flora.

In all cases it is recommended that existing vegetation is cleared to provide a vegetation-free buffer zone around the turbine. This includes turbines T31 and T32 at Cloncumber which are within a *Coillte*-owned, set-aside biodiversity area. This area mainly consists of non-native coniferous woodland and removing such within a 60m radius of both turbines will not impact on the biodiversity value of the site as tree clearance should encourage the growth of ground-cover native bog flora.

### *Buffer zones*

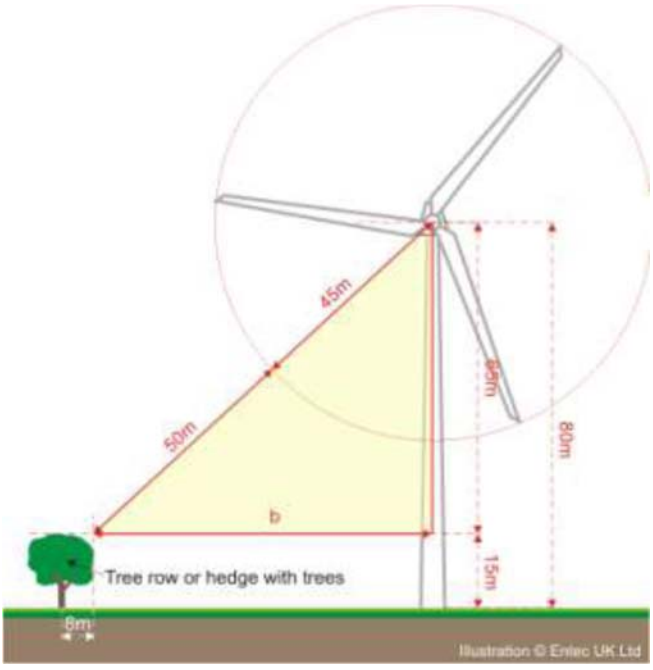
Bats commuting and foraging along onsite forest edge, treelines and hedgerows will be safeguarded by providing a 50m minimum distance buffer zone between the rotors of the planned turbines and the nearest vegetation to reduce the risk of collision and/or barotrauma. This is in line with present best practice guidelines (Carlin and Mitchell-Jones 2012) and should prevent impacts to bats that mainly fly low along such linear features e.g. the pipistrelles. Such a buffer zone can be provided by either siting the turbines so that rotors are a minimum of 50m away from existing vegetation or by felling any trees within 50m of rotors. Such cleared vegetation should be managed and maintained during the operational life of the development.

From Carlin and Mitchell-Jones 2012: "*It is incorrect to measure 50m from the turbine base to habitat feature at ground level as this would bring the blade tips very close to the canopy of a tall hedgerow tree and potentially put bat populations at risk. Instead, it is necessary to calculate the distance between the edge of the feature and the centre of the tower (b) using the formula:*

$$b = \sqrt{(50 + bl)^2 - (hh - fh)^2}$$

*where, (in metres):*

*bl = blade length*
*hh = hub height*
*fh = feature height*




*For the example above, b = 69.3m*

### *Removal of deciduous trees*

Any mature broadleaved trees that are to be removed, will first be surveyed for bat presence by a suitably experienced specialist. If bats are found, an application for a derogation licence will be made to the National Parks and Wildlife Service to allow its legal removal. Such trees will ideally be felled in the period late August to late October, or early November, in order to avoid disturbance of any roosting bats as per *National Roads Authority* guidelines (NRA 2006a and 2006b [22]- see Appendix F8) and also to avoid the bird breeding seasons. Tree felling will be completed by Mid-November at the latest as bats roosting in trees are very vulnerable to disturbance during their hibernation period (November – April). Trees with ivy *Hedera helix* cover, once felled, will be left intact onsite for 24 hours prior to disposal to allow any bats beneath foliage to escape overnight.

Landowners will be advised that the timber from felled trees will remain for their use. This will prevent trees being felled prematurely.

### *Retention of trees*

Several species of bats roost in trees. Where possible, treelines and mature trees that are located immediately adjacent to the line of TDR routes or are not directly impacted will be avoided and retained intact. Overall impacts on these sites will be reduced through modified design and sensitivity during construction. Any trees and treelines along approach roads and planned site access tracks will be retained where possible. Retained trees will be protected from root damage by machinery by an exclusion zone of at least 7m or equivalent to canopy height. Such protected trees will be fenced off by adequate temporary fencing prior to other works commencing.

### *HV and MV cable routes – other structures*

Should any further structures be impacted by changes to the current proposed HV and MV cable routes then these will be assessed for their potential to harbour bats prior to works and the findings reported. If bat use is confirmed, appropriate mitigation measures should be taken to ensure no animals are harmed.

### *Compensation for loss of commuting routes*

Linear features such as hedgerows and treelines serve as commuting corridors for bats (and other wildlife). Mitigation measures are recommended to compensate for the loss of these features that are used by bats as commuting routes. These measures will also compensate for habitat loss and provide continuity in the landscape.

Severed linear features such as hedgerows and treelines should, where possible, be reconnected using semi-mature trees under-planted with hedgerow species to compensate for the loss of treelines and hedgerows that are currently used by bats. The exact locations of such planting will be designed at detailed landscaping stage. Native species should be used as they support more insect life than non-native varieties.

All planting shall preferably, be completed during the pre-construction phase to provide hedgerow/tree growth prior to completion of the development. This would ensure that bats commuting in the area have prior knowledge of newly planted landscape features as well as ensuring the newly planted hedgerows/treelines are well established prior to completion of the wind farm.

### *Habitat retention, replacement and landscaping*

Habitat replacement and landscaping could compensate for or add to the wildlife value of the area and also provide areas of aesthetic as well as wildlife interest. Further pro-active habitat restoration measures are considered below.

In general, best practice design will aim to retain the quality of the landscape where possible and ensure its protection within the landscaping programme. Existing hedgerows and treelines, semi-natural scrub or semi-natural grasslands should be retained where possible and incorporated into the landscaping programme.

The overall design of the project will also include habitat replacement or enhancement of existing onsite woodland, hedgerow, treeline and scrub habitats and it is recommended that the planting of native broadleaved trees is also considered. Native species will be chosen in all landscaping schemes. Planting schemes will attempt to link in with existing wildlife corridors (hedgerows and treelines) to provide continuity of wildlife corridors.

*Bridges and culverts on cable/turbine delivery routes*

If any of the structures previously listed that showed potential for use by bats or any other local bridge that is to be strengthened prior to use for haulage of construction materials for this development, it should first be surveyed/re-surveyed for bat presence prior to any upgrading or maintenance works. Bats, especially Daubenton's, regularly use bridges for roosting and are vulnerable within such structures due to infilling of crevices during which they may be entombed. If bats are found then some crevices beneath the bridge will be retained for their continued use according to best practice bat mitigation measures for bridge works (see *Billington and Norman 1997* [156], *Highways Agency 2001* [157], *Joint Nature Conservation Committee 2004* [158], *National Roads Authority 2006a/2006b* [23] and *Shiel 1999* [159]). Any re-pointing or pressure grouting of bridges will only proceed after an inspection of the structure for bats and, should bats be found, an application for a derogation licence to legally allow works on or near a bat roost, which is a notifiable action under current legislation (see Appendix F6: Bat Survey Report), will be made to the National Parks and Wildlife Service.

*Lighting restrictions*

In general, artificial light creates a barrier to bats so lighting should be avoided where possible. Where lighting is required, directional lighting (i.e. lighting which only shines on work areas and not nearby countryside) should be used to prevent overspill. This will be achieved by the design of the luminaire and by using accessories such as hoods, cowls, louvers and shields to direct the light to the intended area only.

### *7.6.1.8 Other Taxa present on site*

Marsh Fritillary:

Linear habitat features along proposed internal access roads to Derrybrennan, Cloncumber, and Drehid-Hortland where road widening or instatement of new roads is required, will be examined by a suitably qualified ecologist for the presence of Marsh Fritillary butterfly larvae prior to the commencement of works and a translocation programme will be undertaken should Marsh Fritillary be recorded. This will not apply to roads in improved agricultural grassland.

The construction works adjacent to the sensitive butterfly habitats identified within the proposed development will require adequate fencing to avoid trampling and further impacts outside of the required land take.

Monitoring for the presence of Marsh Fritillary and control of the contractor's works on site within these sites will be managed by an appointed site ecologist in direct consultation with the NPWS.

Landscaping works post construction will include the provision of suitable habitats for butterflies in general, including Marsh Fritillary. The following measures will be incorporated into Habitat and Species Management plan as a general enhancement measure, in areas where potentially high quality habitat for butterflies could be created (such as clearfelled forestry on bog/ wet grassland etc.):

Avoidance of smoothing out the soil around any facility; creation of undulations in the ground and do not sew any seed unless taken from plants in the vicinity of the project.

Creation for slopes with a south or west facing aspect.

Any material alongside access tracks/roads will be placed alongside the route and given a broad "A" shape and where possible face south or west.

Clearance of scrub in the area around the facility to allow a semi-natural grassland to develop.

Clearing of encroaching scrub every five years and scraping of parts of the surface to interrupt natural succession and manage the habitat for lepidoptera. Done during winter.

Create a pond/wetland by removal of peat where only a thin layer remains to expose marl. Shallow ponds (maximum depth of about 60 cm) with shallow edges/margins will attract amphibians while wetland plants like Cuckoo-flower, Purple Loosestrife and Devil's-bit Scabious will attract butterflies and moths. Scrape parts of the ground around the pond and drag the parts of the bottom of the pond every five years to maintain the habitat. Do this in September/October.

### 7.6.2 Mitigation Measures During Operation

#### *7.6.2.1 Designated Nature conservation sites*

Implement mitigation measures outlined in Chapter 8 'Geology and Slope Stability', Chapter 9 'Hydrology' and Chapter 10 'Water Quality' of this EIS, in addition to the NIS and Section 7.6.2.3 below, to minimise and prevent the identified indirect impacts on water quality as outlined previously.

#### *7.6.2.2 Habitats and Flora*

Implement mitigation measures outlined in Chapter 8 'Geology and Slope Stability', Chapter 9 'Hydrology' and Chapter 10 'Water Quality' of this EIS, and Section 7.6.2.3, below, to ensure that there will be no contamination of water bodies due to siltation or contaminated run-off during the operational phase.

Wheel washes, draining to silt traps will be implemented at the site entrance to prevent the possible spread of any invasive species.

#### *7.6.2.3 Aquatic Ecology*

During the operation phase, oils will be required for cooling the transformers giving rise to the potential for oil spills within the site. The transformers will be bunded to over 110% of the volume of oil within them.

It is not envisaged that maintenance will involve any significant impacts on the hydrological regime of the area. Weekly inspections of the erosion and sediment control measures on site will be required during the construction period, followed by fortnightly inspections until the risk of erosion or siltation has declined following the successful establishment of vegetation during the operational phase.

Access to the site will be limited using gates to prevent illegal dumping on the site, use of off road vehicles etc.

#### *7.6.2.4 Birds*

Bird diverters shall also be placed on the proposed meteorological mast guy wires following SNH guidance. In a study in the Netherlands, decreases in collision rates of up to 80% were recorded with flight diverters installed at 5m intervals [160]. Additional research shows that the attachment of line markers can reduce bird collisions on overhead lines by at least 50-60% (Jenkins *et al.*, 2010 [161]; Barrientos *et al.,* 2011 [162]; Martin, 2011 [124]; APLIC, 2012 [163]).

A post construction monitoring programme is to be implemented at the subject site in order to confirm the efficacy of this method; the results of this are to be submitted annually to the competent authority and NPWS. published guidance on assessing the impacts of wind farms on birds from English Nature and the Royal Society for the protection of birds recommends the implementation of an agreed post development monitoring programme as a best practice mitigation measure [64].

In addition published recommendations on swans and wind farms [116] suggests that systematic post construction monitoring ; adapted to quantify collision, barrier and displacement, be conducted over a period of sufficient duration to allow for annual variation or in combination effects. The following individual components are proposed.

1) Fatality Monitoring: A comprehensive fatality monitoring programme is to be undertaken following published best practice; the primary components are as follows:

    a. Initial carcass removal trials to establish levels of predator removal of possible fatalities. This is to be done following best recommended practice and with due cognisance to published effects such as predator swamping, whereby excessive placement of carcasses increases predator presence and consequently skews results [164]. No turbines which are used for carcass removal trials are to be used for subsequent fatality monitoring.
    b. Turbine searches for fatalities are to be undertaken following best practice [115] [128] in terms of search area (minimum radius hub height) and at intervals selected to effectively sample fatality rates based on carcass removal rates (e.g. 2 per month). To be conducted for an initial period of 7 years to allow for annual variation and cumulative effects. Dependant on results further monitoring to be agreed with NPWS.
    c. The large scale of the proposed wind farm and clustered nature provides an opportunity for a standardised approach with a possible control group of one cluster and/or variation in search techniques such as straight line transects/ randomly selected spiral transects/ dog searches as a means of robustly estimating the post construction impact in terms of fatality.
    d. Recorded fatalities to be calibrated against known predator removal rates to provide an estimate of overall fatality rates.

An annual report will be submitted to the competent authority and NPWS. Following the first 7 years, a report shall be disseminated publicly via publication in a recognised journal.

2) Flight Activity Survey: A flight activity survey is to be undertaken during the winter months to:

    a. Record any barrier effect i.e. the degree of avoidance exhibited by species such as Whooper Swan approaching or within the wind farm [116]. Target species to be Whooper Swan, Golden Plover, Gulls and Raptors.
    b. Record changes in flight heights of key receptors post construction.

An annual report will be submitted to the competent authority and NPWS. To be conducted for an initial period of 7 years to allow for annual variation and cumulative effects. Dependant on results further monitoring to be agreed with NPWS. Following the first 7 years a report shall be disseminated publicly via publication in a recognised journal.

3) Monthly Wildfowl Census: A monthly wildfowl census, following the methods utilised for the baseline survey, is to be repeated on a monthly basis during the winter period. This aims to:
    a. Assess displacement levels (if any) of wildfowl such as swans post construction
    b. Assess overall habitat usage changes within the vicinity of the wind farm post construction.

To be conducted for an initial period of 7 years to allow for annual variation and cumulative effects. Dependant on results further monitoring to be agreed with NPWS. Following the first 7 years a report shall be disseminated publicly via publication in a recognised journal.

4) Breeding Wader survey: A breeding wader survey, following methods used in the baseline survey to be repeated yearly April-May-June. This aims to:

    a. Assess any displacement effects such as those recorded in the literature [62] [63] [145] on breeding waders. Overall density of breeding waders to be annually recorded.

To be conducted for an initial period of 7 years to allow for annual variation and cumulative effects. Dependant on results further monitoring to be agreed with NPWS. Following the first 7 years a report shall be disseminated publicly via publication in a recognised journal.

#### *7.6.2.5 Bats*

*Buffer zones*

The vegetation-free buffer zones around the identified turbines will be managed and maintained during the operational life of the development.

*Changes to cut-in speeds*

Due to mitigation by design, as each turbine is to be sited a suitable separation distance to hedgerows and/or trees or such vegetation is to be removed to ensure a vegetation-free buffer zone, no operational curtailment of any turbine as a mitigation measure is required however, should any turbine be relocated so that its blade tip is less than 50m from any hedgerow or treeline, the recommended mitigation measure is to increase the turbine's cut-in speed during the active bat period from April to September, inclusive. Increasing the cut-in speed to 5.5m/s from 30 minutes prior to dusk to 30 minutes after dawn has been shown to protect bats (Arnett *et al.* 2010 [165]). This measure should be actioned during optimal bat hunting conditions when wind speeds are less than 5.5m/s and air temperature is greater than 7ºC as measured onsite.

*Bat Fatality Monitoring*

As no research currently exists on bats and wind farms in Ireland, the planned development could provide an opportunity to gain baseline data on bat/turbine interaction and it is recommended that the scheme be monitored for bat fatalities for the first three years of operation. A comprehensive onsite avian fatality monitoring programme is to be undertaken following published best practice. This fatality monitoring programme should be extended and duplicated for bat fauna. The primary components of the bird mortality programme are outlined below and an assessment of bat mortality would essentially follow the same methodology.

a) Carcass removal trials to establish levels of predator removal of possible fatalities. This should be done following best recommended practice and with due cognisance of published effects such as predator swamping, whereby excessive placement of carcasses increases predator presence and consequently skews results. No turbines which are used for carcass removal trials should be used for subsequent fatality monitoring.
b) Turbine searches for fatalities should be undertaken following best practice in terms of search area (minimum radius hub height) and at intervals selected to effectively sample fatality rates as determined by carcass removal trials in (a) above.
c) The large scale of the proposed wind farm and clustered nature provides an opportunity for a standardised approach with a possible control group of one cluster and/or variation in search techniques such as straight line transects/randomly selected spiral transects/dog searches as a means of robustly estimating the post construction impact in terms of fatality.
d) Recorded fatalities should be calibrated against known predator removal rates to provide an estimate of overall fatality rates.

*Monitoring of Mitigation Measures*

The success of the implemented mitigation measures for bats on the project should be monitored for a period of three years after construction and appropriate measures taken to enhance these if and where required. A recommended schedule for such monitoring is given in Table 7.84 below.

### Table 7.84: Monitoring schedule recommended for bat mitigation measures

| Mitigation measure | Monitoring required | Description | Duration |
|---|---|---|---|
| Newly planted hedgerows and treelines | Ensure viable growth of planting | Planted material shall be checked periodically over the growing season to remove dead material. Any dead material shall be replaced within the same season with viable stock according to age/height restrictions already specified in mitigation. | From time of planting to 1 year post construction |
| Bat boxes and tubes | Monitor bat use | Bat boxes and tubes shall be examined by a licensed bat specialist. Records should be submitted to *Bat Conservation Ireland* for inclusion in their bat distribution database. Re-site if necessary. Annual cleaning required if | From mounting to 3 years post construction. |

| Mitigation measure | Monitoring required | Description | Duration |
|---|---|---|---|
| | | well used by bats or if used by birds. Replacement if damaged/lost. | |
| Mortality Study | Fatality Monitoring | Corpse searches beneath turbines to assess the impact of operation on bats. | From initial operation to three years post commissioning. |

#### *7.6.2.6 Other Taxa present on site*

No mitigation required.

### 7.6.3 Mitigation Measures during Decommissioning

#### *7.6.3.1 Nature conservation sites*

Implement mitigation measures outlined in Chapter 8 'Geology and Slope Stability', Chapter 9 'Hydrology' and Chapter 10 'Water Quality' of this EIS, in addition to the NIS and section 7.6.3.3, below, to minimise and prevent the identified indirect impacts on water quality as outlined previously.

#### *7.6.3.2 Habitats*

Habitat restoration measures will be appropriately planned and designed to avoid/minimise any potential conflicts between the proposed development and the positive impacts of increasing habitat diversity in close vicinity to operational turbines. An appropriately qualified and experienced ecologist will review and, where required, amend the proposed Habitat and Species Management Plan and consult with NPWS to seek their views on the implementation of the proposed measures.

Any re-instated habitats such as Hedgerows will utilise native species suitable for the area.

#### *7.6.3.3 Aquatic Ecology*

Decommissioning activities will take place in a similar fashion to the construction phase. There will be disturbance to underlying soils and therefore a risk again of silt laden run-off entering the receiving watercourse. The mitigation measures outlined above will be implemented for the protection of aquatic ecological interests during the decommissioning phase.

#### *7.6.3.4 Flora*

Rhododendron was primarily located within the area of high bog outside the red line boundary and hence any construction works. Any new patches of Rhododendron that are located during decommissioning the wind farm will be treated to prevent further spread of this plant.

Where Rhododendron has established, such areas will be eradicated by a suitably qualified person prior to construction to prevent further spread of this highly invasive plant. Cognisance will be made of 'The Best Practice Management Guidelines' produced by Invasive Species Ireland (Maguire et al, 2008 [154]) .For this location cutting and stump treatment with an appropriate herbicide is likely to be the most effective measure. Additional applications of herbicide of any regrowth will be required to achieve complete eradication.

Giant Hogweed was located close to one of the proposed bridges along the cable/turbine delivery route. Should any off road works be required at this location during decommissioning cognisance will again be made of 'The Best Practice Management Guidelines' produced by Invasive Species Ireland (Maguire et al, 2008 [154]).

### *7.6.3.5 Birds*

Decommissioning operations will take place during the hours of daylight to minimise disturbances to roosting birds, or active nocturnal bird species. This in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds [64]. Limited operations such as turbine removal may require night-time operating hours; these will be detailed in the CEMP and supervised by the project ecologist.

Toolbox talks shall be held with construction staff on disturbance to key species during decommissioning. This will help minimise disturbance. This is in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds [64].

Any re-instated habitats will include native species where possible to enhance diversity of birds. This is in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds [64].

The post construction monitoring programme previously outlines is to be implemented at the subject site with the following components, the results of this are to be submitted annually to the competent authority and NPWS. This will be continued into the decommissioning phase of the project.

### *7.6.3.6 Mammals (excluding Bats)*

Badger

Construction operations will take place during the hours of daylight to minimise disturbances to faunal species at night. Limited operations may require night-time operating hours; these will be detailed in the CEMP and supervised by the project ecologist. Due to the time delays between initial surveys for terrestrial mammals and the likely construction date, a qualified ecologist will re-survey the hedgerow/woodland areas earmarked for development for Badger setts, no more than 10–12 months prior to construction, with a further check immediately prior to vegetation clearance. In the event that a Badger sett is found, the NRA (2006) guidelines (see Appendix F8) for the treatment of Badgers will be followed. In addition the NPWS will be updated and consulted on the status of any Badger setts found.

Otter

Construction operations will take place during the hours of daylight to minimise disturbances to Otter at night. Limited operations may require night-time operating hours; these will be detailed in the CEMP and supervised by the project ecologist. All locations where river crossings are to occur and where construction of bridges or enhancement of existing bridges is required will be surveyed no more than 12-14 months prior to construction as per published guidance from the NRA (see Appendix F8).

This will involve re-survey, by a qualified ecologist, of the locations in question for breeding or resting places of Otter. Survey methods will follow established best practice. Should Otter breeding or resting sites be present then best practice guidance (NRA) in the treatment of Otters will be followed, under the terms of the obtained derogation. The NPWS will be updated on the status of any evidence found.

Pine Marten

Where possible tree felling of trees in forestry areas will be limited to time periods outside which Pine Martens may have young in dens (March and April). If this is unavoidable than areas to be clear felled will be surveyed in advance by a suitable qualified ecologist to determine whether any occupied Pine Marten dens are present. A necessary license under the wildlife act will be applied for.

Red Squirrel

Where possible tree felling of trees in forestry areas will be limited to time periods outside which Red Squirrels may have young in Dreys. If this is unavoidable than areas to be clear felled will be surveyed in advance by a suitable qualified ecologist to determine whether any occupied Pine Marten dens are present. A necessary license under the wildlife act will be applied for.

#### *7.6.3.7* Bats

Mitigation measures implemented during decommissioning should be the same as those recommended during construction.

#### *7.6.3.8 Other Taxa present on site*

Mitigation measures implemented during decommissioning should be the same as during construction.

## 7.7 Residual Impacts

The design of the proposed development has taken the ecology of the existing environment into consideration. Provided all mitigation measures are implemented in full, no significant residual impacts on the nearby designated sites or local ecology are expected from the development of the proposed wind farm development.

### 7.7.1 Designated Nature Conservation Sites

The proposed development may, without mitigation, impact negatively on a number of designated sites connected hydrologically. The primary potential for impact is through siltation and contaminated run-off from the during construction process. Mitigation measures as detailed in the current chapter and accompanying NIS, in addition to Chapter 9 'Hydrology' and Chapter 10 'Water Quality' will be implemented to protect the water quality of streams draining from the proposed development site, this will in turn prevent downstream impacts on designated sites. With the implemented mitigation measures residual impacts as a result of the proposed development are assessed as negligible and adverse effects on the integrity of designated sites are not predicted.

### 7.7.2 Habitats and Flora

Construction of the wind farm will lead to some permanent loss of habitat. The habitat loss will be the total area covered by the roads plus the footprint of each of the proposed turbines and all other wind farm infrastructure. For clarity, associated infrastructure includes borrow pits, compounds, substations and distilling ponds (proposed). Landtake has also been calculated for landtake at junctions along the proposed turbine delivery route.

Not all landtake is permanent as borrowpits and modifications such as at roundabouts along the turbine delivery route will be reinstated. Any hedgerows to be re-instated will utilise locally sourced native species as part of a Habitat and Species Management Plan which shall minimise residual impacts. Mitigation measures as outlined in the current chapter and Chapter 9 Hydrology at the detailed culvert design stage shall ensure no significant loss of aquatic habitat.

Measures to be undertaken to deal with invasive species and included in the detailed CEMP to be submitted prior to commencement of construction. With the application of the appropriate mitigation measures as outlined in the current chapter, it is considered that the impacts of the proposed development will be minimised to an acceptable level, resulting in slight residual impacts (i.e. noticeable changes in the character of the environment without affecting its sensitivities).

### 7.7.3 Terrestrial Mammals (excluding Bats)

Other Fauna in the existing environment are either of low ecological concern or well represented within the wider area. With the application of the appropriate mitigation measures as outline in the current chapter, it is considered that the impacts of the proposed development will be minimised to an acceptable level, resulting in slight residual impacts (i.e. noticeable changes in the character of the environment without affecting its sensitivities).

### 7.7.4 Birds

*Whooper Swan*
Of the bird species recorded as part of this study, Whooper Swan is considered to be of significant conservation concern. Flight activity analysis has shown that where flight activity occurs within the proposed development site is primarily below rotor height, reflecting both the topography of the area and the flight characteristics of the species. Numbers and frequency of occurrence of the species are also low. The proposed development will therefore not result in disturbance to the flightpaths of Whooper Swans. In combination effects, in particular in regard to the other wind farms proposed in the greater area, have also been considered and found to be of low significance. In addition monitoring measures have been proposed to minimise the potential negative impacts of the development on Whooper Swan. It is considered that overall the proposed wind farm will have a negligible residual impact on Whooper Swan in the area.

*Other Birds*
Of the remaining bird species recorded at the subject site mitigation measures have been proposed to minimise effects on those species which the literature suggests can be negatively impacted, in particular breeding waders such as Snipe and Curlew which may be affected during construction. A comprehensive monitoring program will also be implemented following construction of the proposed wind farm; this will monitor the degree of barrier effect, if any, on existing species as a result of the development, in addition to comprehensively monitoring any bird fatalities. The implementation of a monitoring programme is within recommended best practice mitigation measures. It is considered that with the implementation of mitigation, the proposed wind farm development will have a negligible residual impact on birds.

### 7.7.5 Aquatic Ecology

The proposed wind farm will have a Slight negative impact on aquatic ecology and fisheries during the construction phase in the local context in the absence of mitigation measures. However, this will be effectively reduced to an Imperceptible negative impact with the mitigation measures proposed; where the direct loss of riparian habitats due to the required crossings of watercourses within the site remain the most sensitive receptors. The limitation of indirect impacts arising from water quality pollution events such as siltation and run-off of suspended solids will significantly reduce the potential for impacts affecting aquatic ecological interests within the site.

Localised water quality impacts as a result of construction phase will be reduced by undertaking the most sensitive elements of the works outside the salmonid close season and protection of water quality following the implementation of the water management measures detailed in Chapter 9 ‘Hydrology’ and Chapter 10 ‘Water Quality’. With the mitigation measures proposed, residual impacts are evaluated to be limited to a local context and will not affect the conservation status of aquatic ecology receptors in the receiving waters.

### 7.7.6 Bats

Some of the planned turbines are to be located within or close to existing vegetation but providing a 50m vegetation-free buffer zone around each turbine will reduce the risk of collision and/or barotrauma to foraging and/or commuting species such as pipistrelles. Post construction Bat fatality monitoring will also be undertaken at the subject site.

The adjudged worst case scenario is that, during operation, the turbines may possibly cause injury or death to a few individual specimens of Leisler’s bat as it is a high flying species (10m to 70m+). However, the amount of time spent hunting at the upper height limit cannot be assessed accurately due to the maximum distance (60m to 80m) of detection of this species by ultrasound detectors (Rodrigues *et al.* 2008 [25]) but most activity and time can be expected to occur in the mid-region of the species hunting altitude i.e. 40m.

The resulting impact of the proposed development on local bat populations, with implemented mitigation measures, is considered to be minor negative with the favourable conservation status (FCS) of bat species being unaffected and all species confirmed or expected on or near the study areas are anticipated to persist.

### 7.7.7 Other Taxa

Residual effects are assessed as not significant.

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