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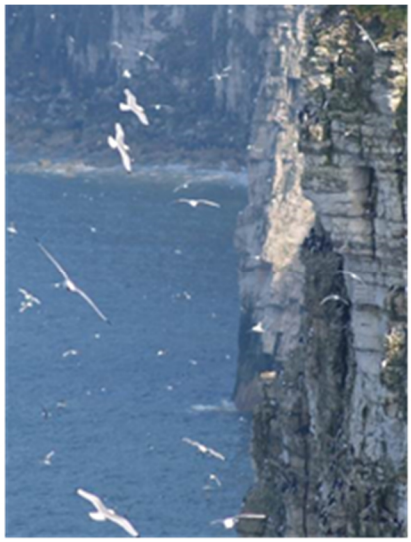


Ecological Impact Assessment

Seven Hills Wind Farm Phase II

For

An Bord Pleanála

Project No.: IABP105/001

November 2016

London & South East
Compass House
Surrey Research Park
Guildford
GU2 7AG . UK

t: +44 (0)1483 466 000

North & Borders
Calls Wharf
2 The Calls
Leeds
LS2 7JU . UK

t: +44 (0)113 247 3780

Wales & South West
Williams House
11-15 Columbus Walk
Cardiff
CF10 4BY . UK

t: +44 (0)2920 020 674

Scotland
20-23 Woodside Place
Glasgow
G3 7QF . UK

t: +44 (0)141 582 1333

Enquiries

e: enquiries@thomsonecology.com

w: www.thomsonecology.com

Project Number	Report No.
IABP105/001	002

Revision No.	Date of Issue	Author	Reviewer	Approver
001	12/11/2016	Richard Arnold	Gabrielle Graham	Richard Arnold
002	24/11/2016	Richard Arnold	Gabrielle Graham	Richard Arnold

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1. Introduction

1.1 Background

1.1.1 The Seven Hills Wind Farm comprises two proposed wind farms in Co. Roscommon. The two wind farms are referred to as Phase I and Phase II and are subject to separate planning applications. The connection to the national electricity grid would either be subject to a third application, as stated by the applicant in its Environmental Impact Statement, or, if buried, could be classed as exempted development and therefore not subject to a planning application. The applicant for each phase of the Seven Hills Wind Farm is Galetech Energy Developments Ltd. Due to the nature of the developments, they are the subject of an environmental impact assessment under the European Communities (Environmental Impact Assessment) Regulations 2010.

1.1.2 This report sets out an ecological assessment of the Phase II wind farm under the EIA Regulations. It also includes consideration of Phase I of the wind farm, and other developments, as part of an assessment of cumulative impacts.

1.1.3 The proposed Seven Hills Wind Farm developments have a complex planning history. The current position is that a previous decision to grant consent for the developments was set aside by the High Court because the decision making process did not comply with the Habitats Directive. It is therefore necessary for both applications to be considered again.

1.1.4 There are a number of objectors to the developments. These include the National Parks and Wildlife Service (NPWS), a division of the Department of the Arts, Heritage, Regional, Rural and Gaeltacht Affairs (DAHRRGA[1]). The basic contention of the NPWS is that insufficient information has been collected by the applicant on the behaviour of qualifying bird species for a firm conclusion to be reached that the development will not adversely affect the integrity of any Natura 2000 site[2]. Other objectors have raised similar concerns in relation to the effect of the development on hydrology/hydrogeology, with potential effects on turloughs, some of which are also designated as Natura 2000 sites.

1.2 Purpose of Report

1.2.1 This report is an ecological impact assessment based upon the information submitted by the applicant in support of the planning application, written submissions made by the NPWS and representations made by others at the Oral Hearing held in Athlone in June 2016.

1.2.2 The purpose of the report is to assist An Bord Pleanála in undertaking its Environmental Impact Assessment of the proposed development.

1.3 Description of the Proposed Development

1.3.1 The general description of the proposed development is given in Chapter 3 of Volume 1 of the Environmental Impact Statement (EIS). In summary, the development comprises:

- Nineteen GE 2.5xl MW wind turbines in two clusters with the lowest turbine at 71m above sea level (ASL) to the highest at 107m ASL. Each turbine has three blades and a rotor diameter of 100m and a rotor hub height of 85m. The turbine rotors would therefore sweep

[1] Previously the Department of the Arts, Heritage and the Gaeltacht (DAHG)
[2] See for example the letter from DAHG dated 19th October 2015.

an area from 35m to 135m above ground level. The turbines rotate at between 5 and 14 revolutions per minute and operate when wind speeds are between 3ms-1 and 25ms-1. The turbine bases are separated by an average distance of approximately 510m.

- A substation comprising a building and compound, measuring approximately 30m by 67m.
- A single, permanent (25 year) anemometer mast at 85m high, with a triangular lattice structure.
- Hard standing and foundations at each turbine location, comprising a hard standing area of 10m x 20m (0.38ha in total for the Phase II site) during the operational phase and a turbine base extending approximately 2.8m underground, occupying an area of approximately 300m^2 (0.57ha in total for the whole Phase II site).
- Site access tracks totalling 11,886m and 5m wide (5.9ha in total) and 1m deep, constructed in a similar manner to agricultural tracks.
- Underground cabling totalling 11,442m, alongside the access tracks.
- Temporary construction compounds and access tracks. Three temporary compounds are proposed (one near turbine 7 (TC2 - 922m^2), one near turbine 10 (TC1 – 2226m^2) and one near turbine 17 (TC3 – 2270m^2) with a total area of 0.54ha.
- Temporary hard-standing areas for cranes next to each turbine. The latter will measure 950sq.m (1.8ha in total for the Phase II site) and will incorporate the hard permanent hard-standing at each turbine location (so the temporary hard stranding will be 1.42ha in total for the Phase II site).

1.3.2 The planning application boundary encompasses a 58ha area which includes all the access tracks, turbines and so on. As the turbines are widely spaced, the area encompassed by a loop drawn around the turbines is approximately 300ha including the land between the two turbine clusters or about 260ha without this land. From an ornithological perspective, it is the latter areas which matter and therefore references to the Phase II site in this report are generally a reference to the 300ha over which the turbines are located.

1.3.3 The development will be connected to the national electrical grid. The EIS states that this will be subject to a separate planning application. However, it may be exempted development if it is buried. A separate assessment has been provided for the Seven Hills Wind Farm Phase II for the cable route which shows a route alongside the R362/R363 road to the Monksland substation (IWCM, 2015b).

1.3.4 During the construction stage, there will be approximately 14,492 vehicle movements with 'much reduced' vehicle movements (number not specified in the EIS) during the operational stage. The site entrance will be on a minor road (L7535) off the R363 to the east of Cuillineerwan (approximately 1.5km east of the Ballyglass River Callows). The likely access route for construction traffic would be from Athlone towards Dysart along the R362/R363 and then southwards along the minor road for about 500m to the site entrance.

1.3.5 The construction period is expected to last 12 – 18 months and the wind farm would be operational for 25 years, with the potential to either (i) continue operation; (ii) refurbish/replace; or (iii) de-commission the wind turbines after this period ends. Options (i) and (ii) would be subject to renewed planning permission.

1.4 Study Area and Zone of Influence

1.4.1 The study area and zone of influence of the development are not defined precisely by the applicant. The immediate survey area encompassed the fields within which the turbines and associated infrastructure are proposed and a selection of adjoining fields, as shown in the EIS, Chapter 7, Appendix 7.1. The applicant also undertook surveys for birds at a number of waterbodies up to 8km from the Phase II site. Other designated sites up to 15km away from the Phase II site also received some consideration as part of a desk based assessment of effects on designated sites. The applicant infers that zone of influence extends about 8km from the Phase II site with this limit defined by foraging distances of birds from their roost sites and hydrological connection of wetland sites.

1.4.2 Ideally, the immediate survey area would have included all land within a loop drawn around the turbines and the anemometer mast plus a 200m buffer for habitats and protected and important species, as well as the access track and 50m either side. For birds, the survey area should ideally have matched this area to record bird flight lines and extend beyond this area by at least 300m (so 500m beyond the turbines) to record foraging wetland birds and by at least a further 800m (so 1km beyond the turbines) to record roosting birds (SNH, 2014). Given the migratory nature of birds and the propensity for birds to move between wetland sites during the winter, the zone of influence clearly extends beyond the immediate survey area, most obviously to the wetland sites located within 5 of 10km of the Phase II site, as determined by the applicant but also further afield. The hydrological connection of wetland sites is clearly also a factor which determines the zone of influence.

1.4.3 In this particular locality, it was important to survey the known roost sites located more than 1km for the wind farm as the applicant has done.

2. Appraisal Methodology

2.1 Consultation

2.1.1 As set out in the EIS (Chapter 7, pages 7 and 8, and Chapter 8, pages 8 and 9), the applicant undertook some pre-submission consultations on the methodology[3].

2.2 Desk Study

2.2.1 As set out in the EIS (Chapter 7, page 6), the applicant undertook a desk study which involved collation of existing records, from NPWS and Birdwatch Ireland, and reference to publications, such as atlases. The information collated includes information on sites designated for nature conservation and records of protected species.

2.3 Field Assessment

Terrestrial Habitats

2.3.1 As set out in the EIS (Chapter 7, page 6 and 7), the applicant undertook habitat surveys in August 2008 and June 2011. The habitats on site were classified in accordance with the standard classification system for Ireland (Fossit, 2000). This survey is in line with standard practice and appears to have been adequate, although it may not have led to an adequate description of some habitats. The survey area encompasses all fields within which a turbine is to be located and those through which an access track passes plus some additional fields apparently in the same land ownership. In some cases not much land beyond the turbine position was subject to survey.

Invertebrates

2.3.2 During the survey of terrestrial habitats described above, the applicant sampled terrestrial invertebrates by sampling and hand netting. The actual dates of the survey and number of samples collected is unstated. However, the survey results suggest that little more than casual observations of invertebrates were made, during the habitat surveys. It is not clear how much effort was expended searching for marsh fritillary butterflies, what method was followed and when the survey was carried out.

Mammals other than bats

2.3.3 During the survey of terrestrial habitats described above, the applicant recorded any evidence of mammals. No specific survey methods are described by the applicant so again it seems that the survey amounts to little more than casual observations of mammals, made during the habitat surveys.

Bats

2.3.4 The applicant undertook a bat survey in June 2011. This described in the EIS (Chapter 7) but is presented in more detail in Appendix 7.2 of the EIS (Bat Eco Services, 2011b). The survey was undertaken between 4th June and 22nd June 2011. It comprised five surveys at dusk and five surveys at dawn, as well as the use of static monitoring devices positioned at the proposed

[3] There has obviously been a significant amount of correspondence and comment on the survey work and its results since then, as part of the ongoing planning and legal process. This has led to the completion of additional survey work for bats on the Phase I site and additional survey work for birds at wetland sites in the local area but not focussed on the Phase I site itself.

location of each turbine for between one and eight nights, depending on location. In 2011, ten of the 19 turbine locations were subject to just one night of static monitoring while three received eight nights. This survey was over a very limited period and with fewer than expected visits to each turbine location. Furthermore the survey work was undertaken at ground level whereas the turbine rotors are between 35m and 135m above ground level.

2.3.5 Further bat survey work was conducted in the months of April to September 2012 (Bat Eco Services, 2013). For Phase II, the survey comprised the following elements:

- Dusk/dawn surveys along field boundaries and farmyards in the vicinity of the proposed turbine locations for Turbines 16, 18 and 19; and
- A bat detector placed on each of two anemometers. These were in place and working for eight survey periods lasting from 2 (or 3) nights to 9 (or 10) nights. The detector was positioned approximately 8m above ground level.

2.3.6 The results of this survey were submitted partially in a bat report submitted with the response to further information request on 8th June 2012 and then fully in a report produced in 2013 (Bat Eco Services, 2013).

2.3.7 Best practice guidelines typically suggest several survey periods through the season which are focused on the turbine locations and potentially at the height of the rotor swept area, which would be between 35m and 135m AGL at the Phase II site (Bat Conservation Ireland, 2012; Hundt, 2012; Rodrigues, Bach, Dubourg-Savage, Goodwin, & Harbusch, 2008). The combined bat surveys fall short of this.

Birds

2.3.8 A desk study was undertaken to collate existing information on birds in the local area. This is described in the EIS (Chapter 8, pages 8 and 9).

2.3.9 Bird surveys were carried out during autumn, winter and spring/summer. These are described in the EIS for Phase II (Chapter 8), the 2012 AA report for Phase II and the wintering bird survey reports for 2012/13 (ECOFACT, 2013) and 2014/15 (ECOFACT, 2015a; ECOFACT, 2015b), albeit that the 2012/13 survey was submitted in relation to the Phase I Wind Farm application. It was however made clear prior to the oral hearing in June 2016 that all documents, whether submitted in relation to Phase I or Phase II, would be taken into account when relevant to either proposal.

2.3.10 In summary, three broad types of survey method were used: (i) 'walkover' surveys; (ii) vantage point surveys; and (iii) foraging and roosting surveys of waterbodies. These are described and assessed in detail in Appendix 1 of my AA report for Phase II, with particular reference to the qualifying species of the local SPAs. A number of short comings are identified in this regard and there are further shortcomings in relation to the ability of these surveys to collect the required information for a more general ecological impact assessment. A summary of the shortcomings is set out below:

- The 'walkover' surveys were conducted only in the breeding season rather than in all three seasons, meaning that birds foraging in and around parts of the Phase II site in winter would not have been detected, as not all fields are sufficiently visible from the selected vantage points.

- The 'walkover' surveys did not follow a standard recognised methodology (such as transects, timed-area counts, point counts, territory mapping) meaning that the results are not comparable to other areas (which is important for evaluation purposes) and the level of survey effort is unclear.
- The survey area for 'walkover' surveys is not shown on any map meaning that it is unclear which areas were surveyed and how much effort was expended in each area.
- Insufficient hours of observation appear to have been made during the migration seasons to record birds on migration to, from or through the local area and no data is presented on this activity.
- There was no survey of the wind farm site at night, which is when lapwing and golden plover are often foraging on grassland and when many species migrate.
- The Vantage Point (VP) watches were focused on just one species of bird, the whooper swan, when in fact all qualifying species of the local SPAs should have been 'target' species for the survey, as well as other important waterbird species such as curlew and snipe.

2.3.11 The results for all species except whooper swan, greylag goose and peregrine falcon were presented initially as a simple list, including birds which were recorded both inside and outside the wind farm, with limited information on abundance and location, except in Appendix A of Appendix 8.1 of Chapter 8 of the EIS where counts are provided for the 2008/9 winter season only. VP2 was the only VP located on the Phase II site in this survey period.

2.3.12 The applicant has subsequently carried out further bird surveys in winter 2012/13 (ECOFACT, 2013) and winter 2014/15 (ECOFACT, 2015a; ECOFACT, 2015b) at local waterbodies and this has provided useful contextual information however this work has not addressed the shortcomings of the survey work carried out on the Phase II site itself. The installation of the avian radar system, as now proposed by the applicant, as a means of collecting such data *post*-consent does not excuse the applicant from providing an adequate description of the bird fauna *pre*-consent.

2.4 Evaluation of Nature Conservation Interest

2.4.1 The applicant uses an evaluation methodology which was developed in 2004 (which is set out in a now fairly obscure publication) for the assessment of national road schemes in Ireland. Firstly, there were more recent guidelines available in relation to roads in Ireland at the time that EIS was prepared in 2011. These guidelines were published in 2006 and updated in 2009 (NRA, 2009). Secondly, generic guidelines on ecological impact assessment were published by the Institute for Ecology and Environmental Management in 2006[4]. Thirdly, the applicant does not explain anywhere what the evaluation categories mean, which renders the assessment unintelligible to anyone without a copy of the 2004 publication mentioned above.

2.4.2 Here, the approach set out in the most recent guidelines produced by the Chartered Institute for Ecology and Environmental Management (CIEEM) are followed.

[4] The CIEEM Guidelines have now also been updated but the updated version would not have been available to the applicant when the EIS was prepared.

3. Description of the Existing Environment

3.1 Approach

3.1.1 The description of the existing environment is based on a combination of the desk study and field assessment work undertaken by the applicant, as well as observations made during my site visit in May 2016. The environmental conditions are not expected to change significantly between the dates the information was collected and the intended start of construction. Therefore, the description here represents the predicted baseline at the time that the project will take place.

3.2 Designated Areas

3.2.1 The applicant identified 12 sites with a designation for nature conservation within 15km of the Phase II site. The nearest is Lough Feacle pNHA which is approximately 550m from the nearest turbine and about 300m from the proposed anemometer. Lough Feacle is a proposed Natural Heritage Area (pNHA) which is primarily designated on the basis of the presence of turlough habitat and its associated plant species (Site Synopsis). The bird interest of this turlough is not described on the site synopsis. Nevertheless, the turlough does support locally important numbers of breeding and wintering birds and it is likely to provide supporting habitat for species of wintering birds associated with the Special Protection Areas (SPAs). The other designated sites are listed in Table 7.1 of the EIS (Chapter 7, pages 8 and 9). Lough Feacle pNHA and Cranberry Lough pNHA are of national importance for nature conservation while the other identified sites are of international importance.

3.2.2 SPAs and Special Areas of Conservation (SACs) are protected under the European Communities (Birds and Natural Habitats) Regulations, 2011. Natural Heritage Areas (NHA) are afforded protection under the Wildlife (Amendment) Act 2000 however proposed Natural Heritage Areas (pNHAs) have not yet received formal statutory designation or protection.

3.3 Non-designated wetlands

3.3.1 There is one non-designated wetland within 2km of the Phase II site and two more within 4km of the Phase II site. These are not described in any detail in the EIS which is serious omission, since these sites are likely to be of high nature conservation value and could be subject to indirect effects as a result of the wind farm development.

Ballyglass River Callows

3.3.2 The Ballyglass River Callows is an ill-defined area along the Ballyglass River. The Ballyglass River is a tributary of the River Suck. The nearest point of the river is located approximately 1.1km from the location proposed for the nearest turbine. It regularly supports whooper swan, as well as mute swan and, occasionally, Bewick's swan. The Ballyglass River Callows adjoin the River Suck Callows and arguably have the same value as both Callows are essentially part of the same ecological unit i.e. it is of up to International Importance.

Cuilleenirwan/Coolagarry Turlough

3.3.3 Cuilleenirwan/Coolagarry Turlough is located approximately 2.1km from the proposed location of the nearest turbine. It is approximately 50ha in size. It supports whooper swan, golden plover, lapwing, mallard and black-headed gull, which again are all qualifying species of nearby SPAs, as well as wintering curlew. It is likely to be of at least County Importance.

Dysart (Thomas Street) Turlough

3.3.4 Dysart (Thomas Street) Turlough is located approximately 3.1km from the proposed location of the nearest turbine. The precise area of the turlough is ill-defined but it extends up to around 37ha. It regularly supports whooper swan, as well as golden plover, lapwing, wigeon, teal and black-headed gull which are all qualifying species of nearby SPAs. It is likely to be of at least County Importance.

3.4 Terrestrial Habitats

3.4.1 A habitat map is provided in Appendix 7.1 of the EIS. This indicates that there are four habitat types within the survey area.

Improved Agricultural Grassland (GA1)

3.4.2 The survey area, as mapped by the applicant, is predominantly improved agricultural grassland and it is described in the EIS (Chapter 7, pages 11 and 12). Certainly, some of the grassland is dominated by perennial rye-grass, with little else, and clearly falls into this category[5] but some of the grassland mapped by the applicant as improved grassland is actually better defined as semi-improved grassland, which is described below.

Dry Calcareous and Neutral Grassland (GS1)

3.4.3 In the Fossitt classification system, the category of dry calcareous and neutral grassland includes both semi-improved and unimproved grasslands. However, more recent research has demonstrated the need for semi-improved grassland to be more clearly distinguished from both improved and unimproved grassland in Ireland (Sullivan, Skeffington, Gormally, & Finn, 2010).

Semi-improved calcareous grassland

3.4.4 The survey area contains some semi-improved grassland with a high cover of forbs and moderate diversity of plants, including common bent (*Agrostis capillaris*), sweet vernal grass (*Anthoxanthum odoratum*), crested dog's-tail (*Cynosurus cristatus*), red fescue (*Festuca rubra*), yarrow (*Achillea millefolium*), meadow buttercup (*Ranunculus acris*), common sorrel (*Rumex acetosa*) and field wood-rush (*Luzula campestris*). The total extent of this grassland within the survey area is not known. However, it is, for example, present in the fields around the location of proposed Turbines 14, 15, 16 and 19.

Unimproved calcareous grassland

3.4.5 Unimproved calcareous grassland is spread across the Phase II site, with approximately 367ha mapped by the applicant. This grassland is described in the EIS (Chapter 7, page 12). In addition to the species listed by the applicant, I noted heather (*Calluna vulgaris*) in places.

3.4.6 In contrast to similar grassland on the Phase I site, the applicant makes the case in the EIS for Phase II that the grassland on the Phase II site is not the Annex I type 6210 (semi-natural dry grasslands and scrubland facies on calcareous substrates). At the oral hearing in June 2016,

[5] Agricultural improvement of grassland is a on a continuum with complete re-seeding and heavy fertiliser and herbicide application at one extreme, yielding single species swards of perennial rye grass, and light applications of organic fertiliser at the other, yielding swards which are more grass-dominated than unimproved grasslands, but still species-rich. The point along the continuum at which improved grassland becomes semi-improved grassland is ill-defined and somewhat subjective.

the applicant stated that neither the Phase I site nor the Phase II site hold grassland of the Annex I type 6210.

3.4.7 Certainly, the grassland on the Phase II site is dry and calcareous, it also contains at least three of the plant species which define the 6210 habitat (kidney vetch (*Anthyllis vulneraria*), carline thistle (*Carlina acaulis*) and early purple orchid (*Orchis mascula*)) (EC, 2013). In addition, it supports 12 species which are positive indicators for the 6210 grassland type, including six which are high quality positive indicators[6] (O'Neill, Martin, Devaney, & Perrin, 2013). There would seem to be reasonable case that this is the Annex I type 6210[7].

3.4.8 The next consideration is whether the grassland could be the orchid rich priority type. The EC guidance is that 6210 grassland should be considered the priority habitat if it supports an important population of at least one orchid species considered not very common in the territory. NPWS guidance is that grasslands should be considered for classification as the priority type if 6210 grassland supports any orchid species other than common spotted orchid (*Dactylorhiza fuschii*). As noted above, the grassland on the Phase II site supports early purple orchid, which the NPWS lists as uncommon (O'Neill, Martin, Devaney, & Perrin, 2013). Moreover, the grassland on the Phase II site and Killeglan Grassland SAC, which is designated because it supports this Annex I type, were probably once part of a now-fragmented unit[8].

3.4.9 The unimproved calcareous grassland, whether the Annex I type or not, is of high nature conservation value on its own and potentially also as supporting habitat for the SAC. This particular example is very extensive at 367ha[9]. It is therefore probably of at least County value for nature conservation. As the grassland on the Phase II site is not included within any designated site, it is not strictly protected[10].

Scrub (WS1)

3.4.10 Scrub habitat is in four main locations in the survey area. It is described by the applicant in the EIS (Chapter 7, pages 12 and 13).

Hedgerows (WL1)

3.4.11 Hedgerows are present in the east and centre of the survey area. This habitat is described by the applicant in the EIS (Chapter 7, page 13).

Stone walls and other stone work (BL1)

3.4.12 Stone walls make up the majority of the field boundaries within the survey area. This habitat is described in the EIS (Chapter 7, page 13). Stone walls or stone field boundaries appear to be more extensive than indicated in Appendix 7.1, as can be seen from the aerial imagery upon

[6] Strictly speaking, positive indicators are used to indicate the quality of this habitat type rather than define the habitat type, however, the presence of these species is also evidence that the grassland conforms to the Annex I type.
[7] In the EIS the applicant seems to have not understood that the there is a broader non-priority type 6210 of which the orchid-rich, priority type is a sub-category.
[8] The grassland mapped by the applicant and Killeglan Grassland SAC are now separated by one improved grassland field which is 200m wide.
[9] An estimate is that there is only 1429ha of 6210 in Ireland and about half of this area is included within SACs. However the total extent (1429ha) is thought to be a significant under-estimate while a previous estimate of 53,100ha is probably an over-estimate.
[10] However Ireland still has an obligation under the Habitats Directive to maintain the Favourable Conservation Status of Annex I habitats which is likely to mean that there should be no net loss of area of each Annex I type.

which the habitat map is based. For example, there are stone-based field boundaries on the fields around the proposed locations of Turbines 17, 18 and 19 which are not mapped.

Table 1 Value of terrestrial habitats within the Phase II site

Habitat Type	Fossitt Code	Likely Importance (Applicant's Assessment)
Improved Agricultural Grassland	GA1	Negligible (Not stated/Low value for bats)
Semi-Improved Calcareous Grassland	GS1	Local (Not stated)
Unimproved Calcareous Grassland	GS1	County, at least (C- high value, locally important/High value for bats)
Scrub	WS1	Local (C- high value, locally important/Medium Local value for bats)
Hedgerow	WL1	Local (Not stated/High value for bats)
Stone walls and other stonework	BL1	Local (Not stated/Medium value for bats)
Ponds (identified in the bat report only)	FL8	Local (but not seen by me) (Not stated/Medium value for bats)

3.5 Invertebrates

3.5.1 The applicant identified just five species of invertebrates during the survey work. No counts or locations are presented in the EIS. This clearly under-represents the likely diversity of invertebrates present within a survey area which includes extensive unimproved calcareous grassland and scrub. The data supplied by the applicant is insufficient for an evaluation of the invertebrate fauna. However, as stated by the applicant, the calcareous grassland and scrub habitats are likely to be of most importance for invertebrates within the survey area.

3.6 Mammals other than bats

3.6.1 The applicant recorded Irish hare, Irish stoat, fox and rabbit in the survey area. No counts or locations are presented in the EIS for any of these mammal species. However, the populations of these species are not likely to be of more than local value.

3.6.2 Irish hare is a protected species.

3.7 Bats

3.7.1 In summary, the applicant has recorded a minimum of six or seven species of bat in the survey area for Phase II. These are as follows:

Table 2. Bat species recorded on the Phase II site

Species	Location of Roosts	Location of Activity (Year)
Leisler's bat	None recorded	Proposed locations for Turbines 1, 2, 3, 4, 6, 7, 8, 10, 11, 12, 14, 16, 17, 18 and 19 (2011) On local road L7535 (2011) Farm track nr. proposed location for Turbine 16 (2011) Farm track nr. proposed location for Turbine 18 (2011) Farmyard south of T16 (2012)

Species	Location of Roosts	Location of Activity (Year)
		Farmyard south of T18 and T19 (2012) Hedgerow south of T19 (2012) Anemometer nr. T14 – T16 (2012) Anemometer nr. T3 (2012)
Common pipistrelle	Roost A- Satellite roost in derelict farm building on L7535 nr. Turbine 3 Roost B - Satellite roost in farm building on L7535 nr. Turbine 6 and 7 Roost C - Maternity roost in derelict farmhouse nr. Turbine 16 Roost D - Maternity roost in derelict farmhouse nr. Turbine 18	Proposed locations for Turbine 3, 4, 6, 7, 8, 10, 14, 15, 16, 17, 18 and 19 (2011) On local road L7535 (2011) Laneway off L7535 nr. Proposed locations for T1 and T2 (2011) Regional Road R357, nr. Junction with L7535 (2011) Other local roads (2011) Farm track nr. proposed location for Turbine 16 (2011) Farm track nr. proposed location for Turbine 18 (2011) Farmyard south of T16 (2012) Farmyard south of T18 and T19 (2012) Hedgerow south of T19 (2012) Stone wall south of T18 (2012) Anemometer nr. T14 – T16 (2012) Anemometer nr. T3 (2012)
Soprano pipistrelle		Proposed locations for Turbine 8, 10, 14, 18 and19 (2011) On local road L7535 (2011) Other local roads (2011) Farm track nr. proposed location for Turbine 16 (2011) Farmyard south of T16 (2012) Farmyard south of T18 and T19 (2012) Hedgerow south of T19 (2012) Stone wall south of T18 (2012) Anemometer nr. T14 – T16 (2012) Anemometer nr. T3 (2012)
Nathusius' pipistrelle		Anemometer nr. T3 (2012)

Species	Location of Roosts	Location of Activity (Year)
Brown long-eared bat	Roost C – satellite roost in derelict farmhouse nr. Turbine 16 Roost E – satellite roost in farm building nr. Turbine 18	Proposed location for Turbine 16 (2011) Farm track nr. proposed location for Turbine 16 (2011) Stone wall south of T18 (2012)
Natterer's bat		Regional Road R357, nr. Junction with L7535 (2011)
Myotis spp., most likely Natterer's bat	Roost F- satellite roost in derelict house nr. Turbine 1	Proposed locations for Turbine 3, 6, 7, 10, 14, 16 and 17 (2011) Farm track nr. proposed location for Turbine 16 (2011) Stone wall south of T18 (2012) Anemometer nr. T14 – T16 (2012) Anemometer nr. T3 (2012)

3.7.2 The applicant did not provide a map of the bat roosts, or grid references, and the descriptions are somewhat vague. So, the locations of roosts are unclear.

3.7.3 The applicant reports a low to very high level of bat activity, depending on the survey location and species, as set out in Table 7 of the 2012 bat survey report (Bat Eco Services, 2013).

3.7.4 The applicant did not offer an evaluation of the bat communities present in the survey area but instead gave an evaluation of bat habitat. Leisler's bat, common pipistrelle and soprano pipistrelle are among the most common and widespread bat species in Ireland. The brown long-eared bat is probably also common and widespread in the country. The populations of these species within the survey area are probably of no more than local value.

3.7.5 Natterer's bat is relatively uncommon and so the population of this bat species on and around the Phase II site could be of more than local value.

3.7.6 Nathusius' pipistrelle is probably widespread but rare in Ireland. The record on the Phase II site is therefore of significance. The species is migratory, at least in part of its range, and as it was recorded in April, the recorded bat(s) could perhaps be migrating to breeding grounds elsewhere in Ireland. Strangely, there is little discussion of this record in the 2013 bat survey report and it is omitted from the appendices where the ecology of the other bat species is described (Bat Eco Services, 2013). A resident population would probably be of county value, while a regularly used migratory pathway would also be of importance. Like Leisler's bat, the Nathusius' pipistrelle is considered to be at high risk from wind turbines.

3.8 Birds

Breeding season

3.8.1 As set out in the EIS (Chapter 8, Appendix 8.1, pages 22 and 23), the applicant identified 57 species during the breeding season survey of which 53 were considered to be breeding.

3.8.2 Eighteen of the bird species identified were considered to be of conservation concern at the time. Among them were redshank, curlew, snipe, kestrel and black-headed gull. Fifteen of these were considered to be breeding in or near the survey area. Since the EIS was produced, the list of birds of conservation concern has been updated, with the net effect of an additional five species of conservation concern recorded on or near the site, bringing the total to 23. The locations and numbers of birds recorded during the survey are not given although it seems likely that many were recorded at a wetland site, possibly Lough Croan Turlough or Lough Feacle, rather than on the Phase II site itself.

3.8.3 Despite some being of conservation concern, all the bird species recorded during the breeding season away from wetland sites are still common and widespread. Taking into account the bird survey results, and the habitat present on the Phase II site, the bird community and the populations of individual species on the Phase II site, are probably of no more than local importance. It would have been useful to have count and locational data to support this assessment and therefore reach a firmer conclusion.

3.8.4 Significantly, the applicant also recorded a number of breeding birds associated with wetlands during the breeding season. The location is not always given but from the EIS the following can be gleaned:

- Curlew was breeding at Lough Croan Turlough (of at least 98 pairs nationally).
- Redshank (one pair) was breeding at Lough Feacle (of 500 pairs nationally).
- Teal was breeding somewhere in the area surveyed (of between 531 and 885 pairs nationally).
- Snipe was breeding at Lough Croan Turlough (of 4725 pairs nationally).
- Little grebe was breeding somewhere in the area surveyed (of at least 3438 pairs nationally).
- Coot was breeding at Lough Feacle and/or Lough Croan Turlough (of 3462 pairs nationally).
- Mute swan bred at Coolagarry Lough and Lough Croan Turlough (of at least 3560 pairs nationally).

3.8.5 Recent survey work indicates that there may now be less than 200 breeding pairs of curlew in the whole of Ireland (Birdwatch Ireland, 2011). If breeding occurs at Lough Croan Turlough then this is clearly a significant population. As set out in the site synopsis, Lough Croan Turlough also supports or supported two other uncommon breeding species, the shoveler (there are 50 to 100 pairs nationally) and pochard (confirmed breeding recently in just four localities in Ireland). In contrast to the populations of breeding birds found on the Phase II site, the populations of these three species Lough Croan Turlough are likely to be of at least county importance. The redshank and teal populations are also likely to be of county importance.

Late summer/autumn season

3.8.6 The bird species recorded during the late summer/autumn season are more or less a subset of those recorded during the breeding and wintering seasons, with no additional birds of conservation concern recorded. The survey indicates the arrival of some wintering waterbirds during the autumn season (i.e. before the end of September), including shoveler, pintail, golden plover and lapwing.

Wintering Birds

3.8.7 Results of the wintering birds surveys are set out in the EIS for Phase II (Chapter 8, including Appendix 8.1), the June 2012 AA report (Appendix 7), the wintering bird survey report for winter 2012/13 for Phase I and the wintering bird survey report 2014/15 for Phase II. The results of these surveys with respect to qualifying species of the local SPAs, including the occurrence of these species are other local wetland sites, such as Lough Feacle, are set out in Appendix 2 of my AA report.

3.8.8 For the Phase II site itself (i.e. observations from VP2), the applicant effectively confirms the presence of just two species of conservation concern during the winter which were sparrowhawk (with one recorded) and black-headed gull (with up to seven recorded). The latter is a qualifying species of the Middle Shannon Callows SPA.

3.8.9 Fifty-eight other bird species were recorded during the baseline survey in 2008/9, including 23 which were of conservation concern at the time that the survey was carried out. Information on the whereabouts and numbers of several of these species is presented in the EIS (Appendix A of Appendix 8.1 of Chapter 8 of the EIS). These are whooper swan, Bewick's swan, mute swan, wigeon, shoveler, pintail, teal, pochard, coot, golden plover, lapwing, dunlin, curlew, peregrine and starling. Other than peregrine and starling, all of these species were reported from VPs 1, 3 or 4, which were at Lough Feacle, Cuileenirwan/Coolagarry Lough and Lough Croan Turlough, respectively.

3.8.10 A further five of the species recorded during the baseline survey in 2008/9 have subsequently been added to the list of birds of conservation concern. However, no information is available on whether these five species, or any of the species recorded during the baseline surveys and not mentioned in paragraph 3.8.8, were found on the Phase II site or nearby. Other than peregrine falcon (for which see below) and waders (also see below), the wintering bird community and the populations of individual bird species present on the Phase II site are likely to be of up to local importance.

3.8.11 A single peregrine falcon was observed hunting on the Phase II site. The peregrine falcon is an uncommon breeding species in Ireland with perhaps no more than several hundred pairs present in the country. This species is more widespread during the winter, when the population may include some birds which breed in Britain, and when this species hunts migratory waterbirds, especially waders. Given the small population size of this species of bird, the local population is likely to be of up to county importance. There is a possibility that this species breeds in the nearby quarry.

3.8.12 The two nearest wetland sites Lough Feacle and Corkip Lough are not as well monitored as some of the local waterbodies, but the applicant's data indicates that these wetlands support locally important populations of whooper swan, ducks and waders. For example, over 100 whooper swan, 49 golden plover, 240 wigeon, 61 curlew and over 300 lapwing have been counted at Lough Feacle. These may also be part of the nationally important populations of these species found at the River Suck Callows, Lough Croan Turlough and Four Roads Turlough.

3.8.13 Given the shortcomings in the survey work, the value of the Phase II site for wintering golden plover and lapwing has not been fully established. These birds roost, at least occasionally, at Lough Feacle and may forage within perhaps 4km from the Lough at night (Fuller & Youngman,

1979; Gillings, Fuller, & Sutherland, 2005). They could well use the wind farm site from time to time.

4. Construction Stage Impacts

4.1 Approach

4.1.1 To assess the construction effects of the development and their significance, all elements shown as being part of the final design have been taken into account if they are shown on a drawing of the development or can otherwise be determined to be an integral part of the development proposals.

4.1.2 Furthermore, it is assumed that good general construction practice (e.g. waste and pollution control, no fires, etc.) will be followed, in line with commitments made by the applicant.

4.1.3 Other mitigation measures, which cannot or have not been mapped or shown on a plan or are unspecific, have generally been excluded from the initial assessment of the significance of the impacts of the development. These include timing of works or a generic commitment to follow guidelines.

4.2 Designated Areas

4.2.1 As set out in the EIS (Chapter 7, page 20), there would not be any direct effects on designated sites. There is however the potential for indirect effects on designated sites. There are three potential mechanisms for such effects.

4.2.2 Firstly, there are potential effects on the local hydrology/hydrogeology which may in turn affect the operation sites designated for their turlough habitat and that are hydrologically connected in some way to the development sites. A separate assessment is being completed of this impact mechanism. The current position is that insufficient investigation has been completed by the applicant to reach a firm conclusion on whether significant effects are likely. The designated sites potentially affected are Lough Feacle, Lough Funshinagh, Ballynamona Bog and Corkip Lough and Castlesampson Esker.

4.2.3 Secondly, construction traffic which will pass along the R363 road which is about 200m from Ballynamona Bog and Corkip Lough SAC. The additional traffic creates an enhanced risk of pollution, both from air pollution and waterborne pollution from road run-off and accidental spillages. Negative effects from traffic on vegetation can extend up to 200m from the road (Angold, 1997; Bernhardt-Römermann, Kirchner, Kudernatsch, Jakobi, & Fischer, 2006; Bignal, Ashmore, Headley, Stewart, & Weigert, 2007). As the SAC lies just beyond that distance from the road, significant effects are unlikely.

4.2.4 Thirdly, there are potential impacts as a result of disturbance and displacement of the populations of bird species which inhabit the designated sites. This potential impact is assessed in detail in my AA report. The main site at risk of significant negative effects is Lough Feacle pNHA. Lough Feacle lies between 480m and1350m from the nearest turbine, with about half of the turlough less then 800m from the nearest turbines and just under 90% of the turlough within 1km of the nearest turbines. In addition, one of the proposed anemometers lies around 300m from Lough Feacle. Depending on the timing of construction works in this area, there is a low risk of disturbance of birds using Lough Feacle, while at the Lough or foraging nearby, with

potential knock-on effects on the sites designated as SPAs. However, as the construction period is limited, such effects are unlikely to be significant in the medium to long term.

4.3 Non-designated wetlands

4.3.1 The non-designated wetlands, Ballyglass River Callows, Dysart (Thomas Street) Turlough and Cuilleenirwan/Coolagarry Turlough, are potentially at risk from the same type of impacts as described above for designated areas in relation to birds, with the Ballyglass River Callows being at most risk as it is the closest wetland to the wind farm site. The Ballyglass River Callows is also the only one of the three potentially connected to the Phase II site by hydrology. The potential effect on bird populations are discussed under birds below and, as noted above, the effect of the development on hydrology requires further investigation.

4.4 Terrestrial Habitats

4.4.1 The total built development area appears to in the order of 9ha, including approximately 1ha of temporary works. The applicant has not provided a breakdown of how this impacts the different habitats found on site. Approximate habitat losses are given in Table 3.

Table 3 Habitat Loss associated with the Phase II wind farm

Habitat Type	Fossitt Code	Area/Length Affected during construction (approx.)	Caused by the construction of..
Improved Agricultural Grassland and Semi-Improved Calcareous Grassland	GA1/GS1	5.6ha	Turbines 1, 3, 6, 7, 8, 9, 14, 15, 16, 17, 18 and 19
Unimproved Calcareous Grassland and Scrub, with scrub very much the minority	GS1/WS1	3.2ha	Turbines 2, 4, 5, 10, 11 and 13 Access track for Turbines 1, 2, and 4 (850m) Access track for Turbine 5 (1000m) Access track between Turbines 9, 10, 11 and 13 (1250m) Access track for Turbines 10 (730m) Access track for Turbines 13 (870m)
Hedgerow	WL1	35m?	Access track for Turbines 17, 18 and 19 Access track for Turbine 16 Access track for Turbine 6
Stone walls and other stonework	BL1	Max 2.4km[11]	Turbines 3, 4, 6, 8, 9, 10, 17, 18, 19 or all turbines expect Turbine 16

[11] The length is unclear. The applicant has presented two sets of contradictory information on the proximity of turbines to field boundaries. In the EIS, Appendix 7.2 of Chapter 7 indicates that five of the turbines are 58m distant from a field boundary, while a further five could easily achieve this distance through micro-siting, leaving 9 at which boundary re-routing would be required, giving an estimate 750m length. In the 2013 bat survey report it indicates that all turbines except Turbine 16 are located within 50m of a field boundary but more precise distances are not given.

Habitat Type	Fossitt Code	Area/Length Affected during construction (approx.)	Caused by the construction of..
Ponds	FL8	0ha	NA

4.4.2 As made clear by the applicant (Chapter 7, page 20), the loss of calcareous grassland is a small proportion of the overall area and the losses will be spread over a wide area and not in one block. Nevertheless, it is valuable habitat and the losses are likely to be locally significant, at least.

4.4.3 Losses of other habitats are not significant.

4.5 Invertebrates

4.5.1 The applicant considers this loss of invertebrate habitat to be a minor negative impact (Chapter 7 of the EIS page 23). As set out in Table 3 above, there would be some loss of good invertebrate habitat in the form of calcareous grassland. In the context of the amount of this type of habitat available within the survey area, the effect on invertebrate populations is unlikely to be significant unless a particularly important population is affected.

4.6 Mammals other than bats

4.6.1 The applicant considers the effect of the development on mammals other than bats to be not significant. As with invertebrates, there will be some loss of good habitat but the small scale of that loss and spatial arrangement (i.e. it is spread out over a wide area) mean that I agree with the applicant that negative effects on the populations of Irish hare and other mammals are unlikely to be significant.

4.7 Bats

4.7.1 The re-arrangement of stone walls has the potential to cause temporary disruption to bat commuting corridors and foraging patterns, depending on the way in which the process is managed and the season within which the work takes place. Lighting during the construction period also has the potential disrupt bat foraging behaviour. Any impacts arising from these activities will take place over one or two summers and then cease. They are unlikely to be significant in the medium to long term.

4.7.2 There will be some loss of higher quality bat foraging habitat as a result of the construction of the trackways across calcareous grassland and through hedgerows. This may have a negative effect on the local bat population but the area affected is a small proportion of that available within the survey area and so such effects are unlikely to be significant.

4.8 Birds

Breeding Birds

4.8.1 As with any construction project taking place during the breeding season, there is the potential for breeding birds to be disturbed as a result of construction activity and for nests and eggs to be destroyed during site clearance. However, none of the bird species recorded breeding on or near the Phase II site are especially sensitive to disturbance and, as all the species are common

and widespread, no lasting effects on the population would be expected as a result of construction stage impacts.

4.8.2 The breeding species at Lough Feacle, such as redshank, are probably too distant to be affected by construction activity but this is uncertain. However, the short duration of the construction stage means that significant effects on the population are unlikely.

4.8.3 There will be some loss of higher quality breeding bird habitat as a result of the loss of calcareous grassland and scrub habitat. As for bats, this loss of habitat may have a negative effect on bird populations but it is unlikely to be significant.

Wintering Birds

4.8.4 As for during the breeding season, the woodland and farmland birds recorded on or near the Phase II site by the applicant are not especially vulnerable to disturbance from human activity and, as the construction activity will be localised and of short duration, there should be no significant effects on this group of birds as a result of disturbance. The negative effects of habitat loss would be the same as described for the breeding season.

4.8.5 During the construction stage, there is the potential for wintering waterbirds to be disturbed and displaced when using Lough Feacle. As noted above, the nearest turbine is around 480m from Lough Feacle, while one of the proposed anemometers is around 300m from Lough Feacle and the birds which roost at Lough Feacle, such as golden plover, lapwing and whooper swan may forage nearer to the Phase II site in winter. These birds could perhaps be disturbed by construction activity, particularly as a result of constructing the anemometer. However, due to the short duration of the construction period and localised construction activity, such effects are unlikely to be significant in the medium to long term.

5. Operational Stage Impacts

5.1 Approach

5.1.1 As with construction stage impacts, only integral avoidance and mitigation measures have been considered as part of the development.

5.2 Designated Areas

5.2.1 During the operational stage, negative effects on designated sites could occur indirectly as a result of increased mortality of qualifying bird species as a result of displacement, creating a barrier to movement and collisions with turbines. This is assessed in detail for the sites designated as SPAs in my AA report. In summary, there is a low risk that the conservation objectives are contravened for the River Suck Callows SPA, Lough Croan Turlough SPA and Four Roads Turlough SPA. Negative effects could also occur as a result of changes in hydrology and this could affect the qualifying features of both SPAs and SACs locally. Again, further investigation is needed to help understand the potential impacts of the development on hydrology.

5.2.2 Lough Feacle pNHA is considerably closer to the Phase II. This designated site could be affected in the same way as for the SPAs and SACs and it is at greater risk. The potential effects on breeding and wintering birds are described below under ‘birds’.

5.3 Non-designated wetlands

5.3.1 The operational wind farm could have similar effects on the non-designated wetlands as for the designated areas. The risks of negative effects are highest for the Ballyglass River Callows as this wetland is the closest non-designated wetland to the Phase II site. The effects on wintering birds are described below and, once again, further information is required to understand how changes in hydrology might affect the callows.

5.4 Terrestrial Habitats

5.4.1 There should be no significant impacts on terrestrial habitats during the operational stage.

5.5 Invertebrates

5.5.1 There should be no significant impacts on invertebrates during the operational stage.

5.6 Mammals other than bats

5.6.1 There should be no significant impacts on mammals other than bats during the operational stage.

5.7 Bats

5.7.1 The applicant provides a fair description of the potential impacts on bats in the 2011 bat survey report (Bat Eco Services, 2011), generically from page 25 to page 28 and then more specifically in Table 6 on pages 28 to 32. During the operational stage, the main risk to bats is a result of collision with the turbines (Cryan & Barclay, 2009).

5.7.2 During the short survey period at each wind turbine location, bat activity was recorded at all bar one. Many of the bats recorded were likely to be commuting however foraging behaviour was also apparently recorded. Commuting bats, other than Leisler's bats, were perhaps navigating along the stone walls and hedgerows, whereas foraging bats may be doing the same or ranging more widely around the location where recorded.

5.7.3 Assuming the 2013 (Bat Eco Services, 2013) report takes precedence over the 2011 report, none of the turbines except possibly proposed Turbine 16 is the requisite 55m[12] distance from a field boundary. This arrangement appears to place commuting bats in the locations of at least 18 locations at considerable risk. The EIS (Chapter 3, page 10) indicates the potential to move the turbines (micro-siting) up to 20m in any direction which may enable some of the turbines to be moved further from a field boundary but it is unclear if such a move would achieve the requisite distance from a field boundary for many of the turbines.

5.7.4 Moving the turbine to a position further from a field boundary will not do anything to address the risks to bats which are foraging in suitable habitats around the turbine. For example, even the location of Turbine 16, which is more than 50m from a field boundary, had a high level of bat activity during the surveys.

5.7.5 As set out in Appendix 1, Leisler's bats tend to fly directly from their roost to their foraging area, at height and at speed, without adhering to field boundaries in the same way as other species of

[12] The applicant gives a minimum distance of 50m from the **tip** of the turbine blade to the nearest part of the field boundary. Applying the formula presented by the applicant on page 24 of the 2011 bat survey report to the proposed turbines for Phase I yields a minimum distance of 55m between the **base** of the turbine and the nearest part of the field boundary for a field boundary which is 1.5m tall and 58m for a field boundary which is 3.5m tall. See also Appendix 1.

bat. Leisler's bat also forages in open pasture. Because of its flight behaviour, this species is one of the most frequent victims of collisions with wind turbines. Separating the turbines and field boundaries will not effectively mitigate the risks of mortality for this species. It was recorded by the applicant at 15 of the 19 turbine locations. Further survey would probably yield more locations for this species.

5.7.6 Without mitigation, significant negative effects on the local bat population are considered likely, as result of mortality of commuting and foraging bats, particularly Leisler's bat. Nathusius' bat is also a species at high risk of collisions with turbines however its status on the Phase II site is unclear. If it is resident, then there is the potential for significant effects on this population as well. Natterer's bat is at low risk of collision due to its flight behaviour and therefore significant effects are less likely.

5.8 Birds

Breeding Birds

Displacement

5.8.1 Birds are less susceptible to displacement from operational wind farms during the breeding season than during the winter. The majority of the breeding species are lowland farmland or woodland passerines which are not likely to be displaced by the presence of the turbines.

5.8.2 The average minimum distances recorded for redshank from wind turbines during the breeding season 183m (Hötker, Thomsen, & Köster, 2006). In contrast to many species, taller turbines have less of a displacement effect on redshank than smaller turbines, so the Phase II site could have a lower displacement effect than the average wind farm. This means that any redshank breeding at Lough Feacle should not be displaced as a result of the Phase II wind farm.

Barrier Effect

5.8.3 Birds migrating to their breeding grounds could be susceptible to the barrier effect, which is where the wind farm interrupts migratory pathways. Lough Croan Turlough is potentially used by breeding shoveler, pochard and curlew, as well as other breeding waterbird species. Any of these birds which migrate from Lough Croan Turlough further to the south and west for the winter and then make the return journey in the spring could encounter the Phase II site. Such birds may then make a detour around the turbines, thereby increasing energy expenditure. Equally, the birds may pass through the 'valley' between the two clusters of turbines. Either way, the overall distance of a detour is not likely to significantly increase the overall journey. Birds migrating similarly to and from Lough Feacle would probably not encounter the wind farm site.

Collision

5.8.4 Breeding birds tend to stay in proximity to the nest, especially those species which are territorial. Therefore, it is only those species which breed on or very near the Phase II site which are vulnerable to collision during the breeding season. Of the birds which have been recorded on the Phase II site (or near it) during the breeding season, many[13] have been recorded as victims

[13] Including sparrowhawk, snipe, black-headed gull, wood pigeon, cuckoo, skylark, swallow, robin, willow warbler, blackbird, great tit, house sparrow, greenfinch, chaffinch, linnet, starling, jackdaw, magpie, raven, rook, carrion crow and even pheasant. Common buzzard, recorded during the autumn surveys, is a fairly frequent victim of collisions with turbines.

of collision with wind turbines. As the applicant has not provided distribution maps or numbers, the level of risk for the populations of these species on the Phase II site is hard to ascertain. Any effects on breeding bird population are however likely to be fairly localised and therefore not significant beyond the 300ha or so that make up the wind farm site.

5.8.5 As set out above, birds migrating from the south to breed at Lough Croan Turlough could encounter the Phase II wind farm. Such birds may make a detour to avoid the wind farm known as macro-avoidance), fly through the valley between the two turbine clusters or they may choose to fly through the wind farm. The majority of birds (>98%) flying through the wind farm are likely to avoid the turbines (micro-avoidance) however a very small proportion could collide with a turbine. The applicant has no records of any bird species making this journey and the breeding populations are understood to be relatively small. A small population size means that the risk that any birds collide with a turbine while migrating to breed at Lough Croan Turlough is therefore very low however a small population size also means that loss of any member of the breeding population could have a significant effect. Again, birds migrating similarly to and from Lough Feacle would probably not encounter the wind farm site.

Wintering Birds

Displacement

5.8.6 As for the breeding season, the farmland and woodland passerines, including starling, which have been recorded on or near the Phase II site are unlikely to be displaced as a result of the presence of the turbines. Birds of prey, such as peregrine, sparrowhawk and buzzard are also not vulnerable to displacement at wind farms.

5.8.7 However, wintering waterbirds generally are generally vulnerable to displacement as a result of the presence of wind turbines, with the effect varying from species to species and generally increasing with the height of the turbines. Typically, for this group of birds, there is a zone within and around the turbines within which complete displacement occurs and then there may be a zone beyond that where birds are present but the numbers are reduced A distance of 1km from the turbines is probably the upper limit for complete displacement for any species for turbines of 85m hub height, while the distances beyond that where numbers are reduced is not well understood (Hötker, Thomsen, & Köster, 2006; Rees, 2012).

5.8.8 The River Suck Callows, Lough Croan Turlough, Dysart (Thomas Street) Turlough, and the Cuillineerwan/Coolagarry Turlough are much greater than 1km away and therefore displacement should not occur at these sites.

5.8.9 There are three wetland areas which are within or near the 1km distance from the nearest turbines. These are Ballyglass River Callows, Ballynamona Bog and Corkip Lough and Lough Feacle. Of these, Lough Feacle is the closest and the birds which use this site are the most at risk of displacement.

5.8.10 Lough Feacle is approximately 550m away from the nearest turbine at its nearest point and the majority of this wetland is within1km from the nearest turbine as well. The wind farm could therefore cause displacement of birds from Lough Feacle, especially if the anemometer mast, which is to be situated approximately 325m from the lough, combines with the turbines to generate a displacement effect.

Table 4: Displacement (minimal) distances for selected bird species found at Lough Feacle

Species	Ave. Minimal (m)	Highest Minimal (m)	Source
Whooper Swan	200 - 400	ND but could be 800m by extrapolation	(Rees, 2012)
Wigeon	311	ND	(Hötker, Thomsen, & Köster, 2006)
Golden Plover	175	850m	(Hötker, Thomsen, & Köster, 2006)
Lapwing	260	850m	(Hötker, Thomsen, & Köster, 2006)
Curlew	212	650m	(Hötker, Thomsen, & Köster, 2006)

5.8.11 In Table 4, the average minimal distance is the average observation, across multiple studies, of the point at which complete displacement occurs. For most of these species, this distance increases by a metre a more for every one metre increase in with turbine height (Hötker, Thomsen, & Köster, 2006). The lapwing is the most sensitive with 9.59m increase in displacement distance for every one metre increase in turbine height. As the wind farms in the studies from which the average distances are derived comprise mostly older and smaller turbines than proposed at the Phase II site, complete displacement distances are likely to be above the average minimal distances shown in the table and closer to the highest minimal distance. Moreover, these distances are measured from the closest bird to the nearest turbine. There is some evidence that numbers beyond that point are reduced by the presence of turbines even if the birds are not completely displaced (Rees, 2012). A further point is that the birds are not restricted to the turloughs with several species also foraging on nearby farmland, including whooper swan, golden plover and lapwing. In conclusion, there is a medium risk of displacement and therefore potential knock-on effects for the populations for these species locally but this is uncertain. Any significant negative effects would be at the county level if restricted to Lough Feacle but if these populations are linked to those occurring at nearby SPAs, the effects would be of higher significance.

Barrier Effect

5.8.12 The farmland and woodland passerines and birds of prey which are resident on the Phase II site in winter are unlikely to experience a barrier effect. However, the small passerines, such as swallow, are vulnerable to barrier effects when migrating. It is not clear what implication this might have for the small number of migratory species recorded in and around the Phase II site but in all probability any detour made to avoid the wind farm site would not add significantly to the migration distance.

5.8.13 Once again, detailed assessments for the qualifying species of the local SPAs are set out in my AA report for Phase II. In summary, there is a medium risk the birds which use the River Suck Callows or the Ballyglass River Callows and Lough Feacle experience a barrier effect and a possibility that this would lead on to effects on their populations. Birds moving between Lough Feacle and Lough Croan Turlough should be able to pass unhindered between the two clusters of turbines that make up the Phase II site.

5.8.14 The other migratory wetland species found at both the River Suck Callows and Lough Feacle are also at risk of experiencing a barrier effect which has a significant effect on the journey distance when moving between these two wetland sites. Curlew has been recorded at both and it is possible that birds move from one site to the other on occasion over the course of a winter, although this was not recorded by the applicant. Flying around rather than across the Phase II site could increase the minimum journey distance between these two sites by 14% to 60% depending on the route taken around the wind farm. As with other species it is unclear if this would have any effect on survival rates or population size but the risk of significant negative effects is considered to be low.

Collision

5.8.15 For woodland and farmland passerines, the risk of collision at the Phase II site and associated negative effects is much the same as during the breeding season.

5.8.16 Any birds which move regularly in number from River Suck Callows or the Ballyglass River Callows and Lough Feacle during the winter are at most risk of collision at the Phase II site. Once again, detailed assessments for the qualifying species of the local SPAs are set out in my AA report for Phase II. In summary, there is a low to medium risk that a few individuals of these species collide with a turbine over the 25 year period that the wind farm will be operational. It is unclear whether any such mortality would have an effect on the population of wintering birds locally and therefore it is uncertain whether such mortality would be significant.

5.8.17 The wintering wetland birds arrive in the Roscommon area from the north and north east. Any birds migrating from this direction directly to Lough Feacle would probably encounter the wind farm site. These birds could make use of the wide gap (the 'valley') between the two clusters of turbines to reach Lough Feacle safely and the same would be true if embarking on a migratory flight from the Lough Feacle back towards the breeding grounds. However it is also possible that the birds pass through the easternmost cluster to reach Lough Feacle and would therefore at risk of collision.

5.8.18 Curlew is not considered to be of particular risk from collision with turbines (EC, 2011) and this species occurs at relatively low numbers, up to around 80 birds at Lough Feacle in some years. The risk of collision is therefore low as is the likelihood of significant effects on the population of this species at Lough Feacle and other local wetland sites during the winter.

6. De-commissioning Stage Impacts

6.1 Approach

6.2 Designated Areas

6.2.1 De-commissioning will again introduce a workforce onto the site with associated activity, including vehicle movements. This re-introduces the risks associated with pollution and waste management but it is expected that these risks can be fully controlled through good construction practice.

6.2.2 During de-commissioning, the activity will be against the background of an operating or still standing wind farm and potentially a degree of existing displacement of wintering birds. The de-

commissioning work should not have effects on designated sites beyond that of an operating wind farm.

6.3 Non-designated wetlands

6.3.1 As for designated sites.

6.4 Terrestrial Habitats

6.4.1 Depending on the degree to which the infrastructure is removed, there is the potential for the baseline conditions to be fully restored.

6.5 Invertebrates

6.5.1 As for terrestrial habitats.

6.6 Mammals other than bats

6.6.1 As for terrestrial habitats.

6.7 Bats

6.7.1 As for terrestrial habitats.

6.8 Birds

6.8.1 As for terrestrial habitats.

7. Proposed Avoidance and Mitigation Measures

7.1 Approach

7.1.1 Below is a summary of the mitigation measures put forward by the applicant. It is not necessarily an exhaustive list and if any measures have not been described here, it should not be taken to imply that such measures are not needed.

7.1.2 Any non-specific, vague or unquantified commitments which are not shown on plans have generally been omitted from the list of measures given below. This includes statements like 'will be minimised' or 'retained or replaced where possible' since there is no certainty that anything will be done at all. Similarly references to following guidelines, which can often be interpreted widely, are not considered definite commitments.

7.2 Designated Areas

7.2.1 The following mitigation measures have been put forward by the applicant in relation to designated areas:

- Preparation of an Environmental Management System which will include a Construction Method Statement and a Waste Management Plan, with measures to avoid spillages and contamination during the construction stage (June 2012 AA report).
- A Site Environmental Management Plan to avoid preventable impacts on the ornithological resource of the local area (June 2012 AA report).
- Foundation design and installation to take account of local ground conditions (June 2012 AA report).

- Excavation during construction works to take place only when periods of heavy and persistent rain are not forecast (June 2012 AA report)
- Shallow interceptor drains to capture run-off from access tracks where these have a steep gradient as well as sediment traps and other drainage management measures (June 2012 AA report)
- Installation of a MERLIN avian radar system to prevent bird collisions with turbines (June 2012 AA report).

7.3 Non-designated wetlands

7.3.1 No specific measures have been put forward by the applicant in relation to non-designated wetlands, however, those given above under designated areas would also apply to non-designated wetlands.

7.4 Terrestrial Habitats

7.4.1 The following mitigation measures have been put forward by the applicant in relation to terrestrial habitats:

- Access tracks to be within [semi-improved and] improved grassland field margins avoiding hedgerows. However, it looks as though about 6 hedgerows will be bisected and the tracks also pass through calcareous grassland so this measure cannot be fully realised (EIS, chapter 7).
- Fencing off 'any' semi-natural habitats adjacent to proposed access routes and turbines to prevent unnecessary damage and degradation as well as clearly defining work areas for the same purpose. Fence to be located 2m from hedgerows. The location of the fencing nor how work areas will be demarcated is not specified (EIS, chapter 7).
- Movement of machinery and storage to be confined to clearly marked areas within the development (EIS, chapter 7).
- Allowing the verges of the proposed access routes to re-colonise naturally by local species in semi-natural grassland sites. This amounts to not re-seeding the disturbed ground next to the access tracks. (EIS, chapter 7).
- The 'removal of any hedgerow sections would be remedied by the enhancement of local hedgerow species' which may mean that lost sections of hedgerow will be replaced but that is unclear. The locations of the planting and loss are not specified, nor is the ratio of loss to gain (EIS, chapter 7).
- Re-instatement of areas affected by temporary compounds and hard standing to grassland (EIS, chapter 7).

7.4.2 The applicant has produced a habitat management plan for Phase II (Appendix G of the Further Information Response) however much of this is a direct copy of the text in the EIS and it sets out no additional commitments to create grassland or other habitats. There are also no commitments to manage the grassland except to say that 'the existing calcareous grassland outside the footprint of the development area will be maintained by each land owner as per current farming practices'. Clearly, this does not serve to mitigate for negative effects on calcareous grassland arising from the development.

7.5 Invertebrates

7.5.1 No specific mitigation measures are proposed.

7.6 Mammals other than bats

7.6.1 No specific mitigation measures are proposed.

7.7 Bats

7.7.1 The following mitigation measures have been put forward by the applicant in relation to bats:

- Re-route field boundaries in proximity to Turbines 3, 4, 6, 8, 9 10, 17, 18, and 19 to achieve 50m (rather than 55m) minimum distance between the field boundary and the turbines (EIS, chapter 7). The 2013 bat report suggests that more extensive re-routing may be required to achieve the 50m distance.
- Removal of [any] trees during the months of March, September, October or November to avoid impacts on bats and under the supervision of bat specialist, with large mature trees felled using a precautionary method (EIS, chapter 7).
- Increasing cut-in speeds for wind turbines to 5.5 – 6m/s from 30 minutes prior to dusk and [until?] 30 minutes after dawn in locations where there is not a high level of bat activity (EIS Appendix 7.2).

7.8 Birds

7.8.1 The following mitigation measures have been put forward by the applicant in relation to birds:

- Removal of trees and vegetation would [not] be carried out between 1st March and 31st August to avoid impacts on breeding birds (Chapter 7 and 8 of the EIS). Of course, this measure does not address the potential impact on ground nesting birds such as skylark and meadow pipit.
- An 'emergency procedure' to be followed in case an active bird nest is encountered (Chapter 8 of the EIS).
- Turbines will be erected over the summer period and be in place when the birds arrive on their wintering grounds in October (June 2012 AA report). This could be contradictory to the construction programme and so may not be achievable. Also some wintering birds arrive before October.
- Use of the MERLIN Avian Radar System to both monitor turbine operation and automatically stop rotors when birds are detected in the wind farm area (Chapter 8 of the EIS).

8. Predicted Residual Impacts

8.1 Approach

8.1.1 The residual impacts are the likely final position following the implementation of the mitigation measures summarised in Section 6 of this document.

8.2 Designated Areas

8.2.1 Potential impacts from pollution and waste could probably be controlled through good construction practice as set out by the applicant. This should be confirmed as part of a hydrology/hydrogeology assessment.

8.2.2 However, the situation with respect to the bird interest of the designated sites, such as the River Suck Callows SPA, is less clear. This is set out in detail in my AA report and summarised under 'birds' below.

8.2.3 The impact on the wetland habitat within designated sites such as Lough Feacle and Ballynamona Bog and Corkip Lough as a result of potential interference with hydrology/hydrogeology is also uncertain. In a separate assessment (Keohane, 2016), it has been determined that further investigation is required in order to reach a conclusion on the effects of the development on hydrology.

8.3 Non-designated wetlands

8.3.1 As for designated sites.

8.4 Terrestrial Habitats

8.4.1 The development would result in the loss of 3.2ha of calcareous grassland of which 0.8ha is to be reinstated, leaving a net loss of 2.4ha. The re-instated grassland will not be of the same quality as that which has not been disturbed by construction activity for some considerable time. This is a small proportion of the total area of this grassland locally but it is a valuable habitat and therefore the loss of calcareous grassland is likely to be of at least local significance. The management plan put forward by the applicant for Phase II does not include the creation of grassland habitat.

8.5 Invertebrates

8.5.1 The residual impacts are not likely to be significant on terrestrial invertebrates, despite the loss of habitat described above.

8.6 Mammals other than bats

8.6.1 As for invertebrates.

8.7 Bats

8.7.1 The development will result in the loss of small areas of scrub habitat and the applicant is not proposing to replace this habitat.

8.7.2 Re-locating turbines or re-routing the stone walls such that they are located 55m (measured along the ground) or more from the each other is only really set out as a recommendation in the bat ecologist's report and not shown on a plan. This makes the proposal difficult to assess. The degree of re-routing required would appear to be considerable and it would presumably have negative effects on a cultural heritage asset. More detail on the proposals on this proposal and its acceptability are therefore required before reaching a firm conclusion. This measure does have the potential to substantially mitigate the risk that the turbines pose to the bats recorded on site, except Leisler's bats and, when migrating, Nathiusus' pipistrelle. If the stone walls and turbines are not re-repositioned to be 55m distant from each other, then collision mortality is likely to have a locally significant effect on the bat population.

8.7.3 Increasing the cut-in speed to 5.5 – 6ms^{-1} appears to now be proposed for all the turbines on the Phase II site as set out in the 2012 bat survey report, page 57, Item 3 (Bat Eco Services, 2013). Again this is set out only as a recommendation in the bat survey report however, at the oral hearing in June 2016, the applicant committed to adhering to all the mitigation measures set out in the specialist's reports. Increasing cut in speeds to 5.5 – 6ms^{-1} should be an effective measure for most species of bats. However, Leisler's bats probably fly in windier conditions than most species of bat and Nathusius' pipistrelle certainly does; around 25% of the Nathusius' pipistrelle population would still be expected to be flying at wind speeds of 6ms^{-1} (Jones, Cooper-Bohannon, Barlow, & Parsons, 2009). As set out in Appendix 1, the cut-in speed may need to be increased to 6.5 – 8ms^{-1} to be a fully effective measure for Leisler's bats. Increasing cut-in speeds to 7 - 8ms^{-1} may necessary for this to be a fully effective measure for Nathusius' pipistrelle. If cut-in speeds are not increased sufficiently, then there is likely to be a locally significant impact on the local bat population.

8.7.4 The access roads bisect hedgerows in places. However, given the small width of the access roads (5m) and the low frequency and speed of the traffic, the effect of removing short sections of hedgerow on the local bat population is not likely to be significant, whether or not alternative routes are provided.

8.8 Birds

8.8.1 Impacts on nesting birds can be avoided during the construction stage through good construction practice.

8.8.2 The applicant has proposed mitigation to deal with collision risk (i.e. installation of turbines before the winter season and the use of MERLIN system) but has not proposed any mitigation measures to deal with the risks associated with displacement and the barrier effect.

8.8.3 The commitment to install the turbines in advance of the winter season seems to be slightly at odds with the construction programme and so further details are required in order to understand if this commitment is achievable. The timing of turbine installation would only influence matters in the first year of operation so perhaps this is a minor point.

8.8.4 The applicant proposes to install and operate the Merlin Avian Radar System to both monitor bird movements and to automatically shut down turbines as birds approach. The applicant describes this system in section 4.3.2.2, pages 93 to 94 of the 2012 AA report for Phase II and a presentation on this system was given at the June 2016 Oral Hearing. If this system is able to function as described then it has the potential to fully mitigate the risks of collision.

8.8.5 However, the NPWS has not accepted that the efficacy of the Merlin Avian Radar System has been demonstrated (see its October 2015 submission). Moreover, a recent search of the scientific literature reveals no peer reviewed scientific papers which fully demonstrate that the system will work as described by the applicant. Indeed, there is some evidence to the contrary. One research project found that the system was good at tracking large flocks of larger birds, such as geese, but poor at tracking single large birds and small flocks of smaller birds such as ducks (Gerringer, Lima, & DeVault, 2015) and there is anecdotal evidence of a fatality of a single large bird at a wind farm using the Merlin system (Subramanian, 2012). The system therefore can be considered to have the potential to reduce mortality of birds approaching the wind farm but it cannot be considered to fully mitigate the risk of collision. It will of course do nothing to address the risks of displacement and the barrier effect.

8.8.6 There would seem to be a residual risk of displacement, a barrier effect and collision, principally on account of the position of the Phase II site in proximity to Lough Feacle. The risk of a significant effect on any of the wintering bird populations is low but if there were to be an effect a feature of considerable, potentially national, importance. In other words, the risks are low but the stakes are high and therefore it would seem prudent to understand and then mitigate the risks as fully as possible.

9. Cumulative Impact Assessment

9.1 Approach

9.1.1 The applicant did not provide an assessment of cumulative impacts in the EIS for the Phase II wind farm or in the Further Information Response of June 2012. There is also no assessment of cumulative impacts on flora and fauna (other than birds) in the EIS for the Phase I wind farm. There is a brief assessment of cumulative impacts on birds in the EIS for the Phase II wind farm (Chapter 8, page 46) and also the 2012 AA report for the Phase II wind farm. The latter did not consider the combined effects of the Phase I and Phase II development and neither did the equivalent document for Phase I.

9.1.2 As the development is a proposed wind farm, a type of development which has quite specific types of impacts, there is clearly the most potential for cumulative effects with other wind farm developments, both existing and proposed. Skrine wind farm, Sliabh Bawn wind farm and Seven Hills Phase I are all within a 20km radius of the Phase II site and therefore should be considered for cumulative effects. These are characterised in Table 4.

Table 4: Summary of projects considered for cumulative effects

	Seven Hills Phase I	Seven Hills Phase II	Skrine	Sliabh Bawn	TOTAL
No. of Turbines	16	19	2	20	57
Wind farm size*	200ha	400ha	40ha?	833ha	1473ha
Habitat Types	Grassland	Grassland	Grassland	Woodland	-

*based on a loop drawn around the turbines rather than the planning application boundary

9.1.3 In addition, there is the potential from cumulative effects arising from the grid connection. The applicant has made clear that its intention is to bury the cables (IWCM, 2015b).

9.1.4 The wind farm developments shown in Table 4 and the grid connections for Phase I and Phase II are therefore the developments which are considered for cumulative impacts.

9.2 Designated Areas

9.2.1 None of the developments will directly affect any designated sites.

9.2.2 However, there is the potential for indirect cumulative effects on qualifying species of birds as a result of the Phase I and Phase II developments and potentially also the Skrine wind farm. This

is described in more detail in my AA report. Given the proximity of these wind farm sites there is the potential for negative effects on the same populations of birds if they move from site to site during the course of a winter.

9.2.3 There are no SACs with turloughs as a qualifying feature which are likely to be connected by hydrology to more than one of the wind farm sites (Keohane, 2016), meaning that cumulative effects on a single SAC by this mechanism are unlikely.

9.2.4 Construction traffic for both the Phase I and Phase II developments would pass about 200m of Ballynamona Bog and Corkip Lough SAC. The risks of pollution are increased compared to considering each development separately however significant cumulative effects are unlikely at this distance.

9.3 Non-designated wetlands

9.3.1 As for designated sites in relation to birds and hydrology. The construction traffic for Phase II will not pass on the roads adjacent to Dysart (Thomas Street) Turlough and so the risks to this turlough from construction traffic are solely in relation to Phase I.

9.4 Terrestrial Habitats

9.4.1 All of the wind farms will have an effect on terrestrial habitats however the impact in each case will be limited due to nature of the development. The Skrine wind farm appears to be located improved agricultural grassland and Sliabh Bawn is located in forestry, whereas the Phase I and Phase II wind farms both affect improved agricultural grassland, calcareous grassland and scrub. Impacts on improved agricultural grassland are not significant except perhaps in relation to bats and birds, for which see below. The grid connection is proposed to be buried under the public road network and so should not result in additional losses of habitat.

9.4.2 The Phase II development would result in the loss of around 3.2ha of calcareous grassland and scrub while the Phase I would result in the loss of 0.6ha of the same habitats, giving a total loss of 3.8ha, reducing to around 3.0ha following habitat reinstatement. The applicant is proposing to create and manage 4ha of this habitat at the Phase I site which has the potential to offset the cumulative impact by area however it may not achieve the same quality as the habitat being lost[14]. The cumulative impact is therefore between negligible and a locally significant negative impact depending on the quality of the habitat created and the length of time it is in place compared to the wind farm infrastructure (hard standing and tracks). If the Phase I development does not proceed then the impact would remain a locally significant negative impact. Ideally, habitat losses at the Phase II site would be mitigated at the Phase II site, rather than remotely.

9.4.3 Depending on the approach taken with the bat mitigation, there is also the potential for several kilometres of stone wall to be relocated. However, as the walls in each case will be relocated rather than lost, there should be no significant cumulative negative impact in the medium to long term.

9.5 Invertebrates

9.5.1 The potential combined loss of habitat for invertebrates, in the context of the amount available, is probably insufficient to result in significant negative effects on any invertebrate populations.

[14] This can be dealt with by creating more habitat than is lost e.g. 2ha created for every 1ha lost.

9.6 Mammals other than bats

9.6.1 As for invertebrates.

9.7 Bats

9.7.1 All of the proposed wind farms have the potential to have negative effects on local bat populations.

9.7.2 Sliabh Bawn wind farm is located in forestry. The common pipistrelle was recorded here, at three turbine locations. Significant negative impacts were discounted, however, bat surveys were conducted on a maximum of two nights only and it may well be the case that additional survey work would have revealed more species and more widespread bat activity. Skrine wind farm is just two turbines set in low quality bat habitat. The Phase II and Phase I sites support the typical bat fauna of rural Ireland.

9.7.3 Some mortality of bats is likely at all four locations. Recent research in the UK indicates that an average of 6.7 bats are killed per wind farm (n=29) per month (Lintott, Richardson, Hosken, Fensome, & Mathews, 2016) which gives some idea of the likely cumulative effects of the wind farms under consideration here, if appropriate mitigation measures are not put in place. Bats are long lived and produce few young per annum and so such mortality is likely to have a negative effect on the population.

9.7.4 Leisler's bat is particularly vulnerable to cumulative effects because it is a species at high risk of collision with wind turbines which can forage up to 13.4km from its roost. This puts at least three of these wind farms potentially in range of the same population of Leisler's bats. The Leisler's bat is relatively common and widespread in Ireland and so the cumulative impacts, if unmitigated, are likely to be of local significance.

9.7.5 Nathusius' pipistrelle has only been recorded at the Phase II site so far and its status there is unclear. This species is migratory in at least part of its range and so would be vulnerable to the cumulative impacts of multiple wind farms located on its migration routes. These routes have not been established in Ireland and so the potential for cumulative impacts is unclear. Increasing cut-in speeds during migration periods may be an effective mitigation measure however it is possible this species may make use of strong tail winds during migration (Boshamer & Bekker, 2008) and in such instances, the measure would be ineffective.

9.7.6 The common and soprano pipistrelle typically remain within 3km and 2km of their roosts respectively, which makes cumulative impacts on the same population, as a result of the wind farms considered here, less likely.

9.8 Birds

9.8.1 The applicant's assessment in the EIS for Phase II did not identify any negative cumulative impacts on birds as a result of the Phase I and Phase II wind farms but did identify a positive effect of 'more meaningful and useful data' as a result of deploying two MERLIN avian radar systems, one for each wind farm. The assessments set out in the 2012 AA reports for Phase I and Phase II did not consider the cumulative effects of the two wind farms.

Breeding Birds

9.8.2 Breeding birds are not likely to be displaced from the wind farms and the four wind farms are too widely spaced to create a combined barrier for birds which migrate to the area to breed.

9.8.3 All four wind farms are likely to result in some mortality of breeding birds albeit at a low level, with mainly common and widespread species affected in each case. The effect on populations is likely to be localised at each wind farm and not more than locally significant.

Wintering Birds

9.8.4 Cumulative effects on wintering waterbirds associated with the designated sites are set out in my AA report. In summary, the main qualifying species which are at risk from cumulative effects are (i) whooper swan, a qualifying feature of the River Suck Callows, as a result of collision with the turbines at Phase I and Phase II; and (ii) golden plover and lapwing, which are also qualifying features of local SPAs, as a result of displacement from grassland foraging habitat at Phase I and Phase II.

9.8.5 There is also the potential for any wintering waterbird population which makes use of both Dysart (Thomas Street) Turlough and Lough Feacle to experience cumulative effects as a result of displacement since both of these wetland sites are less than 1km from one of the proposed wind farms. The risk of displacement in each case is low or moderate and so is the risk of significant cumulative effects.

10. Summary and Conclusion

10.1.1 The applicant has completed a number of surveys to inform the planning application, with a focus on terrestrial habitat, bats and birds. Unfortunately, the earlier surveys in particular are not of a very high standard. The accompanying reports are sometimes not clear on methodology and the survey effort for the Phase II site appears to have been exaggerated in places. Furthermore, the description of the methods, results set out in the reports and responses to further information are all, at times, misleading. The whooper swan surveys were too narrowly focused. The initial bat survey undertaken at the Phase II site stands out as a higher quality piece of work and is clearly presented. These earlier deficiencies have been somewhat addressed by additional bird survey work undertaken at local wetland sites. However, the additional bird survey work has not addressed the deficiencies of the bird survey work on the Phase II site itself.

10.1.2 Nevertheless, it is clear that the Phase II site comprises a patchwork of grasslands of high and low nature conservation value, according to the degree of agricultural improvement. The fauna recorded by the applicant on the Phase II site, including most of the birds and most of the bats, is representative of that which would be expected in the farmed landscape. The record of Nathusius' pipistrelle is potentially of some significance as this is a rare species of bat. It is not clear if the record relates to a resident population or bat which was migrating.

10.1.3 The development would result in the net loss of 2.4ha unimproved calcareous grassland and there seems to be no mitigation proposed for this loss at the Phase II site. The impact is considered to be locally significant. However, there is the potential for this loss to be offset by habitat creation at the Phase I site.

10.1.4 With current layout, the populations of bats are at risk of collision with the turbines. If the applicant can re-route the stone walls or relocate the turbines to 55m apart then the risk would be much reduced for most of the species found on the site. However, such a measure will not mitigate the risk for Leisler's bats and migrating Nathusius' pipistrelle. To mitigate the risk for

these species, and others, the applicant is proposing to increase the cut-in speeds of the wind turbines. This would have the effect of reducing the risk of collision substantially for most species of bats however higher cut-in speeds may be needed to substantially reduce the risk for Leisler's bats and Nathusius' pipistrelle. Without mitigation, there is likely to be a locally significant negative effect on the bat population as a result of collision mortality. This could be reduced to a negligible effect if the mitigation is effectively implemented.

10.1.5 The effects on the birds that are resident on the Phase II site and those which migrate there to breed are unlikely to be significant. However, there appears to be a low residual risk of significant effects on the bird populations of nearby waterbodies because Lough Feacle is located within 1km of the development site. Further survey may help reach a conclusion that these risk are so low as to not be significant or perhaps additional mitigation measures or amendments to the layout could reduce the risks to a level for the same conclusion to be reached.

10.1.6 The effect of the development on designated sites is described in my AA report and the assessment for the non-designated wetlands is similar. For both, the effects of the development on hydrology requires further consideration so it is not yet possible to say whether significant effects will arise as result. The other way in which these sites could be affected is through impacts on their bird populations and this is described above.

11. References

Angold, P. G. (1997). The impact of a road upon adjacent heathland vegetation: effects on plant species composition. *Journal of Applied Ecology*, 409-417.

Arnett, E. B., Huso, M. M., Schirmacher, M. R., & Hayes, J. P. (2011). Altering turbine speed reduces bat mortality at wind-energy facilities. *Frontiers in Ecology and the Environment*, 9(4), 209-214.

Bat Conservation Ireland. (2012). *Wind Turbine/Wind Farm Development: Bat Survey Guidelines, Ver. No. 2.8.* Lisduff: Bat Conservation Ireland.

Bat Eco Services. (2011). *Bat Survey: Evironmental Impact Assessment Seven Hills wind Farm Phase 2.* Lisduff: Bat Eco Surveys.

Bat Eco Services. (2011b). *Bat Survey: Environmental Impact Assessment, Seven Hills Wind Farm Phase 2.* Lisduff: Bat Eco Services.

Bat Eco Services. (2013). *Bat Survey: Seven Hills Wind Farm Phases I and II.* Lisduff: Bat Eco Services.

Bernhardt-Römermann, M., Kirchner, M., Kudernatsch, T., Jakobi, G., & Fischer, A. (2006). Changed vegetation composition in coniferous forests near to motorways in Southern Germany: the effects of traffic-born pollution. *Environmental Pollution*, 143(3), 5.

Bignal, K. L., Ashmore, M. R., Headley, A. D., Stewart, K., & Weigert, K. (2007). Ecological impacts of air pollution from road transport on local vegetation. *Applied Geochemistry*, 22(6), 1265-1271.

Birdwatch Ireland. (2011, July). *Catastrophic Curlew declines uncovered*. Retrieved from Birwatch Ireland: http://www.birdwatchireland.ie/Publications/eWings/eWingsIssue22July2011/CatastrophicCurlewdeclinesuncovered/tabid/1189/Default.aspx

Boshamer, J. P., & Bekker, J. P. (2008). Nathusius' pipistrelles (Pipistrellus nathusii) and other species of bats on offshore platforms in the Dutch sector of the North Sea. *Lutra*, 51(1), 17.

Cryan, P. M., & Barclay, R. M. (2009). Causes of bat fatalities at wind turbines: hypotheses and predictions. *Journal of Mammalogy*, 90(6), 1330-1340.

EC. (2011). *Guidance Document: Wind Energy Developments and Natura 2000.* European Commision.

EC. (2013). *Interpretation Manual of European Union Habitats.* European Commision.

ECOFACT. (2013). *Seven Hills Phase 1: Wintering Bird Survey (January to March 2013).* Limerick: Ecofact Environmental Consultants Ltd.

ECOFACT. (2015a). *Proposed Seven Hills (Phase 1) Wind Farm, Co. Roscommon: Wintering Bird Survey October 2014 to March 2015.* Limerick: Ecofact Environmental Consultants Ltd.

ECOFACT. (2015b). *Proposed Seven Hills (Phase 2) Wind Farm, Co. Roscommon: Wintering Bird Survey (October 2014 to March 2015).* Limerick: Ecofact Environmental Consultants Ltd.

Fossit, J. (2000). *A Guide to Habitats in Ireland.* Herirage Council.

Fuller, R. J., & Youngman, R. E. (1979). The utilisation of farmland by Golden Plovers wintering in southern England. . *Bird Study*, 26(1), 37-46.

Gerringer, M. B., Lima, S. L., & DeVault, T. L. (2015). Evaluation of an avian radar system in a midwestern landscape. *Wildlife Society Bulletin*.

Gillings, S., Fuller, R. J., & Sutherland, W. J. (2005). Diurnal studies do not predict noctutnal habitat choice and site selection of Eurpoean Golden Plover (PLUVIALIS APRICARIA) and Northern Lapwing (VANELLUS VANELLUS). *The Auk*, 122(4), 1249-1260.

Horn, J. W., Arnett, E. B., & Kunz, T. H. (2008). Behavioral responses of bats to operating wind turbines. *The Journal of wildlife management*, 72(1), 123-132.

Hötker, H., Thomsen, K. M., & Köster, H. (2006). Impacts on biodiversity of exploitation of renewable energy sources: the example of birds and bats. In *Facts, gaps in knowledge, demands for further research, and ornithological guidelines for the development of renewable energy exploitation. .* Michael-Otto-Institut im NABU, Bergenhusen, 65.

Hundt, L. (2012). *Bat Surveys: Good Practice Guidelines. 2nd edition.* London: Bat Conservation Trust.

IWCM. (2015b). *Seven Hills (Phase 2) Wind Farm: Supplementary EIS and NIS Information (Grid Infrastructure. Reg. Ref 11/273 & PL20.244347.* IWCM.

Jones, G., Cooper-Bohannon, R., Barlow, K., & Parsons, K. (2009). *Determining the potential ecological impact of wind turbines on bat populations in Britain.* Bat Conservation Trust.

Keohane, J. (2016). *Seven Hills Wind Farm Phase 1: Report to An Bord Pleanala on Hydrology/Hydrogeology.*

Lintott, P., Richardson, S., Hosken, Fensome, S., & Mathews, F. (2016). Ecological impact assessments fail to reduce risk of bat casualties at wind farms. *Current Biology*, Volume 26 , Issue 21 , R1135 - R1136.

Natural England. (2009). *Technical Information Note TIN051: Bats and onshore wind turbines - Interim guidance.* Peterborough: Natural England.

NRA. (2009). *Guidelines for Assessment of Ecological Impacts of National Roads Schemes Revision 2.* National Roads Authority.

O'Neill, F. H., Martin, J. R., Devaney, F. M., & Perrin, P. M. (2013). *The Irish semi-natural grasslands survey 2007-2012.* National Parks and Wildlife Service.

Rees, E. C. (2012). Impacts of wind farms on swans and geese: a review. . *Wildfowl*, 2.62(62), 37-7.

Reynolds, D. S. (2006). Monitoring the potential impact of a wind development site on bats in the northeast. *Journal of Wildlife Management*, 70(5), 1219-1227.

Rodrigues, Bach, Dubourg-Savage, Goodwin, & Harbusch. (2008). *Guidelines for consideration of bats in wind farm projects: EUROBATS Publication Series No. 3.* Bonn: UNEP/EUROBATS Secretariat.

Shiel, C. B., Shiel, R. E., & Fairley, J. S. (1999). Seasonal changes in the foraging behaviour of Leisler's bats (Nyctalus leisleri) in Ireland as revealed by radio-telemetry. *Journal of Zoology*, 249: 347-358.

SNH. (2014). *Recommended bird survey methods to inform impact assessment of onshore wind farms.* Scottish Natural Heritage.

Subramanian, M. (2012). An ill wind. . *Nature*, 486(7403), 310-311.

Sullivan, C. A., Skeffington, M. S., Gormally, M. J., & Finn, J. A. (2010). The ecological status of grasslands on lowland farmlands in western Ireland and implications for grassland classification and nature value assessment. *Biological Conservation*, 143.

Appendix 1: Bat Mitigation

Separation between Turbines and Boundary Features

Many species of bat use boundary features as commuting corridors between their roosts and foraging areas. Boundary features can themselves be foraging habitat. The level of bat activity declines with distance from the boundary feature, with many species of bats typically remaining within a few metres. There are however exceptions such as Leisler's bat.

One of the mitigation measures proposed by the applicant to reduce mortality of bats as a result of collision with the turbine blades and barotrauma is to ensure that there is sufficient separation between the tips of the turbine blades and the boundary features.

This mitigation measure is described in a Technical Information Note produced by Natural England (Natural England, 2009). Natural England's advice is to maintain a 50m buffer around trees and field boundaries into which no part of the turbine intrudes. To achieve this, the turbine base usually needs to be more than 50m from the tree or field boundary, with the actual distance being dependent on the height of the tree or boundary feature and the design of the turbine. For the Phase II site, the applicant is suggesting a minimum distance of 50m between the field boundary and the turbine but it is not clear whether this means the blade tip or the turbine base. In order to achieve 50m separation between the blade tip and the boundary feature, I have calculated that, for 1.5m boundary feature and the type of turbine proposed, there needs to be a minimum of 55m between the turbine base and the nearest part of the boundary feature. For a 3.5m boundary feature the distance between the turbine base and the nearest part of the boundary feature needs to be a minimum of 58m.

There are clearly two ways of achieving the appropriate level of separation. One is to relocate the turbine and the other is to relocate the boundary feature. The applicant appears to be proposing a combination of both.

Increasing Turbine Cut-In Speeds

Bats restrict their flight activity during periods of rain, low temperatures and strong winds and are most active, and fly higher, during dry, warm and still conditions. Research in the US has demonstrated that increasing cut-in speeds, that is the wind speed at which the turbines begin operating, can reduce mortality rates in bats (Reynolds, 2006; Horn, Arnett, & Kunz, 2008; Arnett, Huso, Schirmacher, & Hayes, 2011). This research indicates that increasing the cut in speed to 5.0ms^{-1} could reduce bat fatalities by 44 to 93% (Arnett, Huso, Schirmacher, & Hayes, 2011).

The second mitigation measure proposed by the applicant is therefore to increase the cut in speed from 3ms^{-1} to 5.5 - 6ms^{-1} from half an hour before sunset and (until?) half an hour after dawn. The research suggests that this would have the effect of reducing overall bat fatalities. However, there is variability among bat species in the response to wind speed, with smaller bats generally stopping flying at lower wind speeds than bigger bats. The applicant is proposing to increase cut-in speeds during the months of May to September only (Further Information Response, August 2011).

MERLIN avian radar system

Although not specifically offered as mitigation for bats in the EIS or Further Information Response, the manufacturers of the MERLIN system say that this system can be used to mitigate the risk of bat mortality at wind farms.

Note that the applicant also suggested the deployment of a 'bat scaring' radar device but this technology was shown to be ineffective and the measure has been abandoned by the applicant.

Applicant's approach to mitigation for Leisler's bat

In Appendix 7.2 of Chapter 7 of the EIS for Phase II, the applicant states that "*due to the high Leisler's bat activity at T**14** and T**17**, the buffer zone* [i.e. 50m separation between the turbines and a boundary feature] *is unlikely to reduce the impact of the turbine location on this bat species. This species flies in the open and not along hedgerows and treelines to the same extent as common and soprano pipistrelles*".

The same document goes onto say that "*increasing the cut-in speed …..is not suitable for Turbines 16, 8, **14**, 15, **17**, 18 and 19 due to high level of bat activity and relocation of these wind turbines to minimum distance from linear and foraging habitats is the best practice option in this case"*. Emphasis added in both cases.

In the 2013 bat report for Phases I and II, the recommendation is for relocating turbines with a potential major or moderate negative impact on bats to the a minimum distance of 50m from field boundaries and "*increasing the cut-in speed to 5.5 to 6 m/s from 30 minutes prior to dusk and* [until?] *30 minutes after dawn*".

This is something of confused and contradictory picture.

The foraging ecology of Leisler's bat

Leisler's bat is a large bat which behaves somewhat differently to the smaller bats such as the common pipistrelle. Firstly, it typically commutes directly from its roost to its foraging areas (which can be up to 13.4km distant) rather than along field boundaries. Secondly, it flies at high speed, up to 11ms^{-1}, and up to 100m AGL. Thirdly, it forages in open habitats such as pasture. These factors help to make this species one of the main victims of collisions with wind turbines.

There is limited data available on the wind speeds which this species will tolerate however there is data available for the closely related noctule bat which is a similar size and exhibits similar behaviour. The noctule bat has been observed flying at wind speeds of more than 8ms^{-1}, however it appears that 95% of the population will have stopped flying at this wind speed, about 90% of the population will have stopped flying at a wind speed of 6.5ms^{-1} and about 80% at 5.5ms^{-1} (Jones, Cooper-Bohannon, Barlow, & Parsons, 2009). The smaller bat species generally reduce their flight activity at lower wind speeds than the noctule.

Leisler's bats have a powerful echolocation system which can be detected up to 100m away from the bat. This may mean that some of the records for Leisler's bat made by the applicant were some distance from the location of the bat detector.

Potential to mitigate

It seems that relocating turbines or field boundaries to achieve a minimum separation distance of 50m would not be an effective mitigation measure for Leisler's bat. However, it remains an important measure for the other species of bat found on the Phase II site.

If relocation of turbines is to form part of the strategy for Leisler's bat, it would first be necessary to undertake further survey to determine the roost sites, main foraging areas and commuting routes of the bats. The turbines would then need to be located away from these key areas and routes in order to reduce the risk of collision for Leisler's bats. This has not been put forward as a potential mitigation measure by the applicant.

Increasing the cut-in speed would appear to be an effective measure for Leisler's bat however the cut-in speed proposed by the applicant may not be high enough to achieve the desired reduction in mortality. There is more than likely a diminishing rate of reduction in bat mortality as cut-in speeds increase above 5.5ms^{-1}. However, a cut-in speed of 6.5 - 8ms^{-1} may be necessary to reduce mortality of Leisler's bat to negligible levels. The appropriate cut-in speed, above a set minimum level, could potentially be determined by monitoring at the wind farm post-construction.

It may also be worth exploring varying the cut-in speeds through the night with the highest cut-in speeds at times when Leisler's bat is most likely to be active in a given area and lower cut-in speeds at times when Leisler's bat is less likely to be present. These times would vary from place to place and through the year due to changes in daylight and also the behaviour of the bats (Shiel, Shiel, & Fairley, 1999). Therefore any attempt to mitigate with variable cut-in speeds would need to be based on more data than is available currently.

There is of course no need to increase the cut-in speeds at times when bats are inactive or exhibit low levels of activity. For example, increasing cut-in speeds should not be necessary when temperatures are below 6^{o}C at night, which is likely to be the case from mid-November to mid-March, and when it is raining heavily, in any month of the year. The applicant is not proposing to increase cut-in speeds in the months of March, April, October and November. This could expose bats to higher levels of risk during these months should warm weather occur.