CHAPTER 8: ORNITHOLOGY

INTRODUCTION

8.1 This chapter assesses the effects of the proposed Heckington Fen Wind Park on birds. It complements the assessment of ecological effects in Chapter 7. The chapter describes the methods used to evaluate the bird interest at Heckington Fen and determine its nature conservation importance. It explains the ways in which birds may be affected by the development and assesses the likely effects of the scheme and their significance.

8.2 The assessment was undertaken by Kevin Shepherd - Consultant Ornithologist Limited.

8.3 Birds may be affected by the following phases of the proposed development:

- Construction: construction of tracks, turbines, buildings and hard-standings (including borrow pit operations);
- Operation: turbine operation and associated maintenance activities;
- Decommissioning: the removal of installed structures and reinstatement of habitats if appropriate.

8.4 The potential effects of the proposed wind park on birds are:

- Direct habitat loss: due to land take by wind turbine bases, access tracks and ancillary structures;
- Indirect habitat loss: due to the displacement of birds as a result of construction and maintenance activities, or due to the presence of the operating wind turbines close to nesting or feeding sites or habitual flight routes;
- Collision: the killing or injury of birds following collision with rotating turbine blades and associated structures.

8.5 The assessment is based on information available at the time of writing (June 2011).

METHODS

Guidance

8.6 The following guidance and legislation was taken into account during this assessment:

- Review of relevant guidance documents and methods, including[1] [2] [3] [4] [5] [6] [7] [8] [9] [10] [11] [12];
- Review of relevant legislation, including the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 (EIA Regulations) (as amended) and the Conservation of Habitats and Species Regulations 2010; and
- Review of relevant government policy, including Planning Policy Statement 22: Renewable Energy 2004, Planning for Renewable Energy: A Companion Guide to PPS22 2004 and Planning Policy Statement 9: Biodiversity and Geological Conservation 2005.

Consultations

8.7 Natural England (Neil Pike, NE Grantham) and the Royal Society for the Protection of Birds (Kate Kelly, RSPB Norwich) were consulted prior to the commencement of baseline studies. Although there are no identified statutory nature conservation assets in the vicinity of the site, both emphasised that any proposals brought forward should nevertheless be accompanied by robust bird survey data assessing the use of the site and its surroundings by both breeding and wintering birds.

8.8 Natural England (Ryan Bavin, NE Lincoln) and the Royal Society for the Protection of Birds (Mike Jones, RSPB Norwich) were consulted again during a meeting at NE Lincoln on 3 June 2011. Both confirmed that all aspects of the ornithological assessment (the ornithological approach, survey methods employed, data collection and interpretation, assessment of significance of potential effects of the proposed development on birds, proposed mitigation and habitat/biodiversity enhancement) were entirely satisfactory. Given the potential collision effects of the proposed wind park on wintering golden plover (see paras 8.89 - 8.90), Mike Jones requested that cumulative collision impacts of wind farm development on wintering golden plover in the Heckington Fen area should be investigated. This is addressed in para. 8.103.

Baseline studies

8.9 A review of potential bird issues associated with the proposed development was undertaken by Kevin Shepherd and identified the following field survey requirements:

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[1] *Institute of Environmental Assessment (1995). Guidelines for Baseline Ecological Assessment. E & FN Spon, London.*

[2] *Office of the Deputy Prime Minister (2000). Environmental impact assessment: guide to procedures.* http://www.communities.gov.uk/index.asp?id=1143250.

[3] *Regini, K. (2000). Guidelines for ecological evaluation and impact assessment. Ecology and Environmental Management. In Practice 29 (September). Institute of Ecology and Environmental Management, Winchester.*

[4] *Oxford, M. (2001). Developing Naturally. A handbook for incorporating the natural environment into planning and development. Association of Local Government Ecologists.*

[5] *Scottish Natural Heritage (2002). A Handbook on Environmental Impact Assessment. SNH, Battleby.*

[6] *Institute of Ecology and Environmental Management (2002). Guidelines for Ecological Impact Assessment: Amended Pilot November 2002. IEEM, Winchester.*

[7] *Communities and Local Government (2004). Note on environmental impact assessment directive for local planning authorities.* http://www.communities.gov.uk/index.asp?id=1143273.

[8] *Institute of Environmental Management and Assessment (2004). Guidelines for Environmental Impact Assessment. IEMA, Lincoln.*

[9] *IEEM (2006). Guidelines for Ecological Impact Assessment in the United Kingdom (version 7 July 2006). http://www.ieem.org.uk/ecia/index.html.*

[10] *Gilbert, G., Gibbons, D.W. and Evans, J. (1998). Bird Monitoring Methods; a manual of techniques for key UK species. RSPB, Sandy.*

[11] *SNH (2005). Survey Methods for use in Assessing the Impacts of Onshore Wind Farms on Bird Communities. SNH, Battleby.*

[12] *Band, W., Madders, M. & Whitfield, D.P. (2006). Developing field and analytical methods to assess avian collision risk at wind farms. In: de Lucas, M., Janss, G. & Ferrer, M. (eds). Birds and Wind Power. Lynx Edicions, Barcelona.*

- A breeding bird survey;
- Surveys to investigate use of the area during the non-breeding period;
- Vantage point surveys to assess bird flightlines and use of the area by foraging birds.

8.10 A twelve-month baseline ornithological survey was initiated in September 2007. The objectives were to survey:

- All bird species breeding within an area extending to at least 500m beyond the locations of the proposed turbines and site infrastructure (undertaken during April-July 2008);
- All bird species utilising the above area during the non-breeding period (undertaken during September 2007 – March 2008);
- Flight activity of selected bird species throughout the year; within an area extending to at least 200m beyond the locations of the proposed turbines (undertaken during September 2007 – August 2008).

8.11 Full details of survey methods and results are given in **Appendix 8.1: Ornithological Survey Methods and Results**. Findings relevant to birds of conservation importance are summarised in paragraphs 8.27 – 8.63.

Assessment of significance

Overview

8.12 During the rapid evolution of methods in recent years, ecological consultants and advisory bodies have employed a variety of techniques to assess the significance of potential effects of wind parks on birds. Assessment at Heckington Fen takes these, and published guidance and legislation[13] into account. It ensures that local authorities have sufficient information to determine whether the proposal is likely to have a significant effect on bird interests.

8.13 Where there is a potential effect on a bird population that forms part of the qualifying interest of an internationally or nationally designated site[14], or a site that would meet the criteria for international or national designation, effects are judged against whether the development could significantly affect the site population and its distribution. Where bird populations are not protected by designated sites, judgement is made against a more general expectation that the development would not have a significant adverse effect on the overall population, range or distribution; and that it would not interfere significantly with the flight paths of migratory birds. In assessing the effects, consideration is given to the national and regional populations of species. Trivial or inconsequential effects are excluded.

8.14 The assessment determines the potential effects of the development and the likelihood of their occurrence. Effects are assessed to determine whether or not they are significant with respect to the EIA Regulations. In judging whether a potential effect is significant or not, two principal factors are taken into account:

- The nature conservation importance of the species present;
- The magnitude of the likely effect.

8.15 The significance of potential effects is determined by integrating the assessments of nature conservation importance and magnitude of effects in a reasoned way. In making judgements on significance, consideration is given to the population status and trend of the potentially affected species[15]. If a potential effect is determined to be significant, measures to avoid, reduce or remedy the effect are suggested where possible.

Evaluating Nature Conservation Importance

8.16 The nature conservation importance of the bird species potentially affected by development is defined in accordance with **Table 8.1**. The classification is hierarchical; so species that qualify under more than one category are defined according to the highest class.

Table 8.1 Determining factors for nature conservation importance.

Importance	Definition
Very high	Species that form the qualifying interest of nearby SPAs and SSSIs.
High	Species listed on Annex I of EC Directive 79/409/EEC on the Conservation of Wild Birds 1979 (Annex I species). Breeding species listed on Schedule 1 of the Wildlife and Countryside Act 1981 (Schedule 1 species). Species present in nationally important numbers (>1% UK population).
Moderate	Breeding species listed as UK Biodiversity Action Plan priority species (UK BAP

[13] *See para 8.6.*

[14] *i.e. Ramsar sites, Biosphere Reserves, Special Areas of Conservation (SAC), Special Protection Areas (SPA), Sites of Special Scientific Interest (SSSI).*

[15] *Population status and trends are considered at an appropriate geographical scale.*

	priority species). Breeding species listed on the Birds of Conservation Concern 'Red' list (BOCC Red List species)[16]. Species present in regionally[17] important numbers (>1% regional population). Regularly occurring migratory species, which are either rare or vulnerable, or warrant special consideration on account of the proximity of migration routes, or breeding, moulting, wintering or staging areas in relation to the proposed development.
Low	All other species.

Evaluating the magnitude of effects

8.17 Effect is defined as change in the population of a given bird species present as a result of the development. Change can occur during or beyond the life of the development. Where the response of a population has varying degrees of likelihood, the probability of these differing outcomes is considered. Note that effects can be adverse, neutral or favourable.

8.18 The overall magnitude of effects is determined by taking three factors into account:

- The behavioural sensitivity of the species;
- The spatial magnitude of the effect; and
- The temporal magnitude of the effect.

8.19 Behavioural sensitivity is determined subjectively based on species' ecological function and behaviour, using the broad criteria set out in **Table 8.2**. The judgement takes account of information available on the responses of birds to various stimuli (e.g. predators, noise and disturbance by humans). Note that behavioural sensitivity can differ even between similar species[18] and that, within a particular species, some populations and individuals may be more sensitive than others. Thus the behavioural responses of birds are likely to vary with both the nature and context of the stimulus and the experience and personality of the bird. Sensitivity also depends on the activity of the bird. For example, a species may be less tolerant of disturbance whilst breeding than at other times, though tolerance is likely to increase as breeding progresses[19].

Table 8.2 Determining factors for behavioural sensitivity.

Sensitivity	Definition
High	Species or populations occupying habitats remote from human activities, or that exhibit strong and long-lasting reactions to disturbance events.
Moderate	Species or populations that appear to be warily tolerant of human activities, or exhibit short-term reactions to disturbance events.
Low	Species or populations occupying areas subject to frequent human activity and exhibiting mild and brief reaction (including flushing behaviour) to disturbance events.

8.20 The magnitude of effects is also judged in terms of space (Table 8.3) and time (Table 8.4)[20].

Table 8.3 Spatial magnitude criteria.

Magnitude	Definition
Very high	Total loss or very major alteration to key elements/features of the baseline (pre-development) conditions such that the post development attributes would be fundamentally changed and may be lost altogether. Guide: >80% of regional population affected, >20% of national population affected.
High	Major loss or major alteration to key elements/features of the baseline conditions such that the post development attributes would be fundamentally changed. Guide: 21-80% of regional population affected, 6-20% of national population affected.
Moderate	Loss or alteration to one or more key elements/features of the baseline conditions such that post development attributes would be partially changed. Guide: 6-20% of regional population affected, 1-5% of national population affected.

[16] *Eaton, M.A., Brown, A.F., Noble, D.G., Musgrove, A.J., Hearn, R., Aebischer, N.J., Gibbons, D.W., Evans, A. and Gregory, R.D. (2009). Birds of Conservation Concern 3: the population status of birds in the United Kingdom, Channel Islands and the Isle of Man. British Birds 102: 296-341.*

[17] *Region is defined as the relevant Natural England Regional Area (http://www.naturalengland.org.uk), in this case NE East Midlands Region.*

[18] *Schueck, L.S., Marzluff, J.M., & Steenhof, K. (2001). Influence of military activities on raptor abundance and behavior. Condor 103: 606-615.*

[19] *Holthuijzen , AMA (1985). Behavior and productivity of nesting prairie falcons in relation to construction at Swan Falls Dam and experimental blasting. Snake River Birds of Prey Research Project Annual Report 1985.*

[20] *Regini, K. (2000). Guidelines for ecological evaluation and impact assessment. Ecology and Environmental Management. In Practice 29 (September): 1-7. Institute of Ecology and Environmental Management, Winchester.*

Low	Minor shift away from baseline conditions. Change arising from the loss/alteration would be discernible but the underlying attributes would be similar to pre-development circumstances/patterns. Guide: 1-5% of regional population affected, <1% of national population affected.
Negligible	Very slight change from baseline conditions. Change barely distinguishable, approximating to the "no change" situation. Guide: <1% of regional population affected, no discernible effect on national population.

Table 8.4 Temporal magnitude criteria.

Magnitude	Definition
Permanent	Effects continuing indefinitely beyond the span of one human generation (taken as approximately 25 years), except where there is likely to be substantial improvement after this period (e.g. the replacement of mature trees by young trees which need >25 years to reach maturity, or restoration of ground after removal of a development. Such exceptions can be termed very long term effects).
Long-term	Approximately 15-25 years or longer (see above).
Medium-term	Approximately 5-15 years.
Temporary	Up to approximately 5 years.

8.21 In the case of internationally or nationally designated sites (e.g. SPAs, SSSIs), magnitude is assessed in respect of the area within the designated site boundary. For non-designated sites, magnitude is assessed in respect of an appropriate ecological unit, e.g. Natural England Regional Area.

8.22 Knowledge of how rapidly the population or performance of a species is likely to recover following loss or disturbance (e.g. by birds being recruited from other populations elsewhere) is used to assess temporal effects, where such information is available.

8.23 The above factors are taken into account in order to come to an overall assessment of impact magnitude using simple categories (**Table 8.5**). These place an emphasis on the integrity of species/populations, in line with the approach set out in European law for the protection of populations of birds, particularly within SPAs. The integrity of a population is essentially the coherence of its ecological structure and function, across its range that enables it to sustain itself. A population that achieves such coherence is considered to be in favourable condition.

Table 8.5 Overall impact magnitude.

Magnitude	Criteria
Major negative	The change is likely to cause an adverse effect on the integrity of a species/population of nature conservation importance.
Negative	The change adversely affects the species/population, but there will probably be no effect on its integrity.
Neutral	No or negligible effect.

Evaluating the effects

8.24 A matrix (**Table 8.6**) is then used to assign a level of effect (**Table 8.7**) of the potential impact.

Table 8.6 Impact effect matrix.

Overall Impact Magnitude	Nature conservation importance			
	Very high	High	Moderate	Low
Major negative	Extreme	Extreme	Extreme-moderate	Major-minor
Negative	Major- minor	Major-minor	Major-minor	Moderate-minor
Neutral	No/negligible impact			

Table 8.7 Definitions of effects.

Significance	Definition
Extreme	These effects represent key factors in the decision making process. They are generally, but not exclusively, associated with sites and features of international

	or national importance (e.g. SPA/SSSIs) and resources/features which are unique and which, if lost, cannot be replaced or relocated.
Major	These effects are likely to be important considerations at a regional or district scale, but, if adverse, are potential concerns to the project, depending upon the relative importance attached to the issue during the decision making process.
Moderate	These effects, if adverse, while important at a local scale, are not likely to be key decision making issues. Nevertheless, the cumulative effect of such issues may lead to an increase in the overall effects on a particular area or a particular resource.
Minor	These effects may be raised as local issues but are unlikely to be of importance in the decision making process. Nevertheless, they may be of relevance in the detailed design of the project.
Negligible	No effects (or those beneath levels of perception); within normal bounds of variation or within margins of forecasting error.

8.25 Where the boxes in Table 8.6 contain a range of values, professional judgement is used to assign a value within the range given. Impacts judged to be of moderate or greater significance should be considered 'significant' in terms of the EIA regulations, while impacts assessed as being of minor significance or no impact do not need to be treated as significant effects in terms of the EIA regulations.

BASELINE DESCRIPTION

Designated sites

8.26 No SSSIs lie within 10km of the proposed wind park.

Baseline survey results

8.27 Thirteen Annex I species (little egret, great white egret, Bewick's swan, whooper swan, marsh harrier, hen harrier, merlin, peregrine, golden plover, Mediterranean gull, common tern, short-eared owl and kingfisher) were recorded during the baseline surveys.

8.28 Two little egrets were seen foraging adjacent to the site in Holland Dike on 4 December 2007.

8.29 Single great white egrets seen foraging in dikes c.220m north of the site on 5 November 2007, c.1230m ESE of the site on 13 December 2007 and c.1480m ESE of the site on 7 February 2008 were considered to be the same individual wintering in the wider area.

8.30 A family party of Bewick's swans (an adult pair with three juveniles) was seen foraging in a field c.740m NW of the site on 5 November 2007, an adult in a field c.380m SSE of the site on 5 March 2008.

8.31 An adult whooper swan was seen foraging in a field c.530m SSW of the site on 5 March 2008.

8.32 Marsh harriers were recorded foraging on and around the site during April-September; at least three (an adult male, an adult female and a sub-adult female) in April, at least four (an adult male, an adult female, a sub-adult male and a sub-adult female) in May, at least three (an adult male, an adult female and a sub-adult female) in June and July, at least six (an adult male, an adult female, a sub-adult male, a sub-adult female and two juveniles) in August and at least three (an adult male, an adult female and an indeterminate juvenile/female) in September. No display-flights were recorded and there was no evidence that the species bred within at least 500m of the site in 2008. Furthermore, no birds were seen carrying prey (suggesting that the species did not breed nearby), although the majority of sightings presumably involved birds breeding or attempting to breed in the wider area. During the total of 360 hours of flight activity work undertaken in the five recording zones that include proposed wind turbine locations during the April-September period that marsh harriers were present in the area, a total of 118 flights were recorded (averaging one flight every 3.05 hours), fourteen of these (averaging one flight every 25.71 hours) within potential rotor-sweep height.

8.33 Hen harriers were recorded foraging on and around the site in August (a 2nd calendar-year male), September (a juvenile), October (a juvenile), December (an adult male and a female), January (an adult male), February (an adult male), March (an adult male) and April (a female). The sightings are considered to have related to a very small number of passage/wintering birds foraging generally in the wider area. During the total of 540 hours of flight activity work undertaken in the five recording zones that include proposed wind turbine locations, during the August-April period that hen harriers were recorded in the area, a total of 26 flights were recorded (averaging one flight every 20.77 hours), all below potential rotor-sweep height.

8.34 Single 'brown' (i.e. female or juvenile male) merlins were recorded foraging on and around the site each calendar month during October-March. The sightings are considered to have related to a very small number of passage/wintering birds foraging generally in the wider area, probably just 1-2 individuals. During the total of 360 hours of flight activity work undertaken in the five recording zones that include proposed wind turbine locations, during the October-March period that merlins were recorded in the area, a total of 21 flights were recorded (averaging one flight every 17.14 hours), only one of these within potential rotor-sweep height.

8.35 Peregrines were recorded on and around the site between 26 August-10 March; one (an adult male) in August, three (an adult male, a juvenile and a poorly-viewed third bird) in September, three (an adult male, an adult female and a juvenile) in October, two (an adult male and a juvenile) in November, three (an adult male, an adult female and a juvenile male) during December-February and two (an adult male and an adult female) in March. The sightings are considered to have related to at least three individuals (an adult male, an adult female and a juvenile male) wintering in the area. During the total of 480 hours of flight activity work undertaken in the five recording zones that include proposed wind turbine locations, during the August-March period that peregrines were present in the area, a total of 76 flights were recorded (averaging one flight every 6.32 hours), ten of these (averaging one flight every 48 hours) within potential rotor-sweep height.

8.36 Flocks of golden plover were recorded on agricultural fields on and around the site between 15 July-12 April: up to two in July, 68 in August, 133 in September, 2250 in October, 143 in November, 176

in December, 125 in January, 256 in February, 25 in March and 33 in April. The birds were not ever-present. Instead they were highly mobile and wide-ranging, using a multitude of areas in the vast surrounding agricultural landscape. Closer to the site, fields to the west and NW of the site were particularly favoured during 2007/08, though favoured locations are likely to change constantly due to ever-changing agricultural and cropping regimes and rotations. During the total of 600 hours of flight activity work undertaken in the five recording zones that include proposed wind turbine locations during the July-April period that golden plovers were present in the area, a total of 221 flights were recorded (averaging one flight every 2.71 hours), 125 of these (averaging one flight every 4.8 hours; involving flocks of up to six birds in August, 73 in September, 2100 in October, 328 in November, 130 in December, 77 in January, 37 in February, nine in March and nine in April) within potential rotor-sweep height.

8.37 Golden plovers do not breed in Lincolnshire[21]. Large numbers arrive in autumn (mainly during October-November) from breeding grounds in northern Britain, Iceland, Scandinavia and Russia, the majority then moving on to winter further south or south-west. Wintering birds then return north from February onwards, with spring passage generally being lighter than autumn[22] [23]. The numbers recorded in the Heckington Fen area during the year therefore reflect a typical overall pattern of occurrence.

8.38 An adult Mediterranean gull was seen foraging on agricultural fields on and around the site during 24-27 August 2008.

8.39 1-2 adult common terns were recorded flying low over agricultural fields or low along dikes to the north and east of the site on 9, 12 and 14 May, sightings considered to have related to very small numbers of passage migrants moving through the area at the time.

8.40 Single short-eared owls were recorded foraging on and around the site in February, May, August, September and October. Sightings are considered to have related to very small numbers of passage migrants or wandering wintering birds in the area at these times. During the total of 300 hours of flight activity work undertaken in the five recording zones that include proposed wind turbine locations during the months that short-eared owls were recorded in the area, a total of only three flights were recorded, all below potential rotor-sweep height.

8.41 Small numbers of kingfishers were recorded foraging along dikes on and around the site (mainly along the main Head/Holland Dike) during September-December; three in September, four in October, three in November and one in December.

8.42 Three further[24] Schedule 1 species (hobby, quail and barn owl) were recorded during the baseline surveys.

8.43 Single hobbies were recorded foraging on and around the site during May (an adult), June (an adult), August (an adult and a juvenile) and September (a juvenile), sightings that could have involved passage migrants, wandering summering birds and/or birds breeding in the wider area. There was no evidence to suggest that the species bred within at least 500m of the site in 2008. During the total of 240 hours of flight activity work undertaken in the five recording zones that include proposed wind turbine locations during the months that hobbies were recorded in the area, a total of sixteen flights were recorded, only five within potential rotor-sweep height.

8.44 Single male quail were heard singing in six locations (for mapped locations, see **Figure 8.3a**) on and around the site during 7-23 May 2008. Though birds were not heard singing simultaneously (hence individuals could have been singing in more than one location), and there were no records after 23 May (hence birds involved could have been transient passage migrants), it is likely that quail at least attempted to breed in the area in 2008.

8.45 Present mainly during May-September, Quail is an irruptive summer visitor to Britain in numbers that vary considerably each year[25] [26] [27], 2008 being an above average year[28]. Frequenting agricultural fields and field margins at Heckington Fen, and being subtly dependent upon particular habitats amidst ever-changing agricultural and cropping regimes and rotations, breeding locations as well as numbers are likely to vary considerably each year.

8.46 Two pairs of barn owl were found breeding in farm buildings: one within the proposed development at Six Hundreds Farm (c.185m from nearest proposed wind turbine location) and one c.400m ENE of the site (for mapped locations, see Figure 8.3a). A third pair were known to be breeding just outside the breeding bird survey area at Spinney Farm (c.1.7km east of the site). Birds were resident throughout the year with up to eight recorded during the non-breeding season. Parts of the site and its surrounding area, particularly the banks of dikes and drainage ditches, provided good foraging and a total of 273 flights were recorded during the total of 720 hours of flight activity work undertaken in the five recording zones that include proposed wind turbine locations. Typically, all flights were at low level with none recorded within potential rotor-sweep height.

8.47 Twelve further UK BAP priority species were found breeding in the survey area (for mapped locations, see **Figure 8.3a**); grey partridge, lapwing, skylark, yellow wagtail, dunnock, song thrush,

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[21] Gibbons, D.W., Reid, J.B. and Chapman, R.A. (1993). The New Atlas of Breeding Birds in Britain and Ireland:1988-91. Poyser, Berkhamsted.

[22] Wernham, C.V., Toms, M.P., Marchant, J.H., Clark, J.A., Siriwardena, G.M. & Baillie, S.R. (2002). The Migration Atlas: movements of the birds of Britain and Ireland. Poyser, London.

[23] Cramp, S. (1983). Handbook of the Birds of Europe, the Middle East and North Africa: The birds of the Western Palearctic. Volume III (waders to gulls). Oxford University Press, Oxford.

[24] In addition to Bewick's swan, whooper swan, marsh harrier, hen harrier, merlin, peregrine, Mediterranean gull and kingfisher (see paras 8.30 – 8.35, 8.38 & 8.41 respectively), which are both Annex I and Schedule 1 species.

[25] Cramp, S. (1983). Handbook of the Birds of Europe, the Middle East and North Africa: The birds of the Western Palearctic. Volume II (hawks to bustards). Oxford University Press, Oxford.

[26] Marchant, J.H., Hudson, R., Carter, S.P. & Whittington, P.A. (1990). Population trends in British breeding birds. BTO & NCC, Tring.

[27] Wernham, C.V., Toms, M.P., Marchant, J.H., Clark, J.A., Siriwardena, G.M. & Baillie, S.R. (eds). (2002). The Migration Atlas:movements of the birds of Britain and Ireland. Poyser, London.

[28] Holling, M. & the Rare Breeding Birds Panel (2010). Rare breeding birds in the United Kingdom in 2008. British Birds 103 (September 2010): 482-538.

starling, tree sparrow, linnet, yellowhammer, reed bunting and corn bunting. Ten of these (grey partridge, lapwing, skylark, yellow wagtail, song thrush, starling, tree sparrow, linnet, yellowhammer and corn bunting) are also BOCC 'Red List' species.

8.48 Five pairs of grey partridge were found breeding in agricultural fields and field margins.

8.49 Sixteen pairs of lapwing were found breeding in agricultural fields.

8.50 A total of 151 pairs of skylark were found breeding in agricultural fields and field margins.

8.51 A total of 30 pairs of yellow wagtail were found breeding in agricultural fields and field margins.

8.52 Twenty pairs of dunnock were found breeding in hedgerows and low scrub.

8.53 Two pairs of song thrush were found breeding in copses; one c.600m south and one c.1.3km east of the site.

8.54 One pair of starling was found breeding in a building c.1.3km NE of the site.

8.55 Nine pairs of tree sparrow were found breeding in buildings.

8.56 Sixteen pairs of linnet were found breeding in hedgerows and low scrub.

8.57 A total of 22 pairs of yellowhammer were found breeding in hedgerows and low scrub.

8.58 A total of 131 pairs of reed bunting were found breeding in agricultural fields and field margins, hedgerows and low scrub and in dense vegetation alongside dikes and drainage ditches.

8.59 Eleven male corn buntings held territory in agricultural fields and field margins.

8.60 The site does not support any bird populations of national importance.

8.61 Other than Annex I / Schedule 1 / UK BAP priority / BOCC Red List species, the site does not support any bird populations of regional importance.

8.62 The site does not lie on any recognised bird migration routes and is therefore unlikely to be used by significant numbers of migratory birds. Numbers of migratory birds noted during the baseline surveys were small and clearly insignificant.

8.63 There is no possibility that the site would be designated as internationally or nationally important for birds.

ASSESSMENT OF EFFECTS

Nature conservation importance

8.64 Sixteen species of **high** nature conservation importance were identified using the criteria set out in **Table 8.1**: little egret, great white egret, Bewick's swan, whooper swan, marsh harrier, hen harrier, merlin, peregrine, golden plover, Mediterranean gull, common tern, short-eared owl, kingfisher, hobby, quail and barn owl. Bewick's swan, whooper swan, marsh harrier, hen harrier, merlin, peregrine, Mediterranean gull and kingfisher are both Annex I and Schedule 1 species. Little egret, great white egret, golden plover, common tern and short-eared owl are Annex I species. Hobby, quail and barn owl are Schedule 1 species.

8.65 Twelve species of **moderate** nature conservation importance were identified using the criteria set out in **Table 8.1**: grey partridge, lapwing, skylark, yellow wagtail, dunnock, song thrush, starling, tree sparrow, linnet, yellowhammer, reed bunting and corn bunting are all UK BAP priority species. Grey partridge, lapwing, skylark, yellow wagtail, song thrush, starling, tree sparrow, linnet, yellowhammer and corn bunting are also BOCC 'Red List' species.

Nature and magnitude of potential effects

8.66 Potential effects are discussed in turn and assessed in relation to species of nature conservation importance.

8.67 Just the odd sighting of little egret (see para 8.28), great white egret (see para 8.29), Bewick's swan (see para 8.30), whooper swan (see para 8.31), Mediterranean gull (see para 8.38) and common tern (see para 8.39) was made, the majority of these off-site. Only small numbers of non-breeding kingfishers were recorded in sheltered ditches and dikes (see para 8.41). Only two pairs of song thrush (see para 8.53) and one pair of starling (see para 8.54) were found breeding considerable distances from the site. Potential effects of the development on all these species are considered to be negligible and not significant under the terms of the EIA regulations. They are not discussed further.

Behavioural sensitivity

8.68 Using the criteria set out in **Table 8.2** marsh harrier, hen harrier, merlin, peregrine, golden plover, short-eared owl, hobby, quail, grey partridge and lapwing are judged to have **moderate** behavioural sensitivity and barn owl, skylark, yellow wagtail, dunnock, tree sparrow, linnet, yellowhammer, reed bunting and corn bunting are judged to have **low** sensitivity in the context of this assessment. In broad terms, the former species are generally warily tolerant of human activities and exhibit short-term reactions to disturbance events. The latter exhibit mild and brief reactions (including flushing behaviour) to disturbance events.

Land-take effects

8.69 The total land-take by the development would result in the permanent loss of a small area (9.62 hectares; excluding foundations which would grass over) of available habitat, primarily agricultural fields. The potential effect on all birds is considered to be negligible and not a significant effect under the terms of the EIA regulations.

Construction disturbance

It is likely that noise and visual disturbance associated with construction activities would temporarily displace some breeding and foraging birds. The routines of some birds that are not displaced would also be temporarily disrupted. Potential effects would be greatest during the breeding season. Birds that are disturbed at breeding sites are vulnerable to a variety of potential effects, including the chilling or predation of exposed eggs/chicks, damage or loss of eggs/chicks caused by panicked adults and the premature fledgling of young. Disturbed birds may therefore breed less successfully and feed less efficiently, leading to a reduction in the productivity and survival of bird populations.

Marsh harrier and hobby

8.70 Marsh harrier and hobby are essentially summer visitors to the area and birds were occasionally recorded foraging on and around the site during April-September (marsh harrier) and May-September (hobby). Though there was no evidence to suggest either species bred within at least 500m of the site, at least some of the sightings presumably involved birds breeding in the wider area and foraging areas used presumably provided elements of habitat for the birds involved. Construction disturbance, at least when birds are nearby, could displace the birds. However, such disturbance will be only temporary (construction activities are predicted to last 52 weeks) and construction will be largely sequential i.e. work will be undertaken in relatively localised areas at any one time, not on the entire site as a whole. More importantly, both species are highly mobile and any displaced birds are likely to readily relocate to alternative locations on the vast expanses of agricultural land in the area. Taking these factors into account, though there may be limited effects in the short term, the long term spatial magnitude of effects of construction disturbance on marsh harrier and hobby is considered to be **negligible**. The overall impact is therefore **neutral** and there is predicted to be **no impact** on marsh harrier and hobby as a result of construction disturbance.

Hen harrier, merlin, peregrine and short-eared owl

8.71 Hen harrier, merlin, peregrine and short-eared owl are essentially winter visitors to the area and birds were occasionally recorded foraging on and around the site during August-May. Though the birds were highly mobile, areas used presumably provided elements of habitat for the birds involved. Construction disturbance, at least when birds are nearby, could displace the birds. However, such disturbance will be only temporary (construction activities are predicted to last 52 weeks) and construction will be largely sequential i.e. work will be undertaken in relatively localised areas at any one time, not on the entire site as a whole. More importantly, both species are highly mobile and any displaced birds are likely to readily relocate to alternative locations on the vast expanses of agricultural land in the area. Taking these factors into account, though there may be limited effects in the short term, the long term spatial magnitude of effects of construction disturbance on hen harrier, merlin, peregrine and short-eared owl is considered to be **negligible**. The overall impact is therefore **neutral** and there is predicted to be **no impact** on hen harrier, merlin, peregrine and short-eared owl as a result of construction disturbance.

Quail

8.72 Quail is a Schedule 1 species. It is an offence liable to a special penalty to disturb any Schedule 1 bird while it is nest-building or is in, on or near a nest containing eggs or young or to disturb the dependent young of such a bird. Spending the winter mainly in Africa, quail are present and breeding in Britain only during May-September[21 25]. Should any construction work be planned during May-September, the site and its surrounding area will be carefully surveyed for evidence of breeding quail prior to work commencing. Construction work will not be undertaken within 500m of any breeding quail. The spatial magnitude of effects of construction disturbance on quail is therefore considered to be **negligible**. The overall impact is therefore **neutral** and there is predicted to be **no impact** on quail as a result of construction disturbance.

Golden plover

8.73 Flocks of golden plover were recorded on agricultural fields on and around the site during the non-breeding season. Though the birds were highly mobile and wide-ranging, areas used presumably provided elements of habitat for the birds involved. Construction disturbance, at least when flocks are nearby, could displace the birds. However, such disturbance will be only temporary (construction activities are predicted to last 52 weeks) and construction will be largely sequential i.e. work will be undertaken in relatively localised areas at any one time, not on the entire site as a whole. More importantly, both species are highly mobile and any displaced birds are likely to readily relocate to alternative locations on the vast expanses of agricultural land in the area. Taking these factors into account, though there may be limited effects in the short term, the long term spatial magnitude of effects of construction disturbance on golden plover is considered to be **negligible**. The overall impact is therefore **neutral** and there is predicted to be **no impact** on golden plover as a result of construction disturbance.

Barn owl

8.74 Barn owl is a Schedule 1 species. It is an offence liable to a special penalty to disturb any Schedule 1 bird while it is nest-building or is in, on or near a nest containing eggs or young or to disturb the dependent young of such a bird. The three pairs of barn owl found breeding on and around the site all nest in well enclosed and sheltered locations inside buildings, two of them on active farms amidst frequent human and mechanical disturbance. The birds roost in the buildings for much of each day, foraging in the surrounding agricultural landscape mainly at night (when construction activities will not be taking place). Construction activities are therefore unlikely to disturb the birds. The spatial magnitude of effects of construction disturbance on barn owl is therefore considered to be **negligible**. The overall impact is therefore **neutral** and there is predicted to be **no impact** on barn owl as a result of construction disturbance.

Grey partridge, lapwing, skylark, yellow wagtail, dunnock, tree sparrow, linnet, yellowhammer, reed bunting and corn bunting

8.75 Noise and visual disturbance associated with construction activities could have temporary effects on locally breeding grey partridge, lapwing, skylark, yellow wagtail, dunnock, tree sparrow, linnet, yellowhammer, reed bunting and corn bunting. Birds breeding close to construction activities could be displaced altogether (and fail to breed), or disturbance could lead to decreased breeding success. In turn, this could lead to a temporary reduction in the productivity and survival of local grey partridge, lapwing, skylark, yellow wagtail, dunnock, tree sparrow, linnet, yellowhammer, reed bunting and corn bunting populations. However (a) such disturbance will be only temporary as construction activities are predicted to last only 52 weeks and (b) only birds breeding in less enclosed, more open habitats in proximity to construction activities are likely to be affected, hence numbers of birds affected will be small (if it is assumed that there could be effects in such habitats up to 200m from construction activities, then there could be effects on one pair of grey partridge, five pairs of lapwing, 41 pairs of skylark, five pairs of yellow wagtail, six pairs of dunnock, one pair of tree sparrow, five pairs of linnet, three pairs of yellowhammer, 36 pairs of reed bunting and one pair of corn bunting). Taking these factors into account, though there could be effects on small numbers of grey partridge, lapwing, skylark, yellow wagtail, dunnock, tree sparrow, linnet, yellowhammer, reed bunting and corn bunting in the short term, the long term spatial magnitude of effects of construction disturbance on grey partridge, lapwing, skylark, yellow wagtail, dunnock, tree sparrow, linnet,

yellowhammer, reed bunting and corn bunting is considered to be **negligible**. The overall impact is therefore **neutral** and there is predicted to be **no impact** on these species as a result of construction disturbance.

Operational disturbance

8.76 The disturbance effects of operational turbines on nesting and foraging birds have not yet been adequately quantified. Published information[29] [30] [31] and reviews of impacts[32] [33] [34] suggest that most birds are affected only slightly. Breeding birds have not been found to be displaced at distances greater than 300m from a turbine[35] [36]. However, wind turbines might displace birds from larger areas if they act as a barrier to bird movements, or if the availability of suitable habitat is restricted.

8.77 Displacement effects are likely to be greatest in the initial period of turbine operation. In the medium and long terms, birds may habituate to the operation of the turbines. The limited evidence on breeding birds of open country to date suggests that effects vary between species. Thus, declines have been reported for some species (e.g. curlew) but not others (e.g. skylark)[37] [38] [39]. There is the potential for some disruption of feeding and nesting behaviours due to increased human activity for maintenance purposes. However, this would be relatively infrequent, involve low levels of disturbance and would be restricted to areas of the site accessible by tracks. Therefore the overriding disturbance is considered to be turbine operation.

Marsh harrier, hen harrier, merlin, hobby, peregrine and short-eared owl

8.78 The marsh harriers, hen harriers, merlins, hobbies, peregrines and short-eared owls foraging on and around the proposed development site are individuals foraging over very wide areas and spending limited time on the site. It is unlikely that the site provides critical elements of habitat for such individuals. Furthermore, hen harriers, merlins, peregrines and other raptors (e.g. red kite and kestrel) are known to regularly forage, unperturbed, on operational wind farms[40] [41]. A review of all studies (at least eight studies have been conducted) of northern/hen harrier displacement effects on operational wind farms in the USA and Europe concluded that, if displacement of foraging harriers occurs at all, then it will be limited to within 100m of operational wind turbines[41]. The spatial magnitude of effects of operational disturbance on marsh harrier, hen harrier, merlin, hobby, peregrine and short-eared owl is therefore considered to be **negligible**. The overall impact is therefore **neutral** and there is predicted to be **no impact** on these species as a result of operational disturbance

Quail

8.79 Rarely seen, quail inhabit dense ground vegetation (they were recorded in cereal and oilseed rape fields at Heckington Fen) where they skulk highly secretively and remain carefully hidden (from predators)[25]. The operational wind park will be unlikely to hold more than the occasional individual or breeding pair. The spatial magnitude of effects of operational disturbance on quail is therefore considered to be **negligible**. The overall impact is therefore **neutral** and there is predicted to be **no impact** on quail as a result of operational disturbance.

Golden plover

8.80 Flocks of golden plover are known to regularly rest and forage, unperturbed, on operational wind farms e.g. a flock of up to 500 birds regularly commuted to a pasture completely encircled by wind turbines on the Penrhyddlan & Llidiartywaun Wind Farm, Powys throughout the winters of 1999/2000 – 2002/03[42]. Vehicular movements and most human activity on the operational wind farm also did not disturb the birds, though workers exiting vehicles close to flocks sometimes flushed them. All in all, levels of disturbance to golden plover of the operational Heckington Fen Wind Park are unlikely to be markedly different from current disturbance levels at the site. The spatial magnitude of effects of operational disturbance on golden plover is therefore considered to be **negligible**. The overall impact is therefore **neutral** and there is predicted to be **no impact** on golden plover as a result of operational disturbance.

Barn owl

8.81 All three breeding pairs of barn owl found on and around the proposed development nest in enclosed locations in buildings, considerable distances (c.185m, c. 400m and c.1.7km) from proposed wind turbine locations. Two (the closest and furthest pairs) occupy buildings on active farms amidst frequent human and mechanical disturbance. Flying typically close to ground level, they forage widely across the surrounding agricultural landscape. It is highly unlikely that the operational wind farm will disturb the birds. The spatial magnitude of effects of operational

[29] *Vauk, G. (1990). Biological and ecological study of the effects of construction and operation of wind power sites. Jahrgang/Sonderheft, Endbericht. Norddeutsche Naturschutzakemie, Germany.*

[30] *Phillips, J.F. (1994). The effects of a wind farm on the upland breeding bird communities of Bryn Tytli, mid-Wales: 1993-4. Unpublished report to National Windpower.*

[31] *Leddy, K.L., Higgins, K.F and Naugle, D.E. (1999). Effects of wind turbines on upland nesting birds in conservation reserve program grasslands. Wilson Bull. 111(1): 100-104.*

[32] *Crockford, N.J. (1992). A review of the possible impacts of wind farms on birds and other wildlife. JNCC report no. 27. JNCC, Peterborough.*

[33] *Benner, J.H.B., Berkhuizen, J.C., de Graaf, R.J. and Postma, A.D. (1993). Impact of wind turbines on birdlife. Report no. 9247. Consultants on Energy and the Environment, Rotterdam, The Netherlands.*

[34] *Winkelmann, J.E. (1994). Bird/wind turbine investigations in Europe. Proc. of the National Avian Wind Power Planning Meeting, Denver, Colorado: pp 43-48.*

[35] *Gill, J.P., Townsley, M. and Mudge, G.P. (1996). Review of the impacts of wind farms and other aerial structures upon birds. SNH Review 21: 68pp.*

[36] *Percival, S.M. 1998. Birds and Turbines: managing potential planning issues. Proc. of the 20th BWEA Conference 1998: pp 345- 350.*

[37] *Williams, I. and Young, A.J. (1997). Trannon Moor ornithological studies. RSPB report to Powys County Council, Powys.*

[38] *Young, A.J. (1999). Trannon Moor Ornithological Survey. Unpublished report, RSPB Wales.*

[39] *Shepherd, K.B. (2000, 2001, 2002, 2003). Hare Hill Windfarm, New Cumnock, Ayrshire: Breeding bird monitoring 2000, 2001, 2002, 2003. Reports to Scottish Power plc, Glasgow.*

[40] *Shepherd, K.B. (2001). Penrhyddlan & Llidiartywaun Windfarm proposed extension: Research on foraging raptors and assessment. Report to Ingenco plc, Glasgow.*

[41] *Whitfield, D.P. & Madders, M. 2006. A review of the impacts of wind farms on hen harriers Circus cyaneus and an estimation of collision avoidance rates. Natural Research Information Note 1 (revised). Natural Research Ltd, Banchory, UK.*

[42] *Shepherd, K.B. (2001 & subsequent observations). Penrhyddlan & Llidiartywaun Windfarm proposed extension: Wintering bird survey and assessment. Report to: Ingenco, Glasgow.*

disturbance on barn owl is considered to be **negligible**. The overall impact is therefore **neutral** and there is predicted to be **no impact** on this species as a result of operational disturbance

Grey partridge, lapwing, skylark, yellow wagtail, dunnock, tree sparrow, linnet, yellowhammer, reed bunting and corn bunting

8.82 Breeding skylarks and operational wind turbines have been shown to successfully co-exist. Following a four-year study, a breeding population of 61-67 pairs remained stable following construction of the 20-turbine Hare Hill Windfarm in Ayrshire[39]. Grey partridges, yellow wagtails, dunnocks, tree sparrows, linnets, yellowhammers, reed buntings and corn buntings all nest in hidden locations in cavities or cover and forage within cover or on or close to ground level. Like skylarks, they are likely to generally be able to quickly habituate to the presence of operational wind turbines. A review undertaken in 2006[43] of all available field studies on the impacts of wind farms on breeding birds found, overall, no evidence of operational wind farms causing population declines in breeding lapwings, with disturbance effects on breeding lapwings not recorded beyond a mean distance of 108m from operational wind turbines. The spatial magnitude of effects of operational disturbance on grey partridge, lapwing, skylark, yellow wagtail, dunnock, tree sparrow, linnet, yellowhammer, reed bunting and corn bunting is therefore considered to be **negligible**. The overall impact is therefore **neutral** and there is predicted to be **no impact** on these species as a result of operational disturbance.

Collision

8.83 The level of collision would depend on the amount of flight activity over the site, the extent to which birds are displaced by the turbines and the ability of birds to detect and manoeuvre around rotating turbine blades. Birds that collide with a turbine are likely to be killed or fatally injured.

8.84 The extent to which birds are able to avoid collision with wind turbines has not yet been adequately quantified. The indications from studies so far are that birds readily avoid wind turbines and that collisions are rare events and occur mainly at sites where there are unusual concentrations of birds and turbines, or where the behaviour of the birds concerned leads to high-risk situations[32 33 34 35 44]. Examples include concentrated migration flyways, other situations where large numbers of birds may be flying at night or in poor visibility (e.g. tidal feeding movements), areas where the food resource is exceptional, 'wind wall' turbine layouts (a close array of turbines across a wind funnel), and the use of lattice towers by perching birds. There are no such unusual circumstances at Heckington Fen that are likely to result in a high level of collision to birds.

Marsh harrier

8.85 There was no evidence to suggest that marsh harrier bred in the vicinity of the proposed development site in 2008 and no display-flights (often undertaken at higher altitude) were observed. Instead the vast majority of marsh harrier flights recorded were foraging flights characteristically at low level - during the total of 360 hours of flight activity work undertaken in the five recording zones that include proposed wind turbine locations during the April-September period that marsh harriers were present in the area, a total of 118 flights were recorded, only fourteen of these including portions within potential rotor-sweep height. Though work has yet to be undertaken on marsh harriers foraging on wind farms, extensive work has been conducted on the similar northern/hen harrier in the USA and continental Europe. This has shown that fatalities are extremely rare events such that northern/hen harriers do not appear to be susceptible to colliding with turbine blades and that collision mortality on wind farms should rarely be a serious concern[41]. A full collision risk assessment for marsh harrier at Heckington Fen is presented in **Appendix 8.2**. The data estimate a fatality rate of one marsh harrier every 31.76 years. However, the avoidance rate in this species (input as 99% and crucial to the fatality rate outcome) is completely unknown and may be very much closer to 100%. The true fatality rate is therefore likely to be much less than this. Taking all factors into account, the spatial magnitude of collision effects on marsh harrier is considered to be **negligible**. The overall impact is therefore **neutral** and there is predicted to be **no impact** on marsh harrier as a result of collision.

Hen harrier, merlin, hobby and short-eared owl

8.86 The extensive flight activity work undertaken on the site revealed that hen harriers, merlins, hobbies and short-eared owls fly over the proposed development site rarely, if ever, at rotor-sweep height, the levels of flight activity recorded for these four species (see paras 8.33, 8.34, 8.43 and 8.40 respectively) being of little concern. The magnitude of collision effects on hen harrier, merlin, hobby and short-eared owl is therefore considered to be **negligible**. The overall impact is therefore **neutral** and there is predicted to be **no impact** on these species as a result of collision.

Peregrine

8.87 During the total of 480 hours of flight activity work undertaken in the five recording zones that include proposed wind turbine locations during the August-March period that peregrines were present in the area, a total of 76 flights were recorded, only ten of these within potential rotor-sweep height. A full collision risk assessment for peregrine at Heckington Fen is presented in **Appendix 8.3**. The data estimate a fatality rate of one peregrine every 107.53 years. The spatial magnitude of collision effects on peregrine is therefore considered to be **negligible**. The overall impact is therefore **neutral** and there is predicted to be **no impact** on peregrine as a result of collision.

Quail

8.88 Quail rarely fly and, when they do so, fly close to ground level[25]. The species is therefore not susceptible to collision with turbine blades. The magnitude of collision effects on quail is therefore considered to be **negligible**. The overall impact is therefore **neutral** and there is predicted to be **no impact** on quail as a result of collision.

Golden plover

8.89 During the total of 600 hours of flight activity work undertaken in the five recording zones that include proposed wind turbine locations during the July-April period that golden plovers were present in the area, a total of 221 flights were recorded, 125 of these within potential rotor-sweep height. Though

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

[44] *Dong Energy (2006). Danish Offshore Wind: key environmental issues. Dong Energy, Fredericia, Denmark.*

flights within potential rotor-sweep height were infrequent (averaging one flight every 4.8 hours), flocks of up to 2100 birds (mean flock size 66) were involved. Golden plovers are also known to forage and move around nocturnally[23], so birds may be flying over the site at night. The extent to which golden plovers are able to avoid collision with wind turbines has never been investigated or quantified. However, studies of onshore wind turbines in Schleswig-Holstein showed that waders reacted to turbines up to 200-500m away and showed either a change in flying height or direction in order to avoid them[45]. Studies of offshore wind farms in Denmark recorded similar responses in migrating waterfowl (primarily common eiders), both diurnally and nocturnally[44]. Studies of *Aythya* ducks wintering in the Netherlands showed that they were able to negotiate four turbines, both on moonlit and moonless nights[46]. The eyesight of golden plover is highly likely to be at least as good as all these species, so similar avoidance action is likely to be taken in the majority of instances. Frequent observations over a prolonged period of a flock of up to 500 golden plovers at Penrhyddlan & Llidiartywaun Wind Farm, Powys witnessed frequent avoidance behaviour to enable the birds to regularly commute to a small area of prime foraging habitat completely surrounded by wind turbines[42].

8.90 A full assessment of collision risk for golden plover at Heckington Fen is presented in Appendix 8.4. The data estimate an overall fatality rate of 15.89 golden plovers per annum. However, the avoidance rate in this species (input as 99% and crucial to the fatality rate outcome) is completely unknown and, given the species' characteristic flocking behaviour (where numerous eyes are on the look-out for danger, the entire flock then instantly reacting accordingly) and the observations made in Powys (where the avoidance rate, at least diurnally, was clearly very much more than 99%)[42,] may be very much closer to 100%. Taking all factors into account, the spatial magnitude of collision effects on golden plover is considered to be, at worst, **low**, the overall impact is considered to be **negative** and there is predicted to be an impact of **minor significance** (not significant in terms of the EIA regulations) on golden plover as a result of collision.

Barn owl

8.91 During the total of 720 hours of flight activity work undertaken in the five recording zones that include proposed wind turbine locations, a total of 273 barn owl flights were recorded, all below potential rotor-sweep height. Supported by this data, barn owls characteristically fly at low level and are therefore apparently not susceptible to collision with turbine blades. Barn owls are however, largely nocturnal. Though foraging flights (such as those observed diurnally) are indeed characteristically at low level, nocturnal display flights (which could not be observed during the diurnal flight activity work) may be undertaken at higher levels[47]. Though such flights may be limited to localised areas around nest sites, and may not be made within rotor-sweep height[47], birds breeding close to wind turbines could perhaps be susceptible to collision. Of the three breeding pairs located on and around the site, one (the pair breeding at Six Hundreds Farm; c.185m from nearest proposed wind turbine location) could therefore perhaps be susceptible to collision. The magnitude of collision effects on barn owl is therefore considered to be, at worst, **low**, the overall impact is considered to be **negative** and there is predicted to be an impact of **minor significance** (not significant in terms of the EIA regulations) on barn owl as a result of collision. Habitat/biodiversity enhancement measures will be undertaken to more than compensate for these possible effects (see para 8.98).

Lapwing

8.92 Breeding lapwings often engage in flights within rotor-sweep height in breeding territories, particularly display flights in spring[23]. Any breeding in the vicinity of wind turbines could therefore be susceptible to collision. In 2008, five pairs were found breeding within 200m of proposed wind turbine locations at Heckington Fen. However, lapwings breed on short or sparsely vegetated, open, flat or gently sloping terrain affording ready access to soil carrying prey in the form of an appreciable biomass of surface or subsurface organisms[23]. Consequently localised breeding distribution on ever-changing cropping regimes and rotations on lowland agricultural land changes markedly from year to year, fields generally with little or no vegetation in spring (e.g. fallow or some spring sown crops) being favoured, those vegetated (e.g. most autumn sown crops) being avoided. Should permission be granted for the development to proceed, discussions will be held with the local planning authority, Natural England and RSPB to prepare a suitable farmland bird habitat enhancement plan for the local area – to include measures to dissuade lapwings from breeding in proximity to wind turbines, yet increase breeding numbers in areas away from wind turbines. The spatial magnitude of collision effects on breeding lapwing is therefore considered to be **negligible**. The overall impact is therefore **neutral** and there is predicted to be **no impact** on lapwing as a result of collision.

Skylark

8.93 A fresh male skylark fatality recorded at the Hare Hill Windfarm in Ayrshire in spring 2003 had injuries clearly consistent with a recent collision with a rotating turbine blade[48]. Considerable singing activity had been recorded in the vicinity at the time and the bird was considered to have collided whilst song-flighting. Though skylarks therefore can collide with rotating turbine blades, collisions are likely to be unusual and restricted to birds song-flighting within breeding territories located close to operational wind turbines. The spatial magnitude of collision effects on skylark is therefore considered to be, at worst, **low**, the overall impact is considered to be **negative** and there is predicted to be an impact of **minor significance** (not significant in terms of the EIA regulations) on skylark as a result of collision. Habitat/biodiversity enhancement measures will be undertaken to more than compensate for these possible effects (see para 8.99).

Grey partridge, yellow wagtail, dunnock, tree sparrow, linnet, yellowhammer, reed bunting and corn bunting

8.94 Locally breeding grey partridges, yellow wagtails, dunnocks, tree sparrows, linnets, yellowhammers, reed buntings and corn buntings fly mainly below rotor-sweep height and are unlikely to collide with rotating wind turbine blades. The spatial magnitude of effects of collision on grey partridge, yellow wagtail, dunnock, tree sparrow, linnet, yellowhammer, reed bunting and corn bunting is therefore

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[45] *Koop, B. (1997); cited in Langston, R.H.W. & Pullan, J.D. (2002). Windfarms and birds: an analysis of the effects of windfarms on birds, and guidance on environmental assessment criteria and site selection issues. Birdlife International report to the Bern Convention. Convention on the Conservation of European Wildlife and Natural Habitats, Strasbourg, France.*

[46] *Spaans et al (1998); cited in Langston, R.H.W. & Pullan, J.D. (2002). Windfarms and birds: an analysis of the effects of windfarms on birds, and guidance on environmental assessment criteria and site selection issues. Birdlife International report to the Bern Convention. Convention on the Conservation of European Wildlife and Natural Habitats, Strasbourg, France.*

[47] *Cramp, S. (1985). Handbook of the Birds of Europe, the Middle East and North Africa: The birds of the Western Palearctic. Volume V (terns to woodpeckers). Oxford University Press, Oxford.*

[48] *S Votier pers. obs.*

considered to be **negligible**. The overall impact is therefore **neutral** and there is predicted to be **no impact** on these species as a result of collision.

Decommissioning

8.95 Habitat reinstatement would be decided in consultation with the statutory authorities at the time of decommissioning. It is assumed that habitats lost to the wind park infrastructure would be reinstated. Disturbance effects due to decommissioning and reinstatement of habitats would be similar to those identified for construction. As for construction, no decommissioning work would be undertaken within 500m of any breeding quail. In summary, there is predicted to be **no impact** on all species as a result of decommissioning.

MITIGATION

8.96 Mitigation has been recommended with respect to breeding quail (see paras 8.72 and 8.88) and lapwing (see para 8.92). Following this, the potential effects of the proposed Heckington Fen Wind Park on all bird species are likely to be limited. They are not considered to be significant in terms of the EIA regulations. Limited mitigation is therefore required with regard to birds.

8.97 It is an offence under Section 1 of the Wildlife and Countryside Act 1981 to intentionally take, damage or destroy the nest of any wild bird while it is in use or being built. Any development work that involves clearance or removal of habitat holding nesting birds should therefore take place outside the breeding season, i.e. between September and February.

HABITAT/BIODIVERSITY ENHANCEMENT

8.98 The site and its surrounding area supports farmland bird populations and the development may have effects on small numbers of barn owl, grey partridge, lapwing, skylark, yellow wagtail, dunnock, tree sparrow, linnet, yellowhammer, reed bunting and corn bunting breeding nearby. Should permission be granted for the development to proceed, discussions will be held with the local planning authority, Natural England and RSPB to prepare a suitable farmland bird habitat enhancement plan for the local area. The plan could include, for example:

- the provision of nest-boxes for barn owls and tree sparrows;
- appropriate bank/dike/ditch maintenance protocols to improve breeding bird habitat and maximise prey abundance for barn owls and other raptors;
- the provision of short or sparsely vegetated areas in appropriate locations in spring for breeding lapwings;
- the provision of skylark ‘plots’;
- the provision of conservation headlands and uncultivated margins;
- the maintenance/enhancement of suitable hedgerows for foraging/nesting/roosting birds;
- the sowing of wild bird mixture on set-aside or fallow land.

MONITORING

8.99 Should permission be granted for the development to proceed, an appropriate pre-, during and post-construction bird monitoring programme should be prepared to fully investigate and document the effects of the development, and the habitat/biodiversity enhancement package, on notable species. Such a programme should be discussed and agreed with the local planning authority, Natural England, RSPB and any other interested parties.

SUMMARY OF EFFECTS

8.100 Effects are summarised in Table 8.8 - 8.11.

STATEMENT OF SIGNIFICANCE

8.101 This chapter assesses the effects of the proposed Heckington Fen Wind Park on birds. It is based on baseline data gathered on breeding birds, wintering birds and bird flight activity over the site during the months of September 2007 - August 2008 inclusive.

8.102 Though there may be minor impacts on locally breeding barn owl and skylark and locally wintering golden plover as a result of birds colliding with rotating turbine blades, no effects of the development on birds are considered to be significant under the terms of the EIA regulations.

CUMULATIVE IMPACTS

8.103 During a meeting at NE Lincoln on 3 June 2011, Mike Jones (RSPB Norwich) requested that potential cumulative collision impacts of wind farm development on wintering golden plover in the Heckington Fen area should be investigated. This is addressed in **Appendix 8.5**.

Table 8.8 Summary of construction disturbance effects

Species	Nature conservation importance	Behavioural sensitivity	Spatial magnitude	Temporal magnitude	Overall impact magnitude	Mitigation	Residual significance
Marsh harrier	High	Moderate	Negligible	Short-term	Neutral	Not required	No impact
Hen harrier	High	Moderate	Negligible	Short-term	Neutral	Not required	No impact
Merlin	High	Moderate	Negligible	Short-term	Neutral	Not required	No impact
Peregrine	High	Moderate	Negligible	Short-term	Neutral	Not required	No impact
Golden plover	High	Moderate	Negligible	Short-term	Neutral	Not required	No impact
Hobby	High	Moderate	Negligible	Short-term	Neutral	Not required	No impact
Short-eared owl	High	Moderate	Negligible	Short-term	Neutral	Not required	No impact
Quail	High	Moderate	Negligible	Short-term	Neutral	No construction work to be undertaken within 500m of any breeding quail	No impact
Barn owl	High	Low	Negligible	Short-term	Neutral	Not required	No impact
Grey partridge	Moderate	Moderate	Negligible	Short-term	Neutral	Not required	No impact
Lapwing	Moderate	Moderate	Negligible	Short-term	Neutral	Not required	No impact
Skylark	Moderate	Low	Negligible	Short-term	Neutral	Not required	No impact
Yellow wagtail	Moderate	Low	Negligible	Short-term	Neutral	Not required	No impact
Dunnock	Moderate	Low	Negligible	Short-term	Neutral	Not required	No impact
Tree sparrow	Moderate	Low	Negligible	Short-term	Neutral	Not required	No impact
Linnet	Moderate	Low	Negligible	Short-term	Neutral	Not required	No impact
Yellowhammer	Moderate	Low	Negligible	Short-term	Neutral	Not required	No impact
Reed bunting	Moderate	Low	Negligible	Short-term	Neutral	Not required	No impact
Corn bunting	Moderate	Low	Negligible	Short-term	Neutral	Not required	No impact

Table 8.9 Summary of operational disturbance effects

Species	Nature conservation importance	Behavioural sensitivity	Spatial magnitude	Temporal magnitude	Overall impact magnitude	Mitigation	Residual significance
Marsh harrier	High	Moderate	Negligible	Long-term	Neutral	Not required	No impact
Hen harrier	High	Moderate	Negligible	Long-term	Neutral	Not required	No impact
Merlin	High	Moderate	Negligible	Long-term	Neutral	Not required	No impact
Peregrine	High	Moderate	Negligible	Long-term	Neutral	Not required	No impact
Golden plover	High	Moderate	Negligible	Long-term	Neutral	Not required	No impact
Hobby	High	Moderate	Negligible	Long-term	Neutral	Not required	No impact
Short-eared owl	High	Moderate	Negligible	Long-term	Neutral	Not required	No impact
Quail	High	Moderate	Negligible	Long-term	Neutral	Not required	No impact
Barn owl	High	Low	Negligible	Long-term	Neutral	Not required	No impact
Grey partridge	Moderate	Moderate	Negligible	Long-term	Neutral	Not required	No impact
Lapwing	Moderate	Moderate	Negligible	Long-term	Neutral	Not required	No impact
Skylark	Moderate	Low	Negligible	Long-term	Neutral	Not required	No impact
Yellow wagtail	Moderate	Low	Negligible	Long-term	Neutral	Not required	No impact
Dunnock	Moderate	Low	Negligible	Long-term	Neutral	Not required	No impact
Tree sparrow	Moderate	Low	Negligible	Long-term	Neutral	Not required	No impact
Linnet	Moderate	Low	Negligible	Long-term	Neutral	Not required	No impact
Yellowhammer	Moderate	Low	Negligible	Long-term	Neutral	Not required	No impact
Reed bunting	Moderate	Low	Negligible	Long-term	Neutral	Not required	No impact
Corn bunting	Moderate	Low	Negligible	Long-term	Neutral	Not required	No impact

Table 8.10 Summary of collision effects

Species	Nature conservation importance	Behavioural sensitivity	Spatial magnitude	Temporal magnitude	Overall impact magnitude	Mitigation	Residual significance
Marsh harrier	High	Moderate	Negligible	Long-term	Neutral	Not required	No impact
Hen harrier	High	Moderate	Negligible	Long-term	Neutral	Not required	No impact
Merlin	High	Moderate	Negligible	Long-term	Neutral	Not required	No impact
Peregrine	High	Moderate	Negligible	Long-term	Neutral	Not required	No impact
Golden plover	High	Moderate	Low	Long-term	Negative	Not required	Minor
Hobby	High	Moderate	Negligible	Long-term	Neutral	Not required	No impact
Short-eared owl	High	Moderate	Negligible	Long-term	Neutral	Not required	No impact
Quail	High	Moderate	Negligible	Long-term	Neutral	Not required	No impact
Barn owl	High	Low	Low	Long-term	Negative	Not required	Minor
Grey partridge	Moderate	Moderate	Negligible	Long-term	Neutral	Not required	No impact
Lapwing	Moderate	Moderate	Negligible	Long-term	Neutral	Crop/habitat manipulation to increase numbers of breeding lapwings, but away from wind turbines	No impact
Skylark	Moderate	Low	Low	Long-term	Negative	Not required	Minor
Yellow wagtail	Moderate	Low	Negligible	Long-term	Neutral	Not required	No impact
Dunnock	Moderate	Low	Negligible	Long-term	Neutral	Not required	No impact
Tree sparrow	Moderate	Low	Negligible	Long-term	Neutral	Not required	No impact
Linnet	Moderate	Low	Negligible	Long-term	Neutral	Not required	No impact
Yellowhammer	Moderate	Low	Negligible	Long-term	Neutral	Not required	No impact
Reed bunting	Moderate	Low	Negligible	Long-term	Neutral	Not required	No impact
Corn bunting	Moderate	Low	Negligible	Long-term	Neutral	Not required	No impact

Table 8.11 Summary of decommissioning effects

Species	Nature conservation importance	Behavioural sensitivity	Spatial magnitude	Temporal magnitude	Overall impact magnitude	Mitigation	Residual significance
Marsh harrier	High	Moderate	Negligible	Short-term	Neutral	Not required	No impact
Hen harrier	High	Moderate	Negligible	Short-term	Neutral	Not required	No impact
Merlin	High	Moderate	Negligible	Short-term	Neutral	Not required	No impact
Peregrine	High	Moderate	Negligible	Short-term	Neutral	Not required	No impact
Golden plover	High	Moderate	Negligible	Short-term	Neutral	Not required	No impact
Hobby	High	Moderate	Negligible	Short-term	Neutral	Not required	No impact
Short-eared owl	High	Moderate	Negligible	Short-term	Neutral	Not required	No impact
Quail	High	Moderate	Negligible	Short-term	Neutral	No decommissioning work to be undertaken within 500m of any breeding quail	No impact
Barn owl	High	Low	Negligible	Short-term	Neutral	Not required	No impact
Grey partridge	Moderate	Moderate	Negligible	Short-term	Neutral	Not required	No impact
Lapwing	Moderate	Moderate	Negligible	Short-term	Neutral	Not required	No impact
Skylark	Moderate	Low	Negligible	Short-term	Neutral	Not required	No impact
Yellow wagtail	Moderate	Low	Negligible	Short-term	Neutral	Not required	No impact
Dunnock	Moderate	Low	Negligible	Short-term	Neutral	Not required	No impact
Tree sparrow	Moderate	Low	Negligible	Short-term	Neutral	Not required	No impact
Linnet	Moderate	Low	Negligible	Short-term	Neutral	Not required	No impact
Yellowhammer	Moderate	Low	Negligible	Short-term	Neutral	Not required	No impact
Reed bunting	Moderate	Low	Negligible	Short-term	Neutral	Not required	No impact
Corn bunting	Moderate	Low	Negligible	Short-term	Neutral	Not required	No impact