place. Turbines will undergo blade feathering and curtailment during weather conditions deemed most suitable for bat activity at the site. Proposed curtailment and monitoring is outlined in section 6.2 below.

Table 5-6 Detector Location Recording High Median Activity in 2023 for High-risk Bat Species

Detector ID	Turbine	Species	High Median Activity Survey Period
D11	T11	Common pipistrelle	Summer 2023

5.1.3.1 Autumn Peak Activity NatureScot 2021

Significantly higher levels of activity were recorded within the site across three nights in September 2023, with a significant amount of all activity recorded within the site occurring between the 7th and the 9th of September. Of this, the majority of activity recorded consisted of Common pipistrelle bats. High peak levels were reported across the site during this period. Further assessment will be required during operational monitoring to assess the nature of this peak in activity, and whether, as suspected, it is related to swarming activity or, potentially, to migratory activity. Due to the concentrated nature of the activity peak, as a precautionary measure curtailment will be recommended to limit potential collision during this time period, while further assessments are carried out. Further details are outlined in Section 6.2 below.

5.1.3.2 Dog-led Collision Monitoring Results

Dog-led collision monitoring surveys were conducted to monitor any potential bat related fatalities at the site, and to provide an estimate of potential turbine collision related mortality associated with the Proposed Development. Further details are outlined in Chapter 6, Appendix 6-2.

Surveys were undertaken between November 2022 and October 2023 and included carcass searches, searcher efficiency trials and scavenger activity trials. Throughout the surveys, two bat carcasses (*Pipistrelle spp.*) were identified.

Collision-related mortality at the wind farm was estimated using the GenEst software package (version 1.4.9; Dalthorp *et al.,* 2023). The results of carcasses found during collision monitoring surveys was input into a model, along with information on the existing wind farm and survey effort, such as the number of turbines, the area surveyed and the survey effort. This generated an estimate of mortality at the existing wind farm, which was then corrected for searcher efficiency, scavenger removal and detection probability, based on the results of the trials. Further details are outlined in Appendix 6-2.

The model estimates with 90% confidence that between 3 and 23 bat fatalities could have occurred over the study period at the existing wind farm (estimated mortality = 10.19 bats [confidence intervals 3.00-23.46]. This scales to 1.96 [confidence intervals 0.07-1.96] bats per turbine per year or 0.25 [confidence intervals 0.07-0.57] bats per megawatt hour.

Overall, fatalities recorded at the site were infrequent during the surveys carried out over a 12-month period. However, as two bat fatalities were recorded, an adapted mitigation and monitoring plan has been included in Section 6.2 below.

5.2 Loss or Damage to Commuting and Foraging Habitat

The Proposed Development consists of existing wind farm infrastructure. As has been detailed in Chapter 1 and Chapter 4 of this EIAR, no construction works or ground works are required as part of the existing Castledockrell Wind Farm, as the proposal seeks to extend the operational life of the existing wind farm. No change in habitats within the site is anticipated as a result of the extension of life

application. Given the extensive area of habitat that will remain undisturbed throughout the site, no significant effects with regard to loss of commuting and foraging habitat are anticipated.

5.3 Loss of, or Damage to Roosts

The Proposed Development consists of existing wind farm infrastructure. As has been detailed in Chapter 1 and Chapter 4 of this EIAR, no construction works or ground works are required as part of the existing Castledockrell Wind Farm, as the proposal seeks to extend the operational life of the existing wind farm.

No change in habitats within the site is anticipated as a result of the extension of life application. Therefore, the identified common pipistrelle roost will remain suitable for bats. Consequently, there is no potential for disturbance at the bat roost located in the Stone Building.

No potential for significant effect with regard to the loss of, or damage to, roosting habitat as a result of the Proposed Development, haul route or underground cable route, is anticipated.

5.4 Displacement of Individuals or Populations

The site is an operational windfarm predominantly located in agricultural grassland. There will be no net loss of linear landscape features for commuting and foraging bats and there will be no loss of any roosting site of ecological significance. The habitats on the site will remain suitable for bats and no displacement of individuals or populations is anticipated as a result of the continued operation.

6. BEST PRACTICE AND MITIGATION MEASURES

This section describes the best practice and site-specific mitigation measures that are proposed to avoid and reduce the potential for significant effects on local bat populations.

6.1 Standard Best Practice Measures

6.1.1 Noise Restrictions

The extension of life planning application for Castledockrell Wind Farm will not result in any changes to the infrastructure. Existing agricultural practices within the site will continue. No change in existing noise levels are anticipated as a result of the Wind Farm Activities and farming practises taking place.

6.1.2 Lighting Restrictions

No additional artificial lighting is proposed as part of the Proposed Development. Therefore, no significant effects on bats is anticipated. Should lighting be required in future within the site, the lighting shall be designed in accordance with the Institute of Lighting Professionals Guidance Note 08/23 Bats and artificial lighting at night and Dark Sky Ireland Lighting Recommendations.

No significant effects of lighting on bats are anticipated; however, if in the course of this monitoring, any potential for significant effects on bats is identified, specific measures will be implemented to avoid any such impacts.

6.1.3 Blade Feathering

NIEA Guidelines also recommend that, in addition to buffers applied to habitat features, all wind turbines are subject to 'feathering' of turbine blades when wind speeds are below the cut-in speed of the subject turbine. This means that the turbine blades are pitched at 90 degrees or parallel to the wind to reduce their rotation speed to below two revolutions per minute while idling. This measure has been shown to significantly reduce bat fatalities (by up to 50%) in some studies (NIEA, 2021).

In accordance with NIEA Guidelines, blade feathering will be implemented as a standard across all proposed turbines when wind speeds are below the cut-in speed of the turbine.

6.2 Bat Mitigation and Monitoring Plan

Overall risk levels for high collision risk bat species was typically ***Low*** across all seasons. This risk level is reflective of the nature of the Site, which is comprised predominantly of agricultural grassland, with relatively low levels of bat activity recorded during the walked and driven transects undertaken. A small number of days in Autumn were recorded with significantly higher bat activity.

While overall risk levels were low, a small number of bat carcasses were detected (as outlined in Appendix 6-2) and autumn saw a significant peak in bat activity over a short period. Therefore, taking a precautionary approach, an adaptive monitoring and mitigation strategy has been devised for the Proposed Development, in line with the case study example provided in Appendix 5 of the NatureScot, (2021) and based on the site-specific data.

6.2.1 Operational Monitoring

To continually assess the effects of the ongoing Wind Farm site activities on bat activity, at least 3 years of post-consent monitoring is proposed. Post-consent monitoring will include static detector surveys, manual activity surveys and corpse searching to record any bat fatalities resulting from collision.

The results of post-consent monitoring will be utilised to assess any potential changes in bat activity patterns and to monitor the implementation of the mitigation and curtailment strategy. At the end of each year, the efficacy of the mitigation and curtailment monitoring plan will be reviewed, and any identified efficiencies incorporated into the programme. This approach allows for an evidence-based review of the potential for bat fatalities at the Site, and to ensure that the necessary measures are implemented for the protection of bat species locally. The effectiveness of any mitigation/curtailment needs to be monitored in order to determine (a) whether it is working effectively (i.e. the level of bat mortality is incidental), and (b) whether the curtailment regime can be refined such that turbine down-time can be minimised whilst ensuring that it remains effective at preventing casualties.

The below subsections provide additional detail on the proposed survey effort, timing, and mitigation/curtailment.

6.2.1.1 Monitoring Year 1

Curtailment

Curtailment involves raising the cut-in speed with associated loss of power generation in combination with reducing the blade rotation (blade feathering) below the cut-in speed. Blade Feathering is included in the Standard Best Practice section above Section 6.1.3.

Recent research used to inform NatureScot guidance has found that 90% of all bat activity can occur on sites when temperature exceeded 11.5°C and windspeed was below 5m/s. In addition, the bat activity is generally recorded 30 minutes after sunset and 40 minutes prior to sunrise. These conditions are largely consistent with the high seasonal activity peaks recorded at the proposed development site. Therefore, a software module will be programmed into the SCADA system controlling the turbines to curtail turbines when all these criteria are met. Curtailment is achieved by opening the blade pitch into the fully-feathered position, which reduces blade rotation speed to <1rpm.

Following the R Studio analysis, high median activity levels across at the site was recorded in Autumn, followed by a less activity for the duration of the static surveys (Plate 4-21 and Table 4-8). Additionally, two bat carcasses (*Pipistrelle spp.*) were identified within a 12-month period. Therefore, curtailment will be implemented during periods with significant peaks of activity (i.e. Autumn), with simultaneous activity monitoring taking place. All Turbines will be curtailed during the conditions most suitable for bat activity at the site, as outlined below.

Draft proposal for SCADA programme to curtail turbines during the following conditions –

- Season – mid-August to mid-September
- Duration – dusk until dawn
- Temperature – 11°C
- Wind speed – below 5m/s
- Rainfall – less than 3.5mm per hour

The effectiveness of curtailment will be monitored in order to determine (a) whether it is working effectively (i.e. whether bat mortality is detected, thereby confirming its effectiveness), and (b) whether the curtailment regime can be refined such that turbine down-time can be minimised whilst ensuring that it remains effective at preventing casualties. Taking into consideration the carcass search results including bat fatalities, blade feathering will be implemented as standard, as outlined in Section 6.1.3.

Bat activity surveys

The post-consent baseline surveys will be carried out as per the planning application survey effort. Static monitoring will take place at each turbine during the bat activity season (between April and October) (NatureScot, 2021, NIEA, 2021). Full spectrum recording detectors will be utilised for the same duration as during pre-application surveys and at the same density (NatureScot, 2021). As described in Section 3.5 above, the assessment of bat activity levels will include the use of 'Ecobat' (or similar alternative), a web-based interface, allowing uploaded activity data to be contrasted with a comparable reference range, allowing objective and robust interpretation. Walked survey transects will also be conducted.

Key weather parameters and other factors that are known to influence collision risk will be monitored which include:

- Windspeed in m/s (measured at nacelle height)
- Temperature (ºC)
- Precipitation (mm/hr)

Carcass searches

Carcass searches, to monitor and record potential bat fatalities, will be conducted at each turbine in accordance with NIEA Guidance. This will include searcher efficiency trials and an assessment of scavenger removal rates to determine the appropriate correction factor to be applied in relation to determining an accurate estimate of collision mortality. Surveys will cover all activity seasons and the use of a trained dog detection team will be carried out to ensure maximum efficiency.

6.2.1.2 Monitoring Years 2 & 3

Monitoring surveys shall continue in Year 2 and 3 and the success of the curtailment strategy will be assessed in line with the baseline data collected in the preceding year(s). The performance of the curtailment programme in terms of its ability to respond to the changes in bat abundance based on temperature and wind speed will be analysed to confirm it is neither significantly over- nor under-curtailing during different periods of bat activity.

At the end of each year, the efficacy of the mitigation/curtailment programme will be reviewed, and any identified efficiencies incorporated into the programme. The requirement for continued post-consent monitoring will also be considered. Should no bat fatalities be recorded in Year 1, curtailment (where applicable) in Year 2 and Year 3 could be reduced/re-evaluated or removed with monitoring continuing to inform this strategy. A monitoring programme will be submitted to, and agreed with, the relevant planning authority. Any subsequent changes will be agreed with Wexford County Council.

6.3 Residual Impacts

No Significant Effect

Taking into consideration the sensitive design of the Proposed Development, the proposed best practice and adaptive mitigation measures; significant residual effects on bats with regard to 1) Collision mortality, barotrauma and other injuries, 2) Loss or damage to commuting and foraging habitat, 3) Loss of, or damage to, roosts and 4) Displacement of individuals or populations are not anticipated.

6.4 Cumulative Effects

The Proposed Development was considered in combination with other plans, existing and approved projects and planning applications pending a decision, in the surrounding area that could result in cumulative impacts on bats. This included a review of online Planning Registers and served to identify past, present and future plans and projects, their activities and their predicted environmental effects. The plans and projects considered are listed in Chapter 2 of the EIAR: Background of the Proposed Development.

Following the detailed assessment provided in the preceding sections, it is concluded that, the proposed planning application for extension of life will not result in any residual adverse effects on bats, when considered on its own. There are no existing, permitted or proposed wind farms located within 5km of the Proposed Development, and four located within 10km. There are two further EIA projects including one underground cable and overhead line, and Materials Recovery (waste) Facility within 10km. No potential for the Proposed Development to contribute to any cumulative adverse effects on any bat populations is anticipated when considered in-combination with other plans and projects.

In the review of the projects that was undertaken, no connection that could potentially result in additional or cumulative impacts was identified. Neither was any potential for different (new) impacts resulting from the combination of the various projects and plans in association with the Proposed Development.

Taking into consideration the reported residual impacts from other plans and projects in the area and the predicted impacts with the current proposal, no residual cumulative impacts have been identified regarding bats.

CONCLUSION

This report provides a full and comprehensive assessment of the potential for effect on bat populations at the site of the Proposed Development. The surveys and assessment provided in this report are in accordance with NatureScot guidance. Following consideration of the residual effects (post mitigation) it is noted that the Proposed Development will not result in any significant effects on bats.

Provided that the Proposed Development is maintained and operated in accordance with the design, best practice and mitigation that is described within this report, significant effects on bats are not anticipated at any geographic scale.

7. # BIBLIOGRAPHY

Abbott, I., Aughney, T., Langton, S. and Roche, N. (2015) BATLAS 2020 Pilot Project Report. Bat Conservation Ireland, Virginia, Cavan.

Amorim, F., Rebelo, H., & Rodrigues, L. (2012). Factors influencing bat activity and mortality at a wind farm in the Mediterranean region. Acta Chiropterologica, 14(2), 439-457.

Andrews, H. (2013) Bat Tree Habitat Key. AEcol, Bridgewater.

Arnett, E. B. (2006). A preliminary evaluation on the use of dogs to recover bat fatalities at wind energy facilities. Wildlife Society Bulletin, 34(5), 1440-1445.

Arnett, E. B., Baerwald, E. F., Mathews, F., Rodrigues, L., Rodríguez-Durán, A., Rydell, J., ... & Voigt, C. C. (2016). Impacts of wind energy development on bats: a global perspective. In Bats in the Anthropocene: Conservation of Bats in a Changing World (pp. 295-323). Springer International Publishing.

Aughney, T. (2008) An investigation of the impact of development projects on bat populations: Comparing pre- and post-development bat faunas. Irish Bat Monitoring Programme. Bat Conservation Ireland, Virginia, Cavan.

Aughney, T., Langton, S. and Roche, N. (2011) Brown long-eared bat roost monitoring scheme for the Republic of Ireland: synthesis report 2007-2010. Irish Wildlife Manuals, No.56. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

Aughney, T., Langton, S. and Roche, N. (2012) All Ireland Daubenton's Bat Waterway Monitoring Scheme 2006-2011. Irish Wildlife Manuals, No. 61. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Ireland.

Barataud, M. and Tupinier, Y. Écologie acoustique des chiroptères d'Europe: identification des espèces, étude de leurs habitats et comportements de chasse. Biotope, 2012.

Baerwald, E. F., D'Amours, G. H., Klug, B. J., & Barclay, R. M. (2008). Barotrauma is a significant cause of bat fatalities at wind turbines. Current biology, 18(16), R695-R696.

Baerwald, E. F., & Barclay, R. M. (2009). Geographic variation in activity and fatality of migratory bats at wind energy facilities. Journal of Mammalogy, 90(6), 1341-1349.

BCI (2012a). Wind Turbine/Wind Farm Development Bat Survey Guidelines, Version 2.8, December 2012. Bat Conservation Ireland, Virginia, Co. Cavan

BCI (2012b) Bats and Appropriate Assessment Guidelines, Version 1, December 2012. Bat Conservation Ireland, Virginia, Co. Cavan Berthinussen, A., Richardson. O.C. and Altringham, J.D. (2014) Bat Conservation: Global evidence for the effects of interventions. Exeter: Pelagic Publishing.

Carden, R., Aughney T., Kelleher C. and Roche, N. (2010) Irish Bat Monitoring Schemes. BATLAS Republic of Ireland Report for 2008-2009.

Collins, J. (ed.) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). The Bat Conservation Trust, London.

Collins, J., and Jones, G. (2009). Differences in bat activity in relation to bat detector height: implications for bat surveys at proposed windfarm sites. Acta Chiropterologica, 11(2), 343-350.

Cryan, Paul M., *et al.* (2014) Behavior of bats at wind turbines. Proceedings of the National Academy of Sciences 111.42: 15126-15131.

EUROBATS (2016) Report of the Intersessional Working Group on Wind Turbines and Bat Populations at 21st Meeting of the Advisory Committee, Zandvoort, the Netherlands, 18 – 20 April 2016.

Hein, C.D., Gruver, J. and Arnett, E.B. (2013). Relating pre-construction bat activity and post-construction bat fatality to predict risk at wind energy facilities: a synthesis. A report submitted to the National Renewable Energy Laboratory. Bat Conservation International, Austin, TX, USA.

Hill D., Fasham, M., Tucker P., Shewry, M. and Shaw, P (eds) (2005) Handbook of Biodiversity Methods: Survey, Evaluation and Monitoring, 433-449. Cambridge University Press, Cambridge.

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

Hundt L. (2012) Bat Surveys: Good Practice Guidelines, 2nd edition. Bat Conservation Trust ISBN-13: 9781872745985.

Kelleher, C. and Marnell, F. (2006) Bat Mitigation Guidelines for Ireland. Irish Wildlife Manuals, No. 25. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

Korner-Nievergelt, F., Brinkmann, R., Niermann, I., & Behr, O. (2013). Estimating bat and bird mortality occurring at wind energy turbines from covariates and carcass searches using mixture models. PloS one, 8(7), e67997.

Kunz, Thomas H., Edward B. Arnett, Brian M. Cooper, Wallace P. Erickson, Ronald P. Larkin, Todd Mabee, Michael L. Morrison, M. Dale Strickland, and Joseph M. Szewczak. Assessing impacts of wind-energy development on nocturnally active birds and bats: a guidance document. Journal of Wildlife Management 71, no. 8 (2007): 2449-2486.

Kunz, T.H. and Parsons, S. (2009). Ecological and Behavioral Methods for the Study of Bats, 2nd Edition. The Johns Hopkins University Press, USA.

Marnell, F., Kelleher, C. & Mullen, E. (2022) Bat mitigation guidelines for Ireland v2. Irish Wildlife Manuals, No. 134. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage, Ireland.

Mathews, F., Swindells, M., Goodhead, R., August, T. A., Hardman, P., Linton, D. M., and Hosken, D. J. (2013). Effectiveness of search dogs compared with human observers in locating bat carcasses at wind-turbine sites: A blinded randomized trial. Wildlife Society Bulletin, 37(1), 34-40.

Mathews, F., Richardson, S., Lintott, P. and Hosken, D. (2016) Understanding the risk to European protected species (bats) at onshore wind turbine sites to inform risk management. Final Report. University of Exeter.

Mitchell-Jones, A. J. and McLeish, A. P. (2004). The Bat Worker's Manual, 3rd Edition. JNCC, Peterborough.

Mitchell-Jones, A.J. (2004). Bat Mitigation Guidelines. English Nature.

Montgomery, W. I., Provan, J., McCabe, A. M., and Yalden, D. W. (2014). Origin of British and Irish mammals: disparate post-glacial colonisation and species introductions. Quaternary Science Reviews, 98, 144-165.

NIEA, Natural Environment Division (2021). Guidance on Bat Surveys, Assessment & Mitigation for Onshore Wind Turbine Developments.

NRA (2006a) Best practice guidelines for the conservation of bats in the planning of national road schemes. National Roads Authority, Dublin, Ireland.

NRA (2006b) Guidelines for the treatment of bats during the construction of national road schemes. National Roads Authority, Dublin, Ireland.

NatureScot (2021). Bats and onshore wind turbines: survey, Assessment and mitigation. Version: August 2021 (updated with minor revisions).

Natural England (2014). Bats and onshore wind turbines: interim guidance. Third Edition TIN051. English Nature.

Nealon, Ú.C. (2016) Bats and wind farms in Ireland: An assessment of current practices in surveying and monitoring. Oral presentation at the 1st Ecology and Evolution Ireland conference, Sligo.

Northern Ireland Environment Agency (2011) Bat Survey – Specific Requirements for Wind Farm Proposals.

Perrow, M. (Ed.). (2017). Wildlife and Wind Farms-Conflicts and Solutions, Pelagic Publishing Ltd.

Regini, K. (2000) Guidelines for ecological evaluation and impact assessment, In Practice: Bulletin of the Institute of Ecology and Environmental Management, 29, 1-7.

Roche, N., Langton, S. & Aughney T. (2012) Car-based bat monitoring in Ireland 2003-2011. Irish Wildlife Manuals, No. 60. National Parks and Wildlife Service, Department of the Arts, Heritage and the Gaeltacht, Ireland.

Roche, N., T. Aughney, F. Marnell, and M. Lundy (2014). Irish Bats in the 21st Century. Bat Conservation Ireland, Virginia, Co. Cavan, Ireland.

Roche, N., Aughney T. & Langton S. (2015) Lesser Horseshoe bat: population trends and status of its roosting resource. Irish Wildlife Manuals, No 85. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Ireland.

Rodrigues, L., L. Bach, M. J. Dubourg-Savage, B. Karapandža, D. Kovač, T. Kervyn, J. Dekker, A. Kepel, P. Bach, J. Collins, C. Harbusch, K. Park, B. Micevski, and J. Minderman (2015). Guidelines for consideration of bats in wind farm projects - Revision 2014. UNEP/EUROBATS Secretariat Bonn, Germany.

Russ, J. (2012). British bat calls: a guide to species identification. Pelagic publishing.

Rydell, J., Bach, L. Dubourg-Savage, M.-J., Green, M., Rodrigues, L. and Hedenström, A. (2010). Bat mortality at wind turbines in northwestern Europe. Acta Chiropterologica 12. 2: 261 – 274.

Schofield H. (2008). The Lesser Horseshoe Bat: Conservation Handbook. The Vincent Wildlife Trust, Ledbury, UK.

Schuster, E., L. Bulling, and J. Köppel (2015). Consolidating the State of Knowledge: A Synoptical Review of Wind Energy's Wildlife Effects. Environmental Management 56:300-331.

SNH (2019). Bats and onshore wind turbines: survey, assessment and mitigation.

Wray, S., Wells, D., Long, E. and Mitchell-Jones, T. December (2010). Valuing Bats in Ecological Impact Assessment, CIEEM In-Practice

APPENDIX 1

BAT HABITAT SUITABILITY ASSESSMENT

Planning and Environmental Consultants

HABITAT SUITABILITY ASSESSMENT

Guidelines for assessing the potential suitability of a site for bats, based on the presence of habitat features (taken from Collins, 2016)

Suitability	Roosting Habitats	Commuting and Foraging Habitats
Negligible	Negligible habitat features on site likely to be used by roosting bats.	Negligible habitat features on site likely to be used by commuting or foraging bats.
Low	A structure with one or more potential roost sites that could be used by individual bats opportunistically. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions1 and/or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats, i.e. unlikely to be suitable for maternity or hibernation2. A tree of sufficient size and age to contain potential roost features but with none seen from the ground or features seen with only very limited roosting potential3.	Habitat that could be used by small numbers of commuting bats such as a gappy hedgerow or unvegetated stream, but isolated, i.e. not very well connected to the surrounding landscape by other habitats. Suitable, but isolated habitat that could be used by small numbers of foraging bats such as a lone tree (not in a parkland situation) or a patch of scrub.
Moderate	A structure or tree with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions and surrounding habitat but unlikely to support a roost of high conservation status (with respect to roost type only – the assessments in this table are made irrespective of species conservation status, which is established after presence is confirmed).	Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees and scrub or linked back gardens. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water.
High	A structure or tree with one or potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions and surrounding habitat.	Continuous, high-quality habitat that is well connected to the wider landscape that is likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edge. High-quality habitat that is well connected to the wider landscape that is likely to be used regularly by foraging bats such as broadleaved woodland, tree-lined watercourses and grazed parkland. Site is close to and connected to known roosts.

[1] For example, in terms of temperature, humidity, height above ground, light levels or levels of disturbance.

[2] Larger numbers of Common pipistrelle may be present during autumn and winter in large buildings in highly urbanised areas, based on evidence from the Netherlands (Korsten *et al.* 2015).

[3] Categorisation aligns with BS 8596:2015 Surveying for bats in trees and woodland (BSI, 2015).

APPENDIX 2

SITE RISK ASSESSMENT

SITE RISK ASSESSMENT

Table 3a: *Stage 1 - Initial site risk assessment*

Site Risk Level (1-5)*		Project Size		
		Small	**Medium**	**Large**
Habitat Risk	**Low**	1	2	3
	Moderate	2	3	4
	High	3	4	5

Key: Green (1-2) - low/lowest site risk; Amber (3) - medium site risk; Red (4-5) - high/highest site risk.

* Some sites could conceivably be assessed as being of no (0) risk to bats. This assessment is only likely to be valid in more extreme environments, such as above the known altitudinal range of bats, or outside the known geographical distribution of any resident British species.

Habitat Risk	Description
Low	Small number of potential roost features, of low quality. Low quality foraging habitat that could be used by small numbers of foraging bats. Isolated site not connected to the wider landscape by prominent linear features.
Moderate	Buildings, trees or other structures with moderate-high potential as roost sites on or near the site. Habitat could be used extensively by foraging bats. Site is connected to the wider landscape by linear features such as scrub, tree lines and streams.
High	Numerous suitable buildings, trees (particularly mature ancient woodland) or other structures with moderate-high potential as roost sites on or near the site, and/or confirmed roosts present close to or on the site. Extensive and diverse habitat mosaic of high quality for foraging bats. Site is connected to the wider landscape by a network of strong linear features such as rivers, blocks of woodland and mature hedgerows. At/near edge of range and/or on an important flyway. Close to key roost and/or swarming site.

Project Size	Description
Small	Small scale development (≤10 turbines). No other wind energy developments within 10km. Comprising turbines <50m in height.
Medium	Larger developments (between 10 and 40 turbines). May have some other wind developments within 5km. Comprising turbines 50-100m in height.
Large	Largest developments (>40 turbines) with other wind energy developments within 5km. Comprising turbines >100m in height.

APPENDIX 3

OVERALL SITE RISK ASSESMENT

Table 3b: *Stage 2 - Overall risk assessment*

Site risk level (from Table 3a)	Ecobat activity category (or equivalent justified categorisation)					
	Nil (0)	Low (1)	Low-moderate (2)	Moderate (3)	Moderate-high (4)	High (5)
Lowest (1)	0	1	2	3	4	5
Low (2)	0	2	4	6	8	10
Med (3)	0	3	6	9	12	15
High (4)	0	4	8	12	15	18
Highest (5)	0	5	10	15	20	25

The scores in the table are a product of multiplying site risk level and the Ecobat activity category (or equivalent). The activity categories equate to those given in Table 1 for high collision risk species. Nil (0) means no bat activity was recorded across the whole site, but caution is needed here, because although the values given in this column are "0", at sites where pre-construction surveys found no bat activity, there remains the possibility that new turbines could attract some bat species, thereby altering the level of risk that applies in reality.

Overall assessment:

Low (green)	0-4
Medium (amber)	5-12
High (red)	15-25

It is important to have an understanding of both "typical" and unusually high levels of bat activity at a site so that potentially important peaks in activity are not overlooked. It is therefore recommended that both the highest Ecobat activity category and the most frequent activity category (i.e. the median) are assessed separately in Table 3b and presented in the overall risk assessment. A judgement can then be made on which is the most relevant. It should be noted that presenting mean activity levels can be highly misleading where the data are highly skewed, as is frequently the case with bat activity at wind turbines (Lintott & Mathews, 2018).

APPENDIX 6-2

COLLISION MONITORING SURVEY

Table of Contents

Table of Tables

Tables of Figures

1. INTRODUCTION

MKO was commissioned to complete dog-led collision monitoring surveys as part of an application to extend the operational life of the existing Castledockrell Wind Farm, Ballynelahillan, Co. Wexford (hereafter referred to as the Proposed Development). The surveys were conducted to monitor any potential turbine related bird or bat fatalities at the site, and to provide an estimate of potential turbine collision related mortality associated with the Proposed Development.

This report provides details of the surveys undertaken, including survey design, methods used to carry out those surveys, and results of those surveys. Surveys were undertaken between November 2022 and October 2023 and include carcass searches, searcher efficiency trials and scavenger activity trials on site. Any recommendations that may inform additional mitigation measures during the operational phase of the wind farm are prescribed below. In this report, the "site" is defined as the existing Castledockrell Wind Farm.

The Proposed Development is described in full in Chapter 4 of this EIAR.

1.1 Background

Traditionally, carcass searches were carried out by human observers by means of walking transects and visually identifying the carcasses. Their effectiveness, however, was affected by a variety of variables, such as: size, colour and decomposition of the carcass, topography, weather conditions, vegetation type and density in the environment, and finally observer competency in detecting the carcasses. Hence, according to earlier studies, human searches are frequently carried out with low efficiency rates, which causes a significant bias in mortality estimates.

According to Bernardino *et al.* (2012), the employment of dogs and their olfactory capabilities may boost carcass detection rates. Numerous studies have shown and proven that dogs have a superior ability to detect bird and bat carcasses in respect to humans, particularly with small carcasses or when the carcasses are located in dense vegetation (Arnett 2006, Horman 2001, Mathews F.M. 2013, Paula 2011, Reed 2011, Rafael Barrientosa 2018).

While the guidelines provide recommendations in relation to methodologies, dog-led searches require flexibility while conducting surveys: *"the dog and handler must adapt their survey technique to the current site conditions"*, Bennet (2015). Additionally, the usage of transects should only be used as a guide, with freedom to stray from it if necessary. Bennet also states that a trained dog should be able to pick up the target smells prior to the survey starting, highlighting the importance of allowing the dog the opportunity to "follow the nose" and look for the desired odours somewhat independently. Dog teams are deployed to carry out searches at turbines bases starting at dawn each morning to reduce the possibility of carcasses being removed by scavengers.

It should be emphasized that the dog's ability to find carcass odour can be significantly influenced by wind conditions, as the scent travels with the wind. Hence, each search should ideally start downwind on the outer edge of the search area, and the transect walked horizontally across the wind while also moving upwind. Bennet (2015) lists a number of environmental variables that affect search efficiency rates, which can be seen in Table 1.1.

Table 1-1 Factors influencing a dog's ability to detect carcasses.

Consideration	Issue	Management
Relationship between dog and handler	Handler must be able to monitor the dog's performance to determine interest and likely success on a day-by-day, and hour-by-hour basis	Handlers should be appropriately experienced with dog training and behaviour

Consideration	Issue	Management
	Handler must recognise when the dog has detected a scent to enable them to go off transect	Dog and handler should live together and have a strong relationship outside of work
		Regularly use roadkill to stimulate success and monitor performance
Wind speed: Still	On days with no wind there is nothing to carry the scent of the carcass to the dog and detection will be more difficult	Identify days as low wind
		Reduce the distance between transects to allow the dog to cover more ground and be closer to the source of the scent
Wind speed: Low-Medium	Ideal scenting conditions for dogs	Maximum spacing between transects
Wind speed: High	Dogs will become overloaded with scents from much further than the survey area	Reduce spacing between transacts on downwind side of turbine. Allow the dog freedom to follow scents off transects
Wind speed: Extreme	It is more difficult for dogs to locate sources of scents in extreme wind conditions	Allow the dog freedom to follow scents. Maintain constant spacing along transects. Encourage the dog more frequently. Use roadkill to simulate success and monitor performance
1Temperature: Cold (<8°C approximately)	Scents are reduced in cold conditions	Reduce the distance between transects to allow the dog to cover more ground and be closer to the source of the scent
Temperature Mildly cool to warm (<30°C approximately)	As scents warm up, they become more readily detected	Maintain recommended transect distances (dependent upon wind and precipitation)
Topography: flat	Scents are readily carried from one side of the survey area to the other	Maximum transect spacing
Topography:	Undulating Scents may not be uniformly detected across the site	Ensure transects encompass depressions as well as rises
Topography: Steep	Steep sites may reduce exposure to scents depending upon the interaction with the wind	Ensure transects are crossing the direction of wind from the survey area
Vegetation: low (<5cm)	Detection is based on vision and scent	Maximum transect spacing
Vegetation: medium to tall grass	Dogs may be below the optimum scenting area and vegetation may reduce the exposure of the scent to wind	Ensure the dog has the freedom to "hop/bounce" through the survey area to reach the scents above the vegetation height
Vegetation: dense heath land	Vegetation may reduce the exposure of the scent to wind	Ensure dogs are adequately target trained to eliminate confounding scents. Reduce transects to cover more terrain
	Scented vegetation (i.e. flowers) may increase the time to find target scents	
Vegetation: Trees/Scrub	Reduction in wind speed	Reduce distance between transects
Target Species	Large carcasses are more readily detected then small carcasses	Ensure dogs are adequately target trained to eliminate confounding scents
	Carcasses from species not of interest (i.e. lambs, rabbits) can provide additional scents	

1.2 Statement of Authority

Collision Monitoring Surveys were undertaken by MKO Conservation Detection Dog Handlers Cathal Bergin (BSc.) and Jessica Sara Barbara (BSc., MSc.). They were assisted by Dr. Caroline Finlay (PhD) of Conservation Detection Dogs Northern Ireland. All surveyors are LANTRA accredited handlers with relevant expertise in undertaking the ecological surveys utilised to inform this assessment.

The dogs employed in the surveys were Clay (fox-red Labrador), Kynren (Springer Spaniel), Mac (Springer Spaniel), Monty (Springer Spaniel), Rufus (Springer Spaniel), Taio (Springer Spaniel), and Ziba (German Shorthaired Pointer) and have been specially trained in the detection of bird and bat carcasses.

The Collision Monitoring Report was prepared by Jessica Sara Barbara and reviewed by Cathal Bergin, Aoife Joyce (BSc., MSc.) and John Hynes (BSc., MSc. MCIEEM). Cathal has over 3 years' experience in ecological consultancy and 2 years conservation detection dog handler experience. Aoife has OVER 5 years' experience in advanced bat survey techniques and ecological impact assessments. John is a full member of the Chartered Institute of Ecology and Environmental Management (CIEEM) and has over 10 years' professional ecological consultancy experience.

2. PROJECT DESCRIPTION

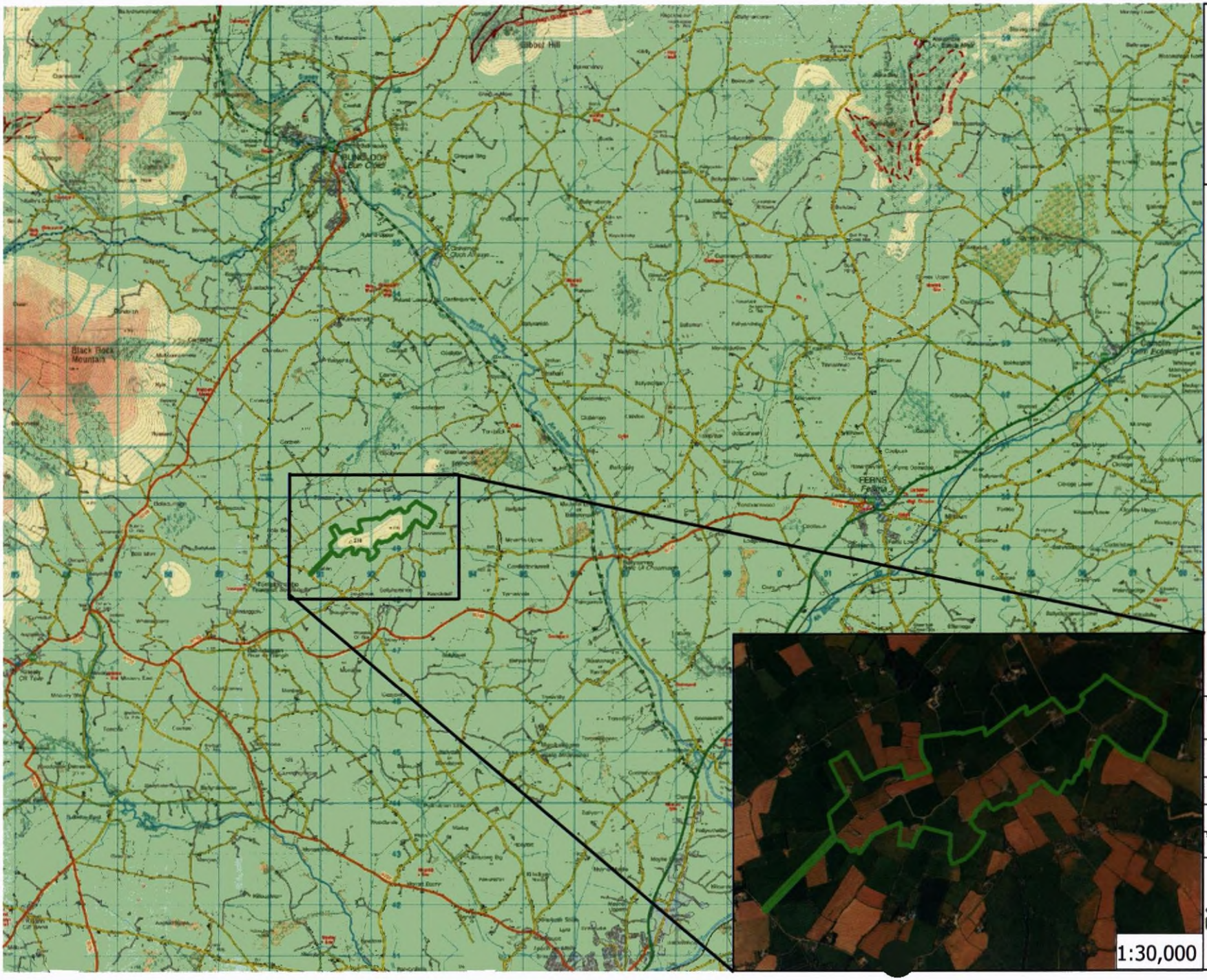
The site of the Proposed Development is situated approximately 10km south of Bunclody in Co. Wexford, as shown in Figure 2-1. The Proposed Development site is served by a network of access roads, used both by landowners to access their agricultural lands, and for the operational phase maintenance of the existing wind farm. The existing Castledockrell Wind Farm includes 12 turbines, however the Proposed Development relates to the operational phase extension to 11 no. turbines (T1-T11), and the permanent extension of the onsite 110kV substation. As has been detailed in Chapter 1 and Chapter 4 of this EIAR, no construction works or ground works are required as part of the existing Castledockrell Wind Farm, as the proposal seeks to extend the operational life of the existing wind farm. Improved grassland and artificial surfaces, with some areas of shrub on the turbine embankments, constitute the main habitats present and recorded on the Proposed Development site.

The full description of the Proposed Wind Farm is provided in Chapter 4 of this EIAR.

The site comprises the existing wind farm infrastructure, including turbines and associated foundation and hardstand areas, an onsite 110kV substation, and the wind farm access roads, which are classified as *Buildings and artificial surfaces (BL3)*. Outside of the existing wind farm infrastructure, the lands within the EIAR site boundary are dominated by agricultural fields, comprised of *Improved agricultural grassland (GA1)* and *Arable crops (BC1)*. Field boundaries are typically delineated by *Hedgerows (WL1)*, while the internal access tracks were often lined with strips of *Dry meadows and grassy verges (GS2)*. Several field boundaries are deep and are best classified as *Scrub (WS1)*, often with pockets of *Dense bracken (HD1)*. A large area of previously farmed land on the south-eastern boundary had been disturbed at the time of the site visits and was best classified as a mosaic of *Spoil and bare ground (ED2)* and *Recolonizing bare ground (ED3)*. The site is accessible from the south via a network of local roads and the existing wind farm access tracks.

Habitats around the turbine bases within the designated survey radius was composted of *Scrub (WS1), Improved Agricultural Grassland (GA1), Arable Crop (BC1), Buildings and Artificial Surfaces (BL3)* along with *Hedgerows (WL1)*.

A full description of the habitats recorded onsite can be found in Chapter 6 of this EIAR.



Map Legend

Site Boundary

N

Drawing Title: Site Location

Project Title: Extension of Operation of the Existing Castledockrell Wind Farm, Co. Wexford

Drawn By	Checked By
DC	LM
Project No.	Drawing No.
210847	Figure 2-1
Scale	Date
1:96,000	04.01.2024

MKO
Planning and Environmental Consultants
Tuam Road, Galway, Ireland, H91 VW84
(0) 91 735611
fo@mkoireland.ie
www.mkoireland.ie

3. METHODS

3.1 Collision Monitoring

3.1.1 Search Area

At the time of designing the scope and carrying out the surveys, there was no standardised boundary surrounding a wind turbine for the detection of bird and bat fatal collisions. The search distance from turbine bases was calculated using a variety of techniques. Recommendations on search areas are listed below.

- Atienza (2011) states "the ground search area has to be at least 10% more than the rotor diameter".
- According to Edkins (2014) "search width should be equal to the maximum rotor tip height".
- Rodrigues (2015) advises a search area with "a radius equal to the total height of the wind turbine, as bats that collide can be blown away from the turbine by strong winds", but due to the impracticality of a 250mx250m search area "it is advisable to search a smaller area (not less than 50m radius)".
- Smallwood (2020) suggests a 50m search area surrounding turbine bases.
- Young (2003) demonstrates how that the majority of bird strikes on wind turbines occur 63 meters or less from the turbine base. And that the chance of carcasses being found outside of this area has recently increased due to the steadily rising turbine height.

At the Proposed Development site, the maximum turbine rotor tip height is 120m, so an agreed survey search area consist of a 60m circumference centred on each turbine base. To account for 100% coverage of each search area around turbines (unless otherwise noted due to impeding factors), the dog and handler movement is tracked using Garmin K5 tracking collars and Alpha 200i devices.

All carcasses found within the search area, regardless of species, are recorded.

Collision Monitoring Surveys were designed to identify and establish the number and species of bird and bat fatalities suspected to have been brought about by collision with wind turbines. For carcasses where the cause of death was uncertain, the fatality was, according to Johnson *et al.* (2003), assigned to the wind farm. Furthermore, when species identification is questionable, like the case of decaying remains or feather spots, samples are submitted for DNA analysis.

Surveys were undertaken monthly at the site between November 2022 and October 2023. Monthly searches allowed for results to be gathered for bird and bat casualties year-round. Dog-led searches for bird and bat carcasses were conducted by a dog and trainer team, as laid out in Table 3-1 below. The search methodology and trials used to inform carcass detection probability are described below.

Table 3-1 Detection Dog Teams

Date	Surveyor	Dogs
Nov-22	Cathal Bergin	Clay and Kynren
Dec-22	Caroline Finlay & Cathal Bergin	Clay, Kynren, Monty, Rufus and Ziba
Jan-23	Cathal Bergin	Clay and Taio
Feb-23	Cathal Bergin	Clay and Taio
Mar-23	Cathal Bergin	Clay and Taio
Apr-23	Cathal Bergin	Clay and Taio
May-23	Cathal Bergin	Clay and Taio
Jun-23	Cathal Bergin	Clay and Taio

Date	Surveyor	Dogs
Jul-23	Cathal Bergin	Clay and Taio
Aug-23	**Cathal Bergin**	**Clay and Taio**
Sep-23	Cathal Bergin & Jessica Sara Barbara	Clay, Taio, Mac and Kynren
Oct-23	**Cathal Bergin & Jessica Sara Barbara**	**Clay, Taio, Mac and Kynren**

3.1.2 Dog-led Searches

Searches were conducted through dog-led surveys, broadly following the methodologies recommended by Bennet (2015).

Before each survey, meteorological data (temperature and wind speed) and ground cover details (habitat) were recorded. When a bird or bat carcass was discovered, the GPS location, a photograph, the distance from the turbine and the date and time were recorded. The carcass condition was assessed and assigned to one of the following categories:

- Intact (carcass that is completely intact or not badly decomposed);
- Scavenged (evidence that the carcass was fed upon by a predator); or
- feather spot (ten or more feathers indicating predation or scavenging or two or more primary feathers must be present to consider the carcass a casualty).

Carcass searching work was calibrated to account for the ability of the search dog to find bird and bat carcasses and likelihood of scavenging by predators (see section 3.5 below), this ensured a more accurate estimation of the total number of collision victims.

3.2 Scavenger Removal Trials

The scavenger removal trials are conducted monthly by leaving a carcass (facing a camera trap) in plots located within the search radius, on a variety of habitats, for a minimum of 21 days, or until scavenger(s) removed the carcasses, before retrieving them. A total of two camera traps were placed on site per month during the duration of the survey with locations being moved each month. Browning Strike Force Trail Camera model BTC-5PX-1080 along with 64GB SD cards were chosen for use. Low numbers of carcasses are placed at a time on a site to avoid scavenger swarming, this is when high number of carcasses on site attract higher than usual numbers of scavengers. A determination on carcass removal was made when no body parts containing flesh or bone or >10 disarticulated feathers could be found. Scavenger removal rate was then determined by the amount of scavenging that occurred in the intervening period.

3.3 Searcher Efficiency

To ensure a more accurate estimation of the total number of fatalities, dog-led searches were calibrated to account for the dog's ability to find bird and bat carcasses (searcher efficiency) and the likelihood of carcasses not being found due to scavenging by other animals (scavenger removal).

The searcher efficiency trials were carried out at a randomly chosen time during the survey cycle by planting a mixture of bird and bat carcasses within the site and allowing the dog and trainer team(s) to search for them. Searcher efficiency was then based on the percentage retrieval success. One worker left carcasses within the various habitats proportional to habitat representativity in the search area, and the dog and trainer team searched for them in the following hours. This time period aided in hiding any scent of the worker laying the carcasses, and allowed a double-blind test to be conducted where the detection team is unaware of the carcasses location in order to simulate as accurately as possible a survey without handler's bias.

3.4 Collision Rates

Collision-related mortality at the Proposed Development was estimated using the GenEst software package (version 1.4.9; Dalthorp *et al.,* 2023). The results of carcasses found during collision monitoring surveys was inputted into a model, along with information on the wind farm and survey, such as the number of turbines, the area surveyed and the survey effort. This generated an estimate of mortality at the Proposed Development site, which was then corrected for searcher efficiency, scavenger removal and detection probability, based on the results of the trials.

4. RESULTS

4.1 Collision Monitoring

4.1.1 Dog-led Carcass Searches

Throughout the Collision Monitoring Surveys undertaken from November 2022 to October 2023, five fatalities were discovered. As outlined in Section 3.2, for carcasses where the cause of death was uncertain, the fatality was assigned to the wind farm (Johnson, 2003).

The results of the carcass found are outlined in Table 4.1 below. Further detailed results are outlined in Appendix 1 to this report.

Table 4-1 Details and photographs of each fatality recorded.

Date	Surveyor	Details	Surrounding Habitat	Photograph
11/01/23	Cathal Bergin and Clay	Corvid feather spot found 43m from T1 on scrub.	GA1	
26/07/2023	Cathal and Clay	Decaying bat (species unknown) found 45m from T6 on gravel on 26/07/2023	BC1	
30/08/2023	Cathal and Clay	Pigeon feather spot found 53m from T10 on grass on 30/08/2023	GA1	

31/08/2023	Cathal and Taio	Intact decaying *pipistrelle spp.* found 35m from T2 on gravel on 31/08/2023	BL3	
31/08/2023	Cathal and Taio	Intact fresh *pipistrelle spp.* found 35m from T2 on gravel on 31/08/2023	BL3	

*WS1 (Scrub), **GA1 (Improved Agricultural Grassland), ***BC1 (Arable Crop), ****BL3 (Buildings and Artificial Surfaces)

4.2 Scavenger Removal Trial

Scavenger removal trials conducted over the duration of the survey cycle sought to gain an insight into scavenger activity levels on site. Results from the scavenger removal trials, represented in Table 4.2, show that predation time varies on the site. It should be noted that in five of the scavenger removal trials carried out onsite, the camera trap was not triggered for the predation event, although the carcass was gone upon retrieval. In these cases, maximum days before predation were attributed. The median number of days a carcass persisted on site for was 7.81 days when including the five events not captured on camera, suggesting high predation. Predators recorded were predominantly foxes, but hooded crow and cats were also recorded.

Table 4-2 Scavenger Removal Trial Results

Turbine	Carcass	ITM	Habitat	Date and time laid	Date and time scavenged/recovered	Total time before predation (days)	Predator
8	Mouse	/	WS1*	29/11/2022 16:10	03/12/2022 09:59	3.71	Hooded crow
9	Mouse	/	WS1	29/11/2022 15:58	11/12/2022 17:58	12.07	Fox
11	Mouse	0692775 0649580	GA1**	19/12/2022 10:06	21/12/2022 07:04	1.85	Fox
2	Mouse	0692208 0649580	GA1	19/12/2022 14:29	20/12/2022 15:47	1.05	Hooded crow
4	Mouse	0692173 0649243	WS1	12/01/2023 11:26	13/01/2023 10:14	2.34	Unknown
6	Mouse	0691682 0649069	BC1***	12/01/2023 13:44	28/01/2023 23:26	16.39	Fox
1	Mouse	0692510 0649765	WS1	23/02/2023 12:48:00	05/03/2023 10:02	10.38	Hooded crow
3	Mouse	0692455	BL3****	27/04/2023	14/05/2023	16.69	Cat

Turbine	Carcass	ITM	Habitat	Date and time laid	Date and time scavenged/recovered	Total time before predation (days)	Predator
		0649403		08:47	01:34		
1	Mouse	0692481 0649728	GA1	27/04/2023 09:51	30/04/2023 06:42	2.85	Hooded crow
4	Mouse	0692205 0649315	BL3	30/05/2023 11:43	28/06/2023 13:00	29.05	Unknown
8	Mouse	0691519 0649347	WS1	30/05/2023 07:59	28/06/2023 08:42	29.02	Unknown
10	Mouse	0691231 0649301	WS1	28/06/2023 12:12	26/07/2023 07:38	27.79	Unknown
9	Mouse	0691912 0649429	WS1	28/06/2023 11:21	29/06/2023 02:19	0.62	Cat
2	Mouse	0692240 0649553	GA1	26/07/2023 11:45	01/08/2023 22:04	6.42	Fox
7	Bird	0691276 0649026	BL3	26/07/2023 11:55	27/07/2023 05:01	0.71	Unknown
11	Mouse	0692743 0649532	BL3	31/08/2023 09:17	31/08/2023 20:52	0.47	Cat
1	Mouse	0692500 0649761	WS1	31/08/2023 11:14	24/09/2023 13:42	24.08	Unknown
6	Mouse	0691650 0649022	WS1	26/09/2023 13:59	28/09/2023 23:18	2.38	Fox
10	Mouse	0691250 0649242	GA1	26/09/2023 14:22	24/10/2023 12:20	28.10	Unknown

*WS1 (Scrub), **GA1 (Improved Agricultural Grassland), ***BC1 (Arable Crop), ****BL3 (Buildings and Artificial Surfaces)

4.3 Searcher Efficiency Trial

During surveys on the 31/08/2023 ten carcasses were randomly placed throughout the site without the dog and handler team being aware of location or number of carcasses placed. Of the ten carcasses lain for the dog searcher efficiency trial, one bat was predated on. Of the other 9 carcasses, 8 were found by the dog and handler team, thus the efficiency rate for Castledockrell Wind Farm was 89% with the exclusion of the predated-upon carcass. Details shown in Table 4.3.

Table 4-3 Efficiency Trial Results

Turbine	Corpse	Condition	Habitat	Location of carcass		Trial results
7	Bat (*Pipistrelle sp.)*	Full	Hardstand	0691287	0649003	Found
10	Bat (Leisler bat)	Full decomposed	Arable	0691251	0649280	Not Found
5	Thrush	Full	Grassland	0691927	0649083	Found
9	Corvid, House Martin	Full	Scrub and Grassland	0691938 0691898	0649429 0649457	Both Found
4	Blackbird	Full	Grassland	0692251	0649256	Found
2	Bat *(Pipistrelle sp.)*	Full	Grassland	0692193	0649613	Scavenged
3	Bat (Leisler's bat), Corvid	Full	Hardstand and Scrub	0692497 0692527	0649390 0649412	Both Found
11	Robin	Full	Grassland	0692797	0649550	Found

4.4 Collision Rates

Collision-related mortality at the wind farm was estimated using the GenEst software package (version 1.4.9; Dalthorp *et al.,* 2023). The results of carcasses found during collision monitoring surveys was input into a model, along with information on the existing wind farm and survey effort, such as the 1) number of turbines, 2) the area surveyed and the 3) survey effort. This generated an estimate of mortality at the existing wind farm, which was then corrected for 4) searcher efficiency, 5) scavenger removal and 6) detection probability, based on the results of the trials.

Results

Results for Castledockrell Wind Farm, with 1) 12 turbines (27.3 megawatts). The search area at each turbine base comprised a 2) 60m circle and 3) 100% of the search area was surveyed. Surveys were conducted by trained dogs Clay, Taio, Kynren, Mac, Monty, Rufus and Ziba, with handlers Jessica Sara, Caroline Finlay and Cathal Bergin (LANTRA Qualified).

- 4) Searcher efficiency was 89% (median = 0.89 [CI 0.58-0.98]),
- 5) The median number of days a carcass persisted was 7.81days,
- 6) Detection probability was 0.31 [CI 0.19-0.42]

Birds

The model estimates with 90% confidence that between 3 and 21 **bird** fatalities occurred over the study period at the existing wind farm (estimated mortality = 9.34 birds [confidence intervals 3.00-20.74]). This scales to 1.73 [confidence intervals 0.07-1.73] birds per turbine per year or 0.34 [confidence intervals 0.11-0.76] birds per megawatt hour.

Bats

The model estimates with 90% confidence that between 3 and 23 **bat** fatalities occurred over the study period at the existing wind farm (estimated mortality = 10.19 bats [confidence intervals 3.00-23.46]. This scales to 1.96 [confidence intervals 0.07-1.96] bats per turbine per year or 0.37 [confidence intervals 0.11-0.86] bats per megawatt hour.

5. DISCUSSION AND CONCLUSION

Fatalities recorded at the site were infrequent during the surveys carried out between November 2022 and October 2023. In total, five fatalities (2 bird feather spots and 3 bat) were recorded over a 12-month period. Bird species recorded included corvid and pigeon species, which are green listed in Birds of Conservation Concern in Ireland. Bat species recorded included pipistrelle species which are common and widespread in Ireland.

GenEst results provided above estimated that no more than 21 bird and 23 bat fatalities could occur over a 12-month period on the entire Proposed Development site.

Continued post-consent monitoring is proposed at the site. The information gathered in this report has been used to inform the impact assessment in the EIAR.

6. BIBLIOGRAPHY

- Arnett, E.B., 2006. A preliminary evaluation on the use of dogs to recover bat fatalities at wind energy facilities. *Wildlife Society Bulletin, 34*(5), pp. 1440-1445.
- Atienza, J.C., Martin Fierro, I., Infante, O., Valls, J. and Dominguez, J., 2011. Guidelines for Assessing the Impact of Wind Farms on Birds and bats (version 4.0). *SEO/BirdLife, Madrid.*
- Barrientos, R., Martins, R.C., Ascensao, F., D'Amico, M., Moreira, F. and Borda-de-Agua, L., 2018. A review of searcher efficiency and carcass persistence in infrastructure-driven mortality assessment studies. *Biological conservation,* 222, pp. 146-153.
- Bennett, E., 2015. Observations from the use of dogs to undertake carcass searches at wind facilities in Australia. In *Wind and Wildlife: Proceedings from the Conference on Wind Energy and Wildlife Impacts, October 2012, Melbourne, Australia* (pp. 113-123). Springer Netherlands.
- Bernardino, J., Bispo, R., Mascarenhas, M. and Costa, H., 2012, May. Are we properly assessing bird and bat mortality at onshore wind farms. In *Proceedings of the 32nd Annual Meeting of International Association for Impact Assessment.*
- Bioscan, 2001. Novar Windfarm Ltd Ornithological Monitoring Studies: Breeding bird and bird strike monitoring 2001 results and five-year review, Rep. No. E1003BM. National Wind Power Ltd.
- Colhoun, K. and Cummins, S., 2013. Birds of Conservation concern in Ireland. *Irish Birds, 9,* pp.523-544.
- Dalthorp D, Simonis J, Madsen L, Huso M, Rabie P, Mintz J, Wolpert R, Studyvin J, Korner-Nievergelt F (2023). GenEst: Generalized Mortality Estimator. R package version 1.4.9. https://CRAN.R-project.org/package=GenEst
- EAS., 1997. Ovenden Moor Ornithological Monitoring. Report to Yorkshire Windpower. Keighley: Ecological Advisory Service.
- Edkins, A., 2014. Impacts of wind energy developments on birds nd bats: looking into the problem.
- EUROBATS (2016) Report of the Intersessional Working Group on Wind Turbines and Bat Populations at 21st Meeting of the Advisory Committee, Zandvoort, the Netherlands, 18 – 20 April 2016.
- Gilbert, G., Stanbury, A. and Lewis, L., 2021. Birds of conservation concern in Ireland 4: 2020-2026. *Irish Birds, 43,* pp 1-22.
- Horman, H.J., Linz, G. and Peer, B.D., 2001. Dogs increase recovery of passerine carcasses in dense vegetation. *Wildlife Society Bulletin,* pp. 292-296.
- Mathews, F., Richardson, S., Lintott, P. and Hosken, D., 2016. Understanding the risk to European protected species (bats) at onshore wind turbine sites to inform risk management.
- Mathews, F., Swindells, M., Goodhead, R., August, T.A., Hardman, P., Linton, D.M. and Hosken, D.J., 2013. Effectiveness of search dogs compared with human observers in locating bat carcasses at wind-turbine sites: a blinded randomized trial. *Wildlife Society Bulletin, 37*(1), pp. 34-40.
- Meek, E.R., Ribbands, J.B., Christer, W.B., Davy, P.R., and Higginson, I., 1993. The effects of aero-generators on moorland bird populations in the Orkney Islands, Scotland. *Bird Study, 40*(2), pp. 140-143
- NatureScot (2021). Bats and onshore wind turbines: survey, Assessment and mitigation. Version: August 2021 (updated with minor revisions).
- Paula, J., Leal, M.C., Silva, M.J., Mascarenhas, R., Costa, H. and Mascarenhas, M., 2011. Dogs as a tool to improve bird-strike mortality estimates at wind farms. *Journal for Nature Conservation, 19*(4), pp. 202-208.
- Power, N.W., Johnson, G., Erickson, W., White, J. and McKinney, R., 2003. Avian and Bat Mortality During the First Year of Operation at the Klondike Phase I Wind Project, Sherman County, Oregon.

- R Core Team (2023). R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing, Vienna, Austria. https://www.R-project.org/
- Reed, S.E., Bidlack, A.L., Hurt, A. and Gertz, W.M., 2011. Detection distance and environmental factors in conservation detection dog surveys. *The Journal of Wildlife Management, 75*(1), pp. 243-251.
- Richardson, S.M., Lintott, P.R., Hosken, D.J., Economou, T. and Mathews, F., 2021. Peaks in bat activity at turbines and the implications for mitigating the impact of wind energy developments on bats. *Scientific Reports, 11*(1), p.3636.
- Rodrigues, L., Bach, L., Dubourg-Savage, M.J., Karapandza, B., Kovac, D., Kervyn, T., Dekker, J., Kepel, A., Bach, P., Collins, J. and Harbusch, C., 2015. *Guidelines for consideration of bats in wind farm projects: Revision 2014.* UNEP/EUROBATS
- Smallwood, K.S., Bell, D.A. and Standish, S., 2020. Dogs detect larger wind energy effects on bats and birds. *The Journal of Wildlife Management, 84*(5), pp. 852-864.
- Stevenson, C.R. and Peasley, C.J., 1995. The impact of the Mynydd y Cemmaes Winfarm. Vol. IID Ecological Impact.
- Tyler, S.J. 1995. Bird strike study at Bryn Titli windfarm, Rhayader. *Report to National Wind Power Ltd.*
- Young, D.P. Jr., Erickson, W., Good, R., Strickland, M., Johnson, G., 2003. Avian and Bat Mortality Associated with the Initial Phase of the Foote Creek Rim Windpower Project, Carbon County, Wyoming November 1998-June 2002. Report by Western Ecosystems Technology Inc (WEST).