Galetech Energy Services

Islandmore Wind Farm

Natura Impact Statement Report

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woodrow

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V1	10/09/2026	Draft	N	John Ball	Senior Ecologist
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1. INTRODUCTION

1.1. Project Background

APEM Group Woodrow (hereafter referred to as "Woodrow") was commissioned by Galetech Energy Services Ltd. on behalf of Islandmore Wind Farm Limited (the "Client" or the "Applicant") to prepare a Natura Impact Statement (NIS) report for a wind farm development at Largan, Boleysillagh, Cloonmeen, Toobrackan, and Tullaghanrock, Co. Roscommon (hereafter referred to as "the Proposed Development").

The Proposed Development site, which extends over a total area of approximately 157ha hectares (ha), is located approximately 2 kilometres (km) north of Ballaghderren, approximately 13km east of Charlestown (County Mayo) and approximately 6km southwest of Gorteen (County Sligo). The wind farm will be located in the townlands of Largan, Boleysillagh, Cloonmeen, Toobrackan, and Tullaghanrock, County Roscommon. The Site location, in the context of the wider landscape, is shown in Figure 1.

1.2. Purpose of this Report

An AA Screening Report of the Proposed Development was prepared by APEM in 2026; this Stage 1 AA Screening concluded that the potential for significant effects on 7 No. European Sites could not be ruled out due to the potential for displacement, collision risk, water pollution or the spread of invasive species. There are various projects and developments at various stages of planning (proposed, existing and permitted) which may result in cumulative effects as a result, a Stage 2 AA is required. The aim of this report is to provide supporting information to assist the Competent Authority (in this case, An Coimisiún Pleanála (ACP), formerly An Bord Pleanála (ABP)) to carry out an AA of the Proposed Development.

This NIS examines proposed mitigation measures and the potential effects of the Proposed Development on European sites and has been prepared with regard to best scientific knowledge. This NIS should be read in conjunction with the AA Screening Report prepared for the proposed development.

1.3. Brief Description of the Proposed Development

The Proposed Development assessed within this NIS report comprises a wind farm, including all associated development works to accommodate its construction, installation, operation, maintenance and the export of electrical power to the national grid. This will include: -

- 3 no. wind turbines (T1-T3) with a hub height of 104m, a rotor diameter of 162m and an overall tip height of 185m;
- 7 no. wind turbines (T4-T10) with a hub height of 82m, a rotor diameter of 136m and an overall tip height of 150m;
- All associated turbine foundations and crane hardstanding areas;
- All associated underground electrical and communications cabling;

- Construction of approximately 4km of wind farm access tracks;
- Construction of 6 no. new site entrances and upgrade of 1 no. existing site entrance;
- 2 no. temporary construction compounds;
- 1 no. borrow pit which, when exhausted, will be utilised to permanently store excess excavated material;
- The storage, as required, of excavated material at dedicated spoil deposition areas;
- Felling of approximately 6.5ha hectares (ha) of forestry plantation to facilitate the construction and operation of wind farm infrastructure; and,
- All associated and ancillary site development, excavation, construction, landscaping and reinstatement work, including provision of site drainage infrastructure and environmental mitigation measures.

Off-site or secondary elements of the Proposed Development which are included for assessment in this NIS report and are included in the current SID planning application, include: -

- Temporary and permanent works to public roads along the turbine component haul route.

Off-site or secondary elements of the Proposed Development which are included for assessment in this NIS report but are not included in the current SID planning application and will be subject to a separate licensing and/or consenting process, include: -

- A 110 kilovolt (kV) electricity substation and all associated electrical equipment; and the installation of *c.* 7km of underground electricity line to facilitate connection of the electricity substation to the existing 110kV electricity substation at Tonroe, Ballaghaderreen, County Roscommon.

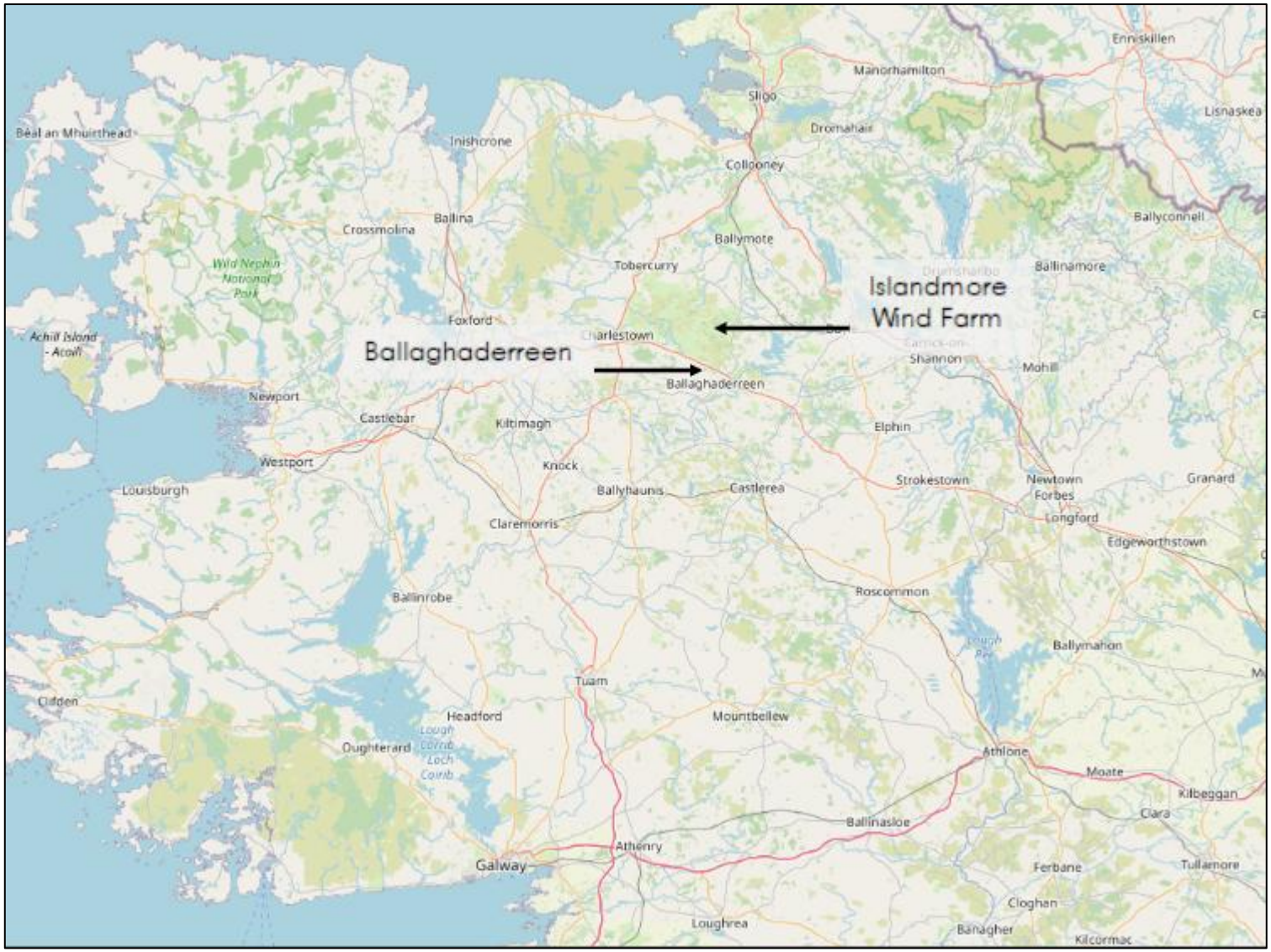


Figure 1. Site Location

1.4. Structure of the Report

The structure of the report relates in sequence to the process of assessing the potential impact of the Proposed Development in the context of sequential requirements of Article 6 of the Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (as amended) (hereafter referred to as the "Habitats Directive") and transposing legislation. The assessment is carried out in adherence to the legislative requirements as outlined in Section 2.

The structure of the report is as follows:

- **Section 1**: Introduction, including purpose of the report, brief project description, and competency of expert authors;
- **Section 2**: Description of the legislative context and AA requirement and process;
- **Section 3**: Description of methodology, including data sources, the approach to the assessment of likely effects resulting from the Proposed Development against the conservation objectives of Natura 2000 sites, and the approach to the assessment of cumulative effects;
- **Section 4**: Description of the Proposed Development, including details of the construction, operational, and decommissioning phases;
- **Section 5**: Description of the receiving environment;
- **Section 6**: NIS, which includes a description of proposed mitigation measures, a detailed assessment of likely effects resulting from the Proposed Development, and assessment of cumulative effects;
- **Section 7**: Consideration of the findings of the NIS; and
- **Section 8**: References

1.5. Evidence of Technical Competence and Experience

Louise Gannon BSc - Ecologist. Louise completed a B.Sc. in Environmental Science and has 4 years of experience working in the consultancy sector. Her main experience lies in carrying out protected species surveys for bats (preliminary roost assessments, emergence/re-entry surveys and activity transect surveys) as well as the deployment of static bat detectors and reporting on the same. She also carries out bat call analysis using Kaleidoscope and BatExplorer, the analysis software used to assess bat calls and activity. She also has experience in carrying out otter, badger and red squirrel surveys. She has volunteered in various surveys such as the BCI All Ireland Daubenton's bat survey, the Countryside bird survey and is a seal rescue volunteer. Louise is a licenced bat surveyor (DER/BAT 2024-27) and a Qualifying member of CIEEM.

Jason Guile BSc - Principal Ecologist. He has over 12 years' relevant industry experience in ecological assessment and has worked in both Ireland and the UK. Jason has a B.Sc. in Marine Biology and Oceanography at University of Wales, Bangor. Jason is a Project Director and Lead Ecologist, providing technical expertise on largescale infrastructure projects, particularly in relation to bats.

Since moving to Ireland Jason's work has involved coordinating, surveying, analysing data, and writing technical reports for several species and numerous projects including renewables, infrastructure, landfill remediation works, urban planning applications and commercial regeneration sites. Jason is

currently lead author of the chapters for several Environmental Impact Assessments (EIA) and contributes to and reviews reports for the Appropriate Assessment (AA) process.

Grisel Calcagno BSc Env MSc Env (Hons) Adv. Dip. Planning and Environmental Law - Environmental Consultant, working primarily within EIA and environmental planning. She has experience preparing Environmental Impact Assessment Reports (EIARs), EIA Scoping and Screening reports, Strategic Environmental Assessment (SEA) Screening, Options Identification and Appraisal reports, preparation and review of Construction Environmental Management Plans (CEMP), Resource & Waste Management Plans (RWMP), Environmental Constraints and Feasibility reports, and Stakeholder Consultation. She has been involved in various infrastructure projects including high-profile schemes such as greenways, solar farms, flood relief schemes, gas-fired power plants, data centres, and airports, in addition to Active Travel and other road schemes, public realm and recreation developments, commercial developments, and underground powerlines, amongst others.

Dr Michael Dobson BSc PhD FLS, MCIEEM - Associate Director. Mike holds a BSc (Hons) in Biology from the University of Southampton and a PhD in freshwater ecology from the University of London (Queen Mary College). Mike spent 20 years as a research scientist, specialising in ecology and management of rivers and freshwater wetlands throughout Europe and East Africa, along with developing biotic indices for river quality assessment in Central America. He was Director of the Freshwater Biological Association for six years before joining APEM in 2013, working initially in the limnology and water quality team before starting APEM's invasive species team in 2019 and moving in 2022 to APEM Ireland. Mike has written many peer-reviewed papers in ecology and biogeography, along with two undergraduate textbooks for Oxford University Press (both in their second editions) and seven identification guides to freshwater invertebrates of Britain and Ireland. He has extensive experience of survey design, data analysis and reporting, including publication and verbal reporting for non-technical audiences.

This report has been reviewed by the Project Manager, John Ball and Approved by the Project Director, Róisín NigFhloinn.

John Ball BSc (Hons) MSc - Senior Ornithologist. John is an experienced ornithologist, project manager, and conservation specialist, with a strong academic background and a professional focus on applied ecology. John has delivered high-quality outcomes across both the public, charity, and private sectors, from complex species recovery projects to large-scale renewable energy developments. As a senior ornithologist he project manages a range of ornithological workstreams for largescale renewable energy developments across the UK and Ireland. This includes overseeing the full lifecycle of ornithological inputs, from initial scoping and survey design through to data management, baseline reporting, and the preparation of EIAR chapters. He works closely with clients to integrate mitigation measures at the design stage, ensuring regulatory compliance and ecological best practice.

Róisín NigFhloinn BSc (Hons) MSc MCIEEM - Associate Director. Róisín has 16 years' practice working as an ecological consultant in the UK and Ireland Her experience includes environmental and ecological impact assessment and mitigation design for development projects including utilities (water & electricity), renewables (wind & solar), national road schemes, national trails, other large infrastructure projects and smaller scale commercial and residential developments. She is competent in the compilation of Ecological and Environmental reports, including Ecological Impact Assessment (EcIA), to inform planning proposals, and as part of Environmental Impact Assessment Reports (EIAR) and reports to inform the Appropriate Assessment process (Screening and Natura Impact Statements

(NIS) (Habitats Regulations Assessment in Northern Ireland). Róisín holds a MSc in Ecology and management of the Natural Environment from University of Bristol (2011) and a B.A. Mod (BSc)(Hons)Natural Sciences from Trinity college, Dublin Specialising in Botany (2008). She is a Full member of CIEEM.

2. APPROPRIATE ASSESSMENT BACKGROUND AND PROCESSS

2.1. Legislative Context

The AA process in Ireland is driven by Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (as amended) (hereafter referred to as the "Habitats Directive") and the associated Council Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (as amended) (hereafter referred to as the "Birds Directive"), both of which are transposed into Irish Law by the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011) (as amended) (hereafter referred to as the "Birds and Natural Habitats Regulations 2011").

The Habitats Directive requires Member States of the European Union (EU) to designate SACs for habitats listed in Annex I and for species listed in Annex II of the Habitats Directive, to preserve habitats and species of international importance for conservation and to take measures to maintain or restore these to a favourable conservation status. Certain Annex I habitats are deemed 'priority' and have greater protection.

The Birds Directive provides a framework for the conservation and management of wild birds and requires Member States to designate SPAs based on the presence of internationally significant populations of rare or vulnerable species listed in Annex I of the Birds Directive, as well as certain regularly occurring migratory birds. The Birds Directive also requires Member States to take measures to maintain or restore bird populations to a favourable conservation status.

SPAs and SACs collectively contribute to Natura 2000, an extensive network of protected sites across the EU. The specific habitats and species for which an SAC is selected are called "Qualifying Interests" (QIs) and the specific bird species for which a SPA is selected are called "Special Conservation Interests" (SCI).

2.2. Requirement for Appropriate Assessment

The requirement for AA is set out in Article 6(3) of the Habitats Directive, which states that:

> *"Any plan or project not directly connected with or necessary to the management of the [Natura 2000] site but likely to have a significant effect thereon, either individually or in combination with other plans and projects, shall be subjected to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public."*

This requirement is transposed into Irish legislation by section 212 - 221 of the Planning and Development Act 2024 (as amended) and the Birds and Natural Habitats Regulations 2011 and included under other associated legislation such as the Planning and Development Regulations 2001 (S.I. No. 600 of 2001) (as amended). These legislations require that, prior to granting approval for a Proposed Development, a screening for AA must be conducted by the relevant Competent Authority

to consider the implications of a Proposed Development of European sites. The AA screening aims to evaluate whether a Proposed Development could potentially have a significant effect, either individually or in combination with other plans or projects, on Natura 2000 sites, taking into consideration their conservation objectives and best scientific knowledge. Planning approval may only be granted where it is determined that a Proposed Development will not adversely affect the integrity of European sites. The objective of AA is to safeguard the long-term survival of habitats and species designated under the Natura 2000 network.

This report has therefore been prepared to provide supporting information to assist the Competent Authority in applying Article 6(3) and 6(4) of the Habitats Directive as necessary, under their roles, functions, and responsibilities, in relation to the AA screening of the Proposed Development. The Competent Authority may use such information to carry out an AA screening of the Proposed Development to ascertain whether or not it may adversely affect the integrity of Natura 2000 sites.

2.3. Stages of the Appropriate Assessment Process

The European Commission's (EC) Notice *'Assessment of plans and projects in relation to Natura 2000 sites – Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC 2021/C 437/01'* (2021) promotes the following staged process for assessing plans or projects that are likely to have impact on Natura 2000 sites, with the need for each stage being dependent upon the outcomes of the preceding stage:

- **Stage 1 – Screening for AA**: *"[…] to ascertain whether the plan or project is […] likely to have a significant effect on the site (either alone or in combination with other plans or projects) in view of the site's conservation objectives"*. The potential for significant effects is determined through the Source-Pathway-Receptor (S-P-R) model (Office of the Planning Regulator (OPR), 2021). During this stage, mitigation or compensatory measures[1] cannot be considered to reach a conclusion that a Proposed Development is unlikely to result in significant effects in Natura 2000 sites (OPR, 2021). If the screening process identifies effects to be significant, potentially significant, or uncertain, then the process must proceed to Stage 2 (AA).
- **Stage 2 – AA**: *"If likely significant effects cannot be excluded, the next stage of the procedure involves assessing the impact of the plan or project (either alone or in combination with other plans or projects) against the site's conservation objectives and ascertaining whether it will affect the integrity of the Natura 2000 site, taking into account any mitigation measures. It will be for the competent authorities to decide whether or not to approve the plan or project in light of the findings of the appropriate assessment".* Stage 2 of the process considers potential effects in greater detail, including whether further mitigation measures are necessary to avoid, reduce, or offset negative effects on Natura 2000 sites. During this stage, a Natura Impact Statement (NIS)[2] must be prepared in order for a Proposed Development to

[1] 'Mitigation measures' are measures that aim to minimise, or even eliminate, the negative impacts likely to arise when a plan or project is implemented so that the site's integrity is not adversely affected. Compensatory measures are independent of the project (including any associated mitigation measures). They are intended to offset the residual negative effects of the plan or project so that the overall ecological coherence of the Natura 2000 network is maintained. They can only be considered in the context of Article 6(4) of the Habitats Directive. Source: EC, 2021.

[2] A statement prepared for the purposes of Article 6 of the Habitats Directive setting out the implications of a project, whether on its own or in combination with other plans or projects, for any European site on which the project may have significant effects, having regard to the conservation objectives in relation to that site. Source: Planning and Development Act 2024 (as amended).

proceed; the NIS must contain the necessary information to enable the Competent Authority to carry out the AA. If the conclusion of the AA is negative (i.e., adverse effects on the integrity of a site cannot be excluded), then the process must proceed to Stage 3, or the plan or project should be abandoned.

- **Stage 3 – Derogation from Article 6(3) under certain conditions:** *"The third stage […] only comes into play if, despite a negative assessment, the developer considers that the plan or project should still be carried out for imperative reasons of overriding public interest. This is only possible if there are no alternative solutions, the imperative reasons of overriding public interest are duly justified, and if suitable compensatory measures are adopted to ensure that the overall coherence of Natura 2000 is protected".* It is up to the Competent Authority to decide whether a derogation from Article 6(3) can be applied (if requested by the Applicant).

A Stage 1 AA Screening of the Proposed Development was completed and concluded that a Stage 2 AA was required. As a result, this NIS has been prepared by APEM to provide supporting information to assist the Competent Authority (i.e., ACP) to carry out an AA of the Proposed Development.

3. METHODOLOGY

3.1. Sources of Information

This NIS has been informed by the AA Screening Report prepared for the Proposed Development by APEM (APEM Group Woodrow, 2026). The AA Screening Report details the methodology used, amongst others, for the approach to the Stage 1 AA process, including the identification of the Zone of Influence (ZoI) of the Proposed Development and the Natura 2000 sites within it. The AA Screening Report also contains details of the methodology and findings of desk and field surveys which informed the baseline environment; the Natura 2000 sites screened in for further assessment, and the plans and projects identified for the assessment of cumulative effects. These details are not repeated in full in this report.

3.1.1. Guidance and Practice Notes

This NIS has been prepared in accordance with standard methods and best practice guidance set out in the following guidelines and practice notes:

- Department of Environment, Heritage and Local Government (DEHLG) (2009), *'Appropriate Assessment of Plans and Projects in Ireland: Guidance for Planning Authorities'*;
- DEHLG and the National Parks and Wildlife Service (NPWS) (2010), *'Circular NPWS 1/10 & PSSP 2/10 – Appropriate Assessment under Article 6 of the Habitats Directive: Guidance for Planning Authorities'*;
- EC (2021), *'Commission notice – Assessment of plans and projects in relation to Natura 2000 sites – Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC 2021/C 437/01';*
- EC (2000), *'Communication from the Commission on the Precautionary Principle'*;
- EC (2019), *'Managing Natura 2000 Sites – The Provisions of Article 6 of the Habitat's Directive 92/43/EEC'*;
- EU (2013), *'Interpretation Manual of European Union Habitats. Version EUR 28'*
- EC (2024), *'Commission notice – Guidance document on the strict protection of animal species of Community interest under the Habitats Directive'*;
- NPWS (2021), *'Strict Protection of Animal Species – Guidance for Public Authorities on the Application of Articles 12 and 16 of the EU Habitats Directive to development / works undertaken on or on behalf of a Public Authority'*; and
- OPR (2021), *'OPR Practice Note PN01 Appropriate Assessment Screening for Development Management'.*

3.1.2. Desk Study

A desk study was carried out in February 2025 to collate information available on Natura 2000 sites within the potential ZoI of the Proposed Development. This comprised a review of the following publications, websites, data sources and datasets:

- An Coimisiún Pleanála Planning Portal;
- Aerial maps;
- Department of Housing, Local Government and Heritage (DHLGH) National Planning Application Database;
- Environmental Protection Agency (EPA) Maps;
- National Biodiversity Data Centre (NBDC);
- NPWS Protected Sites;
- NPWS (2025), *'The Status of EU Protected Habitats and Species in Ireland – 2025'*; and
- Roscommon County Council (RCC) Planning Portal.

3.2. Natura Impact Statement

3.2.1. Assessment of Effects

The approach to preparing the NIS is summarised as follows:

- Describe what measures are to be introduced to avoid, reduce or remedy the adverse effects on the integrity of the Natura 2000 site; and,
- Consider findings and determine if potential for adverse effects on Natura 2000 sites remains after such measures have been implemented.

3.2.2. Cumulative Effects

The CIEEM's '*Guidelines for Ecological Impact Assessment in the UK and Ireland – Terrestrial, Freshwater, Coastal and Marine'* (2024) state that *"cumulative effects can result from individually insignificant but collectively significant actions taking place over a period of time or concentrated in a location"*. Therefore, although a Proposed Development may not result in significant effects on its own, it could still have the potential to result in significant effects when considered in-combination with other plans or projects (OPR, 2021). A planning search for developments with a potential cumulative impact was undertaken by the EIA Co-ordinator. All types of developments were assessed for the likelihood of cumulative effects. Proposed Developments, existing developments in operation, and permitted developments over the last 10 years (01/01/2016 onwards) were identified for cumulative impacts. Plans and projects considered for in-combination effects are presented in Table 1.

As per the OPR Guidelines (2021), the in-combination assessment of effects must consider:

- *"Projects completed;*
- *Projects approved but not started or uncompleted;*

- *Projects proposed, i.e., for which an application for approval or consent has been made, including refusals subject to appeal and not yet determined;*
- *Proposals in adopted plans, and*
- *Proposals in finalised draft plans formally published or submitted for consultation or adoption."*

Table 1. Plans and projects within 20km considered in the assessment of cumulative effects

Development	Planning Register Reference	Development Description	Status
Hanly Quarries, County Roscommon	08/9 (An Coimisiún Pleanála Reference PL20.229770), 05/872, 08/1217, 08/474, 20/310 (An Coimisiún Pleanála Reference ABP-311614-21), 21/668, 22/17, 22/165 (An Coimisiún Pleanála Reference ABP-313866-22)) and 23/129 (An Coimisiún Pleanála Reference ABP-317461-23)	Quarry and all associated quarrying plant and machinery	Existing
Harrington Concrete and Quarries, County Mayo	83/1316, 88/69, 97/165 (An Coimisiún Pleanála Reference PL16.105239), 99/1888 (An Coimisiún Pleanála Reference PL16.127156), 00/1596 04/1843, 24/403, 24/542 and 25/60088	Quarry and all associated quarrying plant and machinery	Existing
Westlands Sand Quarry, County Mayo	00/3017	Quarry and all associated quarrying plant and machinery	Existing
Largan Hill Wind Farm, County Roscommon **(0km to site boundary, *c.* 250m to nearest turbine (T3))**	94/582	9 no. wind turbines and all associated infrastructure	Existing
Curlew Energy Wind Farm, County Roscommon	21/595 (An Coimisiún Pleanála Reference ABP-314120-22)	2 no. wind turbines and all associated infrastructure	Permitted
Natural Forces Renewable Energy Wind Turbine, County Roscommon	23/60142 (An Coimisiún Pleanála Reference ABP-319800-24)	1 no. wind turbine and all associated infrastructure	Permitted
Roosky Wind Farm, County Roscommon	03/341, 03/1400, 07/2255, 11/3055 and 13/3005	2 no. wind turbines and all associated infrastructure	Existing
Grady Joinery Wind Turbine, County Mayo	11/413 (An Coimisiún Pleanála Reference PL16.240083) and 18/222	1 no. wind turbine and all associated infrastructure	Existing

Riverstown Locally Owned Wind Turbine, County Sligo	23/60288 (An Coimisiún Pleanála Reference ABP-320302-24)	1 no. wind turbine and all associated infrastructure	Permitted
Carrigeen Wind Farm, County Roscommon	An Coimisiún Pleanála Reference ABP-322258-25	14 no. wind turbines and all associated infrastructure	Proposed
Ballyfeeny Green Energy Project, County Roscommon	Planning Register Reference 25/60446 (An Coimisiún Pleanála Reference ACP PL20.502020)	6 no. wind turbines and all associated infrastructure	Appealed
N5 Upgrade Works	(An Coimisiún Pleanála Reference HA20.300493)	N5 Ballaghaderreen to Scramoge Road Development	Permitted
North Connacht 110kV Overhead Line Project **(0km to site boundary (underground electricity line route crosses the route of the 110kV project), 500m to nearest turbine (T10).)**	An Coimisiún Pleanála Reference ABP-313724-22	59km of underground electricity line and associated works	Permitted
Overhead Electricity Lines	Various	110kV overhead electricity line	Existing
Electricity Substations	Various	110kV and 38kV substations and all associated infrastructure	Existing
Agricultural Developments	Various	Various	Existing, Permitted and Proposed
Residential Dwellings	Various	Various	Existing, Permitted and Proposed
Commercial Forestry Plantations	-	-	Existing

The methodology used in the Stage 1 AA Screening to identify plans and projects relevant to the in-combination assessment of effects for the Proposed Development is detailed in the AA Screening Report prepared for the Proposed Development.

4. DETAILED DESCRIPTION OF THE PROPOSED DEVELOPMENT

This section contains a detailed description of the Proposed Development, including works associated with the construction of the wind farm, the turbine component haul route, and the electricity substation and underground electricity line; details of the operational phase; and decommissioning and restoration works at the end of the operational life.

The Site extends over across five townlands in County Roscommon: Largan, Boleysillagh, Toobrackan, Tullaghanrock, and Cloonmeen. The Proposed Development Site, the layout of the proposed turbines, and the temporary construction infrastructure and the underground electricity line are illustrated at Figure 2.

The layout of turbines reflects the outcome of the iterative engineering and environmental analysis approach adopted during the wind farm design process which considered a number of factors, including minimising any risk in terms of poor ground conditions, negative influences on the existing drainage, avoidance of sensitive ecological habitats and high flood risk areas, and any known archaeological features.

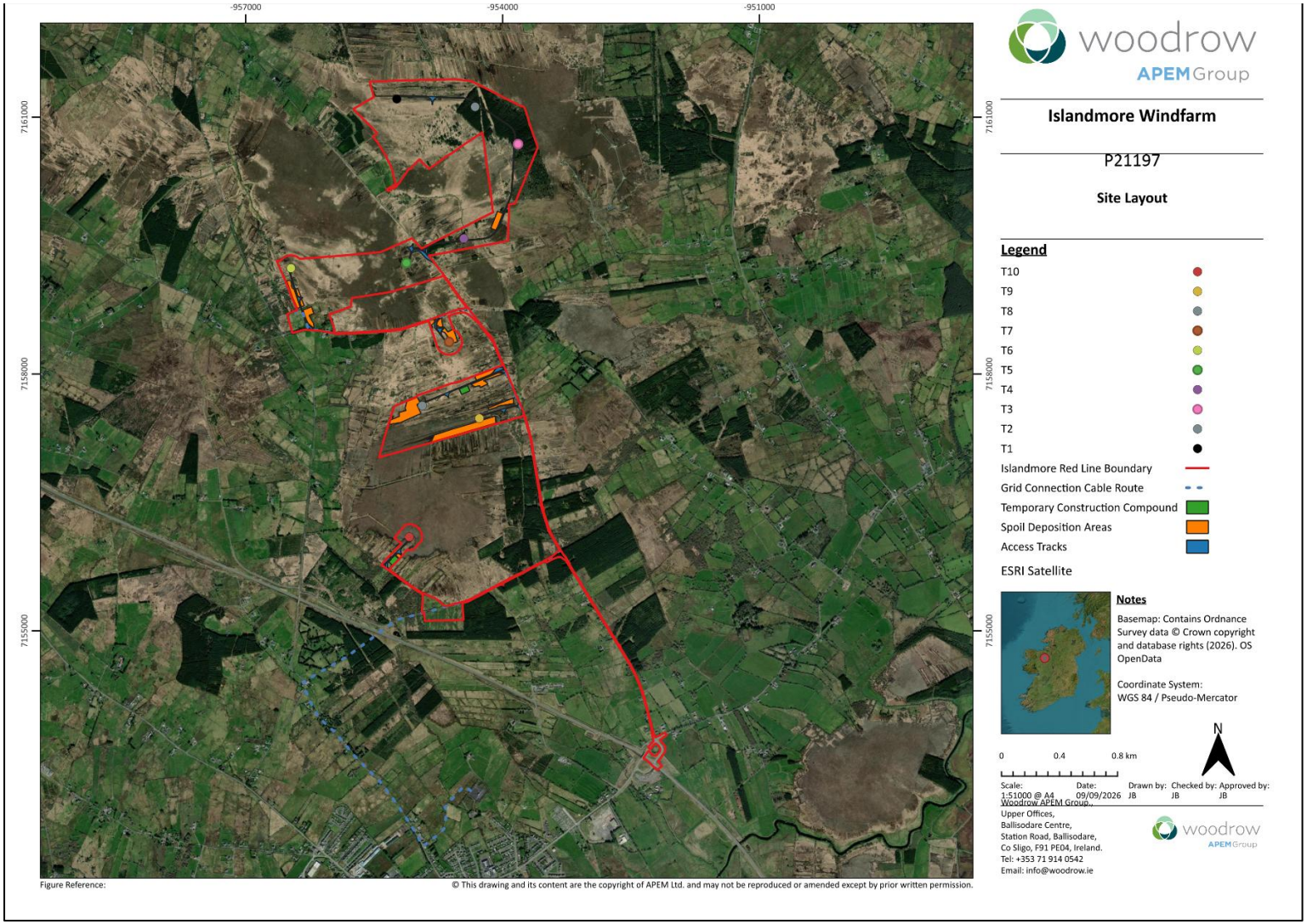


Figure 2: Site Layout

4.1. Design Elements of the Proposed Development

4.1.1. Turbines

There will be a total of 10 turbines erected on-site. This will consist of three wind turbines with a hub height of 104m, a rotor diameter of 162m and an overall tip height of 185m (T1 – T3), and seven wind turbines (T4 – T10) with a hub height of 82m, a rotor diameter of 136m and an overall tip height of 150m. The rated electricity output for each turbine, based on the turbine models selected, is 7.2-megawatt (MW) (T1-T3) and 4.5MW (T4-T10), resulting in a total rated output of 53.1MW for the Proposed Development. Turbines T1 – T3 are the Vestas V162-7.2MW model, whiles turbines T4 – T10 will be the Vestas V136-4.5MW model.

4.1.2. Wind Turbine Foundations

Each turbine tower is secured to a steel ring foundation which can comprise either a reinforced concrete (gravity) foundation or a piled foundation. Subsoil conditions are generally suitable for the construction of standard turbine gravity foundations at turbines T1 – T8 and T10. It is likely that a piled foundation is required at turbine T9. The depth of excavation required for each wind turbine foundation will vary depending on precise ground conditions. The diameter of a standard gravity raft foundation will be c. 27m for turbines T1-T3 and c. 24m for turbines T4-T8 and T10 with foundation depths ranging between c. 3m and 5m, depending on ground conditions at each turbine location. A piled foundation, for turbine T9, will comprise a circular concrete pile cap (c. 20m in diameter) supported by multiple piles ranging from c. 1m to 2m in diameter extending to depths of c. 15-30m below ground level depending on specific ground conditions.

Excavations will be undertaken by conventional mechanical methods, and no blasting will be required for turbine foundations. The total volume of excavated material at each foundation will range from approximately 2,150m^3 to 2,650m^3 depending on local ground conditions. Vegetation and excavated material removed during the construction of turbine foundations will be side-cast and appropriately stockpiled (see **section 4.2**) and, in so far as is practicable, used to reinstate the foundation and provide additional ballast. Any excess material arising will be utilised, firstly, for landscaping and reinstatement purposes elsewhere within the Proposed Development site (e.g. landscaping of hardstands and access tracks [including through the construction of berms as appropriate] and reinstatement of the borrow pit) or, as required, deposited at the dedicated spoil deposition areas or disposed of off-site.

4.1.3. Hardstands and Lay Down Areas

Hardstand areas shall be established adjacent to each turbine to facilitate crane operations for turbine installation. The hardstand areas will typically measure approximately 105m by 28m (T1-T3) and 65m by 25m (T4-T10). Hardstand areas will be established via traditional ‘excavate and replace’ methods, with material being excavated from the relevant area and replaced with a levelled and compacted (unsealed) layer of hardcore placed on top of a geotextile membrane. The location and precise configuration of the hardstands may necessitate some immaterial deviations in accordance with the micro-siting tolerance threshold.

The crane hardstands will be retained *in situ* during the operation phase of the Proposed Development to accommodate any crane activities in the event of a major component change-out (e.g. replacing a turbine blade or gearbox/generator) and during the decommissioning phase.

Temporary set down areas, also comprising levelled and compacted (unsealed) hardcore on a geotextile membrane, will be located immediately adjacent to each hardstand during the construction phase to accommodate the temporary storage of turbine components following their delivery to the Proposed Development site, and crane components during crane assembly. Following the installation of the turbines, reinstatement of these areas will involve removing crushed stone and underlying geotextile and allowing the areas to revegetate naturally.

4.1.4. Site Access

A total of seven site entrances will be required to facilitate access to the Proposed Development site. Of these, six will be new access points and one will comprise the upgrade of an existing agricultural entrance; with four entrances being from the L5501, two entrance from the L55018 and one entrance from an unnamed local road.

These site entrances will be used for the construction, operation and decommissioning phases of the Proposed Development.

4.1.5. Internal Site Access Tracks and Roads

A total of c. 4km of on-site access tracks will be required for construction purposes and for site access during the operation phase.

The majority of access tracks will be of a 'floating' construction type which, given the ground conditions and type of terrain present, is deemed an appropriate construction approach to minimise excavations and the generation of spoil material. This approach typically comprises the placement of a layer of geotextile, or geogrid, on the surface onto which aggregate is spread. Standard 'excavate and replace' type tracks will be constructed at the crane hardstands to ensure sufficient weight bearing capacity for crane operations.

The access tracks shall be similar to normal agricultural tracks but with a slightly wider typical running width of approximately 5m (wider at bends to accommodate turbine component delivery vehicles). Access tracks will be unsealed and constructed of crushed stone material to allow for permeability. Construction materials for access tracks will be sourced from the on-site borrow pit, insofar as practicable; however, material will also be imported to the Proposed Development site from local quarries.

4.1.6. Water Crossings and Drainage

Additional excavated stirps will be required for alongside access tracks for drainage. A number of drainage ditches and lower order watercourses/streams are present including the Owengarve and its related tributaries, and a number of unnamed watercourses. The layout of the Proposed Development has been designed to avoid surface water features insofar as practicable; however, it will be necessary for access tracks to cross two unnamed watercourses (to the east of turbine T4 and east of turbine T9 respectively) and a number of drainage ditches.

4.1.7. Underground Cabling within the Wind Farm

All on-site electrical and communications cables will be placed underground and be of a solid polymeric construction with either aluminium or copper conductors. All electrical cables will follow the alignment of the on-site access tracks and the public road network, insofar as is practical. Trenching will be completed by a mechanical digger. The proposed depth of the cable trench is c. 1m with a width of c. 0.5m.

The excavated material from the cable trenches located within private lands will be side-cast alongside the trench and reinstated following the laying of cable ducts. Material excavated from trenches located within the public road corridor will not be re-used for reinstatement but will be removed and placed in the spoil deposition areas or, in the case of road cuttings, disposed of at an approved waste management facility. These trenches will be backfilled using imported aggregates and the carriageway of the affected road will be subject to a full-width resurfacing.

4.2. Construction Phase

The construction phase is likely to last for approximately 15-18 months from commencement of enabling works through to the installation and commissioning of the turbines and ending with site reinstatement and landscaping.

The construction phase of the development will comprise a 6-day week with normal working hours from 07:00 to 19:00 Monday to Friday and 07:00 to 13:00 on Saturdays. It may be necessary to undertake works outside of these hours to avail of favourable weather conditions (e.g. during time of low wind speed to facilitate turbine installation etc.) or during extended concrete pours (e.g. where turbine foundation pours must be completed within 24-hours). Where construction activities are necessary outside of the normal working hours, local residents and the Planning Authority will receive prior notification.

4.2.1. Construction Programme

The construction of the wind farm will consist of the following general sequence:

- Preliminary traffic management and surface water protection measures to be implemented;
- Establishment of the site entrances, to be commenced and completed, ensuring that adequate visibility splays are provided;
- Progressive installation of surface water protection measures;
- Establishment and continued management of spoil deposition areas;
- Establishment of the borrow pit;
- Progressive construction of internal on-site access tracks utilising material extracted from the borrow pit, where possible, and imported from local quarries;
- Construction of the temporary construction compounds for off-loading materials and equipment and to accommodate temporary site offices;
- Construction of bunded areas for oil, fuel and lubricant storage tanks;

- As the internal access tracks progress to each turbine location, tree felling will be completed where required and foundation excavations for the turbines will commence and foundations laid. The hardstanding areas will also be constructed;
- Permanent and temporary upgrade works along the turbine component haul route will be commenced;
- Once the on-site access tracks are completed, the trenching and laying of underground cable ducting and cabling will begin;
- Installation of turbines will commence once the on-site access tracks, hardstands, foundations and drainage measures are in place and the haul route upgrade works are complete. It is anticipated that each turbine will take approximately 1-week to install. 2 no. cranes will be used for this operation. As each turbine is completed, the electrical connections will be made; and,
- Progressive site reinstatement, restoration and landscaping including habitat management proposals and re-profiling of borrow pit and spoil deposition areas, removal of turbine storage areas; installation of post-and-wire fencing around turbines, access tracks and at site entrances; installation of gates and vegetation at site entrances; and decommissioning of the temporary construction compounds and temporary equipment storage areas.

The construction method for the electricity substation and underground electricity line will consist of the following general sequence (to be completed concurrently with wind farm construction):-

- Site preparatory and groundworks associated with the substation compound footprint including control buildings;
- Construction of the control buildings;
- Construction of bases or plinths for electrical apparatus;
- Installation of palisade fencing around substation;
- Installation of internal and external electrical apparatus in control buildings and within compound area;
- Installation of underground electricity line (including joint bays, communication chambers, and HDD works) between substation and Tonroe 110kV electricity substation;
- Connection of underground electricity to the respective substations;
- Commissioning of electrical apparatus and underground electricity line; and,
- Progressive site reinstatement, restoration, landscaping and planting proposals including the installation of stockproof fencing and the installation of gates.

Once the turbines are installed, and the substation and electrical system completed, the turbines will be tested and commissioned.

A detailed CEMP will be prepared in advance of all construction activities and will incorporate all mitigation measures proposed in the NIS. A Planning-Stage CEMP has been prepared and is enclosed in Annex 3.4 (Appendix A).

The construction phase will be supervised by a range of environmental and engineering specialist personnel; including a Project Supervisor for the Construction Stage (PSCS), Ecological Clerk of Works (ECoW), Archaeological Clerk of Works (ACoW), and Geotechnical Clerk of Works (GCoW), among others; who will liaise closely with the appointed contractor's on-site Environmental Manager to monitor construction activities and to ensure that all applicable environmental control measures are implemented in full.

The detailed CEMP, which will incorporate further technical information following the undertaking of post-consent detailed design, will be submitted to the Planning Authority for approval prior to any works commencing on the Proposed Development site. The CEMP shall also provide additional details of intended construction practices including:-

- Specific design details of the temporary construction compounds and equipment storage compound including identification of areas for the storage of construction materials, construction waste, site offices and staff facilities;
- A detailed Traffic Management Plan for the timing and routing of construction traffic to and from the construction site and associated directional signage, to include, in particular, proposals to facilitate and manage the delivery of oversized loads and alternative arrangements to be put in place for pedestrians and vehicles during the temporary closure of any public road or footpath during the course of site development works;
- Implementation stage details of the proposed construction methods, including detailed measures regarding the management of spoil deposition areas;
- Specific measures to prevent the spillage or deposit of clay, rubble or other debris on the public road network;
- Details of appropriate measures for construction stage noise, dust and vibration, and any monitoring of such levels;
- Storage and containment of all construction related fuel and oil within specially constructed bunds to ensure that fuel spillages are fully contained. All such bunds shall be roofed to exclude rainwater;
- Appropriate provision for re-fuelling of vehicles;
- Off-site disposal of construction/demolition waste:
- Detailed design measures to ensure that surface water run-off is controlled such that no silt or other pollutants enter watercourses in full compliance with the measures outlined in this NIS; and,
- Further details of the intended hours of construction.

The CEMP will also take full cognisance of, and incorporate, the measures outlined within any specific environmental management plans proposed as part of the NIS and will also incorporate any specific requirements set out in conditions of consent, subject to a grant of planning permission.

4.2.2. Construction Compounds

During the construction period, 2 no. temporary construction compounds will be required. The compounds will be located along the access tracks leading to turbines T8 and T10 respectively. The compound proximate to turbine T8 will have an approximate area of 2,500m^2 (0.25ha), while the compound at turbine T10 will have an approximate area of 2,200m^2 (0.22ha). The compounds will generally comprise:-

- Temporary cabins to be used for the contractor's site office, the monitoring of incoming vehicles and temporary welfare facilities for the construction staff, including temporary toilets and potable water;
- Parking for construction staff, construction vehicles, and visitors;
- Secure storage for tools, plant and small parts;
- Waste management area where waste will be sorted and collected by a licensed service provider;
- Safe bunded storage of components and materials including fuels, lubricants and oils; and,
- Security fencing around the compound.

The temporary construction compounds have been located and designed such that all cabins, storage containers, waste management facilities and bunded areas will be located a minimum distance of 50 m from all natural watercourses in order to minimise the risk of pollution and the discharge of deleterious matter to watercourses. Stormwater which may arise from the roofs of cabins, containers or from sealed bunds will be passed through an oil interceptor prior to being discharged to the local environment.

4.2.3. Borrow Pits and Material Storage Areas

On the completion of site investigations (see Chapter 6), rock to the southeast of turbine T5 has been assessed as being suitable for construction and proposed to develop a borrow pit, which will extend to an approximate depth of 10 m. Rock will be extracted from the borrow pit by standard means of excavation and rock breaking. In the unlikely event that blasting is required, a mobile drilling rig will bore vertical holes into the designated rock area. Boreholes will be charged with explosives under the supervision of a qualified and experienced blasting engineer who will determine the precise location, depth, and charge requirements for each blast and will coordinate the secure delivery of explosives to the Proposed Development site.

Given the characteristics of the Proposed Development site, it is likely that peat will be used to reinstate the borrow pit. The peat will be placed in the borrow pit in accordance with best practice guidelines to prevent desiccation and minimise carbon losses and to encourage vegetative regeneration of the top layer. No treatment of peat will be carried out prior to its placement within the borrow pit thus ensuring the maintenance of its integrity to the greatest possible degree. Further details are set out at Chapters 5 and 6. Following the backfilling of the borrow pit, the top layer of peat will be graded to match the surrounding ground profile and the borrow pit will be permanently fenced off for safety reasons. Works at the borrow pit will be monitored, on a weekly basis during the construction phase and, monthly, for a 6-month period thereafter by an appropriately qualified geotechnical engineer.

4.2.4. Vegetation Removal

There will be tree felling and vegetation removal required during the construction phase of the Proposed Development.

The felling of commercial forestry will be required to accommodate the construction and operation of the wind turbines, the construction of access tracks and the completion of haul route upgrade works. The total area of forestry to be felled is approximately 6.5ha.

A felling plan has been prepared for the Proposed Development and is enclosed in Appendix B, which illustrates the areas where forestry will be felled to accommodate the physical infrastructure of the Proposed Development and bat buffer zones. Further details on the felling requirements for bats are provided at Chapter 5 of the EIAR.

Following the post-consent detailed design process and consultation with the turbine manufacturer/supplier, further felling may be required to ensure the efficient and effective operation of the wind turbines. The areas illustrated at Appendix B are, therefore, the minimum felling requirements and additional areas of forestry; surrounding turbines T1, T2 & T3; may also be subsequently felled.

All felling works, including any felling additional to that illustrated at Annex 3.8, will be undertaken entirely in accordance with the mitigation measures, where relevant, and therefore, it is assessed that any such additional felling will have no likely significant impacts on the substantive conclusions of this NIS.

All tree felling to be undertaken will be the subject of a felling licence application to the Forest Service in accordance with the Forestry Act 2014 and the Forestry Regulations 2017. In accordance with the Forest Service's policy on granting felling licenses for wind farm developments, a copy of the relevant planning consent is required to be submitted with the felling licence application which, as a result, cannot be applied for until such time as planning permission is obtained for the Proposed Development.

4.2.4.1. Replanting Area

In accordance with the Forest Service's published policy on granting felling licences for wind farm developments, areas of forestry which have been felled to accommodate turbine bases, access tracks and any other wind farm-related uses (i.e. the approximately 6.5ha of forestry identified in Appendix B) must be replaced by replanting at an alternative site. The replanting of forestry must be completed under licence in accordance with the Forestry Act 2014 (as amended) and Forestry Regulations 2017.

In addition to the forestry felling, some further hedgerow and tree removal will be required throughout the Proposed Development site to enable the construction of the wind farm or enable the delivery of wind turbine components. The extent of hedgerow and tree removal has, by design, been minimised and no vegetation will be unnecessarily removed.

The Ecological Clerk of Works (ECoW), to be appointed to monitor works during the construction phase, will select appropriate locations for the replacement of hedgerows and trees. The siting of this replacement vegetation will be carefully selected to maintain or enhance the ecological connectivity of the site while ensuring that adverse effects do not arise as a consequence. All new treelines or

hedgerows will be planted using native species and in a similar composition to treelines or hedgerows lost. The replacement of these trees and hedgerows will be conducted in accordance with the wider reinstatement and landscaping proposals for the Proposed Development.

As part of the felling licence application process, it will be necessary for the Developer to identify appropriate replacement lands. These lands can be located anywhere within the Republic of Ireland and will be subject to a separate environmental assessment and technical approval process as part of the felling licence consenting regime.

The replanting process, regardless of location, will be completed in accordance with the *Forestry Standards Manual* (Department of Agriculture, Food and the Marine; 2026) and will follow best practice methods generally comprising the following:-

- Site Preparation & Installation of Drainage Infrastructure;
- Planting;
- Fencing: Installation of stockproof fencing (post-and-wire);
- Vegetation Control: Undertaken throughout the crop establishment period (generally 4-5 years);
- Replacement of Failures: Undertaken throughout the crop establishment period (generally 4-5 years); and,
- Monitoring: Undertaken throughout the crop establishment period (generally 4-5 years).

4.2.5. Turbine Delivery Route

Whilst the final turbine component haul route has not been selected and will be entirely dependent on the turbine supplier and the chosen port of entry, it has been determined that turbine components will, most likely, enter via the Port of Galway. It is envisaged that, from here, the turbines will then be transported by specialised HGVs for the transport of turbine components along the L5048, R339, L5034, R336, N6, M6, M17, N17, N5, R293, L5501 and various local roads in the immediate vicinity of the Proposed Development site before accessing the site via the proposed site entrances.

In order to facilitate the delivery of turbine components, both permanent and temporary works will be required at various locations along the above route.

Between the Port of Galway and the junction of the N5 and R293, works will be of a temporary nature, including the temporary removal of street furniture such as road signs, bollards and street lighting and the temporary placement of hardcore at roundabouts and junctions to accommodate their navigation by turbine components. In addition, some pruning of roadside vegetation may be required on occasion.

The precise works at each location, which will be fully reinstated and the areas returned to their original condition following the delivery of turbine components, will be agreed in advance with the relevant local authority prior to the movement of any abnormal loads in the form of a Traffic Management Plan and/or Abnormal Load Permit application, as is the normal course.

Between the junction of the N5 and R293 and the respective site entrances, turbine components will follow the R293 for a short distance before transitioning to the local road network. Due to the characteristics of the local roads, a combination of temporary and permanent works will be required to facilitate the delivery of turbine components. These works will include the temporary removal of street furniture, temporary junction upgrades, permanent carriageway widening, and permanent reprofiling of carriageways. A full description is provided in Annex 3.5.

4.2.6. Construction Environmental Management Plan

Construction works will be undertaken in accordance with safeguards and best practice measures included in the Construction Environment Management Plan (CEMP) prepared for the Proposed Development. The appointed Contractor (hereafter referred to as "the Contractor") will be responsible for updating this CEMP into a Contractor's CEMP. The CEMP will be treated as a live document to be updated as required throughout the construction phase of the Proposed Development.

The CEMP will be a key construction contract document which will ensure that measures considered necessary to protect the environment prior to and during construction are implemented. The environmental commitments of the Proposed Development, which shall include any relevant planning conditions set out by ACP (subject to planning permission) will be managed through the CEMP and will be secured in contract documentation and arrangements for the construction phase. The CEMP will mainly address the construction phase; however, if mitigation and monitoring is required to continue into the operational phase, these commitments will be communicated and transcribed into operational process documentation.

A monitoring period of 2-years immediately following the decommissioning and restoration activities will be implemented. The monitoring period allows for the subject site to experience seasonal changes and to determine if additional restoration works are required. If, during this time, any failure of works or reinstatements carried out were to occur, they shall be made good using similar methods as described above, or as agreed with the Planning Authority.

4.3. Operational Phase

The operation phase of the Proposed Development is 40-years. During this period, the wind turbines will be operational.

On average, the Proposed Development will be visited on 1-2 no. occasions per week by a light commercial vehicle for maintenance purposes. In exceptional circumstances there may be a requirement to replace a turbine component, which would require more substantive works on site. Waste will be generated during the operation phase including, for example, cooling oils, lubricating oils and packaging from spare parts or equipment. All waste will be removed from site and reused, recycled or disposed of in accordance with best-practice and all regulations in a licensed facility.

4.4. Decommissioning Phase

The proposed operation phase of the Proposed Development is 40-years. At the end of this period, several options will exist: -

- Continued operation of the existing turbines;
- Refurbishment/replacement of the turbines and continued operation; and
- Decommissioning of the wind farm.

Any further operation beyond 40-years would be subject to a further planning application and EIA. In its scope, the associated NIS assumes full decommissioning of the Proposed Development will take place after 40-years. All structures above ground level shall be demolished and removed from the site for reuse/recycling; however, access tracks may be retained for continued use by landowners for agricultural purposes. Drainage/surface water management infrastructure will likely be decommissioned; however, where it is assessed to be serving an ongoing or wider beneficial drainage function, it shall remain *in situ*.

A Decommissioning Management Plan will be agreed with the Planning Authority in advance of decommissioning works.

4.4.1. Wind Turbines

Wind turbines are comprised of the tower, nacelle and blades which are modular items that can be disassembled. This will involve a process which will be similar to the construction phase, but in reverse. If the turbines are to be sold on or reused elsewhere, they shall be removed from site by specialist vehicles similar to those used during their transportation to site. If wind turbine components are not to be reused, then they shall be scrapped by the removal of all components to an approved waste handling/recycling facility where components will be sorted according to their material of construction. Turbine components are mainly inert steel/ferrous metals which can be reused or recycled.

The turbine blades are constructed of fibreglass which is not readily re-used or recyclable with research being undertaken to find an alternative use for the fibreglass, with a number of emerging innovations for fibreglass recycling including the re-purposing of fibreglass for other civil engineering Proposed Developments (e.g. as a component in concrete production, roofs for social housing and incorporation to the construction of electrical powerline masts/structures.) Given the extensive research being undertaken to find a means of recycling decommissioned wind turbine blades, the associated EIAR assumes that, at the proposed date of decommissioning, all blades will be fully re-purposed and that no disposal, to landfill, will be required.

4.4.2. Turbine Foundations

Wind turbine foundations shall be grubbed up to a depth of 1 m below ground level using conventional mechanical diggers. Exposed rebar and holding down bolts shall be burned off and removed off site to an approved waste handling facility for recycling or disposal. The broken concrete can be processed to provide an aggregate material to be used elsewhere in construction Proposed Developments. Alternatively, it may be used on site as an inert fill to make up levels as part of a wider decommissioning/restoration plan, reducing the need for the importation of material onto the site. Excavations shall be backfilled with excavated material and allowed to revegetate naturally.

4.4.3. Hardstands & Access Tracks

Hardstands and access tracks shall be removed with all aggregates and geotextile exposed and removed from site. As the hardstands and access tracks will be of floated construction, substantial excavations are not assessed as likely to be required and minimal earthworks are likely to be required. Additional inert material derived from decommissioning activities in other areas of the site may be used if required. Once the area has been profiled to match the surrounding ground, if required, the area shall be allowed to revegetate naturally.

4.4.4. Transformers & Cabling

The decommissioning of transformers will depend entirely on any future use of the wind turbine. If the turbine is to be used elsewhere, the transformer will be removed from site for refurbishment and future use. If the turbine is to be scrapped, the transformer will be removed to an approved waste handling/recycling facility and stripped of any useable parts with the remainder being recycling.

Excavations shall be carried out to expose any cables buried in trenches to a depth of 1m below ground level and the cable removed. The majority of cables used in wind farm construction contain a core of either copper or aluminium. Both of these materials can be recycled. Any cable off-cuts shall be removed off site to an approved waste handling facility where the cores shall be recycled and the remaining material shall be disposed of at an approved facility. Excavations carried out to expose cables shall be backfilled with excavated material and allowed to revegetate naturally.

4.4.5. Electrical Substation & Electricity Line

The electricity substation and electricity substation will, once operational, be 'taken-in-charge' by EirGrid/ESB Networks, who will operate and maintain the infrastructure as part of the national electricity network. As a result, the substation and electricity line do not have a specified operation period and may continue to be operated following the decommissioning of the wind farm (i.e. after its 40-year operation period). However, for the purposes of this NIS, full decommissioning of the substation and grid connection have been assumed.

The decommissioning of the substation will involve the strip-out and removal of steel, conductors, switches, transformer and other materials and equipment that can be reconditioned and reused or sold as scrap. A soft strip of the building shall ensure that all fixtures and fittings are removed prior to demolition.

Demolition of the building shall take place using conventional methods. Foundations and building services shall be grubbed up to a depth of 1m below ground level. The demolition waste shall comprise mainly rubble (bricks, block, broken concrete, plaster etc.) and timber. Rubble can be processed to provide an aggregate material to be used elsewhere in construction projects. Alternatively, it could be used on site as fill elsewhere on the subject site.

Timber and other waste shall be segregated according to material type with a view to recycling where possible or disposal. All demolition materials which cannot be reused on site shall be removed off site to a licensed waste handling facility for recycling or disposal. Excavations shall be backfilled with suitable material, soiled over and seeded out or allowed to revegetate naturally.

Decommissioning of the electricity line will involve the removal of the cabling from the ducting; however, the ducting will remain *in situ* to avoid further excavations. The majority of cables used in wind farm grid connections contain a core of either copper or aluminium, both of which can be recycled. All cables will be removed to an appropriate licensed facility for recycling; while the ducting will remain *in situ* to avoid the requirement for further excavations.

4.5. Monitoring

A monitoring period of two years immediately following the decommissioning and restoration activities will be implemented. The monitoring period allows for the subject site to experience seasonal changes and to determine if additional restoration works are required. If, during this time, any failure of works or reinstatements carried out were to occur, they shall be made good using similar methods as described above, or as agreed with the Planning Authority.

4.6. Other Elements included in the Assessment

Off-site or secondary elements of the Proposed Development which are included for assessment in this NIS but are **not** included in the current SID planning application and will be subject to a separate licensing and/or consenting process, include:

- A 110 kilovolt (kV) electricity substation and all associated electrical equipment; and,
- The installation of approximately 7 km of underground electricity line to facilitate connection of the electricity substation to the existing 110 kV electricity substation at Tonroe, Ballaghaderreen, County Roscommon.

The construction and operation of a 110kV electricity substation and associated underground electricity line to the Tonroe 110kV substation has been assessed throughout this NIS; however, the final selected grid connection infrastructure will be subject to a separate future planning application, as required.

As part of the felling licence application process, it will be necessary for the Developer to identify appropriate replacement lands. These lands can be located anywhere within the Republic of Ireland and will be subject to a separate environmental assessment and technical approval process as part of the felling licence consenting regime

4.6.1. Grid Connection Infrastructure

The point of connection to the national grid will ultimately be decided by EirGrid or ESB Networks, as the independent electricity system operators with statutory responsibility. However, on the basis of a detailed analysis including an assessment of the existing grid network and its capacity; it is assessed that the existing Tonroe 110 kV electricity substation is the most likely point of connection to the national network. It is further assessed that the most likely method of connecting to the Tonroe 110 kV substation is through the construction of a 110 kV substation at the wind farm site south of turbine T6 and the installation of approximately 7 km of 110 kV underground electricity line.

Therefore, the construction and operation of a 110 kV electricity substation and associated underground electricity line to the Tonroe 110 kV substation has been assessed; however, the final

selected grid connection infrastructure will be subject to a separate future planning application and EIAR, as required.

4.6.2. Electricity Substation

The proposed on-site 110kV electricity substation (switchroom & compound) will extend to an area of approximately 8,800m^2 and will be surrounded by a palisade fence, with associated gates, of 2.6m in height for safety and security reasons. The substation compound will contain two control buildings and all necessary electrical equipment and apparatus to facilitate the export of electricity to the national grid.

The layout of the substation has been designed in accordance with current EirGrid specifications; however, the Developer may be instructed by EirGrid to immaterially alter the precise siting and/or specification of control buildings and/or electrical equipment within the overall substation footprint.

The substation site is located in a relatively flat area of agricultural pasture and scrub and does not traverse any drains or watercourses; however, a tributary (26_2105) of the River Lung is located to the southwest boundary of the substation site. There will be a requirement to undertake minor modifications to ground levels in order to achieve the required levels for the buildings, structures and electrical equipment. As part of the design process, it is estimated that approximately 14,000m^3 of material will be excavated to facilitate the construction of the electricity substation.

The substation compound will be surfaced with free-draining crushed stone aggregates such that rainwater can percolate to ground. Rock and capping material will be sourced from local (appropriately licenced) quarries.

The boundaries of the electricity substation are largely surrounded by open agricultural grassland and peatland. Whilst the substation site is not particularly prominent, it is likely that additional strengthening of existing hedgerows and planting of new hedgerows will be undertaken to further screen the substation from view.

The electricity substation will be accessed via a wind farm site entrance from the L55018 and will be connected to the wind turbines via underground electrical cabling.

4.6.3. Control Buildings

The electricity substation compound will contain two control buildings; one of which, the Independent Power Producer Building (the 'IPP) Building'), will be operated and maintained by the Developer, while the Transmission System Operator Control Building ('the EirGrid Building') will be operated and maintained by EirGrid.

The IPP Building will have a gross floor area of approximately 172m^2. The EirGrid Building will have a gross floor area of approximately 450m^2.

A water connection will also be provided to the substation and will comprise either a connection to local water scheme or a bored well. Wastewater from the control buildings will be stored in a sealed tank and will be tankered off-site as required by a local licensed waste collector. Water supply and wastewater management proposals of this nature are common practice for wind farm developments.

4.6.4. 110kV Underground Electricity Line

The electricity substation will be connected to the Tonroe 110kV substation via approximately 7km of underground electricity line. From the electricity substation, the electricity line will be located within wind farm access track before following the L55018, L5501, L5506, crossing beneath the N5 via horizontal directional drilling, L55019, L1203, L12032 and L12034 before following private lands to the Tonroe 110kV electricity substation.

Due to the characteristics of the relevant public roads, the electricity line will generally be located within the paved carriageways.

The electricity line will be installed within ducting in excavated trenches of approximately 1.2m deep and approximately 0.6m wide. The electricity line will be pulled through the ducting in sections of 650/750m in length or as may be required. The lengths of electricity line will be connected at designated 'joint bays' to be constructed along the proposed route.

Existing utility services are present along the route. Where existing utilities/services are encountered, the underground electricity line will be installed either above or below the third-party infrastructure depending on the depth of cover available and following consultation with the service provider.

Communication chambers are also required along the route and will include an access cover to facilitate access should it be required.

Following the installation of the ducts, joint bays, and communication chambers; ground levels will then be made up using appropriate material (including excavated material where possible) and finished/reinstated to the requirements of ESB Networks, the Planning Authority (public road) or landowner (private lands). Further, all local roads within which it is proposed to install the underground electricity line will be subject to a full-carriageway reinstatement thus ensuring that there are no long-term effects on the public road network.

All trenching works will be undertaken to ensure that only short sections of trench are open at any one time. Excavated material will be segregated and stored separately for use during the reinstatement of the trench/joint bays/communication chambers or for disposal at an appropriate licensed facility as necessary.

The sequence of works is typically as follows:-

- Identify existing underground services prior to excavation;
- Excavate the trench to the required dimensions;
- Place a blinding layer at the base of the trench;
- Place and joint the high-density polyethylene (HDPE) power ducts using ties at 3m intervals;
- Lay in and compact a layer of leanmix concrete around and above ducts and place red marker strips above;
- Install 2 no. HDPE communications cable ducts;
- Lay in and compact an additional layer of leanmix concrete and place further red marker strips above;
- Final backfill layer (excavated material if suitable) to include yellow marker strips; and,

- Appropriate reinstatement as discussed above.

Prior to the commencement of construction, a detailed Method Statement will be prepared by the contractor outlining the precise methodology to be put in place during the trenching phase. This Method Statement will be reviewed by the Environmental Manager (EM; to be appointed by the contractor) to ensure that the environmental protective measures to be implemented are suitable and to the required standard.

Horizontal Directional Drilling (HDD) will be undertaken at seven locations along the route of the underground electricity line. At six locations, HDD will be undertaken to navigate watercourse crossings and to avoid trenching/excavations within either the channel of watercourses or bridging structures over watercourses. Launch and receptor pits will be excavated at either side of the crossings to accommodate the drilling rig and will be located a minimum distance of 15m from each watercourse.

The precise depth of the bore below each stream bed will be determined during the detailed design process and informed by future site investigations; however, it is anticipated that the depth will be a minimum of 3m below the stream bed. At this depth, there will be no impacts on the stream channel, aquatic habitats or the structural integrity and stability of the bridges/culverts. Following the installation of the underground electricity line, the launch and receptor pits will be reinstated to match the surrounding area and marker posts will be placed at either side of the road to indicate the location and alignment of the electrical cabling.

The underground electricity line will also be installed via HDD beneath the N5. Launch and receptor pits will be excavated north and south of the N5, respectively; while the bore will be at a depth of approximately 4.5m below the road carriageway. It should also be noted that an underground electricity line associated with the permitted North Connacht 110kV Project (An Bord Pleanála Reference ABP-313724-22) will be installed within the N5 at this location. The depth of the HDD bore has been designed to avoid any adverse effects on the structure or carriageway of the N5 or on the North Connacht 110kV Project underground electricity line.

Prior to the commencement of drilling operations, the appointed contractor will prepare a detailed Method Statement outlining the precise methodology to be followed. This statement may be reviewed as necessary by the Planning Authorities.

As part of the design process, it is estimated that approximately 5,000m^3 of material will be excavated to accommodate the underground electricity line; while approximately 5,000m^3 of backfill material (stone and concrete) will be imported from a local quarry (quarries). Full details of excavated material volumes, and the management of same, are provided in the Spoil Management Plan.

4.6.5. Construction Drainage Management and Disposal

Construction works will be carried out in accordance with the assessments and mitigation measures included in the NIS in order to prevent any likely significant effects on nearby watercourses by debris, silt and hydrocarbons. These measures have also been implemented in this NIS.

Sources of likely significant effects on the hydrological environment during construction include increased volumes of surface water runoff; the generation of silt laden surface water runoff from

excavations and the storage of stockpiled materials; contamination due to the leakage of oils/fuel from site vehicles; spillage during refuelling operations; and leakage from chemical, waste and fuel storage areas.

Specific mitigation measures are presented in the relevant chapters of this EIAR in relation to each of these issues and have been incorporated within the Planning-Stage CEMP (Appendix A). The precise implementation and siting of these measures will be determined, subject to planning permission being granted, following the further post-consent detailed design process and will be included within a detailed CEMP to be agreed with the Planning Authority prior to the commencement of construction.

All surface water runoff from stockpiles (including the spoil deposition areas), excavations, or from dewatering operations will be passed through an appropriate attenuation train, including silt fences (also known as silt curtains) and silt traps (also known as silt/settlement/sediment/stilling ponds). Other surface water protection measures which may be implemented, as appropriate, include straw bales, silt bags and siltbusters.

Surface water control measures will be implemented as construction progresses through the site; however, prior to the commencement of earthworks, temporary silt/sediment control infrastructure (e.g. straw bales) will be placed in agricultural/peatland drains around the site until the full range of construction phase measures are installed.

The installation of surface water runoff measures will avoid any discharge of silt or sediment laden waters directly to any surface water feature prior to being fully treated. At the point of discharge, buffered outfalls (or level spreaders) will be installed to ensure that erosion or scouring does not occur.

A Planning-Stage Surface Water Management Plan (SWMP) has been prepared in respect of the Proposed Development (enclosed at Appendix C). This SWMP will be further developed prior to the commencement of development, following the post-consent detailed design process, and will incorporate the precise implementation and siting of surface water management infrastructure.

Following the completion of construction, surface water treatment infrastructure will, where appropriate, be decommissioned and removed from site; however, it is likely that the majority of infrastructure will be retained to serve a drainage function during the operation phase of the Proposed Development.

Stormwater drainage infrastructure will be installed around the electricity substation to capture any runoff from roofed or paved areas and will be passed through an oil interceptor before being discharged to an agricultural drain. Discharge rates will be designed to mimic greenfield runoff rates thus avoiding any long-term alteration to the hydrological regime of the Proposed Development site.

5. RECEIVING ENVIRONMENT

5.1. Description of Natura 2000 sites

This section provides a description of Natura 2000 sites within the ZoI of the Proposed Development for which the Stage 1 AA Screening identified a S-P-R link and were therefore screened in for AA. The location of these sites is shown in Figure 3. The qualifying interests and conservation objectives of each site are listed in Table 2.

Table 2: Qualifying Interests and Conservation Objectives of Natura 2000 sites considered in the NIS

Distance from Site*	QIs	Conservation Objectives
River Moy SAC [002298]		
3.3 km north-west	Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*) [6510] Active raised bogs [7110] Degraded raised bogs still capable of natural regeneration [7120] Depressions on peat substrates of the R*hynchosporion* [7150] Alkaline fens [7230] Old sessile oak woods with ilex and Blechnum in the British Isles [91A0] Alluvial forests with Alnus glutinosa and Fraxinus excelsior (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0] White-clawed Crayfish (*Austropotamobius pallipes*) [1092] Sea Lamprey (*Petromyzon marinus*) [1095] Brook Lamprey (*Lampetra planeri*) [1096] Salmon (*Salmo salar*) [1106] Otter (*Lutra lutra*) [1355]	Conservation objectives for active raised bogs set out to restore the favourable conservation condition. There is no specific conservation objective for degraded raised bogs still capable of natural regeneration due to it being inherently linked to the conservation objective of the active raised bog. There is also no specific conservation objective for depressions on peat substrates of the *Rhynchosporion* as this QI is an integral part of good quality active raised bog. Conservation objectives for alkaline fens, old sessile oak woods with *Ilex* and *Blechnum* in the British Isles, alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior,* white-clawed crayfish, sea lamprey, brook lamprey, salmon, and otter set out to maintain favourable conservation condition.
Tullaghanrock Bog SAC [0002354]		
750 m south-east	Active raised bogs [7110] Degraded raised bogs still capable of natural regeneration [7120] Depressions on peat substrates of the *Rhynchosporion* [7150]	The SAC conservation objectives include restoring the favourable conservation condition of active raised bogs within the SAC. There

Distance from Site*	QIs	Conservation Objectives
		is no specific conservation objective for degraded raised bogs still capable of natural regeneration due to it being inherently linked to the conservation objective of the active raised bog. There is also no specific conservation objective for depressions on peat substrates of the *Rhynchosporion* as this QI is an integral part of good quality active raised bog.
Callow Bogs SAC [000595]		
2 km north-east	Active raised bogs [7110] Degraded raised bogs still capable of natural regeneration [7120] Depressions on peat substrates of the R*hynchosporion* [7150]	The SAC conservation objectives include restoring the favourable conservation condition of active raised bogs within the SAC. There is no specific conservation objective for degraded raised bogs still capable of natural regeneration due to it being inherently linked to the conservation objective of the active raised bog. There is also no specific conservation objective for depressions on peat substrates of the *Rhynchosporion* as this QI is an integral part of good quality active raised bog.
Bricklieve Mountains and Keishcorran SAC [001656]		
14 km north-east	Turloughs [3180] Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites) [6210] Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*) [6510] Calcareous and calcschist screes of the montane to alpine levels (*Thlaspietea rotundifolii)* [8120] Marsh Fritillary (*Euphydryas aurinia*) [1065] White-clawed Crayfish (*Austropotamobius pallipes*) [1092]	Conservation objectives for turloughs, marsh fritillary, and white-clawed crayfish set out to maintain the favourable conservation condition of these Qis. Conservation objectives for semi-natural dry grasslands and scrubland facies on calcareous substrates, lowland hay meadows, and calcareous and calcschist screes of the mountains to alpine levels set out to restore the

Distance from Site*	QIs	Conservation Objectives
		favourable conservation condition.
Lough Gara SPA [004048]		
3.5 km east	Whooper Swan (*Cygnus cygnus*) [A038] Greenland White-fronted Goose (*Anser albifrons flavirostris*) [A395]	This SPA conservation objective sets out to restore the favourable conservation condition of Greenland white-fronted goose and whooper swan within the SPA. This SPA is adjacent to Callow Bog SAC [000595]. These SAC conservation objectives should be used in conjunction with the SPA conservation objectives.
Bellanagare Bog SPA [004105]		
10.3 km south-east	Greenland White-fronted Goose (*Anser albifrons flavirostris*) [A395]	This SPA conservation objective sets out to restore the favourable conservation condition of Greenland white-fronted goose within the SPA. This SPA overlaps with Bellanagare Bog SAC [Site code: 000592]. The SAC has QIs for active raise bogs [7110], degraded raised bogs still capable of natural regeneration [7120] and depressions on peat substrates of the *Rhynchosporion* [7150]. The SAC conservation objectives include restoring the favourable conservation condition of active raised bogs within the SAC. There is no specific conservation objective for degraded raised bogs still capable of natural regeneration due to it being inherently linked to the conservation objective of the active raised bog. There is also no specific conservation objective for depressions on peat substrates of the *Rhynchosporion* as this QI is an integral part of good quality active raised bog. These SAC conservation objectives should be used in conjunction with the SPA conservation objectives

Distance from Site*	QIs	Conservation Objectives
Lough Arrow SPA [004050]		
17.5 km north-west	Little Grebe (*Tachybaptus ruficollis*) [A004] Tufted Duck (*Aythya fuligula*) [A061] Wetland and Waterbirds [A999]	The conservation objectives set out to restore the favourable condition of little grebe and tufted duck, and to maintain the favourable conservation condition of wetland habitats in Lough Arrow for the regularly occurring migratory waterbirds that utilise these areas. This SPA overlaps with Lough Arrow SAC [Site code: 001673]. The SAC has a QI for hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. [3140]. The SAC conservation objectives include restoring the favourable conservation condition of hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.. The Unshin River SAC [001898] is adjacent to this SPA has QIs for water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260], semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) [6210], molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae)* [6410], alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae*) [91E0], Atlantic salmon (*Salmo salar*) ([1106] and otter (*Lutra lutra*) [1355].

The following sections provide a brief description of the characteristics of each Natura 2000 site.

5.1.1. River Moy SAC

The River Moy SAC [002298], located approximately 3.3km north-west from the closest point of the Proposed Development Site boundary. The QIs for this SAC include lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*) [6510], active raised bogs [7110], degraded raised bogs still capable of natural regeneration [7120], depressions on peat substrates of the *Rhynchosporion* [7150], alkaline fens [7230], old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0], alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae*) [91E0], white-clawed crayfish (*Austropotamobius pallipes*) [1092], sea lamprey (*Petromyzon marinus*) [1095], brook lamprey (*Lampetra planeri*) [1096], salmon *(Salmo salar)* [1106] and otter (*Lutra lutra*) [1355].

In addition to the River Moy, there are a number of other river waterbodies within this SAC. The Proposed Development Site is hydrologically linked to this SAC via a tributary of the Owengarve (34O03).

The NPWS Site Synopsis for this SAC provides the following description:

> *"This site comprises almost the entire freshwater element of the River Moy and its tributaries including both Loughs Conn and Cullin. The system drains a catchment area of 805 sq. km. Most of the site is in Co. Mayo, though parts are in west Sligo and north Roscommon. […] The underlying geology is Carboniferous Limestone for the most part, though Carboniferous Sandstone is present at the extreme west of the site, with Dalradian Quartzites and schists at the south-west. Some of the tributaries at the east, the south of Lough Conn and all of Lough Cullin are underlain by granite."*

The synopsis also notes the following important ecological features supported by the River Moy SAC:

> *"The site supports populations of several species listed on Annex II of the E.U. Habitats Directive, and habitats listed on Annex I of this Directive, as well as examples of other important habitats. The presence of a fine example of broadleaved woodland in this part of the country increases the overall habitat diversity and adds to the ecological value of the site, as does the presence of the range of nationally rare and Red Data Book plant and animal species."*

5.1.2. Tullaghanrock Bog SAC

The Tullaghanrock Bog SAC [002354], located approximately 750 m south-east from the closest point of the Proposed Development Site boundary, is the closest Natura 2000 site to the Proposed Development. This SAC has QIs for active raise bogs [7110], degraded raised bogs still capable of natural regeneration [7120] and depressions on peat substrates of the *Rhynchosporion* [7150]. The Proposed Development Site is hydrologically linked to this SAC via the Fallsollus Stream and the River Lung.

The NPWS Site Synopsis for this SAC provides the following description:

> *"Tullaghanrock Bog SAC [0002354] is situated approximately 5 km east of Ballaghaderreen, Co. Roscommon and is located in the townlands of Tullaghan Rock and Creggan. The site comprises a raised bog that includes both areas of high bog and cutover*

bog. The southern and eastern margins are bounded by the River Lung and the old Ballaghaderreen railway line adjoins the north-west margin.

[…]

Active raised bog comprises areas of high bog that are wet and actively peat-forming, where the percentage cover of bog mosses (Sphagnum spp.) is high, and where some or all of the following features occur: hummocks, pools, wet flats, Sphagnum lawns, flushes and soaks. Degraded raised bog corresponds to those areas of high bog whose hydrology has been adversely affected by peat cutting, drainage and other land use activities, but which are capable of regeneration. The Rhynchosporion habitat occurs in wet depressions, pool edges and erosion channels where the vegetation includes White Beak-sedge (Rhynchospora alba) and/or Brown Beak-sedge (R. fusca), and at least some of the following associated species, Bog Asphodel (Narthecium ossifragum), sundews (Drosera spp.), Deergrass (Scirpus cespitosus) and Carnation Sedge (Carex panicea).

[…]

Current land use on the site consists of a small forestry plantation on the southeastern high bog and another on the western margin. Areas of cutover have been reclaimed for agricultural grassland on the west and north-west margins and agricultural grazing occurs on the southern boundary. While most of the drains are old and infilling, there are new deep drains around the forestry."

5.1.3. Callow Bog SAC

The Callow Bog SAC [000595], located approximately 2 km east from the closest point of the Proposed Development Site boundary. This SAC has QIs for active raise bogs [7110], degraded raised bogs still capable of natural regeneration [7120] and depressions on peat substrates of the *Rhynchosporion* [7150]. The Proposed Development Site is hydrologically linked to this SAC via the Fallsollus Stream and the River Lung. The NPWS Site Synopsis for this SAC provides the following description:

"Callow Bog is located approximately 7 km north-west of Frenchpark, Co. Roscommon, in the townlands of Callow or Runnawillin, Cloonmagunnaun, Keelbanada, Creggan and Ratra. It is situated on the south-western shore of Lough Gara and is underlain by Carboniferous limestone. The site includes both areas of high bog and cutover. The high bog consists of five lobes dissected by roads and a stream.

Active raised bog comprises areas of high bog that are wet and actively peat-forming, where the percentage cover of bog mosses (Sphagnum spp.) is high, and where some or all of the following features occur: hummocks, pools, wet flats, Sphagnum lawns, flushes and soaks.

[…]

Current land use on the site consists of peat-cutting along much of the bog margins, apart from the north-east where the presence of Lough Gara has curtailed access, and the bog margins are relatively intact. Afforestation has occurred on the high bog to the north of the site."

5.1.4. Bricklieve Mountains and Keishcorran SAC

The Bricklieve Mountains and Keishcorran SAC [001656] is located approximately 14 km north-east from the closest point of the Proposed Development Site boundary. This SAC has QIs including marsh fritillary (*Euphydryas Aurinia*) [1065], white-clawed crayfish (*Austropotamobius pallipes*) [1092], turloughs [3180], semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) [6210], lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*) [6510], and calcareous and calcschist screes of the montane to alpine levels (*Thlaspietea rotundifolii*) [8120]. There is no hydrological connectivity between this SAC and the Proposed Development Site. The NPWS Site Synopsis for this SAC provides the following description:

> *"The Bricklieve Mountains and Keishcorran SAC [001656] are located in Co. Sligo, west of Lough Arrow and c. 6 km north-west of the town of Boyle. The site is a large, isolated block of carboniferous limestone that reaches a height of approximately 300m. Typical landscape features associated with a karst topography are present, including caves, dry valleys and limestone pavement. A striking feature of the Bricklieve Mountains is that they are cut into four slices by narrow rift valleys which run north-west and south-east. The walls of these valleys are vertical cliffs which vary between 10-30m in height. During the last ice age retreating ice deposited morainic debris across the rift valleys. This helped to form lakes, which subsequently developed into bog."*

The dominant habitats on this SAC are upland grassland on peaty soil, blanket bog, heath, upland grassland on mineral soil, and scrub woodland. There are also important habitats associated with Lough Availe, Lough na Leibe, Lough Gowra, Greenan Fen and a number of small springs. Lough Gowra, for example, is of significant importance given that it is one of the most elevated turlough in Ireland and is considered to be of excellent quality, supporting *"good populations of several rare or uncommon plant species"*. The site also is notable for supporting an excellent population of the scarce butterfly, Marsh Fritillary (*Euphydryas aurinia*), a species that is listed on Annex II of the Habitats Directive.

5.1.5. Lough Gara SPA

Lough Gara SPA [004048], which is also designated as a Ramsar site and a Wildfowl Sanctuary, is located approximately 3.5 km East from the closest point of the Proposed Development Site boundary. This SPA has a SCI for Greenland white-fronted goose (*Anser albifrons flavirostris*) [A395] and whooper swan (*Cygnus cygnus*) [A038]. The Proposed Development Site is hydrologically linked to this SPA via the Fallsollus Stream and the River Lung. The NPWS Site Synopsis for this SPA provides the following description:

> *"Lough Gara SPA [004048] is located on the Co. Sligo/Roscommon border south-west of the Curlew Mountains and between the towns of Boyle and Ballaghaderreen. Most of the lake is in Co. Sligo, but two sections in the south and north-east lie within Co. Roscommon. It is a shallow (maximum depth 16m), medium-sized lake, which overlies Carboniferous limestones and shales, and Devonian sandstone. The main inflowing river is the River Lung while the main outflow is the Boyle River. There are two main sections to the lake, a larger northern basin and a smaller southern basin, joined by a narrow channel. The shoreline is*

convoluted and has receded substantially from its original level due to various drainage schemes since the mid-19th century. The site includes several low-lying islands."

This SPA is of high ornithological importance, amongst other things, due to the presence of Golden Plover and internationally important populations of Greenland White-fronted Goose and Whooper Swan (all Annex I of the Birds Directive) associated with Lough Gara.

5.1.6. Bellanagare Bog SPA

The Bellanagare Bog SPA [004105] is located approximately 10. 4 km south-east from the closest point of the Proposed Development Site boundary. This SPA has SCI for Greenland white-fronted goose (*Anser albifrons flavirostris*). There is no hydrological connectivity between this SPA and the Proposed Development Site. The NPWS Site Synopsis for this SPA provides the following description:

"Bellanagare Bog is a large bog located 6km north-north-east of Castlerea in Co. Roscommon. It is classified as a western, or intermediate, raised bog as it displays features of both raised bog and blanket bog. The bog is underlain by muddy Carboniferous limestone with a low permeability. The sub-soil is predominantly of clayey limestone till. The site lies in an upland area at the top of a surface catchment divide. The surface of the bog is undulating and the peat is concentrated on ridges, with flushes occurring in between. A number of streams, including the Frances River, rise on the site."

The SCI for this SPA is the Greenland white-fronted goose (*Anser albifrons flavirostris*) [A395], with part of an internationally important population of this species known to utilise the site at the time of its designation as an SPA.

5.1.7. Lough Arrow SPA

The Lough Arrow SPA [004050] is located approximately 17.5 km north-east from the closest point of the Proposed Development Site boundary. This SPA has SCIs including little grebe (*Tachybaptus ruficollis*) [A004], tufted duck (*Aythya fuligula*) [A061] and wetlands [A999]. There is no hydrological connectivity between this SPA and the Proposed Development Site. The NPWS Site Synopsis for this SPA provides the following description:

"Lough Arrow SPA is a large limestone lake situated almost entirely within Co. Sligo with a small section extending into Co. Roscommon. It is sheltered on three sides by hills and is the source of the Unshin River which flows north-westwards from its northern end. It has a relatively small catchment and is largely spring-fed. The average depth of water is 9m (maximum 33 m). The lake is classified as a mesotrophic system. There is a well-developed submerged aquatic flora, with a notable charophyte community."

The SCIs for this SPA are Little Grebe and Tufted Duck, as well as Wetland and Waterbirds supported by the site.

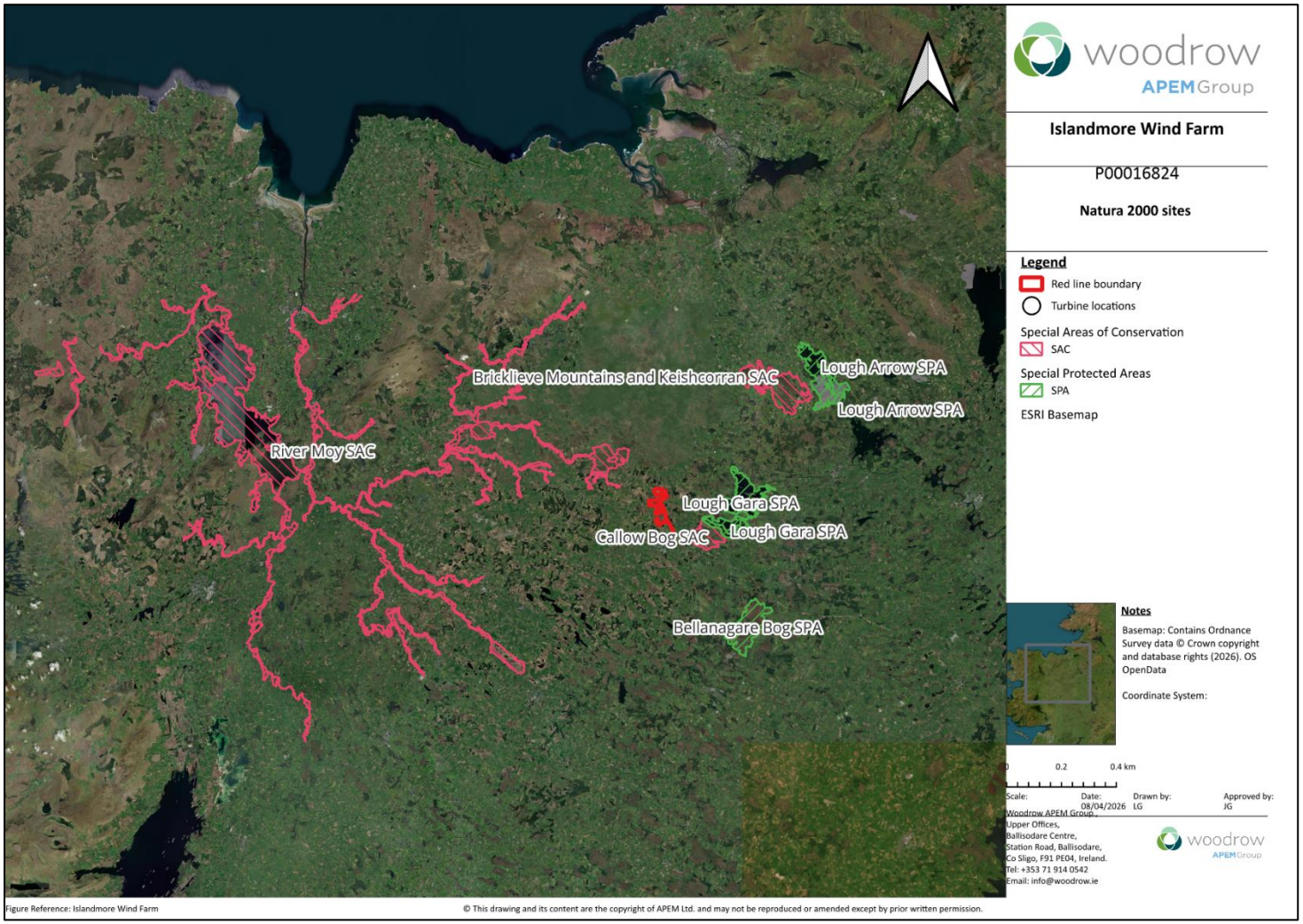


Figure 3. Natura 2000 sites within the Proposed Development ZoI

5.2. Field Surveys

This section provides a summary of the findings of ecological field surveys carried out in the Proposed Development site which informed the Stage 1 AA Screening, with a focus on Natura 2000 sites considered in this NIS; further details field survey results are presented in the AA Screening Report prepared for the Proposed Development. Table 3 provides a summary of the surveys undertaken to date.

Table 3. Ecological field surveys carried out for the Proposed Development

Survey type		Survey Date	Associated Report
Site scoping			
Initial walkover of site to identify ecological constraints with multidisciplinary surveys (habitat mapping, invasive species surveys, amphibian/reptile habitat suitability assessments, mammal surveys and bat habitat assessments)		06 September 2023	Ecological scoping report
Habitat surveys			
Habitat assessment – Fossitt 2000		25 September 2023, 26 September 2023, 27 September 2023, 28 September 2023, and 20 March 2025.	Islandmore Habitats Constraints and Scoping Report
Detailed botanical surveys – Annex I conservation assessment surveys		11 July 2024, 27 August 2024, 28 August 2024, 10 September 2024, 11 September 2024, and 12 September 2024	Islandmore Habitats Constraints and Scoping Report Islandmore Habitats Technical Appendix
Irish Vegetation Classification (IVC) surveys		11 July 2024, 27 August 2024, 28 August 2024, 10 September 2024, 11 September 2024, and 12 September 2024.	Islandmore Habitats Technical Appendix
Invasive species surveys		20 March 2025, and 13 May 2025	Islandmore Habitats Technical Appendix
Ornithology surveys			
Vantage point (VP) surveys:			
Non-breeding 2019- 2020	VP1	25 October 2019, 26 October 2019, 01 November 2019, 07 November 2019, 13 November 2019, 03 December 2019, 11 December 2019, 17 December 2019, 08 January 2020, 17 January 2020, 23 January 2020, 05 February 2020, 12 February 2020, 20 February 2020,	Islandmore Ornithological Baseline Technical Appendix

Survey type		Survey Date	Associated Report
		and 21 February 2020.	
	VP2	25 October 2019, 26 October 2019, 01 November 2019, 07 November 2019, 14 November 2019, 03 December 2019, 11 December 2019, 17 December 2019, 08 January 2020, 17 January 2020, 23 January 2020, 05 February 2020, 12 February 2020, 20 February 2020, and 21 February 2020.	
	VP3	25 October 2019, 26 October 2019, 01 December 2019, 07 November 2019, 14 November 2019, 28 November 2019, 10 December 2019, 19 December 2019, 08 January 2020, 17 January 2020, 23 January 2020, 05 February 2020, 12 February 2020, 20 February 2020, and 21 February 2020.	
Breeding 2020	VP1	24 March 2020, 22 April 2020, 24 April 2020, 30 April 2020, 06 May 2020, 14 May 2020, 25 May 2020, 26 May 2020, 12 June 2020, 24 June 2020, 03 July 2020, 09 July 2020, 23 July 2020, 05 August 2020, 11 August 2020, 24 August 2020, 25 August 2020, and 27 August 2020.	Islandmore Ornithological Baseline Technical Appendix
	VP2	24 March 2020, 25 March 2020, 22 April 2020, 24 April 2020, 30 April 2020, 08 May 2020, 14 May 2020, 26 May 2020, 11 June 2020, 03 July 2020, 09 July 2020, 23 July 2020, 05 August 2020, 11 August 2020, 24 August 2020, and 27 August 2020.	
	VP3	24 March 2020, 22 April 2020, 24 April 2020, 30 April 2020, 07 May 2020, 14 May 2020, 25 May 2020, 26 May 2020, 11 June 2020, 25 June 2020, 03 July 2020, 09 July 2020, 23 July 2020, 05 August 2020, 11 August 2020, 24 August 2020, and 27 August 2020.	
Non-breeding 2020 - 2021	VP1	19 September 2020, 21 October 2020, 10 November 2020, 08 December 2020,	Islandmore Ornithological Baseline Technical Appendix

Survey type		Survey Date	Associated Report
		05 January 2021, 25 February 2021, 07 March 2021, and 08 March 2021.	
	VP2	19 September 2020, 22 October 2020, 07 November 2020, 10 December 2020, 07 January 2021, 09 February 2021, 06 March 2021, and 09 March 2021.	
	VP3	22 September 2020, 20 October 2020, 08 November 2020, 12 December 2020, 08 January 2021, 06 February 2021, and 06 March 2021.	
Breeding 2021	VP1	23 March 2021, 30 April 2021, 06 May 2021, 11 May 2021, 11 June 2021, 14 June 2021, 29 June 2021, 30 June 2021, 05 July 2021, 08 July 2021, 03 August 2021, 11 August 2021, 16 August 2021, and 27 August 2021.	Islandmore Ornithological Baseline Technical Appendix
	VP2	24 March 2021, 29 April 2021, 05 May 2021, 06 May 2021, 11 May 2021, 14 June 2021, 29 June 2021, 30 June 2021, 06 July 2021, 03 August 2021, 04 August 2021, 11 August 2021, and 27 August 2021.	
	VP3	23 March 2021, 29 April 2021, 05 May 2021, 06 May 2021, 11 June 2021, 14 June 2021, 25 June 2021, 29 June 2021, 30 June 2021, 07 July 2021, 16 July 2021, 03 August 2021, 04 August 2021, 05 August 2021, 13 August 2021, and 16 August 2021.	
Non-breeding 2021 - 2022	VP1	28 October 2021, 30 November 2021, 01 December 2021, 09 December 2021, 14 December 2021, 12 January 2022, 18 January 2022, 20 January 2022, 11 February 2022, 16 February 2022, 26 February 2022, 28 February 2022, 23 March 2022, and 28 March 2022.	Islandmore Ornithological Baseline Technical Appendix
	VP2	28 October 2021, 21 November 2021, 22 November 2021, 23 November 2021, 28 November 2021, 09 December 2021, 18 December 2021, 19 December 2021, 25 January 2022, 26 January 2022,	

Survey type		Survey Date	Associated Report
		27 January 2022, 21 February 2022, 22 February 2022, and 23 March 2022.	
	VP3	28 October 2021, 24 November 2021, 28 November 2021, 13 December 2022, 14 December 2022, 12 January 2022, 18 January 2022, 20 January 2022, 11 February 2022, 16 February 2022, 26 February 2022, and 24 March 2022.	
	VP4	28 October 2021, 24 November 2021 30 November 2021, 13 December 2021, 18 December 2021, 19 December 2021, 26 January 2022, 28 January 2022, 21 February 2022, 22 February 2022, 01 March 2022, 23 March 2022, and 27 March 2022.	
Breeding 2022	VP1	29 March 2022, 07 April 2022, 13 April 2022, 19 April 2022, 10 May 2022, 16 May 2022, 15 June 2022, 22 June 2022, 19 July 2022, 26 July 2022, 24 August 2022, and 28 August 2022.	Islandmore Ornithological Baseline Technical Appendix
	VP2	27 March 2022, 28 March 2022, 04 May 2022, 16 May 2022, 24 May 2022, 02 June 2022, 15 June 2022, 19 July 2022, 26 July 2022, 03 August 2022, 18 August 2022, and 25 August 2022.	
	VP3	29 March 2022, 13 April 2022, 19 April 2022, 10 May 2022, 18 May 2022, 24 May 2022, 14 June 2022, 29 June 2022, 13 July 2022, 19 July 2022, 31 July 2022, 03 August 2022, 16 August 2022, and 31 August 2022.	
	VP4	28 March 2022, 29 March 2022, 12 May 2022, 30 May 2022, 14 June 2022, 26 June 2022, 13 July 2022, 17 July 2022, 31 July 2022, 16 August 2022, 18 August 2022, 25 August 2022, and 31 August 2022.	
Non-breeding 2022 - 2023	VP1	13 December 2022, 14 December 2022, 06 January 2023, 17 January 2023, 19 January 2023, 27 January 2023, 08 February 2023, 13 February 2023,	Islandmore Ornithological Baseline Technical Appendix

Survey type		Survey Date	Associated Report
		22 February 2023, 26 February 2023, 14 March 2023, 16 March 2023, and 20 March 2023.	
	VP2	13 December 2022, 06 January 2023, 17 January 2023, 19 January 2023, 27 January 2023, 08 February 2023, 13 February 2023, 22 February 2023, 26 February 2023, 09 March 2023, 14 March 2023, and 20 March 2023.	
	VP3	15 December 2022, 04 January 2023, 12 January 2023, 26 January 2023, 30 January 2023, 07 February 2023, 09 February 2023, 21 February 2023, 23 February 2023, 09 March 2023, 16 March 2023, and 20 March 2023.	
	VP4	14 December 2022, 15 December 2022, 04 January 2023, 12 January 2023, 26 January 2023, 30 January 2023, 07 February 2023, 09 February 2023, 21 February 2023, 23 February 2023, 13 March 2023, and 19 March 2023.	
Breeding 2023	VP1	04 April 2023, 19 April 2023, 05 May 2023, 11 May 2023, 21 June 2023, 28 June 2023, 04 July 2023, 11 July 2023, 11 August 2023, 22 August 2023, 31 August 2023, and 05 September 2023.	Islandmore Ornithological Baseline Technical Appendix
	VP2	06 April 2023, 20 April 2023, 02 May 2023, 12 May 2023, 09 June 2023, 20 June 2023, 06 July 2023, 12 July 2023, 11 August 2023, 22 August 2023, 31 August 2023, and 05 September 2023.	
	VP3	06 April 2023, 25 April 2023, 02 May 2023, 22 May 2023, 27 June 2023, 28 June 2023, 05 July 2023, 12 July 2023, 10 August 2023, 18 August 2023, 30 August 2023, and 04 September 2023.	
	VP4	17 April 2023, 23 April 2023, 07 May 2023, 30 May 2023, 27 June 2023, 29 June 2023, 09 July 2023, 25 July 2023, 10 August 2023, 18 August 2023,	

Survey type		Survey Date	Associated Report
		30 August 2023, and 04 September 2023.	
Dusk surveys (Breeding seasons 2020, 2021 and 2022)		10 June 2020, 16 June 2021, 29 June 2021, 23 March 2022, 29 March 2022, 17 August 2022, and 31 August 2022.	Islandmore Ornithological Baseline Technical Appendix
Walkover surveys	Non-breeding season 2019 - 2020	06 December 2019, 12 January 2020, And 07 February 2020.	Islandmore Ornithological Baseline Technical Appendix
	Breeding season 2020	07 May 2020, 10 June 2020, 11 June 2020, 21 July 2020, 22 July 2020, and 23 July 2020.	
	Non-breeding season 2020 - 2021	23 October 2020, 11 December 2020, and 27 February 2021	
	Breeding season 2021	16 June 2021, 24 June 2021, 05 July 2021, and 07 July 2021.	
	Non-breeding season 2021 - 2022	01 December 2021, 03 December 2021, 26 January 2022, 28 January 2022, and 03 March 2022.	
	Breeding season 2022	04 May 2022, 10 May 2022, 12 May 2022, 16 May 2022, 24 May 2022, 02 June 2022, 14 June 2022, 22 June 2022, 29 June 2022, 03 August 2022, 16 August 2022, 24 August 2022, 25 August 2022, and 31 August 2022.	
	Non-breeding 2022 – 2023	23 January 2023, 25 January 2023, 31 January 2023, 09 February 2023, 13 March 2023, 14 March 2023, 19 March 2023, and 20 March 2023.	
	Breeding season 2023	17 April 2023, 17 April 2023, 20 April 2023, 25 April 2023, 02 May 2023, 12 May 2023, 22 May 2023, 30 May 2023, 09 June 2023, 19 June 2023, 20 June 2023, 21 June 2023, 04 July 2023, 09 July 2023, 11 July 2023, and 25 July 2023.	
Waterbird surveys	Non-breeding 2019 - 2020	07 November 2019, 14 November 2019, 10 December 2019, and 11 January 2020.	Islandmore Ornithological Baseline Technical Appendix
	Non-breeding 2020- 2021	09 November 2019, 09 December 2020, 06 January 2021, 08 February 2021, and 07 March 2021.	

Survey type		Survey Date	Associated Report
Hen harrier non-breeding seasons	2019 – 2020	12 January 2020	Islandmore Ornithological Baseline Technical Appendix
	2020 - 2021	21 October 2020, 22 October 2020, 07 November 2020, 08 November 2020, 09 December 2020, 11 December 2020, 12 December 2020, 06 January 2021, 07 January 2021, 08 January 2021, 06 February 2021, 08 February 2021, 09 February 2021, 25 February 2021, 06 March 2021, and 07 March 2021.	
	2021 - 2022	20 October 2021, 21 October 2021, 23 November 2021, 24 November 2021, 09 December 2021, 13 December 2021, 14 December 2021, 12 January 2022, 18 January 2022, 19 January 2022, 20 January 2022, 26 January 2022, 27 January 2022, 28 January 2022, 11 February 2022, 21 February 2022, 22 February 2022, 28 February 2022, 01 March 2022, and 03 March 2022.	
	2022 - 2023	14 December 2022, 15 December 2022, 17 January 2023, 23 January 2023, 25 January 2023, 09 February 2023, 13 February 2023, and 15 February 2023.	
	2024 - 2025	24 October 2024, 21 November 2024, 09 January 2025, 17 January 2025, 29 January 2025, 24 February 2025, and 12 March 2025.	
Hen harrier breeding raptor surveys	2020	26 March 2020, 27 March 2020, 05 May 2020, 06 May 2020, 10 June 2020, 25 June 2020, 26 June 2020, 22 July 2020, and 24 July 2020.	Islandmore Ornithological Baseline Technical Appendix
	2021	23 March 2021, 24 March 2021, 24 May 2021, 26 May 2021, 28 May 2021, 06 July 2021, 07 July 2021, and 08 July 2021.	
	2022	07 April 2022, 13 April 2022, 04 May 2022, 30 May 2022, 22 June 2022, 26 June 2022, 13 July 2022, 26 July 2022, and 24 August 2022.	
	2023	04 April 2023, 09 April 2023, 18 April 2023, 19 April 2023, 23 April 2023, 05 May 2023,	

Survey type		Survey Date	Associated Report
		11 May 2023, 22 May 2023, 30 May 2023, 20 June 2023, 21 June 2023, 28 June 2023, 29 June 2023, 04 July 2023, 06 July 2023, 11 July 2023, and 12 July 2023.	
Protected terrestrial			
Habitat suitability and field signs surveys for badger, otter, Irish hare, red squirrel, pine marten and other mammal		05 March 2025, 06 March 2025, and 27 March 2025.	Islandmore Technical Appendix Habitat Results
Aquatic and fisheries assessment			
Salmon/lamprey suitability surveys (River Hydromorphology Hydro morphology Assessment Techniques - RHAT) and baseline water quality assessment (Q-values). Also conducted otter survey and kingfisher habitat suitability assessment survey		25 September 2024, 26 September 2024, 10 October 2024, 11 October 2024, 06 May 2025, and 07 May 2025.	Islandmore Technical Appendix Aquatics Survey Results
Bat surveys			
habitat suitability assessment and potential roost availability/suitability surveys		04 March 2023	Islandmore Technical Appendix Bat Survey Results 2023
Deployment of static bat detectors Three deployments of minimum 10-nights covering spring, summer & autumn		26 April 2023, 27 June 2023, and 30 August 2023.	
Emergence/re-entry surveys		04 August 2023, and 30 August 2023.	
Nighttime bat walkover survey (completed by NM Ecology Ltd)		05 May 2020, 21 July 2020, and 14 September 2020.	

5.2.1. Survey limitations

During ornithology surveys, there were no significant limitations on the data gathered or approaches taken. There were some minor limitations, however this did not affect the overall robustness of the data. Vantage point survey in non-breeding season 2019 - 2020, survey hours at VP3 were 34.45, being 1 hour, 15 minutes short of the recommended 36 hours per VP. This does not represent a serious limitation. Due to the length of survey period (5 years) digital recording methods for collecting data in the field were updated and surveyors changed over time. During non-breeding season winter walk over surveys in 2022 - 2023 two surveys were subject to data corruption and unusable. Additional surveys remedied this potential data loss.

During bat surveys, there was one survey limitation recorded during the bat static deployment survey. This was the case at D.03 where the detector was placed approximately 15 m from the exact turbine location. The detector was placed on the edge of the forestry plantation as opposed to the interior as the interior was inaccessible due to windfallen trees. While this was not considered to limit the robustness of the data set, it is important to acknowledge the deployment locations in relation to the turbines, as this has implications for interpretation of bat activity.

6. NATURA IMPACT STATEMENT

The Competent Authority (in this case, ACP) will be required to carry out an AA to determine whether the Proposed Development would adversely affect the integrity of Natura 2000 sites should the Proposed Development proceed. *The "integrity of the site" can* be defined as '"*the coherence of the site's ecological structure and function, across its whole area, or the habitats, complex of habitats and/or populations of species for which the site is or will be classified"*[3].

The structure of the AA Report Template provided in the EC '*Assessment of plans and projects significantly affecting Natura 2000 sites'*[4] has been used to provide a basis to examine the potential effects of the Proposed Development.

The AA Screening concluded that Natura 2000 sites within the potential ZoI of the Proposed Development include 7 No. sites, namely: Bellanagare Bog SPA, Lough Arrow SPA, Lough Gara SPA, Bricklieve Mountains and Keishcorran SAC, Callow Bog SAC, River Moy SAC, and Tullaghanrock Bog SAC. In addition, there are various projects and developments at various stages of their development cycle (proposed, existing and permitted) which may result in cumulative effects. There is potential for likely significant effects on QIs in SACs and SCIs in SPAs due to displacement, pollution, habitat loss and spread of invasive species. Therefore, in line with the recommendations of guidance and case law it is considered that the Proposed Development should progress to the next stage of the process to determine if it will adversely affect the integrity of the Natura 2000 site.

6.1. Assessment of the Effects on the integrity of Natura 2000 sites

This section of the report sets out the potential effects of the Proposed Development (either alone or in combination with other projects or plans) on the integrity of Natura 2000 sites with respect to their respective conservation objectives and to their structure and function. The focus is on demonstrating, with supporting evidence, that there will be no adverse effects on the integrity of Natura 2000 sites should the Proposed Development proceed. Where this is not the case, adverse effects must be assumed.

The following QIs/SCIs of Natura 2000 sites within the ZoI of the Proposed Development have been brought forward for detailed assessment:

- Brook lamprey (*Lampetra planeri*) [1096];
- Greenland white-fronted goose (*Anser albifrons flavirostris);*
- Little grebe (*Tachybaptus ruficollis*) [A004];
- Marsh fritillary (*Euphydryas Aurinia*) [1065];
- Otter (*Lutra lutra*) [1355];
- Salmon (*Salmo salar*) [1106];
- Sea lamprey (*Petromyzon marinus*) [1095];

[3] http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/provision_of_art6_en.pdf (last accessed 24/05/24)
[4] http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/natura_2000_assess_en.pdf (last accessed 24/05/24)

- Tufted duck (*Aythya fuligula*) [A061];
- Wetlands species [A999];
- White-clawed crayfish (*Austropotamobius pallipes*) [1092];
- Whooper swan (*Cygnus cygnus*) [A038];
- Active raise bogs [7110];
- Alkaline fens [7230];
- Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae*) [91E0];
- Calcareous and calcshist screes of the montane to alpine levels (*Thlaspietea rotundifolii*) [8120];
- Degraded raised bogs still capable of natural regeneration [7120];
- Depressions on peat substrates of the Rhynchosporion [7150];
- Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*) [6510];
- Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0];
- Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) [6210]; and
- Turloughs [3180].

The elements of the Proposed Development identified as having potential to result in adverse effects on Natura 2000 sites are;

- Emissions to water;
- Collision risk to SCI bird species
- Disturbance/displacement; and
- Invasive alien species.

6.1.1. Emissions to Water

Emissions to water (silt, hydrocarbons/oils and concrete waste) have potential to be generated from ground works and carried to surface waters by rainfall and wind, potentially affecting mobile QIs of the SACs and SPAs hydrologically connected to the Proposed Development.

In the absence of a suitable design and control measures, the Proposed Development will have the potential to result in emissions to surface waters. There is potential for run-off at locations of works close to watercourses within the Proposed Development site. Run-off could contain silt, hydrocarbons or oils from machinery, and concrete waste. Silt-laden run-off can alter the physico-chemical conditions of receiving water bodies. Hydrocarbons are toxic to flora and fauna, including fish, and these chemicals tend to be persistent in the environment. They are also a nutrient supply for adapted micro-organisms, which can rapidly deplete dissolved oxygen in waters, resulting in death of aquatic organisms. The release of concrete and other cement-based products to an aquatic environment can

have the effect of altering the levels of pH, nitrate, phosphate, total solids, total suspended solids, total dissolved solids, turbidity and biochemical oxygen demand (BOD) in the water.

Earthworks are required for turbine foundations, turbine hardstands, some access tracks, the borrow pit, and underground cabling and excavations are required at the electricity substation site and along the length of the underground electricity line and at pinch points along the turbine component haul route. At all underground electricity line watercourse crossings, no instream works are required as the 110kV cable will cross via HDD.

6.1.2. Collision Risk to SCI Bird Species

The Proposed Development has the potential to result in collision mortality of SCI species associated with the Bellanagare Bog SPA, Lough Arrow SPA, and Lough Gara SPA. The SCI species consist of Greenland white-fronted goose (*Anser albifrons flavirostris*), whooper swan (*Cygnus cygnus*), little grebe (*Tachybaptus ruficollis*), and tufted duck (*Aythya fuligula*). Potential collision risk may arise through interactions with turbine blades during flight, particularly during commuting, foraging, migratory or seasonal movements. Following NatureScot (2016) connectivity guidance on core foraging ranges, it is extremely unlikely that SPA SCIs other than whooper swan or Greenland white-fronted goose would interact with the proposed development.

Greenland white-fronted goose and little grebe were not observed within the Proposed Development area during ornithological surveys (Appendix D: Ornithological Baseline Report) and therefore there is no potential for impacts on these species. While whooper swan and tufted duck were observed within the Proposed Development area during the ornithology baseline surveys, observations were infrequent (Appendix D: Ornithological baseline report). As their total aggregate flight time (i.e., number of individuals x flight time) was less than 300 seconds over the two-year survey period, they were excluded as target species in the collision risk modelling as collision risk for them would be negligible (Appendix E: Collision Risk Modelling report).

Accordingly, although a risk of collision exists during the operational phase of the Proposed Development, this is assessed as negligible. Given the observed absence or limited use of the site by the SCI species concerned, collision mortality is not predicted to result in a measurable reduction in the populations of these qualifying species, nor to adversely affect the conservation objectives of Bellanagare Bog SPA, Lough Arrow SPA, or Lough Gara SPA.

6.1.3. Disturbance

Disturbance has potential to affect mobile QIs of the Bricklieve Mountains and Keishcorran SAC, Callow Bog SAC, River Moy SAC and Tullaghanrock bog SAC and SCIs of Bellanagare Bog SPA, Lough Arrow SPA, and Lough Gara SPA in the ZoI. Disturbance to a European site is representative of an indirect impact arising as a result of anthropogenic activities generated by a project (i.e. increased human presence and associated pressures). Otter are a QI of the River Moy SAC and there were two possible holts identified within the Proposed Development site. Otters can experience disturbance if present within approximately 150m of works, depending on the nature of the works (NRA, 2008).

Greenland white-fronted goose and little grebe were not observed within the Proposed Development area during ornithological surveys and therefore there is no potential for disturbance. The nearest records of Greenland white-fronted goose, whooper swan and tufted duck during distribution surveys

was at Lough Gara, more than 3km from the Proposed Development and therefore there is no potential for disturbance of these SCIs. Whooper swan was recorded during VP Surveys, however all records related to birds commuting through rather than using habitats within and adjacent to the Proposed Development, and therefore there is no potential for disturbance of this species.

Invasive Alien Species

Invasive Alien Species (IAS) have potential to be spread or introduced by machinery during ground works and can be carried to surface waters by rainfall and wind, potentially affecting QIs and SCIs of the SACs and SPAs within the ZoI.

Invasive alien species can out complete native species, invasive alien epically aquatic plant species.

One stand of Japanese knotweed (*Fallopia japonica*) was identified along the L5501, where road widening works are proposed for the turbine component haul route. The stand is approximately 1m in width and 5m in length and is located along the boundary wall beside an access gate to an agricultural field.

Japanese knotweed (Fallopia japonica) is listed on the Third Schedule of the European Communities ('Birds and Natural Habitats') Regulations 2011 (S.I. No. 477/2011 (as amended). Regulations 49 and 50 prohibit the introduction and dispersal of the invasive species of flora and fauna that are included on the Third Schedule list appended to these Regulations. In addition, this species is considered a high impact invasive species by the NBDC (NBDC, 2025b).

Rhododendron ponticum is a Third Schedule listed species and is considered a high impact invasive species by the NBDC (NBDC 2025c). Five stands of *Rhododendron ponticum* were identified across the Site. Two small stands (approximately 5m x 2m) are located in close proximity to T10. One of these (E561754 N 797362) is located within the footprint of the proposed access track to T10. The other (E 561788 N797402) is located approximately 12.5m to the north-west of the access track. A large stand (approximately 20m x 20m) is located to approximately 20m the west of the hardstand for T3 (E562631 N800178). Another large stand (approximately 20m x 20m) is located in the (WD4) Commercial forestry to the west of the lesser road (L5501) and the proposed road widening works along the Turbine Delivery Route. Finally, one small shrub (approximately 1m x 1m) is located on the (PB2) Upland blanket bog between T5 and T6 (E561526 N799427).

Several cherry-laurel shrubs (*Prunus laurocerasus*) were identified across the Site. Although this species is not listed within the Third Schedule, it is considered a 'High Impact' invasive species (NBDC 2025d). Two large shrubs (approximately 5m x 5m) are located within the footprint of the proposed access track to T10 (E561746 N797342 and E561753 N797354). A thicket (approximately 3m x 3m) of *Prunus laurocerasus* is located within the (WN7) Bog woodland to the south of the unnamed road to T10 and falls within the site boundary for road widening works (E561993 N 797137). A second thicket (approximately 8m x 8m) is located within the (WN7) Bog woodland but falls outside of the site boundary for road widening works by approximately 5m (E561908 N797174). These records include one new roadside planting of the species (E562699 N798410) and one location where cut plant material was dumped by the side of the lesser road (L5501) along the Red Line Boundary to the north of T5 (E561987 N799550). Furthermore, two stands of *Prunus laurocerasus* are located along an unnamed road outside of the site boundary between T8 and T7.

Semi-mature sycamore (*Acer pseudoplatanus)* trees are frequently present within the hedgerows along the turbine component haul route and electricity line route. This species is considered to be a medium impact invasive species (NBDC 2025e).

A single stand of montbretia (*Crocosmia x crocosmiiflora*) was identified within the Proposed Development site, along the lesser road (L55018) where road widening works are proposed.This species is listed on the Invasive Species Ireland's Amber List (Invasive Species Ireland n.d.).

Red osier dogwood (*Cornus sericea*) was identified along the proposed access track to T10. This species is listed on the Invasive Species Ireland's Amber List (Invasive Species Ireland n.d.). Two shrubs (approximately 1m x 2m) were identified in close proximity to one another either side of a farm gate. One of the shrubs is located within the footprint of the proposed access track while the other is approximately 1.5m to the east of the proposed access track.

Snowberry (*Symphoricarpos albus*) is a non-native species considered to have a low risk of impact (NBDC 2025f). This species is listed on the Invasive Species Ireland's Amber List (Invasive Species Ireland n.d.). A long linear hedge of snowberry was identified along the electricity line route, measuring approximately 1m in width and 50m in length.

Fuschia (*Fuchsia magellanica*) was identified at two locations along the electricity line route. Fuchsia is a non-native species, which has naturalised within Irish hedgerows, particularly in the south of the country. The invasiveness status of this species is listed as "not assessed" on the NBDC website, and it is not listed on the invasive species Ireland website.

Wilson's honeysuckle (*Lonicera nitida*) is a non-native species which is commonly considered a garden escape and has become somewhat naturalised within (WL1) Hedgerows across the Proposed Development site. The invasiveness status of this species is listed as "not assessed" on the NBDC website, and it is not listed on the invasive species Ireland website. It was identified along the local roads within the site, including along the turbine component haul route, electricity line route, and the proposed access track to T6 and T10.

Best practice guidance on the control of Invasive Alien Species is publicly available (TII, 2020). It is advisable to engage a qualified Registered Pesticide Advisor with appropriate training, experience, and expertise in managing invasive alien species to support the planning and implementation of control measures for these Invasive Species.

The spread of crayfish plague is an infectious disease that can decimate white-clawed crayfish populations. White-clawed crayfish are a QI of the River Moy SAC, which is hydrologically connected to the Proposed Development.

6.1.4. Conservation Objectives

The conservation objectives of Natura 2000 sites and the list of specific attributes and targets defining the conservation objectives for each qualifying interest, are listed in Table 2.

The conservation objectives for Natura 2000 sites can be summarised as: to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC/SPA has been selected.

6.2. Assessment of Cumulative Effects

There are eight other wind farms (3 existing, 3 permitted, 2 proposed), the North Connacht 110 kV Project, and various overhead electricity line projects identified within the ZoI, which will increase the chance of collision risk from SCI. The risk of collision from the Proposed Development, in conjunction with the existing, permitted and proposed developments, could have a likely significant effect on wintering birds which may be migrating to the various SPAs within the ZoI.

There are various residential dwellings and agricultural developments in various stages of planning (proposed, permitted and existing) and existing commercial forestry plantations which would likely attribute to a loss of roosting and foraging habitat. This, in combination with the Proposed Development, could have a significant impact on residential and wintering SCIs within the SPAs and for various QIs within the SACs.

The noise during the construction, operation and decommissioning phase may cause displacement for SCIs of SPAs or QIs of SACs. This noise of the Proposed Development, combined with the existing and proposed projects, could have a likely significant effect.

Finally, emissions to water occurring as a result of the Proposed Development could, in combination with other developments, adversely affect water quality in downstream SACs and significantly affect Qis which are dependent on good water quality.

6.3. Mitigation Measures

Deterioration in water quality, disturbance, collision risk and the introduction or spread of IAS have the potential to adversely affect qualifying interests of the River Moy SAC, Tullaghanrock Bog SAC, Callow Bog SAC, Bricklieve Mountains and Keishcorran SAC, Lough Gara SPA, Bellanagare Bog SPA and Lough Arrow SPA. No impacts on SPAs are predicted, and therefore mitigation for birds has not been proposed. The following mitigation measures proposed focus on the protection of QI species, their breeding habitats and on water quality during works.

6.3.1. Avoidance by Design

This involves turbine locations and associated infrastructure being placed at a minimum set-back distance of 50m from any point of watercourses (measured from the bank top), insofar as possible. The buffer zone will avoid physical damage to watercourses and associated release of sediment; and avoid the entry of suspended sediment from earthworks into watercourses. However, some infrastructure; including the crossing of 2 no. watercourses within the wind farm site and crossings of watercourses by the underground electricity line; will be located within this buffer where additional measures will be employed.

6.3.2. Site-Specific Mitigation Measures

The mitigation measures proposed are tried and tested standard environmental protection measures applied at construction sites that will aim to protect mobile QI species and their breeding sites, prevent deterioration of water quality and prevent the spread of invasive alien species to the SACs and SPAs as a result of the Proposed Development.

6.3.2.1. Construction Environmental Management Plan

Construction works will be undertaken in accordance with safeguards and best practice measures included the Planning Stage CEMP prepared for the Proposed Development (Appendix C: CEMP). The Contractor will be responsible for updating this CEMP into a Contractor's CEMP, which shall include the following Environmental Management Plans (EMPs):

- Pollution Prevention Management Plan;
- Emergency Response and Flood Risk Management Plan;
- Biosecurity Management Plan;
- Construction Waste Management Plan;
- Habitat Management Plan;
- Construction Traffic Management Plan;
- Surface Water Management Plan;
- Water Quality Management Plan;
- Water Crossing Plan; and
- SOWAR (schedule of works operation record).

These EMPs will be prepared and approved by Roscommon County Council prior to any works commencing on-site.

The Contractor's CEMP shall also include measures set out in this report as well as other reports prepared for this planning application; site-specific environmental management measures; details of any environmental monitoring requirements; communication protocols; non-conformance and non-compliance protocols; detailed roles and responsibilities; and particular measures as required by conditions associated with planning approval (if granted). In preparing the CEMP, the Contractor will adopt best practice construction measures and relevant guidelines and ensure that the works adhere to these standards at all times; these include, for example:

- IFI (2016), *'Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters'*;
- CIRIA (2023), '*Environmental Good Practice on Site Guide (fifth edition) (C811)*';
- BSI (2012), *'Trees in Relation to Design, Demolition and Construction'* (BS 5837:2012);
- BSI (2013), *'Code of Practice for Surface Water Management of Development Sites'* (BS8582);
- BSI (2014), *'Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise'* (BS 5228-1:2009+A1:20140);
- BSI (2014), *'Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 2: Vibration'* (BS 5228-2:2009+A1:20140);
- CIRIA (2001), *'Control of Water Pollution from Construction Sites. Guidance for Consultants and Contractors'* (C532);
- CIRIA (2006), *'Control of Water Pollution from Linear Construction Projects Technical Guidance'* (C648D);

- CIRIA (2006), *'Control of Water Pollution from Linear Construction Projects. Site Guide'* (C649);
- NetRegs (2018), *'Guidance for Pollution - Prevention Dealing with Spills'* (GPP 22);
- NetRegs (2021), *'Guidance for Pollution Prevention Understanding Your Environmental Responsibilities – Good Environmental Practices'* (GPP 1); and
- NetRegs (2021), *'Pollution Incident Response Planning'* (GPP 21).

All construction personnel involved with the construction phase of the Proposed Development will receive environmental training to inform them of the environmental sensitivities of the Site and their responsibilities throughout the works in terms of measures to be implemented and precautions required. Training will include an on-site induction (prior to the works) and ToolBox Talks (prior to and during the works). The frequency and content of environmental training will be specified in the Contractor's CEMP, and it will adhere with any requirements set out in documents prepared for the planning application and planning conditions set out by ACP (if any).

6.3.2.1.1. Roles and responsibilities

The names and contact details of the individuals with responsibilities for implementation and supervision of mitigation measures during all phases of the works will be clearly identified and displayed on notice boards at the site compounds as well as set out in documents such as the CEMP and site- specific method statements.

All staff and subcontractors will have the responsibility to:

- Work to agreed plans, methods and procedures to eliminate and minimise environmental impacts;
- Understand the importance of avoiding emissions on-site, including pollutants, sediments and noise, and how to respond in the event of an incident to avoid or limit environmental impact;
- Respond in the event of an incident to avoid or limit environmental impact;
- Report all incidents immediately to their site environmental manager;
- Monitor the workplace for potential environmental risks and alert the immediate line manager if any are observed; and
- Co-operate as required, with site inspections.

Environmental Manager

The Contractor for the Proposed Development will be required to designate a member of staff, or engage a specific person, with demonstrable experience of environmental management and monitoring of construction at wind farm sites, referred to hereafter as the "Environmental Manager" (EM). The EM will assume responsibility for overseeing the implementation of all environmental protective measures and mitigation measures set out in this document and in the CEMP. The EM will be responsible for employing good working practice during all phases of the Proposed Development and for providing a briefing on environmental protection measures and ecological sensitivities of the Site to all site personnel in advance of commencement of works.

Ecological Clerk of Works

A suitably qualified Ecological Clerk of Works (ECoW) will be appointed to audit the site and report on the mitigation measures put in place, as outlined in the CEMP. The ECoW is independent of the contractor. The appointed contractor has sole responsibility for the implementation of all mitigation measures prescribed within environmental documents and best practise guidance The ECoW will be responsible for:

- Developing and delivering ToolBox Talks to contractors and sub-contractors and keeping a register of these training sessions. As a minimum, ToolBox Talks on relevant site sensitivities regarding ecology to all contractors, including sub-contractors, prior to construction;
- Liaising with stakeholders such as regulators, planners and members of the public;
- Undertake and document regular monthly audits of the Proposed Development site to ensure compliance with ecological protection and mitigation measures;
- Offer best practice guidance relevant to each activity and due diligence;
- Ensuring that ecological mitigation measures set out in all documents prepared in relation to the Proposed Development (e.g., this NIS, the EIAR, and the Contractor's CEMP, amongst others) are implemented, working, and reviewed; and
- Monitor the efficacy of mitigation measures implemented by the contractors and to report on the application and success of these measures.

The ECoW will have a 'Stop Works' authority if mitigation measures put in place are failing. Once contractors remedy the situation with further measures and the ECoW agrees, then works can proceed.

6.3.2.2. Pollution Prevention

Clear Felling and Surface Water Quality Effects

Best practice methods and mitigation measures related to the protection of water have been derived from:

- Department of Agricultural, Food and the Marine (2019) *Standards for Felling and Reforestation*;
- Forestry Commission (2004*) Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh*;
- Coillte (2009) *Forest Operations and Water Protection Guidelines*;
- Forest Services (Draft) *Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measur*es;
- Coillte (2009) *Methodology for Clear Felling Harvesting Operations*; and
- Forest Service (2000) *Forestry and Water Quality Guidelines. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford*.

Mitigation by Avoidance

There is a requirement in the *Forest Service Code of Practice* and in the *FSC Certification Standard* for the installation of buffer zones adjacent to aquatic zones at planting stage. Minimum buffer zone

widths recommended in the Forest Service (2000) guidance document *Forestry and Water Quality Guidelines* are detailed in Table 4**.**

Table 4. Minimum Buffer Zone Widths (Forest Service, 2000)

Average slope leading to the aquatic zone		Buffer zone width on either side of the aquatic zone	Buffer zone width for highly erodible soils
Moderate	(0–15%)	10m	15m
Steep	(15–30%)	15m	20m
Very steep	(>30%)	20m	25m

A total of 6.5ha of forestry will be permanently felled to accommodate the construction and operation of the Proposed Development.

During the construction phase, a self-imposed conservative buffer zone of 50m will be maintained for all streams. Only approximately 0.8ha of the total 6.5ha proposed for felling is located inside a 50m watercourse buffer zone. Where tree felling is required in the vicinity of streams, the additional mitigation measures outlined below will be employed.

Mitigation by Design

Mitigation measures which will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses comprise best practice methods, as follows:

- Machine combinations (i.e. handheld or mechanical) will be chosen which are most suitable for ground conditions and which will minimise soils disturbance;
- Checking and maintenance of tracks and culverts will be ongoing through any felling operation. No tracking of vehicles through watercourses will occur. Where possible, existing drains will not be disturbed during felling works;
- Ditches which drain from the areas to be felled towards existing surface watercourses will be blocked, and temporary silt traps will be constructed. No direct discharge of such ditches to watercourses will occur. Drains and sediment traps will be installed during ground preparation. Collector drains will be excavated at an acute angle to the contour (c. 0.3%-3% gradient), to minimise flow velocities. Main drains to take the discharge from collector drains will include water drops and rock armour, as required, where there are steep gradients and avoid being placed at right angles to the contour;
- Sediment traps will be sited in drains downstream of felling areas. Machine access will be maintained to enable the accumulated sediment to be excavated. Sediment will be carefully disposed of in the spoil deposition areas. All new silt traps will be constructed on even ground and not on sloping ground;

- In areas particularly sensitive to erosion or where felling inside the 50m buffer is required, it will be necessary to install double or triple sediment traps;
- All drainage channels will taper out before entering the 50m buffer zone. This ensures that discharged water gently fans out over the buffer zone before entering the aquatic zone, with sediment filtered out from the flow by ground vegetation within the zone. On erodible soils, silt traps will be installed at the end of the drainage channels;
- Drains and silt traps will be maintained throughout all felling works, ensuring that they are clear of sediment build-up and are not severely eroded. Correct drain alignment, spacing and depth will ensure that erosion and sediment build-up are minimised and controlled;
- Brash mats will be used to support vehicles on soft ground, reducing topsoil and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal will take place before they become heavily used and worn. Provision will be made for brash mats along all off-road (track) routes, to protect the soil from compaction and rutting. Where there is risk of severe erosion occurring, extraction will be suspended during periods of high rainfall;
- Timber will be stacked in dry areas, and outside the 50m watercourse buffer. Straw bales and check dams will be emplaced on the down gradient side of timber storage/processing sites;
- Works will be carried out during periods of no, or low, rainfall in order to minimise entrainment of exposed sediment in surface water run-off;
- Checking and maintenance of tracks and culverts will be ongoing through the felling operation;
- Refuelling or maintenance of machinery will not occur within 100m of a watercourse. Mobile bowser, drip kits and qualified personnel will be used where refuelling is required;
- A permit to refuel system will be adopted:
- Branches, logs or debris will not be allowed to build up in the 50m buffer. All such material will be removed when harvesting operations have been completed, but care will be taken to avoid removing natural debris deflectors;
- Trees will be cut manually from along streams and using machinery to extract whole trees; and,
- Travel will only be permitted perpendicular to and away from surface water features.

Silt Traps

Silt traps will be strategically placed down-gradient within forestry drains near streams. The main purpose of the silt traps is to slow water flow, increase residence time and allow settling of silt in a controlled manner.

Drain Inspection and Maintenance

The following items will be carried out during pre-felling inspections and regularly thereafter:

- Communication with tree felling operatives in advance to determine whether any areas have been reported where there is unusual waterlogging or bogging of machines;

- Inspection of all areas reported as having unusual ground conditions;
- Inspection of main drainage ditches and outfalls. During pre-felling inspections, the main drainage ditches will be identified. Where possible, the pre-felling inspection will be carried out during rainfall;
- Following tree felling, all main drains will be inspected to ensure that they are functioning;
- Extraction tracks within 10m of drains will be broken up and diversion channels created to ensure that water in the tracks spreads out over the adjoining ground;
- Culverts on drains exiting the site, if impeded by silt or debris, will be unblocked; and,
- All accumulated silt will be removed from drains, culverts and silt traps, and this removed material will be deposited away from watercourses to ensure that it will not be carried back into the trap or stream during subsequent rainfall.

Surface Water Quality Monitoring

Sampling will be completed before, during (if the operation is conducted over a protracted time) and after the felling activity. The 'before' sampling will be conducted within 4-weeks of the felling activity commencing, preferably in medium-to-high water flow conditions. The 'during' sampling will be undertaken once a week or after rainfall events. The 'after' sampling will comprise as many samplings as necessary to demonstrate that water quality has returned to pre-activity status (i.e. where an impact has been shown).

The surface water sampling locations used for the Proposed Development site (i.e. SW1–SW4) will also be used as sampling locations during felling activities.

Also, daily surface water monitoring forms (for visual inspections and field chemistry measurements) will also be utilised at every works site near any watercourse. These will be populated daily and kept on site for record and inspection.

Earthworks (Removal of Vegetation Cover, Excavations and Stock Piling) Resulting in Suspended Solids Entrainment in Surface Water

The key mitigation measure during the construction phase is the avoidance of sensitive aquatic areas by using a 50m buffer.

Other than some small sections of crane hardstanding and associated access tracks at T1 and T4, the watercourse crossings at turbines T4 and T9, and some sections of haul route upgrade works; the majority of the wind farm infrastructure (including all turbine foundation locations, borrow pit and peat/spoil deposition areas) is located outside of areas that have been assessed to be hydrologically sensitive.

Specific measures, incorporated into the design of Proposed Development and through implementation of best practice methodologies (discussed below), will be employed where work inside buffer zones is proposed.

The generally large setback distance from sensitive hydrological features ensures that sufficient space is provided for the installation of drainage mitigation measures (discussed below) and to ensure their effective operation. The proposed buffer zone will ensure:

- Avoidance of physical damage to watercourses, and associated release of sediment;

- Avoidance of excavations within close proximity to surface water courses;
- Avoidance of the entry of suspended sediment from earthworks into watercourses; and,
- Avoidance of the entry of suspended sediment from the construction phase drainage system into watercourses, achieved in part by ending drain discharge outside the buffer zone and allowing percolation across the vegetation of the buffer zone.

Mitigation by Prevention

The following section details the measures which will be put in place during the construction phase to ensure that surface water features are protected from the release of silt or sediment and to ensure that all surface water runoff is fully treated and attenuated to avoid the discharge of dirty water.

- Source controls to limit the likelihood for 'dirty water' to occur:
    - Interceptor drains, vee-drains, diversion drains, flume pipes, erosion and velocity control measures such as use of sand bags, oyster bags filled with clean washed gravel, filter fabrics, and other similar/equivalent or appropriate systems; and,
    - Small working areas, covering stockpiles, weathering off stockpiles, cessation of works in certain areas or other similar/equivalent or appropriate measures.
- In-Line controls to ensure appropriate management of silt laden water:
    - Interceptor drains, vee-drains, oversized swales, erosion and velocity control measures such as check dams, sand bags, oyster bags, straw bales, flow limiters, weirs, baffles, silt bags, silt fences, sedimats, filter fabrics, and collection sumps, temporary sumps/attenuation lagoons, sediment traps, pumping systems, settlement ponds, temporary pumping chambers, or other similar/equivalent or appropriate systems.
- Treatment systems to fully attenuate silt laden waters prior to discharge:
    - Temporary sumps and attenuation ponds, temporary storage lagoons, sediment traps, and settlement ponds, and proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems.

It should be noted for this site that an extensive network of land, bog and forestry drains already exists and these will be integrated and enhanced as required and used within the wind farm drainage system. The integration of existing land drainage networks and wind farm networks is common practice in wind energy developments and will also result in benefits to surrounding lands.

The main elements of interaction with existing drains will be as follows:

- Apart from interceptor drains, which will convey clean runoff water to the downstream drainage system, there will be no direct discharge (without treatment for sediment reduction and attenuation for flow management) of runoff from the wind farm drainage into the existing site drainage network. This will reduce the likelihood of any increased risk of downstream flooding or sediment transport/erosion;
- Silt traps will be placed in the existing drains upstream of any streams where construction works is taking place, and these will be diverted into proposed interceptor drains, or culverted under/across the works area; and,

- Buffered outfalls, which will be numerous over the site, will promote percolation of drainage waters across vegetation and close to the point at which the additional runoff is generated, rather than direct discharge to the existing drains of the site.

Pre-commencement Temporary Drainage Works

Prior to the commencement of haul route upgrades, access tracks, crane hardstandings and turbine foundations, the following key temporary drainage measures will be installed:

- All existing dry bog, forestry or agricultural drains that intercept the proposed works area will be temporarily blocked down-gradient of the works using check dams/silt traps;
- Clean water interceptor drains will be installed upgradient of the works areas;
- Check dams/silt fence arrangements (silt traps) will be placed in all existing drains that have surface water flows and also along existing roadside drains; and,
- A double silt fence perimeter will be placed down-slope of works areas that are located inside the watercourse 50m buffer zone.

Water Treatment Train

While the proposed drainage plan is assessed as providing a sufficient level of protection to avoid any deterioration in downstream water quality; a temporary final line of defence can be provided by a water treatment train (i.e. sequence of water treatment processes), if required. If the discharge water from construction areas fails to be of a high quality, then a filtration treatment system (such as a 'Siltbuster' or similar equivalent treatment train) will be used to filter and treat all surface discharge water collected in the dirty water drainage system. This water treatment train will apply for the entirety of the construction phase.

Silt Fences

Silt fences will be emplaced within drains down-gradient of all construction areas. Silt fences are effective at removing heavy settleable solids. This will act to prevent entry to watercourses of sand and gravel sized sediment, released from excavation of mineral sub-soils of glacial and glacio-fluvial origin, and entrained in surface water runoff. Inspection and maintenance of these of these structures during construction phase is critical to their functioning to stated purpose. They will remain in place throughout the entire construction phase. Double silt fences will be emplaced within drains down-gradient of all construction areas inside the hydrological buffer zones to provide an additional layer of protection in these areas.

Silt Bags

Silt bags will be used where small to medium volumes of water need to be pumped from excavations. As water is pumped through the bag, most of the sediment is retained by the geotextile fabric allowing filtered water to pass through. Silt bags will be used with natural vegetation filters or sedimats (sediment entrapment mats, consisting of coir or jute matting) placed at the silt bag location to provide further treatment of the water outfall from the silt bag. Sedimats will be secured to the ground surface using stakes/pegs. The sedimat will extend to the full width of the outfall to ensure all water passes through this additional treatment measure.

Management of Runoff from Peat/Spoil Deposition Areas

It is proposed that excavated peat/overburden/spoil will be utilised for reinstatement of excavated areas etc. and for landscaping purposes. Excess material, or material which is unsuitable for this purpose, will be stored, permanently, at dedicated peat/spoil deposition areas and in the 1 no. spent borrow pit.

Proposed peat/spoil deposition areas and the borrow pit are located outside the 50m stream buffer zone**.**

During the initial placement of peat/spoil in the deposition areas, silt fences, straw bales and biodegradable matting will be used to control surface water runoff. Drainage from overburden deposition areas will ultimately be routed to an oversized swale and a number of silt/settlement ponds with appropriate storage and settlement capacity, designed for a '1-in-100 year 6-hour return' period, before being discharged.

Spoil deposition areas will be sealed with a digger bucket. Once re-vegetated and stabilised, spoil deposition areas will no longer be a likely source of silt laden runoff. Surface water protection infrastructure will be left in place until the areas have stabilised.

Underground Electricity Line Installation Works

Mitigation measures which are outlined below will be implemented to ensure that silt laden or contaminated surface water runoff from the trenching work does not discharge directly to the water:

All existing dry drains that intercept the works area will be temporarily blocked down-gradient of the works using temporary check dams/silt traps (e.g. straw bales);

Clean water diversion drains will be installed upgradient of the works areas, as required;

Check dams/silt fence arrangements (silt traps or straw bales) will be placed in all existing drains that have surface water flows and also along existing roadside drains; and,

A double silt fence perimeter will be placed down-slope of works areas that are located inside the watercourse 50m buffer zones such as at watercourse crossing locations.

Specific mitigation measures relating to the directional drilling at the crossing location are detailed below.

Directional Drilling

The following mitigation will be carried out during directional drilling works:

- Firstly, the crossing works area will be clearly marked out with fencing or flagging tape to avoid unnecessary disturbance of vegetation;
- A minimum 10 metre vegetative buffer zone will be maintained (if present) between disturbed areas and the watercourse bank. There will be no storage of material/equipment, excavated material (see below) or overnight parking of machinery inside the 10m buffer zone;
- Double silt fencing will be placed upslope of the buffer zone on each side of the watercourse.
- Mats will be used underneath the excavator, inside the 10 metre vegetative buffer zone, to prevent soil erosion/rutting and potential surface water quality impacts from localised surface water runoff;

- Temporary storage of excavated material will be undertaken outside of the 10m buffer on flat ground or within a local hollow area. A containment berm will be placed downslope of the excavated material which in turn will be surrounded by secondary silt fence protection to prevent saturated soil from flowing back into the watercourse;
- Operation of machinery and use of equipment within the 10m buffer will be kept to a minimum to avoid any unnecessary disturbance;
- There will be no refuelling allowed within 100m of the watercourse crossing;
- All plant will be checked for purpose of use prior to mobilisation at the watercourse crossing; and,
- Works shall not take place during periods of heavy rainfall and will be scaled back or suspended if heavy rain is forecasted.

Mitigation measures relating to the use of a mixture of a natural, inert and fully biodegradable drilling fluid such as Clear Bore™ and water for directional drilling include:

- The area around the Clear Bore™ batching, pumping and recycling plants will be bunded using terram and sandbags in order to contain any spillages;
- Two or more lines of silt fences will be placed between the works area and adjacent rivers and streams on both banks;
- Accidental spillage of fluids will be cleaned up immediately and transported off site for disposal at a licensed facility; and,
- Adequately sized skips will be used for temporary storage of drilling arisings during directional drilling works. This will ensure containment of drilling arisings and drilling flush.

A Fracture Blow-out (Frac-out) Prevention and Contingency Plan will be prepared by the drilling contractor prior to construction and will include the following measures:

- The drilling fluid/bentonite will be non-toxic and naturally biodegradable (i.e., Clear Bore Drilling Fluid or similar will be used);
- The area around the drilling fluid batching, pumping and recycling plants will be bunded using terram and/or sandbags to contain any potential spillage;
- A double row of silt fencing will be placed between the works area and the adjacent river;
- Spills of drilling fluid will be cleaned up immediately and transported off-site for disposal at a licensed facility;
- Adequately sized skips will be used where temporary storage of arisings are required;
- The drilling process/pressure will be constantly monitored to detect any possible leaks or breakouts into the surrounding geology or local watercourse;
- This will be gauged by observation and by monitoring the pumping rates and pressures. If any signs of breakout occur then drilling will be immediately stopped;
- Any frac-out material will be contained and removed off-site;

- The drilling location will be reviewed, before re-commencing with a higher viscosity drilling fluid mix; and,
- If the risk of further frac-out is high, a new drilling alignment will be sought at the crossing location.

Pre-emptive Site Drainage Management

The works programme for the initial construction stage of Proposed Development will also take account of weather forecasts, and predicted rainfall in particular. Large excavations and movements of peat/subsoil or vegetation stripping will be suspended or scaled back if prolonged or intense rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

The following forecasting systems are available and will be used on a daily basis at the site to direct proposed construction activities:

- General Forecasts: Available on a national, regional and county level from the Met Eireann website (www.met.ie/forecasts). These provide general information on weather patterns including rainfall, wind speed and direction but do not provide any quantitative rainfall estimates;
- Meteo Alarm: Alerts to the possible occurrence of severe weather for the next 2-days. Less useful than general forecasts as only available on a provincial scale;
- 3-hour Rainfall Maps: Forecast quantitative rainfall amounts for the next 3-hours but does not account for possible heavy localised events;
- Rainfall Radar Images: Images covering the entire country are freely available from the Met Eireann website (www.met.ie/latest/rainfall_radar.asp). The images are a composite of radar data from Shannon and Dublin airports and give a picture of current rainfall extent and intensity. Images show a quantitative measure of recent rainfall. A 3-hour record is given and is updated every 15-minutes. Radar images are not predictive; and
- Consultancy Service: Met Eireann provide a 24-hour telephone consultancy service. The forecaster will provide interpretation of weather data and give the best available forecast for the area of interest.

The use of safe threshold rainfall values will allow work to be safely controlled (from a water quality perspective) in the event of an impending high rainfall intensity event.

Works will be suspended if forecasting suggests either of the following is likely to occur:

- >10 mm/hr (i.e. high intensity local rainfall events);
- >25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or,
- >half monthly average rainfall in any 7 days.

Prior to works being suspended the following control measures will be completed:

- Secure all open excavations;
- Provide temporary or emergency drainage to prevent back-up of surface runoff; and,

- Avoid working during heavy rainfall and for up to 24-hours after heavy events to ensure drainage systems are not overloaded.

Timing of Site Construction Works

The construction of the site drainage system will be carried out, at the respective locations, prior to other activities being commenced. The construction of the drainage system will only be carried out during periods of, where possible, no rainfall, therefore avoiding runoff. This will avoid the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses. Construction of the drainage system during this period will also ensure that attenuation features associated with the drainage system will be in place and functional for all subsequent construction works.

Monitoring

Prior to the commencement of development, a detailed Site Drainage Plan and SWMP will be prepared to detail the precise siting and composition of the surface water management measures. The respective plans, which will form part of a detailed CEMP, will be prepared prior to the commencement of development.

The CEMP will also include a detailed Water Quality Monitoring Plan for the monitoring of surface waters in the vicinity of the construction site by a designated Environmental Manager. The monitoring programme will comprise field testing and laboratory analysis of a range of agreed parameters. The civil works contractor, who will be responsible for the construction of the site drainage system, and Environmental Manager will undertake regular inspections of the drainage system to ensure that all measures are functioning effectively. The surface water sampling locations (i.e. SW1–SW4) will be used during construction activities. Regular inspections of all installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended.

Any excess build-up of silt levels that may decrease the effectiveness of the drainage feature, will be removed and disposed of in an appropriate manner.

Excavation Dewatering and Effects on Surface Water Quality

The management of excavation dewatering (pumping), particularly in relation to any accumulation of water in foundations or cabling and electricity line trenches, and subsequent treatment prior to discharge into the drainage network will be undertaken as follows:

- Appropriate interceptor drainage, to prevent upslope surface runoff from entering excavations, will be put in place;
- The interceptor drainage will be discharged to the site constructed drainage system or onto natural vegetated surfaces and not directly to surface waters to ensure that greenfield runoff rates are mimicked;
- If required, pumping of excavation inflows will prevent build-up of water in the excavation;
- All pumped water volumes will be discharged to the surface water management system adjacent to excavation areas, or via specialist treatment systems such as a Siltbuster unit;
- There will be no direct discharge to surface watercourses, and therefore no risk of hydraulic loading or contamination will occur;

- Daily monitoring of wind farm excavations by the Environmental Manager will occur during the construction phase. If high levels of seepage inflow occur, excavation work at this location will cease immediately and a geotechnical assessment undertaken; and,
- A mobile 'Siltbuster' or similar equivalent specialist treatment system will be available on-site for emergencies. Siltbusters are mobile silt traps that can remove fine particles from water using a proven technology and hydraulic design in a rugged unit. The mobile units are specifically designed for use on construction-sites. They will be used as final line of defence if required.

Release of Hydrocarbons during Construction and Storage

Mitigation measures proposed to avoid release of hydrocarbons at the site are as follows:

- The volume of fuels or oils stored on site will be minimised. All fuel and oil will be stored in an appropriately bunded area within the temporary construction compounds. Only an appropriate volume of fuel will be stored at any given time. The bunded area will be roofed to avoid the ingress of rainfall and will be fitted with a storm drainage system and an appropriate oil interceptor;
- All bunded areas will have 110% capacity of the volume to be stored;
- On site refuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled at the temporary compound and will be towed around the site by a 4x4 jeep to where plant and machinery is located. No refuelling will be permitted at works locations within the 50m hydrological buffer. The 4x4 jeep will also be fully stocked with fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations to avoid any accidental leakages;
- All plant and machinery used during construction will be regularly inspected for leaks and fitness for purpose;
- Spill kits will be readily available to deal with and accidental spillages;
- All waste tar material arising from road cuttings (from trenching or other works in public roads) will be removed off-site and taken to a licensed waste facility. Due to the potential for contamination of soils and subsoils, it is not proposed to utilise this material for any reinstatement works or for storage within the spoil deposition areas; and
- An outline emergency plan for the construction phase to deal with accidental spillages is contained within the Planning-Stage CEMP (**Annex 3.4**). This emergency plan will be further developed prior to the commencement of development and will be agreed with the Planning Authority as part of the detailed CEMP.

Groundwater and Surface Water Contamination from Wastewater Disposal

Measures to avoid contamination of ground and surface waters by wastewaters will comprise:

- Self-contained port-a-loos (chemical toilets) with an integrated waste holding tank will be installed at the site compound, maintained by the providing contractor, and removed from site on completion of the construction works;
- Water supply for the site office and other sanitation will be brought to site and removed after use to be discharged at a suitable off-site treatment location; and
- No water will be sourced on the site, nor will any wastewater be discharged to the site.

Release of Cement-Based Products

The following mitigation measures are proposed to ensure that the release of cement-based products is avoided:

- No batching of wet-cement products will occur on site. Ready-mixed concrete will be brought to site as required and, where possible, emplacement of pre-cast products will be utilised;
- All watercourse crossings will utilise pre-cast products and the use of wet-cement products within the hydrological buffer will be avoided
- Where concrete is delivered on site, only the chute will be cleaned, using the smallest volume of water practicable. Chute cleaning will be undertaken at lined cement washout ponds with waters being stored in the temporary construction compounds, removed off site and disposed of at an approved licensed facility. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed;
- Weather forecasting will be used to ensure that prolonged or intense rainfall is not predicted during concrete pouring activities; and,
- The concrete pour sites will be kept free of standing water and plastic covers will be ready in case of sudden rainfall event.

Morphological Changes to Surface Water Courses & Drainage Patterns

The following mitigation measures are proposed:

- The two no. proposed new stream crossings will be clear span bridges (bottomless culverts) and the stream beds will remain undisturbed. No in-stream excavation works at the crossing locations are proposed and therefore there will be no impact on the stream at the proposed crossing location;
- Wind farm electrical cabling or the underground electricity line cabling will be installed either above or below an existing culvert and will not directly interfere with the culvert;
- At the time of construction, all guidance/best practice requirements of the Office of Public Works (OPW) or Inland Fisheries Ireland will be incorporated into the design/construction of the proposed watercourse/culvert crossings;
- As a further precaution, in-stream construction work (if/where required) will only be carried out during the period permitted by Inland Fisheries Ireland for in-stream works according to *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (2016)* (i.e., July to September inclusive). This time period coincides with the period of lowest expected rainfall, and therefore minimum runoff rates. This will minimise the risk of

entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses (any deviation from this will be done in discussion with the IFI);

- During the near stream construction works (i.e. within the 50m buffer zone), double row silt fences will be emplaced immediately down-gradient of the construction area for the duration of the construction phase;
- The two no. new watercourse crossings at the wind farm site will require a Section 50 license application to the OPW in accordance with the Arterial Drainage Act 1945. The river/stream crossings will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent; and,
- No instream works are proposed at the underground electricity line watercourse crossings, with all crossings being carried out via HDD.

Progressive Replacement of Natural Surface with Lower Permeability Surfaces

The operational phase drainage system of the Proposed Development is described below:

- Interceptor drains will be installed up-gradient of all infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. It will then be directed to areas where it can be re-distributed over the ground by means of a level spreader;
- Swales/track side drains will be used to collect runoff from access tracks, crane hardstanding areas and substation compound areas which may contain entrained suspended sediment, and channel it to settlement ponds for sediment settling;
- Transverse drains ('grips') will be constructed, where appropriate, in the surface layer of access tracks to divert any runoff into swales/track side drains;
- Check dams will be used along sections of access tracks drains to intercept silts at source. Check dams will be constructed from a 40mm non-friable crushed rock or similar;
- Swales and check dams will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to watercourses; and,
- Settlement ponds will be designed in accordance the greenfield runoff rate requirements; and
- Imported rock for construction purposes and road surfacing will be strong, well-graded limestone which will be resistant to erosion and have a low likelihood to generate fines in hardstand runoff.

The operation of the underground electricity line will not result in any likely hydrological or water quality effects and therefore does not require mitigation measures.

Hydrocarbons Spillages/Leakages

Mitigation measures relating to oils and fuels are as follows:

- All storage containers will be labelled appropriately, including hazardous markings;
- Fuels stored on site will be minimised. Any storage areas will be bunded appropriately for the fuel storage volume for the time period of the construction;

- The substation transformer and oil storage tanks will be located in a concrete bund, impervious to rainwater ingress, capable of holding 110% of the stored oil volume;
- Bunds will be to standard specified in CIRIA Report 163 'Construction of bunds for oil storage tanks' and CIRIA Report C535 'Above-ground proprietary prefabricated oil storage tank systems;
- Barrels and bunded containers will be stored upright and internally where appropriate and always on drip trays or sump pallets;
- Appropriate spill kits will be available at all storage locations;
- Turbine transformers will be located within the turbines, and any leaks will be fully contained within the turbine thus eliminating any pathway for leakages to affect land and soil.
- Maintenance vehicles will be regularly inspected for leaks and fitness for purpose;
- All fuel/chemical storage facilities will be subject to weekly inspection; and
- An emergency plan for the operational phase to deal with accidental spillages will be contained within Environmental Management Plan. Spill kits will be available to deal with accidental spillages.

Invasive Species

Medium and high impact invasive species such as cherry laurel, Rhododendron and Japanese knotweed were recorded within the project site (species recorded included scheduled and non-scheduled invasive species as outlined in Section 6.1.3). Due to the passage of time from initial site surveys to the start of construction works, a preconstruction invasive species survey must be carried out to determine baseline conditions for the presence of invasive species. Results of this survey will be presented in a site-specific Invasive Species Management Plan (ISMP) which will be prepared by the Appointed Contractor. The management plan will set out strict biosecurity measures with reference to Best Practice guidance to ensure there is no potential for the spread of alien invasive species during the construction works.

Measures within the ISMP will include (but are not limited to) 1) A Method Statement for avoidance of invasive species within the project site; 2) if avoidance is not possible then removal and treatment measures will be required to be used to prevent the spread of invasive species; and 3) A specialist invasive species contractor will be employed during the project life to ensure all removal and treatment is carried under the appropriate licensing and guidance.

While the ISMP will contain specific measures (relevant to specific species) to be employed on site subject to the outcome of the pre-construction invasive species, the following measures will be employed as a matter of course:-

- An invasive species management plan will be developed and implemented. This will include the general prevention and containment measures and species-specific treatment measures as may be required;
- An Ecological Clerk of Works will be employed for the duration of the construction period to make contractors aware of any invasive and non-native species sensitivities of the project and

to undertake pre-construction surveys, enforcing any exclusion zones and mitigation measures as required;

- Use of toolbox talks as part of site introduction to workers, including what to look out for and what procedures to follow if invasive species are observed;
- Signs will be used to warn workers of invasive species contamination;
- Only planting and sowing of native species if any reinstatement works are required or where invasive plant species are physically removed;
- Unwanted material contaminated with invasive species will be transported offsite by an appropriate licenced waste contractor and disposed of at a suitably licenced facility (NRA, 2010);
- Good hygiene practices will be adhered to including the removal of build-up of soil on equipment; keeping equipment clean; washing vehicles exiting the site using a pressure washer to prevent the transport of seeds; storing wastewater from washing facilities securely and treating to prevent spread of invasive species; checking footwear and clothing of workers for seeds, fruits or other viable material before leaving the site; any plant material arising from cleaning equipment, footwear and clothing will be carefully disposed of following (NRA, 2010) guidelines in such a manner not to cause the spread of invasive species;
- A pre-construction walkover survey of the project will be undertaken during the growing season (April to August). This will search for invasive and non-native species, which could change over time. The extent of invasive plant species will be physically marked out if there have been any changes since baseline surveys; and,
- If any are identified, then appropriate exclusion zone(s) will be implemented. A buffer will be used to cordon off invasive species outside the works footprint.

6.3.2.3. Disturbance

Foraging and commuting otter are considered to be potentially affected by the Proposed Development, with two suspected holts found near turbines T1 and T6. Active signs of otter were observed including fresh spraint, slides, trails and trail camera footage and, therefore, have potential to be impacted by disturbance. There are two possible otter holts near the site outside of the site boundary by 20m and 103m, T1 is c. 220 m from the active otter holt. T6 is c. 210 m from the inactive otter holt.

Where works are to occur within 150m of a potential otter holt, a wildlife licence is required to undertake these works according to an agreed methodology with NPWS. If such a licence is required, it is recommended that in order to determine whether the potential otter holts observed are in active use (or how known active sites are being used), further pre-construction surveys should be undertaken by installing a weatherproof motion-triggered camera at each location, for periods of several days, ideally at least one week, repeated as per standard methodology. This could be carried out at any time of year as otter active all year round.

Should the identified otter holts be found to be active, it will be necessary to delineate an exclusion zone of up to 150m around the feature for the duration of construction.

Habitat suitability for salmonids and lamprey within the surveyed section was limited. IFI records indicate no salmonid or lamprey presence in the Owengarve or Lung Rivers. Populations of salmonids and lamprey larvae (ammocoetes) occur downstream in the Moy catchment, at distances of 20–30 km from the study area. No salmonids are recorded 30 km downstream of the Lung River, but brook lamprey has been recorded 25 km downstream. A survey for suitable spawning and fish habitat will be conducted by suitably experience and qualified ecologist for all watercourses on Site.

The following measures will be implemented to minimise as far as possible the disturbance which could be generated:

- Adoption of Best Practice Methods for works[5];
- Soft-start techniques will be employed during working hours; and
- Machinery will not be used early in the day or late in the day (i.e., they will not start until at least one hour after sunrise and will cease not later than one hour prior to sunset). Lamprey species typically migrate in darkness, so this restriction will benefit them particularly. In addition to the above, to further minimise the potential for disturbance to be caused.

Depending on the timing of the proposed works, different life stages of migratory fish species may be impacted by factors such as noise and disturbance associated with construction activities, or by increased sediment ingress into the watercourse during works involving excavation. Spawning and egg incubation for salmon occurs from October to February and for lamprey species from March to May, so works near watercourses should be carried out over summer if possible, bearing in mind that juveniles of these species may be present at any time of year.

6.3.2.4. Efficacy of Mitigation Measures

All works will follow the best practice guidance outlined in the following documents:

- National Roads Authority (NRA) (now Transport Infrastructure Ireland (TII)) (2008), *'Guidelines for the crossing of Watercourses During Construction of National Road Schemes'*; and,
- IFI (2016), *'Guidelines on protection of fisheries during construction works in and adjacent to waters'.*

The NRA publication details design and construction requirements for watercourses which interact with national road schemes which is also relevant to these works. In addition to this guidance, there is also a requirement to consult and comply with the relevant statutory authority e.g. IFI for works within and adjacent to watercourses.

The environmental measures set out above are proven to work and provide certainty that the integrity of the SACs and SPAs within the ZoI will not be affected by the Proposed Development, both individually and cumulatively. These measures will ensure that suspended solids or other pollutants will not be discharged to surface waters during construction and operation.

5 https://safety.networkrail.co.uk/wp-content/uploads/2019/11/NR_GN_ESD25-Guidance-on-Best-Practicable-Means-BPM-for-the-Control-of-Noise-and-Vibration.pdf (last accessed 24/05/2024)

Table 5. Summary of Mitigation Measures, Responsibilities and Efficacy in Preventing Adverse Effects on Natura 2000 sites

Effect	Mitigation Measures	Responsibility for Implementation	Efficacy of Mitigation	Adverse effect on integrity of Natura 2000 sites
Deterioration of Water quality	Mitigation by Avoidance by design	Client and Contractor	Established and proven working near watercourse measures	No
	Surface water management during construction	Client and Contractor	Established and proven working near watercourse measures	No
	Pollution Prevention	Client and Contractor	Established and proven working near watercourse measures	No
	Sediment control	Client and Contractor	Established and proven working near watercourse measures	No
	Water quality monitoring during works	Client and Contractor	Established and proven working near watercourse measures	No
Disturbance	Pre-construction checks for otter holts and fish habitat	Client	Established and proven working near watercourse measures	No
	Following best practice for working in streams – timing of works	Client and Contractor	Established and proven working near watercourse measures	No
IAS	Biosecurity Measures	Client and Contractor	Established and proven working near watercourse measures	No

7. CONSIDERATION OF FINDINGS

The mitigation measures outlined in this report, once implemented, are considered to be sufficient to prevent any effect on Qualifying Interests or the integrity of the Natura 2000 sites identified as potentially affected by the Proposed Development.

It is assessed that the Proposed Development will have no adverse effects on the integrity of the River Moy SAC, Tullaghanrock Bog SAC, Bricklieve Mountains and Keishcorran SAC, Lough Gara SPA, Bellanagare SPA and Lough Arrow SPA or any other Natura 2000 sites.

Based on the information set out in this report, it can be concluded, in the light of best scientific knowledge, that there is reasonable scientific certainty that there will be no significant effects from the Proposed Development, either individually or in combination with other plans or projects, adversely affecting the conservation interests or conservation objectives of any Natura 2000 sites. It is therefore concluded that Proposed Development will not, beyond reasonable scientific doubt, adversely affect the integrity of any Natura 2000 site either directly or indirectly".

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APPENDIX A: PLANNING-STAGE CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

GALETECH
ENERGY SERVICES



Islandmore Wind Farm

Environmental Impact Assessment Report

Planning-Stage Construction Environmental Management Plan

Islandmore Wind Farm Limited

DOCUMENT CONTROL

Stage	Date	Name
Content	19/10/2026	Simon Carleton
Approval	19/10/2026	Gavin Daly

RECORD OF CHANGES

Revision	Issue Date	Summary of Changes	Approved
00	19/10/2026	Content	Simon Carleton
01			
02			

DISTRIBUTION LIST

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1.0 INTRODUCTION

Galetech Energy Services (GES), on behalf of Islandmore Wind Farm Limited, has prepared this Planning-Stage Construction Environmental Management Plan (CEMP) for the construction of the Islandmore Wind Farm.

1.1 PURPOSE OF THIS REPORT

This CEMP has been prepared to outline the management of activities during the construction of the project to ensure that all construction activities are undertaken in an environmentally responsible manner. This CEMP summarises the environmental commitments made in respect of the project and the measures to be adopted to ensure compliance with legislation and the requirements of statutory bodies.

This CEMP (Planning-Stage/Preliminary) is a live document and will be updated by the appointed contractor prior to the commencement of development. Prior to the commencement of construction, the updated CEMP will be reviewed by the Environmental Manager (EM) and Ecological Clerk of Works (ECoW), as necessary, to confirm the appropriateness of the measures set out therein. This CEMP will form part of the main civil construction works contract. The contractor will take account of the structure, content, methods and requirements contained within the various sections of this CEMP when further developing this document (to include environmental plans and other related construction management plans and method statements) as required.

1.2 OBJECTIVES OF THE CEMP

This CEMP has been developed in accordance with the Institute of Environmental Management and Assessment (IEMA) *Practitioner Environmental Management Plans Best Practice Series Volume 12 (December 2008)* and has been designed to address the proposed environmental construction strategies that are to be implemented in advance of and during the construction of the project.

This CEMP aims to define good working practices as well as specific actions required to implement mitigation requirements as identified in the Environmental Impact Assessment Report (EIAR), Natura Impact Statement (NIS), the planning process, and/or other licensing or consenting processes.

1.3 STRUCTURE OF THE CEMP

The CEMP has been structured such that it can be read as consolidated document or as discreet documents addressing specific environmental topics. In particular, we refer to the technical annexes enclosed which address specific matters such as spoil management, surface water management, waste management, and emergency responses.

A copy of the CEMP will be maintained in the site offices for the duration of the construction phase and will be available for review at any time. The contractor's EM will be responsible for the continued development of the CEMP throughout the construction phase.

Where specific construction management plans or method statements are prepared by the contractor, these will be inserted into the relevant section of this CEMP.

1.4 ROLES & RESPONSIBILITIES

Islandmore Wind Farm Limited, and its appointed Project Manager, will be responsible for the overall implementation of the environmental measures and procedures set out in the CEMP. The role of the Project Manager relates to compliance monitoring with the CEMP and other planning/environmental/licensing requirements. Additionally, the Project Manager shall be empowered to halt works where he/she considers that continuation of the works would be likely to result in a substantial environmental risk.

The Project Manager will also carry out site checks that the works are being undertaken in accordance with the CEMP and will prepare a record of same.

The Contractor will appoint an EM who will be responsible for coordination and development of the CEMP and any other surveys, reports or construction management plans necessary for the discharge of the requirements of the CEMP. The EM will also review the contractors construction management plans as required, carry out compliance auditing during the construction phase and coordinate the Environmental Management Group (see below) and required liaisons between Islandmore Wind Farm Limited, the Contractor, and other statutory authorities.

Prior to commencement of construction, the Contractor will identify a core Environmental Management Group, comprising of specific project personnel and including the Project Manager, EM and ECoW. The Environmental Management Group will meet monthly to discuss the monthly environmental report and will advise site personnel on areas where improvements may be made on site. The group will draw on technical expertise from relevant specialists where required and will liaise with other relevant external bodies as required.

1.5 REPORTING PROCEDURES

Appropriate reporting procedures are key to the proper implementation of the measures outlined within this CEMP, and include reporting between parties involved in the construction of the project and also external stakeholders, such as the relevant local authorities.

Emergency and environmental incident reporting procedures are set out in the Environmental & Emergency Response Plan.

2.0 DESCRIPTION OF THE PROJECT

Islandmore Wind Farm Limited intends to construct the Islandmore Wind Farm which will consist of:-

- 10 no. wind turbines, 3 no. with an overall height of 185m and 7 no. with an overall height of 150m;
- All associated and ancillary site development, excavation, construction, landscaping and reinstatement works, including provision of site drainage infrastructure and forestry felling;
- Works to the public road network along the turbine component haul route; and,
- 110kV electricity substation and installation of c. 7km of underground electricity line to facilitate connection of the wind farm to the existing Tonroe 110kV electricity substation at Ballaghaderreen, County Roscommon.

The project is located in north County Roscommon; c. 2km north of Ballaghaderreen, c. 13km east of Charlestown (Co. Mayo) and c. 6km southwest of Gorteen (Co. Sligo);

and is located in close proximity to the county boundaries between counties Roscommon, Sligo and Mayo.

Various environmental reports have been prepared in respect of the project and have been utilised in the preparation of this CEMP, including:-

- Environmental Impact Assessment Report (Galetech Energy Services); and,
- Natura Impact Statement (Woodrow/APEM Group).

3.0 GENERAL CONSTRUCTION SEQUENCE

The construction phase is likely to last for approximately 15-18 months from commencement of enabling works through to the installation and commissioning of the turbines and ending with site reinstatement and landscaping.

The construction phase of the development will comprise a 6-day week with normal working hours from 07:00 to 19:00 Monday to Friday and 07:00 to 13:00 on Saturdays. It may be necessary to undertake works outside of these hours to avail of favourable weather conditions (e.g. during time of low wind speed to facilitate turbine installation etc.) or during extended concrete pours (e.g. where turbine foundation pours must be completed within 24-hours). Where construction activities are necessary outside of the normal working hours, local residents and the Planning Authority will receive prior notification.

3.1 CONSTRUCTION METHOD

The construction of the wind farm will consist of the following general sequence:-

- Preliminary traffic management and surface water protection measures to be implemented;
- Establishment of the site entrances, to be commenced and completed, ensuring that adequate visibility splays are provided;
- Progressive installation of surface water protection measures;
- Establishment and continued management of spoil deposition areas;
- Establishment of the borrow pit;
- Progressive construction of internal on-site access tracks utilising material extracted from the borrow pit, where possible, and imported from local quarries;
- Construction of the temporary construction compounds for off-loading materials and equipment and to accommodate temporary site offices;
- Construction of bunded areas for oil, fuel and lubricant storage tanks;
- As the internal access tracks progress to each turbine location, tree felling will be completed where required and foundation excavations for the turbines will commence and foundations laid. The hardstanding areas will also be constructed;
- Permanent and temporary upgrade works along the turbine component haul route will be commenced;
- Once the on-site access tracks are completed, the trenching and laying of underground cable ducting and cabling will begin;

- Installation of turbines will commence once the on-site access tracks, hardstands, foundations and drainage measures are in place and the haul route upgrade works are complete. It is anticipated that each turbine will take approximately 1-week to install. 2 no. cranes will be used for this operation. As each turbine is completed, the electrical connections will be made; and,
- Progressive site reinstatement, restoration and landscaping including habitat management proposals and re-profiling of borrow pit and spoil deposition areas, removal of turbine storage areas; installation of post-and-wire fencing around turbines, access tracks and at site entrances; installation of gates and vegetation at site entrances; and decommissioning of the temporary construction compounds and temporary equipment storage areas.

The construction method for the electricity substation and underground electricity line will consist of the following general sequence (to be completed concurrently with wind farm construction):-

- Site preparatory and groundworks associated with the substation compound footprint including control buildings;
- Construction of the control buildings;
- Construction of bases or plinths for electrical apparatus;
- Installation of palisade fencing around substation;
- Installation of internal and external electrical apparatus in control buildings and within compound area;
- Installation of underground electricity line (including joint bays, communication chambers, and HDD works) between substation and Tonroe 110kV electricity substation;
- Connection of underground electricity to the respective substations;
- Commissioning of electrical apparatus and underground electricity line; and,
- Progressive site reinstatement, restoration, landscaping and planting proposals including the installation of stockproof fencing and the installation of gates.

Once the turbines are installed, and the substation and electrical system completed, the turbines will be tested and commissioned.

In addition to the roles of the EM and ECoW described above, the construction phase will be supervised by a range of environmental and engineering specialist personnel; including a Project Supervisor for the Construction Stage (PSCS), Archaeological Clerk of Works (ACoW), and Geotechnical Clerk of Works (GCoW), among others; who will liaise closely with the appointed contractor's on-site EM to monitor construction activities and to ensure that all applicable environmental control measures are implemented in full.

3.2 SITE ENTRANCES

A total of 7 no. site entrances will be required to facilitate access to the project site. Of these, 6 no. will be new access points and 1 no. will comprise the upgrade of an existing agricultural entrance; with 4 no. entrances being from the L5501, 2 no. entrances from the L55018 and 1 no. entrance from an unnamed local road.

The construction of site entrances will be carried out by placing geotextile or geogrid within the defined entrance footprint followed by the placement of granular fill (rock) in compacted layers. Drainage features will be installed to manage runoff and prevent sedimentation of adjacent surface water channels. Visibility splays will be cleared and temporary traffic management measures will be implemented during construction to ensure the safety of road users and construction personnel.

Following the delivery of turbine components, the scale of the wind farm (construction phase) site entrances will be reduced but will be reinstated such that they remain capable of accommodating abnormal loads in the event of a major component change-out during the operation phase of development. The reinstatement of the site entrances will comprise the installation of post and rail fencing, gates and the planting of hedgerows (where appropriate and as advised by the ECoW). Hedgerows, where planted, will be appropriately located to allow for future growth while ensuring, at all times, that visibility splays are maintained during the operation phase.

3.3 Hardstanding Areas and On-Site Access Tracks

The areas of hardstanding for crane operations and on-site access tracks will generally be constructed as follows:-

- Rock/stone will be laid on a geotextile mat and compacted in layers to an appropriate depth. The sub-layers of the hardstanding areas and access tracks will be constructed of rock/stone extracted from the borrow pit insofar as possible, with the upper layer comprising capping material imported from a local quarry (quarries). All such areas of hardstanding will be permeable to avoid significant volumes of surface water run-off;
- Where access tracks are required to cross drainage ditches, these will be piped or spanned with an appropriate bridging structure. At the crossings of the watercourses to the east of turbine T4 and east of turbine T9 respectively, bottomless culverts or clear-span structures will be installed (subject to final post-consent detailed design) to prevent any interference with the hydraulic capacity of the watercourses; and,
- Areas of temporary hardstanding (for turbine component storage and crane assembly) will be reinstated following the construction phase by removing aggregates, placing excavated material and allowing the areas to revegetate naturally. The crane hardstandings and on-site access tracks will be retained during the operation phase to facilitate access for maintenance personnel and in the event of a major component change-out.

3.4 Temporary Construction Compounds & Equipment Storage areas

The compound base, which will be placed on a geotextile mat, will be made up of well graded aggregates, compacted as necessary. A designated waste management area and fuels and chemicals storage area will be provided within the compounds along with site offices, parking, staff welfare facilities and equipment storage areas. The compounds will be fenced with temporary security fencing to restrict access. Following the completion of the construction phase, the compounds will be fully reinstated involving the removal of crushed stone and underlying geotextile, spreading of excavated material (as required) and allowing the areas to revegetate naturally.

3.5 Chemical Storage & Refuelling

Storage areas for oils, chemicals and fuels will comprise bunded areas of hardstand of sufficient capacity within the temporary construction compounds. Bunds will have a watertight roof structure and will be supplied by a licensed manufacturer to enable adequate safe storage for the quantities of material required. An adequate supply of spill kits will be readily available in order to clean up any minor spillages should they occur. A hydrocarbon interceptor will be installed within the surface water drainage system during the construction phase to trap any hydrocarbons that may be present. As part of the design process, a 50m buffer has been observed around all surface water features and no fuel/chemicals shall be handled or stored within this zone.

From the construction compounds, fuel will be transported to works areas by a 4x4 with a double skinned bowser with drip trays under a strict protocol and carried out by suitably trained personnel. The bowser/4x4 will be fully stocked with spill kits and absorbent material, with delivery personnel being fully trained to deal with any accidental spills. The bowser will be bunded appropriately for its carrying capacity. As above, a 50m buffer will be observed around all surface water features and no refuelling will be permitted within this zone.

3.6 WASTE MANAGEMENT

Waste will be generated during the construction phase and the main items of anticipated construction waste are as follows:-

- Hardcore, stone, gravel, concrete, plaster, topsoil, subsoil, timber, concrete blocks and miscellaneous building materials;
- Waste from chemical portaloo toilets;
- Plastics; and,
- Oils and chemicals.

Waste disposal measures proposed include:-

- On-site segregation of all waste materials into appropriate categories including, for example, topsoil, bedrock, concrete, bricks, tiles, oils /diesels, metals, dry recyclables e.g. cardboard, plastic, timber;
- All waste materials will be stored in skips or other suitable and sealed receptacles in a designated area of the construction compound;
- Wherever possible, left over materials (e.g. timber off-cuts) and any suitable demolition materials shall be re-used on-site;
- Uncontaminated excavated material (rock, topsoil, subsoil, etc.) will be re-used on-site in preference to importation of clean inert fill;
- Bedrock may be encountered during foundation excavation. If bedrock is encountered it will be utilised for infill during construction;
- All waste leaving the site will be transported by permitted contractors and taken to suitably licensed or permitted facilities and will be recycled, recovered or reused, where possible; and,
- All waste leaving the site will be recorded in accordance with legal requirements and copies of relevant documentation maintained.

The contractor shall ensure that all waste generated at the project site is managed in an appropriate manner. The precise methods to be implemented are detailed in the

accompanying Waste & Resource Management Plan which shall ensure that waste is managed in accordance with all relevant legislation, best practice methods, and in accordance with the waste management priority hierarchy.

Excavated spoil material shall be managed in accordance with the provisions of the Peat & Spoil Management Plan. Only material which cannot be re-used for reinstatement or landscaping purposes shall be removed from the project site and disposed of at an approved waste management facility.

3.7 CONSTRUCTION EMPLOYMENT

It is estimated that up to 100 no. people will be employed during the construction phase. The actual number present on site will depend on the activities being undertaken at any given time and will vary throughout the course of the construction programme. Employment will be the responsibility of the construction contractor but it is likely that the workforce will include labour from the local area.

3.8 CONSTRUCTION TRAFFIC

Vehicular traffic required for the construction phase is likely to include:-

- Articulated trucks (HGVs) to bring initial equipment onto site and later to bring the turbine components, electrical cables, steel reinforcement for foundations, anemometer mast, and ancillary equipment;
- Tipper trucks and excavation plant involved in site development and excavation works;
- Cranes to erect the turbines;
- Miscellaneous vehicles and handling equipment, including vehicles associated with construction workforce.

Deliveries of turbine components will take place at times to avoid peak traffic periods and are likely to occur during night-time hours. All abnormal loads will be accompanied by an advance escort vehicle.

Traffic mitigation measures will be implemented during the construction phase, as follows:-

- Signage at site entrances giving access information;
- Temporary traffic restrictions kept to minimum duration and extent;
- Diversions put in place to facilitate continued use of roads, where restrictions have to be put in place (e.g. along the underground electricity line route);
- Construction traffic management – one way systems where possible and strictly enforced speed limits;
- Provision of a designated person to manage access arrangements and act as a point of contact to the public; and,
- All temporary road alterations and public road upgrades to be carried out in full consultation with the respective planning authorities.

4.0 ENVIRONMENTAL MANAGEMENT MEASURES

4.1 POPULATION & HUMAN HEALTH

A series of measures has been agreed with involved landowners regarding the management of agricultural/forestry activities during the construction phase. These measures have been incorporated into signed legal agreements with the landowners and will be implemented in full.

4.2 BIODIVERSITY

- The direct loss of (FW4) Drainage ditches to construction will be strictly limited to sections essential for the viability of the project, with all feasible measures taken to retain existing ditches where possible and to avoid unnecessary crossings or culverting;
- Medium and high impact invasive species such as cherry laurel, Rhododendron and Japanese knotweed were recorded within the project site. Due to the passage of time from initial site surveys to the start of construction works, a preconstruction invasive species survey must be carried out to determine baseline conditions for the presence of invasive species. Results of this survey will be presented in a site-specific Invasive Species Management Plan (ISMP) which will be prepared by the Appointed Contractor. The management plan will set out strict biosecurity measures with reference to Best Practice guidance to ensure there is no potential for the spread of alien invasive species during the construction works.

  Measures within the ISMP will include (but are not limited to) 1) A Method Statement for avoidance of invasive species within the project site; 2) if avoidance is not possible then removal and treatment measures will be required to be used to prevent the spread of invasive species; and 3) A specialist invasive species contractor will be employed during the project life to ensure all removal and treatment is carried under the appropriate licensing and guidance.

  While the ISMP will contain specific measures (relevant to specific species) to be employed on site subject to the outcome of the pre-construction invasive species, the following measures will be employed as a matter of course:-

  - An invasive species management plan will be developed and implemented. This will include the general prevention and containment measures and species-specific treatment measures as may be required;
  - An Ecological Clerk of Works will be employed for the duration of the construction period to make contractors aware of any invasive and non-native species sensitivities of the project and to undertake pre-construction surveys, enforcing any exclusion zones and mitigation measures as required;
  - Use of toolbox talks as part of site introduction to workers, including what to look out for and what procedures to follow if invasive species are observed;
  - Signs will be used to warn workers of invasive species contamination;
  - Only planting and sowing of native species if any reinstatement works are required or where invasive plant species are physically removed;
  - Unwanted material contaminated with invasive species will be transported offsite by an appropriate licenced waste contractor and disposed of at a suitably licenced facility (NRA, 2010);

- Good hygiene practices will be adhered to including the removal of build-up of soil on equipment; keeping equipment clean; washing vehicles exiting the site using a pressure washer to prevent the transport of seeds; storing wastewater from washing facilities securely and treating to prevent spread of invasive species; checking footwear and clothing of workers for seeds, fruits or other viable material before leaving the site; any plant material arising from cleaning equipment, footwear and clothing will be carefully disposed of following (NRA, 2010) guidelines in such a manner not to cause the spread of invasive species;
- A pre-construction walkover survey of the project will be undertaken during the growing season (April to August). This will search for invasive and non-native species, which could change over time. The extent of invasive plant species will be physically marked out if there have been any changes since baseline surveys;
- If any are identified, then appropriate exclusion zone(s) will be implemented. A buffer will be used to cordon off invasive species outside the works footprint;

- Due to the presence of suitable habitat for otter and badger within the project site and within the ZoI of the project site, and the mobile nature of these species, a pre-works ecological constraints walkover survey will be carried out by an appropriately qualified Ecologist. If breeding otter holts are discovered, then construction must stop within 150m until the holt is no longer in use. NPWS can be consulted to obtain a derogation, but this process and criteria is frequently changing and may be difficult to obtain.

  The baseline surveys found badger setts adjacent to the works corridor. The following mitigation measures will be applied to avoid disturbance to badgers:-

  - Where possible, no works will be undertaken within 50m of active badger sett(s), as measured from all the entrances to burrows;
  - Where this is not possible, a method statement will be drafted based on pre-construction badger surveys carried out on site by a suitably qualified Ecologist a minimum of –4-6 months prior to site works. Seasonal restrictions and badger sett closures (temporary or permanent) may be required. And all such work would require approval from the Local Authority and local NPWS ranger;
  - Ideally, all heavy machinery will be excluded from areas within 30m of active badger sett(s), as measured from all the entrances to burrows;
  - TII guidance and mitigation: 'Guidelines for the Treatment of Badgers Prior to the construction of National Road Schemes' will be followed and form the best practice guidance;
  - Exclusion zone buffers of 30m around all sett entrances will be marked off prior to commencement of construction works to ensure protection of these locations. Buffer zones will be appropriately signposted and will be marked out using fencing posts and rope;
  - To avoid the period of time when badgers are particularly sensitive to disturbance (birthing and raising young cubs); no heavy construction works, including tree felling will be undertaken during the badger breeding

season (December to June inclusive) if occurring near an active badger sett. This will be assessed by the appointed ECoW 4-6 months prior to works commencing;

- Disturbance to foraging mammals will be avoided by:-
  - Construction works being largely limited to daylight hours allowing nocturnal animals like badgers and otters to forage through the night;
  - Minimising the risk of mammals becoming trapped if falling into excavated holes and trenches through the provision of egress points, e.g. placing escape planks or spoil runs. In addition, the length of time holes will be exposed will be limited;
- In terms of bats, mitigation on a precautionary basis will be applied in the form of pre-construction tree inspections to identify and protect any bats potentially occupying roosts in vegetation designated for removal. Vegetation removal will also be carried out, where possible, during the period when bats are least likely to be using tree roosts (November to March) to further diminish the likelihood of any roosting bats being present.

  For any occupied or likely occupied roost sites where vegetation removal is not proposed (around F.1), an exclusion zone will be implemented to prevent disturbance during times of occupancy. provides optimal time periods for works depending on the roost type, and therefore by extension restrictive periods for construction works, during which the exclusion zone for construction work would be applicable. Reporting of pre-construction bat surveys and action taken will be required to demonstrate due diligence regarding avoidance of disturbance to roosting bats.

  The principal mitigation measure incorporated into the design of the proposed development to reduce the potential risk of bat collision and barotrauma is the application of bat feature buffers between turbines and habitats used by bats for foraging and commuting.

  In accordance with the guidance Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation (NatureScot *et al.*, 2021), a precautionary separation distance has been applied between turbine rotor-swept areas and identified bat habitat features. The required separation distance is calculated based on turbine dimensions and the height of adjacent vegetation or habitat features.

  NatureScot guidance recommends that a minimum buffer of 50 m is maintained between the rotor-swept area and features likely to be used by bats, including woodland edges, treelines, hedgerows and other linear landscape features. The buffer distance is measured from the outermost tip of the turbine blade to the nearest bat habitat feature.

  Bat feature buffers for the proposed development were calculated using the NatureScot methodology and have informed the turbine layout and vegetation management requirements. Where required, vegetation removal has been incorporated into the design to achieve compliance with the recommended stand-off distances and thereby reduce collision risk for bats during the operational phase.

  Removal of hedgerow vegetation and replacement planting will mitigate the impacts of artificial lighting at night on the project site as the replanting has

been designed to encourage foraging and commuting bats away from turbine locations, thereby reducing the attraction effect of lighting for certain collision-risk bat species. The use of screening planting around the substation and motion-sensor controlled lighting will minimise the impact of the lighting installations.

- The mitigation measures relevant to freshwater ecology include:-
  - Avoidance of sensitive aquatic areas where possible by implementing a 50m construction zone buffer;
  - As described in Water specific mitigation measures, incorporated into the design of the development and through implementation of best practice methodologies will be employed where work inside buffer zones is proposed for the watercourse crossings required;
  - Any works for stream crossings will be carried out during the working window for instream works. This working window is defined by Inland Fisheries Ireland (IFI) as 01 July to 30 September to avoid vulnerable spawning salmonids/lamprey that may be present in downstream environments outside of this window. Any works outside of this period would require a derogation under the Local Authorities (Works) Act, 1949 and permissions from Inland Fisheries Ireland after consultation;
  - Work in areas liable to sediment erosion to be carried out only during dry conditions and no excavations to take place during forecasted yellow or higher rain warnings. Topsoil stripping and peat removal to be carried out only during dry conditions. All other work to be undertaken in dry conditions wherever possible, and no works (other than monitoring) to be carried out during heavy rain or snowmelt;
  - There will be no crossing of rivers or streams by machinery during the construction phase, other than by constructed access routes, and all machinery must remain within the works corridor and utilise designated access routes. Constriction machinery to access the project site via alternative means to the river crossing wherever possible;
  - There will be no direct dewatering to watercourses during the construction phase. All outflows from drainage associated with construction will be by diffuse overland drainage at appropriate locations and through settlement ponds/tanks/silt socks;
  - For works taking place within watercourse buffer zones, enhanced sediment control measures including double silt fencing and additional filtration controls will be implemented where required in accordance with the CEMP and SWMP;
  - Cement leachate, hydrocarbon oils and other toxic poisonous materials will require full containment and will not be permitted to discharge to any waters, and control measures to be place will include:-
    - Appropriate bunded storage area for storage of fuels/oils, with onsite storage of hydrocarbons to be kept to a minimum;
    - Mobile double skinned fuel bowser will be used for re-fuelling on-site;
    - No refuelling will be permitted at works locations within the 50m hydrological buffer;

- Spill kits will be readily available to deal with any accidental spillage;
- There is an outline emergency plan for the construction phase to deal with accidental spillages;
- Ready-mixed concrete will be brought to site, with no batching of wet-cement products occurring on site;
- Where possible pre-cast products will be installed, including all watercourse crossings;
- Use of wet-cement products within the hydrological buffer will be avoided, insofar as possible;
- Lined cement washout ponds will be used for chute cleaning, with minimal use of water take will be imported to the project site;
- No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be permitted;

- Wastewater emanating on-site (sewage, wastewater from site office) will be taken off-site for disposal/treatment at controlled facilities. To this effect, welfare facilities for construction site workers will include self-contained port-a-loos with an integrated waste holding tank. No water will be sourced on the project site, nor will any wastewater be discharged to the project site. Foul drainage from the temporary site offices and facilities is to be properly stored and removed to a suitable treatment facility. Storage facilities should be robust enough to ensure no spillage or leakage occurs.

- **Chapter 7** (Water) also provides details of the Sustainable Drainage Systems (SuDS) that will be implemented to manage surface water taking account of water quantity (flooding), water quality (pollution) and associated ecological receptors. The drainage design will incorporate the following key elements: -
  - Clean water interceptor drains to collect and divert upslope runoff away from construction areas and prevent unnecessary contamination;
  - Swales and drainage channels to collect and convey runoff from construction and operational infrastructure;
  - A treatment train approach comprising interception, attenuation, settlement and controlled discharge measures in accordance with the SWMP;
  - Check dams and other flow attenuation measures to reduce runoff velocities, promote settlement and minimise erosion;
  - Settlements ponds and buffered outfalls to provide attenuation and treatment of runoff prior to diffuse discharge at greenfield runoff rates. No direct discharge of untreated runoff to mapped watercourses will be permitted.

- The project site drainage and attenuation system will be installed prior to the main construction activities and includes excavation of drainage ditches and installation of settlement ponds and soakaways. The site-specific drainage scheme is required to attenuate, hydraulically (flow) and hydro-chemically (pollutants), the projected increase in runoff of *ca.* 63 m^3/day (worst-case scenario) that will arise from the creation of additional areas of hardstanding. **Chapter 7** (Water) also provides details of management of soil/peat deposition areas to avoid impacting on water quality including:-
  - Spoil deposition areas are located outside the 50m stream buffer zone;
  - Silt fences, straw bales and biodegradable matting will be used to control surface water runoff for deposition areas;
  - Deposition areas will be sealed with a digger bucket and vegetated as soon possible to reduce sediment entrainment in runoff.
- Other measures include:-
  - To avoid run-off of silt-laden water impacting upon water quality within surface water features adjacent to the works corridor, reinstatement works including measures to re-vegetate disturbed areas through re-seeding and/or placement of saved turves will be carried out immediately after construction works;
  - During construction, turves will be stored separately from spoil (soil/rock). Separate storage of turves will ensure vegetation is not significantly damaged and that turves can be replaced as a top mat to facilitate rapid re-instatement of the surface vegetation, thereby significantly reducing the likelihood of soil erosion and the likelihood of silt laden surface waters affecting water quality;
  - To ensure control measures are implemented appropriately, an Environmental Manager as part of the construction team will be employed for the duration of the construction works; also an independent Ecological Clerk of Works (ECoW) will be auditing the project site intermittently to report on the efficacy of mitigation measures put in place by the appointed contractor;
  - Water quality monitoring will be undertaken before, during and following construction works in accordance with the Water Quality Monitoring Plan and SWMP. Monitoring will include regular visual inspections, field hydrochemistry measurements and water quality sampling at agreed monitoring locations.
- For Marsh Fritillary, all construction activities at T10 will be scheduled when marsh fritillary butterfly are on the wing (May-July) (NIEA, 2017) insofar as practicable. Adult butterflies only fly in warm, sunny conditions, so construction activities at T10 will only take place in favourable weather conditions between 10.30 and 16.30 (NIEA, 2017), where possible, following a site check by the appointed Ecological Clerk of Works. Construction works must be designed to avoid the peak larval development period (August-April) in order to minimise incidence of mortality (NIEA, 2017). An ECoW will be present to survey for any larval webs within suitable habitat within the project footprint, and will have authority to stop works should marsh fritillary larva be present.

- For drainage ditches, Where works/infrastructure interfaces with drainage ditches, appropriate design measures will be implemented to minimise the effect on the habitat and to avoid any hydraulic change to the channel;
- To avoid construction damage from excavation or compaction to the roots of plants in hedgerows, treelines and woodlands adjacent to the proposed infrastructure that will be retained post-construction, appropriate root protection area (RPAs) will be implemented, in accordance with best practice guidance (NRA 2006). To this effect an appropriately qualified arboriculturist will undertake a pre-construction assessment to ensure impacts to vegetation are avoided;
- To avoid widespread disturbance to (PB4) Cutover bog and other habitats, access within the project site will be restricted to the proposed works corridor. No access between different parts of the infrastructure will be permitted, except via the proposed works corridor. An experienced and suitably qualified ECoW will be employed for the pre-construction, during and completion of construction works. They will be tasked with monitoring work practices, which will ensure that construction activities are tightly constrained to the works corridor and the project footprint, and that all mitigation is appropriately applied on site. They will have the power to stop works and can proposed suitable amelioratory action as required during the works;
- To minimise ecological impacts associated with the direct loss of (WS1) Scrub, clearance works within woody vegetation will be scheduled outside the bird breeding season (March 1st to August 31st, inclusive) insofar as possible, and an ECoW will survey such habitat before it's removal. The ECoW will check for the resting places of protected species in accordance with best practice and legal requirements under the Wildlife Act 1976 (as amended);
- The contractor will be required to implement the following standard practice construction methods and mitigation measures for release of dust:-
  - Preparing and maintaining the project site;
  - Plan construction compound layout so that machinery and dust causing activities are located away from receptors, as far as is possible;
  - Erect a 2m minimum site hoarding around all construction/ contractor compounds;
  - Keep site fencing, barriers and scaffolding clean using wet methods;
  - Cover, seed or fence stockpiles to prevent wind whipping;
- Trees requiring felling and identified as having roost suitability, where surveying proves that features are unoccupied, will be soft felled, as outline in with the National Roads Authority guidelines (NRA, 2005). This procedure involves:-
  - Where tree removal is extensive (T2 and T3), instigate staggering or phasing felling over several days or weeks to reduce sudden loss of habitat and allow for gradual dispersal;
  - Removing the tree in sections, starting with the top branches and then working down the trunk trying to avoid cutting through cavities;

- Any sections with PRFs must be lowered with care and laid on the ground with potential entrances to roosts orientated upwards to allow bat to vacate the roost;
- Sections must be left *in situ* for at least 24 hours in suitable weather conditions to allow any bats to disperse. In addition to leaving sections in situ for 24 hours, reattaching or storing felled PRF-containing sections in adjacent retained woodland would act as artificial roost opportunities;

- The contractor will be required to implement standard practice construction methods and mitigation measures for in-stream or near-stream works. The following measures are to be read and implemented in conjunction with the Construction Environmental Management Plan (CEMP) and Surface Water Management Plan (SWMP):-
  - Maintain a minimum 50m buffer from watercourses wherever practicable and a 50m stand-off from wells and boreholes, in order to minimise the risk of impacts arising from tracks, turbine foundations, hardstandings, spoil storage areas and other construction activities. Where works are required within these buffer areas, including at identified watercourse crossings (i.e. near T4 and T9), site-specific mitigation measures will be implemented in accordance with the Water Chapter (**Chapter 7**) and CEMP;
  - Spoil will be stored in line with a spoil management plan, which is included at **Annex 6.2** of the EIAR;
  - Peat and spoil storage areas will be located outside watercourse buffer zones and managed using silt fencing, straw bales, biodegradable matting and settlement infrastructure. Storage areas will be stabilised and revegetated as soon as practicable following placement to minimise sediment mobilisation and erosion.
  - For works occurring within 50m of a watercourse, weather conditions will be continuously monitored (e.g. via Met Éireann) and earthworks scaled back or suspended where forecast rainfall exceeds the trigger thresholds set out in the SWMP, including high-intensity rainfall events (>10mm/hr) and prolonged heavy rainfall (>25mm in 24 hours);
  - In the event of heavy rainfall, open excavations or peat storage works will be secured, and emergency drainage measures will be implemented to prevent water backup and pollution;
  - It will be ensured that the site drainage system does not discharge directly into watercourses, but rather through a riparian buffer area of intact vegetation.
  - All outflows from drainage associated with construction activities will be treated through temporary settlement ponds and associated drainage controls prior to discharge. Treated water will be discharged via buffered outfalls and diffuse overland flow across vegetated areas, in accordance with the SWMP, thereby preventing direct discharge of untreated runoff to mapped watercourses;
  - Watercourse crossings will be constructed during low-flow periods, adhering to any working period restrictions imposed, with filtration measures installed downstream to trap sediments;

- Silt traps and fencing will be placed in working areas that have the potential to carry silt-laden material from the working area to aquatic environments;
- Refuelling of machinery will take place in bunded enclosures, at a minimum of 50m away from watercourses to prevent runoff into nearby watercourses. All machinery must carry an onboard spill kit in the event of an oil/fuel spill during all phases;
- A complete mechanical check of all hoses and fluid reservoirs of machinery will be carried out by a competent member of the construction team before the machinery arrives at the project site;
- To reduce the amount of silt-laden water to be treated, temporary cut-off drains will be created to divert water away from dirty water and construction areas. This will lessen the volume of water to be treated onsite;
- Deposition areas for spoil will be enclosed with silt fencing to prevent mobilisation of solids during adverse weather conditions and no drainage from these areas will be directed into the temporary drainage systems. A Sustainable Urban Drainage System (SUDS) will be implemented to allow controls to be designed for the retention of large volumes of water that may arise from spoil deposition areas;
- Surface water runoff will be managed through a treatment train comprising interceptor drains, swales, check dams, silt traps and settlement ponds, with treated water discharged via buffered outfalls and diffuse overland flow in accordance with the project SWMP;
- Re-seeding of all areas of bare ground or the placement of jute matting will take place as soon as practicable to prevent run-off;
- All onsite welfare facilities will be installed and managed as per regulations to prevent nutrient overloading of aquatic environments;

- In relation to earthworks:-
  - Earthworks and exposed areas/soil stockpiles will be re-vegetated to stabilise surfaces as soon as practicable, using appropriate native plant (e.g. heather brash) seed from a local source;
  - Hessian, mulches or tackifiers will be used where it is not possible to re-vegetate or cover with topsoil, as soon as practicable;
  - Vegetation removal and exposure of soils will be minimised as far as possible, with only areas being actively worked on being exposed, to minimise silt mobilisation;
- Following a pre-construction survey in Mid-August/September/October (by a suitably experienced Ecologist) to update the location of webs, the turves supporting the larval webs at turbine T10 will be removed in November-February when the larvae hibernate and become less sensitive to light disturbance (DAERA, 2023). The turves will be translocated to an alternative area, which supports abundant devil's-bit scabious, located to the east of T1. This condition of the habitat in this area was assessed as suitable under-grazed. Further details on translocation can be found in the Habitat Management Plan;

- Approximately 460m of hedgerow habitat and 5m of treeline will be removed as a result of the project. It is proposed that the planting of c. 700m of new and enhanced hedgerow habitat to offset for the direct loss of these features will similarly provide sufficient mitigation for indirect impact upon terrestrial (non-volant) mammal IEFs foraging and commuting within the project site. Replacement planting will occur along lengths removed to facilitate the construction of temporary enlarged access where appropriate on the approaches to T6 and T10. Additional new planting along historic field boundary lengths to the east of the access towards T6 and adjacent peat storage;
- As a short-term mitigation measure, the installation of bat boxes within the woodland and treelines outside of the bat buffer zones (and outside of the project footprint) will take place prior to construction works. To replace potential roosting features being lost, eight Schwegler 2F (or similar woodcrete alternatives) bat boxes will be installed on suitably mature trees. Boxes will be installed at a height of around 3m under the supervision of a Bat Ecologist; and,
- In the long-term mitigation, there will be a like-for-like replacement of treelines lost as a result of the proposed infrastructure or required to be felled in order to achieve sufficient buffers to avoid potential impacts on bats. It is acknowledged that there will be a time lag for replanted treelines to compensate fully for the established treelines that will be removed, therefore compensatory planting will take place as early as possible.

4.3 LAND & SOIL

To help offset the loss of peat at the proposed site, Habitat Management Plan (refer to **Annex 5.3**) has been prepared and comprises the following:-

- Drain management;
- Marginal, cell and contour bunding;
- Forest to bog restoration;
- Bare peat revegetation;
- Scrub removal;
- Cessation of turf cutting; and,
- Prevention of uncontrolled burning;

The following avoidance and design measures are proposed to reduce erosion effects at excavation and spoil storage areas:-

- Mats will be used, as necessary, to support construction plant and machinery on soft ground, thus reducing the likelihood of soil and subsoil erosion and avoiding the formation of rutted areas. This will substantially reduce the likelihood for surface water ponding to occur;
- Excavated material will be side cast and stored temporarily adjacent to excavation areas for use during reinstatement and landscaping. Where material is not required for reinstatement or landscaping, it shall be immediately transported to the spoil deposition areas;

- Silt fences, and all necessary surface water management measures (including upslope interceptor drains), will be installed around all temporary stockpiles to limit movement of entrained sediment in surface water runoff. All slopes will be sealed with the bucket of an excavator;
- In order to minimise erosion during the construction phase, works will not take place during periods of intense or prolonged rainfall (to prevent increased silt laden runoff). Drainage systems, as outlined in **Chapter 7**, will be implemented to limit runoff effects during the construction phase;
- At the designated spoil deposition areas, material will be placed in layers to ensure stability is maintained and works will be undertaken in accordance with best practice construction methodologies. Works at the spoil deposition areas (including the borrow pit) will be monitored, on a weekly basis during the construction phase and monthly for a 6 no. month period thereafter, by an appropriately qualified Geotechnical Engineer. In the event that any ground stability issues arise, the Engineer will have the power to cease works until such time as remedial works have been completed to his/her satisfaction;
- Permanently mounded spoil; for example, berms surrounding turbines and hardstands, berms located along access tracks and the spoil deposition areas; will be seeded and grassed over at the earliest opportunity to prevent erosion; and,
- The underground electricity line (grid connection) trench will be reinstated to the required EirGrid/ESB Networks specification and in accordance with landowner requirements and will be reseeded or allowed to vegetate naturally (on agricultural land) or topped with asphalt (or similar along public roads) at the earliest opportunity to prevent erosion.

The following measures are proposed to specifically prevent contamination of soils and subsoils:-

- The volume of fuels or oils stored on site will be minimised. All fuel and oil will be stored in an appropriately bunded area within the temporary construction compound. Only an appropriate volume of fuel will be stored at any given time. The bunded area will be roofed to avoid the ingress of rainfall and will be fitted with a storm drainage system and an appropriate oil interceptor;
- All bunded areas will have 110% capacity of the volume to be stored;
- On site re-fuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled at the temporary compound and will be towed around the site by a 4x4 jeep to where plant and machinery is located. The 4x4 jeep will also be fully stocked with fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use and only designated, trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations to avoid any accidental leakages;
- All plant and machinery used during construction will be regularly inspected for leaks and fitness for purpose;
- Spill kits will be available to deal with any accidental spillages within the temporary construction compound and during re-fuelling;

- All waste tar material arising from road cuttings (from trenching in public roads and haul route temporary alteration works) will be removed off-site and disposed of at a licensed waste facility. Due to the potential for contamination of soils and subsoils, it is not proposed to utilise this material for any reinstatement works or to store it within the spoil deposition areas; and,
- An emergency plan for the construction phase to deal with accidental spillages is contained within the Planning-Stage Construction and Environmental Management Plan. This emergency plan will be further developed by the contractor prior to the commencement of construction.

6.5ha of forestry will be felled to accommodate wind farm infrastructure. However, all tree coverage felled will be replaced at a replanting site which will be subject to technical approval through a separate consenting process. No specific measures, other than best-practice felling and replanting methodologies are proposed and the efficacy and appropriateness of these measures will be assessed, separately, through the felling and replanting licensing process.

The key mitigation with regard peat stability risk at the project site was the carrying out of a robust, multidisciplinary site investigation and peat stability risk assessment in accordance with best practice guidance (PLHRAG, Scottish Government, 2017).

The findings of the geotechnical and peat stability assessment demonstrates that the project site has an acceptable margin of safety and is suitable for the development of the project.

The assessment provides a number of mitigation/control measures to reduce the potential risk of peat failure at each infrastructure location.

The following control measures will be incorporated into the construction phase of the project will ensure the management of the risks for this site:-

- Appointment of experienced and competent contractors;
- The site will be supervised by experienced and qualified personnel;
- Allocate sufficient time for the project (be aware that decreasing the construction time has the potential to increase the risk of initiating a localised peat movement);
- Prevent undercutting of slopes and unsupported excavations;
- Maintain a managed robust drainage system;
- Prevent placement of loads/overburden on marginal ground;
- Implementation of safety buffers around deep peat areas;
- Adhere to the spoil and peat storage restriction areas detailed in the Geotechnical and Peat Stability Assessment;
- Set up, maintain and report findings from monitoring systems as outlined in the Geotechnical and Peat Stability Assessment;
- Ensure construction method statements are developed and agreed before commencement of construction and are followed by the contractor; and,
- Revise and amend the Construction Risk Register as construction progresses to ensure that risks are managed and controlled for the duration of construction.

4.4 WATER

Forestry Felling

There is a requirement in the *Forest Service Code of Practice* and in the *FSC Certification Standard* for the installation of buffer zones adjacent to aquatic zones at planting stage. Minimum buffer zone widths recommended in the Forest Service (2000) guidance document *Forestry and Water Quality Guidelines* are detailed below.

Average slope leading to the aquatic zone		Buffer zone width on either side of the aquatic zone	Buffer zone width for highly erodible soils
Moderate	(0–15%)	10m	15m
Steep	(15–30%)	15m	20m
Very steep	(>30%)	20m	25m

A total of 6.5ha of forestry will be permanently felled to accommodate the construction and operation of the project.

During the construction phase, a self-imposed conservative buffer zone of 50m will be maintained for all streams. Only approximately 0.8ha of the total 6.5ha proposed for felling is located inside a 50m watercourse buffer zone.

Where tree felling is required in the vicinity of streams, the additional mitigation measures outlined below will be employed.

Mitigation by Design

Mitigation measures which will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses comprise best practice methods, as follows:-

- Machine combinations (i.e. handheld or mechanical) will be chosen which are most suitable for ground conditions and which will minimise soils disturbance;
- Checking and maintenance of tracks and culverts will be ongoing through any felling operation. No tracking of vehicles through watercourses will occur. Where possible, existing drains will not be disturbed during felling works;
- Ditches which drain from the areas to be felled towards existing surface watercourses will be blocked, and temporary silt traps will be constructed. No direct discharge of such ditches to watercourses will occur. Drains and sediment traps will be installed during ground preparation. Collector drains will be excavated at an acute angle to the contour (c. 0.3%-3% gradient), to minimise flow velocities. Main drains to take the discharge from collector drains will include water drops and rock armour, as required, where there are steep gradients and avoid being placed at right angles to the contour;
- Sediment traps will be sited in drains downstream of felling areas. Machine access will be maintained to enable the accumulated sediment to be excavated. Sediment will be carefully disposed of in the spoil deposition areas. All new silt traps will be constructed on even ground and not on sloping ground;
- In areas particularly sensitive to erosion or where felling inside the 50m buffer is required, it will be necessary to install double or triple sediment traps;
- All drainage channels will taper out before entering the 50m buffer zone. This

ensures that discharged water gently fans out over the buffer zone before entering the aquatic zone, with sediment filtered out from the flow by ground vegetation within the zone. On erodible soils, silt traps will be installed at the end of the drainage channels;

- Drains and silt traps will be maintained throughout all felling works, ensuring that they are clear of sediment build-up and are not severely eroded. Correct drain alignment, spacing and depth will ensure that erosion and sediment build-up are minimised and controlled;
- Brash mats will be used to support vehicles on soft ground, reducing topsoil and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal will take place before they become heavily used and worn. Provision will be made for brash mats along all off-road (track) routes, to protect the soil from compaction and rutting. Where there is risk of severe erosion occurring, extraction will be suspended during periods of high rainfall;
- Timber will be stacked in dry areas, and outside the 50m watercourse buffer. Straw bales and check dams will be emplaced on the down gradient side of timber storage/processing sites;
- Works will be carried out during periods of no, or low, rainfall in order to minimise entrainment of exposed sediment in surface water run-off;
- Checking and maintenance of tracks and culverts will be ongoing through the felling operation;
- Refuelling or maintenance of machinery will not occur within 100m of a watercourse. Mobile bowser, drip kits and qualified personnel will be used where refuelling is required;
- A permit to refuel system will be adopted:
- Branches, logs or debris will not be allowed to build up in the 50m buffer. All such material will be removed when harvesting operations have been completed, but care will be taken to avoid removing natural debris deflectors;
- Trees will be cut manually from along streams and using machinery to extract whole trees; and,
- Travel will only be permitted perpendicular to and away from surface water features.

Silt Traps

Silt traps will be strategically placed down-gradient within forestry drains near streams. The main purpose of the silt traps is to slow water flow, increase residence time and allow settling of silt in a controlled manner.

Drain Inspection and Maintenance

The following items will be carried out during pre-felling inspections and regularly thereafter:-

- Communication with tree felling operatives in advance to determine whether any areas have been reported where there is unusual waterlogging or

bogging of machines;

- Inspection of all areas reported as having unusual ground conditions;
- Inspection of main drainage ditches and outfalls. During pre-felling inspections, the main drainage ditches will be identified. Where possible, the pre-felling inspection will be carried out during rainfall;
- Following tree felling, all main drains will be inspected to ensure that they are functioning;
- Extraction tracks within 10m of drains will be broken up and diversion channels created to ensure that water in the tracks spreads out over the adjoining ground;
- Culverts on drains exiting the site, if impeded by silt or debris, will be unblocked; and,
- All accumulated silt will be removed from drains, culverts and silt traps, and this removed material will be deposited away from watercourses to ensure that it will not be carried back into the trap or stream during subsequent rainfall.

Surface Water Quality Monitoring

Sampling will be completed before, during (if the operation is conducted over a protracted time) and after the felling activity. The 'before' sampling will be conducted within 4-weeks of the felling activity commencing, preferably in medium-to-high water flow conditions. The 'during' sampling will be undertaken once a week or after rainfall events. The 'after' sampling will comprise as many samplings as necessary to demonstrate that water quality has returned to pre-activity status (i.e. where an impact has been shown).

Details of the proposed surface water quality monitoring programme are outlined in the Water Quality Monitoring Plan.

The surface water sampling locations used in this EIAR for the project site (i.e. SW1–SW4) will also be used as sampling locations during felling activities.

Also, daily surface water monitoring forms (for visual inspections and field chemistry measurements) will also be utilised at every works site near any watercourse. These will be populated daily and kept on site for record and inspection.

Earthworks (Removal of Vegetation Cover, Excavations and Stock Piling) Resulting in Suspended Solids Entrainment in Surface Water

The generally large setback distance from sensitive hydrological features ensures that sufficient space is provided for the installation of drainage mitigation measures (discussed below) and to ensure their effective operation. The proposed buffer zone will ensure:-

- Avoidance of physical damage to watercourses, and associated release of sediment;
- Avoidance of excavations within close proximity to surface water courses;
- Avoidance of the entry of suspended sediment from earthworks into watercourses; and,
- Avoidance of the entry of suspended sediment from the construction phase

drainage system into watercourses, achieved in part by ending drain discharge outside the buffer zone and allowing percolation across the vegetation of the buffer zone.

Mitigation by Prevention

The following section details the measures which will be put in place during the construction phase to ensure that surface water features are protected from the release of silt or sediment and to ensure that all surface water runoff is fully treated and attenuated to avoid the discharge of dirty water.

- Source controls to limit the likelihood for 'dirty water' to occur:-
  - Interceptor drains, vee-drains, diversion drains, flume pipes, erosion and velocity control measures such as use of sand bags, oyster bags filled with clean washed gravel, filter fabrics, and other similar/equivalent or appropriate systems; and,
  - Small working areas, covering stockpiles, weathering off stockpiles, cessation of works in certain areas or other similar/equivalent or appropriate measures.
- In-Line controls to ensure appropriate management of silt laden water:-
  - Interceptor drains, vee-drains, oversized swales, erosion and velocity control measures such as check dams, sand bags, oyster bags, straw bales, flow limiters, weirs, baffles, silt bags, silt fences, sedimats, filter fabrics, and collection sumps, temporary sumps/attenuation lagoons, sediment traps, pumping systems, settlement ponds, temporary pumping chambers, or other similar/equivalent or appropriate systems.
- Treatment systems to fully attenuate silt laden waters prior to discharge:-
  - Temporary sumps and attenuation ponds, temporary storage lagoons, sediment traps, and settlement ponds, and proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems.

It should be noted for this site that an extensive network of land, bog and forestry drains already exists and these will be integrated and enhanced as required and used within the wind farm drainage system. The integration of existing land drainage networks and wind farm networks is common practice in wind energy developments and will also result in benefits to surrounding lands.

The main elements of interaction with existing drains will be as follows:-

- Apart from interceptor drains, which will convey clean runoff water to the downstream drainage system, there will be no direct discharge (without treatment for sediment reduction and attenuation for flow management) of runoff from the wind farm drainage into the existing site drainage network. This will reduce the likelihood of any increased risk of downstream flooding or sediment transport/erosion;
- Silt traps will be placed in the existing drains upstream of any streams where construction works is taking place, and these will be diverted into proposed interceptor drains, or culverted under/across the works area; and,
- Buffered outfalls, which will be numerous over the site, will promote percolation of drainage waters across vegetation and close to the point at which the additional runoff is generated, rather than direct discharge to the

existing drains of the site.

Pre-commencement Temporary Drainage Works

Prior to the commencement of haul route upgrades, access tracks, crane hardstandings and turbine foundations, the following key temporary drainage measures will be installed:-

- All existing dry bog, forestry or agricultural drains that intercept the proposed works area will be temporarily blocked down-gradient of the works using check dams/silt traps;
- Clean water interceptor drains will be installed upgradient of the works areas;
- Check dams/silt fence arrangements (silt traps) will be placed in all existing drains that have surface water flows and also along existing roadside drains; and,
- A double silt fence perimeter will be placed down-slope of works areas that are located inside the watercourse 50m buffer zone.

Water Treatment Train

While the proposed drainage plan is assessed as providing a sufficient level of protection to avoid any deterioration in downstream water quality; a temporary final line of defence can be provided by a water treatment train (i.e. sequence of water treatment processes), if required. If the discharge water from construction areas fails to be of a high quality, then a filtration treatment system (such as a 'Siltbuster' or similar equivalent treatment train) will be used to filter and treat all surface discharge water collected in the dirty water drainage system. This water treatment train will apply for the entirety of the construction phase.

Silt Fences

Silt fences will be emplaced within drains down-gradient of all construction areas. Silt fences are effective at removing heavy settleable solids. This will act to prevent entry to watercourses of sand and gravel sized sediment, released from excavation of mineral sub-soils of glacial and glacio-fluvial origin, and entrained in surface water runoff. Inspection and maintenance of these of these structures during construction phase is critical to their functioning to stated purpose. They will remain in place throughout the entire construction phase. Double silt fences will be emplaced within drains down-gradient of all construction areas inside the hydrological buffer zones to provide an additional layer of protection in these areas.

Silt Bags

Silt bags will be used where small to medium volumes of water need to be pumped from excavations. As water is pumped through the bag, most of the sediment is retained by the geotextile fabric allowing filtered water to pass through. Silt bags will be used with natural vegetation filters or sedimats (sediment entrapment mats, consisting of coir or jute matting) placed at the silt bag location to provide further treatment of the water outfall from the silt bag. Sedimats will be secured to the ground surface using stakes/pegs. The sedimat will extend to the full width of the outfall to ensure all water passes through this additional treatment measure.

Management of Runoff from Peat/Spoil Deposition Areas

It is proposed that excavated peat/overburden/spoil will be utilised for reinstatement of excavated areas etc. and for landscaping purposes. Excess material, or material which is unsuitable for this purpose, will be stored, permanently, at dedicated peat/spoil deposition areas and in the 1 no. spent borrow pit.

Proposed peat/spoil deposition areas and the borrow pit are located outside the 50m stream buffer zone.

During the initial placement of peat/spoil in the deposition areas, silt fences, straw bales and biodegradable matting will be used to control surface water runoff. Drainage from overburden deposition areas will ultimately be routed to an oversized swale and a number of silt/settlement ponds with appropriate storage and settlement capacity, designed for a '1-in-100 year 6-hour return' period, before being discharged.

Spoil deposition areas will be sealed with a digger bucket and allowed to vegetate naturally. Once re-vegetated and stabilised, spoil deposition areas will no longer be a likely source of silt laden runoff. Surface water protection infrastructure will be left in place until the areas have stabilised.

Underground Electricity Line Installation Works

Mitigation measures which are outlined below will be implemented to ensure that silt laden or contaminated surface water runoff from the trenching work does not discharge directly to the water:-

- All existing dry drains that intercept the works area will be temporarily blocked down-gradient of the works using temporary check dams/silt traps (e.g. straw bales);
- Clean water diversion drains will be installed upgradient of the works areas, as required;
- Check dams/silt fence arrangements (silt traps or straw bales) will be placed in all existing drains that have surface water flows and also along existing roadside drains; and,
- A double silt fence perimeter will be placed down-slope of works areas that are located inside the watercourse 50m buffer zones such as at watercourse crossing locations.

Specific mitigation measures relating to the directional drilling at the crossing location are detailed below.

Directional Drilling

The following mitigation will be carried out during directional drilling works:-

- Firstly, the crossing works area will be clearly marked out with fencing or flagging tape to avoid unnecessary disturbance of vegetation;
- A minimum 10 metre vegetative buffer zone will be maintained (if present) between disturbed areas and the watercourse bank. There will be no storage of material/equipment, excavated material (see below) or overnight parking of machinery inside the 10m buffer zone;
- Double silt fencing will be placed upslope of the buffer zone on each side of the watercourse.
- Mats will be used underneath the excavator, inside the 10 metre vegetative

buffer zone, to prevent soil erosion/rutting and potential surface water quality impacts from localised surface water runoff;

- Temporary storage of excavated material will be undertaken outside of the 10m buffer on flat ground or within a local hollow area. A containment berm will be placed downslope of the excavated material which in turn will be surrounded by secondary silt fence protection to prevent saturated soil from flowing back into the watercourse;
- Operation of machinery and use of equipment within the 10m buffer will be kept to a minimum to avoid any unnecessary disturbance;
- There will be no refuelling allowed within 100m of the watercourse crossing;
- All plant will be checked for purpose of use prior to mobilisation at the watercourse crossing; and,
- Works shall not take place during periods of heavy rainfall and will be scaled back or suspended if heavy rain is forecasted.

Mitigation measures relating to the use of a mixture of a natural, inert and fully biodegradable drilling fluid such as Clear Bore™ and water for directional drilling include:-

- The area around the Clear Bore™ batching, pumping and recycling plants will be bunded using terram and sandbags in order to contain any spillages;
- Two or more lines of silt fences will be placed between the works area and adjacent rivers and streams on both banks;
- Accidental spillage of fluids will be cleaned up immediately and transported off site for disposal at a licensed facility; and,
- Adequately sized skips will be used for temporary storage of drilling arisings during directional drilling works. This will ensure containment of drilling arisings and drilling flush.

A Fracture Blow-out (Frac-out) Prevention and Contingency Plan will be prepared by the drilling contractor prior to construction and will include the following measures:-

- The drilling fluid/bentonite will be non-toxic and naturally biodegradable (i.e., Clear Bore Drilling Fluid or similar will be used);
- The area around the drilling fluid batching, pumping and recycling plants will be bunded using terram and/or sandbags to contain any potential spillage;
- A double row of silt fencing will be placed between the works area and the adjacent river;
- Spills of drilling fluid will be cleaned up immediately and transported off-site for disposal at a licensed facility;
- Adequately sized skips will be used where temporary storage of arisings are required;
- The drilling process/pressure will be constantly monitored to detect any possible leaks or breakouts into the surrounding geology or local watercourse;
- This will be gauged by observation and by monitoring the pumping rates and pressures. If any signs of breakout occur then drilling will be immediately stopped;

- Any frac-out material will be contained and removed off-site;
- The drilling location will be reviewed, before re-commencing with a higher viscosity drilling fluid mix; and,
- If the risk of further frac-out is high, a new drilling alignment will be sought at the crossing location.

Pre-emptive Site Drainage Management

The works programme for the initial construction stage of the project will also take account of weather forecasts, and predicted rainfall in particular. Large excavations and movements of peat/subsoil or vegetation stripping will be suspended or scaled back if prolonged or intense rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

The following forecasting systems are available and will be used on a daily basis at the site to direct proposed construction activities:-

- General Forecasts: Available on a national, regional and county level from the Met Eireann website (www.met.ie/forecasts). These provide general information on weather patterns including rainfall, wind speed and direction but do not provide any quantitative rainfall estimates;
- Meteo Alarm: Alerts to the possible occurrence of severe weather for the next 2-days. Less useful than general forecasts as only available on a provincial scale;
- 3-hour Rainfall Maps: Forecast quantitative rainfall amounts for the next 3-hours but does not account for possible heavy localised events;
- Rainfall Radar Images: Images covering the entire country are freely available from the Met Eireann website (www.met.ie/latest/rainfall_radar.asp). The images are a composite of radar data from Shannon and Dublin airports and give a picture of current rainfall extent and intensity. Images show a quantitative measure of recent rainfall. A 3-hour record is given and is updated every 15-minutes. Radar images are not predictive; and,
- Consultancy Service: Met Eireann provide a 24-hour telephone consultancy service. The forecaster will provide interpretation of weather data and give the best available forecast for the area of interest.

The use of safe threshold rainfall values will allow work to be safely controlled (from a water quality perspective) in the event of an impending high rainfall intensity event.

Works will be suspended if forecasting suggests either of the following is likely to occur:-

- >10 mm/hr (i.e. high intensity local rainfall events);
- >25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or,
- >half monthly average rainfall in any 7 days.

Prior to works being suspended the following control measures will be completed:-

- Secure all open excavations;
- Provide temporary or emergency drainage to prevent back-up of surface runoff; and,
- Avoid working during heavy rainfall and for up to 24-hours after heavy events

to ensure drainage systems are not overloaded.

Timing of Site Construction Works

The construction of the site drainage system will be carried out, at the respective locations, prior to other activities being commenced. The construction of the drainage system will only be carried out during periods of, where possible, no rainfall, therefore avoiding runoff. This will avoid the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses. Construction of the drainage system during this period will also ensure that attenuation features associated with the drainage system will be in place and functional for all subsequent construction works.

Monitoring

Prior to the commencement of development, a detailed Site Drainage Plan and SWMP will be prepared to detail the precise siting and composition of the surface water management measures. The respective plans, which will form part of a detailed CEMP, will be prepared prior to the commencement of development.

The CEMP will also include a detailed Water Quality Monitoring Plan for the monitoring of surface waters in the vicinity of the construction site by a designated Environmental Manager. The monitoring programme will comprise field testing and laboratory analysis of a range of agreed parameters. The civil works contractor, who will be responsible for the construction of the site drainage system, and Environmental Manager will undertake regular inspections of the drainage system to ensure that all measures are functioning effectively. The surface water sampling locations used in this EIAR (i.e. SW1–SW4) will be used during construction activities. Regular inspections of all installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended.

Any excess build-up of silt levels that may decrease the effectiveness of the drainage feature, will be removed and disposed of in an appropriate manner.

Excavation Dewatering and Effects on Surface Water Quality

The management of excavation dewatering (pumping), particularly in relation to any accumulation of water in foundations or cabling and electricity line trenches, and subsequent treatment prior to discharge into the drainage network will be undertaken as follows:-

- Appropriate interceptor drainage, to prevent upslope surface runoff from entering excavations, will be put in place;
- The interceptor drainage will be discharged to the site constructed drainage system or onto natural vegetated surfaces and not directly to surface waters to ensure that greenfield runoff rates are mimicked;
- If required, pumping of excavation inflows will prevent build-up of water in the excavation;
- All pumped water volumes will be discharged to the surface water management system adjacent to excavation areas, or via specialist treatment systems such as a Siltbuster unit;
- There will be no direct discharge to surface watercourses, and therefore no

risk of hydraulic loading or contamination will occur;

- Daily monitoring of wind farm excavations by the Environmental Manager will occur during the construction phase. If high levels of seepage inflow occur, excavation work at this location will cease immediately and a geotechnical assessment undertaken; and,
- A mobile 'Siltbuster' or similar equivalent specialist treatment system will be available on-site for emergencies. Siltbusters are mobile silt traps that can remove fine particles from water using a proven technology and hydraulic design in a rugged unit. The mobile units are specifically designed for use on construction-sites. They will be used as final line of defence if required.

Release of Hydrocarbons during Construction and Storage

Mitigation measures proposed to avoid release of hydrocarbons at the site are as follows:-

- The volume of fuels or oils stored on site will be minimised. All fuel and oil will be stored in an appropriately bunded area within the temporary construction compounds. Only an appropriate volume of fuel will be stored at any given time. The bunded area will be roofed to avoid the ingress of rainfall and will be fitted with a storm drainage system and an appropriate oil interceptor;
- All bunded areas will have 110% capacity of the volume to be stored;
- On site refuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled at the temporary compound and will be towed around the site by a 4x4 jeep to where plant and machinery is located. No refuelling will be permitted at works locations within the 50m hydrological buffer. The 4x4 jeep will also be fully stocked with fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations to avoid any accidental leakages;
- All plant and machinery used during construction will be regularly inspected for leaks and fitness for purpose;
- Spill kits will be readily available to deal with and accidental spillages;
- All waste tar material arising from road cuttings (from trenching or other works in public roads) will be removed off-site and taken to a licensed waste facility. Due to the potential for contamination of soils and subsoils, it is not proposed to utilise this material for any reinstatement works or for storage within the spoil deposition areas; and,
- An outline emergency plan for the construction phase to deal with accidental spillages is contained within the Planning-Stage CEMP. This emergency plan will be further developed prior to the commencement of development, and will be agreed with the Planning Authority as part of the detailed CEMP.

Groundwater and Surface Water Contamination from Wastewater Disposal

Measures to avoid contamination of ground and surface waters by wastewaters will comprise:-

- Self-contained port-a-loos (chemical toilets) with an integrated waste holding tank will be installed at the site compound, maintained by the providing contractor, and removed from site on completion of the construction works;
- Water supply for the site office and other sanitation will be brought to site and removed after use to be discharged at a suitable off-site treatment location; and,
- No water will be sourced on the site, nor will any wastewater be discharged to the site.

Release of Cement-Based Products

The following mitigation measures are proposed to ensure that the release of cement-based products is avoided:-

- No batching of wet-cement products will occur on site. Ready-mixed concrete will be brought to site as required and, where possible, emplacement of pre-cast products will be utilised;
- All watercourse crossings will utilise pre-cast products and the use of wet-cement products within the hydrological buffer will be avoided
- Where concrete is delivered on site, only the chute will be cleaned, using the smallest volume of water practicable. Chute cleaning will be undertaken at lined cement washout ponds with waters being stored in the temporary construction compounds, removed off site and disposed of at an approved licensed facility. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed;
- Weather forecasting will be used to ensure that prolonged or intense rainfall is not predicted during concrete pouring activities; and,
- The concrete pour sites will be kept free of standing water and plastic covers will be ready in case of sudden rainfall event.

Morphological Changes to Surface Water Courses & Drainage Patterns

The following mitigation measures are proposed:-

- The 2 no. proposed new stream crossings will be clear span bridges (bottomless culverts) and the stream beds will remain undisturbed. No in-stream excavation works at the crossing locations are proposed and therefore there will be no impact on the stream at the proposed crossing location;
- Wind farm electrical cabling or the underground electricity line cabling will be installed either above or below an existing culvert and will not directly interfere with the culvert;
- At the time of construction, all guidance/best practice requirements of the Office of Public Works (OPW) or Inland Fisheries Ireland will be incorporated into the design/construction of the proposed watercourse/culvert crossings;
- As a further precaution, in-stream construction work (if/where required) will

only be carried out during the period permitted by Inland Fisheries Ireland for in-stream works according to *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (2016)* (i.e., July to September inclusive). This time period coincides with the period of lowest expected rainfall, and therefore minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses (any deviation from this will be done in discussion with the IFI);

- During the near stream construction works (i.e. within the 50m buffer zone), double row silt fences will be emplaced immediately down-gradient of the construction area for the duration of the construction phase;
- The 2 no. new watercourse crossings at the wind farm site will require a Section 50 license application to the OPW in accordance with the Arterial Drainage Act 1945. The river/stream crossings will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent; and,
- No instream works are proposed at the underground electricity line watercourse crossings, with all crossings being carried out via HDD.

4.5 AIR QUALITY

4.5.1 Communications

- Develop and implement a stakeholder communications plan that includes community engagement before work commences on site;
- Display the name and contact details of person(s) accountable for air quality and dust issues at the site entrances. This may be the environment manager/engineer or the site manager; and,
- Display the head or regional office contact information.

4.5.2 Site Management

- Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken;
- Make the complaints log available to the local authority when asked; and,
- Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the logbook.

4.5.3 Preparing and Maintaining the Site

- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible;
- Erect solid screens or barriers around dusty activities that are at least as high as any stockpiles on site;
- Fully enclose site or specific operations where there is a high likelihood of dust production and the site is actives for an extensive period;
- Avoid site runoff of water or mud;
- Keep site fencing, barriers and scaffolding clean using wet methods;

- Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below; and,
- Cover, seed or fence stockpiles to prevent wind whipping.

4.5.4 Operating Vehicle/Machinery and Sustainable Travel

- Ensure all vehicles switch off engines when stationary – no idling vehicles;
- Avoid the use of diesel- or petrol-powered generators and use mains electricity or battery powered equipment where practicable;
- Impose and signpost a maximum-speed-limit of 25kph on surfaced and 15kph on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate);
- Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing); and,
- Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.

4.5.5 Operations

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems;
- Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate;
- Use enclosed chutes and conveyors and covered skips;
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate; and,
- Ensure equipment is readily available on site to clean any dry spillages and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.

4.5.6 Waste Management

- Bonfires and burning of waste materials are legally prohibited.

4.5.7 Measures Specific to Earthworks

- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable;
- Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as is practicable; and,
- Only remove the cover in small areas during work and not all at once.

4.5.8 Measures Specific to Construction

- Avoid scabbling (roughening of concrete surfaces) if possible;
- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place;
- Ensure fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery; and,
- For smaller supplies of fine powder materials, ensure bags are sealed after use and stored appropriately to prevent dust.

4.5.9 Measures Specific to Trackout

- Use water-assisted dust sweeper(s) on the access tracks and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use;
- Avoid dry sweeping of large areas;
- Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport;
- Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable;
- Record all inspections of haul routes and any subsequent action in a site logbook;
- Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned;
- Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable); and,
- Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.

4.6 CLIMATE

During the construction phase, the following best practice measures shall be implemented to prevent significant GHG emissions and reduce effects on climate:-

- Procurement of low carbon materials, the majority of GHG emissions from a construction project are associated with embodied carbon within materials. It is understood and accepted that market availability and price mean that it is difficult to commit to alternatives at this early stage in the project's development cycle; however, alternative options are set out below:-
  - Concrete: GGBS (Ground granulated blast-furnace slag), 30% lower clinker content cement, or better, where practicable;
  - Fibre reinforced concrete or similar instead of steel reinforcement;
  - Steel: recycled or electric arc foundry steel, cross laminated timber;
  - Bricks and aggregates: reclaimed or recycled;

- Re-use of materials on site e.g. excavated material;
- Use of EVs during construction;
- Use of mains electricity or batteries during construction rather than diesel generators; and,
- All plant adheres to Euro Stage V or better and all vehicles are Euro VI/Euro 6 (Euro 7 for new vehicles will commence late 2026).

During construction, the Contractor will be required to mitigate against the effects of extreme rainfall/flooding through site risk assessments, method statements and good site management practise. The Contractor will also be required to mitigate against the effects of extreme wind/storms, temperature extremes through site risk assessments, method statements and good site management practise. All materials used during construction will be accompanied by certified datasheets which will set out the limiting operating temperatures. Temperatures can affect the performance of some materials, and this will require consideration during construction. During construction, the Contractor will be required to mitigate against the effects of fog, lighting and hail through site risk assessments and method statements.

4.7 LANDSCAPE

Aside from mitigation measures to minimise land and vegetation disturbance and dust emissions (which may reduce visual amenity), no specific landscape or visual mitigation measures are proposed in relation to the construction phase beyond adherence to best practice methods to reduce environmental impacts upon the environment.

The appropriate management and reinstatement of excavations in a timely manner will ensure that any adverse effects caused, for example at site entrances or road upgrade locations, are minimised insofar as possible.

The construction methodology has sought to minimise landscape disturbance. All areas affected during construction will be reinstated to their original condition where appropriate to do so or allowed to vegetate naturally. Trees and hedgerow planting, to replace that which may be lost during the construction phase, will be undertaken in accordance with approved landscaping plans and best practice and under the supervision of the ECoW. Overall, there will be no net loss of hedgerow or tree lines as a result of the project. The following standards are widely adopted as representing best practice in landscape operations:-

- *BS 4428:1989 Code of practice for general landscape operations (excluding hard surfaces)*;
- *BS 5837:2012 – Trees in Relation to design, demolition and construction*;
- *BS 8545 Trees: from nursery to independence in the landscape – Recommendations*; and,
- *BS 3936 – Part 1: Nursery stock specification for trees and shrubs*.

4.8 CULTURAL HERITAGE

In advance of construction, and where site conditions are suitable, targeted non-intrusive geophysical survey will be undertaken to further inform archaeological risk assessment within areas of proposed ground disturbance.

Survey methods may include magnetometry and, where appropriate, Ground Penetrating Radar. The suitability and scope of survey will be determined having regard to peat depth, forestry cover, ground conditions and accessibility, and will be agreed in consultation with the National Monuments Service.

Targeted advance archaeological testing shall be undertaken in the vicinity of the junction of the N5 and R293, where temporary junction upgrade works occur in proximity to recorded monuments RO008-023, RO008-023001, RO008-023002 and RO008-065. The extent and location of testing shall be targeted to areas of proposed ground disturbance and informed by the final construction design, existing ground conditions and the results of any preceding non-intrusive survey, where undertaken. Testing shall be carried out under the appropriate statutory license and in consultation with the National Monuments Service.The objectives of advance testing are to:-

- confirm the presence or absence of archaeological remains;
- determine their character, extent and state of preservation;
- inform refinement of mitigation strategy prior to construction; and,
- reduce residual archaeological risk and uncertainty.

Particular attention shall be given to areas where road carriageway widening intersects historic townland boundaries to identify any surviving boundary features of archaeological significance.

Where archaeological remains are identified, appropriate preservation in situ or preservation by record will be agreed in consultation with the National Monuments Service. Where necessary, micro-siting of turbines or associated infrastructure will be employed to avoid previously unidentified archaeological features which may be identified during pre-construction investigations.

All ground disturbance associated with the project shall be subject to archaeological monitoring by a suitably qualified archaeologist under licence issued by the National Monuments Service. This includes works within both previously undisturbed areas and existing road corridors.

Monitoring will apply to all elements of the project involving ground disturbance, including turbine foundation excavations, crane hardstandings, access track construction, approach road widening, drainage infrastructure, borrow pit excavation, peat removal, electricity substation construction, electricity line installation, and all associated works.

Where archaeological features or deposits are identified, works in the immediate area will cease pending consultation with the National Monuments Service. Appropriate mitigation measures will then be implemented, which may include preservation in situ, preservation by record or controlled archaeological excavation.

Archaeological monitoring will:-

- identify previously unrecorded archaeological remains;
- ensure preservation by record where necessary;
- provide a real-time mitigation response in the event of discovery; and,
- ensure compliance with statutory obligations under the National Monuments Acts.

Particular attention shall be given to areas of road carriageway widening, including locations where works intersect historic townland boundaries, to identify and record any surviving boundary features of archaeological significance.

In the event of archaeological features or material being uncovered during the construction phase:-

- all machine work will cease in the immediate area to allow the archaeologist/s time to inspect and record any such material;
- if any features of archaeological potential are discovered during the course of the works further archaeological mitigation may be required, such as preservation in-situ or by record; and,
- any further mitigation will require approval from the National Monuments Service of the Department of Housing, Local Government and Heritage (DoHLGH).

Although no recorded archaeological monuments occur within the direct wind farm footprint, precautionary measures shall be implemented to ensure protection of heritage assets within the wider study area.

These measures include:-

- a programme of detailed measured and photographic recording shall be undertaken in advance of any alteration, removal or modification of the unrecorded stone bridge along the turbine component haul route;
- avoidance of known archaeological constraints through established design layout;
- maintenance of appropriate separation distances during construction activities;
- marking of exclusion zones where required; and,
- contractor awareness briefings regarding heritage protection obligations and legal responsibilities.

4.9 NOISE & VIBRATION

Construction activities will be completed in accordance with the provisions, where relevant, of BS 5228-1 which offers detailed guidance on the control of noise & vibration from demolition and construction activities. The relevant practices to be adopted during construction shall include:-

- Limiting the hours during which site activities likely to create high levels of noise or vibration are permitted;
- Establishing channels of communication between the contractor/developer, the Planning Authority and residents;
- Appointing a site representative responsible for matters relating to noise and vibration;
- Monitoring typical levels of noise and vibration during critical periods and at sensitive locations; and,
- Keeping site access tracks even to mitigate the potential for noise and vibration from HGVs.

Furthermore, a variety of practical noise control measures will be employed. These include:-

- Selection of plant with low inherent potential for generation of noise and/or vibration;
- Placing of noisy/vibratory plant as far away from sensitive properties as permitted by site constraints; and,
- Regular maintenance and servicing of plant items.

The various contractors involved in the construction phase will be obliged, under contract, to take specific noise abatement measures and comply with the recommendations of BS 5228-1. The following list of measures will be implemented, as relevant, to ensure compliance with the relevant construction noise criteria: -

- No plant or machinery will be permitted to cause a public nuisance due to noise;
- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations.
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract;
- Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers;
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use;
- Any plant, such as generators or pumps, which may be required to operate outside of general construction hours will be surrounded by an acoustic enclosure or portable screen;
- During the course of the construction programme, supervision of the works will include ensuring compliance with the limits detailed at **Chapter 12** using methods outlined in BS 5228-1; and,
- The hours of construction activity will be limited to avoid unsociable hours where possible. Construction operations, including the delivery of construction materials, shall be restricted to between 07:00hrs and 19:00hrs Monday to Friday and between 07:00hrs and 13:00hrs on Saturdays, with no operations on Sundays or public holidays. However, to ensure that optimal use is made of good weather periods, at occasional critical periods within the construction programme (i.e. concrete pours, turbine component deliveries and turbine erection) or in the event of an emergency; activities may be necessary outside out of these hours.

The following measures will be implemented, where necessary, to control and mitigate noise emissions associated with blasting operations and the processing of quarried stone:-

- Notification of nearby residents before blasting starts (e.g. 24-hour written notification);
- Carry out blasting using a series of trial blasts, each with progressively increasing charges. Larger charge weights are only to be used if the trial blast shows

acceptable levels of air overpressure;

- If air overpressure from blasting is too high a reduction in the amount of primer cord used, together with the adequate burial of any that is above the ground can greatly reduce;
- Where NSRs are situated close to the blast site and air over pressure levels are cause for complaint, blasting shall be postponed during weather conditions whereby the NSRs are down wind of the blast;
- The firing of blasts at similar times of the day to reduce the 'startle' effect.
- Fit suitably designed muffler or sound reduction equipment to the rock breaking tool to reduce noise without impairing machine efficiency;
- Ensure all air lines are sealed;
- Use a dampened bit to eliminate a 'ringing' sound;
- Erect an acoustic screen between compressors or generators and NSRs. When possible, line of sight between top of machine and NSR will be obscured; and,
- Enclose the breaker or rock drill in portable or fixed acoustic enclosure with suitable ventilation.

No specific mitigation measures are proposed in respect of vibration.

The transmission and magnitude of ground vibrations associated with blasting operations at borrow pits are subject to many complex influences including charge type and position, and importantly, the precise nature of the ground conditions (material composition, compaction, discontinuities) at the source, receiver, and at every point along all potential ground transmission paths. Mitigation of the impacts of these activities is best achieved through on site testing processes, with progressively increased charges, carried out in consultation with the Planning Authority.

4.10 TRANSPORT & ACCESS

In order to ensure the avoidance of significant effects and reduce the predicted magnitude and significance of effects to the greatest possible degree during the construction and decommissioning phases, the following mitigation measures will be implemented:-

- Traffic movements will be limited to 07:00-19:00 Monday to Friday and 07:00–13:00 on Saturdays with no movements on Sundays or public holidays. It may be occasionally necessary to undertake works outside of these hours to avail of favourable weather conditions or during extended concrete pours. Where construction activities are necessary outside of the normal working hours, local residents and the Planning Authority will receive prior notification;
- A designated contact point and coordinator will be put in place to manage all access arrangements and to interface with the public and the respective local authorities;
- All works to the public road shall be undertaken in consultation with, and to the satisfaction of, the Planning Authority. The detailed design process shall also been informed by a further Road Safety Audit to be carried out prior to the commencement of development;
- A Traffic Management Plan shall be agreed as part of the Construction

Environmental Management Plan (CEMP) with the Planning Authority prior to the commencement of development. The Traffic Management Plan shall include *inter alia* confirmed details of construction material haul routes; confirmed details of vehicle specifications; a materials delivery programme; traffic management measures including details of 'Stop/Go' systems, signage, road closures and diversionary routes; and road reinstatement details;

- Traffic restrictions shall be kept to minimum duration and extent;
- Appropriate traffic management; including maintenance of local access, pedestrian access (where safe to do so) and diversions (where required); shall be implemented to facilitate continued public use of roads where temporary traffic restrictions have to be put in place. Precise details of these measures will be detailed in the Traffic Management Plan to be agreed with the Planning Authority prior to the commencement of development;
- The site shall be closed, and strictly secured, to the public during the construction phase;
- All reasonable steps shall be taken to ensure that national and regional routes are used to transport all materials to the site in so far as practicable;
- Prior to, and post, construction; pavement condition surveys will be undertaken along all non-national access routes proposed to be utilised in the delivery of construction materials (other than the locally classed routes at the project site which will be subject to upgrade works). Given the high-quality and well-maintained nature of motorways and national routes, it is not assessed as necessary to carry out surveys of these carriageways or structures. Following the completion of the pre-construction survey, any works which are assessed as necessary to facilitate the delivery of components and materials to the project site shall be undertaken, while any deterioration of carriageways or structures identified in the post-construction survey shall be put right at the expense of the developer and to the satisfaction of the Planning Authority;
- Appropriate and adequate signage shall be provided at entrances providing access, safety and warning information;
- At the site entrances, roadside hedgerows and vegetation shall be trimmed or removed prior to the commencement of construction to ensure that sightlines are provided in advance of the delivery of construction materials;
- Speed limit compliance; particularly along the L5501, L55018 and L5506 and along the route of the underground electricity line; will be emphasised to all staff and contractors prior to the commencement of construction during site induction, and will be strictly enforced throughout the construction phase;
- Sufficient car parking spaces will be available at the temporary construction compounds during the construction phase. Additionally, during construction of the underground electricity line, it is likely that agricultural (or other) premises will be used for the temporary storage of materials (e.g. ducting, cabling, etc.) and for the parking of construction plant, machinery, and work vehicles (cars, vans, etc.). No parking of cars by persons associated with the project will be permitted on any part of the public road that is not closed to traffic. All staff will be instructed to ensure that private entrances remain

unobscured (particularly along the route of the underground electricity line);

- The project will involve the delivery of a number of abnormal and exceptionally abnormal loads to the site due to the size of the delivery/load. It should be noted that abnormal weight loads are not expected to feature as part of the project as maximum axle loadings for abnormal/oversized loads shall be strictly enforced in accordance with the Road Traffic (Construction and Use of Vehicles) Regulations 2003 (S.I. No. 5 of 2003);
- The timing of oversized/abnormal loads shall be agreed with the relevant local authorities and An Garda Síochána, and all relevant licenses and permits shall be obtained in advance. All oversized/abnormal loads shall be accompanied by escort vehicles to ensure the maintenance of public safety;
- Following the installation of the electricity and communications cable ducting, the trench will be backfilled with appropriate material and temporarily reinstated. Following the installation of the underground electricity line and electrical and communications cabling, all public roads within which it is proposed to install the infrastructure will be subject to a full-width carriageway reinstatement (re-surfacing) of the relevant road section. Road reinstatement specifications and methodologies will be agreed with the Planning Authority prior to the commencement of development and as part of the road opening licencing process;
- Dry wheel washing facilities will be provided at site entrances to prevent any debris being transferred from site to the adjacent public roads. All drivers will be required to ensure that their vehicle is free from dirt and stones prior to departure from the project site. Where conditions exist for dust to become friable, techniques such as damping down of the affected areas will be employed and vehicles/loads will be covered to reduce dust emissions;
- Road sweeping, particularly along the route of the underground electricity line, will be carried out as appropriate to ensure construction traffic does not adversely affect road conditions; and,
- Due to the transient nature of the underground electricity line works, rolling road closures will be implemented where the electricity line is to be installed within the carriageway of public roads. Diversions and traffic restrictions shall be kept to minimum duration and extent.

4.11 AVIATION

A minimum of 30-days prior notification will be provided regarding the commencement of crane operations at the project site. Additionally, as is best practice and implemented as standard, warning lights will be fitted to cranes during the installation of the wind turbines.

4.12 RESOURCES & UTILITY INFRASTRUCTURE

Accidental collision with overhead wires and sub-surface cables/pipes will be mitigated through the implementation of good construction practice and procedures.

The sourcing of aggregates locally, and from facilities which have been subject to EIA, will mitigate against the likelihood of significant effects during the construction phase.

Additionally, during the process of connecting the project to the national grid, EirGrid will balance the loading on the network to ensure that no significant disruption occurs, and likely significant effects do not arise.

5.0 IMPLEMENTATION OF ENVIRONMENTAL MANAGEMENT MEASURES

In the first instance, the construction phase of the project shall be undertaken in strict compliance with all measures set out in the EIAR and NIS; unless where revised or where required to be revised in order to ensure compliance which a condition of planning consent. All relevant conditions of consent shall be inserted at **Table 1** below.

Planning Conditions		
Condition No.	**Content**	**Relevance to Construction Phase (Yes/No)**

This CEMP; which will be further developed prior to the commencement of construction; all associated documentation, construction management plans, and construction method statements shall be prepared to ensure strict accordance with each of the measures of the EIAR, NIS, and conditions of consent. As stated at **Section 1.4** above, it will be the responsibility of the EM to ensure coordination between this CEMP, all associated construction management plans & method statements, and the requirements set out in relation to the project.

6.0 COMMUNICATION PLAN

Given the multitude of stakeholders to be involved in the construction phase of the project, a clear and concise communications plan will be implemented to ensure that all matters arising are appropriately reported and recorded. The Communications Plan, which will be developed by the contractor will include a reporting strategy including, but not limited to, the following personnel:-

- Islandmore Wind Farm Limited Project Manager;
- Contractor Project Manager;
- Islandmore Wind Farm Limited Project Supervisor Construction Phase (PSCS);
- Contractor Site Foreman;
- Environmental Manager;
- Ecological Clerk of Works;
- Geotechnical Clerk of Works; and
- Archaeological Clerk of Works.

Additionally, Islandmore Wind Farm Limited shall appoint a designated person who shall be responsible for engaging with members of the local community regarding the provision of project updates, etc., and shall also be responsible for relaying any matters raised to the project team.

A list of project contacts, to be developed prior to the commencement of construction and included within the detailed CEMP, shall be made available to all construction staff while a copy shall also be provided at the site offices.

7.0 STAFF TRAINING & ENVIRONMENTAL AWARENESS

Only staff who have received appropriate training and have the necessary safety training/certification shall be permitted on-site.

All construction phase personnel will receive environmental awareness information as part of their initial site induction. The extent of their induction shall be tailored to the scope of their work; however, as a minimum, all environmental protection matters will be addressed in full. This will ensure that staff are familiar with environmental obligations associated with the construction process and the procedures and measures to be implemented. Staff will also be advised of the likely effects of any non-compliance with the relevant environmental measure.

As described at **Section 1.4**, the EM shall provide regular environmental updates to personnel and shall advise of any improvements which can be implemented.

Tool box talks will be held by the EM, or other relevant personnel at the commencement of each day or at the commencement of new activities. The aims of the tool box talks are to identify the specific work activities that are scheduled for that day or phase of work. In addition, the necessary work method statements will be identified and discussed. Additionally, any non-compliance with a measures in this CEMP will also be discussed with the aim of avoiding a re-occurrence of the same non-compliance.

8.0 EMERGENCY RESPONSE PROCEDURES

Prior to the commencement of construction, the Contractor shall prepare a comprehensive emergency response procedure to be implemented by on-site personnel. This on-site procedure shall be incorporated within the Environmental & Emergency Response Plan to ensure that appropriate procedures are in place to manage any incident and report same to the relevant stakeholders.

9.0 RECORDING & REPORTING

Over the course of the construction phase, a significant volume of reporting will be undertaken to record the activities, methodologies, and measures implemented during the construction phase. With regards to environmental recording, the following is a non-exhaustive list of reports/records which are likely to be appended to the CEMP as the construction phase progresses:-

- Site Sign-In Records;
- Weekly Environmental Reports;
- Monthly Environmental Reports;
- Site Visual Inspection Checklists;
- Environmental Audits;
- Ecological Survey Reports;
- Water Quality Monitoring Reports;
- Archaeological Monitoring Reports;

- Geotechnical Monitoring Reports;
- Traffic Management Plans;
- Waste management documentation;
- All relevant licences, consents, and permits;
- All correspondence (internal and external) regarding environmental matters; and,
- Staff Training Records.

10.0 COMPLIANCE & REVIEW PROCEDURES

10.1 SITE INSPECTIONS & ENVIRONMENTAL AUDITS

Routine inspections of construction activities will be carried out on a daily and weekly basis by the Contractor Project Manager, PSCS, Contractor Site Foreman, EM, and ECoW to ensure all environmental controls, relevant to the construction activities taking place at the time, are in place. Environmental inspections will ensure that the works are undertaken in accordance with this CEMP and all other relevant documentation.

10.2 AUDITING

The contractor will be responsible for ensuring that all construction staff are aware of the requirement to, and understand the importance of, strictly implementing the procedures of the CEMP. Environmental audits will be undertaken during the construction phase of the project. In contrast to monitoring and inspection activities, audits are designed to identify the underlying causes of non-compliances, and not to merely detect the non-compliance itself.

Moreover, audits are the means by which system and performance improvement opportunities may be identified. Environmental audits will be carried out by the contractor or by external personnel acting on their behalf. The impartiality and objectivity of the audit process is crucial in the identification of improvements to the activities being undertaken at the project site. Environmental audits will be scheduled and conducted at regular intervals to determine whether the CEMP is being appropriately implemented. The findings of the audits will be provided to the Islandmore Wind Farm Limited Project Manager, Contractor Project Manager, PSCS, EM, and ECoW.

A sample Environmental Audit is included within the accompanying Environmental & Emergency Response Plan.

10.3 ENVIRONMENTAL COMPLIANCE

As has been set out in the preceding sections, construction activities will be continuously and rigorously assessed to ensure that works are undertaken in accordance with the provisions of the detailed CEMP (to be prepared prior to construction). Where an environmental 'event/occurrence' has been identified, the following definitions shall apply:-

- Near-Miss: An event which has not resulted in an adverse environmental effect but which, if not addressed, could re-occur and result in adverse effects;

- Incident: An event which has occurred and which, if un-controlled, could result in substantial effects; however, on-site measures/procedures avoided such effects;
- Exceedance Event: Where an event has resulted in identifiable adverse effects which exceed the appropriate limit value (e.g. a deterioration of downstream water quality below acceptable limits). An exceedance event usually triggers the cessation of particular activities until an investigation has been completed and additional measures implemented; and,
- Non-Compliance: The identification of an un-agreed deviation from prescribed procedures/measures set out in this CEMP.

10.4 CORRECTIVE ACTIONS

A corrective action relates to the implementation of revised measures/procedures to rectify an identified environmental matter/concern/issue. Corrective actions will be implemented by the Contractor Project Manager, as advised by the PSCS and EM,

Corrective actions may be required as a consequence of:-

- Environmental Audits;
- Environmental Inspections; Environmental Monitoring;
- Environmental Incidents; and,
- Environmental Complaints.

A Corrective Action Notice will be used to communicate the details of the action required. A Corrective Action Notice will describe the cause and effect of the environmental issue/concern and will detail the recommended corrective action to be implemented.

If an environmental matter/concern/issue arises which requires immediate intervention; direct communications between the Contractor Project Manager, PSCS and EM will be conducted. A Corrective Action Notice will be completed subsequently.



GALETECH
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APPENDIX B: FELLING PLAN



LEGEND:

- TURBINE HARDSTANDS
- ACCESS TRACKS
- FORESTRY FELLING AREAS

N

Prepared Using Irish Transverse Mercator (ITM).

Date:	Rev:	Description:	Drawn By:

Prepared By:

GALETECH ENERGY SERVICES

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ISLANDMORE WIND FARM LIMITED

Job Title:

ISLANDMORE WIND FARM

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ANNEX 3.8: FELLING PLAN

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APPENDIX C: SURFACE WATER MANAGEMENT PLAN

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Islandmore Wind Farm

Environmental Impact Assessment Report

Planning-Stage Construction Environmental Management Plan (Surface Water Management Plan)

Islandmore Wind Farm Limited

DOCUMENT CONTROL

Stage	Date	Name
Content	12/10/2026	Simon Carleton
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1.0 INTRODUCTION

Galetech Energy Services (GES), on behalf of Islandmore Wind Farm Limited, has prepared this Surface Water Management Plan (SWMP) for the construction and operational phases of the Islandmore Wind Farm.

1.1 PURPOSE OF THIS REPORT

This SWMP provides the framework for water management at the site of the Islandmore Wind Farm for contractors and incorporates the measures set out in the various environmental assessment documents associated with the development. The purpose of this report is to detail the practical implementation of these measures such that the construction and operational phases do not have an adverse effect on water quality.

This is a live document and will be updated by the appointed contractor prior to the commencement of development. Prior to the commencement of construction, the updated SWMP will be reviewed by the Environmental Manager (EM) and Ecological Clerk of Works (EcoW), as necessary, to confirm the appropriateness of the measures set out therein.

This SWMP aims to:-

- Describe environmental sensitives of the site and any applicable buffer zones;
- Describe how the system will operate to minimise modification and disruption to the existing site hydrology;
- Outline the proposed maintenance regime; and,
- Outline the proposed drainage management post-construction.

1.2 REFERENCE DOCUMENTS

The production of this SWMP has been supported by best practice manuals and will be accounted for in the further development of the appointed contractor's detailed CEMP.

Other documents have been used to develop this SWMP; including a Planning-Stage Construction Environmental Management Plan, Spoil Management Plan, and Environmental & Emergency Response Plan.

1.2.1 Legislative Background

This plan has been prepared in accordance with the following legislation:-

- *S.I. 10 of 1972 Dangerous Substances Act, 1972, as amended*;
- *S.I. No. 293 of 1988 Quality of Salmon Water Regulations*;
- *S.I. No. 249 of 1989 Quality of Surface Water Intended for Abstraction (Drinking Water)*;
- *S.I. No. 94 of 1997 European Communities (Natural Habitats) Regulations*;
- *S.I. No. 41 of 1999 Protection of Groundwater Regulations*;
- *Water Framework Directive (2000/60/EC)*;
- *S.I. No. 600 of 2001 Planning and Development Regulations 2001, as amended;*

- *S.I. No. 722 of 2003 European Communities (Water Policy) Regulations*;
- *S.I. 547 of 2008 European Communities (Environmental Liability) Regulations*;
- *S.I. No. 272 of 2009 European Communities Environmental Objectives (Surface Waters) Regulations*;
- *S.I. No. 9 of 2010 European Communities Environmental Objectives (Groundwater) Regulations 2010*; and,
- *S.I. No. 350 of 2014 European Union (Water Policy) Regulations 2014*.

1.2.2 Construction Industry Research & Information Association (CIRIA) Manuals

- *CIRIA (Construction Industry Research & Information Association) Report C502 Environmental Good Practice on Site*;
- *CIRIA 521 - Sustainable Urban Drainage Systems; Design Manual for Scotland and Northern Ireland*;
- *CIRIA Report C532 Control of Water Pollution from Construction Sites*;
- *CIRIA Report C648 Control of Pollution from Linear Construction Project Technical Guidance*;
- *CIRIA Handbook C650 Environmental good practice on site*;
- *CIRIA Handbook C651 Environmental good practice on site checklist*;
- *CIRIA Report C609 - SuDS - hydraulic, structural & water quality advice*;
- *CIRIA Report C697 - The SuDS Manual*; and,
- *Guidelines on Protection of Fisheries during Construction Work in and Adjacent to Water (Inland Fisheries Ireland, January 2016)*.

2.0 DESCRIPTION OF THE PROJECT

Islandmore Wind Farm Limited intends to construct the Islandmore Wind Farm which will consist of:-

- 10 no. wind turbines, 3 no. with an overall height of 185m and 7 no. with an overall height of 150m;
- All associated and ancillary site development, excavation, construction, landscaping and reinstatement works, including provision of site drainage infrastructure and forestry felling;
- Works to the public road network along the turbine component haul route; and,
- 110kV electricity substation and installation of c. 7km of underground electricity line to facilitate connection of the wind farm to the existing Tonroe 110kV electricity substation at Ballaghaderreen, County Roscommon.

The project is located in north County Roscommon; c. 2km north of Ballaghaderreen, c. 13km east of Charlestown (Co. Mayo) and c. 6km southwest of Gorteen (Co. Sligo); and is located in close proximity to the county boundaries between counties Roscommon, Sligo and Mayo.

As well as the reference documents listed in **Section 1.2**, various environmental reports have been prepared for the project including:-

- Environmental Impact Assessment Report (Galetech Energy Services);
- Biodiversity chapter (Woodrow/APEM Group);
- Land & Soil chapter (Hydro Environmental Services); and,
- Water chapter (Hydro Environmental Services), and,
- Natura Impact Statement (Woodrow/APEM Group).

3.0 DESCRIPTION OF BASELINE ENVIRONMENT

3.1 SITE LOCATION

The project site is located in north County Roscommon, c. 2-kilometres (km) north of Ballaghaderreen (**see Figure 3.1**), c. 13km east of Charlestown (County Mayo) and c. 6km southwest of Gorteen (County Sligo). The wind farm will be located in the townlands of Largan, Islandmore, Boleysillagh, Cloonmeen, Toobrackan, and Tullaghanrock, County Roscommon.

According to the Corine 2018 database, land use at the project site is predominately classed as wetlands, forest and semi-natural areas and agricultural areas (pastures). The wider landscape comprises a mosaic of peat bogs, commercial forestry and agricultural scrub; with pockets of improved agricultural pasture generally limited to areas to the southwest of Ballaghaderreen and west and northwest of the town of Frenchpark.

The N5 national primary route is located c. 500m south of the wind farm site; while the N17 national secondary route, along which turbine components will be transported, is located c. 13km to the west. The project site is crossed by a network of local secondary and tertiary classed roads.

Population density at the project site and in its immediate environs is sparse and settlement patterns largely comprise dispersed rural dwellings often accompanied by agricultural holdings and buildings. The town of Ballaghaderreen, located c. 2km south, is the primary settlement in the environs of the project site.

3.2 TOPOGRAPHY

The project site is located in an upland peatland setting where the topography of the local area is generally undulating and sloping. The central portion of the wind farm site is centred on a hill (c. 180m OD [ordnance datum] elevation), which slopes away to c. 160m OD to the east and west, c. 140m OD to the south and c. 150m OD to the north.

3.3 HYDROLOGICAL ENVIRONMENT

On a regional scale, the project site is mapped within 2 no. WFD Catchments. The northern portion of the project site, including 6 no. turbines (T1–T6), are located in the regional Moy and Killala Bay Catchment (HA: 34) and within the Moy_SC_030 sub catchment.

The southern section of the project site is mapped in the Upper Shannon Catchment (HA: 26B) and within Lung_SC_020 sub catchment.

The underground electricity line is located entirely in the Upper Shannon Catchment and within the Lung_SC_020 sub catchment. The electricity substation location sits on the surface water catchment divide between the two regional catchments, with the

majority of the substation footprint draining south into the Upper Shannon Catchment.

On a more local hydrology scale, the northern portion of the project site (within the Moy regional catchment) is located in the Owengarve River catchment (Owengarve (Sligo)_010 river sub basin). The Owengarve River flows in a north-westerly direction for approximately 25km before entering the River Moy.

The southern portion of the project site (within the regional Upper Shannon Catchment) lies within the Lung River catchment (Lung_050 river sub basin). This portion of the project site is drained by 3 no. tributaries of the Lung River that flow in a southernly direction for c. 2.5 to 3km towards the main channel of the Lung River which flows to the south of the project site.

From this point the Lung River flows northeasterly for approximately 4.5km, where it discharges to the Lough Gara middle lake. Lough Gara comprises 3 no. separate lake waterbodies (upper, middle and lower) that drain in a northerly direction into the Boyle River.

The northern portion of the project site (within the Moy and Killala Bay Catchment) is drained by 3 no. headwater streams of the Owengarve River. These streams merge c. 1km to the northwest of the project site. The most westerly stream (EPA Name: Brogher Stream), which emerges from the Bockagh Hill area to the west of the project site, drains the area of turbine location T6, northern portion of the electricity substation location, along with a large portion of the intact bog located to the northwest of the project site.

The most easterly stream (unnamed by the EPA), which emerges 1km to the east of the project site, flows along the northern boundary of the project site close to the locations of turbines T1 and T2, which drain towards this watercourse via forestry drains and bog drains.

The central stream (EPA Name: Owengarve [Sligo]) emerges within the project site to the south of turbine location T4 and drains the area of turbine locations T3, T4 and T5 and the borrow pit. There is a proposed watercourse crossing on the Owengarve [Sligo] Stream located along the proposed wind farm access road between turbine locations T3 and T4.

The southern portion of the project site (within the Lung River Catchment) is drained by 3 no. headwater streams which flow for c. 2.5-3km south towards the Lung River.

The majority of the southern portion of the project site (including turbine locations T7 to T10 is drained by the central stream (unnamed by the EPA) which emerges less than 0.5km to the east of turbine T9 prior to flowing southerly through the project site.

The western stream emerges approximately 0.2km west and downstream of the electricity substation location (unnamed by the EPA) where it continues to flow south and drains the area of turbine location T10 in the southwestern portion of the project site.

The eastern stream (EPA Name: Tullaghanmore Stream or Monstown Demesne) emerges close to the southeastern boundary of the project site and flows southerly adjacent to local road L5501 where road widening is proposed as part of the haul route works (there is no requirement to alter alignment of this watercourse).

The underground electricity line is located entirely within the Lung River Catchment. The underground electricity line intercepts EPA mapped watercourses at 6 no. locations. 5 no. of these locations are on existing public roads where a culvert or

bridge is present; while the 6th location is an existing crossing/culvert located on a private access track near the Tonroe electricity substation.

Bog drains associated with peat cutting are present across the project site, with the larger of these drains located in the central area of the project site, near turbine T8 and T9.

There are also networks of drains associated with forestry on the northeast and southeast of the project site.

3.4 GEOLOGICAL ENVIRONMENT

Land cover within the project site is predominately a mixture of cutover bogs, intact bogs and small pockets of agricultural fields. All 10 no. wind turbines are located on peat bogs.

The GSI have mapped the bogs as cutover raised bogs but some of the bog areas, particularly the northern portion of the project site, have a more blanket bog appearance. The bog on the southern portion of the project site has a raised bog appearance.

There are also pockets of forestry and semi-natural areas on the northeast and southeast of the project site which are planted-on peat bogs. Pockets of grassland are located in the northwestern parts of the project site.

3.5 FLOOD RISK ASSESSMENT

No recurring flood incidents within the project site, along the underground electricity line or haul route work areas have been identified from OPW's Past Flood Event Mapping.

The closest mapped recurring flooding event to the project site is situated in a low-lying area c.1.5km west of the project site. This mapped recurring flood event is not downstream of the project site and there are no mapped single or recurring flooding events downstream of the project site within a 10km distance.

Identifiable map text on local available historical 6" or 25" mapping for the project site area do not identify any lands that are "liable to flood".

There is no OPW River Flood Extents (CFRAM) Mapping available for the watercourses draining the project site or underground electricity line and therefore the National Indicative Fluvial Mapping was consulted which has mapped fluvial flood zones for watercourses in both the Owengarve River and Lung River catchments.

Based on the National Indicative Fluvial Mapping (NIFM), no 100-year or 1000-year flood zones encroach the project site, underground electricity line or haul route works areas.

There are fluvial flood zones within the Owengarve River catchment c. 1.2km northwest and downstream of the project site. Fluvial flood zones within the Lung River catchment are mapped 0.5km south and downstream of the project site.

All project infrastructure is therefore located above the mapped 1000-year flood level and therefore all infrastructure is located in Flood Zone C (Low Risk).

It is a key design feature of the project to ensure that all surface water runoff is treated (water quality control) and attenuated (water quantity control) prior to diffuse discharge at pre-existing greenfield rates.

3.6 NATURE CONSERVATION SITES

Within the Republic of Ireland, designated sites include National Heritage Areas (NHAs), proposed National Heritage Areas (pNHAs), candidate Special Areas of Conservation (cSAC), Special Areas of Conservation (SAC) and Special Protection Areas (SPAs).

The project site is hydrologically connected to the River Moy SAC (Site Code: 002298). At its closest point, this designated site is located approximately 5.5km to the northwest and downstream of the project site and is hydrologically connected via the Owengarve River which drains the northern portion of the project site.

Lough Gara SPA (Site Code: 004048) and pNHA (Site Code: 000587) are located approximately 6km downstream of the project site and are hydrologically connected via the Lung River which the drains the southern portion of the project site.

Tullaghanrock Bog SAC (Site Code: 002354) and Callow Bog SAC (Site Code: 000595) are located along the banks of the Lung River upstream of Lough Gara and are located c. 1.6km downstream of the project site. Hydrological connectively with the project site and will be limited to surface water flows in the Lung River (i.e. there is no groundwater flow connectivity with the project site and these designated bogs due to large separation distances and dominant surface water drainage regime).

There are also several pNHA designated sites located along the banks of the Owengarve River, approximately 5.5km downstream of the project site. These bogs include Gowlaun Bog pNHA, Tawnaghbeg Bog pNHA, Kilgarriff Bog pNHA, and Derrynabrock Bog pNHA). Hydrological connectively with the project site and these designated bogs will be limited to surface water flows in the Owengarve River (i.e. there is no groundwater flow connectivity with the project site and these designated bogs due to separation distances and the surface water flow regime).

4.0 DRAINAGE SYSTEM

4.1 SUSTAINABLE DRAINAGE SYSTEM

Surface water is a valuable resource and this should be reflected in the way it is managed. The appropriate management of surface water should be considered at the early stages of the project design process. It is important, particularly on large developments such as the Islandmore Wind Farm, that surface water is managed in a fashion which prevents significant alterations to the existing hydrological regime whilst ensuring the appropriate drainage of the site.

The project has been designed to implement a Sustainable Drainage System (SuDS) which seeks to:-

- Minimise any change to the surface water and groundwater conditions within the site;
- Avoid sensitive areas where possible by employing hydrological constraints (i.e. buffer zones);
- Replicate the natural drainage of the site;
- Minimise sediment loads in the runoff, with particular attention being given to the construction phase of the project;

- Maintain runoff rates and volumes at Greenfield rates for a range of storm events (to be incorporated into final detailed design); and,
- Avoid high flow velocities internally within new drain networks and at outfall locations to prevent erosion.

The purpose of a SuDS is:-

- To provide sufficient detail to ensure that water pollution will not occur as a result of construction and operational activities at the site and to minimise the risk of any such occurrence;
- To regulate the rate of surface water run-off downslope to prevent scouring and to encourage settlement of sediment locally; and,
- To minimise the quantity of sediment laden stormwater and resulting settlement pond sizes by separating 'clean' water from the 'dirty' development runoff.

4.1.1 SuDS Design

The overarching objective of the SuDS design is to ensure that all surface water runoff is comprehensively attenuated such that no silt or sediment laden waters or deleterious material is discharged into the local drainage system. While the SuDS is, overall, an amalgamation of a suite of drainage infrastructure; the objectives are straightforward. In summary:-

- Clean water drains will be installed upslope of the works area to intercept clean surface water to prevent it becoming contaminated by silt/sediment from construction activities;
- All surface water runoff from construction works areas will be directed to specially constructed downslope dirty-water swales surrounding all areas of ground proposed to be disturbed (including areas for the temporary storage of material);
- The swales will direct runoff into settlement ponds/silt traps where silt/sediment will be allowed to settle; and,
- Following treatment and the settlement of silt/sediment, clean water will be discharged indirectly to the local drainage network via buffered outfalls thus ensuring that no scouring occurs.

The design criteria for the SuDS is as follows:-

- To minimise alterations to the ambient site hydrology and hydrogeology;
- To provide settlement and treatment controls as close to the site footprint as possible and to replicate, where possible, the existing hydrological environment of the site;
- To minimise sediment loads resulting from the development runoff during the construction phase;
- To preserve greenfield runoff rates and volumes;
- To strictly control all surface water runoff such that no silt or other pollutants shall enter watercourses and that no artificially elevated levels of downstream siltation or no plumes of silt arise when substratum is disturbed;

- To provide appropriate retention times such that and no flooding will occur in the vicinity of the project site which may cause a hazard;
- To provide settlement ponds to encourage sedimentation and storm water runoff settlement;
- To reduce stormwater runoff velocities throughout the site to prevent scouring and encourage settlement of sediment locally;
- To manage erosion and allow for the effective revegetation of bare surfaces;
- To ensure that oils, fuels and other contaminants are stored appropriately and bunded to prevent any discharge of such materials. The temporary construction compounds, where such oils and fuels will be stored, shall incorporate an oil/petrol interceptor within its drainage system. Similarly, an oil/petrol interceptor shall be installed at the proposed electricity substation;
- Additional drainage measures will only be added as necessary. The dimensions of these features will avoid intercepting large volumes of water;
- Storm water runoff from hardstandings and access tracks will be managed via filter drains consisting of swales and settlement ponds. Access tracks and hardstandings will crossfall downslope to mimic the natural drainage patterns of the site;
- Temporary erosion protection together with silt fences may be required until the vegetation becomes established (coir matting or similar);
- Access tracks and hardstandings will be constructed from aggregate and will not be surfaced with bitumen materials, thus helping to reduce runoff volumes.
- An additional allowance has/will be included to take account for global warming;
- The stone used for the construction of the check dams will be washed graded stone with a size range between approximately 5mm and 40mm;
- Under track drainage will be provided with associated sumps and silt fences. The under track drainage will provide a means for flows to pass from a swale on the uphill side of the slope to the downhill side of the slope.
- A sump may be required to collect dewaterings from excavations for turbine foundations; water will subsequently be pumped into the settlement pond system and allowed to settle prior to discharging into the swales;
- All swales and ponds will be kept as shallow as possible so that they do not pose any health and safety risk to plant or personnel;
- Field drains/forestry will be piped directly under access tracks through appropriately sized drainage pipes;
- The Office of Public Works (OPW) will be consulted on all stream crossings through the applications for Section 50 consent, prior to works commencing. The design of these crossings follow guidance from Inland Fisheries Ireland;
- Appropriate site management measures will be taken such that runoff from the construction site is not contaminated by fuel or lubricant spillages;
- There will be no discharge of sewage effluent or contaminated drainage into any watercourse system or ditch; and,

- The drainage system will be monitored regularly during the construction phase for effectiveness, and cleaned or unblocked if necessary.

4.1.2 SuDS Design Philosophy

The SuDS design principles are as follows:-

Minimise →	Intercept →	Treat →	Disperse →	Dilute

Minimise

The main principle of this SuDS design is to minimise the volume of 'dirty' water requiring treatment through means of informed, integrated and sustainable drainage design. This is achieved by keeping 'clean' water clean by interception and separation, and by collecting the 'dirty' water and treating it by removing the suspended sediments. The resultant outflow is dispersed across vegetation and will become diluted through contact with the clean water runoff before entering the natural drainage system.

Intercept

The key silt/sediment control measure is the separation of construction runoff from the clean water runoff that arises in the undisturbed areas of the project site and surrounding lands. This significantly reduces the volume, and velocity, of dirty water that the control measures are required to manage. To achieve separation, clean water infiltration interception drains are positioned on the upslope and dirty water swales/drains positioned along the verge, with site surfaces sloped towards dirty water swales/drains. The remainder of this clean water will be regularly piped under both the access tracks and dirty water swales/drains to prevent contamination. This process allow for the mimicking the paths which clean water would have taken in the absence of the project.

Treat, Disperse, & Dilute

'Dirty water' swales/drains collect all incident rainwater that falls on the development infrastructure and drain into the silt traps/ponds. Following a period of attenuation, during which time all suspended solids will have 'fallen', the treated water is dispersed through buffered outfalls to prevent erosion.

4.2 Design Measures

4.2.1 Planning-Stage Design of Surface Water Management System

A planning-stage drainage/surface water management system has been designed by Jennings O'Donovan & Partners, enclosed at **Annex 1** hereto, and includes preliminary specifications for surface water management infrastructure particularly in relation to the appropriate sizing of silt/settlement ponds. Details of the sizing of each silt/settlement pond, which have been informed by rainfall data for the project site, are provided at **Table 1** below.

Pond Reference (SP)	Drainage Area (m^2)	Length (m)	Width (m)	Depth (m)	Overall Volume of Silt Pond (m^3)
1	6,153	16	9	1.2	172.8

2	4,295	14	7	1.2	117.6
3	7,212	18	9	1.2	194.4
4	2,193	15	4	1	60
5	6,987	19	10	1	190
6	4,014	18	6	1	108
7	1,819	10	5	1	50
8	N/A	N/A	N/A	N/A	N/A
9	1,217	13	2	1	26
10	N/A	N/A	N/A	N/A	N/A
11	4,105	14	8	1	112
12	1,265	11.5	3	1	34.5
13	955	7	4.5	1	31.5
14	4,718	20	6.5	1	130
15	2,419	14	5	1	70
16	2,712	12.5	6	1	75
17	3,474	16	6	1	96
18	2,776	14	5.5	1	77
19	957	25	12	1	300
20	1,863	13	4	1	52
21	4,063	16	7	1	112
22	4,443	19	6.5	1	123.5
23	3,345	15.5	6	1	93
24	4,664	16	8	1	128
25	3,059	17	5	1	85
26	328	13	7	1	91
27	1,146	7	4.5	1	31.5
28	5,163	19	7.5	1	142.5

Table 1: Silt/Settlement Pond Specifications

Prior to the commencement of development, the appointed Contractor; in conjunction with the project design team, EM, and ECoW; shall prepare a detailed SWMP which shall detail the precise specifications and locations of all surface water management infrastructure to be installed.

5.0 CONSTRUCTION PHASE MEASURES

In the first instance, the project seeks to avoid adverse effects on surface water through avoidance. In particular, the project has sought to avoid direct interactions with watercourses; through minimising the number of watercourse crossings and the implementation of a 50m buffer zone around natural watercourses. The design of the project has, where possible, sought to avoid this buffer area.

Best practice measures are also proposed to minimise impacts to water quality, as follows:-.

- All site personnel will be made aware of their environmental responsibilities at the site;

- Contractors will be required to include contingency plans to deal with spillages, should they occur;
- Land disturbance will be kept to minimum and disturbed areas will be stabilised as soon as possible;
- In principle, soil excavation should be undertaken during dry periods, whenever possible;
- Site visits by a Design Engineer will be undertaken at various stages of the construction process to ensure that the SuDS scheme is being constructed and implemented appropriately; and,
- In order to verify the efficacy of pollution prevention works during construction, water quality monitoring will be undertaken by a suitably qualified EM, prior to, during and post completion of construction works. This will include all watercourses within the catchment of the construction area. The monitoring will comprise visual and hydrochemistry monitoring, as described in detail in the Water Quality Monitoring Plan.

Finally, all mitigation measures proposed in the Water chapter of the EIAR will be implemented in full, as set out in the following sections.

5.1 Clear Felling and Surface Water Quality Effects

5.1.1 Avoidance

There is a requirement in the *Forest Service Code of Practice* and in the *FSC Certification Standard* for the installation of buffer zones adjacent to aquatic zones at planting stage. Minimum buffer zone widths recommended in the Forest Service (2000) guidance document *Forestry and Water Quality Guidelines* are detailed at **Table 2**.

Average slope leading to the aquatic zone		Buffer zone width on either side of the aquatic zone	Buffer zone width for highly erodible soils
Moderate	(0–15%)	10m	15m
Steep	(15–30%)	15m	20m
Very steep	(>30%)	20m	25m

Table 2: Minimum Buffer Zone Widths (Forest Service, 2000)

A total of 6.5ha of forestry will be permanently felled to accommodate the construction and operation of the project.

During the construction phase, a self-imposed conservative buffer zone of 50m will be maintained for all streams. Only approximately 0.8ha of the total 6.5ha proposed for felling is located inside a 50m watercourse buffer zone. The large distance between the majority of the felling areas and sensitive aquatic zones means that any poor quality runoff arising from felling areas can be adequately managed and attenuated prior to reaching the aquatic buffer zone and primary drainage routes. Where tree felling is required in the vicinity of streams, the additional mitigation measures outlined below will be employed.

5.1.2 Design

Mitigation measures which will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses comprise best practice methods, as follows:-

- Machine combinations (i.e. handheld or mechanical) will be chosen which are most suitable for ground conditions and which will minimise soils disturbance;
- Checking and maintenance of tracks and culverts will be ongoing through any felling operation. No tracking of vehicles through watercourses will occur. Where possible, existing drains will not be disturbed during felling works;
- Ditches which drain from the areas to be felled towards existing surface watercourses will be blocked, and temporary silt traps will be constructed. No direct discharge of such ditches to watercourses will occur. Drains and sediment traps will be installed during ground preparation. Collector drains will be excavated at an acute angle to the contour (c. 0.3%-3% gradient), to minimise flow velocities. Main drains to take the discharge from collector drains will include water drops and rock armour, as required, where there are steep gradients and avoid being placed at right angles to the contour;
- Sediment traps will be sited in drains downstream of felling areas. Machine access will be maintained to enable the accumulated sediment to be excavated. Sediment will be carefully disposed of in the spoil deposition areas. All new silt traps will be constructed on even ground and not on sloping ground;
- In areas particularly sensitive to erosion or where felling inside the 50m buffer is required, it will be necessary to install double or triple sediment traps;
- All drainage channels will taper out before entering the 50m buffer zone. This ensures that discharged water gently fans out over the buffer zone before entering the aquatic zone, with sediment filtered out from the flow by ground vegetation within the zone. On erodible soils, silt traps will be installed at the end of the drainage channels;
- Drains and silt traps will be maintained throughout all felling works, ensuring that they are clear of sediment build-up and are not severely eroded. Correct drain alignment, spacing and depth will ensure that erosion and sediment build-up are minimised and controlled;
- Brash mats will be used to support vehicles on soft ground, reducing topsoil and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal will take place before they become heavily used and worn. Provision will be made for brash mats along all off-road (track) routes, to protect the soil from compaction and rutting. Where there is risk of severe erosion occurring, extraction will be suspended during periods of high rainfall;
- Timber will be stacked in dry areas, and outside the 50m watercourse buffer. Straw bales and check dams will be emplaced on the down gradient side of timber storage/processing sites;
- Works will be carried out during periods of no, or low, rainfall in order to minimise entrainment of exposed sediment in surface water run-off;
- Checking and maintenance of tracks and culverts will be ongoing through the felling operation;
- Refuelling or maintenance of machinery will not occur within 100m of a watercourse. Mobile bowser, drip kits and qualified personnel will be used where refuelling is required;

- A permit to refuel system will be adopted:
- Branches, logs or debris will not be allowed to build up in the 50m buffer. All such material will be removed when harvesting operations have been completed, but care will be taken to avoid removing natural debris deflectors;
- Trees will be cut manually from along streams and using machinery to extract whole trees; and,
- Travel will only be permitted perpendicular to and away from surface water features.

Silt Traps

Silt traps will be strategically placed down-gradient within forestry drains near streams. The main purpose of the silt traps is to slow water flow, increase residence time and allow settling of silt in a controlled manner.

Drain Inspection and Maintenance

The following items will be carried out during pre-felling inspections and regularly thereafter:-

- Communication with tree felling operatives in advance to determine whether any areas have been reported where there is unusual waterlogging or bogging of machines;
- Inspection of all areas reported as having unusual ground conditions;
- Inspection of main drainage ditches and outfalls. During pre-felling inspections, the main drainage ditches will be identified. Where possible, the pre-felling inspection will be carried out during rainfall;
- Following tree felling, all main drains will be inspected to ensure that they are functioning;
- Extraction tracks within 10m of drains will be broken up and diversion channels created to ensure that water in the tracks spreads out over the adjoining ground;
- Culverts on drains exiting the site, if impeded by silt or debris, will be unblocked; and,
- All accumulated silt will be removed from drains, culverts and silt traps, and this removed material will be deposited away from watercourses to ensure that it will not be carried back into the trap or stream during subsequent rainfall.

Surface Water Quality Monitoring

Sampling will be completed before, during (if the operation is conducted over a protracted time) and after the felling activity. The 'before' sampling will be conducted within 4-weeks of the felling activity commencing, preferably in medium-to-high water flow conditions. The 'during' sampling will be undertaken once a week or after rainfall events. The 'after' sampling will comprise as many samplings as necessary to demonstrate that water quality has returned to pre-activity status (i.e. where an impact has been shown).

Also, daily surface water monitoring forms (for visual inspections and field chemistry measurements) will also be utilised at every works site near any watercourse. These will be populated daily and kept on site for record and inspection.

5.2 EARTHWORKS (REMOVAL OF VEGETATION COVER, EXCAVATIONS AND STOCK PILING) RESULTING IN SUSPENDED SOLIDS ENTRAINMENT IN SURFACE WATER

The key mitigation measure during the construction phase is the avoidance of sensitive aquatic areas by using a 50m buffer.

The following section details the measures which will be put in place during the construction phase to ensure that surface water features are protected from the release of silt or sediment and to ensure that all surface water runoff is fully treated and attenuated to avoid the discharge of dirty water.

- Source controls to limit the likelihood for 'dirty water' to occur:-
  - Interceptor drains, vee-drains, diversion drains, flume pipes, erosion and velocity control measures such as use of sand bags, oyster bags filled with clean washed gravel, filter fabrics, and other similar/equivalent or appropriate systems; and,
  - Small working areas, covering stockpiles, weathering off stockpiles, cessation of works in certain areas or other similar/equivalent or appropriate measures.
- In-Line controls to ensure appropriate management of silt laden water:-
  - Interceptor drains, vee-drains, oversized swales, erosion and velocity control measures such as check dams, sand bags, oyster bags, straw bales, flow limiters, weirs, baffles, silt bags, silt fences, sedimats, filter fabrics, and collection sumps, temporary sumps/attenuation lagoons, sediment traps, pumping systems, settlement ponds, temporary pumping chambers, or other similar/equivalent or appropriate systems.
- Treatment systems to fully attenuate silt laden waters prior to discharge:-
  - Temporary sumps and attenuation ponds, temporary storage lagoons, sediment traps, and settlement ponds, and proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems.

It should be noted for this site that an extensive network of land, bog and forestry drains already exists and these will be integrated and enhanced as required and used within the wind farm drainage system. The integration of existing land drainage networks and wind farm networks is common practice in wind energy developments and will also result in benefits to surrounding lands.

The main elements of interaction with existing drains will be as follows:-

- Apart from interceptor drains, which will convey clean runoff water to the downstream drainage system, there will be no direct discharge (without treatment for sediment reduction and attenuation for flow management) of runoff from the wind farm drainage into the existing site drainage network. This will reduce the likelihood of any increased risk of downstream flooding or sediment transport/erosion;
- Silt traps will be placed in the existing drains upstream of any streams where construction works is taking place, and these will be diverted into proposed interceptor drains, or culverted under/across the works area; and,

- Buffered outfalls, which will be numerous over the site, will promote percolation of drainage waters across vegetation and close to the point at which the additional runoff is generated, rather than direct discharge to the existing drains of the site.

Pre-Commencement Temporary Drainage Works

Prior to the commencement of haul route upgrades, access tracks, crane hardstandings and turbine foundations, the following key temporary drainage measures will be installed:-

- All existing dry bog, forestry or agricultural drains that intercept the proposed works area will be temporarily blocked down-gradient of the works using check dams/silt traps;
- Clean water interceptor drains will be installed upgradient of the works areas;
- Check dams/silt fence arrangements (silt traps) will be placed in all existing drains that have surface water flows and also along existing roadside drains; and,
- A double silt fence perimeter will be placed down-slope of works areas that are located inside the watercourse 50m buffer zone.

Water Treatment Train

While the proposed drainage plan is assessed as providing a sufficient level of protection to avoid any deterioration in downstream water quality; a temporary final line of defence can be provided by a water treatment train (i.e. sequence of water treatment processes), if required. If the discharge water from construction areas fails to be of a high quality, then a filtration treatment system (such as a 'Siltbuster' or similar equivalent treatment train) will be used to filter and treat all surface discharge water collected in the dirty water drainage system. This water treatment train will apply for the entirety of the construction phase.

Silt Fences

Silt fences will be emplaced within drains down-gradient of all construction areas. Silt fences are effective at removing heavy settleable solids. This will act to prevent entry to watercourses of sand and gravel sized sediment, released from excavation of mineral sub-soils of glacial and glacio-fluvial origin, and entrained in surface water runoff. Inspection and maintenance of these of these structures during construction phase is critical to their functioning to stated purpose. They will remain in place throughout the entire construction phase. Double silt fences will be emplaced within drains down-gradient of all construction areas inside the hydrological buffer zones to provide an additional layer of protection in these areas.

Silt Bags

Silt bags will be used where small to medium volumes of water need to be pumped from excavations. As water is pumped through the bag, most of the sediment is retained by the geotextile fabric allowing filtered water to pass through. Silt bags will be used with natural vegetation filters or sedimats (sediment entrapment mats, consisting of coir or jute matting) placed at the silt bag location to provide further treatment of the water outfall from the silt bag. Sedimats will be secured to the ground surface using stakes/pegs. The sedimat will extend to the full width of the outfall to

ensure all water passes through this additional treatment measure.

Management of Runoff from Peat/Spoil Deposition Areas

It is proposed that excavated peat/overburden/spoil will be utilised for reinstatement of excavated areas etc. and for landscaping purposes. Excess material, or material which is unsuitable for this purpose, will be stored, permanently, at dedicated peat/spoil deposition areas and in the 1 no. spent borrow pit.

During the initial placement of peat/spoil in the deposition areas, silt fences, straw bales and biodegradable matting will be used to control surface water runoff. Drainage from overburden deposition areas will ultimately be routed to an oversized swale and a number of silt/settlement ponds with appropriate storage and settlement capacity, designed for a '1-in-100 year 6-hour return' period, before being discharged.

Spoil deposition areas will be sealed with a digger bucket and allowed to vegetate naturally or may be reseeded subject to the advice of the ECoW. Once re-vegetated and stabilised, spoil deposition areas will no longer be a likely source of silt laden runoff. Surface water protection infrastructure will be left in place until the areas have stabilised.

Underground Electricity Line Installation Works

Mitigation measures which are outlined below will be implemented to ensure that silt laden or contaminated surface water runoff from the trenching work does not discharge directly to the water:-

- All existing dry drains that intercept the works area will be temporarily blocked down-gradient of the works using temporary check dams/silt traps (e.g. straw bales);
- Clean water diversion drains will be installed upgradient of the works areas, as required;
- Check dams/silt fence arrangements (silt traps or straw bales) will be placed in all existing drains that have surface water flows and also along existing roadside drains; and,
- A double silt fence perimeter will be placed down-slope of works areas that are located inside the watercourse 50m buffer zones such as at watercourse crossing locations.

Specific mitigation measures relating to the directional drilling at the crossing location are detailed below.

Directional Drilling

The following mitigation will be carried out during directional drilling works:-

- Firstly, the crossing works area will be clearly marked out with fencing or flagging tape to avoid unnecessary disturbance of vegetation;
- A minimum 10 metre vegetative buffer zone will be maintained (if present) between disturbed areas and the watercourse bank. There will be no storage of material/equipment, excavated material (see below) or overnight parking of machinery inside the 10m buffer zone;
- Double silt fencing will be placed upslope of the buffer zone on each side of the watercourse.

- Mats will be used underneath the excavator, inside the 10 metre vegetative buffer zone, to prevent soil erosion/rutting and potential surface water quality impacts from localised surface water runoff;
- Temporary storage of excavated material will be undertaken outside of the 10m buffer on flat ground or within a local hollow area. A containment berm will be placed downslope of the excavated material which in turn will be surrounded by secondary silt fence protection to prevent saturated soil from flowing back into the watercourse;
- Operation of machinery and use of equipment within the 10m buffer will be kept to a minimum to avoid any unnecessary disturbance;
- There will be no refuelling allowed within 100m of the watercourse crossing;
- All plant will be checked for purpose of use prior to mobilisation at the watercourse crossing; and,
- Works shall not take place during periods of heavy rainfall and will be scaled back or suspended if heavy rain is forecasted.

Mitigation measures relating to the use of a mixture of a natural, inert and fully biodegradable drilling fluid such as Clear Bore™ and water for directional drilling include:-

- The area around the Clear Bore™ batching, pumping and recycling plants will be bunded using terram and sandbags in order to contain any spillages;
- Silt fences will be placed between the works area and adjacent rivers and streams on both banks;
- Accidental spillage of fluids will be cleaned up immediately and transported off site for disposal at a licensed facility; and,
- Adequately sized skips will be used for temporary storage of drilling arisings during directional drilling works. This will ensure containment of drilling arisings and drilling flush.

A Fracture Blow-out (Frac-out) Prevention and Contingency Plan will be prepared by the drilling contractor prior to construction and will include the following measures:-

- The drilling fluid/bentonite will be non-toxic and naturally biodegradable (i.e., Clear Bore Drilling Fluid or similar will be used);
- The area around the drilling fluid batching, pumping and recycling plants will be bunded using terram and/or sandbags to contain any potential spillage;
- A double row of silt fencing will be placed between the works area and the adjacent river;
- Spills of drilling fluid will be cleaned up immediately and transported off-site for disposal at a licensed facility;
- Adequately sized skips will be used where temporary storage of arisings are required;
- The drilling process/pressure will be constantly monitored to detect any possible leaks or breakouts into the surrounding geology or local watercourse;

- This will be gauged by observation and by monitoring the pumping rates and pressures. If any signs of breakout occur then drilling will be immediately stopped;
- Any frac-out material will be contained and removed off-site;
- The drilling location will be reviewed, before re-commencing with a higher viscosity drilling fluid mix; and,
- If the risk of further frac-out is high, a new drilling alignment will be sought at the crossing location.

Pre-emptive Site Drainage Management

The works programme for the initial construction stage of the project will also take account of weather forecasts, and predicted rainfall in particular. Large excavations and movements of peat/subsoil or vegetation stripping will be suspended or scaled back if prolonged or intense rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

The following forecasting systems are available and will be used on a daily basis at the site to direct proposed construction activities:-

- General Forecasts: Available on a national, regional and county level from the Met Eireann website (www.met.ie/forecasts). These provide general information on weather patterns including rainfall, wind speed and direction but do not provide any quantitative rainfall estimates;
- Meteo Alarm: Alerts to the possible occurrence of severe weather for the next 2-days. Less useful than general forecasts as only available on a provincial scale;
- 3-hour Rainfall Maps: Forecast quantitative rainfall amounts for the next 3-hours but does not account for possible heavy localised events;
- Rainfall Radar Images: Images covering the entire country are freely available from the Met Eireann website (www.met.ie/latest/rainfall_radar.asp). The images are a composite of radar data from Shannon and Dublin airports and give a picture of current rainfall extent and intensity. Images show a quantitative measure of recent rainfall. A 3-hour record is given and is updated every 15-minutes. Radar images are not predictive; and,
- Consultancy Service: Met Eireann provide a 24-hour telephone consultancy service. The forecaster will provide interpretation of weather data and give the best available forecast for the area of interest.

The use of safe threshold rainfall values will allow work to be safely controlled (from a water quality perspective) in the event of an impending high rainfall intensity event.

Works will be suspended if forecasting suggests either of the following is likely to occur:-

- >10 mm/hr (i.e. high intensity local rainfall events);
- >25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or,
- >half monthly average rainfall in any 7 days.

Prior to works being suspended the following control measures will be completed:-

- Secure all open excavations;
- Provide temporary or emergency drainage to prevent back-up of surface

runoff; and,

- Avoid working during heavy rainfall and for up to 24-hours after heavy events to ensure drainage systems are not overloaded.

Timing of Site Construction Works

The construction of the site drainage system will be carried out, at the respective locations, prior to other activities being commenced. The construction of the drainage system will only be carried out during periods of, where possible, no rainfall, therefore avoiding runoff. This will avoid the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses. Construction of the drainage system during this period will also ensure that attenuation features associated with the drainage system will be in place and functional for all subsequent construction works.

5.3 Excavation Dewatering and Effects on Surface Water Quality

The management of excavation dewatering (pumping), particularly in relation to any accumulation of water in foundations or cabling and electricity line trenches, and subsequent treatment prior to discharge into the drainage network will be undertaken as follows:-

- Appropriate interceptor drainage, to prevent upslope surface runoff from entering excavations, will be put in place;
- The interceptor drainage will be discharged to the site constructed drainage system or onto natural vegetated surfaces and not directly to surface waters to ensure that greenfield runoff rates are mimicked;
- If required, pumping of excavation inflows will prevent build-up of water in the excavation;
- All pumped water volumes will be discharged to the surface water management system adjacent to excavation areas, or via specialist treatment systems such as a Siltbuster unit;
- There will be no direct discharge to surface watercourses, and therefore no risk of hydraulic loading or contamination will occur;
- Daily monitoring of wind farm excavations by the Environmental Manager will occur during the construction phase. If high levels of seepage inflow occur, excavation work at this location will cease immediately and a geotechnical assessment undertaken; and,
- A mobile 'Siltbuster' or similar equivalent specialist treatment system will be available on-site for emergencies. Siltbusters are mobile silt traps that can remove fine particles from water using a proven technology and hydraulic design in a rugged unit. The mobile units are specifically designed for use on construction-sites. They will be used as final line of defence if required.

5.4 Release of Hydrocarbons during Construction and Storage

Measures proposed to avoid release of hydrocarbons at the site are as follows:-

- The volume of fuels or oils stored on site will be minimised. All fuel and oil will be stored in an appropriately bunded area within the temporary construction compounds. Only an appropriate volume of fuel will be stored at any given time. The bunded area will be roofed to avoid the ingress of rainfall and will

be fitted with a storm drainage system and an appropriate oil interceptor;

- All bunded areas will have 110% capacity of the volume to be stored;
- On site refuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled at the temporary compound and will be towed around the site by a 4x4 jeep to where plant and machinery is located. No refuelling will be permitted at works locations within the 50m hydrological buffer. The 4x4 jeep will also be fully stocked with fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations to avoid any accidental leakages;
- All plant and machinery used during construction will be regularly inspected for leaks and fitness for purpose;
- Spill kits will be readily available to deal with and accidental spillages;
- All waste tar material arising from road cuttings (from trenching or other works in public roads) will be removed off-site and taken to a licensed waste facility. Due to the potential for contamination of soils and subsoils, it is not proposed to utilise this material for any reinstatement works or for storage within the spoil deposition areas; and,
- An outline emergency plan for the construction phase to deal with accidental spillages is contained within the Planning-Stage CEMP. This emergency plan will be further developed prior to the commencement of development, and will be agreed with the Planning Authority as part of the detailed CEMP.

5.5 Groundwater and Surface Water Contamination from Wastewater Disposal

Measures to avoid contamination of ground and surface waters by wastewaters will comprise:-

- Self-contained port-a-loos (chemical toilets) with an integrated waste holding tank will be installed at the site compound, maintained by the providing contractor, and removed from site on completion of the construction works;
- Water supply for the site office and other sanitation will be brought to site and removed after use to be discharged at a suitable off-site treatment location; and,
- No water will be sourced on the site, nor will any wastewater be discharged to the site.

5.6 Release of Cement-Based Products

The following measures are proposed to ensure that the release of cement-based products is avoided:-

- No batching of wet-cement products will occur on site. Ready-mixed concrete will be brought to site as required and, where possible, emplacement of pre-cast products will be utilised;
- All watercourse crossings will utilise pre-cast products and the use of wet-cement products within the hydrological buffer will be avoided

- Where concrete is delivered on site, only the chute will be cleaned, using the smallest volume of water practicable. Chute cleaning will be undertaken at lined cement washout ponds with waters being stored in the temporary construction compounds, removed off site and disposed of at an approved licensed facility. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed;
- Weather forecasting will be used to ensure that prolonged or intense rainfall is not predicted during concrete pouring activities; and,
- The concrete pour sites will be kept free of standing water and plastic covers will be ready in case of sudden rainfall event.

5.7 MORPHOLOGICAL CHANGES TO SURFACE WATER COURSES & DRAINAGE PATTERNS

The following measures are will be implemented:-

- The 2 no. proposed new stream crossings will be clear span bridges (bottomless culverts) and the stream beds will remain undisturbed. No in-stream excavation works at the crossing locations are proposed and therefore there will be no impact on the stream at the proposed crossing location;
- Wind farm electrical cabling or the underground electricity line cabling will be installed either above or below an existing culvert and will not directly interfere with the culvert;
- At the time of construction, all guidance/best practice requirements of the Office of Public Works (OPW) or Inland Fisheries Ireland will be incorporated into the design/construction of the proposed watercourse/culvert crossings;
- As a further precaution, in-stream construction work (if/where required) will only be carried out during the period permitted by Inland Fisheries Ireland for in-stream works according to *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (2016)* (i.e., July to September inclusive). This time period coincides with the period of lowest expected rainfall, and therefore minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses (any deviation from this will be done in discussion with the IFI);
- During the near stream construction works (i.e. within the 50m buffer zone), double row silt fences will be emplaced immediately down-gradient of the construction area for the duration of the construction phase;
- The 2 no. new watercourse crossings at the wind farm site will require a Section 50 license application to the OPW in accordance with the Arterial Drainage Act 1945. The river/stream crossings will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent; and,
- No instream works are proposed at the underground electricity line watercourse crossings, with all crossings being carried out via HDD.

6.0 OPERATION PHASE MEASURES

Following the completion of construction, the generation of 'dirty' water runoff will be significantly diminished. It is important to reiterate that areas of hardstanding will be

impermeable and the majority of incident rainfall will percolate naturally to ground.

Infiltration interceptor drains will be retained for the duration of the project to ensure that up-slope ('clean') runoff is directed away from site infrastructure and managed in an appropriate manner.

Swales, check dams and settlement/silt ponds (i.e. for the management of 'dirty' water) shall be retained for the duration of the project. The swales, having become vegetated, and check dams will act as a filtration feature for the low volume of surface water runoff arising and provide primary treatment and attenuation for runoff.

The following measures will also be implemented.

6.1 Replacement of Natural Surfaces

The operational phase drainage system of the project is described below:-

- Interceptor drains will be installed up-gradient of all infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. It will then be directed to areas where it can be re-distributed over the ground by means of a level spreader;
- Swales/track side drains will be used to collect runoff from access tracks, crane hardstanding areas and substation compound areas which may contain entrained suspended sediment, and channel it to settlement ponds for sediment settling;
- Transverse drains ('grips') will be constructed, where appropriate, in the surface layer of access tracks to divert any runoff into swales/track side drains;
- Check dams will be used along sections of access tracks drains to intercept silts at source. Check dams will be constructed from a 40mm non-friable crushed rock or similar;
- Swales and check dams will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to watercourses; and,
- Settlement ponds will be designed in accordance the greenfield runoff rate requirements; and,
- Imported rock for construction purposes and road surfacing will be strong, well-graded limestone which will be resistant to erosion and have a low likelihood to generate fines in hardstand runoff.

6.2 Hydrocarbons Spillages/Leakages

Measures relating to oils and fuels are as follows:-

- All storage containers will be labelled appropriately, including hazardous markings;
- Fuels stored on site will be minimised. Any storage areas will be bunded appropriately for the fuel storage volume for the time period of the construction;
- The substation transformer and oil storage tanks will be located in a concrete bund, impervious to rainwater ingress, capable of holding 110% of the stored

oil volume;

- Bunds will be to standard specified in CIRIA Report 163 'Construction of bunds for oil storage tanks' and CIRIA Report C535 'Above-ground proprietary prefabricated oil storage tank systems;
- Barrels and bunded containers will be stored upright and internally where appropriate and always on drip trays or sump pallets;
- Appropriate spill kits will be available at all storage locations;
- Turbine transformers will be located within the turbines, and any leaks will be fully contained within the turbine thus eliminating any pathway for leakages to affect land and soil.
- Maintenance vehicles will be regularly inspected for leaks and fitness for purpose;
- All fuel/chemical storage facilities will be subject to weekly inspection; and,
- An emergency plan for the operational phase to deal with accidental spillages will be contained within Environmental Management Plan. Spill kits will be available to deal with accidental spillages.

7.0 DECOMMISSIONING PHASE MEASURES

Prior to decommissioning works, a detailed Decommissioning Plan will be developed to detail the methods and measures to be adopted during that phase of works. The Decommissioning Plan will avail of, and implement, prevailing best practice measures including surface water protection methods.

It is likely that the methods adopted will be similar to those presented above in respect of the construction phase but of a reduced scale. Regardless of the specific practices and methods to be adopted; the overall objective will be the prevention of any silt, sediment or deleterious matter being discharged from the site such that could cause a deterioration in downstream water quality.

8.0 CONCLUSION

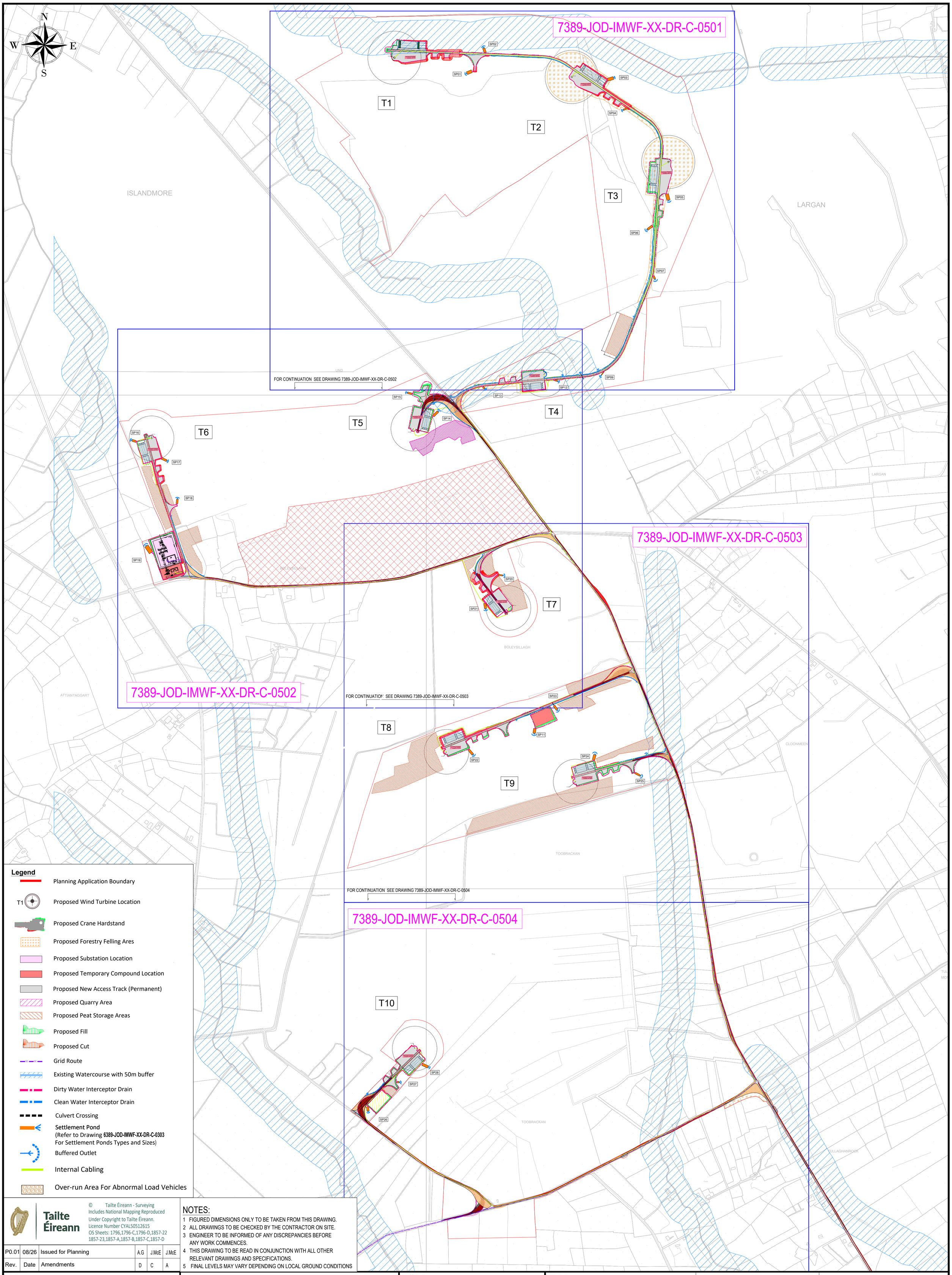
This SWMP has been prepared to detail the practical implementation of surface water management infrastructure to address the requirements of measures set out in the EIAR. This is a live document and will be updated by the appointed Contractor prior to the commencement of development. Prior to the commencement of construction, the updated SWMP will be reviewed by the Environmental Manager (EM) and Ecological Clerk of Works (EcoW), as necessary, to confirm the appropriateness of the measures set out therein.

The SWMP incorporates the principles of SuDS; with the overall objective of ensuring that no silt, sediment or other material is discharged from the site to surrounding drainage features; to ensure that the project does not adversely affect the drainage regime within the project site and in its vicinity.

The proposed SuDS comprises drainage infrastructure to intercept and direct 'clean' incidental runoff away from works locations; and a separate surface water management train to effectively control manage and treat 'dirty' water runoff from the works areas.

The efficacy of the measures set out in this SWMP will be regularly monitored and will be supported by water quality monitoring as set out in the Water Quality Monitoring Plan.

ANNEX 1 - PLANNING-STAGE DRAINAGE/SURFACE WATER MANAGEMENT SYSTEM



Legend

- Planning Application Boundary
- T1 — Proposed Wind Turbine Location
- Proposed Crane Hardstand
- Proposed Forestry Felling Ares
- Proposed Substation Location
- Proposed Temporary Compound Location
- Proposed New Access Track (Permanent)
- Proposed Quarry Area
- Proposed Peat Storage Areas
- Proposed Fill
- Proposed Cut
- Grid Route
- Existing Watercourse with 50m buffer
- Dirty Water Interceptor Drain
- Clean Water Interceptor Drain
- Culvert Crossing
- Settlement Pond (Refer to Drawing **6389-JOD-IMWF-XX-DR-C-0303** For Settlement Ponds Types and Sizes)
- Buffered Outlet
- Internal Cabling
- Over-run Area For Abnormal Load Vehicles

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Rev.	Date	Amendments			
P0.01	08/26	Issued for Planning	A.G	J.McE	J.McE

NOTES:

1 FIGURED DIMENSIONS ONLY TO BE TAKEN FROM THIS DRAWING.
2 ALL DRAWINGS TO BE CHECKED BY THE CONTRACTOR ON SITE.
3 ENGINEER TO BE INFORMED OF ANY DISCREPANCIES BEFORE ANY WORK COMMENCES.
4 THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.
5 FINAL LEVELS MAY VARY DEPENDING ON LOCAL GROUND CONDITIONS

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Project: Islandmore Wind Farm.

Title: Drainage Layout Plan & Index Sheet.

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T3

SP01
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SP12

FOREST FELLING AREAS

PROPOSED CLEAN WATER DRAIN

PROPOSED CRANE HARDSTAND

PROPOSED DIRTY WATER DRAIN

EXISTING MAJOR WATER COURSE WITH 50m BUFFER ZONE

Hardstand Finished Level(Z) 150.0m

Hardstand Finished Level(Z) 163.0m

Hardstand Finished Level(Z) 169.0m

Hardstand Finished Level(Z) 156.45m

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5 FINAL LEVELS MAY VARY DEPENDING ON LOCAL GROUND CONDITIONS

Legend

- Planning Application Boundary
- T1 Proposed Wind Turbine Location
- Proposed Crane Hardstand
- Proposed Forestry Felling Ares
- Proposed Substation Location
- Proposed Temporary Compound Location
- Proposed New Access Track (Permanent)
- Proposed Quarry Area
- Proposed Peat Storage Areas
- Proposed Fill
- Proposed Cut
- Grid Route
- Existing Watercourse with 50m buffer
- Dirty Water Interceptor Drain
- Clean Water Interceptor Drain
- Culvert Crossing
- Settlement Pond (Refer to Drawing **6389-JOD-IMWF-XX-DR-C-0303** For Settlement Ponds Types and Sizes)
- Buffered Outlet
- Internal Cabling
- Over-run Area For Abnormal Load Vehicles

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T6

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T7

SP12
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SP18
SP19
SP20
SP21
SP23

PROPOSED DIRTY WATER DRAIN
PROPOSED CLEAN WATER DRAIN
PROPOSED CRANE HARDSTAND

Hardstand Finished Level(Z):166.45m
Hardstand Finished Level(Z):166.63m
Hardstand Finished Level(Z):153.63m
Hardstand Finished Level(Z):160.85m

BOLEYSILLAGH

EXISTING MAJOR WATER COURSE WITH 50m BUFFER ZONE

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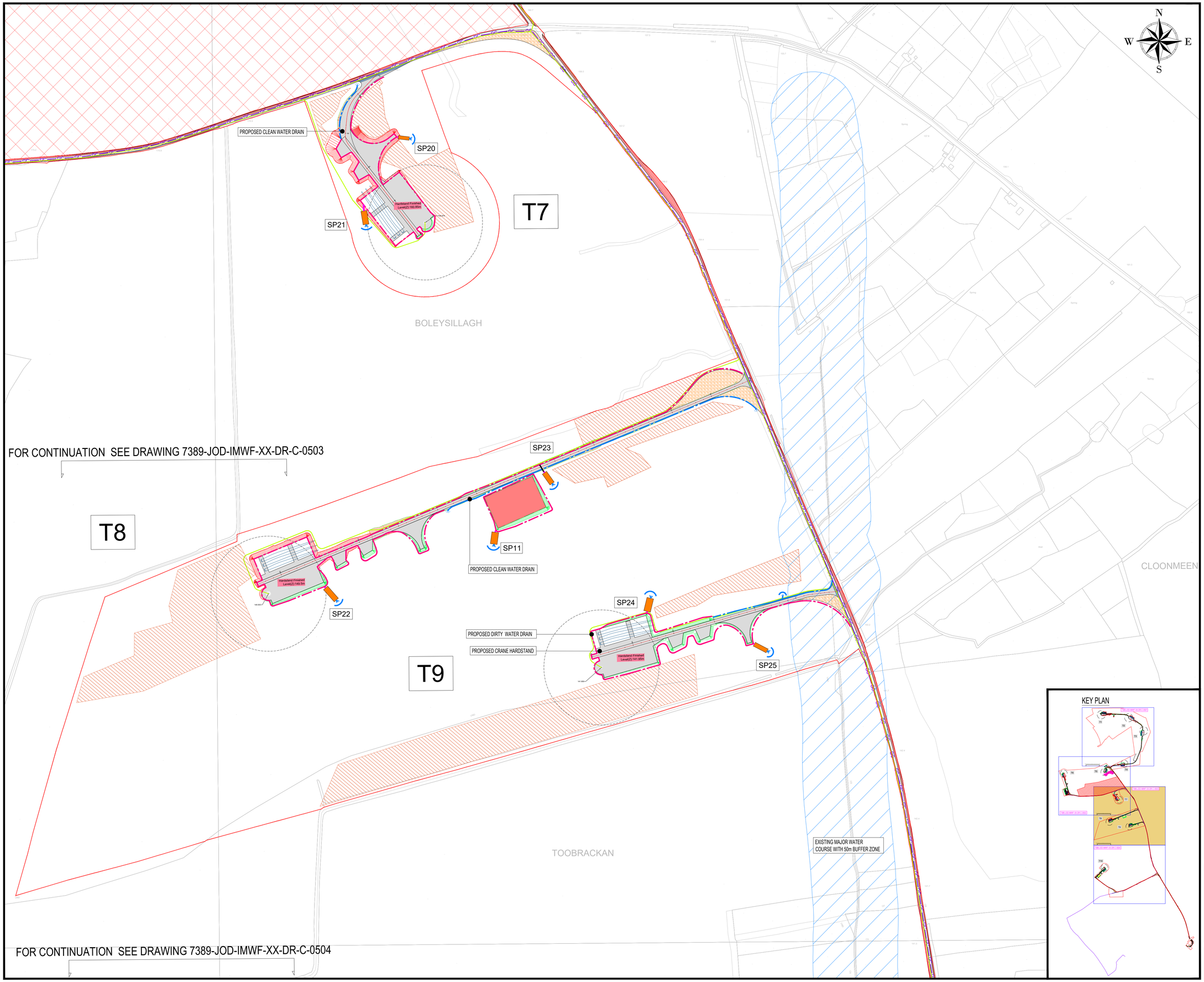
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T10

PROPOSED CLEAN WATER DRAIN

PROPOSED DIRTY WATER DRAIN

Hardstand Finished Level=143.100

SP28

SP27

SP26

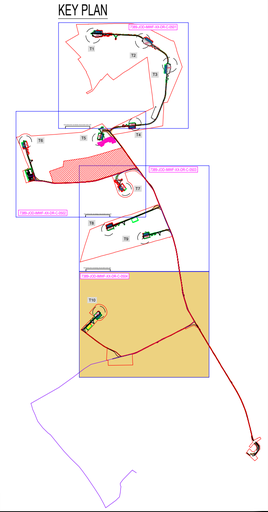
EXISTING MAJOR WATER COURSE WITH 50m BUFFER ZONE

TOOBRACKAN

Bog

Curry

KEY PLAN



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ENERGY SERVICES

APPENDIX D: ORNITHOLOGICAL BASELINE REPORT



GALETECH
ENERGY SERVICES

Islandmore Wind Farm

Environmental Impact Assessment Report

Annex 5.7: Ornithological Baseline

Islandmore Wind Farm Limited

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1.1 INTRODUCTION

Islandmore Wind Farm Limited ('the Developer') has commissioned Galetech Energy Services (GES) to manage the preparation of an Environmental Impact Assessment Report (EIAR) for the Islandmore Wind Farm ('the project' and/or 'the project site') in County Roscommon. APEM Group Woodrow has been commissioned by GES to prepare a technical appendix which presents the baseline data for ornithology to accompany **Chapter 5** (Biodiversity) of the Environmental Impact Assessment Report (EIAR).

This technical appendix documents the results of the ornithological surveys undertaken at the project site, and where required by survey methodology, within the wider study area. The surveys span a five-year period and provide the data used to inform the ornithological baseline:-

- Non-breeding season 2019/20;
- Breeding season 2020;
- Non-breeding season 2020/21;
- Breeding season 2021;
- Non-breeding season 2021/22;
- Breeding season 2022;
- Non-breeding season 2022/23;
- Breeding season 2023; and,
- Non-breeding season 2024/25 (hen harrier only).

All surveyors and authors of this report are suitably qualified ecologists. As required by CIEEM, all APEM Group Woodrow staff are required to abide by a strict code of professional conduct in all aspects of their work.

1.2 SITE OVERVIEW

The project site is located c. 2 km to the north of Ballaghaderreen, Co. Roscommon, c. 13km east of Charlestown (Co. Mayo) and c. 6km southwest of Gorteen (Co. Sligo). Habitats within the project site include upland peat bog, unimproved/semi-improved grassland, wet grassland, commercial forestry and scrub. The surrounding landscape is a mixture of semi-improved agricultural land, peat bog and large wetland habitats.

1.3 DESK STUDY

An initial desk-based review was undertaken to collate existing ornithological information relevant to the project site and its surrounding landscape. A 15km radius was applied as the baseline search, based on Office of the Planning Regulator guidance. However, recognising that wider foraging ranges and functional linkages can extend beyond this distance, additional consideration was given to sites up to 20km that may have hydro-ecological connections or where potential species movements could create pathways of effect.

1.4 DATA SOURCES

A preliminary desk-based review was undertaken to assess the availability and suitability of avian habitats within and surrounding the project site. The review collated

existing ornithological and environmental information from a range of datasets and mapping resources as follows:-

- Aerial and Cartographic Data
  - Ortho-imagery and 6-inch mapping were examined using Bing Maps, Google Earth Pro, Google Maps, and Ordnance Survey Ireland GeoHive to identify potential habitat types and assess landscape connectivity.
- Designated Site Information (NPWS Designations Viewer)
  - The NPWS Designations Viewer was consulted to identify Special Protection Areas (SPAs) and their Special Conservation Interests (SCIs), as well as Natural Heritage Areas (NHAs) and proposed NHAs (pNHAs), to determine the presence of ornithologically important features.
- Hydrological and Connectivity Analysis
  - Scottish Natural Heritage (2016) guidance was followed to assess potential SPA connectivity. Core ranges of SCI species, including up to 20 km for geese species e.g., greylag goose (*Anser anser*) and pink-footed goose (*Anser brachyrhynchus*), Lough Gara and Lough Arrow fall within these ranges.
  - EPA map view was used to investigate potential hydrological connectivity to designated sites. The analysis confirmed there is a hydrological link between the project site and Lough Garra SPA on the river network, via the Lung River.
- Bird Sensitivity and Distribution Mapping
  - Bird Sensitivity Mapping for Wind Energy Development (McGuinness *et al.*, 2015) was reviewed using the National Biodiversity Data Centre (NBDC) Biodiversity Maps to assess potential species sensitivity.
- Ornithological Records
  - Ornithological records from the National Biodiversity Data Centre (NBDC) were analysed for the past ten years across the two 10km Irish national grid squares [M69] and [G60], which encompass the project site.
- Conservation Status and Target Species
  - Target species considered include red- and amber-listed Birds of Conservation Concern in Ireland (BoCCI) (Gilbert *et al.*, 2021).
    - Red-listed species are those of highest conservation concern, showing rapid declines, historic declines without recovery, or global threat.
    - Amber-listed species are those with unfavourable European status, internationally important populations, moderate declines, or small national populations.
- Hen Harrier Assessment
  - Hen harrier (*Circus cyaneus*) distribution and breeding range were reviewed using data from national surveys (Norriss *et al.*, 2002; Barton *et al.*, 2006; Ruddock *et al.*, 2012, 2016, 2024) and NPWS (2022) roost mapping.
- Scientific Nomenclature
  - Bird species are presented using binomial nomenclature at first mention,

with scientific names italicised. Subsequent references use common names only. Nomenclature follows the British Ornithologists' Union (BOU) list, with geographic prefixes omitted where appropriate.

1.5 DESK STUDY FINDINGS

1.5.1 EUROPEAN AND NATIONAL DESIGNATED SITES

Site Name[1]	Distance to Development	Special Conservation Interests (SCI)
Lough Gara SPA [004048]	c. 3.2km	Whooper swan (Cygnus cygnus). Greenland white-fronted goose (Anser albifrons flavirostris)
Bellanagare Bog SPA [004105]	c. 11km	Greenland white-fronted goose Anser albifrons flavirostris
Lough Arrow SPA [004050]	c. 16.5km	Little grebe (Tachybaptus ruficollis). Tufted duck (Aythya fuligula) Wetland and Waterbirds [A999]

Table 1: Designated Sites with ornithological features within 20km

1.5.2 SENSITIVITY MAPPING FOR WINDFARMS

The National Biodiversity Data Centre (NBDC) map viewer was utilised to assess the 22 species presented in McGuinness *et al.* (2015); the project site and the surrounding landscape were classified as having low (14.1), medium (36.7) and high (51.8) areas of sensitivity as presented in **Figure 1**

Six of the species assessed in McGuinness, are present within the 2km site buffer (based on survey results) including: -

- Hen harrier (*Circus cyaneus*);
- Golden plover (*Pluvialis apricaria*);
- Whooper swan (*Cygnus cygnus*);
- Black-headed gull (*Chroicocephalus ridibundus*);
- Curlew (*Numenius arquata*); and,
- Red grouse (*Lagopus lagopus scotica*).

[1] Within the accessible pNHA records, there are no such sites listed for their bird species of interest.

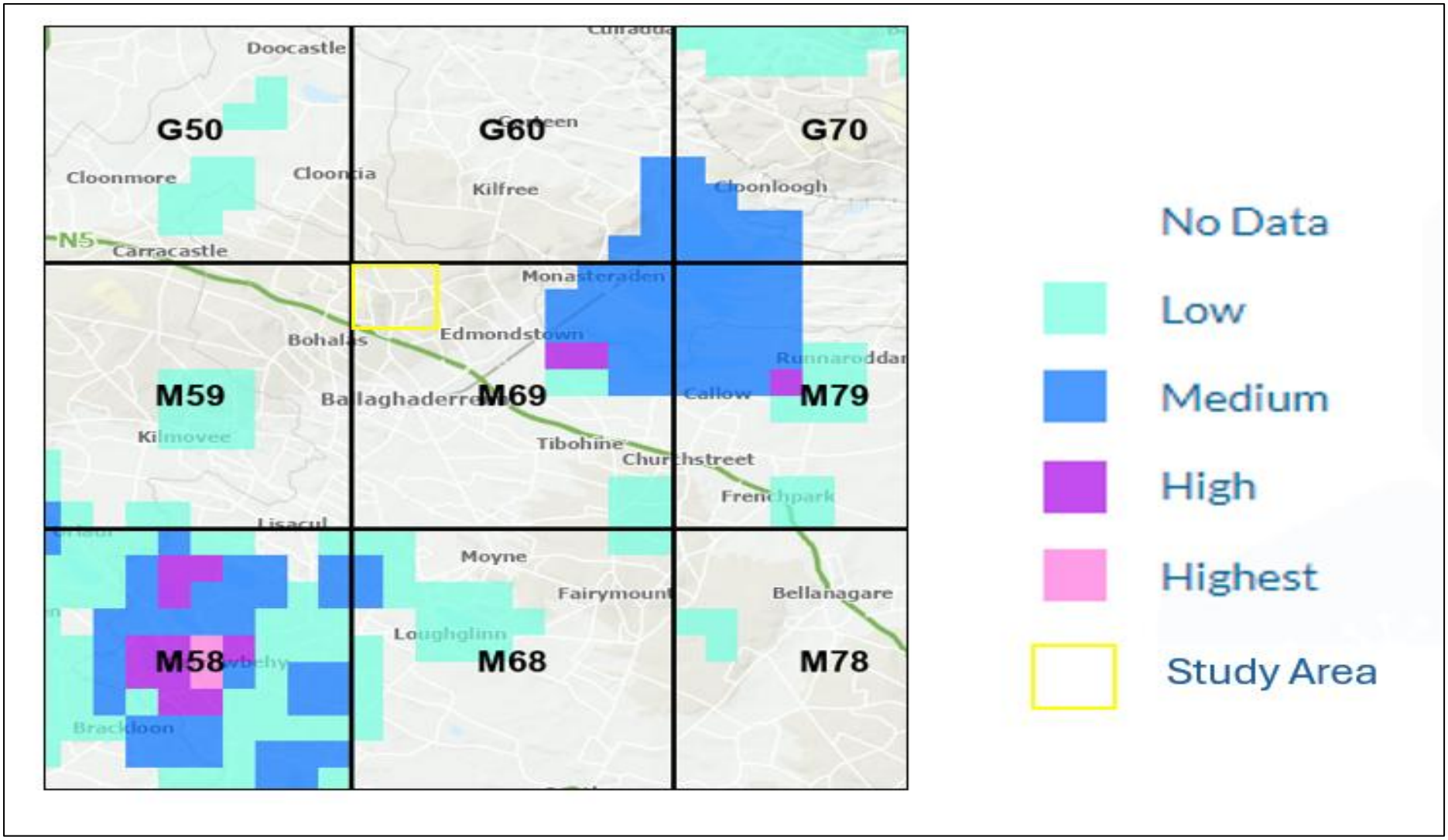


Figure 1: Birds Sensitive to Wind Energy (NBDC Maps) with indicative study area

1.5.3 Ornithological Records and Species of Conservation Concern

Analysis of records from the National Biodiversity Data Centre (NBDC) for the two 10km Irish national grid squares [M69] and [G60], which encompass the project site, identified 25 species of conservation concern, see Table 51 and **Table 51**: NBDC bird records from national grid square M69 2011-2024 (2011 retained due to it being the most up to date bird atlas for Ireland)

.

1.5.4 Waterbirds

There are two main I-WeBS sites within 15km of the project site, each of which is further divided into sub-sites. The nearest, Lough Gara SPA, lies c. 3.5km to the east. The habitats within this site support significant populations of wintering waterbirds. Over the past five years, peak counts have exceeded the 1% national importance threshold for several waterbird species (**Table 1**).

Annex I species recorded at Lough Gara SPA include whooper swan and barnacle goose (*Branta leucopsis*), both of which are amber listed in Ireland. These species occur only during the non-breeding season.

NBDC records for squares M69 and G60 do not show any red-listed waterbird species. Between 2019 and 2020, amber-listed species recorded include cormorant (*Phalacrocorax carbo*), common tern (*Sterna hirundo*), common gull (*Larus canus*), black-headed gull, great, crested grebe (*Podiceps cristatus*), greylag goose, teal (*Anas crecca*), wigeon (*Mareca penelope*), mallard (*Anas platyrhynchos*), mute swan (*Cygnus olor*) and whooper swan.

Species	Peak count 2019-2024	Mean count 2019-2024	All Ireland 1% threshold for national importance (Burke *et al.* 2019)
Greenland white-fronted goose	135	135	100
Mallard	322	234	280
Mute swan	236	168	90
Pochard	342	342	110
Shoveler	23	23	20
Tufted duck	1,308	1,246	270
Whooper swan	333	256	150

Table 1: Waterbird species at Lough Gara SPA exceeding the national importance threshold

Ballyhaunis lakes are located c. 12km southwest of the project site. Over the past five years, whooper swan has exceeded the 1% national importance threshold (150 birds), with a peak count of 195 individuals. These lakes, together with other wetland sites in the surrounding landscape, provide essential habitats and resources that support substantial populations of ecologically significant species.

Full datasets for Lough Gara, Ballyhaunis Lakes, and their respective subsites are presented in **Appendix 1**, along with NBDC records for the 10km grid squares M69 and G60, which encompass the project site. The wider area supports wintering and breeding waterbirds through a diverse network of loughs, bogs, connected drainage

and river systems, surrounding agricultural fields. including the eastern tip of Lough Gara, which may support nationally important populations of waterbirds.

1.5.5 WADERS

Within the wider area of the project site, the following species were recorded in Irish grid squares M69 (**Table 51**) and G60 (**Table 51**: NBDC bird records from national grid square M69 2011-2024 (2011 retained due to it being the most up to date bird atlas for Ireland)

):-

- Red-listed - Snipe (*Gallinago gallinago*), curlew, lapwing (*Vanellus vanellus*), woodcock (*Scolopax rusticola*);
- Green-listed - Whimbrel (*Numenius phaeopus*);
- I-WeBS sites contain records for:-
  - Red-listed - Golden plover; and,
  - Amber-listed - Ringed plover (*Charadrius hiaticula*).

I-WeBS data does not indicate any wader species reaching nationally important population levels at these sites. The wider area supports wintering and breeding waders through a mix of bog, loughs, drainage ditches, river networks, forestry, and agricultural fields. The 5km turbine buffer encompasses a mosaic of habitats suitable for both wintering and breeding waders. The nearest breeding wader hot spot is over 20km away (Lauder & Lauder, 2020).

1.5.6 RAPTORS AND OWLS

Full NBDC records are presented for square M69 (Table 51) and G60 (**Table 51**: NBDC bird records from national grid square M69 2011-2024 (2011 retained due to it being the most up to date bird atlas for Ireland)

).

1.5.6.1 Barn Owl

A historic record from 2015 exists in NBDC records for barn owl (*Tyto alba*), a red-listed species undergoing severe decline in Ireland due to agricultural intensification and expanding road network (Lusby and O'Cleary 2014). In Ireland, barn owls typically hunt within 1-2km of their nesting or roosting sites, though may range up to 6km (Lusby and O'Cleary 2014).

1.5.6.2 Kestrel

Kestrel (*Falco tinnunculus*), a red-listed, declining but widespread resident species throughout Ireland (Balmer et al, 2013), is recorded as present in the NBDC records for square G60. Its recent declines are driven by land use change in the rural landscape. The project site holds habitat suitable for hunting and foraging.

1.5.6.3 Hen Harrier

Hen Harrier is an Annex I species and is Amber-listed in Ireland (NPWS, 2022). NBDC records confirm its presence within grid square M69, which encompasses the project site. The 2022 national survey also identifies a regular winter roost in M69 (NPWS, 2022;

Balmer *et al.*, 2013), although the precise location is not provided. This indicates long-term use of the wider landscape during the non-breeding season.

Hen Harriers are highly mobile in winter, with individuals ranging up to 20km from communal roosts (NPWS, 2015a). The primary sensitivity relevant to wind farm developments is disturbance or displacement from winter roosts (NPWS, 2022).

No recent or confirmed breeding activity occurs within or near the project site. The nearest SPAs and non-designated breeding areas are located well outside ecological connectivity (>60 km) and therefore do not influence the baseline for the project site.

1.5.6.4 Buzzard and Sparrowhawk

Both species are green-listed and widely distributed throughout Ireland, NBDC records confirm the presence of buzzard (*Buteo buteo*) and sparrowhawk (*Accipiter nisus*) in grid squares M69 and G60. Suitable hunting and foraging habitat for both species available within the 2km buffer.

1.6 METHODOLOGY

Guidelines provided by SNH (2017) list recommended methodologies for the assessment of avian populations in the context of onshore wind farms. The methodology for each survey type conducted at the project site are outlined in the following sections.

1.6.1 OVERVIEW OF THE PROJECT SITE

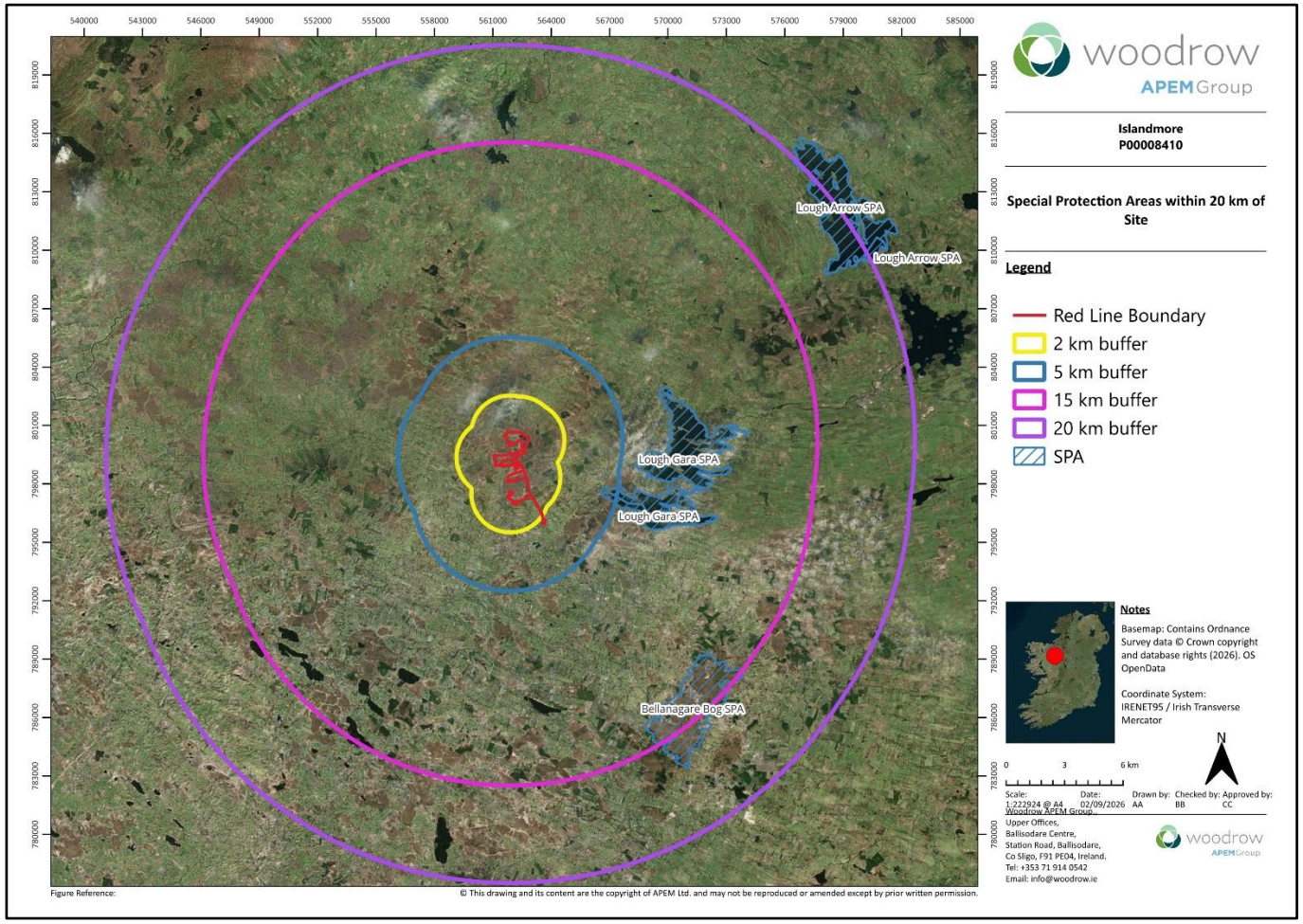


Figure 2: Site buffer of 2km, 5km, 15km with extended 20 km site buffer for potential connectivity with SPA species

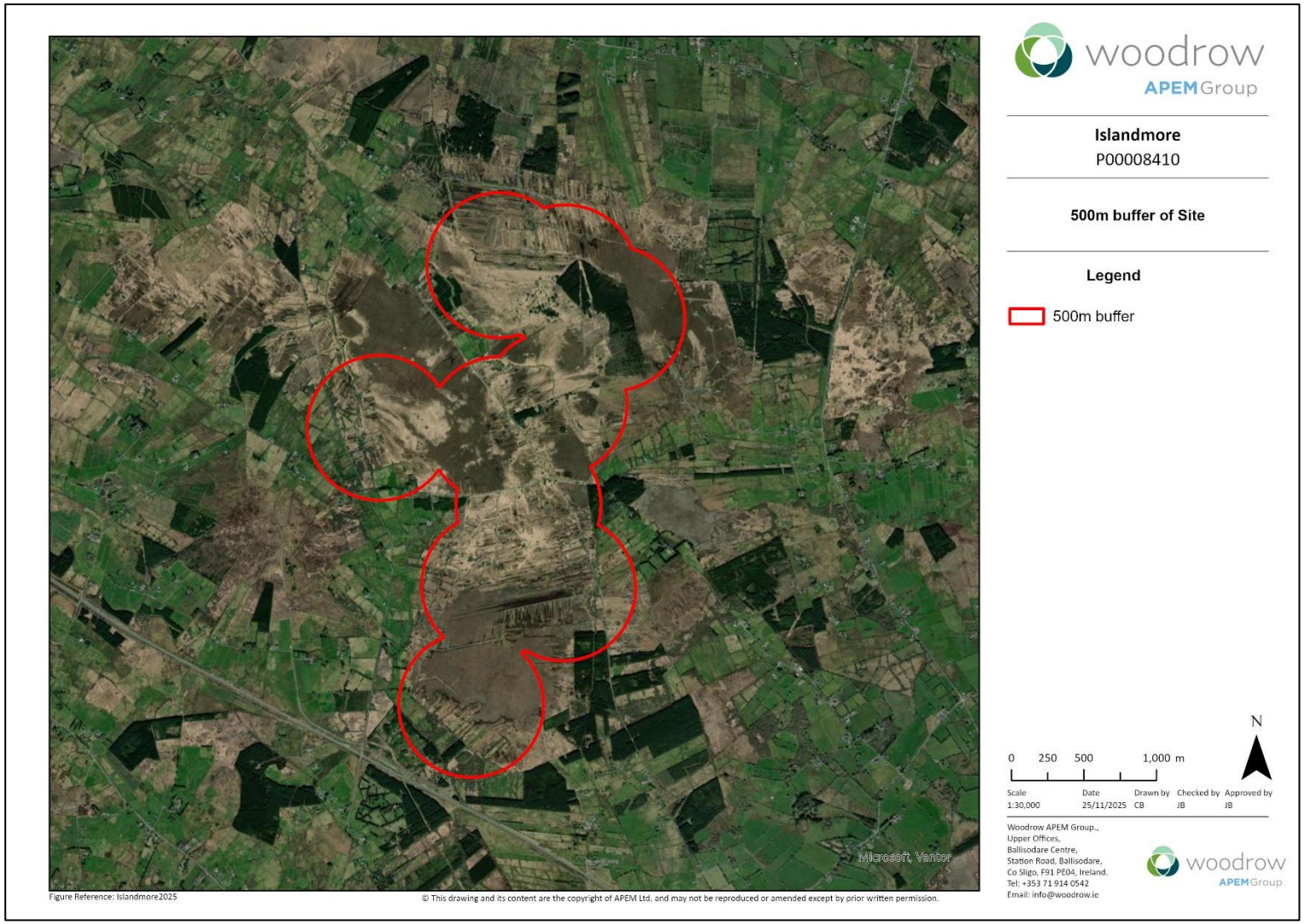


Figure 3: 500m Turbine Buffer

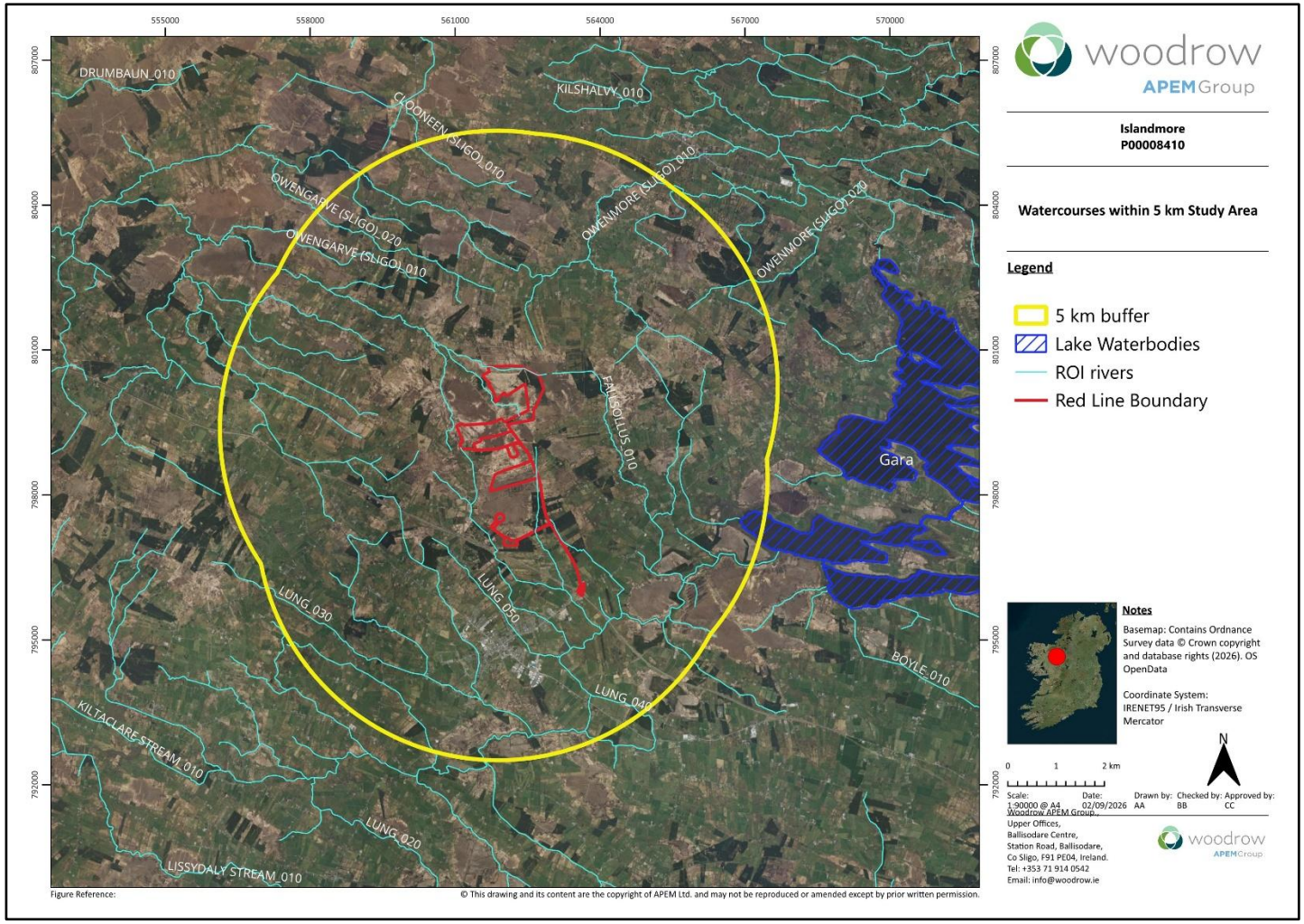


Figure 4: River and Waterbody Connectivity with the project site

1.6.2 VANTAGE POINT (VP) WATCHES

Vantage point surveys were conducted between October 2019 to September 2023 in accordance with NatureScot (formerly SNH) guidance (2017), which outlines best practice methods for assessing bird flight activity and potential collision risk associated with wind energy developments.

The VP study area was defined as a 500m buffer surrounding the turbine layout, representing the core ornithological study area, initially three VPs were established to provide full coverage of this buffer. In 2022, an additional VP was added and VP1 was relocated 50m north to reflect a revised viable area and the enlarged 500m buffer.

All VP locations were ground-truthed to ensure unobstructed visibility and practical accessibility. A viewshed analysis confirmed that the combined VPs provided 100% coverage of the survey area. Individual VP viewsheds are presented in **Annex 5.7b** (Viewshed Analysis).

Surveys followed NatureScot (2017) guidance, with target species selected based on conservation status, susceptibility to collision or displacement effects, and potential functional connectivity to designated sites. Flight activity of target species was systematically recorded and digitised to inform the Collision Risk Model (CRM).

Target species during VP were as follows:-

- All waterbird species (including swans, geese, ducks, waders, herons and gulls);
- All raptors;
- Species listed as SCIs of any SPAs considered to be within the potential zone of influence of proposed turbine locations;
- Any species listed on Annex I of the Birds Directive; and,
- Any species listed as red-listed on the BoCCI 2020-26 (Gilbert *et al.*, 2021)

Each recorded flight path was numbered and cross-referenced, with the following data recorded:-

- Time on detection;
- Bird species, age and sex (where age and sex were determinable);
- Number of birds;
- Behaviour where applicable (e.g. foraging, commuting, display etc);
- Duration of flight within the VP viewshed; and,
- Height of flight.

In line with NatureScot guidance, surveyors aimed to complete 36 hours of survey at each VP location. Surveys were stratified to ensure coverage of all times of day, including dawn and dusk, to account for variation in bird activity. Each watch typically lasted three hours, with a 30-minute break between watches to minimise observer fatigue.

A summary of VP survey effort is provided in the tables below, with a full breakdown, including weather data, presented in **Annex 5.7a** (Survey Effort).

Non-breeding Season 2019/20			
Month	**VP1**	**VP2**	**VP3**
Oct 2019	5	6	5
Nov 2019	8	7	8
Dec 2019	9	9	7.45
Jan 2020	6	6	6
Feb 2020	8	8	8
Total	36	36	34.45[2]

Table 2: Survey effort non-breeding season 2019/20

Non-breeding Season 2020/21			
Month	**VP1**	**VP2**	**VP3**
Sep 2020	4	4	4
Oct 2020	6	6	6
Nov 2020	6	6	6
Dec 2020	6	6	6
Jan 2021	6	6	6
Feb 2021	4	4	4
Mar 2021	4	4	4
Total	36	36	36

Table 3: Survey effort non-breeding season 2020/21

Non-breeding Season 2021/22				
Month	**VP1**	**VP2**	**VP3**	**VP4**
Oct 2021	2.5	2	2	2
Nov 2021	3	10	6	6
Dec 2021	9	9	6	9
Jan 2022	9	8	9	6
Feb 2022	11.5	6	12	6
Mar 2022	4	1	3	8
Total	36	36	38	37

Table 4: Survey effort non-breeding season 2021/22

Non-breeding Season 2022/23				
Month	**VP1**	**VP2**	**VP3**	**VP4**
Dec 2022	5.75	3	3	6
Jan 2023	12	12	12	12
Feb 20323	12	12	12	12
Mar 2023	6.25	9	9	6
Total	36	36	36	36

Table 5: Survey effort non-breeding season 2022/23

[2] See **Section 1.6.8**

Breeding Season 2020			
Month	VP1	VP2	VP3
Mar	3	6	3
Apr	5	5	5
May	9	7	9
Jun	6	3	6
Jul	6	6	6
Aug	9	11	9
Total	38	38	38

Table 6: Survey effort breeding season 2020

Breeding Season 2021			
Month	VP1	VP2	VP3
Mar	3	3	3
Apr	3	2	3
May	4	6.25	4
Jun	7	6	11
Jul	9	9	9
Aug	10	9.75	13
Total	36	36	43

Table 7: Survey effort breeding season 2021

Breeding Season 2022				
Month	VP1	VP2	VP3	VP4
Mar	3	6	1	5
Apr	9		6	
May	6	9	7	6
Jun	6	6	6	6
Jul	6	6	9	9
Aug	6	9	7	10
Total	36	36	36	36

Table 8: Survey effort breeding season 2022

Breeding Season 2023				
Month	VP1	VP2	VP3	VP4
Apr	6	6	6	6
May	6	6	6	6
Jun	6	6	6	6
Jul	6	6	6	6
Aug	9	9	9	9
Sep	3	3	3	3
Total	36	36	36	36

Table 9: Survey effort breeding season 2023

1.6.3 BREEDING BIRD SURVEYS

The breeding bird study area was defined as a 500m turbine buffer. Breeding bird surveys were undertaken during Year 1 (breeding season 2020), Year 2 (breeding season 2021), Year 3 (breeding season 2022) and Year 4 (breeding season 2023).

Survey methodology combined elements of Smith and O'Brien (1992) for lowland breeding waders, Brown and Shepherd (1993) for upland and moorland species, and the Common Bird Census approach described by Gilbert *et al.* (1998). This combined approach provided systematic coverage of all representative habitat types within the study area, including grassland, wetland margins, moorland edge, and scrub.

In line with NatureScot guidance, survey effort focused on non-passerine species of conservation concern breeding within open habitats. All species encountered were recorded; however, passerine were not considered target species unless they were particularly sensitive to habitat change (e.g. yellowhammer).

Surveys were conducted along routes designed to provide comprehensive spatial coverage within the 500m buffer. Each route was walked at a steady pace, with all birds seen or heard recorded on field maps or digitally using Survey123, and routes tracked using GPS. Surveys were aimed to be undertaken in favourable weather conditions (wind speeds below Beaufort scale F5 and moderate to good visibility) to ensure optimal detectability.

Territory mapping followed the methods described in Bibby (2000) and Gilbert *et al.* (1998). A precautionary approach was followed, whereby a bird was considered to hold a territory if breeding behaviour (e.g. singing, alarm-calling, food carrying) was recorded, or if a pair was observed in suitable habitat during any survey visit.

Further details on survey effort and weather conditions for each season are provided in **Annex 5.7a** (Survey Effort).

Breeding Season 2020		
Date	**Survey type**	**Surveyor**
07/05/2020	Breeding Bird	KW[3]
07/05/2020	Breeding Bird	KW
10/06/2020	Breeding Bird	KW
11/06/2020	Breeding Bird	KW
21/07/2020	Breeding Bird	KW
22/07/2020	Breeding Bird	KW
23/07/2020	Breeding Bird	KW

Table 10: Survey effort breeding season 2020

Breeding Season 2021		
Date	**Survey type**	**Surveyor**
16/06/2021	Breeding Bird	PD[4]
24/06/2021	Breeding Bird	PD
05/07/2021	Breeding Bird	JB[5]

[3] Ken Westman
[4] Patrick Devereux
[5] Jamie Bliss

07/07/2021	Breeding Bird	JB

Table 11: Survey effort breeding season 2021

Breeding Season 2022		
Date	**Survey type**	**Surveyor**
04/05/2022	Breeding Bird	DR[6]
10/05/2022	Breeding Bird	DR
12/05/2022	Breeding Bird	DR
16/05/2022	Breeding Bird	DR
24/05/2022	Breeding Bird	DR
02/06/2022	Breeding Bird	DR
14/06/2022	Breeding Bird	DR
22/06/2022	Breeding Bird	DR
29/06/2022	Breeding Bird	DR
03/08/2022	Breeding Bird	DR
16/08/2022	Breeding Bird	DR
24/08/2022	Breeding Bird	DR
25/08/2022	Breeding Bird	DR
31/08/2022	Breeding Bird	DR

Table 12: Survey effort breeding season 2022

Breeding Season 2023		
Date	**Survey type**	**Surveyor**
17/04/2023	Breeding Bird	DR
18/04/2023	Breeding Bird	DR
20/04/2023	Breeding Bird	DR
25/04/2023	Breeding Bird	DR
02/05/2023	Breeding Bird	DR
12/05/2023	Breeding Bird	DR
22/05/2023	Breeding Bird	DR
30/05/2023	Breeding Bird	DR
09/06/2023	Breeding Bird	DR
19/06/2023	Breeding Bird	DR
20/06/2023	Breeding Bird	DR
21/06/2023	Breeding Bird	DR
04/07/2023	Breeding Bird	DR
09/07/2023	Breeding Bird	DR
11/07/2023	Breeding Bird	DR
25/07/2023	Breeding Bird	DR

Table 13: Survey effort breeding season 2023

[6] David Russel

1.6.4 BREEDING RAPTOR SURVEYS

Breeding raptor surveys were undertaken in Year 1 March - July 2020, Year 2 March – July 2021, Year 3 March – August 2022, and Year 4 April to July 2023, following the methodologies detailed in Hardey *et al.* (2013) and consistent with NatureScot guidance (2017).

The study area was defined as a 2km buffer of the turbine layout to encompass all habitats suitable for breeding raptors. Surveys covered all accessible areas of suitable nesting and foraging habitat within this buffer.

Survey methods involved a combination of ad-hoc VP locations positioned to overlook key habitat features, and systematic walkover surveys to identify evidence of breeding activity. Surveyors looked for evidence including displaying, territorial, or nesting behaviour, as well as the presence of occupied nests, recently fledged young, or alarm-calling adults.

Although the surveys primarily targeted Annex I species and raptors red-listed under the Birds of Conservation Concern in Ireland 4 (BoCCI 2020-2026), other raptor species were also recorded where encountered.

All observations were recorded on large-scale field maps, with accompanying notes on behaviour, activity type, and habitat context.

Survey weather conditions for each season are provided in **Annex 5.7a** (Survey Effort).

Breeding season 2020		
Date	**Survey type**	**Surveyor**
26/03/2020	Breeding raptor	KW
27/03/2020	Breeding raptor	KW
05/05/2020	Breeding raptor	KW
06/05/2020	Breeding raptor	KW
10/06/2020	Breeding raptor	KW
25/06/2020	Breeding raptor	KW
26/06/2020	Breeding raptor	KW
22/07/2020	Breeding raptor	KW
24/07/2020	Breeding raptor	KW

Table 14: Survey effort breeding raptor 2020

Breeding season 2021		
Date	**Survey type**	**Surveyor**
23/03/2021	Breeding raptor	JB
24/03/2021	Breeding raptor	JB
24/05/2021	Breeding raptor	PD
26/05/2021	Breeding raptor	PD
28/05/2021	Breeding raptor	PD
06/07/2021	Breeding raptor	JB
07/07/2021	Breeding raptor	JB
07/07/2021	Breeding raptor	DB
08/07/2021	Breeding raptor	JB

Table 15: Survey effort breeding raptor 2021

Breeding season 2022		
Date	**Survey type**	**Surveyor**
07/04/2022	Breeding raptor	DR
13/04/2022	Breeding raptor	DR
04/05/2022	Breeding raptor	DR
30/05/2022	Breeding raptor	DR
22/06/2022	Breeding raptor	DR
26/06/2022	Breeding raptor	DR
13/07/2022	Breeding raptor	DR
26/07/2022	Breeding raptor	DR
24/08/2022	Breeding raptor	DR

Table 16: Survey effort breeding raptor 2022

Breeding season 2023		
Date	**Survey type**	**Surveyor**
04/04/2023	Breeding raptor	DR
09/04/2023	Breeding raptor	DR
18/04/2023	Breeding raptor	DR
19/04/2023	Breeding raptor	DR
23/04/2023	Breeding raptor	DR
05/05/2023	Breeding raptor	DR
11/05/2023	Breeding raptor	DR
22/05/2023	Breeding raptor	DR
30/05/2023	Breeding raptor	DR
20/06/2023	Breeding raptor	DR
21/06/2023	Breeding raptor	DR
28/06/2023	Breeding raptor	DR
29/06/2023	Breeding raptor	DR
04/07/2023	Breeding raptor	DR
06/07/2023	Breeding raptor	DR
11/07/2023	Breeding raptor	DR
12/07/2023	Breeding raptor	DR

Table 17: Survey effort breeding raptor 2023

1.6.5 NON-BREEDING WALKOVER SURVEYS

Non-breeding walkover surveys took place in Year 1 (non-breeding season 2019/20), Year 2 (non-breeding season 2020/21), Year 3 (non-breeding season 2021/22) and Year 4 (non-breeding season 2022/23). Surveys were designed to ensure that no point within the 500m buffer was more than 250m from a transect route, providing comprehensive coverage of the project site. During these surveys, surveyors systematically walked the study area along predefined transects to sample all habitat types and record all bird species encountered, providing insight into species distribution and habitat use across the project site. Observations were recorded digitally using Survey 123 and geo referenced with behavioural notes added where appropriate.

Individual survey weather conditions can be found in **Annex 5.7a** (Survey Effort).

Non-breeding season 2019/20		
Date	**Survey type**	**Surveyor**
06/12/2019	Walkover	MH
12/01/2020	Walkover	MH
07/02/2020	Walkover	KW

Table 18: Survey effort non-breeding season 2019/20

Non-breeding season 2020/21		
Date	**Survey type**	**Surveyor**
23/10/2020	Walkover	JB
11/12/2020	Walkover	JB
27/02/2021	Walkover	JB

Table 19: Survey effort non-breeding season 2020/21

Non-breeding season 2021/22		
Date	**Survey type**	**Surveyor**
01/12/2021	Walkover	DR
03/12/2021	Walkover	DR
26/01/2022	Walkover	DR
28/01/2022	Walkover	DR
03/03/2022	Walkover	DR

Table 20: Survey effort non-breeding season 2021/22

Non-breeding season 2022/23		
Date	**Survey type**	**Surveyor**
23/01/2023	Walkover	DL
25/01/2023	Walkover	DL
31/01/2023	Walkover	DR
09/02/2023	Walkover	DR
13/03/2023	Walkover	DR
14/03/2023	Walkover	DR
19/03/2023	Walkover	DR
20/03/2023	Walkover	DR

Table 21: Survey effort non-breeding season 2022/23

1.6.6 Non-breeding Wider Area Wintering Waterbird Surveys

Non-breeding waterbirds surveys were undertaken between November 2019 to January 2020 and October 2020 to March 2021. SNH guidance (SNH, 2017) recommends monitoring swan and geese foraging and roosting activity within the wider area of the project site, particularly where SPAs are designated for these species.

Surveys effort encompassed the wider landscape within a 5km buffer of the project site Waterbird counts were conducted at all publicly accessible or observable wetland habitats, including bogs, ponds, canals, rivers, and other waterbodies.

Observations of incidental species, particularly raptors, were also recorded during these surveys.

Individual survey dates and weather conditions can be found in **Annex 5.7a** (Survey Effort).

Non-breeding season 2019/20		
Date	**Survey type**	**Surveyor**
07/11/2019	Waterbirds	KW
14/11/2019	Waterbirds	KW
10/12/2019	Waterbirds	KW
11/01/2020	Waterbirds	KW

Table 22: Survey effort non-breeding season 2019/20

Non-breeding season 2020/21		
Date	**Survey type**	**Surveyor**
15/10/2020	Waterbirds	KW
09/11/2020	Waterbirds	JB
09/12/2020	Waterbirds	JB
06/01/2021	Waterbirds	JB
08/02/2021	Waterbirds	JB
07/03/2021	Waterbirds	JB

Table 23: Survey effort non-breeding season 2020/21

Non-breeding season 2020/21		
Date	**Survey type**	**Surveyor**
09/02/2023	Waterbirds	DR

Table 24: Survey effort non-breeding season 2022/23

1.6.7 Hen Harrier Roost Searches

Roost searches were undertaken in October 2019, October 2020 to March 2021, October 2021 to March 2022, December 2022 to February 2023 and October 2024 to March 2025.

SNH (2017) guidelines stipulate that communal raptor roosts, including those of hen harriers, within 2km of a proposed development should be identified.

The approach to surveying for hen harrier roosts is influenced by two main factors:-

1. Any hen harrier activity observed during VP watches, site walkovers, and wider area surveys; and,
2. The availability of potentially suitable roosting habitat near the proposed development, as outlined by Clarke & Watson (1990) and in the Irish national hen harrier winter roost survey guidelines (O'Donoghue, 2019).

SNH (2017) references Hardey *et al.* (2013) for specific roost survey methodology, which emphasises the use of professional judgment to identify and target potential roosts based on observed flight activity within or near the project site. Further recommendation for locating birds, is to find them in the late afternoon and track them back to their roosts. O'Donoghue (2019) suggests the optimal time for roost

watches is at least 40-minutes before sunset until dark, or 30 minutes before sunrise until at least 30-minutes after sunrise. The dates for hen harrier roost watches are provided in the **Annex 5.7a**.

Once a roost is identified, further monitoring is necessary to document roost attendance and track flight lines to and from the roost in relation to the project site. Additional monitoring is typically conducted based on the frequency of roost occupancy and the proximity of roosting birds to the project site.

Non-breeding season 2019/20		
Date	**Survey type**	**Surveyor**
12/01/2020	Hen harrier roost watch	MH[7]

Table 25: Survey effort hen harrier roost watch non-breeding season 2019/20

Non-breeding season 2020/21		
Date	**Survey type**	**Surveyor**
21/10/2020	Hen harrier roost watch	JB
22/10/2020	Hen harrier roost watch	JB
07/11/2020	Hen harrier roost watch	JB
08/11/2020	Hen harrier roost watch	JB
09/12/2020	Hen harrier roost watch	JB
11/12/2020	Hen harrier roost watch	DB
11/12/2020	Hen harrier roost watch	JB
12/12/2020	Hen harrier roost watch	JB
12/12/2020	Hen harrier roost watch	DB
06/01/2021	Hen harrier roost watch	DB
06/01/2021	Hen harrier roost watch	JB
07/01/2021	Hen harrier roost watch	JB
07/01/2021	Hen harrier roost watch	DB
08/01/2021	Hen harrier roost watch	JB
08/01/2021	Hen harrier roost watch	DB
06/02/2021	Hen harrier roost watch	DB
06/02/2021	Hen harrier roost watch	JB
08/02/2021	Hen harrier roost watch	JB
09/02/2021	Hen harrier roost watch	DB
09/02/2021	Hen harrier roost watch	JB
25/02/2021	Hen harrier roost watch	JB
25/02/2021	Hen harrier roost watch	DB
06/03/2021	Hen harrier roost watch	JB
06/03/2021	Hen harrier roost watch	DB
07/03/2021	Hen harrier roost watch	JB

Table 26: Survey effort hen harrier roost watch non-breeding season 2020/21

Non-breeding season 2021/22

[7] Mike Holt

Date	Survey type	Surveyor
20/10/2021	Hen harrier roost watch	PD[8]
21/10/2021	Hen harrier roost watch	PD
23/11/2021	Hen harrier roost watch	DR[9]
24/11/2021	Hen harrier roost watch	DR
09/12/2021	Hen harrier roost watch	DR
13/12/2021	Hen harrier roost watch	DR
14/12/2021	Hen harrier roost watch	DR
12/01/2022	Hen harrier roost watch	DR
18/01/2022	Hen harrier roost watch	DR
19/01/2022	Hen harrier roost watch	AM
19/01/2022	Hen harrier roost watch	JOC
20/01/2022	Hen harrier roost watch	JOC
20/01/2022	Hen harrier roost watch	AM
20/01/2022	Hen harrier roost watch	DR
26/01/2022	Hen harrier roost watch	DR
26/01/2022	Hen harrier roost watch	GO[10]
27/01/2022	Hen harrier roost watch	GO
28/01/2022	Hen harrier roost watch	DR
11/02/2022	Hen harrier roost watch	DR
21/02/2022	Hen harrier roost watch	GO
22/02/2022	Hen harrier roost watch	GO
28/02/2022	Hen harrier roost watch	DR
01/03/2022	Hen harrier roost watch	AM[11]
01/03/2022	Hen harrier roost watch	JOC
03/03/2022	Hen harrier roost watch	DR

Table 27: Survey effort hen harrier roost watch non-breeding season 2021/22

Non-breeding season 2022/23		
Date	**Survey type**	**Surveyor**
14/12/2022	Hen harrier roost watch	DL[12]
15/12/2022	Hen harrier roost watch	DL
17/01/2023	Hen harrier roost watch	DL
23/01/2023	Hen harrier roost watch	DL
25/01/2023	Hen harrier roost watch	DL
25/01/2023	Hen harrier roost watch	DL
09/02/2023	Hen harrier roost watch	DL
13/02/2023	Hen harrier roost watch	DL
13/02/2023	Hen harrier roost watch	DL

[8] Patrick Devroux
[9] David Russel
[10] Geoff Oliver
[11] Aoife Moroney
[12] Daithi Lavelle

Non-breeding season 2022/23		
Date	**Survey type**	**Surveyor**
15/02/2023	Hen harrier roost watch	DL

Table 28: Survey effort hen harrier roost watch non-breeding season 2022/23

Non-breeding season 2022/23		
Date	**Survey type**	**Surveyor**
24/10/2024	Hen harrier roost watch	DL
24/10/2024	Hen harrier roost watch	AW, SPO
24/10/2024	Hen harrier roost watch	CB, AS[13]
21/11/2024	Hen harrier roost watch	DL
21/11/2024	Hen harrier roost watch	AJ, SP
09/01/2025	Hen harrier roost watch	AJ[14]
09/01/2025	Hen harrier roost watch	SPO[15]
09/01/2025	Hen harrier roost watch	BM, CB, LMcS
17/01/2025	Hen harrier roost watch	JOC[16]
29/01/2025	Hen harrier roost watch	BM[17]
29/01/2025	Hen harrier roost watch	LMcS, DL
29/01/2025	Hen harrier roost watch	SPO
24/02/2025	Hen harrier roost watch	BM
24/02/2025	Hen harrier roost watch	CB[18]
24/02/2025	Hen harrier roost watch	LMcS[19]
24/02/2025	Hen harrier roost watch	SPO, DL
12/03/2025	Hen harrier roost watch	BM, CB
12/03/2025	Hen harrier roost watch	LMcS
12/03/2025	Hen harrier roost watch	SPO, JOSB[20]

Table 29: Survey effort hen harrier roost watch non-breeding season 2022/23

1.6.8 SURVEY LIMITATIONS

Methods followed SNH (2017) guidance and there were no significant limitations on the data gathered or approaches taken.

Vantage point survey in non-breeding season 2019-20, survey hours at VP3 were 34.45 falling short of the recommended 36 hours per VP. This does not represent a serious limitation.

Due to the length of survey period (5-years) digital recording methods for collecting data in the field were updated and surveyors working on the changed over time.

[13] Aron Sapsford
[14] Ajay Cheruthon
[15] Sammy Pooley
[16] James O'Connor
[17] Bruno Mels
[18] Conn Barry
[19] Leona McSharry
[20] John Ball

During non-breeding season winter walk over surveys in 2022/23, two surveys were subject to data corruption and unusable. Additional surveys remedied this potential data loss, resulting in no overall limitation in these results.

1.7 SURVEY RESULTS

1.7.1 VANTAGE POINT (VP) WATCHES

A total of 21 target species, resulting in 467 flights, were recorded during VP watches conducted over four years of surveys between October 2019 and September 2023. Flight activity for these species within the 500m buffer is presented separately for the non-breeding and breeding seasons.

Collision risk modelling uses data from the most recent two years, spanning non-breeding season 2021-22 to the breeding season 2023 (see the CRM report for further details). Full flight line maps are provided in **Appendix 2** (hereto), with corresponding survey tables in **Annex 5.7c**.

VP results non-breeding season 2019/20			
Species[21]	**Number of flights**	**Max number. of birds**	**Flight seconds in 500m buffer**
BoCCI (2020-2026) Red-listed			
Golden plover *	16	500	6340
Kestrel	12	1	3105
Snipe	1	1	13
BoCCI (2020-2026) Amber-listed			
Hen harrier *	7	1	2455
Lesser black-backed gull	1	1	48
Mallard	1	2	70
Merlin *	1	1	44
Whooper swan *	6	12	583
BoCCI (2020-2026) Green-listed			
Grey heron	1	2	83
Sparrowhawk	2	1	134

Table 30: VP results non-breeding season 2019/20

VP results breeding season 2020			
Species[22]	**Number of flights**	**Max number. of birds**	**Flight seconds in 500m buffer**
BoCCI (2020-2026) Red-listed			
Curlew	1	1	88
Golden plover *	2	60	676
Kestrel	24	2	6743
Red grouse	2	1	41
Snipe	9	2	314
BoCCI (2020-2026) Amber-listed			
Hen harrier *	2	1	401

[21] * Denotes EU Annex 1 status.

[22] * Denotes EU Annex 1 status.

Lesser black-backed gull	3	3	373
Mallard	6	2	249
Merlin *	2	1	36
BoCCI (2020-2026) Green-listed			
Buzzard	2	2	30
Sparrowhawk	1	1	10

Table 31: VP results breeding season 2020

VP results non-breeding season 2020/21			
Species[23]	**Number of flights**	**Max number. of birds**	**Flight seconds in 500m buffer**
BoCCI (2020-2026) Red-listed			
Golden plover *	34	1000	2971
Kestrel	43	2	5088
Red grouse	2	1	0*
Snipe	2	2	280
BoCCI (2020-2026) Amber-listed			
Hen harrier *	9	1	189
Herring gull	2	2	206
Mallard	3	2	72
Merlin *	3	1	148
Whooper swan *	4	9	212
BoCCI (2020-2026) Green-listed			
Buzzard	2	1	250
Grey heron	3	1	220
*Species was recorded during surveys but not in flight (eg. Perched, on ground etc)			

Table 32: VP results non-breeding season 2020/21

VP results breeding season 2021			
Species[24]	**Number of flights**	**Max number. of birds**	**Flight seconds in 500m buffer**
BoCCI (2020-2026) Red-listed			
Golden plover *	6	39	1192
Kestrel	27	1	4127
Red grouse	3	2	54
Snipe	11	4	1269
Swift	7	4	1059
BoCCI (2020-2026) Amber-listed			
Hen harrier *	1	1	30
Herring gull	1	1	18
Lesser black-backed gull	26	2	1961
Mallard	8	2	192
Merlin *	1	1	12

[23] * Denotes EU Annex 1 status.

[24] * Denotes EU Annex 1 status.

Whooper swan *	2	34	89
BoCCI (2020-2026) Green-listed			
Buzzard	1	1	10
Great black-backed gull	5	1	432
Grey heron	2	1	319
Sparrowhawk	3	1	86

Table 33: VP results breeding season 2021

VP results non-breeding season 2021/22			
Species[25]	**Number of flights**	**Max number. of birds**	**Flight seconds in 500m buffer**
BoCCI (2020-2026) Red-listed			
Curlew	2	20	22
Golden plover *	12	500	930
Kestrel	6	1	34
Lapwing	1	15	5
Red grouse	3	2	0*
Snipe	2	2	9
Woodcock	1	1	0*
BoCCI (2020-2026) Amber-listed			
Hen harrier *	7	2	27
Lesser black-backed gull	1	1	10
Mallard	4	2	18
BoCCI (2020-2026) Green-listed			
Grey heron	1	1	1
Pheasant	4	1	7
Raven	4	3	135
Sparrowhawk	2	1	3
*Species was recorded during surveys but not in flight (eg. Perched, on ground etc)			

Table 34: VP results non-breeding season 2021/22

VP results breeding season 2022			
Species[26]	**Number of flights**	**Max number. of birds**	**Flight seconds in 500m buffer**
BoCCI (2020-2026) Red-listed			
Kestrel	5	4	238
Snipe	1	1	0
Swift	1	1	12
BoCCI (2020-2026) Amber-listed			
Common gull	1	1	13
Lesser black-backed gull	8	3	77
Mallard	2	2	0*
Merlin *	1	1	9

[25] * Denotes EU Annex 1 status.

[26] * Denotes EU Annex 1 status.

BoCCI (2020-2026) Green-listed			
Buzzard	6	2	4
Pheasant	4	2	0*
Sparrowhawk	1	1	0*
*Species was recorded during surveys but not in flight (eg. Perched, on ground etc)			

Table 35: VP results breeding season 2022

VP results breeding non-season 2022/23			
Species[27]	**Number of flights**	**Max number. of birds**	**Flight seconds in 500m buffer**
BoCCI (2020-2026) Red-listed			
Curlew	2	3	5
Golden plover *	1	8	4
Kestrel	2	1	0*
Snipe	5	1	11
BoCCI (2020-2026) Amber-listed			
Black-headed gull	3	2	17
Common gull	1	1	9
Hen harrier *	10	1	180
Lesser black-backed gull	1	1	8
Mallard	5	2	34
Merlin *	2	1	25
BoCCI (2020-2026) Green-listed			
Buzzard	1	1	190
*Species was recorded during surveys but not in flight (eg. Perched, on ground etc)			

Table 36: VP results breeding non-season 2022/23

VP results breeding season 2023			
Species	**Number of flights**	**Max number. of birds**	**Flight seconds in 500m buffer**
BoCCI (2020-2026) Red-listed			
Curlew	1	6	8
Kestrel	15	1	98
Snipe	1	1	0*
Swift	2	1	11
BoCCI (2020-2026) Amber-listed			
Black-headed gull	1	1	0*
Lesser black-backed gull	8	2	48
Mallard	7	1	55
BoCCI (2020-2026) Green-listed			
Sparrowhawk	5	2	47
*Species was recorded during surveys but not in flight (eg. Perched, on ground etc)			

Table 37: VP results breeding season 2023

[27] * Denotes EU Annex 1 status.

1.7.2 BREEDING SEASON SURVEY RESULTS

1.7.2.1 Dusk Survey Results

Dusk surveys were undertaken in Year 1 (June 2020), Year 2 (June 2021), Year 3 (between March and August 2022). Snipe was the only target species recorded during dusk surveys in Year 1 and Year 2 with drumming behaviour observed on three occasions within the 500m buffer. Three indicative territories are presented in **Figure 54**.

Red grouse was recorded incidentally in two survey years; due to its cryptic behaviour, it is often underrepresented in surveys. Mallard, pheasant, and grey heron were also recorded incidentally, with Mallard observed flying over and using drainage ditches in the cut bog areas. Full survey tables are presented in **Annex 5.7d** (Walkover and Dusk Survey Data).

Species	No. individuals	BoCCI 2020-2026
	10/06/20	
Snipe	2	Red
Red grouse	1	Red

Table 38: Dusk results breeding season 2020

Species	No. individuals		BoCCI 2020-2026
	16/06/21	29/06/21	
Snipe	4	5	Red
Red grouse	-	1	Red

Table 39: Dusk results breeding season 2021

Species	No. individuals				BoCCI 2020-2026
	23/03/22	29/03/22	17/08/22	31/08/22	
Mallard	4	2	-	-	Amber
Grey heron	1	-	-	-	Green
Pheasant		1	-	-	Green

Table 40: Dusk results breeding season 2022

1.7.2.2 Breeding Birds

A total of six species of conservation concern were recorded exhibiting breeding behaviour during breeding bird surveys undertaken within the 500 m buffer across Year 1 (breeding season 2020), Year 2 (breeding season 2021), Year 3 (breeding season 2022) and Year 4 (breeding season 2023).

These included two red-listed and four amber-listed species. **Table 41** summarises the red-listed and amber-listed species recorded in each respective season. While some year-to-year variation in species presence was observed, overall population distribution and species ranges remained broadly consistent as shown in **Figure 5**, Figure 6, **Figure 7** and **Figure 8**. Notable breeding species include snipe observed in two of the four years.

Full results are presented in **Annex 5.7d** (Walkover and Dusk Survey Data).

Species	BTO Code	Breeding status 2020	Breeding status 2021	Breeding status 2022	Breeding status 2023
BoCCI (2020-2026) Red-listed					
Meadow pipit	MP	Observed once in June with one individual exhibiting breeding behaviour. Breeding status: Definite	Observed 29 times from May to July with a peak count of two individuals. Breeding behaviour ranged from display flights, alarm calling, and provisioning. Breeding status: Definite	Observed 18 times from May to June with a peak count of three individuals. Breeding behaviour ranged from alarm calling, courtship, singing, and sightings of fledging birds. Breeding status: Definite	Observed six times from April to June with a peak count of two individuals. Breeding behaviour included territorial, display flights and alarm calling. Breeding status: Definite
Snipe	SN	Observed four times between May – June with a peak count of one individual exhibiting display behaviour – chipping/drumming. Breeding status: Definite	Observed four times in May with a peak count of two individuals exhibiting display behaviour – chipping/drumming. Breeding status: Definite	No observations	No observations
BoCCI (2020-2026) Amber-listed					
Goldcrest	GC	A single individual was observed alarm calling in early May. Breeding status: probable.	No observations	A family party was observed once in late June comprising one adult and one fledged bird. Breeding status: Definite	Observed three times April to May with a peak count of three individuals. Breeding behaviour included courtship and observation of fledging birds. Breeding status: Definite
Skylark	S	Observed 13 times throughout the season in May to June with a peak count of 2 individuals. Breeding behaviour included singing and display flights. Breeding status: Definite	Observed 13 times throughout June to July with a peak count of one individual. Breeding behaviour included singing, display flights and provisioning. Breeding status: Definite	Observed 27 times throughout May to June with a peak count of five individuals. Breeding behaviour included singing, and alarm calling. Breeding status: Definite	Observed 32 times throughout April to June with a peak count of three individuals. Breeding behaviour included singing, and territorial behaviour. Breeding status: Definite
Swallow	SL	No observations	No observations	Four individuals were observed in early May in two separate nests at the old farmhouse.	No observations

Species	BTO Code	Breeding status 2020	Breeding status 2021	Breeding status 2022	Breeding status 2023
				Breeding status: Definite	
Willow warbler	WW	Observed eight times in early May exhibiting breeding behaviour – singing. Breeding status: Definite	Observed 36 times throughout June and July with a peak count of four individuals and breeding behaviour of singing and provisioning observed. Breeding status: Definite	Observed 27 throughout May to August with a peak count of 4 individuals. Breeding behaviour included singing, alarm calling and courtship. Breeding status: Definite	Observed 38 times throughout April to June with a peak count of three individuals. Breeding behaviour included singing and displaying. Breeding status: Definite

Table 41: Breeding bird survey results.

In addition, a typical assemblage of green-listed species, not of conservation concern and not typically affected by wind farm developments, was present throughout the breeding season. Species exhibiting breeding behaviour included blackbird (*Turdus merula*), blackcap (*Sylvia atricapilla*), blue tit (*Cyanistes caeruleus*), chaffinch (*Fringilla coelebs*), chiffchaff (*Phylloscopus collybita*), cuckoo (*Cuculus canorus*), dunnock (*Prunella modularis*), goldfinch (*Carduelis carduelis*), grasshopper warbler (*Locustella naevia*), great tit (*Parus major*), hooded (grey) crow (*Corvus cornix*), magpie (*Pica pica*), reed bunting (*Emberiza schoeniclus*), robin (*Erithacus rubecula*), sedge warbler (*Acrocephalus schoenobaenus*), siskin (*Spinus spinus*), stonechat (*Saxicola rubicola*), whitethroat (*Curruca communis*) and wren (*Troglodytes troglodytes*).

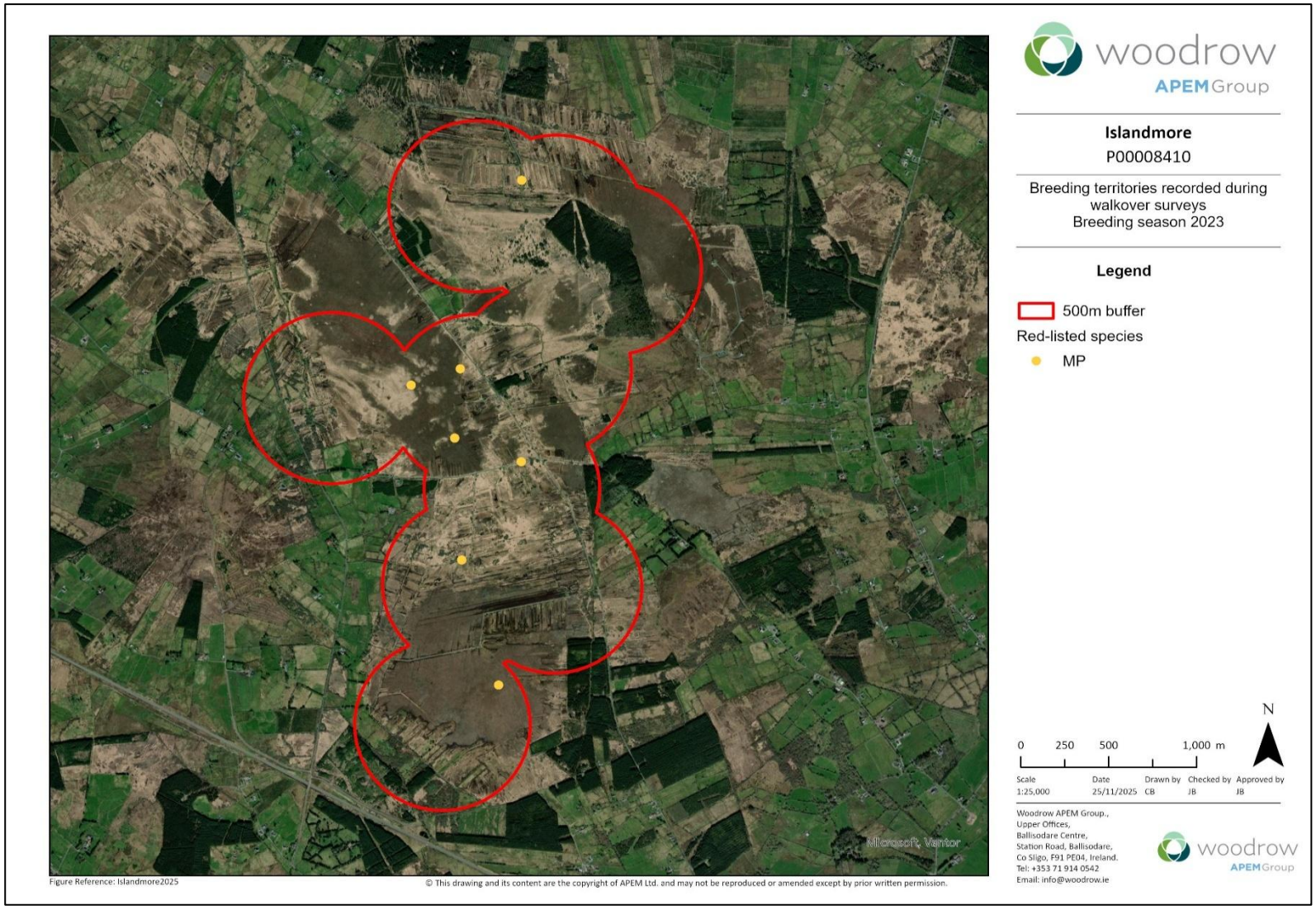


Figure 5: Indicative, red-listed species breeding territories 2023

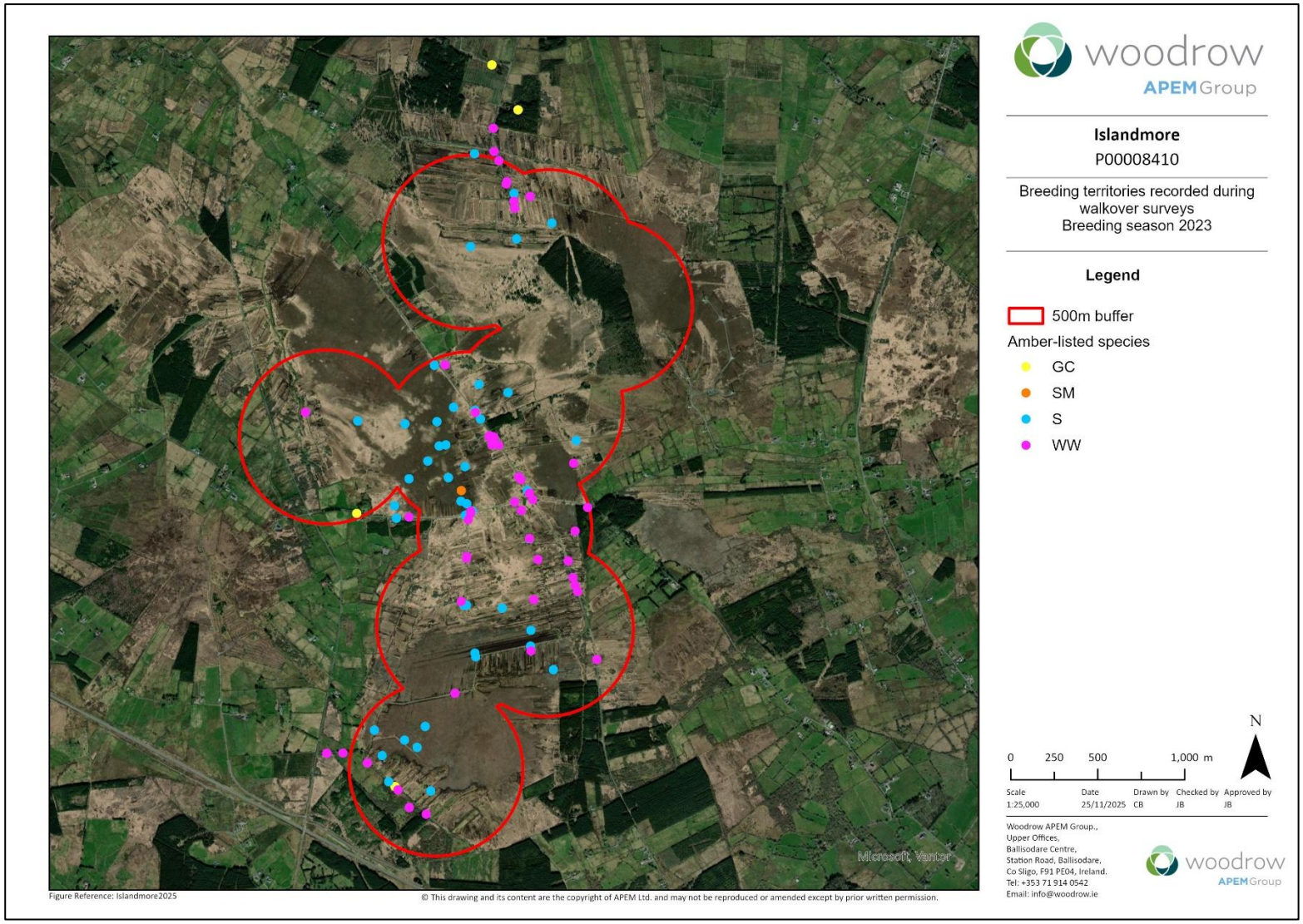


Figure 6: Indicative, amber-listed breeding territories 2023

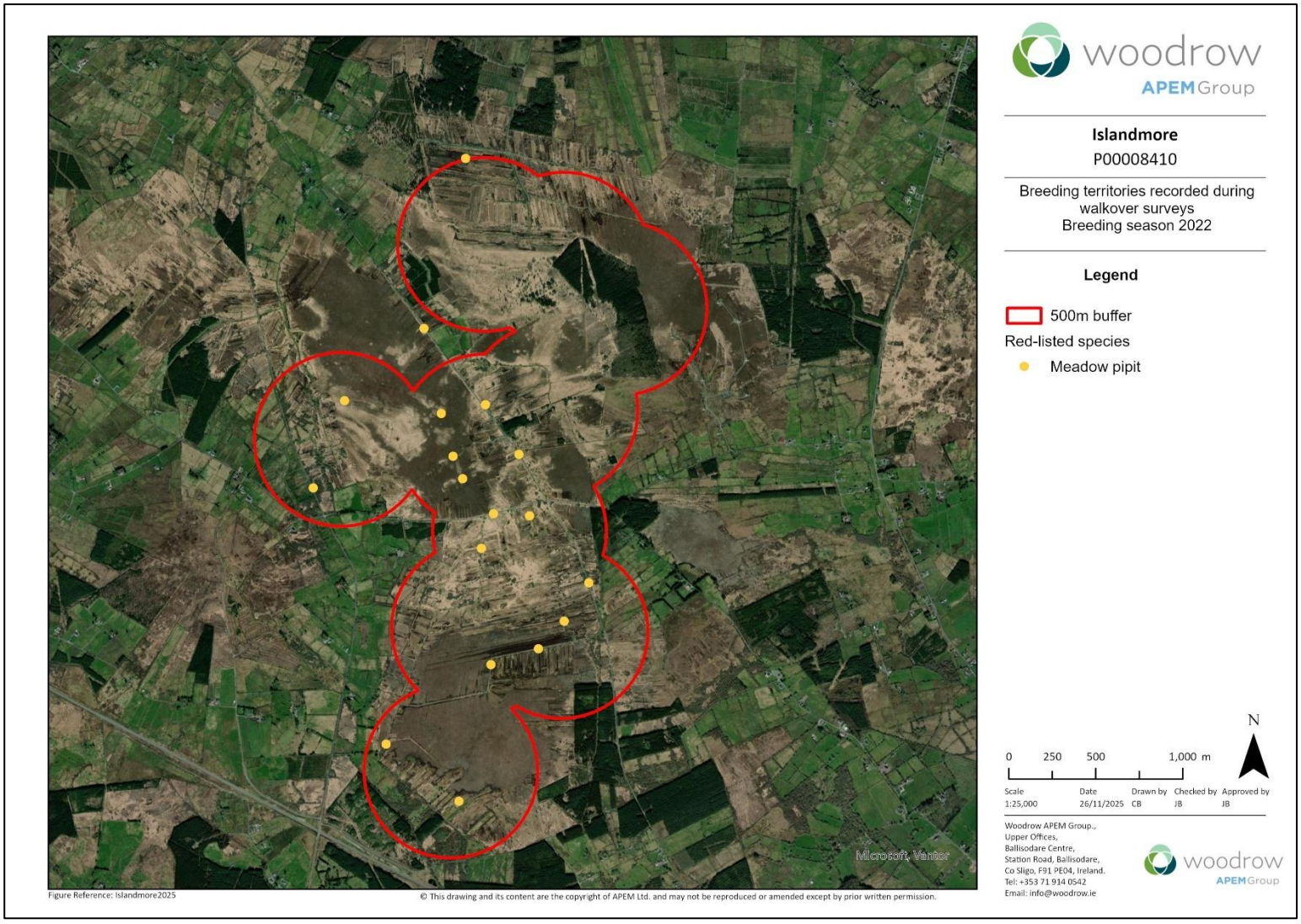


Figure 7: Indicative, red-listed species breeding territories 2022

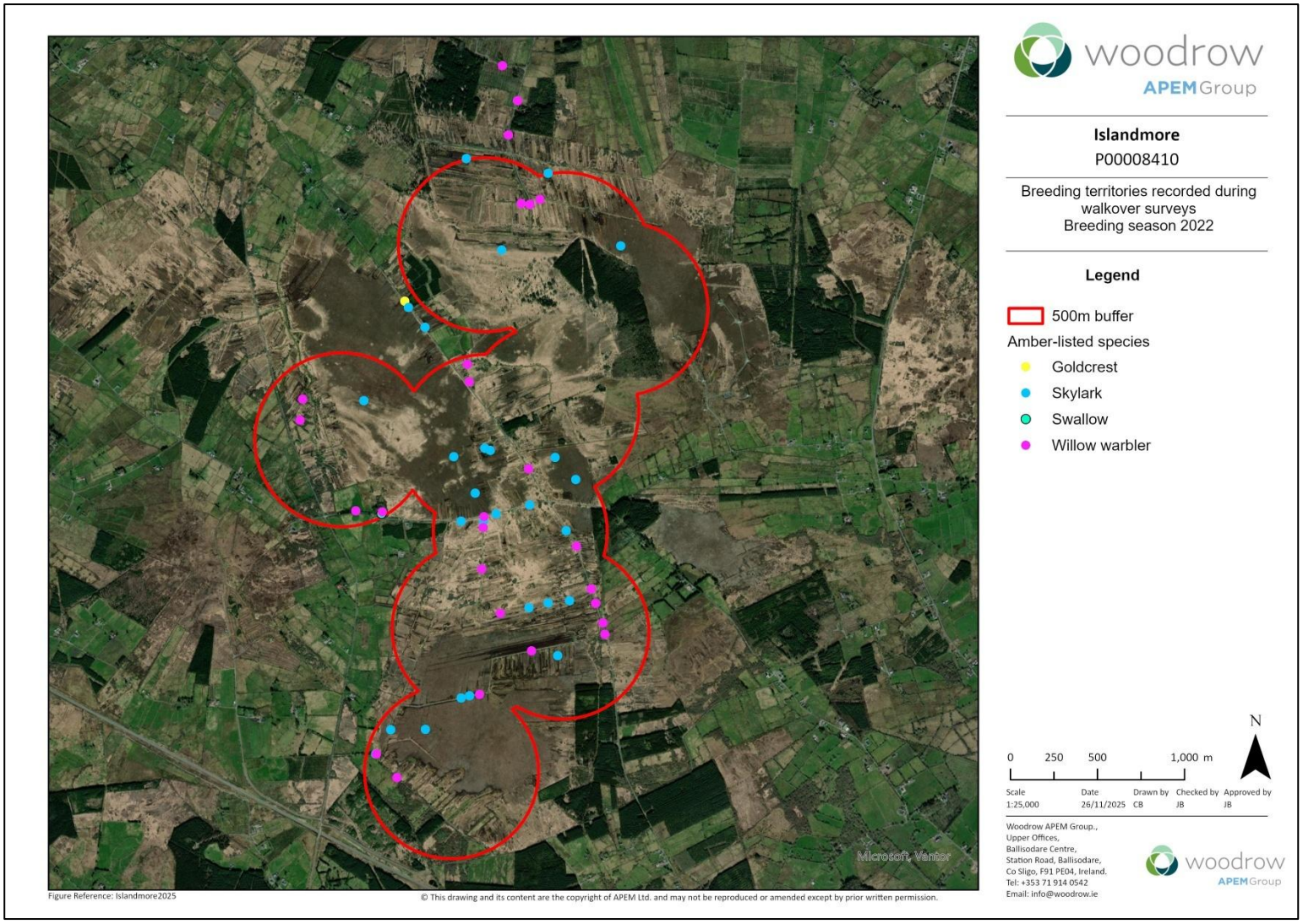


Figure 8: Indicative, amber-listed breeding territories 2022

1.7.2.3 Raptors

Breeding raptor surveys were undertaken in Year 1 (March and July 2020), Year 2 (March and July 2021), Year 3 (April and August 2022) and Year 4 (April and July 2023). Evidence of breeding raptors is limited to observations of late season juvenile sparrowhawk in 2020, a probable juvenile kestrel in 2021. Buzzard was observed in 2020 soaring over suitable habitats but there was no further observation. There was a single observation of Merlin alarm calling in 2021.

Full results are presented in **Appendix 3** hereto.

Species	BTO Code	Breeding status 2020	Breeding status 2021	Breeding status 2022	Breeding status 2023
BoCCI (2020-2026) Red-listed					
Kestrel	K	Observed 13 times between March and July with a speak count of two individuals. There was no breeding behaviour observed.	Observed three times between March and July. There was no breeding behaviour observed, but in July the sighting was of a probable juvenile individual.	Observed four times between July and August. There was no breeding behaviour observed.	Observed seven times between April and July with a speak count of two individuals. There was no breeding behaviour observed.
BoCCI (2020-2026) Amber-listed					
Hen harrier	HH	-	A single adult female individual was observed flying through the project site in July. There was no breeding behaviour observed.	-	-
Merlin	ML	Observed once in late March a female individual flew through the project site. There was no breeding behaviour observed,	A single individual was observed alarm calling in late March. There were no further observations.	-	-
BoCCI (2020-2026) Green-listed					
Buzzard	BZ	There was one observation of buzzard soaring over suitable habitat in late March. There were no further breeding related activity observed.	-	-	There were two observations of buzzard in April but there was no breeding behaviour observed.

Sparrowhawk	SH	There was one observation of fledgling individual calling in late July.	Observed four times between Match to May with a peak count of two birds. There was no breeding behaviour observed.	A single individual was observed in April flying through the project site. There was no breeding behaviour observed.	There were two observations of sparrowhawk flying through the project site in July. There was no breeding behaviour observed.

Table 42: Breeding raptor results summary table

1.7.2.4 Incidental Observations

2020 – Three observations of snipe exhibiting chipping/breeding behaviour on the bog Three mallard and one wheatear were observed with no breeding behaviour.

2021 – There was a single observation of four whooper swans in late March flying north, two swift foraging in July and a great spotted woodpecker within the forestry plantation.

2022 – Two teal were flushed from the ditch network, two pheasant were observed, and a single lesser black-backed gull was also observed.

2023 – Two flocks of golden plover were observed early in the season of 16 and 25 birds; there was no breeding behaviour. Mallard was observed three times and red grouse once both with no breeding behaviour.

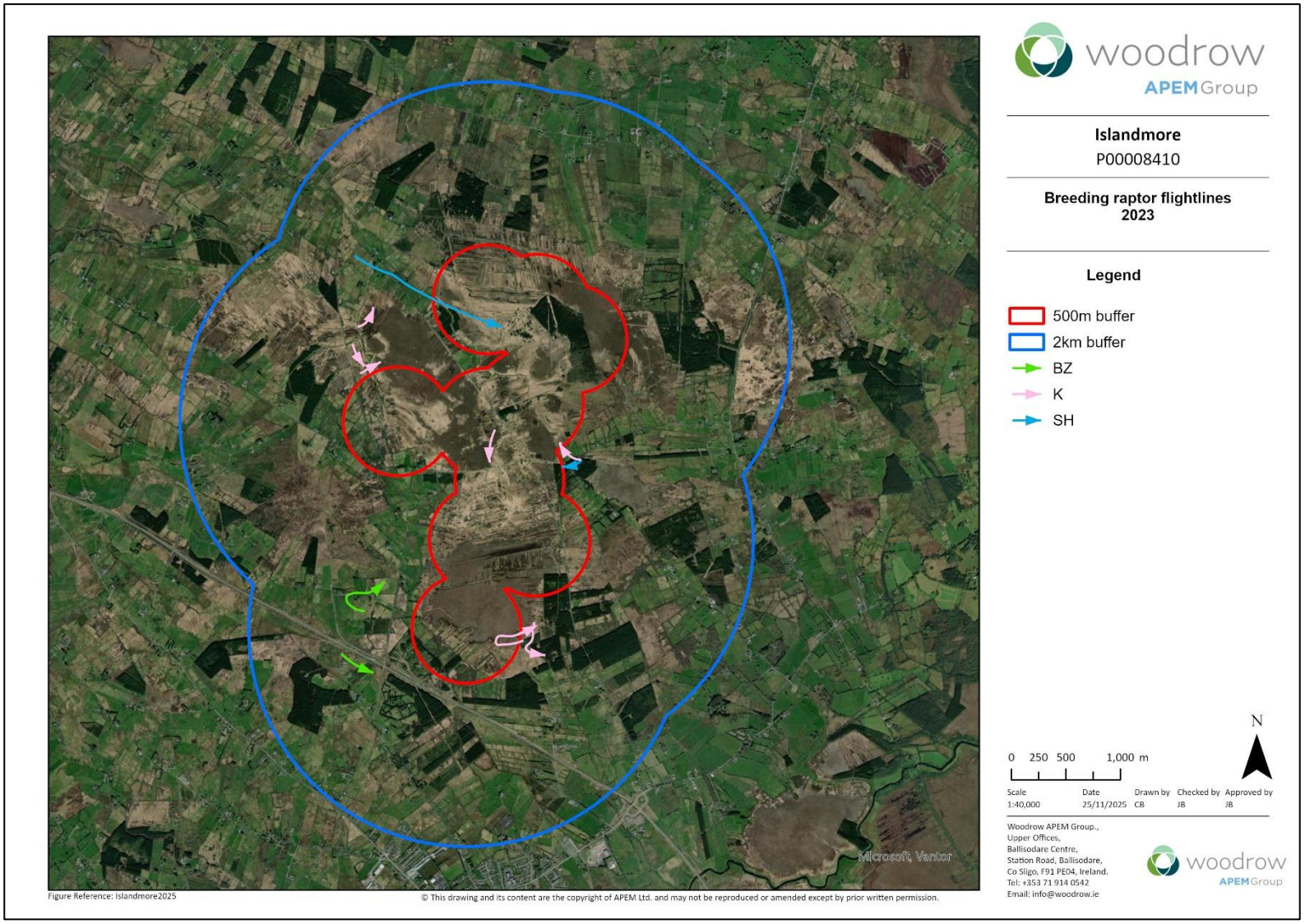


Figure 9: Breeding raptor flightlines 2023

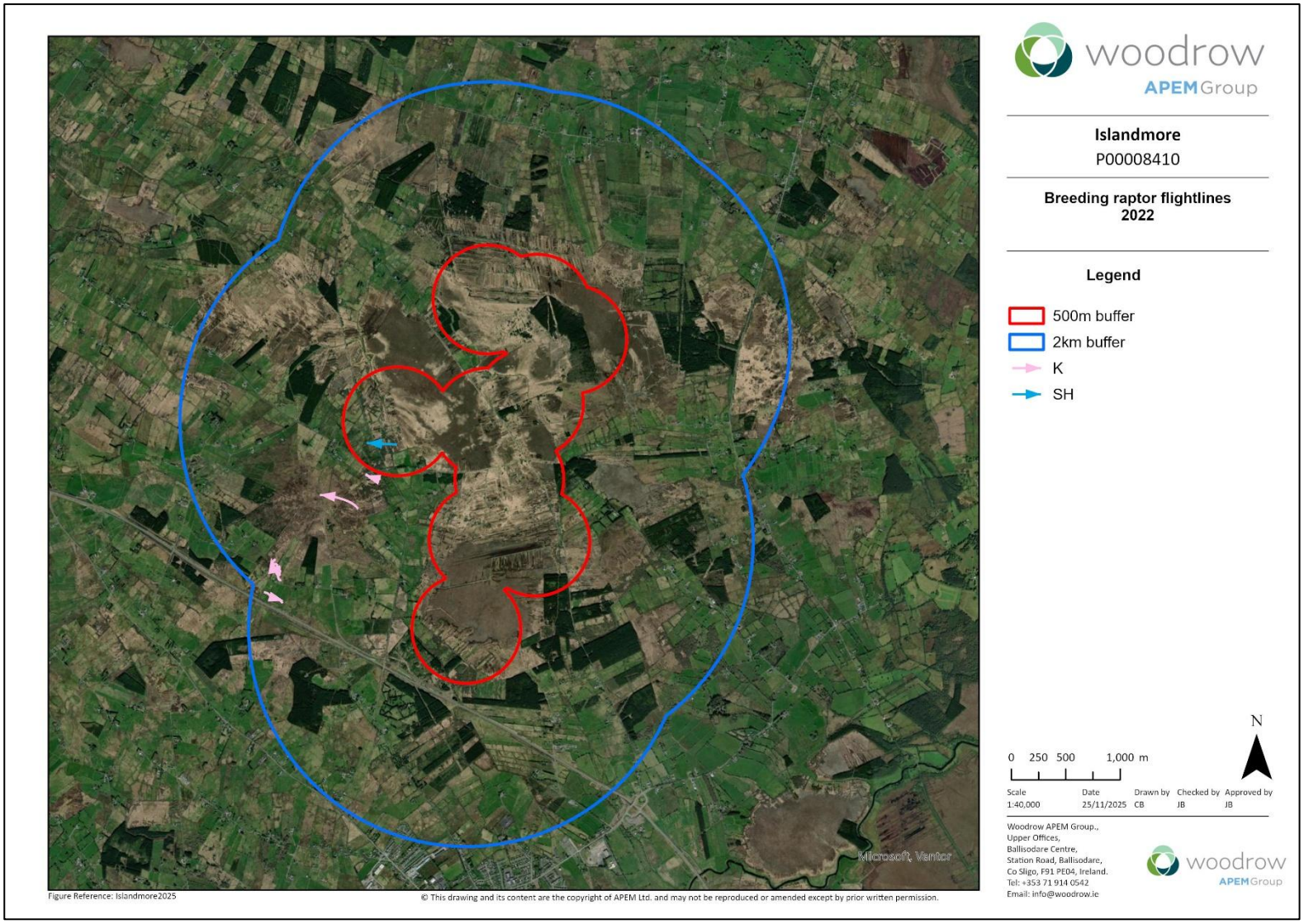


Figure 10: Breeding raptor flightlines 2022

1.7.3 NON-BREEDING SEASON SURVEY RESULTS

1.7.3.1 Walkover Survey Results

Surveys took place in Year 1 (non-breeding season 2019/20), Year 2 (non-breeding season 2020/21), Year 3 (non-breeding season 2021/22) and Year 4 (non-breeding season 2022/23). A total of 11 red-listed, 16 amber-listed and 29 green-listed species were recorded.

The range of species recorded between the survey years was broadly similar although yellowhammer was present in Year 3. Therefor the locations of species shown **in Figure 11**, **Figure 12**, **Figure 13** and **Figure 14** and considered broadly indicative of the project site.

Species	Number of individuals		
	Visit 1 06/12/19	Visit 2 12/01/20	Visit 3 07/02/20
BoCCI (2020-2026) Red listed species			
Golden plover	12	19	4
Meadow pipit			14
Red grouse	1		3
Snipe	3	2	5
BoCCI (2020-2026) Amber listed species			
Hen harrier		1	

Table 43: Walkover results non-breeding season 2019-20

Species	Number of individuals		
	Visit 1 23/10/20	Visit 2 11/12/20	Visit 3 27/02/21
BoCCI (2020-2026) Red listed species			
Golden plover		4	7
Grey wagtail			2
Kestrel		1	
Meadow pipit	33	20	49
Snipe	6	6	6
BoCCI (2020-2026) Amber listed species			
Goldcrest		2	2
Hen harrier		1	
Mallard			2
Ringed plover		2	
Skylark			3
Starling			12

Table 44: Walkover results non-breeding season 2020-21

Species	Number of individuals				
	Visit 1 01/12/21	Visit 2 03/12/21	Visit 3 26/02/22	Visit 4 28/01/22	Visit 5 03/03/22
BoCCI (2020-2026) Red listed species					
Curlew			1		1
Golden plover		1			
Meadow pipit		5	6	8	5
Red grouse			1		
Snipe		3			1
Yellowhammer				1	
BoCCI (2020-2026) Amber listed species					
Goldcrest				3	
Skylark					1

Table 45: Walkover results non-breeding season 2021-22

Species	Number of individuals				
	Visit 1 23/01/23	Visit 2 25/01/23	Visit 3 14/03/23	Visit 4 19/03/23	Visit 5 20/03/23
BoCCI (2020-2026) Red listed species					
Kestrel			1		
Meadow pipit	3	20	3	4	6
Snipe	6	5			
BoCCI (2020-2026) Amber listed species					
Black-headed gull			1		
Hen harrier		1			
Mallard	3	2	2	2	1
Goldcrest	1			2	2

Table 46: Walkover results non-breeding season 2022-23

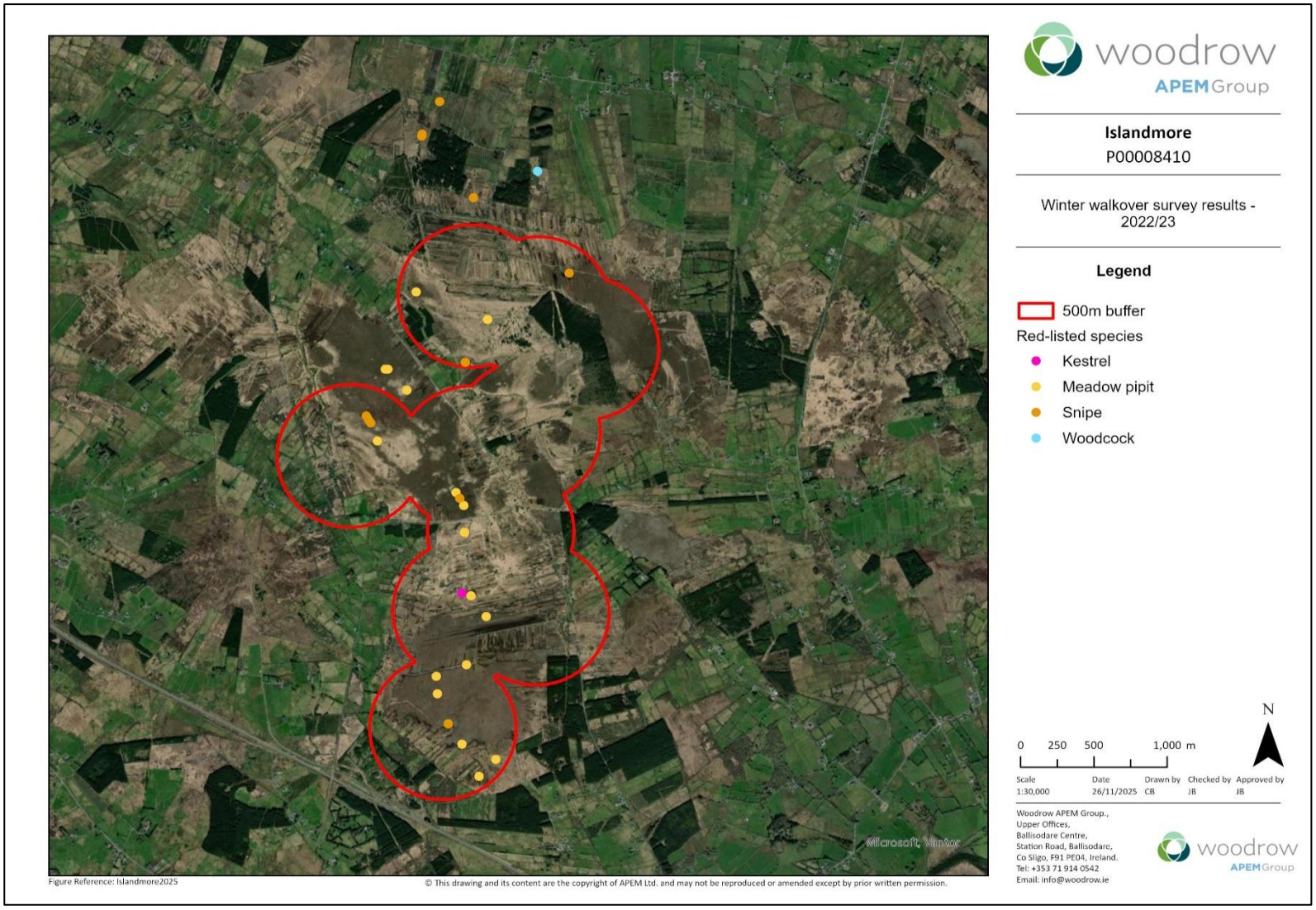


Figure 11: Winter walkover survey results red-listed species 2022/23

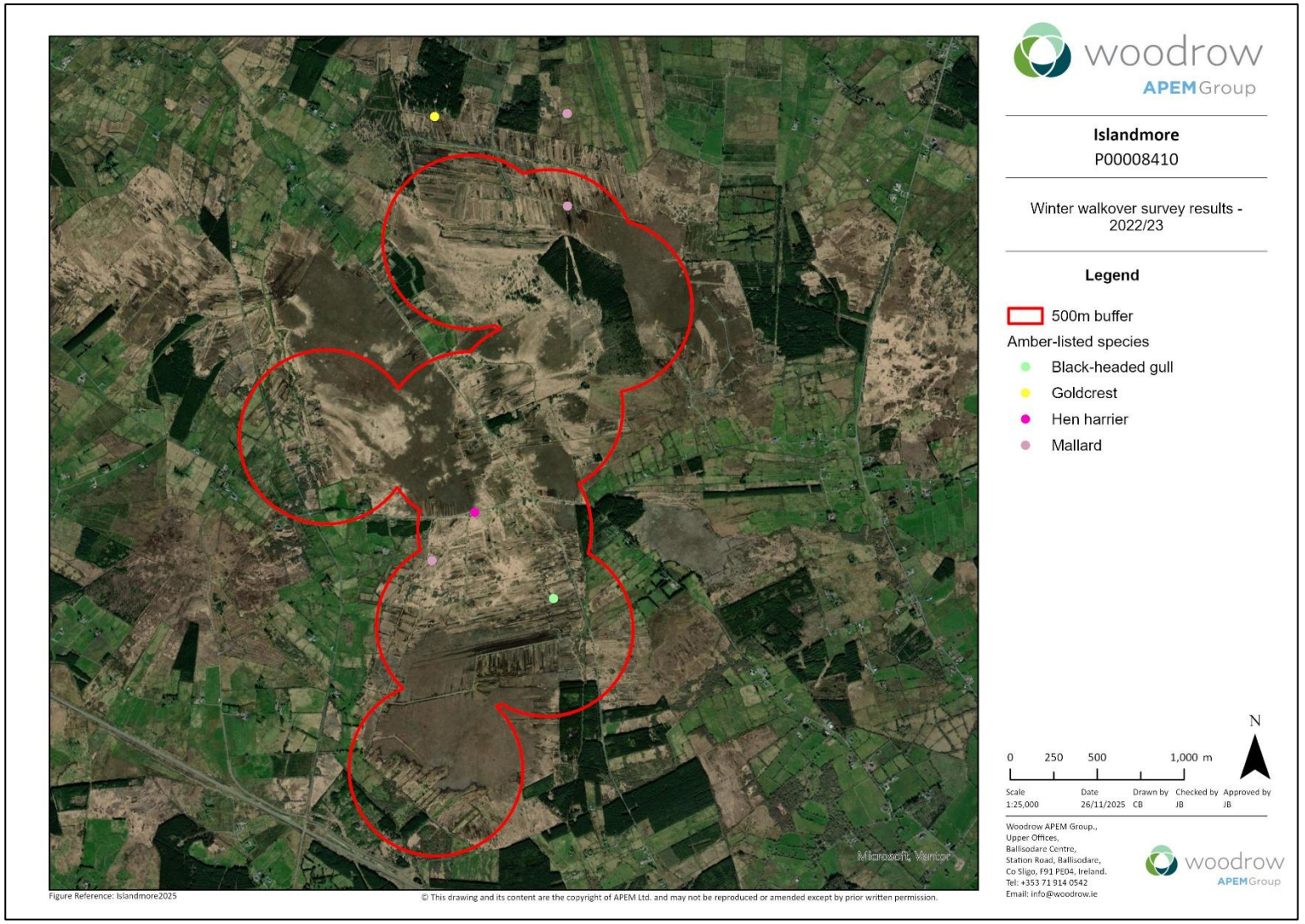


Figure 12: Winter walkover survey results amber-listed species 2022/23

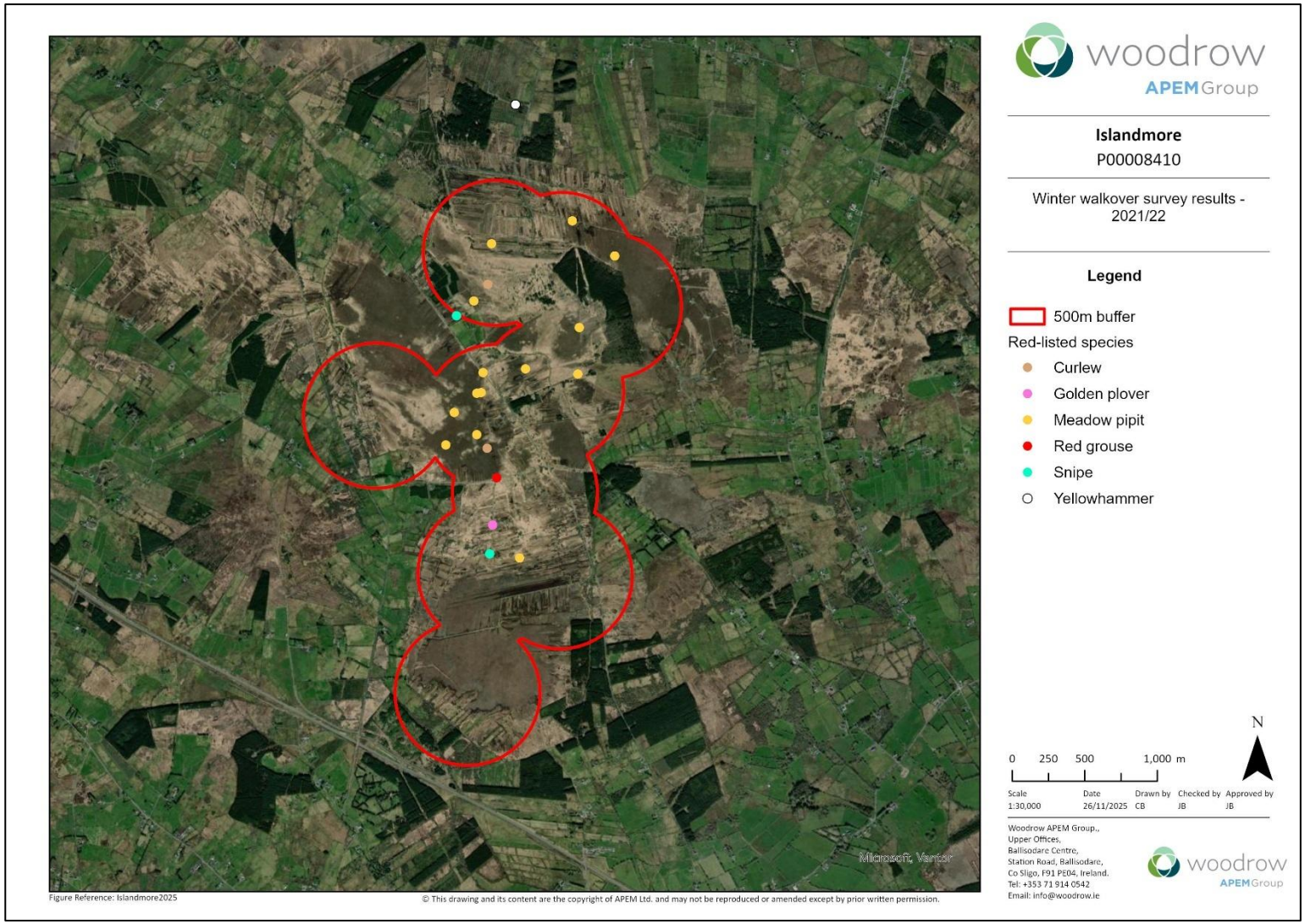


Figure 13: Winter walkover survey results red-listed species 2021/22

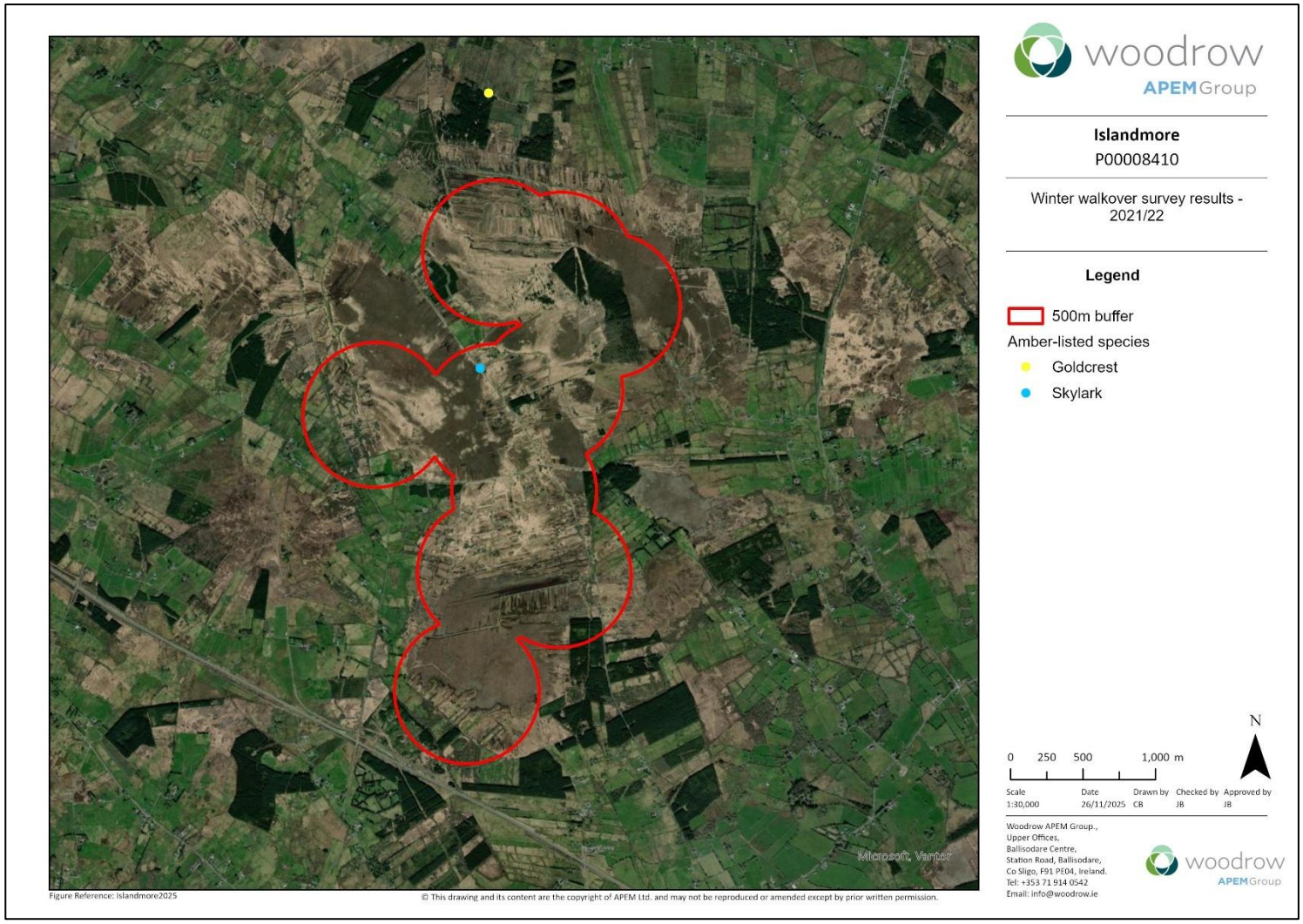


Figure 14: Winter walkover survey results amber-listed species 2021/22

1.7.3.2 Waterbird Survey Results

Surveys took place in Year 1 (non-breeding season 2019/20) and Year 2 (non-breeding season 2020/21). A total of nine red-listed, 20 amber-listed species and 7 green-listed species were observed.

Lough Gara SPA supports nationally important populations within its southwestern portion, which extends into the outer portion of the 5km buffer (Error! Reference source not found.). Notably, Greenland white-fronted goose and whooper swan, both qualifying interests of Lough Gara, were observed at Lough Gara during surveys. Waterbirds were only recorded at this location during surveys.

Species	Number of individuals	
	Visit 1 07/11/19	Visit 2 14/11/19
BoCCI (2020-2026) Red listed species		
Goldeneye		5
Pochard		3
BoCCI (2020-2026) Amber listed species		
Greenland white fronted goose		47
Great crested grebe		1
Mallard		51
Tufted duck		46
Whooper swan	14	32
Wigeon		32

Table 47: Wider area wintering water birds results non-breeding season 2019-20

Species	Number of individuals					
	Visit 1 07/11/19	Visit 2 14/11/19	Visit 3 09/12/20	Visit 4 06/01/21	Visit 5 08/02/21	Visit 6 07/03/21
BoCCI (2020-2026) Red listed species						
Curlew		33	48	46	46	1
Golden plover				7		75
Goldeneye		15	18	61	17	26
Lapwing		160	2	20	62	20
Pochard		145	321	315	185	145
Scaup (Greater)		1				1
Shoveler			7			21
Snipe				5		2
White-tailed eagle	1					
BoCCI (2020-2026) Amber listed species						
Greenland white-fronted goose	28			110	44	132
Black-headed gull						9
Common gull						4
Coot		40	23	40		
Cormorant		22	28	22	23	9

Gadwall			6			12
Goosander					4	
Great crested grebe	28	11	6	30	7	34
Greylag goose		116	103	58	47	34
Hen harrier				2		
Herring gull						1
Kingfisher						2
Mallard		86	129	199	66	82
Merlin		1		1		
Mute swan		46	12	11	24	27
Teal		97	63	241	14	49
Tufted duck		804	779	1259	843	410
Whooper swan	133	74	100	223	81	114
Wigeon		277	125	844	273	148
Willow warbler					35	

Table 48: Wider area winter waterbirds survey results non-breeding 2020-21

Species	Number of individuals
	Visit 1 07/11/19
BoCCI (2020-2026) Red listed species	
Curlew	18
Lapwing	28
Pochard	342
BoCCI (2020-2026) Amber listed species	
Coot	1
Cormorant	34
Great crested grebe	18
Greylag goose	42
Mallard	2
Mute swan	91
Teal	6
Tufted duck	558
Whooper swan	14
Wigeon	2

Table 49: Wider area winter waterbirds survey results non-breeding season 2022/23

1.7.3.3 Incidental Observations

In 2020/21 a white-tailed eagle was observed once, hen harrier, merlin and buzzard were observed twice, there were 35 willow warbler observed and there was a single observation of whitethroat.

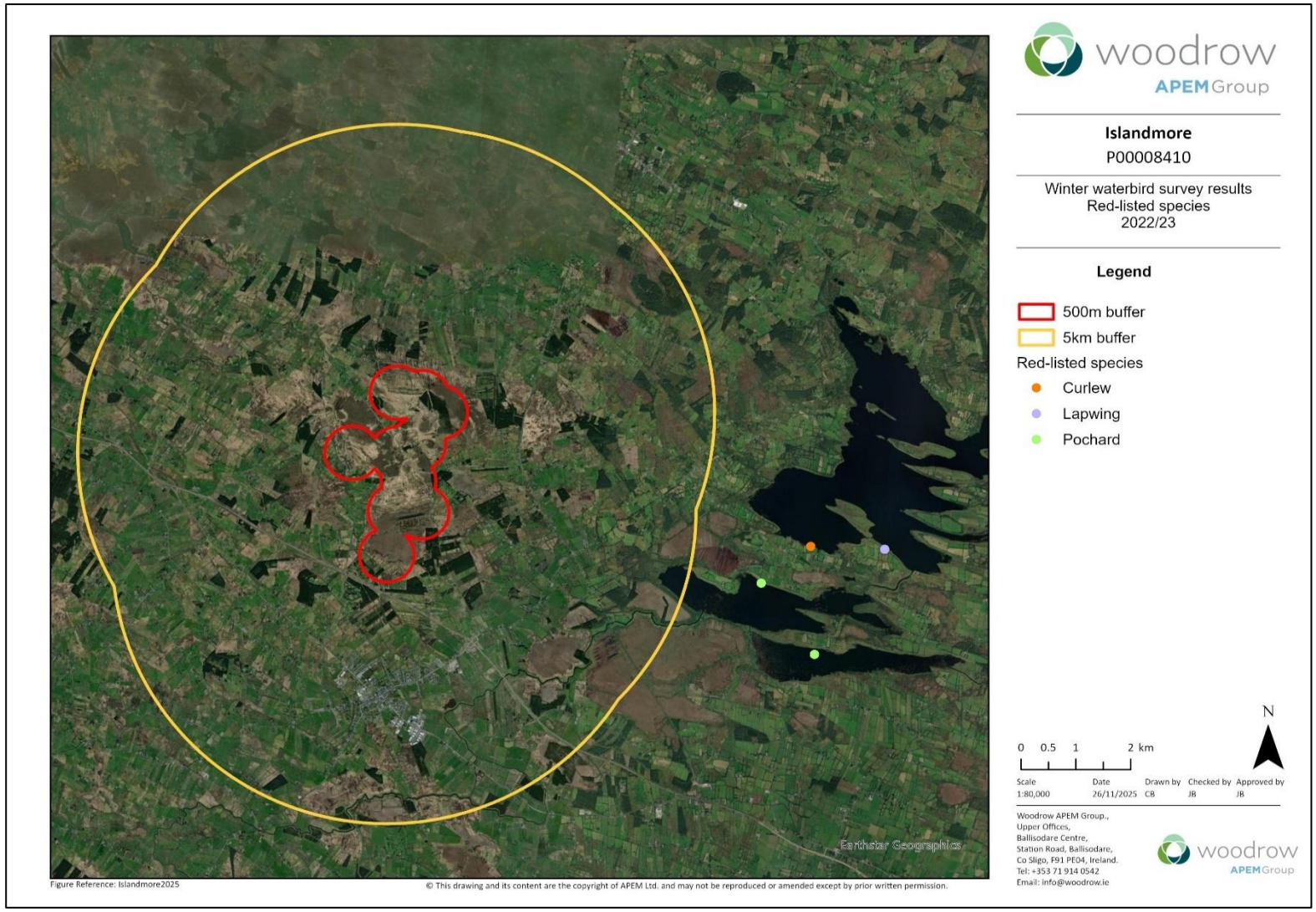


Figure 15: Winter waterbirds survey results red-listed species 2022/23

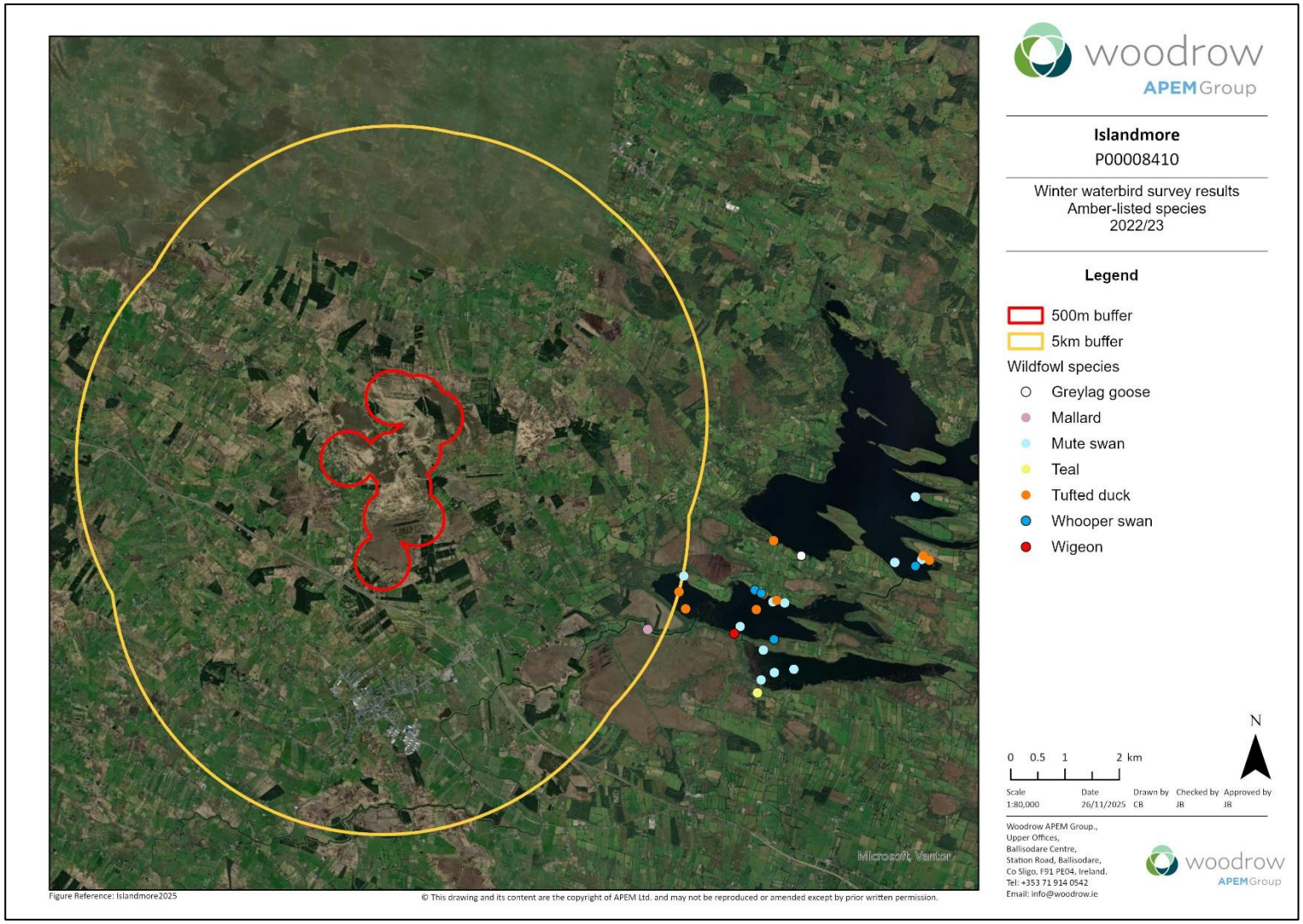


Figure 16: Winter waterbirds survey results amber-listed species 2022/23

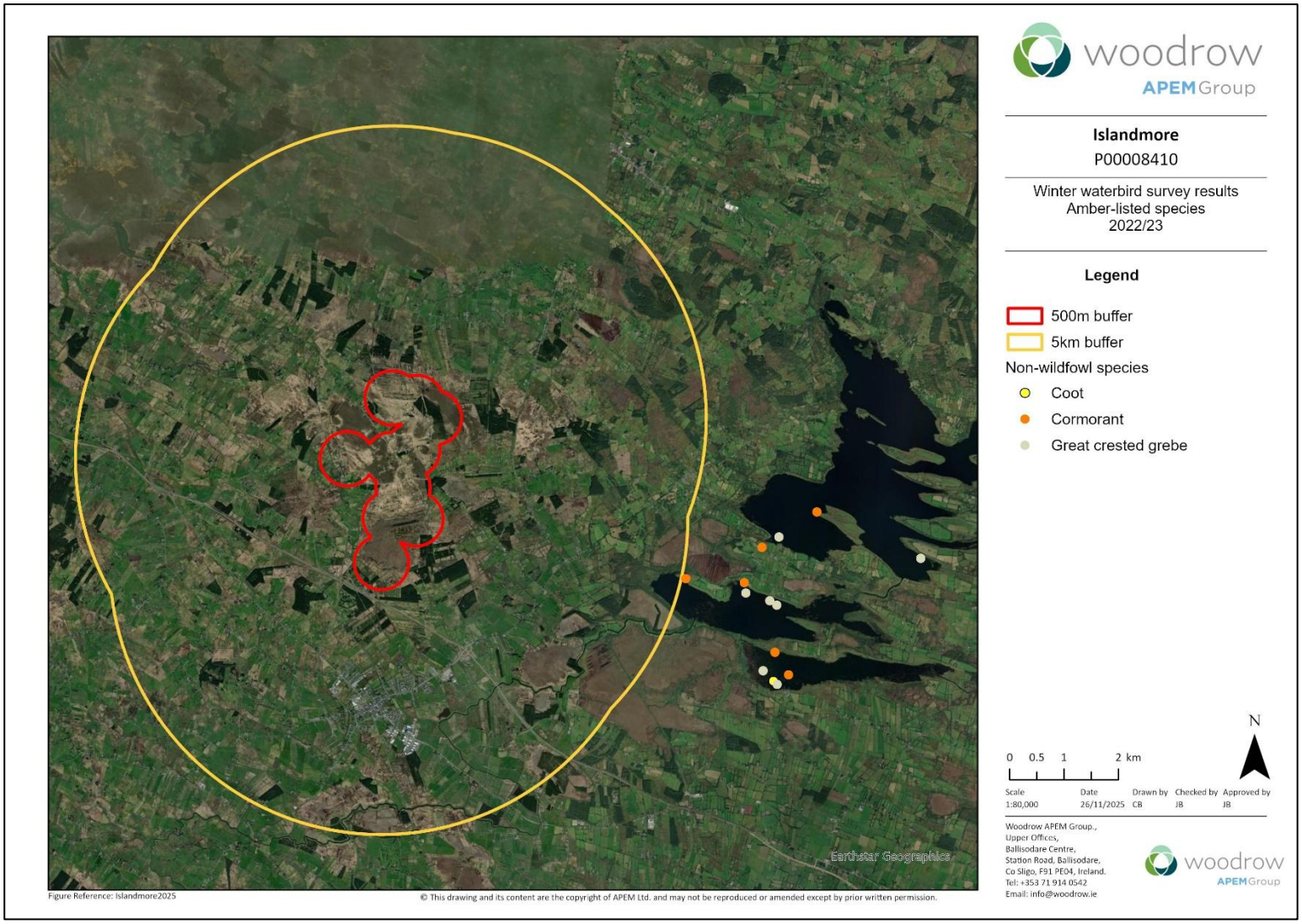


Figure 17: Winter waterbirds survey results amber-listed species continued 2022/23

1.8 HEN HARRIER ROOST SEARCHES

Surveys took place in Year 1 (non-breeding season 2019/20), Year 2 (non-breeding season 2020/21), Year 3 (non-breeding season 2021/22), Year 4 (non-breeding season 2022/23) and an additional Year 5 (non-breeding season 2024-25).

A regular hen harrier roost has been observed to the north-west and west of the project site, within the 2km site buffer, since the 2020-21 non-breeding season. Typically, two or more birds use the roost throughout the winter months. Two distinct locations are utilised, with further, detailed information from teach year that roosts were recorded provided in the Confidential Hen Harrier **Annex 5.8**.

Species	Non-breeding season 2020-21	Non-breeding season 2021-22	Non-breeding season 2022-23	Non-breeding season 2024-25
Hen harrier	A total of 24 observations were recorded during the survey season between October and February. Flights were recorded throughout the non-breeding season, with two birds (a male and a female/juvenile) recorded roosting during a survey on the 8th November 2020.	A total of 25 observations over the survey season October to March. Roost is regularly in used by at least two birds, with the occasional third bird recorded.	A total of 15 observations over the survey season December to February. Roost is in regular use. Two males were seen in a single visit. On a separate visit both male and ringtail were seen.	A total of 22 observations over the survey season October – March. Three males seen roosting together on two occasions. Ringtail birds also observed throughout the season.

Table 50: Hen harrier roost summary table

1.9 ORNITHOLOGICAL BASELINE

1.9.1 FLIGHT ACTIVITY ALL YEARS

A total of 467 flights were recorded during the VP surveys over the two-year period. Kestrel (134 flights), golden plover (71 flights), and lesser black-backed gull (48 flights) were the most frequently observedspecies, indicating relatively high activity levels within the project site and the 500 m turbine buffer.

Detailed information on modelled collision risk is provided in the Collision Risk Report.

1.9.2 SUMMARY OF WETLAND BIRD ASSEMBLAGE

1.9.2.1 Non-breeding Season (Year 1) 2019-20

Two red-listed species were recorded within the 500m buffer. Golden plover reached a peak count of 500 on two occasions, primarily flying over the project site (**Figure 26**). Snipe were also recorded, with a peak count of five individuals. The mixed habitats of bog and surrounding agricultural land provide roosting and winter-feeding opportunities for both species.

Three amber-listed species were observed within the 500m buffer. Whooper swan was recorded flying over or through the project site (**Figure 52**), with no regular flight paths

identified, and a total of four flights over the survey season. Mallard and Lesser-black backed gull were each recorded once (**Figure 40** and **Figure 38**, respectively). During the same period, the Green-listed grey heron was observed once during VP surveys.

1.9.2.2 Non-breeding Season (Year 2) 2020-21

Three red-listed species were observed within the 500m buffer.

Golden plover reached a peak count of 39 birds, transiting through the project site and roosting twice near VP2 (**Figure 26**). Snipe peaked at six individuals, using wetter habitats for winter feeding. Red grouse were heard twice during the survey season.

Four amber-listed species were observed within the 500m buffer. Whooper swan reached a peak count of nine birds, flying over the project site on four occasions without landing (Figure 52). Mallard was observed in flight, with a peak count of two birds (Figure 40). Herring gull was recorded twice in flight, with a peak count of two (**Figure 33**). Ringed plover was observed once on bog habitat within the 500m buffer with a peak count of two birds.

Green-listed grey heron was observed transiting through the project site on three occasions.

1.9.2.3 Non-breeding Season (Year 3) 2021-22

Five red-listed species were recorded within the 500m buffer. Curlew flocks were observed twice, with a peak count of 20 birds, flying through the project site and circling on one occasion (Figure 24), and landing once. Golden plover flocks were recorded through the season (Figure 28), ranging from 4-22 birds early in the season to 300-500 birds by late season (February) on two consecutive occasions. These flocks were mobile within the 500m buffer and wider area, using bog habitat for landing. Snipe reached a peak of three individuals, with short flights recorded close to the redline boundary (**Figure 47**). Lapwing were observed once, with a flock of 15 birds flying southwest through the 500m buffer (Figure 37), likely transiting through to breeding grounds. A single red grouse was heard, and one woodcock was flushed outside of the 500m buffer (Figure 53).

Two amber-listed species were recorded within the 500m buffer. Mallard was observed on two dates, with a peak count of two birds using ditch cuttings. A single lesser black-backed gull was observed flying though the project site without stopping (**Figure 39**).

Green-listed heron was observed once flying through the project site.

1.9.2.4 Non-breeding Season (Year 4) 2022-23

Three red-listed species were observed within the 500m buffer. Snipe was observed regularly throughout the season, with a peak count of six birds and typical observations of 1-2 individuals. Curlew were recorded on two occasions, with a peak count of three birds briefly flying through the 500m buffer on each occasion without stopping (Figure 24). Golden plover were observed once, with a flock of eight birds flying at speed through the 500m buffer (Figure 28).

Four amber-listed species were recorded within the 500m buffer. Black-headed gull was observed four times flying through the project site, with a peak count of two birds. Mallard was recorded throughout the season, utilising flooded peat cuttings and ditch habitats within the 500 m buffer. Lesser black-backed gull was observed once flying

through the project site (**Figure 39**). Common gull was also recorded once, flying through the project site (**Figure 22**).

1.9.2.5 Breeding Season (Year 1) 2020

Three red-listed species were recorded within the 500m buffer. Snipe were present throughout the season, with up to eight individuals recorded. Chipping and drumming were noted from wet bog habitats in both the northern and southern parts of the 500m buffer (Figure 54).

Golden plover was recorded twice in late March, with a peak flock of 60 birds briefly settling before continuing northward, likely undertaking passage flights to breeding grounds.

Curlew was recorded once, calling and flying within the southern portion of the 500m buffer (Figure 23) in early July. Given this single observation over the survey period, the species does not appear to be a regular user of the project site.

Two amber-listed species were recorded within the 500m buffer. Mallard had a peak count of seven birds, with no breeding behaviour observed; birds utilised a range of wet habitats throughout the 500m buffer (Figure 40). Lesser black-backed gull was observed on three occasions, with a peak count of three birds, flying through the project site (**Figure 38**).

1.9.2.6 Breeding Season (Year 2) 2021

Three red-listed species were observed within the 500m buffer. Snipe were seen throughout the season with a peak count of five birds. Breeding behaviour was observed, with chipping and drumming recorded during dusk surveys (Figure 54). As in the 2020 breeding season, suitable habitat for breeding snipe remains present across the project site. Golden plover was recorded on a single visit in late March, with 39 birds flying though the 500m buffer and attempting to land. Given the timing, these birds were on northward passage to breeding grounds and were not recorded again. Red grouse were observed roosting, and flying within, the 500m buffer, with a peak count of two birds.

Four amber-listed species were recorded within the 500m buffer. Whooper swan was observed in a single day, with two flocks observed and a peak count of 34 birds flying through the project site until out of view (**Figure 52**). These birds were seen in late March and were on northward passage to breeding grounds; none were seen landing or feeding within the project site. Lesser black-backed gull was recorded throughout the season, flying though the 500m buffer (**Figure 38**) while foraging and transiting the project site. One probable juvenile was observed, suggesting the presence of suitable breeding habitat in the wider region. Mallard was observed seven times during the survey period, with a peak count of two birds. Birds were recorded both flying through the project site (Figure 40) and landing, likely for opportunistic feeding. Herring gull was recorded once, transiting the project site (**Figure 33**).

1.9.2.7 Breeding Season (Year 3) 2022

One red-listed species was recorded within the 500m buffer. Snipe were present throughout the season, with a peak count of two birds. No definitive breeding activity was recorded.

Three amber-listed species were recorded within the 500m buffer. Mallard activity began early in the season, with a peak count of two birds. A juvenile accompanied by a female in mid-July indicates local breeding success, although a nest site was not identified. Lesser black-backed gull was recorded on four days in the latter half of the survey season, with a peak count of three birds, including a juvenile. No breeding behaviour was observed on site, and birds were recorded flying through the area without landing (Figure 39). Common gull was observed once, flying through the project site (**Figure 22**).

1.9.2.8 Breeding Season (Year 4) 2023

Three red-listed species were recorded within the 500m buffer. Snipe was observed on three occasions, with a peak count of one bird and no evidence of breeding activity. Red grouse were heard calling twice in the area, although no individuals were visually observed. A single flock of six curlew was recorded flying over the project site in late August (Figure 24), likely representing early autumn passage through the region.

Two amber-listed species were recorded within the 500m buffer. Mallard (peak count two birds) occurred throughout the season, utilising ditch habitats within the bog. Lesser black-backed gull was observed on eight occasions, with a peak count of two birds flying through the 500m buffer (Figure 39). Black-headed gull was recorded once, flying outside the 500m buffer (**Figure 19**).

1.9.3 Summary of Bird of Prey Assemblage

1.9.3.1 Non-breeding Season (Year 1) 2019-20

One red-listed species was recorded within the 500m buffer. Kestrel was recorded on eight days during the season, with single birds observed either flying or hunting over the bog habitats within the project site (Figure 34).

Two amber-listed species were recorded within the 500m buffer. Both male and ringtail Hen harrier was observed flying (Figure 31) through the project site and hunting over bog habitats. However no roosts were identified. Merlin was recorded once during the survey period, hunting low over bog habitats (Figure 42).

Green-listed sparrowhawk was observed twice hunting within the 500m buffer.

1.9.3.2 Non-breeding Season (Year 2) 2020-21

One red-listed species was recorded in the 500m buffer. Kestrel was recorded 43 times across the season, regularly flying and hunting throughout the project site (Figure 35).

Two amber-listed species were recorded in the 500m buffer. Hen harrier was observed consistently throughout the season, with both female and male birds hunting over bog habitats (Figure 31). A regular communal roost was again present within the 2km buffer, with two birds frequently recorded together using the roost site. Due to the confidential nature of this record, it is discussed further in **Annex 5.8**. Merlin was observed three times over the season, flying through the project site without exhibiting hunting behaviour (Figure 42).

Two green-listed species were recorded within the 500m buffer. Sparrowhawk was recorded once in the northern part of the 500m buffer, where male and female birds were seen transiting; these observations just outside the 500m buffer, and no flight line

was therefore mapped. Buzzard was observed twice; first perched outside the 500m buffer, and later in the season circling over the project site (**Figure 20**).

1.9.3.3 Non-breeding Season (Year 3) 2021-22

One red-listed species was observed within in the 500m buffer. Both male and female Kestrel were recorded hunting and flying (Figure 36) on six occasions. Activity was less than in previous years, with greater use of areas outside the 500m buffer.

One amber-listed species was recorded within the 500m buffer. Hen harrier was recorded six times in flight (**Figure 32**), with a peak of two birds observed together within the 500 m buffer. The established roosting sites within the 2km buffer remained active throughout the season, with two birds regularly present. Both adult males and ringtail birds (female/juvenile) were observed at the roost. Due to the confidential nature of this record, it is discussed further in **Annex 5.8**.

One green-listed species was recorded within the 500m buffer. Sparrowhawk was recorded twice, with single birds observed on each occasion flying rapidly through the area; only one of these birds spent a brief period within the 500m buffer.

1.9.3.4 Non-breeding Season (Year 4) 2022-23

One red-listed species was recorded within the 500m buffer. Kestrel was recorded twice hunting within the 500 m buffer, although the majority of observed flights occurred outside the buffer.

Two amber-listed species were recorded within the 500m buffer. Hen harrier was recorded ten times, with hunting and roosting behaviours observed. Flight lines (**Figure 32**) show that most activity occurred outside the 500m buffer, concentrated towards one of the known roosting locations. The roost continued to be regularly used, with a male and ringtail observed together. On one occasion, two males were observed calling at each other before settling to roost. Due to the confidential nature of this record, it is discussed further in **Annex 5.8** Merlin was recorded twice, once hunting in the northern part of the 500m buffer, and once outside of the 500m buffer.

One green-listed species was recorded within the 500m buffer. Buzzard was observed being mobbed as it soared high over the project site.

1.9.3.5 Non-breeding Season (Year 5) 2024-25 (Hen harrier only)

The well-established roost continued to be in regular use throughout the season. Both male and ringtail birds have been observed, and notably, three male birds were recorded using the roost on two occasions, once in October, early in the season, and again in January during the peak of the non-breeding season. Due to the confidential nature of this record, it is discussed further in **Annex 5.8.**

1.9.3.6 Hen harrier Winter Roost Summary

A regularly occurring hen harrier roost is present within the 2km study area. As an amber-listed and Annex 1 species, hen harrier receives a high level of protection year-round. Dedicated winter roost surveys conducted between 2020 to 2025 have identified three consistently used roost locations. Due to the confidential nature of hen harrier roost sites, further information is provided in **Appendix 5.8**.

Breeding Season (Year 1) 2020

One red-listed species was recorded within the 500m buffer. Kestrel was regularly observed throughout the season (**Figure 34**), with birds hunting across the range of available habitats. Later in the season, up to two juvenile birds were seen together hunting over the bog on two separate days. This suggests the presence of suitable breeding habitat within the wider area and indicates that the project site provides appropriate conditions for juvenile birds during the post-fledging period.

Two amber-listed species were recorded within the 500m buffer. Hen harrier was recorded on a single day in late March (**Figure 31**) when a female was observed hunting over the bog. This individual was likely associated with the nearby communal winter roost and preparing to disperse to breeding grounds, as no further observations were made. Merlin was recorded twice early in the breeding season, with single birds flying through the project site on each occasion (**Figure 42**).

Two green-listed species were recorded within the 500m buffer. Sparrowhawk was observed once hunting within the bog habitats (**Figure 48**). During the wider breeding raptor surveys, both male and female sparrowhawks were recorded throughout the season, with fledglings observed within the northern part of the project site. Although no nest was located, the presence of fledglings indicates the project site's suitability for raising young raptors. Buzzard was observed twice, soaring high through the 500m buffer (**Figure 20**).

Breeding Season (Year 2) 2021

One red-listed species was recorded in the 500m buffer. Kestrel was regularly observed hunting throughout the season (**Figure 35**), with 33 observations made across the survey period. No juveniles were recorded during this season.

Two amber-listed species were recorded within the 500m buffer. Hen harrier was recorded once in July, when a single male was observed hunting over bog habitat. Merlin was observed once early in the season, hunting across the wider landscape.

Two green-listed species were recorded within the 500m buffer. Buzzard was observed once, flying along the southeastern edge of the buffer (**Figure 20**). Sparrowhawk was recorded three times throughout the season, including one repeat sighting of the same individual. On each occasion, sparrowhawks were observed flying within the buffer, with no hunting behaviour recorded.

Breeding Season (Year 3) 2022

One red-listed species was recorded within the 500m buffer. Kestrel was recorded eight times over the survey period (**Figure 36**), with a peak count of four birds forming a family party (male, female and two juveniles) in late August. This indicates suitable breeding habitat in the wider area, likely to the east where the birds later moved; no nest was observed on site. Hunting behaviour was recorded throughout the season.

One amber-listed species was recorded within the 500m buffer. Merlin was recorded once, flying at speed through the project site with no hunting activity observed.

Two green-listed species were recorded within the 500m buffer. Sparrowhawk was observed once being mobbed by small birds (**Figure 49**). Buzzard was recorded six times (**Figure 21**), with a peak count of two birds observed together; behaviour predominantly consisted of birds flying through the project site or soaring overhead.

Breeding Season (Year 4) 2023

One red-listed species was recorded within the 500m buffer. Kestrel was recorded four times over the season (**Figure 36**). Behaviour within the 500m buffer consisted mainly of hunting or transiting though the area, with the majority of flights occurring outside of the 500 m buffer. Unlike previous years, no juvenile birds were observed.

Two green-listed species were recorded within the 500m buffer. Sparrowhawk was recorded four times flying through the 500m buffer, with a peak count of two birds (male and female) observed on three of the four occasions, often being mobbed by smaller birds. Buzzard was recorded once within the 500m buffer, where a single bird was observed being mobbed.

1.9.4 SUMMARY OF PASSERINE/OTHER SPECIES OF CONSERVATION CONCERN

Typically, passerine species are not significantly impacted by wind farm developments, except for those that are particularly sensitive to habitat alteration, such as breeding yellowhammer. Concise summaries for passerines species of conservation concern are provided below. In all seasons, a range of green-listed species not of conservation concern was also present and breeding throughout the project site.

1.9.4.1 Breeding Season

Red-listed meadow pipit was recorded continually throughout the 500m turbine buffer, with evidence of an established breeding population. Red grouse was observed during dusk surveys, although the habitat is suitable for breeding pairs, no nests were detected due to the species' highly cryptic behaviour.

Among amber-listed species, goldcrest showed breeding activity in three of the four breeding seasons, while skylark exhibited breeding behaviour in all seasons. Swallow held two active nests in 2022, and willow warbler was assessed as having a breeding population throughout the project site.

1.9.4.2 Non-breeding Season

Red-listed meadow pipit was frequently recorded across all non-breeding seasons. Two grey wagtail were observed during the 2020/21 non-breeding season, and a single yellowhammer was recorded in the 2021/22 non-breeding season. Amber-listed goldcrest was present in 2021/22 and 2022/23, and skylark was observed once in 2021/22.

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APPENDIX 1 - NATIONAL BIODIVERSITY DATA CENTRE AND I-WEBS RECORDS

Species	BoCCI 2020-2026	Date of last record	Record database
Barn Owl	Red	07/05/2015	Birds of Ireland
Curlew	Red	01/05/2025	Birds of Ireland
Golden Plover	Red	02/04/2024	Birds of Ireland
Snipe	Red	30/05/2025	Birds of Ireland
Swift	Red	02/05/2025	Swifts of Ireland
Black-headed gull	Amber	10/05/2020	Birds of Ireland
Coot	Amber	31/12/2011	Bird Atlas 2007-2011
Cormorant	Amber	10/05/2020	Birds of Ireland
Common tern	Amber	10/05/2020	Birds of Ireland
Common gull	Amber	10/05/2020	Birds of Ireland
Greenfinch	Amber	19/09/2015	Birds of Ireland
Greenland white-fronted goose	Amber	31/12/2011	Bird Atlas 2007-2011
Great crested grebe	Amber	10/05/2020	Birds of Ireland
Greylag goose	Amber	10/05/2020	Birds of Ireland
Kingfisher	Amber	31/12/2011	Bird Atlas 2007-2011
Linnet	Amber	31/12/2011	Bird Atlas 2007-2011
Mallard	Amber	10/05/2020	Birds of Ireland
Merlin	Amber	31/12/2011	Bird Atlas 2007-2011
Mute swan	Amber	10/05/2020	Birds of Ireland
Sand martin	Amber	02/04/2024	Birds of Ireland
Whooper swan	Amber	28/03/2019	Birds of Ireland
Willow warbler	Amber	02/04/2024	Birds of Ireland
Blackcap	Green	02/04/2024	Birds of Ireland
Buzzard	Green	02/04/2024	Birds of Ireland
Chiffchaff	Green	02/04/2024	Birds of Ireland
Collared dove	Green	31/12/2011	Bird Atlas 2007-2011

Cuckoo	Green	05/05/2018	Birds of Ireland
Goldfinch	Green	29/11/2017	Birds of Ireland
Grasshopper warbler	Green	31/12/2011	Bird Atlas 2007-2011
Grey heron	Green	19/03/2016	Birds of Ireland
Jay	Green	02/04/2024	Birds of Ireland
Lesser redpoll	Green	31/12/2011	Bird Atlas 2007-2011
Mistle thrush	Green	30/05/2025	Birds of Ireland
Pheasant	Green	31/12/2011	Bird Atlas 2007-2011
Robin	Green	29/11/2017	Birds of Ireland
Reed bunting	Green	20/03/2016	Birds of Ireland
Sedge warbler	Green	05/05/2018	Birds of Ireland
Sisken	Green	31/12/2011	Bird Atlas 2007-2011
Treecreeper	Green	31/12/2011	Bird Atlas 2007-2011
Whimbrel	Green	10/05/2020	Birds of Ireland
Whitethroat	Green	30/05/2025	Birds of Ireland

Table 51: NBDC bird records from national grid square M69 2011-2024 (2011 retained due to it being the most up to date bird atlas for Ireland)

Species	BoCCI 2020-2026	Date of last record	Record database
Curlew	Red	31/12/2011	Bird Atlas 2007 - 2011
Grey Wagtail	Red	31/12/2011	Bird Atlas 2007 - 2011
Kestrel	Red	18/06/2018	Birds of Ireland
Lapwing	Red	31/12/2011	Bird Atlas 2007 - 2011
Meadow pipit	Red	31/12/2011	Bird Atlas 2007 - 2011
Redwing	Red	31/12/2011	Bird Atlas 2007 - 2011
Snipe	Red	31/12/2011	Bird Atlas 2007 - 2011
Swift	Red	18/07/2019	Birds of Ireland
Woodcock	Red	31/12/2011	Bird Atlas 2007 - 2011
Cormorant	Amber	31/12/2011	Bird Atlas 2007 - 2011
Greenfinch	Amber	31/12/2011	Bird Atlas 2007 - 2011

Goldcrest	Amber	16/07/2023	Heritage Council's Traditional Farm Buildings Scheme Fauna Records from 2016 to 2023
House martin	Amber	05/05/2018	Birds of Ireland
House sparrow	Amber	31/12/2011	Bird Atlas 2007 - 2011
Linnet	Amber	31/12/2011	Bird Atlas 2007 - 2011
Mallard	Amber	31/12/2011	Bird Atlas 2007 - 2011
Mute swan	Amber	31/12/2011	Bird Atlas 2007 - 2011
Sand martin	Amber	31/12/2011	Bird Atlas 2007 - 2011
Skylark	Amber	03/06/2019	Birds of Ireland
Spotted flycatcher	Amber	31/12/2011	Bird Atlas 2007 - 2011
Swallow	Amber	16/07/2023	Heritage Council's Traditional Farm Buildings Scheme Fauna Records from 2016 to 2023
Starling	Amber	04/04/2019	Birds of Ireland
Teal	Amber	31/12/2011	Bird Atlas 2007 - 2011
Whooper swan	Amber	31/12/2011	Bird Atlas 2007 - 2011
Wigeon	Amber	31/12/2011	Bird Atlas 2007 - 2011
Willow warbler	Amber	31/12/2011	Bird Atlas 2007 - 2011
Blackbird	Green	16/07/2023	Heritage Council's Traditional Farm Buildings Scheme Fauna Records from 2016 to 2023
Blackcap	Green	03/06/2019	Birds of Ireland
Blue tit	Green	03/06/2019	Birds of Ireland
Bullfinch	Green	30/12/2020	Birds of Ireland
Buzzard	Green	06/09/2025	Birds of Ireland
Chaffinch	Green	03/06/2019	Birds of Ireland
Chiffchaff	Green	31/12/2011	Bird Atlas 2007 - 2011
Coal tit	Green	31/12/2011	Bird Atlas 2007 - 2011
Collared dove	Green	31/12/2011	Bird Atlas 2007 - 2011
Cuckoo	Green	10/06/2019	Irish Vascular Plant Data - Robert Northridge
Dunnock	Green	31/12/2011	Bird Atlas 2007 - 2011
Fieldfare	Green	31/12/2011	Bird Atlas 2007 - 2011

Goldfinch	Green	16/07/2023	Heritage Council's Traditional Farm Buildings Scheme Fauna Records from 2016 to 2023
Grasshopper warbler	Green	16/07/2023	Heritage Council's Traditional Farm Buildings Scheme Fauna Records from 2016 to 2023
Great black-backed gull	Green	31/12/2011	Bird Atlas 2007 - 2011
Great spotted woodpecker	Green	31/01/2023	Birds of Ireland
Great tit	Green	20/03/2019	Birds of Ireland
Grey heron	Green	31/12/2011	Bird Atlas 2007 - 2011
Hooded crow	Green	31/12/2011	Bird Atlas 2007 - 2011
Jackdaw	Green	31/12/2011	Bird Atlas 2007 - 2011
Lesser redpoll	Green	03/06/2019	Birds of Ireland
Lesser white-fronted goose	Green	29/03/2019	Birds of Ireland
Little grebe	Green	31/12/2011	Bird Atlas 2007 - 2011
Long-tailed tit	Green	06/05/2018	Birds of Ireland
Magpie	Green	16/07/2023	Heritage Council's Traditional Farm Buildings Scheme Fauna Records from 2016 to 2023
Mistle thrush	Green	31/12/2011	Bird Atlas 2007 - 2011
Moorhen	Green	31/12/2011	Bird Atlas 2007 - 2011
Pheasant	Green	16/03/2019	Birds of Ireland
Pied wagtail	Green	16/03/2019	Birds of Ireland
Raven	Green	31/12/2011	Bird Atlas 2007 - 2011
Reed bunting	Green	31/12/2011	Bird Atlas 2007 - 2011
Robin	Green	16/07/2023	Heritage Council's Traditional Farm Buildings Scheme Fauna Records from 2016 to 2023
Rook	Green	27/03/2019	Birds of Ireland
Sedge warbler	Green	31/12/2011	Bird Atlas 2007 - 2011
Siskin	Green	31/12/2011	Bird Atlas 2007 - 2011
Song thrush	Green	16/07/2023	Heritage Council's Traditional Farm Buildings Scheme Fauna Records from 2016 to 2023
Sparrowhawk	Green	31/12/2011	Bird Atlas 2007 - 2011
Stonechat	Green	16/07/2023	Heritage Council's Traditional Farm Buildings Scheme

			Fauna Records from 2016 to 2023
Treecreeper	Green	31/12/2011	Bird Atlas 2007 - 2011
White wagtail	Green	31/12/2011	Bird Atlas 2007 - 2011
Whitethroat	Green	31/12/2011	Bird Atlas 2007 - 2011
Wren	Green	16/07/2023	Heritage Council's Traditional Farm Buildings Scheme Fauna Records from 2016 to 2023
Woodpigeon	Green	16/03/2019	Birds of Ireland

Table 52: NBDC bird records from national grid square G60 2011-2024 (2011 retained due to it being the most up to date bird atlas for Ireland)

Species Name	All Ireland 1% threshold	Peak count (last 5 years) 2019-2024
Mute swan	90	119
Whooper swan	150	78
Greenland white-fronted goose	100	28
Barnacle goose	160	27
Wigeon	560	31
Teal	360	23
Mallard	280	158
Shoveler	20	17
Tufted duck	270	68
Great crested grebe	30	4
Cormorant	110	11
Grey heron	25	2
Moorhen	-	21
Coot	190	17
Ringed plover	120	21
Lapwing	850	71
Jack snipe	-	13
Snipe	-	13
Whimbrel	-	21

Common gull	-	4
Herring gull	-	5
Great black-backed gull	-	6

Table 53: I-WeBS peak count data for last five years. Lough Gara: Callows Lough

Species Name	All Ireland 1% threshold	Peak count (last 5 years) 2019-2024
Mute swan	90	62
Whooper swan	150	168
Greylag goose	35	48
Wigeon	560	235
Gadwall	20	5
Teal	360	56
Mallard	280	96
Shoveler	20	6
Pochard	110	1
Tufted duck	270	542
Goldeneye	40	5
Great crested grebe	30	13
Cormorant	110	39
Moorhen		1
Snipe		3
Black-headed gull		1
Lesser black-backed gull		14
Greylag goose		18

Table 54: I-WeBS peak count data for last five years. Lower Lough Gara

Species Name	All Ireland 1% threshold	Peak count (last 5 years) 2019-2024
Mute swan	90	9
Whooper swan	150	6
Greylag goose	35	19

Wigeon	560	63
Teal	360	176
Mallard	280	17
Pochard	110	186
Tufted duck	270	402
Goldeneye	40	6
Great crested grebe	30	4
Cormorant	110	2
Curlew	350	24

Table 55: I-WeBS peak count data for last five years. Upper Lough Gara

Species Name	All Ireland 1% threshold	Peak count (last 5 years) 2019-2024
Whooper swan	150	81
Greenland white-fronted goose	100	107
Wigeon	560	91
Teal	360	48
Mallard	280	51
Pochard	110	155
Tufted duck	270	296
Goldeneye	40	24
Goosander		5
Great crested grebe	30	7
Cormorant	110	17
Grey Heron	25	4
Water Rail		1
Coot	190	3
Lapwing	850	71
Snipe		1
Curlew	350	3

Table 56: I-WeBS peak count data last five years. Upper Lough Gara & Callows Lake

Species Name	All Ireland 1% threshold	Peak count (last 5 years) 2019-2024
Mute swan	90	36
Whooper swan	150	128
Wigeon	560	92
Teal	360	5
Mallard	280	5
Pochard	110	4
Tufted duck	270	36
Cormorant	110	18
Little egret	20	1
Moorhen		2
Coot	190	1
Golden plover	920	180
Lapwing	850	57
Snipe		7
Curlew	350	37
Black-headed gull		26
Common gull		6

Table 57: I-WeBS peak count data last five years. Ballyhaunis Lakes -Bekan Lough

Species Name	All Ireland 1% threshold	Peak count (last 5 years) 2019-2024
Mute swan	90	2
Mallard	280	1
Tufted duck	270	2

Table 58: I-WeBS peak count data last five years. Ballyhaunis Lakes Cloonacurry Lough (Turlough Lake)

Species Name	All Ireland 1% threshold	Peak count (last 5 years) 2019-2024
Mute swan	90	4
Wigeon	560	3
Teal	360	4
Mallard	280	10
Tufted duck	270	3
Great crested grebe	30	1
Cormorant	110	1
Grey heron	25	1
Moorhen		2

Table 59: I-WeBS peak count data last five years. Ballyhaunis Lakes Cloonturnaun Lough & Lakehill Pond

Species Name	All Ireland 1% threshold	Peak count (last 5 years) 2019-2024
Mute swan	90	1
Whooper swan	150	20
Wigeon	560	40
Mallard	280	22
Lapwing	850	43

Table 60: I-WeBS peak count data last five years. Ballyhaunis Lakes Crossbeg Turlough

Species Name	All Ireland 1% threshold	Peak count (last 5 years) 2019-2024
Mute swan	90	2
Wigeon	560	7
Teal	360	1

Mallard	280	10
Cormorant	110	2
Grey Heron	25	1

Table 61: I-WeBS peak count data last five years. Ballyhaunis Lakes Cullentragh Lough

Species Name	All Ireland 1% threshold	Peak count (last 5 years) 2019-2024
Mute swan	90	2
Teal	360	4
Mallard	280	2
Little grebe	20	1
Cormorant	110	2
Grey heron	25	1

Table 62: I-WeBS peak count data last five years. Ballyhaunis Lakes Curragh Lough (Lake SE of Cullentragh L)

Species Name	All Ireland 1% threshold	Peak count (last 5 years) 2019-2024
Mute swan	90	3
Gadwall	20	3
Teal	360	9
Mallard	280	15
Tufted duck	270	3
Little grebe	20	2
Great crested grebe	30	1
Cormorant	110	2
Grey heron	25	1
Moorhen		1
Coot	190	1
Lapwing	850	85
Snipe		2
Curlew	350	37

Table 63: I-WeBS peak count data last five years. Ballyhaunis Lakes Derry Lough

Species Name	All Ireland 1% threshold	Peak count (last 5 years) 2019-2024
Mute swan	90	3
Cormorant	110	1
Grey heron	25	1
Snipe		2

Table 64: I-WeBS peak count data last five years. Ballyhaunis Lakes Derrykin Lough

Species Name	All Ireland 1% threshold	Peak count (last 5 years) 2019-2024
Mute swan	90	30
Whooper swan	150	47
Teal	360	11
Mallard	280	47
Tufted duck	270	17
Cormorant	110	4
Grey heron	25	2
Moorhen		11
Coot	190	7
Lapwing	850	11
Whimbrel		14

Table 65: I-WeBS peak count data last five years. Ballyhaunis Lakes Lough Glinn

Species Name	All Ireland 1% threshold	Peak count (last 5 years) 2019-2024
Mute swan	90	3
Mallard	280	1
Cormorant	110	6
Grey heron	25	1
Snipe		3

Table 66: I-WeBS peak count data last five years. Ballyhaunis Lakes Rowans Lough (Drum Lake)

Species Name	All Ireland 1% threshold	Peak count (last 5 years) 2019-2024
Mute swan	90	2
Wigeon	560	33
Teal	360	13
Mallard	280	46
Tufted duck	270	12
Little grebe	20	2
Cormorant	110	1
Grey heron	25	1
Lapwing	850	55
Snipe		2
Curlew	350	4
Black-headed gull		1

Table 67: I-WeBS peak count data last five years. Ballyhaunis Turloughs 4K West of Ballyhaunis

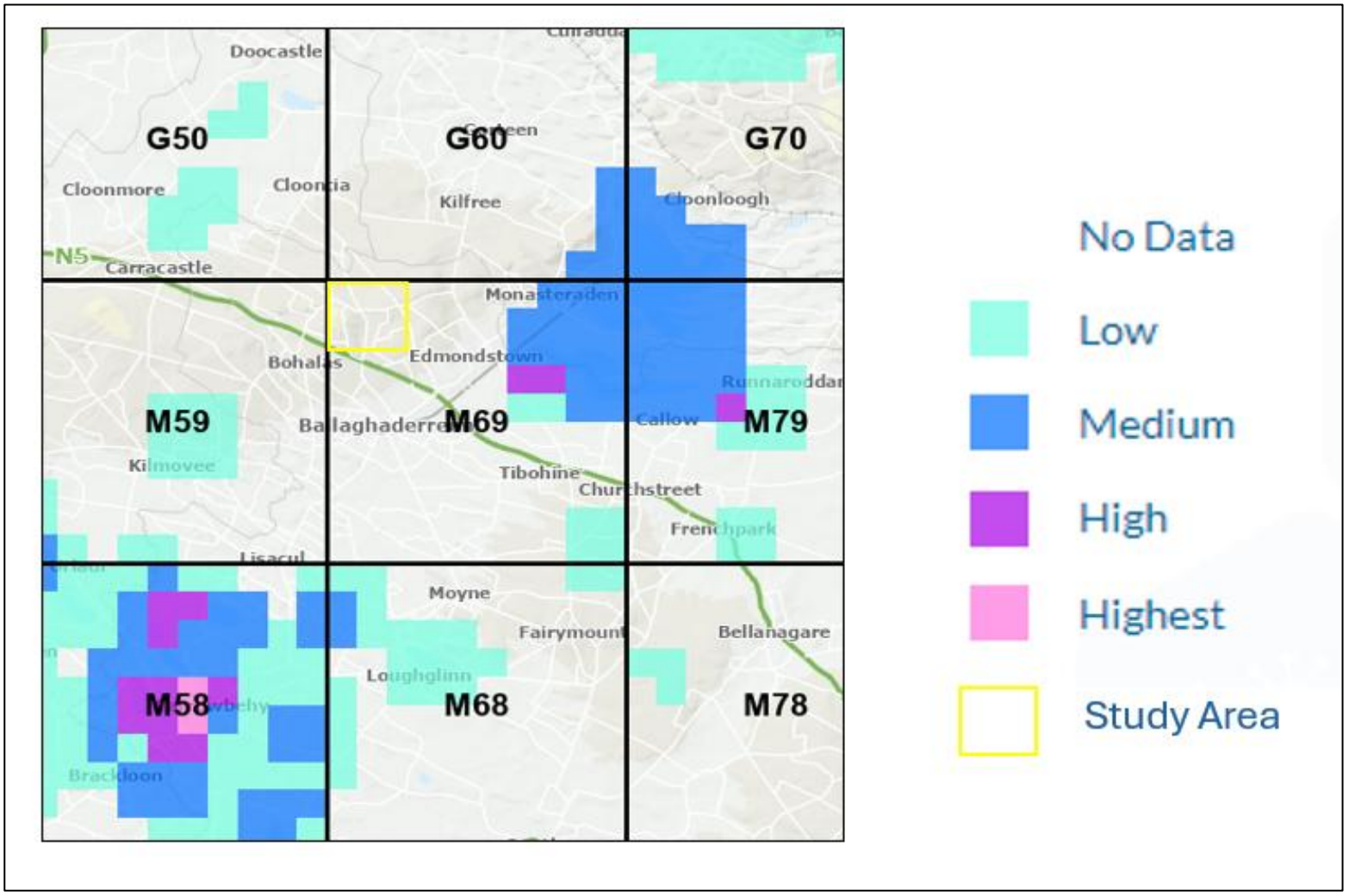


Figure 18: Birds sensitive to wind energy map (Mc Guinness *et al.* 2015)

APPENDIX 2 - VP FLIGHTLINES

Flight line maps are presented below each species has a map for Seasons 1-4 which were observed using 3 VPs on the original turbine layout. Seasons 5-8 were observed using 4 VPs covering a larger area and a different turbine layout. These maps are titled as such even if the species was not recorded in all seasons.

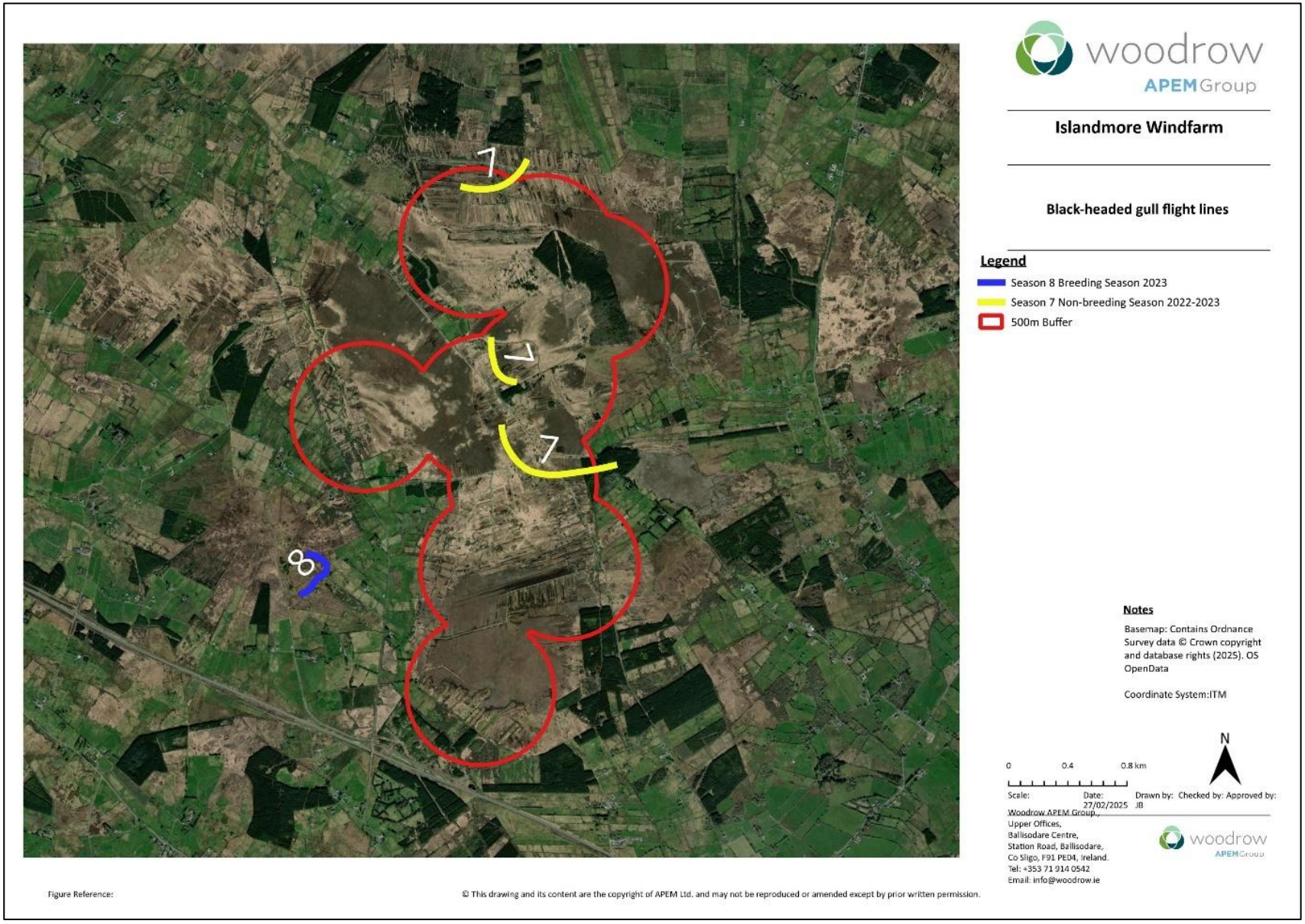


Figure 19: Black-headed gull flight lines season non-breeding season 2022/23 and breeding season 2023

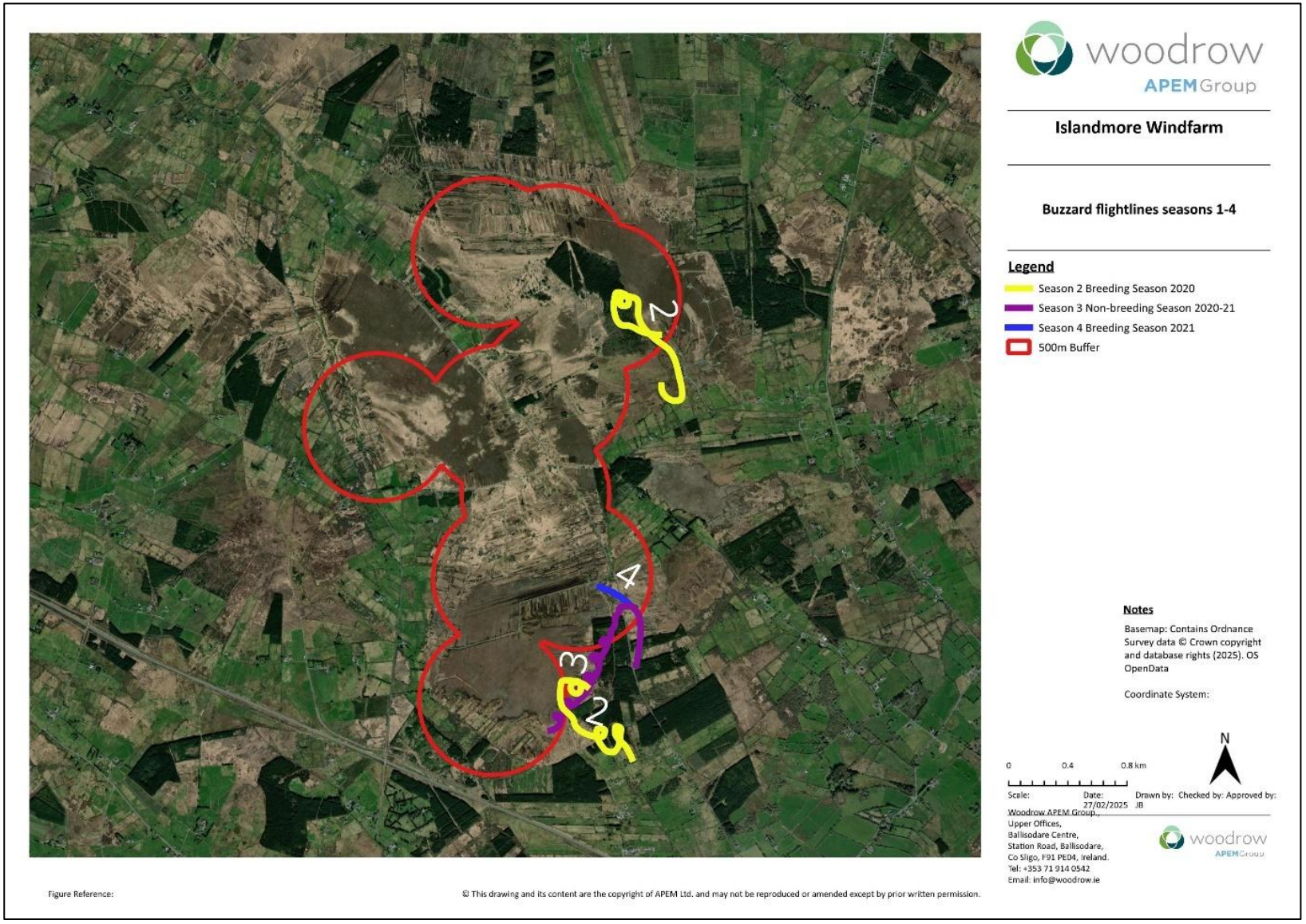


Figure 20: Buzzard flight lines seasons 1-4 breeding season 2020, non-breeding season 2020/21 and breeding season 2021

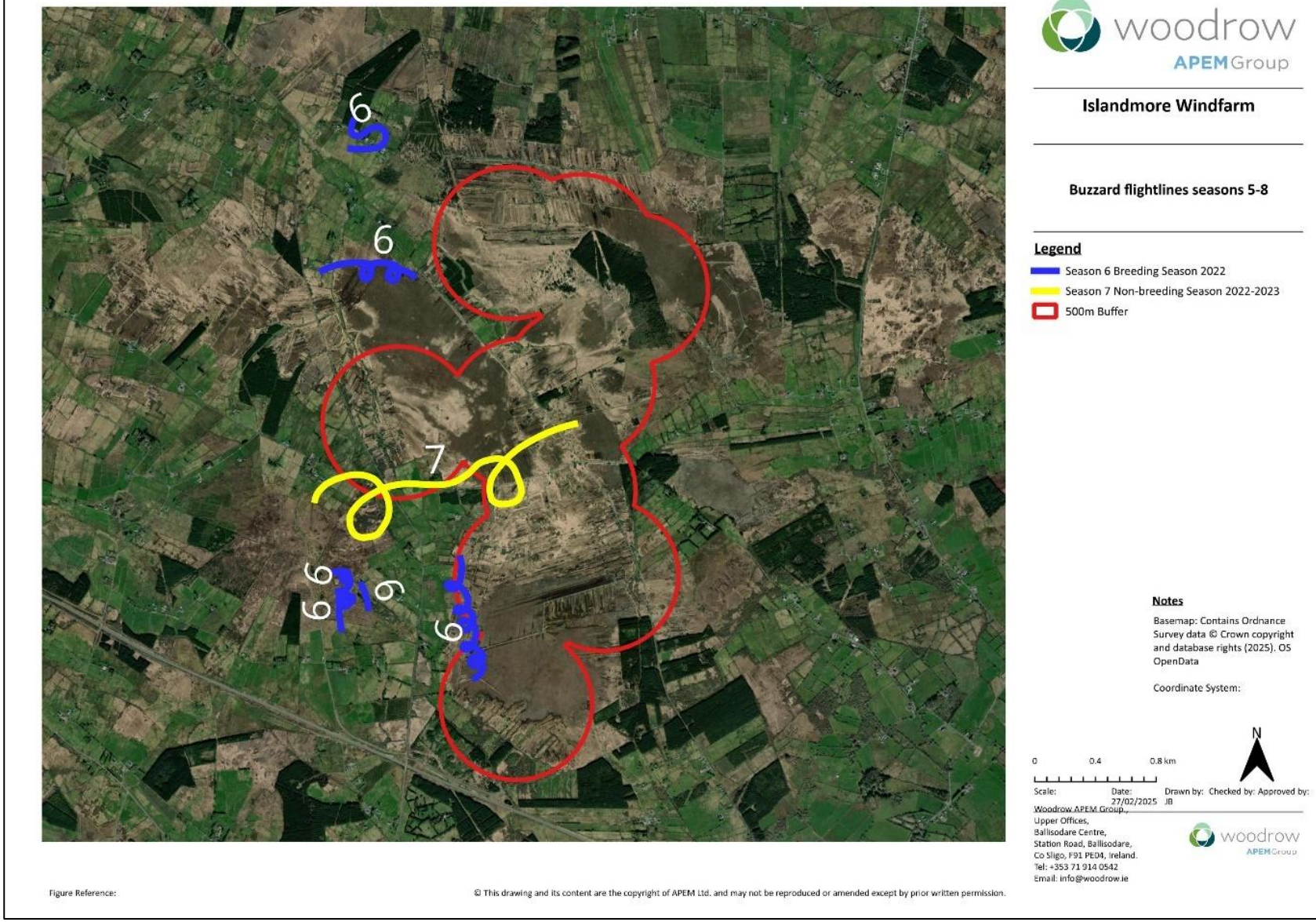


Figure 21: Buzzard flight lines season 5-8 breeding season 2022 and non-breeding season 2022/23

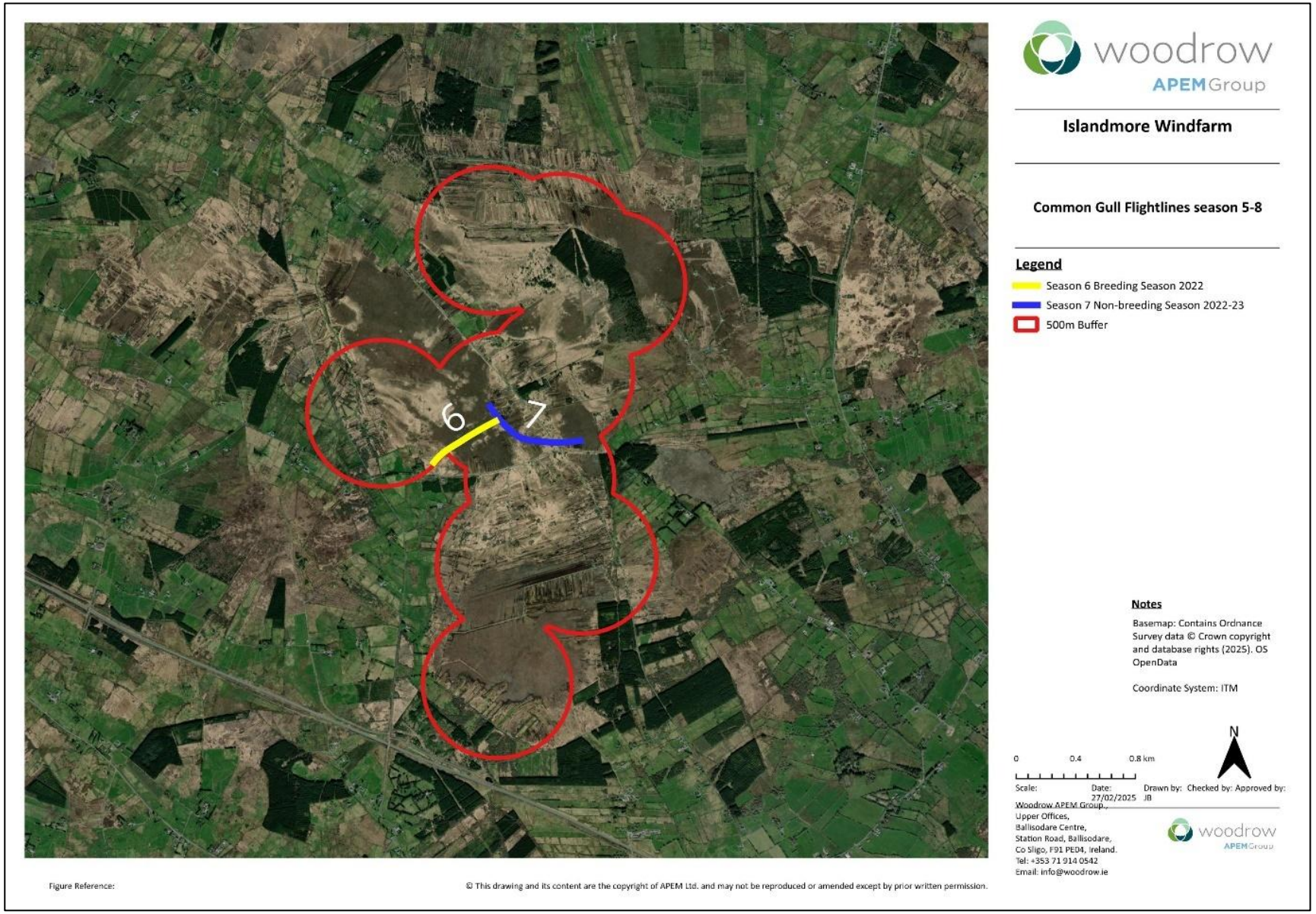


Figure 22: Common gull flight lines season 5-8 breeding season 2022 and non-breeding season 2022/23

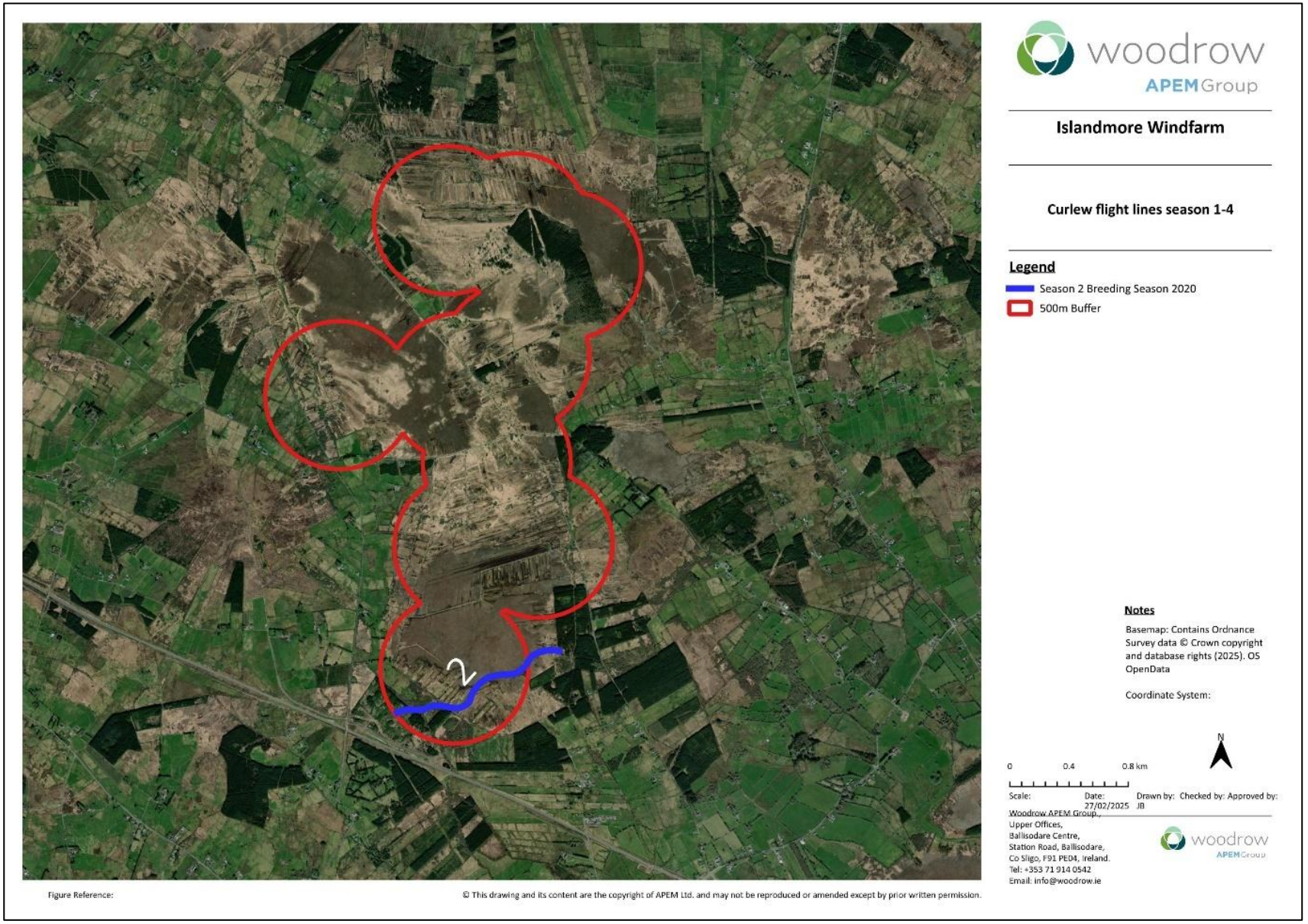


Figure 23: Curlew flight lines seasons 1-4 breeding season 2020

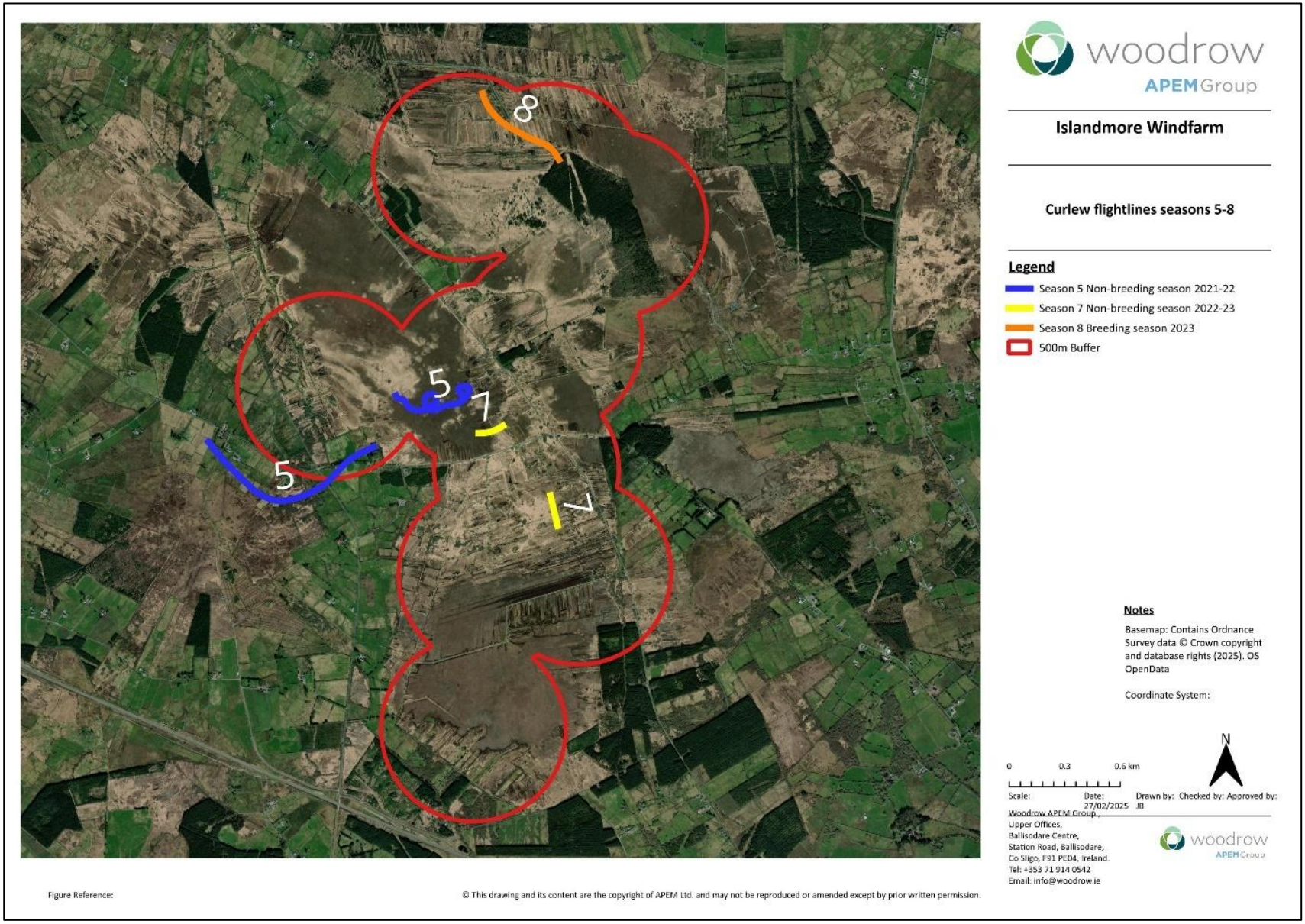


Figure 24: Curlew flight lines season 5-8 non-breeding season 2021/22, non-breeding season 2022/23 and breeding season 2023

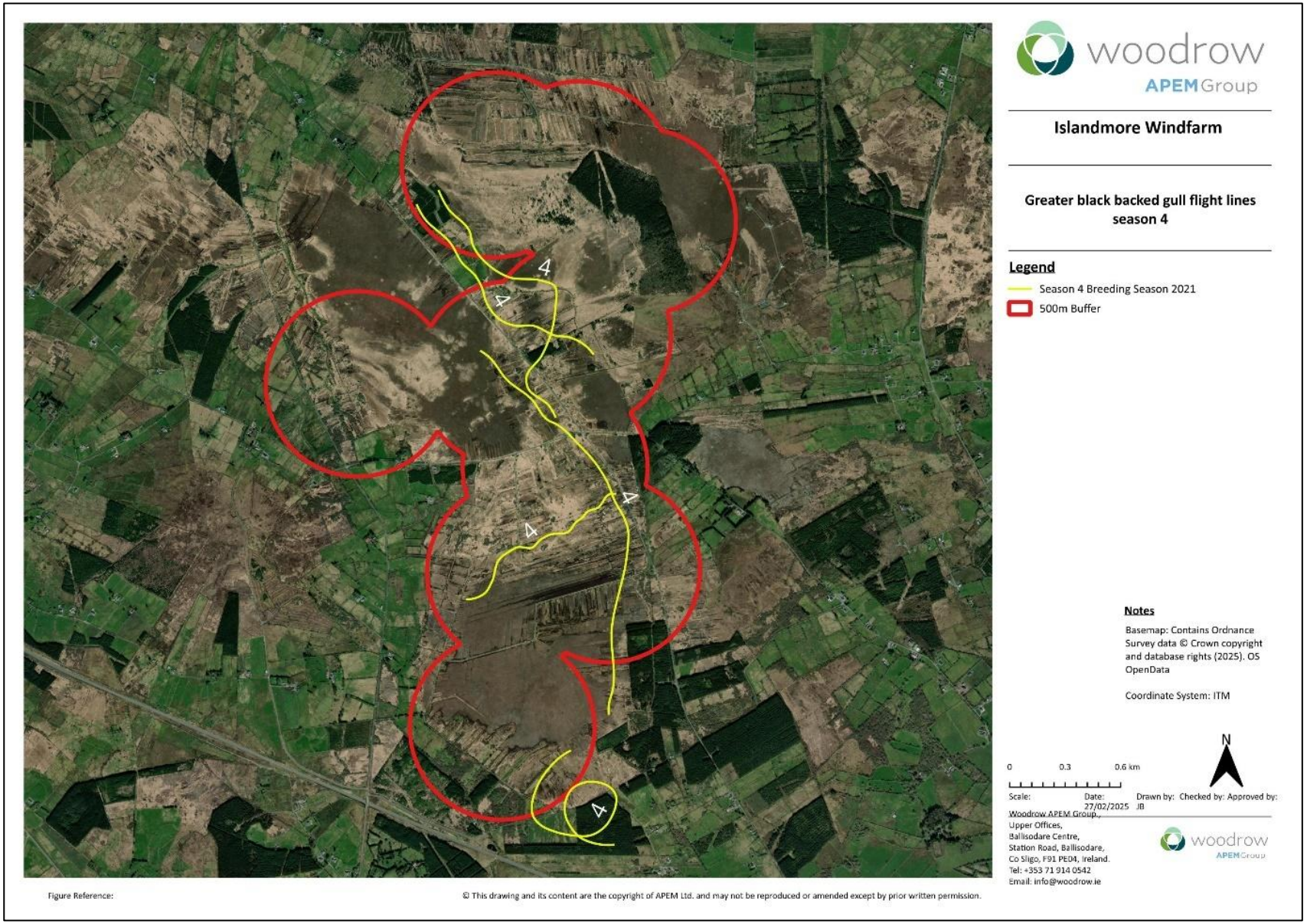


Figure 25: Greater black backed gull season 1-4 breeding season 2021

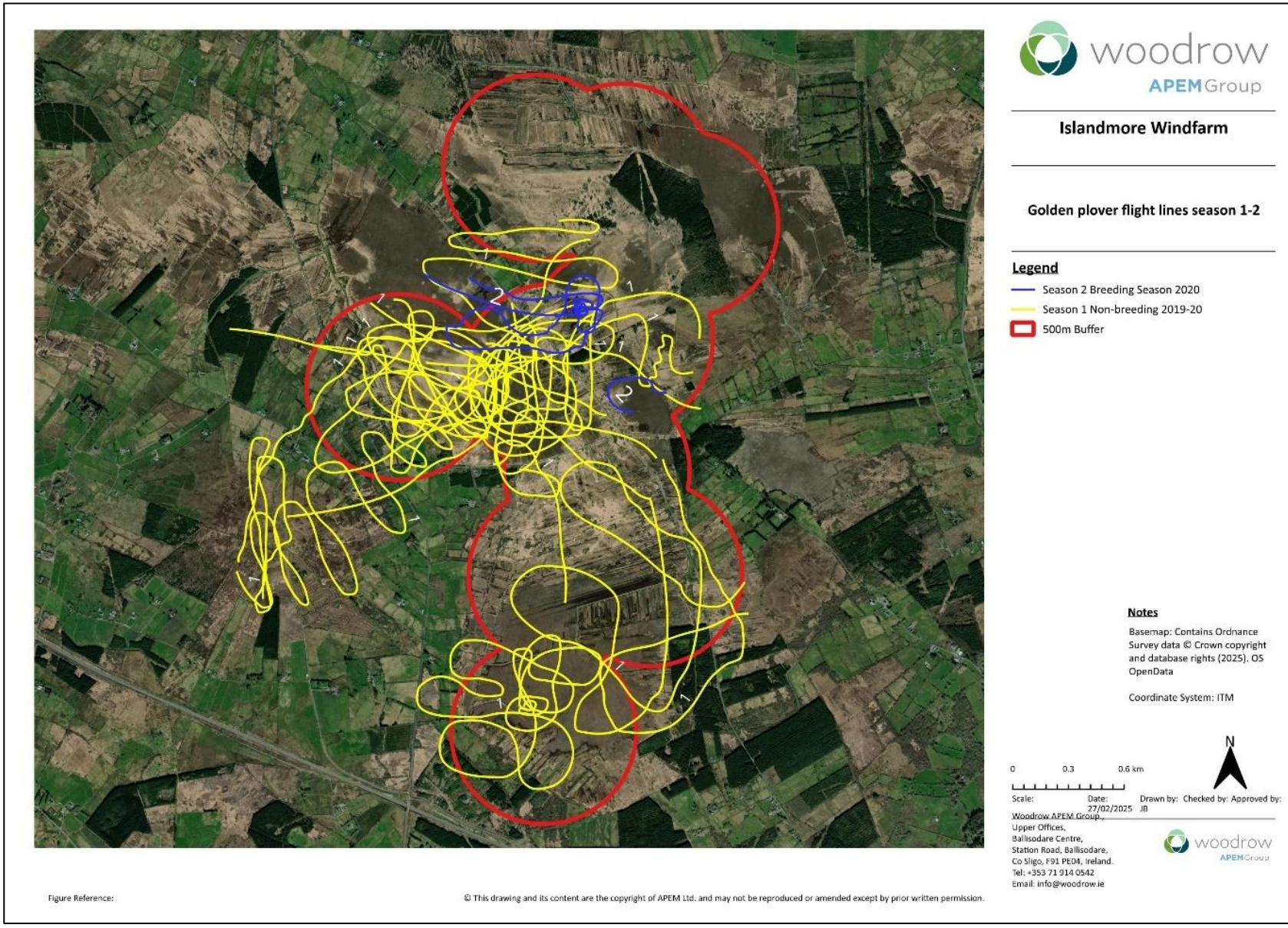


Figure 26: Golden plover flight lines season 1-2 (1-4) breeding season 2020 and non-breeding season 2019/20

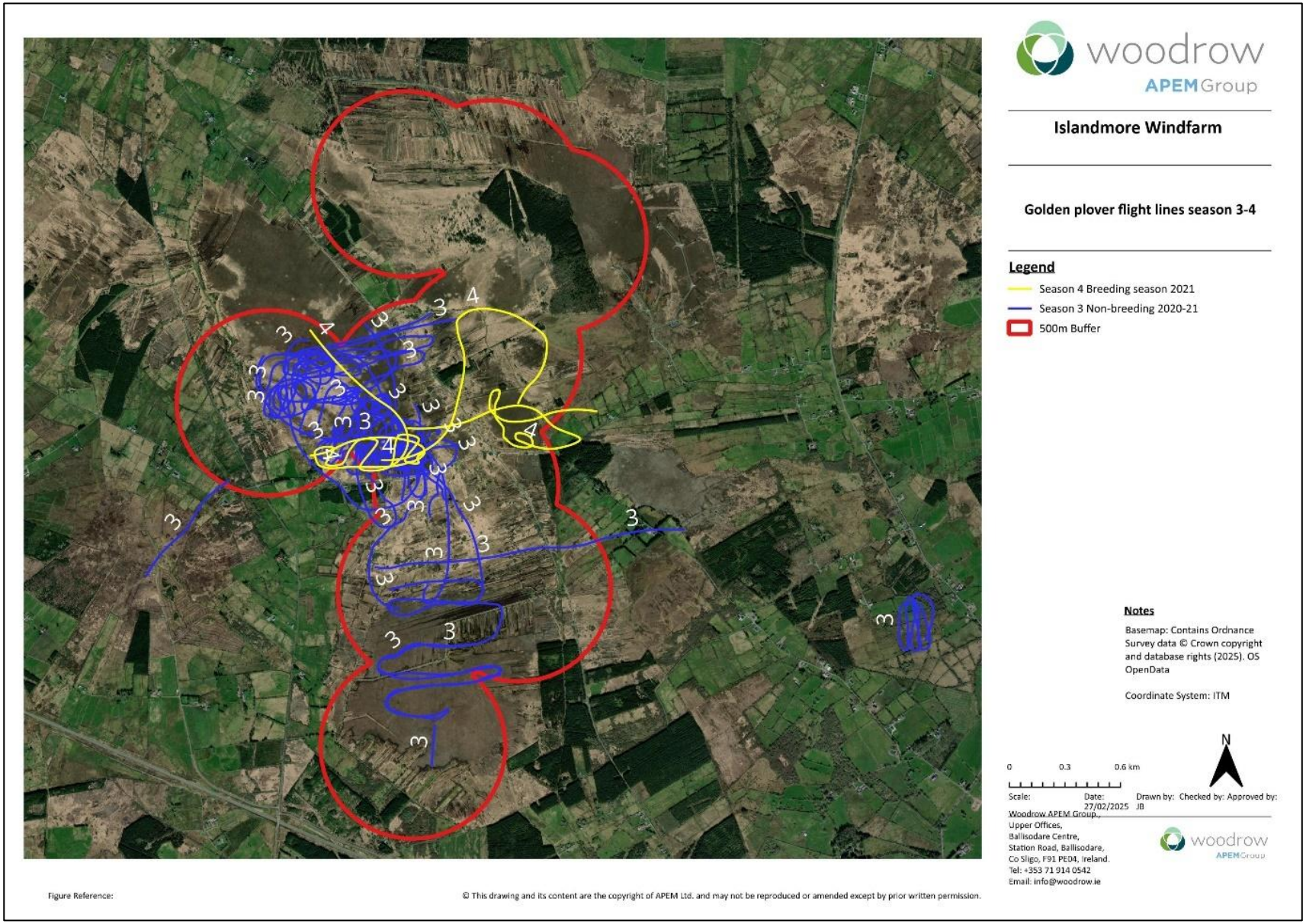


Figure 27: Golden plover flight lines season 3-4 (1-4) breeding season 2021 and non-breeding season 2020/21

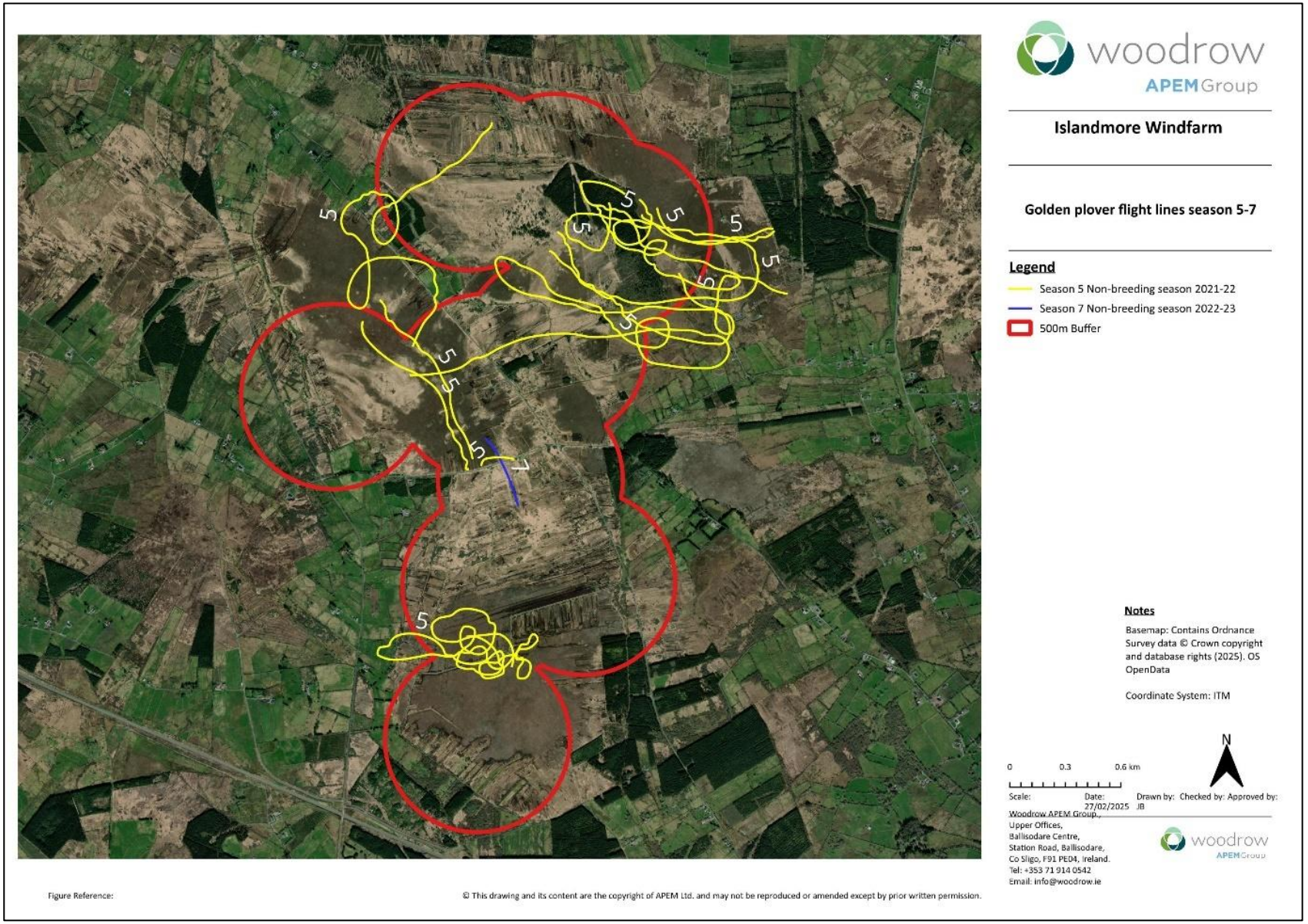


Figure 28: Golden plover flight lines season 5-8 non-breeding season 2021/22 and non-breeding season 2022/23

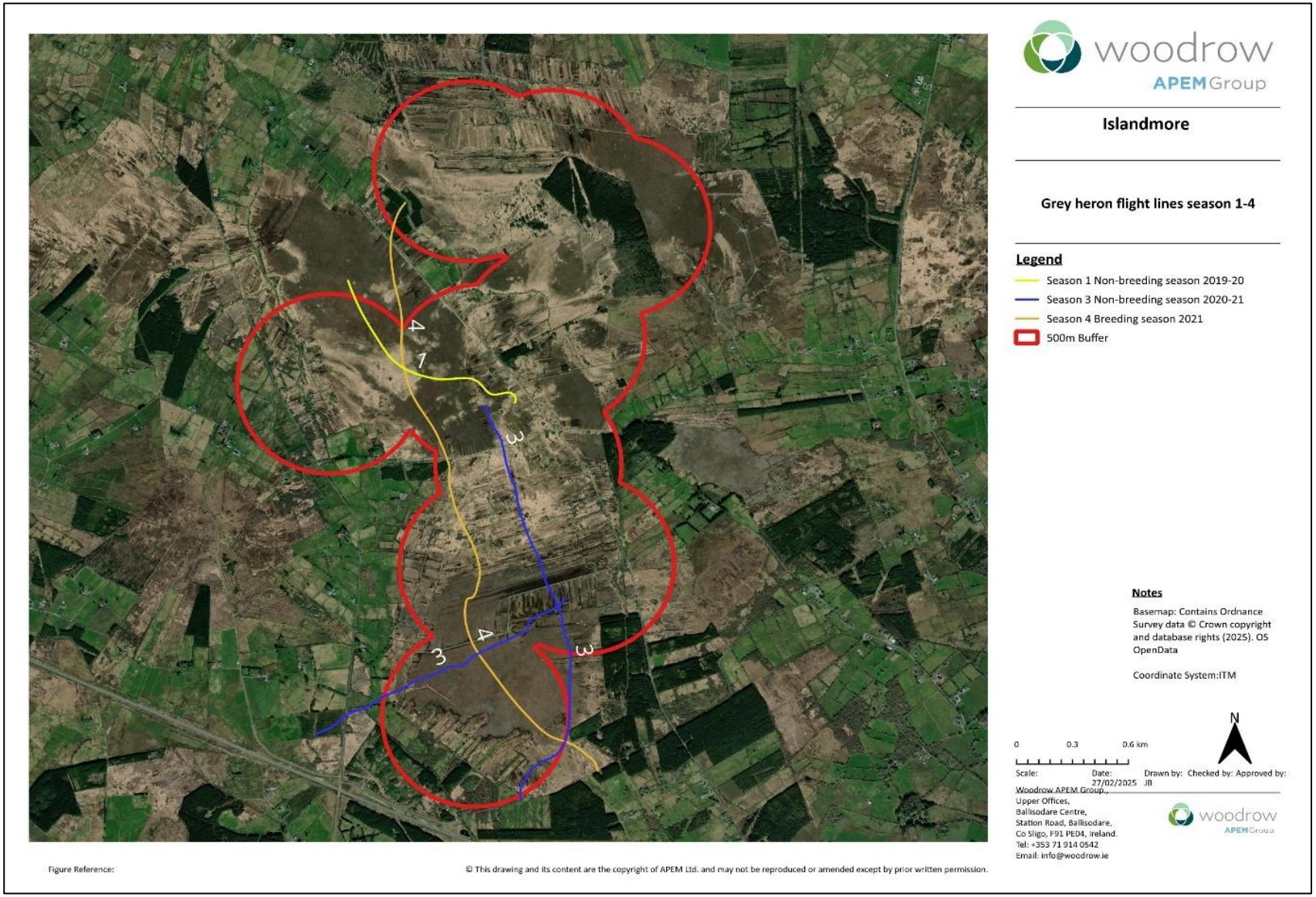


Figure 29: Grey heron flight lines season 1-4 non-breeding season 2019/20, non-breeding season 2020/21 and breeding season 2021.

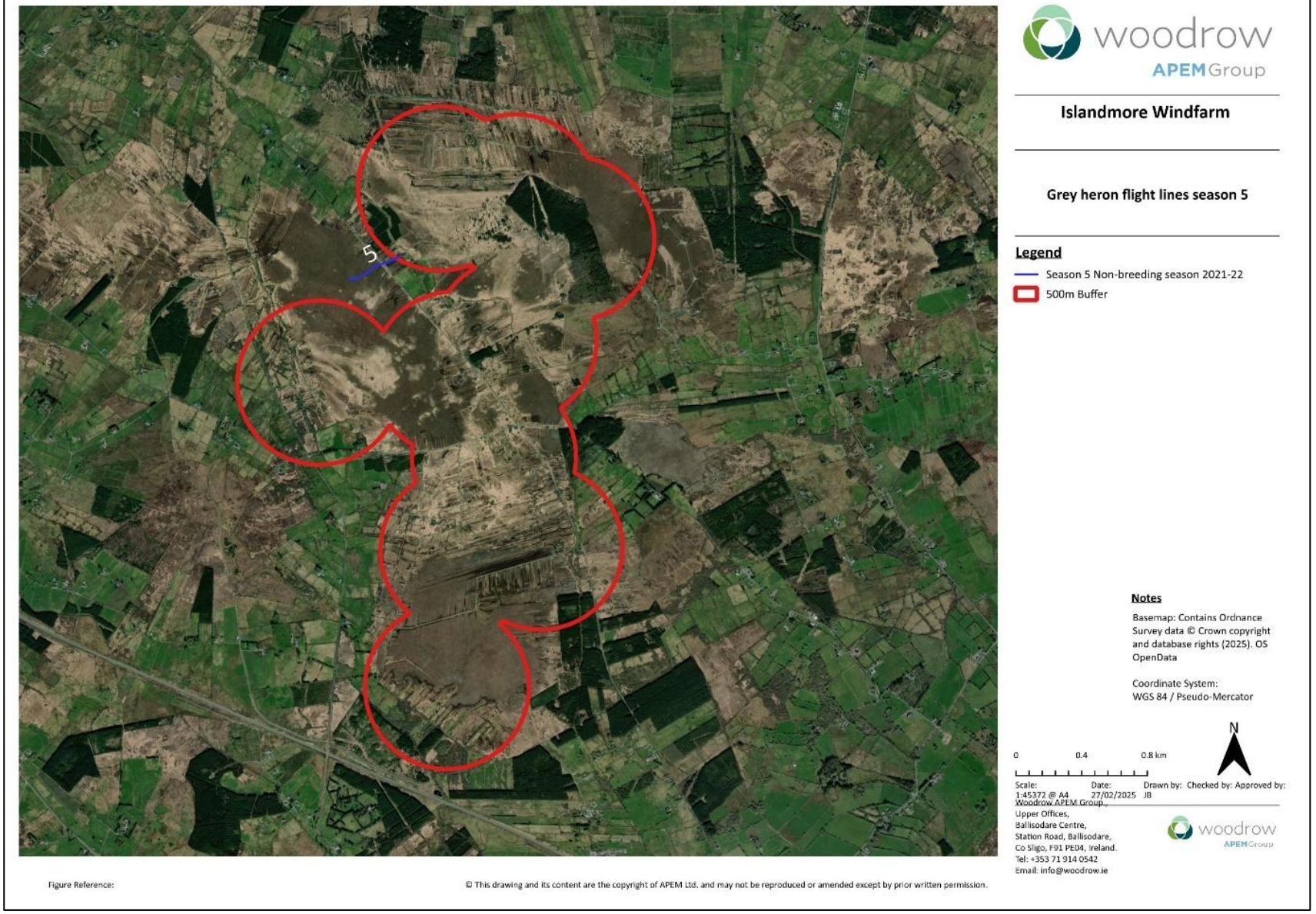


Figure 30: Grey heron flight lines season 5-8 non-breeding season 2021/22

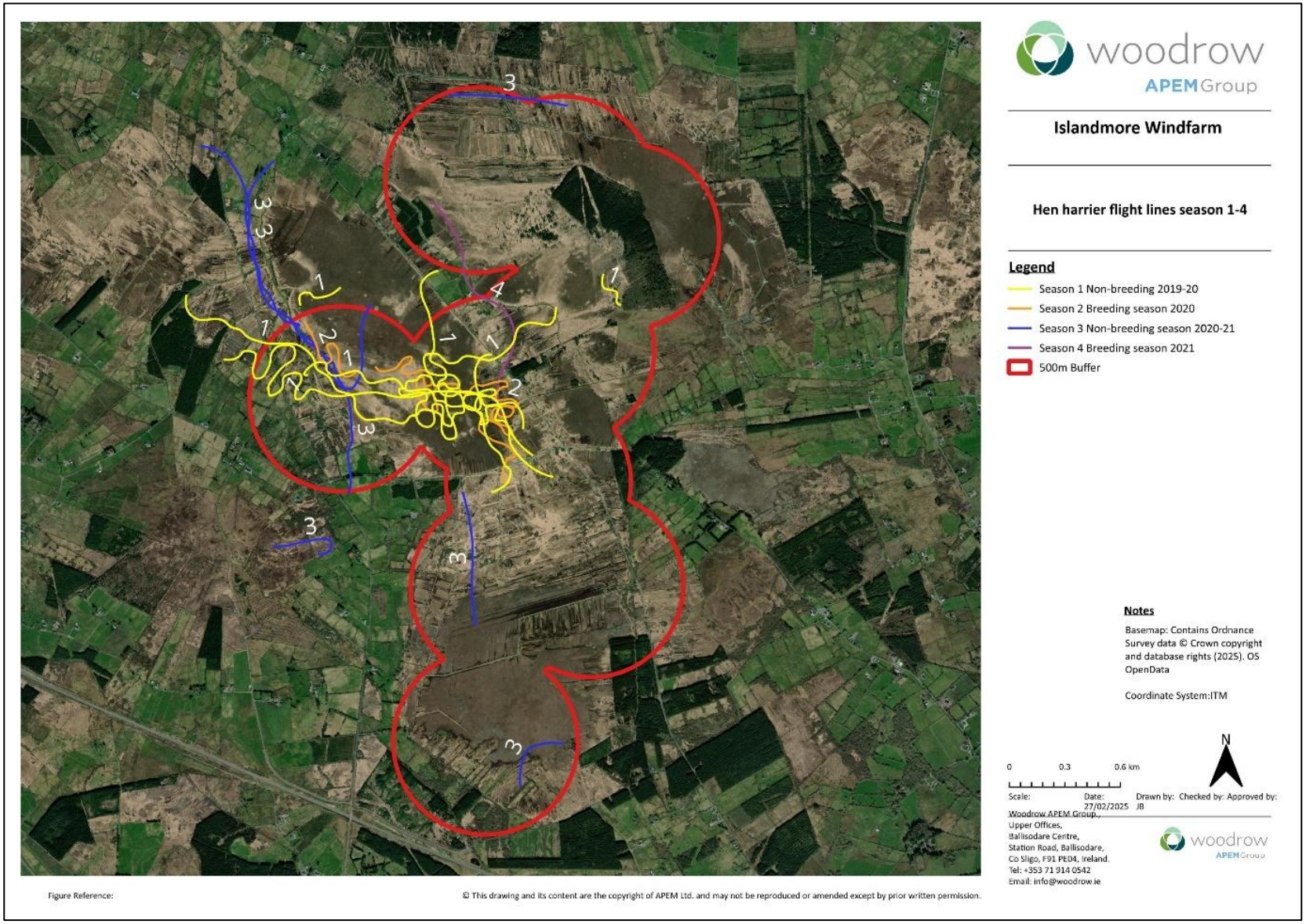


Figure 31: Hen harrier flight lines season 1-4 non-breeding season 2019/20, breeding season 2020, nonbreeding season 2020/21, breeding season 2021

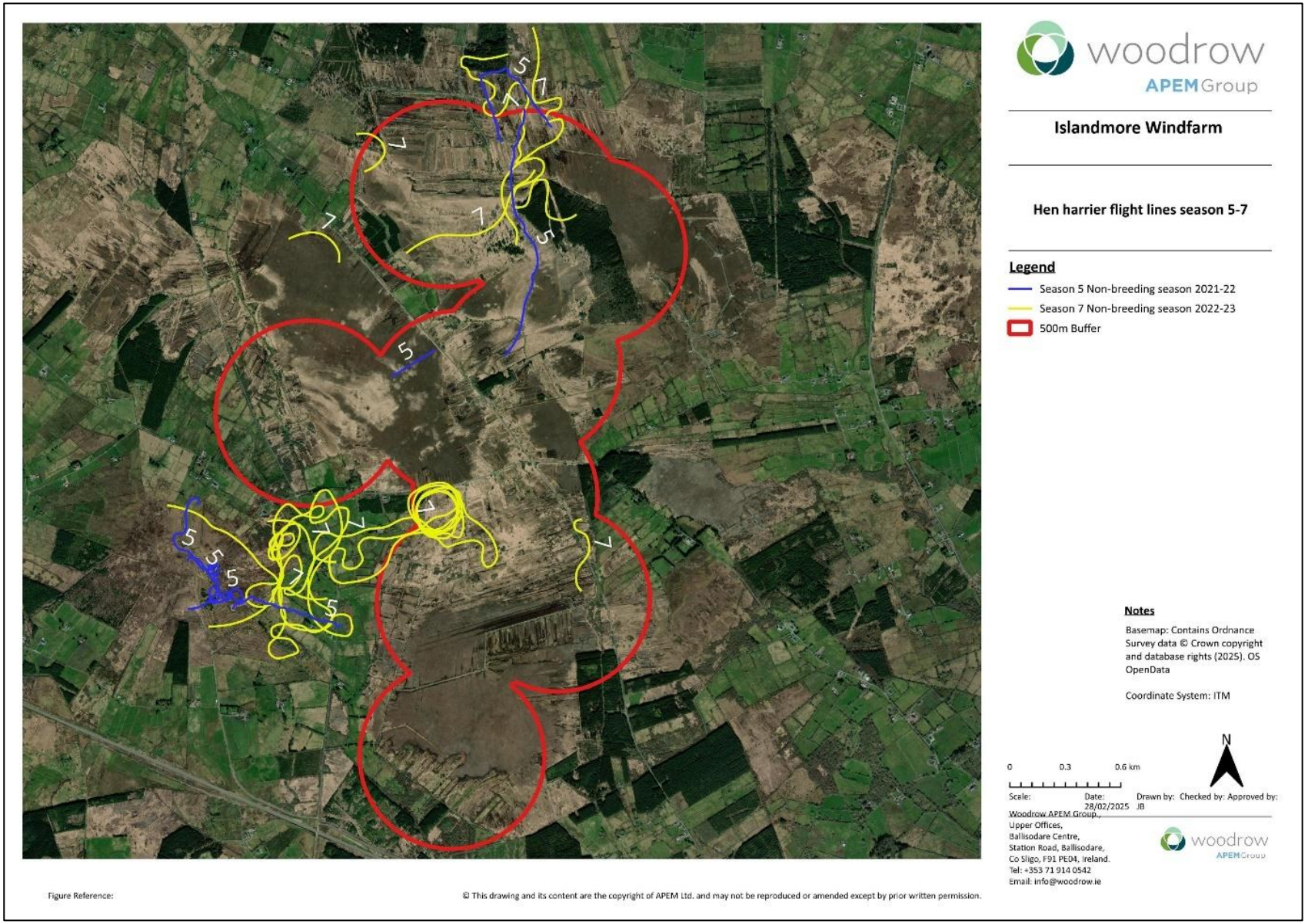


Figure 32 Hen harrier flight lines season 5-8 non-breeding season 2021/22 and non-breeding season 2022/23

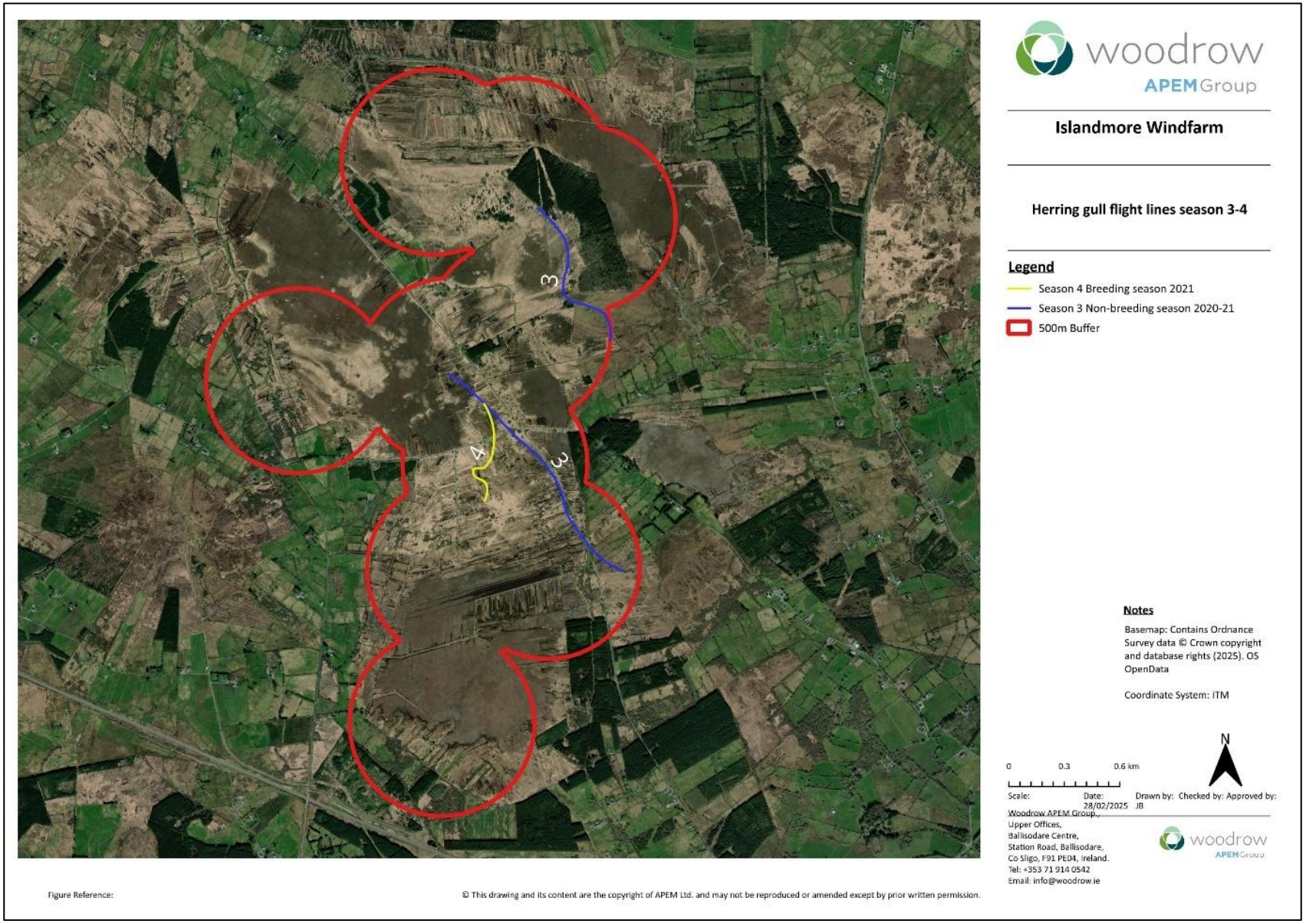


Figure 33: Herring gull flight lines season 1-4 breeding season 2021 and non-breeding season 2020/21

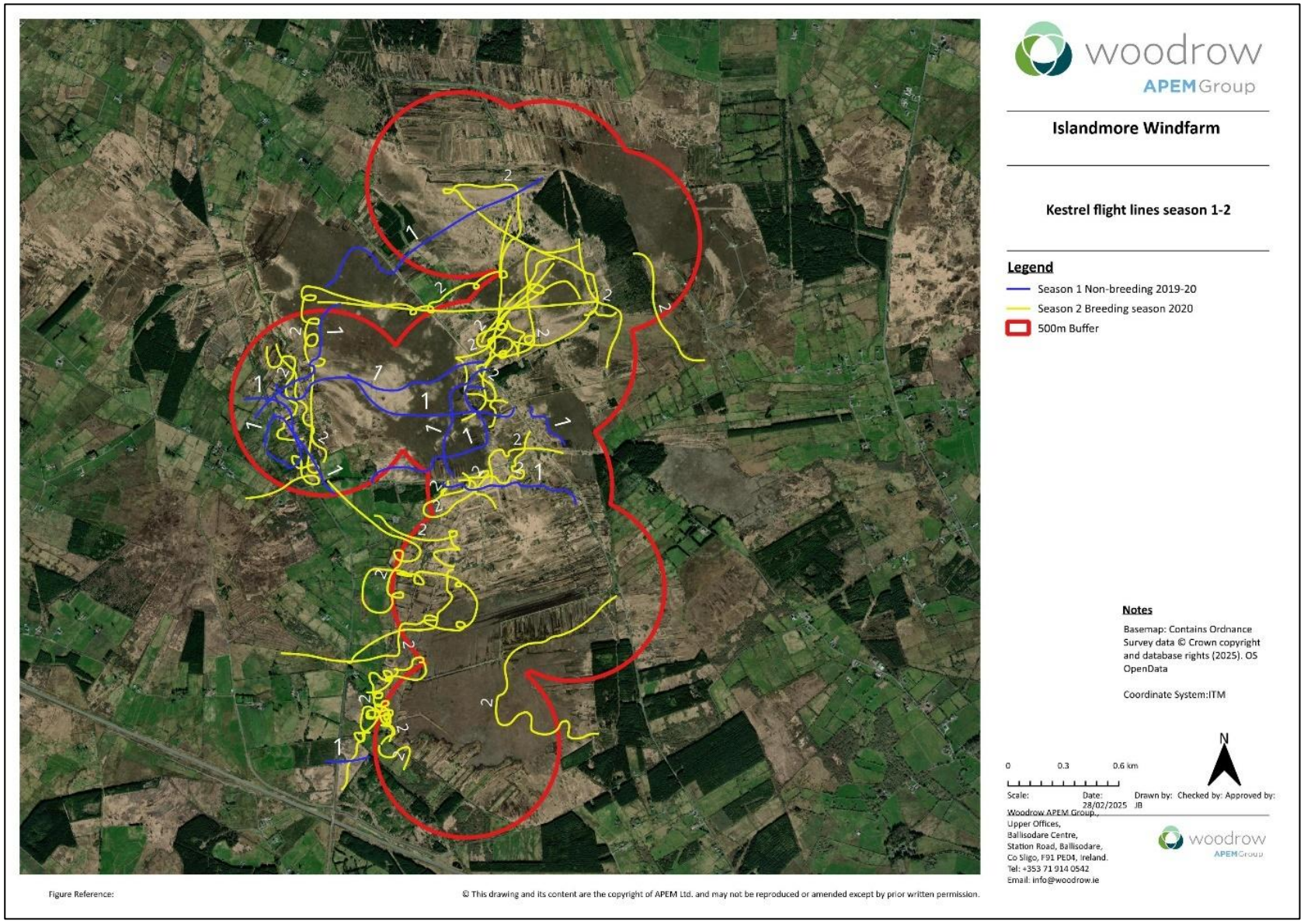


Figure 34: Kestrel flight lines season 1-2 (1-4) non-breeding season 2019/20 breeding season 2020

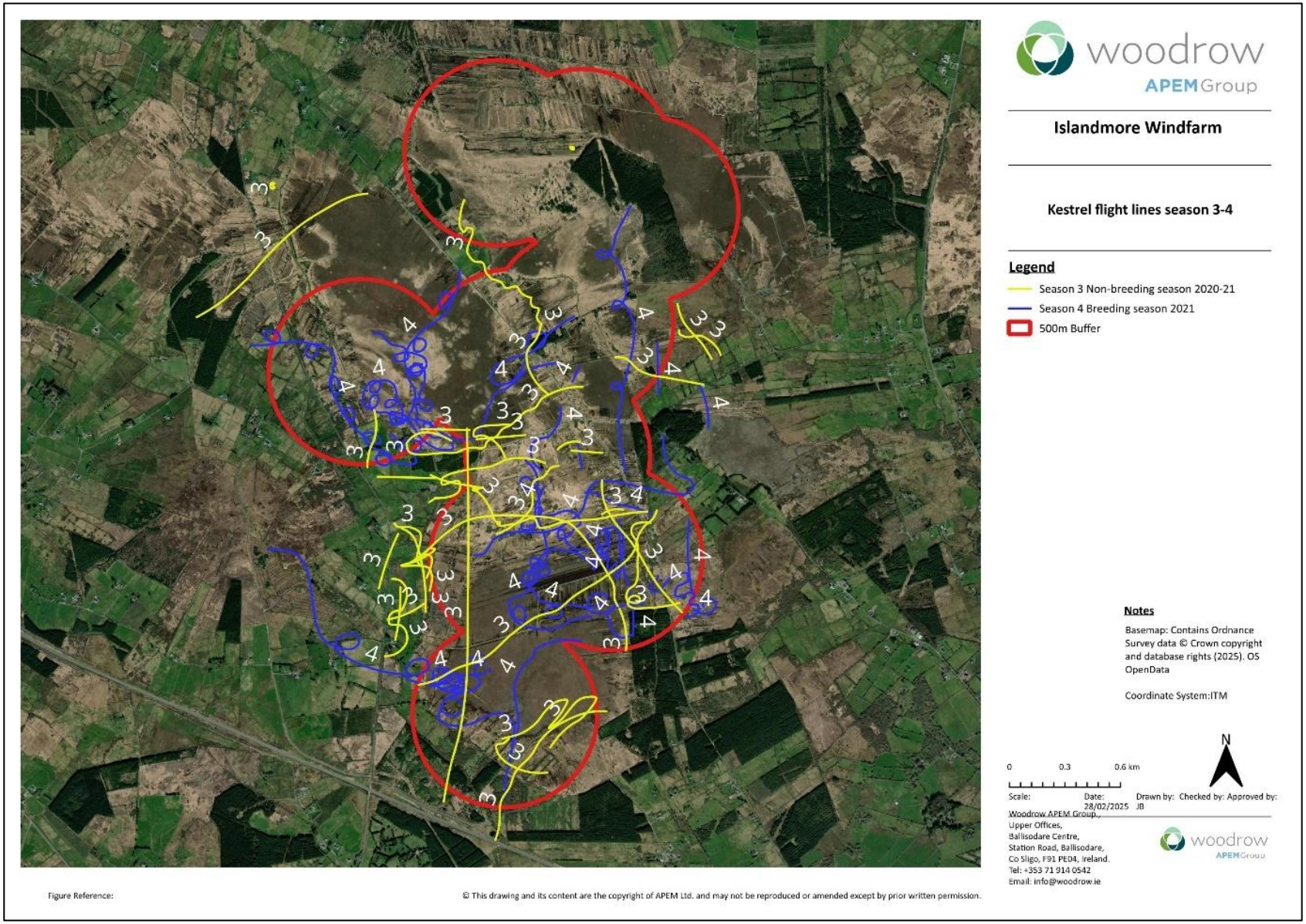


Figure 35: Kestrel flight lines season 3-4 (1-4) non-breeding season 2020/21 and breeding season 2021

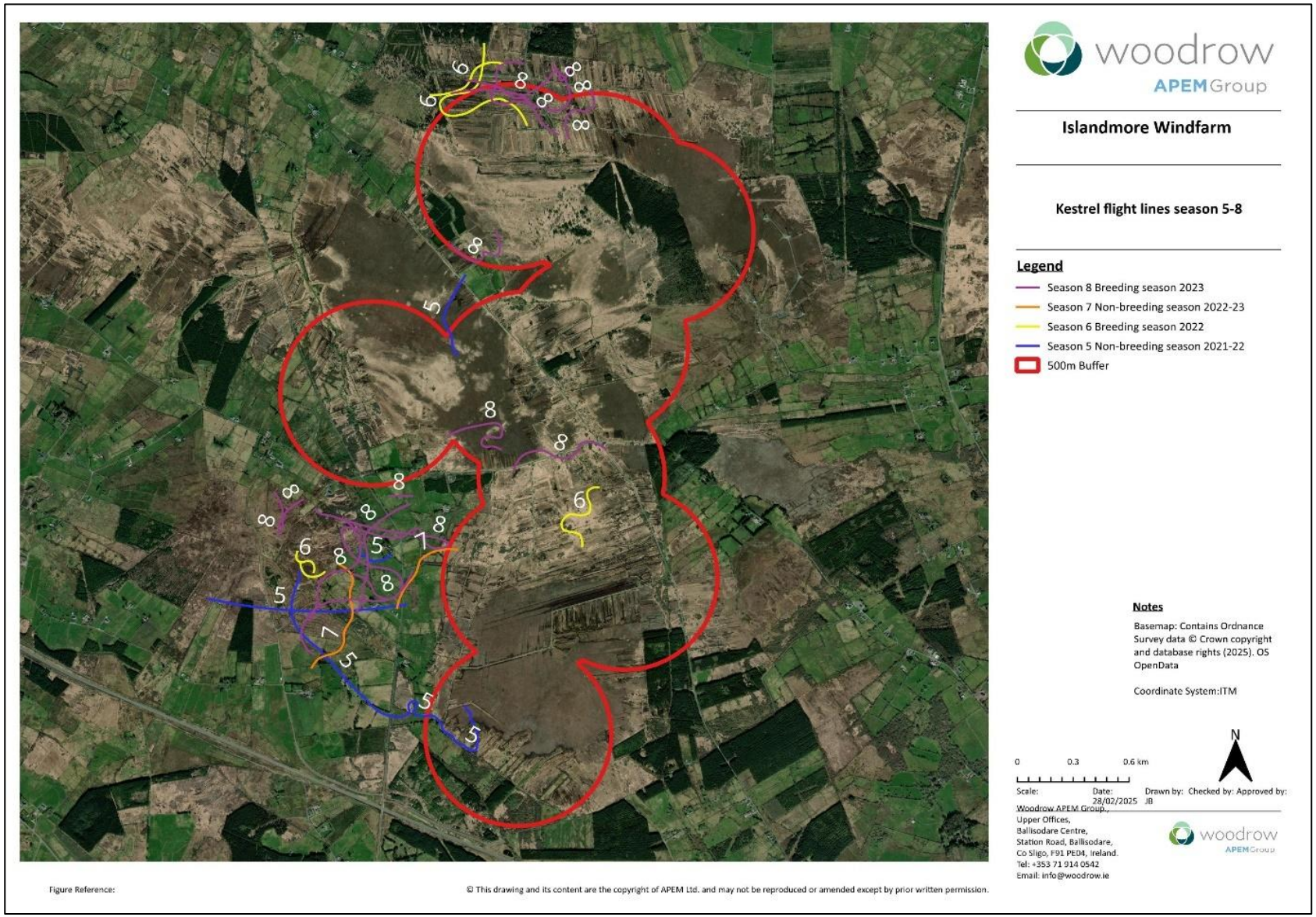


Figure 36: Kestrel flight lines season 5-8 non-breeding season 2021/22, breeding season 2022, non-breeding season 2022/23 and breeding season 2023

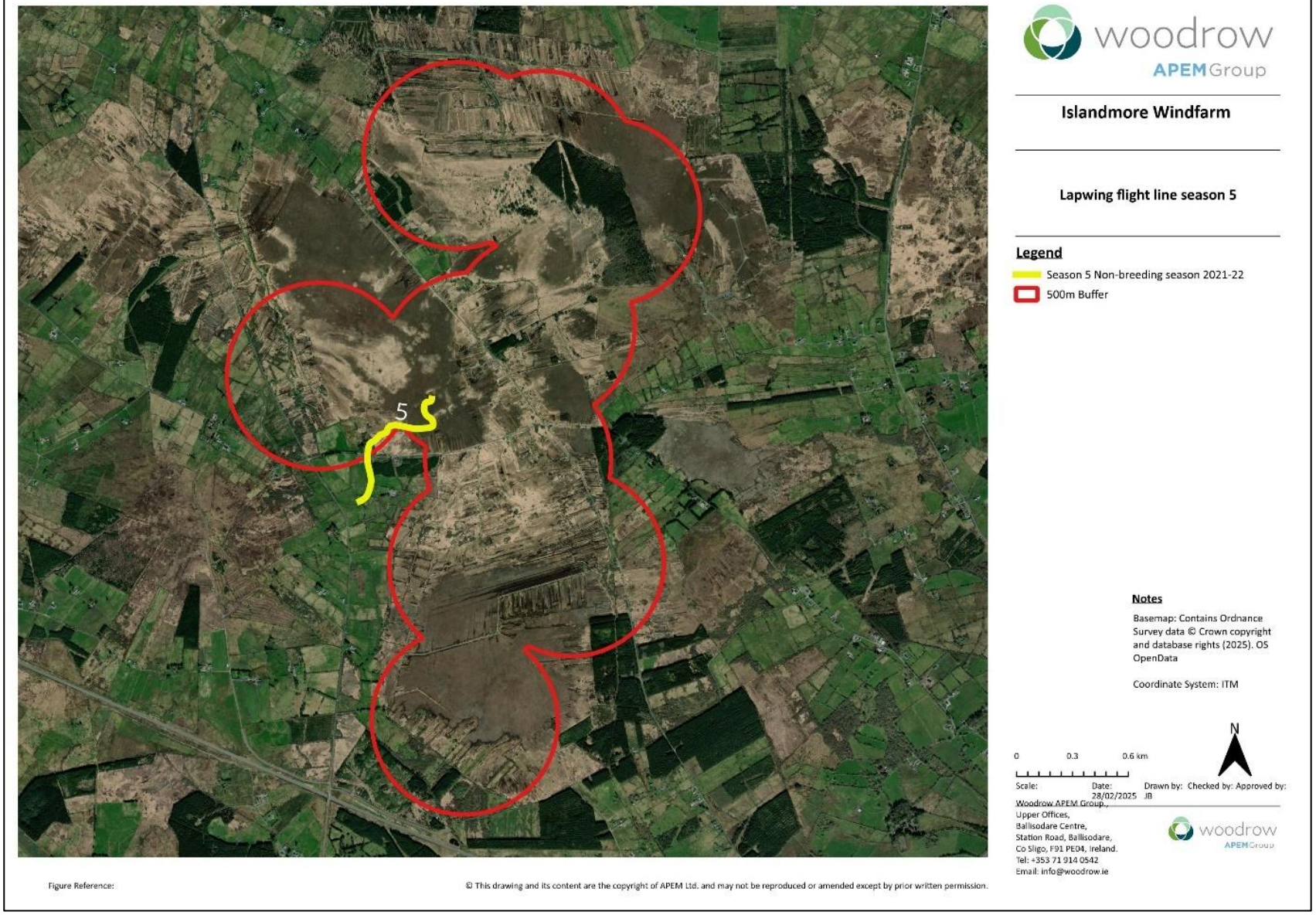


Figure 37: Lapwing flight lines season 5-8 non-breeding season 2021/22

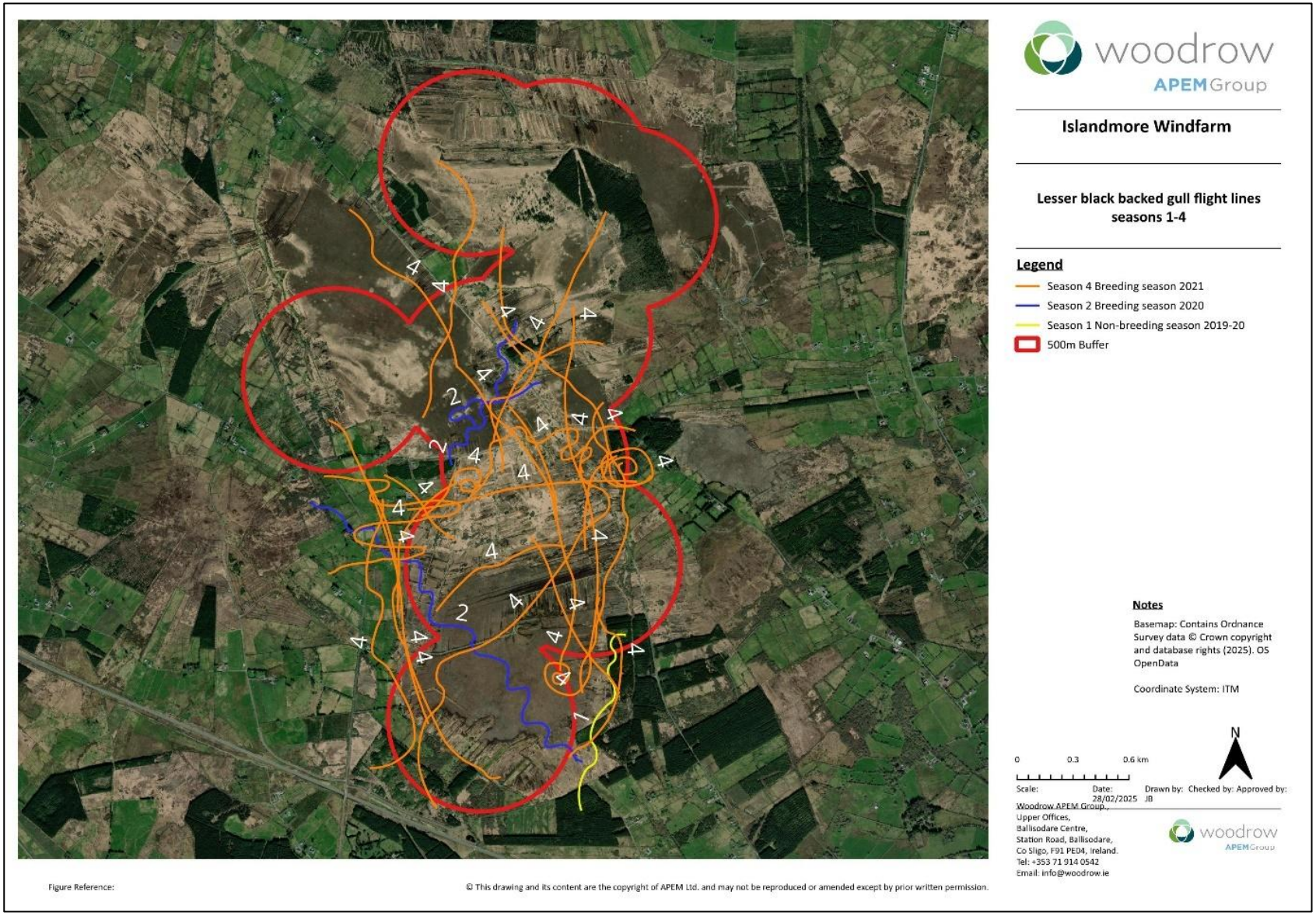


Figure 38: Lesser black backed gull flight lines season 1-4 non-breeding season 2019/20, breeding season 2020, breeding season 2021

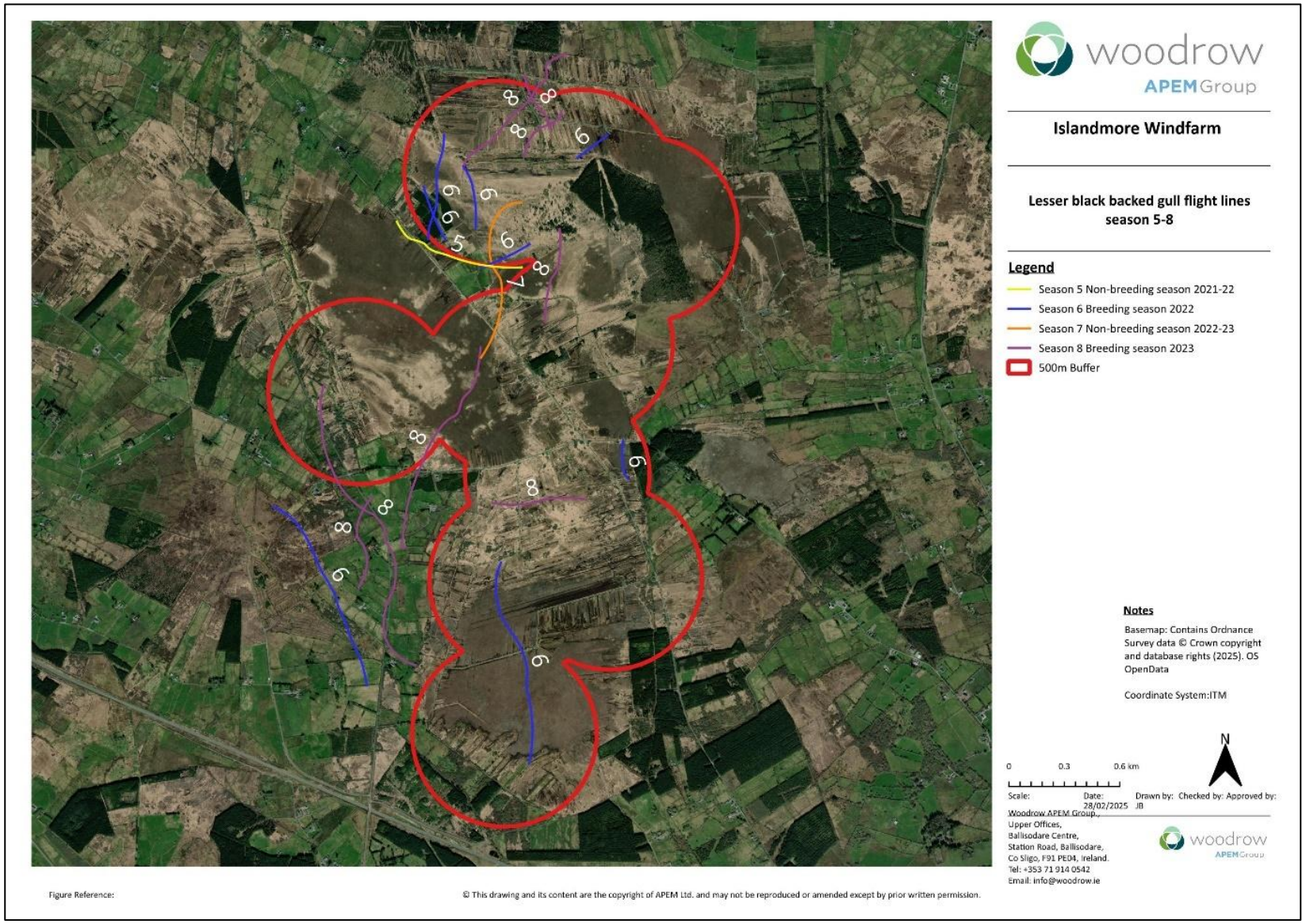


Figure 39: Lesser black backed gull season 5-8 non-breeding season 2021/22, breeding season 2022, non-breeding season 2022/23, breeding season 2023

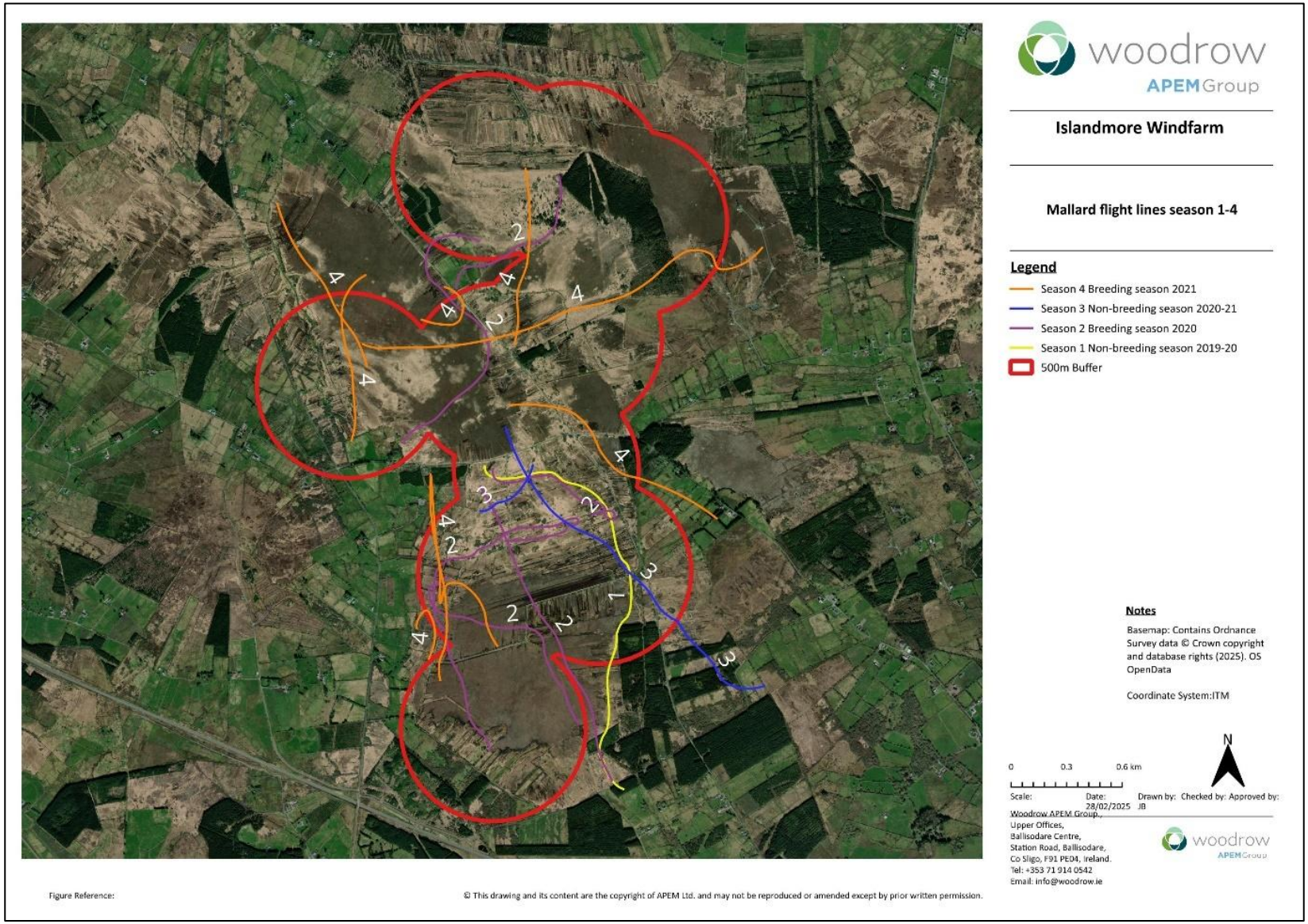


Figure 40: Mallard flight lines season 1-4 non-breeding season 2019/20, breeding season 2020, non-breeding season 2020/21, breeding season 2021

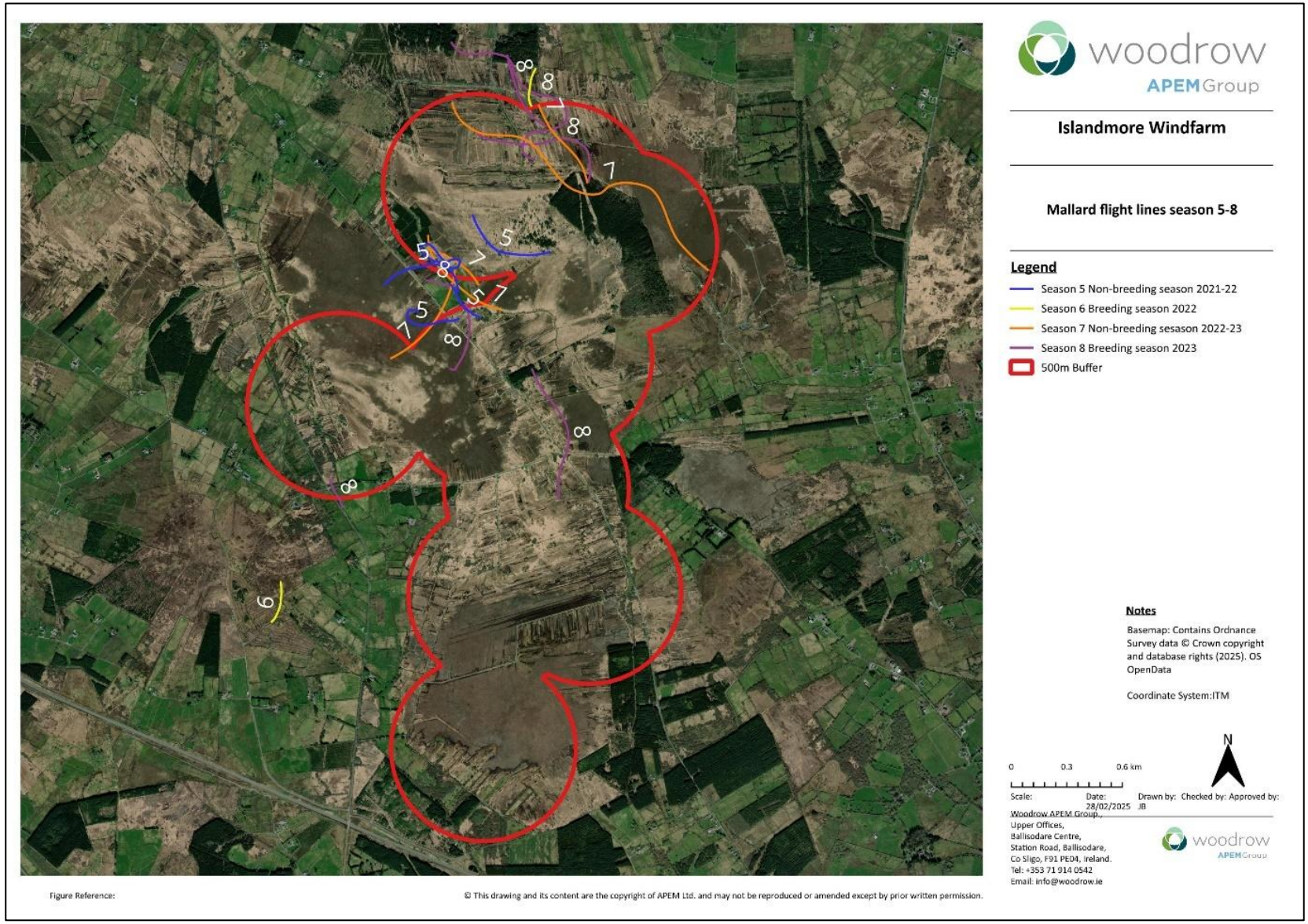


Figure 41: Mallard flight lines season 5-8 no-breeding season 2021/22, breeding season 2022, non-breeding season 2022/23 and breeding season 2023

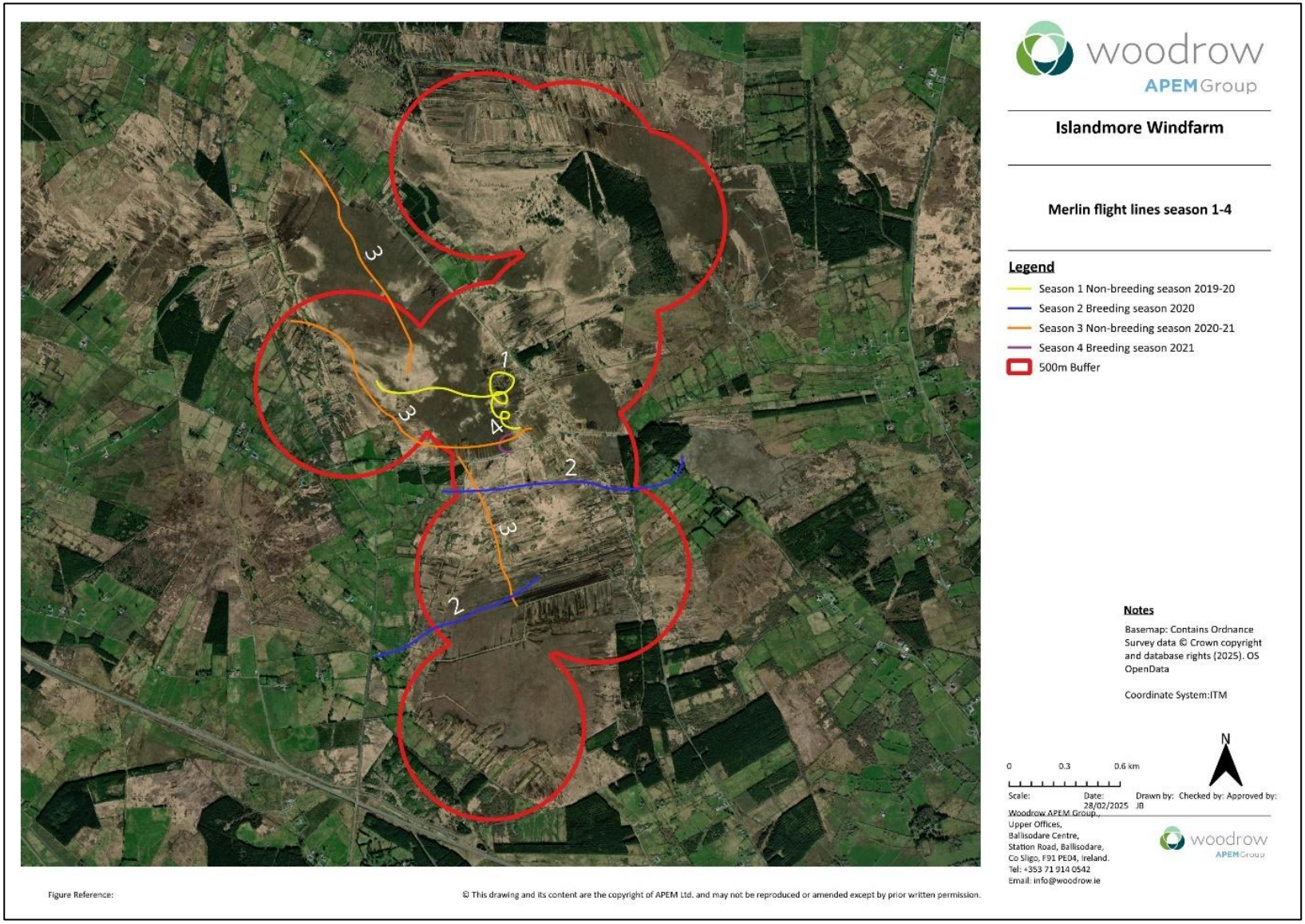


Figure 42: Merlin flight lines season 1-4 non-breeding season 2019/20, breeding season 2020, non-breeding season 2020/21 and breeding season 2021

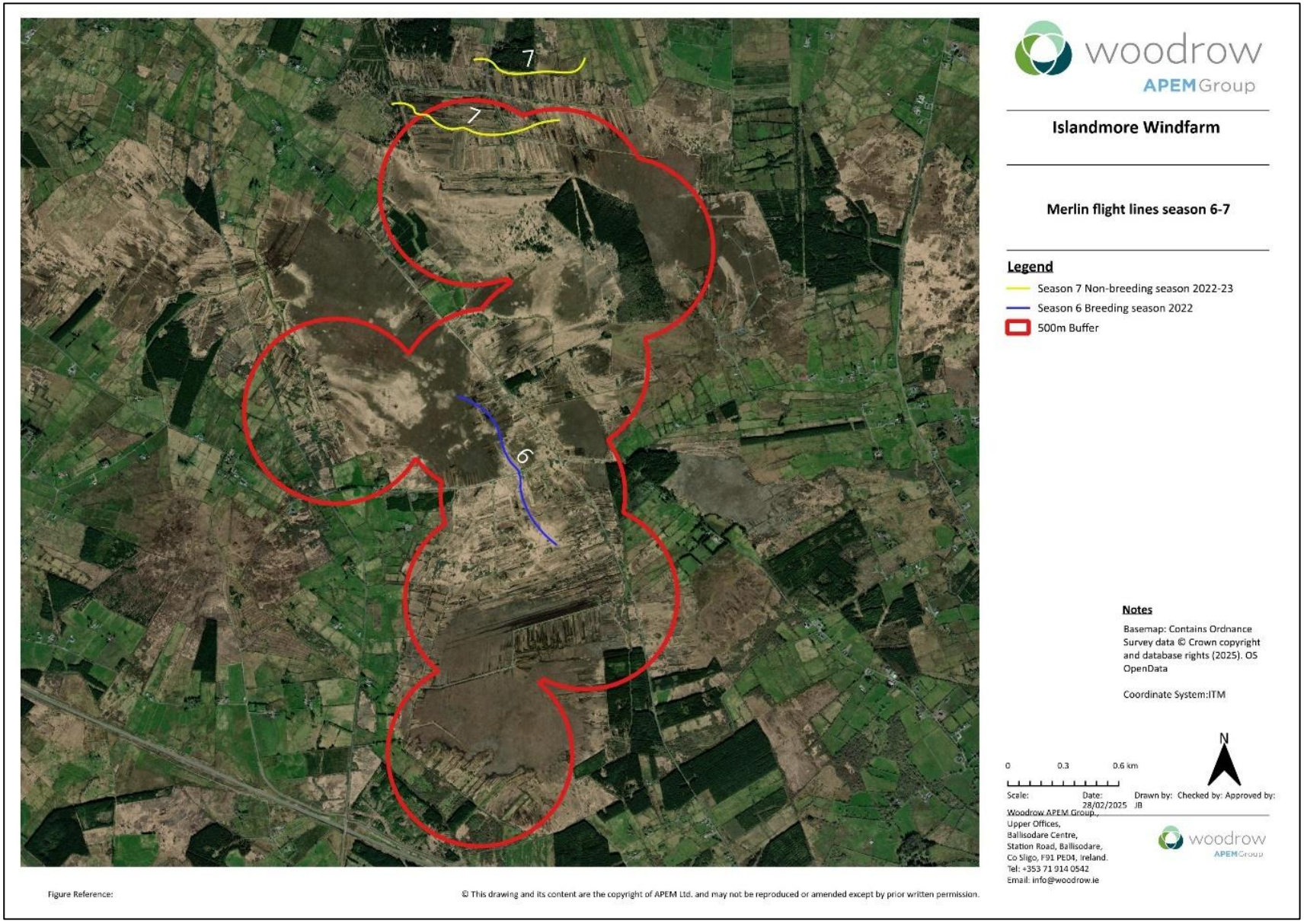


Figure 43: Merlin flight lines season 5-8 breeding season 2022 and non-breeding season 2022/23

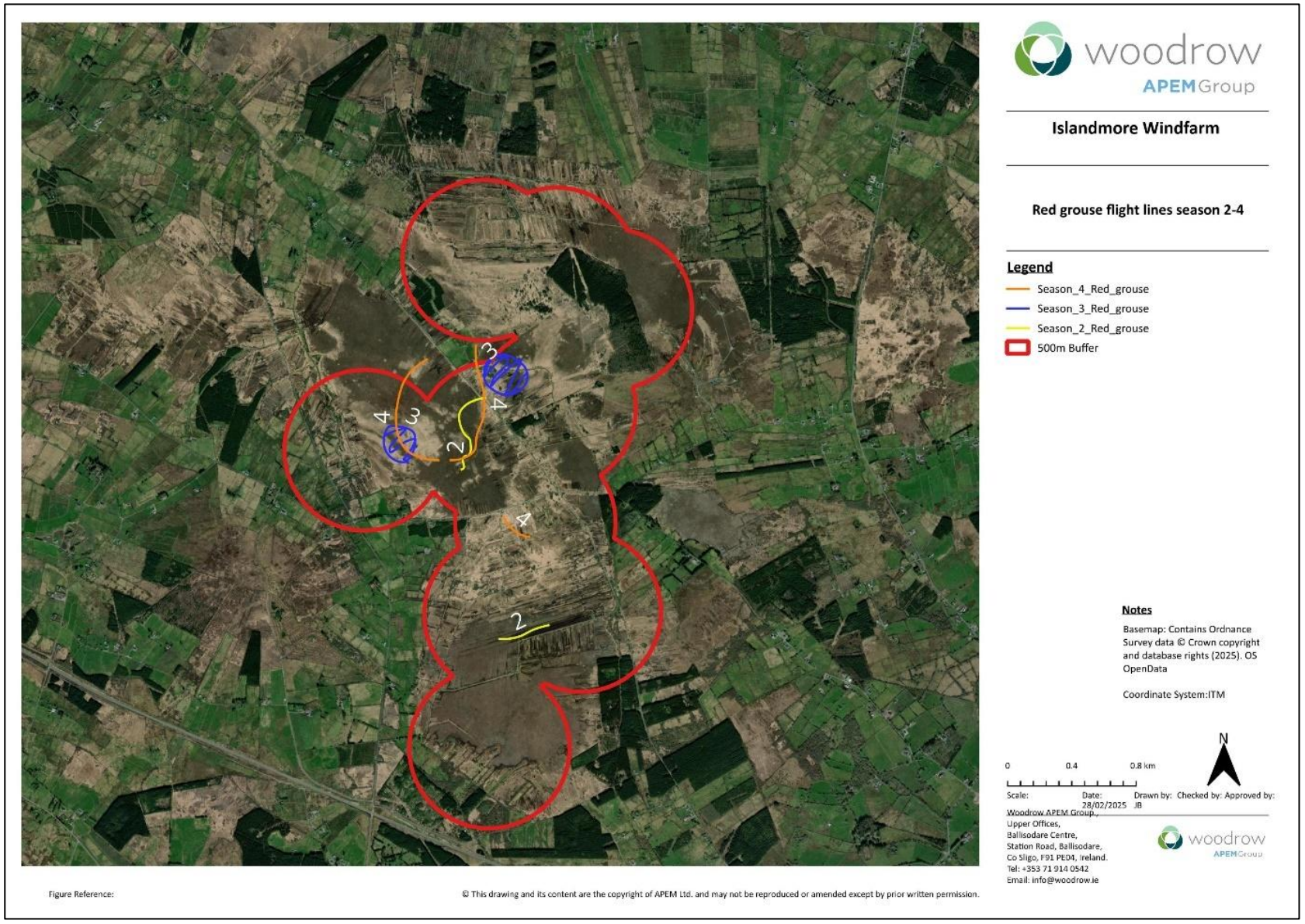


Figure 44: Red grouse flight lines season 1-4 breeding season 2020, non-breeding season 2020/21, breeding season 2021

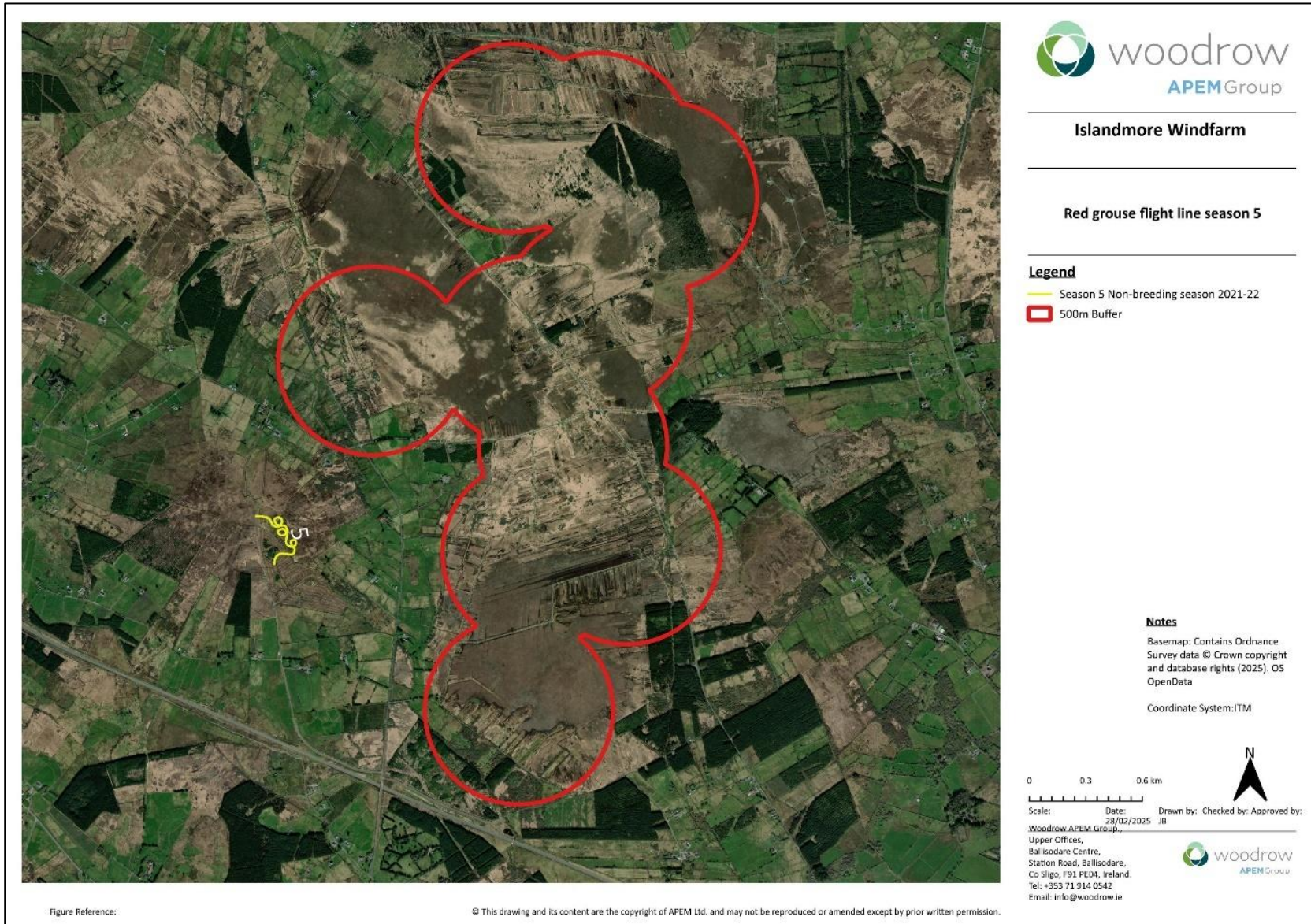


Figure 45: Red grouse flight lines season 5-8 non-breeding season 2021/22

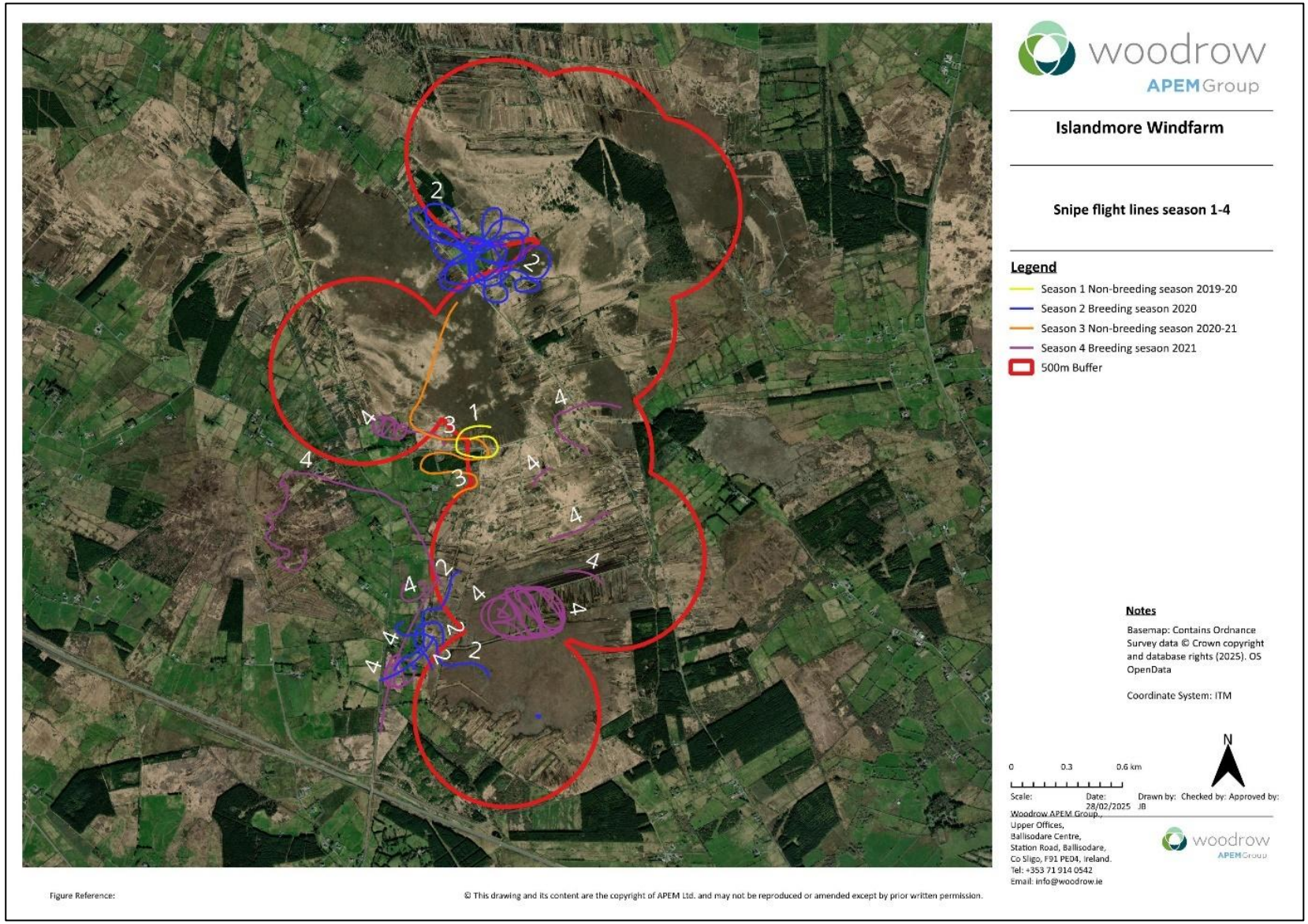


Figure 46: Snipe flight lines season 1-4 non-breeding season 2019/20, breeding season 2020, non-breeding season 2020/21 and breeding season 2021

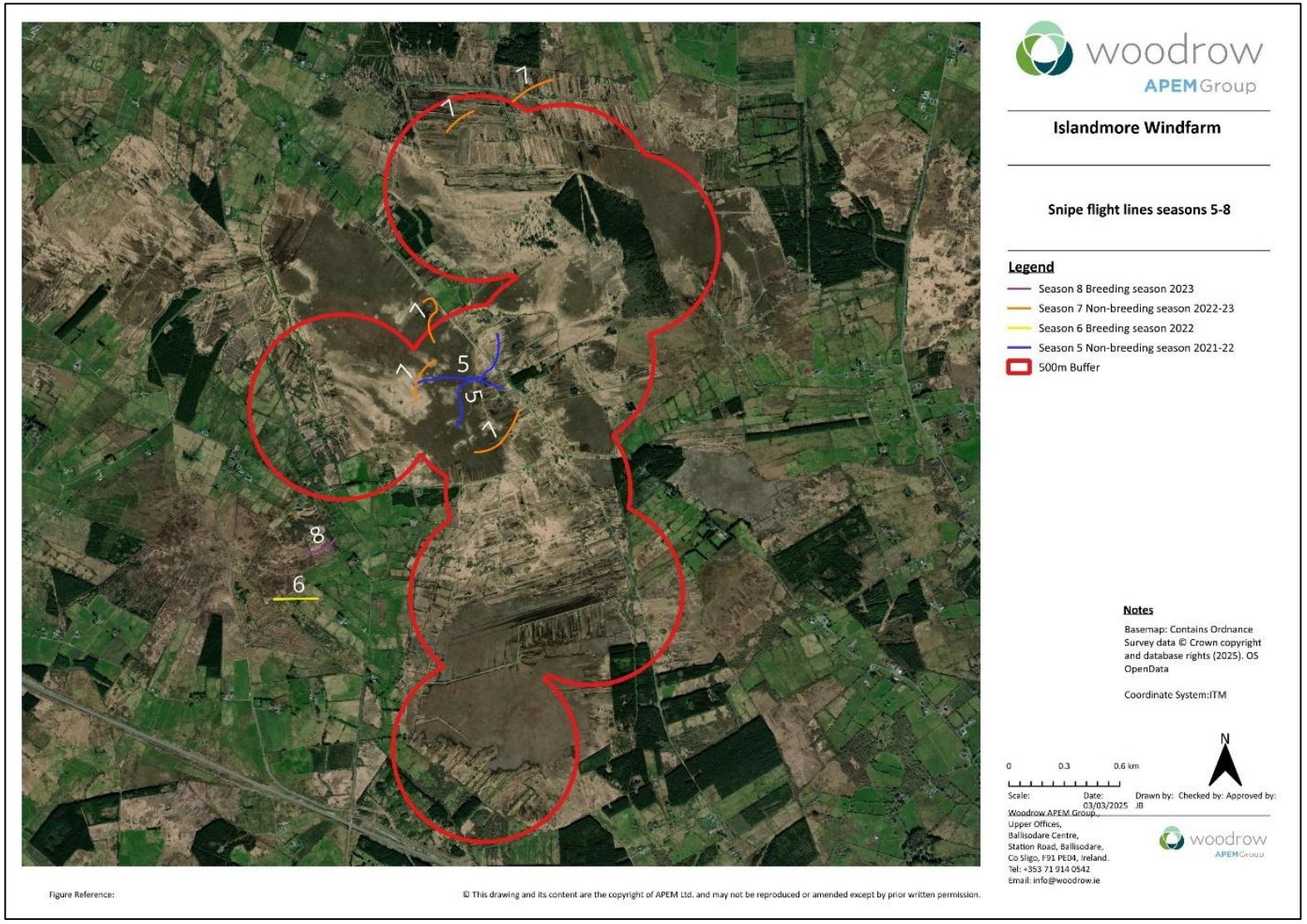


Figure 47: Snipe flight lines season 5-8 breeding season 2021/22, breeding season 2022, non-breeding season 2022/23 and breeding season 2023

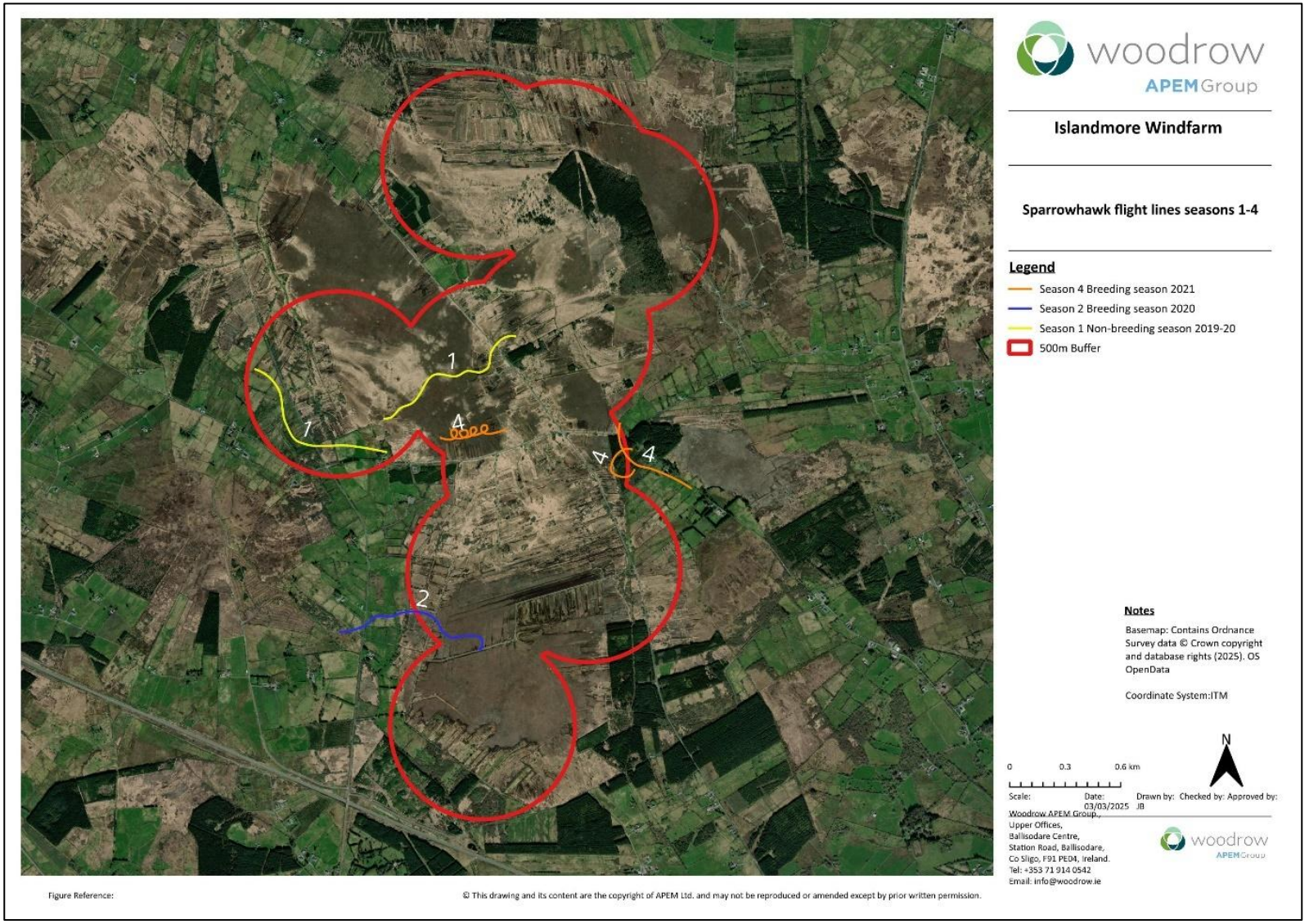


Figure 48: Sparrowhawk flight lines season 1-4 non-breeding season 2019/20, breeding season 2020, breeding season 2021

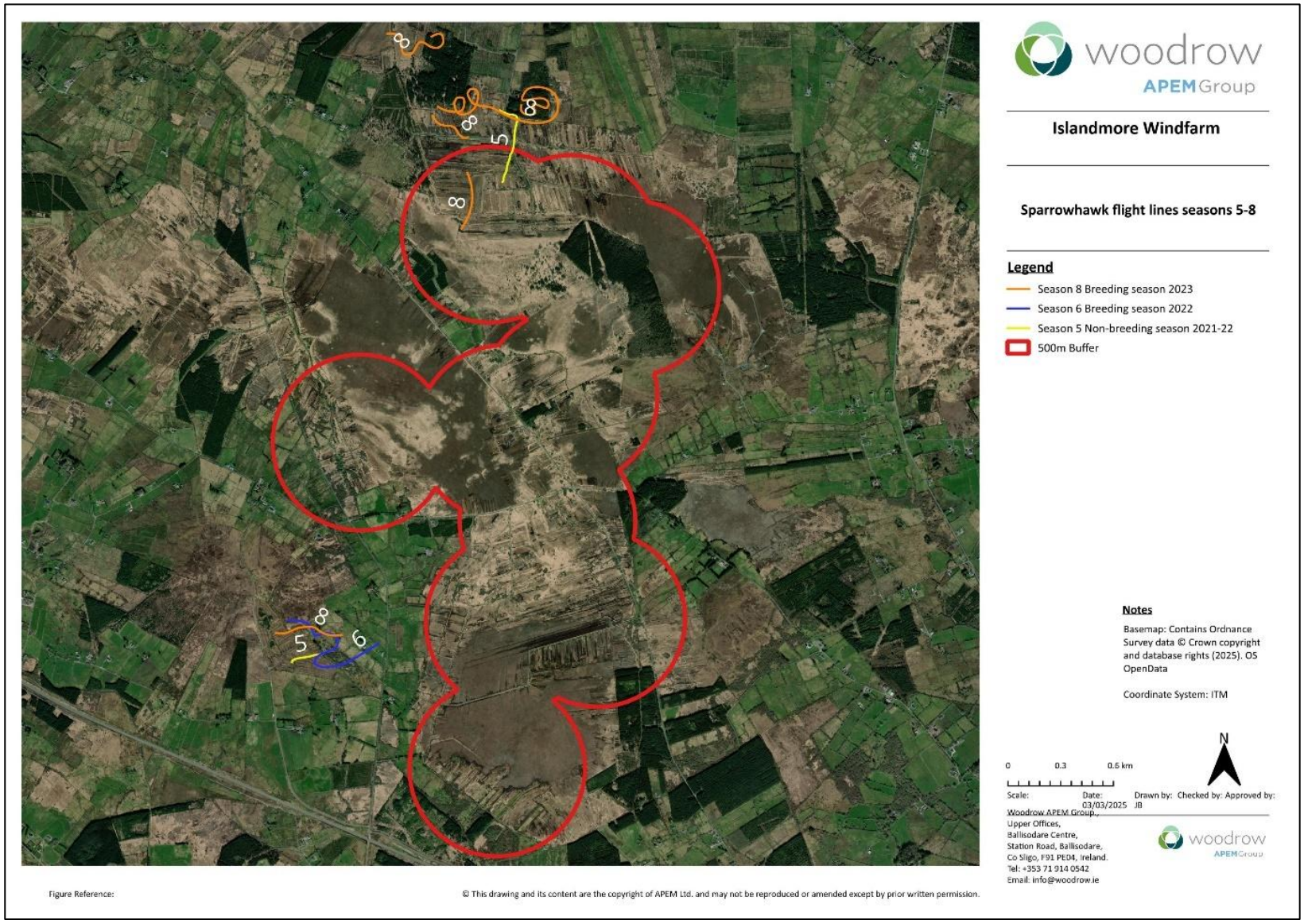


Figure 49: Sparrowhawk flight lines season 5-8 breeding season 2021/22, breeding season 2022 and breeding season 2023

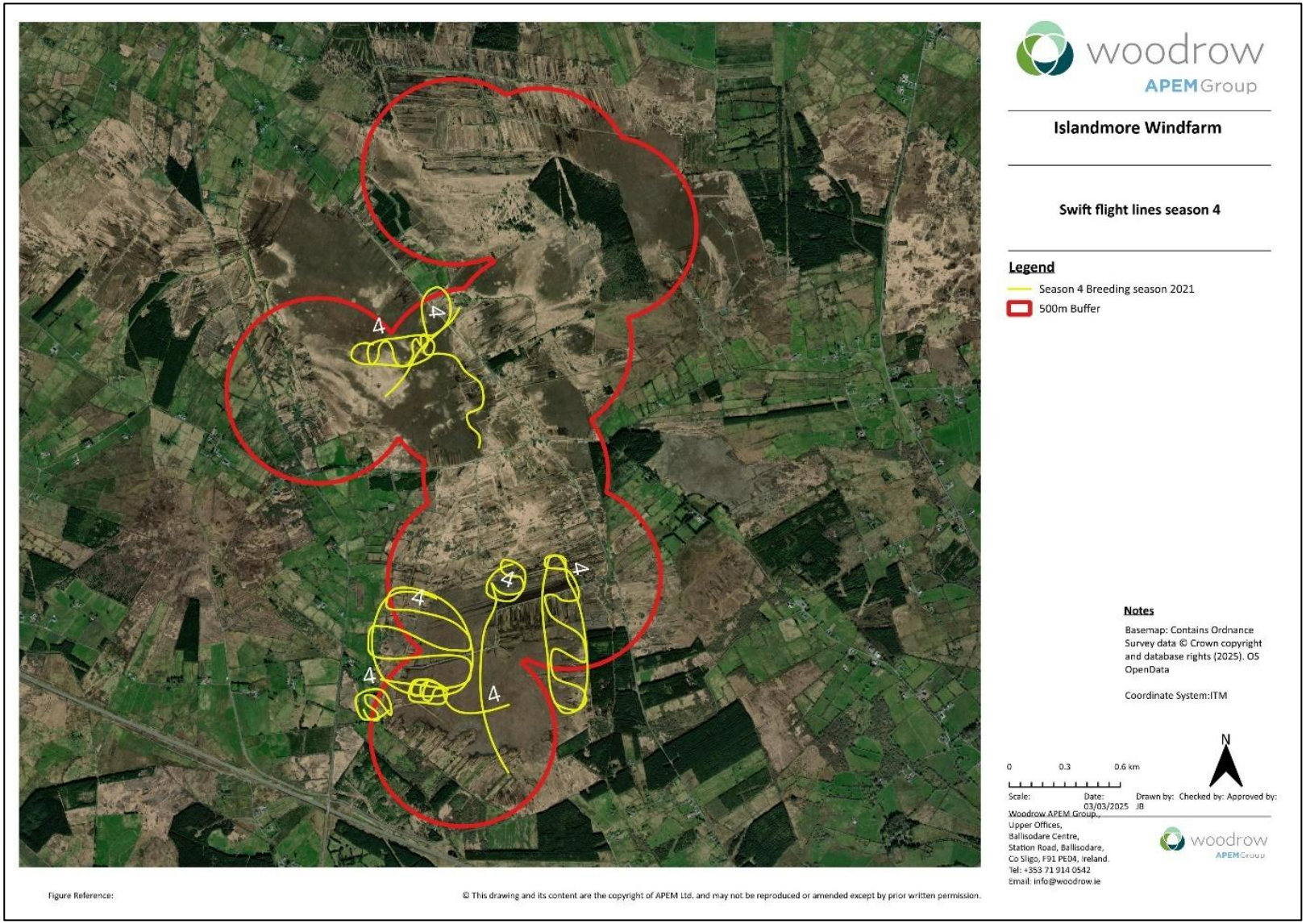


Figure 50: Swift flight lines season 1-4 breeding season 2021

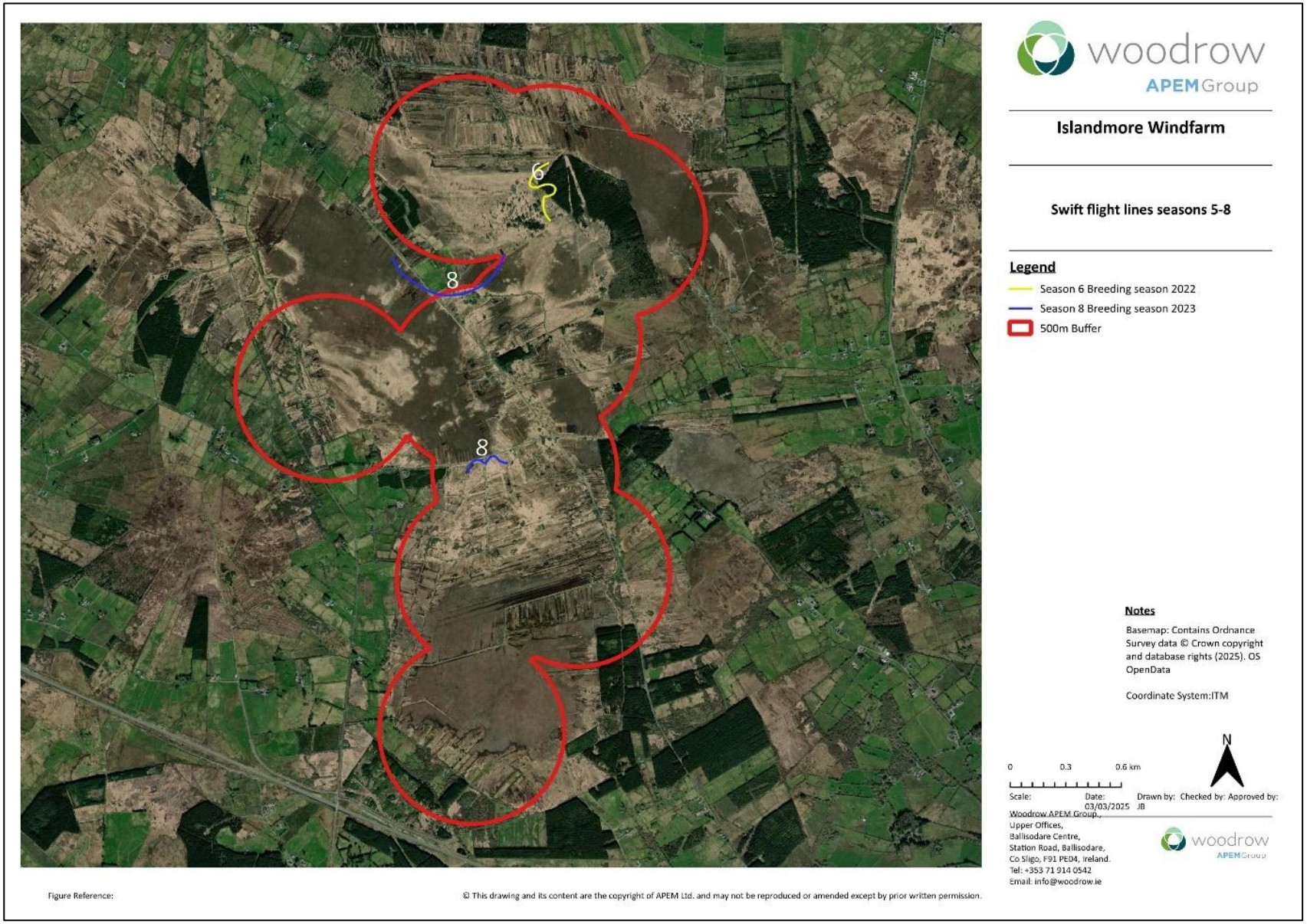


Figure 51: Swift flight lines season 5-8 breeding season 2022 and 2023

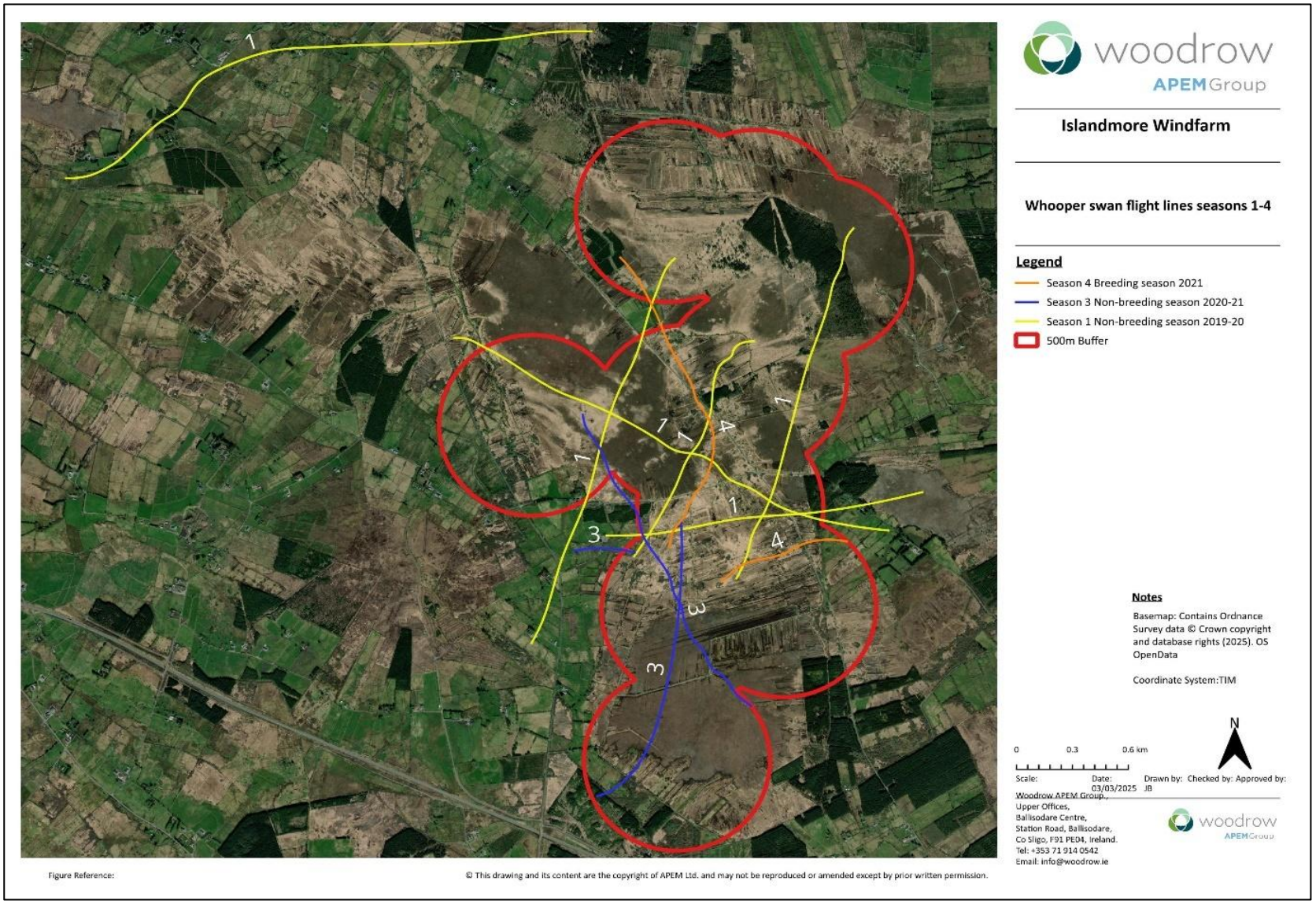


Figure 52: Whooper swan flight lines season 1-4 non-breeding season 2019/20, non-breeding season 2020/21, breeding season 2021

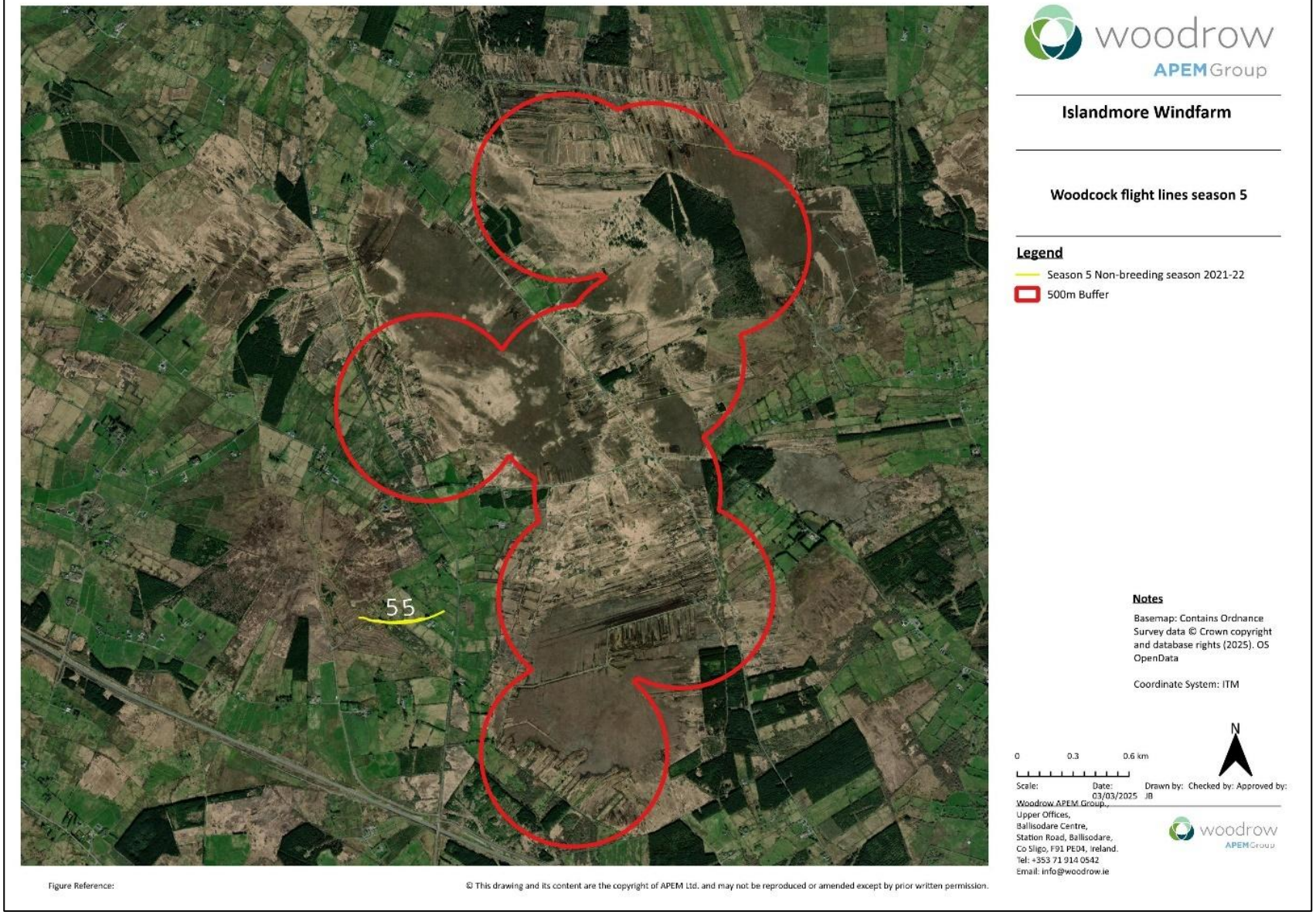


Figure 53: Woodcock flight lines season 5-8 non-breeding season 2021/22

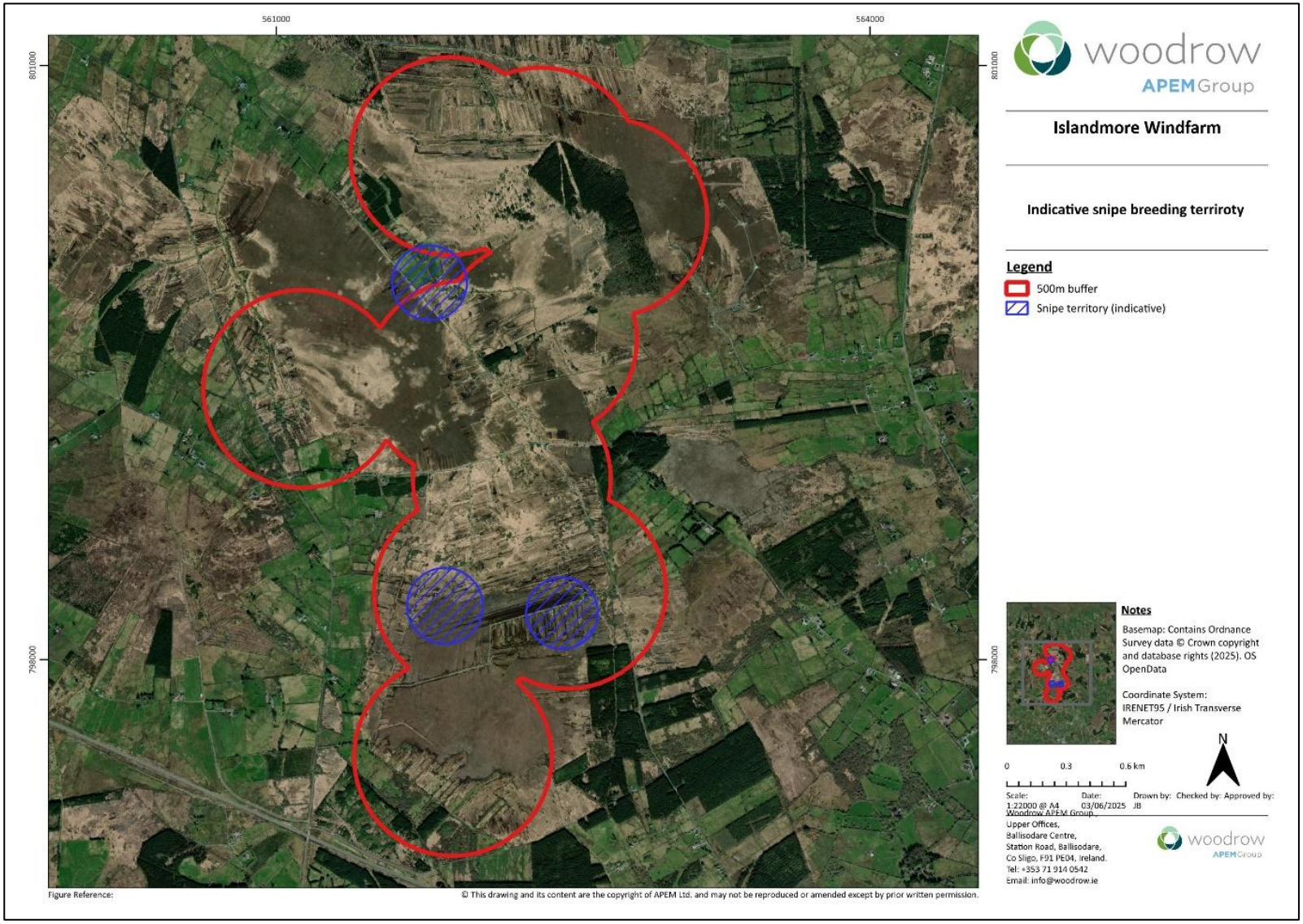


Figure 54: Indicative snipe breeding territory locations informed by dusk surveys

APPENDIX 3 – FULL BREEDING RAPTOR SURVEY RESULTS

Species	Number of individuals									BoCCI 2020-2026
	Visit 1	Visit 2	Visit 3	Visit 4	Visit 6	Visit 7	Visit 8[28]	Visit 9	Visit 10	
Kestrel	2	3	1		1	2		3	2	Red
Merlin	1									Amber
Buzzard	1	1								Green
Sparrowhawk	1			1					6	Green

Table 68: Raptor survey breeding season 2020

Species	Number of individuals							BoCCI 2020-2026
	Visit 1	Visit 2	Visit 3	Visit 4[29]	Visit 6	Visit 7	Visit 9	
Kestrel	2						1	Red
Merlin	1							Amber
Hen harrier						1		Amber
Sparrowhawk	2	2	2					Green

Table 69: Raptor survey breeding season 2021

Species	Number of individuals						BoCCI 2020-2026
	Visit 2	Visit 3[30]	Visit 5	Visit 7	Visit 8	Visit 9	
Kestrel				1	2	1	Red
Sparrowhawk	1						Green

Table 70: Raptor survey breeding season 2022

[28] Visit 8 no target species

[29] Visit 4/6 no target species

[30] Visit 3/5 no target species

Species	Number of individuals											BoCCI 2020-2026
	Visit 1	Visit 2	Visit 4	Visit 5[31]	Visit 6	Visit 7	Visit 10	Visit 12	Visit 14	Visit 16	Visit 17	
Kestrel		1	1		1	1	1	1		2		Red
Buzzard	1	1										Green
Sparrow hawk									1		1	Green

Table 71: Raptor survey breeding season 2023

[31] Visit 5 no target species



GALETECH
ENERGY SERVICES

APPENDIX E: COLLISION RISK MODELLING REPORT



GALETECH
ENERGY SERVICES

Islandmore Wind Farm

Environmental Impact Assessment Report

Annex 5.9: Collision Risk Modelling

Islandmore Wind Farm Limited

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1.1 INTRODUCTION

APEM Group Woodrow was commissioned by Galetech Energy Services (GES) to undertake ornithological survey work for the proposed Islandmore Wind Farm (hereafter referred to as the project). The project is located in Co. Roscommon and is for a ten-turbine wind farm.

The intention of this report is to display modelled data, based on observed bird usage of the area, to provide an indication of the likely collision risk imposed by the proposed wind farm on potentially sensitive avian populations. The report uses bird usage data derived from vantage point (VP) watches conducted by appropriately experienced ornithological surveyors. Furthermore, the new guidance published by Scottish Natural Heritage (SNH) (2007, 2014, 2024) was used, which aims to promote a standardised approach to collision risk assessment for onshore wind farms, to increase the transparency of calculations and to promote greater confidence in the results. A detailed report is available explaining the derivation of the model (Band 2024).

Flightline data for selected target species was collected from four VPs between October 2021 and September 2023. The survey period covered two breeding seasons and two non-breeding seasons of VP watches. This amounted to a total of 582 hours of VP watch data (294 hours during the non-breeding seasons and 288 hours during breeding seasons). Further information on VP locations and survey effort can be found in the main ornithological report (**Annex 5.7**) and supporting documentation (see **Annex 5.7b** and **5.7c**), which provide details of timings for VP watches and demonstrates that the minimum requirement of 36 hours per VP per season was achieved over the two-year survey period.

Two turbine models have been specified for use in the proposed development; one with a hub height of 104m, a rotor diameter of 162m and an overall tip height of 185m, and a second with a hub height of 82m, a rotor diameter of 136m and an overall tip height of 150m. The Vestas V162-7.2MW (V162) and the Vestas V136-4.5MW (V136) turbines have been utilised as models representative of these dimensions. The model has been run for each turbine model based on turbines T1-T3 comprising the V162 and turbines T4-T10 comprising the V136. The collision risk zone (CRZ, defined as the height between the minimum and maximum swept height of the turbine rotor within a 500 m buffer of turbines) is 14-150 m for the V136 and 23-185 for the V162 model, as detailed in **Table 2**.

Based on professional judgement, Collision Risk Modelling (CRM) was run for target species with a total aggregate flight time (i.e., number of individuals x flight time) of > 300 seconds occurring within the potential CRZ over the two years (i.e. at collision risk height and within the turbine envelope = 500 m turbine buffer), and with more than 3 observations over the study period. Target species with an aggregate flight time of < 300 seconds were excluded from this analysis as collision risk for them would be negligible. Based on the criteria outlined above, CRMs were run for the following three target species (**Table 1**).

Species	Total flight time (seconds) recorded across all height bandsAnne
Curlew	478
Golden plover	174,441
Kestrel	458

Table 1: Target species total aggregated flight time within the 500m turbine buffer over three years of surveys

Further information on the species recorded within the 500m turbine buffer along with the number of observations per species can be found in the Ornithological Baseline Report (**Annex 5.7**).

1.2 METHODOLOGY

The collision risk analysis was undertaken using the SNH model and guidelines (Band 2000, 2024, Band et al. 2007). The SNH model uses two approaches for different situations (SNH 2024). The first approach is for birds that take regular flights through a wind farm area and the second is for birds that may occupy an area, including a wind farm, as a regular territory. The model approach used in this case is the second, relating to birds occupying a given area.

The model estimates the number of collisions through a process of five stages:-

- Stage A utilises bird survey data that has been collected through the VP surveys (detailed in **Annex 5.7c**), to establish the density of flying birds within 500m of turbines, and the proportion of birds that are flying at a potential risk height between the lowest and highest points of the rotors;
- Stage B estimates the potential number of bird passages through rotors in the relevant time period, based on both the bird density, and the proportion of birds flying at risk height;
- Stage C determines the collision probability during a single bird rotor transit;
- Stage D estimates the rate of potential collision for a given bird species based on current levels of bird usage of the site, whilst taking into consideration the proportional of time in which the turbines are not in operation;
- Stage E takes into consideration the likely proportion of birds avoiding either the wind farm or its turbines. This may either be due to displacement from the site, birds undertaking evasive action or birds being attracted to the wind farm, for example, as a response to habitat changes; and,
- Stage F considers potential uncertainties and an estimate of error in the number of predicted collisions.

1.2.1 STAGE A - FLIGHT ACTIVITY

Stage A estimated the number of flights that may potentially be at risk of turbine collision in the absence of the displacement of birds, birds taking other avoidance actions, or birds being attracted towards the wind farm.

In the case of non-directional flights, there are two key parameters derived from survey observations that are needed in order describe the magnitude of flight activity:-

- Areal bird density (DA); and,
- Proportion of birds flying at risk height (Q2R)

The definition of areal bird density (DA) is the number of birds that are in flight at any height at a particular time, per unit area (generally per square kilometer, km2). Bird occupancy was converted to areal bird density (per m2) by dividing by the area watched from each VP (the VP viewshed, shown in **Annex 5.7b**). The flight activity from VP watches was recorded in bird seconds, which is particularly appropriate for low bird numbers. DA was calculated as shown in Equation 1.

$$DA = b / (t \times A)\ birds\ m - 2 \text{ (Equation 1)}$$

where:-

- (b) is the number of target species flight seconds recorded from a VP;
- (t) is the duration (in seconds) of all VP watches during either a month, season or year; and,
- is the area of the VP viewshed (km2) as shown in **Annex 5.7b**.

DA was calculated for each VP separately, with the figure subsequently averaged. However, where there exists a considerable difference in the time and/or area that is covered by relevant VP surveys the average figure should be weighted appropriately. Thus, the weighting factor used acknowledges that the quantity of data collected in a watch is proportional both to the size of the area observed and the duration of the VP watch.

The mean density DA is calculated using Equation 2:-

$$Mean\ density\ DA = \Sigma\ bi\ \sqrt{(ti \times Ai)} / (ti \times Ai) / \Sigma\ \sqrt{(ti \times Ai)} \text{ (Equation 2)}$$

In the case of conditions where a VP viewshed results in a significant difference in mean density DA (for example, due to a difference in underlying habitat), the bird density should then either be calculated separately for each individual VP site and then applied to determine the likely collision risk within that area. Alternatively, a turbine-weighted average bird density should be employed instead, i.e. the bird density for each VP should be weighted by the number of turbines present within that viewshed.

In this case, the average areal bird density (D average) was estimated using Equation 3.

The formula for this is:-

$$Daverage = \Sigma\ (Ni \times Di) / \Sigma\ Ni \text{ (Equation 3)}$$

where:-

- Di is the areal bird density within the VP viewshed (i);
- Ni is the number of turbines to be sited in that VP viewshed; and
- $D_{average}$ is the average areal bird density.

The definition of proportion of birds flying at risk height (Q2R) is the proportion of birds present between the lowest and highest points of a rotor, measured relative to the rotor base. In cases where flights are only recorded in the rotor swept height band, Q2R will be 100%.

1.2.1.1 Daylight Hours and Nocturnal Activity

Bird surveys are generally undertaken diurnally, with recorded levels of flight activity assumed to be representative of flight activity across all daylight hours. Daylight hours depend on the wind farm site's latitude and the time of year. Daylight and night hours per month are provided within the NatureScot CRM spreadsheet when the latitude of a particular site is inputted. The latitude of the wind farm site is expressed as degrees and minutes in degrees with decimal places. This data is subsequently utilised to calculate the daylight hours for each given month. The latitude of the wind farm site in question is 53° 56' north (entered in decimals as 53.93°).

Calculations used in the collision model account for collision risk associated with

diurnal and nocturnal flights. Diurnal activity is based on the flight activity recorded for each target species during field surveys. As nocturnal surveys were not possible, nocturnal flight activity is based on the diurnal flight activity, and professional judgement regarding the likely levels of nocturnal activity for each target species.

Levels of nocturnal activity by all target species were estimated, using a one to five scale to approximate nocturnal flight (with a score of one equal to 0% nocturnal activity, two equal to 25% of diurnal activity, three equal to 50% of diurnal activity, four equal to 75% of diurnal activity and five whereby nocturnal activity is equal to diurnal activity, see Table 3. It should be noted that for truly nocturnal species, this will underestimate nocturnal flight activity, which will be >100% of diurnal activity.

1.2.2 STAGE B - ESTIMATING NUMBER OF BIRD FLIGHTS THROUGH ROTORS

The total amount of bird transit flights anticipated through rotors is proportional to the number of turbines, as well as the cross-sectional area of the turbine rotors, and the density of birds in the airspace flying at risk height (calculated at Stage A). The total number of bird transits through rotors was calculated separately for each month. Therefore, a key output within the collision risk assessment is a statement of the potential number of bird transits per month and season or year through the wind farm turbines, assuming that birds exhibit no avoidance behaviour. As such, the risk of collision is considered to be directly proportional to the potential number of bird transit flights.

Stage B considers the available figures for bird density (DA), the proportion of risk height flights (Q2R), the nocturnal activity factor (f_{night}), and the figures for monthly daylight and night hours calculated at Stage A. In order to estimate the number of birds flying through rotors, the model takes into account the number of turbines, the turbine rotor radius and the flight speed of the target species. For flight speed, a typical mean flight speed is selected based on standard key literature, acknowledging that flight speed (and thus collision risk) will vary depending on bird behaviour (commuting, migration, foraging etc).

The number of bird transits expected through rotors was calculated using Equation 4.

$$Number\ of\ transits = v * (Daverage\ Q2R\ /\ 2R) * (T\ \pi R2) * (tday + fnight\ tnight)$$

(Equation 4)

where:-

- v is bird speed, relative to the ground (m sec-1);
- $D_{average}$ is the average areal bird density (Birds m-2);
- Q2r is the proportion of birds flying at risk height (%);
- R is the length of the rotor blades, from axis to tip (m);
- T is the number of turbines;
- f_{night} is the nocturnal activity factor; and,
- t_{day} and t_{night} the wind farm latitude is used to calculate daylight and night-time hours for each month, and the total for a year.

1.2.3 STAGE C- PROBABILITY OF COLLISION FOR A SINGLE ROTOR TRANSIT

Stage C utilises information on turbine size and speed (**Table 2**), as well as physical details on bird size and speed in order to accurately calculate the collision risk for birds flying through an active turbine rotor (**Table 3**).

It is presumed that birds have the ability to avoid stationary infrastructure. This model therefore estimates the likely probability of collisions occurring if a bird passes at random at any point through the rotor disk on a flight path perpendicular to the rotor plane. The collision probability for birds approaching at an oblique angle is the same as the probability for those approaching at a perpendicular angle; there is no additional effect of turbulence in the wake of a rotor blade; and also, no slipstream effect, i.e. air rushing over a blade may carry a bird clear of it.

Due to the geometry of the blades relational to the direction of flight, upwind flights carry a higher collision risk that downwind flights. This remains the case even when the flight speed of the bird relative to the ground is taken to be the same. In situations where there is an equal likelihood of both upwind and downwind flights, it is considered suitable to take an average of both collision probabilities. As such, the relative proportion of both upwind and downwind flights was utilised in this case to weigh the respective probabilities of collision. The default proportion was set to a probability of 50:50 upwind:downwind.

The NatureScot CRM spreadsheet provides a collision risk calculator for a single passage through the rotor. This calculator assesses the collision risk probability for a bird taking a single passage flight through a rotor at each radius (r) and angle (φ), in increments from r/R=0.05 out to r/R=1, and at 10-degree intervals of φ. The probability of collision was then averaged out over the entire area of the rotor disc to generate the average collision risk for a passage at any given point across the rotor.

By design, wind turbines operate at a range of various speeds. Typically, wind turbines do not operate below a cut-in speed, which is generally between three and four m/sec. The turbines then increase in speed in line with wind speed, up to a maximum operating wind speed of around 12 m/sec.

The model assessed the probability of collision risk using the turbine rotational speed for the two turbine models. In such cases where wind turbines operate at a range of different rotational speeds, the calculation should be carried out using a mean operational turbine speed. Preferably, the mean speed utilised in the calculation should be measured over time using an analysis of available wind data to determine the likely frequency distribution of turbine speeds. However, in cases where this is not available, the speed used should be based on the most likely value as anticipated by the wind farm developer. At Stage D of the model, an allowance is made to account for the proportion of time in which a wind turbine is not in operation. This may be due either because of low wind speeds or maintenance being carried out on the turbine. In this case, the mean turbine speed used in the calculation takes only the operational time of the turbine into account and excludes times when the turbine was idle or stationary.

Symbol	Description	Units	Turbine model	
			V162	V136
b	Number of blades		3	3
	Hub height	m	104	82
R	Rotor radius	m	81	68
	Minimum swept height	m	23	14
	Maximum swept height	m	185	150
C	Maximum blade width	m	4.8	4.1
γ	Average blade pitch*	°	9	9
Ω	Average rotation speed	rpm	5.71	5.45
	Average rotational period	s	10.5	11

Table 2: Turbine Data

Note: Pitch angle varies along the length of the blade, from a high angle close to the hub, to a low pitch angle towards the blade tips, i.e. the blade is twisted. Pitch angle also varies as the pitch is controlled to alter the rotation speed of the turbine. In the model, an average angle is used, representing an average pitch along the blade length. 6-15 degrees is reasonable for a typical large turbine.

Target species	Bird length (m)	Wingspan (m)	Bird speed (m/s)	% of flight upwind/downwind	Nocturnal activity (From 1 to 5)	Avoidance rate*
Curlew	0.55	0.9	16.3	50/50	2	0.980
Golden plover	0.28	0.72	17.9	50/50	2	0.998
Kestrel	0.34	0.76	10.1	50/50	1	0.950
*Source SNH 2018, 2024 and Furness 2019 T Gittings (2022)						

Table 3: Bird Data and Avoidance Rates for Target Species

1.2.4 Stage D - Multiplying to Yield Expected Collisions per Year

1.2.4.1 Single Transit Risk

Stage D multiplies the number of flights through rotors across the wind farm (Stage B) and the risk of collision for each single bird transit through a rotor (Stage C) to yield an estimate of total potential collision risk using Equation 5.

*Single transit risk = (No. of bird transits through rotors * Weighted probability of collision single)/100* (Equation 5)

1.2.4.2 Non-Operational Time

The factor Qop accounts for the time in which the turbine is not in operation, by representing the proportion of time in which the turbine is operational. Wind turbines are not in constant operation. Generally, a wind turbine is either idle or at rest for a certain proportion of time due either to wind speeds being too weak to generate power or, in exceptional cases, due to the turbines being intentionally shut down in order to avoid damage in the event of exceptionally high winds. Additionally, there is a requirement that wind turbines are occasionally shut down to allow for maintenance to be carried out.

Finally, the single transit risk is multiplied by the factor Qop to allow for the proportion of time that the wind turbines are operational. This is before considering avoidance behaviour, which is stage E.

1.2.5 STAGE E- APPLYING THE AVOIDANCE RATE

1.2.5.1 Avoidance

The preceding stages of the model operate on the assumption that birds will not undertake any avoidance action in response to the presence of wind turbines. However, birds do generally undertake avoidance action in order to prevent wind turbine collisions. Data derived from collision monitoring based on frequent searches of the wind farm site for bird corpses and observations of habitat use in the vicinity indicatives avoidance rates of 98% and over for many bird species. This data therefore indicates the collision risk to be less than 2% of that calculated from Stages A-D alone.

During this project, the potential collision mortality, for each month and for a year, after avoidance was calculated using a range of assumed avoidance rates of 95%, 98%, 99% and 99.5%.

1.2.5.2 Large Turbine Array Correction Factor

The large turbine array correction factor should be included only for large wind farms developments (more than 50 turbine wind farm). Therefore, this is not a requirement for the project site and there is no need for further discussion.

1.2.6 STAGE F - EXPRESSING UNCERTAINTY

In the estimate of collision risk following the method detailed above, there exists numerous sources of variability or uncertainty in the output. Band (2024) sets out an accurate description of potential sources of uncertainty, as well as a procedure of evaluating and presenting these sources.

The aim of this stage is to reflect the range of uncertainty in the collision estimate that could impact target species populations and/or growth rates. Information to include should reflect:-

- uncertainty or variability in flight activity data, such as imprecise flight height estimates and lack of knowledge about night-time behaviour;
- uncertainty surrounding the limitations of the collision model, such as the variability of bird dimensions and flight speed, the simplification in the shape of a bird and turbine blades; and
- uncertainty arising from turbine options such as the number, size and speed.

1.3 RESULTS

1.3.1 VIEWSHED SPATIAL COVERAGE

The VP locations used were the same during two-year survey period October 2021 to September 2023. Viewshed analysis was undertaken to determine spatial coverage from each VP. This was calculated using ArcGIS Pro, and the accuracy of viewsheds was confirmed in the field by surveyors. The viewshed analysis was calculated using a surface offset of 14m (the lowest rotor swept height of both turbine models) which mapped visible airspace available to surveyors (of an assumed height of 1.75m) at 14m. This illustrates the visible area at collision risk height.

Given the difference in size (and location) between the proposed turbine models, the 500m turbine buffer was comprised two areas, a northern sector that included only three turbines and was covered by VP2 and VP4 and a southern sector that included the remaining seven turbines and was covered by all four VPs .

Spatial coverage of the viewsheds within the 500m turbine buffer is given as a proportion in **Table 4** (Northern sector) and **Table 5** (Southern sector). The locations of the VPs and their viewsheds are mapped in **Annex 5.7b**.

VP	Area of CRZ visible within 500 m turbine buffer (Km²)	% Coverage of the 500 m turbine buffer	VP survey effort (hrs)		
			Non-breeding season (Oct - Mar)	Breeding season (Apr-Sep)	Total
VP1	3.27	80.37	75	72	147
VP2	2.21	54.23	72	72	144
VP3	1.59	39.02	74	72	146
VP4	1.55	38.06	73	72	145
Total	4.07	100.00*	294	288	582
*This is the total area within the 500m turbine buffer that is covered by at least one viewshed					

Table 1: Viewshed coverage of 500m buffer of turbines located in the Southern sector and VP survey effort

VP	Area of CRZ visible within 500 m turbine buffer (Km²)	% Coverage of the 500 m turbine buffer	VP survey effort (hrs)		
			Non-breeding season (Oct - Mar)	Breeding season (Apr-Sep)	Total
VP2	0.714	43.43	72	72	144
VP4	1.620	98.54	73	72	145
Total	1.64	100.00*	145	144	289
*This is the total area within the 500m turbine buffer that is covered by at least one viewshed					

Table 5: Viewshed coverage of 500m buffer of turbines in the Northen sector and VP survey effort

1.3.2 STAGE A: FLIGHT ACTIVITY

1.3.2.1 Bird Density

VP watches have been undertaken over two years (two breeding seasons and two non-breeding seasons), covering the entire site plus a buffer area of 500 m around the proposed turbine locations (100% coverage, see **Annex 5.7b**). The project site was covered from four VP locations. Overlapping viewsheds are discussed in **Table 4** and **Table 5**. Two separate CRMs were built for each section of the study area, one for the Northern sector that includes three turbines, and the proposed turbine model was the V162 and another for the Southern sector that included the remaining seven turbines, and the proposed turbine model was the V136.

VP watches were undertaken for a minimum of 72 hours per year; 36 hours during the breeding season (April – September) and 36 hours during the non-breeding season (October – March) in each of two years in line with SNH guidance (SNH, 2017, 2018). The watches were divided into sessions of less than three hours in duration with breaks between sessions to limit observer fatigue, and the sessions spread to include a representative sample of daylight hours. All flights of target species were recorded during each watch period, yielding total flying time in bird-seconds throughout the watch. Flying time was divided by the period of the watch (in seconds) and the area watched to give the average density of birds in flight per square kilometre.

Survey results are presented in **Table 6**. The number of VP watches is detailed in the Ornithological Baseline Report (see **Annex 5.7**), including flightlines tables and maps.

Flight times within the study area (500 m turbine buffer) and the analysis period are provided in **Table 6** for the three target species included in the model.

It should also be noted that, golden plover is a winter visitor in Ireland, which also remains during the passage season (i.e., the month of April) and this was accounted for in the model. There are also localised breeding populations of golden plover in Ireland, however no breeding birds were recorded during baseline surveys.

The mean density (DA) is given in **Table 6** for each target species and was calculated for each period (breeding and non-breeding); except for golden plover where the DA was estimated using flight time recorded during the non-breeding season and the month of April.

Target species	Analysis Period	Time in flight (bird-secs)				Northern sector: DA (birds/km^2)		Southern sector: DA (birds/km^2)	
		VP1	VP2	VP3	VP4	Non-breeding season	Breeding season	Non-breeding season	Breeding season
Curlew	Year-round	13	411	-	54	0.001	0.0001	0.0002	0.00003
Golden plover	Non-breeding (+ April)	-	173,099	1,342	-	0.468	-	0.076	-
Kestrel	Year-round	36	210	30	182	-	0.001	0.00001	0.0002
*Birds recorded in April were included in the density estimation for the non-breeding period, as these were birds recorded on passage, rather than breeding birds.									

Table 6: Flight seconds and mean bird density for all target species during two years of survey in the Northern and Southern sector

1.3.2.2 Proportion Flying at Risk Height

The assessment considers two turbine options of which have rotor swept heights of 14-150 m (V136) and 23-185 m (V162) respectively (see **Table 2**). The surveys recorded the flight heights of birds, estimated visually. The proportion of observed birds at rotor risk height (or within the CRZ), was calculated for the Northern sector (turbine model V162) and for the Southern sector (turbine model V136) (**Table 7** and **Table 8**), respectively.

It is important to note that since there were no curlew and kestrel observed at rotor risk height (%Q2R) during all VP watches in the Northern sector, these species were removed from further CRM analysis, and only golden plover CRM was run for the Northern sector.

Target species	Number of birds observed	%Q2R for V162
Curlew	30	0.00
Golden Plover	2,580	24.11
Kestrel	8	0.00

Table 7: Proportion of observed birds flying at rotor risk height (%Q2R) during all VP watches in the Northern sector

Target species	Number of birds observed	%Q2R for V136
Curlew	37	35.14
Golden Plover	2,646	25.70
Kestrel	14	42.86

Table 8: Proportion of observed birds flying at rotor risk height (%Q2R) during all VP watches in the Southern sector

1.3.3 STAGE B: ESTIMATING NUMBER OF FLIGHTS THROUGH ROTORS

The output from Stage B is the potential number of bird transits through rotors, per month and per annum (**Table 9**). The total number of bird transits expected through rotors is proportional to the number and cross-sectional area of the rotors, and to the density of birds in the airspace at risk height or in the CRZ.

Model	Target species	Projected number of rotor transits												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
V162	Golden plover	1,029	1,028	1,272	-	-	-	-	-	-	1,194	1,033	995	6,551
V136	Curlew	1	1	1	-	-	-	-	-	-	1	1	1	6
	Golden Plover	302	302	374	-	-	-	-	-	-	351	303	292	1,924
	Kestrel	-	-	-	1	1	1	1	1	1	-	-	-	6

Table 9: Potential Number of Bird Transits through Rotors per Month and Year

1.3.4 STAGE C: PROBABILITY OF COLLISION FOR SINGLE ROTOR TRANSIT

Data relating to the likelihood of a bird being hit when flying through the rotor is derived from the NatureScot CRM spreadsheet. The outputs are provided for each target species in **Table 10**.

Target species	Average single transit	
	V162	V136
Curlew	4.75%	4.91%
Golden plover	4.35%	4.56%
Kestrel	4.67%	4.79%

Table 10: Probability of collision for a single rotor transit for target species

1.3.5 STAGE D: MULTIPLYING TO YIELD EXPECTED COLLISIONS PER YEAR

Following the above steps, the number of bird transits per year through the rotors can be combined with the probability of a bird being hit when flying through the rotor to give a likely collision rate per month and per year (assuming no avoidance). An avoidance figure is then applied to get a predicted likely collision rate, and thus a likely mortality rate. This stage considers the proportion of time that turbines are likely to be operational. The collision rate before this avoidance figure is applied is illustrated in **Table 11**.

Model	Target species	Collision rate before avoidance												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
V162	Golden plover	38.03	37.99	47.01	-	-	-	-	-	-	44.15	38.19	36.78	242.17
V136	Curlew	0.04	0.04	0.05	0.01	0.01	0.01	0.01	0.01	0.01	0.04	0.04	0.04	0.30
	Golden plover	11.72	11.70	14.48	-	-	-	-	-	-	13.60	11.76	11.33	74.59
	Kestrel	-	-	-	0.04	0.04	0.05	0.05	0.04	0.03	-	-	-	0.25

Table 11: Collision Rate before Avoidance for Target Species

1.3.6 STAGE E: APPLYING THE AVOIDANCE RATE

NatureScot (2018) guides the use of avoidance rates in collision risk assessments. Collision risks have been calculated using the avoidance rate suggested by SNH (2018) except for Golden plover (Gittings, 2022) (**Table 3**) to provide estimates of the number of collisions per annum, per decade and for the operational lifespan of the project (40 years) (**Table 12**).

Table 12 provides the collision probability of the selected target species passing through the rotors, taking into account different avoidance rate estimates for the non-breeding and breeding seasons and years. Species in bold denote a rate of more than 0.05 collisions per year.

Taking into account the V136 model, the CRMs generated low levels of theoretical collision risk (i.e. less than 1 collision per decade, with SNH suggested avoidance rate) over the 40-year life span of the project for curlew and kestrel (**Table 12**). This level of predicted collisions would be considered negligible and would not affect these species at the population level, i.e., collision-mediated mortality would not add significantly (>1%) to background levels of mortality.

Higher levels of predicted collision risk (i.e. more than 1 collision per decade), with the use of Gittings, (2022) 0.998 avoidance rate for golden plover, were predicted for both turbine models (**Table 12**).

These levels of predicted collision risk warrant further investigation in terms of potential effects on these species populations. The population-level consequences of predicted collision risks can be assessed by considering the additional mortality that would be caused (assuming that the collision risk is non-additive) relative to background mortality rates in the population, with a threshold level of a 1% increase in annual mortality used to determine whether the impact will be significant (Percival, 2003). Estimates of the potential increase in annual mortality rates for target species are delineated within the species account in **Chapter 5** of the EIAR.

Turbine	Target species	Collision rate after 0.95 avoidance			Collision rate after 0.98 avoidance			Collision rate after 0.99 avoidance			Collision rate after 0.998 avoidance [1]			Per decade using suggested avoidance rate*	Per 40 years using suggested avoidance rate*
		NB	B	Year	NB	B	Year	NB	B	Year	NB	B	Year		
V162	Golden plover	12.108		12.108	4.843		4.843	2.422		2.422	0.484		0.484	4.84	19.36
V136	Curlew	0.013	0.003	0.016	0.005	0.001	0.006	0.003	0.001	0.003				0.06	0.24
	Golden plover	3.73		3.73	1.492		1.492	0.746		0.746	0.149		0.149	1.49	5.96
	Kestrel		0.011	0.011		0.004	0.004		0.002	0.002				0.11	0.44

Table 12: Collision rate estimated by the non-breeding (NB) and the breeding seasons (B) and year-round, applying different avoidance rates

**Golden plover 0.998, Curlew 0.98 and Kestrel 0.95 avoidance rate*

[1] Use of 0.998 for golden plover only (Gittings, 2022).

1.3.7 STAGE F: EXPRESSING UNCERTAINTY

As outlined in NatureScot guidance, it is important to consider potential uncertainties when interpreting predicted collisions and quantifying this uncertainty as much as possible. There are many sources of uncertainty throughout the CRM process, however these generally fall into three main categories:-

- Uncertainty or variability in the survey data collected;
- Uncertainty arising from limitations which are inbuilt into the CRM due to the requirement for simplification; and,
- Uncertainty arising from turbine specifications.

Uncertainty can arise during data collection, for example imprecisions when mapping the location of flights or categorising flight heights. This has been limited as much as possible by using experienced surveyors, and the same survey team throughout the survey programme. Data has been collected over multiple years to increase robustness; however, it should be acknowledged that data is recorded over a relatively short survey period and is extrapolated to predict activity across the year. The inability to collect nocturnal survey data means that there is uncertainty in predicted nocturnal flight activity throughout the operational phase, however significant nocturnal activity is only predicted for snipe. It is considered that data collection introduces uncertainty of ±20%.

The NatureScot CRM model contains simplifications, for example assuming uniform bird dimensions and flight speeds, and simplifications of turbine blade dimensions. This is inaccurate due to inherent natural variability within species populations and different flight speeds associated with different activities (commuting, hunting, display etc), however it is necessary to ensure that the model is not overly complex. It is considered that simplifications in the model introduce uncertainty of ±20%.

The turbine model dimensions used in the CRM have been provided by the client and are based on specifications for the proposed turbine model that will be used when the project is constructed. However, an allowance for turbine micro-siting means that there is uncertainty over the precise turbine layout, while their average rotor speed is assumed based on the highest and lowest possible rotor speeds. It is considered that simplifications relating to the turbine model and layout introduce uncertainty of ±10%.

Overall uncertainty can be quantified by combining the three sources of uncertainty using the following equation.

$$\sqrt{(\ 〚0.2〛\ \hat{}\ 2 + \ 〚0.2〛\ \hat{}\ 2 + \ 〚0.1〛\ \hat{}\ 2\ )}$$

This gives an overall uncertainty of ±30%.

1.4 SUMMARY

The model presents very low-levels theoretical collision risk for both Curlew and Kestrel not amounting a single predicted collision over the 40-year operational life. For both these species collision risk would appear to be negligible for the life span of the development.

For golden plover the model predicts a theoretical collision rate of 4.84 for the V162 and 1.49 for the V136, combined predicating 6.33 collisions per decade. Theoretical collision risk would appear to be low but will be further examined against background mortality and tested for any population level effects greater than 1% within the EIAR.

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