# Natura Impact Statement

## Broiler Breeder House

## Gorteen

## Co. Limerick

Report prepared for Enfield Broiler Breeders Ltd

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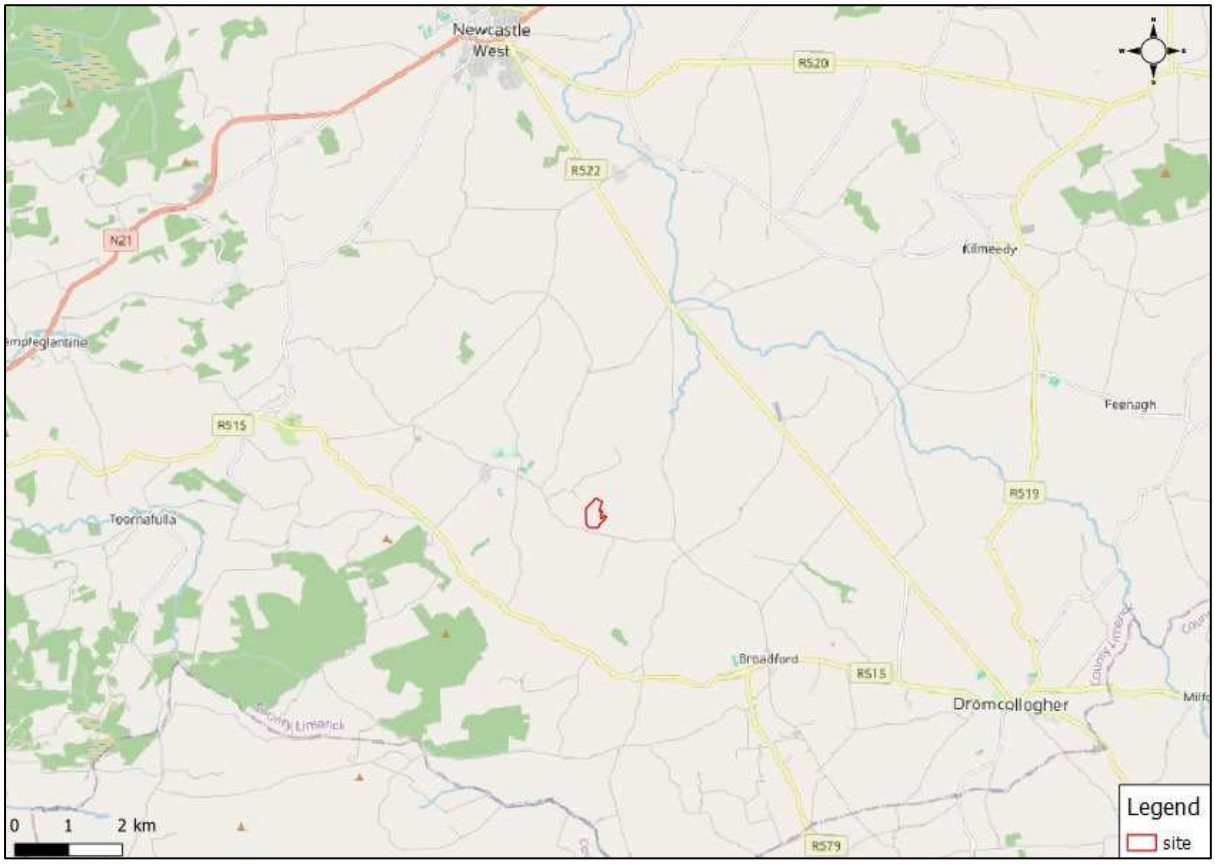
# 1 Introduction

This Natura Impact Statement (NIS) provides information in support of the Appropriate Assessment (AA), prepared by Greenleaf Ecology on behalf of Enfield Broiler Breeders Ltd, in respect of the proposed increase in stocking numbers of hens at the poultry housing unit at Gorteen (hereafter referred to as "the proposed project"). This report provides information and appraises the potential that the proposed project, alone or in combination with other plans and projects, will have an adverse effect on the integrity of European sites in view of best scientific knowledge and the conservation objectives of the sites. European sites are those identified as sites of European Community importance designated as Special Areas of Conservation under the Habitats Directive (92/43/EEC) or as Special Protection Areas under the Birds Directive (79/409/ECC as codified by Directive 2009/147/EC).

The proposed project is described in Section 1.2 of this report. The location of the proposed project is illustrated in Figure 1-1.

*Figure 1-1: Site location map*




## 1.1 Statement of Competence

This NIS has been prepared by Karen Banks. Karen is an ecologist with 19 years' experience in the field of ecological assessment. She holds a BSc (Hons) in Environment and Development from Durham University and is a full member of the Chartered Institute of Ecology and Environmental Management. Karen has extensive experience in ecological field survey and impact assessment. In her career as an ecologist Karen has completed reports to inform Appropriate Assessments (AA) covering the transport, energy and land use sectors, with work including assessment of Plans at the national, regional and local level; and numerous AAs of projects.

## 1.2 Project Description

The description of the broiler breeder house operation is as follows:

- 39,000 birds on site at any one time
- Chicks arrive at 18 wks old
- Birds stay on site for approx. 13 months and site is run by 2-3 full-time staff during this time
- The site is effectively operated as a closed unit for this entire period
- Water is sourced from an on-site well
- Birds are then removed en masse by specialist operators
- Entire site (all 8 buildings) are emptied/cleaned/disinfected at the end of each 13 month cycle; the cleaning and restocking process takes c.6wks
- Litter is removed by licenced specialist operators (Kelly Brothers)
- 13 month cycle then restarts

Any wastewater generated from the cleaning process is diverted and stored in concrete slatted tanks. This wastewater is subsequently land spread during suitable weather conditions. No soiled wastewater enters the drainage ditches within the site at any time.

Surface water from roofs of sheds and clean concrete yards is diverted directly to land drains.

## 1.3 Findings of Screening for Appropriate Assessment

In July 2024, Enfield Broiler Breeders submitted a licence application to EPA. The licence register number for the application is P1214-01. On 11 December 2024, EPA issued a request for further information (RFI) under section Regulation 10(2)(b)(ii) of the EPA (Industrial Emissions) (Licensing) Regulations 2013. The RFI included the following item:

10. Appropriate Assessment

*A screening for Appropriate Assessment was undertaken on 13 August 2024 and the Agency determined that an Appropriate Assessment of the proposed activity is required. You are thereby required to submit a Natura Impact Statement (NIS), as defined in Regulation 2(1) of the European Communities (Birds and Natural Habitats) Regulations 2011 as amended.*

*The NIS should be prepared in accordance with the EPA Licence Application*

*Instruction Note 1 (IN1) "Assessment of the impact of ammonia and nitrogen on Natura 2000 sites from Intensive Agriculture Installations".*

*You are furthermore advised to refer to the document 'Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities', issued in 2009 by the Department of the Environment, Heritage and Local Government, and revised in 2010. This document is available on the National Parks & Wildlife Survive website at:*

*http://www.npws.ie/sites/default/files/publications/pdf/NPWS_2009_AA_Guidance.pdf.*

This NIS is informed by an Ammonia Impact Assessment completed by Katestone Environmental Pty Ltd (2025).

## 1.4 NIS Objectives

This NIS considers impacts to European sites within the likely zone of influence of the proposed project, namely Blackwater River (Cork/Waterford) SAC (002170), Lower River Shannon SAC (002165) and Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161), focusing on potential impacts of the deposition of ammonia and nitrogen.

# 2 Methodology

## 2.1 Legislative Background for Appropriate Assessment

The Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora, better known as "The Habitats Directive", provides legal protection for habitats and species of European importance. Articles 3 to 9 provide the legislative means to protect habitats and species of Community interest through the establishment and conservation of an EU-wide network of sites known as Natura 2000. As defined under the Habitats Directive (Article 3(1)) Natura 2000 is a European ecological network composed of sites hosting the natural habitat types listed in Annex I and habitats of the species listed in Annex II, shall enable the natural habitat types and the species' habitats concerned to be maintained or, where appropriate, restored at a favourable conservation status in their natural range.

In Ireland, these sites are designated as European sites and include SPAs, established under the EU Birds Directive (79/409/EEC, as codified by 2009/147/EC) for birds and SACs, established under the Habitats Directive 92/43/EEC for habitats and species.

The Habitats Directive has been transposed into Irish law by Part XAB of the Planning and Development Act (as amended) and the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. 477/2011) as amended.

Articles 6(3) and 6(4) of the Habitats Directive sets out the decision-making tests for plans and projects likely to have a significant effect on or to adversely affect the integrity of European sites. Article 6(3) establishes the requirement for Appropriate Assessment (AA):

*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 or projects, shall be subjected to appropriate assessment of its implications for the site in view of the site's conservation objectives. In 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*.

Both EU and national guidance exists in relation to Member States fulfilling their requirements under the EU Habitats Directive, with particular reference to Article 6(3) and 6(4) of that Directive. The methodology followed in this report to inform the assessment has had regard to the following legislation and guidance listed in Section 2.2:

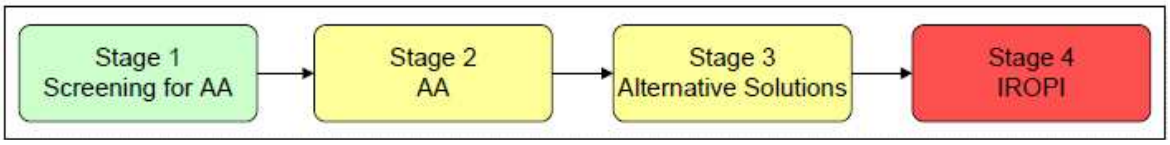
- Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (also known as the 'Habitats Directive');
- Council Directive 2009/147/EC on the conservation of wild birds, codified version, (also known as the 'Birds Directive');
- The European Communities (Birds and Natural Habitats) Regulations 2011 to 2015; and
- The Planning and Development Act (as amended).

## 2.2 Stages of Appropriate Assessment

Article 6(3) & (4) of the Habitats Directive defines a step-wise procedure where plans or projects are considered. The Department of the Environment, Heritage and Local Government guidelines (DoELHG, 2009, rev 2010) outlines the European Commission's methodological guidance (EC, 2002) promoting a four-stage process to complete the AA and outlines the issues and tests at each stage. An important aspect of the process is that the outcome at each successive stage determines whether a further stage in the process is required.

The four stages are summarised diagrammatically in Figure 2-1. Stages 1-2 deal with the main requirements for assessment under Article 6(3). Stage 3 may be part of the Article 6(3) Assessment or may be a necessary precursor to Stage 4. Stage 4 is the main derogation step of Article 6(4).

*Figure 2-1: Four stages of appropriate assessment*[1]




**Stage 1 Appropriate Assessment**

Stage 1 AA comprises the Screening process that addresses and records the reasoning and conclusions in relation to the first two tests of Article 6(3) as follows:

i. whether a plan or project (in this instance the proposed solar array project) is directly connected to or necessary for the management of the European sites, and

ii. whether a plan or project, alone or in combination with other plans and projects, is likely to have significant effects on the European sites in view of their conservation objectives.

If the effects are deemed to be significant, potentially significant, or uncertain, or if the screening process becomes overly complicated, then the process must proceed to Stage 2 (AA).

**Stage 2: Appropriate Assessment**

The aim of the stage 2 AA process is to identify any adverse impacts that the plan or project might have on the integrity of relevant European sites. As part of the assessment, a key consideration is 'in combination' effects with other plans or projects. Where adverse impacts are identified, mitigation measures can be proposed that would avoid, reduce or remedy any such negative impacts and the plan or project can be amended and / or conditions and restrictions imposed. If it is considered that mitigation measures will not be able to satisfactorily reduce potential adverse impact on a Natura 2000 site then an assessment of alternative solutions is considered in Stage 3. This is then followed by Stage 4 in the event that adverse impacts remain and the proposed activity or development is deemed to be of Imperative Reasons of Overriding Public Interest (IROPI), allowing an assessment of compensatory measures to be considered.

This NIS informs Stage 2 of the AA process and determines if the project is likely to affect the integrity (structure and function) of European sites. As the screening process identified that potential impacts to the Blackwater River (Cork/Waterford) SAC (002170), Lower River Shannon SAC (002165) and Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161) are unknown, uncertain or cannot be ruled out without further assessment, then an AA is required.

The NIS represents a detailed, targeted assessment of the nature and potential significance of direct and indirect impacts arising from the proposed project. An assessment of cumulative impacts (both from the project objectives, and other policies, plans and programmes) is also completed as part of the NIS. The NIS also incorporates best practice and mitigation measures to eliminate potential adverse impacts.

This NIS has been prepared having regard to the following guidance and legislation:

**Guidance**

- Department of the Environment, Heritage and Local Government (DoEHLG) (2009, rev 2010a), Appropriate Assessment of Plans and Projects in Ireland Guidance for Planning Authorities.

[1] IROPI – Imperative Reasons for Overriding Public Interest

- Department of the Environment, Heritage and Local Government (DoEHLG, 2010b), Department of Environment Heritage and Local Government Circular NPWS 1/10 and PSSP 2/10 on Appropriate Assessment under Article 6 of the Habitats Directive – Guidance for Planning Authorities.
- EPA (2013) Integrated Biodiversity Impact Assessment – Streamlining AA, SEA and EIA Processes: Practitioners Manual. Environmental Protection Agency.
- European Commission (2018), Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC, Office for Official Publications of the European Communities, Luxembourg.
- European Commission (2000a), Communication from the Commission on the Precautionary Principle, Office for Official Publications of the European Communities, Luxembourg.
- European Commission Notice Brussels C (2021) 6913 final 'Assessment of plans and projects in relation to Natura 2000 sites - Methodological guidance on Article 6(3) and (4) of the Habitats Directive 92/43/EEC' (EC, 2021).
- European Commission (2007) Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC – Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence, opinion of the Commission. Office for Official Publications of the European Communities, Luxembourg.
- European Commission (2013), Interpretation Manual of European Union Habitats. Version EUR 28.
- European Commission (2006), Nature and biodiversity cases: Ruling of the European Court of Justice. Office for Official Publications of the European Communities.

# 3 European Sites within Project Zone of Influence

Three European sites, namely the Blackwater River (Cork/Waterford) SAC (002170), Lower River Shannon SAC (002165) and Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161), are located within the ZoI of the proposed project.

Table 3-1 details these European sites and their proximity and connectivity to the proposed development. Figure 3-1 illustrates the location of the proposed site in relation to these European sites.

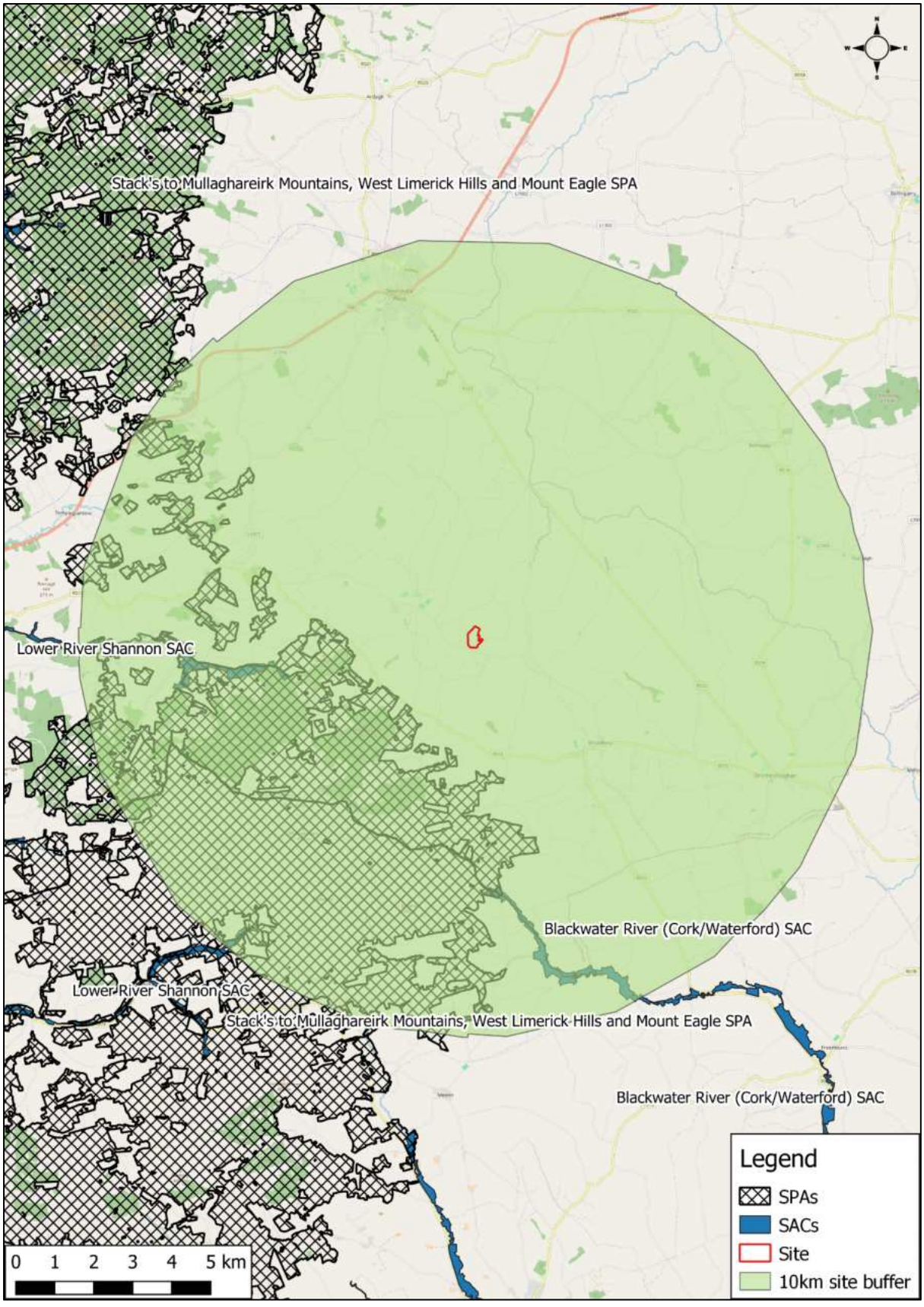
*Table 3-1: Connectivity of European sites within the zone of influence of the proposed project*

| European Site | Distance from Proposed Site (km)[2] | Connectivity |
|---|---|---|
| **Blackwater River (Cork/Waterford) SAC (Site Code: 002170)** | 6.1km | There is no connectivity via surface water or ground water.<br>There is potential connectivity via air. |
| **Lower River Shannon SAC (Site Code: 002165)** | 4.7km | The Lower River Shannon SAC is located c.40km downstream of the proposed site.<br>There is no hydrogeological connectivity.<br>There is potential connectivity via air. |
| **Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (Site Code: 004161)[3]** | 2.2km | There is no hydrological connectivity between the proposed site and this SPA.<br>The proposed site and this SPA are both located within the Shanagolden ground waterbody. However, review of local topography indicates that ground water at the proposed site would not flow in the direction of this SPA.<br>There is potential connectivity via air. |

[2] Straight line distance

[3] Lower River Shannon SAC | National Parks & Wildlife Service (npws.ie)

*Figure 3-1: European Sites Located within the likely zone of influence of the Proposed Project*



## 3.1 Screened-In European Sites- Potential Impacts and Proposed Mitigation

*Table 3-2: Screened-in European Sites, potential impacts and mitigation*

| **Blackwater River (Cork/Waterford) SAC (002170)** | | | |
|---|---|---|---|
| **Qualifying Interest/ Special Conservation Interest** | **Components of the Conservation Objectives (information including attributes, conservation status & locations) relevant to this project**<br><br>**Attributes for each QI were reviewed to assess potential impacts. The attributes contained in Blackwater River (Cork/Waterford) SAC Conservation Objectives are available at the following link:**<br><br>**Site_specific_cons_obj (npws.ie)**<br><br>**Conservation status obtained from the Blackwater River (Cork/Waterford) SAC Natura 2000 Data Form:**<br><br>**N2K IE0002170 dataforms (europa.eu)** | **Likelihood that the project will have an adverse effect on this QI / SCI & the achievement of the corresponding Conservation Objective considering the QI / SCI & the Conservation Objective(s) and supporting habitats and species/** | **Necessary mitigation to avoid, reduce or prevent potential adverse effects and description of the mechanism through which this is achieved, if the potential for an adverse effect on this QI / SCI exists** |
| Estuaries [1130]<br><br>Mudflats and sandflats not covered by seawater at low tide [1140]<br><br>*Salicornia* and other annuals colonising mud and sand [1310]<br><br>Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330]<br><br>Mediterranean salt meadows (Juncetalia maritimi) [1410] | Conservation status: all B (good)<br><br>Coastal habitats located c.85km to the south-east of the site at Youghal. | **No:** there is no hydrological or hydrogeological connectivity between the proposed project and these habitats. These habitats were not identified as a sensitive receptor within the Ammonia Impact Assessment. | N/A |

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| Perennial vegetation of stony banks [1220] | Conservation status: B (good)<br>A coastal habitat located c.85km to the south-east of the site at Youghal. | **No:** Identified as a sensitive receptor within the Ammonia Impact Assessment. However, this coastal habitat is not present within a 15km radius of the site. | N/A |
| Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [3260] | Conservation status: A (excellent)<br>Location of this habitat is not mapped.<br>High-conservation value sub-types have not been defined for this SAC. However, review of the available data identifies three high conservation elements (sub-types) within Lower River Shannon SAC which are used as a reference point for the purposes of this assessment, namely:<br>1. Groenlandia densa (L.) Fourr., Opposite-leaved Pondweed<br>2. Schoenoplectus triqueter (L.) Palla, Triangular Club-rush<br>3. Bryophyte-rich streams and rivers | **No:** Identified as a sensitive receptor within the Ammonia Impact Assessment.<br>However, there are no mapped occurrences of this habitat, including high conservation sub-types within a 15km radius of the site. | N/A |
| Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0]<br>Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) [91E0] | Conservation status: Old sessile oak woods C (poor); Alluvial forests A (excellent). | **No:** Identified as a sensitive receptor within the Ammonia Impact Assessment.<br>However, there are no mapped occurrences of these habitats within a 15km radius of the site. | N/A |
| *Margaritifera margaritifera* (Freshwater Pearl Mussel) [1029] | Conservation status: B (good) | **No:** there is no hydrological or hydrogeological | N/A |

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| | Present within the Blackwater (Munster) River c.6.5km downstream of the site. | connectivity between the proposed project and this QI species.<br>This species was not identified as a sensitive receptor within the Ammonia Impact Assessment. | |
| *Austropotamobius pallipes* (White-clawed Crayfish) [1092] | Conservation status: C (poor)<br>The main Blackwater downstream of the site is considered chemically unsuitable for the crayfish. | **No:** there is no hydrological or hydrogeological connectivity between the proposed project and this QI species.<br>This species was not identified as a sensitive receptor within the Ammonia Impact Assessment. | N/A |
| *Petromyzon marinus* (Sea Lamprey) [1095]<br>*Lampetra planeri* (Brook Lamprey) [1096]<br>*Lampetra fluviatilis* (River Lamprey) [1099] | Conservation status: A (excellent)<br>Mapped occurrence within the Blackwater River<br>Conservation status: A (excellent)<br>Mapped occurrence within the Blackwater River<br>Conservation status: B (good)<br>Mapped occurrence within the Blackwater River | **No:** there is no hydrological or hydrogeological connectivity between the proposed project and these QI species.<br>These species were not identified as a sensitive receptor within the Ammonia Impact Assessment. | N/A |

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| *Alosa fallax fallax* (Twaite Shad) [1103] | Conservation status: B (good)<br>In some catchments, artificial barriers block twaite shads' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas, however regular breeding has been confirmed in the River Blackwater in recent years | **No:** there is no hydrological or hydrogeological connectivity between the proposed project and this QI species.<br>This species was not identified as a sensitive receptor within the Ammonia Impact Assessment. | N/A |
| *Salmo salar* (Salmon) [1106] | Conservation status: B (good)<br>Locations not mapped; however the Blackwater River is a Salmonid river. | **No:** there is no hydrological or hydrogeological connectivity between the proposed project and this QI species.<br>This species was not identified as a sensitive receptor within the Ammonia Impact Assessment. | N/A |
| *Lutra lutra* (Otter) [1355] | Conservation status: A (excellent) | **No:** there is no hydrological or hydrogeological connectivity between the proposed project and this QI species.<br>This species was not identified as a sensitive | N/A |

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| | | receptor within the Ammonia Impact Assessment. | |
| Trichomanes speciosum (Killarney Fern) [1421] | Conservation status not listed. | **No:** Identified as a sensitive receptor within the Ammonia Impact Assessment.<br><br>However, there are no mapped occurrences of this species within a 15km radius of the site. | N/A |
| **Lower River Shannon SAC (Site Code: 002165)**<br><br>Components of the Conservation Objectives (relevant information including attributes, conservation status & locations) relevant to this project<br><br>Attributes for each QI were reviewed to assess potential impacts. The attributes contained in Lower River Shannon SAC Conservation Objectives are available at the following link:<br><br>Site_specific_cons_obj<br><br>Conservation status obtained from Lower River Shannon SAC Natura 2000 Data Form:<br><br>Natura 2000 SDF - IE0002165 | | | |
| Sandbanks which are slightly covered by sea water all the time [1110]<br><br>Estuaries [1130]<br><br>Mudflats and sandflats not covered by seawater at low tide [1140]<br><br>Coastal lagoons [1150] | Conservation status:<br><br>➢ 1160, 1170, 1220, 1230 = A (excellent)<br>➢ 1110, 1130, 1140, 1150, 1330 and 1410 = B (good)<br>➢ 1310 = C (average/reduced)<br><br>These coastal habitats are located c.30km from the site at nearest. | **No:** the attributes of these Annex I habitats will not be impacted by the proposed works due to the distance (c.30km at nearest) and remote connectivity between the project and the location of these coastal habitats | N/A |

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| Large shallow inlets and bays [1160]<br><br>Reefs [1170]<br><br>Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]<br><br>Salicornia and other annuals colonising mud and sand [1310]<br><br>Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330]<br><br>Mediterranean salt meadows (Juncetalia maritimi) [1410] | | within the Lower River Shannon SAC.<br><br>These habitats were not identified as a sensitive receptor within the Ammonia Impact Assessment. | |
| Perennial vegetation of stony banks [1220] | Conservation status: A (excellent) | **No:** Identified as a sensitive receptor within the Ammonia Impact Assessment.<br><br>However, there are no mapped occurrences of this habitat within a 15km radius of the site. | N/A |
| Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [3260] | Conservation status: B (good)<br><br>Site-specific conservation objectives for this habitat identify and concentrate upon the high-conservation value sub-types. Review of the available data identifies three high conservation elements (sub-types) in the site, namely: | **No:** Identified as a sensitive receptor within the Ammonia Impact Assessment. | N/A |

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|---|---|---|---|
| | 1. Groenlandia densa (L.) Fourr., Opposite-leaved Pondweed<br>2. Schoenoplectus triqueter (L.) Palla, Triangular Club-rush<br>3. Bryophyte-rich streams and rivers | However, there are no mapped occurrences of this habitat within a 15km radius of the site. | |
| Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) [6410] | Conservation status: B (good)<br>The location of *Molinia* meadows within the SAC are not mapped. | **No:** Identified as a sensitive receptor within the Ammonia Impact Assessment.<br>However, there are no mapped occurrences of these habitats within a 15km radius of the site. | N/A |
| Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) [91E0] | Conservation status: B (good)<br>Closest mapped location of Alluvial forests is 55km north-east of the site. | **No:** Identified as a sensitive receptor within the Ammonia Impact Assessment.<br>However, the results of the Step 4 assessment show that the proposed project complies with the criteria for ammonia at all sites of sensitive species or habitats, including 91E0. The proposed project also complies with the criteria for nitrogen deposition at all sites if sensitive species or habitats, including 9IE0. | N/A |

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| *Margaritifera margaritifera* (Freshwater Pearl Mussel) [1029] | Conservation status: B (good)<br>This conservation objective applies to the freshwater pearl mussel population in the Cloon River, Co. Clare only. | **No:** there is no hydrological connectivity between the proposed project and the Cloon River FWPM population.<br>This species was not identified as a sensitive receptor within the Ammonia Impact Assessment. | N/A |
| *Petromyzon marinus* (Sea Lamprey) [1095]<br>*Lampetra planeri* (Brook Lamprey) [1096]<br>*Lampetra fluviatilis* (River Lamprey) [1099] | Conservation status: B (good)<br>Conservation status: B (good)<br>Conservation status: B (good) | **No:** These species were not identified as a sensitive receptor within the Ammonia Impact Assessment. | N/A |
| *Salmo salar* (Salmon) [1106] | Conservation status: A (excellent) | **No:** This species was not identified as a sensitive receptor within the Ammonia Impact Assessment. | N/A |
| *Lutra lutra* (Otter) [1355] | Conservation status: A (excellent) | **No:** This species was not identified as a sensitive receptor within the Ammonia Impact Assessment. | N/A |

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| *Tursiops truncatus* (Common Bottlenose Dolphin) [1349] | Conservation status: B (good) | **No:** This species was not identified as a sensitive receptor within the Ammonia Impact Assessment. | N/A |
| **Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (Site Code: 004161)**<br>Attributes for each QI were reviewed to assess potential impacts. The attributes contained in Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA Conservation Objectives are available at the following link:<br>CO004161.pdf<br>Conservation status obtained from the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA Natura 2000 Data Form:<br>Natura 2000 SDF - IE0004161 | | | |
| Hen Harrier (*Circus cyaneus*) [A082] | Conservation status: A (excellent) | **No:** The Ammonia Impact Assessment identified the potential for impacts from ammonia and nitrogen deposition on blanket bog, which provides nesting and foraging habitat for Hen Harrier.<br>However, the results of the Step 4 assessment show that the proposed project complies with the criteria for ammonia at all sites of sensitive species | N/A |

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| | | or habitats, including blanket bog. The proposed project also complies with the criteria for nitrogen deposition at all sites if sensitive species or habitats, including blanket bog. | |

## 3.2 Residual Effect

Potential impacts identified in Section 3.1 relate to deposition of ammonia and nitrogen on sensitive QI species and habitats for Blackwater River (Cork/Waterford) SAC and Lower River Shannon SAC; and supporting habitats for the SCI species for Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (see Ammonia Impact Assessment, Appendix A).

The impacts of the proposed poultry farm in isolation are under EPA limits and, therefore, the proposed increase in bird numbers at the site complies with the Step 4 evaluation criteria at all sites of sensitive ecological species or habitats modelled on the Blackwater River (Cork/Waterford) SAC, Lower River Shannon SAC and Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA.

It can be concluded that there is no possibility of the project itself (i.e. 'individually') having an adverse effect on the integrity of Blackwater River (Cork/Waterford) SAC, Lower River Shannon SAC and Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA.

## 3.3 In-Combination Effects

It is a requirement of Appropriate Assessment that the cumulative or in-combination effects of the proposed development together with other Plans or projects are assessed. Cumulative or in-combination impacts can result from the successive, incremental, and/or combined effects of a development (plan, project or activity) when added to other existing, planned, and/or reasonably anticipated developments.

A search of the Limerick County Council planning enquiry system[4] was conducted for developments that may have in-combination effects on European sites with the proposed project. The search included developments that are proximal to the proposed site and those that may have an adverse in-combination impact with the proposals on European sites.

Plans relevant to the area were searched in order to identify any elements of the Plans that may act in-combination with the proposed development.

A list of those projects and Plans which may potentially contribute to in-combination impacts with the proposed solar array development was generated for as listed in Table 3-3 below.

It is concluded that there will be no negative in-combination effects between the proposed project and plans or project in the area.

*Table 3-3: List of potential projects and Plans which may contribute to cumulative impacts*

| **Plan / Programme/Policy** | **Key Objectives/Policies/Proposals** | **Potential for In-combination Effects and Mitigation** |
|---|---|---|
| **Limerick County Development Plan 2022-2028** | The Limerick County Development Plan includes the following Policies and Objectives of relevance to this report:<br>**Policy EH P1**<br>**Protection of Natural Heritage and Biodiversity**<br>It is a policy of the Council to:<br>a) Protect and conserve Limerick's natural heritage and biodiversity, in particular, areas designated as part of the European Sites Natura | Policies and objectives of the Limerick County Development Plan 2022-2028 ensure that local planning applications comply with proper planning and sustainability and with the requirements of relevant EU Directives and environmental considerations, there is no potential for adverse in- |

[4] Planning Enquiry (limerick.ie)

| | | |
|---|---|---|
| | 2000 network, such as Special Protection Areas (SPAs) and Special Areas of Conservations (SACs), in accordance with relevant EU Directives and national legislation and guidelines.<br>b) Maintain the conservation value of all Natural Heritage Areas and proposed Natural Heritage Areas (pNHAs) for the benefit of existing and future generations.<br>**Objective EH O1**<br>**Designated Sites and Habitats Directive**<br>It is an objective of the Council to ensure that projects/plans likely to have significant effects on European Sites (either individually or in combination with other plans or projects) are subject to an appropriate assessment and will not be permitted under the Plan unless they comply with Article 6 of the Habitats Directive. The Council, will through the planning enforcement process where applicable, seek to restore the ecological functions of designated sites, where they have been damaged through inappropriate development. | combination effects on European Sites. |
| **Water Action Management Plan 2024** | The Water Action Plan includes targeted measures for all water bodies, with the objective of either protecting water bodies at good or high status or restoring water bodies to at least good status.<br>Where further specific measures are needed in addition to those set in this plan, integrated catchment planning approaches will be used to identify and decide on further specific measures for each water body. This will be reported in 46 Catchment Management Work Plans. These will be used to locate measures within each catchment.<br>The list of water bodies and their associated status, significant pressures/issues and targeted measures, which are to be included in the Catchment Management Work Plans, will include targets for the third-cycle, along with Key Performance Indicators to monitor progress and outcomes. | The implementation and compliance with key environmental policies, issues and objectives of this management plan will result in positive in-combination effects to European sites. The implementation of this plan will have a positive impact for the biodiversity. It will not contribute to in-combination effects with the proposed development. |
| **Inland Fisheries Ireland Corporate Plan 2021 -2025**<br><br>**The Inland Fisheries Act 2010.** | To place the inland fisheries resource in the best sustainable position possible for the benefit of future generations. To protect, manage and conserve Ireland's inland fisheries and sea angling resources and to maximise their sustainability and natural biodiversity.<br>▪ To sustainably develop and improve fish habitats.<br>▪ To protect, maintain and enhance Ireland's wild fish populations. | The implementation and compliance with key environmental issues and objectives of this corporate plan will result in positive on-combination effects to European sites. The implementation of this corporate plan will have a positive impact for biodiversity |

| | | |
|---|---|---|
| | ▪ To actively engage with stakeholders in the continued stewardship of our shared resource.<br>▪ To play a leadership role in achieving our climate action and biodiversity goals.<br>▪ To vlaue our people and support their development and performance.<br>▪ To foster a culture of value for money and evaluation of performance in a measurable, transparent and accountable manner.<br>▪ Harness the power of innovation to continue to deliver a modern fisheries service. | of inland fisheries and ecosystems. It will not contribute to in-combination or cumulative impacts with the proposed project. |
| **WWTP discharges** | Dromcollagher Town and Environs | Discharges from municipal WWTPs are required to meet water quality standards. Irish Water Capital Investment Plan 2020-2024 proposes to upgrade water treatment services countrywide. The long-term cumulative impact is predicted to be negligible. |
| **Residential Applications**[5] | Local developments[6] in the zone of influence of the proposed site that may contribute to potential cumulative or in-combination effects on European sites include a broiler breeder house (Ref: 19497), poultry house and hardstand (Ref: 20758 & 211715 respectively), agricultural (Ref: 211594) and domestic dwelling developments (Ref: 21473, 21668, 22350, 22767 & 22372). | No potential for significant adverse in combination effects on European sites has been identified. |

[5] The Local Planning Applications included in this potential in-combination impacts assessment support the following criteria: planning applications granted within the past five years that may contribute to potential cumulative impacts on European sites of concern.

[6] Planning Enquiry (limerick.ie) (accessed 13/03/2024)

# 4 Mitigation

No potential for direct, indirect or cumulative impacts arising from the proposed project has been identified, therefore no specific mitigation measures are required.

# 5 Analysis and Conclusions

## 5.1 Integrity of the European Site

From "*Managing Natura 2000 sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC*" (EC, 2018), the meaning of integrity is described as follows:

'*The integrity of the site involves its constitutive characteristics and ecological functions. The decision as to whether it is adversely affected should focus on and be limited to the habitats and species for which the site has been designated and the site's conservation objectives*.' (MN2000, Section 4.6.4)'.

## 5.2 Conclusion

It is objectively concluded, in light of the above objective scientific information, that the proposed project, individually or in combination with other plans and projects, will not have an adverse effect on the integrity of Blackwater River (Cork/Waterford) SAC, Lower River Shannon SAC and Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA, or any other European Site, in view of their conservation objectives and in view of best scientific knowledge.

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# Appendix A Ammonia Impact Assessment Report

# Ammonia Impact Assessment – Poultry Farm at Gorteen, Broader, Co. Limerick

**Prepared for:**

## Ceres Consulting Ltd

## August 2025

## Final

**Prepared by:**

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| | Simon Welchman |
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# Glossary

| Term | Definition |
|---|---|
| g/s | gram per second |
| kg | kilogram |
| kg/m³ | Kilogram per cubic meter |
| km | kilometre |
| km/hr | kilometre per hour |
| m | metre |
| m/s | metres per second |
| $m^2$ | square metres |
| $m^3$ | cubic metres |
| $m^3/s$ | cubic metres per second |
| m³/hr | cubic metres per hour |
| mg | milligram |
| $Z_0$ | roughness length |
| µg/$m^3$ | micrograms per cubic meter |
| **Abbreviations** | **Definition** |
| AG4 | Air Guidance 4 |
| AIA | Ammonia Impact Assessment |
| BAT | Best available techniques |
| EPA | Environmental Protection Agency |
| EF | Emission factor |
| EU | European Union |
| IEL | Industrial Emissions Licence |

# 1. INTRODUCTION

Katestone Environmental Pty Ltd (Katestone) was commissioned by Ceres Consulting Ltd (Ceres Consulting) to complete an ammonia impact assessment (AIA) for a poultry breeding operation located at Gorteen, Broadford, Co. Limerick (site).

The site is owned and operated by Enfield Broiler Breeders Limited (Enfield Broiler Breeders). There are currently eight (8) poultry housing units that hold 39,999 egg laying hens at the site. Enfield Broiler Breeders proposes to increase stocking numbers at the site to 61,800 hens. The proposed increase in bird numbers will be housed in the existing housing units at the site. No additional buildings or floorspace will be required to facilitate the additional bird numbers.

The proposed increase in bird numbers will result in the site exceeding the Industrial Emissions License (IEL) threshold for bird numbers. An IEL will, therefore, be required for the site.

In July 2024, Enfield Broiler Breeders submitted a licence application to EPA. Ceres Consulting managed the licence application. The licence register number for the application is P1214-01. On 11 December 2024, EPA issued a request for further information (RFI) under section Regulation 10(2)(b)(ii) of the *EPA (Industrial Emissions) (Licensing) Regulations 2013*. The RFI included the following item:

> 10. Appropriate Assessment
>
> *A screening for Appropriate Assessment was undertaken on 13 August 2024 and the Agency determined that an Appropriate Assessment of the proposed activity is required. You are thereby required to submit a Natura Impact Statement (NIS), as defined in Regulation 2(1) of the European Communities (Birds and Natural Habitats) Regulations 2011 as amended.*
>
> *The NIS should be prepared in accordance with the EPA Licence Application*
>
> *Instruction Note 1 (IN1) "Assessment of the impact of ammonia and nitrogen on Natura 2000 sites from Intensive Agriculture Installations".*
>
> *You are furthermore advised to refer to the document 'Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities', issued in 2009 by the Department of the Environment, Heritage and Local Government, and revised in 2010. This document is available on the National Parks & Wildlife Survive website at:*
>
> *http://www.npws.ie/sites/default/files/publications/pdf/NPWS_2009_AA_Guidance.pdf.*

This ammonia impact assessment will form part of the supporting documentation for the response to RFI and, subsequently, the licence application. The assessment has been conducted in accordance with the RFI requirements and, in particular, *Licence Application Instruction Note 1 (IN1) Assessment of the Impact of Ammonia and Nitrogen on Natura 2000 Sites from Intensive Agriculture Installations* (Version 2.0) (EPA, 2023), which is referred to here as EPA's Ammonia Assessment Guidance.

Nitrogen deposition results from the settlement of nitrogenous compounds from the air onto land surfaces. Emissions of ammonia from the Facility were considered in this assessment.

This ammonia impact assessment was undertaken using dispersion modelling techniques. The dispersion modelling has been completed in accordance with the requirements of EPA's Air Dispersion Modelling Guidance Note (AG4).

# 2. PROPOSED OPERATIONS AT THE FACILITY

This section presents an overview of the Facility as it will operate after the completion of the increase in stocking numbers from 39,999 to 61,800 hens. The Facility is located in a rural area of Co. Limerick, approximately 8 km south of Newcastle West.

Current operations involve:

- The rearing of 39,999 hens in eight (8) housing units for the production of eggs
- Removal of soiled litter from the site at the end of each lay cycle by a licenced provider.

The proposed operations involve:

- The housing of 61,800 hens in the eight (8) housing units for the production of eggs
- Removal of soiled litter from the site at the end of each lay cycle by a licenced provider.

No additional buildings or floorspace will be required to facilitate the additional bird numbers.

The site layout of the existing operations is presented in Figure 1.The layout of the Facility is presented in Figure 1.

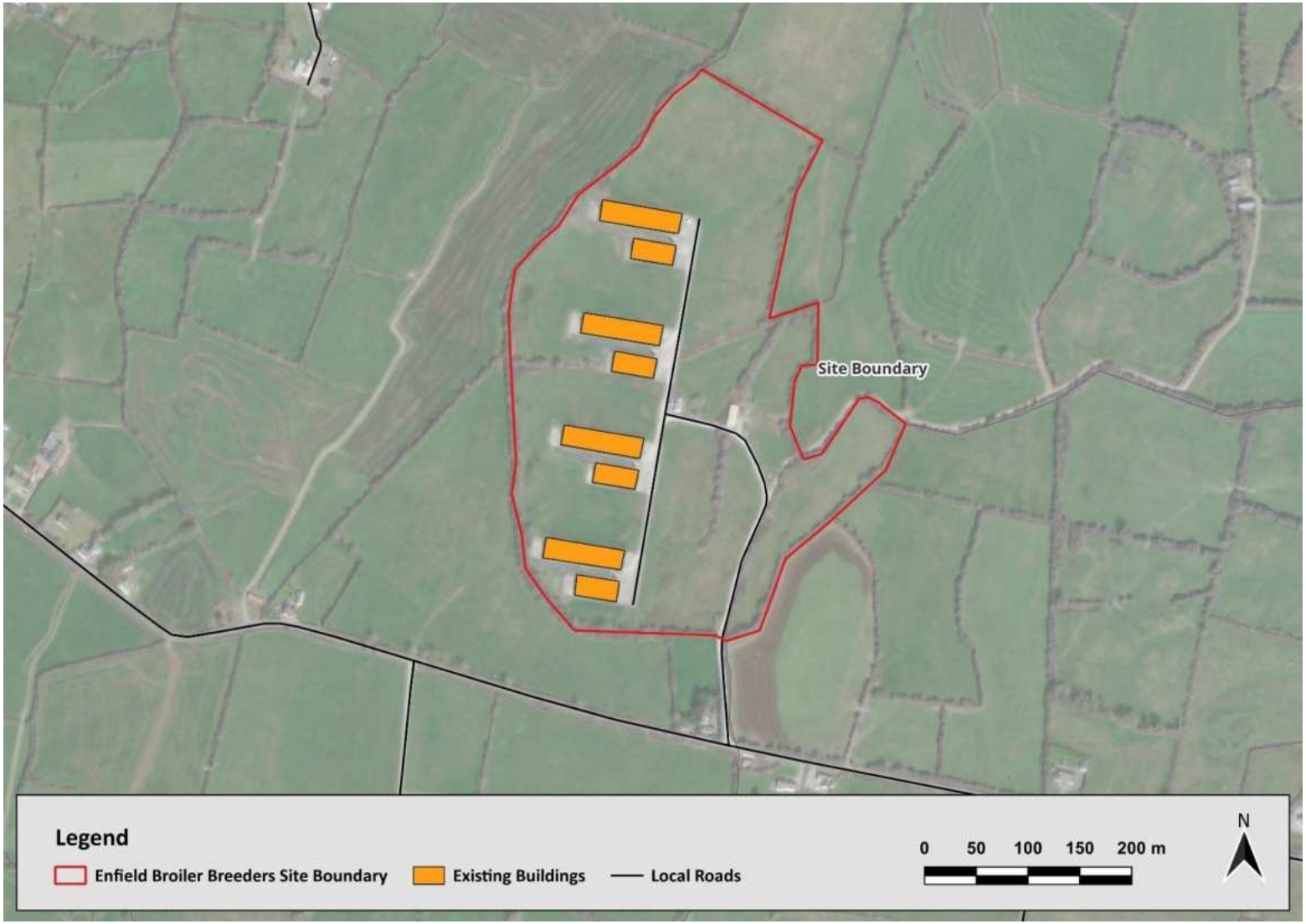


**Figure 1** **Layout of the Facility**

# 3. REGULATORY FRAMEWORK AND ASSESSMENT CRITERIA

## 3.1 *Environmental Protection Agency Acts 1992 and 2003*

The *Environmental Protection Agency Act 1992 (EPA Act)* and Part 2 of the *Protection of the Environment Act 2003* are collectively referred to as the *Environmental Protection Agency Acts 1992 and 2003*. These Acts provide for the management of air emissions from activities (meaning any process, development or operation) that are listed in the First Schedule of the Acts.

Section 4 (2) of the *Environmental Protection Agency Acts 1992 and 2003* defines Air Pollution as follows:

> *"…the direct or indirect introduction to an environmental medium, as a result of human activity, of substances, heat or noise which may be harmful to human health or the quality of the environment, result in damage to material property, or impair or interfere with amenities and other legitimate uses of the environment, and includes –*
>
> *(a) 'air pollution' for the purposes of the Air Pollution Act 1987,*
>
> *(b) ……..*
>
> *(c) ……."*

The *Air Pollution Act 1987* (AP Act) provides for the control of air pollution and other matters connected with air pollution. Under the AP Act 'pollutant' means any substance that is specified in the First Schedule or any other substance (including a substance which gives rise to odour) or energy which, when emitted into the atmosphere either by itself or in combination with any other substance, may cause air pollution.

Section 4 of the AP Act defines air pollution as follows:

> *"Air pollution" in this Act means a condition of the atmosphere in which a pollutant is present in such a quantity as to be liable to —*
>
> (1) *be injurious to public health, or*
>
> *(ii) have a deleterious effect on flora or fauna or damage property, or*
>
> *(iii) impair or interfere with amenities or with the environment."*

Section 24 of the AP Act details the obligations of the occupier of a premises in respect to preventing emissions, nuisance and what constitutes defences against prosecution:

> *(1) The occupier of any premises, other than a private dwelling, shall use the best practicable means to limit and, if possible, to prevent an emission from such premises.*
>
> *(2) The occupier of any premises shall not cause or permit an emission from such premises in such a quantity, or in such a manner, as to be a nuisance.*
>
> *(3) In any prosecution for a contravention of this section, it shall be a good defence to establish that—*
>
> *(a) the best practicable means have been used to prevent or limit the emission concerned, or*
>
> *(b) the emission concerned was in accordance with a licence under this Act, or*
>
> *(c) the emission concerned was in accordance with an emission limit value, or*
>
> *(d) the emission concerned was in accordance with a special control area order in operation in relation to the area concerned, or*

*in the case of an emission of smoke, the emission concerned was in accordance with regulations under section 25, or*

*(f) the emission did not cause air pollution.*

Section 75 (1) of the *Environmental Protection Agency Acts 1992 and 2003* requires the EPA to publish reasonable and desirable quality objectives to protect the environment, namely:

*"The Agency shall, in relation to any environmental medium and without prejudice to its functions under section 103, specify and publish quality objectives which the Agency considers reasonable and desirable for the purposes of environmental protection."*

## 3.2 Birds Directive and Habitats Directive

Concerned with the decline of wild bird species, EU Member States unanimously adopted the Birds Directive (79/409/EEC) in April 1979 that aims to conserve species of wild birds and the habitats that are crucial for their conservation. The Birds Directive was amended in 2009 (2009/147/EC).

The Habitats Directive (92/43/EEC) aims to promote the maintenance of biodiversity, taking account of economic, social, cultural and regional requirements. It forms the cornerstone of Europe's nature conservation policy with the Birds Directive and establishes the EU wide Natura 2000 ecological network of protected areas.

The Habitats Directive requires EU Member States to take measures to maintain or restore natural habitats and wildlife species at a favourable conservation status. Sites designated under the Birds Directive and the Habitats Directive form the Natura 2000 network. Maintaining or restoring the Natura 2000 network is an obligation that must be considered concurrently with requirements for increased food production and economic growth targets set for agricultural sectors in EU Member States.

The main aim of the Habitats Directive is to contribute towards the conservation of biodiversity by requiring EU Member States to take measures to maintain or restore natural habitats and wild species listed on the Annexes to the Directive at a favourable conservation status. These annexes list habitats (Annex I) and species (Annexes II, IV and V) that are considered threatened in the EU territory. The listed habitats and species represent a considerable proportion of biodiversity in Ireland and the Habitats Directive itself is one of the most important pieces of legislation governing the conservation of biodiversity in Europe.

The protection and conservation duties of EU Member States for Natura 2000 sites are specified in Article 6 of the Habitats Directive and are summarised below:

- Article 6(1): establish necessary conservation measures, management plans and appropriate statutory, administrative or contractual measures which correspond to the ecological requirements of the natural habitats and species present at the sites
- Article 6(2): take appropriate steps to avoid deterioration of Natura 2000 sites
- Article 6(3) and 6(4): assess the impact of new plans and projects and only agree to the plan or project if it will not adversely affect the integrity of the site unless the plan or project is imperative for reasons of overriding public interest.

The European Communities (Birds and Natural Habitats) Regulations 2011 to 2015, as amended (Birds and Natural Habitats Regulations) give effect to the Habitats Directive in Irish law. The regulations require, inter alia, that a public authority carry out screening for Appropriate Assessment of a plan or project for which an application for consent is received, to assess, in view of best scientific knowledge and in view of the conservation objectives of the site, if that plan or project, individually or in combination with other plans or projects is likely to have a significant effect on the European site. Where it is determined that an Appropriate Assessment is required, the Birds and Natural Habitats Regulations require that the assessment carried out by a public authority include a determination

pursuant to Article 6(3) of the Habitats Directive as to whether or not the plan or project would adversely affect the integrity of a European site.

## 3.3 Ammonia impact assessment – Guidance

In May 2021, due to a high volume of intensive agriculture applications/reviews and licenses, EPA published ammonia and nitrogen assessment guidance for the intensive agricultural sector entitled *Licence Application Instruction Note 1 (IN1) Assessment of the impact of ammonia and nitrogen on Natura 2000 sites from intensive agricultural installations* (EPA, 2021). This guidance was updated in March 2023 (EPA, 2023, referred to here as EPA's Ammonia Assessment Guidance). It describes how applicants should assess, the impact of air emissions, as part of a licence application for the following activities listed under the First Schedule of the Environmental Protection Agency Acts 1992 as amended:

- Class 6.1 (the rearing of poultry in an installation, where the capacity exceeds 40,000 places)
- Class 6.2 (the rearing of pigs in an installation where the capacity exceeds – (a) 750 places for sows, or. (b) 2,000 places for production pigs).

EPA's Ammonia Assessment Guidance. describes a six-step process for the assessment of emissions of ammonia to the atmosphere from intensive agricultural installations (IAIs). Step 1 needs to be completed for all applications to inform the additional steps that need to be completed.

Compliance with the criteria defined in the subsequent steps means that no further steps need to be undertaken and the compliant results can be presented to EPA for review as part of the approvals process.

Katestone followed the step-wise approach described in EPA's Ammonia Assessment Guidance in this assessment. The graphical summary format of the step-wise approach is reproduced here in Figure 2. The methodology adopted to complete this assessment is described in Section 5.

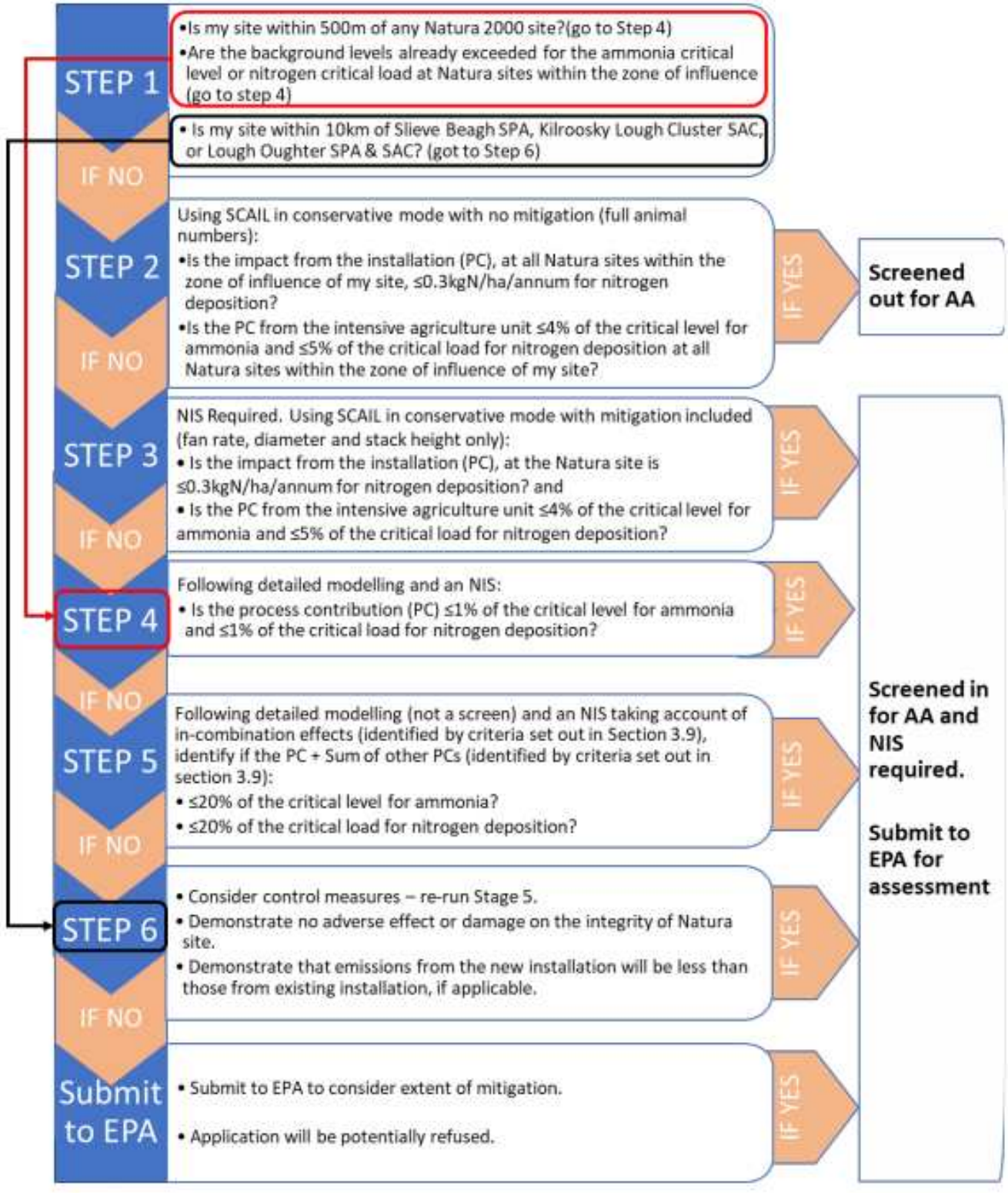


**Figure 2** **The steps involved in the assessment process described in EPA's Ammonia Assessment Guidance (reproduced from EPA, 2023)**

## 3.4 Assessment Criteria for ammonia and nitrogen deposition

The compliance criteria adopted in the assessment are based on critical limits. A critical limit, in its simplest form, is a threshold set to indicate when impacts on the terrestrial environment are likely to occur from air pollutants. These can be used as part of the regulatory process for the assessment of impacts of air quality on terrestrial ecology (Kelleghan *et al.*, 2022). The EPA's Ammonia Assessment Guidance adopts criteria based on critical limits including:

- Critical levels for ammonia
- Empirical critical loads for nitrogen deposition.

Both critical levels and loads are international guidelines used to protect habitats, primarily across Europe. Critical levels here refer specifically to the threshold for impacts that can occur directly from atmospheric ammonia, allowing for an acute measurement of direct effects. Critical levels are defined as "the concentration in the atmosphere above which direct adverse effects on receptors, such as plants, ecosystems or materials, may occur according to present knowledge" (Posthumus, 1988; Kelleghan *et al.*, 2022).

Empirical critical loads are based on total nitrogen deposition. A critical load is defined as a deposition rate below which significant harmful effects do not occur "according to present knowledge" (Posthumus, 1988).

The critical level for ammonia and the critical load for nitrogen deposition for each of the species and habitat are presented in Section 4.3 for the modelled discrete receptors.

# 4. EXISTING ENVIRONMENT

This section presents information on the existing environment in the vicinity of the site, within the dispersion modelling domain and within the meteorological modelling domain. The meteorological modelling domain has been generated using geophysical data (terrain and land use) and meteorological data.

The extents of the dispersion modelling domain were determined based on the locations of the nearest ecological receptors in all directions from the site.

## 4.1 Local terrain and land-use

The poultry farm is located in an expansive area of relatively flat rolling rural terrain that is part of the River Deel Valley. The River Deel Valley is bordered by elevated terrain of the Mullaghareirk Mountains, the eastern facing slopes of which form a crescent shape that borders the River Dell Valley starting northwest of Newcastle West, initially extending south before curving around to the east towards Dromcolliher. The Mullaghareirk Mountains rise to an elevation of 420 m approximately 6 km southwest of the site. The terrain to the east of the site is primarily flat with small, isolated areas of higher terrain.

The site is in a remote rural location surrounded by predominately agricultural land with sparsely located residences. The Mullaghareirk Mountains contain extensive areas of forest and bog land that extend to the south and west, starting approximately 3 km from the site.

The terrain of the modelling domain is presented as:

- A 2-dimenstional surface plot in in Figure 3
- A 3-dimenstional surface plot in in Figure 4.

The mountains and hills of the modelling domain will affect synoptic scale wind patterns in the area by:

- Blocking wind coming from certain directions
- Channelling winds along the valleys created by the hills and mountains
- Creating very specific local air flows under low windspeed conditions due to katabatic and anabatic air flows created by the slopes of the complex terrain.

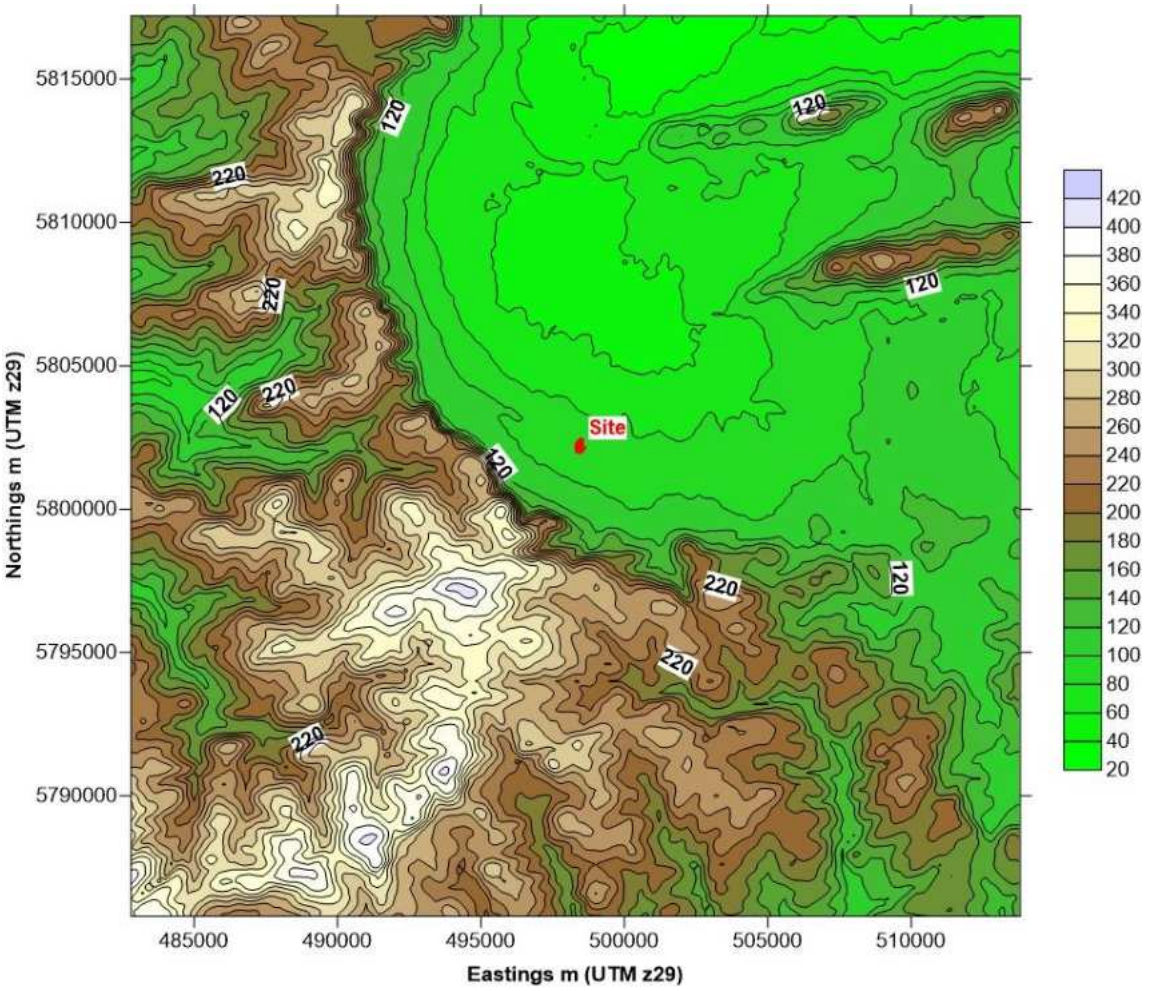


**Figure 3** **2-dimensional terrain of the modelled domain**

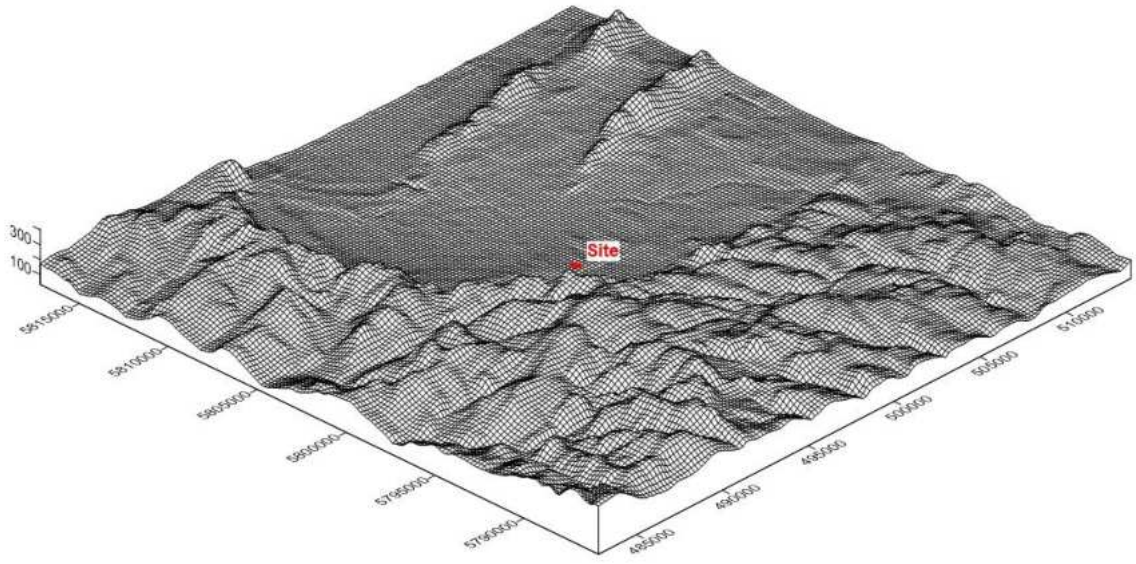


**Figure 4** **3-dimensional terrain of the modelled domain**

## 4.2 Meteorology

Wind speed and wind direction are important parameters for the transport and dispersion of air pollutants from a source. The winds in the vicinity of the Site have been characterised using a three-dimensional meteorological model called CALMET. The 1-hour average wind speed for the modelling period is 4.01 m/s. A wind rose representing the annual distribution of 1-hour average winds is presented in Figure 5.

The prevailing wind direction in Ireland is between south and west. It is clear from Figure 5 that westerly winds occur more frequently than southwesterlies throughout the year at this site. Both daytime and nighttime winds are heavily influenced by the prevailing westerly wind observed at the site. It is clear that wind speed on average rises steadily through the early hours of morning before peaking in the afternoon before dropping again overnight (Figure 6)

The seasonal distribution of wind speed and wind direction is presented in Figure 7. The strongest winds at the site occur most frequently from the west during the winter months. The greatest proportion of light winds occur during summer. The overarching westerly and southerly winds persist through all seasons. A higher proportion of southeasterly winds occurs during the spring months.

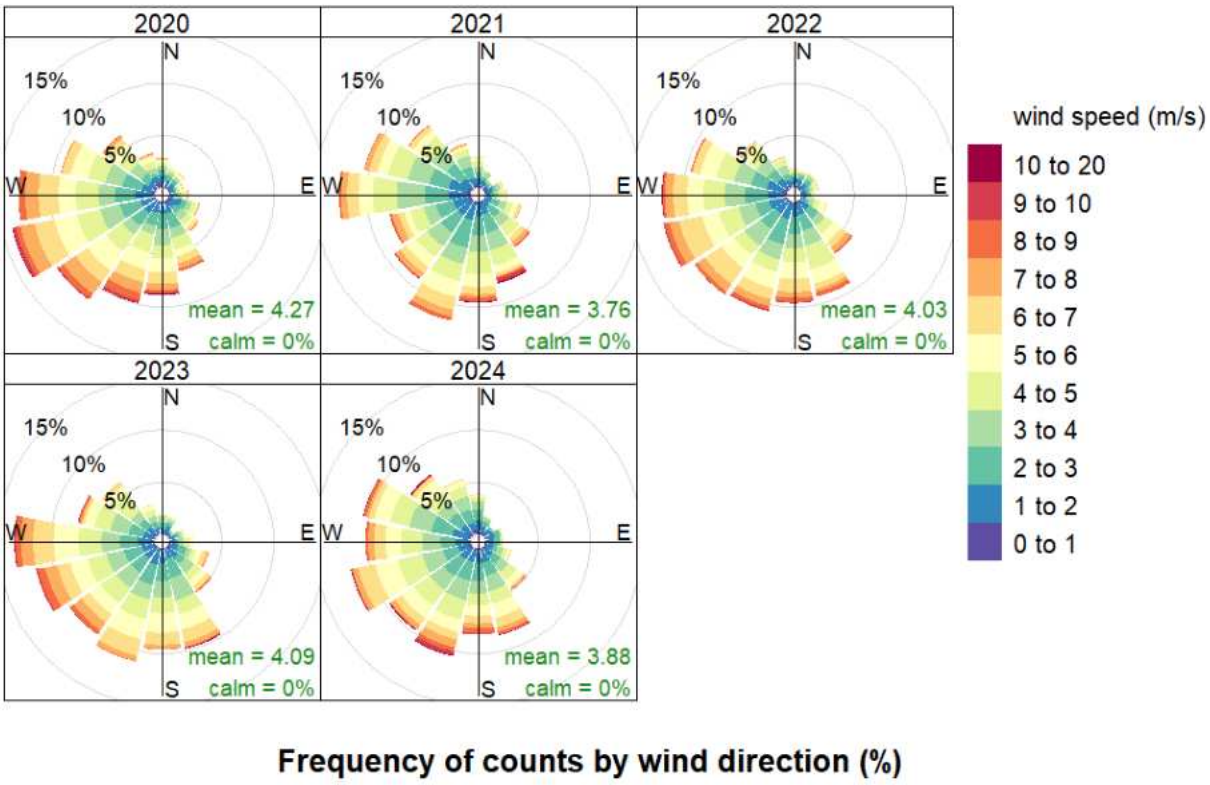


**Figure 5 Annual wind distribution predicted at the Site using CALMET for 2020 to 2024**

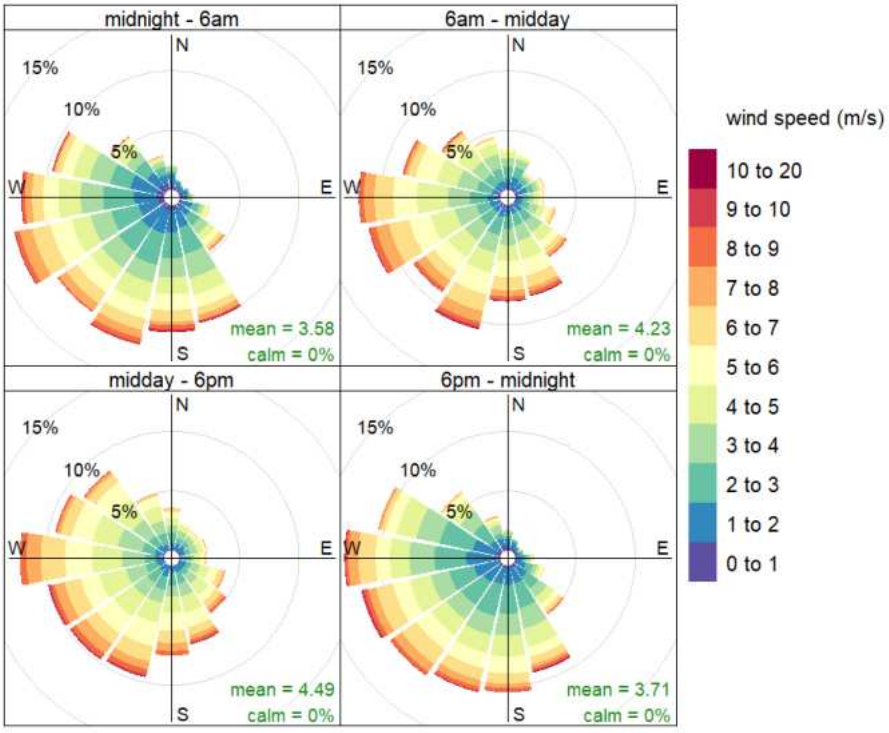


**Figure 6** **Diurnal wind distribution predicted at the Site using CALMET**

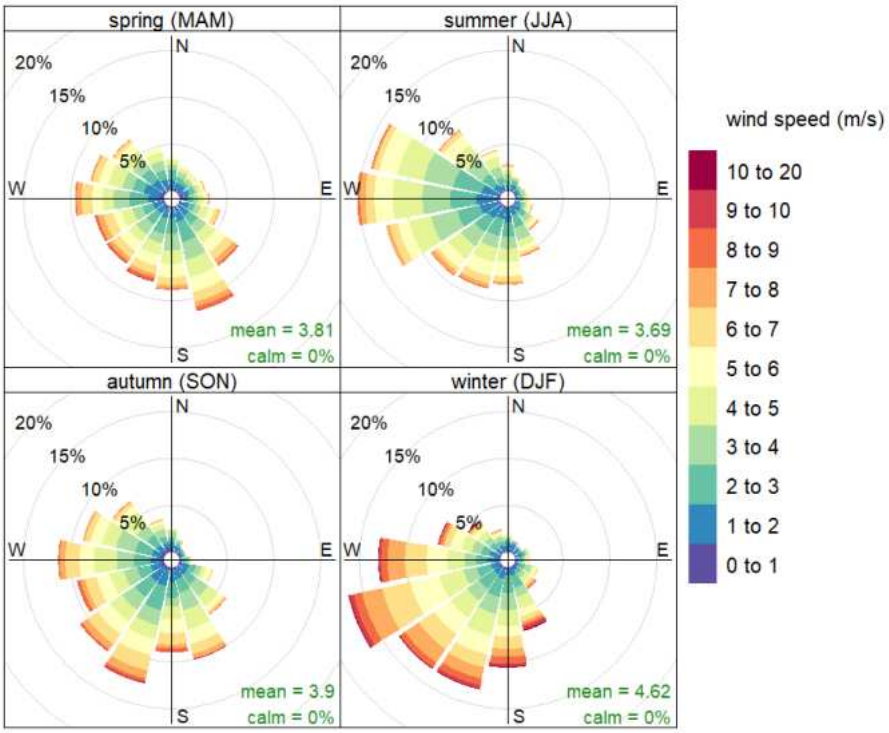


**Figure 7** **Seasonal wind distribution predicted at the Site using CALMET**

## 4.3 Sensitive receptors

The sensitive receptors that are nearest to the site are presented in Figure 8. The sensitive receptors included in the dispersion modelling assessment are at Natura 2000 sites in the vicinity of the poultry farm. The Natura 2000 sites within 15 km, which are indicated by a red dashed circle in Figure 8, have been considered in this assessment. The Natura 2000 sites within 15 km of the poultry farm that have been considered in this assessment include:

- Blackwater River (Cork/Waterford) SAC (002170)
- Lower River Shannon SAC (002165)
- Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161).

Several tributaries of the Blackwater River (Cork/Waterford) SAC and the Lower River Shannon SAC are within 15 km of the poultry farm. A significant portion of the Stack's to Mullaghareirk Mountains SPA, West Limerick Hills and Mount Eagle SPA is located within 15 km of the poultry farm.

These Natura 2000 sites contain a range of ammonia and nitrogen sensitive species and habitats that are listed as conservation interests, some of which are within 15 km of the site including:

- The Blackwater River (Cork/Waterford) SAC:
    - Perennial vegetation of stony banks [1220]
    - Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [3260]
    - 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]
    - Trichomanes speciosum (Killarney Fern) [1421].
- The Lower Shannon SAC:
    - Perennial vegetation of stony banks [1220]
    - Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [3260]
    - 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].

SPAs focus on the protection of areas that bird species typically use as nesting, breeding or over wintering sites. The protection of SPA habitats from projects that are likely to have significant adverse impacts is crucial to maintaining or restore the protected species of birds to a favourable conservation status.

A review of the conservation objectives published by NPWS for the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA indicate that the species listed as conservation objectives is the Hen Harrier (*Circus cyaneus)* (A082).

NPWS conservation objectives highlight the extent and condition of heath and bog and associated habitats as important nesting and foraging resources for the breeding population of Hen Harrier. As a result, heath and bog habitats within the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA have been considered in this assessment.

The critical level for ammonia and the critical load for nitrogen deposition for each of the species and habitat considered in this assessment is presented in Table 1.

**Table 1 The critical level for ammonia and the critical load for nitrogen deposition for each of the species and habitat within 15 km of the poultry farm**

| Habitat or Species | Critical Level | Critical Load |
|---|---|---|
| | µg/m³ | kg/ha/year |
| Perennial vegetation of stony banks [1220] | 1 | 10 |
| Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [3260] | 1 | 10 |
| Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0] | 1 | 10 |
| Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) [91E0] | 1 | 15.3 |
| Trichomanes speciosum (Killarney Fern) [1421] | 1 | 10 |
| Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) [6410] | 1 | 15 |
| Blanket bogs (* if active bog) [7130] | 1 | 5 |

Fifty-three sensitive receptor locations were included in the dispersion modelling assessment. The locations were chosen to represent places within each Natura 2000 site where:

- A qualifying habitat or species that are sensitive to ammonia and nitrogen deposition have been mapped
- Potential impacts from the Facility are likely to be greatest (i.e. at locations on the natura 2000 site closest to the Facility).

A review of National Parks and Wildlife Service surveys of the habitats and species of the Natura 2000 sites indicates that only the following habitats of interest are present within sites within 15 km of the poultry farm:

- Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0]
- Blanket bogs (* if active bog) [7130].

The Blackwater River (Cork/Waterford) SAC flows to the southeast of the site. The closest point of the Blackwater River is located 6.2 km from the site boundary. A review of the conservation objectives published by NPWS for the stretch of the Blackwater River within 15 km of the site indicates that there are no ammonia and nitrogen sensitive species or habitats within 15 km of the poultry farm.

The Lower River Shannon SAC flows to the west of the site. The closest point of the Lower River Shannon is located 4.6 km from the site boundary. A review of the conservation objectives published by NPWS for the stretch of the Lower River Shannon within 15 km of the site indicates that there are two areas of old sessile oak woods with Ilex and Blechnum in the British Isles [91A0] with the closest located 7.0 km west of the site boundary. There are no other ammonia and nitrogen sensitive species or habitats identified along the stretch of the Lower River Shannon within 15 km of the poultry farm.

The Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA is located along the eastern side of the site extending from the south to the north. NPWS databases were reviewed to determine the extent of habitats on the Mullaghareirk Mountains within 15 km of the site that are:

- Important nesting and foraging resources for the breeding population of Hen Harrier
- Sensitive to airborne ammonia and nitrogen deposition.

This review indicates that there are several Active Blanket bogs [7130] with the closest 4 km southeast of the site boundary. In addition, NPWS database indicates an area of Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0] is located 14.7 km northwest of the site boundary. No other ammonia and nitrogen sensitive species or habitats were identified in the area of the Mullaghareirk Mountains within 15 km of the site.

The sensitive receptor locations included in the dispersion modelling assessment are at points on Natura 2000 sites including:

- Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161) – N2K_R1 to N2K_R22 and N2K_37 to N2K_53
- Blackwater River (Cork/Waterford) SAC (002170) – N2K_R23 to N2K_R29
- Lower River Shannon SAC (002165) – N2K_R30 to N2K_R36.

The sensitive receptors represent locations across the extents of all Natura 2000 sites within 15 km of the poultry farm and are presented graphically in a map in Figure 8.

The sensitive receptors are presented in tabular format in Table 2, which includes for each location:

- The conservation objectives of the habitats or species identified at that point
- The critical level for ammonia adopted in the modelling assessment
- The critical load for nitrogen deposition adopted in the modelling assessment.

**Table 2** **Sensitive receptor locations included in the dispersion modelling assessment, the conservation interest at each location, the critical level for ammonia adopted in the modelling assessment and the critical load for nitrogen deposition at each location**

| Receptor | Species or Habitat | | | | | | | Relevant Criteria | |
|---|---|---|---|---|---|---|---|---|---|
| | Perennial vegetation of stony banks [1220] | Water courses of plain to montane levels (3260) | Old sessile oak woods with Ilex and Blechnum [91A0] | Alluvial forests with Alnus glutinosa and Fraxinus excelsior [91E0] | Trichomanes speciosum (Killarney Fern) [1421] | Molinia meadows on calcareous, peaty or clayey-silt-laden soils [6410] | Blanket bogs (* if active bog) [7130] | Ammonia Concentration | Nitrogen Deposition |
| Cle (µg/m³) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | µg/m³ | kg/ha/yr |
| Clo (kg/ha/yr) | 10 | 10 | 10 | 15.3 | 10 | 15 | 5 | | |
| N2K_R1 | | | | | | | | 3 | 30 |
| N2K_R2 | | | | | | | | 3 | 30 |
| N2K_R3 | | | | | | | | 3 | 30 |
| N2K_R4 | | | | | | | | 3 | 30 |
| N2K_R5 | | | | | | | | 3 | 30 |
| N2K_R6 | | | | | | | | 3 | 30 |
| N2K_R7 | | | | | | | | 3 | 30 |
| N2K_R8 | | | | | | | | 3 | 30 |
| N2K_R9 | | | | | | | | 3 | 30 |
| N2K_R10 | | | | | | | | 3 | 30 |
| N2K_R11 | | | | | | | | 3 | 30 |
| N2K_R12 | | | | | | | | 3 | 30 |
| N2K_R13 | | | | | | | | 3 | 30 |
| N2K_R14 | | | | | | | | 3 | 30 |
| N2K_R15 | | | | | | | | 3 | 30 |

| Receptor | Species or Habitat | | | | | | | Relevant Criteria | |
|---|---|---|---|---|---|---|---|---|---|
| | Perennial vegetation of stony banks [1220] | Water courses of plain to montane levels (3260) | Old sessile oak woods with Ilex and Blechnum [91A0] | Alluvial forests with Alnus glutinosa and Fraxinus excelsior [91E0] | Trichomanes speciosum (Killarney Fern) [1421] | Molinia meadows on calcareous, peaty or clayey-silt-laden soils [6410] | Blanket bogs (* if active bog) [7130] | Ammonia Concentration | Nitrogen Deposition |
| N2K_R16 | | | | | | | | 3 | 30 |
| N2K_R17 | | | | | | | | 3 | 30 |
| N2K_R18 | | | | | | | | 3 | 30 |
| N2K_R19 | | | | | | | | 3 | 30 |
| N2K_R20 | | | | | | | | 3 | 30 |
| N2K_R21 | | | | | | | | 3 | 30 |
| N2K_R22 | | | | | | | | 3 | 30 |
| N2K_R23 | | | | | | | | 3 | 30 |
| N2K_R24 | | | | | | | | 3 | 30 |
| N2K_R25 | | | | | | | | 3 | 30 |
| N2K_R26 | | | | | | | | 3 | 30 |
| N2K_R27 | | | | | | | | 3 | 30 |
| N2K_R28 | | | | | | | | 3 | 30 |
| N2K_R29 | | | | | | | | 3 | 30 |
| N2K_R30 | | | | | | | | 3 | 30 |
| N2K_R31 | | | | | | | | 3 | 30 |
| N2K_R32 | | | | | | | | 3 | 30 |
| N2K_R33 | | | | | | | | 3 | 30 |
| N2K_R34 | | | ✓ | | | | | 1 | 10 |
| N2K_R35 | | | ✓ | | | | | 1 | 10 |

| Receptor | Species or Habitat | | | | | | | Relevant Criteria | |
|---|---|---|---|---|---|---|---|---|---|
| | Perennial vegetation of stony banks [1220] | Water courses of plain to montane levels (3260) | Old sessile oak woods with Ilex and Blechnum [91A0] | Alluvial forests with Alnus glutinosa and Fraxinus excelsior [91E0] | Trichomanes speciosum (Killarney Fern) [1421] | Molinia meadows on calcareous, peaty or clayey-silt-laden soils [6410] | Blanket bogs (* if active bog) [7130] | Ammonia Concentration | Nitrogen Deposition |
| N2K_R36 | | | ✓ | | | | | 1 | 10 |
| N2K_R37 | | | | | | | ✓ | 1 | 5 |
| N2K_R38 | | | | | | | ✓ | 1 | 5 |
| N2K_R39 | | | | | | | ✓ | 1 | 5 |
| N2K_R40 | | | | | | | ✓ | 1 | 5 |
| N2K_R41 | | | | | | | ✓ | 1 | 5 |
| N2K_R42 | | | | | | | ✓ | 1 | 5 |
| N2K_R43 | | | ✓ | | | | | 1 | 10 |
| N2K_R44 | | | | | | | ✓ | 1 | 5 |
| N2K_R45 | | | | | | | ✓ | 1 | 5 |
| N2K_R46 | | | | | | | ✓ | 1 | 5 |
| N2K_R47 | | | | | | | ✓ | 1 | 5 |
| N2K_R48 | | | | | | | ✓ | 1 | 5 |
| N2K_R49 | | | | | | | ✓ | 1 | 5 |
| N2K_R50 | | | | | | | ✓ | 1 | 5 |
| N2K_R51 | | | | | | | ✓ | 1 | 5 |
| N2K_R52 | | | | | | | ✓ | 1 | 5 |
| N2K_R53 | | | | | | | ✓ | 1 | 5 |

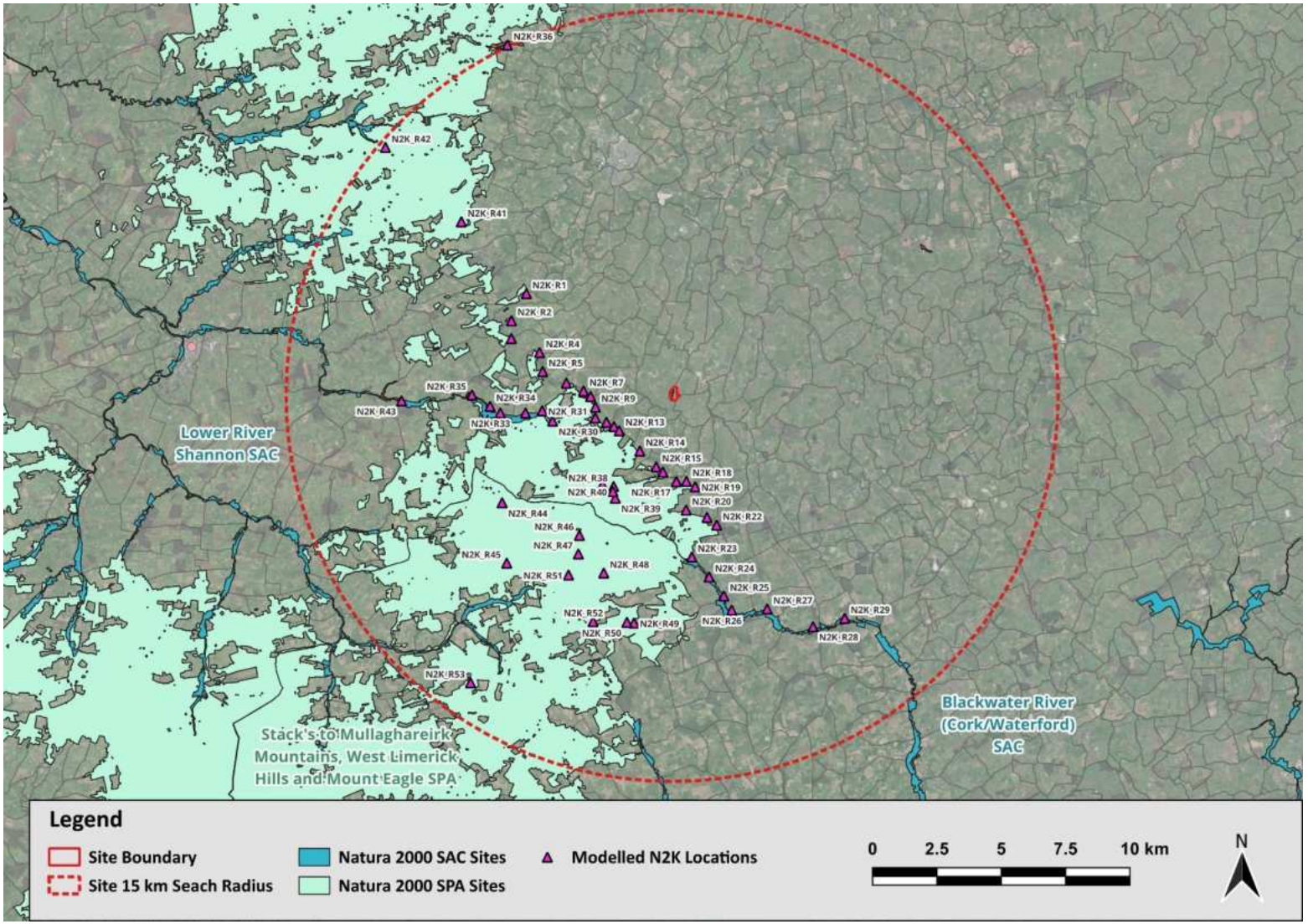


**Figure 8** **The sensitive receptors included in the dispersion modelling assessment to represent locations on Natura 2000 sites**

## 4.4 Background concentrations of ammonia and nitrogen deposition

The background ammonia concentration and nitrogen deposition flux rates at each modelled sensitive receptor were obtained from the Simple Calculation of Atmospheric Impacts Limits (SCAIL) online tool as recommended in EPA's Ammonia Assessment Guidance. The background concentrations of ammonia and nitrogen deposition levels adopted in the assessment are presented in Table 3.

Background ammonia concentration and nitrogen deposition flux rates adopted in the assessment were included in the assessment methodology defined in EPA's Ammonia Assessment Guidance.

**Table 3 The background concentrations of ammonia and nitrogen deposition levels adopted in the assessment (based on SCAIL)**

| Receptor | SCAIL Background | |
|---|---|---|
| | Concentration of ammonia (µg/m³) | Nitrogen Deposition Flux (kg/ha/yr) |
| N2K_R1 | 2.39 | 6.72 |
| N2K_R2 | 2.39 | 6.72 |
| N2K_R3 | 2.39 | 6.72 |
| N2K_R4 | 1.97 | 6.40 |
| N2K_R5 | 2.16 | 6.73 |
| N2K_R6 | 1.85 | 6.45 |
| N2K_R7 | 1.85 | 6.45 |
| N2K_R8 | 1.85 | 6.45 |
| N2K_R9 | 2.07 | 6.64 |
| N2K_R10 | 2.07 | 6.64 |
| N2K_R11 | 2.26 | 6.78 |
| N2K_R12 | 1.88 | 6.51 |
| N2K_R13 | 1.96 | 6.75 |
| N2K_R14 | 1.74 | 6.54 |
| N2K_R15 | 1.94 | 6.77 |
| N2K_R16 | 1.94 | 6.77 |
| N2K_R17 | 1.94 | 6.77 |
| N2K_R18 | 2.14 | 6.99 |
| N2K_R19 | 2.14 | 6.99 |
| N2K_R20 | 2.24 | 7.11 |
| N2K_R21 | 2.24 | 7.11 |
| N2K_R22 | 2.22 | 7.16 |
| N2K_R23 | 2.59 | 7.32 |
| N2K_R24 | 2.59 | 7.32 |
| N2K_R25 | 2.55 | 7.29 |
| N2K_R26 | 2.49 | 7.32 |
| N2K_R27 | 2.49 | 7.32 |
| N2K_R28 | 2.85 | 7.72 |
| N2K_R29 | 2.62 | 7.51 |

| Receptor | SCAIL Background | |
|---|---|---|
| | Concentration of ammonia (µg/m³) | Nitrogen Deposition Flux (kg/ha/yr) |
| N2K_R30 | 2.49 | 6.85 |
| N2K_R31 | 2.07 | 6.38 |
| N2K_R32 | 2.07 | 6.38 |
| N2K_R33 | 2.39 | 6.72 |
| N2K_R34 | 2.62 | 7.51 |
| N2K_R35 | 2.91 | 7.65 |
| N2K_R36 | 2.00 | 6.09 |
| N2K_R37 | 2.06 | 6.49 |
| N2K_R38 | 2.00 | 6.19 |
| N2K_R39 | 1.77 | 6.01 |
| N2K_R40 | 1.77 | 6.01 |
| N2K_R41 | 2.00 | 6.19 |
| N2K_R42 | 1.46 | 5.09 |
| N2K_R43 | 1.83 | 5.73 |
| N2K_R44 | 1.43 | 5.51 |
| N2K_R45 | 1.29 | 5.70 |
| N2K_R46 | 1.24 | 5.96 |
| N2K_R47 | 1.28 | 5.88 |
| N2K_R48 | 1.35 | 5.97 |
| N2K_R49 | 1.57 | 6.46 |
| N2K_R50 | 1.57 | 6.46 |
| N2K_R51 | 1.33 | 5.84 |
| N2K_R52 | 1.48 | 6.45 |
| N2K_R53 | 1.28 | 5.68 |

# 5. ASSESSMENT

## 5.1 Methodology

The following section describes the dispersion modelling methodology that was adopted to determine concentrations of ammonia and deposition rates of nitrogen from the poultry farm in combination with background levels at ecologically sensitive locations near the Site. The methodology is based on a dispersion modelling study incorporating source characteristics and operational activity data of the poultry farm with meteorological data that is representative of the Site and surrounding region. The dispersion modelling assessment has been prepared in accordance with industry standards, regulatory requirements and best practice approaches.

The assessment methodology has included:

- Derivation of an emissions inventory for onsite sources of ammonia based on their design, capacity and monitoring reports
- Characterisation of regional and local meteorology.
- Generation of a representative meteorological dataset using prognostic meteorological modelling techniques.
- Dispersion modelling using the regulatory dispersion model, CALPUFF, to predict ground-level concentrations of ammonia and nitrogen deposition at sensitive receptor locations.
- Comparison of the predicted ground-level concentrations of air contaminants against the relevant air contaminant assessment criteria for the existing operations compared to the proposed operations in accordance with EPA's Ammonia Assessment Guidance.

## 5.2 SCAIL-Agriculture

The baseline levels of ammonia and flux rates of nitrogen deposition at the sensitive ecological receptor locations were determined using SCAIL- Agriculture for Step 1 of EPA's Ammonia Assessment Guidance.

SCAIL-Agriculture is a tool for assessing impacts of atmospheric nitrogen from agricultural installations in the UK and Ireland. It is a model underpinned by a detailed air dispersion model, AERMOD (Kelleghan *et al.*, 2022).

SCAIL-Agriculture includes estimates of baseline levels of ammonia and flux rates of nitrogen deposition across Ireland. The SCAIL-Agriculture ambient concentration model (1 x 1 km grid) has been updated to include modelled 2018 emissions by the UKCEH on behalf of the EPA. Similarly, the coarser international 2018 European Monitoring and Evaluation Programme (EMEP) national concentration and deposition models for Ireland have been made available through the AmmoniaN2K website (AmmoniaN2K, 2021). Both these models currently rely on the MapEire emissions model, which utilises cattle and sheep distribution from 2010 and locations of pig and poultry farms from 2015 according to the Irish Wildlife Manual 135 (Kelleghan *et al.*, 2022).

## 5.3 Meteorological modelling

### 5.3.1 Overview

The modelling domain includes areas of complex terrain. The meteorological parameters that affect dispersion are likely to vary spatially and temporally across the modelling domain due to the complexity of the terrain.

The closest Met Eireann monitoring location to the site is at Shannon Airport, which is 39 km north of the poultry farm. This monitoring station is at an airport located to the north of the River Shannon that runs east to west. Meteorological data at Shannon Airport is characterised by frequent westerly and south-westerly winds. The meteorological station at Shannon Airport is not likely to be representative of meteorological conditions at the site due to the differences in surrounding terrain characteristics at both sites.

A review by Katestone indicates that there are no other meteorological observation stations on the Met Eireann Network that meet the requirements specified in AG4 to be considered representative of the modelling domain.

Where site specific or representative meteorological data is not available, AG4 provides the following alternatives:

> *Prognostic meteorological data should be considered in locations where there is no comparable representative Met Eireann station particularly in areas of complex terrain or at a land / sea interface.*

and

> *Prognostic meteorological data may be useful in locations where there is no comparable representative Met Eireann station. Locations where prognostic meteorological data may be required include regions of complex terrain and at a land/sea interface in circumstances where the nearest meteorological stations are outside of the modelling domain. As outlined by the USEPA, meteorological data should be spatially representative of the modelling domain and in particular of the pathway from the source to the most impacted receptor.*

Accordingly, prognostic meteorological data was generated for the site due to the complexity of the terrain. The approach adopted to generate representative site-specific data utilised a numerical model to generate a 3-dimensional grid of spatially varying meteorological parameters to represent conditions surrounding the site. The approach is described in Appendix A1.

### 5.3.2 Meteorology

The prognostic model TAPM (developed in Australia by the Commonwealth Scientific and Industrial Research Organisation [CSIRO], version 4.0.5) and the diagnostic meteorological model CALMET (developed by EarthTec, version 6.5) were used to generate the three-dimensional meteorological dataset for the region.

The CALMET simulation was initialised with the gridded TAPM 3D wind field data from the innermost nest. CALMET treats the prognostic model output as the initial guess field for the CALMET diagnostic model wind fields. The initial guess field is then adjusted for the kinematic effects of terrain, slope flows, blocking effects and 3D divergence minimisation.

The three-dimensional wind field produced by TAPM/CALMET was then used to create a meteorological file suitable for us with the CALPUFF dispersion model.

Details of the model configuration and evaluation are presented in Appendix A.

The TAPM/CALMET approach has been used in jurisdictions like Australia to generate suitable meteorological data for modelling odour impacts for over 15 years. It has been adopted in for the assessment of a number proposed projects in Ireland in the last 5 years. There is significant experience using these approaches in jurisdictions such as Australia. Industry specific guidance on modelling odour dispersion from sources such as intensive poultry farms

and cattle feedlots recommend the use of TAPM/CALMET to generate representative site-specific data. Research in Europe indicates that meteorological data generated using a numerical model provided a better indication of locations where odour nuisance occurred (Feliubadaló et al, 2008). In that study, locations of likely odour nuisance were determined using the German VDI grid assessment approach. The correlation between observed and modelled odour concentrations was significantly better using the TAPM/CALMET approach compared to traditional steady state gaussian models such as AERMOD.

## 5.4 Development of an emissions inventory

### 5.4.1 Overview

The derivation of the ammonia emissions inventory adopted for the dispersion modelling assessment is presented in this section. Ammonia emission inventories were derived based on the design and capacity for the housing units at the poultry farm for the proposed operations.

There are no emissions monitoring data available for the poultry farm. Ammonia and other nitrogenous compound emission rates from poultry housing units at poultry farms vary considerably depending on factors such as:

- The ventilation rate, which is heavily influenced by:
    - The target temperature of the birds in the shed, which is influenced by:
        - Type of bird
        - The age of the birds
    - The ambient temperature outside the poultry unit.
- The design of the housing system includes but is not limited to the following:
    - Depth of manure hand litter
    - Frequency of manure removal
    - Ventilation design
    - Surface area of manure in the housing unit.
- The depth of manure in the house, which varies considerably with season.

The ammonia emission inventory derived for the poultry farm for the proposed operations is based on:

- The livestock type and associated housing type / livestock maintenance system
- The number of livestock
- The housing floor area
- Ammonia emission rates derived from published literature.

### 5.4.2 Proposed Operations

Proposed operations will involve an increase in stocking numbers from 39,999 to 70,000 egg laying hens, which will be housed in the existing housing units. There are no additional houses required for the proposed development.

Each housing unit at the site contains a centralised elevated structure that contains nests, perches and an egg collection belt below the nest. On each side of the elevated structure are solid floor areas.

Hens are brought to the housing unit at the start of the lay cycle which starts when hens are approximately 18 weeks of age. The housing units are freshly cleaned and disinfected before hens are placed. Solid floor areas of

the housing units have fresh litter when hens are placed. The lay cycle lasts until hens are approximately 14 months old at which time they are removed. Subsequently, all soiled litter is removed from the housing unit. The housing unit is then cleaned and disinfected before new hens placed in the housing unit to start of the next lay cycle.

The poultry housing units operate as free-range, deep litter housing systems. Manure accumulates in the litter over the course of the lay cycle.

The ammonia emission rate adopted for the deep litter system at the site was taken from Table 3.50 of the BAT reference document (BREF) (IPCC, 2017) titled 'Intensive Rearing of Poultry or Pigs for housing units described as "Hens on floor, with manure pit" which specifics an ammonia emission rate of 0.29 kg $NH_3$. $bird^{-1}$. $year^{-1}$. This emission rate is considered appropriate as:

- The ammonia emission rate is dependent on the amount of manure held in a housing unit
- In relation to both deep pit and deep litter, all manure generated in the housing unit remains in the housing unit until the house is cleaned at the end of the lay cycle.

Soiled litter removed from housing units is immediately taken from the site by an external contractor. As a result, the storage of manure onsite external to the housing units has not been considered in the dispersion modelling assessment.

## 5.5 Dispersion modelling

The assessment was conducted in accordance with recognized techniques for dispersion modelling specified in EPA's Air Dispersion Modelling Guidance Note (AG4). CALPUFF was used to predict ground-level concentrations of ammonia and nitrogen deposition rates across the modelling domain and at sensitive ecological receptor locations on nearby Natura 2000 site due to sources at the poultry farm.

The details of source characterisation utilised for the poultry farm in the modelling assessment are provided in Section 5.8.

## 5.6 Methods to consider Nitrogen Deposition

Deposition flux rates of nitrogen at sensitive receptors were estimated based on the predicted concentrations of ammonia across the modelled domain and using the following calculation methodology that is described in AG4:

> *The critical loads in ecologically sensitive areas such as SPAs, SACs and NHAs can be determined using the methodology outlined in the UK publication "AQTAG06 – Technical Guidance on Detailed Modelling Approach For An Appropriate Assessment For Emissions To Air" (Environment Agency, 2014)(64) . The approach is based on using the maximum annual average ground level concentration within the ecologically sensitive area and converting this concentration into a deposition flux based on a chemical species specific deposition velocity (m/s) as outlined in Table A3.*

The recommended dry deposition velocities for ammonia in Table A3 of AG4 are:

- 0.02 m/s for grassland
- 0.03 m/s for forest.

Dry deposition flux (µg $m^{-2}$ $s^{-1}$) is calculated as the product of the ground-level process contribution (µg/$m^3$) and the deposition velocity (m/s).

The dry deposition velocities adopted in the modelling assessment were assumed as follows for the Blanket Bog Areas (Active) and the Old Sessile Oak Woodlands:

- Blanket Bog Areas (Active) were assumed to be 0.02 based on their low-lying grassland nature

- Old Sessile Oak Woodlands were assumed to be 0.03 based on their forest-like structure

For the remaining modelled locations 0.03 m/s was assumed to obtain a conservative estimation of nitrogen deposition at the remaining modelled locations.

## 5.7 Sources of Emissions

The poultry housing units included in the dispersion modelling assessment are presented in Table 4, which specifies:

- The housing unit at the poultry farm
- The details of the housing system operation
- The maximum number of laying hens within each housing unit
- The ammonia emission rate per housing unit.

All poultry housing units at the Site will be naturally ventilated and were configured as volume sources in the modelling assessment.

**Table 4 Poultry housing units included in the dispersion modelling assessment**

| Housing Unit | Type of shed | Number of birds | Ammonia Emission rate (g/s) |
|---|---|---|---|
| House 1 | Perchery with deep litter | 5150 | 0.0474 |
| House 2 | | 10300 | 0.0947 |
| House 3 | | 5150 | 0.0474 |
| House 4 | | 10300 | 0.0947 |
| House 5 | | 5150 | 0.0474 |
| House 6 | | 10300 | 0.0947 |
| House 7 | | 5150 | 0.0474 |
| House 8 | | 10300 | 0.0947 |

## 5.8 Source configuration

The building locations, configuration and heights were determined from site plans provided by Ceres Consulting Farms and from satellite imagery. All existing houses have been included in the modelling assessment as volume sources.

Table 5 provides details of the volume sources included in the modelling assessment and relevant modelling parameters including:

- The source coordinates
- The base elevations
- Emission height
- Initial sigma-y
- Initial sigma-z.

**Table 5 Source parameters for the volume sources at the poultry farm**

| Source Number | x-coordinate | y-coordinate | Base Elevation | Emission Height | Sigma-y | Sigma-z |
|---|---|---|---|---|---|---|
| | km | km | m | m | m | m |
| House 1 | 498.367 | 5801.991 | 94.2 | 3.0 | 4.19 | 2.33 |
| House 2 | 498.354 | 5802.024 | 94.0 | 3.0 | 4.19 | 2.33 |
| House 3 | 498.385 | 5802.099 | 93.2 | 3.0 | 4.19 | 2.33 |
| House 4 | 498.372 | 5802.132 | 93.0 | 3.0 | 4.19 | 2.33 |
| House 5 | 498.403 | 5802.207 | 92.2 | 3.0 | 4.19 | 2.33 |
| House 6 | 498.391 | 5802.241 | 91.9 | 3.0 | 4.19 | 2.33 |
| House 7 | 498.421 | 5802.316 | 90.7 | 3.0 | 4.19 | 2.33 |
| House 8 | 498.409 | 5802.349 | 90.4 | 3.0 | 4.19 | 2.33 |

# 6. RESULTS

The results of the assessment are presented in this section. Katestone followed the step-wise approach described in EPA's Ammonia Assessment Guidance in this assessment. The results of each step considered in the modelling assessment are presented in this section.

In summary, the step-wise approach described in EPA's Ammonia Assessment Guidance requires the following steps to be completed:

- Step 1
- Step 4.

## 6.1 Results of Step 1

Question 2 of Step 1 in the EPA's Ammonia Assessment Guidance asks:

> *Are the background levels already exceeded for the ammonia critical level or nitrogen critical load at Natura Sites within the zone of influence of my site (as reported by SCAIL)?*

The background concentrations of ammonia and the background nitrogen deposition flux as determined using the SCAIL screening tool are presented along with the appropriate critical level for ammonia and critical load for nitrogen deposition fluxes in Table 6.

The results show that the background concentrations of ammonia and the background nitrogen deposition flux exceed the relevant critical level for ammonia and critical load for nitrogen deposition fluxes at a number of the modelled discrete receptor locations.

According to Step 1 of EPA's Ammonia Assessment:

- The approaches using the SCAIL-Agriculture model described in Step 2 and Step 3 of the EPA's Ammonia Assessment Guidance are not applicable.
- A detailed assessment in accordance with Step 4 of EPA's Ammonia Assessment Guidance is, therefore, required to be completed. The results of the Step 4 assessment are presented in Section 6.2.

**Table 6 Background concentrations of ammonia and the background nitrogen deposition flux as determined using the SCAIL screening tool are presented along with the appropriate critical level for ammonia and critical load for nitrogen deposition fluxes**

| Receptor | SCAIL background concentration of ammonia | Critical Level | SCAIL background nitrogen deposition flux | Critical Load |
|---|---|---|---|---|
| | µg/m³ | | kg/ha/yr | |
| N2K_R1 | 2.39 | 3.0 | 6.72 | 30.0 |
| N2K_R2 | 2.39 | 3.0 | 6.72 | 30.0 |
| N2K_R3 | 2.39 | 3.0 | 6.72 | 30.0 |
| N2K_R4 | 1.97 | 3.0 | 6.40 | 30.0 |
| N2K_R5 | 2.16 | 3.0 | 6.73 | 30.0 |
| N2K_R6 | 1.85 | 3.0 | 6.45 | 30.0 |

| Receptor | SCAIL background concentration of ammonia | Critical Level | SCAIL background nitrogen deposition flux | Critical Load |
|---|---|---|---|---|
| | µg/m³ | | kg/ha/yr | |
| N2K_R7 | 1.85 | 3.0 | 6.45 | 30.0 |
| N2K_R8 | 1.85 | 3.0 | 6.45 | 30.0 |
| N2K_R9 | 2.07 | 3.0 | 6.64 | 30.0 |
| N2K_R10 | 2.07 | 3.0 | 6.64 | 30.0 |
| N2K_R11 | 2.26 | 3.0 | 6.78 | 30.0 |
| N2K_R12 | 1.88 | 3.0 | 6.51 | 30.0 |
| N2K_R13 | 1.96 | 3.0 | 6.75 | 30.0 |
| N2K_R14 | 1.74 | 3.0 | 6.54 | 30.0 |
| N2K_R15 | 1.94 | 3.0 | 6.77 | 30.0 |
| N2K_R16 | 1.94 | 3.0 | 6.77 | 30.0 |
| N2K_R17 | 1.94 | 3.0 | 6.77 | 30.0 |
| N2K_R18 | 2.14 | 3.0 | 6.99 | 30.0 |
| N2K_R19 | 2.14 | 3.0 | 6.99 | 30.0 |
| N2K_R20 | 2.24 | 3.0 | 7.11 | 30.0 |
| N2K_R21 | 2.24 | 3.0 | 7.11 | 30.0 |
| N2K_R22 | 2.22 | 3.0 | 7.16 | 30.0 |
| N2K_R23 | 2.59 | 3.0 | 7.32 | 30.0 |
| N2K_R24 | 2.59 | 3.0 | 7.32 | 30.0 |
| N2K_R25 | 2.55 | 3.0 | 7.29 | 30.0 |
| N2K_R26 | 2.49 | 3.0 | 7.32 | 30.0 |
| N2K_R27 | 2.49 | 3.0 | 7.32 | 30.0 |
| N2K_R28 | 2.85 | 3.0 | 7.72 | 30.0 |
| N2K_R29 | 2.62 | 3.0 | 7.51 | 30.0 |
| N2K_R30 | 2.49 | 3.0 | 6.85 | 30.0 |
| N2K_R31 | 2.07 | 3.0 | 6.38 | 30.0 |
| N2K_R32 | 2.07 | 3.0 | 6.38 | 30.0 |
| N2K_R33 | 2.39 | 3.0 | 6.72 | 30.0 |
| N2K_R34 | **2.62** | 1.0 | 7.51 | 10.0 |
| N2K_R35 | **2.91** | 1.0 | 7.65 | 10.0 |
| N2K_R36 | **2.00** | 1.0 | 6.09 | 10.0 |
| N2K_R37 | **2.06** | 1.0 | **6.49** | 5.0 |
| N2K_R38 | **2.00** | 1.0 | **6.19** | 5.0 |
| N2K_R39 | **1.77** | 1.0 | **6.01** | 5.0 |
| N2K_R40 | **1.77** | 1.0 | **6.01** | 5.0 |
| N2K_R41 | **2.00** | 1.0 | **6.19** | 5.0 |
| N2K_R42 | **1.46** | 1.0 | **5.09** | 5.0 |

| Receptor | SCAIL background concentration of ammonia | Critical Level | SCAIL background nitrogen deposition flux | Critical Load |
|---|---|---|---|---|
| | µg/m³ | | kg/ha/yr | |
| N2K_R43 | **1.83** | 1.0 | 5.73 | 10.0 |
| N2K_R44 | **1.43** | 1.0 | **5.51** | 5.0 |
| N2K_R45 | **1.29** | 1.0 | **5.70** | 5.0 |
| N2K_R46 | **1.24** | 1.0 | **5.96** | 5.0 |
| N2K_R47 | **1.28** | 1.0 | **5.88** | 5.0 |
| N2K_R48 | **1.35** | 1.0 | **5.97** | 5.0 |
| N2K_R49 | **1.57** | 1.0 | **6.46** | 5.0 |
| N2K_R50 | **1.57** | 1.0 | **6.46** | 5.0 |
| N2K_R51 | **1.33** | 1.0 | **5.84** | 5.0 |
| N2K_R52 | **1.48** | 1.0 | **6.45** | 5.0 |
| N2K_R53 | **1.28** | 1.0 | **5.68** | 5.0 |
| Note:<br>Bold text indicates where SCAIL background exceeds the critical level or critical load. | | | | |

## 6.2 Results of Step 4

Step 4 of EPA's Ammonia Assessment Guidance requires a licensee/applicant to complete a detailed dispersion modelling assessment.

Dispersion modelling has been conducted for five years of meteorological data. The following sections present the highest concentrations across the five-year modelled period as required by EPA dispersion modelling guidance.

The predicted ground-level concentrations of ammonia and annual average flux rate of nitrogen deposition at the nearest ecologically sensitive locations due to the poultry farm are presented in Table 7.

The results in Table 7 are compared against the Step 4 criteria identified in EPA's Ammonia Assessment Guidance, which require the process contribution of the poultry farm (PC) to be:

- ≤1% of the critical level for ammonia at sites of sensitive ecological species or habitats
- ≤1% of the critical load for nitrogen deposition at sites of sensitive ecological species or habitats.

The results presented in Table 7 show that, in relation to the 1% threshold identified in Step 4 of EPA's Ammonia Assessment Guidance, the PC due to the poultry farm:

- as a result of concentrations of ammonia and nitrogen deposition at N2K_R1 to N2K_R37 are above the criteria identified in Step 4 on several occasions. These receptors represent the boundaries of Natura 2000 sites and do not represent sites of sensitive ecological species of habitats.
- as a result of concentrations of ammonia and nitrogen deposition at N2K_R38 to N2K_R58 **comply** with criteria identified in Step 4. These receptors represent sites of sensitive ecological species or habitats, N2K_R38 to N2K_R58.

The concentrations of ammonia and nitrogen deposition levels comply with the criteria identified in Step 4 of EPA's Ammonia Assessment Guidance at the sites of sensitive ecological species or habitats; therefore, no further steps are required.

**Table 7 The predicted ground-level concentrations of ammonia and annual average flux rate of nitrogen deposition at the nearest ecologically sensitive locations due to the poultry farm**

| Receptor | Ammonia | | | Nitrogen Deposition | | |
|---|---|---|---|---|---|---|
| | Concentration | Criteria | % of criteria | Rate | Criteria | % of criteria |
| | µg/m³ | µg/m³ | | kg/ha/yr | µg/m³ | |
| N2K_R1* | 0.02773 | 3 | 0.924% | 0.262 | 30 | 0.87% |
| N2K_R2* | 0.01664 | 3 | 0.555% | 0.157 | 30 | 0.52% |
| N2K_R3* | 0.01948 | 3 | 0.649% | 0.184 | 30 | 0.61% |
| N2K_R4* | 0.03211 | 3 | **1.070%** | 0.303 | 30 | **1.01%** |
| N2K_R5* | 0.01748 | 3 | 0.583% | 0.165 | 30 | 0.55% |
| N2K_R6* | 0.02483 | 3 | 0.828% | 0.234 | 30 | 0.78% |
| N2K_R7* | 0.03390 | 3 | **1.130%** | 0.320 | 30 | **1.07%** |
| N2K_R8* | 0.03575 | 3 | **1.192%** | 0.337 | 30 | **1.12%** |
| N2K_R9* | 0.02819 | 3 | 0.940% | 0.266 | 30 | 0.89% |
| N2K_R10* | 0.01638 | 3 | 0.546% | 0.155 | 30 | 0.52% |
| N2K_R11* | 0.02476 | 3 | 0.825% | 0.234 | 30 | 0.78% |
| N2K_R12* | 0.02699 | 3 | 0.900% | 0.255 | 30 | 0.85% |
| N2K_R13* | 0.02236 | 3 | 0.745% | 0.211 | 30 | 0.70% |
| N2K_R14* | 0.01833 | 3 | 0.611% | 0.173 | 30 | 0.58% |
| N2K_R15* | 0.02053 | 3 | 0.684% | 0.194 | 30 | 0.65% |
| N2K_R16* | 0.02265 | 3 | 0.755% | 0.214 | 30 | 0.71% |
| N2K_R17* | 0.04922 | 3 | **1.641%** | 0.464 | 30 | **1.55%** |
| N2K_R18* | 0.08361 | 3 | **2.787%** | 0.789 | 30 | **2.63%** |
| N2K_R19* | 0.07150 | 3 | **2.383%** | 0.675 | 30 | **2.25%** |
| N2K_R20* | 0.04393 | 3 | **1.464%** | 0.414 | 30 | **1.38%** |
| N2K_R21* | 0.03541 | 3 | **1.180%** | 0.334 | 30 | **1.11%** |
| N2K_R22* | 0.03405 | 3 | **1.135%** | 0.321 | 30 | **1.07%** |
| N2K_R23* | 0.02150 | 3 | 0.717% | 0.135 | 30 | 0.45% |
| N2K_R24* | 0.01911 | 3 | 0.637% | 0.120 | 30 | 0.40% |
| N2K_R25* | 0.01622 | 3 | 0.541% | 0.102 | 30 | 0.34% |
| N2K_R26* | 0.01466 | 3 | 0.489% | 0.092 | 30 | 0.31% |
| N2K_R27* | 0.01524 | 3 | 0.508% | 0.096 | 30 | 0.32% |
| N2K_R28* | 0.01379 | 3 | 0.460% | 0.087 | 30 | 0.29% |
| N2K_R29* | 0.01739 | 3 | 0.580% | 0.109 | 30 | 0.36% |
| N2K_R30* | 0.00709 | 3 | 0.236% | 0.045 | 30 | 0.15% |
| N2K_R31* | 0.01081 | 3 | 0.360% | 0.068 | 30 | 0.23% |
| N2K_R32* | 0.00983 | 3 | 0.328% | 0.062 | 30 | 0.21% |
| N2K_R33* | 0.00885 | 3 | 0.295% | 0.056 | 30 | 0.19% |
| N2K_R34* | 0.00915 | 1 | 0.915% | 0.086 | 10 | 0.86% |
| N2K_R35* | 0.00843 | 1 | 0.843% | 0.079 | 10 | 0.79% |

| Receptor | Ammonia | | | Nitrogen Deposition | | |
|---|---|---|---|---|---|---|
| | Concentration | Criteria | % of criteria | Rate | Criteria | % of criteria |
| | µg/m³ | µg/m³ | | kg/ha/yr | µg/m³ | |
| N2K_R36* | 0.00997 | 1 | 0.997% | 0.094 | 10 | 0.94% |
| N2K_R37* | 0.00456 | 1 | 0.456% | 0.029 | 5 | 0.57% |
| N2K_R38 | 0.00471 | 1 | 0.471% | 0.030 | 5 | 0.59% |
| N2K_R39 | 0.00408 | 1 | 0.408% | 0.026 | 5 | 0.51% |
| N2K_R40 | 0.00441 | 1 | 0.441% | 0.028 | 5 | 0.55% |
| N2K_R41 | 0.00688 | 1 | 0.688% | 0.043 | 5 | 0.87% |
| N2K_R42 | 0.00220 | 1 | 0.220% | 0.014 | 5 | 0.28% |
| N2K_R43 | 0.00512 | 1 | 0.512% | 0.048 | 10 | 0.48% |
| N2K_R44 | 0.00195 | 1 | 0.195% | 0.012 | 5 | 0.25% |
| N2K_R45 | 0.00169 | 1 | 0.169% | 0.011 | 5 | 0.21% |
| N2K_R46 | 0.00247 | 1 | 0.247% | 0.016 | 5 | 0.31% |
| N2K_R47 | 0.00213 | 1 | 0.213% | 0.013 | 5 | 0.27% |
| N2K_R48 | 0.00283 | 1 | 0.283% | 0.018 | 5 | 0.36% |
| N2K_R49 | 0.00326 | 1 | 0.326% | 0.020 | 5 | 0.41% |
| N2K_R50 | 0.00296 | 1 | 0.296% | 0.019 | 5 | 0.37% |
| N2K_R51 | 0.00199 | 1 | 0.199% | 0.013 | 5 | 0.25% |
| N2K_R52 | 0.00229 | 1 | 0.229% | 0.014 | 5 | 0.29% |
| N2K_R53 | 0.00112 | 1 | 0.112% | 0.007 | 5 | 0.14% |

Table Note:
* No sensitive ecological species of habitats identified as part of NPWS mapping at these locations

# 7. CONCLUSIONS

Katestone Environmental Pty Ltd (Katestone) was commissioned by Ceres Consulting Limited to complete an assessment of the impact of ammonia and nitrogen on Natura 2000 sites for a poultry breeding operation located at Gorteen, Broadford, Co. Limerick (site). The site is owned and operated by Enfield Broiler Breeders.

There is an existing poultry operation at the site, which has a capacity of 39,999 egg laying hens, which is below the poultry stocking threshold and, therefore, does not require an Industrial Emissions Directive (IED) licence.

Enfield Broiler Breeders proposes to:

- Increase bird numbers to 61,800
- Utilise the existing housing units at the site, no additional buildings or floorspace will be required to facilitate the additional bird numbers.

As a consequence of the increase in bird numbers, the stocking numbers at the site will be above the IED licence threshold for poultry.

This assessment is required in response to an RFI issued by EPA on 11 December 2024 requesting an ammonia impact assessment prepared in accordance with *Instruction Note 1 (IN1) "Assessment of the impact of ammonia and nitrogen on Natura 2000 sites from Intensive Agriculture Installations".*

The AIA was conducted in accordance with:

- The stepwise procedure described in EPA's Ammonia Assessment Guidance.
- Recognised techniques for dispersion modelling specified in EPA's Air Dispersion Modelling Guidance Note (AG4). The dispersion model, CALPUFF, was used to predict ground-level concentrations of ammonia and nitrogen deposition flux rates across the model domain due to the poultry farm.

The results of the AIA are as follows:

- The Step 1 assessment indicated that:
    - The approaches using the SCAIL-Agriculture model described in Step 2 and Step 3 of the EPA's Ammonia Assessment Guidance are not applicable
    - A detailed assessment completed in accordance with Step 4 of EPA's Ammonia Assessment Guidance is, therefore, required to be completed.
- The Step 4 assessment shows that, in relation to the 1% threshold identified in Step 4 of EPA's Ammonia Assessment Guidance, the PC due to the proposed development at the poultry farm:
    - Complies with the criteria for ammonia at all sites of sensitive ecological species or habitats modelled on the Blackwater River (Cork/Waterford) SAC, Lower River Shannon SAC and Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA.
    - Complies with the criteria for nitrogen deposition at all sites of sensitive ecological species or habitats modelled on the Blackwater River (Cork/Waterford) SAC, Lower River Shannon SAC and Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA.

The assessment, therefore, indicates that:

- The impacts of the proposed poultry farm in isolation are under EPA limits and, therefore, the proposed increase in bird numbers at the site **complies** with the Step 4 evaluation criteria at all sites of sensitive ecological species or habitats modelled on the Blackwater River (Cork/Waterford) SAC, Lower River Shannon SAC and Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA.

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# APPENDIX A MODELLING METHODOLOGY

## A1 METEOROLOGICAL MODELLING

### A1.1 TAPM

The meteorological model, TAPM (The Air Pollution Model) Version 4.0.5, was developed by the CSIRO and has been validated by the CSIRO, Katestone and others for many locations in Australia, southeast Asia, North America and Ireland. Katestone has used the TAPM model throughout Australia and has performed well for simulating regional winds patterns. Katestone has recently used the TAPM model to generate gridded data over Waterford city and Harbour. The data generated correlated well with observed data at Waterford Airport. TAPM has proven to be a useful model for simulating meteorology in locations where monitoring data is unavailable.

TAPM requires synoptic meteorological information for the region surrounding the project. This information is generated by a global model similar to the large-scale models used to forecast the weather. The data are supplied on a grid resolution of approximately 75 km, and at elevations of 100 metres to five kilometres above the ground. TAPM uses this synoptic information, along with specific details of the location such as surrounding terrain, land-use, soil moisture content and soil type to simulate the meteorology of a region as well as at a specific location.

TAPM resolves local terrain and land-use features that may influence local meteorology and generates a meteorological dataset that is representative of Site-specific geographic conditions. A year of synoptic data must be selected as input for TAPM. TAPM has been modelled for the five most recent years data is available as per AG4.

TAPM was configured as follows:

- 41 x 41 grid point domain with an outer grid resolution of 30 kilometres and nesting grids of 10, 3and 1 kilometre.
- 5 modelled years (1 January 2020 to 31 December 2024)
- Grid centred near the Project Site at latitude 52°22’0 and longitude -9°1’30
- US Geological Survey EROS global terrain height database
- TAPM default land use database, modified to be consistent with aerial imagery in the innermost grid
- 25 vertical grid levels
- No data assimilation.

### A1.2 CALMET meteorological modelling

CALMET is an advanced non-steady-state diagnostic 3D meteorological model with micro-meteorological modules for overwater and overland boundary layers. The model is the meteorological pre-processor for the CALPUFF modelling system. CALMET is capable of reading hourly meteorological data as data assimilation from multiple Sites within the modelling domain; it can also be initialised with the gridded three-dimensional prognostic output from other meteorological models such as TAPM. This can improve dispersion model output, particularly over complex terrain as the near surface meteorological conditions are calculated for each grid point.

CALMET (version 6.5.0) was used to simulate meteorological conditions in the region. The CALMET simulation was initialised with the gridded TAPM 3D wind field data from the 1 km grid. CALMET treats the prognostic model output as the initial guess field for the CALMET diagnostic model wind fields. The initial guess field is then adjusted for the kinematic effects of terrain, slope flows, blocking effects and 3D divergence minimisation.

CALMET was configured with twelve vertical levels with heights at 20, 60, 100, 150, 200, 250, 350, 500, 800, 1600, 2600 and 4600 metres at each grid point.

All options and factors were selected in accordance with NSW EPA CALPUFF Guidance released by TRC Environmental in 2011 except where noted below.

Key features of CALMET used to generate the wind fields are as follows:

- Domain area of 156 x 158 grid cells at 200m spacing
- 5 years modelled (1 January 2020 to 31 December 2024)
- Prognostic wind fields input as MM5/3D.dat for “initial guess” field (as generated by TAPM)
- Gridded cloud cover from prognostic relative humidity at all levels
- No extrapolation of surface wind observations to upper layers (not used in no-obs mode)
- Terrain radius of influence set to 2 km
- Maximum search radius of 10 grid cells in averaging process
- Use prognostic relative humidity
- Land use data modified to be consistent with aerial imagery.

All other options set to default.

## A2 CALPUFF DISPERSION MODELLING

CALPUFF simulates the dispersion of air pollutants to predict ground-level concentration and deposition rates across a network of receptors spaced at regular intervals, and at identified discrete locations. CALPUFF is a non-steady-state Lagrangian Gaussian puff model containing parameterisations for complex terrain effects, overwater transport, coastal interaction effects, building downwash, wet and dry removal, and simple chemical transformation. CALPUFF employs the 3D meteorological fields generated from the CALMET model by simulating the effects of time and space varying meteorological conditions on pollutant transport, transformation and removal. CALPUFF takes into account the geophysical features of the study area that affects dispersion of pollutants and ground-level concentrations of those pollutants in identified regions of interest. CALPUFF contains algorithms that can resolve near-source effects such as building downwash, transitional plume rise, partial plume penetration, sub-grid scale terrain interactions, as well as the long-range effects of removal, transformation, vertical wind shear, overwater transport and coastal interactions. Emission sources can be characterised as arbitrarily-varying point, area, volume and lines or any combination of those sources within the modelling domain.

Key features of CALPUFF used to simulate dispersion:

- Domain area of 156 x 158 grid cells at 200m spacing, which is a sub-set of the CALMET domain centred on the Site
- 5 years modelled (1 January 2020 to 31 December 2024)
- Gridded 3D hourly-varying meteorological conditions generated by CALMET
- Partial plume path adjustment for terrain modelled
- Dispersion coefficients calculated internally from sigma v and sigma w using micrometeorological variables.

All other options set to default.