Ammonia Assessment

Dunnimere Farm, Tamworth

Client: Dunnimere Poultry Ltd

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Executive Summary

Redmore Environmental Ltd was commissioned by Dunnimere Poultry Ltd to undertake an Ammonia Assessment in support of a planning application for the proposed expansion to existing poultry rearing operations at Dunnimere Farm, Tamworth.

The farm features an established poultry rearing unit. This comprises a single mechanically ventilated building which currently provides accommodation for up to 56,000 broilers. It is proposed to construct three new buildings at the site in order to increase the overall capacity of the unit to 240,000 bird places.

The proposals have the potential to result in additional ammonia emissions and associated impacts at sensitive ecological designations in the surrounding area. An Ammonia Assessment was therefore undertaken to quantify effects in the vicinity of the site.

Potential ammonia releases were defined based on the size and nature of the existing and proposed rearing operations. Impacts at sensitive receptors were quantified using dispersion modelling, the results compared with the relevant standards and the significance assessed in accordance with the appropriate guidance.

The results of the dispersion modelling indicated that impacts as a result of emissions under the proposed rearing arrangements were below the relevant significance criteria at all ecological designations. As such, it is considered that no further assessment of potential effects is required in support of planning consent for the development.

Based on the assessment results, potential ammonia emissions from the proposed expanded poultry unit are not considered to represent a constraint to the development.

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1.0 INTRODUCTION

1.1 Background

1.1.1 Redmore Environmental Ltd was commissioned by Dunnimere Poultry Ltd to undertake an Ammonia Assessment in support of a planning application for the proposed expansion to poultry rearing operations at Dunnimere Farm, Tamworth.

1.1.2 The proposals have the potential to result in ammonia (NH_3) emissions and associated impacts at sensitive ecological locations. An Ammonia Assessment was therefore undertaken to quantify effects in the vicinity of the site.

1.2 Site Location and Context

1.2.1 Dunnimere Farm is located on land off Porthway Lane, Tamworth, at National Grid Reference (NGR): 421500, 309750. Reference should be made to Figure 1 for a map of the site and surrounding area.

1.2.2 The farm features an established poultry rearing unit. This comprises a single mechanically ventilated building of conventional design which currently provides accommodation for up to 56,000 broilers.

1.2.3 It is proposed to increase the overall capacity of the unit to 240,000 bird places. This will be facilitated through the construction of three additional mechanically ventilated buildings, as well as an increase in stocking of the existing shed.

1.2.4 The expanded unit may result in additional NH_3 emissions during normal operation. These have the potential to cause impacts at sensitive ecological locations within the vicinity of the site and have therefore been assessed within this report.

2.0 AMMONIA BACKGROUND

2.1 Atmospheric Ammonia and Nitrogen Deposition

2.1.1 The breakdown of urea or uric acid in animal manures produces NH_3. As such, the potential for atmospheric emissions of NH_3 from agricultural facilities depends largely on the type of animals housed, the manure management system utilised during production and building ventilation arrangements.

2.1.2 Exposure to high concentrations of NH_3 can lead to direct damage to vegetation, as well as acute toxicity in some sensitive plants. Certain species are more sensitive than others. For example, lichens and mosses have a much lower tolerance to atmospheric NH_3 than higher plants species such as grasses and trees.

2.1.3 Atmospheric emissions of NH_3 can also lead to indirect effects on vegetation. Deposition of the nitrogen component of NH_3 on to land can cause a fertilising effect which leads to an increase in plants which thrive in a nitrogen rich environment. This may lead to competition between species and imbalances in the natural diversity of flora within the receiving habitat.

2.1.4 The combination of these effects can lead to changes in ecosystem structure and function. Some of the most significant problems resulting from NH_3 and nitrogen deposition are found at nature conservation sites located in intensive agricultural areas.

2.2 Critical Loads and Levels

2.2.1 A critical load is defined by the UK Air Pollution Information System (APIS)[1] as:

> "A quantitative estimate of exposure to deposition of one or more pollutants, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. The exceedance of a critical load is defined as the atmospheric deposition of the pollutant above the critical load."

[1] UK Air Pollution Information System, www.apis.ac.uk.

2.2.2 A critical level is defined as:

> "Threshold for direct effects of pollutant concentrations according to current knowledge. Exceedance of a critical level is defined as the atmospheric concentration of the pollutant above the critical level."

2.2.3 A critical load refers to deposition of a pollutant, while a critical level refers to pollutant concentrations in the atmosphere (which usually have direct effects on vegetation or human health).

2.2.4 When pollutant loads (or concentrations) exceed the critical load or level it is considered that there is a potential risk of harmful effects. The excess over the critical load or level is termed the exceedence. A larger exceedence is often considered to represent a greater risk of harm.

2.2.5 Maps of critical loads and levels and their exceedences have been used to show the potential extent of pollution damage and aid in developing strategies for reducing pollution. Decreasing deposition below the critical load is seen as means for preventing the risk of damage. However, even a decrease in the exceedence may infer that less harm will occur.

2.2.6 Table 1 presents the critical levels for the protection of vegetation for pollutants considered within this assessment.

Table 1 Critical Levels for the Protection of Vegetation

Pollutant	Critical Level	
	Concentration (µg/m^3)	Averaging Period
NH_3	1	Where lichens and bryophytes are present (where they form a key part of the ecosystem integrity)
	3	Other vegetation

2.2.7 Critical loads have been designated within the UK based on the sensitivity of the receiving habitat and have been identified for the relevant designations considered within the assessment in Section 3.4.

3.0 METHODOLOGY

3.1 Introduction

3.1.1 The proposed expanded poultry unit may result in NH_3 emissions during normal operation. Associated impacts were assessed in accordance with the following stages:

- Identification of NH_3 sources;
- Identification of NH_3 emission rates;
- Dispersion modelling of NH_3 emissions; and,
- Comparison of modelling results with relevant criteria.

3.1.2 The following Sections outline the methodology and inputs used for the assessment.

3.2 Ammonia Sources

3.2.1 The existing unit comprises a single building which is ventilated via 12 ridge mounted fans. The proposed buildings will utilise the same ventilation arrangements as the existing shed.

3.2.2 There is the potential for NH_3 emissions from the ridge mounted fans on the existing and proposed buildings during normal operation. As such, releases from these sources have been considered throughout the assessment.

3.2.3 Litter generated by the proposed rearing operations will be removed from site at the end of each growing cycle. As such, there will be no external storage of manure and associated emissions were therefore not considered further in the assessment.

3.3 Ammonia Emission Rates

3.3.1 NH_3 emission rates for use in the assessment were obtained from the Environment Agency (EA) 'Intensive Farming Guidance Note'[2]. The EA guidance indicates an NH_3 emission rate of 0.034kgNH_3/bird place/yr for fan ventilated broiler houses. The total release rates for the existing and proposed buildings were calculated by multiplying this value by the number of birds that will be housed. A summary of the results is provided in Table 2.

[2] Intensive Farming Guidance Note, EA, 2012.

Table 2 Total NH_3 Emission Rates - Existing and Proposed Poultry Buildings

Source	NH_3 Emission Rate (kg/place/yr)	Number of Broilers	Total NH_3 Emission (kg/yr)	Total NH_3 Emission Rate (g/s)
Existing Building	0.034	60,000	2,040	0.065
Proposed Building 1	0.034	60,000	2,040	0.065
Proposed Building 2	0.034	60,000	2,040	0.065
Proposed Building 3	0.034	60,000	2,040	0.065

3.4 Dispersion Modelling

3.4.1 Dispersion modelling was undertaken using ADMS-5.2 (v5.2.4.0), which is developed by Cambridge Environmental Research Consultants (CERC) Ltd. ADMS-5 is a short-range dispersion modelling software package that simulates a wide range of buoyant and passive releases to atmosphere. It is a new generation model utilising boundary layer height and Monin-Obukhov length to describe the atmospheric boundary layer and a skewed Gaussian concentration distribution to calculate dispersion under convective conditions.

3.4.2 The model utilises hourly meteorological data to define conditions for plume rise, transport and diffusion. It estimates the concentration for each source and receptor combination for each hour of input meteorology and calculates user-selected long-term and short-term averages.

3.4.3 The model requires input data that details the following parameters:

- Assessment area;
- Process conditions;
- Pollutant emission rates;
- Terrain information;
- Building dimensions;
- Meteorological data;
- Roughness length (z_0); and,
- Monin-Obukhov length.

3.4.4 These are detailed in the following Sections.

Modelling Scenarios

3.4.5 The scenarios considered in the modelling assessment are summarised in Table 3.

Table 3 Assessment Scenarios

Parameter	Modelled As	
	Long Term	Short Term
NH_3	Annual mean	-
Nitrogen deposition	Annual deposition	
Acid deposition	Annual deposition	

3.4.6 Predicted pollutant concentrations were summarised in the following format:

- Process contribution (PC) - Predicted pollutant level as a result of emissions from the proposed poultry sheds only; and,
- Predicted environmental concentration (PEC) - Total predicted pollutant level as a result of emissions from the proposed poultry sheds and the existing baseline.

3.4.7 Predicted ground level pollutant concentrations and deposition rates were compared with the relevant Critical Levels and Critical Loads. These criteria are collectively referred to as Environmental Quality Standards (EQSs).

Process Conditions and Emissions

3.4.8 The data shown in Table 2 was utilised with additional information provided by the applicant to define releases within the dispersion model. These are summarised within the following Section.

3.4.9 Emissions from the ridge mounted fans on the existing and proposed buildings were represented by 48-point sources within the model. A summary of the inputs is provided in Table 4.

Table 4 Model Inputs - Existing and Proposed Buildings

Parameter	Unit	Value
Number of sources (per building)	-	12
Positions	-	As shown on Figure 2
Source diameter	m	0.8
Source height	m	6.6
Source efflux velocity	m/s	11
Emission temperature	°C	22
Total NH_3 emission rate (per building)	g/s	0.065
NH_3 emission rate (per source)	g/s	0.0054

3.4.10 Emissions were assumed to be constant 24-hours per day, 365-days per year in order to provide a worst-case assessment of potential impacts.

Ecological Receptors

3.4.11 The Conservation of Habitats and Species Regulations (2010) and subsequent amendments require competent authorities to review applications and consents that have the potential to impact on ecological designations. A study was therefore undertaken to identify the following sites of ecological or nature conservation importance:

- Special Areas of Conservation (SACs), Special Protection Areas (SPAs) Sites of Special Scientific Interest (SSSI) or Ramsar sites within 10km of the unit; and,
- National Nature Reserves, Local Nature Reserves and Ancient Woodland within 2km of the unit.

3.4.12 The study was completed using the Multi-Agency Geographic Information for the Countryside (MAGIC) web-based interactive mapping service[3] which draws together information on key environmental schemes and designations. The findings indicated that

[3] Multi-Agency Geographic Information for the Countryside, www.magic.gov.uk.

the following ecological designations are located in the vicinity of the site and should be considered as part of the assessment:

- River Mease SSSI and SAC;
- Alvecote Pools SSSI;
- Stowe Pool and Walk Mill Clay Pit SSSI; and,
- Birches Barn Meadows SSSI.

3.4.13 For the purpose of the dispersion modelling, discrete receptors were placed on the closest point of the designations to the development site in order to facilitate a worst-case appraisal of potential impacts. These are summarised in Table 5.

Table 5 Ecological Receptor Locations

Receptor		NGR (m)	
		X	Y
E1	River Mease SSSI and SAC	420768.5	311697.1
E2	River Mease SSSI and SAC	421541.2	311149.2
E3	River Mease SSSI and SAC	422379.3	311114.3
E4	River Mease SSSI and SAC	423058.3	311007.7
E5	Alvecote Pools SSSI	423855.5	304907.0
E6	Alvecote Pools SSSI	424262.0	305221.3
E7	Alvecote Pools SSSI	424663.3	305385.5
E8	Stowe Pool and Walk Mill Clay Pit SSSI	412209.8	310103.0
E9	Birches Barn Meadows SSSI	427945.7	302163.8

3.4.14 Reference should be made to Figure 3 for a map of the ecological receptor locations.

Site Specific Critical Loads and Levels

3.4.15 Critical loads and levels have been designated within the UK based on the sensitivity and relevant features of the receiving habitat. A review of the APIS[4] website was undertaken

[4] http://www.apis.ac.uk/.

in order to identify the most sensitive habitats within each designation to NH_3 emissions and nitrogen and acid deposition, as well as the associated EQSs.

3.4.16 The relevant critical levels for NH_3 are summarised in Table 6.

Table 6 Critical Levels

Designation	Critical Level for NH_3 (µg/m³)
River Mease SSSI and SAC	-(a)
Alvecote Pools SSSI	3
Stowe Pool and Walk Mill Clay Pit SSSI	-(a)
Birches Barn Meadows SSSI	3

NOTE: (a) Aquatic habitat and site interest feature is not sensitive to NH_3.

3.4.17 The relevant critical loads for nitrogen deposition are presented in Table 7.

Table 7 Critical Loads for Nitrogen Deposition

Designation	Feature	Relevant Nitrogen Critical Load Class	Critical Load (kgN/ha/yr)	
			Low	High
River Mease SSSI and SAC	Cobitis taenia - Spined Loach	Rivers and streams	-(a)	-(a)
Alvecote Pools SSSI	Aythya ferina - Pochard	Pioneer, low-mid, mid-upper saltmarshes	20	30
Stowe Pool and Walk Mill Clay Pit SSSI	Austropotamobius pallipes - White-Clawed (Or Atlantic Stream) Crayfish	Rivers and Streams	-(a)	-(a)
Birches Barn Meadows SSSI	Neutral grassland (Alopecurus pratensis - Sanguisorba officinalis grassland)	Low and medium altitude hay meadows	20	30

NOTE: (a) No critical loads have been assigned to the qualifying feature at the designation.

3.4.18 The relevant acid deposition critical loads are presented in Table 8.

Table 8 Critical Loads for Acid Deposition

Designation	Feature	Relevant Acid Critical Load Class	Acid Critical Load (keq/ha/yr)		
			CLMinN	CLMaxS	CLMaxN
River Mease SSSI and SAC	Cobitis taenia - Spined Loach	Freshwater	-(a)	-(a)	-(a)
Alvecote Pools SSSI	Aythya ferina - Pochard	Littoral sediment	-(b)	-(b)	-(b)
Stowe Pool and Walk Mill Clay Pit SSSI	Austropotamobius pallipes - White-Clawed (Or Atlantic Stream) Crayfish	Rivers and streams	-(a)	-(a)	-(a)
Birches Barn Meadows SSSI	Neutral grassland (Alopecurus pratensis - Sanguisorba officinalis grassland)	Acid grassland	0.223	0.48	0.703

NOTE: (a) No critical loads have been assigned to the qualifying feature at the designation.
(b) Habitat not sensitive to acid deposition.

Baseline Pollutant Levels

3.4.19 Background NH_3 concentrations, as well as nitrogen and acid deposition rates, at each ecological receptor location were obtained from the APIS website[5]. These are summarised in Table 9. It should be noted that the reported values represent the maximum concentrations and deposition rates for the designations.

Table 9 Baseline Pollutant Levels

Receptor	Baseline Annual Mean NH_3 Conc. ($\mu g/m^3$)	Baseline Deposition Rate		
		Nitrogen (kgN/ha/yr)	Acid (keq/ha/yr)	
			Nitrogen	Sulphur
E1	3.18	13.8	1.0	0.2
E2	3.18	13.8	1.0	0.2
E3	3.18	13.8	1.0	0.2
E4	3.18	13.8	1.0	0.2

[5] http://www.apis.ac.uk/.

Receptor	Baseline Annual Mean NH_3 Conc. ($\mu g/m^3$)	Baseline Deposition Rate		
		Nitrogen (kgN/ha/yr)	Acid (keq/ha/yr)	
			Nitrogen	Sulphur
E5	2.52	21.3	1.5	0.2
E6	2.52	21.3	1.5	0.2
E7	2.52	21.3	1.5	0.2
E8	7.31	16.7	1.2	0.2
E9	2.44	20.9	1.5	0.2

Terrain Data

3.4.20 Ordnance Survey OS Terrain 50 data was included in the model for the site and surrounding area in order to take account of the specific flow field produced by variations in ground height throughout the assessment extents. This was pre-processed using the method suggested by CERC[6].

Buildings

3.4.21 The dispersion of substances released from elevated sources can be influenced by the presence of buildings close to the emission point. Structures can interrupt the wind flows and cause significantly higher ground-level concentrations close to the source than would arise in the absence of the buildings.

3.4.22 Analysis of the site layout indicated that the proposed building should be included within the model in order to take account of effects on pollutant dispersion. Input geometries are shown in Table 10.

Table 10 Building Geometries

Building	NGR (m)		Height (m)	Length (m)	Width (m)	Angle (°)
	X	Y				
Existing Building	421506.8	309745.5	6.2	24.7	113.7	111.9

6 Note 105: Setting up Terrain Data for Input to CERC Models, CERC, 2016.

Building	NGR (m)		Height (m)	Length (m)	Width (m)	Angle (°)
	X	Y				
Proposed Building 1	421537.1	309732.9	6.2	24.7	113.7	111.9
Proposed Building 2	421566.9	309721.6	6.2	24.7	113.7	111.9
Proposed Building 3	421597.7	309709.4	6.2	24.7	113.7	111.9

3.4.23 Reference should be made to Figure 2 for a map of the building locations.

Meteorological Data

3.4.24 Meteorological data used in the assessment was taken from East Midlands Airport meteorological station over the period 1st January 2015 to 31st December 2019 (inclusive). East Midlands Airport meteorological station is located at NGR: 445745, 326055, which is approximately 29.8km north-east of the development. It is anticipated that conditions would be reasonably similar over a distance of this magnitude. The data was therefore considered suitable for an assessment of this nature.

3.4.25 All meteorological files used in the assessment were provided by Atmospheric Dispersion Modelling Ltd, which is an established distributor of data within the UK. Reference should be made to Figure 4 for wind roses of utilised meteorological records.

Roughness Length

3.4.26 The z_0 is a modelling parameter applied to allow consideration of surface height roughness elements. A z_0 of 0.3m was used to describe the modelling extents. This is considered appropriate for the morphology of the area and is suggested within ADMS-5 as being suitable for 'agricultural areas (max)'.

3.4.27 A z_0 of 0.2m was used within the model to describe the meteorological site. This is considered appropriate for the morphology of the area and is suggested within ADMS-5 as being suitable for 'agricultural areas (min)'.

Monin-Obukhov Length

3.4.28 The Monin-Obukhov length provides a measure of the stability of the atmosphere. A minimum Monin-Obukhov length of 1m was used to describe the modelling extents. This value is considered appropriate for the nature of the area and is suggested within ADMS-5 as being suitable for a 'rural location'.

3.4.29 A minimum Monin-Obukhov length of 10m was used to describe the meteorological site. This value is considered appropriate for the nature of the area and is suggested within ADMS-5 as being suitable for 'small towns <50,000'.

Deposition Calculation

Stage 1 Assessment

3.4.30 Nitrogen deposition rates were calculated using the conversion factors provided within EA document 'Technical Guidance on Detailed Modelling approach for an Appropriate Assessment for Emissions to Air AQTAG 06'[7]. Predicted pollutant concentrations were multiplied by the relevant deposition velocity and conversion factor to calculate the speciated dry deposition flux. The conversion factors used for the determination of nitrogen deposition are presented within Table 11.

Table 11 Conversion Factors to Determine Dry Deposition Flux for Nitrogen Deposition

Pollutant	Deposition Velocity (m/s)		Conversion Factor (µg/m²/s to kg/ha/yr of pollutant species)
	Grassland	Forest	
NH_3	0.020	0.030	260

3.4.31 The relevant deposition velocity for each ecological receptor was selected from Table 11 based on the vegetation type present within the designation.

3.4.32 Predicted ground level NH_3 concentrations were converted to kilo-equivalent ion depositions (keq/ha/yr) for comparison with the critical load for acid deposition at each

[7] Technical Guidance on Detailed Modelling approach for an Appropriate Assessment for Emissions to Air AQTAG 06, EA, 2014.

of the identified ecological receptors. The conversion to units of equivalents, a measure of the potential acidifying effect of a species, was undertaken using the standard conversion factors shown in Table 12.

Table 12 Conversion Factors to Determine Dry Deposition Flux for Acid Deposition

Pollutant	Deposition Velocity (m/s)		Conversion Factor (µg/m²/s to keq/ha/yr of pollutant species)
	Grassland	Forest	
NH_3	0.02	0.03	18.5

3.4.33 The following formula was used to calculate predicted PCs as a proportion of the critical load function where PECs were identified to be greater than the CLminN value.

PC as %CL function = ((PC of S+N deposition)/CLmaxN) x 100

3.4.34 The above formula was obtained from the APIS website[8].

3.4.35 It should be noted that plume depletion was turned off for the Stage 1 Assessment.

Stage 2 Assessment

3.4.36 Scientific literature suggests that the dry deposition velocity of NH_3 is concentration dependent and is significantly reduced at high concentrations, i.e. from 0.02m/s to 0.03m/s at ambient concentration down to approximately 0.003m/s at a long-term average over 80µg/m³ [9] [10]. When the concentration dependence of the deposition velocity is considered, the reported cumulative depletion ratio (the ratio of NH_3 deposited to the total emitted) was about 10% at 500m to 1,000m downwind[11] [12].

8 http://www.apis.ac.uk/.

9 Walker J, Spence P, Kimbrough S and Robarge W, 2008. Inferential model estimates of ammonia dry deposition in the vicinity of a swine production facility. Atmospheric Environment 42, 3407-3418.

10 Cape JN, Jones MR, Leith ID, Sheppard LJ, van Dijk N, Sutton MA, Fowler D, Estimate of annual NH3 dry deposition to a fumigated ombrotrophic bog using concentration-dependant deposition velocities. Atmospheric Environment 42 (2008) 6637-6646.

11 Walker J, Spence P, Kimbrough S and Robarge W, 2008. Inferential model estimates of ammonia dry deposition in the vicinity of a swine production facility. Atmospheric Environment 42, 3407-3418.

12 Cape JN, Jones MR, Leith ID, Sheppard LJ, van Dijk N, Sutton MA, Fowler D, Estimate of annual NH3 dry deposition to a fumigated ombrotrophic bog using concentration-dependant deposition velocities. Atmospheric Environment 42 (2008) 6637-6646.

3.4.37 In order to represent the above within the model, the Stage 2 Assessment utilised the variable concentration dependent deposition velocity function within ADMS-5, as outlined within EA guidance[13]. This utilised the concentrations predicted in Stage 1 to determine location specific deposition velocities throughout the assessment extents. This provided predicted annual mean NH_3 concentrations and deposition rates for comparison with the relevant criteria.

3.4.38 It should be noted that plume depletion was turned on for the Stage 2 Assessment.

Assessment Criteria

3.4.39 A summary of the assessment criteria utilised to provide interpretation of the modelling results is provided in the following Sections.

Environment Agency Guidance

3.4.40 The EA guidance 'Intensive farming risk assessment for your environmental permit'[14] provides screening thresholds for the assessment of predicted PCs to atmospheric NH_3 concentrations and nitrogen/acid deposition rates at ecological designations. A summary of the relevant criteria is provided in Table 13.

Table 13 EA Screening Thresholds

Designation	Lower Threshold (%)	Upper Threshold (%)
SPAs, SACs and Ramsar sites	4	20
SSSIs	20	50

3.4.41 The guidance indicates that if predicted PCs are less than the lower threshold of the relevant critical level or load, no further detailed assessment of potential impacts is required.

[13] Guidance on Modelling the Concentration and Deposition of Ammonia Emitted from Intensive Farming, Environment Agency, 2010.

[14] https://www.gov.uk/guidance/intensive-farming-risk-assessment-for-your-environmental-permit.

3.4.42 If predicted PCs are above the upper threshold of the relevant critical level or load, further detailed modelling is required in order to quantify potential effects.

3.4.43 If predicted PCs are above the lower threshold but less than the upper threshold of the relevant critical level or load, further detailed assessment may be required in order to determine the potential for in-combination effects due to other agricultural installations in the vicinity of the site.

Natural England Advisory Criteria

3.4.44 NE are a statutory consultee for planning applications in England. Review of consultation reports prepared by NE in relation to agricultural developments which are exempt from regulation by the EA under the Environmental Permitting (England and Wales) Regulations (2016) and subsequent amendments, such as the proposed expanded unit, indicates that the following advisory screening thresholds are applicable to predicted PCs to atmospheric NH_3 concentrations and nitrogen/acid deposition rates at statutory ecological designations:

- 1% of the relevant critical level or load at SACs, SPAs and Ramsar sites; and,
- 4% of the relevant critical level or load at SSSIs.

3.4.45 Should predicted PCs exceed the thresholds at relevant ecological designations, there is usually a requirement to consider whether there is the potential for in-combination effects as a result of emissions from other agricultural installations in the vicinity of the site.

3.4.46 It should be noted that the stated screening thresholds are advisory and have not been published as part of any formal guidance produced by NE. However, interpretation of the modelling results has been undertaken with reference to the criteria in order to determine an indicative requirement for further assessment as a result of emissions from the proposed development.

Modelling Uncertainty

3.4.47 Uncertainty in dispersion modelling predictions can be associated with a variety of factors, including:

- Model uncertainty - due to model limitations;
- Data uncertainty - due to errors in input data, including emission estimates, operational procedures, land use characteristics and meteorology; and,
- Variability - randomness of measurements used.

3.4.48 Potential uncertainties in the model results were minimised as far as practicable and worst-case inputs used in order to provide a robust assessment. This included the following:

- Choice of model - ADMS-5 is a commonly used atmospheric dispersion model and results have been verified through a number of studies to ensure predictions are as accurate as possible;
- Meteorological data - Modelling was undertaken using five annual meteorological data sets from a local observation station in order to take account of conditions at the site. The assessment was based on the worst-case year to ensure maximum concentrations were considered;
- Surface characteristics - The z_0 and Monin-Obukhov length were determined for both the dispersion and meteorological sites based on the surrounding land uses and guidance provided by CERC. Terrain data was included and processed using the method outlined by CERC;
- Emission rates - Emission rates were derived from EA guidance. As these values have been validated and reported at similar facilities, they are considered to be representative of potential releases during normal operation;
- Proposed conditions - Operational parameters were provided by the applicant to describe the existing and proposed rearing operations at the farm. As such, these are considered to be representative of anticipated operating conditions; and,
- Variability - All model inputs are as accurate as possible and worst-case conditions were considered as necessary in order to ensure a robust assessment of potential pollutant concentrations.

3.4.49 Results were considered in the context of the relevant EQSs, EA and NE criteria. It is considered that the use of the stated measures to reduce uncertainty and the use of worst-case assumptions when necessary has resulted in model accuracy of an acceptable level.

4.0 ASSESSMENT

4.1 Introduction

4.1.1 Dispersion modelling was undertaken using the input data specified previously. The results are summarised in the following Sections.

4.2 Ammonia

4.2.1 Predicted annual mean NH_3 PCs at the ecological receptor locations are summarised in Table 14.

Table 14 Predicted Annual Mean NH_3 PC Concentrations

Receptor		Predicted Annual Mean NH_3 PC (µg/m³)				
		2015	2016	2017	2018	2019
E1	River Mease SSSI and SAC	0.014	0.014	0.016	0.012	0.016
E2	River Mease SSSI and SAC	0.046	0.033	0.044	0.046	0.046
E3	River Mease SSSI and SAC	0.083	0.065	0.081	0.071	0.082
E4	River Mease SSSI and SAC	0.044	0.048	0.047	0.036	0.043
E5	Alvecote Pools SSSI	0.003	0.003	0.002	0.003	0.003
E6	Alvecote Pools SSSI	0.003	0.003	0.003	0.003	0.002
E7	Alvecote Pools SSSI	0.003	0.003	0.003	0.003	0.002
E8	Stowe Pool and Walk Mill Clay Pit SSSI	0.001	0.001	0.001	0.001	0.001
E9	Birches Barn Meadows SSSI	0.001	0.001	0.001	0.001	0.001

4.2.2 Maximum predicted annual mean NH_3 concentrations at the ecological receptor locations are summarised in Table 15.

Table 15 Maximum Predicted Annual Mean NH_3 PC Concentrations

Receptor		Maximum Predicted Annual Mean NH_3 PC Concentration ($\mu g/m^3$)	PC Proportion of EQS (%)
E1	River Mease SSSI and SAC	0.016	-
E2	River Mease SSSI and SAC	0.046	-
E3	River Mease SSSI and SAC	0.083	-
E4	River Mease SSSI and SAC	0.048	-
E5	Alvecote Pools SSSI	0.003	0.1
E6	Alvecote Pools SSSI	0.003	0.1
E7	Alvecote Pools SSSI	0.003	0.1
E8	Stowe Pool and Walk Mill Clay Pit SSSI	0.001	-
E9	Birches Barn Meadows SSSI	0.001	-

4.2.3 As shown in Table 15, the predicted PC proportion of the EQS was less than 1% at Alvecote Pools SSSI. As such, in accordance with the EA guidance and the advisory NE criteria, impacts are not considered to be significant and no further assessment of potential effects at the designation as a result of NH_3 emissions is required.

4.3 Nitrogen Deposition

4.3.1 Predicted annual nitrogen PC deposition rates at the receptor locations are summarised in Table 16.

Table 16 Predicted Annual PC Nitrogen Deposition Rates

Receptor		Predicted Annual PC Nitrogen Deposition Rate (kgN/ha/yr)				
		2015	2016	2017	2018	2019
E1	River Mease SSSI and SAC	0.072	0.074	0.084	0.065	0.085
E2	River Mease SSSI and SAC	0.240	0.172	0.227	0.240	0.240
E3	River Mease SSSI and SAC	0.432	0.336	0.424	0.367	0.424
E4	River Mease SSSI and SAC	0.231	0.250	0.243	0.187	0.223

Receptor		Predicted Annual PC Nitrogen Deposition Rate (kgN/ha/yr)				
		2015	2016	2017	2018	2019
E5	Alvecote Pools SSSI	0.022	0.024	0.018	0.020	0.020
E6	Alvecote Pools SSSI	0.025	0.025	0.020	0.022	0.019
E7	Alvecote Pools SSSI	0.025	0.024	0.021	0.022	0.018
E8	Stowe Pool and Walk Mill Clay Pit SSSI	0.004	0.005	0.003	0.005	0.005
E9	Birches Barn Meadows SSSI	0.005	0.005	0.005	0.005	0.004

4.3.2 Maximum predicted annual nitrogen deposition rates at the receptor locations are summarised in Table 17.

Table 17 Maximum Predicted Annual PC Nitrogen Deposition Rates

Receptor		Maximum Predicted Annual PC Nitrogen Deposition Rate (kgN/ha/yr)	PC Proportion of EQS (%)	
			Low EQS	High EQS
E1	River Mease SSSI and SAC	0.085	-	-
E2	River Mease SSSI and SAC	0.240	-	-
E3	River Mease SSSI and SAC	0.432	-	-
E4	River Mease SSSI and SAC	0.250	-	-
E5	Alvecote Pools SSSI	0.024	0.1	0.1
E6	Alvecote Pools SSSI	0.025	0.1	0.1
E7	Alvecote Pools SSSI	0.025	0.1	0.1
E8	Stowe Pool and Walk Mill Clay Pit SSSI	0.005	-	-
E9	Birches Barn Meadows SSSI	0.005	0.0	0.0

4.3.3 As shown in Table 17, the predicted PC proportion of the EQS was less than 1% at all ecological designations. As such, in accordance with the EA guidance and the advisory NE criteria, impacts are not considered to be significant and no further assessment of potential effects at the designation as a result of nitrogen deposition is required.

4.4 Acid Deposition

4.4.1 Predicted annual acid PC deposition rates at the ecological receptor locations are summarised in Table 18.

Table 18 Predicted Annual PC Acid Deposition Rates

Receptor		Predicted Annual PC Acid Deposition Rate (keg/ha/yr)				
		2015	2016	2017	2018	2019
E1	River Mease SSSI and SAC	0.005	0.005	0.006	0.005	0.006
E2	River Mease SSSI and SAC	0.017	0.012	0.016	0.017	0.017
E3	River Mease SSSI and SAC	0.031	0.024	0.030	0.026	0.030
E4	River Mease SSSI and SAC	0.016	0.018	0.017	0.013	0.016
E5	Alvecote Pools SSSI	0.002	0.002	0.001	0.001	0.001
E6	Alvecote Pools SSSI	0.002	0.002	0.001	0.002	0.001
E7	Alvecote Pools SSSI	0.002	0.002	0.002	0.002	0.001
E8	Stowe Pool and Walk Mill Clay Pit SSSI	0.000	0.000	0.000	0.000	0.000
E9	Birches Barn Meadows SSSI	0.000	0.000	0.000	0.000	0.000

4.4.2 Maximum predicted annual acid deposition rates at the ecological receptor locations are summarised in Table 19.

Table 19 Maximum Predicted Annual PC Acid Deposition Rates

Receptor		Maximum Predicted Annual PC Acid Deposition Rate (keq/ha/yr)	Proportion of EQS (%)
E1	River Mease SSSI and SAC	0.006	-
E2	River Mease SSSI and SAC	0.017	-
E3	River Mease SSSI and SAC	0.031	-
E4	River Mease SSSI and SAC	0.018	-
E5	Alvecote Pools SSSI	0.002	-

Receptor		Maximum Predicted Annual PC Acid Deposition Rate (keq/ha/yr)	Proportion of EQS (%)
E6	Alvecote Pools SSSI	0.002	-
E7	Alvecote Pools SSSI	0.002	-
E8	Stowe Pool and Walk Mill Clay Pit SSSI	0.000	-
E9	Birches Barn Meadows SSSI	0.000	0.1

4.4.3 As shown in Table 19, the predicted PC proportion of the EQS was less than 1% at Birches Barn Meadows SSSI. As such, in accordance with the EA guidance and the advisory NE criteria, impacts are not considered to be significant and no further assessment of potential effects at the designation as a result of acid deposition is required.

5.0 CONCLUSION

5.1.1 Redmore Environmental Ltd was commissioned by Dunnimere Poultry Ltd to undertake an Ammonia Assessment in support of a planning application for the proposed expansion to poultry rearing operations at Dunnimere Farm, Tamworth.

5.1.2 The farm features an established poultry rearing unit. This comprises a single mechanically ventilated building which currently provides accommodation for up to 56,000 broilers. It is proposed to construct three new buildings at the site in order to increase the overall capacity of the unit to 240,000 bird places.

5.1.3 The proposals have the potential to result in additional NH_3 emissions and associated impacts at sensitive ecological designations in the surrounding area. An Ammonia Assessment was therefore undertaken to quantify effects in the vicinity of the site.

5.1.4 Potential NH_3 releases were defined based on the size and nature of the existing and proposed poultry rearing operations. These were represented within a dispersion model produced using ADMS-5. Impacts at sensitive ecological designations in the vicinity of the site were quantified, the results compared with relevant standards and the significance assessed in accordance with the relevant criteria.

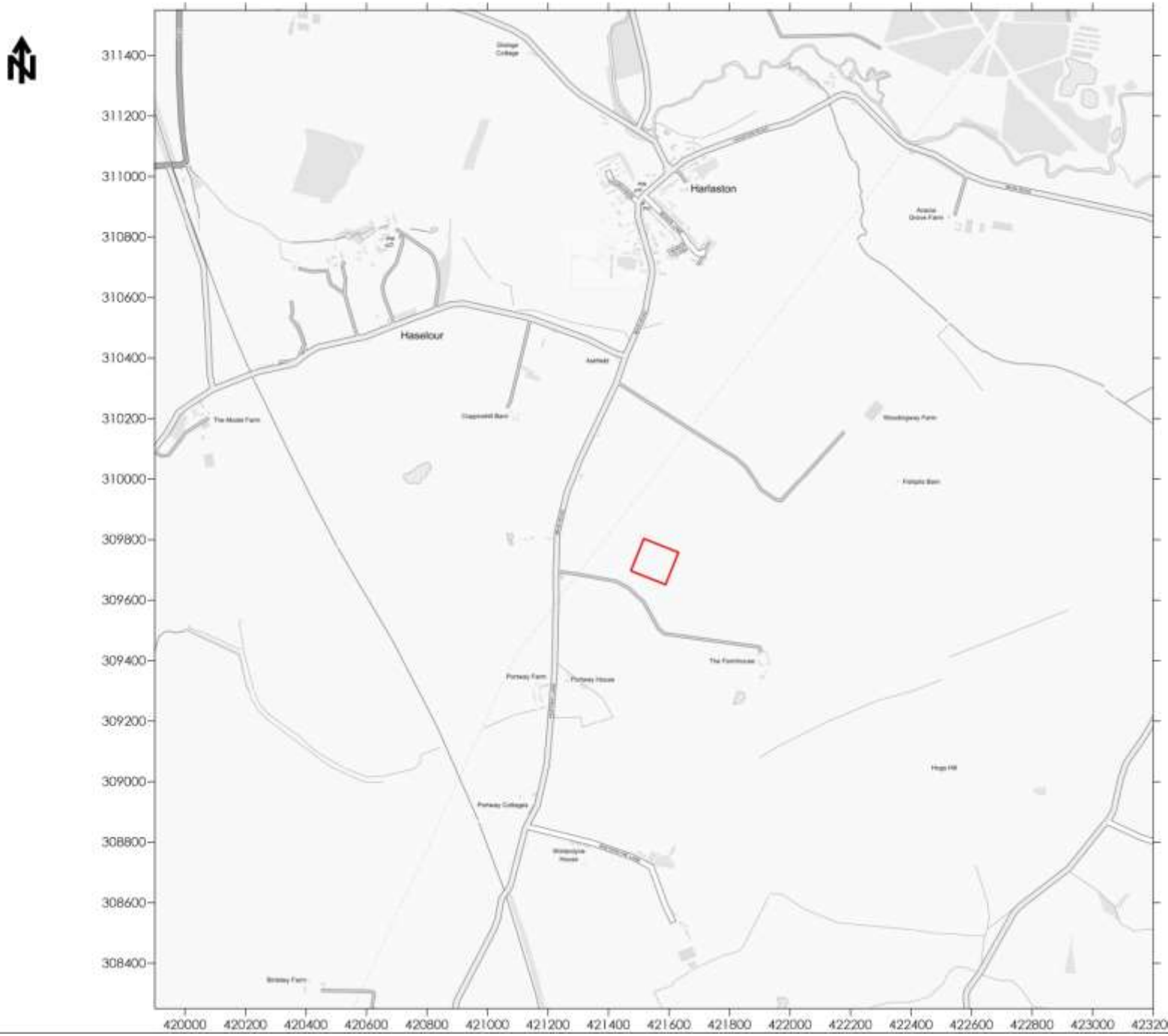
5.1.5 The results of the dispersion modelling indicated that impacts as a result of emissions from the proposed development were below the relevant significance criteria at all ecological designations. As such, impacts are not considered to be significant and no further assessment of potential effects is required in support of planning consent for the scheme.

5.1.6 Based on the assessment results, potential NH_3 emissions from the proposed expanded poultry unit are not considered to represent a constraint to the development.

6.0 ABBREVIATIONS

APIS	UK Air Pollution Information System
CERC	Cambridge Environmental Research Consultants
DEFRA	Department for Environment, Food and Rural Affairs
EA	Environment Agency
EQS	Environmental Quality Standards
NE	Natural England
NGR	National Grid Reference
NH_3	Ammonia
PC	Process Contribution
PEC	Process Environmental Concentration
SAC	Special Area of Conservation
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest

Figures



Legend

Proposed Expanded Poultry Unit

Title
Figure 1 - Site Location

Project
Ammonia Assessment
Dunnimere Farm, Tamworth

Project Reference
5293

Client
Dunnimere Poultry Ltd

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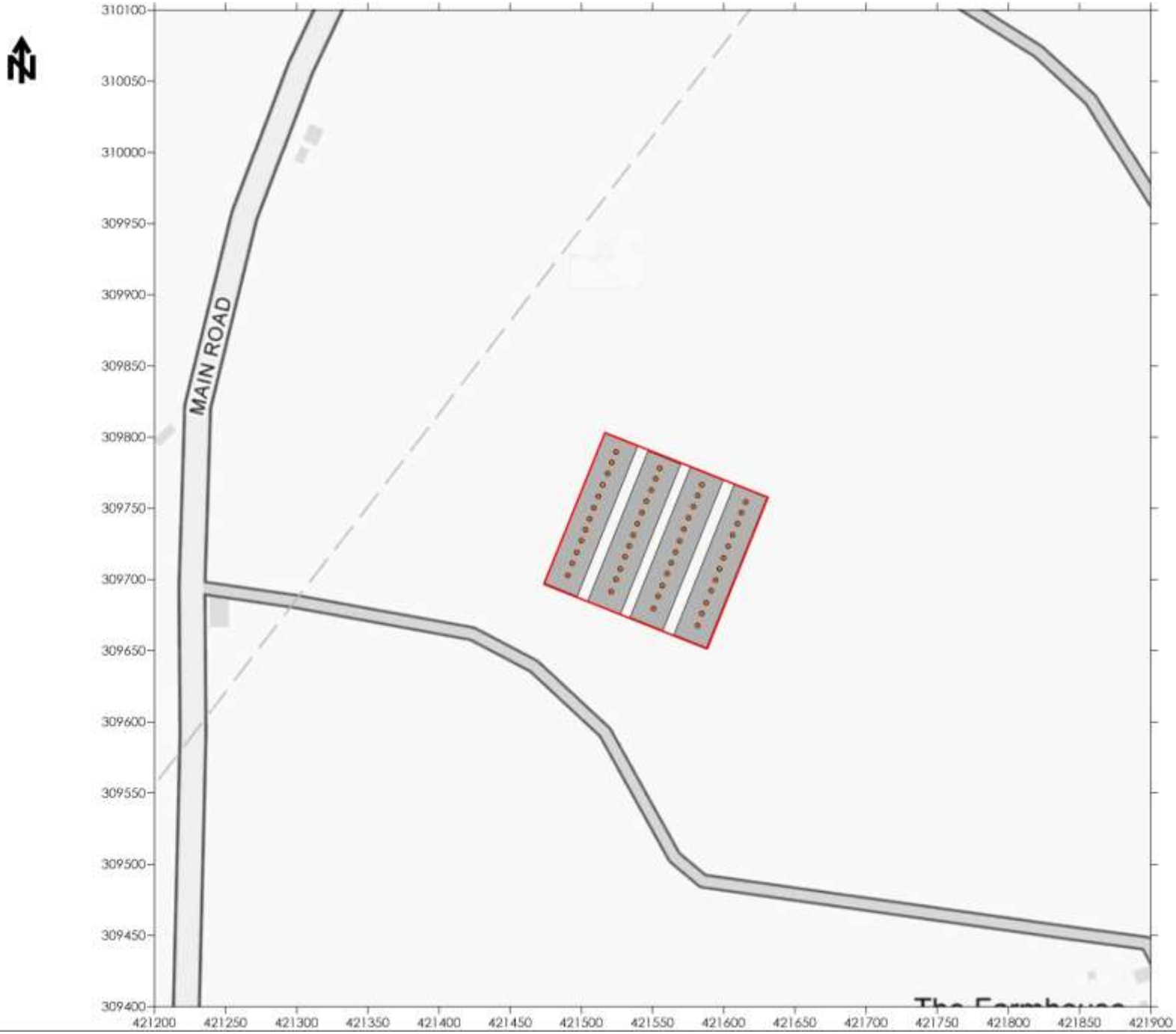
www.red-env.co.uk | 0161 7060075



Legend

- Proposed Expanded Poultry Unit
- Building
- Point Source

Title
Figure 2 - ADMS-5 Inputs

Project
Ammonia Assessment
Dunnimere Farm, Tamworth

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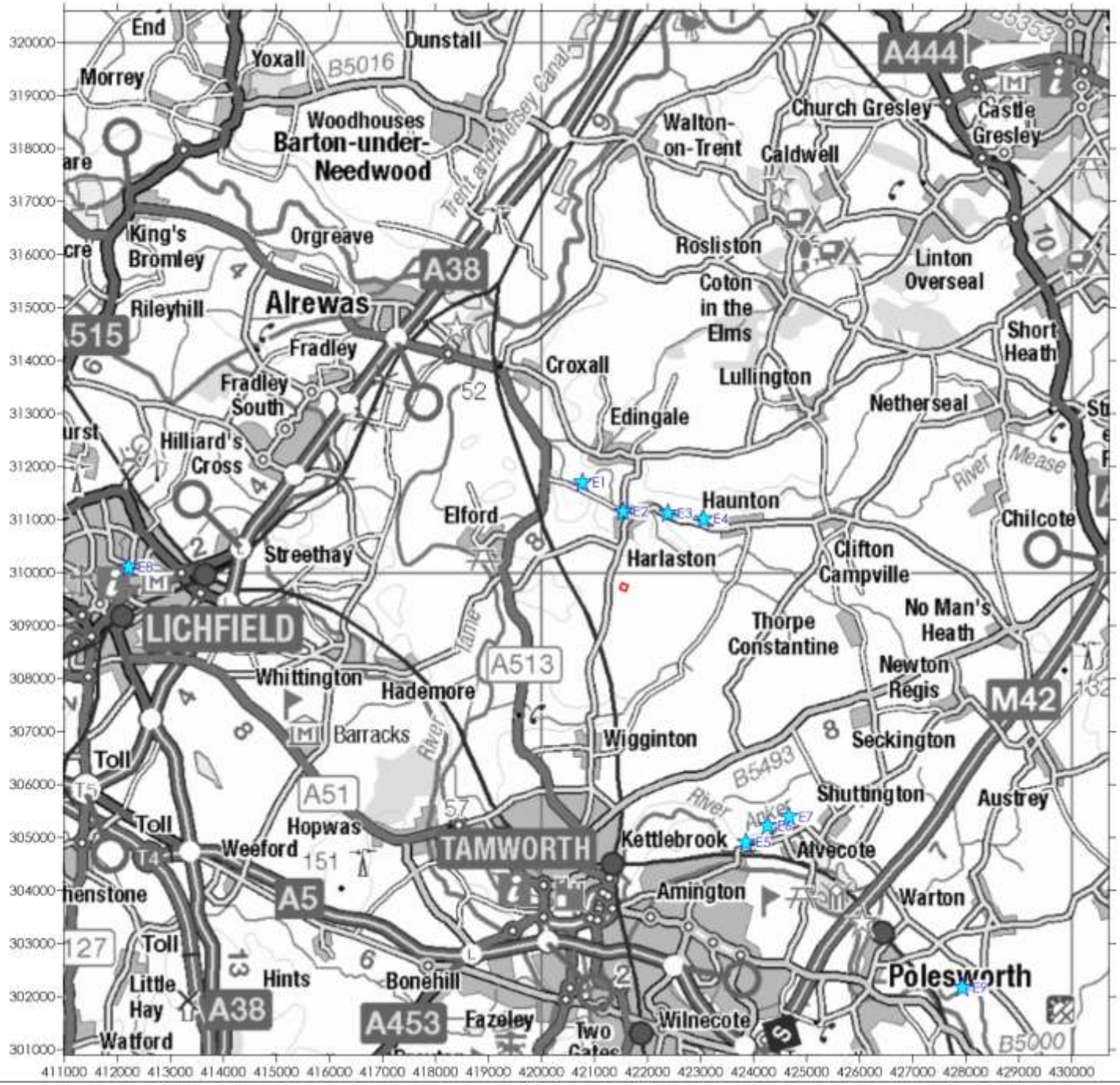

Legend

Proposed Expanded Poultry Unit

Ecological Receptor

Title
Figure 3 - Ecological Receptor Locations

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Ammonia Assessment
Dunnimere Farm, Tamworth

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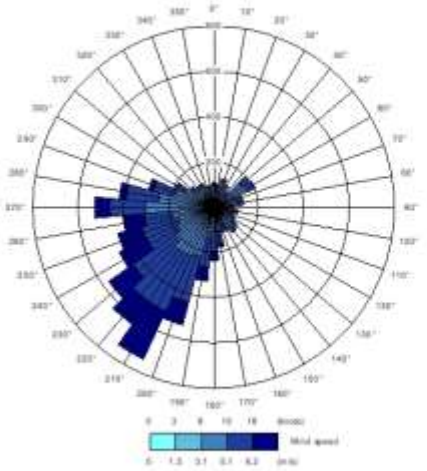
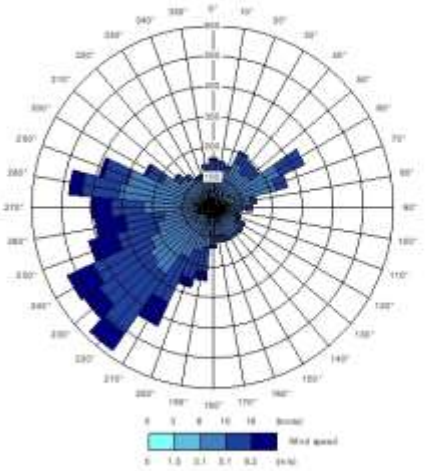


2015 Meteorological Data



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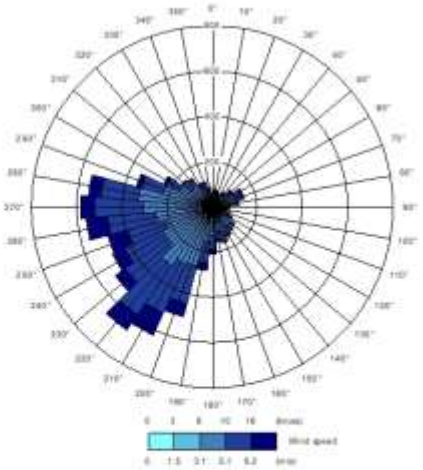

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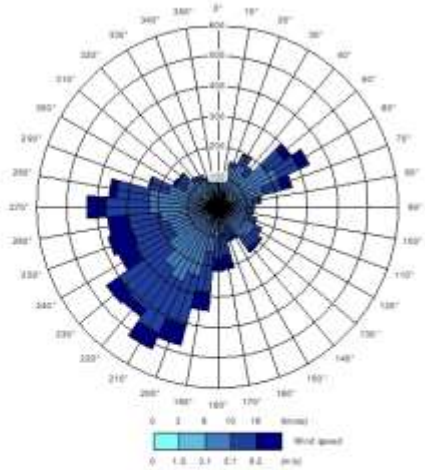
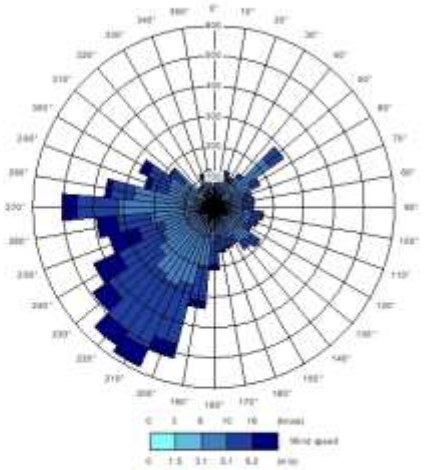


2018 Meteorological Data



2019 Meteorological Data

Legend

Title
Figure 4 - Wind Roses of 2015 to 2019 East Midlands Airport Meteorological Data

Project
Ammonia Assessment
Dunnimere Farm, Tamworth

Project Reference
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