A Report on the Modelling of the Dispersion and Deposition of Ammonia from the Existing and Proposed Broiler Chicken Rearing Houses at Allisons Farm, High Dyke, near Great Ponton in Lincolnshire

AS Modelling & Data Ltd.

www.asmodata.co.uk

Prepared by Steve Smith

stevesmith@asmodata.co.uk
07523 993370
2nd May 2026

Reviewed by Sally Young

BSc (Hons), MSc, CSci, MIEnvSc, MIAQM
sally@asmodata.co.uk
07483 345124
3rd May 2026

1. Introduction

AS Modelling & Data Ltd. has been instructed by Mr. Ian Pick of Harrison Pick Ltd. to use computer modelling to assess the impact of ammonia emissions from the existing and proposed broiler chicken rearing houses at Allisons Farm, High Dyke, Great Ponton, Grantham, Lincolnshire. NG33 5DY.

Ammonia emission rates from the existing and proposed broiler chicken rearing houses have been assessed and quantified based upon the Environment Agency standard ammonia emission factors. The emission rates have then been used as inputs to an atmospheric dispersion and deposition model which calculates ammonia exposure levels and nitrogen and acid deposition rates in the surrounding area.

This report is arranged in the following manner:

- Section 2 provides relevant details of the site and potentially sensitive receptors in the area.
- Section 3 provides some general information on ammonia; details of the method used to estimate ammonia emissions; relevant guidelines and legislation on exposure limits and where relevant, details of likely background levels of ammonia.
- Section 4 provides some information about ADMS, the dispersion model used for this study and details the modelling procedure.
- Section 5 contains the results of the modelling.
- Section 6 provides a discussion of the results and conclusions.

2. Background Details

The poultry houses at Allisons Farm are in a rural area, approximately 1.1 km to the north-east of the village of Great Ponton in Lincolnshire. The site is at an elevation of between 100 m and 105 m with the land rising towards slightly higher ground to the east and falling towards the valley formed by the River Witham to the west. The surrounding land is used predominantly for arable farming, however, there are some wooded areas and pasture.

There are six existing poultry houses at Allisons Farm, which are used to rear up to 270,000 broiler chickens. The existing houses are ventilated by high-speed ridge/roof mounted fans, each with a short chimney and have gable end fans for use in hot weather conditions. The birds are raised from day old chicks to around 38 days old (with a maximum stocking density of 38 kg/m^2) and there are around 7.5 flocks per year.

It is proposed that two new poultry rearing houses be constructed to the south of the existing houses. The new poultry houses would be ventilated by high-speed ridge fans, each with a short chimney and would have gable end fans for use in hot weather conditions. As proposed, the capacity of the farm would remain at 270,000 broiler chickens; however, the additional floorspace would allow stocking densities to be reduced. The birds would be raised from day old chicks to around 38 days old (with a maximum stocking density of 30 kg/m^2) and there would be around 7.5 flocks per year.

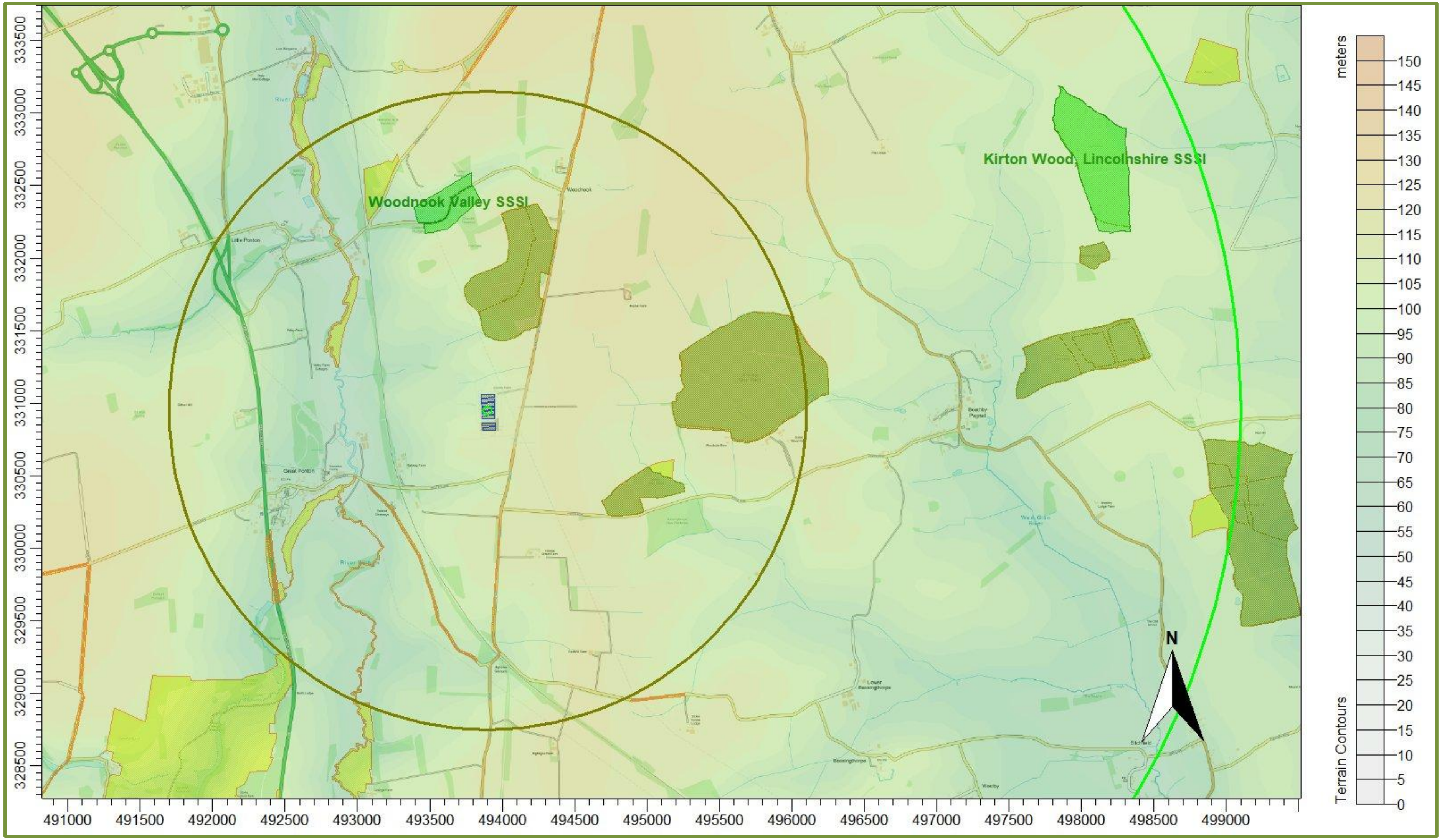
AS Modelling & Data Ltd. have identified several Local Wildlife Sites (LWSs) within 2 km of the site (the normal screening distance for non-statutory wildlife sites). Three of the LWSs are wholly, or partly designated as Ancient Woodlands (AWs). There are two Sites of Special Scientific Interest (SSSIs) within 5 km of the site (Natural England and Environment Agency screening distance). There are no internationally designated wildlife sites within 10 km of the site (Natural England screening distance). Some further details of the SSSIs are provided below:

- **Woodnook Valley SSSI** - Approximately 1.1 km to the north-north-west - A very good representative example of calcareous grassland. Since the fields are grazed, grasses are not dominant over most of the site, and characteristic limestone herbs are very well represented. The southern field has a northern aspect and is rich in mosses.

- **Kirton Wood, Lincolnshire SSSI** - Approximately 4.3 km to the east-north-east - A species-rich example of ash-lime woodland with a rich ground flora is present. South of Kirton Wood is an area of damp unimproved neutral grassland with several plants that are characteristic of calcareous clay pastures.

A map of the surrounding area showing the positions of: the poultry houses (outlined in blue); the LWSs (shaded in yellow); the AWs (shaded in olive) and the SSSIs (shaded in green) is provided in Figure 1.

Figure 1. The area surrounding Allisons Farm – concentric circles radii 2.2 km and 5.2 km



3. Ammonia, Background Levels, Critical Levels & Loads & Emission Rates

3.1 Ammonia concentration and nitrogen and acid deposition

When assessing potential impact on ecological receptors, ammonia concentration is usually expressed in terms of micrograms of ammonia per metre cubed of air (μg-NH_3/m^3) as an annual mean. Ammonia in the air may exert direct effects on the vegetation or indirectly affect the ecosystem through deposition which causes both hyper-eutrophication (excess nitrogen enrichment) and acidification of soils. Nitrogen deposition, specifically in this case the nitrogen load due to ammonia deposition/absorption, is usually expressed in kilograms of nitrogen per hectare per year (kg-N/ha/y). Acid deposition is expressed in terms of kilograms equivalent (of H^+ ions) per hectare per year (keq/ha/y).

3.2 Background ammonia levels and nitrogen and acid deposition

The source of the background figures is the Air Pollution Information System (APIS, April 2026). It should be noted that the 1 km APIS database background levels are extrapolated from 5 km modelled data. Ammonia levels may vary markedly over relatively short distances and the APIS website itself notes that, the background values should be used only to assist the user in obtaining a broad indication of the likely pollutant impact at a specific location and cannot be considered representative of any particular location within the 5 km grid square; extrapolation to a 1 km grid does not alter this.

The APIS figures for background ammonia concentration (2021) in the area around the site is 1.48 μg-NH_3/m^3. The background nitrogen deposition rate to woodland is 29.42 kg-N/ha/y and to short vegetation is 15.82 kg-N/ha/y. The background acid deposition rate to woodland is 2.03 keq/ha/y and to short vegetation is 1.05 keq/ha/y.

The APIS background figures are subject to correction and revision and appear to change fairly frequently, the latest figures can be obtained at https://www.apis.ac.uk/app.

In most cases, the APIS background figures, which are modelled, extrapolated and statistically manipulated figures, nevertheless, are the only figures available and although it is noted that the background values should be used only to assist in obtaining a broad indication of the likely pollutant impact, it is also noted that across the majority of the UK the lower bounds of the Critical Level and Critical Load are already exceeded.

3.3 Critical Levels & Critical Loads

Critical Levels and Critical Loads are a benchmark for assessing the risk of air pollution impacts to ecosystems. It is important to distinguish between a Critical Level and a Critical Load. The Critical Level is the gaseous concentration of a pollutant in the air, whereas the Critical Load relates to the quantity of pollutant deposited from air to the ground.

Critical Levels are defined as, "concentrations of pollutants in the atmosphere above which direct adverse effects on receptors, such as human beings, plants, ecosystems or materials, may occur according to present knowledge" (UNECE).

Critical Loads are defined as, "a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge" (UNECE). However, AS Modelling & Data Ltd. would note that effects have been shown to occur at loads that are well below existing Critical Loads (as currently defined) and that these effects are likely to adversely impact the most sensitive species first. Furthermore, recent research suggests that responses are far from linear and where background levels are high and sensitive species that may be associated with the habitat have already been negatively impacted, or indeed are now absent, responses to changes in nitrogen load (in terms of biodiversity) are relatively limited compared to where background levels are low. Therefore, what is deemed significant (in terms of a percentage of Critical Load), where background levels are low, is not necessarily significant where background levels are high.

For ammonia concentration in air, the Critical Level for higher plants is 3.0 $\mu g\text{-}NH_3/m^3$ as an annual mean. For sites where there are sensitive lichens and bryophytes present, or where lichens and bryophytes are an integral part of the ecosystem, the Critical Level is 1.0 $\mu g\text{-}NH_3/m^3$ as an annual mean.

Critical Loads for nutrient nitrogen are set under the Convention on Long-Range Transboundary Air Pollution. They are based on empirical evidence, mainly observations from experiments and gradient studies. Critical Loads are given as ranges (e.g. 10-20 kg-N/ha/y); these ranges reflect variation in ecosystem response across Europe.

The Critical Levels and Critical Loads at the wildlife sites used as the assessment criteria at the relevant receptor locations are provided in Table 1. N.B. Where the Critical Level of 1.0 $\mu g\text{-}NH_3/m^3$ is assumed, it is usually unnecessary to consider the Critical Load as the Critical Level provides the stricter test. However, it may be necessary to consider nitrogen deposition should a Critical Load of 5.0 kg-N/ha/y be appropriate.

Normally, the Critical Load for nitrogen deposition provides a stricter test than the Critical Load for acid deposition, therefore acid deposition has not been considered further.

Please note that the assessment requirement is to use the lower bound of the range of Critical Loads for habitats that are present; however, the APIS database (https://www.apis.ac.uk/app) may contain Critical Levels and Critical Loads for species/habitats that are not present at the site, or not present at the parts of the site under consideration.

Table 1. Critical Levels and Critical Loads at the wildlife sites

Site	Critical Level ($\mu g\text{-}NH_3/m^3$)	Critical Load - Nitrogen Deposition (kg-N/ha/y)	Critical Load - Acid Deposition (keq/ha/y)
LWSs and AWs	1.0 [1 & 2]	-	-
Woodnook Valley SSSI	1.0 [1 & 2]	10.0 [2 & 3]	
Kirton Wood, Lincolnshire SSSI	1.0 [1 & 2]	15.0 [2 & 3]	

1. A precautionary figure used where details of the site are entirely unknown, or where although citations do not explicitly mention lichens or bryophytes, they are likely to be present.
2. Based upon the citation for the site. Please note that in some cases, the APIS database contains Critical Levels/Loads for habitats/species that are not present, or not present at the site.
3. The lower bound of the range of Critical Loads for habitats present at the site (Review and revision of empirical critical loads of nitrogen for Europe 2022). Please note that the APIS database may contain Critical Loads for habitats/species that are not present at the site.

3.4 Guidance on the Significance of Ammonia Emissions

3.4.1 Environment Agency Criteria

The Environment Agency and Department for Environment, Food & Rural Affairs published guidance, "Intensive farming risk assessment for your environmental permit" (last updated August 2025) applies to ammonia emitting developments requiring a permit. The Environment Agency ammonia screening thresholds for designated nature conservation sites are given in Table 2.

Table 2. Environment Agency Screening Thresholds

Nature conservation site designation	Distance from site (km)	Lower threshold %	Upper threshold %
Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Ramsar sites	5	1	No upper threshold
Sites of Special Scientific Interest (SSSIs)	5	20	50
Local nature sites (National Nature Reserves, Local Nature Reserves, Local Wildlife Sites, Ancient Woodlands)	2	100	100

If the predicted process contributions to Critical Level or Critical Load are below the lower threshold percentage, the impact is usually deemed acceptable.

If the predicted process contributions to Critical Level or Critical Load are in the range between the lower and upper thresholds, whether or not the impact is deemed acceptable is at the discretion of the Environment Agency. In making their decision, the Environment Agency will consider whether other farming installations might act in-combination with the farm and the sensitivities of the wildlife sites. In the case of LWSs and AWs, the Environment Agency do not usually consider other farms that may act in-combination and therefore a Process Contribution of up to 100% of Critical Level and/or Critical Load is usually deemed acceptable for permitting purposes and therefore the upper and lower thresholds are the same (100%).

3.4.2 Natural England guidance for Local Authorities

Natural England, a statutory consultee at planning, published the "Air pollution and development: advice for local authorities" guidance document in October 2025, which is applicable to ammonia assessments of agricultural proposals in England.

For livestock and poultry units (over 500 m^2 floorspace) the screening distance for SSSIs is 5 km and for habitats sites (SPAs, SAC's and Ramsar Sites) is 10 km. It should be noted that Natural England screening distances may differ from the Environment Agency and Department for Environment, Food & Rural Affairs published guidance.

If the predicted process contributions of the proposal to the relevant Critical Level and/or Critical Load are 1% or more further assessment may be required. If a proposal does not exceed 1% of the Critical Level and/or Critical Load alone, the Local Authority should consider the proposal in-combination. It is a legal requirement to assess process contributions in-combination for habitats sites (SPAs, SACs and Ramsar sites) only. In-combination assessment would not be required where the proposal would result in a reduction in emissions or where process contributions would be below the Joint Nature Conservancy Committee Decision Making Thresholds.

3.4.4 Joint Nature Conservancy Committee - Guidance on Decision-making Thresholds for Air Pollution

In December 2021, the Joint Nature Conservancy Committee (JNCC) published a report titled, "Guidance on Decision-making Thresholds for Air Pollution". This report provides decision-making criteria to inform the assessment of air quality impacts on designated conservation sites. The criteria are intended to be applied to individual sources to identify those for which a decision can be taken without the need for further assessment effort. The Decision-making thresholds (DMT) for on-site emission sources provided in the JNCC report are reproduced below:

- For NH_3 - 0.08%, 0.20%, 0.34% and 0.75% of the Critical Level for high, medium, low and very low development density areas, respectively.
- For nitrogen deposition to woodland (Critical Load 10 kg-N/ha/y) - 0.13%, 0.34%, 0.57% and 1.30% of the Critical Level for high, medium, low and very low development density areas, respectively.
- For nitrogen deposition to grassland (Critical Load 10 kg-N/ha/y) 0.09%, 0.24%, 0.40% and 0.88% of the Critical Level for high, medium, low and very low development density areas, respectively.

Note that 'development density' is defined as the assumed number of additional new sources below the DMT within 5 km of the proposed development over 13 years: very low density - 1 development; low - 5 developments; medium - 10 developments and high - 30 developments.

Subject to some exceptions, where the process contribution from an on-site source is below the DMT, no further assessment is required. Where the process contribution exceeds the DMT there are two possible outcomes:

- Where site-relevant thresholds have been derived these can be applied to see if it is possible to avoid further assessment effort on the basis of site-specific circumstances.
- If site-relevant thresholds have not yet been derived, further assessment in combination with other plans and projects is required.

3.5 Quantification of Ammonia Emissions

Ammonia emission rates from poultry housing depend on many factors and are likely to be highly variable. However, the benchmarks for assessing impacts of ammonia and nitrogen deposition are framed in terms of an annual mean ammonia concentration and annual nitrogen deposition rates. To obtain relatively robust figures for these statistics, it is not necessary to model short term temporal variations and a steady continuous emission rate can be assumed. In fact, modelling short term temporal variations might introduce rather more uncertainty than modelling continuous emissions.

The emission factors used in this report have been obtained from: https://www.gov.uk/guidance/ammonia-emission-factors-for-pig-and-poultry-screening-modelling-and-reporting#ammonia-emission-factors-for-poultry.

Details of the poultry numbers and type, emission factors used and calculated ammonia emission rates are provided in Table 3.

Table 3. Details of poultry numbers and ammonia emission rates

Housing	Bird numbers (broilers)	Emission Factor (kg-NH_3/place/y)	Emission rate (g-NH_3/s)
Existing Scenario	270,000	0.024	0.205339
Proposed Scenario	270,000	0.024	0.205339

4. The Atmospheric Dispersion Modelling System (ADMS) and model parameters

The Atmospheric Dispersion Modelling System (ADMS) ADMS 6 is a new generation Gaussian plume air dispersion model, which means that the atmospheric boundary layer properties are characterised by two parameters: the boundary layer depth, and the Monin-Obukhov length rather than in terms of the single parameter Pasquill-Gifford class.

Dispersion under convective meteorological conditions uses a skewed Gaussian concentration distribution (shown by validation studies to be a better representation than a symmetrical Gaussian expression).

ADMS has several model options, that include dry and wet deposition; NO_x chemistry; impacts of hills, variable roughness, buildings and coastlines; puffs; fluctuations; odours; radioactivity decay (and γ-ray dose); condensed plume visibility; time varying sources and inclusion of background concentrations.

ADMS has an in-built meteorological pre-processor that allows flexible input of meteorological data both standard and more specialist. Hourly sequential and statistical data can be processed, and all input and output meteorological variables are written to a file after processing.

The user defines the pollutant, the averaging time (which may be an annual average or a shorter period), which percentiles and exceedance values to calculate, whether a rolling average is required or not and the output units. The output options are designed to be flexible to cater for the variety of air quality limits, which can vary from country to country and are subject to revision.

4.1 Meteorological data

Computer modelling of dispersion requires hourly sequential meteorological data and to provide robust statistics the record should be of a suitable length; preferably four years or longer.

The meteorological data used in this study is obtained from assimilation and short-term forecast fields of the Numerical Weather Prediction (NWP) system known as the Global Forecast System (GFS)[1].

The GFS physics are discrete. The physics/dynamics model has a resolution or had an equivalent resolution of approximately 7 km over the UK; terrain is understood to be resolved at a resolution of approximately 2 km, with sub-7 km terrain effects parameterised. Site specific data may be extrapolated from nearby archive grid points or a most representative grid point chosen. The GFS resolution adequately captures major topographical features and the broad-scale characteristics of the weather over the UK. Smaller scale topological features may be included in the dispersion modelling by using the flow field module of ADMS (FLOWSTAR[2]). The use of NWP data has advantages over traditional meteorological records because:

- Calm periods in traditional records may be overrepresented because the instrumentation used may not record wind speed below approximately 0.5 m/s and start up wind speeds may be greater than 1.0 m/s. In NWP data, the wind speed is continuous down to 0.0 m/s, allowing the calms module of ADMS to function correctly.

- Traditional records may include very local deviations from the broad-scale wind flow that would not necessarily be representative of the site being modelled; these deviations are difficult to identify and remove from a meteorological record. Conversely, local effects at the site being modelled are relatively easy to impose on the broad-scale flow and provided horizontal resolution is not too great, the meteorological records from NWP data may be expected to represent well the broad-scale flow.

- Information on the state of the atmosphere above ground level which would otherwise be estimated by the meteorological pre-processor may be included explicitly.

A wind rose showing the distribution of wind speeds and directions in the GFS derived data is shown in Figure 2a. Wind speeds are modified by the treatment of roughness lengths (see Section 4.7) and because terrain data is included in the modelling, the raw GFS wind speeds and directions will be modified. The terrain and roughness length modified wind rose for the site is shown in Figure 2b. Please note that FLOWSTAR[2] is used to obtain a local flow field, not to explicitly model dispersion in complex terrain as defined in the ADMS User Guide; therefore, the ADMS default value for minimum turbulence length has been amended[3].

As discussed above, the use of NWP data (suitably processed and quality controlled), removes the usual uncertainties and gross errors associated with using "representative" data from a remote meteorological station.

1. The GFS data used is derived from the high-resolution operational GFS datasets, the data is not obtained from the lower resolution (0.5 degree) long-term archive.
2. Note that FLOWSTAR requirements are for meteorological data representative of the upwind flow over the modelling domain and that single site meteorological data (observational or from high resolution modelled

data) that is representative of the application site is not generally suitable (personal correspondence: CERC 2019 and UK Met O 2015). If data are deemed representative of a particular application site, either wholly or partially, then these data cannot also be representative of the upstream flow over the modelling domain. Furthermore, it would be extremely poor practice to use such data as the boundary conditions for a flow-solver, such as FLOWSTAR.

3. When modelling complex terrain with ADMS, by default, the minimum turbulence length has 0.1 m added to the flat terrain value (calculated from the Monin-Obukhov length). Whilst this might be appropriate over hill/mountain tops in terrain with slopes > 1:10 (and quite possibly only in certain wind directions) in lesser terrain it introduces model behaviour that is not desirable where FLOWSTAR is simply being used to modify the upwind flow. Specifically, the parameter sigma z of the Gaussian plume model is overly constrained, which for elevated point sources emissions, may on occasion cause over prediction of ground level concentrations in stable weather conditions and light winds (Steven R. Hanna & Biswanath Chowdhury, 2013), conversely for low level emission sources, this will cause gross under prediction. Note that this becomes particularly important overnight and if calm and light wind conditions are not being ignored, as they often are when using traditional observational meteorological datasets. To reduce this behaviour, where terrain is modelled, AS Modelling & Data Ltd. have set a minimum turbulence length of 0.025 m in ADMS. This approximates the normal behaviour of ADMS with flat terrain.

Figure 2a. The wind rose. Raw GFS derived data for 52.866 N, 0.605 W, 2022-2025

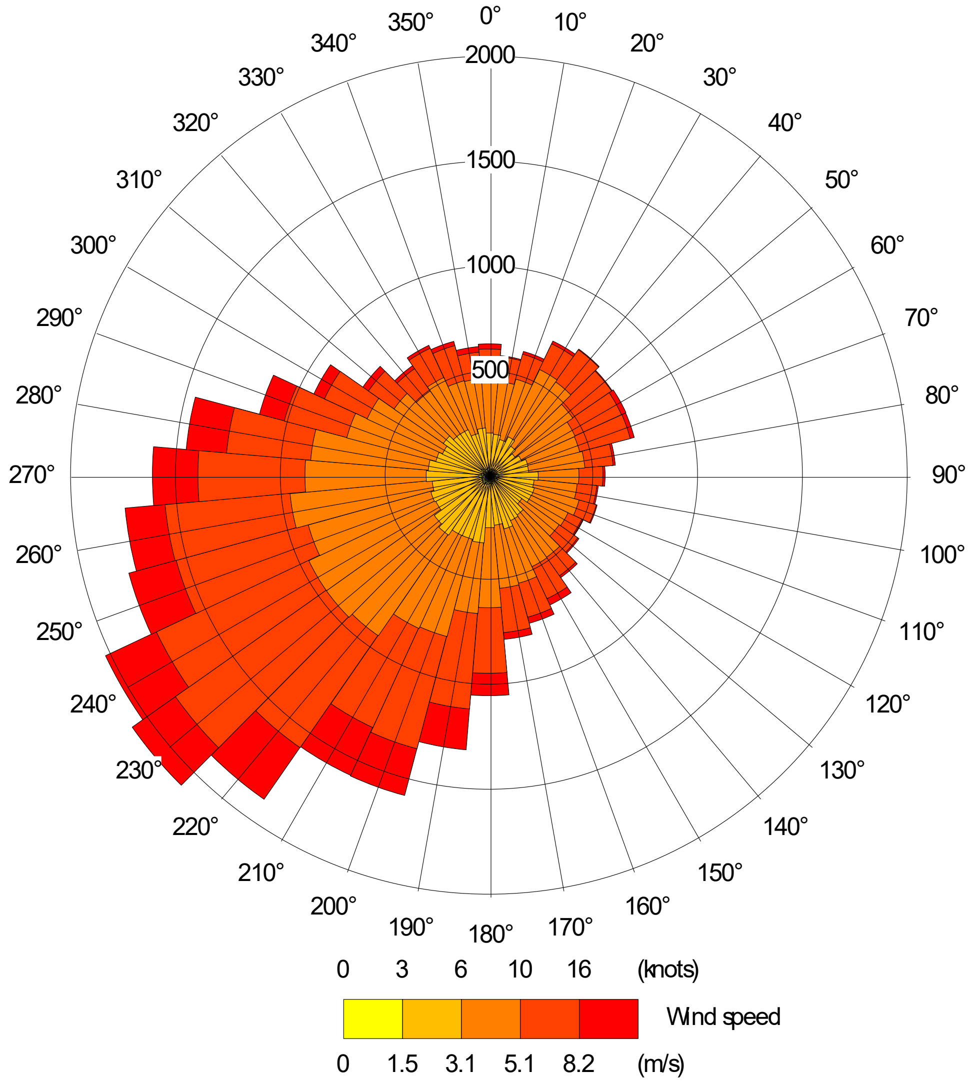
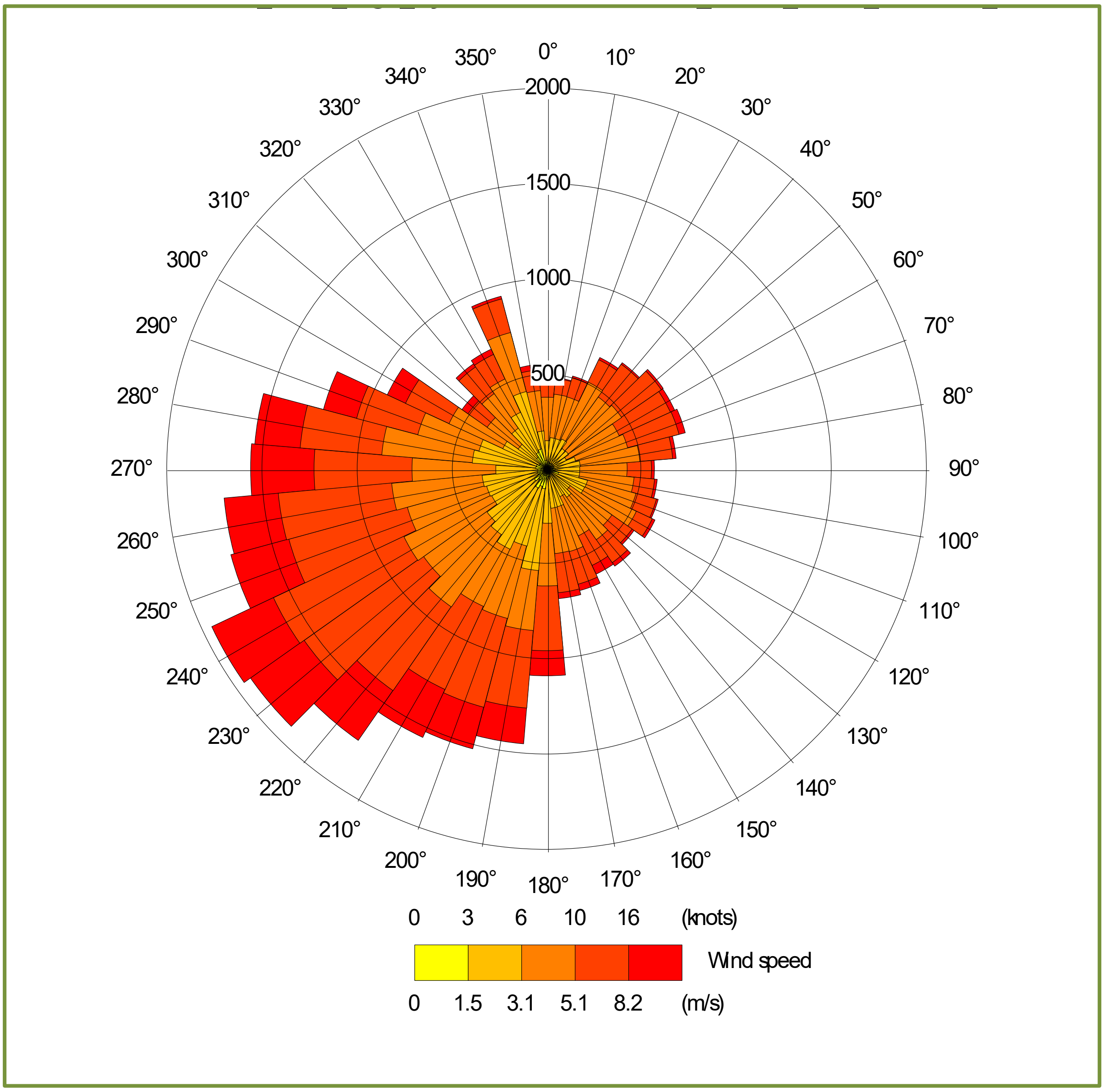


Figure 2b. The wind rose. FLOWSTAR modified GFS derived data for NGR 493900, 330950, 2022-2025



4.2 Emission sources

Emissions from the chimneys of the uncapped high-speed ridge fans that are/would be used for the primary ventilation of the poultry houses are characterised by three point sources per house within ADMS (H1 to H8; 1, 2 & 3).

Emissions from the gable end fans that are/would be used for supplementary ventilation of the houses are characterised by two volume sources within ADMS (H1to6_GAB and H78_GAB).

The emissions from the gable end fans are assumed to be zero unless the ventilation requirement within the poultry houses exceeds the capacity of the ridge fans. As a precautionary measure, it is assumed this occurs whenever the ambient temperature exceeds 23 Celsius and the proportion of emissions is 50:50 between ridge fans and gable end fans.

Details of the emissions source parameters are shown in Tables 4a and 4b. The positions of the point and volume sources used are shown in Figure 3 (marked by green circles and red shaded rectangles, respectively).

Table 4a. Point source parameters

Source ID (Scenario)	Height (m)	Diameter (m)	Efflux velocity (m/s)	Emission temperature (˚C)	Emission rate per source (g-NH_3/s)
H1 to H6; 1, 2 & 3 (existing)	6.2	0.8	11.0	Variable [1]	0.011408 [1 & 2]
H1 to H8; 1, 2 & 3 (proposed)	6.2	0.8	11.0	Variable [1]	0.008556 [1 & 2]

Table 4b. Volume source parameters

Source ID (Scenario)	Length (m)	Width (m)	Depth (m)	Base height (m)	Emission temperature (°C)	Emission rate (g-NH_3/s)
H1TO6_GAB (existing)	164.0	10.0	3.0	1.0	Ambient	0.205339 [1 & 3]
H1TO6_GAB (proposed)	164.0	10.0	3.0	1.0	Ambient	0.154004 [1 & 3]
H78_GAB (proposed)	50.0	10.0	3.0	1.0	Ambient	0.051335 [1 & 3]

1. Dependent on ambient temperature.
2. Reduced by 50% when ambient temperature exceeds 23 Celsius.
3. 50% of total only emitted when ambient temperature exceeds 23 Celsius.

4.3 Modelled buildings

The structure of the poultry houses may affect the plumes from the point sources. Therefore, the buildings are modelled within ADMS. The positions of the modelled buildings may be seen in Figure 3 (marked by grey rectangles).

4.4 Discrete receptors

Fourty-one discrete receptors have been defined at the nearby wildlife sites. These receptors are defined at ground level within ADMS. The positions of the discrete receptors may be seen in Figures 4 (marked by enumerated pink rectangles).

4.5 Cartesian grid

To produce the contour plots presented in Section 5 of this report and to define the spatially varying deposition velocity field, a regular Cartesian grid has been defined within ADMS. The individual grid receptors are defined at ground level within ADMS. The position of the Cartesian grid may be seen in Figures 4 (marked by grey lines).

4.6 Terrain data

Terrain has been considered in the modelling. The terrain data are based upon the Ordnance Survey 50 m Digital Elevation Model. A 10.0 km by 10.0 km domain has been resampled at 100 m horizontal resolution for use within ADMS for the modelling. The resolution of FLOWSTAR is 64 x 64 grid points; therefore, the effective resolution of the wind field for the terrain runs is approximately 150 m.

4.7 Roughness Length

In this case, a spatially varying roughness length file has been defined, this is based upon the Defra land use database. The GFS meteorological data is assumed to have a roughness length of 0.162 m (arithmetic average of the spatially varying roughness over the modelling domain). The sample of the central area of the spatially varying roughness length field is shown in Figure 5.

Figure 3. The positions of modelled buildings and sources

Figure 4. The discrete receptors and regular Cartesian grid

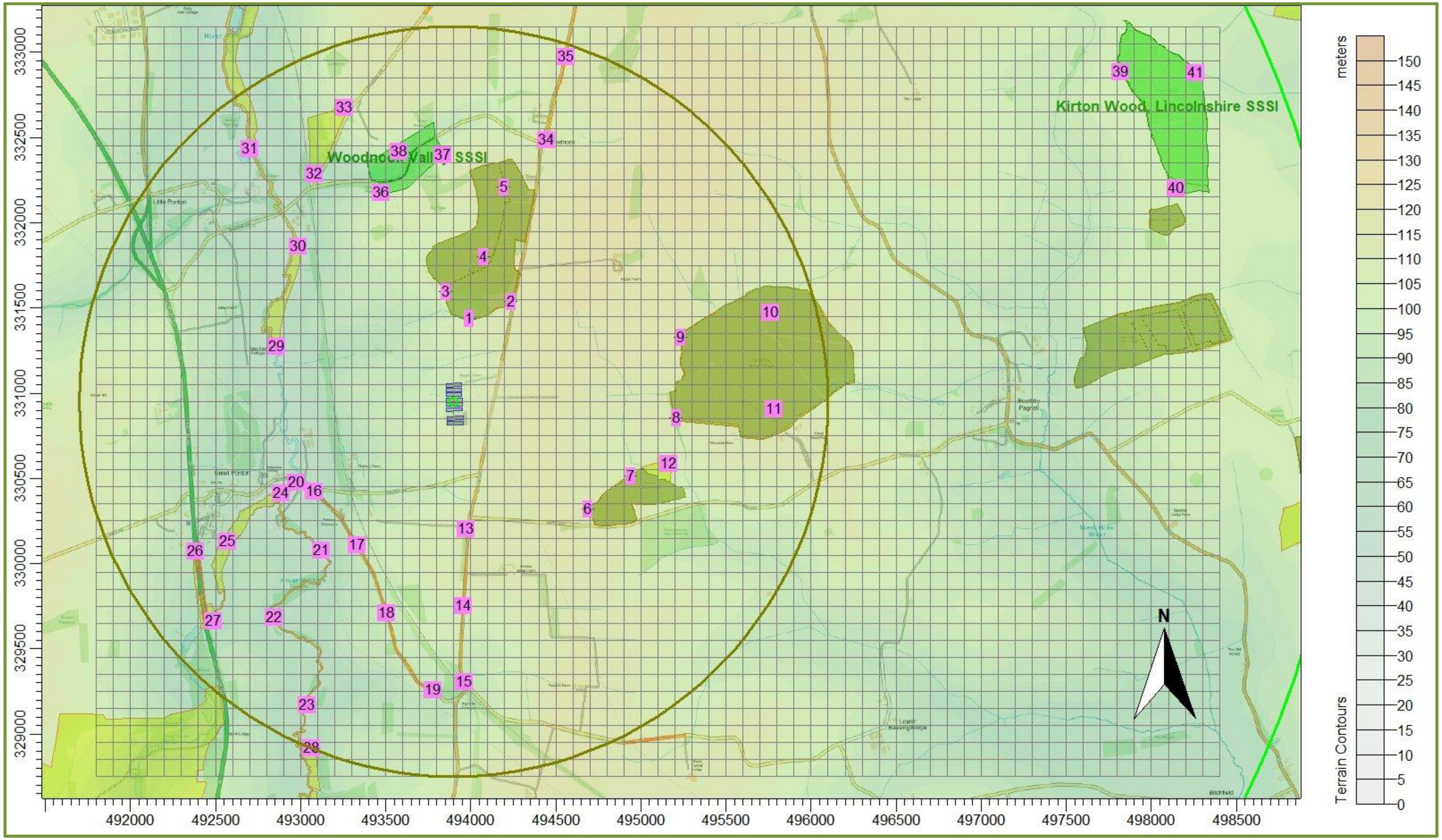
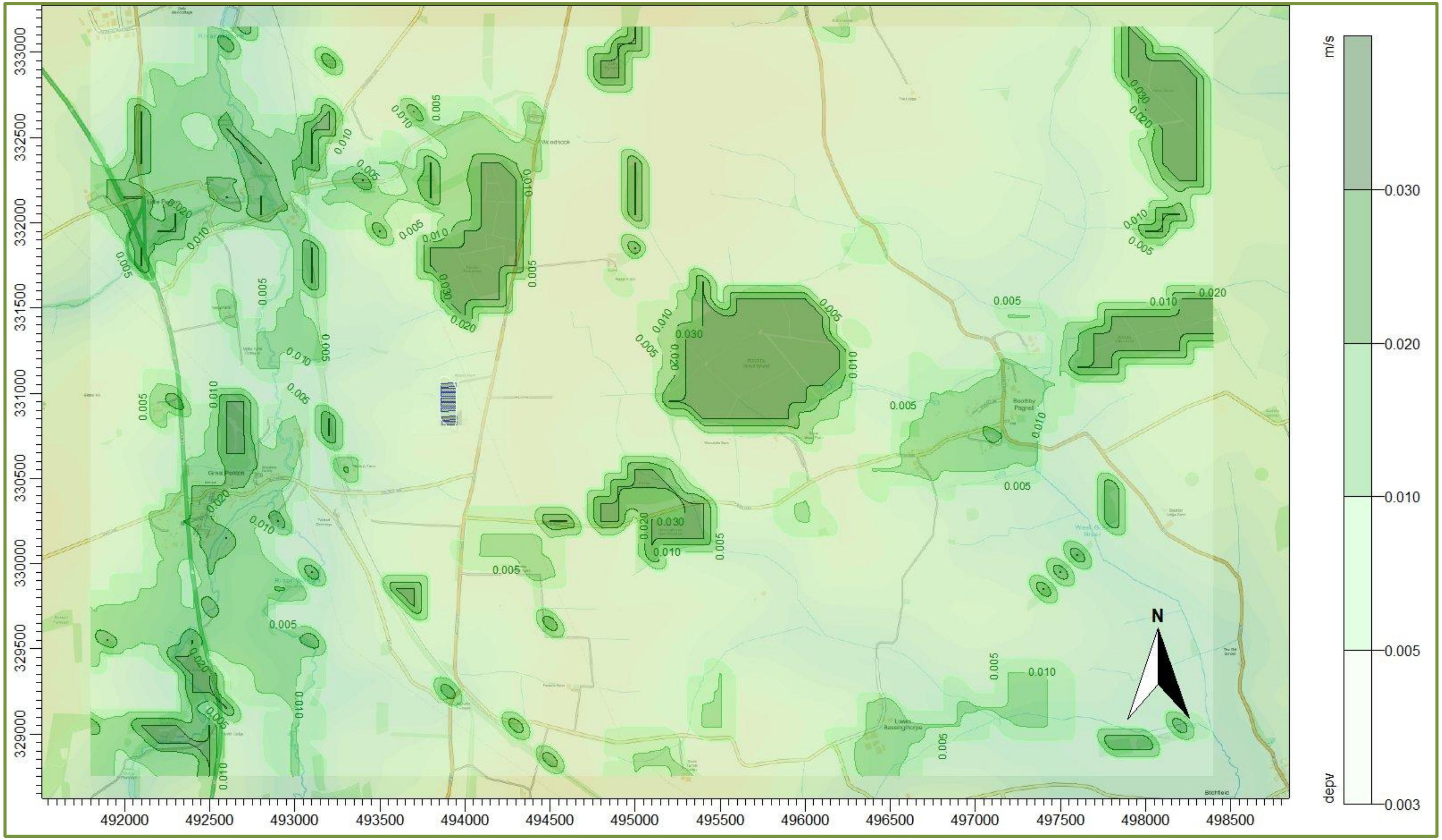


Figure 5. The spatially varying surface roughness field (central area)



4.8 Deposition

The method used to model deposition of ammonia and consequent plume depletion is based primarily upon Frederik Schrader and Christian Brümmer. Land Use Specific Ammonia Deposition Velocities: a Review of Recent Studies (2004-2013). AS Modelling & Data Ltd. has restricted deposition over arable farmland and heavily grazed and fertilised pasture; this is to compensate for possible saturation effects due to fertilizer application and to allow for periods when fields are clear of crops (Sutton), the deposition is also restricted over areas with little or no vegetation and the deposition velocity is set to 0.002 m/s where grid points are over the poultry housing and 0.010 m/s to 0.015 m/s over heavily grazed grassland. Where deposition over water surfaces is calculated, a deposition velocity of 0.005 m/s is used.

In summary, the method is as follows:

- A preliminary run of the model without deposition is used to provide an ammonia concentration field.
- The preliminary ammonia concentration field, along with land usage, has been used to define a deposition velocity field. The deposition velocities used are provided in Table 5.

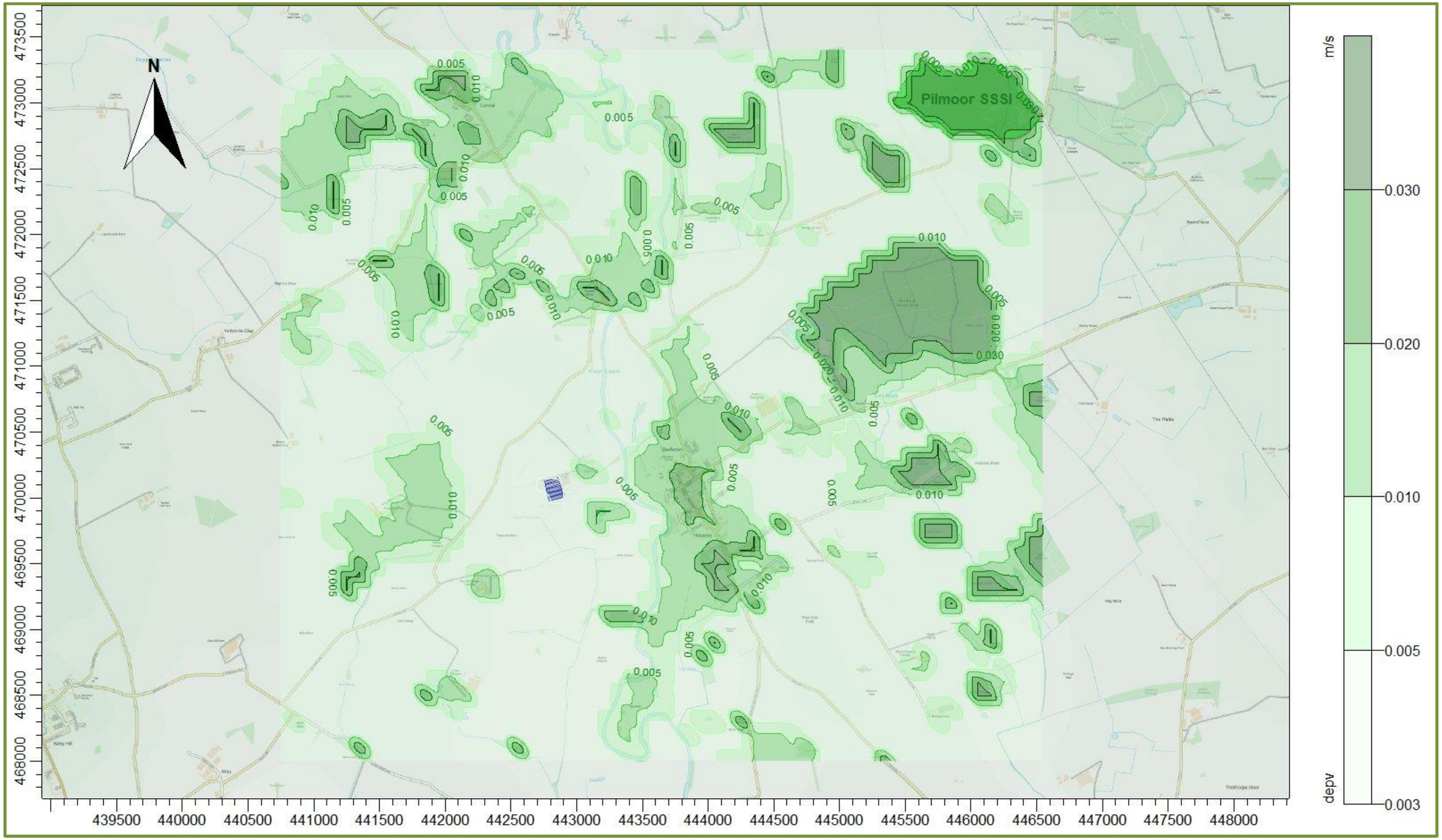
Table 5. Deposition velocities

NH_3 concentration (PC + background) ($\mu g/m^3$)	< 10	10 - 20	20 - 30	30 - 80	> 80
Deposition velocity - woodland (m/s)	0.03	0.015	0.01	0.005	0.003
Deposition velocity - short vegetation (m/s)	0.02 (0.010 to 0.015 over heavily grazed grassland)	0.015	0.01	0.005	0.003
Deposition velocity - arable farmland/rye grass (m/s)	0.005	0.005	0.005	0.005	0.003

- The model is then rerun with the spatially varying deposition module.

A contour plot of the spatially varying deposition field is provided in Figure 6.

Figure 6. The spatially varying deposition field



5. Details of the Model Runs and Results

5.1 Preliminary modelling and model sensitivity tests

ADMS was run a total of eight times: once for each year of the meteorological record and in the following modes:

- In basic mode without calms, or terrain – GFS data.
- With calms and without terrain – GFS data.

For each mode, statistics for the maximum annual mean ammonia concentration at each receptor were compiled. Details of the predicted annual mean ammonia concentrations at each receptor are provided in Table 6. The primary purpose of the preliminary modelling is to assess the effect of calms on the results.

Table 6. Predicted maximum annual mean ammonia concentration at the discrete receptors – preliminary modelling

Receptor number	X(m)	Y(m)	Name/Designation	Maximum annual mean ammonia concentration ($\mu g/m^3$)			
				Existing		Proposed	
				GFS No Calms No Terrain	GFS Calms No Terrain	GFS No Calms No Terrain	GFS Calms No Terrain
1	493988	331437	AW/LWS	0.441	0.437	0.403	0.399
2	494236	331540	AW/LWS	0.312	0.309	0.291	0.288
3	493854	331597	AW/LWS	0.204	0.207	0.193	0.195
4	494076	331803	AW/LWS	0.178	0.176	0.168	0.167
5	494195	332211	AW/LWS	0.096	0.095	0.093	0.092
6	494690	330321	AW/LWS	0.090	0.090	0.096	0.096
7	494938	330512	AW/LWS	0.102	0.101	0.105	0.105
8	495207	330858	AW/LWS	0.095	0.095	0.096	0.096
9	495233	331328	AW/LWS	0.099	0.099	0.099	0.098
10	495759	331473	AW/LWS	0.059	0.059	0.059	0.058
11	495785	330910	AW/LWS	0.054	0.054	0.055	0.054
12	495165	330590	LWS	0.086	0.086	0.088	0.088
13	493973	330207	LWS	0.105	0.104	0.112	0.112
14	493954	329754	LWS	0.052	0.052	0.054	0.054
15	493960	329307	LWS	0.034	0.034	0.035	0.034
16	493078	330426	LWS	0.084	0.083	0.086	0.085
17	493331	330109	LWS	0.082	0.081	0.085	0.084
18	493503	329713	LWS	0.053	0.053	0.055	0.055
19	493779	329258	LWS	0.034	0.034	0.035	0.034
20	492977	330478	LWS	0.077	0.076	0.078	0.077
21	493122	330079	LWS	0.064	0.064	0.066	0.066
22	492846	329687	LWS	0.039	0.039	0.040	0.040
23	493036	329169	LWS	0.030	0.030	0.031	0.030
24	492884	330415	LWS	0.066	0.065	0.067	0.066
25	492570	330131	LWS	0.041	0.041	0.042	0.042
26	492384	330075	LWS	0.035	0.035	0.036	0.035
27	492488	329665	LWS	0.030	0.030	0.030	0.030
28	493065	328920	LWS	0.025	0.025	0.026	0.026
29	492859	331275	LWS	0.058	0.058	0.056	0.056
30	492988	331863	LWS	0.050	0.050	0.049	0.049
31	492704	332437	LWS	0.033	0.033	0.033	0.033
32	493081	332287	LWS	0.045	0.045	0.045	0.044
33	493256	332679	LWS	0.040	0.040	0.039	0.039
34	494444	332488	LWS	0.068	0.068	0.067	0.066
35	494557	332979	LWS	0.046	0.046	0.045	0.045
36	493473	332178	Woodnook Valley SSSI	0.064	0.064	0.062	0.062
37	493835	332400	Woodnook Valley SSSI	0.060	0.061	0.059	0.059
38	493576	332421	Woodnook Valley SSSI	0.054	0.055	0.053	0.054
39	497816	332886	Kirton Wood, Lincolnshire SSSI	0.019	0.019	0.019	0.019
40	498142	332206	Kirton Wood, Lincolnshire SSSI	0.018	0.018	0.018	0.017
41	498257	332882	Kirton Wood, Lincolnshire SSSI	0.017	0.017	0.017	0.017

5.2 Detailed modelling

In this case, detailed modelling has been carried out over a high resolution 6.6 km x 4.4 km domain surrounding the site of the poultry houses. The primary purpose is to determine the magnitude of deposition of ammonia and consequent plume depletion close to the sources where it is of the greatest importance, but also to provide results should any further non-statutory wildlife sites be identified within 2 km. Outside of this domain, a fixed deposition velocity of 0.005 m/s is assumed (with appropriate deposition velocities applied post-modelling at the discrete receptors).

The predicted maximum annual mean ground level ammonia concentrations and maximum annual nitrogen deposition rates at the discrete receptors are shown in Tables 7a (existing scenario), 7b (proposed houses only) and 7c (proposed scenario). In the Tables, there are no predicted ammonia concentrations or nitrogen deposition rates that are in excess of the Environment Agency upper threshold (50% for a SSSI and 100% for a non-statutory site) of the Critical Level/Load nor within the range of the Environment Agency lower and upper thresholds (20% and 50% for a SSSI and 100% and 100% for a non-statutory site) of the Critical Level/Load. Exceedances of 1% of the Critical Level and/or Load at a SSSI are highlighted in bold text.

The detailed deposition run was made with terrain. Calms cannot be used with terrain or spatially varying deposition; therefore, calms have not been included in the detailed modelling. In this case, the results of the preliminary modelling indicate that the effects of calms are insignificant.

The predicted changes in annual mean ground level ammonia concentrations and maximum annual nitrogen deposition rates are shown in Table 8 (proposed scenario minus existing scenario).

It has been noted previously that at least the lower bound Critical Levels and Loads are almost certainly already exceeded and that available background levels are suitable only to provide a broad indication of likely pollutant impact at a specific location. Therefore, in this case, PECs are not presented.

Contour plots of the predicted ground level maximum annual mean ammonia concentration and maximum annual nitrogen deposition rates for the proposed scenario are shown in Figures 7a and 7b. Contour plots for other scenarios/partial scenarios can be made available upon request.

Table 7a. Predicted maximum annual mean ammonia concentrations and maximum annual nitrogen deposition – Existing Scenario

Receptor number	X(m)	Y(m)	Name	Site Parameters			Maximum annual ammonia concentration		Maximum annual nitrogen deposition rate	
				Deposition Velocity	Critical Level ($\mu g/m^3$)	Critical Load (kg/ha)	Process Contribution ($\mu g/m^3$)	%age of Critical Level	Process Contribution (kg/ha)	%age of Critical Load
1	493988	331437	AW/LWS	0.03	1.0	10.0	0.403	40.30	3.140	31.40
2	494236	331540	AW/LWS	0.03	1.0	10.0	0.272	27.17	2.117	21.17
3	493854	331597	AW/LWS	0.03	1.0	10.0	0.148	14.78	1.152	11.52
4	494076	331803	AW/LWS	0.03	1.0	10.0	0.146	14.63	1.140	11.40
5	494195	332211	AW/LWS	0.03	1.0	10.0	0.076	7.64	0.595	5.95
6	494690	330321	AW/LWS	0.03	1.0	10.0	0.099	9.86	0.768	7.68
7	494938	330512	AW/LWS	0.03	1.0	10.0	0.113	11.27	0.878	8.78
8	495207	330858	AW/LWS	0.03	1.0	10.0	0.101	10.08	0.785	7.85
9	495233	331328	AW/LWS	0.03	1.0	10.0	0.097	9.74	0.759	7.59
10	495759	331473	AW/LWS	0.03	1.0	10.0	0.049	4.91	0.382	3.82
11	495785	330910	AW/LWS	0.03	1.0	10.0	0.044	4.40	0.343	3.43
12	495165	330590	LWS	0.03	1.0	10.0	0.080	8.02	0.625	6.25
13	493973	330207	LWS	0.03	1.0	10.0	0.100	9.98	0.778	7.78
14	493954	329754	LWS	0.03	1.0	10.0	0.048	4.78	0.373	3.73
15	493960	329307	LWS	0.03	1.0	10.0	0.034	3.37	0.262	2.62
16	493078	330426	LWS	0.03	1.0	10.0	0.089	8.93	0.696	6.96
17	493331	330109	LWS	0.03	1.0	10.0	0.082	8.17	0.636	6.36
18	493503	329713	LWS	0.03	1.0	10.0	0.048	4.84	0.377	3.77
19	493779	329258	LWS	0.03	1.0	10.0	0.032	3.21	0.250	2.50
20	492977	330478	LWS	0.03	1.0	10.0	0.076	7.62	0.594	5.94
21	493122	330079	LWS	0.03	1.0	10.0	0.068	6.76	0.527	5.27
22	492846	329687	LWS	0.03	1.0	10.0	0.034	3.45	0.269	2.69
23	493036	329169	LWS	0.03	1.0	10.0	0.028	2.79	0.217	2.17
24	492884	330415	LWS	0.03	1.0	10.0	0.062	6.20	0.483	4.83
25	492570	330131	LWS	0.03	1.0	10.0	0.032	3.19	0.249	2.49
26	492384	330075	LWS	0.03	1.0	10.0	0.028	2.77	0.216	2.16
27	492488	329665	LWS	0.03	1.0	10.0	0.025	2.50	0.195	1.95
28	493065	328920	LWS	0.03	1.0	10.0	0.025	2.54	0.198	1.98
29	492859	331275	LWS	0.03	1.0	10.0	0.052	5.24	0.408	4.08
30	492988	331863	LWS	0.03	1.0	10.0	0.045	4.50	0.351	3.51
31	492704	332437	LWS	0.03	1.0	10.0	0.023	2.25	0.175	1.75
32	493081	332287	LWS	0.03	1.0	10.0	0.038	3.81	0.297	2.97
33	493256	332679	LWS	0.03	1.0	10.0	0.024	2.44	0.190	1.90
34	494444	332488	LWS	0.03	1.0	10.0	0.058	5.80	0.452	4.52
35	494557	332979	LWS	0.03	1.0	10.0	0.042	4.16	0.324	3.24
36	493473	332178	Woodnook Valley SSSI	0.02	1.0	10.0	0.043	**4.32**	0.224	**2.24**
37	493835	332400	Woodnook Valley SSSI	0.02	1.0	10.0	0.048	**4.84**	0.251	**2.51**
38	493576	332421	Woodnook Valley SSSI	0.02	1.0	10.0	0.037	**3.74**	0.194	**1.94**
39	497816	332886	Kirton Wood, Lincolnshire SSSI	0.03	1.0	15.0	0.017	**1.65**	0.129	0.86
40	498142	332206	Kirton Wood, Lincolnshire SSSI	0.03	1.0	15.0	0.012	**1.20**	0.094	0.62
41	498257	332882	Kirton Wood, Lincolnshire SSSI	0.03	1.0	15.0	0.011	**1.13**	0.088	0.59

Table 7b. Predicted maximum annual mean ammonia concentrations and maximum annual nitrogen deposition – Proposed House Only

Receptor number	X(m)	Y(m)	Name	Site Parameters			Maximum annual ammonia concentration		Maximum annual nitrogen deposition rate	
				Deposition Velocity	Critical Level ($\mu g/m^3$)	Critical Load (kg/ha)	Process Contribution ($\mu g/m^3$)	%age of Critical Level	Process Contribution (kg/ha)	%age of Critical Load
1	493988	331437	AW/LWS	0.03	1.0	10.0	0.064	6.37	0.497	4.97
2	494236	331540	AW/LWS	0.03	1.0	10.0	0.050	5.01	0.390	3.90
3	493854	331597	AW/LWS	0.03	1.0	10.0	0.028	2.77	0.216	2.16
4	494076	331803	AW/LWS	0.03	1.0	10.0	0.028	2.81	0.219	2.19
5	494195	332211	AW/LWS	0.03	1.0	10.0	0.016	1.62	0.126	1.26
6	494690	330321	AW/LWS	0.03	1.0	10.0	0.030	3.03	0.236	2.36
7	494938	330512	AW/LWS	0.03	1.0	10.0	0.034	3.39	0.264	2.64
8	495207	330858	AW/LWS	0.03	1.0	10.0	0.027	2.72	0.212	2.12
9	495233	331328	AW/LWS	0.03	1.0	10.0	0.024	2.40	0.187	1.87
10	495759	331473	AW/LWS	0.03	1.0	10.0	0.012	1.20	0.094	0.94
11	495785	330910	AW/LWS	0.03	1.0	10.0	0.011	1.14	0.089	0.89
12	495165	330590	LWS	0.03	1.0	10.0	0.023	2.32	0.181	1.81
13	493973	330207	LWS	0.03	1.0	10.0	0.033	3.34	0.260	2.60
14	493954	329754	LWS	0.03	1.0	10.0	0.014	1.40	0.109	1.09
15	493960	329307	LWS	0.03	1.0	10.0	0.009	0.93	0.073	0.73
16	493078	330426	LWS	0.03	1.0	10.0	0.024	2.44	0.190	1.90
17	493331	330109	LWS	0.03	1.0	10.0	0.024	2.40	0.187	1.87
18	493503	329713	LWS	0.03	1.0	10.0	0.014	1.44	0.112	1.12
19	493779	329258	LWS	0.03	1.0	10.0	0.009	0.88	0.069	0.69
20	492977	330478	LWS	0.03	1.0	10.0	0.020	1.99	0.155	1.55
21	493122	330079	LWS	0.03	1.0	10.0	0.019	1.91	0.149	1.49
22	492846	329687	LWS	0.03	1.0	10.0	0.009	0.94	0.073	0.73
23	493036	329169	LWS	0.03	1.0	10.0	0.008	0.76	0.059	0.59
24	492884	330415	LWS	0.03	1.0	10.0	0.016	1.63	0.127	1.27
25	492570	330131	LWS	0.03	1.0	10.0	0.009	0.86	0.067	0.67
26	492384	330075	LWS	0.03	1.0	10.0	0.007	0.74	0.057	0.57
27	492488	329665	LWS	0.03	1.0	10.0	0.007	0.68	0.053	0.53
28	493065	328920	LWS	0.03	1.0	10.0	0.007	0.69	0.054	0.54
29	492859	331275	LWS	0.03	1.0	10.0	0.013	1.32	0.103	1.03
30	492988	331863	LWS	0.03	1.0	10.0	0.010	1.00	0.078	0.78
31	492704	332437	LWS	0.03	1.0	10.0	0.005	0.51	0.040	0.40
32	493081	332287	LWS	0.03	1.0	10.0	0.009	0.85	0.066	0.66
33	493256	332679	LWS	0.03	1.0	10.0	0.005	0.55	0.043	0.43
34	494444	332488	LWS	0.03	1.0	10.0	0.013	1.32	0.103	1.03
35	494557	332979	LWS	0.03	1.0	10.0	0.010	0.97	0.075	0.75
36	493473	332178	Woodnook Valley SSSI	0.02	1.0	10.0	0.009	0.94	0.049	0.49
37	493835	332400	Woodnook Valley SSSI	0.02	1.0	10.0	0.011	**1.07**	0.056	0.56
38	493576	332421	Woodnook Valley SSSI	0.02	1.0	10.0	0.008	0.84	0.044	0.44
39	497816	332886	Kirton Wood, Lincolnshire SSSI	0.03	1.0	15.0	0.004	0.42	0.032	0.22
40	498142	332206	Kirton Wood, Lincolnshire SSSI	0.03	1.0	15.0	0.003	0.30	0.023	0.16
41	498257	332882	Kirton Wood, Lincolnshire SSSI	0.03	1.0	15.0	0.003	0.29	0.022	0.15

Table 7c. Predicted maximum annual mean ammonia concentrations and maximum annual nitrogen deposition – Proposed Scenario

Receptor number	X(m)	Y(m)	Name	Site Parameters			Maximum annual ammonia concentration		Maximum annual nitrogen deposition rate	
				Deposition Velocity	Critical Level ($\mu g/m^3$)	Critical Load (kg/ha)	Process Contribution ($\mu g/m^3$)	%age of Critical Level	Process Contribution (kg/ha)	%age of Critical Load
1	493988	331437	AW/LWS	0.03	1.0	10.0	0.366	36.60	2.851	28.51
2	494236	331540	AW/LWS	0.03	1.0	10.0	0.254	25.39	1.978	19.78
3	493854	331597	AW/LWS	0.03	1.0	10.0	0.139	13.86	1.080	10.80
4	494076	331803	AW/LWS	0.03	1.0	10.0	0.138	13.78	1.074	10.74
5	494195	332211	AW/LWS	0.03	1.0	10.0	0.073	7.35	0.572	5.72
6	494690	330321	AW/LWS	0.03	1.0	10.0	0.104	10.42	0.812	8.12
7	494938	330512	AW/LWS	0.03	1.0	10.0	0.118	11.84	0.922	9.22
8	495207	330858	AW/LWS	0.03	1.0	10.0	0.103	10.27	0.800	8.00
9	495233	331328	AW/LWS	0.03	1.0	10.0	0.097	9.71	0.756	7.56
10	495759	331473	AW/LWS	0.03	1.0	10.0	0.049	4.89	0.381	3.81
11	495785	330910	AW/LWS	0.03	1.0	10.0	0.044	4.44	0.346	3.46
12	495165	330590	LWS	0.03	1.0	10.0	0.083	8.33	0.649	6.49
13	493973	330207	LWS	0.03	1.0	10.0	0.108	10.83	0.843	8.43
14	493954	329754	LWS	0.03	1.0	10.0	0.050	4.98	0.388	3.88
15	493960	329307	LWS	0.03	1.0	10.0	0.035	3.46	0.269	2.69
16	493078	330426	LWS	0.03	1.0	10.0	0.091	9.14	0.712	7.12
17	493331	330109	LWS	0.03	1.0	10.0	0.085	8.53	0.664	6.64
18	493503	329713	LWS	0.03	1.0	10.0	0.051	5.07	0.395	3.95
19	493779	329258	LWS	0.03	1.0	10.0	0.033	3.29	0.256	2.56
20	492977	330478	LWS	0.03	1.0	10.0	0.077	7.70	0.600	6.00
21	493122	330079	LWS	0.03	1.0	10.0	0.070	6.98	0.544	5.44
22	492846	329687	LWS	0.03	1.0	10.0	0.035	3.52	0.274	2.74
23	493036	329169	LWS	0.03	1.0	10.0	0.029	2.85	0.222	2.22
24	492884	330415	LWS	0.03	1.0	10.0	0.063	6.28	0.489	4.89
25	492570	330131	LWS	0.03	1.0	10.0	0.033	3.26	0.254	2.54
26	492384	330075	LWS	0.03	1.0	10.0	0.028	2.82	0.219	2.19
27	492488	329665	LWS	0.03	1.0	10.0	0.026	2.56	0.199	1.99
28	493065	328920	LWS	0.03	1.0	10.0	0.026	2.59	0.202	2.02
29	492859	331275	LWS	0.03	1.0	10.0	0.053	5.25	0.409	4.09
30	492988	331863	LWS	0.03	1.0	10.0	0.044	4.38	0.341	3.41
31	492704	332437	LWS	0.03	1.0	10.0	0.022	2.20	0.172	1.72
32	493081	332287	LWS	0.03	1.0	10.0	0.037	3.71	0.289	2.89
33	493256	332679	LWS	0.03	1.0	10.0	0.024	2.38	0.185	1.85
34	494444	332488	LWS	0.03	1.0	10.0	0.057	5.68	0.442	4.42
35	494557	332979	LWS	0.03	1.0	10.0	0.041	4.08	0.318	3.18
36	493473	332178	Woodnook Valley SSSI	0.02	1.0	10.0	0.042	**4.18**	0.217	**2.17**
37	493835	332400	Woodnook Valley SSSI	0.02	1.0	10.0	0.047	**4.70**	0.244	**2.44**
38	493576	332421	Woodnook Valley SSSI	0.02	1.0	10.0	0.036	**3.64**	0.189	**1.89**
39	497816	332886	Kirton Wood, Lincolnshire SSSI	0.03	1.0	15.0	0.017	**1.65**	0.129	0.86
40	498142	332206	Kirton Wood, Lincolnshire SSSI	0.03	1.0	15.0	0.012	**1.20**	0.093	0.62
41	498257	332882	Kirton Wood, Lincolnshire SSSI	0.03	1.0	15.0	0.011	**1.13**	0.088	0.59

Table 8. Changes in maximum annual mean ammonia concentrations and maximum annual nitrogen deposition – Proposed Scenario minus Existing Scenario

Receptor number	X(m)	Y(m)	Name	Site Parameters			Maximum annual ammonia concentration		Maximum annual nitrogen deposition rate	
				Deposition Velocity	Critical Level (µg/m³)	Critical Load (kg/ha)	Process Contribution (µg/m³)	%age of Critical Level	Process Contribution (kg/ha)	%age of Critical Load
1	493988	331437	AW/LWS	0.03	1.0	10.0	-0.037	-3.70	-0.288	-2.88
2	494236	331540	AW/LWS	0.03	1.0	10.0	-0.018	-1.78	-0.139	-1.39
3	493854	331597	AW/LWS	0.03	1.0	10.0	-0.009	-0.92	-0.072	-0.72
4	494076	331803	AW/LWS	0.03	1.0	10.0	-0.009	-0.85	-0.066	-0.66
5	494195	332211	AW/LWS	0.03	1.0	10.0	-0.003	-0.29	-0.023	-0.23
6	494690	330321	AW/LWS	0.03	1.0	10.0	0.006	0.56	0.044	0.44
7	494938	330512	AW/LWS	0.03	1.0	10.0	0.006	0.57	0.044	0.44
8	495207	330858	AW/LWS	0.03	1.0	10.0	0.002	0.20	0.015	0.15
9	495233	331328	AW/LWS	0.03	1.0	10.0	0.000	-0.04	-0.003	-0.03
10	495759	331473	AW/LWS	0.03	1.0	10.0	0.000	-0.02	-0.002	-0.02
11	495785	330910	AW/LWS	0.03	1.0	10.0	0.000	0.04	0.003	0.03
12	495165	330590	LWS	0.03	1.0	10.0	0.003	0.31	0.025	0.25
13	493973	330207	LWS	0.03	1.0	10.0	0.008	0.84	0.066	0.66
14	493954	329754	LWS	0.03	1.0	10.0	0.002	0.20	0.016	0.16
15	493960	329307	LWS	0.03	1.0	10.0	0.001	0.09	0.007	0.07
16	493078	330426	LWS	0.03	1.0	10.0	0.002	0.21	0.016	0.16
17	493331	330109	LWS	0.03	1.0	10.0	0.004	0.36	0.028	0.28
18	493503	329713	LWS	0.03	1.0	10.0	0.002	0.23	0.018	0.18
19	493779	329258	LWS	0.03	1.0	10.0	0.001	0.08	0.006	0.06
20	492977	330478	LWS	0.03	1.0	10.0	0.001	0.08	0.006	0.06
21	493122	330079	LWS	0.03	1.0	10.0	0.002	0.22	0.017	0.17
22	492846	329687	LWS	0.03	1.0	10.0	0.001	0.07	0.006	0.06
23	493036	329169	LWS	0.03	1.0	10.0	0.001	0.06	0.005	0.05
24	492884	330415	LWS	0.03	1.0	10.0	0.001	0.08	0.006	0.06
25	492570	330131	LWS	0.03	1.0	10.0	0.001	0.06	0.005	0.05
26	492384	330075	LWS	0.03	1.0	10.0	0.000	0.04	0.003	0.03
27	492488	329665	LWS	0.03	1.0	10.0	0.001	0.06	0.005	0.05
28	493065	328920	LWS	0.03	1.0	10.0	0.001	0.05	0.004	0.04
29	492859	331275	LWS	0.03	1.0	10.0	0.000	0.01	0.001	0.01
30	492988	331863	LWS	0.03	1.0	10.0	-0.001	-0.12	-0.010	-0.10
31	492704	332437	LWS	0.03	1.0	10.0	0.000	-0.05	-0.004	-0.04
32	493081	332287	LWS	0.03	1.0	10.0	-0.001	-0.10	-0.008	-0.08
33	493256	332679	LWS	0.03	1.0	10.0	-0.001	-0.06	-0.005	-0.05
34	494444	332488	LWS	0.03	1.0	10.0	-0.001	-0.13	-0.010	-0.10
35	494557	332979	LWS	0.03	1.0	10.0	-0.001	-0.07	-0.006	-0.06
36	493473	332178	Woodnook Valley SSSI	0.02	1.0	10.0	-0.0014	-0.138	-0.0072	-0.072
37	493835	332400	Woodnook Valley SSSI	0.02	1.0	10.0	-0.0014	-0.140	-0.0073	-0.073
38	493576	332421	Woodnook Valley SSSI	0.02	1.0	10.0	-0.0010	-0.096	-0.0050	-0.050
39	497816	332886	Kirton Wood, Lincolnshire SSSI	0.03	1.0	15.0	0.00003	0.0029	0.00023	0.0015
40	498142	332206	Kirton Wood, Lincolnshire SSSI	0.03	1.0	15.0	-0.00001	-0.0008	-0.00006	-0.0004
41	498257	332882	Kirton Wood, Lincolnshire SSSI	0.03	1.0	15.0	0.00004	0.0039	0.00030	0.0020

Figure 7a. Maximum annual mean ammonia concentration – Proposed Scenario

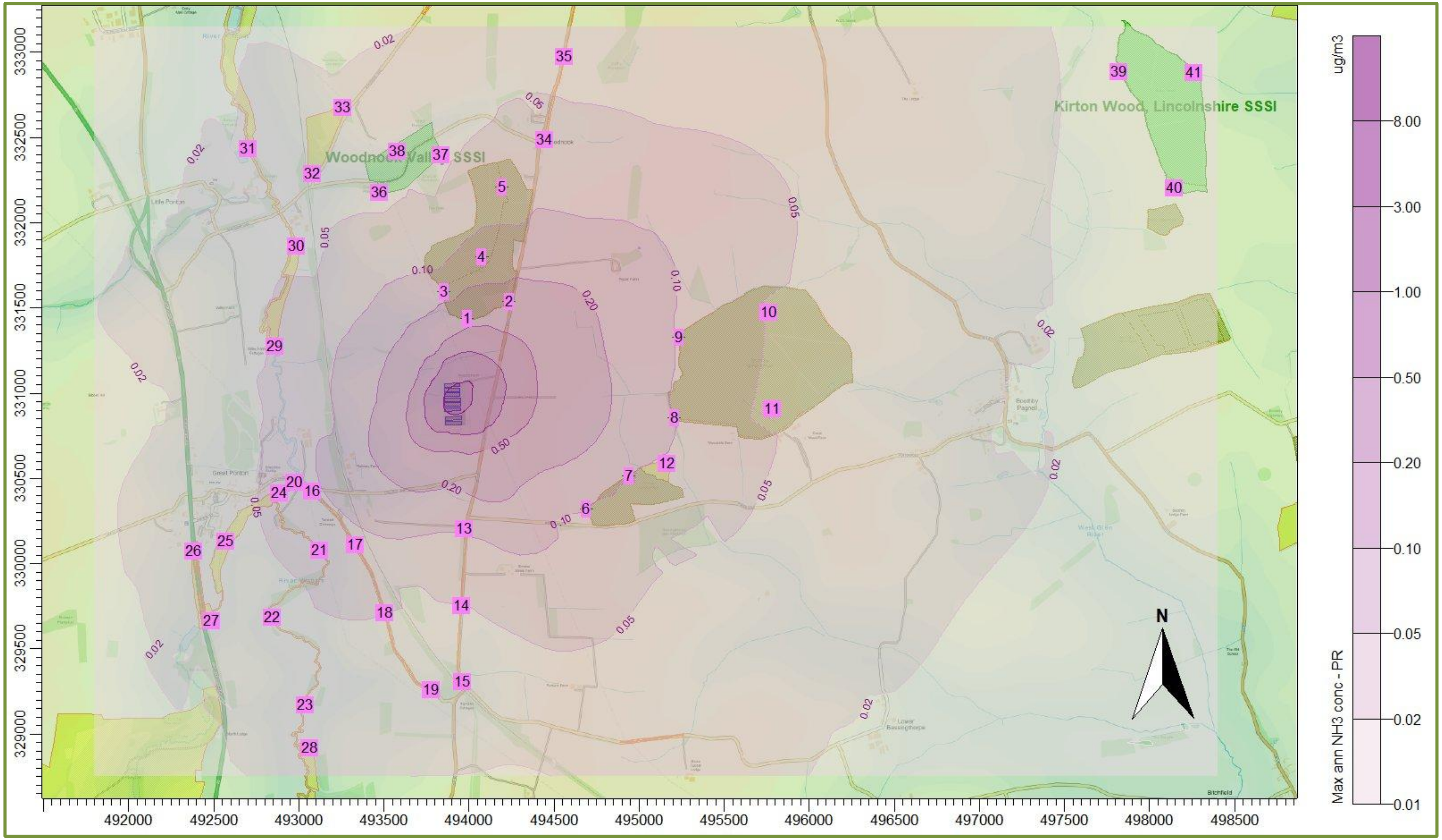
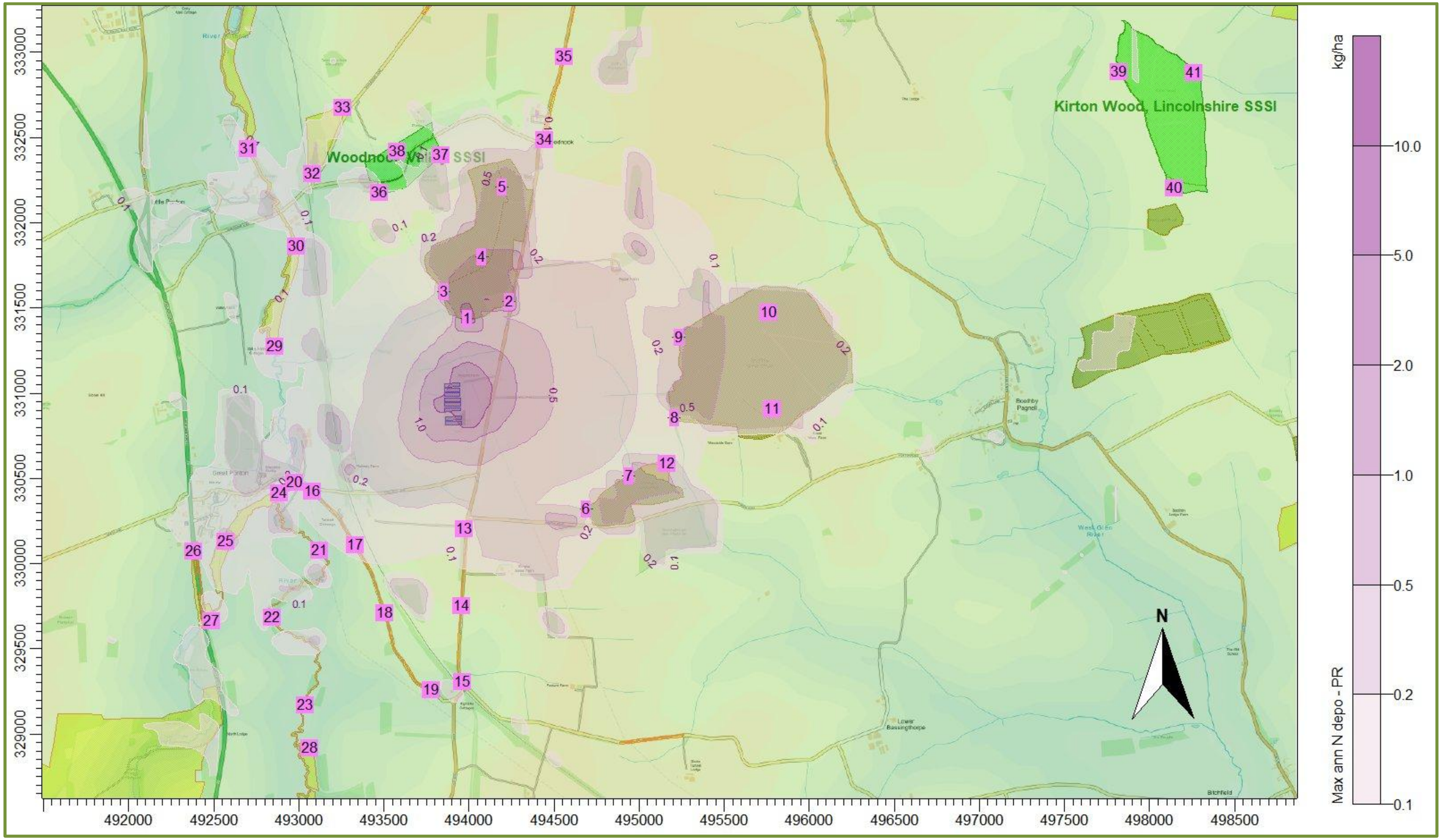


Figure 7b. Maximum annual nitrogen deposition rates – Proposed Scenario



© Crown copyright and database rights. 2026.

6. Summary and Conclusions

AS Modelling & Data Ltd. has been instructed by Mr. Ian Pick of Harrison Pick Ltd. to use computer modelling to assess the impact of ammonia emissions from the existing and proposed broiler chicken rearing houses at Allisons Farm, High Dyke, Great Ponton, Grantham, Lincolnshire. NG33 5DY.

Ammonia emission rates from the existing and proposed broiler chicken rearing houses have been assessed and quantified based upon the Environment Agency standard ammonia emission factors. The emission rates have then been used as inputs to an atmospheric dispersion and deposition model which calculates ammonia exposure levels and nitrogen and acid deposition rates in the surrounding area.

Existing Scenario

The modelling predicts that:

- Process contributions to ammonia concentrations and nitrogen deposition rates are well below the Environment Agency lower and upper thresholds of the Critical Level/Load20 and 50% for SSSIs and 100% and 100% for non statutory sites) at all wildlife sites considered.
- Process contributions currently exceed 1% of Critical Level/Load at Woodnook Valley SSSI and Kirton Wood, Lincolnshire SSSI.

Proposed Poultry Houses Only

The modelling predicts that:

- Process contributions to ammonia concentrations and nitrogen deposition rates are below the Environment Agency lower and upper thresholds of the Critical Level/Load (20% and 50% for SSSIs and 100% and 100% for non statutory sites) at all wildlife sites considered.
- Process contributions would exceed 1% of precautionary Critical Level by a small margin over a small part of Woodnook Valley SSSI, but would otherwise be below 1% of the Critical Level/Load at all statutory wildlife sites considered.

Proposed Scenario

The modelling predicts that, should the redevelopment of Allisons Farm proceed:

- Process contributions to ammonia concentrations and nitrogen deposition rates would be well below the Environment Agency lower and upper thresholds of the Critical Level/Load (20% and 50% for SSSIs and 100% and 100% for non statutory sites) at all wildlife sites considered.
- Process contributions would exceed 1% of the Critical Level/Load at Woodnook Valley SSSI and Kirton Wood, Lincolnshire SSSI.
- At the majority of receptors, small decreases in the process contributions to ammonia concentrations and nitrogen deposition rates are predicted. Where increases are predicted, the changes are very small, 2 to 3 orders of magnitude below the level of insignificance (1%).

7. References

Cambridge Environmental Research Consultants (CERC) (website).

Chapman, C. and Kite, B. Joint Nature Conservation Committee. Guidance on Decision-making Thresholds for Air Pollution.

Environment Agency and Department for Environment, Food & Rural Affairs "Intensive farming risk assessment for your environmental permit", last updated August 2025 (website).

Natural England, "Air pollution and development: advice for local authorities", October 2025 (website).

Steven R Hanna, & Biswanath Chowdhury. Minimum turbulence assumptions and u* and L estimation for dispersion models during low-wind stable conditions.

M. A. Sutton *et al*. Measurement and modelling of ammonia exchange over arable croplands.

Frederik Schrader and Christian Brümmer. Land Use Specific Ammonia Deposition Velocities: a Review of Recent Studies (2004-2013).

United Nations Economic Commission for Europe (UNECE) (website).

UK Air Pollution Information System (APIS) (website).