A Report on the Modelling of the Dispersion and Deposition of Ammonia from the Existing and Proposed Pig Rearing Houses at Bucknell Court, near Dilwyn in Herefordshire

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1. Introduction

AS Modelling & Data Ltd. has been instructed by Mr. Ian Pick of Ian Pick Associates Ltd., on behalf of BL Thomas & Son, to use computer modelling to assess the impact of ammonia emissions from the existing and proposed pig rearing houses at Bucknell Court, Dilwyn, Herefordshire. HR4 8EX.

Ammonia emission rates from the existing and proposed pig rearing houses have been assessed and quantified based upon emission figures obtained from Agriculture and Horticulture Development Board (AHDB) reports and the Environment Agency's standard ammonia emission factors. The ammonia emission rates so obtained 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 farm 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

Bucknell Court is in a rural area approximately 3.1 km to the east of the village of Dilwyn in Herefordshire. The surrounding land is used primarily for arable farming, although there are some wooded areas and pasture. The farm is on fairly level land at an elevation of around 94 m in the broad valley formed by the Stretford Brook.

The existing pig rearing houses at Bucknell Court, provide accommodation for up to 990 pigs which arrive at the farm at a weight of around 7 kg and are reared to a finishing weight of around 105 kg. The pigs are housed on a solid floor-straw system and the buildings are naturally ventilated. Some manure is stored at the farm temporarily, but it is removed from the site frequently.

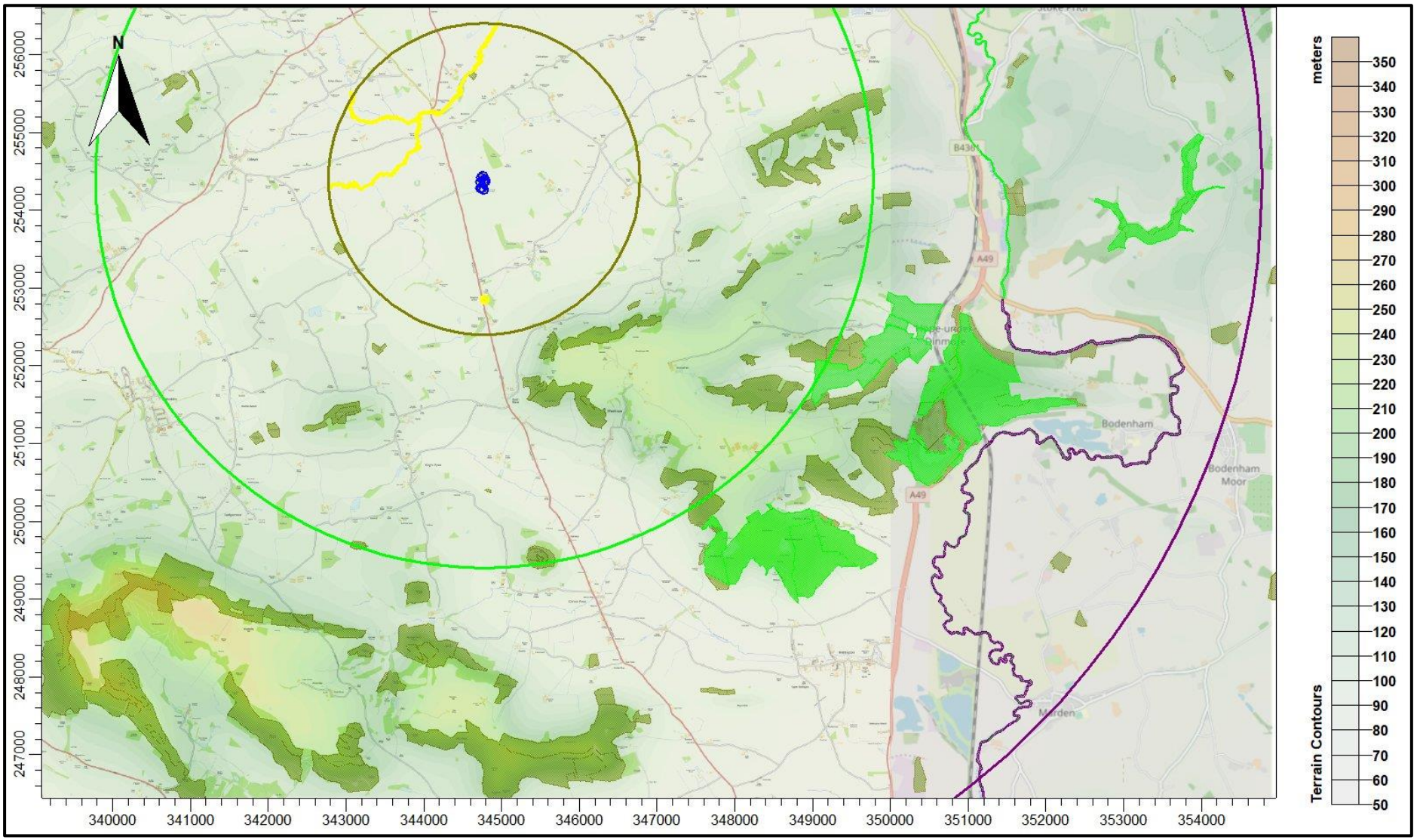
Under the proposal, a new pig house would be constructed adjacent to the existing house. The new building would provide accommodation for up to 990 pigs which would arrive at the farm at 7 kg and would be reared to a finishing weight of around 105 kg. The pigs would be housed on a solid floor-straw system and the new building would be naturally ventilated. Manure would continue to be stored temporarily, but would be removed from the farm frequently.

There are two Local Wildlife Sites (LWSs) and two areas of remnant Ancient Woodlands (AWs) within 2 km of the farm. There is one Site of Special Scientific Interest (SSSI) within 5 km and parts of the river Wye Special Area of Conservation (SAC) are within 10 km. Further details of the SSSI and the SAC are provided below:

- The Bury Farm SSSI - Approximately 4.8 km to the south-east - nationally important for its complex of species-rich, unimproved neutral and calcareous grasslands, and an assemblage of saproxylic (dead wood) invertebrates chiefly associated with veteran orchard trees.
- River Lugg SSSI/River Wye SAC - Approximately 7.1km to the south-south-east at its closest point - Most of the middle and lower reaches have species-rich, calcareous, lowland river communities.

A map of the surrounding area showing the site of the pig houses, the LWSs, the AWs, the SSSI and the SAC is provided in Figure 1. In the Figures, the LWSs are shaded yellow, the AWs are shaded olive, the SSSI is shaded green, the SAC is shaded purple and the site of the pig houses at Bucknell Court is outlined in blue.

Figure 1. The area surrounding Bucknell Court



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 background ammonia concentration (annual mean) in the area around Bucknell Court is 2.18 µg-NH_3/m^3. The background nitrogen deposition rate to woodland is 30.24 kg-N/ha/y and to short vegetation is 17.36 kg-N/ha/y. The background acid deposition rate to woodland is 2.10 keq/ha/y and to short vegetation is 1.27 keq/ha/y. The source of these background figures is the Air Pollution Information System (APIS, April 2020).

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).

For ammonia concentration in air, the Critical Level for higher plants is 3.0 µg-NH_3/m^3 as an annual mean. For sites where there are sensitive lichens and bryophytes present, or lichens and bryophytes are an integral part of the ecosystem, the Critical Level is 1.0 µg-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 assumed in this study are provided in Table 1. Where the Critical Level of 1.0 µg-NH_3/m^3 is assumed, it is usually unnecessary to consider the Critical Load as the Critical Level provides the stricter test. Normally, the Critical Load for nitrogen deposition provides a stricter test than the Critical Load for acid deposition.

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

Site	Critical Level (µg-NH_3/m^3)	Critical Load Nitrogen Deposition (kg-N/ha/y)	Critical Load Acid Deposition (keq/ha/y)
LWSs & AWs	1.0 [1]	-	-
The Bury Farm SSSI	1.0 [1 & 2]	15.0 [3]	-
River Lugg SSSI/River Wye SAC	1.0 [1 & 2]	10.0 [3]	-

1. Used as a precautionary figure where details of the site ecology are unavailable, or where sensitive lichens and bryophytes are present.
2. Based on the citation for the wildlife site and information from APIS.
3. The lower bound of the range of Critical Loads for the site/species, obtained from APIS.

3.4 Guidance on the significance of ammonia emissions

3.4.1 Environment Agency Criteria

The Environment Agency web-page titled "Intensive farming risk assessment for your environmental permit", contains a set of criteria, with thresholds defined by percentages of the Critical Level or Critical Load, for: internationally designated wildlife sites (Special Protection Areas (SPAs), Special Areas of Conservation (SACs) and Ramsar sites); Sites of Special Scientific Interest (SSSIs) and other non-statutory wildlife sites. The lower and upper thresholds are: 4% and 20% for SACs, SPAs and Ramsar sites; 20% and 50% for SSSIs and 100% and 100% for non-statutory wildlife sites. 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; 4% to 20% for SACs, SPAs and Ramsar sites; 20% to 50% for SSSIs and 100% to 100% for other non-statutory wildlife sites, 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 non-statutory sites, the Environment Agency do not usually consider other farms that may act in-combination and therefore a PC of up to 100% of Critical Level 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 advisory criteria

Natural England are a statutory consultee at planning and usually advise that, if predicted process contributions exceed 1% of Critical Level or Critical Load at a SSSI, SAC, SPA or Ramsar site, then the local authority should consider whether other farming installations[1] might act in-combination or cumulatively with the farm and the sensitivities of the wildlife sites. This advice is based primarily upon the Habitats Directive, EIA Directive and the Countryside and Rights of Way Act.

1. The process contribution from most farming installations is already included in the background ammonia concentrations and nitrogen and acid deposition rates. Therefore, it is normally only necessary to consider new installations and installations with extant planning permission and proposed developments when understanding the additional impact of a proposal upon nearby ecologies. However, established farms in close proximity may need to be considered given the background concentrations and deposition rates are derived as an average for a 5 km by 5 km grid.

Note that a process contribution of 1% of Critical Level or Critical Load would normally be considered insignificant. A process contribution that is above 1% of Critical Level or Critical Load should be regarded as potentially significant; however, 1% of Critical Level or Critical Load should not be used as a threshold above which damage is implied.

3.5 Quantification of ammonia emissions

Ammonia emission rates from piggeries 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 factor for the proposed pig housing is based upon recent AHDB reports on ammonia emissions from modern solid floor straw based pig houses which provides a range of 0.49 to 1.69 kg-NH_3/animal place/y.

The Environment Agency Intensive Farming guidance note also provides an emission factor for a manure heap, namely 1.49 kg-NH_3/tonne/year; this figure has been used for the manure storage areas.

Details of the pig numbers and types and emission factors used and calculated ammonia emission rates are provided in Table 2.

Table 2. Details of pig numbers and ammonia emission factors and rates

Source	Number of animals or weight (t)	Animal type/source type	Emission factor (kg-NH_3/animal place/year)	Emissions (g-NH_3/s)
Existing & Proposed Housing	1,980	Pigs 7-105 kg	2.00	0.125485
Existing & Proposed Manure Storage	200 t	Manure Storage	1.49	0.009443

4. The Atmospheric Dispersion Modelling System (ADMS) and Model Parameters

The Atmospheric Dispersion Modelling System (ADMS) ADMS 5 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 a number of 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).

The GFS is a spectral model: the physics/dynamics model has an equivalent resolution of approximately 13 km (latterly 9 km); terrain is understood to be resolved at a resolution of approximately 2 km, with sub-13/9 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). The use of NWP data has advantages over traditional meteorological records because:

- Calm periods in traditional records may be over represented, this is 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 where terrain data is included in the modelling, wind speeds and directions will be modified. The terrain and roughness length modified wind rose for the area around Bucknell Court is shown in Figure 2b. Note that elsewhere in the modelling domain, modified wind roses may differ more markedly. The resolution of the wind field in terrain runs is approximately 300 m.

Figure 2a. The wind rose. GFS derived data for 52.185 N, 2.808 W, 2016 to 2019

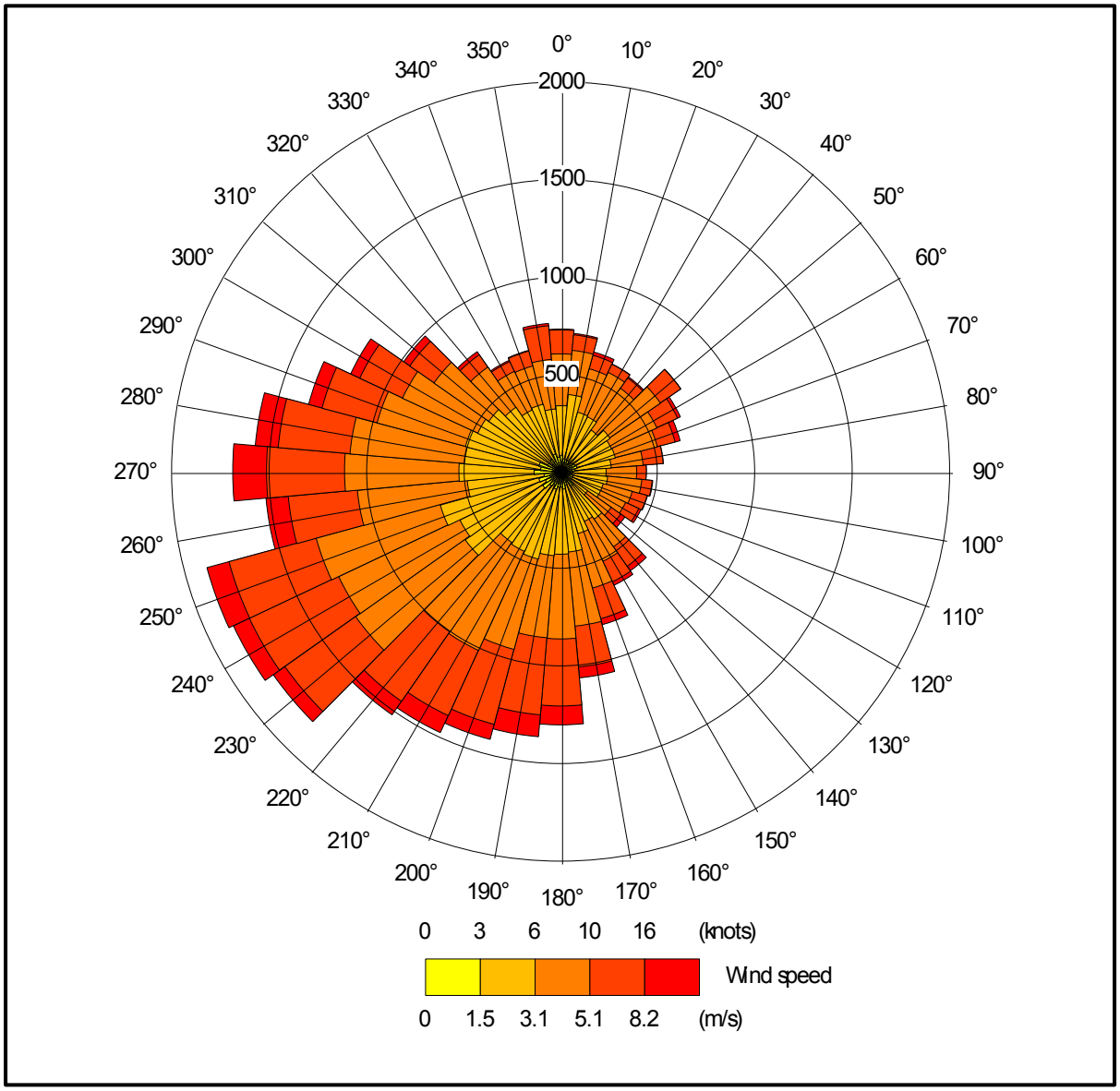
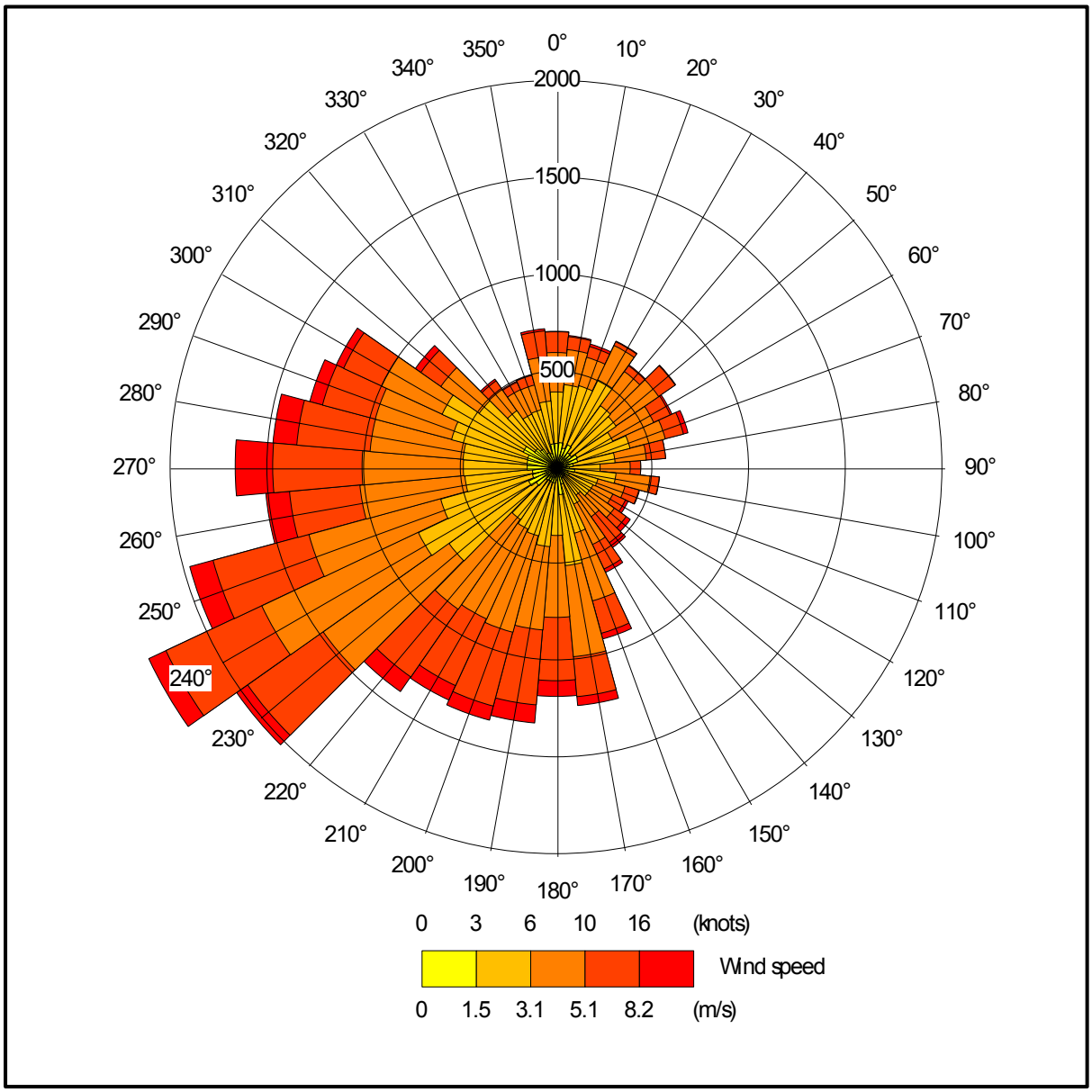


Figure 2b. The wind rose for Bucknell Court, NGR 344750, 254400 - derived from FLOWSTAR output, 2016 to 2019



4.2 Emission sources

Emissions from the existing and proposed manure storage areas and pig houses are represented by volume sources within ADMS (EX1, PR2, EX_MAN & PR_MAN). Further details of the volume source parameters are shown in Table 3 and the positions of the sources may be seen in Figure 3.

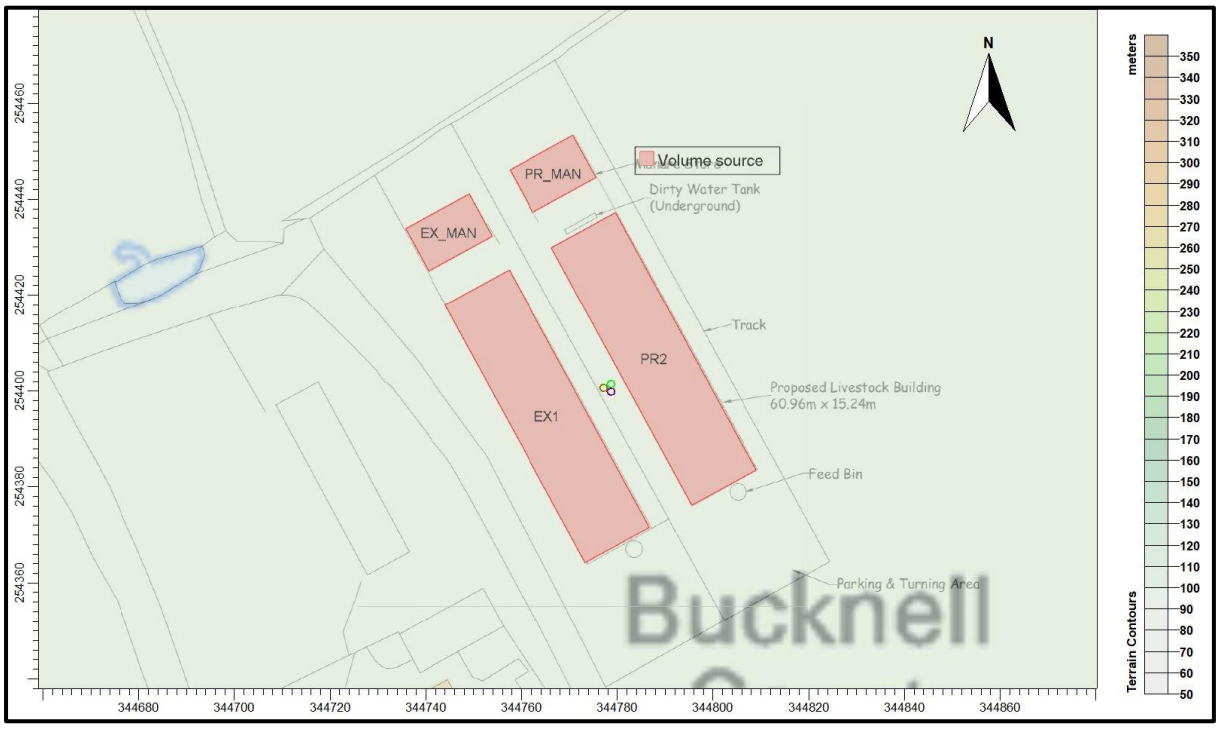
Table 3. Volume source parameters

Source ID	Length (m)	Width (m)	Depth (m)	Base height (m)	Emission temperature (°C)	Emission rate per source ($g\text{-}NH_3/s$)
EX1	61.0	15.2	4.0	2.0	Ambient	0.062742
PR2	61.0	15.2	4.0	2.0	Ambient	0.062742
EX_MAN	10.0	15.0	2.0	0.0	Ambient	0.004722
PR_MAN	10.0	15.0	2.0	0.0	Ambient	0.004722

4.3 Modelled buildings

Not modelled.

Figure 3. The positions of the modelled sources



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4.4 Discrete receptors

Eighteen discrete receptors have been defined at the nearby wildlife sites: nine at the LWSs (1 to 9); two at the AWs (10 and 11); two at the SSSI (12 and 13) and five at the SAC (14 to 18). These receptors are defined at ground level within ADMS. The positions of the discrete receptors may be seen in Figure 4, where they are 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, where it is marked by grey lines.

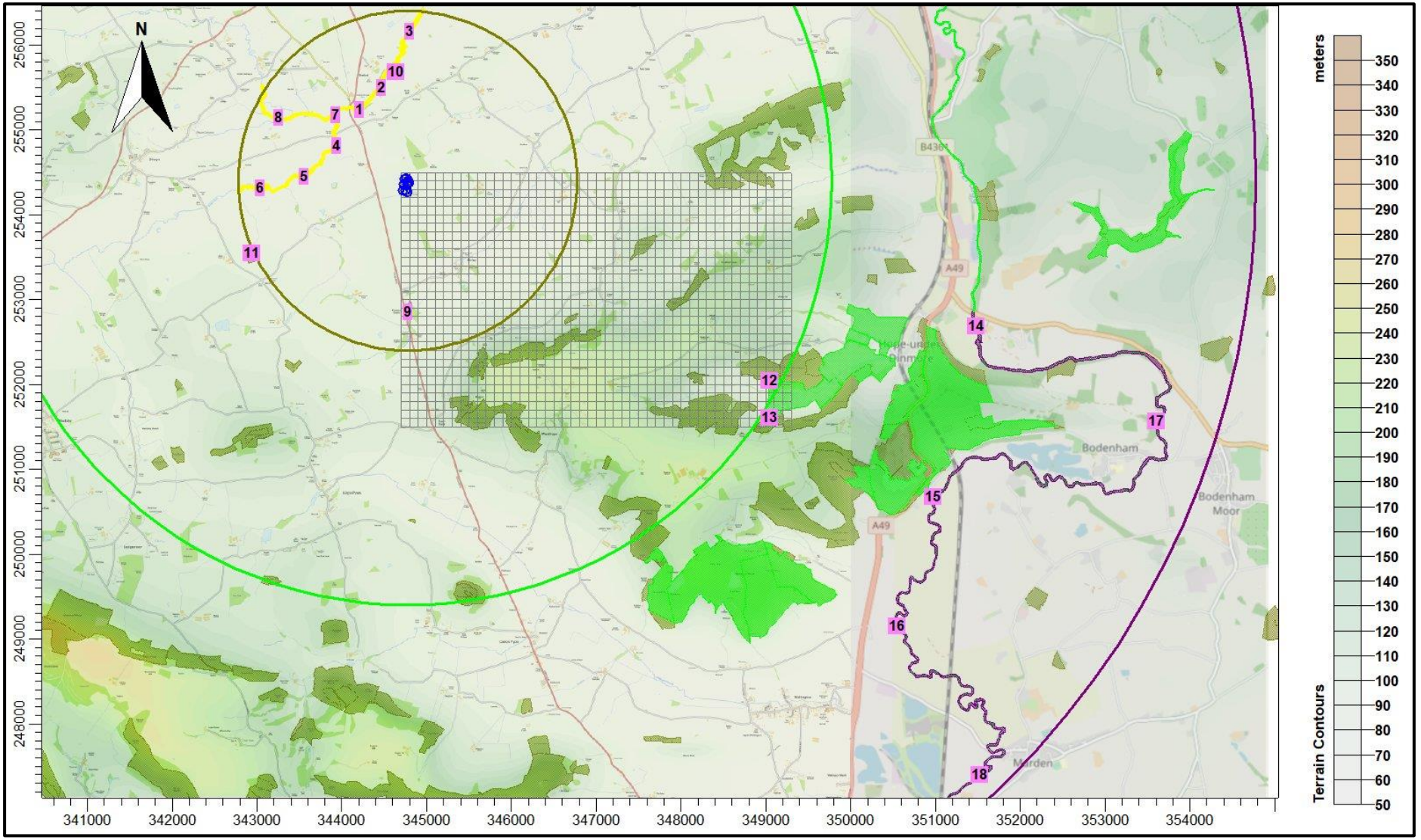
4.6 Terrain data

Terrain has been considered in the modelling. The terrain data are based upon the Ordnance Survey 50 m Digital Elevation Model. A 20.0 km by 20.0 km domain has been resampled at 100 m horizontal resolution for use within ADMS. The resolution of FLOWSTAR is 64 by 64 grid points; therefore, the effective resolution of the wind field for the terrain runs is approximately 300 m.

4.7 Roughness Length

A fixed surface roughness length of 0.325 m has been applied over the entire modelling domain. As a precautionary measure, the GFS meteorological data is assumed to have a roughness length of 0.3 m. The effect of the difference in roughness length is precautionary as it increases the frequency of low wind speeds and the stability and therefore increases predicted ground level concentrations.

Figure 4. The discrete receptors and regular Cartesian grid



4.8 Deposition

The method used to model deposition of ammonia and consequent plume depletion is based on a document titled "Guidance on modelling the concentration and deposition of ammonia emitted from intensive farming" from the Environment Agency's Air Quality Modelling and Assessment Unit, 22 November 2010. N.B. 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 piggery and 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 is used to define a deposition velocity field. The deposition velocities used are provided in Table 4.

Table 4. Deposition velocities

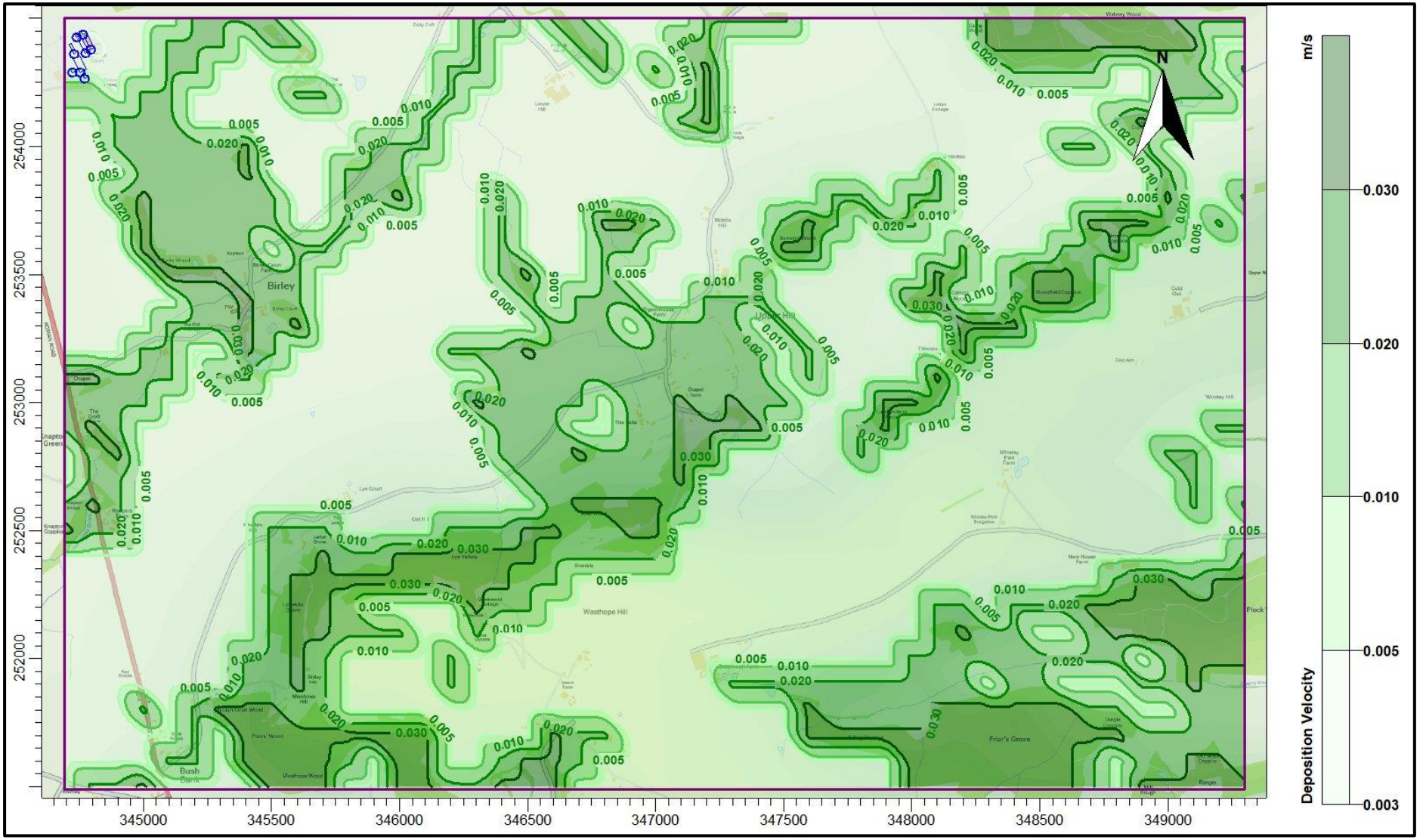
NH_3 concentration (PC + background) ($\mu g/m^3$)	< 10	10 - 20	20 - 30	30 – 80	> 80
Deposition velocity – woodland (m/s)	0.03	0.015	0.01	0.005	0.003
Deposition velocity – short vegetation (m/s)	0.02 (0.015 over heavily grazed grassland)	0.015	0.01	0.005	0.003
Deposition velocity – arable farmland/rye 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 5.

Please note that, in this case, as part of the preliminary modelling, the model has also been run with a fixed deposition at 0.003 m/s and similarly to not modelling deposition at all, the predicted ammonia concentrations (and nitrogen and acid deposition rates) are always higher than if deposition were modelled explicitly as Environment Agency guidance, particularly where there is some distance between the source and a receptor.

Figure 5. The spatially varying deposition field



5. Details of the Model Runs and Results

5.1 Preliminary modelling

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

- In basic mode without calms and without terrain – GFS data.
- With calms and without terrain – GFS data.
- Without calms and with terrain – GFS data.
- With calms correction, with terrain and fixed deposition at 0.003 m/s – GFS data.

For each mode, statistics for the maximum annual mean ammonia concentration at each receptor were compiled for the existing and proposed scenario.

Details of the predicted annual mean ammonia concentrations at each receptor are provided in Table 5. In the Table, predicted ammonia concentrations (or concentrations equivalent to deposition rates) that are in excess of the Environment Agency's upper threshold percentage of the relevant Critical Level or Critical Load (20% for a SAC, 50% for a SSSI and 100% for a LWS or an AW) are coloured red. Concentrations (or concentrations equivalent to deposition rates) in the range between the Environment Agency's lower and upper threshold percentages of the relevant Critical Level or Critical Load (4% and 20% for a SAC, 20% and 50% for a SSSI and 100% to 100% for a LWS or an AW) are coloured blue. Additionally, predicted ammonia concentrations (or ammonia concentrations equivalent to nitrogen deposition rates) that exceed 1% of the Critical Level or Critical Load at a statutory site are highlighted with bold text.

Table 5. Predicted maximum annual mean ammonia concentration at the discrete receptors

Receptor number	X(m)	Y(m)	Designation	Maximum annual mean ammonia concentration - (µg/m^3)			
				GFS No Calms No Terrain	GFS Calms No Terrain	GFS No Calms Terrain	GFS Calms Correction Terrain Fixed depo 0.003 m/s
1	344208	255235	LWS	0.224	0.326	0.225	0.172
2	344464	255498	LWS	0.233	0.314	0.239	0.193
3	344801	256160	LWS	0.121	0.163	0.125	0.096
4	343939	254810	LWS	0.241	0.354	0.246	0.184
5	343558	254448	LWS	0.126	0.198	0.132	0.097
6	343039	254311	LWS	0.063	0.103	0.069	0.046
7	343933	255179	LWS	0.161	0.246	0.166	0.119
8	343252	255142	LWS	0.087	0.130	0.094	0.061
9	344782	252848	LWS	0.108	0.158	0.125	0.087
10	344639	255685	AW	0.204	0.272	0.207	0.166
11	342933	253542	AW	0.070	0.081	0.077	0.051
12	349048	252042	The Bury Farm SSSI	**0.027**	**0.033**	**0.020**	**0.011**
13	349046	251612	The Bury Farm SSSI	**0.023**	**0.030**	**0.017**	0.009
14	351475	252686	River Lugg SSSI/River Wye SAC	**0.017**	**0.021**	**0.017**	0.009
15	350972	250674	River Lugg SSSI/River Wye SAC	**0.014**	**0.017**	**0.010**	0.005
16	350546	249155	River Lugg SSSI/River Wye SAC	**0.011**	**0.014**	0.008	0.004
17	353604	251564	River Lugg SSSI/River Wye SAC	**0.011**	**0.013**	**0.012**	0.006
18	351523	247403	River Lugg SSSI/River Wye SAC	0.007	0.010	0.007	0.003

5.2 Detailed deposition modelling

The detailed deposition modelling was carried out over a domain that includes the pig houses at Bucknell Court and The Bury Farm SSSI, where the preliminary modelling of ammonia emissions from the piggery (fixed deposition, terrain and calms correction runs) indicated that annual mean concentrations, or concentrations equivalent to nitrogen deposition rates would potentially exceed 1% of the Critical Level or Critical Load. At all other receptors considered, the preliminary modelling indicated that ammonia levels (and nitrogen and acid deposition rates) would be below 1% of the Critical Level or Critical Load.

The results of the detailed deposition modelling are shown in Table 6. In the Table, predicted ammonia concentrations or nitrogen deposition rates that are in excess of the Environment Agency's upper threshold percentage of the relevant Critical Level or Critical Load (20% for a SAC, 50% for a SSSI and 100% for a LWS or an AW) are coloured red. Concentrations or nitrogen deposition rates that are in the range between the Environment Agency's lower and upper threshold percentages (4% to 20% for a SAC, 20% and 50% for a SSSI and 100% and 100% for a LWS or an AW) are coloured blue. Additionally, predicted ammonia concentrations that exceed 1% of the Critical Level or Critical Load are highlighted with bold text. Where receptors are outside of the spatially varying deposition field, the deposition velocity (outside of the spatially varying deposition field) is set at a precautionary value of 0.005 m/s.

Contour plots of the predicted maximum annual ammonia concentration and predicted nitrogen deposition rates are shown in Figures 6a and 6b.

Table 6. Annual ammonia concentration and nitrogen deposition rates at the discrete receptors

Receptor number	X(m)	Y(m)	Name	Site Parameters			Maximum annual ammonia concentration		Maximum annual nitrogen deposition rate	
				Deposition Velocity	Critical Level (µg/m^3)	Critical Load (kg/ha)	Process Contribution (µg/m^3)	%age of Critical Level	Process Contribution (kg/ha)	%age of Critical Load
12	349048	252042	The Bury Farm SSSI	0.02	1.0	15.0	0.006	0.6	0.03	0.2
13	349046	251612	The Bury Farm SSSI	0.02	1.0	15.0	0.005	0.5	0.02	0.2
14	351475	252686	River Lugg SSSI/River Wye SAC	0.03	1.0	10.0	0.004	0.4	0.03	0.3
15	350972	250674	River Lugg SSSI/River Wye SAC	0.03	1.0	10.0	0.002	0.2	0.02	0.2
16	350546	249155	River Lugg SSSI/River Wye SAC	0.03	1.0	10.0	0.002	0.2	0.01	0.1
17	353604	251564	River Lugg SSSI/River Wye SAC	0.03	1.0	10.0	0.002	0.2	0.02	0.2
18	351523	247403	River Lugg SSSI/River Wye SAC	0.03	1.0	10.0	0.001	0.1	0.01	0.1

Figure 6a. Maximum annual mean ammonia concentration

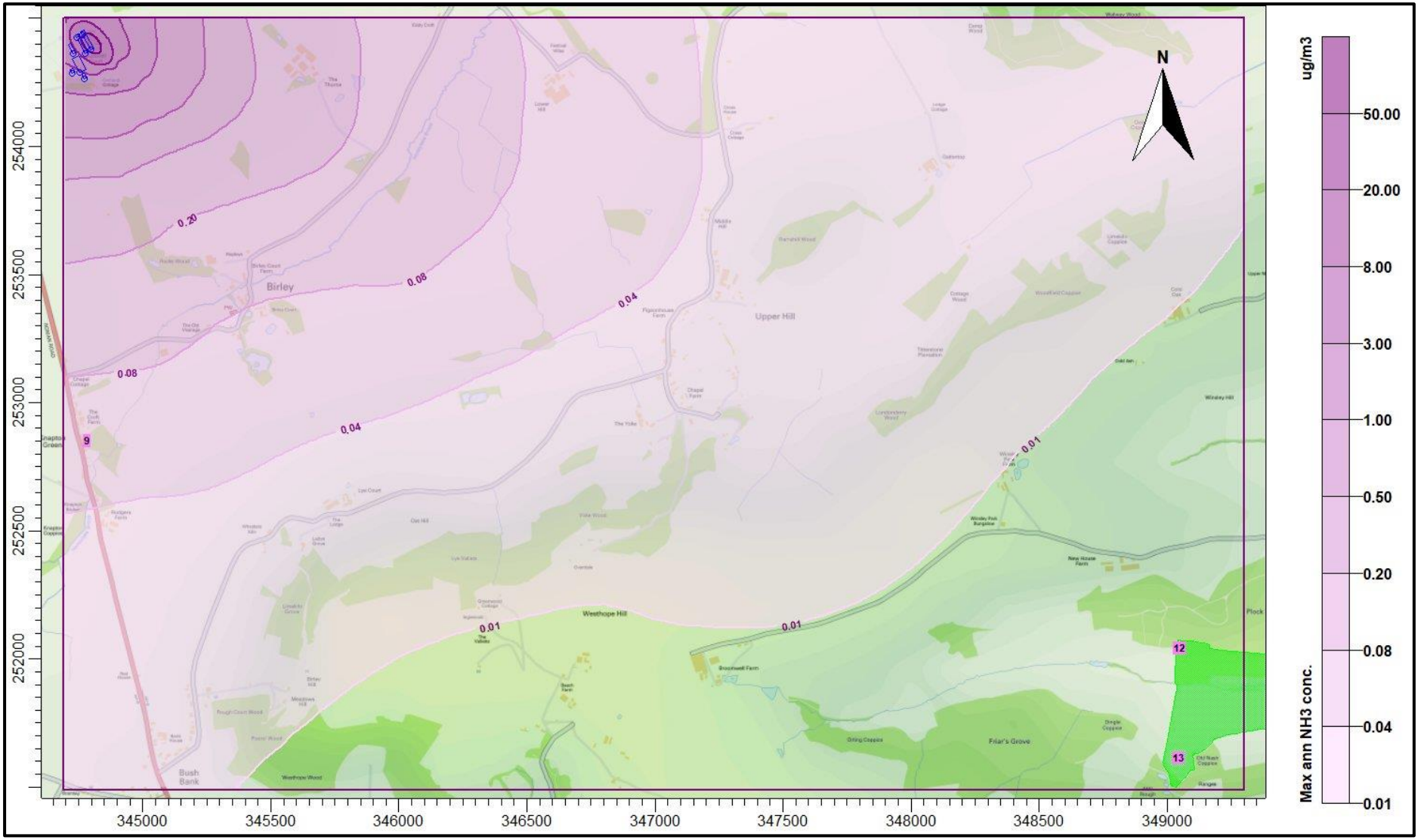
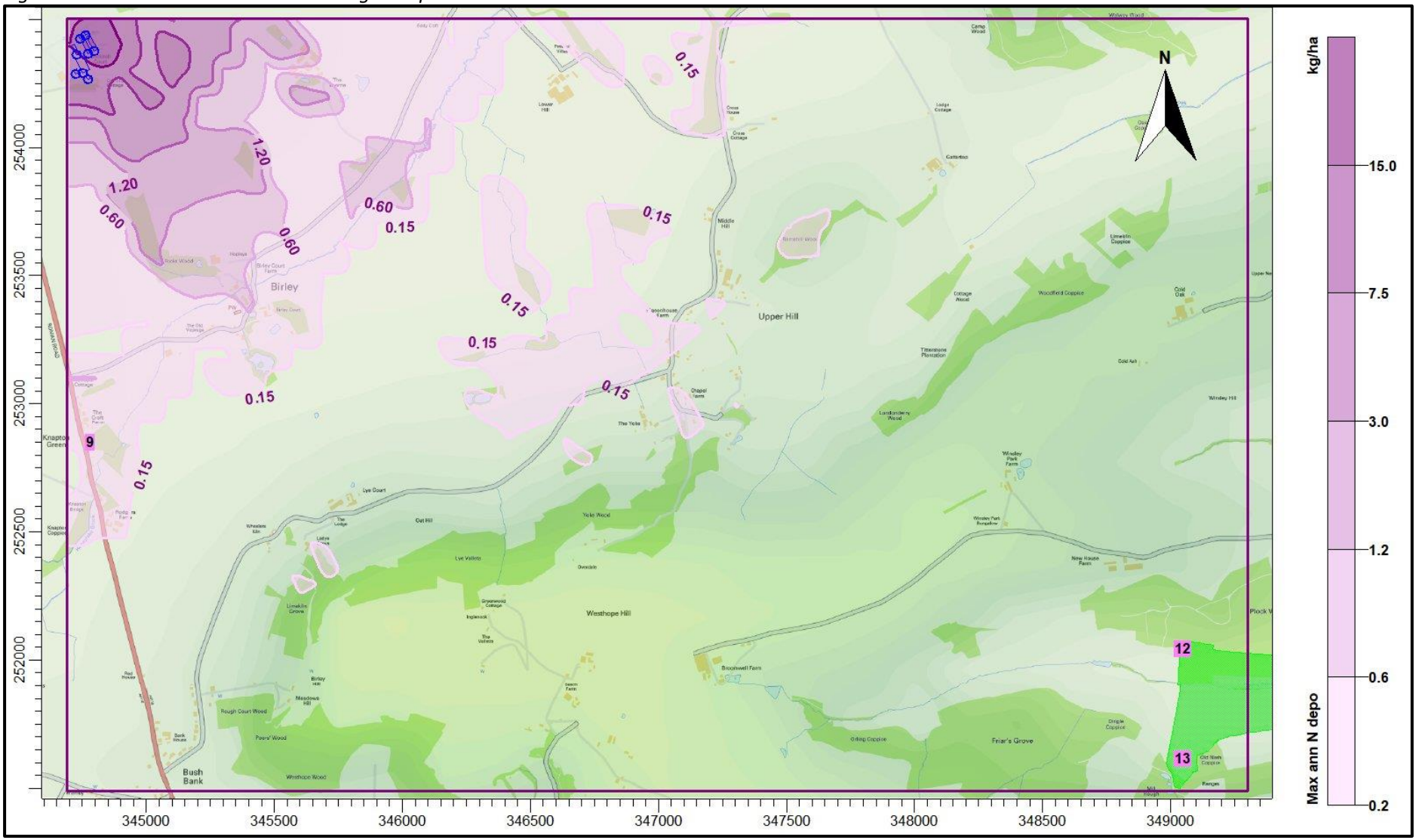


Figure 6b. Maximum annual mean nitrogen deposition rate



6. Summary and Conclusions

AS Modelling & Data Ltd. has been instructed by Mr. Ian Pick of Ian Pick Associates Ltd., on behalf of BL Thomas & Son, to use computer modelling to assess the impact of ammonia emissions from the existing and proposed pig rearing houses at Bucknell Court, Dilwyn, Herefordshire. HR4 8EX.

Ammonia emission rates from the existing and proposed pig rearing houses have been assessed and quantified based upon emission figures obtained from Agriculture and Horticulture Development Board (AHDB) reports and the Environment Agency's standard ammonia emission factors. The ammonia emission rates so obtained 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.

The modelling predicts that the process contribution from the existing and proposed piggeries to ammonia concentration and nitrogen deposition rate:

- Would be below the Environment Agency's lower threshold percentage (100%) of the Critical Level and Critical Load at all AWs and LWS considered.

- Would be below the Environment Agency's lower threshold percentage (20%) of the Critical Level and Critical Load at The Bury Farm SSSI.

- Would be below the Environment Agency's lower threshold percentage (4%) of the Critical Level and Critical Load at the River Lugg SSSI/River Wye SAC.

- Would be well below 1% of the Critical Level and Critical Load at The Bury Farm SSSI and the River Lugg SSSI/River Wye SAC.

7. References

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