A Dispersion Modelling Study of the Impact of Odour from the Proposed Pullet Chicken Rearing Houses at Court House Farm, near Llanbadarn Fynydd in Powys

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1. Introduction

AS Modelling & Data Ltd. has been instructed by John Ward, on behalf of David Davies Resources Ltd., to use computer modelling to assess the impact of odour emissions from the existing egg laying chicken houses and the proposed pullet rearing house at Court House Farm, Mellington, Churchstoke, Montgomery, Powys. SY15 6TQ.

Odour emission rates from the existing egg laying chicken houses and the proposed pullet rearing house have been assessed and quantified based upon emission models that take into account the likely internal odour concentrations and ventilation rates of the poultry houses. The odour emission rates so obtained have then been used as inputs to an atmospheric dispersion model which calculates odour exposure levels 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 odour; details of the methods used to estimate odour emissions from the poultry houses; relevant guidelines and legislation on exposure limits and where relevant, details of likely background levels of odour.

- Section 4 provides some information about ADMS, the dispersion model used for this study and details the modelling parameters and procedures.

- Section 5 contains the results of the modelling.

- And Section 6 provides a discussion of the results and conclusions.

2. Background Details

Court House Farm is in a rural area, approximately 1.8 km to the south-south-west of the village of Churchstoke in Powys. The surrounding land is used predominantly for livestock and arable farming, but there are some wooded areas and areas of semi-natural grassland nearby. The site is southern side of the valley formed by Camlad and Caebitra at an altitude of around 144 m, with the land falling gently towards the rivers to the north and rising to hills/mountains to the south.

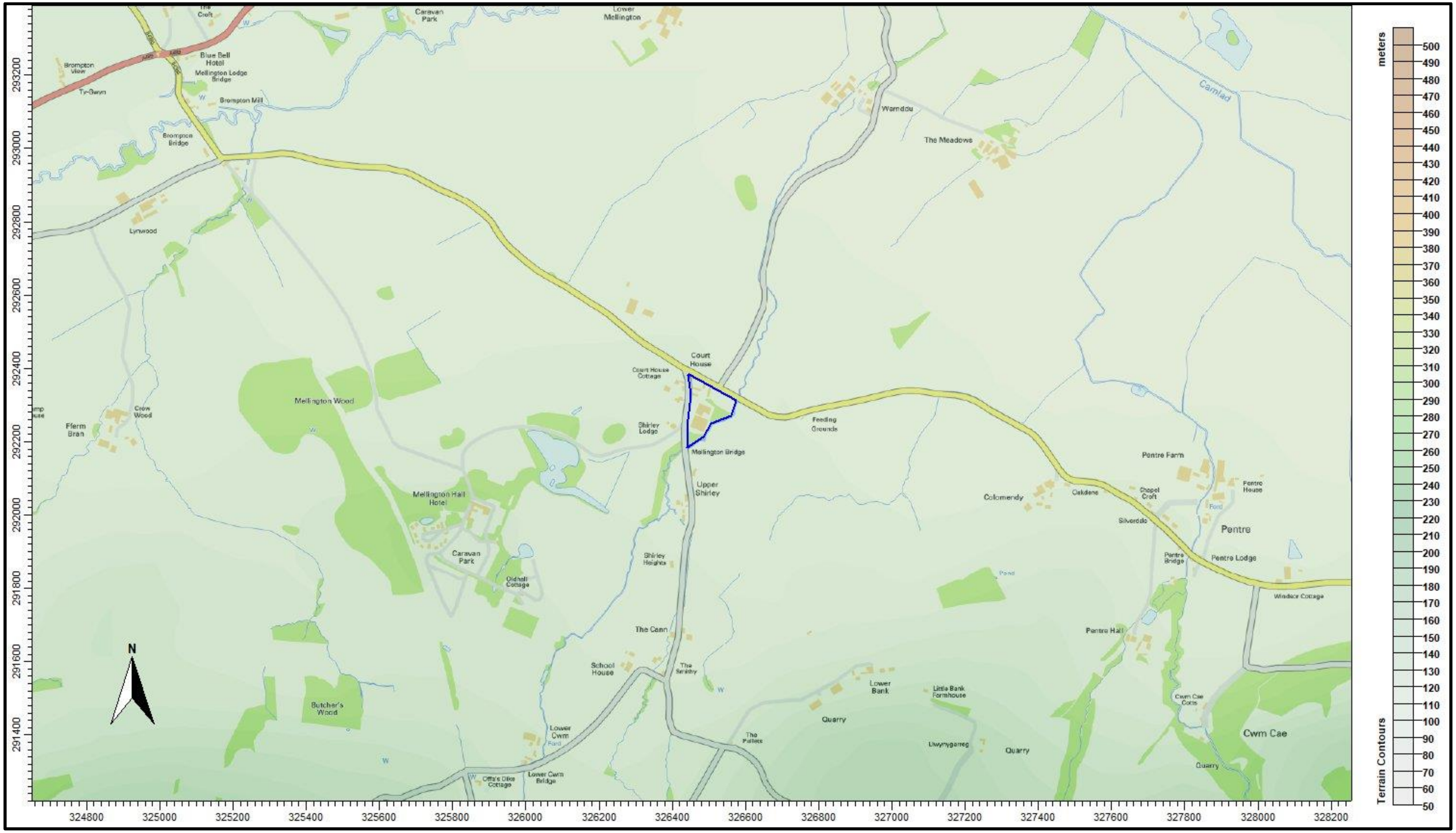
There are currently three poultry houses at Court House Farm, these houses accommodate up to 39,999 egg laying chickens. The birds droppings collect within the houses and is removed at the end of each flock cycle, which is approximately once per year. The houses are ventilated by cowled side mounted fans.

Under the proposal, the existing poultry houses would be demolished and replaced by a single new poultry house. The new poultry house would provide accommodation for up to 100,000 pullets which would be reared from day old chicks to around 18 weeks old, prior to transfer to egg laying units elsewhere. The poultry house would be ventilated by uncapped high speed ridge/roof mounted fans, each with a short chimney.

There are some residences and commercial properties in the area surrounding Court House Farm. Excluding the farmhouse at the site, the closest residences are: Court House Cottage and two other residences, which are between approximately 50 m and 90 m to the west-north-west; Shirley Lodge, approximately 30 m to the west; residences at Upper Shirley, approximately 90 m and 160 m to the south; a residence on the B4385, approximately 230 m to the east and Shirley Heights, approximately 330 m to the south.

A map of the surrounding area is provided in Figure 1; Court House Farm is outlined in blue.

Figure 1. The area surrounding Court House Farm



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3. Odour, Emission Rates, Exposure Limits & Background Levels

3.1 Odour concentration, averaging times, percentiles and FIDOR

Odour concentration is expressed in terms of European Odour Units per metre cubed of air (ou_E/m^3). The following definitions and descriptions of how an odour might be perceived by a human with an average sense of smell may be useful, however, it should be noted that within a human population there is considerable variation in acuity of sense of smell.

- 1.0 ou_E/m^3 is defined as the limit of detection in laboratory conditions.

- At 2.0 – 3.0 ou_E/m^3, a particular odour might be detected against background odours in an open environment.

- When the concentration reaches around 5.0 ou_E/m^3, a particular odour will usually be recognisable, if known, but would usually be described as faint.

- At 10.0 ou_E/m^3, most would describe the intensity of the odour as moderate or strong and if persistent, it is likely that the odour would become intrusive.

The character, or hedonic tone, of an odour is also important; typically, odours are grouped into three categories.

Most offensive:

- Processes involving decaying animal or fish remains.
- Processes involving septic effluent or sludge.
- Biological landfill odours.

Moderately offensive:

- Intensive livestock rearing.
- Fat frying (food processing).
- Sugar beet processing.
- Well aerated green waste composting.

Less offensive:

- Brewery.
- Confectionery.
- Coffee roasting.
- Bakery.

Dispersion models usually calculate hourly mean odour concentrations and Environment Agency guidelines and findings from UK Water Industry Research (UKWIR) are also framed in terms of hourly mean odour concentration.

The Environment Agency guidelines and findings from UKWIR use the 98th percentile hourly mean; this is the hourly mean odour concentration that is equalled or exceeded for 2% of the time period considered, which is typically one year. The use of the 98th percentile statistic allows for some consideration of both frequency and intensity of the odours.

At some distance from a source, it would be unusual if odour concentration remained constant for an hour and in reality, due to air turbulence and changes in wind direction, short term fluctuations in concentration are observed. Therefore, although average exposure levels may be below the detection threshold, or a particular guideline, a population may be exposed to short term concentrations which are higher than the hourly average. It should be noted that a fluctuating odour is often more noticeable than a steady background odour at a low concentration. It is implicit that within the models' hourly averaging time and the Environment Agency guidelines and findings from UKWIR that there would be variation in the odour concentration around this mean, i.e. there would be short periods when odour concentration would be higher than the mean and lower than the mean.

The FIDOR acronym is a useful reminder of the factors that will determine the degree of odour pollution:

- **F**requency of detection.
- **I**ntensity as perceived.
- **D**uration of exposure.
- **O**ffensiveness.
- **R**eceptor sensitivity.

3.2 Environment Agency guidelines (Rebranded by Natural Resources Wales)

In April 2011, the Environment Agency published H4 Odour Management guidance (H4). In Appendix 3 – Modelling Odour Exposure, benchmark exposure levels are provided. The benchmarks are based on the 98th percentile of hourly mean concentrations of odour modelled over a year at the site/installation boundary. The benchmarks are:

- 1.5 ou_E/m^3 for most offensive odours.
- 3.0 ou_E/m^3 for moderately offensive odours.
- 6.0 ou_E/m^3 for less offensive odours.

Any modelled results that project exposures above these benchmark levels, after taking uncertainty into account, indicates the likelihood of unacceptable odour pollution.

3.3 UK Water Industry Research findings

The main source of research into odour impacts in the UK has been the wastewater industry. An in-depth study of the correlation between modelled odour impacts and human response was published by UKWIR in 2001. This was based on a review of the correlation between reported odour complaints and modelled odour impacts in relation to nine wastewater treatment works in the UK with on-going odour complaints. The findings of this research and subsequent UKWIR research indicated the following, based on the modelled 98th percentile of hourly mean concentrations of odour:

- At below 5.0 ou_E/m^3, complaints are relatively rare at only 3% of the total registered.

- At between 5.0 ou_E/m^3 and 10.0 ou_E/m^3, a significant proportion of total registered complaints occur, 38% of the total.

- The majority of complaints occur in areas of modelled exposures of greater than 10.0 ou_E/m^3, 59% of the total.

3.4 Choice of odour benchmarks for this study

Odours from poultry rearing are usually placed in the moderately offensive category. Therefore, for this study, the Environment Agency's benchmark for moderately offensive odours, a 98th percentile hourly mean of 3.0 ou_E/m^3 over a one year period, is used to assess the impact of odour emissions from the proposed poultry unit at potentially sensitive receptors in the surrounding area.

3.5 Quantification of odour emissions

3.5.1 Existing egg laying chicken housing

Odour emission rates from egg laying chicken houses depend on many factors and may be variable. When only minimum ventilation is required, the odour emission rate may be relatively small, but in hot weather, ventilation requirements and odour emission rates are greater. The main source of odour from the existing poultry houses would be from the side mounted fans mounted fans. The modelling assumes that good practices for farm cleanliness are followed and that other sources of odour may be considered negligible.

Peak odour emission rates are likely to occur when the housing is cleared of spent litter at the end of each production cycle, approximately once per annum. There is little available information on the magnitude of this peak emission, but it is likely to be greater than any emission that might occur whilst the birds are in the housing. The clearing of spent litter and manure usually takes one or two working days and it is normal to maintain ventilation during this time. There are measures that can be taken to minimise odour production whilst the housing is being cleared of spent litter and there is usually some discretion as to when the operation is carried out; therefore, to avoid high odour levels at nearby sensitive receptors, it may be possible to time the operation to coincide with winds blowing in a favourable direction.

For the calculation of the emission rates from the houses, the internal odour concentration is assumed to be a constant 1,500 ou_E/m^3. This figure is based upon a review of available literature and measured concentrations from similar poultry houses that are available to AS Modelling & Data Ltd.

The ventilation rates used in the calculations are based on industry standard practices. For the calculations, the minimum ventilation rate is set at 1.0 m^3-air/bird/h and the maximum ventilation rate is 7.5 m^3-air/bird/h. If the external temperature is 13 Celsius, or lower, minimum ventilation only is assumed for the calculation. If the external temperature is 23 Celsius, or more, then the maximum ventilation rate is assumed. A transitional ventilation rate is calculated between these extremes.

Based upon these principles, an emission rate for each hour of the period modelled is calculated by multiplying the concentration by the ventilation rate. A summary of the emission rates used in this study are provided in Table 1a. As additional information, the 98th percentile emission rate is approximately 2.10ou_E/bird/s. As an example, a graph of the specific emission rate over the first year of the meteorological record is shown in Figure 2a.

3.5.2 Proposed pullet rearing house

Odour emission rates from poultry rearing houses depend on many factors and are highly variable. At the beginning of a flock cycle, when chicks are small, litter is clean and only minimum ventilation is required, the odour emission rate may be small. Towards the end of the flock, odour production within the poultry housing increases and ventilation requirements are greater, particularly in hot weather, therefore emission rates are considerably greater than at the beginning of the flock cycle.

Peak odour emission rates are likely to occur when the housing is cleared of spent litter at the end of each flock cycle. There is little available information on the magnitude of this peak emission, but it is likely to be greater than any emission that might occur when there are birds in the house. The time taken to perform the operation is usually around two hours per house. Note that it is normal to maintain ventilation during this time. There are measures that can be taken to minimise odour production whilst the housing is being cleared of spent litter and there is usually some discretion as to when the operation is carried out; therefore, to avoid high odour levels at nearby sensitive receptors it may be possible to time the operation to coincide with winds blowing in a favourable direction.

For the calculation for pullet rearing houses, the internal concentration is assumed to be a function of the age of the crop and the stocking density. The internal concentrations used in the calculations increase exponentially from 300 ou_E/m^3 at day 1 of the crop, to approximately 2,000 ou_E/m^3 at day 49 of the flock cycle.

The ventilation rates used in the calculations are based on industry practices and standard bird growth factors. Minimum ventilation rates are as those of an operational poultry house and maximum ventilation rates are based on Defra guidelines. Target internal temperature is 32 Celsius at the beginning of the crop and is decreased to 21 Celsius by day 91 of the cycle. If the external temperature is 7 Celsius, or more, lower than the target temperature, minimum ventilation only is assumed for the calculation. Above this, ventilation rates are increased in proportion to the difference between ambient temperature and target internal temperature. A maximum transitional ventilation rate (35% of the maximum possible ventilation rate) is reached when the temperature is equal to the target temperature. A high ventilation rate (70% maximum possible ventilation rate) is reached when the temperature is 4 degrees above target and if external temperature is above 33 Celsius the maximum ventilation rate is assumed.

At high ventilation rates, it is likely that internal odour concentrations fall because odour is extracted much faster than it is created. Therefore, if the calculated ventilation rate exceeds that required to replace the volume of air in the house every 5 minutes, internal concentrations are reduced (by a factor of the square root of 7.5 times the shed volume/divided by the ventilation rate as an hourly figure).

Based upon these principles, an emission rate for each hour of the period modelled is calculated by multiplying the concentration by the ventilation rate. Both the crop length and period the housing is empty can be varied. An estimate of the emission during the cleaning out process can also be included. In this case, it is assumed that the houses are cleared sequentially and each house takes 2 hours to clear.

In this case, it is assumed for the calculations that the crop length is 126 days and that there is an empty period of 14 days after each crop. To provide robust statistics, four sets of calculations were performed; the first with the first day of the meteorological record coinciding with day 1 of the crop cycle, the second coinciding with day 35 of the crop, the third coinciding with day 70 of the crop and the fourth coinciding with day 105 of the crop. A summary of the emission rates used in this study is provided in Table 1b. It should be noted that the figures in this table refer to the whole of the crop length whilst most figures quoted in literature are figures obtained from the latter stages of the crop cycle and therefore should not be compared directly to the AS Modelling & Data Ltd. figures in the table. The specific odour emission rate used for the clearing process is approximately 3.3 ou_E/bird/s and the 98th percentile emission rate is approximately 10.95 ou_E/bird/s. As an example, a graph of the specific emission rate over the first year of the meteorological record for each of the four crop cycles is shown in Figure 2b.

Table 1a. Summary of odour emission rates – existing layer chickens

Emission rate (ou_E/s per bird as stocked, during crop)				
Season	Average	Night-time Average	Day-time Average	Maximum
Winter	0.418	0.417	0.420	1.345
Spring	0.624	0.465	0.782	3.125
Summer	0.902	0.526	1.128	3.125
Autumn	0.455	0.431	0.478	1.719

Table 1b. Summary of odour emission rates – proposed pullet rearing (average/maximum of all 4 cycles)

Emission rate (ou_E/s per bird as stocked, during crop)				
Season	Average	Night-time Average	Day-time Average	Maximum
Winter	0.360	0.324	0.432	0.963
Spring	0.389	0.325	0.453	1.243
Summer	0.419	0.327	0.474	1.293
Autumn	0.379	0.324	0.435	1.025

Figure 2a. Specific emission rate over the first year of year of the meteorological data - existing layer chickens

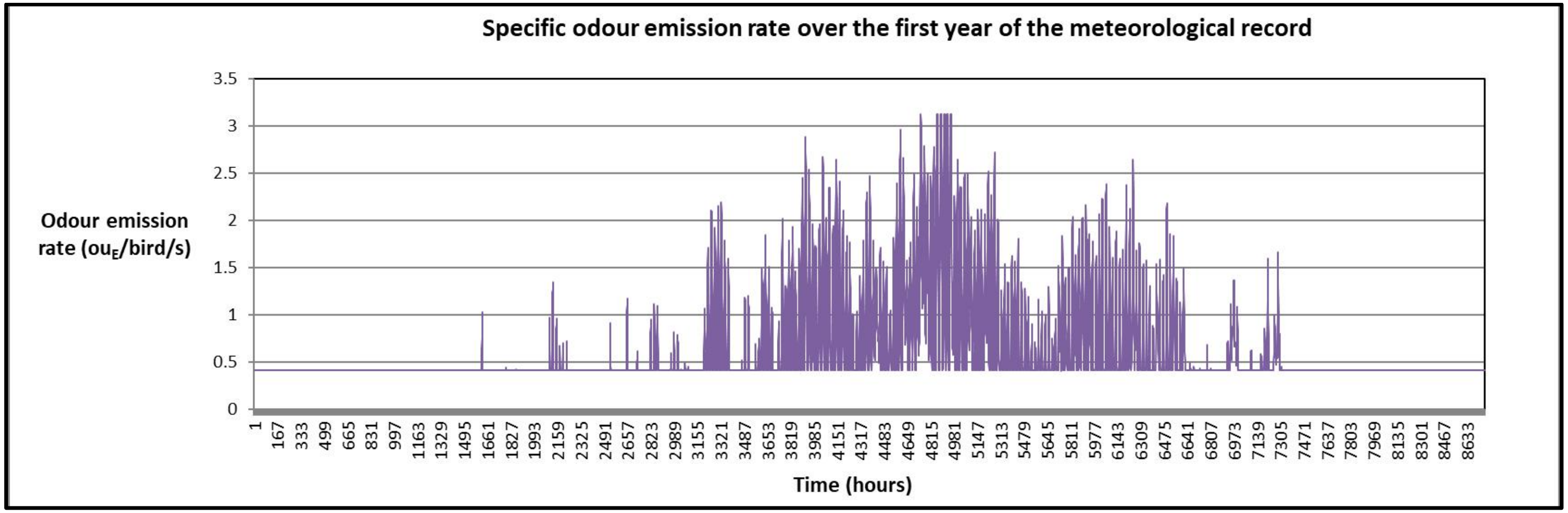
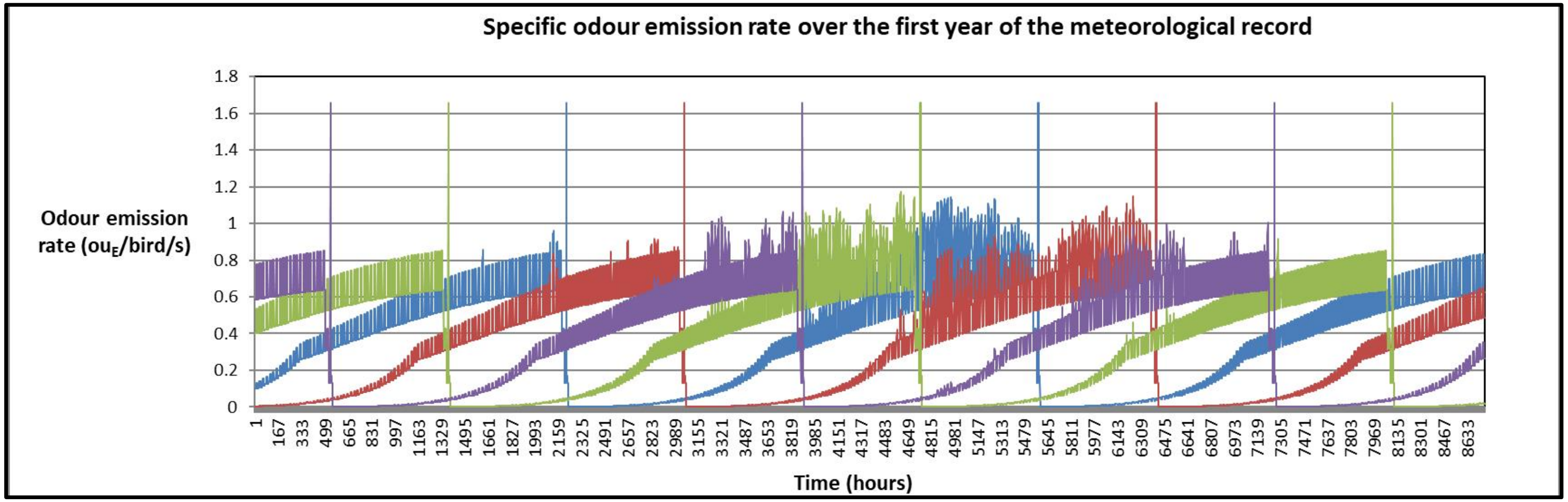


Figure 2b. Specific emission rate over the first year of year of the meteorological data – proposed pullet rearing



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 including: 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). In this case, observational meteorological data from the recording stations at Lake Vyrnwy and RAF Shawbury have also been considered.

The GFS is a spectral model and data are archived at a horizontal resolution of 0.25 degrees, which is approximately 25 km over the UK (formerly 0.5 degrees, or approximately 50 km). 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 observational records may be over represented, this is because the instrumentation used may not record wind speeds 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.

The wind rose for the raw GFS data at the site of the poultry unit is shown in Figure 3a.

Wind speeds are modified by the treatment of roughness lengths (see Section 4.7) and because 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 Court House Farm is shown in Figure 3b. Note that elsewhere in the modelling domain modified wind roses may differ more markedly and that the resolution of the wind field in terrain runs is 100 m. Please also note that FLOWSTAR 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.

Data from the meteorological recording stations at Lake Vyrnwy and RAF Shawbury have also been considered. However, neither Lake Vyrnwy nor RAF Shawbury, has an aspect that in any way could be considered similar to the area around Court House Farm; therefore, it should be noted that the frequency of winds from a particular direction in Lake Vyrnwy and RAF Shawbury data may be either high or low in comparison to what might occur at Court House Farm, which means mean concentrations downwind may be either over or under predicted. Additionally, periods of light winds and calms cannot be properly modelled. Therefore, it is the opinion of AS Modelling & Data Ltd. that the results obtained using the GFS data, particularly when modified by using FLOWSTAR, should be given more weight when interpreting the results of the modelling.

The wind roses for Lake Vyrnwy and RAF Shawbury are shown in Figures 3c and 3d.

Figure 3a. The wind rose. Raw GFS derived data, for 52.523 N, 3.084 W, 2014-2017

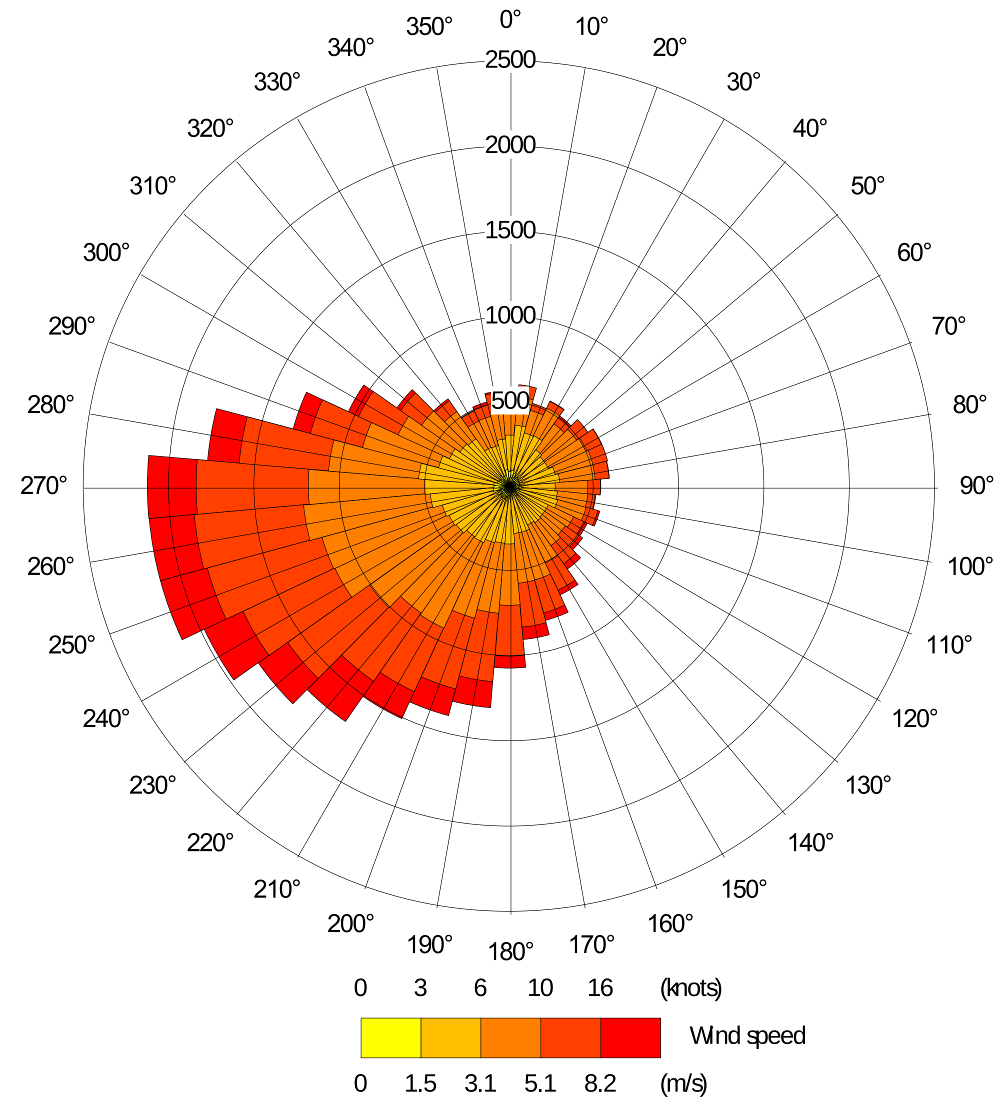


Figure 3b. The wind rose. FLOWSTAR modified GFS derived data for NGR 326500, 292250

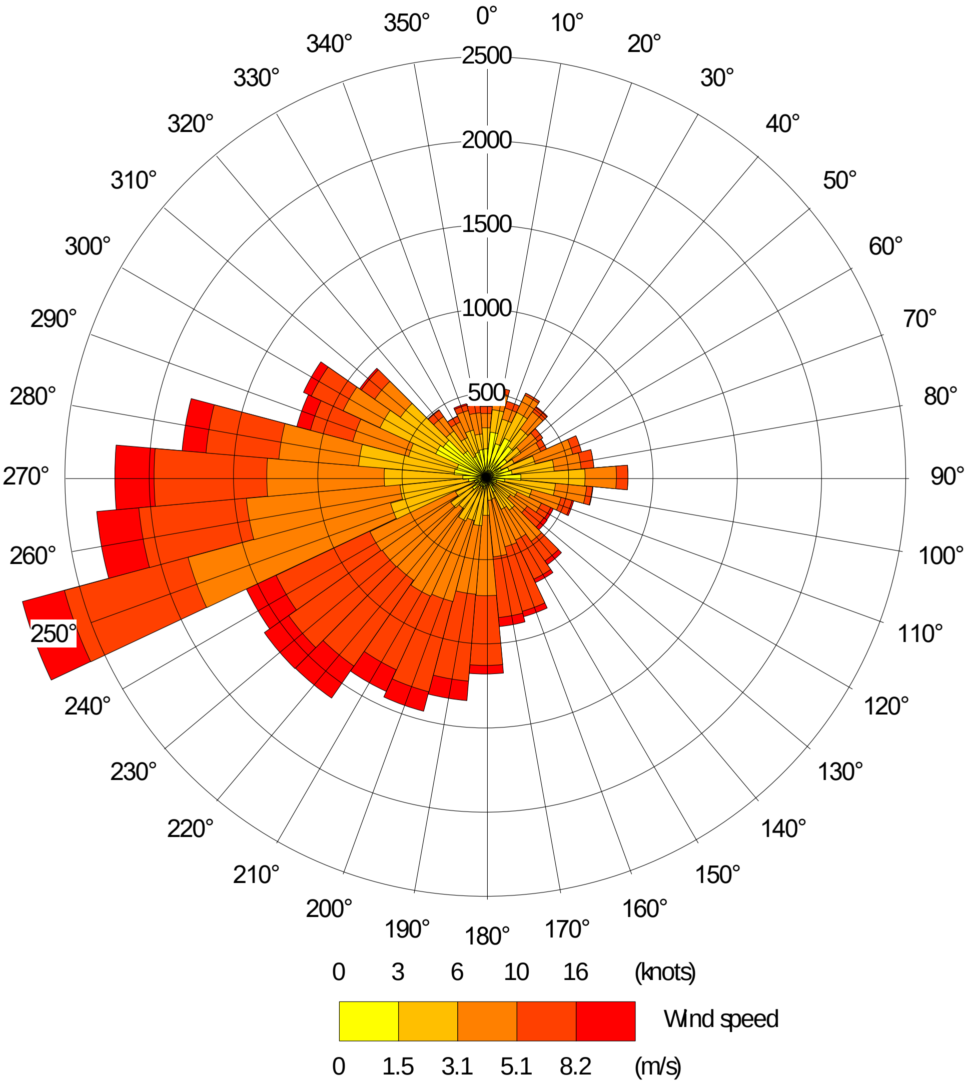


Figure 3c. The wind rose. Lake Vyrnwy, 2014 -2017

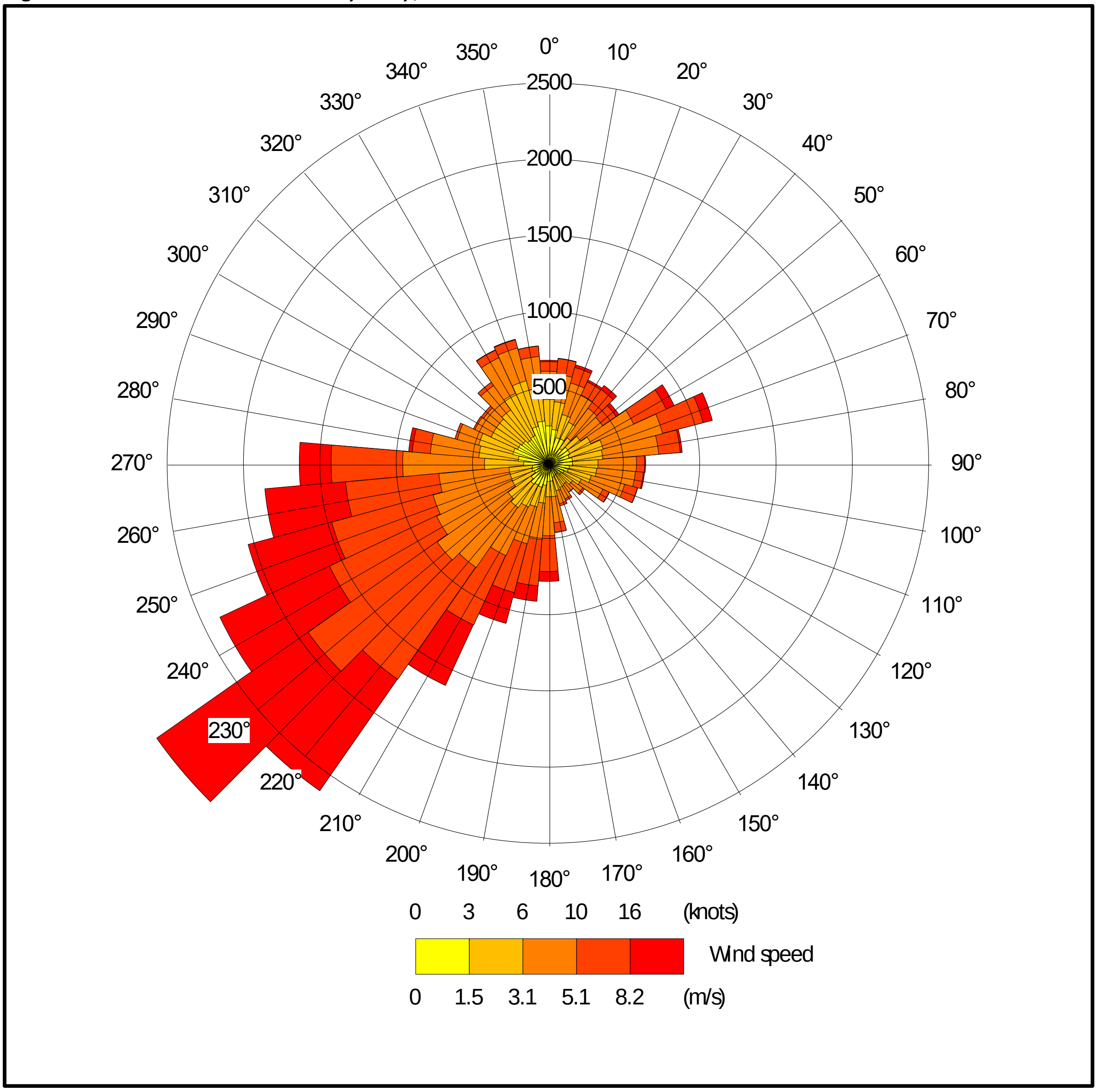
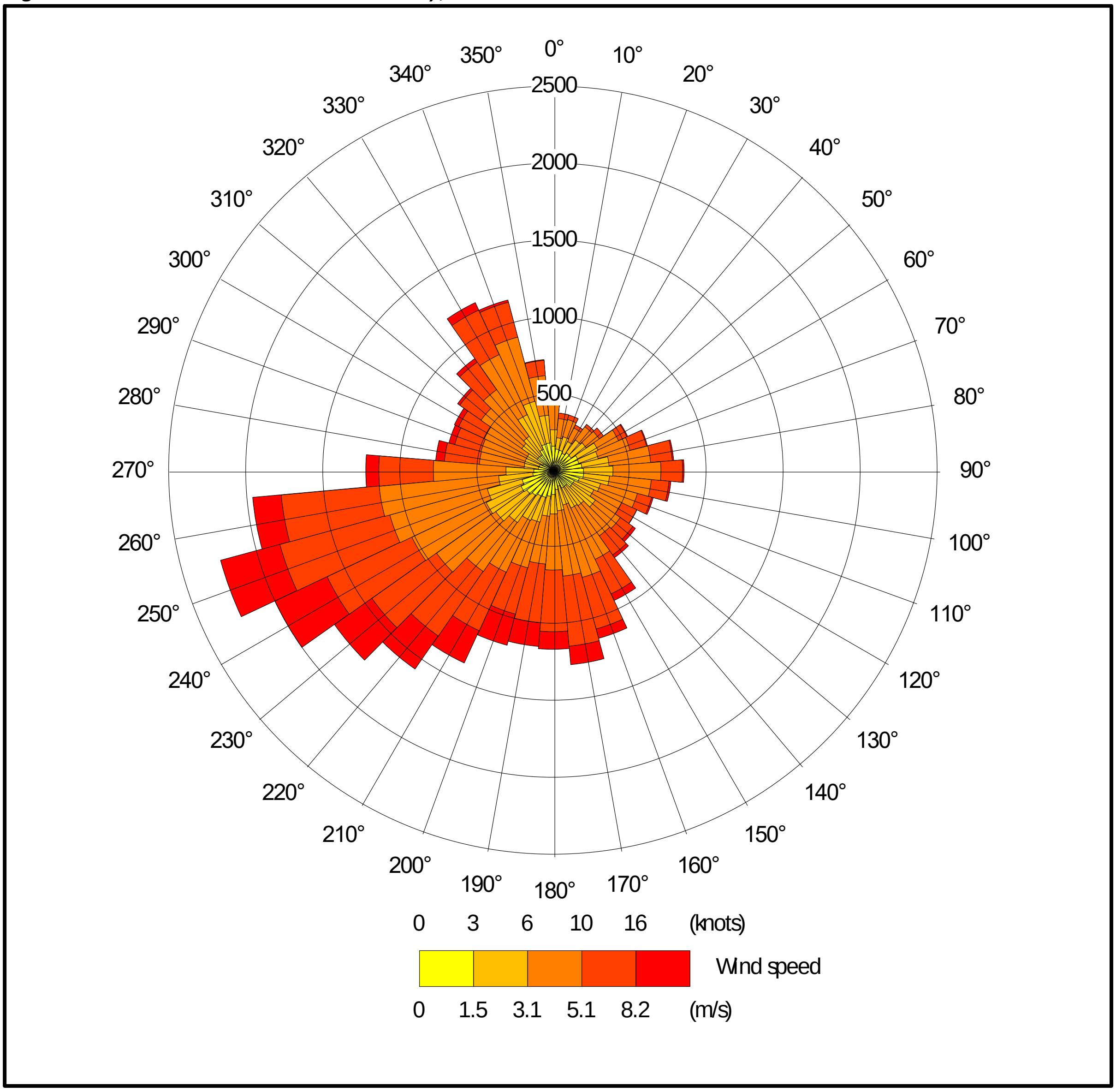


Figure 3d. The wind rose. RAF Shawbury, 2014 -2017



4.2 Emission sources

Emission from the cowled side fans on the existing poultry houses are represented by three volume sources within ADMS (EX1, EX2 & EX3).

Emissions from the high speed ridge/roof fans that would be used to ventilate the proposed poultry house are represented by three point sources within ADMS (PR1 a, b & c).

Details of the volume and point source parameters are shown in Tables 2a and 2b. The positions of the volume and point sources may be seen in Figure 4.

Table 2a. Volume source parameters

Source ID	Length Y (m)	Width X (m)	Depth (m)	Base height (m)	Emission temperature (°C)	Emission rate (ou_E/s)
EX1	35.63	16.86	3.0	0.0	Ambient	Variable [1]
EX2	39.15	14.42	3.0	0.0	Ambient	Variable [1]
EX3	39.15	14.42	3.0	0.0	Ambient	Variable [1]

Table 2b. Point source parameters

Source ID	Height (m)	Diameter (m)	Efflux velocity (m/s)	Emission temperature (˚C)	Emission rate per source (ou_E/s)
PR1 a, b & c	7.0	0.8	11.0	Variable [2]	Variable [2]

1. Dependent on ambient temperature.
2. Dependent on crop stage and ambient temperature.

4.3 Modelled buildings

The structure of the poultry house may affect the plumes from the point sources. Therefore, the proposed poultry house is modelled within ADMS. The position of the modelled building may be seen in Figure 4, where it is marked by a grey rectangle.

4.4 Discrete receptors

Twenty-five discrete receptors have been defined at a selection of nearby residences and commercial properties. The receptors are defined at 1.5 m above ground level within ADMS and their positions may be seen in Figure 5, where they are marked by enumerated pink rectangles.

4.5 Nested Cartesian grid

To produce the contour plots presented in Section 5 of this report, a nested Cartesian grid has been defined within ADMS. The grid receptors are defined at 1.5 m above ground level within ADMS. The positions of the receptors may be seen in Figure 5, where they are marked by green crosses bounded by a purple rectangle.

4.6 Terrain data

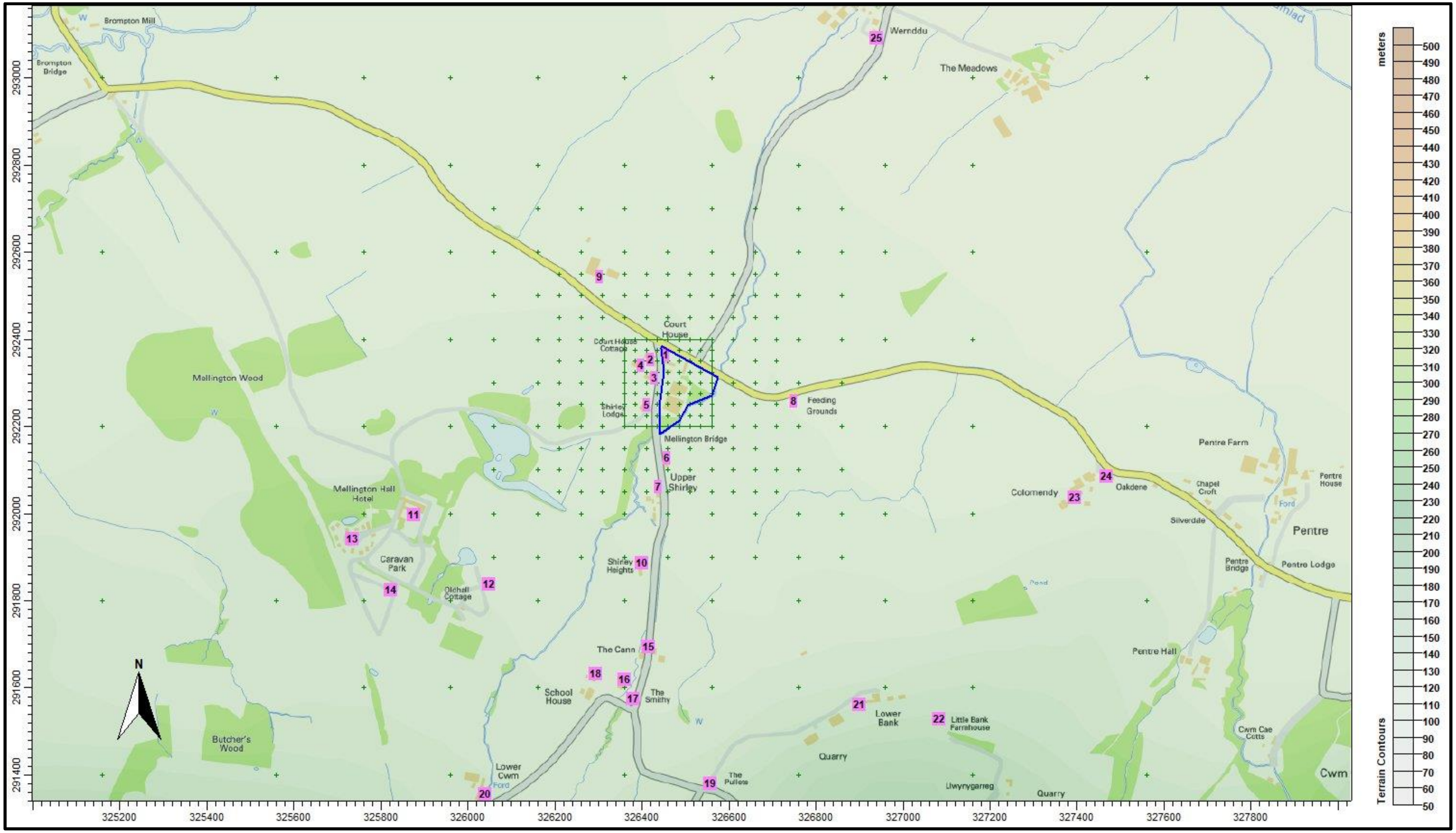
Terrain has been considered in the modelling. The terrain data are based upon the Ordnance Survey 50 m Digital Elevation Model. A 6.4 km x 6.4 km domain has been resampled at 50 m horizontal resolution for use within ADMS. N.B. The resolution of FLOWSTAR is 64 x 64 grid points; therefore, the effective resolution of the wind field for the terrain runs is 100 m.

4.7 Other model parameters

A fixed surface roughness length of 0.3 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 0.25 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 positions of modelled buildings & sources

Figure 5. The discrete receptors and nested Cartesian grid receptors



5. Details of the Model Runs and Results

For this study, ADMS was run with calms module of ADMS and with terrain. ADMS was run a total of twelve times, once for each year of the four year meteorological record in the following three modes:

- GFS meteorological data.
- Recorded meteorological data from the Lake Vyrnwy weather station.
- Recorded meteorological data from the RAF Shawbury weather station.

Statistics for the annual 98th percentile hourly mean odour concentration at each receptor were compiled for each of the twelve runs.

A summary of the results at the discrete receptors is shown in Table 3, where the maximum annual 98th percentile hourly mean odour for the existing and the proposed scenarios for each mode is shown. Contour plots of the maximum annual 98th percentile hourly mean odour concentration for the existing and the proposed scenarios (using GFS data) are shown in Figures 6a and 6b, respectively.

In Table 3, predicted odour exposures in excess of the Environment Agency's benchmark of 3.0 ou_E/m^3 as an annual 98th percentile hourly mean are coloured blue; those in the range that UKWIR research suggests gives rise to a significant proportion of complaints, 5.0 ou_E/m^3 to 10.0 ou_E/m^3 as an annual 98th percentile hourly mean, are coloured orange and predicted exposures likely to cause annoyance and complaint, those in excess of 10.0 ou_E/m^e as an annual 98th percentile hourly mean, are coloured red.

Table 3. Predicted maximum annual 98th percentile hourly mean odour concentrations at the discrete receptors

Receptor number	X(m)	Y(m)	Name/Location	Maximum annual 98th percentile hourly mean odour concentration (ou_E/m^3)					
				Existing			Proposed		
				GFS Calms Terrain	Lake Vyrnwy Calms Terrain	Shawbury Calms Terrain	GFS Calms Terrain	Lake Vyrnwy Calms Terrain	Shawbury Calms Terrain
1	326456	292364	Court House Farm	**18.61**	**18.40**	**19.20**	**6.60**	**4.61**	**6.80**
2	326420	292352	Courth House Cottage	**24.26**	**24.72**	**43.58**	**4.90**	**3.57**	**5.50**
3	326429	292310	Courth House Cottage	**51.00**	**56.73**	**70.72**	**7.29**	**6.30**	**7.32**
4	326397	292340	Courth House Cottage	**20.74**	**23.63**	**37.49**	**4.60**	**4.08**	**4.51**
5	326411	292249	Shirley Lodge	**52.65**	**46.68**	**56.36**	**9.78**	**9.92**	**9.21**
6	326458	292128	Upper Shirley	**13.75**	**18.71**	**12.76**	**4.02**	**3.59**	**3.73**
7	326437	292060	Upper Shirley	**8.00**	**6.67**	**5.75**	2.28	2.05	2.00
8	326749	292258	B4385	**4.46**	**4.17**	**3.39**	2.43	1.98	2.06
9	326302	292543	R V W Pugh Ltd.	2.19	2.29	2.41	1.20	0.38	1.31
10	326399	291885	Shirley Heights	2.64	2.10	1.86	0.87	0.81	0.72
11	325876	291997	Mellington Hall Hotel/camping site	0.65	0.69	0.77	0.40	0.39	0.37
12	326047	291837	Mellington Hall Hotel/camping site	0.70	0.79	0.84	0.47	0.39	0.36
13	325733	291942	Mellington Hall Hotel/camping site	0.45	0.48	0.52	0.29	0.28	0.26
14	325823	291824	Mellington Hall Hotel/camping site	0.43	0.50	0.52	0.30	0.26	0.22
15	326415	291693	The Cann	1.36	1.58	1.03	0.44	0.39	0.35
16	326360	291619	The Smithy	1.12	0.97	0.74	0.34	0.34	0.29
17	326380	291574	The Smithy	0.94	0.97	0.73	0.30	0.29	0.25
18	326293	291631	School House	0.98	0.88	0.76	0.38	0.34	0.28
19	326557	291380	The Pullets	0.40	2.09	0.61	0.15	0.16	0.17
20	326039	291356	Lower Cwm	0.43	0.38	0.36	0.21	0.21	0.13
21	326900	291561	Lower Bank Farmhouse	0.44	2.10	0.53	0.13	0.17	0.21
22	327082	291528	Little Bank	0.34	1.36	0.42	0.11	0.17	0.17
23	327395	292036	Colomendy	0.59	1.41	0.37	0.35	0.33	0.25
24	327467	292086	Oakdene	0.51	0.96	0.32	0.36	0.32	0.24
25	326938	293092	wernddu	0.33	0.41	0.38	0.33	0.22	0.25

Figure 6a. Predicted maximum annual 98th percentile hourly mean odour concentration – Existing Scenario

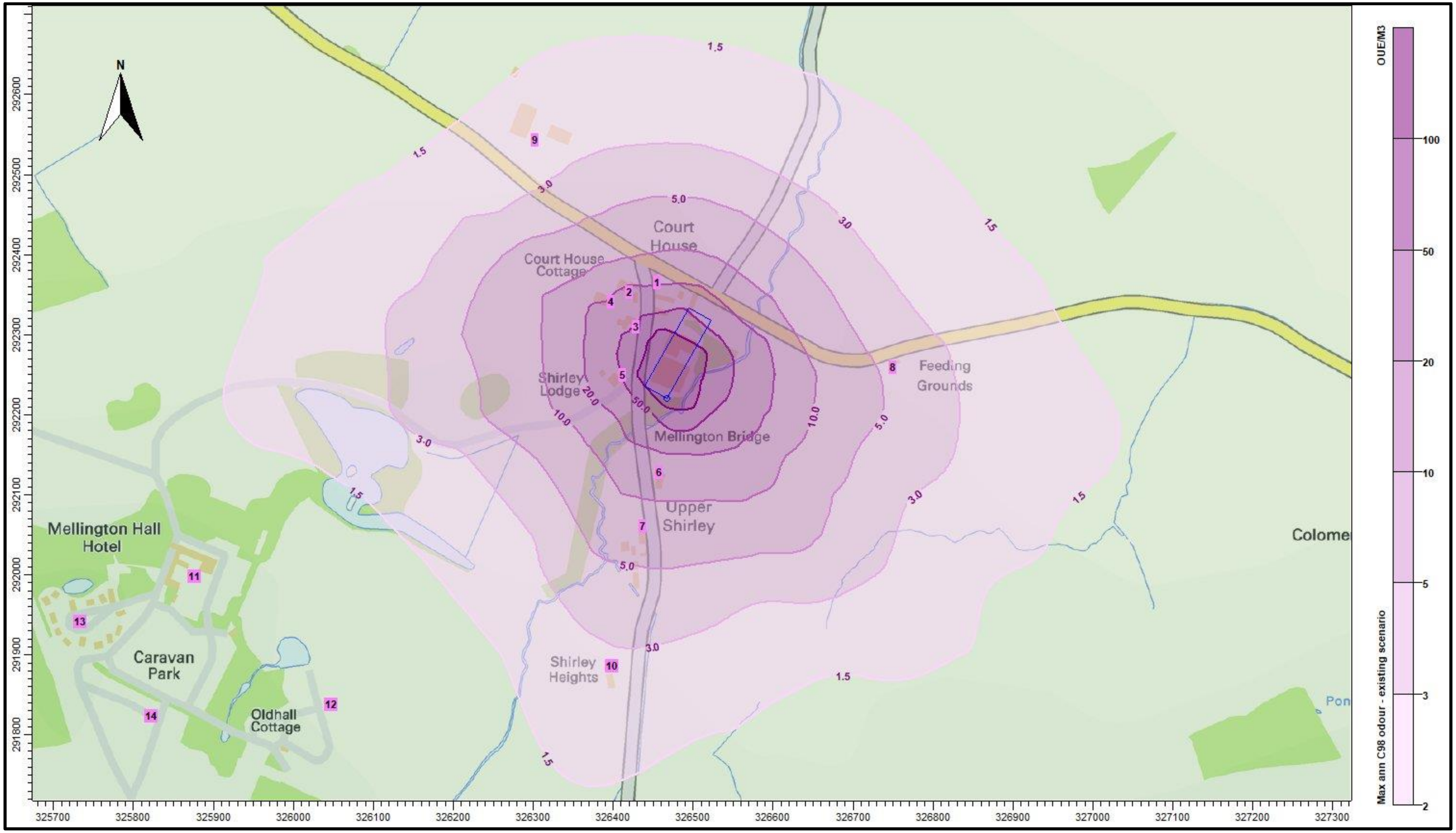
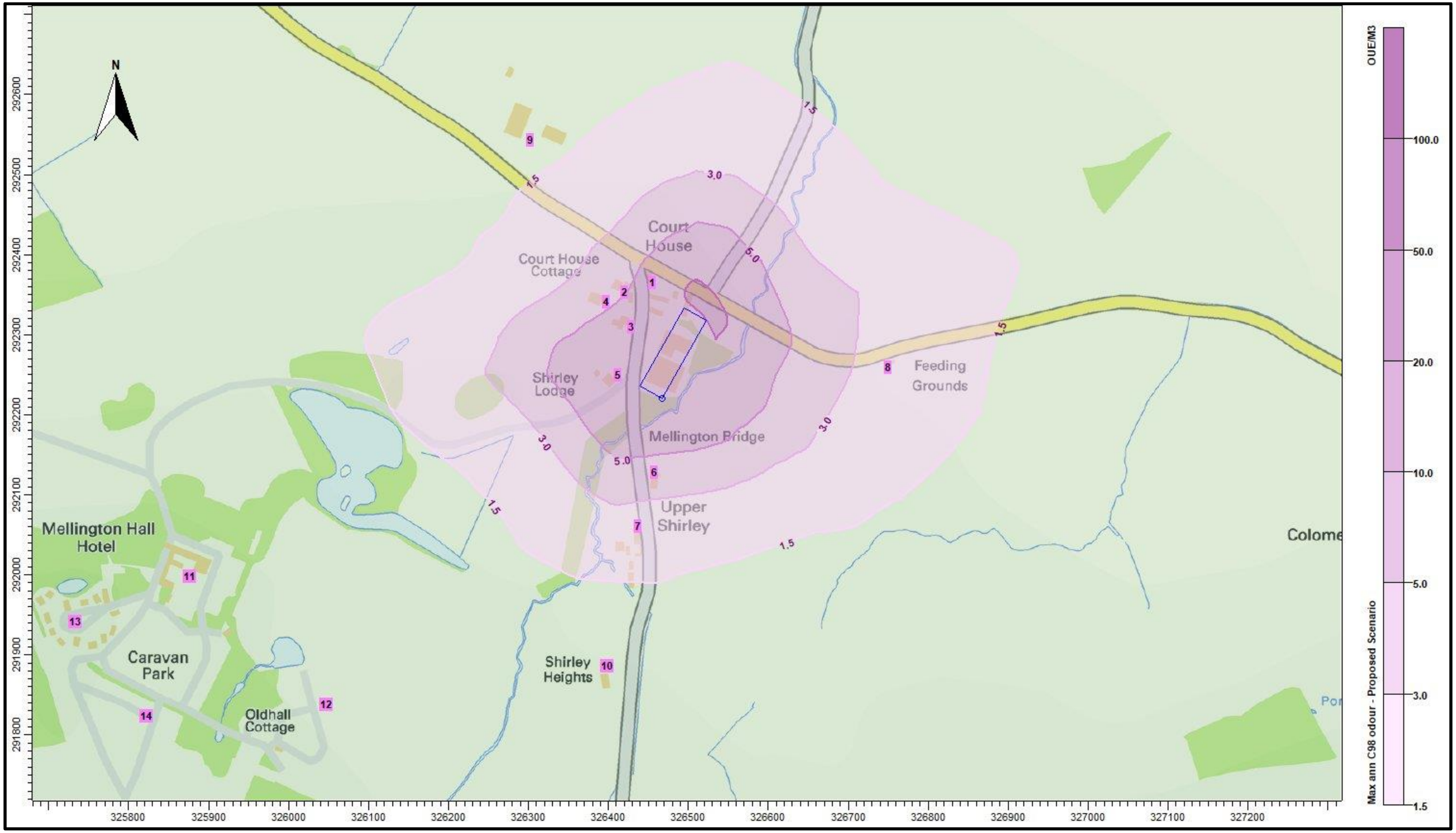


Figure 6b. Predicted maximum annual 98th percentile hourly mean odour concentration – Proposed Scenario



6. Summary and Conclusions

AS Modelling & Data Ltd. has been instructed by John Ward, on behalf of David Davies Resources Ltd., to use computer modelling to assess the impact of odour emissions from the existing egg laying chicken houses and the proposed pullet rearing house at Court House Farm, Mellington, Church Stoke, Montgomery, Powys. SY15 6TQ.

Odour emission rates from the existing egg laying chicken houses and the proposed pullet rearing house have been assessed and quantified based upon emission models that take into account the likely internal odour concentrations and ventilation rates of the poultry houses. The odour emission rates so obtained have then been used as inputs to an atmospheric dispersion model which calculates odour exposure levels in the surrounding area.

The results of the modelling indicate that the process contribution of the proposed pullet rearing unit at Court House Farm to local odour concentrations would exceed the Environment Agency's benchmark for moderately offensive odours, a 98th percentile hourly mean of 3.0 ou_E/m^3 over a one year period at six nearby residences. (receptors 1 to 6) and at three of these receptors would also be in the lower end of the range where UKWIR research would suggest that complaints about odour become increasingly likely. However, the predicted odour exposure levels in the proposed scenario are much lower than those predicted in the existing scenario.

7. References

Chartered Institution of Water and Environmental Management website. Control of Odour. http://www.ciwem.org/policy-and-international/policy-position-statements/control-of-odour.aspx

Defra. Heat Stress in Poultry - Solving the Problem

Environment Agency, April 2007. H4 Odour Management, How to comply with your environmental permit. http://a0768b4a8a31e106d8b0-50dc802554eb38a24458b98ff72d550b.r19.cf3.rackcdn.com/geho0411btqm-e-e.pdf

R. E. Lacey, S. Mukhtar, J. B. Carey and J. L. Ullman, 2004. A Review of Literature Concerning Odors, Ammonia, and Dust from Broiler Production Facilities. http://japr.fass.org/content/13/3/500.full.pdf+html

S. Fournela, F. Pelletierb, S. Godboutb. Odour emissions, hedonic tones and ammonia emissions from three cage layer housing systems.

Nimmermark S. & Gustafsson G. Influence of Temperature, Humidity and Ventilation Rate on the Release of Odour and Ammonia in a Floor Housing System for Laying Hens.

Fardausur Rahaman et al. ESTIMATION OF ODOUR EMISSIONS FROM BROILER FARMS – AN ALTERNATIVE APPROACH

A. P. Robertson *et al*, 2002. Commercial-scale Studies of the Effect of Broiler-protein Intake on Aerial Pollutant Emissions.

ROSS. Environmental Management in the Broiler House