

ENVIRONMENT ACT 1995 PART IV

DETAILED ASSESSMENT FOR PM₁₀

**Stoneleigh Cottage Poultry Farm, Cubley,
Derbyshire**



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Executive Summary

The Environment Act 1995, Part IV places a statutory obligation on all local authorities to review and assess the air quality within their area against air quality objectives for seven pollutants. Where the risk of exceeding an air quality objective is identified through the review and assessment process, a Detailed Assessment must be carried out to identify with reasonable certainty whether an objective is likely to be breached.

Cubley Poultry Farm is a small (69,900 broiler bird places) poultry unit situated on Derby Road, Cubley, Derbyshire. The site does not meet the criteria stipulated in LAQM.TG(09) for poultry farms where further consideration of air pollution is required, and was not identified as requiring a Detailed Assessment in the 2009 Updating and Screening Assessment. This assessment was undertaken in response to dust complaints received from a residential property situated in close proximity to the poultry farm.

This Detailed Assessment is based around monitoring undertaken by the Environment Agency Ambient Air Monitoring Team from 23 October 2008 to 5 May 2009 (195 days). Pollutants considered were particulates (PM₁₀ and PM_{2.5}), sulphur dioxide (SO₂), ammonia (NH₃), oxides of nitrogen (NO_x) and nitrogen dioxide (NO₂).

PM₁₀, PM_{2.5}, SO₂, and NO₂ have been compared with the objectives of the UK Air Quality Strategy and, with the exception of PM_{2.5}, are pollutants that must be considered by Local Authorities under Local Air Quality Management for the protection of human health. Ammonia (NH₃) has been compared with the WHO guidelines and Environment Agency H1 guidance and is considered by the Environment Agency for the protection of ecosystems.

Comparison of the PM₁₀ data with the 24-hour (midnight-midnight) mean objective has indicated that this objective is predicted to be exceeded at the monitoring site. All other objectives for the purpose of Local Air Quality Management are considered likely to be met.

Based on this Detailed Assessment the following recommendations have been made:

- To declare an Air Quality Management Area in the vicinity of Stoneleigh Cottage poultry farm, incorporating the single residential dwelling 'Stoneleigh'.

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Appendix 1 - Study of Ambient Air Quality at Cubley. Environment Agency NMA/TR/2009/05.

Appendix 2 - Report on the characterisation of a particulate matter sample collected using an ACCU located in the vicinity of a poultry unit. Advance Environmental Ref: ae/dddc/pm/accu/01/09/v2.

1. Introduction

1.1 Legislative Background

1.1.1 Air Quality Strategy Objectives

The latest National Air Quality Strategy (AQS) published by Defra (2007) provides a framework for air quality improvements in the UK and contains national air quality standards and objectives established by the Government to protect human health. The objectives for nine pollutants (benzene, 1,3-butadiene, carbon monoxide, lead, nitrogen dioxide, sulphur dioxide, PM₁₀ and PM_{2.5} and ozone) have been prescribed within the AQS based on The Air Quality Standards (England) Regulations 2007. The objectives for PM_{2.5} and ozone are not prescribed for Local Air Quality Management (LAQM) and local authorities have no statutory obligation to review and assess air quality against them.

The Air Quality Standards (England) Regulations 2007 came into force on 15 February 2007. The Regulations bring together in one statutory instrument the Government's requirements to fulfil separate EU Daughter Directives through a single consolidated statutory instrument. The Objectives set out in the AQS for the protection of human health are presented in Table 1.

Table 1. Air Quality Objectives included in Regulations for the purpose of Local Air Quality Management in England.

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as (averaging period)	
Benzene	16.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2003
	5.00 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2010
1,3-Butadiene	2.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2003
Carbon monoxide	10.0 mg/m^3	Running 8-hour mean	31.12.2003
Lead	0.5 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2004
	0.25 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2008
Nitrogen dioxide	200 $\mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2005
Particles (PM ₁₀) (gravimetric)	50 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2004
Particles (PM _{2.5}) (gravimetric)*	25 $\mu\text{g}/\text{m}^3$	Annual mean	2020

Sulphur dioxide	350 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005
Ozone*	100 $\mu\text{g}/\text{m}$ not to be exceeded more than 10 times a year	8 hourly running or hourly mean	31.12.2005

* Not prescribed for LAQM

1.1.2 World Health Organisation Air Quality Guidelines and United National Economic Commission for Europe Critical Levels

Whilst the main objective of the WHO guidelines is the direct protection of human health, the WHO strategy for health for all recognizes the importance of protecting the environment in terms of benefits to human health and wellbeing. The WHO therefore began publishing ecologically based guideline values to protect against ecotoxic effects in their first edition of *Air quality guidelines for Europe* in 1987.

The World Health Organisation (WHO) published Air Quality Guidelines for Europe (2000), which were revised and published as a Global Update (2005). These guideline values are used as a basis for setting EU standards for human health and also include guideline values focused on the ecological effects of air pollutants. The WHO ecologically based guideline values are not prescribed for LAQM and authorities therefore have no statutory obligation to review and assess air quality against them.

The Environment Agency consider these guideline values when assessing the impact of intensive farming units (e.g. pigs and poultry) on the environment and therefore the emissions of ammonia have been considered in their monitoring report (Appendix 1) that forms part of this Detailed Assessment. The Environment Agency also use the United National Economic Commission for Europe (UNECE) Critical Levels (annual average) for ammonia to protect sensitive vegetation of 3 $\mu\text{g}/\text{m}^3$ for higher plants, 1 $\mu\text{g}/\text{m}^3$ for sensitive plants such as lichens and bryophytes, and a monthly critical level of 23 $\mu\text{g}/\text{m}^3$.

1.2 Local Air Quality Management

The Environment Act 1995, Part IV places a statutory obligation on all local authorities to review and assess the air quality within their area against Air Quality Objectives. Where the LAQM Review and Assessment process identifies that pollutant concentrations are unlikely to meet the Air Quality Objectives in areas where the Objectives apply, the Local Authority is required to declare an Air Quality Management Area (AQMA) under Section 83 (1) of the Environment Act 1995.

Exceedences of the Objectives are assessed in areas where members of the public are regularly present and are likely to be exposed to a period of time appropriate to the averaging period (see Table 1) of the Objective.

Guidance on LAQM is provided in Technical Guidance LAQM.TG(09) (Defra 2009a) and Policy Guidance PG09 (Defra 2009b), and has been followed in the preparation of this Detailed Assessment. At the time of writing 237 local authorities have declared AQMAs, mostly for NO₂ and PM₁₀ from traffic sources. There are currently no AQMAs within Derbyshire Dales.

This report focuses on emissions to atmosphere of those pollutants that are prescribed for LAQM and it is not the purpose of this report to consider pollutants that fall outside of LAQM.

2. Stoneleigh Cottage Poultry Farm

The area administered by Derbyshire Dales District Council is primarily rural in character comprising 113 parishes with a total population in the region of 70,000. The total area of the District is approximately 780 square kilometres and at its extremes is 58 km long and 27 km wide. Half of the District is within the Peak District National Park.

Stoneleigh Cottage poultry farm (Figures 1 and 2) is situated approximately eight kilometres south of Ashbourne on the outskirts of a small, rural village (NGR 416318, 338084). Planning permission was granted in 1965 for the first poultry house, the second in 1966, the third in 1967, the fourth and fifth in 1968 and the sixth in 1969. The facility was granted minor extensions to two existing sheds in 1982 and 1984. The residential property 'Stoneleigh' has been in existence since prior to 1965. The poultry farm has a capacity for 69,900 broilers (524,000 per annum) and is currently operated by CD Vernon Ltd. The poultry farm consists of six rearing sheds, six externally sited feed silos and three LPG tanks, covering an approximate area of 2.1 acres.

The poultry farm became a regulated facility under the Environmental Permitting Regulations 2007 (formerly the Pollution Prevention and Control Regulations 2000) in October 2007.

It is considered that poultry houses are responsible for in the region of five percent of PM₁₀ emissions in the United Kingdom (Health Protection Agency, 2006). Sources of particulate matter from poultry farms include feed material (delivery and storage), bedding, skin cells and faeces. Particulate matter can also be a carrier of odourous compounds. There are a number of factors that influence emissions of particulate matter from poultry houses and these include amongst others building design, ventilation systems, temperature, number of animals, litter management and removal, catching regimes and bird behaviour.

Stoneleigh Cottage poultry farm is mechanically ventilated to atmosphere (ridge extraction) with fans running on an on or off system, with no variable speed control. The extraction velocity is in the region of 15 m/sec per fan. Day old chicks are placed into the heated sheds with poultry bedding (litter) on the floor. The ideal internal shed temperature is 19 to 32°C, depending on the age of the birds. As the ambient temperature within the sheds increases the number of fans in use will increase, resulting in air and particulate matter from the sheds being released to atmosphere. Ambient temperature within the sheds will increase in the summer months when the outside air temperature is greater and will increase throughout the 37 day rearing cycle as the birds increase in size and activity.

Litter (straw or wood shavings / sawdust) is typically kept dry with a moisture content in the region of 30% to minimize odour issues (e.g. release of ammonia) and to maintain animal welfare. Litter is removed at the end of every 37 day cycle for off-site disposal. The feed diet is supplied in crumb or pellet form to reduce the amount of dust material within the poultry houses. All silos are fitted with fabric filter dust 'socks' on all exhausts to atmosphere.

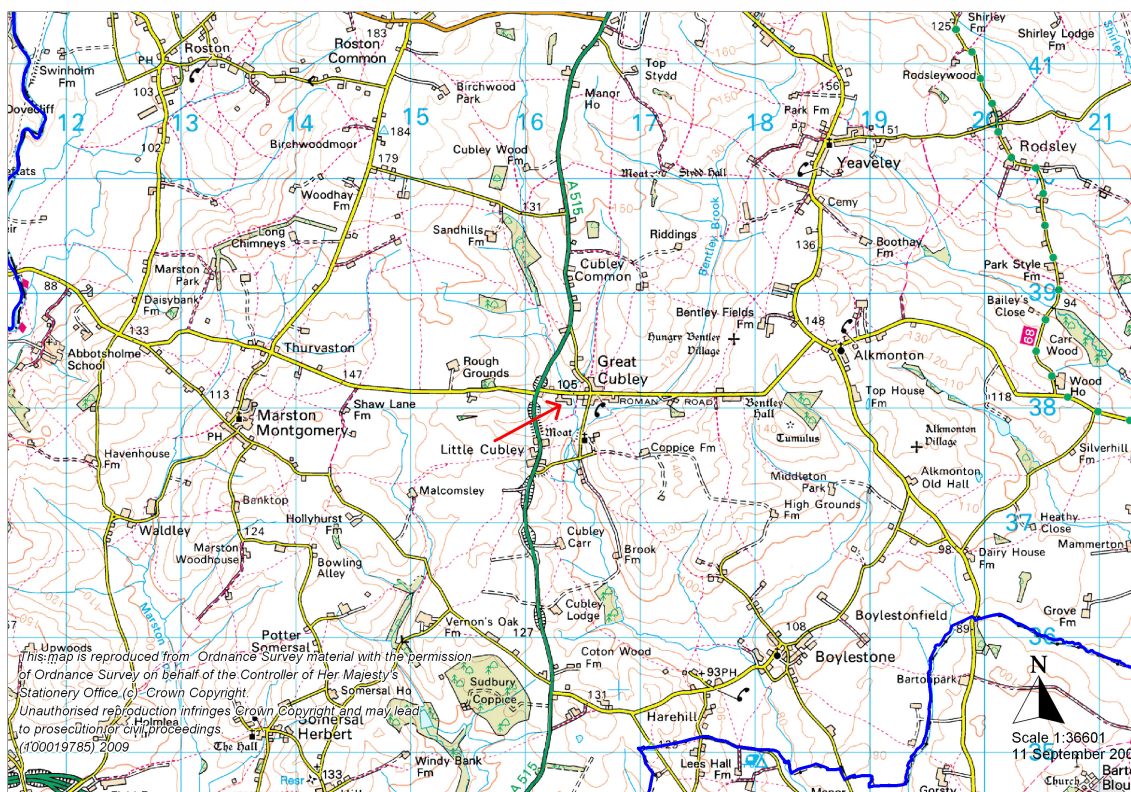


Figure 1. Location of Stoneleigh Cottage poultry farm. The solid blue line shows the boundary of Derbyshire Dales District Council.

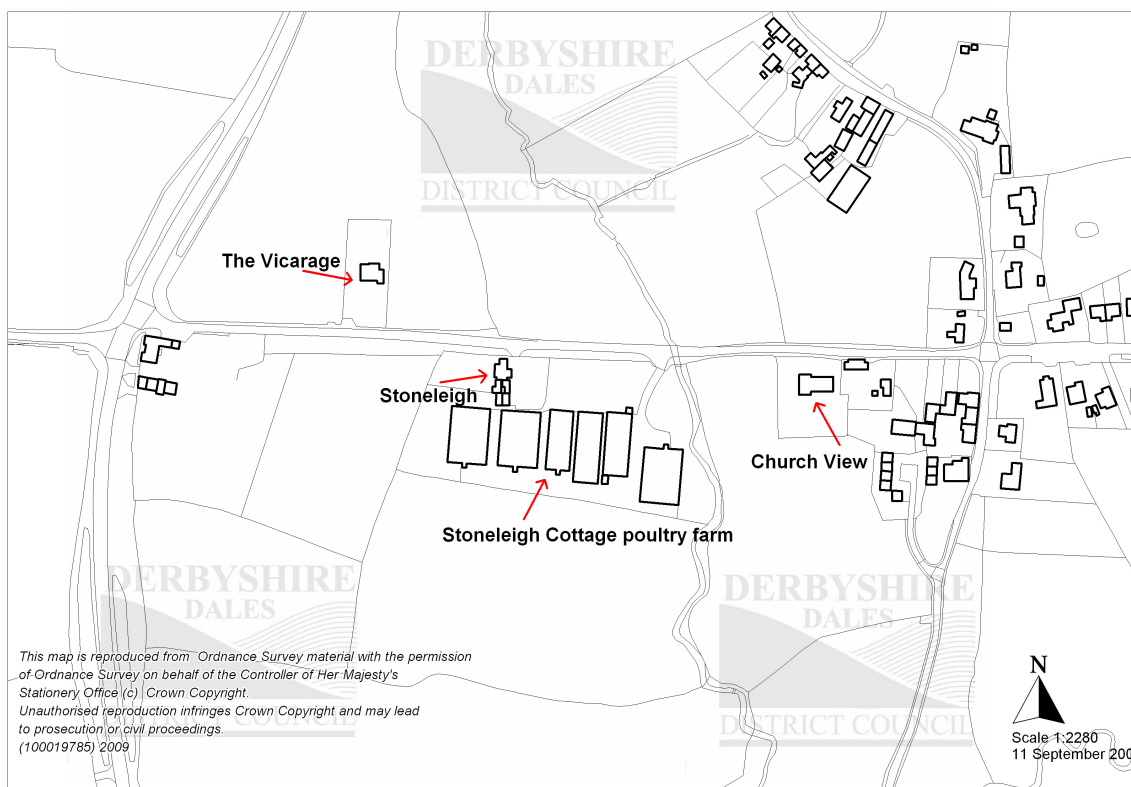


Figure 2. Layout of Stoneleigh Cottage poultry farm and the three nearest residential properties.

3. Monitoring Study

3.1 Scope and methodology

The aim of this Detailed Assessment is to identify with reasonable certainty whether or not pollutant concentrations prescribed for LAQM are likely to be exceeded. Monitoring was undertaken in response to nuisance dust and odour complaints made to Environmental Health at Derbyshire Dales District Council and to the Environment Agency over a number of years. The focus for Environmental Health was the likely exceedance of any Air Quality Objectives (in particular PM₁₀), whilst the investigative remit of the Environment Agency was wider.

The scope of the monitoring study undertaken by the Environment Agency extended beyond the Air Quality Objectives prescribed for LAQM and has included NH₃ to assess the ecological impact of the poultry farm on the environment and as an indicator of odour nuisance. The NH₃ emissions are discussed within the Environment Agency report, but are not discussed further within this Detailed Assessment as they fall outside of LAQM and the purpose of this assessment.

The full Environment Agency report is presented in Appendix 1 and is summarised here. The full report should be read in conjunction with this summary of the results. The Environment Agency report is presented as a basic monitoring report with no associated dispersion modelling. Dispersion models are better suited for use with clearly defined point sources (e.g. stacks) or well defined fugitive emissions, and it is not considered the absence of modeling at this point in time will alter the conclusion to declare an AQMA. Dispersion modeling may be considered appropriate as part of a further assessment or to assist the operator in managing and mitigating the emissions.

3.2 Air quality monitoring

The mobile monitoring facility (MMF2) was deployed by the Environment Agency Ambient Air Monitoring Team between 23 October 2008 and 5 May 2009 for 195 days. This period covered two full rearing cycles, and part of two further rearing cycles at the start and end of the monitoring period. The monitor was located within the curtilage of the poultry farm at a bearing of 130° – 260° from the MMF, approximately 40 m from the boundary of the garden of the closest receptor and 60 m from the boundary of the closest dwelling (see Figure 2.1, Appendix 1).

Particulate matter (PM₁₀ and PM_{2.5}) was measured using a Rupprecht & Patashnick (R&P) Tapered Element Oscillating Microbalance (TEOM), oxides of nitrogen using a chemiluminescent ML9841B analyser and SO₂ using a UV fluorescence ML9850B.

3.3 Baseline information and background concentrations

No previous air quality monitoring has been undertaken in the vicinity of Stoneleigh poultry farm.

Estimated background air pollution maps show pollutant concentrations for 1 km by 1 km grid squares (<http://www.airquality.co.uk/lagm/tools.php?tool=background06>). The centre of the relevant grid square (NGR 416500, 338500) within which Stoneleigh Cottage poultry farm falls has predicted background concentrations for 2009 for NO_x of 12.16 µg/m³, NO₂ of 9.79 µg/m³, and PM₁₀ of 14.32 µg/m³ (gravimetric).

3.4 Results

3.4.1 PM₁₀

Successful data capture for PM₁₀ monitoring was 71% for the collection of 15-minute mean data and 67% (130 days) for the collection of 24-hour data. Data was corrected using the Kings College London Volatile Correction Model. Results were compared to the annual mean (40 µg/m³) and 24-hour (50 µg/m³) Air Quality Objectives. The mean PM₁₀ concentration over the monitoring period was 25.4 µg/m³. On 13 occasions the 24-hour PM₁₀ concentration exceeded 50 µg/m³ and the maximum 24-hour average concentration recorded was 81.5 µg/m³. Ten of the exceedances occurred later than 26 days in the rearing cycle, when birds would be largest and most active. The Environment Agency report concludes that if the monitoring period was considered representative of a typical year, over a year the 24-h Air Quality Objective (50 µg/m³) would be exceeded on 37 occasions, compared to the permitted 35 number of exceedances over a year.

Whilst the number of exceedances predicted over a year is only slightly above the permitted 35, it is considered that the monitoring was undertaken during the winter and spring seasons which is not when emissions are likely to be highest. Emissions are likely to increase during warmer months when poultry shed temperatures are higher, birds are more active and more ventilation is required. Consequently the factoring up of the number of exceedances over the 130 days of the monitoring period when data was captured, is likely to be a conservative prediction.

3.4.2 PM_{2.5}

The Air Quality Objective for PM_{2.5} is not currently prescribed for LAQM, although may become so in the future. The monitoring did not identify any likely breach of the annual mean Air Quality Objective (25 µg/m³), with a mean concentration over the monitoring period of 12.1 µg/m³.

3.4.3 NO₂

The 1-hour (200 µg/m³) and annual mean (40 µg/m³) Air Quality Objectives for NO₂ were not considered to be breached during the monitoring period, nor were they considered likely to be breached had the monitoring covered a full 12 month period. On two occasions 1-hour NO₂ concentrations were above the 200 µg/m³ limit, with a maximum recorded concentration of 266 µg/m³. The average NO₂ concentration over the monitoring period was 12.7 µg/m³.

3.4.4 SO₂

The 15-minute (266 µg/m³), 1-hour (350 µg/m³) and 24-hour (125 µg/m³) Air Quality Objectives for SO₂ were not considered to be breached during the monitoring period, nor were they considered likely to be breached had the monitoring covered a full 12 month period. The maximum recorded SO₂ concentration over the monitoring period was for a 15-minute mean at 32.3 µg/m³.

3.5 Directional and diurnal analysis for PM₁₀

Directional analysis has been used to help identify the likely source of air pollutants by enabling an investigation of how wind direction relates to the observed elevated pollutant concentrations. Diurnal analysis can be used as an indicator for traffic as a source of pollutants, since traffic flows vary diurnally with typical peaks at morning and evening rush hours.

Wind speed and direction measurements were collected at the MMF over the monitoring period. A high percentage of the wind came from a near Northerly wind direction and at extremely low speeds, which was considered to be unusual.

The five highest PM₁₀ concentrations were recorded when the wind was coming from the direction of the poultry farm (216° – 254°) and the data does not show any double or single diurnal peaks that are typically associated with traffic sources or industrial emissions respectively. Further directional analysis was undertaken to calculate whether a significant number of exceedances were associated with a particular wind sector. The analysis reported that the majority of the 13 exceedances (69%) were measured from the wind direction 170° – 270° suggesting that these can be attributed from a source situated within the wind from this direction, which is where the poultry farm is located.

3.6 Sample characterisation

At the request of the Council, on two occasions particulate matter was collected by the Environment Agency using an Automatic Cartridge Collection Unit (ACCU) in conjunction with the TEOM, for characterisation using Scanning Electron Microscopy with Energy Dispersive x-ray Spectrometry (SEM/EDS). The characterization was undertaken by Advance Environmental and the report is presented in Appendix 2.

The aim of this characterization was to try to differentiate between different types of particulate matter and potentially apportion likely sources. The filters were unfortunately loaded upside down within the ACCU cases resulting in the particulate matter being collected on limited areas of the reverse of the filter. As such the results are considered to be compromised and are only discussed for information purposes. No conclusions have been drawn based on the results of the characterization.

Both samples were dominated by sulphates and carbon-based materials, which included large flakes of skin although the larger flakes were greater than 10 µm and hence would not be classified as PM₁₀. The report cautions that the data is compromised, but that a portion of the sample collected on the filter may be derived from a poultry unit.

4. Outcome of the Detailed Assessment

The monitoring report has identified a likely breach of the 24-h PM₁₀ Air Quality Objective where receptors are likely to be exposed to a period of time appropriate to the averaging period. There are no predicted exceedances of the Air Quality Objectives for PM_{2.5}, NO₂ or SO₂.

It is proposed to designate an AQMA incorporating Stoneleigh Cottage poultry farm and the residential dwelling Stoneleigh (Figure 3). If modelling is undertaken as part of any further assessment, the boundary of the AQMA may be reviewed and redrawn.



Figure 3. Proposed boundary (red line) of the AQMA.

5. Area and Population Affected

The nearest residential property (Stoneleigh) borders the poultry farm and the house is situated approximately 10 m from the closest poultry shed. The next two closest residential properties are The Vicarage and Church View, which are situated approximately 76 m and 70 m respectively from the nearest poultry shed. These distances are based on the distance between the buildings, rather than the boundary for each property.

As discussed in Section 3.1, dispersion modelling has not been undertaken as part of this Detailed Assessment. At the current time it is predicted that the 24-h PM₁₀ Air Quality Objective is being exceeded at the site of the MMF and at the nearest residential property (Stoneleigh) situated 10 m directly due west of the MMF.

The area of the proposed AQMA, based on the monitoring study, is 11540 m² and from the electoral register five adults are listed at the property.

6. Recommendations

The following recommendations are made based on this Detailed Assessment report:

- Undertake formal consultation on the Detailed Assessment.
- Declare an AQMA in the vicinity of Stoneleigh Cottage poultry farm, incorporating the single residential dwelling 'Stoneleigh'.

- Continue to work with the Environment Agency as the Regulator for Stoneleigh Cottage poultry farm.

7. References

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