Odour Assessment

Streetly Hall Farm, West Wickham

Client: Streetly Hall Estate Partnership

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Prepared by	Olivia Davidson	Olivia Davidson		
Position	Graduate Air Quality Consultant	Graduate Air Quality Consultant		
Reviewed by	Ceri Haines	Ceri Haines		
Position	Air Quality Consultant	Senior Air Quality Consultant		
Authorised by	Ger Parry	Ger Parry		
Position	Director	Director		
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Serendipity Labs, Building 7, Exchange Quay, Salford, M5 3EP

info@red-env.co.uk | 0161 706 0075 | www.red-env.co.uk

Executive Summary

Redmore Environmental Ltd was commissioned by Streetly Hall Estate Partnership to undertake an Odour Assessment in support of a proposed Anaerobic Digestion plant at Streetly Hall Farm, West Wickham.

Odour emissions from the facility have the potential to cause impacts at sensitive locations. An Odour Assessment was therefore undertaken to quantify effects in the vicinity of the plant.

Emissions from the relevant sources were defined based on the nature and size of the plant, as well as information provided by the future operators and design engineers for the facility. Impacts at sensitive receptors were quantified using dispersion modelling, the results compared with the relevant odour benchmark level and the significance assessed in accordance with the appropriate guidance.

Predicted odour concentrations were below the relevant benchmark at all sensitive receptor locations in the vicinity of the site for all modelling years. Resultant impacts were also classified as not significant in accordance with the relevant guidance criteria. As such, potential impacts associated with odour emissions from the facility are not considered to be significant.

Table of Contents

1.0 INTRODUCTION

1.1 Background

1.1.1 Redmore Environmental Ltd was commissioned by Streetly Hall Estate Partnership to undertake an Odour Assessment in support of a proposed Anaerobic Digestion (AD) plant at Streetly Hall Farm, West Wickham.

1.1.2 Odour emissions from the facility have the potential to cause impacts at sensitive locations. An Odour Assessment was therefore undertaken to quantify effects in the vicinity of the plant.

1.2 Site Location and Context

1.2.1 The proposed facility will be located on land at Streetly Hall Farm, West Wickham, at National Grid Reference (NGR): 560000, 248500. Reference should be made to Figure 1 for a map of the site and surrounding area.

1.2.2 The AD plant will utilise three fermenters and one post-fermenter to process the following feedstock types:

- Purpose grown crops (principally maize);
- Waste and non-waste crop residues; and,
- Animal manures/slurries.

1.2.3 It is anticipated that approximately 70% of the feedstocks listed above will be sourced from Streetly Hall Farm, with the remaining portion obtained from local farms or industrial processing facilities. The plant will process between 60,000 and 75,000 tonnes per annum (tpa) of feedstock.

1.2.4 Purpose-grown crops such as maize will be delivered to the site using a tractor and trailer during typical harvest periods and deposited in three dedicated clamps. The clamps will be compacted and covered using protective plastic sheeting. This will form an airtight layer to minimise emissions and preserve the feedstock throughout the year. It should be noted that any decomposition of the material would affect its effectiveness as a feedstock. As such, the protective sheeting will be specified to prevent water and air

reaching the material and hence avoid any unwanted breakdown with associated emissions. The cover on each clamp will be slightly open at both ends to allow access to the feedstock for transportation to one of two external feed hoppers. Loading will occur twice a day, in the morning and evening. Only one hopper will be operational at any one time and the remaining will be available as a back-up.

1.2.5 Cattle manure will be delivered to the site using a tractor and trailer and will be stored in an uncovered clamp prior to transfer to one of the external feed hoppers.

1.2.6 The site will include a dedicated intake and processing building. This will receive poultry litter and straw bales. The material will be stored and then processed using a separate feed hopper contained within the building. Air will be extracted from the building and transferred to an odour abatement system for treatment prior to exhaust to atmosphere. This arrangement will help to promote negative pressure within the structure and reduce the potential for fugitive emissions to atmosphere when doors are opened to allow access.

1.2.7 Biogas produced by the AD process will be upgraded on site to generate biomethane for export to national gas grid, as well as carbon dioxide (CO_2) which will be recovered for use in the food industry or sequestration off-site. A proportion of the biogas will be combusted within a Combined Heat and Power (CHP) unit to generate electricity and heat. Additionally, a proportion will be combusted in a Power to Heat (PTH) module to generate heat. A flare is also included at the plant for venting of biogas during abnormal operation.

1.2.8 The facility will produce liquid digestate which will be stored on site prior to removal for use in agriculture as a biofertiliser. This will be held in a covered storage lagoon.

1.2.9 The AD plant may result in odour emissions from a number of activities during normal operation. These have the potential to cause impacts at sensitive locations within the vicinity of the site and have therefore been assessed within this report.

2.0 ODOUR BACKGROUND

2.1 Odour Definition

2.1.1 The Institute of Air Quality Management (IAQM) guidance[1] defines odour as:

> "[…] the human olfactory response (perception followed by psychological appraisal) to one, or more often a complex mixture of, chemical species in the air."

2.1.2 The stated definition is considered to be relevant in the context of this assessment.

2.2 Odour Impacts

2.2.1 The magnitude of odour impact depends on a number of factors and the potential for complaints varies due to the subjective nature of odour perception. The **FIDOL** acronym (also stated as **FIDOR** in Environment Agency (EA) guidance[2]) is a useful reminder of the factors that will determine the degree of odour pollution. These are described by the IAQM[3] as follows:

- **F**requency - how often an individual is exposed to odour;
- **I**ntensity - the individual's perception of the strength of the odour;
- **D**uration - The overall duration that individuals are exposed to an odour over time;
- **O**dour unpleasantness - Odour unpleasantness describes the character of an odour as it relates to the 'hedonic tone' (which may be pleasant, neutral or unpleasant) at a given odour concentration/ intensity. This can be measured in the laboratory as the hedonic tone, and when measured by the standard method and expressed on a standard nine-point scale it is termed the hedonic score; and,
- **L**ocation - The type of land use and nature of human activities in the vicinity of an odour source. Tolerance and expectation of the receptor. The 'Location' factor can be considered to encompass the receptor characteristics, receptor sensitivity, and socio-economic factors.

[1] Guidance on the Assessment of Odour for Planning v1.1, IAQM, 2018.

[2] H4: Odour Management, EA, 2011.

[3] Guidance on the Assessment of Odour for Planning v1.1, IAQM, 2018.

2.2.2 It is important to note that even infrequent emissions may cause loss of amenity if odours are perceived to be particularly intense or offensive.

2.2.3 The **FIDOL** factors can be further considered to provide the following issues in regards to the potential for an odour emission to cause an impact:

- The rate of emission of the compound(s);
- The duration and frequency of emissions;
- The time of the day that this emission occurs;
- The prevailing meteorology;
- The sensitivity of receptors to the emission i.e. whether the odorous compound is more likely to cause an impact, such as the sick or elderly, who may be more sensitive;
- The odour detection capacity of individuals to the various compound(s); and,
- The individual perception of the odour (i.e. whether the odour is regarded as unpleasant). This is greatly subjective, and may vary significantly from individual to individual. For example, some individuals may consider some odours as pleasant, such as petrol, paint and creosote.

2.3 Odour Legislative Control

2.3.1 The main requirement with respect to odour control from industrial activities is the Environmental Permitting (England and Wales) Regulations (2016) and subsequent amendments. If a process is deemed potentially odorous then the relevant regulator will usually include an appropriate condition in the site's Environmental Permit to restrict impacts beyond the facility boundary.

2.3.2 Enforcement of the condition is by the relevant regulator, either the EA for Part A(1) processes, or the Local Authority for Part A(2) and B processes. If the regulator is satisfied that odour from a facility is causing pollution beyond the site boundary, then they can serve an improvement notice that requires remedial works to be undertaken to reduce impacts to an acceptable level. The measures that are deemed appropriate will depend on the industry sector and site-specific circumstances and will take costs and benefits into account. Should appropriate actions not be taken by the operator then the regulator has a number of available options, cumulating in the revocation of the Environmental Permit and cessation of all activities on site.

2.4 Odour Benchmark Levels

2.4.1 There is no statutory limit in the UK for ambient odour concentrations, whether set for individual chemical species or for mixtures. However, the EA has issued guidance on odour[4] which contains indicative benchmark levels for use in the assessment of potential impacts from industrial facilities.

2.4.2 Benchmark levels are stated as the 98th percentile (%ile) of hourly mean concentrations in European odour units (ou_E) over a year for odours of different offensiveness. In practice this means that for 2% of the year, or 175-hours, concentrations will be higher than this value, whilst for 98% of the year, or 8,585-hours, they will be lower. This parameter reflects the previously described **FIDOL** factors, where an odour is likely to be noted on several occasions above a particular threshold concentration before an annoyance occurs. EA odour benchmark levels are summarised in Table 1.

Table 1 Odour Benchmark Levels

Relative Offensiveness of Odour	Benchmark Level as 98th %ile of 1-hour Means (ou_E/m^3)
Most offensive odours: • Processes involving decaying animal or fish • Processes involving septic effluent or sludge • Biological landfill odours	1.5
Moderately offensive odours: • Intensive livestock rearing • Fat frying (food processing) • Sugar beet processing • Well aerated green waste composting	3.0
Less offensive odours: • Brewery • Confectionery • Coffee roasting • Bakery	6.0

[4] H4: Odour Management, EA, 2011.

2.4.3 Odours from the facility would be classified as 'moderately offensive' as they are likely to be similar to green waste composting and agricultural emissions. As such, an odour benchmark level of $3.0ou_E/m^3$ as the 98th %ile of 1-hour mean concentrations has been utilised throughout the report.

2.4.4 In order to provide some context to the odour benchmark values, the Department for Environment, Food and Rural Affairs (DEFRA) have provided the following descriptors[5]:

- $1ou_E/m^3$ is the point of detection;
- $5ou_E/m^3$ is a faint odour; and,
- $10ou_E/m^3$ is a distinct odour.

2.4.5 An odour at a strength of $1ou_E/m^3$ is in reality so weak that it would not normally be detected outside the controlled environment of an odour laboratory by the majority of people (that is individuals with odour sensitivity in the "normal" range - approximately 96% of the population[6]). It is important to note that these values are based on laboratory measurements and in the general environment other factors affect our sense of odour perception. These include:

- The population is continuously exposed to a wide range of background odours at a range of different concentrations, and usually people are unaware of there being any background odours at all due to normal habituation. Individuals can also develop a tolerance to background and other specific odours. In an odour laboratory the determination of detection threshold is undertaken by comparison with non-odorous air, and in carefully controlled, odour-free, conditions. Normal background odours such as those from traffic, vegetation, grass mowing etc, can provide background odour concentrations from 5 to $60ou_E/m^3$ or more[7];
- The recognition threshold may be about $3ou_E/m^3$ [8], although it might be less for offensive substances or higher if the receptor is less familiar with the odour or distracted by other stimuli; and,

5 Odour Guidance for Local Authorities, DEFRA, 2010.

6 Odour Guidance for Local Authorities, DEFRA, 2010.

7 Odour Guidance for Local Authorities, DEFRA, 2010.

8 Odour Guidance for Local Authorities, DEFRA, 2010.

- An odour which fluctuates rapidly in concentration is often more noticeable than a steady odour at a low concentration.

2.5 National Planning Policy

2.5.1 The revised National Planning Policy Framework[9] (NPPF) was published in July 2021 and sets out the Government's planning policies for England and how these are expected to be applied.

2.5.1 The purpose of the planning system is to contribute to the achievement of sustainable development. In order to ensure this, the NPPF recognises three overarching objectives, including the following of relevance to odour:

> "c) An environmental objective - to protect and enhance our natural, built and historic environment; including making effective use of land, improving biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy."

2.5.2 Chapter 12 of the NPPF details objectives in relation to achieving well-designed place. It states that:

> "Planning policies and decisions should ensure that developments:
>
> […]
>
> f) create places that are safe, inclusive and accessible and which promote health and well-being, with a high standard of amenity for existing and future users; and where crime and disorder, and the fear of crime, do not undermine the quality of life or community cohesions and resilience."

2.5.3 The implications of the NPPF have been considered throughout this assessment.

[9] NPPF, Ministry of Housing, Communities and Local Government, 2021.

2.6 Local Planning Policy

2.6.1 The South Cambridgeshire Local Plan[10] was adopted by South Cambridgeshire District Council (SCDC) in September 2018. Review of the document indicated the following policy of relevance to this assessment:

> "Policy CC/2: Renewable and Low Carbon Energy Generation
>
> Planning permission or proposals to generate energy from renewable and low carbon sources, with the exception of proposals for wind turbines, will be permitted provided that:
>
> a. The development, and any associated infrastructure, either individually or cumulatively with other developments, does not have unacceptable adverse impacts on heritage assets (including their settings), natural assets, high quality agricultural land, the landscape, or the amenity of nearby residents (visual impact, noise, shadow flicker, odour, fumes, traffic); […]"

2.6.2 This policy has been considered throughout the undertaking of the assessment.

2.7 Institute of Air Quality Management Guidance

2.7.1 The IAQM published the 'Guidance on the Assessment of Odour for Planning'[11] on 20th May 2014. This was updated in 2018[12] and specifically deals with assessing odour impacts for planning purposes, namely potential effects on amenity. The assessment methodology outlined in the guidance has been utilised in throughout this report where relevant.

10 South Cambridgeshire Local Plan, SCDC, 2018.

11 Guidance on the Assessment of Odour for Planning, IAQM, 2014.

12 Guidance on the Assessment of Odour for Planning, IAQM, 2018.

3.0 METHODOLOGY

3.1 Introduction

3.1.1 The facility may result in odour emissions during normal operation. Associated impacts were assessed in accordance with the following stages:

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

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

3.2 Odour Sources

3.2.1 Potential odour sources associated with the facility were identified from information provided by Streetly Hall Estate Partnership and Plandescil Ltd. These are summarised in Table 2.

Table 2 Odour Sources

Source		Source Description	Emission Characteristics
1	Exposed material within the clamps	Odours generated by exposed feedstocks within the clamp storage area	Diffuse emissions from the surfaces of exposed material
2	Exposed material within the operational external feed hopper	Odours generated by exposed feedstocks within the hopper	Diffuse emissions from the surfaces of exposed material
3	Exposed material during transfer from the clamps to the feed hopper	Odours generated by exposed feedstocks	Diffuse emissions from the surface of exposed material
4	Digestate within the storage lagoon	Odours generated by digestate within the covered lagoon	Fugitive emissions from the cover on the digestate lagoon
5	Emissions from the proposed intake and processing building odour abatement system which is yet to be formalised	Odours generated by operations within the intake and processing building	Residual emissions from the abatement system outlet

3.2.2 It should be noted that the actual AD process itself is sealed and therefore does not form a source of odour, or other emissions such as methane or hydrogen sulphide under normal operation. Should releases of these species occur then this would indicate a fault with the plant and immediate remedial measures would be taken to eliminate the problem to avoid affecting the AD process, with associated financial consequences for the operator. Similarly, the CHP unit and flare only emit products of combustion which do not typically have any associated odour. As such, they have not been considered as potential sources in the context of this assessment.

3.2.3 It should be noted that a formal design specification for the intake/ processing building abatement system has not yet been prepared. As such, in lieu of specific information, precautionary assumptions regarding emissions from the plant and the associated dispersion characteristics have been made in order to ensure a robust assessment. These are detailed in Section 3.6.

3.3 Odour Emission Rates

3.3.1 The AD plant is not operational. As such, in lieu of site-specific data, estimations of odour emission rates were identified for use in the assessment based on monitoring results reported for similar facilities. These are summarised in Table 3.

Table 3 Odour Emission Rates

Source	Odour Emission Rate	Unit	Reference
Liquid digestate	1.0	$ou_E/m^2/s$	University of Liège and Universidad Politécnica de Valencia(1)
Maize, rye, barley, sugar beet, fodder beet, grass and other whole crops	20.0	$ou_E/m^2/s$	ADAS(2)
Cattle manure	0.8	$ou_E/m^2/s$	Odournet UK Ltd(3)

NOTES: (1) Multi-method Monitoring of Odor Emissions in Agricultural Biogas Facilities, Jacques Nicolas, Gilles Adam, Yolanda Ubeda, Anne-Claude Romain, University of Liège and Universidad Politécnica de Valencia.
(2) An Odour Impact Study for a Proposed Agricultural Anaerobic Digester at Cleat Hill Farm, Haunton, ADAS.
(3) Odour Impact Assessment for a proposed Biomass AD Facility near Kenninghall, Norfolk, produced by Odournet UK Ltd.

3.4 Dispersion Modelling

3.4.1 Dispersion modelling was undertaken using ADMS-6.0 (v6.0.0.1), which is developed by Cambridge Environmental Research Consultants (CERC) Ltd. ADMS-6 is a short-range dispersion modelling software package that simulates a wide range of buoyant and passive releases to atmosphere. It is a new generation model utilising boundary layer height and Monin-Obukhov length to describe the atmospheric boundary layer and a skewed Gaussian concentration distribution to calculate dispersion under convective conditions.

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

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

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

3.4.4 These are detailed in the following Sections.

3.5 Modelling Scenarios

3.5.1 The scenarios considered in the modelling assessment are summarised in Table 4.

Table 4 Assessment Scenarios

Parameter	Modelled As	
	Short Term	Long Term
Odour	98th %ile 1-hour mean	-

3.6 Process Conditions

3.6.1 The inputs used to describe the relevant emission sources within the model were derived from the data shown in Table 3 and information provided by Streetly Hall Estate Partnership and Plandescil Ltd. A summary of the data is provided in Table 5.

Table 5 Process Conditions

Source		Characteristics and Assumptions
1	Exposed maize within clamp 1 and clamp 2	• Two area sources were used to represent emissions from the open faces of each clamp within the model • The emission rate for maize is 20$ou_E/m^2/s$, as shown in Table 3 • A total area of 148.2m^2 of maize is exposed within clamp 1 continuously • A total area of 148.2m^2 of maize is exposed within clamp 2 continuously • Emissions were assumed to be constant, 24-hours per day, 365-days per year. This is considered to be a worst-case assessment scenario as periods of reduced operating capacity are not reflected in the modelled emissions
	Exposed whole crop cereal within clamp 3	• Two area sources were used to represent emissions from the open faces of the clamp within the model • The emission rate for whole crop cereal is 20$ou_E/m^2/s$, as shown in Table 3 • A total area of 126.0m^2 of whole crop cereal is exposed within clamp 3 continuously • Emissions were assumed to be constant, 24-hours per day, 365-days per year. This is considered to be a worst-case assessment scenario as periods of reduced operating capacity are not reflected in the modelled emissions
	Exposed cattle manure within clamp 4	• A single area source was used to represent emissions from the manure within the model • The emission rate for cattle manure is 0.8$ou_E/m^2/s$, as shown in Table 3

Source		Characteristics and Assumptions
		• A total area of 800.0m^2 of cattle manure is exposed within clamp 4 continuously • Emissions were assumed to be constant, 24-hours per day, 365-days per year. This is considered to be a worst-case assessment scenario as periods of reduced operating capacity are not reflected in the modelled emissions
2	Exposed maize, whole crop cereal and cattle manure within the feed hopper	• A single area source was used to represent emissions from the source within the model • A total of 116.8m^2 of maize, whole crop cereal and cattle manure is exposed within the hopper during operation • The emission rate for maize, whole crop cereal and cattle manure is 20ou$_E$/m^2/s, as shown in Table 3. The emission rate for cattle manure is 0.8 ou$_E$/m/s, as shown in Table 3. The higher emission rate of 20ou$_E$/m/s was used to represent releases from the hopper as a worst case. This was multiplied by a factor of 10 to represent the potential for increased emissions as a result of agitation of the material within the hopper • Emissions were assumed to be constant, 24-hours per day, 365-days per year. This is considered to be a worst-case assessment scenario as periods of shut down or reduced operating capacity are not reflected in the modelled emissions
3	Exposed material during transfer of silage from clamps to feed hopper	• Four line sources were used to represent emissions from material transfer within the model • The emission rate for maize and whole crop cereal is 20ou$_E$/m/s, as shown in Table 3. The emission rate for cattle manure is 0.8 ou$_E$/m/s, as shown in Table 3. The higher emission rate of 20ou$_E$/m/s was used to represent releases from transfer as a worst case. This was converted to a line specific emission rate of 10 ou$_E$/m/s based on the stated area release rate and width of the source • The transfer routes were defined as a 2m line source between the clamps and feed hopper • Plandescil Ltd confirmed that loading will occur twice per day. However, it was assumed that material will be transferred across all routes over a period of 12-hours per day. This is considered to represent a conservative over-estimation based on the proposed loading schedule

Source		Characteristics and Assumptions
4	Liquid digestate within lagoon	• A single area source was used to represent emissions from the source within the model • The emission rate for liquid digestate is 1.0$ou_E/m^2/s$, as shown in Table 3 • It was assumed that the lagoon has a maximum emitting area of 4,069.6m^2. This is considered to represent a worst-case assumption as it does not take into account the freeboard that needs to be maintained in order to prevent overflow • The lagoon is covered and liquid digestate is not exposed to atmosphere during storage. The SCAIL-Agriculture Update report[13] indicates that a reduction of 90% would be expected from engineered covers. As such, the stated emission rate was reduced by this factor in order to represent containment of digestate and associated emissions during storage • Emissions were assumed to be constant, 24-hours per day, 365-days per year. This is considered to be a worst-case assessment scenario as periods of reduced operating capacity are not reflected in the modelled emissions
5	Emissions from the proposed intake and processing building odour abatement system which is yet to be formalised	• A single point source was used to represent emissions from the vent on the abatement system within the model • A formal design specification for the system has not yet been prepared. As such, in lieu of specific information, it was assumed that treated air will be discharged to atmosphere from the system at height 4.0m above ground level in order to ensure a worst-case assessment • The maximum air volumetric flow rate through the unit was assumed to be 27.96m^3/s which is equivalent to a building extract rate of 3 air changes per hour (ac/hr) • A diameter of 1.5m was assumed. Based on the volumetric flow of 27.96m^3/s, the efflux velocity of the emissions from the source is 15.83m/s • The odour concentration of treated air vented from the unit will be 1,000ou_E/m^3 which is the upper range Best Available Techniques (BAT) Associated Emission Level (AEL) for channelled emissions to air specified in European Commission (EC) guidance[14] • The emission rate utilised for the unit was 27,960.00ou_E/s. This was calculated by multiplying the stated volumetric air flow rate by the upper range BAT AEL

[13] SCAIL-Agriculture Update Sniffer ER26: Final Report, Sniffer, 2014.

[14] BAT Reference Document for Waste Treatment, European Commission, 2018.

Source		Characteristics and Assumptions
		• Emissions were assumed to be constant, 24-hours per day, 365-days per year. This is considered to be a worst-case assessment scenario as periods of shut down or reduced operating capacity are not reflected in the modelled emissions

3.6.2 Reference should be made to Figure 2 for a graphical representation of the source locations.

3.7 Assessment Area

3.7.1 The assessment area was defined based on the site location, anticipated pollutant dispersion patterns and the positioning of sensitive receptors. Ambient concentrations were predicted over NGR: 558710, 247080 to 561460, 249830. One Cartesian grid with a resolution of 10m was used within the model to produce data suitable for contour plotting using the Surfer software package.

3.7.2 Reference should be made to Figure 2 for a graphical representation of the assessment grid extents.

3.7.3 A desk-top study was undertaken in order to identify any sensitive receptor locations in the vicinity of the site that required specific consideration during the assessment. These are summarised in Table 6.

Table 6 Sensitive Receptor Locations

Receptor		NGR (m)	
		X	Y
R1	Residential - Bottle Hall	560709.9	249545.8
R2	Residential - Ivy Todd Farm	561221.2	249143.9
R3	Residential - Streetly Hall Cottages	560438.4	248246.7
R4	Residential - New Hall	560434.5	248110.2
R5	Residential - Mill House	560337.5	247517.3
R6	Residential - The Lodge House	559428.6	247168.7
R7	Residential - The Farmhouse	559255.2	247708.2

Receptor		NGR (m)	
		X	Y
R8	Residential - Dene Road Cottages	559359.3	248153.1

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

3.8 Building Effects

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

3.8.2 Analysis of the site layout indicated that the intake and processing building should be included within the model in order to take account of effects on pollutant dispersion. The building input geometry is shown in Table 7.

Table 7 Building Geometry

Building	NGR (m)		Height (m)	Length / Diameter (m)	Width (m)	Angle (°)
	X	Y				
Intake and processing building	560008.5	248469.1	12.6	80.0	36.0	122.6

3.9 Meteorological Data

3.9.1 Meteorological data used in the assessment was taken from Andrewsfield meteorological station over the period 1st January 2016 to 31st December 2020 (inclusive). This observation station is located at NGR: 568732, 222996, which is approximately 25km south of the facility. It is anticipated that conditions would be reasonably similar over a distance of this magnitude. The data was therefore considered suitable for an assessment of this nature.

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

3.10 Roughness Length

3.10.1 A z_0 of 0.2m was used within the model to describe the modelling extents and meteorological site. This value is considered appropriate for the morphology of both areas and is suggested within ADMS-6 as being suitable for 'agricultural areas (min)'.

3.11 Monin-Obukhov Length

3.11.1 The Monin-Obukhov length provides a measure of the stability of the atmosphere. A minimum Monin-Obukhov length of 1m was used to describe the modelling extents and meteorological site. This value is considered appropriate for the nature of the area and is suggested within ADMS-6 as being suitable for 'rural areas'.

3.12 Terrain Data

3.12.1 Ordnance Survey OS Terrain 50 data was included in the model for the site and surrounding area in order to take account of the specific flow field produced by variations in ground height throughout the assessment extents. This was pre-processed using the method suggested by CERC[15].

3.13 Significance of Odour Impacts

3.13.1 The significance of impacts was assessed through the interaction of the predicted 98th %ile of 1-hour mean odour concentrations and receptor sensitivity, as outlined in the IAQM guidance[16]. The relevant assessment matrix is summarised in Table 8.

Table 8 Odour Impact

Odour Exposure Level as 98th %ile of 1-hour Means (ou_E/m^3)	Receptor Sensitivity		
	Low	Medium	High
Greater than 10	Moderate	Moderate	Substantial
5 - 10	Slight	Moderate	Moderate

[15] Note 105: Setting up Terrain Data for Input to CERC Models, CERC, 2016.

[16] Guidance on the Assessment of Odour for Planning, IAQM, 2018.

Odour Exposure Level as 98th %ile of 1-hour Means (ou_E/m^3)	Receptor Sensitivity		
	Low	Medium	High
3 - 5	Negligible	Slight	Moderate
1.5 - 3	Negligible	Negligible	Slight
0.5 - 1.5	Negligible	Negligible	Negligible
Less than 0.5	Negligible	Negligible	Negligible

3.13.2 The IAQM guidance[17] states that an assessment must reach a conclusion on the likely significance of the predicted impact. Where the overall effect is **moderate** or **substantial**, the effect is likely to be considered **significant**, whilst if the impact is **slight** or **negligible**, the impact is likely to be considered **not significant**. It should be noted that this is a binary judgement of either it is **significant** or it is **not significant**. This has been considered to determine the overall significance of potential odour impacts associated with the facility.

3.14 Modelling Uncertainty

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

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

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

- Choice of model - ADMS-6 is a commonly used atmospheric dispersion model and results have been verified through a number of studies to ensure predictions are as accurate as possible;

[17] Guidance on the Assessment of Odour for Planning, IAQM, 2018.

- Meteorological data - Modelling was undertaken using five annual meteorological data sets from the closest observation station to the development to take account of a range of conditions. The assessment was based on the worst-case year to ensure maximum concentrations were considered;
- Surface characteristics - The z_0 and Monin-Obukhov length were determined for both the dispersion and meteorological sites based on the surrounding land uses and guidance provided by CERC;
- Plant operating conditions - Parameters were supplied by Streetly Hall Estate Partnership and Plandescil Ltd to describe the activities that will be undertaken at the facility and associated durations. As such, these are considered to be representative of likely operating procedures;
- Emission rates - Emission rates were derived from monitoring undertaken at similar facilities. As such, they are considered to be representative of potential releases during normal operation;
- Receptor locations - A Cartesian Grid was included in the model in order to provide suitable data for contour plotting. Receptor points were also included at sensitive locations to provide additional consideration of these areas; and,
- Variability - All model inputs are as accurate as possible and worst-case conditions were considered as necessary in order to ensure a robust assessment of potential pollutant concentrations.

3.14.3 Results were considered in the context of the relevant odour benchmark level and IAQM criteria. It is considered that the use of the stated measures to reduce uncertainty and the use of worst-case assumptions when necessary has resulted in model accuracy of an acceptable level.

4.0 ASSESSMENT

4.1 Predicted Odour Concentrations

4.1.1 Dispersion modelling of potential odour emissions was undertaken using the input data specified previously. Predicted odour concentrations at the discrete receptor locations are summarised in Table 9. It should be noted that the odour concentrations are presented as a 98th %ile of 1-hour mean values over the relevant assessment year. The maximum concentration across the five years of results is highlighted in **bold**.

Table 9 Predicted Odour Concentrations

Receptor		Predicted 98th %ile 1-hour Mean Odour Concentration (ou_E/m^3)				
		2016	2017	2018	2019	2020
R1	Residential - Bottle Hall	0.38	0.45	0.48	**0.55**	0.39
R2	Residential - Ivy Todd Farm	0.37	**0.56**	0.46	0.48	0.39
R3	Residential - Streetly Hall Cottages	**2.87**	2.75	1.98	2.42	2.18
R4	Residential - New Hall	1.51	**1.87**	1.30	1.57	1.57
R5	Residential - Mill House	0.66	0.43	0.53	**0.71**	0.37
R6	Residential - The Lodge House	0.33	0.11	**0.38**	0.36	0.26
R7	Residential - The Farmhouse	0.40	0.23	0.33	**0.44**	0.30
R8	Residential - Dene Road Cottages	**0.63**	0.36	0.52	0.62	0.55

4.1.2 As indicated in Table 9, predicted odour concentrations were below the EA odour benchmark of $3.0ou_E/m^3$ at all receptor locations for all modelling years.

4.1.3 Reference should be made to Figure 5 to Figure 9 for graphical representations of predicted odour concentrations throughout the assessment extents. These indicate maximum levels in close proximity to the odour sources with levels reducing sharply over a short distance.

4.2 Impact Significance

4.2.1 The significance of predicted odour impacts at the sensitive receptors is summarised in Table 10.

Table 10 Predicted Odour Impacts

Receptor		Odour Exposure Level as 98th %ile of 1-hour Means (ou_E/m^3)	Receptor Sensitivity	Significance of Impact
R1	Residential - Bottle Hall	0.5 - 1.5	High	Negligible
R2	Residential - Ivy Todd Farm	0.5 - 1.5	High	Negligible
R3	Residential - Streetly Hall Cottages	1.5 - 3	High	Slight
R4	Residential - New Hall	1.5 - 3	High	Slight
R5	Residential - Mill House	0.5 - 1.5	High	Negligible
R6	Residential - The Lodge House	Less than 0.5	High	Negligible
R7	Residential - The Farmhouse	Less than 0.5	High	Negligible
R8	Residential - Dene Road Cottages	0.5 - 1.5	High	Negligible

4.2.2 As indicated in Table 10, the significance of odour impacts as a result of emissions from the plant was predicted to be **slight** at two receptors and **negligible** at six locations.

4.2.3 The IAQM guidance[18] states that only if the impact is **moderate** or **substantial**, the effect is considered **significant**. As such, impacts are considered **not significant**, in accordance with the stated methodology.

4.2.4 Based on the dispersion modelling results, it is not anticipated that significant odour impacts will occur at any sensitive location as a result of emissions from the facility.

[18] Guidance on the Assessment of Odour for Planning, IAQM, 2018.

5.0 CONCLUSION

5.1.1 Redmore Environmental Ltd was commissioned Streetly Hall Estate Partnership to undertake an Odour Assessment in support of a proposed AD plant at Streetly Hall Farm, West Wickham.

5.1.2 Odour emissions from the facility have the potential to cause impacts at sensitive locations. An Odour Assessment was therefore undertaken to quantify effects in the vicinity of the plant.

5.1.3 Potential odour releases were defined based on the size and nature of the facility. These were represented within a dispersion model produced using ADMS-6. Impacts at sensitive receptor locations in the vicinity of the site were quantified, the results compared with the relevant odour benchmark level and the significance assessed in accordance with the IAQM guidance.

5.1.4 Predicted odour concentrations were below the relevant odour benchmark level at all residential receptor locations for all modelling years. The significance of predicted impacts was defined as **slight** at two receptors and **negligible** at six locations.

5.1.5 In accordance with the stated guidance, the overall odour effects as a result of the facility are considered to be **not significant**. As such, potential odour emissions are not considered to represent a constraint to the development.

6.0 ABBREVIATIONS

ac/hr	Air Changes Per Hour
AD	Anaerobic Digestion
CERC	Cambridge Environmental Research Consultants
CHP	Combined Heat and Power
CO_2	Carbon Dioxide
DEFRA	Department for Environment, Food and Rural Affairs
EA	Environment Agency
IAQM	Institute of Air Quality Management
NGR	National Grid Reference
NPPF	National Planning Policy
ou_E	European Odour Units
z_0	Roughness Length
SCDC	South Cambridgeshire District Council
%ile	Percentile
PTH	Power to Heat
tpa	Tonnes per annum

Figures

Legend

Site Boundary

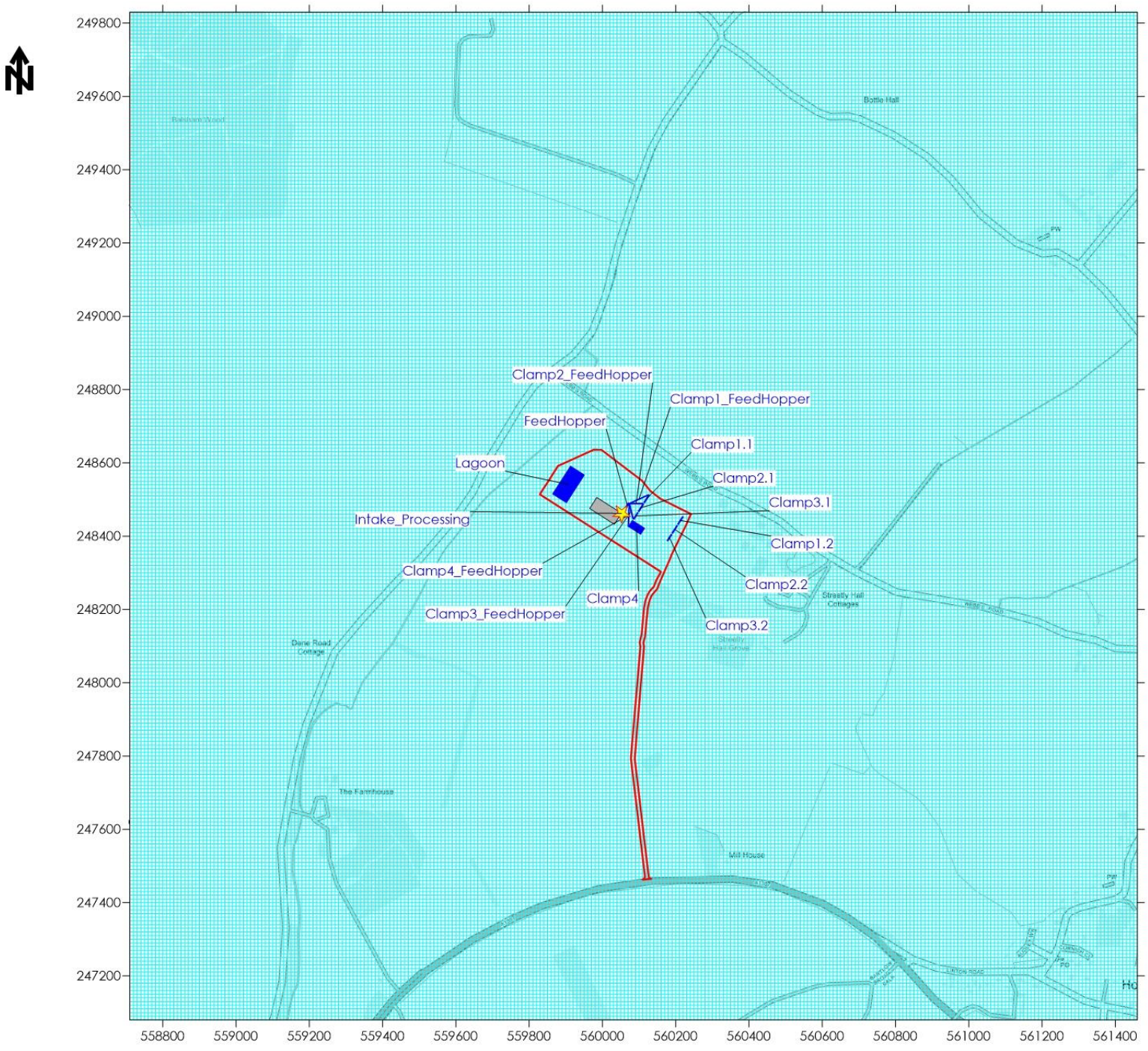
Title
Figure 1 - Site Location Plan

Project
Odour Assessment
Streetly Hall Farm, West Wickham

Project Reference
5949

Client
Streetly Hall Estate Partnership

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



Legend

- Site Boundary
- Output Grid
- Area/ Line Source
- Building
- Point Source

Title
Figure 2 - ADMS-6 Inputs

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Odour Assessment
Streetly Hall Farm, West Wickham

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Streetly Hall Estate Partnership

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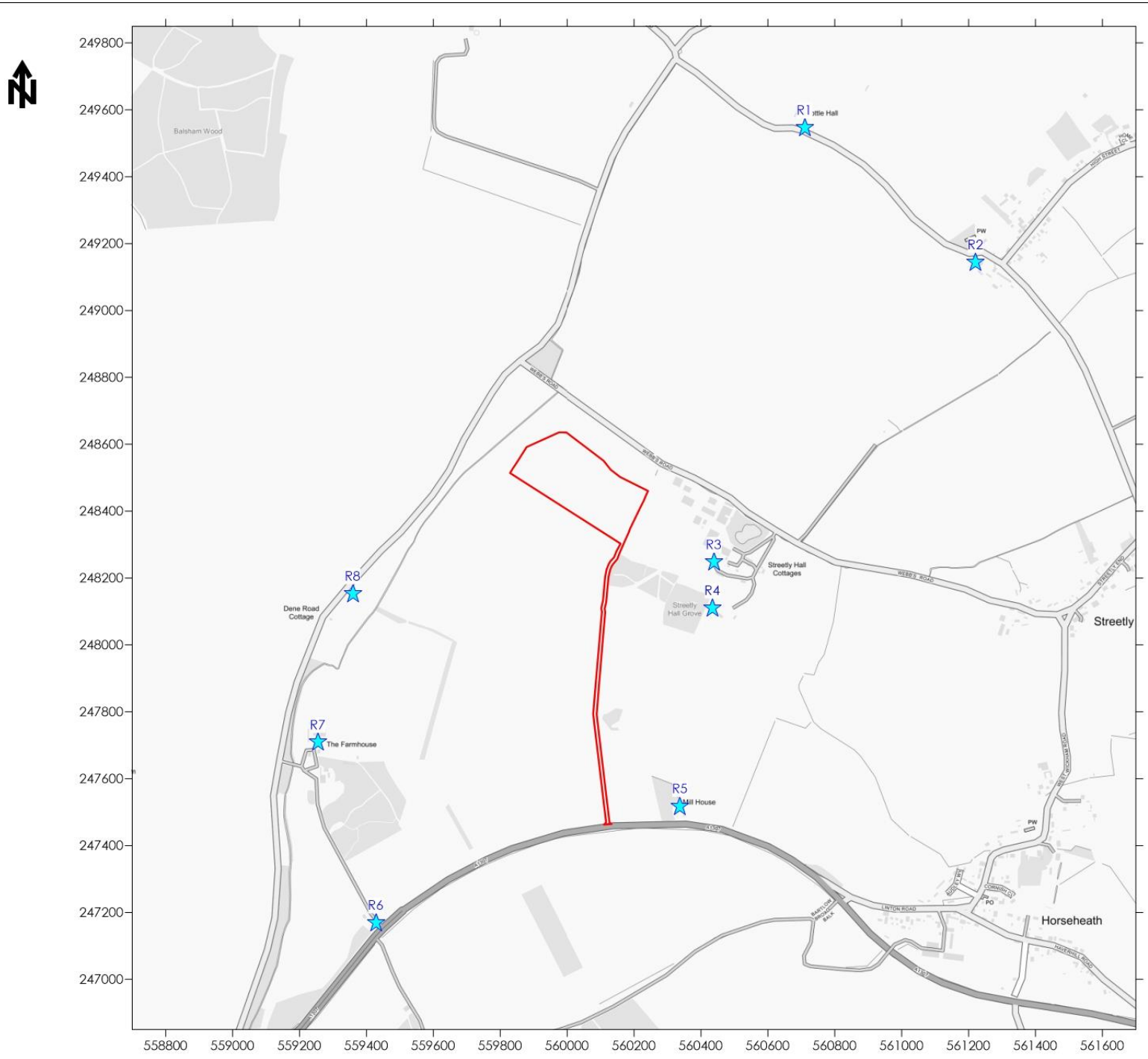

Legend

Site Boundary

Receptor

Title
Figure 3 - Sensitive Receptors

Project
Odour Assessment
Streetly Hall Farm, West Wickham

Project Reference
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Client
Streetly Hall Estate Partnership

Redmore environmental
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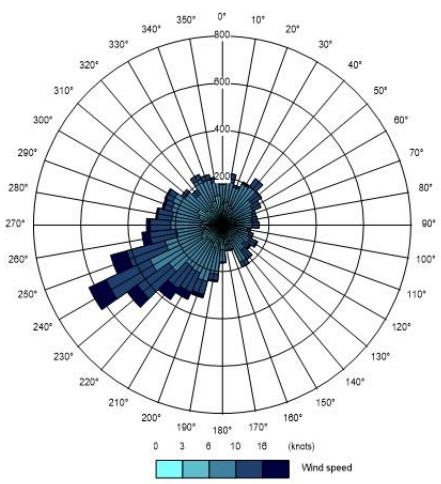

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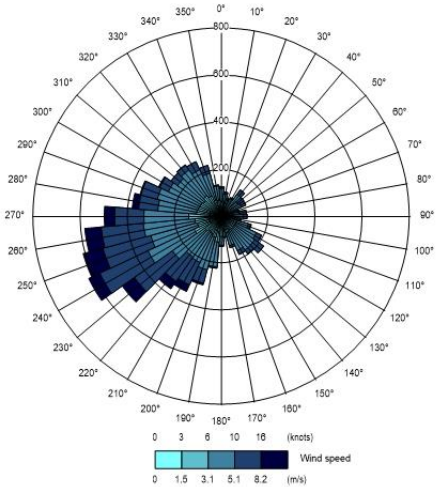

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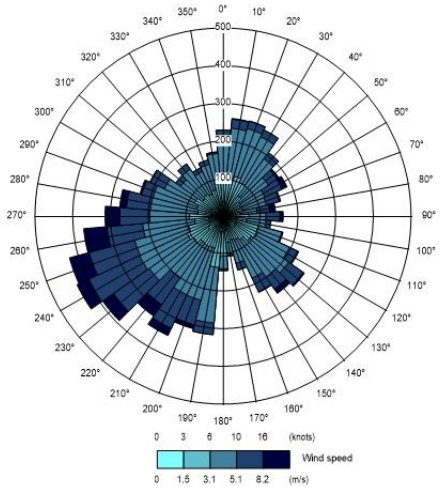
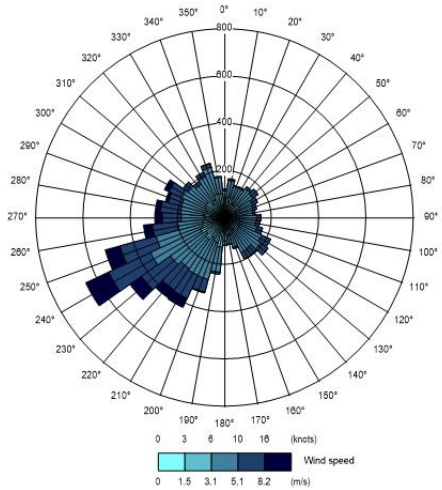
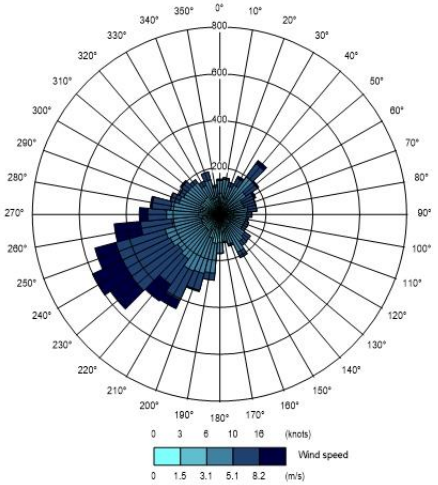


2018 Meteorological Data



2019 Meteorological Data



2020 Meteorological Data

Legend

Title
Figure 4 - Wind Roses of 2016 to 2020 Andrewsfield Meteorological Station Data

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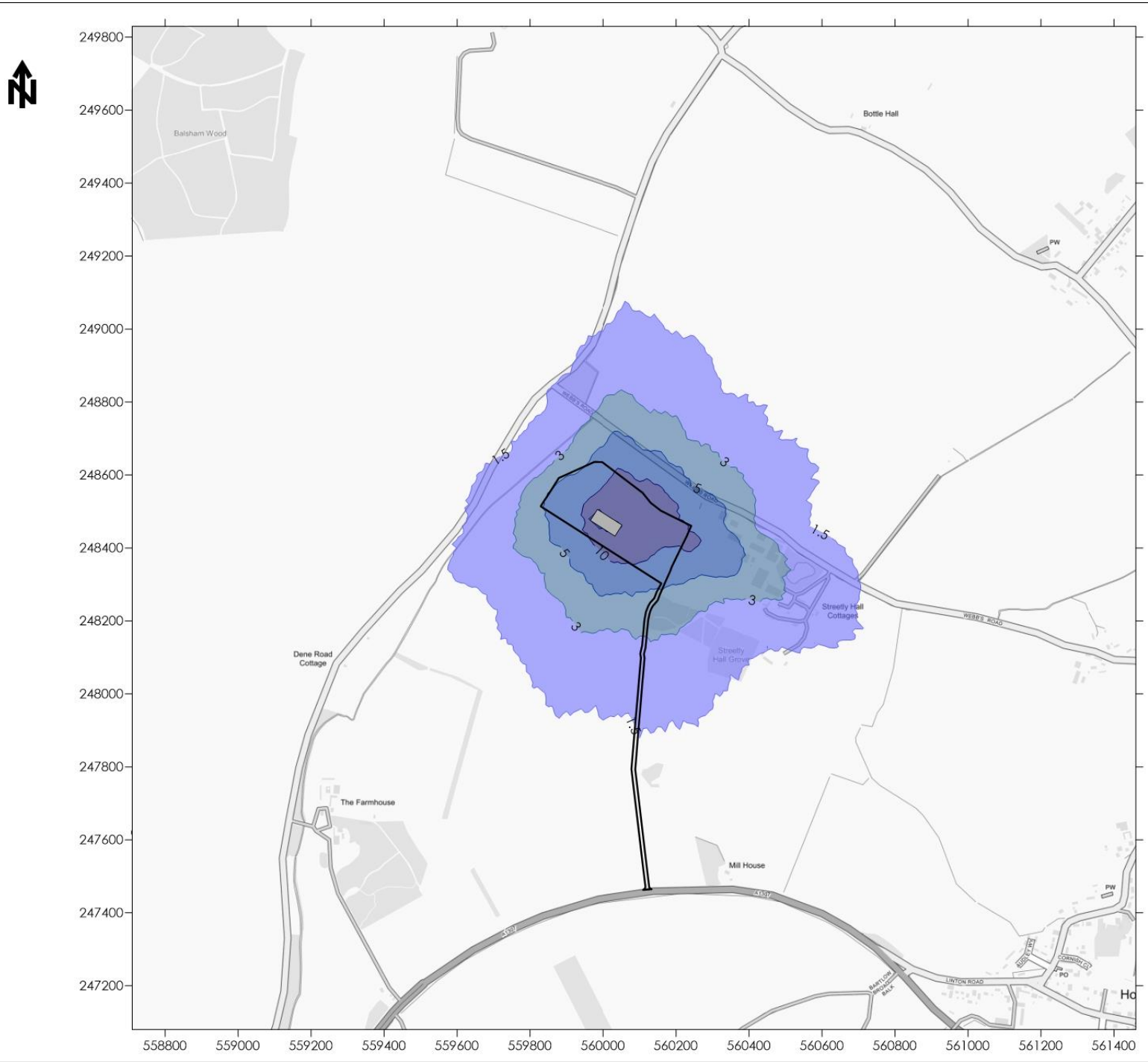

Legend

Site Boundary

Building

Predicted 98th %ile 1-hour Mean Odour Concentration (ou_E/m^3)

10
5
3
1.5

Title

Figure 5 - Predicted 98th %ile 1-hour Mean Odour Concentration (ou_E/m^3) 2016 Meteorological Data

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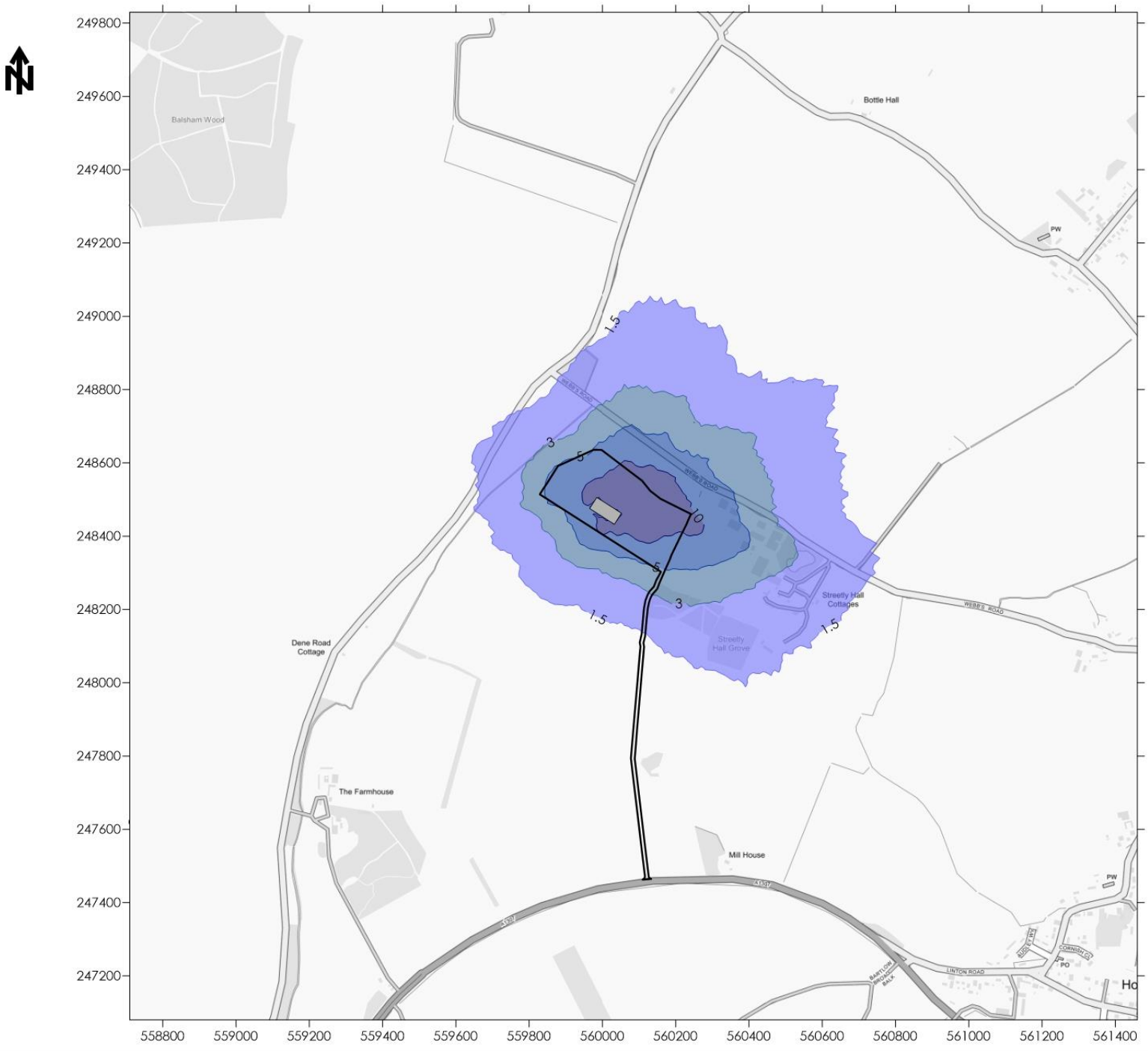

Legend

Site Boundary

Building

Predicted 98th %ile 1-hour Mean Odour Concentration (ou_E/m^3)

10
5
3
1.5

Title

Figure 6 - Predicted 98th %ile 1-hour Mean Odour Concentration (ou_E/m^3) 2017 Meteorological Data

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Odour Assessment
Streetly Hall Farm, West Wickham

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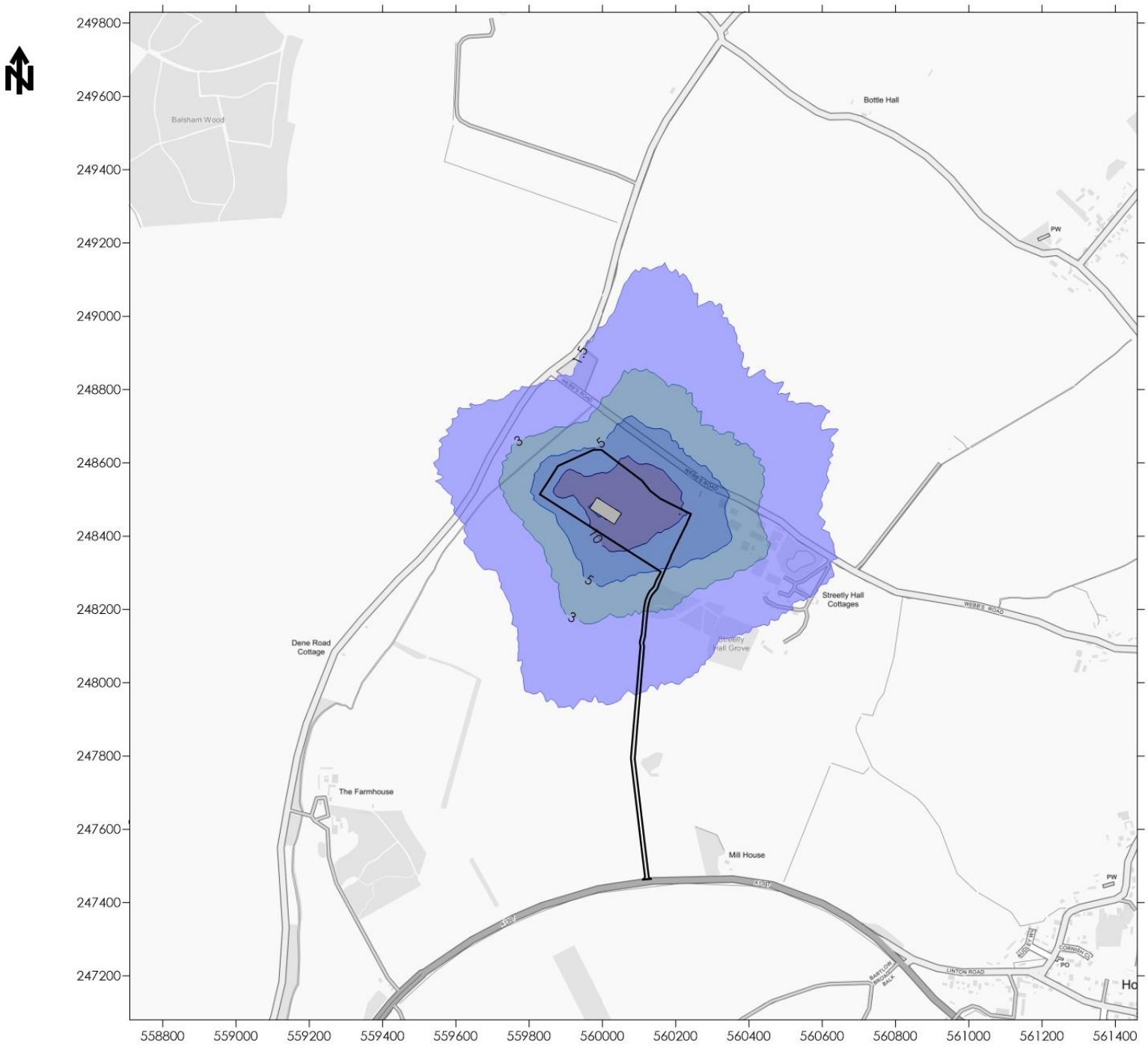

Legend

Site Boundary

Building

Predicted 98th %ile 1-hour Mean Odour Concentration (ou_E/m^3)

10
5
3
1.5

Title

Figure 7 - Predicted 98th %ile 1-hour Mean Odour Concentration (ou_E/m^3) 2018 Meteorological Data

Project

Odour Assessment
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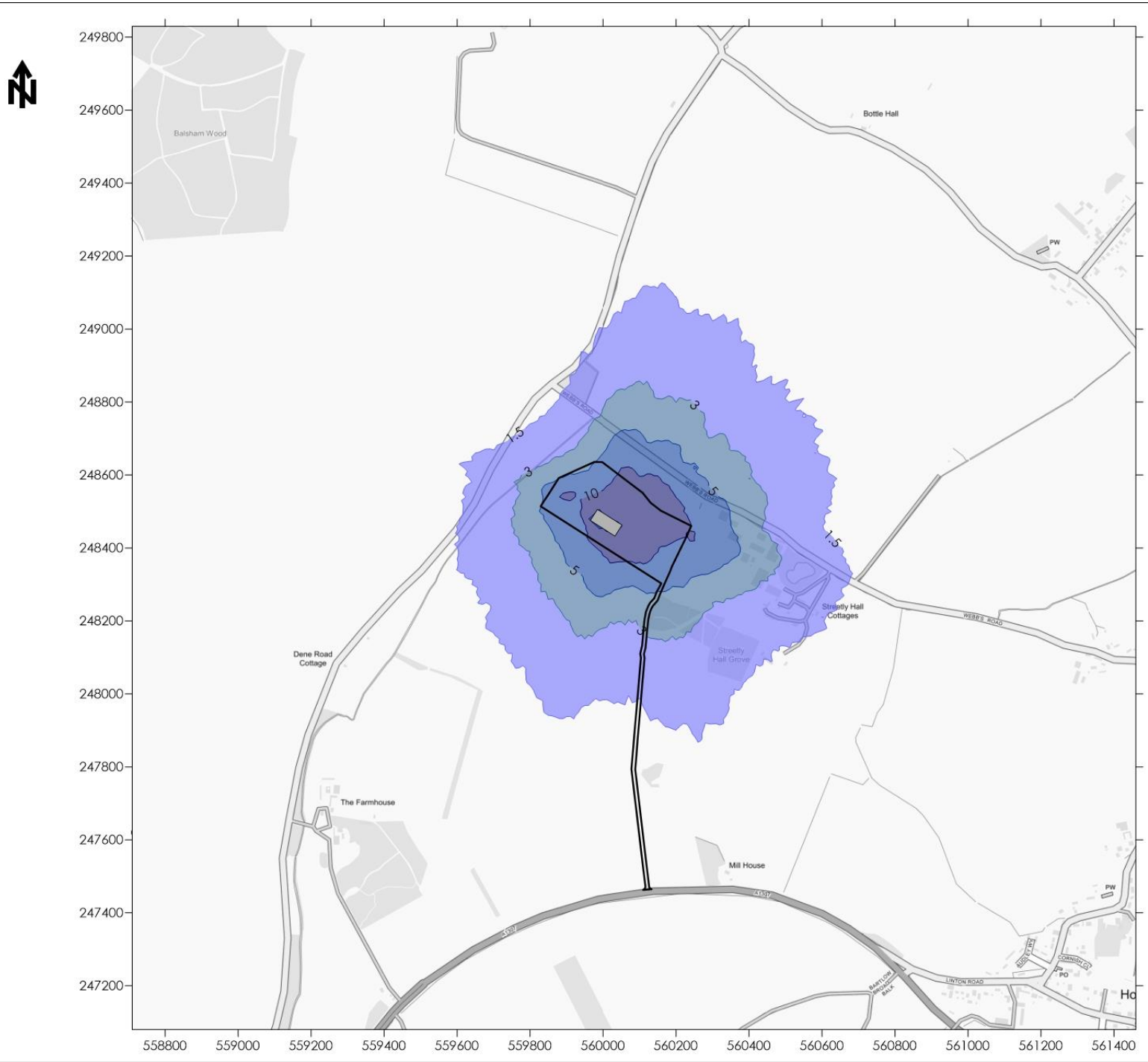

Legend

Site Boundary

Building

Predicted 98th %ile 1-hour Mean Odour Concentration (ou_E/m^3)

Title

Figure 8 - Predicted 98th %ile 1-hour Mean Odour Concentration (ou_E/m^3) 2019 Meteorological Data

Project

Odour Assessment
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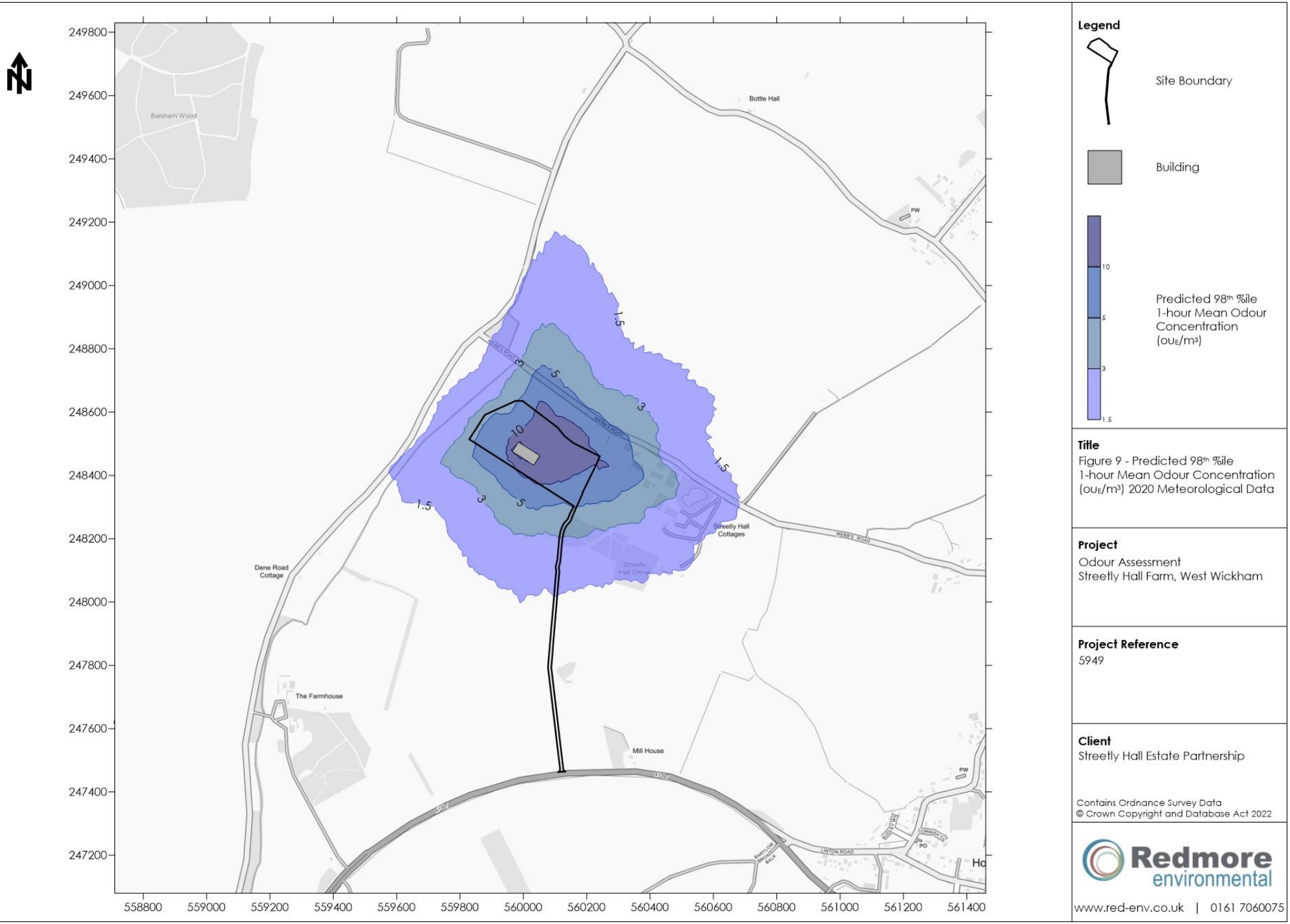

Legend

Site Boundary

Building

Predicted 98th %ile 1-hour Mean Odour Concentration (ou_E/m^3)

10
5
3
1.5

Title

Figure 9 - Predicted 98th %ile 1-hour Mean Odour Concentration (ou_E/m^3) 2020 Meteorological Data

Project

Odour Assessment
Streetly Hall Farm, West Wickham

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