Air Quality Assessment

Greencore, Chapel Road, Old Leake, Boston

Client: Bakkavor Foods Ltd

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Executive Summary

Redmore Environmental Ltd was commissioned by Bakkavor Foods Ltd to undertake an Air Quality Assessment in support of an Environmental Permit Application for Greencore, Chapel Road, Old Leake, Boston.

Atmospheric emissions of combustion products from on site boilers have the potential to cause air quality impacts. As such, an Air Quality Assessment was undertaken in order to determine baseline conditions and quantify potential effects.

Dispersion modelling was undertaken in order to predict pollutant concentrations at sensitive locations as a result of emissions from the site. The results indicated that impacts on pollutant concentrations were not predicted to be significant at any human or ecological receptor location.

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1.0 INTRODUCTION

1.1 Background

1.1.1 Redmore Environmental Ltd was commissioned by Bakkavor Foods Ltd to undertake an Air Quality Assessment in support of an Environmental Permit Application for Greencore, Chapel Road, Old Leake, Boston.

1.1.2 Atmospheric emissions of combustion products from on site boilers have the potential to cause air quality impacts. As such, an Air Quality Assessment was undertaken in order to determine baseline conditions and quantify potential effects.

1.2 Site Location and Context

1.2.1 The facility is located on land off Chapel Road, Old Leake, Boston, PE22 9PN, at National Grid Reference (NGR): 539885, 351555. Reference should be made to Figure 1 for a map of the site and surrounding area.

1.2.2 The facility includes three Liquid Petroleum Gas (LPG) fired boilers. Two of these operate concurrently, with the third available as back-up.

1.2.3 Emissions from the facility have the potential to affect pollution levels at sensitive locations. An Air Quality Assessment was therefore undertaken to define baseline conditions, assess potential impacts and consider the significance of any predicted effects. The results are summarised in the following report.

2.0 LEGISLATION AND POLICY

2.1 Legislation

2.1.1 The Air Quality Standards Regulations (2010) and subsequent amendments include Air Quality Limit Values (AQLVs) for the following pollutants:

- Nitrogen dioxide (NO_2);
- Sulphur dioxide;
- Lead;
- Particulate matter with an aerodynamic diameter of less than 10µm;
- Particulate matter with an aerodynamic diameter of less than 2.5µm;
- Benzene; and,
- Carbon monoxide (CO).

2.1.2 Air Quality Target Values have also been provided for several additional pollutants.

2.1.3 The Air Quality Strategy (AQS) was produced by the Department for Environment, Food and Rural Affairs (DEFRA) and published on 28th April 2023[1]. The document contains standards, objectives and measures for improving ambient air quality, including a number of Air Quality Objectives (AQOs). These are maximum ambient pollutant concentrations that are not to be exceeded either without exception or with a permitted number of exceedences over a specified timescale. These are generally in line with the AQLVs, although the requirements for the determination of compliance vary.

2.1.4 Table 1 presents the AQOs for pollutants considered within this assessment.

Table 1 Air Quality Objectives

Pollutant	Air Quality Objective	
	Concentration (µg/m^3)	Averaging Period
NO_2	40	Annual mean
	200	1-hour mean, not to be exceeded on more than 18 occasions per annum

[1] The AQS: Framework for Local Authority Delivery, DEFRA, 2023.

Pollutant	Air Quality Objective	
	Concentration (µg/m³)	Averaging Period
CO	10,000	8-hour running mean

2.2 Local Air Quality Management

2.2.1 Local Authorities (LAs) are required to periodically review and assess air quality within their area of jurisdiction under the system of Local Air Quality Management (LAQM). This review and assessment of air quality involves comparing present and likely future pollutant concentrations against the AQOs. If it is predicted that levels at locations of relevant exposure are likely to be exceeded, the LA is required to declare an Air Quality Management Area (AQMA). For each AQMA the LA is required to produce an Air Quality Action Plan (AQAP), the objective of which is to reduce pollutant concentrations in pursuit of the AQOs.

2.3 Industrial Pollution Control Legislation

2.3.1 Atmospheric emissions from industry are controlled in the UK through the Environmental Permitting (England and Wales) Regulations (2016) and subsequent amendments. As such, the facility is required to obtain an Environmental Permit issued by the Environment Agency (EA). Conditions of operation will be stated Emission Limit Values (ELVs) for various pollutants produced by the process. Compliance with these conditions must be demonstrated through periodic monitoring requirements, which have been set in order to limit potential impacts in the surrounding area.

2.4 Critical Loads and Levels

2.4.1 A critical load is defined by the UK Air Pollution Information System (APIS)[2] as:

> "A quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge."

[2] UK APIS, www.apis.ac.uk.

2.4.2 A critical level is defined as:

> "Concentrations of pollutants in the atmosphere above which direct adverse effects on receptors, such as human beings, plants, ecosystems or materials, may occur according to present knowledge."

2.4.3 A critical load refers to deposition of a pollutant, while a critical level refers to pollutant concentrations in the atmosphere (which usually have direct effects on vegetation or human health).

2.4.4 When pollutant loads (or concentrations) exceed the critical load or level it is considered that there is a risk of harmful effects. The excess over the critical load or level is termed the exceedence. A larger exceedence is often considered to represent a greater risk of damage.

2.4.5 Maps of critical loads and levels and their exceedences have been used to show the potential extent of pollution damage and aid in developing strategies for reducing pollution. Decreasing deposition below the critical load is seen as means for preventing the risk of damage. However, even a decrease in the exceedence may infer that less damage will occur.

2.4.6 Table 2 presents the critical levels for the protection of vegetation for pollutants considered within this assessment.

Table 2 Critical Levels for the Protection of Vegetation

Pollutant	Critical Level	
	Concentration (µg/m^3)	Averaging Period
Oxides of nitrogen (NO_x)	30	Annual mean
	75	24-hour mean

2.4.7 Critical loads have been designated within the UK based on the sensitivity of the receiving habitat and have been identified for the relevant designations considered within the assessment in Section 3.5.

3.0 BASELINE

3.1 Introduction

3.1.1 Existing air quality conditions in the vicinity of the site were identified in order to provide a baseline for assessment. These are detailed in the following Sections.

3.2 Local Air Quality Management

3.2.1 As required by the Environment Act (1995), Boston Borough Council (BBC) has undertaken Review and Assessment of air quality within their area of jurisdiction. This process has indicated that annual mean concentrations of NO_2 are above the AQO within the borough. As such, one AQMA has been declared. This is described as follows:

> "AQMA 1 - Haven Bridge: The AQMA follows the A16 trunk road through the centre of town encompassing properties on either side. It extends from Queen Street roundabout through to the intersection of John Adams Way and Main Ridge East."

3.2.2 The site is located approximately 10.4km south-west of the AQMA. It is considered unlikely the facility would cause air quality impacts over a distance of this magnitude. As such, the AQMA has not been considered further in the context of the assessment.

3.2.3 BBC has concluded that concentrations of all other pollutants considered within the AQS are currently below the relevant AQOs. As such, no further AQMAs have been designated.

3.3 Air Quality Monitoring

3.3.1 Monitoring of NO_2 concentrations is undertaken by BBC throughout their area of jurisdiction. However, the closest survey location to the site is approximately 9.5km south-west of the boundary. It is considered unlikely that similar pollutant levels would occur over a distance of this magnitude. As such, this source of data was not considered further in the context of the assessment.

3.3.2 BBC do not undertake CO monitoring within the vicinity of the site.

3.4 Background Pollutant Concentrations

3.4.1 Predictions of background pollutant concentrations on a 1km by 1km grid basis have been produced by DEFRA for the entire of the UK to assist Local Authorities in their Review and Assessment of air quality. The site is located in grid square NGR: 539500, 351500. Data for this location was downloaded from the DEFRA website[3] for the purpose of the assessment and is summarised in Table 3.

Table 3 Background Pollutant Concentration Predictions

Pollutant	Predicted Background Pollutant Concentration (µg/m³)
NO_2	5.40
CO	231

3.4.2 It should be noted that concentrations of NO_2 are predicted for 2026 and CO for 2001. These were the most recent predictions available at the time of assessment and are therefore considered to provide a reasonable representation of background concentrations in the vicinity of the site.

3.5 Sensitive Receptors

3.5.1 A sensitive receptor is defined as any location which may be affected by changes in air quality. These have been defined for human and ecological receptors in the following Sections.

Human Receptors

3.5.2 A desk-top study was undertaken in order to identify any sensitive human receptor locations in the vicinity of the site that required specific consideration during the assessment. These are summarised in Table 4.

[3] http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html.

Table 4 Human Receptor Locations

Receptor		NGR (m)	
		X	Y
R1	Residential - Church Road	539998.9673	351323.7781
R2	Residential - Church Road	540030.0416	351364.0526
R3	Residential - Chapel Road	539996.1685	351555.2559
R4	Residential - Chapel Road	540017.5155	351520.2248
R5	Residential - Chapel Road	540028.4627	351557.4453
R6	Residential - Chapel Road	540044.3362	351607.2551
R7	Residential - Chapel Road	539948.841	351698.7721
R8	Residential - Chapel Road	539919.7198	351672.012
R9	Residential - Fellands Gate	539818.976	351713.7262
R10	Residential - Fellands Gate	539754.1649	351710.9958
R11	Residential - Cowbroads Lane	539476.263	351246.0896
R12	Residential - Cowbroads Lane	539452.0513	351355.6793

3.5.3 Reference should be made to Figure 2 for a map of the human receptor locations.

Ecological Receptors

3.5.4 Atmospheric emissions from the facility have the potential to impact on receptors of ecological sensitivity within the vicinity of the site. A pre-application Nature and Heritage Conservation Screening Report from the EA indicated the following sites of ecological nature conservation importance within the relevant screening distances:

- The Wash & North Norfolk Coast Special Area of Conservation (SAC);
- The Wash Special Protection Area (SPA); and,
- The Wash Ramsar.

3.5.5 For the purpose of the modelling assessment discrete receptors were placed at the closest points of each designation to the facility to ensure the maximum potential impact was predicted. These are summarised in Table 5.

Table 5 Ecological Receptor Locations

Receptor		NGR (m)	
		X	Y
E1	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	549462.8	352929.4
E2	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	546814.5	350902.6
E3	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	544895.8	348902.9
E4	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	543490.61	347308.5
E5	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	541950.3	344660.2

3.5.6 Critical loads have been designated within the UK based on the sensitivity and relevant features of the receiving habitat. A review of the APIS[4] website was undertaken in order to identify the most sensitive habitat and associated critical load for each designation considered within the assessment.

3.5.7 The relevant nitrogen deposition critical loads are presented in Table 6.

Table 6 Critical Loads for Nitrogen Deposition

Ecological Designation	Feature	APIS Habitat	Nitrogen Critical Load (kgN/ha/yr)	
			Low	High
The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	Sterna albifrons (Eastern Atlantic - breeding)	Coastal dune grasslands (grey dunes)	5	15

3.5.8 The relevant acid deposition critical loads are presented in Table 7.

[4] http://www.apis.ac.uk/.

Table 7 Critical Loads for Acid Deposition

Ecological Designation	Feature	APIS Habitat	Acid Critical Load (keq/ha/yr)		
			CLMinN	CLMaxS	CLMaxN
The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	Lutra lutra	Freshwater	-	-	-

3.5.9 Baseline pollutant concentrations and deposition rates at each ecological receptor were obtained from the APIS website and are summarised in Table 8.

Table 8 Baseline Pollution Levels

Receptor		Annual Mean NO_x Conc. ($\mu g/m^3$)	Baseline Deposition Rate	
			Nitrogen (kgN/ha/yr)	Acid (keq/ha/yr)
E1	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	5.9	15.3	1
E2	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	5.9	15.3	1
E3	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	5.9	15.3	1
E4	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	5.9	15.3	1
E5	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	5.9	15.3	1

4.0 METHODOLOGY

4.1 Introduction

4.1.1 Combustion emissions from the boilers have the potential to contribute to elevated pollutant concentrations in the vicinity of the site. These have been quantified through dispersion modelling in accordance with the methodology outlined in the following Sections.

4.2 Dispersion Model

4.2.1 Dispersion modelling was undertaken using ADMS-6 (v6.0.2.5), 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.

4.2.2 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.

4.3 Modelling Scenarios

4.3.1 The pollutants and associated averaging periods considered in the modelling assessment for human receptors are summarised in Table 9.

Table 9 Human Receptor Pollutants and Averaging Periods

Parameter	Modelled As	
	Short Term	Long Term
NO_2	99.8th percentile (%ile) 1-hour mean	Annual mean
CO	100th %ile 8-hour rolling mean	-

4.3.2 Some short-term air quality criteria are framed in terms of the number of occasions in a calendar year on which the concentration should not be exceeded. As such, the %iles shown in Table 9 were selected to represent the relationship between the permitted number of exceedences of short-period concentrations and the number of periods within a calendar year.

4.3.0 The pollutants and associated averaging periods considered for ecological receptors in the modelling assessment are summarised in Table 10.

Table 10 Ecological Receptor Pollutants and Averaging Periods

Parameter	Modelled As	
	Short Term	Long Term
NO_x	24-hour mean	Annual mean
Nitrogen deposition	-	Annual deposition
Acid deposition	-	Annual deposition

4.3.1 Predicted pollutant concentrations were summarised in the following formats:

- Process Contribution (PC) - Predicted pollutant level as a result of emissions from the facility only; and,
- Predicted Environmental Concentration (PEC) - Total predicted pollutant level as a result of emissions from the facility and existing baseline conditions.

4.3.2 Predicted ground level pollutant concentrations and deposition rates were compared with the relevant AQOs, critical loads and critical levels. These criteria are collectively referred to as Environmental Quality Standards (EQSs).

4.4 Assessment Area

4.4.1 The assessment area was defined based on the facility location, anticipated pollutant dispersion patterns and the positioning of sensitive receptors. Ambient concentrations were predicted over NGR: 539125, 350795 to 540625, 352295. 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.

4.4.2 Reference should be made to Figure 3 for a graphical representation of the assessment grid extents.

4.5 Process Conditions

4.5.1 A summary of the source parameters used in the assessment is provided in Table 11. These were obtained from Stack Emissions Monitoring reports produced by Cura Terrae with supplementary information provided by the Applicant. Exhaust gas concentrations of NO_x were based on the ELVs for existing gas-fired boilers[5] and concentrations of CO were obtained from the monitoring reports. It should be noted that only two of the three boilers are operated concurrently. As such, review of the monitoring data was undertaken to identify the two units with the highest emissions profile for use in the assessment. This indicated Boilers 2 and 3 had the highest NO_x emissions. These were subsequently represented within the model.

Table 11 Source Parameters

Parameter	Unit	EP2 - Boiler 2	EP2 - Boiler 3
Stack position	NGR	539866.2, 351545.4	539875.2, 351539.6
Stack height	m	8.2	6.2
Stack diameter	m	0.35	0.45
Exhaust gas temperature	°C	183	183
Exhaust gas moisture content	%	5	5
Exhaust gas oxygen (O_2) content	%	5.0	5.7
Exhaust gas flow rate	m^3/s	1.22	1.94
Exhaust gas flow rate (dry, 3% O_2)	Nm^3/s	0.61	0.91
Exhaust gas efflux velocity	m/s	12.71	12.17
NO_x emission concentration	mg/Nm^3	250	250
NO_x emission rate	g/s	0.1532	0.2281
CO emission concentration	mg/Nm^3	0.45	0.47
CO emission rate	g/s	0.0003	0.004

5 https://www.gov.uk/guidance/medium-combustion-plant-mcp-comply-with-emission-limit-values.

4.5.2 Reference should be made to Figure 3 for a map of the source locations.

4.5.3 Emissions from all plant were assumed to be constant, 24-hours per day, 365-days per year. This is considered to be a worst-case assessment as plant shutdown or periods of reduced work load are not reflected in the modelled emissions.

4.6 NO_x to NO_2 Conversion

4.6.1 Emissions of total NO_x from combustion processes are predominantly in the form of nitric oxide (NO). Excess oxygen in the combustion gases and further atmospheric reactions cause the oxidation of NO to NO_2. Comparisons of ambient NO and NO_2 concentrations in the vicinity of point sources in recent years has indicated that it is unlikely that more than 30% of the NO_x is present at ground level as NO_2.

4.6.2 Ambient NO_x concentrations were predicted through dispersion modelling. Concentrations of NO_2 shown in the results section assume 70% conversion from NO_x to NO_2 for annual means and 35% conversion for 1-hour concentrations, based upon EA guidance[6].

4.7 Building Effects

4.7.1 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.

4.7.2 Analysis of the site layout indicated that a number of structures should be included within the model in order to take account of effects on pollutant dispersion. Building input geometries are shown in Table 12.

[6] https://www.gov.uk/guidance/environmental-permitting-air-dispersion-modelling-reports.

Table 12 Building Geometries

Building	NGR (m)		Height (m)	Length / Diameter (m)	Width (m)	Angle (°)
	X	Y				
Building 1	539845.1	351590.9	7.0	26.3	87.2	123.0
Building 2	539901.2	351573.7	10.6	86.4	54.9	123.0
Building 3	539868.2	351549.5	5.2	26.6	10.8	123.0

4.8 Meteorological Data

4.8.1 Meteorological data used in the assessment was taken from Coningsby meteorological station over the period 1st January 2019 to 31st December 2023 (inclusive). This observation station is located at NGR: 522784, 356757, which is approximately 17.7km north-west 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.

4.8.2 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 the utilised meteorological records.

4.9 Roughness Length

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

4.10 Monin-Obukhov Length

4.10.1 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 both areas and is suggested within ADMS-6 as being suitable for 'rural area'.

4.11 Terrain Data

4.11.1 Inclusion of terrain data is recommended within the ADMS-6 user guide if the gradient within a modelling area varies by more than 10% (1 in 10). Assessment of changes in elevation throughout the modelling extents using Google Earth indicated the average gradient was below this value. As such, terrain data was not included within the model.

4.12 Nitrogen Deposition

4.12.0 Nitrogen deposition rates were calculated using the conversion factors provided within EA document 'Technical Guidance on Detailed Modelling approach for an Appropriate Assessment for Emissions to Air AQTAG 06'[7]. Predicted pollutant concentrations were multiplied by the relevant deposition velocity and conversion factor to calculate the speciated dry deposition flux. The conversion factors used for the determination of nitrogen deposition are presented within Table 13.

Table 13 Conversion Factors to Determine Dry Deposition Flux for Nitrogen Deposition

Pollutant	Deposition Velocity (m/s)		Conversion Factor (µg/m²/s to kg/ha/yr of pollutant species)
	Grassland	Forest	
NO_2	0.0015	0.003	95.9

4.12.1 The relevant deposition velocity for each ecological receptor was selected from Table 13 based on the vegetation type present within the designation.

4.13 Acid Deposition

4.13.0 Predicted ground level NO_2 concentrations were converted to kilo-equivalent ion depositions (keq/ha/yr) for comparison with the critical load for acid deposition at each of the identified ecological receptors. The conversion to units of equivalents, a measure of the potential acidifying effect of a species, was undertaken using the standard conversion factors shown in Table 14.

[7] Technical Guidance on Detailed Modelling approach for an Appropriate Assessment for Emissions to Air AQTAG 06, EA, 2014.

Table 14 Conversion Factors to Determine Dry Deposition Flux for Acid Deposition

Pollutant	Deposition Velocity (m/s)		Conversion Factor (µg/m²/s to keq/ha/yr of pollutant species)
	Grassland	Forest	
NO_2	0.0015	0.003	6.84

4.13.1 The following formula was used to calculate predicted PCs as a proportion of the critical load function where PECs were identified to be greater than the CLminN value.

PC as %CL function = ((PC of N deposition)/CLmaxN) x 100

4.13.2 The above formula was obtained from the APIS website[8].

4.14 Background Concentrations

4.14.1 Review of existing data in the vicinity of the site was undertaken in Section 3.0 in order to identify suitable background values for use in the assessment. This indicated the closest NO_2 monitor is positioned a significant distance from the plant, and the result is unlikely to be representative of the facility location. As such, the background concentration predicted by DEFRA was utilised to represent existing levels in the vicinity of the site.

4.14.2 CO is not monitored in the vicinity of the site. The DEFRA mapped background concentration was therefore utilised in lieu of alternative data sources.

4.14.3 Background levels at the ecological receptors were obtained from the APIS website, as summarised in Table 8.

4.14.4 It is not possible to add short-term peak baseline and process concentrations. This is because the conditions which give rise to peak ground-level concentrations of substances emitted from an elevated source at a particular location and time are likely to be different to the conditions which give rise to peak concentrations due to emissions from other sources. This point is addressed in in EA guidance 'Air emissions risk assessment for your environmental permit'[9], which advises that an estimate of the maximum

[8] http://www.apis.ac.uk/.

[9] https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit.

combined pollutant concentration can be obtained by adding the maximum predicted short-term concentration due to emissions from the source to twice the annual mean baseline concentration. This approach was adopted throughout the assessment.

4.15 Assessment Criteria

Human Receptors

4.15.1 EA guidance 'Air emissions risk assessment for your environmental permit'[10] states that PCs can be screened as insignificant if they meet the following criteria:

- The short-term PC is less than 10% of the short-term environmental standard; and,
- The long-term PC is less than 1% of the long-term environmental standard.

4.15.2 If these criteria are exceeded the following guidance is provided on when whether PECs can be screened as insignificant:

- The short-term PC is less than 20% of the short-term environmental standards minus twice the long-term background concentration; and,
- The long-term PEC is less than 70% of the long-term environmental standards.

Ecological Receptors

4.15.3 EA guidance 'Air emissions risk assessment for your environmental permit'[11] states that PCs at SACs, SPAs and Ramsar sites can be screened as insignificant if they meet the following criteria:

- The short-term PC is less than 10% of the short-term environmental standard for protected conservation areas; and,
- The long-term PC is less than 1% of the long-term environmental standard for protected conservation areas.

10 https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit.

11 https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit.

4.15.4 Predicted PCs have been compared to the relevant EQSs and the criteria stated above. Where the impact is within these parameters, the EA concludes that impacts associated with an installation are acceptable.

4.16 Modelling Uncertainty

4.16.1 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.

4.16.2 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;
- Meteorological data - Modelling was undertaken using five annual meteorological data sets from an observation station local to the site to account for inter-year variability. 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 - Operational parameters were based on monitoring undertaken at the site. As such, input parameters are considered to be representative of normal operating conditions;
- Emission rates - Emission rates were based on the relevant ELV and site specific monitoring results. As such, these are considered to be representative of anticipated emissions from the installation;

- Background concentrations - Background pollutant levels were obtained from DEFRA and APIS. These are considered representative of baseline air quality conditions at sensitive locations within the vicinity of the site;
- 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 were as accurate as possible and worst-case conditions were considered as necessary in order to ensure a robust assessment of potential pollutant concentrations.

4.16.3 Results were considered in the context of the relevant EQSs. 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.

5.0 RESULTS

5.1 Introduction

5.1.1 Dispersion modelling was undertaken with the inputs described in Section 4.0. The results are outlined in the following Sections.

5.1.2 Reference should be made to Figure 5 to Figure 7 for graphical representations of predicted pollutant concentrations, inclusive of background, throughout the assessment extents. It should be noted that the values shown in the Figures are predictions from the meteorological data set which resulted in the maximum pollutant concentration for that species. For example, the maximum annual mean NO_2 concentration was predicted using the 2020 meteorological data set. As such, the contours shown in Figure 5 were produced from the 2020 model outputs.

5.2 Maximum Pollutant Concentrations

5.2.1 The maximum predicted pollutant concentrations at any point within the modelling extents for any meteorological data set are summarised in Table 15.

Table 15 Maximum Predicted Pollutant Concentrations

Pollutant	Averaging Period	EQS (µg/m³)	PC (µg/m³)	PC Proportion of EQS (%)	PEC (µg/m³)	PEC Proportion of EQS (%)
NO_2	Annual	40	21.80	54.5	27.20	68.0
	99.8th %ile 1-hour	200	64.30	32.1	75.10	37.5
CO	Rolling 8-hour	10,000	462.32	4.6	693.32	6.9

5.2.2 As shown in Table 15, there were no predicted exceedences of any EQS at any location for any pollutant or averaging period of interest.

5.3 Human Receptors

5.3.1 Predicted concentrations of each pollutant at the sensitive human receptor locations identified in Table 4 are summarised in the following Sections.

Nitrogen Dioxide

5.3.2 Predicted annual mean NO_2 PECs, inclusive of background levels, are summarised in Table 16.

Table 16 Predicted Annual Mean NO_2 Concentrations

Receptor		Predicted Annual Mean NO_2 PEC (µg/m³)				
		2019	2020	2021	2022	2023
R1	Residential - Church Road	6.16	6.05	6.37	6.15	6.05
R2	Residential - Church Road	6.44	6.20	6.51	6.39	6.18
R3	Residential - Chapel Road	8.75	9.14	8.39	8.55	9.02
R4	Residential - Chapel Road	7.44	7.37	7.31	7.36	7.43
R5	Residential - Chapel Road	7.77	8.03	7.55	7.65	7.95
R6	Residential - Chapel Road	7.54	7.80	7.25	7.38	7.82
R7	Residential - Chapel Road	7.83	8.09	7.61	7.85	7.82
R8	Residential - Chapel Road	8.56	8.94	8.40	8.77	8.50
R9	Residential - Fellands Gate	6.48	6.50	6.33	6.65	6.30
R10	Residential - Fellands Gate	6.10	5.93	5.87	6.03	5.85
R11	Residential - Cowbroads Lane	5.55	5.61	5.62	5.57	5.58
R12	Residential - Cowbroads Lane	5.63	5.67	5.66	5.60	5.63

5.3.3 As indicated in Table 16, predicted NO_2 concentrations were below the annual mean EQS of 40µg/m³ at all sensitive receptor locations for all meteorological data sets.

5.3.4 Maximum predicted annual mean NO_2 concentrations at the receptor locations are summarised in Table 17. Reference should be made to Figure 5 for a graphical representation of predicted concentrations throughout the assessment extents.

Table 17 Maximum Predicted Annual Mean NO_2 Concentrations

Receptor		Maximum Predicted Annual Mean NO_2 Concentration (µg/m³)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
R1	Residential - Church Road	0.97	6.37	2.4	15.9
R2	Residential - Church Road	1.11	6.51	2.8	16.3
R3	Residential - Chapel Road	3.74	9.14	9.3	22.8
R4	Residential - Chapel Road	2.04	7.44	5.1	18.6
R5	Residential - Chapel Road	2.63	8.03	6.6	20.1
R6	Residential - Chapel Road	2.42	7.82	6.0	19.5
R7	Residential - Chapel Road	2.69	8.09	6.7	20.2
R8	Residential - Chapel Road	3.54	8.94	8.8	22.3
R9	Residential - Fellands Gate	1.25	6.65	3.1	16.6
R10	Residential - Fellands Gate	0.70	6.10	1.7	15.2
R11	Residential - Cowbroads Lane	0.22	5.62	0.6	14.1
R12	Residential - Cowbroads Lane	0.27	5.67	0.7	14.2

5.3.5 As indicated in Table 17, PECs were below 70% of the EQS at all receptors. As such, effects on annual mean NO_2 concentrations are not considered to be significant.

5.3.6 Predicted 99.8th %ile 1-hour mean NO_2 PECs, inclusive of background levels, are summarised in Table 18.

Table 18 Predicted 99.8th %ile 1-hour Mean NO_2 Concentrations

Receptor		Predicted 99.8th %ile 1-hour Mean NO_2 PEC (µg/m³)				
		2019	2020	2021	2022	2023
R1	Residential - Church Road	18.29	18.07	18.40	18.17	18.33
R2	Residential - Church Road	19.75	19.35	19.74	19.83	19.27
R3	Residential - Chapel Road	28.99	29.21	29.00	29.01	29.00
R4	Residential - Chapel Road	25.21	25.21	25.17	25.30	25.32

Receptor		Predicted 99.8th %ile 1-hour Mean NO_2 PEC (µg/m³)				
		2019	2020	2021	2022	2023
R5	Residential - Chapel Road	24.83	24.97	24.67	24.61	24.74
R6	Residential - Chapel Road	22.24	22.52	22.38	22.38	22.38
R7	Residential - Chapel Road	23.56	23.21	23.26	23.50	23.19
R8	Residential - Chapel Road	27.07	27.00	27.11	27.16	27.02
R9	Residential - Fellands Gate	22.15	22.28	21.94	22.71	22.01
R10	Residential - Fellands Gate	20.13	20.18	19.79	20.19	19.53
R11	Residential - Cowbroads Lane	14.54	13.99	14.43	14.34	13.68
R12	Residential - Cowbroads Lane	15.13	14.86	14.82	14.24	14.38

5.3.7 As indicated in Table 18, predicted 99.8th %ile 1-hour mean NO_2 concentrations were below the EQS of 200µg/m³ at all sensitive receptor locations for all meteorological data sets.

5.3.8 Maximum predicted 99.8th %ile 1-hour mean NO_2 concentrations at the receptor locations are summarised in Table 19. Reference should be made to Figure 6 for a graphical representation of predicted concentrations throughout the assessment extents.

Table 19 Maximum Predicted 99.8th %ile 1-hour Mean NO_2 Concentrations

Receptor		Maximum Predicted 99.8th %ile 1-hour Mean NO_2 Concentration (µg/m³)		PC Proportion of EQS (%)	PC Proportion of EQS Headroom (%) [a]
		PC	PEC		
R1	Residential - Church Road	7.60	18.40	3.8	4.0
R2	Residential - Church Road	9.03	19.83	4.5	4.8
R3	Residential - Chapel Road	18.41	29.21	9.2	9.7
R4	Residential - Chapel Road	14.52	25.32	7.3	7.7
R5	Residential - Chapel Road	14.17	24.97	7.1	7.5
R6	Residential - Chapel Road	11.72	22.52	5.9	6.2
R7	Residential - Chapel Road	12.76	23.56	6.4	6.7

Receptor		Maximum Predicted 99.8th %ile 1-hour Mean NO_2 Concentration (µg/m³)		PC Proportion of EQS (%)	PC Proportion of EQS Headroom (%) [a]
		PC	PEC		
R8	Residential - Chapel Road	16.36	27.16	8.2	8.6
R9	Residential - Fellands Gate	11.91	22.71	6.0	6.3
R10	Residential - Fellands Gate	9.39	20.19	4.7	5.0
R11	Residential - Cowbroads Lane	3.74	14.54	1.9	2.0
R12	Residential - Cowbroads Lane	4.33	15.13	2.2	2.3

NOTE (a) PC proportion of EQS minus twice the long-term background concentration.

5.3.9 As indicated in Table 19, the PC proportion of the EQS was below 10% at all sensitive locations. As such, predicted effects on 1-hour mean NO_2 concentrations are not considered to be significant in accordance with the stated criteria.

Carbon Monoxide

5.3.10 Predicted 100th %ile 8-hour rolling mean CO PECs, inclusive of background levels, are summarised in Table 20.

Table 20 Predicted 8-hour Rolling Mean CO Concentrations

Receptor		Predicted 100th %ile 8-hour Rolling Mean CO PEC (µg/m³)				
		2019	2020	2021	2022	2023
R1	Residential - Church Road	462.03	462.03	462.03	462.04	462.04
R2	Residential - Church Road	462.04	462.04	462.04	462.04	462.04
R3	Residential - Chapel Road	462.08	462.08	462.08	462.08	462.08
R4	Residential - Chapel Road	462.07	462.06	462.07	462.06	462.06
R5	Residential - Chapel Road	462.06	462.06	462.06	462.06	462.06
R6	Residential - Chapel Road	462.05	462.05	462.05	462.05	462.06
R7	Residential - Chapel Road	462.06	462.06	462.05	462.05	462.06
R8	Residential - Chapel Road	462.08	462.08	462.07	462.08	462.07

Receptor		Predicted 100th %ile 8-hour Rolling Mean CO PEC (µg/m³)				
		2019	2020	2021	2022	2023
R9	Residential - Fellands Gate	462.05	462.05	462.05	462.06	462.05
R10	Residential - Fellands Gate	462.05	462.04	462.04	462.05	462.04
R11	Residential - Cowbroads Lane	462.01	462.01	462.01	462.01	462.01
R12	Residential - Cowbroads Lane	462.02	462.01	462.01	462.01	462.02

5.3.11 As indicated in Table 20, predicted CO concentrations were below the 8-hour rolling mean EQS of 10,000µg/m³ at all sensitive receptor locations for all meteorological data sets.

5.3.12 Maximum predicted 8-hour rolling mean CO concentrations at the receptor locations are summarised in Table 21. Reference should be made to Figure 7 for a graphical representation of predicted concentrations throughout the assessment extents.

Table 21 Maximum Predicted 8-hour Rolling Mean CO Concentrations

Receptor		Maximum Predicted 8-hour Rolling Mean CO Concentration (µg/m³)		PC Proportion of EQS (%)	PC Proportion of EQS Headroom (%) [a]
		PC	PEC		
R1	Residential - Church Road	0.04	462.04	0.0	4.6
R2	Residential - Church Road	0.04	462.04	0.0	4.6
R3	Residential - Chapel Road	0.08	462.08	0.0	4.6
R4	Residential - Chapel Road	0.07	462.07	0.0	4.6
R5	Residential - Chapel Road	0.06	462.06	0.0	4.6
R6	Residential - Chapel Road	0.06	462.06	0.0	4.6
R7	Residential - Chapel Road	0.06	462.06	0.0	4.6
R8	Residential - Chapel Road	0.08	462.08	0.0	4.6
R9	Residential - Fellands Gate	0.06	462.06	0.0	4.6
R10	Residential - Fellands Gate	0.05	462.05	0.0	4.6
R11	Residential - Cowbroads Lane	0.01	462.01	0.0	4.6

Receptor		Maximum Predicted 8-hour Rolling Mean CO Concentration (µg/m³)		PC Proportion of EQS (%)	PC Proportion of EQS Headroom (%) [a]
		PC	PEC		
R12	Residential - Cowbroads Lane	0.02	462.02	0.0	4.6

NOTE (a) PC proportion of EQS minus twice the long-term background concentration.

5.3.13 As indicated in Table 21, the PC proportion of the EQS was below 10% at all sensitive locations. As such, predicted effects on 8-hour rolling mean CO concentrations are not considered to be significant in accordance with the stated criteria.

5.4 Ecological Receptors

5.4.1 Predicted concentrations and deposition rates of each pollutant at the sensitive ecological receptor locations identified in Table 5 are summarised in the following Sections.

Nitrogen Oxides

5.4.2 Predicted annual mean NO_x PECs at the receptor locations, inclusive of background levels, are summarised in Table 22.

Table 22 Predicted Annual Mean NO_x Concentrations

Receptor		Predicted Annual Mean NO_x PEC (µg/m³)				
		2019	2020	2021	2022	2023
E1	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	5.91	5.91	5.91	5.91	5.91
E2	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	5.91	5.91	5.91	5.91	5.91
E3	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	5.91	5.91	5.91	5.92	5.91
E4	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	5.92	5.91	5.92	5.92	5.91
E5	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	5.91	5.91	5.91	5.91	5.91

5.4.3 As indicated in Table 22, predicted annual mean NO_x concentrations were below the EQS of 30µg/m^3 at all ecological receptors.

5.4.4 Maximum predicted annual mean NO_x concentrations at the ecological receptors are summarised in Table 23.

Table 23 Maximum Predicted Annual Mean NO_x Concentrations

Receptor		Maximum Predicted Annual Mean NO_x Concentration (µg/m^3)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
E1	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.01	5.91	0.0	19.7
E2	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.01	5.91	0.0	19.7
E3	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.02	5.92	0.1	19.7
E4	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.02	5.92	0.1	19.7
E5	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.01	5.91	0.0	19.7

5.4.5 As shown in Table 23, PCs were below 1% of the EQS at all receptors. As such, predicted effects on annual mean NO_x concentrations are not considered to be significant in accordance with the stated criteria.

5.4.6 Predicted 24-hour mean NO_x PECs at the receptor locations, inclusive of background levels, are summarised in Table 24.

Table 24 Predicted 24-hour Mean NO_x Concentrations

Receptor		Predicted 24-hour Mean NO_x PEC (µg/m³)				
		2019	2020	2021	2022	2023
E1	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	11.88	11.95	11.91	11.95	11.93
E2	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	11.96	11.91	11.90	11.96	11.93
E3	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	11.97	12.01	12.00	12.00	11.98
E4	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	12.02	11.98	12.03	11.96	11.98
E5	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	11.91	11.94	12.02	12.02	11.94

5.4.7 As indicated in Table 24, predicted NO_x concentrations were below the 24-hour mean EQS of 75µg/m³ at all ecological receptor locations.

5.4.8 Maximum predicted 24-hour mean NO_x concentrations at the ecological receptor locations are summarised in Table 25.

Table 25 Maximum Predicted 24-hour Mean NO_x Concentrations

Receptor		Maximum Predicted 24-hour Mean NO_x Concentration (µg/m³)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
E1	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.15	11.95	0.2	15.9
E2	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.16	11.96	0.2	16.0
E3	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.21	12.01	0.3	16.0
E4	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.23	12.03	0.3	16.0

Receptor		Maximum Predicted 24-hour Mean NO_x Concentration (µg/m³)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
E5	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.22	12.02	0.3	16.0

5.4.9 As shown in Table 25, PCs were below 10% of the EQS at all receptors. As such, predicted effects on 24-hour mean NO_x concentrations are not considered to be significant in accordance with the stated criteria.

Nitrogen Deposition

5.4.10 Predicted annual nitrogen PC deposition rates at the receptor locations are summarised in Table 26.

Table 26 Predicted Annual Nitrogen Deposition Rates

Receptor		Predicted Annual PC Nitrogen Deposition Rate (kgN/ha/yr)				
		2019	2020	2021	2022	2023
E1	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.001	0.001	0.001	0.001	0.001
E2	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.001	0.001	0.001	0.001	0.001
E3	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.001	0.001	0.001	0.002	0.001
E4	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.002	0.001	0.002	0.002	0.001
E5	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.001	0.001	0.001	0.001	0.001

5.4.11 Maximum predicted annual nitrogen deposition rates at the ecological receptor locations are summarised in Table 27.

Table 27 Maximum Predicted Annual Nitrogen Deposition Rates

Receptor		Maximum Predicted Annual Nitrogen Deposition Rate (kgN/ha/yr)		Proportion of EQS (%)			
		PC	PEC	Low EQS		High EQS	
				PC	PEC	PC	PEC
E1	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.001	15.301	0.0	306.0	0.0	102.0
E2	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.001	15.301	0.0	306.0	0.0	102.0
E3	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.002	15.302	0.0	306.0	0.0	102.0
E4	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.002	15.302	0.0	306.0	0.0	102.0
E5	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.001	15.301	0.0	306.0	0.0	102.0

5.4.12 As shown in Table 27, PCs were below 1% of the EQS at all receptors. As such, predicted effects on nitrogen deposition are not considered to be significant in accordance with the stated criteria.

5.4.13 It should be noted that PECs are predicted to exceed the relevant EQSs at all locations as a base condition.

Acid Deposition

5.4.14 Predicted annual acid PC deposition rates are summarised in Table 28.

Table 28 Predicted Annual PC Acid Deposition Rates

Receptor		Predicted Annual PC Acid Deposition Rate (keq/ha/yr)				
		2019	2020	2021	2022	2023
E1	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.0001	0.0001	0.0001	0.0001	0.0001
E2	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.0001	0.0001	0.0001	0.0001	0.0001
E3	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.0001	0.0001	0.0001	0.0001	0.0001
E4	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.0001	0.0001	0.0001	0.0001	0.0001
E5	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.0001	0.0001	0.0001	0.0001	0.0001

5.4.15 Maximum predicted annual acid deposition rates at the ecological receptor locations are summarised in Table 29.

Table 29 Predicted Annual Acid Deposition Rates

Receptor		Maximum Predicted Annual Acid PC Deposition Rate (keq/ha/yr)	Proportion of EQS (%)
E1	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.0001	-
E2	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.0001	-
E3	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.0001	-
E4	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.0001	-
E5	The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar	0.0001	-

5.5 Sensitivity Analysis

5.5.1 Dispersion model outputs can be affected by a number of variables, including:

- Meteorological data;
- Emission parameters;
- Receptor grid resolution;
- Treatment of terrain and buildings; and,
- Special model treatments.

5.5.2 As shown previously, maximum pollutant concentrations at all points on the grid were well below the relevant EQSs. There is also a considerable difference between the predictions and the values required to result in a significant impact at the discrete receptors. As such, there is sufficient headroom to account for model uncertainty without affecting the assessment conclusions. Further Sensitivity Analysis of specific variables is therefore not warranted for the project.

6.0 CONCLUSION

6.1.1 Redmore Environmental Ltd was commissioned by Bakkavor Foods Ltd to undertake an Air Quality Assessment in support of an Environmental Permit Application for Greencore, Chapel Road, Old Leake, Boston.

6.1.2 Atmospheric emissions of combustion products from on site boilers have the potential to cause air quality impacts. As such, an Air Quality Assessment was undertaken in order to determine baseline conditions and quantify potential effects.

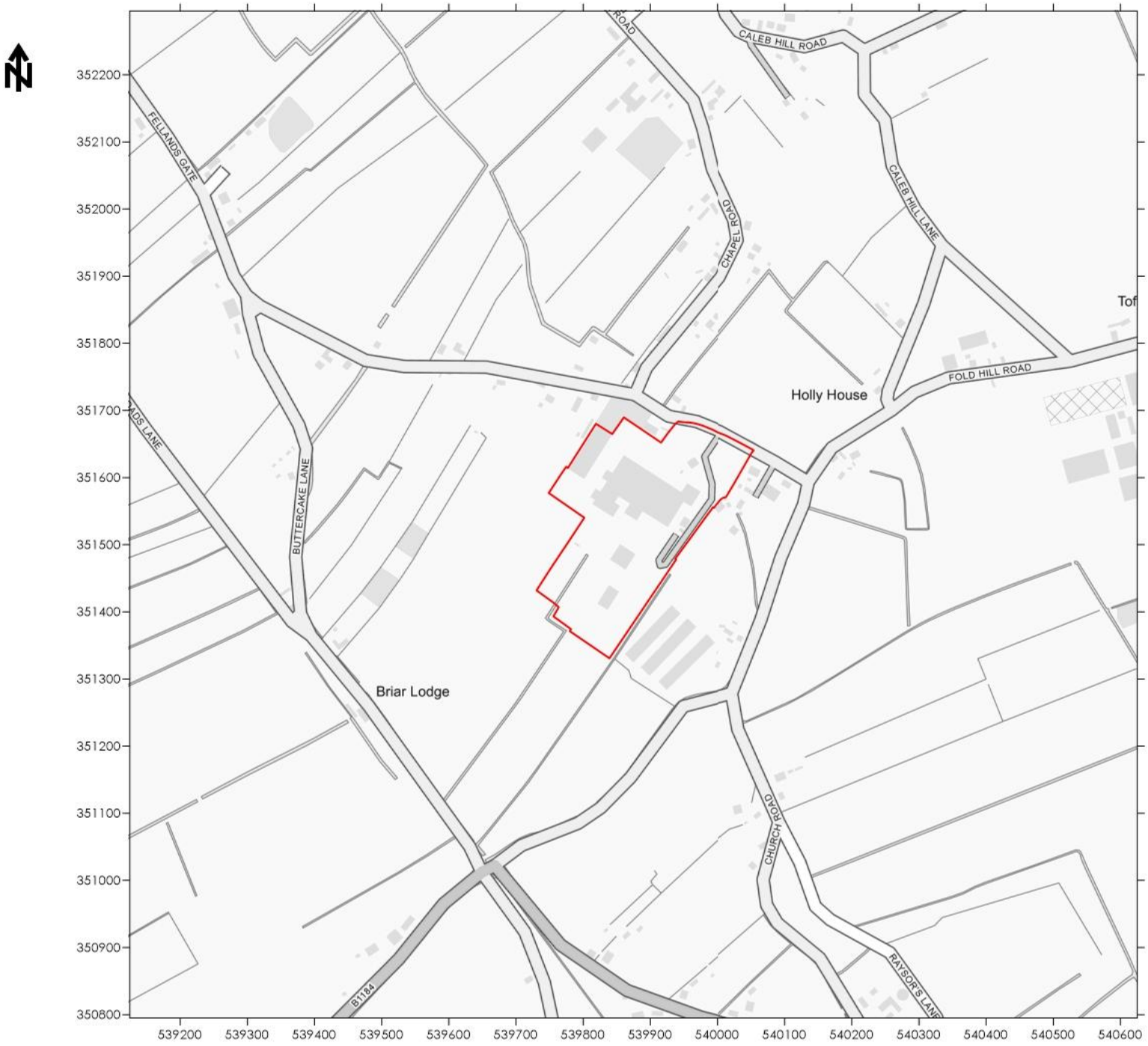
6.1.3 Dispersion modelling of NO_x and CO emissions was undertaken using ADMS-6. Impacts at sensitive receptors were quantified and the results compared with the relevant EQSs and significance criteria.

6.1.4 The results indicated that impacts on pollutant concentrations at any human or ecological location were predicted to be not significant.

7.0 ABBREVIATIONS

APIS	Air Pollution Information System
AQLV	Air Quality Limit Value
AQMA	Air Quality Management Area
AQO	Air Quality Objective
AQS	Air Quality Strategy
BBC	Boston Borough Council
CERC	Cambridge Environmental Research Consultants
CO	Carbon monoxide
DEFRA	Department for Environment, Food and Rural Affairs
EA	Environment Agency
EQS	Environmental Quality Standard
LAQM	Local Air Quality Management
LPG	Liquified Petroleum Gas
MAGIC	Multi-Agency Geographic Information for the Countryside
NGR	National Grid Reference
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
PC	Process Contribution
PEC	Predicted Environmental Concentration
SAC	Special Area of Conservation
SPA	Special Protection Area
z_0	Roughness length
%ile	Percentile

Figures



Legend

Site Boundary

Title
Figure 1 - Site Location

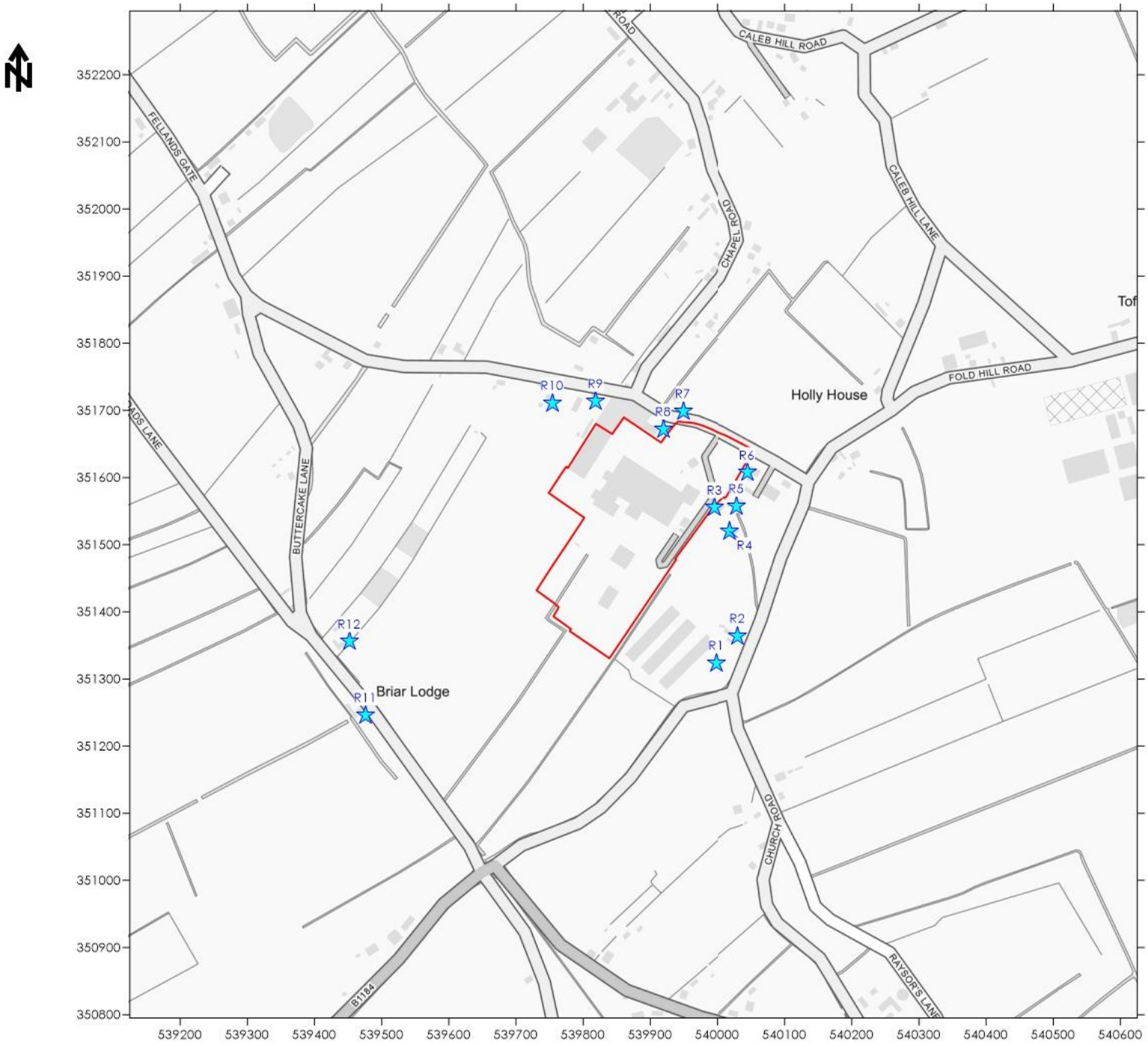
Project
Air Quality Assessment
Greencore, Chapel Road,
Old Leake, Boston

Project Reference
11280

Client
Bakkavor Foods Ltd

Contains Ordnance Survey Data
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Legend

Site Boundary

Receptor

Title
Figure 2 - Human Receptors

Project
Air Quality Assessment
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11280

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Legend

- Site Boundary
- Emission Point
- Building
- Output Grid

Title
Figure 3 - ADMS-6 Inputs

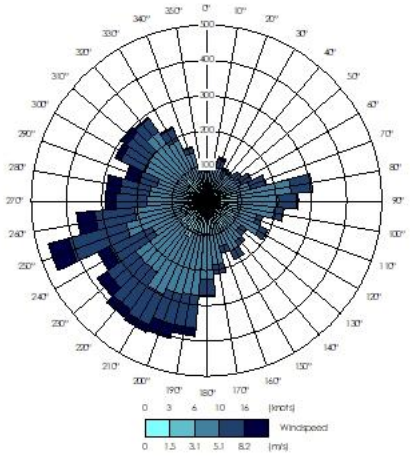
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Air Quality Assessment
Greencore, Chapel Road,
Old Leake, Boston

Project Reference
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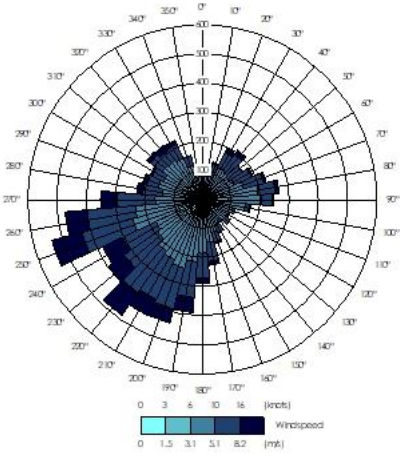
Client
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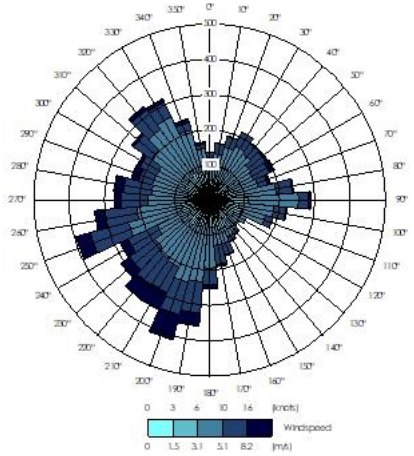
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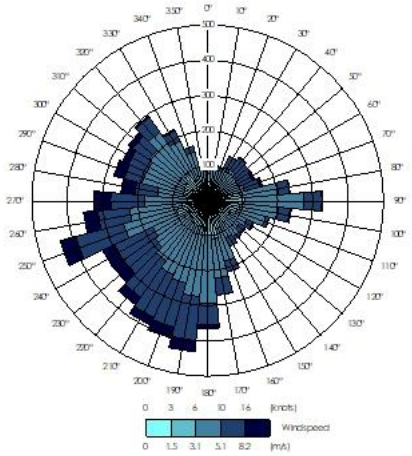
2019 Meteorological Data



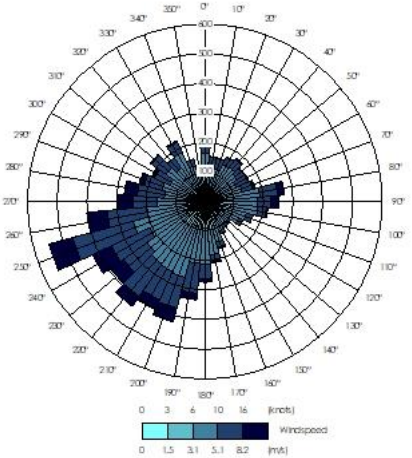
2020 Meteorological Data



2021 Meteorological Data



2022 Meteorological Data



2023 Meteorological Data

Legend

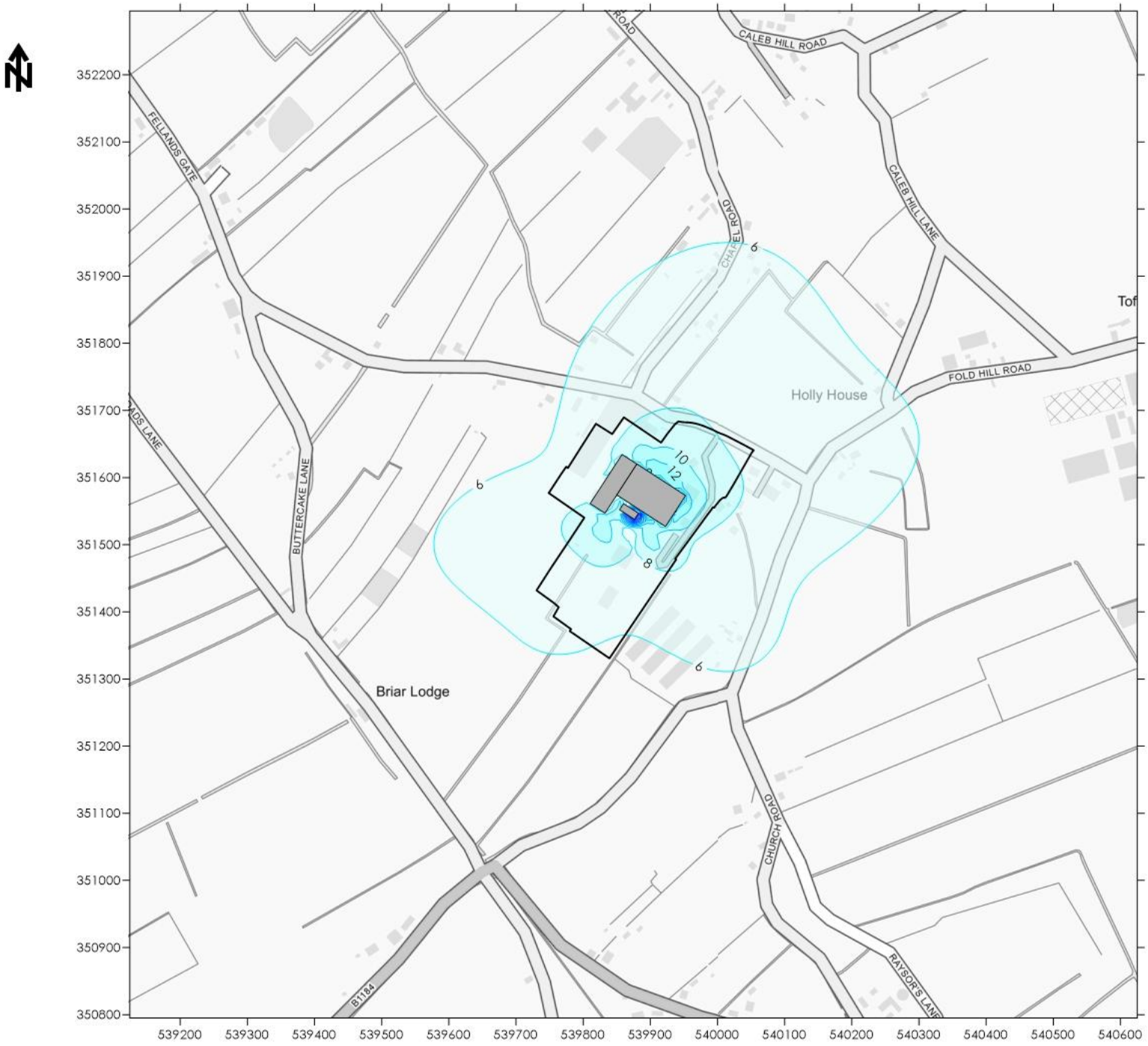
Title
Figure 4 - Wind Roses of 2019 to 2023 Coningsby Meteorological Station Data

Project
Air Quality Assessment
Greencore, Chapel Road,
Old Leake, Boston

Project Reference
11280

Client
Bakkavor Foods Ltd

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Legend

Site Boundary

Annual Mean NO_2 Concentration ($\mu g/m^3$)

26
24
22
20
18
16
14
12
10
8
6

Title

Figure 5 - Predicted Annual Mean NO_2 Concentrations ($\mu g/m^3$) 2020 Meteorological Data

Project

Air Quality Assessment
Greencore, Chapel Road,
Old Leake, Boston

Project Reference

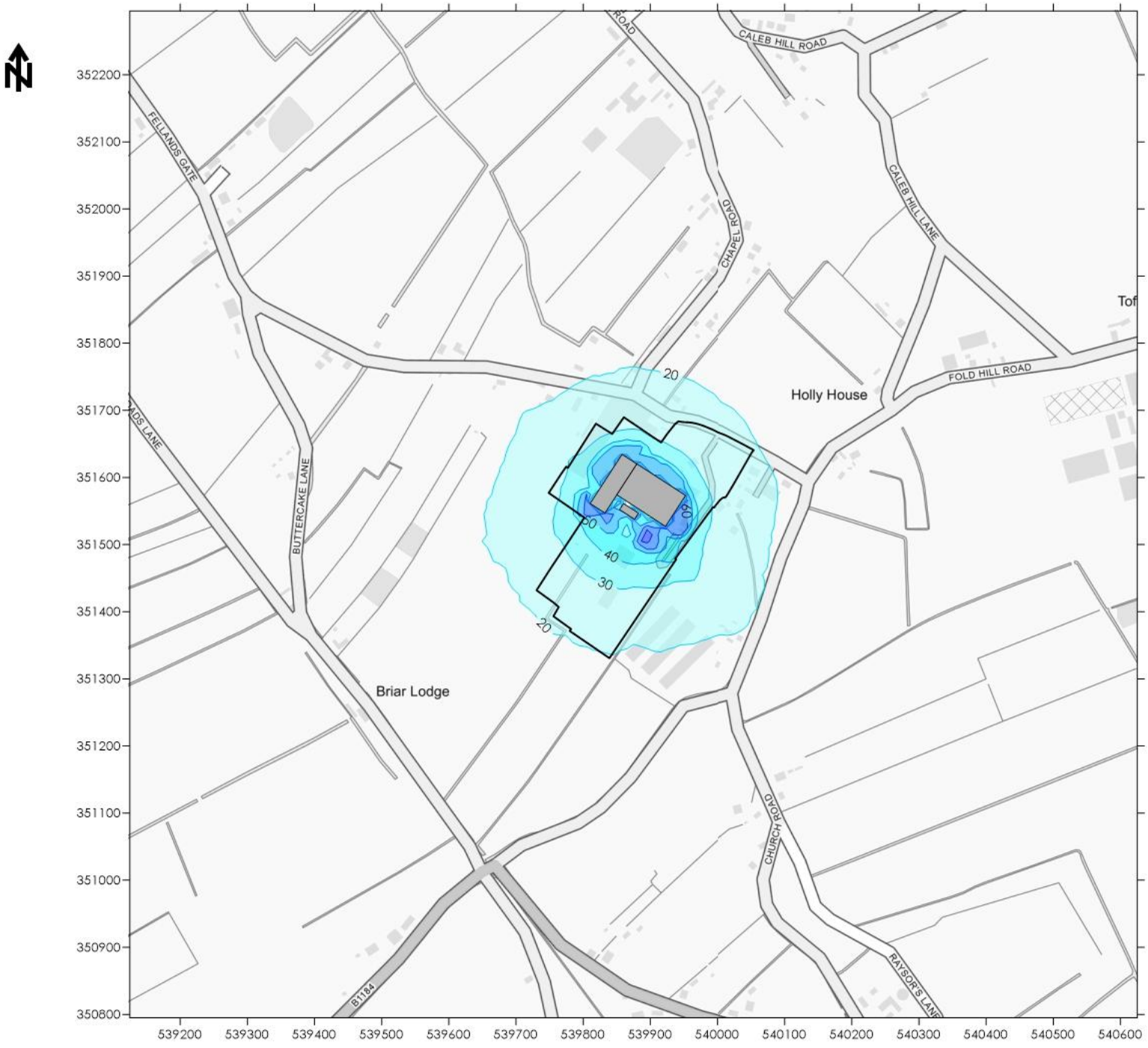
11280

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Legend

Site Boundary

99.8th %ile 1-hour Mean NO_2 Concentration ($\mu g/m^3$)

70
60
50
40
30
20

Title

Figure 6 - Predicted 99.8th %ile 1-hour Mean NO_2 Concentrations ($\mu g/m^3$)
2022 Meteorological Data

Project

Air Quality Assessment
Greencore, Chapel Road,
Old Leake, Boston

Project Reference

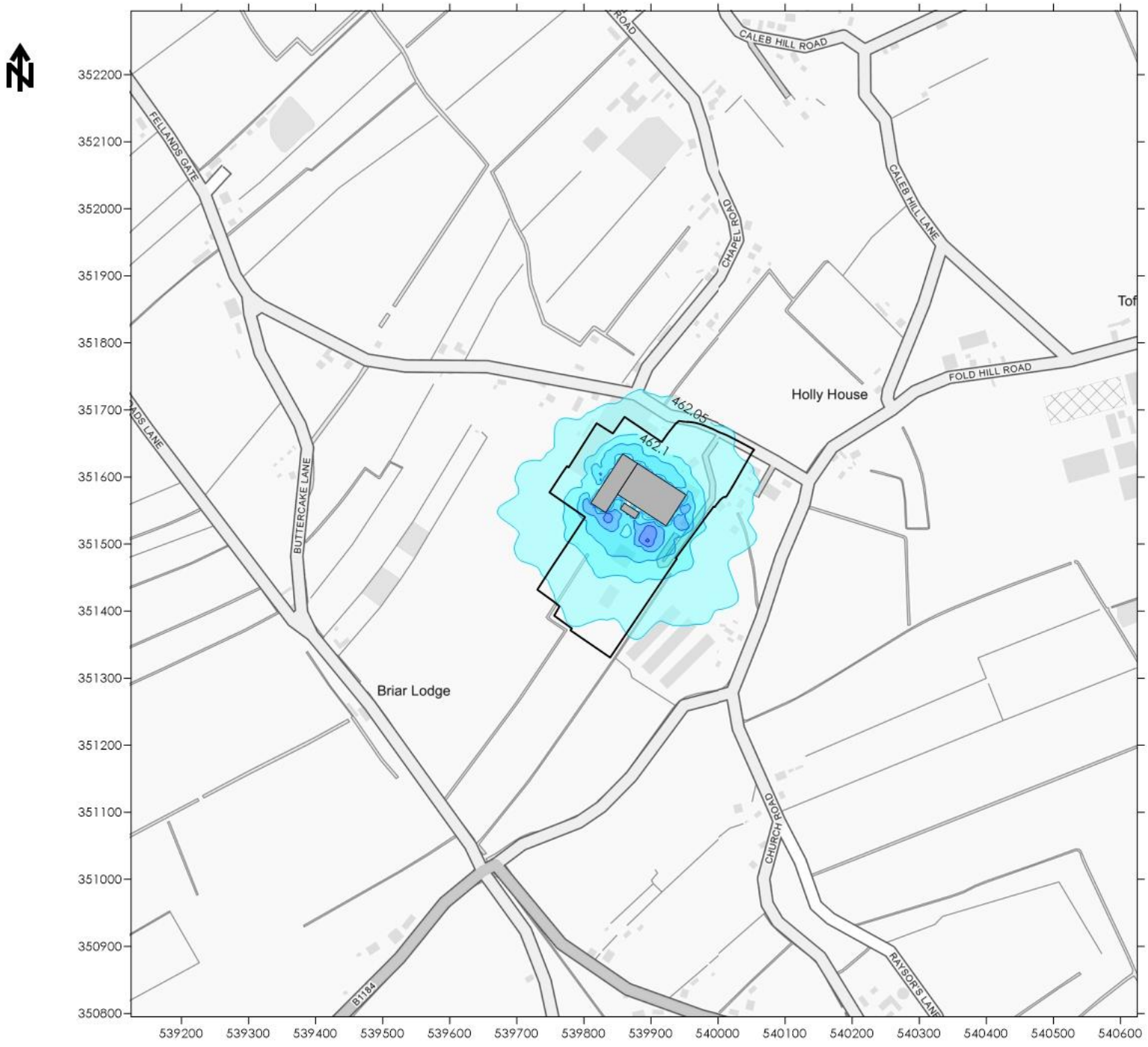
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Legend

Site Boundary

462.3
462.25
462.2
462.15
462.1
462.05

8-hour Rolling Mean CO Concentration (µg/m³)

Title

Figure 7 - Predicted 8-hour Rolling Mean CO Concentrations (µg/m³)
2021 Meteorological Data

Project

Air Quality Assessment
Greencore, Chapel Road,
Old Leake, Boston

Project Reference

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