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Air Quality Assessment

Salisbury Poultry, Vulcan Road, Bilston

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1 INTRODUCTION

1.1 BACKGROUND AND INSTRUCTION

1.1.1 Crestwood Environmental was commissioned by Salisbury Poultry (Midlands) Ltd to undertake an Air Quality Assessment in support of an Environmental Permit Application for the Salisbury Poultry facility on land off Vulcan Road, Bilston.

1.1.2 Combustion emissions from boilers at the site have the potential to cause impacts at sensitive locations. An Air Quality Assessment was therefore undertaken to define baseline conditions and quantify potential effects.

1.2 SITE LOCATION AND CONTEXT

1.2.1 The site is located off Vulcan Road, Bilston, at approximate National Grid Reference (NGR): 395810, 296395. Reference should be made to Figure 1 for a map of the site and surrounding area.

1.2.2 There are a number of gas boilers installed on site to generate hot water and heat for the facility. Associated combustion emissions have the potential to cause impacts at sensitive locations. An Air Quality Assessment was therefore undertaken to define baseline conditions and quantify potential effects. The results are summarised in the following report.

1.3 REPORT UPDATES

1.3.1 Following of the original Air Quality Assessment, the site boundary has been amended to include a Breading Plant situated in a separate building on Dale Street. An additional two boiler were included within this assessment associated with the breading plant. It is understood that one of these boilers in presently installed. The assessment has been run with two boilers as a second may be installed by the Operator.

2 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 (PM_{10});
- Particulate matter with an aerodynamic diameter of less than 2.5µm;
- Benzene; and,
- Carbon monoxide.

2.1.2 Air Quality Target Values were also 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 in April 2023[1]. The document contains standards, objectives and measures for improving ambient air quality, including a number of 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/m³)	**Averaging Period**
NO_2	40	Annual mean
	200	1-hour mean not to be exceeded on more than 18 occasions per annum

2.1.5 Table 2 summarises the advice provided in DEFRA guidance[2] on where the AQOs for pollutants considered within this report apply.

Table 2 Examples of Where the Air Quality Objectives Apply

Averaging Period	Objective Should Apply At	Objective Should Not Apply At
Annual mean	All locations where members of the public might be regularly exposed	Building façades of offices or other places of work where members of the public do not have regular access

1 The AQS for England, Scotland, Wales and Northern Ireland, DEFRA, 2023.
2 Local Air Quality Management Technical Guidance (TG22), DEFRA, 2022.

Averaging Period	Objective Should Apply At	Objective Should Not Apply At
	Building façades of residential properties, schools, hospitals, care homes etc.	Hotels, unless people live there as their permanent residence Gardens of residential properties Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
1-hour mean	All locations where the annual mean and 24 and 8-hour mean objectives apply. Kerbside sites (for example, pavements of busy shopping streets) Those parts of car parks, bus stations and railway stations etc which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more Any outdoor locations where members of the public might reasonably be expected to spend one hour or longer	Kerbside sites where the public would not be expected to have regular access

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, as summarised in Table 2, are likely to be exceeded, the Local Authority is required to declare an Air Quality Management Area (AQMA). For each AQMA, the LA is required to produce an Air Quality Action Plan, 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 England through the Environmental Permitting (England and Wales) Regulations (2016) and subsequent amendments. Activities at the site are included within the Regulations. As such, the facility is required to operate in accordance with an Environmental Permit issued by the Environment Agency (EA).

2.4 CRITICAL LOADS AND LEVELS

2.4.1 A critical load is defined by the UK Air Pollution Information System (APIS)[3] as:

> *"A quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do*

3 UK Air Pollution Information System, www.apis.ac.uk.

not occur according to present knowledge"

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 3 presents the critical levels for the protection of vegetation for pollutants considered within this assessment.

Table 3 Critical Levels for the Protection of Vegetation

Pollutant	**Critical Level**	
	Concentration (µg/m³)	**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 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), as amended by the Environment Act (2021), City of Wolverhampton Council (CoWC) has undertaken Review and Assessment of air quality. This process has indicated that annual mean concentrations of NO_2 and 24-hour mean concentrations of PM_{10} are above the AQOs within their area of jurisdiction. As such, one AQMA has been declared. This is described as follows:

"The City of Wolverhampton"

3.2.2 The site is located within the AQMA. As such, there is the potential emissions from the facility to affect pollution levels in this sensitive area. This has been considered throughout the assessment.

3.2.3 CoWC 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 pollutant concentrations is undertaken by CoWC throughout their area of jurisdiction. Recent NO_2 results recorded in the vicinity of the development are shown in Table 4.

Table 4 Monitoring Results - NO_2

Monitoring Site	Monitored NO_2 Concentration (μg/m^3)		
	2019	2020	2021
TRI	28	18	20
OXF	30	26	29
BIL1	39	31	34
BIL2	29	25	27
BIL3	39	31	34
BIL4	42	34	39

3.3.2 As shown in Table 4, annual mean NO_2 concentrations were below the AQO of 40μg/m^3 at all monitors in recent years, with the exception of BIL4. Reference should be made to Figure 2 for a map of the survey positions.

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 LAs in their Review and Assessment of air quality. The site is located in grid square NGR: 395500, 296500. Data for this location was downloaded from the DEFRA website[4] for the purpose of this assessment and is summarised in Table 5.

Table 5 Background Pollutant Concentrations

Pollutant	Predicted 2024 Background NO_2 Concentration (µg/m³)
NO_2	16.98

3.4.2 As shown in Table 5, predicted background NO_2 concentrations are below the relevant AQO at 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 6.

Table 6 Sensitive Human Receptor Locations

Receptor		NGR (m)	
		X	Y
R1	Residential - Bissel Street	395607.5	296316.6
R2	Residential - Tame Street	395569.5	296263.1
R3	Residential - Oxford Street	395565.6	296117.6
R4	Residential - Oxford Street	395630.7	296075.8
R5	Residential - Hughes Road	396237.8	296126.4
R6	Residential - Marbury Drive	396022.1	296799.7
R7	Residential - Lunt Road	395823.3	296620.3
R8	Residential - Lunt Road	395786.2	296587.9
R9	Residential - Lunt Road	395742.2	296555.4
R10	Residential - Hilton Place	395578.8	296450.0
R11	Loxdale Primary School	395664.2	295924.6
R12	Holy Trinity Roman Catholic Primary School	395419.4	296554.2

4 http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018.

Receptor		NGR (m)	
		X	Y
R13	Field View Primary School	395648.3	296870.5

3.5.3 Reference should be made to Figure 3 for a map of the sensitive human receptor locations.

Ecological Receptors

3.5.4 Emissions from the plant have the potential to impact on receptors of ecological sensitivity within the vicinity of the site. The Conservation of Habitats and Species Regulations (2010) and subsequent amendments require competent authorities to review applications and consents that have the potential to impact on ecological designations. The EA consultation response indicated the following should be considered within the assessment:

- Fen Pools Special Area of Conservation (SAC).

3.5.5 For the purpose of the assessment, a discrete receptor was selected at the closest point of the designation to the facility to ensure the maximum potential impact was predicted. This is summarised in Table 7.

Table 7 Sensitive Ecological Receptor Locations

Receptor		NGR (m)	
		X	Y
E1	Fen Pools SAC	392080.4	289223.9

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[5] website was undertaken in order to identify the most suitable habitat description and associated critical load for the area of each designation considered within the assessment.

3.5.7 The relevant nitrogen deposition critical loads are presented in Table 8.

Table 8 Critical Loads for Nitrogen Deposition

Designation	Site Interest Feature	Relevant Nitrogen Critical Load Class	Nitrogen Critical Load (kgN/ha/yr)	
			Low	High
Fen Pools SAC	Triturus cristatus	No comparable habitat with established critical load estimate available	-	-

3.5.8 The critical loads for acid deposition are presented in Table 9.

5 http://www.apis.ac.uk/.

Table 9 Critical Loads for Acid Deposition

Designation	Interest Feature	Relevant Acidity Critical Load Class	Acid Critical Load (keq/ha/yr)		
			CLMinN	CLMaxS	CLMaxN
Fen Pools SAC	Triturus cristatus	Freshwater	-	-	-

3.5.9 Background annual mean NO_X concentrations and nitrogen and acid deposition rates were obtained from the APIS[6] website. These are summarised in Table 10.

Table 10 Baseline Pollution Levels at Ecological Receptors

Receptor		Annual Mean NO_X Conc. ($\mu g/m^3$)	Baseline Deposition Rate	
			Nitrogen (kgN/ha/yr)	Acid (keq/ha/yr)
E1	Fen Pools SAC	21.6	17.1	1.3

6 http://www.apis.ac.uk/.

4 METHODOLOGY

4.1 INTRODUCTION

4.1.1 Combustion emissions from the boilers have the potential to cause air quality impacts 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 (v6.0.0.1), 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.

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 scenarios considered in the modelling assessment for human receptors are summarised in Table 11.

Table 11 Human Receptor Assessment Scenarios

Parameter	Modelled As	
	Short Term	**Long Term**
NO_2	99.8th percentile (%ile) 1-hour mean	Annual 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 percentile shown in Table 11 was selected to represent the relationship between the permitted number of exceedances of short-period concentrations and the number of periods within a calendar year.

4.3.3 The scenarios considered for ecological receptors in the modelling assessment are summarised in Table 12.

Table 12 Ecological Receptor Assessment Scenarios

Parameter	Modelled As	
	Short Term	**Long Term**
NO_x	24-hour mean	Annual mean

Parameter	Modelled As	
	Short Term	**Long Term**
Nitrogen deposition	-	Annual deposition
Acid deposition	-	Annual deposition

4.3.4 Predicted pollutant levels 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 levels.

4.3.5 Predicted ground level pollutant concentrations and deposition rates were compared with the relevant AQOs, critical levels and critical loads. 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: 395295, 295880, to 396295, 296880. One cartesian grid with a resolution of 6.7m 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 4 for a graphical representation of the assessment grid extents.

4.5 PROCESS CONDITIONS AND EMISSIONS

4.5.1 Information to describe the physical parameters of the emission sources were provided by the Applicant. These are summarised in Table 13.

Table 13 Physical Parameters of Release Points

Boiler	Location	NGR (m)		Stack Height (m)	Stack Diameter (m)
		X	**Y**		
Lockinvar Ecoknight	SMA Plant Room	395703	296288	4.5	0.15
Lochinvar Ecosword	SMA Plant Room	395703	296287	4.5	0.15
Lochinvar Ecosword	Hare Street	395736	296330	3.65	0.05
Lochinvar Ecosword	Hare Street	395736	296330	3.4	0.05
Lochinvar Ecosword	Vulcan Rd Boiler Room	395886	296362	3.4	0.05
Keston System 30	Vulcan Rd Boiler Room	395885	296362	3.4	0.05
Keston System 30	Vulcan Rd Boiler Room	395886	296361	2.4	0.05
Lockinvar Ecoknight	Vulcan Rd Boiler Room	395885	296361	2.2	0.05

Boiler	Location	NGR (m)		Stack Height (m)	Stack Diameter (m)
		X	Y		
Lockinvar Ecoknight	Dale Street SMA Plant Room	396027	296493	5.5	0.15
Lockinvar Ecoknight	Dale Street SMA Plant Room	396026	296492	5.5	0.15

4.5.2 Process conditions and emission parameters for each source were derived from the technical data sheets for the boilers. These are summarised in Table 14.

Table 14 Process Conditions

Emission Source	Boiler Output (kW)	NO_x Emission Rate (mg/kWh)	NO_x Emission Rate (g/s)	Exhaust Gas Temperature (°C)	Exhaust Gas Flow Rate (Nm^3/s)	Exhaust Gas Efflux Velocity (m/s)
Lockinvar Ecoknight	227.2	33	0.0021	120	0.112	9.12
Lochinvar Ecosword	19.1	30	0.0002	61	0.010	6.23
Keston	30.3	29	0.0002	69	0.016	10.21

4.5.3 Reference should be made to Figure 4 for a map of the emission source locations.

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[7].

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. Input geometries are shown in Table 15.

[7] Environmental permitting: air dispersion modelling reports, EA, 2021.

Table 15 Building Geometries

Building	NGR (m)		Height (m)	Length (m)	Width (m)	Angle (°)
	X	Y				
Building 1	395874.5	296393.7	3.1	69.0	10.4	167.4
Building 2	395832.1	296385.1	6.5	69.0	76.1	167.4
Building 3	395836.7	296434.1	12.0	25.1	24.1	167.4
Building 4	395733.2	296296.0	7.5	33.9	39.6	116.3
Building 5	395759.9	296349.9	2.7	33.8	80.6	116.3
Building 6	395705.5	296287.5	3.8	7.9	3.2	113.5
Building 7	396011.3	296512.6	4.3	78.0	30.9	169.0
Building 8	396008.5	296512.3	8.2	78.0	13.3	169.0

4.8 METEOROLOGICAL DATA

4.8.1 Meteorological data used in the assessment was taken from Birmingham Airport meteorological station over the period 1st January 2016 to 31st December 2020 (inclusive). Birmingham Airport meteorological station is located at NGR: 418446, 283594, which is approximately 25.9km south-east of the facility. It is anticipated that conditions would be 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 5 for wind roses of utilised meteorological records.

4.9 ROUGHNESS LENGTH

4.9.1 Roughness length (z_0) is a modelling parameter applied to allow consideration of surface height roughness elements. A z_0 of 0.5m was used 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 'cities, woodlands'.

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 30m was used to describe the modelling extents and the meteorological site. This value is considered appropriate for the nature of both areas and is suggested within ADMS as being suitable for 'cities and large towns'.

4.11 TERRAIN DATA

4.11.1 Ordinance 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 preprocessed using the method suggested by CERC[8].

4.12 NITROGEN DEPOSITION

4.12.1 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'[9]. 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 16.

Table 16 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

4.12.2 The relevant deposition velocity for each ecological receptor was selected from Table 16 based on the vegetation type present within the designation.

4.13 ACID DEPOSITION

4.13.1 Predicted ground level pollutant 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 17.

Table 17 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

4.13.2 The PC proportion of the EQS was calculated using the following formula obtained from the APIS website[10]:

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

4.14 BACKGROUND CONCENTRATIONS

4.14.1 A review of existing data in the vicinity of the plant was undertaken in Section 3.0 in order to identify a suitable background NO_2 value for use in this assessment. This

8 Note 105: Setting up Terrain Data for Input to CERC Models, CERC, 2016.
9 Technical Guidance on Detailed Modelling approach for an Appropriate Assessment for Emissions to Air AQTAG 06, EA, 2014.
10 https://www.apis.ac.uk/.

indicated that concentrations recorded at OXF, approximately 320m south-west of the site, were above the DEFRA background. As such, the 2021 recorded value of 29μg/m^3 was utilised as a baseline throughout the assessment in order to ensure robust results.

4.14.2 Baseline pollutant levels at the ecological receptors were obtained from APIS. These are shown in Table 10.

4.14.3 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 EA guidance 'Air emissions risk assessment for your environmental permit'[11], which advises that an estimate of the maximum 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'[12] 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 whether PECs can be screened as insignificant:

- The short-term PEC 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.

4.15.3 Should these criteria be exceeded then additional consideration to potential impacts should be provided.

Ecological Receptors

4.15.4 EA guidance 'Air emissions risk assessment for your environmental permit'[13] states that PCs at SACs 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;

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

- The long-term PC is less than 1% of the long-term environmental standard for protected conservation areas; or,
- The long-term PC is greater than 1% and the long-term PEC is less than 70% of the long-term environmental standard.

4.15.5 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. Should the criteria be exceeded then additional consideration to potential impacts should be provided.

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 emissions 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. The analysis was based on the worst-case year for each averaging period 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. Terrain data was included and processed using the method outlined by CERC;
- Plant operating conditions - Operational parameters were derived from the boiler specifications. As such, these are considered to be representative of normal operating conditions;
- Emission rates - Emission rates were derived from the boiler specifications. As such, these are considered to be representative of normal operating conditions;
- Background concentrations - Background pollutant levels were obtained from the APIS website and local monitoring results. 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 and EA significance 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.

5 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 6 and Figure 7 for graphical representations of PECs, inclusive of background levels, 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 averaging period. For example, the maximum annual mean NO_2 concentration was predicted using the 2018 meteorological data set. As such, the contours shown in Figure 6 were produced from the 2018 model outputs.

5.2 MAXIMUM OFF SITE POLLUTANT CONCENTRATIONS

5.2.1 Maximum predicted pollutant concentrations for any meteorological data set are summarised in Table 18.

Table 18 Maximum Predicted Pollutant Concentrations

Pollutant	Averaging Period	EQS ($\mu g/m^3$)	PC ($\mu g/m^3$)	PC Proportion of EQS (%)	PEC ($\mu g/m^3$)	PEC Proportion of EQS (%)
NO_2	Annual	40	3.16	7.9	32.16	80.4
	99.8th %ile 1-hour	200	12.67	6.3	70.67	35.3

5.2.2 As shown in Table 18, maximum PECs were below the relevant EQSs at all locations.

5.2.3 It should be noted that the assessment assumed constant boiler emissions without allowance for reduced work load or shut down. As such, actual impacts on annual mean concentrations are likely to be lower than those predicted.

5.3 HUMAN RECEPTORS

5.3.1 Predicted annual mean NO_2 PECs at the sensitive human receptors, inclusive of background levels, are summarised in Table 19.

Table 19 Predicted Annual Mean NO_2 Concentrations

Receptor		Predicted Annual Mean NO_2 PEC (μg/m^3)				
		2016	2017	2018	2019	2020
R1	Residential - Bissel Street	29.05	29.05	29.06	29.07	29.05
R2	Residential - Tame Street	29.03	29.02	29.03	29.03	29.03
R3	Residential - Oxford Street	29.02	29.01	29.02	29.01	29.02
R4	Residential - Oxford Street	29.02	29.01	29.02	29.01	29.02
R5	Residential - Hughes Road	29.01	29.01	29.01	29.01	29.01
R6	Residential - Marbury Drive	29.03	29.03	29.03	29.03	29.03
R7	Residential - Lunt Road	29.03	29.03	29.03	29.03	29.03
R8	Residential - Lunt Road	29.03	29.04	29.03	29.04	29.03
R9	Residential - Lunt Road	29.04	29.04	29.04	29.04	29.04
R10	Residential - Hilton Place	29.03	29.03	29.04	29.04	29.03
R11	Loxdale Primary School	29.01	29.00	29.01	29.01	29.01
R12	Holy Trinity Roman Catholic Primary School	29.01	29.01	29.01	29.01	29.01
R13	Field View Primary School	29.01	29.01	29.01	29.01	29.01

5.3.2 As indicated in Table 19, NO_2 PECs were below the annual mean EQS of 40μg/m^3 at all human receptor locations for all meteorological data sets.

5.3.3 Reference should be made to Figure 6 for a graphical representation of predicted concentrations throughout the assessment extents.

5.3.4 Maximum predicted annual mean NO_2 concentrations at the human receptor locations are summarised in Table 20.

Table 20 Maximum Predicted Annual Mean NO_2 Concentrations

Receptor		Maximum Predicted Annual Mean NO_2 Concentration (μg/m^2)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
R1	Residential - Bissel Street	0.07	29.07	0.2	72.7
R2	Residential - Tame Street	0.03	29.03	0.1	72.6
R3	Residential - Oxford Street	0.02	29.02	0.0	72.5
R4	Residential - Oxford Street	0.02	29.02	0.1	72.6
R5	Residential - Hughes Road	0.01	29.01	0.0	72.5
R6	Residential - Marbury Drive	0.03	29.03	0.1	72.6
R7	Residential - Lunt Road	0.03	29.03	0.1	72.6
R8	Residential - Lunt Road	0.04	29.04	0.1	72.6
R9	Residential - Lunt Road	0.04	29.04	0.1	72.6

Receptor		Maximum Predicted Annual Mean NO_2 Concentration (µg/m²)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
R10	Residential - Hilton Place	0.04	29.04	0.1	72.6
R11	Loxdale Primary School	0.01	29.01	0.0	72.5
R12	Holy Trinity Roman Catholic Primary School	0.01	29.01	0.0	72.5
R13	Field View Primary School	0.01	29.01	0.0	72.5

5.3.5 As indicated in Table 20, PCs were below 1% of the EQS at all receptors. As such, impacts are not considered to be significant.

5.3.6 Predicted 99.8th %ile 1-hour mean NO_2 PECs at the sensitive human receptors, inclusive of background levels, are summarised in Table 21.

Table 21 Predicted 99.8th %ile 1-hour Mean NO_2 Concentrations

Receptor		Predicted 99.8th %ile 1-hour Mean NO_2 PEC (µg/m³)				
		2016	2017	2018	2019	2020
R1	Residential - Bissel Street	58.68	58.66	58.67	58.69	58.67
R2	Residential - Tame Street	58.47	58.41	58.46	58.47	58.47
R3	Residential - Oxford Street	58.25	58.19	58.24	58.23	58.24
R4	Residential - Oxford Street	58.30	58.24	58.29	58.25	58.25
R5	Residential - Hughes Road	58.09	58.09	58.09	58.09	58.09
R6	Residential - Marbury Drive	58.19	58.19	58.19	58.19	58.20
R7	Residential - Lunt Road	58.16	58.16	58.17	58.17	58.17
R8	Residential - Lunt Road	58.19	58.20	58.20	58.20	58.20
R9	Residential - Lunt Road	58.24	58.24	58.24	58.24	58.24
R10	Residential - Hilton Place	58.29	58.25	58.29	58.29	58.26
R11	Loxdale Primary School	58.14	58.11	58.13	58.12	58.12
R12	Holy Trinity Roman Catholic Primary School	58.09	58.09	58.09	58.10	58.10
R13	Field View Primary School	58.08	58.07	58.08	58.08	58.08

5.3.7 As indicated in Table 21, 99.8th %ile 1-hour mean NO_2 PECs were below the EQS of 200µg/m³ at all human receptor locations for all meteorological data sets.

5.3.8 Reference should be made to Figure 7 for a graphical representation of predicted concentrations throughout the assessment extents.

5.3.9 Maximum predicted 99.8th %ile 1-hour mean NO_2 concentrations at the human receptor locations are summarised in Table 22.

Table 22 Maximum Predicted 99.8th %ile 1-hour Mean NO_2 Concentrations

Receptor		Maximum Predicted 99.8th %ile 1-hour Mean NO_2 Concentration (µg/m²)		PC Proportion of EQS (%)	PC Proportion of EQS Headroom (%)[a]
		PC	PEC		
R1	Residential - Bissel Street	0.69	58.69	0.3	0.5
R2	Residential - Tame Street	0.47	58.47	0.2	0.3
R3	Residential - Oxford Street	0.25	58.25	0.1	0.2
R4	Residential - Oxford Street	0.30	58.30	0.1	0.2
R5	Residential - Hughes Road	0.09	58.09	0.0	0.1
R6	Residential - Marbury Drive	0.20	58.20	0.1	0.1
R7	Residential - Lunt Road	0.17	58.17	0.1	0.1
R8	Residential - Lunt Road	0.20	58.20	0.1	0.1
R9	Residential - Lunt Road	0.24	58.24	0.1	0.2
R10	Residential - Hilton Place	0.29	58.29	0.1	0.2
R11	Loxdale Primary School	0.14	58.14	0.1	0.1
R12	Holy Trinity Roman Catholic Primary School	0.10	58.10	0.0	0.1
R13	Field View Primary School	0.08	58.08	0.0	0.1

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

5.3.10 As indicated in Table 22, the PC proportion of EQS was below 10% at all receptors. As such, impacts are not considered to be significant.

5.4 ECOLOGICAL RECEPTORS

Nitrogen Oxides

5.4.1 Predicted annual mean NO_x PECs at the ecological receptor location, inclusive of background levels, are summarised in Table 23.

Table 23 Predicted Annual Mean NO_X Concentrations

Receptor		Predicted Annual Mean NO_X PEC (µg/m³)				
		2016	2017	2018	2019	2020
E1	Fen Pools SAC	21.600	21.600	21.600	21.600	21.600

5.4.2 As indicated in Table 23, annual mean NO_X PECs were below the EQS of 30µg/m³ at the ecological receptor for all meteorological data sets.

5.4.3 Maximum predicted annual mean NO_x concentrations at the ecological receptor are summarised in Table 24.

Table 24 Maximum Predicted Annual Mean NO_X Concentrations

Receptor		Maximum Predicted Annual Mean NO_X Concentration (μg/m²)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
E1	Fen Pools SAC	0.000	21.600	0.0	72.0

5.4.4 As shown in Table 24, the PC proportion of the EQS was below 1% at the SAC. As such, impacts are not considered to be significant.

5.4.5 Predicted 24-hour mean NO_X PECs at the ecological receptor, inclusive of background levels, are summarised in Table 25.

Table 25 Predicted 24-hour Mean NO_X Concentrations

Receptor		Predicted 24-hour Mean NO_X PEC (μg/m³)				
		2016	2017	2018	2019	2020
E1	Fen Pools SAC	43.201	43.201	43.201	43.201	43.201

5.4.6 As indicated in Table 25, predicted 24-hour mean NO_X PECs were below the EQS of 75μg/m³ at the ecological receptor for all meteorological data sets.

5.4.7 Maximum predicted 24-hour mean NO_X concentrations at the ecological receptor locations are summarised in Table 26.

Table 26 Maximum Predicted 24-hour Mean NO_X Concentrations

Receptor		Maximum Predicted 24-hour Mean NO_X Concentration (μg/m²)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
E1	Fen Pools SAC	0.001	43.201	0.0	57.6

5.4.8 As shown in Table 26, the predicted PC proportion of the EQS was below 10% at the SAC. As such, impacts are not considered to be significant.

Nitrogen Deposition

5.4.9 Predicted annual nitrogen PC deposition rates at the ecological receptor are summarised in Table 27.

Table 27 Predicted Annual PC Nitrogen Deposition Rates

Receptor		Predicted Annual PC Nitrogen Deposition Rate (kgN/ha/yr)				
		2016	2017	2018	2019	2020
E1	Fen Pools SAC	0.0000	0.0000	0.0000	0.0000	0.0000

5.4.10 Maximum predicted annual nitrogen PC deposition rates at the ecological receptor are summarised in Table 28.

Table 28 Maximum Predicted Annual Nitrogen Deposition Rates

Receptor		Maximum Predicted Annual PC Nitrogen Deposition Rate (kgN/ha/yr)	Proportion of EQS (%)	
			Low EQS	High EQS
E1	Fen Pools SAC	0.0000	-	-

Acid Deposition

5.4.11 Predicted annual acid PC deposition rates at the ecological receptor are summarised in Table 29.

Table 29 Predicted Annual PC Acid Deposition Rates

Receptor		Predicted Annual PC Acid Deposition Rate (keq/ha/yr)				
		2016	2017	2018	2019	2020
E1	Fen Pools SAC	0.0000	0.0000	0.0000	0.0000	0.0000

5.4.12 Maximum predicted annual acid deposition rates at the ecological receptor are summarised in Table 30.

Table 30 Maximum Predicted Annual Acid Deposition Rates

Receptor		Maximum Predicted Annual Acid PC Deposition Rate (keq/ha/yr)	Proportion of EQS (%)
E1	Fen Pools SAC	0.0000	-

6 CONCLUSION

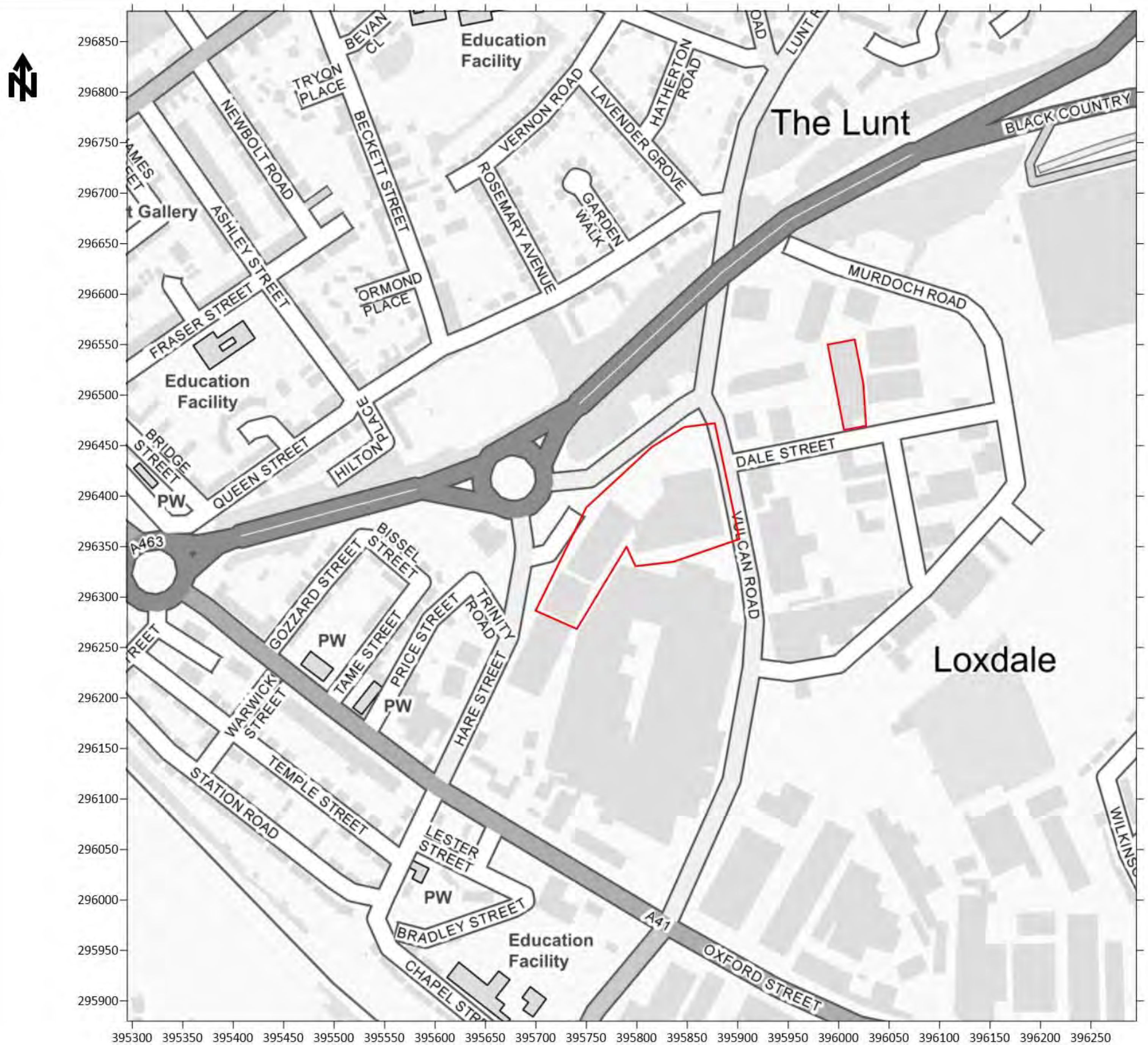
6.1.1 Crestwood Environmental was commissioned by Salisbury Poultry (Midlands) Ltd to undertake an Air Quality Assessment in support of an Environmental Permit Application for the Salisbury Poultry facility on land off Vulcan Road, Bilston.

6.1.2 Combustion emissions from boilers on site have the potential to cause impacts at sensitive locations. An Air Quality Assessment was therefore undertaken to define baseline conditions and quantify potential effects.

6.1.3 Dispersion modelling was undertaken using ADMS-6 to predict NO_2 and NO_x concentrations, as well as nitrogen and acid deposition, at sensitive locations as a result of emissions from the plant.

6.1.4 The results of the assessment indicated that the operation of the plant is not predicted to result in exceedances of the relevant EQSs at any sensitive human receptor within the vicinity of the installation. Impacts were not predicted to be significant in accordance with the relevant methodology.

6.1.5 Impacts were also predicted at relevant ecological sites. The results indicated that emissions from the facility would not significantly affect existing conditions at any designation.



Legend

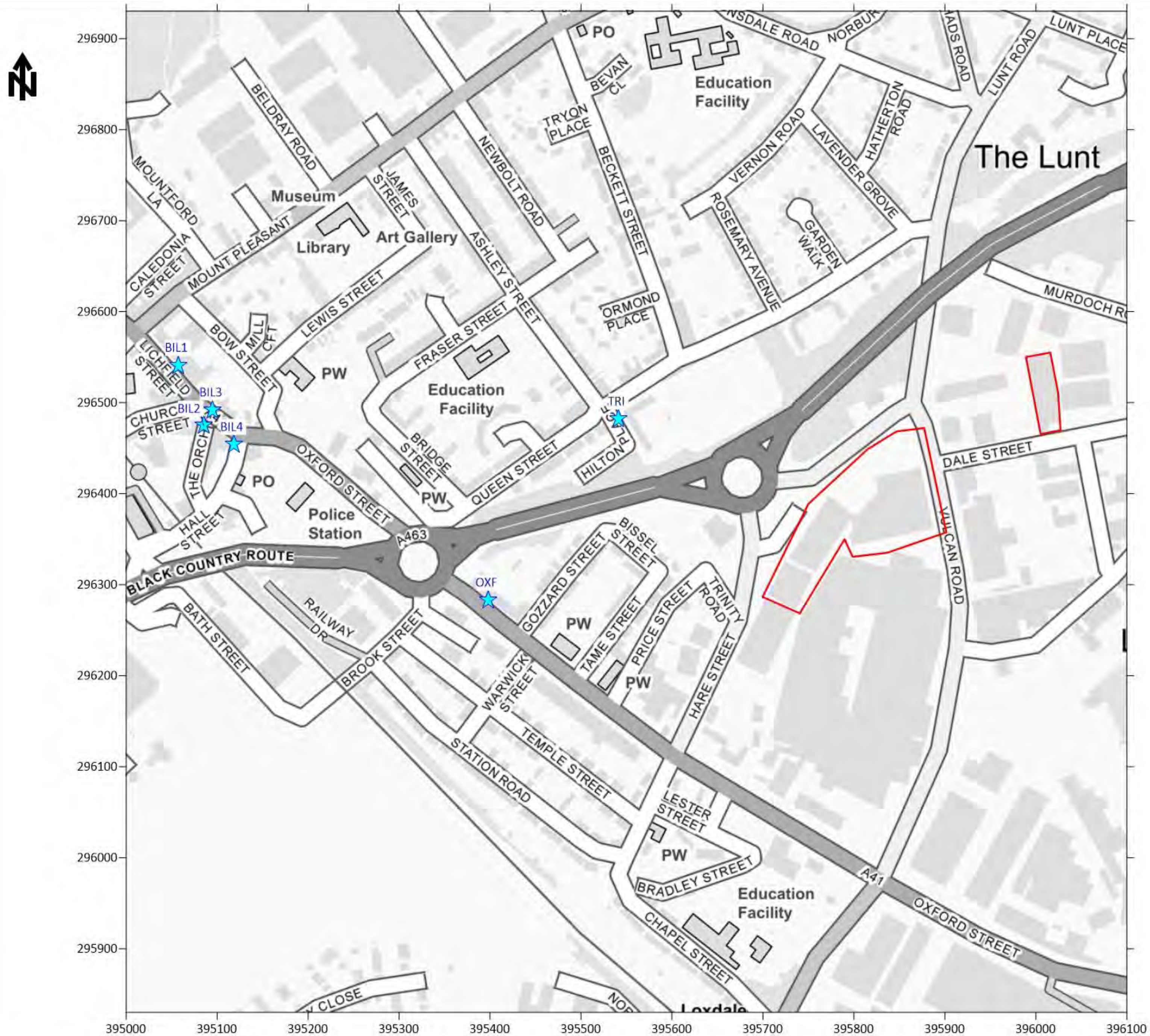
Site Boundary

Title

Figure 1 - Site Location

Project

Air Quality Assessment
Vulcan Road, Bilston



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Site Boundary

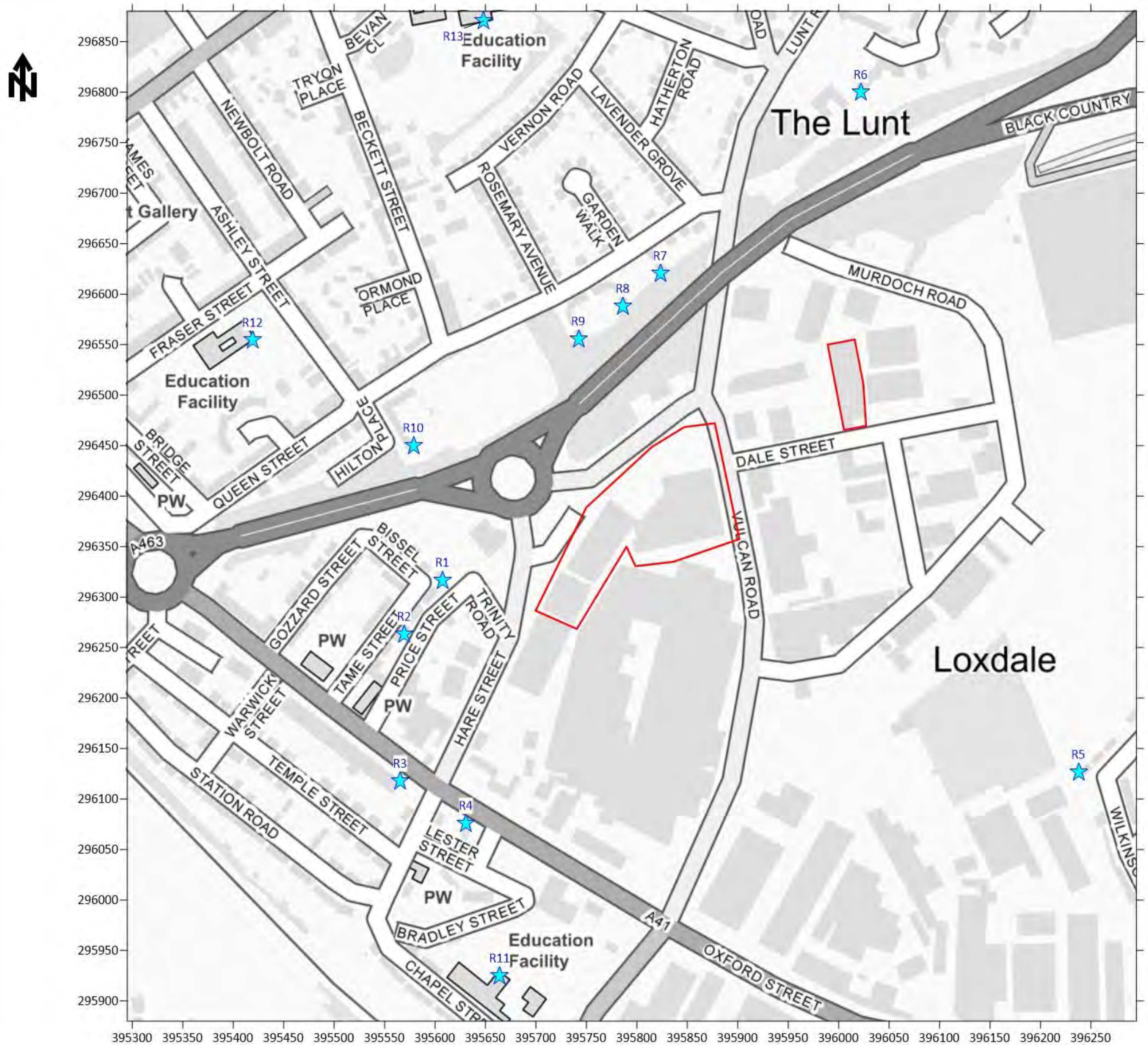
Monitor

Title

Figure 2 - Monitoring Locations

Project

Air Quality Assessment
Vulcan Road, Bilston



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Site Boundary

Receptor

Title

Figure 3 - Receptor Locations

Project

Air Quality Assessment
Vulcan Road, Bilston

Legend

Site Boundary

Emission Point

Output Grid

Building

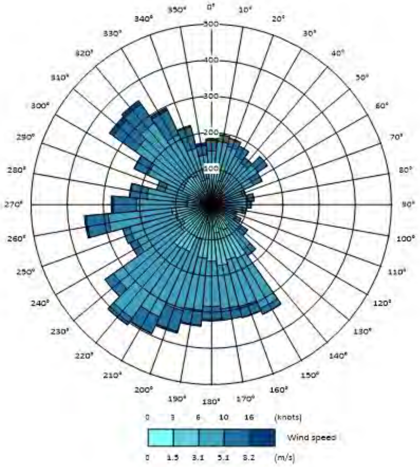
Title

Figure 4 - ADMS-6 Inputs

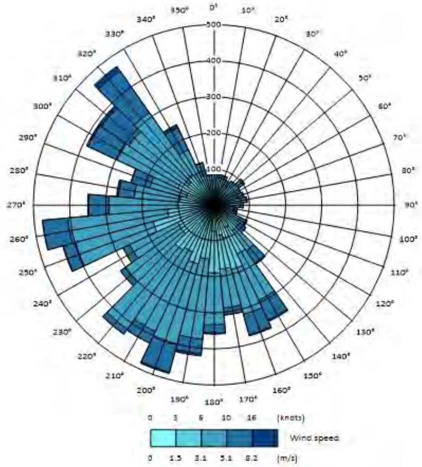
Project

Air Quality Assessment
Vulcan Road, Bilston

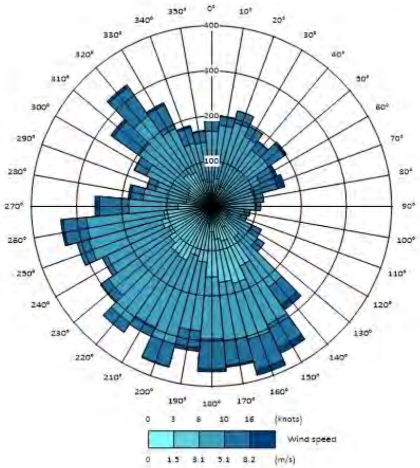
Legend



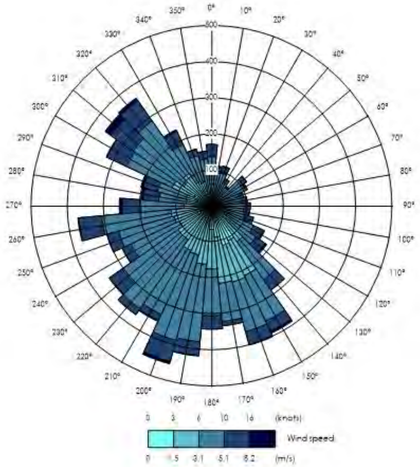
2016 Meteorological Data



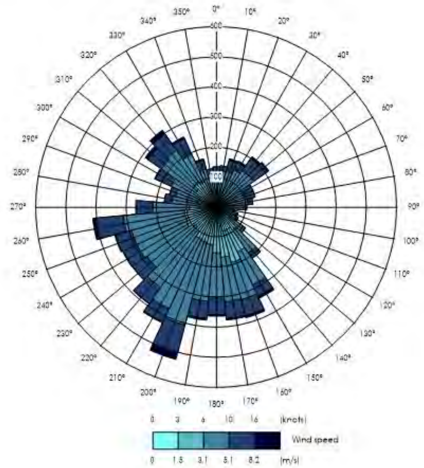
2017 Meteorological Data



2018 Meteorological Data



2019 Meteorological Data



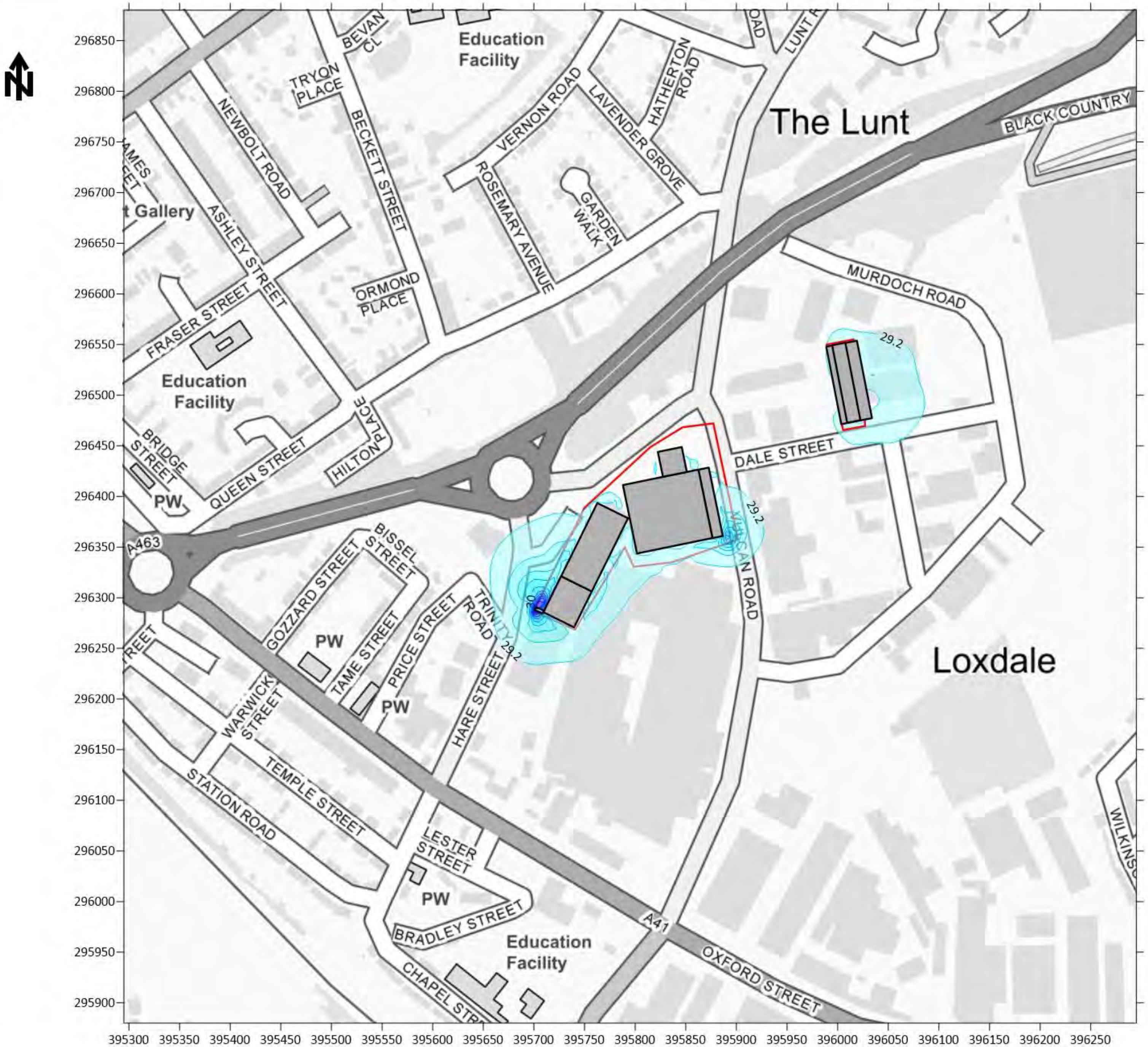
2020 Meteorological Data

Title

Figure 5 - Wind Roses of 2016 - 2020
Birmingham Airport Meteorological Data

Project

Air Quality Assessment
Vulcan Road, Bilston



Legend

Site Boundary

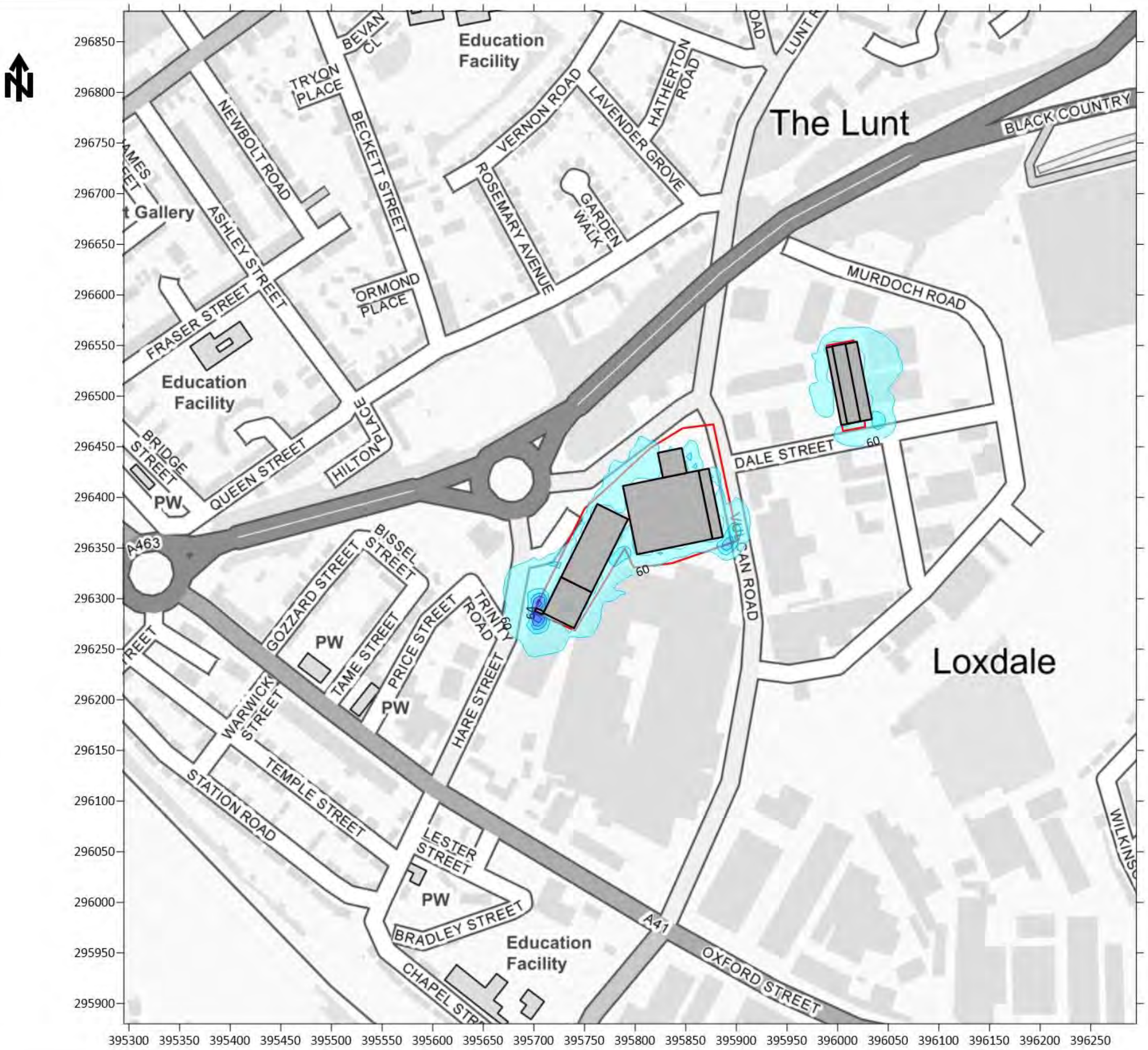
Annual Mean NO_2 Concentration (µg/m³)
31
30.8
30.6
30.4
30.2
30
29.8
29.6
29.4
29.2

Title

Figure 6 - Predicted Annual Mean NO_2 Concentration (µg/m³) 2018 Meteorological Data

Project

Air Quality Assessment
Vulcan Road, Bilston



Legend

Site Boundary

99.8th %ile 1-hour Mean NO_2 Concentration (µg/m³)

68
66
64
62
60

Title

Figure 7 - Predicted 99.8th %ile 1-hour Mean NO_2 Concentration (µg/m³) 2018 Meteorological Data

Project

Air Quality Assessment
Vulcan Road, Bilston