2017 Air Quality Annual Status Report (ASR)

In fulfilment of Part IV of the
Environment Act 1995
Local Air Quality Management

June 2017

Local Authority Officer	Zandra Waterford
Department	Environmental Protection
Address	Elizabeth House, Walpole Loke, Dereham Norfolk NR19 1EE
Telephone	01362 656350
E-mail	Zandra.waterford@breckland.gov.uk
Report Reference number	ASR 1/2017
Date	June 2017

Executive Summary: Air Quality in Our Area

Air Quality in Breckland

Air pollution is associated with a number of adverse health impacts. It is recognised as a contributing factor in the onset of heart disease and cancer. Additionally, air pollution particularly affects the most vulnerable in society: children and older people, and those with heart and lung conditions. There is also often a strong correlation with equalities issues, because areas with poor air quality are also often the less affluent areas[1,2].

The annual health cost to society of the impacts of particulate matter alone in the UK is estimated to be around £16 billion[3].

The Breckland area is predominantly rural with five market towns. There is no heavy industry. There are two major roads, the A11 which runs through the district to the south east, and the A47 which runs through the northern half of the district. These roads now bypass the market towns and reduce the volume of traffic in more populated areas. Breckland has two air quality monitoring stations, one in Swaffham measuring nitrogen dioxide (NO_2) only, and one near Thetford measuring NO_2, fine particles (PM10) and Ozone (O3). There is a network of NO_2 diffusion tubes which covers all the towns and any areas about which the public tell us they are concerned

Generally the air quality across the district is good but there is one area of Swaffham of particular concern. The A1065 runs through the centre of the town and is the main through route for both local traffic and for traffic travelling to North Norfolk. The layout of the town leads to frequent traffic congestion and this leads to elevated concentrations of NO_2. Over the past few years these concentrations have hovered mostly above, but occasionally below, the Annual Objective of 40ug/m3. Previous AQ reports with full details of all monitoring and results can be found on the Council website with this link http://www.breckland.gov.uk/article/3244/Air-Pollution

This year the annual mean for the Station Street area exceeded the annual objective and thus the Council declared an Air Quality Management Area from 1st May 2017.

[1] Environmental equity, air quality, socioeconomic status and respiratory health, 2010
[2] Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006
[3] Defra. Abatement cost guidance for valuing changes in air quality, May 2013

The Council has continued working with our partners at Norfolk County Council (NCC) to assess measures to improve air quality in Swaffham.

Actions to Improve Air Quality

Working with our NCC partners we have been looking at ways to improve traffic flow in the town. Very simply, reducing congestion will to some extent reduce emissions and improve air quality. With a view to this, the traffic lights in central Swaffham were re-phased in 2014 but this was not noticeably effective. After further discussions, Breckland Council commissioned a report from NCC to assess the feasibility of changing the road layout to improve traffic flow. Modelling of the various options predicted a reduction in all oxides of nitrogen (NOx) of up to 25%. This is not the same as NO_2. Reduction in NO_2 would be significantly less than this but may still be sufficient to avoid further exceedences of the Annual Objective. These options would incur significant cost and require further detailed work to fully assess whether implementation is possible. Unfortunately we were unsuccessful in a joint bid with NCC earlier this year for Defra Funds to finance further work on this.

Conclusions and Priorities

This year's ASR is an update of the monitoring carried out last year and clearly shows that there is a continuing exceedence in Swaffham. Because of this the Council has declared an AQMA with the aim of working to reduce the levels of nitrogen dioxide to below the annual objective.

Local Engagement and How to get Involved

As part of the AQMA process we will be holding public meetings where residents and local business and interest groups can hear about what we are doing and have input to improve air quality in the area. We will be meeting with local and regional organisations and Councils to ensure we are in touch with local concerns and are better placed to explore potential solutions.

Find out more about your local air quality by

- Contacting the Air Quality officer at Breckland (details at the beginning of this report) or email envprotect@breckland.gov.uk.

- Contact your local councillor with any concerns http://democracy.breckland.gov.uk/mgMemberIndex.aspx?FN=ALPHA&VW=LIST&PIC=0
- Consider how and when you use your car, especially at peak times. Consider using public transport where possible for trips into towns and walking or cycling for a non-polluting and healthy alternative.

Table of Contents

Executive Summary: Air Quality in Our Area i

Air Quality in Breckland i

Actions to Improve Air Quality ii

Conclusions and Priorities ii

Local Engagement and How to get Involved ii

1 Local Air Quality Management 1

2 Actions to Improve Air Quality 2

2.1 Air Quality Management Areas 2

2.2 Progress and Impact of Measures to address Air Quality in Breckland Council 4

2.3 $PM_{2.5}$ – Local Authority Approach to Reducing Emissions and/or Concentrations 6

3 Air Quality Monitoring Data and Comparison with Air Quality Objectives and National Compliance 7

3.1 Summary of Monitoring Undertaken 7

3.1.1 Automatic Monitoring Sites 7

3.1.2 Non-Automatic Monitoring Sites 7

3.2 Individual Pollutants 7

3.2.1 Nitrogen Dioxide (NO_2) 8

3.2.2 Particulate Matter (PM_{10}) 9

3.2.3 Particulate Matter ($PM_{2.5}$) 9

3.2.4 Sulphur Dioxide (SO_2) 9

Appendix A: Monitoring Results 10

Appendix B: Full Monthly Diffusion Tube Results for 2016 20

Appendix C: Supporting Technical Information / Air Quality Monitoring Data QA/QC 23

Appendix D: Map(s) of Monitoring Locations and AQMAs 25

Appendix E: Summary of Air Quality Objectives in England 31

Glossary of Terms 32

References 33

List of Tables

Table 2.1 – Declared Air Quality Management Areas 3

Table 2.2 – Progress on Measures to Improve Air Quality 5

1 Local Air Quality Management

This report provides an overview of air quality in Breckland Council during 2016 It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995) and the relevant Policy and Technical Guidance documents.

The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where an exceedance is considered likely the local authority must declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives. This Annual Status Report (ASR) is an annual requirement showing the strategies employed by Breckland Council to improve air quality and any progress that has been made.

The statutory air quality objectives applicable to LAQM in England can be found in Table E.1 in Appendix E.

2 Actions to Improve Air Quality

The area of Swaffham where NO_2 concentrations have exceeded the annual objective was declared an Air Quality Management Area (AQMA) on 1st May 2017. Table 2.1 below shows the details and Appendix D incudes maps which show the boundary and the monitoring locations.

Work is in progress with the early stages of the Action Plan and over the coming months we will be working with our partners in Public Health and County Council, local businesses and interest groups.

2.1 Air Quality Management Areas

Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely exceedance of an air quality objective. After declaration, the authority must prepare an Air Quality Action Plan (AQAP) within 12-18 months setting out measures it intends to put in place in pursuit of compliance with the objectives.

A summary of AQMAs declared by Breckland Council can be found in Table 2.1. Further information related to declared or revoked AQMAs, including maps of AQMA boundaries will shortly be available online at the Council Website https://www.breckland.gov.uk/article/3244/Air-Pollution. Alternatively, see Appendix D: Map(s) of Monitoring Locations and AQMAs, which provides for a map of air quality monitoring locations in relation to the AQMA(s).

Table 2.1 – Declared Air Quality Management Areas

AQMA Name	Date of Declaration	Pollutants and Air Quality Objectives	City / Town	One Line Description	Is air quality in the AQMA influenced by roads controlled by Highways England?	Level of Exceedance (maximum monitored/modelled concentration at a location of relevant exposure)		Action Plan (inc. date of publication)
						At Declaration	Now	
Breckland District Council Air Quality Management Area number 2 Order 2017	Declared 1 May 2017	NO2 Annual mean	Swaffham	An area encompassing a number of residential properties in Station Street and London Road Swaffham	NO	41.02 µg/m^3	N/A	In progress

☐ **Breckland Council confirm the information on UK-Air regarding their AQMA is up to date**

2.2 Progress and Impact of Measures to address Air Quality in Breckland Council

Defra's appraisal of last year's ASR concluded "On the basis of the evidence provided by the local authority the conclusions reached are acceptable for all sources and pollutants. The next step for Breckland District Council is to review the DA for Swaffham and submit their next Annual Status Report in 2017.

Breckland Council has taken forward a number of direct measures during the current reporting year of 2016 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2.

Breckland Council expects the following measures to be completed over the course of the next reporting year: Production of Action Plan

Breckland Council's priorities for the coming year are to engage with all relevant bodies and public with the aim of reducing exposure to NO_2. This will include raising public awareness and working with Public Heath colleagues.

The principal challenges and barriers to implementation that Breckland Council anticipates facing are financial pressures and a lack of possibilities for reducing exposure without being able to divert traffic from the area.

Whilst the measures stated above and in Table 2.2 will help to contribute towards compliance, Breckland Council anticipates that further additional measures not yet prescribed will be required in subsequent years to achieve compliance and enable the revocation of Breckland District Council Air Quality Management Area number 2 Order 2017

Table 2.2 – Progress on Measures to Improve Air Quality

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
1	Item in Local Plan	Policy Guidance and Development Control	Other policy	Breckland	2016	2016	N/A	N/A	In consultation	2016/7	Currently in the draft Local Plan under consultation. Will allow air quality to be a “material consideration”

2.3 $PM_{2.5}$ – Local Authority Approach to Reducing Emissions and/or Concentrations

As detailed in Policy Guidance LAQM.PG16 (Chapter 7), local authorities are expected to work towards reducing emissions and/or concentrations of $PM_{2.5}$ (particulate matter with an aerodynamic diameter of 2.5µm or less) as practicable. In doing so they are not required to carry out any additional local review and assessment (including monitoring) but make use of national monitoring.

There is clear evidence that $PM_{2.5}$ has a significant impact on human health, including premature mortality, allergic reactions, and cardiovascular diseases.

Breckland Council is taking the following measures to address $PM_{2.5}$:

We do not have the facility to measure $PM_{2.5}$ which is a fraction of the PM_{10} which we do measure. We have not had above the permitted number of exceedences for PM_{10} for several years. However we will follow guidance on all measures that would be appropriate to reducing exposure to $PM_{2.5}$ although this is largely out of local control. We will consult with Norwich City Council which monitors $PM_{2.5}$ at one site, and Public Health colleagues and be advised by them, and national guidance, on any relevant measures that will reduce exposure. The Local Plan will address $PM_{2.5}$ reduction indirectly. It is recognised that there is a correlation between NO_2 and $PM_{2.5}$ so that measures planned to reduce NO_2, particularly in Swaffham, will also reduce $PM_{2.5.}$

3 Air Quality Monitoring Data and Comparison with Air Quality Objectives and National Compliance

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

This section sets out what monitoring has taken place and how it compares with objectives.

Breckland Council undertook automatic (continuous) monitoring at 2 sites during 2015 Table A.1 in Appendix A shows the details of the sites. NB. Local authorities do not have to report annually on the following pollutants: 1,3 butadiene, benzene, carbon monoxide and lead, unless local circumstances indicate there is a problem. National monitoring results are available at http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html

Maps showing the location of the monitoring sites are provided in Appendix D. Further details on how the monitors are calibrated and how the data has been adjusted are included in Appendix C.

3.1.2 Non-Automatic Monitoring Sites

Breckland Council undertook non- automatic (passive) monitoring of NO_2 at 25 sites during 2017 Table A.2 in Appendix A shows the details of the sites.

Maps showing the location of the monitoring sites are provided in Appendix D. Further details on Quality Assurance/Quality Control (QA/QC) for the diffusion tubes, including bias adjustments and any other adjustments applied (e.g. “annualisation” and/or distance correction), are included in Appendix C.

3.2 Individual Pollutants

The air quality monitoring results presented in this section are, where relevant, adjusted for bias, “annualisation” and distance correction. Further details on adjustments are provided in Appendix C.

3.2.1 Nitrogen Dioxide (NO_2)

Breckland has a network of diffusion tubes that cover the 5 towns and some additional areas that are of interest to concerned members of the public or to validate modelling. Since October 2015 we have used tube id number 30 for a road in East Harling where residents are concerned over the numbers of HGV traffic. This is primarily due to safety issues but also some concern over air quality. We are not seeing any reason for concern with respect to air quality/

Tube id number D3 has been omitted in 2016 because it is not used for NO_2 arising from traffic but from biomass combustion. A 9MW biomass boiler was installed at a private residence and screening initially indicated a possible exceedence of NO_2. Changes were made to the stack height and this was screened out. The owner has kindly allowed us to use the site to validate the modelling. However measurement shows no reason for concern, with results being similar or less than tube 20. We have now discontinued monitoring at this site.

There is only one site where the annual objective for NO_2 is exceeded. This is in Swaffham as mentioned above. There are two sites in the town where NO_2 concentrations are at or near the annual objective. This is due to traffic and the layout of the town. Some lengths of the road form a “street canyon” where emissions are unable to disperse quickly, or a narrow point where traffic queues. These areas are to the north of the traffic lights in the centre of the town (tube S8) and to the south of the market place where the road narrows on London Road (tube S2). All the locations have relevant receptors, meaning that the public can be exposed for the time that the objective is exceeded.

An AQMA has just been declared for this area and the boundary is set out in Appendix A. We will be working on the Action Plan in 2017.

Table A.3 in Appendix A compares the ratified and adjusted monitored NO_2 annual mean concentrations for the past 5 years with the air quality objective of 40µg/m^3.

For diffusion tubes, the full 2016 dataset of monthly mean values is provided in Appendix B.

Table A.4 in Appendix A compares the ratified continuous monitored NO_2 hourly mean concentrations for the past 5 years with the air quality objective of 200µg/m^3, not to be exceeded more than 18 times per year. We do not have any such exceedences for 2017.

3.2.2 Particulate Matter (PM_{10})

Table A.5 in Appendix A compares the ratified and adjusted monitored PM_{10} annual mean concentrations for the past 5 years with the air quality objective of 40µg/m^3.

Table A.6 in Appendix A compares the ratified continuous monitored PM_{10} daily mean concentrations for the past 5 years with the air quality objective of 50µg/m^3, not to be exceeded more than 35 times per year.

3.2.3 Particulate Matter ($PM_{2.5}$)

As stated above, there is no monitoring of $PM_{2.5}$ carried out at Breckland Council.

3.2.4 Sulphur Dioxide (SO_2)

There is no monitoring of sulphur dioxide carried out at Breckland Council.

Appendix A: Monitoring Results

Table A.1 – Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Inlet Height (m)
W1	East Wretham	Urban background	591315	288704	NO_2; PM_{10}	N	NOx Chemi-luminescence PM10 TEOM light-scattering photometer (nephelometer)	0	10	2.5
S 3	Swaffham	Roadside	582093	308469	NO_2	N	Chemiluminescent	0	2	1.5

Notes:

(1) 0m if the monitoring site is at a location of exposure (e.g. installed on the façade of a residential property).

(2) N/A if not applicable.

Table A.2 – Details of Non-Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
A1	Attleborough	Urban centre	604550	295125	NO_2	N	0	6	N	2
A2	Attleborough	Urban b'ground	603843	294085	NO_2	N	0	7	N	2
D1	Dereham	Urban centre	598920	313267	NO_2	N	0	2	N	2
D2	Dereham	Urban centre	599283	313599	NO_2	N	0	8	N	2
S1	Swaffham	Urban centre	581986	309031	NO_2	N	0	5	N	2.5
S2	Swaffham	Urban Centre	582008	308764	NO_2	N	0	3	N	2
S3/S3a/S3b **colocated**	Swaffham	Urban roadside Colocation	582182	308434	NO_2	N	0	4	Y	2
S4	Swaffham	Urban roadside	582058	308625	NO_2	N	0	4	N	2
S5	Swaffham	Urban roadside	582075	308496	NO_2	N	0	7	N	2
S6	Swaffham	Urban roadside	582048	308609	NO_2	N	0	5	N	2

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) [1]	Distance to kerb of nearest road (m) [2]	Tube collocated with a Continuous Analyser?	Height (m)
S7	Swaffham	Urban roadside	581999	309099	NO_2	Y	0	7	N	2
S8	Swaffham	Urban roadside	581979	309162	NO_2	Y	0	5	N	2
S9	Swaffham	Urban roadside	581959	309057	NO_2	Y	0	4	N	2
S10	Swaffham	Urban roadside	5820670	309058	NO_2	Y	0	3	N	2
S11	Swaffham	Urban roadside	581990	309145	NO_2	Y	0	3	N	2
S12	Swaffham	Urban roadside	581986	309213	NO_2	Y	0	3	N	2
S13	Swaffham	Urban roadside	581978	309312	NO_2	N	0	3	N	1
S14	Swaffham	Urban roadside	582082	3098566	NO_2	N	0	3	N	2
T1	Thetford	Urban Roadside	587126	283336	NO_2	N	0	3	N	2
T2	Thetford	Urban Roadside	586846	282721	NO_2	N	0	3	N	2

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
T3	Thetford	Suburban b'ground	587036	284579	NO_2	N	0	101	N	2
W1	Watton	Urban centre	591747	300796	NO_2	N	0	2.5	N	2
W2	Watton	Urban b'ground	591885	300622	NO_2	N	0	2	N	2
20/20a/20b **Colocated**	Wretham SSSI	Rural Co-location	591315	288704	NO_2	Y	0	55	Y	3
30	East Harling	Rural	599403	286353	NO_2	N	0	2.5	N	2

Notes:

(1) 0m if the monitoring site is at a location of exposure (e.g. installed on/adjacent to the façade of a residential property).

(2) N/A if not applicable.

Table A.3 – Annual Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	NO_2 Annual Mean Concentration (µg/m^3) (3)				
					2012	2013	2014	2015	2016
20	Rural Backgrounde	Automatic	99	100	12	17	22	27	25
S3	Roadside	Automatic	97.5	100	31	33	33	29	28
S8	Roadside	Diffusion Tube	100	100	38.75	**41.63**	**40.36**	37.68	**41.02**

☒ **Diffusion tube data has been bias corrected**

☒ **Annualisation has been conducted where data capture is <75%**

☒ **If applicable, all data has been distance corrected for relevant exposure**

Notes:

Exceedances of the NO_2 annual mean objective of 40µg/m^3 are shown in **bold**.

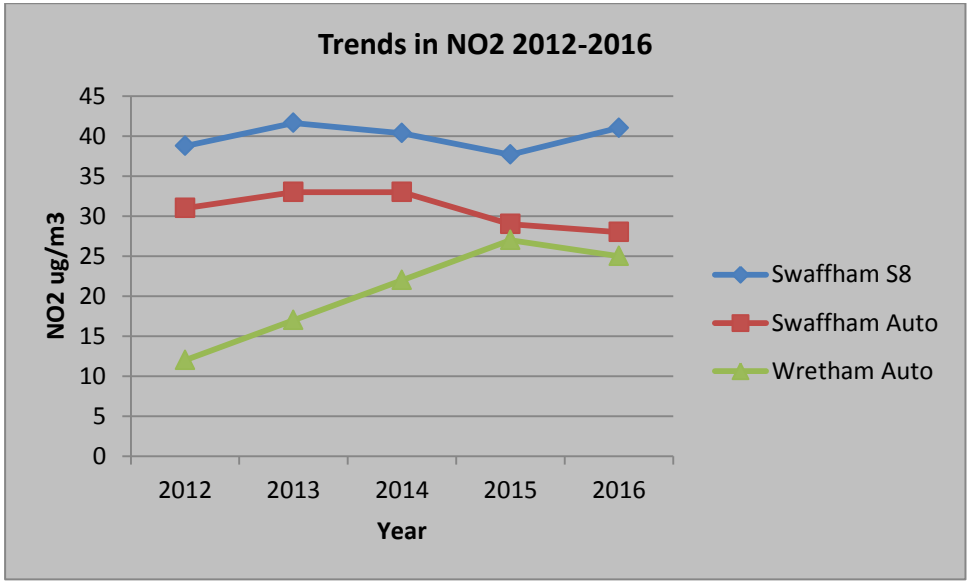
NO_2 annual means exceeding 60µg/m^3, indicating a potential exceedance of the NO_2 1-hour mean objective are shown in **bold and underlined.**

(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) Means for diffusion tubes have been corrected for bias. All means have been "annualised" as per Boxes 7.9 and 7.10 in LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Figure A.1 – Trends in Annual Mean NO_2 Concentrations



Please note that the Swaffham automatic site includes results for the three months that there was doubt as to the accuracy due to the water (condensation) in the inlet line. Results were unexpectedly low for these months and thus the national bias adjustment was used for all reported diffusion tube results.

The Wretham site appears to be settling to a more expected pattern now that the NO_2 permeation tube has been removed from the instrument. This is a component that allows self-calibration and is not essential to the operation of the instrument.

Table A.4 – 1-Hour Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	NO_2 1-Hour Means > 200µg/m^3 (3)				
					2012	2013	2014	2015	2016
S3	Roadside	Automatic	97.5	100	1	1	0	0	0
20	Rural Background	Automatic	99	100	0	0	0	0	0

Notes:

Exceedances of the NO_2 1-hour mean objective (200µg/m^3 not to be exceeded more than 18 times/year) are shown in **bold.**

(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) If the period of valid data is less than 85%, the 99.8th percentile of 1-hour means is provided in brackets.

Table A.5 – Annual Mean PM_{10} Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	PM_{10} Annual Mean Concentration ($\mu g/m^3$) (3)				
				2012	2013	2014	2015	2016
20	Rural background	98.2	100	17	19	18	16	15

☒ **Annualisation has been conducted where data capture is <75%**

Notes:

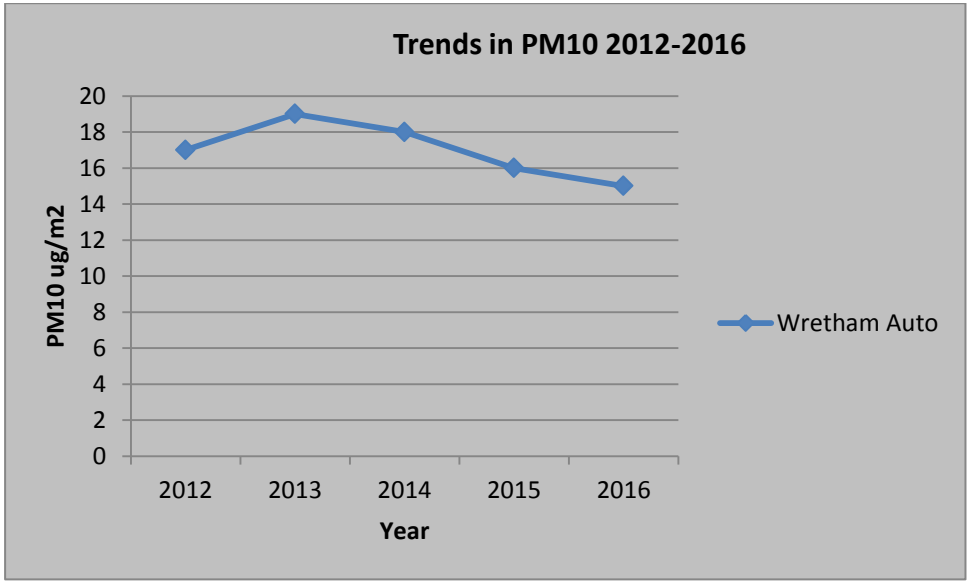
Exceedances of the PM_{10} annual mean objective of 40$\mu g/m^3$ are shown in **bold.**

(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) All means have been "annualised" as per Boxes 7.9 and 7.10 in LAQM.TG16, valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Figure A.2 – Trends in Annual Mean PM_{10} Concentrations



The annual trend appears to be downward for measured PM10 at the East Wretham site

Table A.6 – 24-Hour Mean PM_{10} Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	PM_{10} 24-Hour Means > 50µg/m^3 (3)				
				2012	2013	2014	2015	2016
20	Rural Background	98.2	100	3	9	7	2	1

Notes:

Exceedances of the PM_{10} 24-hour mean objective (50µg/m^3 not to be exceeded more than 35 times/year) are shown in **bold.**

(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) If the period of valid data is less than 85%, the 90.4th percentile of 24-hour means is provided in brackets.

Appendix B: Full Monthly Diffusion Tube Results for 2016

Table B.1 – NO_2 Monthly Diffusion Tube Results - 2016

Site ID	NO_2 Mean Concentrations ($\mu g/m^3$)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean		
													Raw Data	Bias Adjusted (0.92)	Distance Corrected to Nearest Exposure **(2)
A1	33.59	32.71	33.98	30.40	26.28	22.81	23.9	23.55	25.33	27.34	35.78	38.40	29.51	28.62	**
A2	14.75	14.59	13.57	9.39	8.34	6.46	7.45	8.61	11.02	12.11	15.16	20.63	11.84	11.48	**
D1	42.89	39.15	35.02	32.67	28.55	29.44	34.74	35.78	32.25	36.36	36.34	41.38	35.38	34.32	**
D2	40.88	33.64	28.00	24.05	24.19	25.84	29.99	29.04	27.12	26.76	29.81	34.57	29.49	28.61	**
D3	32.96	27.47	9.00	6.97	6.47	5.03	5.08	7.27	7.13	7.02	10.52	13.78	11.56	11.21	**
S1	23.53	25.62	26.19	23.27	24.73		18.12	24.21	22.73	26.04	28.75	31.26	24.95	24.20	**
S2	47.60	40.38	42.33	37.99	37.27	33.28	39.66	38.46	35.17	33.35	42.73	46.17	39.53	38.35	**
S3	33.56	33.28	33.25	33.81	32.72	26.58	26.36	28.55	31.49	33.15	31.07	43.96	32.32	31.35	**
S3a	33.47	31.83	32.93	31.97	31.18	26.91	25.45	30.91	31.68	30.88	29.15	35.02	30.95	30.02	**
S3b	35.62	32.43	31.21	32.27	32.03	28.76	25.11	28.04	32.38	29.08	28.69	38.53	31.18	30.24	**
S4	28.45	28.68	30.68	26.30	27.17	27.44	21.65	26.67	24.75	29.81	29.46	32.22	27.77	26.94	**
S5	29.29	29.24	29.85	28.36	25.87	22.77	11.44		25.63	24.32	28.22	35.99	26.45	25.66	**
S6	39.30	33.87	32.62	33.18	36.59	28.34	31.91	32.32	38.99	29.83	30.99	42.33	34.19	33.16	**
S7	42.59	41.04	37.68	39.44	41.79	38.21	33.2	36.40	37.01	46.14	29.18	51.71	39.53	38.35	**
S8	41.72	48.04	47.14	41.67	38.11	37.49	38.92	39.97	40.89	37.54	37.93	58.10	42.29	**41.02**	**

Site ID	NO_2 Mean Concentrations ($\mu g/m^3$)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean		
													Raw Data	Bias Adjusted (0.92)	Distance Corrected to Nearest Exposure **([2])
S9		31.03	27.37	24.41	25.53	26.09	22.35	27.06	24.1	29.85	30.4	34.24	27.49	26.67	**
S10	29.76	31.11	27.02	21.89	20.73	21.27	24.18	25.27	23.02	21.98	27.8	34.46	25.71	24.94	**
S11	34.92	37.52	40.41	38.88	40.34	42.00	32.61	37.69	37.45	37.96	35.56	42.79	38.18	37.03	**
S12	34.52	33.16	31.28	30.95	33.45	39.00	26.89	33.24	34.01	31.14		34.95	32.96	31.97	**
S13	29.57	28.49	26.31	25.58	27.96	29.80	19.09	24.34	26.07	27.32	28.22	33.17	27.16	26.35	**
S14	30.24	27.23	23.89		22.22	21.87	20.15			21.55	25.04	32.16	24.93	24.18	**
T1	27.10	32.78	29.32	28.12	28.66	19.28	24.15	20.27	26.46		33.07	38.86	28.01	27.17	**
T2	27.52	28.75	26.31	26.58	23.49	26.82	18.19	22.33	24.18	27.4	31.32	35.26	26.51	25.72	**
T3	22.18	18.45	14.30	13.38	11.53	10.27	10.96	12.60	13.57	12.98	20.01	24.28	15.38	14.91	**
W1	24.16	28.77	23.79				27.5	26.63	23.74	29.17	28.4	35.98	27.57	26.74	**
W2	17.91	17.84	13.48	10.36	10.92	8.12	9.69	11.10	10.81	11.09	16.25	25.02	13.55	13.14	**
20	14.53	12.55	9.18	9.32	10.05	7.54	7.48	10.41	11.11	10.03	14.06	21.6	11.49	11.14	**
20a	15.06	12.84	8.67	9.06	9.48	8	7.3	9.91	11.77	10.13	15:21	21.06	11.49	11.15	**
20b	15.70	12.64	8.96	9.23	9.44	7.85	6.69	10.47	11.29	10.22	12.39	21.22	11.34	11.00	**
30	20.73	17.98	16.20	12.18	12.84	12.87	12.04	14.36	15.32		18.96	26.18	16.33	15.84	**

☐ **Local bias adjustment factor used**

☒ **National bias adjustment factor used**

☒ **Annualisation has been conducted where data capture is <75%**

Notes:

Exceedances of the NO_2 annual mean objective of 40µg/m^3 are shown in **bold**.

NO_2 annual means exceeding 60µg/m^3, indicating a potential exceedance of the NO_2 1-hour mean objective are shown in **bold and underlined.**

(1) See Appendix C for details on bias adjustment and annualisation.

(2) Distance corrected to nearest relevant public exposure.

**** no distance correction because all tubes are located at the façade with eh exception of tubes 20, 20a and 20b which are not, but are actually the same distance from the road side.**

Appendix C: Supporting Technical Information / Air Quality Monitoring Data QA/QC

The monitoring station in Swaffham that is normally used to determine the bias adjustment figure for the local area. In 2016 there was an issue with condensation in the line due to the air conditioning unit. This gave a bias adjustment factor that was unusually low. Three months of data covering this period were removed and the factor was then 0.92. The national bias adjustment figure for the Gradko laboratory was also 0.92 for this period, so we have used this factor.

PM Monitoring Adjustment
Kings College VCM model used.

QA/QC of diffusion tube monitoring
Quality Control Procedures for Monitoring NO_2

1 Diffusion Tube Monitoring

The diffusion tube network exposes each set of diffusion tubes to the atmosphere for approximately 4 weeks. Care is taken with the storage, handling and analysis of the tubes. All the diffusion tubes are stored in air tight bags under refrigerated conditions prior to use and used within the expiry date. Upon collection, the date, site and times are recorded. These tubes are then individually stored in sealed bags.

On the day of collection, the tubes are sent to Gradko International Limited for analysis, together with an unexposed tube as a blank 'control'. The tubes are then collected and analysed by Gradko International Limited, in accordance with a quality control procedure.

Gradko adopt the following procedures, to ensure the results of the analysis are within the accepted accuracy range:-

- Prior to each tube analysis undertaken, nitrite solutions ranging from 1-2ppm made up from a standard stock solution are run and checked against a calibration graph.
- Every month a full range of nitrite standard solutions ranging from 0.5-4ppm are measured and compared against the instrument calibration graph.
- Periodically, samples of tubes prepared for exposure are spiked with known concentrations of nitrite solution and measured. Blank tube values are also monitored from each new batch of tubes prepared.
- Once per month, a stock solution containing a known amount of nitrite, is received from AEA Technology Environment and measured. The results are used as part of the UK NO2 Survey QA/QC Scheme. This stock solution is then used by Gradko to check the u.v. spectrophotometer

calibration graph. The values are blank corrected, using blank "control" diffusion tubes provided by Breckland Council.

The accuracy of the measurements made by Gradko are also monitored by participation in an external laboratory measurement proficiency scheme AIR. This is an independent analytical proficiency-testing (PT) scheme, operated by LGC Standards and supported by the Health and Safety Laboratory (HSL). AIR PT is a new scheme, started in April 2014, which combines two long running PT schemes: LGC Standards STACKS PT scheme and HSL WASP PT scheme.

Diffusion tubes are spiked using a working nitrite solution prepared from a stock solution. The concentration of this stock solution is initially assayed using a titrimetric procedure. All steps in the subsequent test sample production process, involving gravimetric and volumetric considerations, are undertaken using calibrated instruments employing traceable standards. As an additional cross check, 12 spiked Palmes tubes are picked at random from each spike loading level and submitted to a third party laboratory which is accredited to ISO 17025 to undertake this analysis using an ion chromatographic procedure.

The table below gives the results of the AIR PT scheme showing Gradko laboratory performance.

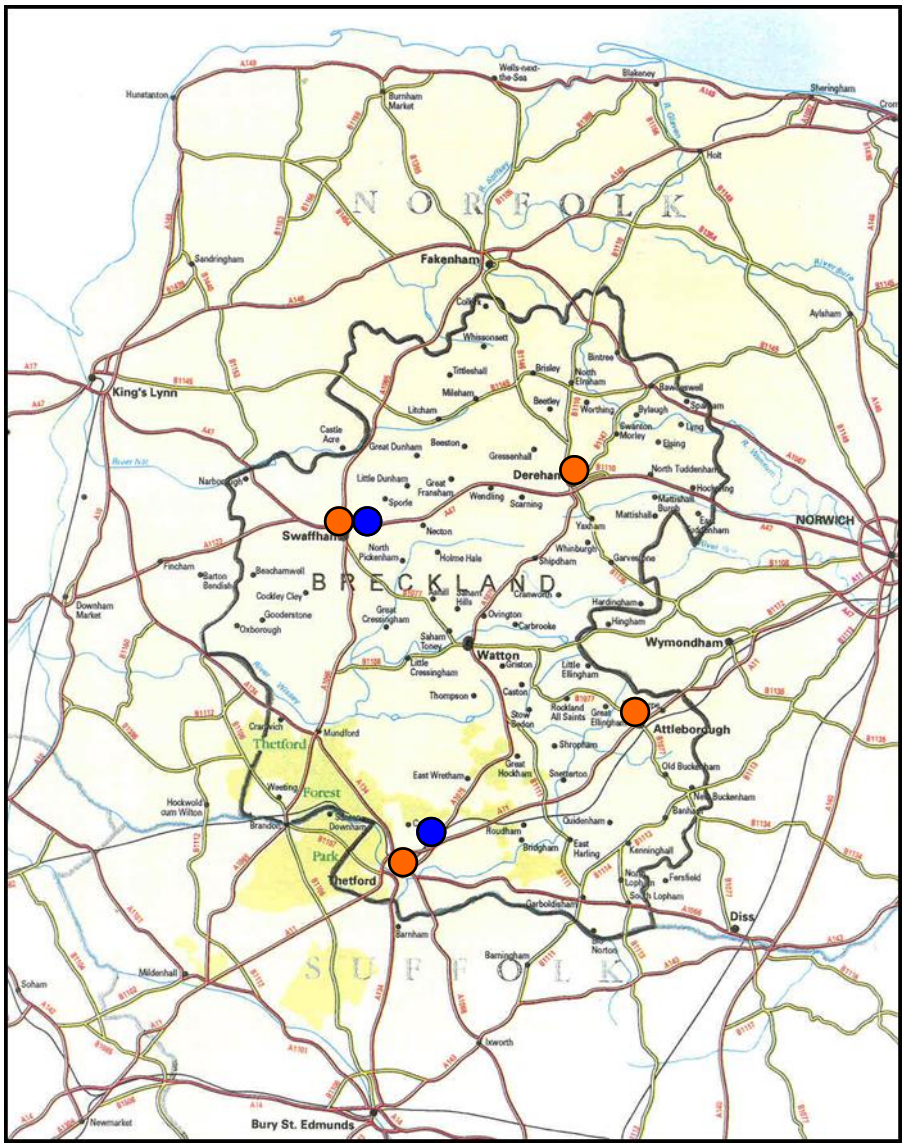
The following table lists those UK laboratories undertaking LAQM activities that have participated in recent AIR NO_2 PT rounds and the percentage (%) of results submitted which were subsequently determined to be **satisfactory** based upon a z-score of ≤ ± 2 as defined above.

AIR PT Round	AR001	AR003	AR004	AR006	AR007	AR009	AR010	AR012
Round conducted in the period	April – May 2014	July – August 2014	October – November 2014	January – February 2015	April – May 2015	July – August 2015	October – November 2015	January – February 2016
Aberdeen Scientific Services	100 %	100 %	100 %	100 %	100 %	75 %	100 %	100 %
Cardiff Scientific Services	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Edinburgh Scientific Services	100 %	100 %	100 %	75 %	100 %	100 %	100 %	100 %
Environmental Services Group, Didcot [1]	100 %	100 %	100 %	87.5 %	100 %	100 %	100 %	100 %
Exova (formerly Clyde Analytical)	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Glasgow Scientific Services	100 %	100 %	100 %	100 %	100 %	100 %	100 %	75 %
Gradko International [1]	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Kent Scientific Services	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Kirklees MBC	100 %	100 %	100 %	75 %	100 %	100 %	100 %	100 %
Lambeth Scientific Services	50 %	100 %	100 %	25 %	100 %	100 %	100 %	100 %
Milton Keynes Council	100 %	100 %	75 %	100 %	100 %	100 %	100 %	50 %
Northampton Borough Council	100 %	0 %	0 %	100 %	100 %	100 %	100 %	50 %
Somerset Scientific Services	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
South Yorkshire Air Quality Samplers	100 %	100 %	100 %	100 %	100 %	100 %	75 %	100 %
Staffordshire County Council	100 %	25 %	100%	100 %	100 %	75 %	75 %	75 %
Tayside Scientific Services (formerly Dundee CC)	NR [2]	100 %	100 %	100 %	NR [2]	NR [2]	NR [2]	100 %
West Yorkshire Analytical Services	75 %	100 %	75 %	100 %	75 %	75 %	75 %	75 %

[1] Participant subscribed to two sets of test samples (2 x 4 test samples) in each AIR PT round.
[2] NR No results reported
[3] Kent Scientific Services, Cardiff Scientific Services and Exova (formerly Clyde Analytical) no longer carry out NO_2 diffusion tube monitoring and therefore did not submit results.

Table C2. AIR PT scheme (Gradko Highlighted) 2017 results not available at time of writing

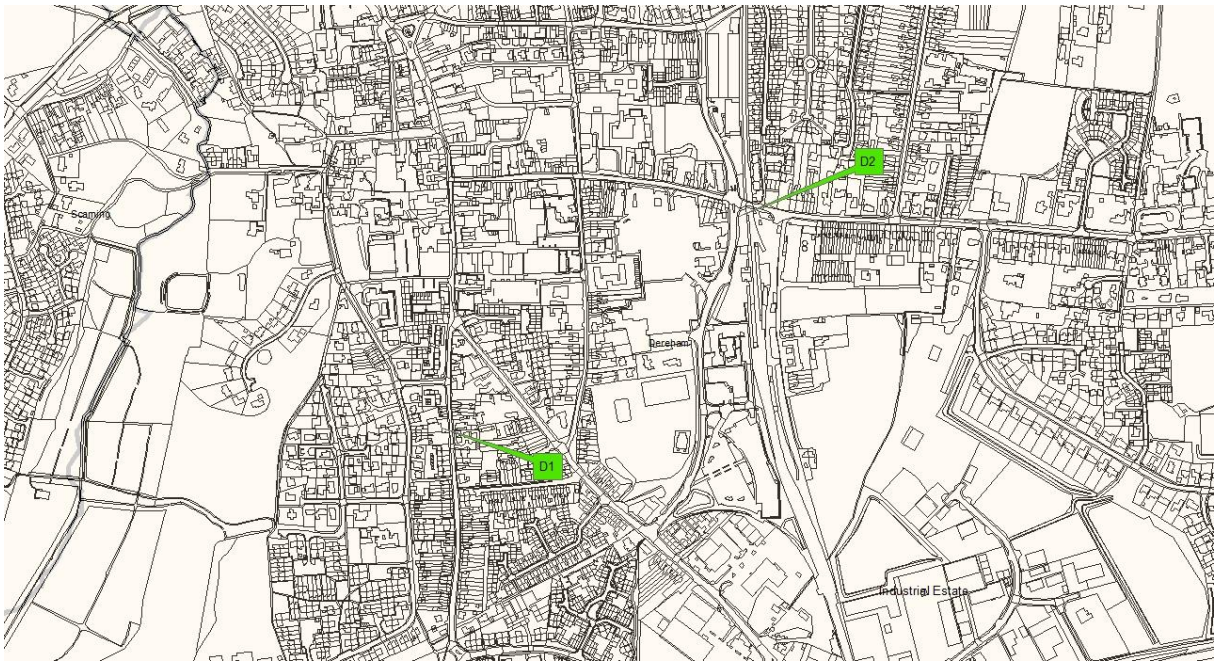
Appendix D: Map(s) of Monitoring Locations and AQMAs



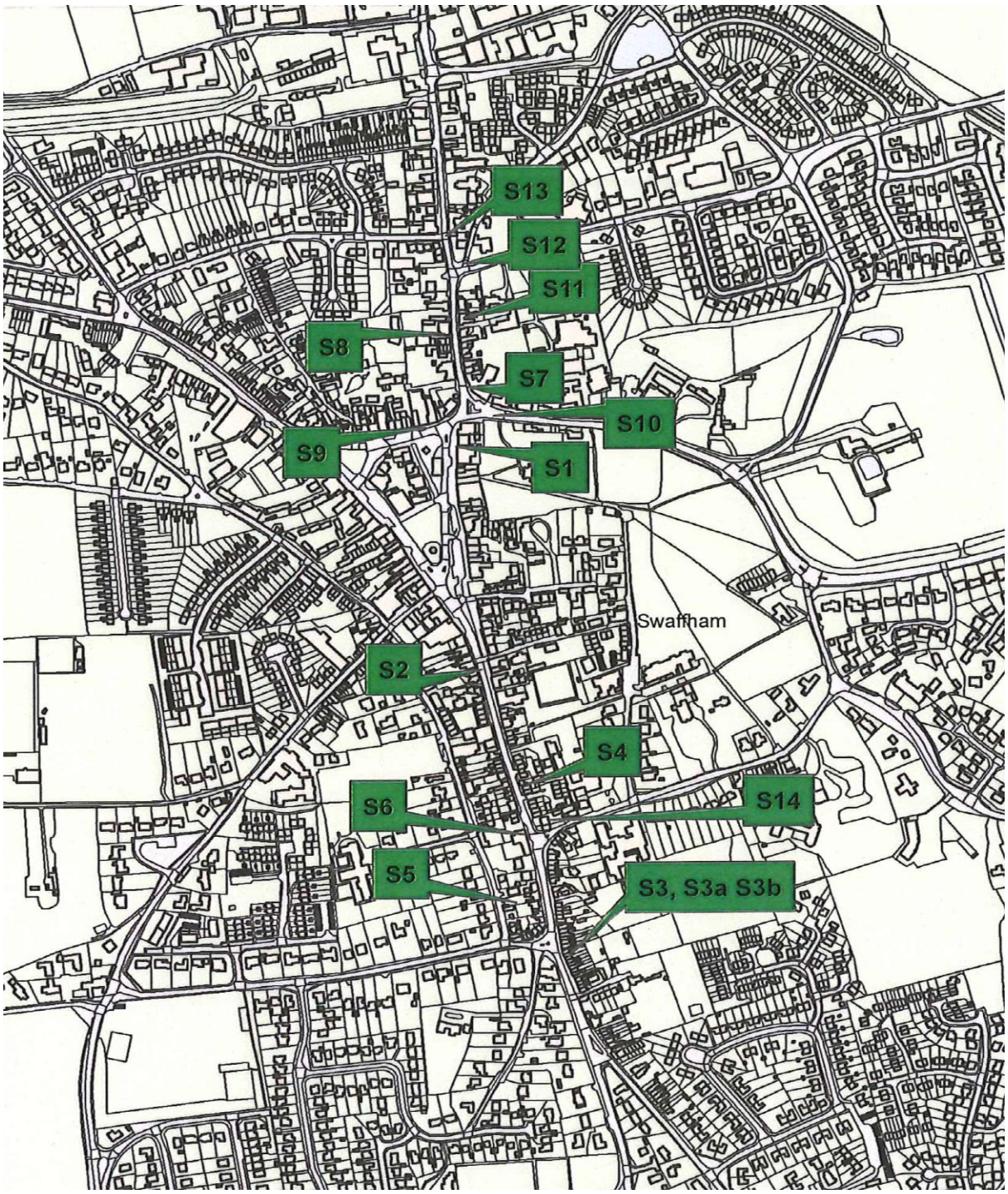
Map showing Automatic Monitoring Sites

- Automatic Monitoring Station
- Market towns

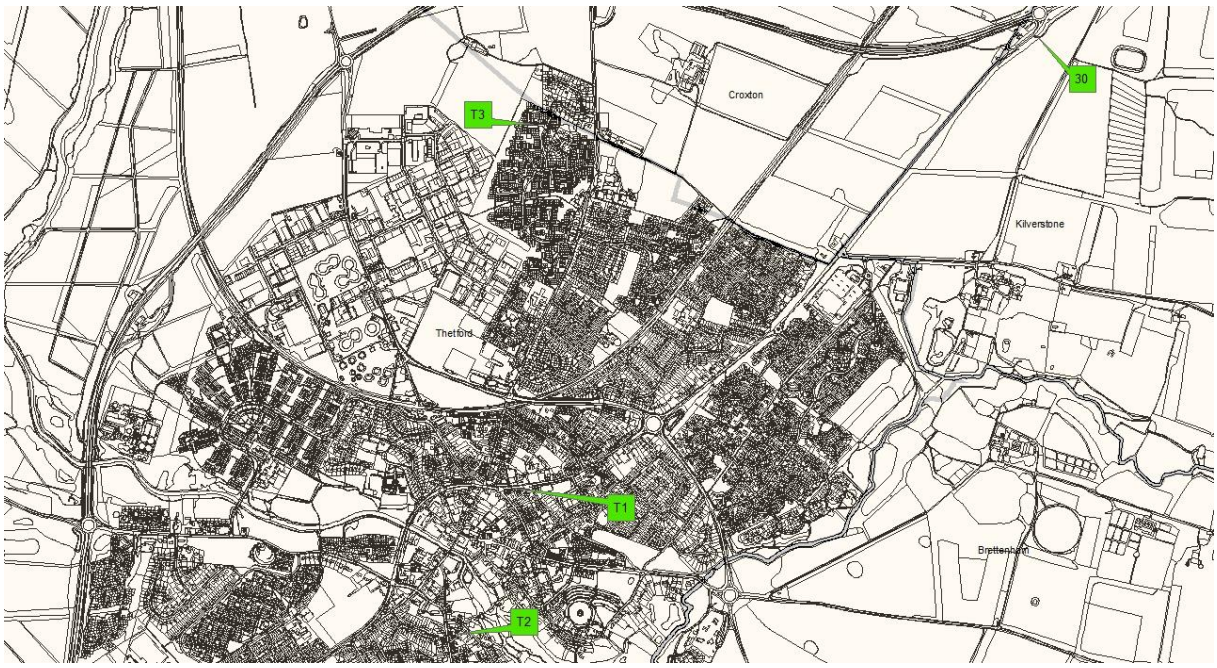
Map to show locations of diffusion tubes in Attleborough



Map to show locations of diffusion tubes in Dereham

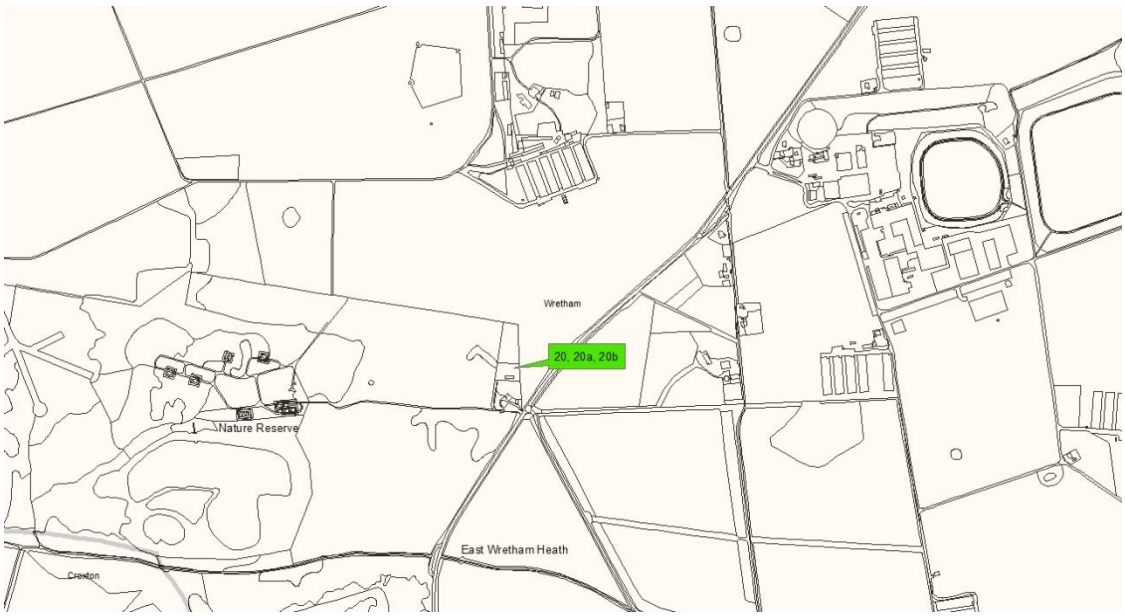


Map of Swaffham showing continuous monitoring site (S3) and diffusion tube sites



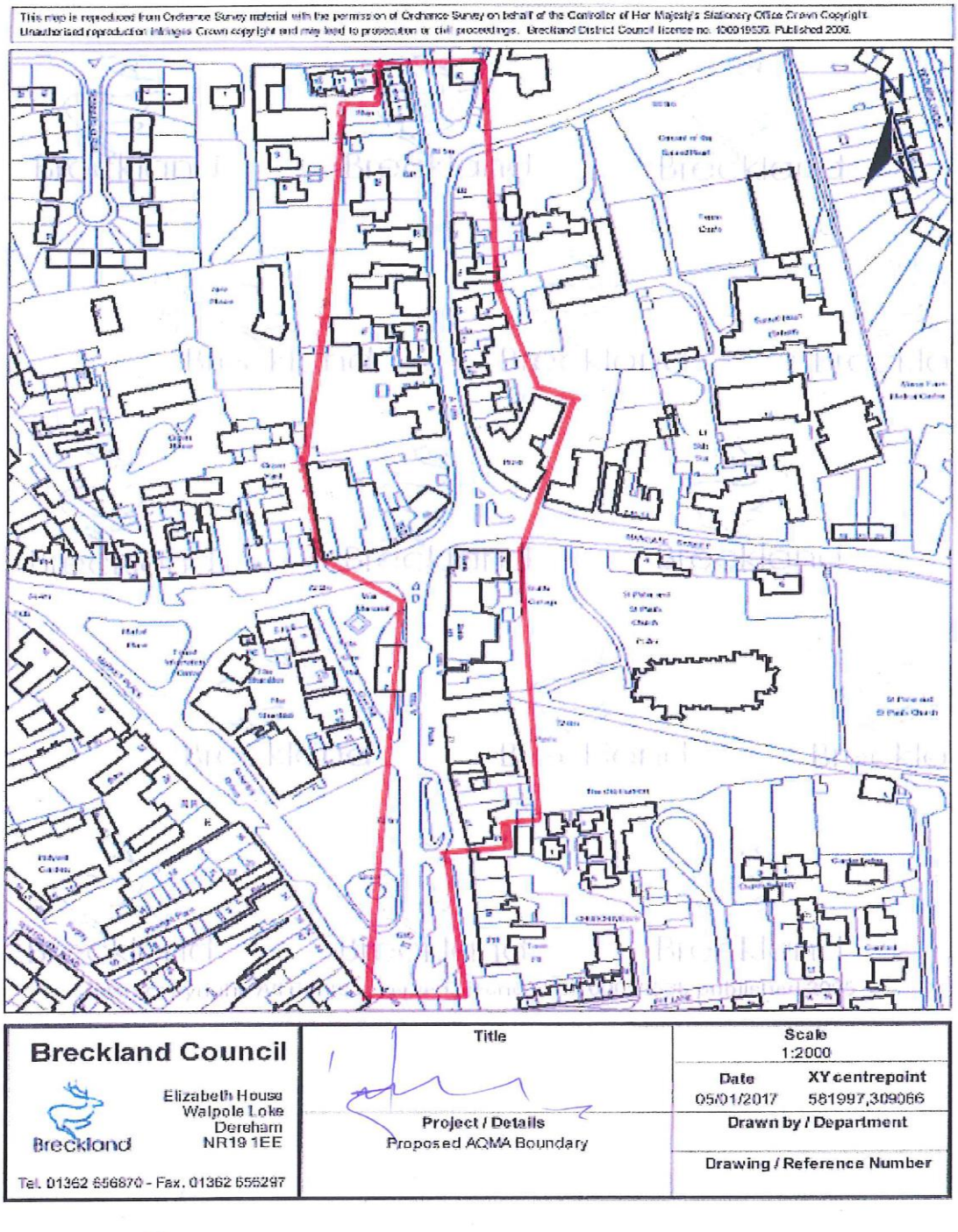
Map to show locations of diffusion tubes in Thetford

Map to show locations of diffusion tubes in Watton



Map to show locations of diffusion tubes and continuous analysers in East Wretham

Reference SAQMA2



Map of boundary for Breckland District Council Air Quality Management Area number 2 Order 2017 Declared 1 May 2017

Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England

Pollutant	Air Quality Objective[4]	
	Concentration	Measured as
Nitrogen Dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean
	40 µg/m^3	Annual mean
Particulate Matter (PM_{10})	50 µg/m^3, not to be exceeded more than 35 times a year	24-hour mean
	40 µg/m^3	Annual mean
Sulphur Dioxide (SO_2)	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean
	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean
	266 µg/m^3, not to be exceeded more than 35 times a year	15-minute mean

[4] The units are in microgrammes of pollutant per cubic metre of air (µg/m^3).

Glossary of Terms

Abbreviation	Description
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the local authority intends to achieve air quality limit values'
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
ASR	Air quality Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by Highways England
EU	European Union
FDMS	Filter Dynamics Measurement System
LAQM	Local Air Quality Management
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
PM_{10}	Airborne particulate matter with an aerodynamic diameter of 10µm (micrometres or microns) or less
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
QA/QC	Quality Assurance and Quality Control
SO_2	Sulphur Dioxide
…	…

References

LAQM TG(16) (2016), *Local Air Quality Management Technical Guidance LAQM.TG(16)*. DEFRA publications London

Breckland (2009) Site Operator's Manual for the Breckland Air Quality Monitoring Sites February 2009 Breckland Council Website

Breckland Council, (2012) *Upgrading and Screening Assessment*. Breckland Council Website

Bureau Veritas, (2012) *Detailed Assessment for Swaffham*. Breckland Council Website

Breckland Council, (2013) *Progress Report*. Breckland Council Website

Breckland Council, (2014) *Progress Report*. Breckland Council Website

Breckland Council, (2015) *Upgrading and Screening Assessment* Breckland Council Website

Breckland Council, (2016) *Annual Status Report* Breckland Council Website

DEFRA (2003) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland: Addendum. Defra Publications: London

Defra and the Devolved Administrations 2009 *Site Operators Manual Automatic Urban and Rural Network* Report No: AEAT/ENV/R2750 March 2009 viewed at http://www.airquality.co.uk/reports/empire/lsoman/lsoman.html

Loader, A., and Targa, J., (2008) Diffusion Tubes for Ambient NO2 Monitoring: Practical Guidance for Laboratories and Users. AEAT/ENV/R/2504 - Issue 1a