









Borough Council of King's Lynn and West Norfolk
**Updating And Screening
Assessment 2015**

Bureau Veritas Air Quality
December 2015



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Borough Council of
**King's Lynn &
West Norfolk**



2015 Updating and Screening
Assessment for the
Borough Council of King's Lynn and West
Norfolk

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

December 2015

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Executive Summary

Part IV of the Environment Act 1995 places a statutory duty on local authorities to review and assess the air quality within their area and take account of Government Guidance when undertaking such work. This Updating and Screening Assessment (USA) is a requirement of the Sixth Round of Review and Assessment for all local authorities. The Report has been undertaken in accordance with the Technical Guidance LAQM.TG(09) and associated tools.

This report considers monitoring data from 2014, assessing this against the Air Quality Strategy (AQS) objectives. It also considers any potential new pollutant emission sources that may have an impact on local air quality.

The review of 2014 monitoring data found that there were two NO₂ diffusion tube locations where the annual mean NO₂ objective was exceeded, one of which was inside the existing Town Centre AQMA. The remaining site was located at the Bus Station monitoring location. This site is not relevant of public exposure with regards to the annual mean NO₂ objective. From the 2014 data it is unlikely that the hourly NO₂ objective would be exceeded at this location as the annual mean is less than 60µg/m³.

Automatic monitoring of PM₁₀ in 2014 revealed that the annual mean and the 24-hour mean PM₁₀ objectives continued to be met at both the North Lynn TEOM monitoring location and all four Osiris sites.

A number of planning applications have been received that through their operation or processes have the potential to impact local air quality. Following review of these applications it is considered that it will not be necessary to undertake any further assessment.

The proposed actions from the 2015 Updating and Screening Assessment are:

- Continue NO₂ diffusion tube and continuous monitoring in the Borough to identify future changes in pollutant concentrations;

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- Undertake further monitoring at relevant receptors in the areas of Stoke Ferry and Page Stair Lane, King's Lynn, using a Defra approved method to confirm existing concentrations; proceed to a monitoring based Detailed Assessment in these areas;
- Proceed to an Annual Progress Report in 2016.

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1 Introduction

1.1 Description of Local Authority Area

The Borough of King's Lynn & West Norfolk covers approximately 550 square miles (142,877 hectares) and is essentially rural in nature. The Borough includes the two market towns of King's Lynn and Downham Market, the Victorian coastal town of Hunstanton, and more than one hundred villages of varying sizes. The Borough is located about 100 miles north of London and stretches from the north Norfolk coast, along the eastern side of The Wash, through the Marshland, Fens and Brecks to the borders of Lincolnshire, Cambridgeshire and Suffolk. The Borough is the tenth largest district council area in England and Wales. In 2010, the population of King's Lynn & West Norfolk was estimated at approximately 143,631 (source: ONS).

King's Lynn is an important nodal point, where major transport routes converge, including a trunk road (A47) and three principal roads (A10, A17 and A134); a direct, electrified rail service to London and Cambridge; an extensive system of inland navigable waterways; and sea links to northern and eastern Europe. The town lies some forty miles from the other regional centres of Cambridge, Norwich and Peterborough.

The main source of air pollution in the Borough is road traffic emissions, notably along the A148 (London Road / Gaywood Road / Wootton Road) going through King's Lynn town centre. Other pollution sources, including commercial, industrial and domestic sources, also make a contribution to background pollution concentrations.

Two Air Quality Management Areas (AQMA) have been declared in King's Lynn where exceedences of the annual mean Air Quality Strategy (AQS) objective for nitrogen dioxide (NO₂) were identified, mainly due to traffic congestion.

Another AQMA had previously been declared in 2002 in South Quay, King's Lynn, where the loading of grain onto vessels, highlighted as a potential source of fugitive PM₁₀ emissions, contributed to the exceedence of the PM₁₀ daily mean AQS objective. However, the South Quay AQMA was revoked in 2006 following the

implementation of an Air Quality Action Plan (AQAP) and evidence that PM₁₀ levels met the objective.

1.2 Purpose of Report

This report fulfils the requirements of the Local Air Quality Management process as set out in Part IV of the Environment Act (1995), the Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2007 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 exceedences are considered likely, the local authority must then 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.

The objective of this Updating and Screening Assessment is to identify any matters that have changed which may lead to risk of an air quality objective being exceeded. A checklist approach and screening tools are used to identify significant new sources or changes and whether there is a need for a Detailed Assessment. The USA report should provide an update of any outstanding information requested previously in Review and Assessment reports.

1.3 Air Quality Objectives

The air quality objectives applicable to LAQM **in England** are set out in the Air Quality (England) Regulations 2000 (SI 928), The Air Quality (England) (Amendment) Regulations 2002 (SI 3043), and are shown in Table 1.1. This table shows the objectives in units of microgrammes per cubic metre $\mu\text{g}/\text{m}^3$ (milligrammes per cubic metre, mg/m^3 for carbon monoxide) with the number of exceedences in each year that are permitted (where applicable).

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Table 1.1: Air Quality Objectives included in Regulations for the purpose of LAQM in England

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	16.25 µg/m ³	Running annual mean	31.12.2003
	5.00 µg/m ³	Annual mean	31.12.2010
1,3-Butadiene	2.25 µg/m ³	Running annual mean	31.12.2003
Carbon monoxide	10.0 mg/m ³	Running 8-hour mean	31.12.2003
Lead	0.5 µg/m ³	Annual mean	31.12.2004
	0.25 µg/m ³	Annual mean	31.12.2008
Nitrogen dioxide	200 µg/m ³ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 µg/m ³	Annual mean	31.12.2005
Particles (PM ₁₀) (gravimetric)	50 µg/m ³ , not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 µg/m ³	Annual mean	31.12.2004
Sulphur dioxide	350 µg/m ³ , not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 µg/m ³ , not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 µg/m ³ , not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

1.4 Summary of Previous Review and Assessments

Between 1999 and 2003, the Borough Council of King's Lynn & West Norfolk undertook its First Round of Review and Assessment of air quality, which concluded that PM₁₀ and NO₂ concentrations were likely to exceed the AQS objectives at a number of locations in King's Lynn. As a result, the Council declared two AQMAs, one in South Quay (for PM₁₀) in April 2002, and another one in Railway Road (for NO₂) in November 2003. The South Quay AQMA was revoked in June 2006 following the effective implementation of an AQAP for the area.

The Second Round of Review and Assessment began with an Updating and Screening Assessment (USA), completed in 2003. The report concluded that there had been no significant changes since the First Round and that it was not necessary to carry out a Detailed Assessment at that time. However, the subsequent Progress Report (2004) recommended proceeding to a Detailed Assessment for NO₂, following

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new monitored exceedences of the annual mean objective outside the AQMA in King's Lynn. The Detailed Assessment (2005) confirmed that exceedences were likely to occur at several sites outside the AQMA, and as a result, made the recommendation to extend the AQMA to encompass properties along Railway Road, Blackfriars Road and London Road.

The Third Round of Review and Assessment began with the USA, completed in 2006. The report provided an update with respect to air quality issues within the Borough since the previous round. A number of changes made to the technical guidance for the Review and Assessment process since the Second Round (Technical Guidance LAQM.TG(03)) were taken into account for this assessment. Having considered each pollutant, the USA concluded that the AQS objectives for benzene, 1,3-butadiene, carbon monoxide, lead, PM₁₀ and sulphur dioxide were still being met and that no further assessment was required for these pollutants. The report also recommended (following the conclusions of the Detailed Assessment 2005) that monitoring of NO₂ be continued in the Borough to validate the proposal to extend the Railway Road AQMA in King's Lynn.

The Council approved a variation order (February 2007) to extend the AQMA, which now includes all of Railway Road, Austin Street, Blackfriars Road, St James Road and London Road.

Modelling undertaken by a neighbouring Local Authority, Fenland District Council, also predicted potential exceedences of the NO₂ annual mean AQS objective along Elm High Road in Wisbech. The area lies on the border of the Borough of King's Lynn & West Norfolk; therefore, both local authorities deployed additional diffusion tubes in the area to confirm the modelling results. Subsequent monitoring for Elm High Road, Wisbech, showed compliance with the annual mean objective for NO₂ and demonstrated that there is no requirement to declare an AQMA.

The Progress Report carried out in 2007 confirmed that NO₂ concentrations were still exceeding the objective at the majority of the monitoring sites in the AQMA; justifying its extension. It also concluded that a Detailed Assessment for NO₂ in Wisbech was not required, as new monitoring results were below the AQS objective. However, new available NO₂ monitoring results showed an exceedence of the objective at the 'Wootton Road 2' diffusion tube in the Gaywood Clock area of King's Lynn. This site

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is located about 1km east of the extended AQMA in the town centre; therefore, it was recommended that a Detailed Assessment be carried out in this area.

The Detailed Assessment, which also included the Further Assessment of the Railway Road AQMA, was completed in 2008. The report concluded that a new AQMA in the Gaywood Clock area was required, as both updated monitoring data and predicted NO₂ concentrations confirmed that the AQS annual mean objective was likely to be exceeded. The new AQMA was declared in April 2009, for an area encompassing properties at the junction of Wootton Road, Gayton Road and Lynn Road.

The Further Assessment confirmed that the extended Railway Road AQMA in King's Lynn Town Centre was still valid and should remain, as both monitoring and modelling confirmed exceedences of the AQS objective. The source apportionment results showed that cars are the main contributors with respect to high levels of NO₂ in the AQMA, followed by buses, HGVs and LGVs, while background pollution levels also contribute significantly.

The 2009 USA took into consideration changes to the Technical Guidance LAQM.TG(09) and concluded that although exceedences of NO₂ were still recorded in the Borough, these were confined to the existing AQMAs. Pollutant concentrations outside the AQMAs met the objectives and no Detailed Assessment was required.

The Further Assessment of the Gaywood Clock AQMA was completed in July 2010. The report confirmed the need for the AQMA as both monitoring and modelled concentrations still exceeded the NO₂ annual mean objective.

The 2010 and 2011 Annual Progress Reports concluded that no new Detailed Assessment were required as there were no new exceedences recorded outside the existing AQMAs.

The 2012 Updating and Screening Assessment found that a Detailed Assessment was required in the Page Stair Lane area due to potential exceedences of the annual mean and 24-hour mean with regards to PM₁₀. During 2011 particulate monitoring was completed in this area using an Osiris instrument, an indicative method of monitoring only.

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The 2012 USA also identified two new developments on Hardwick Road, a new Tesco Superstore and Sainsbury's Superstore, which modelling had predicted to increase NO₂ concentrations on Hardwick Road. Both applications had highway improvements as part of the application and developments. It was advised that the Borough Council of King's Lynn & West Norfolk continue to monitor at this location in order to assess the impact of the development.

The 2013 Progress Report found no exceedences of the NO₂ objectives outside of existing AQMAs. The monitoring site at Hardwick Road showed that the annual mean NO₂ concentrations were generally reducing (based on the 2012 and 2013 diffusion tube results, both of which were below 2011 levels). From this data it would appear that the Tesco and Sainsbury's developments have not led to increases in NO₂ concentrations as predicted. With regards to PM₁₀, the 2012 results from an Osiris monitoring site in Stoke Ferry showed an exceedence of both the annual mean and 24-hour mean objectives. Therefore a Detailed Assessment with regards to PM₁₀ in this area was recommended.

The 2014 Progress Report found no exceedences of the NO₂ objectives outside of the existing AQMAs. At Southgates Park, the concentrations showed an increasing trend in 2012 and 2013. The 2013 results from Gaywood also showed an increase from 2012 and were very close to the annual mean objective. The majority of diffusion tube sites in 2013 showed an increase from 2012 concentrations; however the 2013 concentrations were still lower than those in 2011.

Continuous monitoring of PM₁₀ found that the objectives were met at the TEOM monitoring stations. Osiris monitoring at four locations through the year also showed compliance with the annual mean and 24-hour mean objectives in 2013. The Council continued to undertake PM₁₀ monitoring at relevant receptors in the areas of Stoke Ferry and Page Stair Lane, King's Lynn, using Osiris monitoring to confirm existing concentrations, and so ascertain the necessity to proceed to a Detailed Assessment in these areas.

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Figure 1.1: AQMA 1 King's Lynn Town Centre (Railway Road)

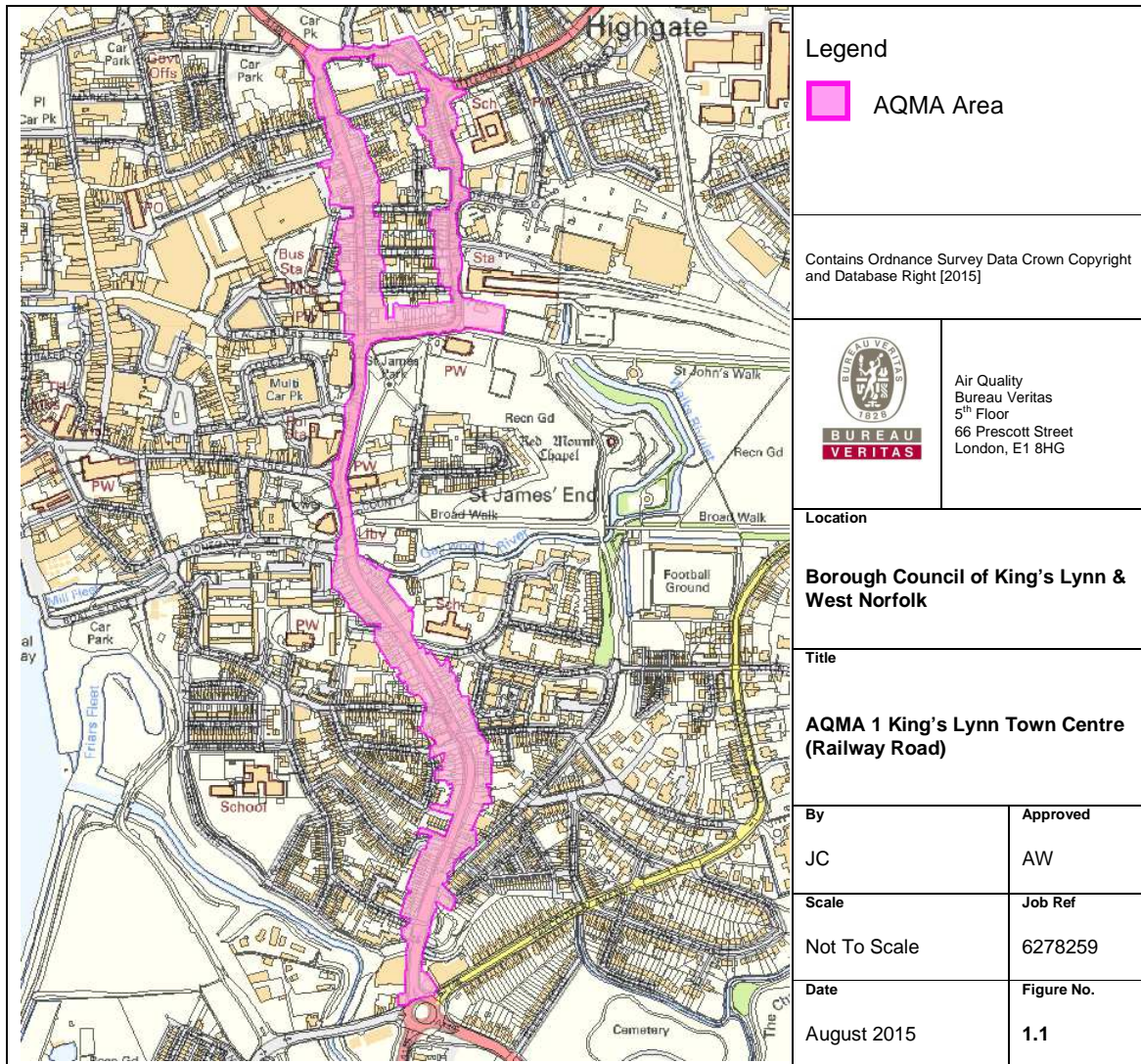
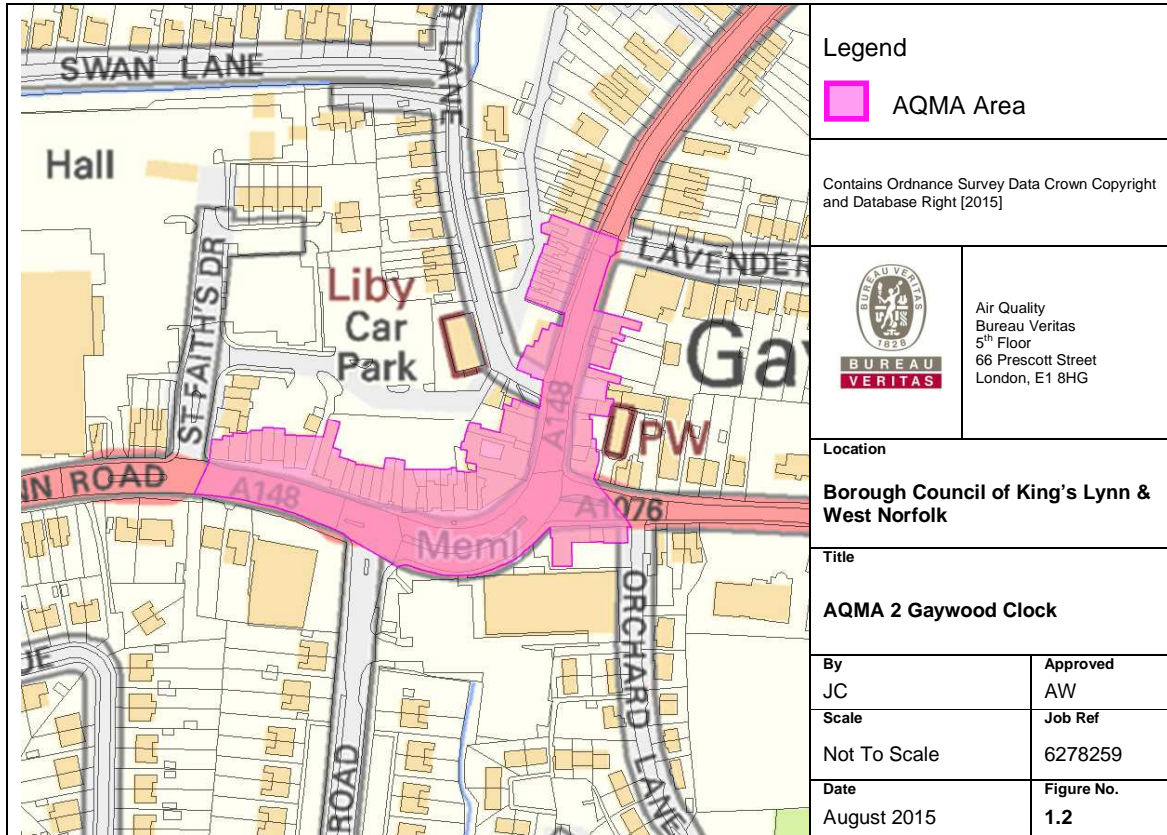


Figure 1.2: AQMA 2 Gaywood Clock



2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

The Borough Council of King's Lynn & West Norfolk undertook continuous monitoring of pollutants using reference methods at three locations during 2014: in Southgates Park, King's Lynn, in Gaywood, King's Lynn, and at the North Lynn site at Edward Benefer Way, King's Lynn (site added in August 2013). These sites are shown in Figure 2.1.

The Southgates Park station, which monitors nitrogen dioxide (NO₂) in King's Lynn town centre AQMA, comprises a chemiluminescence NO_x / NO₂ analyser, which has been operational since 2006. The Southgates Park station previously monitored particulates (PM₁₀) using a TEOM analyser, however this was ceased in March 2013.

The Gaywood monitoring station was installed in 2011; full data capture began in January 2012. The site monitors NO_x / NO₂ using a chemiluminescence analyser.

The North Lynn monitoring site at Edward Benefer Way commenced monitoring in August 2013. The site monitors PM₁₀ using a TEOM analyser.

In 2014 the Council also monitored particulate levels based on the indicative method of Osiris dust and particle analysers across the Borough. Instruments were installed in the following locations:

- the village of Stoke Ferry near an industrial site;
- Page Stair Lane to monitor dust from King's Lynn Docks;
- St Michael's Primary School, Saddlebow Road, King's Lynn, to monitor background concentrations near Saddlebow Road and industrial sites; and
- Estuary Road, King's Lynn near an industrial site/dock.

Further details of these monitoring stations are provided in Table 2.1 and locations illustrated in Figure 2.1 and Figure 2.2.

Figure 2.1: Map of Automatic Monitoring Sites, King's Lynn



Figure 2.2: Map of Automatic Monitoring Site, Stoke Ferry



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Table 2.1: Details of Automatic Monitoring Sites

Site ID	Site Location	Site Type	X OS Grid Reference	Y OS Grid Reference	Inlet Height (m) ^a	Pollutants Monitored	In AQMA?	Monitoring Technique	Relevant Exposure?	Distance to Kerb of Nearest Road (m)	Does this Location Represent Worst-Case Exposure?
Southgates Park, King's Lynn	London Road, King's Lynn	Roadside	562225	319191	1.70	NO ₂	Y	Chemiluminescence,	N	5m	N
Gaywood, King's Lynn	Lynn Road, Gaywood, King's Lynn	Roadside	563437	320472	1.70	NO ₂	Y	Chemiluminescence	Y – 5m	1m	Y
North Lynn, King's Lynn	Edward Benefer Way, off St Edmundsbury Road, King's Lynn	Near-Road	562086	321325	3.00	PM ₁₀	N	TEOM	Y – 35m	17m	Y
Page Stair Lane, King's Lynn	Page Stair Lane, King's Lynn	Industrial	561527	320437	3.50	TSP, PM ₁₀ , PM _{2.5} , PM ₁	N	Osiris	Y – 5m	3.3m	Y
Stoke Ferry	Lynn Road/Furlong Road, Stoke Ferry	Industrial	570339	300083	3.50	TSP, PM ₁₀ , PM _{2.5} , PM ₁	N	Osiris	Y – 5m	1m	Y
St Michael's, King's Lynn	St Michaels C of E Primary School, Saddlebow Road, King's Lynn.	Urban background	561826	318543	3.50	TSP, PM ₁₀ , PM _{2.5} , PM ₁	N	Osiris	Y – 2m	55m	N
Estuary Road, King's Lynn	Estuary Road, King's Lynn	Industrial	561593	321466	3.50	TSP, PM ₁₀ , PM _{2.5} , PM ₁	N	Osiris	Y – 2m	1m	Y

^a Heights are estimates.

2.1.2 Non-Automatic Monitoring Sites

In 2014 the Council monitored NO₂ at 69 sites in the Borough using passive diffusion tubes. The vast majority of the monitoring sites are located in King's Lynn town centre, including a set of triplicate tubes co-located with the continuous monitoring analyser in Southgates.

The Borough Council of King's Lynn and West Norfolk continue to monitor at the following locations in response to a waste incinerator application at the Willows, Saddlebow Industrial Area:

- Site 61- Sydney Terrace;
- Site 62 - Burnley Road;
- Site 63 - Mayfield House Lynn Road, Saddlebow;
- Site 64 - New Farm House, High Road, Saddlebow;
- Site 72 - Ferry Square, West Lynn;
- Site 73 - Main Road, West Winch; and
- Site 74 - Saddlebow Caravan Park, King's Lynn.

In 2014 four new sites were added to the survey:

- Site 82 - The Elms, A47;
- Site 83 - Marshland High School, School Road, West Walton;
- Site 84 - School Road, West Walton; and
- Site 85 - Feltwell Road, Southery.

One monitoring site, Site 78 – King John Bank, was discontinued in 2014.

There are 27 diffusion tube sites located in the town centre AQMA, and 6 other sites within the Gaywood Clock AQMA.

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Diffusion tubes in 2014 were prepared and analysed by Gradko International Limited using 20% triethanolamine (TEA) in water. Quality control procedures, including bias adjustment, are discussed in Appendix A.

The details of the NO₂ monitoring network are shown in Table 2.2 and Figure 2.3 through to Figure 2.6.

Figure 2.3: Map of Non-Automatic Monitoring Sites: King's Lynn

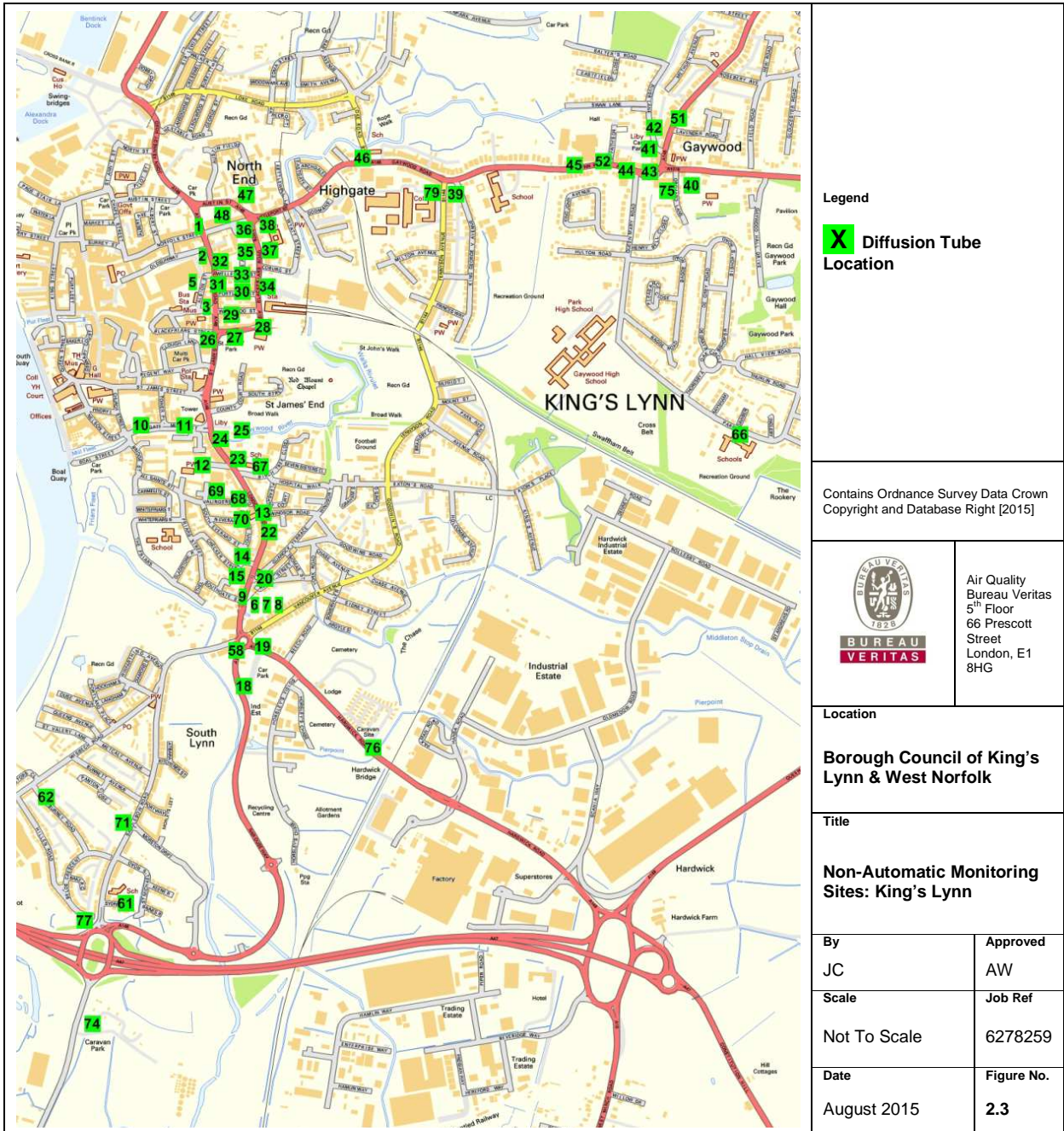


Figure 2.4: Map of Non-Automatic Monitoring Sites: Roydon

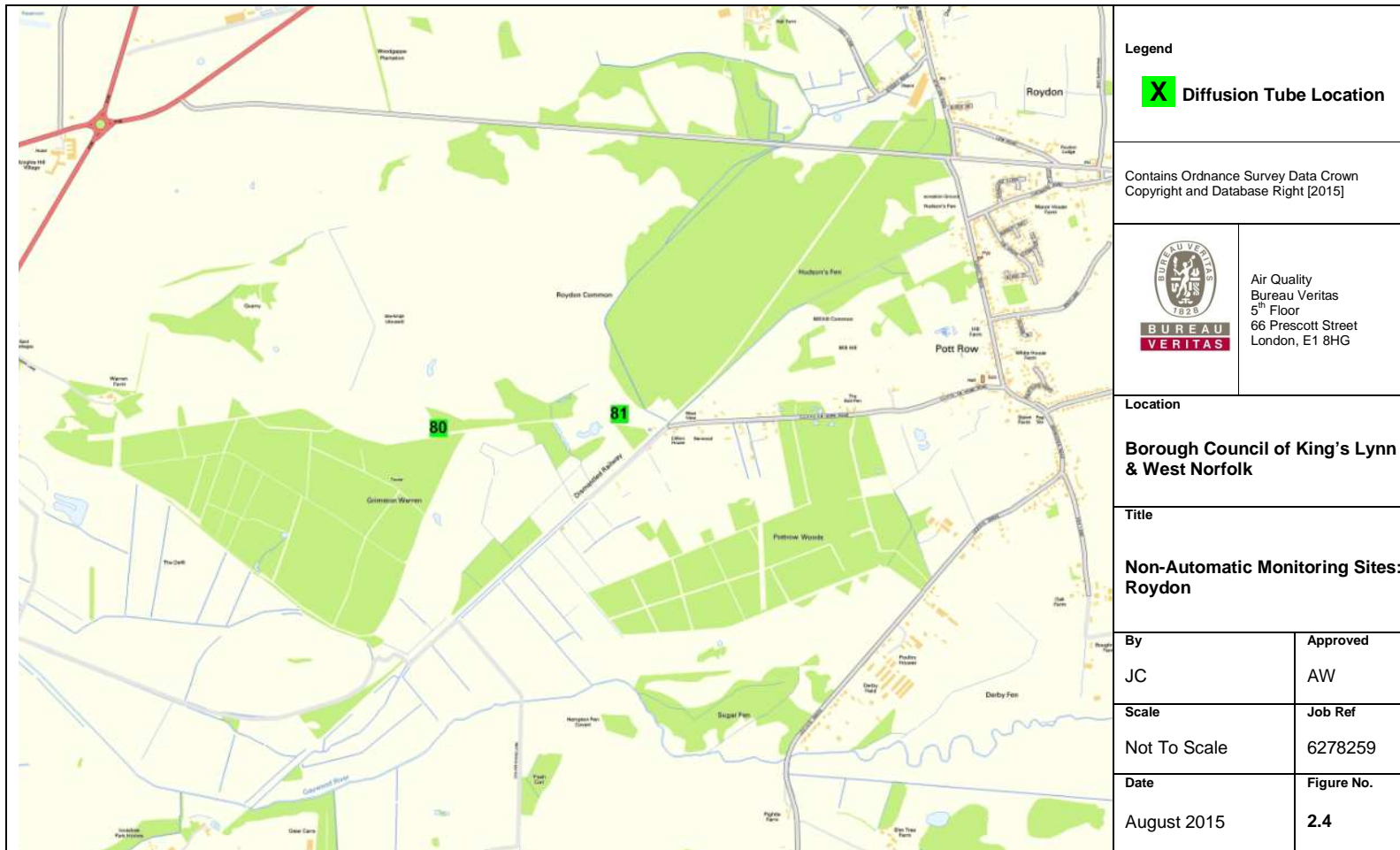
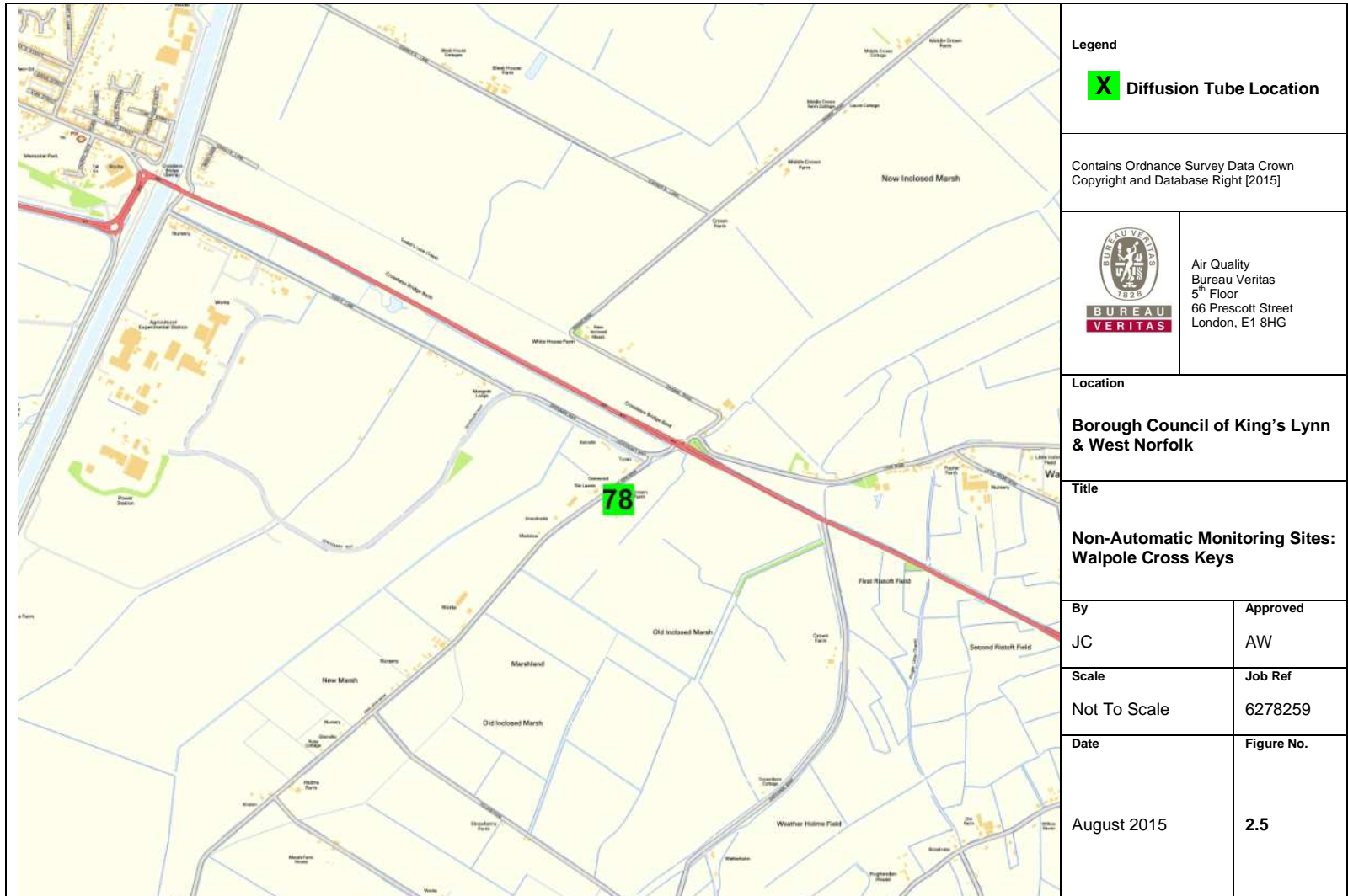


Figure 2.5: Map of Non-Automatic Monitoring Sites: Walpole Cross Keys




<p>Legend</p> <p>X Diffusion Tube Location</p>	
<p>Contains Ordnance Survey Data Crown Copyright and Database Right [2015]</p>	
	<p>Air Quality Bureau Veritas 5th Floor 66 Prescott Street London, E1 8HG</p>
<p>Location</p> <p>Borough Council of King's Lynn & West Norfolk</p>	
<p>Title</p> <p>Non-Automatic Monitoring Sites: Walpole Cross Keys</p>	
<p>By</p> <p>JC</p>	<p>Approved</p> <p>AW</p>
<p>Scale</p> <p>Not To Scale</p>	<p>Job Ref</p> <p>6278259</p>
<p>Date</p> <p>August 2015</p>	<p>Figure No.</p> <p>2.5</p>

Figure 2.6: Map of Non-Automatic Monitoring Sites: Saddlebow and West Winch



Table 2.2: Details of Non-Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure?	Distance to Kerb of Nearest Road (m)	Does this Location Represent Worst-Case Exposure?
1	Railway Road 1	Kerbside	562073	320304	2.5	Y – TC	N	Y - 3m	2m	Y
2	Railway Road 4	Roadside	562100	320222	2.4	Y – TC	N	Y - 0m	2m	Y
3	Railway Road 5	Roadside	562117	320095	2.4	Y – TC	N	Y - 0m	1.5m	Y
5	Bus Station	Roadside (Bus Station)	562055	320137	2.2	N	N	N	N/A	Y
6,7,8	Southgates Monitoring Station	Roadside	562225	319191	3.2	Y – TC	Y	No but property façade 4m from kerb further north	5m	Y
9	Mill Fleet	Roadside	562227	319198	2.5	N	N	No but property façade 4m from kerb in same street	4m	Y
10	London Road 1	Roadside	561900	319707	1.4	Y - TC	N	Y - 2.5m	3m	Y
11	London Road 2	Roadside	562101	319679	2.2	Y – TC	N	Y - 0m	3m	Y
12	London Road 3	Roadside	562154	319594	2.1	Y – TC	N	Y - 1m	3m	Y
13	London Road 4	Roadside	562242	319452	2.2	Y – TC	N	Y - 0m	4.5m	Y
14	London Road 5	Roadside	562227	319266	2.2	Y – TC	N	Y – 0.5m	4m	Y
15	Southgates	Roadside	562226	319263	2.4	Y – TC	N	Y – 1m	0.5m	Y
18	Hardwick Rd	Roadside	562209	318924	1.6	N	N	Y – 0m	7m	Y
19	Vancouver Avenue 1	Roadside	562266	319043	1.5	N	N	Y – 0m	6m	Y
20	London Road 10	Kerbside	562244	319261	2.2	Y – TC	N	Y – 0m	3.5m	Y
22	London Road 6	Roadside	562285	319386	1.3	Y – TC	N	Y – 0m	5m	Y
23	London Road 7	Roadside	562162	319614	2.1	Y – TC	N	Y – 0m	4.5m	Y

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Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure?	Distance to Kerb of Nearest Road (m)	Does this Location Represent Worst-Case Exposure?
24	London Road 8	Roadside	562136	319651	2.2	Y – TC	N	Y – 0m	5.5m	Y
25	The Walks	Urban Background	562191	319695	1.7	N	N	Y – 0m	75m	Y
26	Railway Road 7	Roadside	562131	319996	2.3	Y – TC	N	Y – 0m	2m	Y
27	St John's Terrace	Roadside	562178	319999	2.1	Y – TC	N	Y – 3m	2m	Y
28	St John's Terrace/Blackfriar's	Roadside	562253	320016	2.6	Y – TC	N	Y – 0m	1.5m	Y
29	Waterloo Street	Kerbside	562175	320055	1.6	N	N	Y – 2.5m	1m	Y
30	Portland Street	Kerbside	562204	320108	2.4	N	N	Y – 2.5m	1m	Y
31	Railway Road 2	Kerbside	562129	320132	2.3	Y – TC	N	Y – 0m	2m	Y
32	Railway Road 3	Roadside	562119	320216	2.4	Y – TC	N	Y – 0m	2m	Y
33	Wellsley Street	Kerbside	562203	320159	2.4	N	N	Y – 2.5m	0.5m	Y
34	Blackfriars 2	Roadside	562244	320129	2.4	Y – TC	N	Y – 0m	2.5m	Y
35	Blackfriars 1	Roadside	562248	320239	2.3	Y – TC	N	Y – 3m	1.5m	Y
36	Norfolk Street	Roadside	562219	320319	2.2	Y – TC	N	Y – 0m	2m	Y
37	Blackfriars 3	Roadside	562257	320243	2.5	Y – TC	N	No	2m	Y
38	Littleport Street	Roadside	562257	320323	2.4	Y – TC	N	Y – 0m	2.5m	Y
39	Gaywood Road 2	Roadside	562822	320427	5	N	N	Y – 0m	7m	Y
40	The Swan (1) Gayton Road	Roadside	563480	320470	2.5	Y – GC	N	Y – 0m	2m	Y
41	Wootton Road 2	Roadside	563478	320515	3.4	Y – GC	N	Y – 0m	2m	Y
42	Wootton Road 1	Roadside	563480	320582	1.7	Y – GC	N	Y – 0m	3m	Y
43	Lynn Road 1	Roadside	563412	320477	3.4	Y – GC	N	Y – 0m	5m	Y

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Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure?	Distance to Kerb of Nearest Road (m)	Does this Location Represent Worst-Case Exposure?
44	Lynn Road 2	Roadside	563377	320484	3.4	Y – GC	N	Y – 0m	2m	Y
45	Gaywood Road 3	Roadside	563202	320488	2.2	N	N	Y – 0m	4.5m	Y
46	Gaywood Road 1	Roadside	562565	320509	2.09	N	N	Y – 0m	6.5m	Y
47	Austin Street 1	Roadside	562193	320369	1.7	Y – TC	N	Y – 0.5m	1m	Y
48	Austin Street 2	Roadside	562180	320365	2.6	Y – TC	N	Y – 0m	2m	Y
51	Wootton Road 3	Roadside	563515	320628	1.8	N	N	Y – 6m	1.5m	Y
52	Lynn Road 3	Roadside	563288	320499	1.6	N	N	Y – 5.5m	1m	Y
58	NORR	Roadside	562186	319031	2.5	N	N	Y – 18m	2m	Y
61	Sydney Terrace	Roadside	561854	318272	1.55	N	N	Y – 0m	3.5m	Y
62	Burney Road	Roadside	561615	318591	1.55	N	N	Y – 0m	7m	Y
63	Lynn Road, Saddlebow	Roadside	560593	315712	1.7	N	N	Y – 0m	15m	N
64	High Road, Saddlebow	Roadside	560917	316766	1.7	N	N	Y – 0m	22m	N
66	Gaywood Road	Urban Background	563699	319679	2.4	N	N	Y – 0m	N/A	Y
67	Greyfriars, London Road	Urban Background	562222	319576	2.3	N	N	Y – 0m	N/A	Y
68	Nursery, London Road	Urban Background	562208	319493	1.6	N	N	Y – 0m	N/A	Y
69	Whitefriars 1, Whitefriars Road	Urban Background	562215	319502	2.2	N	N	Y – 0m	N/A	Y
70	Whitefriars 2, Whitefriars Road	Urban Background	562215	319502	2.4	N	N	Y – 0m	N/A	Y
71	St Michael's,	Urban	561846	318514	2.2	N	N	Y – 0m	N/A	Y

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Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure?	Distance to Kerb of Nearest Road (m)	Does this Location Represent Worst-Case Exposure?
	Saddlebow Road	Background								
72	Ferry Square West Lynn	Roadside	561223	320295	2.2	N	N	Y – 0.5m	1.5m	Y
73	Main Road, West Winch	Urban Background	563161	315848	1.7	N	N	Y – 10m	11m	Y
74	Saddlebow Caravan Park, King's Lynn	Roadside	561754	317910	2.2	N	N	Y – 5m	1m	Y
75	The Swan (2) Gayton Road	Roadside	563480	320470	2.8	Y – GC	N	Y – 0m	2m	Y
76	Hardwick Road	Roadside	562597	318739	1.58	N	N	Y – 1m	8m	N
77	Hillen Road	Near-Road	561730	318220	1.88	N	N	Y-0m	13m	Y
78	King John Bank	Urban background	550039	319757	1.78	N	N	Y – 0m	45m	Y
79	Tennyson Ave	Roadside	562804	320422	3.8	N	N	Y – 0m	2m	Y
80	Roydon Common top	Rural	568100	321789	1.44	N	N	Y – 360m	934m	N
81	Roydon Common bottom	Rural	568809	321844	1.47	N	N	Y – 180m	200m	N
82	The Elms	Suburban	560778	318503	1.7	N	N	Y – 0m	115m	Y
83	Marshland High School	Suburban	547773	313150	2.4	N	N	Y – 0m	2m	Y
84	School Road, West Walton	Suburban	547807	313096	1.7	N	N	Y – 0m	16m	Y
85	Feltwell Road, Southery,	Suburban	562110	294806	1.6	N	N	Y – 0m	12m	Y

Note, TC – Town Centre, GC – Gaywood Clock

2.2 Comparison of Monitoring Results with Air Quality Objectives

2.2.1 Nitrogen Dioxide

There are two AQS objectives for NO₂, namely:

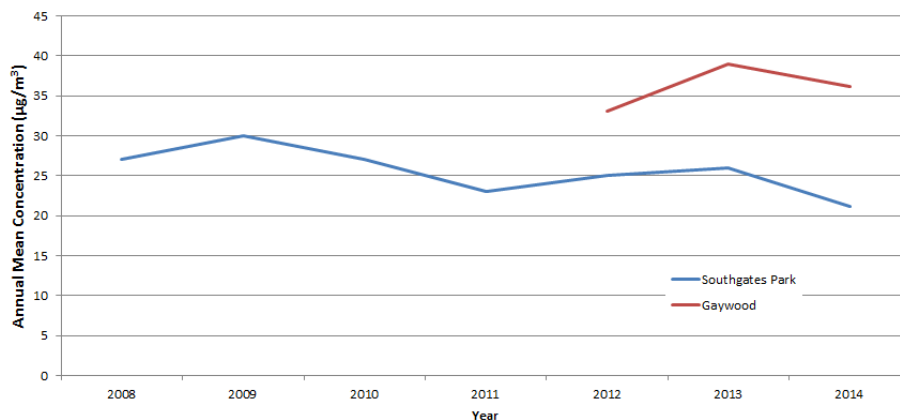
- the annual mean of 40 µg/m³; and
- the 1-hour mean of 200 µg/m³ not to be exceeded more than 18 times per year.

Automatic Monitoring Data

The Council monitored NO₂ at two locations during 2014: the roadside Southgates Park monitoring station in King's Lynn and the Gaywood monitoring station. Data capture was good during 2014 at both sites and as such annualisation is not required. The monitoring data can be seen in Table 2.3 and Table 2.4 below. Results for 2014 indicate that both the annual mean objective and the 1-hour objective were met at both monitoring locations.

Figure 2.7 shows the trend in NO₂ concentration from 2008 through to 2014 at the Southgates Park and Gaywood monitoring locations. At Southgates Park, the concentrations peaked in 2009; following this, the annual mean has shown a generally decreasing trend through to 2014. The 2014 annual mean NO₂ concentration at Gaywood is observed to be below 2013 concentration level, but above the 2012 level.

Figure 2.7: Trends in Annual Mean NO₂ Concentrations Measured at Automatic Monitoring Sites



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Table 2.3: Results of Automatic Monitoring for NO₂: Comparison with Annual Mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture for Monitoring Period %	Valid Data Capture 2014 %	Annual Mean Concentration (µg/m ³)						
					2008	2009	2010	2011	2012	2013	2014
Southgates Park, King's Lynn	Roadside	Y	98.7	98.7	27	30	27	23	25	26	21
Gaywood, King's Lynn	Roadside	Y	98.0	98.0	-	-	-	-	33	39	36

Table 2.4: Results of Automatic Monitoring for NO₂: Comparison with 1-hour Mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture for Monitoring Period %	Valid Data Capture 2014 %	Number of Hourly Means > 200µg/m ³						
					2008	2009	2010	2011	2012	2013	2014
Southgates Park, King's Lynn	Roadside	Y	98.7	98.7	0	0	0	0	0	0	0
Gaywood, King's Lynn	Roadside	Y	98.0	98.0	-	-	-	-	0	0	0

Diffusion Tube Monitoring Data

The NO₂ diffusion tube data are summarised in Table 2.6. The full dataset (monthly mean values) are included in Appendix A.

Annualisation was required for three sites only, Site 71, and the new sites 83 and 84. Full details regarding the annualisation can be found in Appendix A.

The discontinued Site 78 – King John Bank and the new site 85 – Feltwell Road, Southery, only had data capture of 1 month. Results of these sites have therefore been expressed as the raw monitoring value without bias adjustment or annualisation.

For the 2014 data set there were two sites where the annual mean NO₂ objective was exceeded as shown in Table 2.5.

Table 2.5: Diffusion tube sites where the annual mean NO₂ objective was exceeded in 2014

Site ID	Site Name	Within AQMA?	2014 Annual Mean Concentration (µg/m ³) – Local Bias Adjustment factor = 0.9	Comments
2	Railway Road 4	Y – Town Centre	47.1	Exceedences in each of six previous years.
5	Bus Station	N	46.0	Exceedences in each of three previous years.

One of the sites showing to be exceeding, Railway Road 4, is located within the existing Town Centre AQMA. Of the 26 other sites located within the Town Centre AQMA, the following five are within 10% of the 40 µg/m³ annual mean objective:

- Railway Road 1;
- Railway Road 5;
- London Road 1;
- Southgates; and
- Railway Road 7.

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Site 44 (Lynn Road 1) was the only site located within the Gaywood Clock AQMA where 2014 NO₂ concentrations were within 10% of the 40 µg/m³ annual mean objective.

Site 5 (Bus Station) was the only site to exceed the annual mean objective outside of the existing AQMAs. This site is positioned to give an indication as to whether the hourly objective is likely to be met at this location, as there is relevant exposure with regards to this objective as people may spend up to one hour at the bus station. There is no relevant exposure with regards to the annual mean. With respect to the hourly NO₂ objective, there could be a potential risk of exceedence where the annual mean concentration is greater than 60 µg/m³. As the NO₂ concentrations in 2014 was considerably below 60 µg/m³ it is unlikely that the hourly mean objective will be exceeded at this site.

The 2012 Updating and Screening Assessment identified that there was the potential for increases in NO₂ emissions following ADMS Roads modelling in relation to the Tesco Store and Sainsbury developments on Hardwick Road. The Borough Council of King's Lynn and West Norfolk therefore commissioned monitoring on Hardwick Road (Site 18) to monitor the effects of the developments. The NO₂ concentration has remained well below the 40 µg/m³ annual mean objective since 2013, ranging between 31.5 µg/m³ and 25.4 µg/m³.

Table 2.6: Results of Nitrogen Dioxide Diffusion Tubes in 2014

Site ID	Location	Site Type	Within AQMA?	Triplicate or Co-located Tube	Full Calendar Year Data Capture 2014 (Number of Months)	2014 Annual Mean Concentration ($\mu\text{g}/\text{m}^3$) - Bias Adjustment factor = 0.91
1	Railway Road 1	Kerbside	Y – TC	N	12	38.2
2	Railway Road 4	Roadside	Y – TC	N	12	47.1
3	Railway Road 5	Roadside	Y – TC	N	10	39.6
5	Bus Station	Roadside (Bus Station)	N	N	12	46.0
6,7,8	Southgates Monitoring Station	Roadside	Y – TC	Y	12	26.6
9	Mill Fleet	Roadside	N	N	12	21.2
10	London Road 1	Roadside	Y - TC	N	12	38.1
11	London Road 2	Roadside	Y – TC	N	12	30.4
12	London Road 3	Roadside	Y – TC	N	11	34.5
13	London Road 4	Roadside	Y – TC	N	12	31.5
14	London Road 5	Roadside	Y – TC	N	12	35.0
15	Southgates	Roadside	Y – TC	N	12	38.5
18	Hardwick Rd	Roadside	N	N	12	26.6
19	Vancouver Avenue 1	Roadside	N	N	12	23.6
20	London Road 10	Kerbside	Y – TC	N	12	33.0
22	London Road 6	Roadside	Y – TC	N	11	34.1
23	London Road 7	Roadside	Y – TC	N	12	35.2
24	London Road 8	Roadside	Y – TC	N	12	32.2
25	The Walks	Urban Background	N	N	11	16.3
26	Railway Road 7	Roadside	Y – TC	N	11	36.1

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Site ID	Location	Site Type	Within AQMA?	Triplicate or Co-located Tube	Full Calendar Year Data Capture 2014 (Number of Months)	2014 Annual Mean Concentration ($\mu\text{g}/\text{m}^3$) - Bias Adjustment factor = 0.91
27	St John's Terrace	Roadside	Y – TC	N	12	30.1
28	St John's Terrace/Blackfriar's	Roadside	Y – TC	N	11	30.1
29	Waterloo Street	Kerbside	N	N	9	17.5
30	Portland Street	Kerbside	N	N	11	21.3
31	Railway Road 2	Kerbside	Y – TC	N	12	30.8
32	Railway Road 3	Roadside	Y – TC	N	11	31.0
33	Wellsley Street	Kerbside	N	N	12	29.8
34	Blackfriars 2	Roadside	Y – TC	N	12	32.1
35	Blackfriars 1	Roadside	Y – TC	N	12	28.9
36	Norfolk Street	Roadside	Y – TC	N	11	29.2
37	Blackfriars 3	Roadside	Y – TC	N	12	33.0
38	Littleport Street	Roadside	Y – TC	N	9	35.1
39	Gaywood Road 2	Roadside	N	N	12	26.8
40	The Swan (1) Gayton Road	Roadside	Y – GC	N	12	32.7
41	Wootton Road 2	Roadside	Y – GC	N	12	35.2
42	Wootton Road 1	Roadside	Y – GC	N	12	29.7
43	Lynn Road 1	Roadside	Y – GC	N	12	30.8
44	Lynn Road 2	Roadside	Y – GC	N	12	36.5
45	Gaywood Road 3	Roadside	N	N	12	26.9
46	Gaywood Road 1	Roadside	N	N	12	26.1
47	Austin Street 1	Roadside	Y – TC	N	12	34.9
48	Austin Street 2	Roadside	Y – TC	N	11	32.0
51	Wootton Road 3	Roadside	N	N	12	19.0

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Site ID	Location	Site Type	Within AQMA?	Triplicate or Co-located Tube	Full Calendar Year Data Capture 2014 (Number of Months)	2014 Annual Mean Concentration ($\mu\text{g}/\text{m}^3$) - Bias Adjustment factor = 0.91
52	Lynn Road 3	Roadside	N	N	12	28.7
58	NORR	Roadside	N	N	12	28.9
61	Sydney Terrace	Roadside	N	N	12	14.7
62	Burney Road	Roadside	N	N	12	16.6
63	Lynn Road, Saddlebow	Roadside	N	N	12	10.4
64	High Road, Saddlebow	Roadside	N	N	12	11.1
66	Gaywood Road	Urban Background	N	N	9	18.7
67	Greyfriars , London Road	Urban Background	N	N	12	16.8
68	Nursery, London Road	Urban Background	N	N	11	19.5
69	Whitefriars 1, Whitefriars Road	Urban Background	N	N	11	14.1
70	Whitefriars 2, Whitefriars Road	Urban Background	N	N	10	13.9
71	St Michael's, Saddlebow Road	Urban Background	N	N	7	18.4*
72	Ferry Square West Lynn	Roadside	N	N	10	13.1
73	Main Road, West Winch	Urban Background	N	N	10	24.2
74	Saddlebow Caravan Park, King's Lynn	Roadside	N	N	12	14.8
75	The Swan (2) Gayton Road	Roadside	Y – GC	N	10	35.2
76	Hardwick Road	Roadside	N	N	11	19.1
77	Hillen Road	Near-Road	N	N	12	16.9

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Site ID	Location	Site Type	Within AQMA?	Triplicate or Co-located Tube	Full Calendar Year Data Capture 2014 (Number of Months)	2014 Annual Mean Concentration ($\mu\text{g}/\text{m}^3$) - Bias Adjustment factor = 0.91
78	King John Bank	Urban background	N	N	1	19.7**
79	Tennyson Ave	Roadside	N	N	10	34.5
80	Roydon Common top	Rural	N	N	11	8.9
81	Roydon Common bottom	Rural	N	N	11	10.7
82	The Elms	Suburban	N	N	10	11.8
83	Marshland High School	Suburban	N	N	3	13.4*
84	School Road, West Walton	Suburban	N	N	3	11.1*
85	Feltwell Road, Southery	Suburban	N	N	1	12.5**

Notes – Exceedences of the NO₂ annual mean AQS objective of 40 $\mu\text{g}/\text{m}^3$ in bold.

TC – Town Centre, GC – Gaywood Clock.

* - Diffusion tube with data capture of less than 25% - 75% has been annualised.

** - Diffusion tube with data capture of less than 25% have been reported as un bias adjusted period means

Table 2.7: Results of Nitrogen Dioxide Diffusion Tubes (2008 to 2014)

Site ID	Site Type	Within AQMA?	Annual Mean Concentration ($\mu\text{g}/\text{m}^3$) - Adjusted for Bias						
			2008 (Bias Adjustment Factor = 0.76)	2009 (Bias Adjustment Factor = 0.83)	2010 (Bias Adjustment Factor = 0.89)	2011 (Bias Adjustment Factor = 0.70)	2012 (Bias Adjustment Factor = 0.84)	2013 (Bias Adjustment Factor = 0.90)	2014 (Bias Adjustment Factor = 0.91)
1	Kerbside	Y – TC	44.4	46.7	37.4	35.7	38.2	37.1	38.2
2	Roadside	Y – TC	51.5	56.6	46.8	50.3	42.6	47.1	47.1
3	Roadside	Y – TC	46.8	53.1	45.6	45.4	38.3	42.2	39.6
5	Roadside (Bus Station)	N	40.0	41.6	38.1	42.5	40.9	43.9	46.0
6,7,8	Roadside	Y – TC	28.9	29.5	27.1	25.2	24.2	25.9	26.6
9	Roadside	N	23.4	24.4	24.6	22.3	19.9	22.9	21.2
10	Roadside	Y	41.1	45.8	40.0	42.1	36.5	38.5	38.1
11	Roadside	Y – TC	31.6	34.6	31.9	30.6	28.4	28.4	30.4
12	Roadside	Y – TC	38.5	39.6	33.5	33.9	31.3	33.5	34.5
13	Roadside	Y – TC	36.0	38.5	32.7	32.0	30.1	30.8	31.5
14	Roadside	Y – TC	39.1	37.5	37.5	34.3	34.9	34.4	35.0
15	Roadside	Y – TC	42.1	44.3	43.8	36.7	35.4	36.7	38.5
18	Roadside	N	30.0	31.5	28.4	28.2	25.4	26.4	26.6
19	Roadside	N	24.6	29.0	26.3	25.3	24.0	24.8	23.6
20	Kerbside	Y – TC	32.2	36.2	33.7	30.6	27.8	33.5	33.0
22	Roadside	Y – TC	37.2	38.8	38.6	34.7	30.6	33.3	34.1
23	Roadside	Y – TC	35.5	35.9	39.0	34.3	31.9	36.2	35.2
24	Roadside	Y – TC	32.2	36.6	34.1	31.8	30.2	32.5	32.2
25	Urban Background	N	18.8	20.1	17.9	17.3	17.0	16.4	16.3

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Site ID	Site Type	Within AQMA?	Annual Mean Concentration ($\mu\text{g}/\text{m}^3$) - Adjusted for Bias						
			2008 (Bias Adjustment Factor = 0.76)	2009 (Bias Adjustment Factor = 0.83)	2010 (Bias Adjustment Factor = 0.89)	2011 (Bias Adjustment Factor = 0.70)	2012 (Bias Adjustment Factor = 0.84)	2013 (Bias Adjustment Factor = 0.90)	2014 (Bias Adjustment Factor = 0.91)
26	Roadside	Y – TC	40.7	43.0	37.8	37.7	35.2	37.2	36.1
27	Roadside	Y – TC	31.9	37.7	33.8	32.5	29.6	30.4	30.1
28	Roadside	Y – TC	33.9	36.8	29.5	32.1	27.8	32.1	30.1
29	Kerbside	N	24.8	25.8	23.5	23.1	20.7	18.5	17.5
30	Kerbside	N	25.2	28.4	24.4	26.5	22.0	22.8	21.3
31	Kerbside	Y – TC	36.8	43.5	38.5	35.4	34.7	32.7	30.8
32	Roadside	Y – TC	33.8	37.9	33.4	33.4	29.1	30.6	31.0
33	Kerbside	N	32.7	35.2	30.7	30.4	26.7	26.9	29.8
34	Roadside	Y – TC	35.4	39.4	32.9	33.8	30.4	31.3	32.1
35	Roadside	Y – TC	33.1	37.6	34.3	30.6	28.7	29.9	28.9
36	Roadside	Y – TC	34.9	36.9	30.8	31.7	29.6	28.6	29.2
37	Roadside	Y – TC	32.1	37.4	34.0	32.3	27.4	35.2	33.0
38	Roadside	Y – TC	39.5	44.5	37.5	36.7	33.8	31.7	35.1
39	Roadside	N	27.8	31.5	29.0	28.9	24.6	27.5	26.8
40	Roadside	Y – GC	36.6	39.0	33.7	35.7	32.2	31.7	32.7
41	Roadside	Y – GC	40.4	45.1	42.4	38.8	31.8	37.1	35.2
42	Roadside	Y – GC	31.6	35.4	31.2	30.6	30.6	30.8	29.7
43	Roadside	Y – GC	30.0	32.7	32.0	29.4	29.2	30.6	30.8
44	Roadside	Y – GC	34.1	38.6	35.8	35.5	32.5	35.5	36.5
45	Roadside	N	30.8	33.3	34.4	31.5	28.4	31.5	26.9
46	Roadside	N	28.2	30.4	28.7	27.3	24.1	26.3	26.1
47	Roadside	Y – TC	41.0	43.8	39.5	38.3	34.1	33.9	34.9

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Site ID	Site Type	Within AQMA?	Annual Mean Concentration ($\mu\text{g}/\text{m}^3$) - Adjusted for Bias						
			2008 (Bias Adjustment Factor = 0.76)	2009 (Bias Adjustment Factor = 0.83)	2010 (Bias Adjustment Factor = 0.89)	2011 (Bias Adjustment Factor = 0.70)	2012 (Bias Adjustment Factor = 0.84)	2013 (Bias Adjustment Factor = 0.90)	2014 (Bias Adjustment Factor = 0.91)
48	Roadside	Y – TC	33.4	38.3	30.6	33.7	29.4	30.2	32.0
51	Roadside	N	21.4	23.6	20.5	20.7	19.0	19.6	19.0
52	Roadside	N	30.7	37.0	32.1	29.6	28.6	29.4	28.7
58	Roadside	N	30.8	34.3	29.1	26.2	23.9	30.1	28.9
61	Roadside	N	-	-	17.2	18.2	15.8	16.9	14.7
62	Roadside	N	-	-	18.8	17.8	18.1	17.7	16.6
63	Roadside	N	-	-	13.7	11.2	10.6	11.5	10.4
64	Roadside	N	-	-	12.2	11.6	10.8	11.3	11.1
66	Urban Background	N	26.2	26.0	24.0	22.8	21.9	22.3	18.7
67	Urban Background	N	21.5	21.9	18.8	18.7	17.5	18.2	16.8
68	Urban Background	N	23.8	25.3	22.8	25.0	24.4	21.0	19.5
69	Urban Background	N	17.5	18.5	16.1	15.2	15.0	13.8	14.1
70	Urban Background	N	16.5	17.0	17.3	15.0	12.1	12.5	13.9
71	Urban Background	N	-	-	17.2	18.3	17.5	16.4	18.4*
72	Roadside	N	-	-	-	13.9	12.3	12.8	13.1
73	Urban Background	N	-	-	-	21.2	22.8	28.0	24.2
74	Roadside	N	-	-	-	15.5	15.0	14.5	14.8
75	Roadside	Y	-	-	-	-	30.1	34.8	35.2

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Site ID	Site Type	Within AQMA?	Annual Mean Concentration ($\mu\text{g}/\text{m}^3$) - Adjusted for Bias						
			2008 (Bias Adjustment Factor = 0.76)	2009 (Bias Adjustment Factor = 0.83)	2010 (Bias Adjustment Factor = 0.89)	2011 (Bias Adjustment Factor = 0.70)	2012 (Bias Adjustment Factor = 0.84)	2013 (Bias Adjustment Factor = 0.90)	2014 (Bias Adjustment Factor = 0.91)
76	Roadside	N	-	-	-	-	-	20.1	19.1
77	Near-Road	N	-	-	-	-	-	16.0	16.9
78	Urban background	N	-	-	-	-	-	11.2	19.7**
79	Roadside	N	-	-	-	-	-	34.6	34.5
80	Rural	N	-	-	-	-	-	9.7	8.9
81	Rural	N	-	-	-	-	-	9.8	10.7
82	Suburban	N	-	-	-	-	-	-	11.8
83	Suburban	N	-	-	-	-	-	-	13.4*
84	Suburban	N	-	-	-	-	-	-	11.1*
85	Suburban	N	-	-	-	-	-	-	12.5**

Notes – Exceedences of the NO₂ annual mean AQS objective of 40 $\mu\text{g}/\text{m}^3$ in bold.

TC – Town Centre, GC – Gaywood Clock.

* - Diffusion tube with data capture of less than 25% - 75% has been annualised.

** - Diffusion tube with data capture of less than 25% have been reported as un bias adjusted period means

Figure 2.8: Trends in Annual Mean Nitrogen Dioxide Concentrations Measured at Diffusion Tube Monitoring Sites – King's Lynn AQMA 1 – Northern Sites

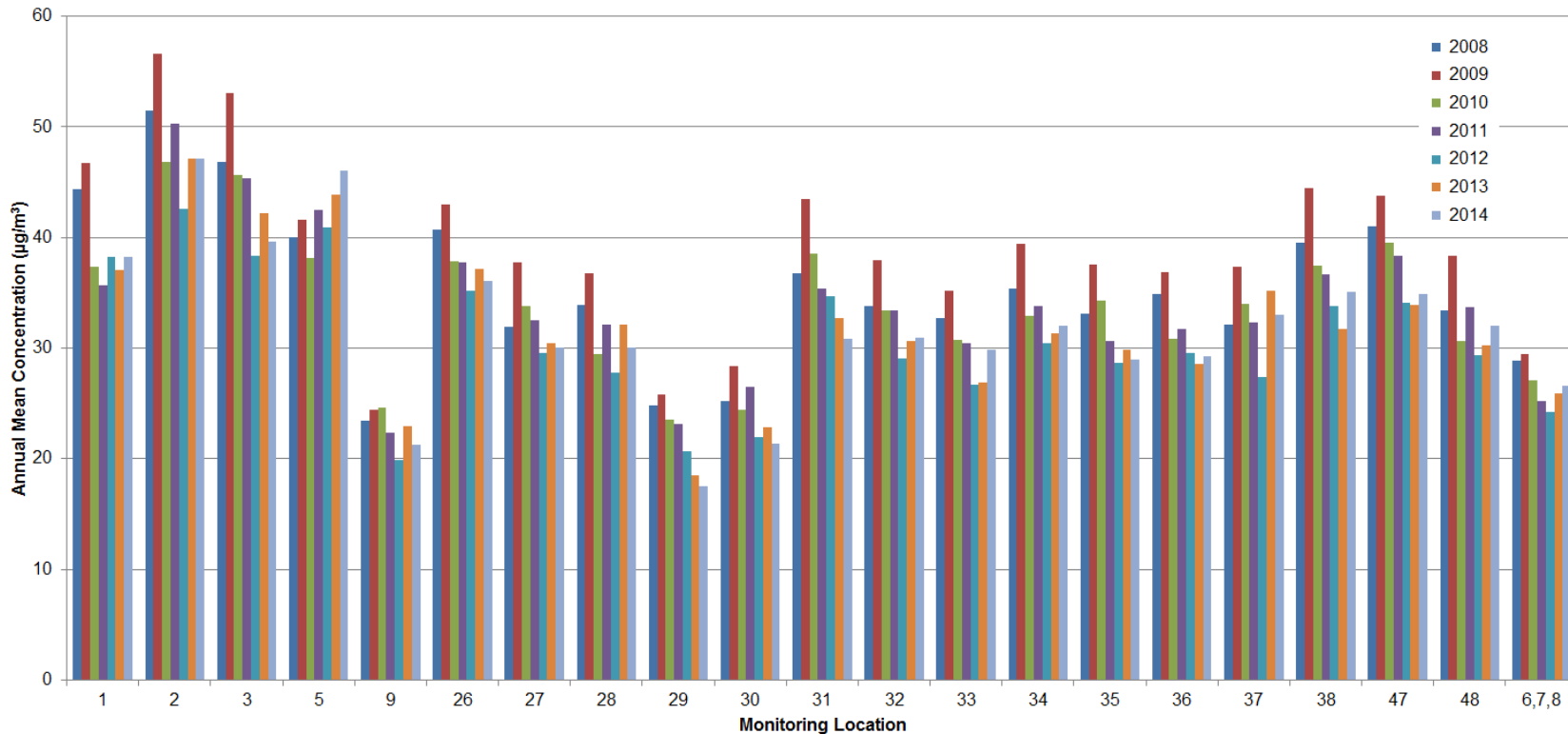


Figure 2.8 shows the trend in NO₂ concentrations for those sites located in the northern areas of the Town Centre AQMA. In 2014 around half of the sites showed an increase in the NO₂ concentration when compared to 2013 levels and around half showed a decrease. The graph shows that in the north of the town there were two locations (Sites 2 and 5) where the concentration in 2014 exceeded the annual mean of 40 µg/m³.

Figure 2.9: Trends in Annual Mean Nitrogen Dioxide Concentrations Measured at Diffusion Tube Monitoring Sites – King's Lynn AQMA 1 – Southern Sites

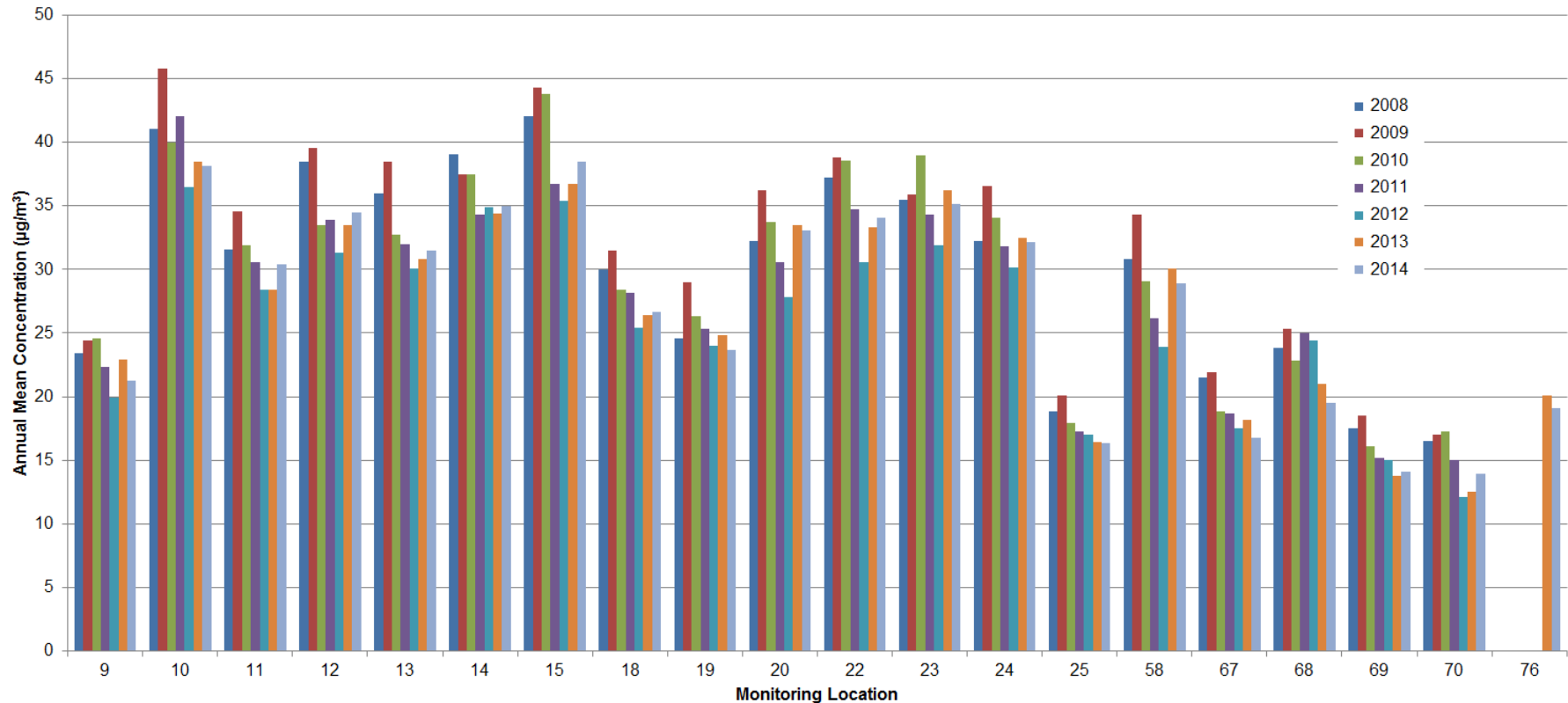


Figure 2.9 shows the trend in NO₂ concentrations for those sites located in the southern areas of the Town Centre AQMA. In 2014 around half of the sites showed an increase in the NO₂ concentration when compared to 2013 levels, and around half showed a decrease. The graph shows that in the southern area of the King's Lynn AQMA there were no monitoring locations where the concentration in 2014 exceeded the annual mean of 40 µg/m³.

Figure 2.10: Trends in Annual Mean Nitrogen Dioxide Concentrations Measured at Diffusion Tube Monitoring Sites – Gaywood Clock

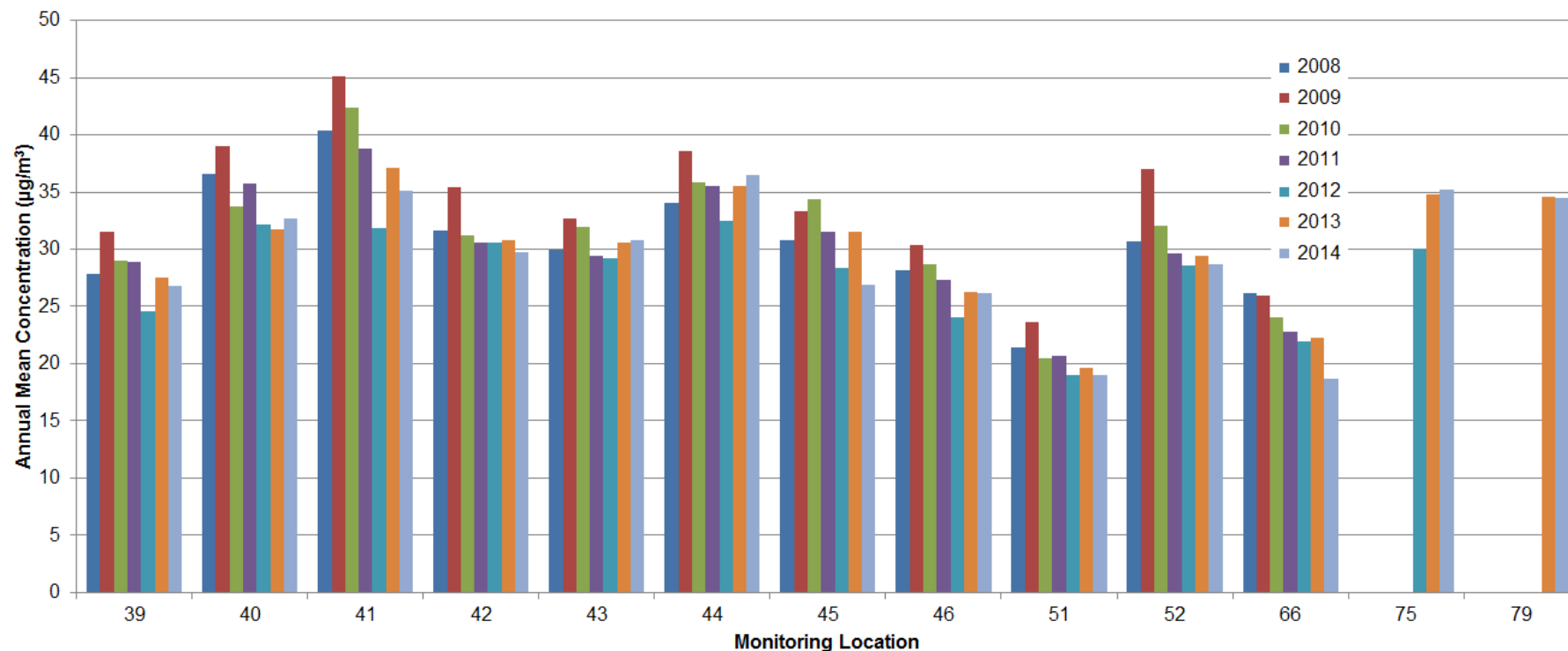


Figure 2.10 shows the trend in NO₂ concentrations for those sites located in the Gaywood Clock AQMA and surrounding area. The majority of sites showed a decrease in the annual mean NO₂ concentration in 2014 when compared to 2013 values. The graph shows that in the Gaywood Clock area there were no monitoring locations where the concentration in 2014 exceeded the annual mean of 40 µg/m³.

Figure 2.11: Trends in Annual Mean Nitrogen Dioxide Concentrations Measured at Diffusion Tube Monitoring Sites – South King's Lynn & The Willows EfW Application

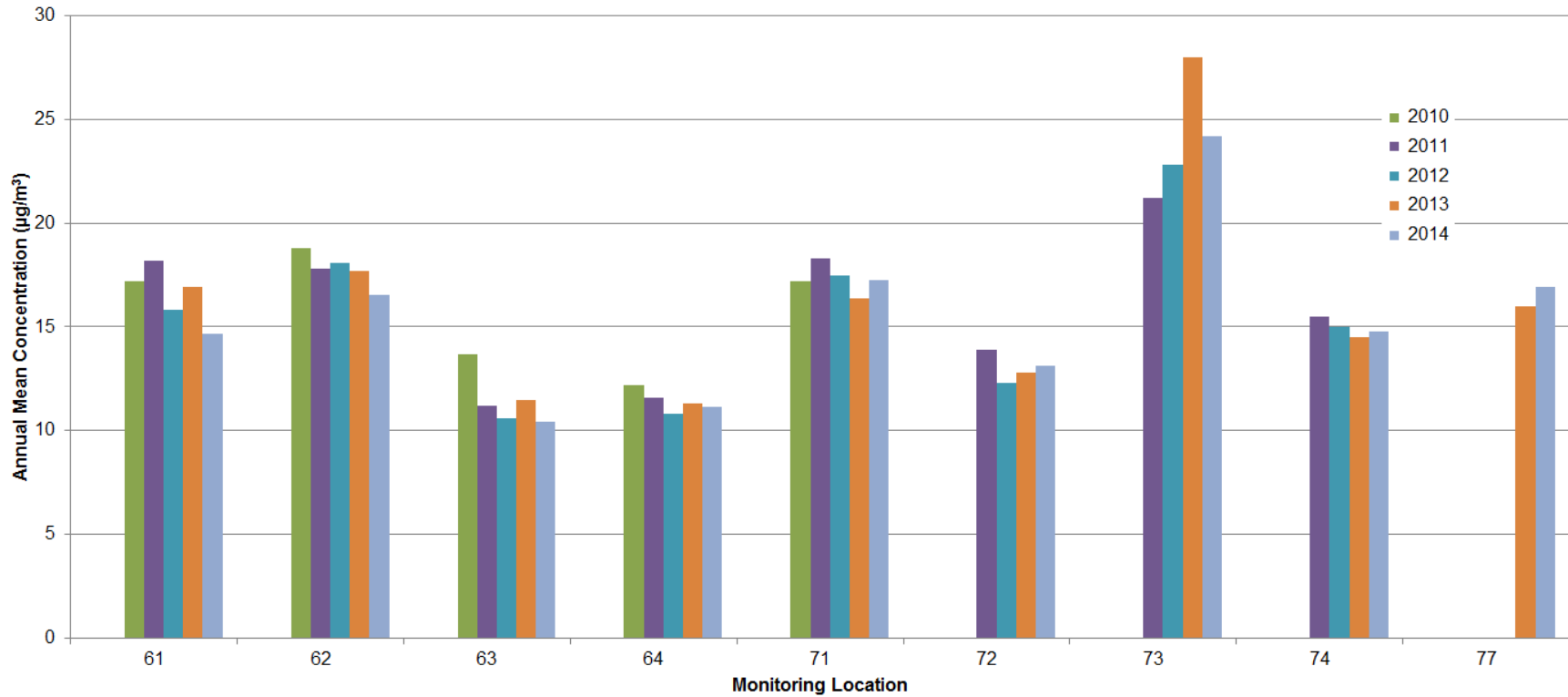


Figure 2.11 shows the trend in NO₂ concentrations in the south of King's Lynn as well as for those sites monitored as background sites as part of the planning application submitted for an Energy from Waste (EfW) incinerator at The Willows Industrial Estate. In 2014 around half of the sites showed an increase in the NO₂ concentration when compared to 2013 levels, and around half showed a decrease. For all sites the NO₂ concentration in 2014 remained below the annual mean objective of 40 µg/m³.

2.2.2 Particulate Matter (PM₁₀)

There are two Air Quality Objectives for PM₁₀, namely:

- the annual mean of 40µg/m³; and
- the 24-hour mean of 50µg/m³ not to be exceeded more than 35 times a year.

The Council undertook monitoring of PM₁₀ using a TEOM analyser at one location in 2014, North Lynn. Additionally, dust and particulates were monitored at four locations in 2014 using Osiris analysers.

2014 monitoring data for the TEOM analyser have been VCM¹ corrected. 2014 monitoring data for the Osiris analysers has also been corrected using a gravimetric factor of 1.3 by AQDM who conduct the data management for the Council. Data capture was above 90% at the TEOM monitoring site and all four Osiris analysers, so annualisation was not required.

Table 2.8 and Table 2.9 show the PM₁₀ monitoring results for the annual mean and 24-hour mean PM₁₀ objectives respectively. The 2014 results at North Lynn show that the annual mean and the 24-hour mean PM₁₀ objectives continue to be met, and in fact show a decrease when compared to 2013 levels.

There is a great uncertainty around Osiris monitoring results and as such they should be used as an indicative monitoring method only. All four sites showed compliance with both the annual mean and 24-hour mean PM₁₀ objectives in 2014.

The Council have commissioned a Detailed Assessment to be undertaken in the area around King's Lynn docks in response to complaints from members of the public and exceedences of the annual mean and the 24-hour mean PM₁₀ objectives in 2011. The Detailed Assessment will consider monitoring data from the North Lynn TEOM monitoring site, in addition to data from the Osiris monitoring locations Page Stair Lane and Estuary Road.

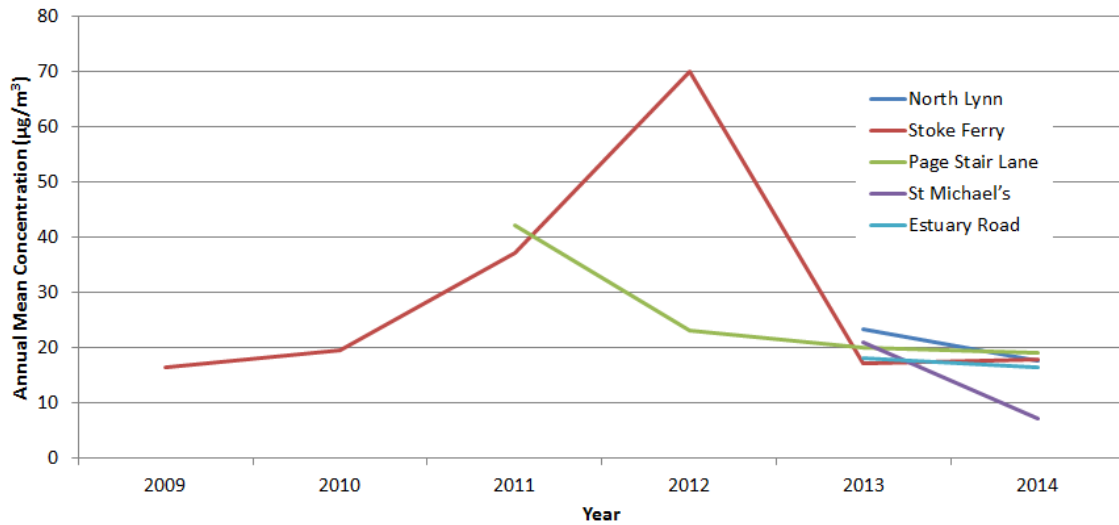
Figure 2.12 shows the trend in PM₁₀ concentrations at the North Lynn TEOM monitoring location and the four Osiris monitoring locations. The graph shows that in

¹ Volatile Correction Model – Used to correct TEOM measurements for the loss of volatile components of particulate matter that occur due to the high sampling temperatures employed by this instrument.

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2014 most sites show a decrease when compared to 2013 values. Annual mean PM₁₀ concentrations at Stoke Ferry have decreased dramatically since the high recorded in 2012.

Figure 2.12 Trends in Annual Mean PM₁₀ Concentrations



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Table 2.8: Results of Automatic Monitoring for PM₁₀: Comparison with Annual Mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture for Monitoring Period %	Valid Data Capture 2013 %	Confirm Gravimetric Equivalent (Y or N/A)	Annual Mean Concentration (µg/m ³)						
						2008	2009	2010	2011	2012	2013	2014
North Lynn, King's Lynn	Near-Road	N	98.5	98.5	Y	-	-	-	-	-	23.2*	17.8
Stoke Ferry	Industrial	N	97.5	97.5	N		16.5	19.5	37	70	17	17.9
Page Stair Lane, King's Lynn	Industrial	N	92.7	92.7	N	-	-	-	42	23	20	19.1
St Michael's, King's Lynn	Urban background	N	93.9	93.9	N	-	-	-	-	-	21	7.1
Estuary Road, King's Lynn	Industrial	N	93.9	93.9	N	-	-	-	-	-	18	16.4

Table 2.9: Results of Automatic Monitoring for PM₁₀: Comparison with 24-hour Mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture for Monitoring Period %	Valid Data Capture 2013 %	Confirm Gravimetric Equivalent (Y or N/A)	Number of Daily Means > 50µg/m ³						
						2008	2009	2010	2011	2012	2013	2014
North Lynn, King's Lynn	Near-Road	N	98.5	98.5	Y	-	-	-	-	-	1 (29.8)	4
Stoke Ferry King's Lynn	Industrial	N	97.5	97.5	N	-	-	-	22	193	20	3
Page Stair Lane, King's Lynn	Industrial	N	92.7	92.7	N	-	-	-	78	16	6	7
St Michael's, King's Lynn	Urban background	N	93.9	93.9	N	-	-	-	-	-	13	1
Estuary Road, King's Lynn	Industrial	N	93.9	93.9	N	-	-	-	-	-	1	2

2.2.3 Sulphur Dioxide (SO₂)

The Borough Council of King's Lynn and West Norfolk does not currently monitor sulphur dioxide as there are no new sources requiring monitoring.

2.2.4 Benzene (C₆H₆)

The Borough Council of King's Lynn and West Norfolk does not currently monitor benzene as previous monitoring indicated compliance with the objectives.

2.2.5 Other pollutants monitored

The target for PM_{2.5} is an annual mean of 25µg/m³ by 2020. PM_{2.5} objectives have been set out in the UK Air Quality Regulations. There is no obligation upon local authorities to carry out monitoring of PM_{2.5}. The UK's monitoring requirements with respect to PM_{2.5} are fulfilled by data from national monitoring networks.

The latest AEA-Ricardo Air Pollution in the UK Report for 2013 shows that the annual mean concentrations of PM_{2.5} were within the limit value across the UK (25 µg/m³ to be achieved by 1st Jan 2010); the Stage 1 limit value (25 µg/m³ to be achieved by 1st Jan 2015) was also met. The Stage 2 limit value (20 µg/m³ to be achieved by 1st Jan 2020) was exceeded at one location only – London Marylebone Road, annual mean: 21 µg/m³.

As part of the Air Quality Directive the UK is required to achieve a National Exposure Reduction Target (NERT) for PM_{2.5}, between 2010 and 2020. The Average Exposure Indicator (AEI) statistic for the UK is 13µg/m³. This AEI determines the NERT to be achieved by 2020. An AEI of 13µg/m³ sets a reduction target of 15%.

2.2.6 Summary of Compliance with AQS Objectives

There were two NO₂ diffusion tube locations where the annual mean NO₂ objective was exceeded in 2014, one of which was inside the existing Town Centre AQMA. The other site was located at the Bus Station monitoring location. This site is not relevant of public exposure with regards to the annual mean NO₂ objective. Based on the 2014 annual mean NO₂ concentration it is unlikely that the hourly NO₂ objective would be exceeded at this location as the annual mean is less than 60 µg/m³.

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Automatic monitoring of PM₁₀ in 2014 revealed that the annual mean and the 24-hour mean PM₁₀ objectives continued to be met at both the North Lynn TEOM monitoring location and all four Osiris sites.

The Borough Council of King's Lynn and West Norfolk has examined the results from monitoring in the Borough.

Concentrations within the AQMAs still exceed the annual mean objective for NO₂ at several locations and the AQMA should remain.

3 Road Traffic Sources

3.1 Narrow Congested Streets with Residential Properties Close to the Kerb

Defra Technical Guidance TG(09) defines narrow congested streets to have the following:

- Daily traffic flow (AADT) of around 5,000 vehicles per day;
- A congested street is one that has slow moving traffic that is frequently stopping and starting through the day; and
- A narrow street is one where residential properties are within 2m of the kerb and there are buildings on both sides of the road.

No new roads have been identified within the Borough Council of King's Lynn and West Norfolk as meeting this requirement.

The Borough Council of King's Lynn and West Norfolk confirms that there are no new/newly identified congested streets with a flow above 5,000 vehicles per day and residential properties close to the kerb, which have not been adequately considered in previous rounds of Review and Assessment.

3.2 Busy Streets Where People May Spend 1-hour or More Close to Traffic

There will be some street locations where individuals may regularly spend 1-hour or more, for example streets with many shops and streets with outdoor cafes and bars. People occupationally exposed in such locations should not be included, as they are not covered by the regulations.

No new busy streets have been identified within the Borough Council of King's Lynn and West Norfolk as meeting this requirement.

The Borough Council of King's Lynn and West Norfolk confirms that there are no new/newly identified busy streets where people may spend 1 hour or more close to traffic.

3.3 Roads with a High Flow of Buses and/or HGVs.

A road with a high flow of buses or HGV's would be one where the proportion of these vehicles within the daily traffic flow is greater than 20%.

The Borough Council of King's Lynn and West Norfolk confirms that there are no new/newly identified roads with high flows of buses/HGVs.

3.4 Junctions

Defra Technical Guidance TG(09) states that for a junction to require assessment the following criteria must be met:

- A 'busy' junction can be taken to be one with more than 10,000 vehicles per day; and
- There is relevant exposure within 10m of the kerb.

The Borough Council of King's Lynn and West Norfolk confirms that there are no new/newly identified busy junctions/busy roads.

3.5 New Roads Constructed or Proposed Since the Last Round of Review and Assessment

The following planning applications, which could result in changes to air quality emissions from road traffic, have been submitted to the Council since the last round of review and assessment:

- **Land at Broomhill, Downham Market** – Pre-application enquiry: Residential development for 150 dwellings. The Council advised that this development has the potential to create significant additional traffic movements and has the potential to generate dust during construction. The Council would expect to see an air quality assessment with any application to establish the significance of any air quality impact and set out any necessary mitigation which may be required by condition.
- **43 Norfolk Street, King's Lynn** – Conversion of first and second floors to two flats. The application site is adjacent to the King's Lynn Air Quality Management Area. While the application is not likely to introduce significant

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additional traffic movements, there is the potential for residents of the proposed flats to be exposed to unacceptable risks from existing pollution. The Council recommended that an air quality screening assessment be undertaken before a decision was taken on this application.

- **Land South of Hunstanton Manor Farm, Heacham** – Erection of 166 dwellings. The development is predicted to increase traffic movements on local roads by only 2%. Air quality in this area is generally very good with low background levels of nitrogen dioxide. The proposal includes a residential travel plan. Therefore the Council did not require any further air quality assessment in relation to operation of the development. Construction of the development has the potential to have an impact on air quality due to dust from construction activities. Therefore the Council have recommended that should permission be granted that it should contain a condition requiring that a construction environmental management plan be submitted for approval.
- **Harwick Estate Extension, Scania Way, Hardwick Industrial Estate, King's Lynn** – Outline Application: mixed used development comprising business / industrial / storage and distribution. This development has the potential to create additional traffic movements on the local road network and possibly through the King's Lynn Air Quality Management Area. The application included a transport assessment. However, an air quality assessment has not been submitted. The Council have therefore recommended that the applicant should assess the potential impact on local air quality and recommend any suitable mitigation measures. It may be appropriate to require funding for additional nitrogen dioxide (NO₂) diffusion tubes as part of our existing network to monitor the impact of the development on local air quality before, during and after development.
- **Glendevon Hotel, 49-51 Railway Road, King's Lynn** – Demolition of existing hotel and re-built with 14 new bedrooms. This development is within the AQMA, however as accommodation will be short term and temporary the planning authority deemed that mitigation for poor air quality was unnecessary.

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- **King's Lynn Bus Station, Old Market Street, King's Lynn** – Refurbishment of existing bus station and improvement of routes to train station, relocation of taxi rank. This application is adjacent to the King's Lynn town centre AQMA. Changes to the bus station could have an impact on air quality in this area. However the changes to the transport route may bring about a decrease in bus movements on a section of Railway Road. The taxi rank is being re-located to an undercover car park. Additional NO₂ diffusion tubes installed to monitor.
- **Area 4 Land South Of Railway Road, Downham Market** – Outline application for up to 32 dwellings. The applicant submitted an air quality assessment. The assessment considers both the construction and operational phases of the development. The predicted increase in Annual Average Daily Traffic would be 2.65% on Railway Road therefore mitigation of this impact was not required. As there are residential receptors within 350m of the site there is a potential impact from construction dust and the assessment recommended agreement of a management plan to mitigate this impact.

The Borough Council of King's Lynn and West Norfolk has assessed new/proposed roads meeting the criteria in Section A.5 of Box 5.3 in TG(09), and concluded that it will not be necessary to proceed to a Detailed Assessment.

3.6 Roads with Significantly Changed Traffic Flows

The Borough Council of King's Lynn and West Norfolk confirms that there have been no roads with a traffic flow greater than 10,000 vehicles per day that have experienced an increase in traffic flow of more than 25%.

The Borough Council of King's Lynn and West Norfolk confirms that there are no new/newly identified roads with significantly changed traffic flows.

3.7 Bus and Coach Stations

The assessment considers both NO₂ and PM₁₀ emissions at bus stations that are not enclosed with greater than 2,500 movements per day.

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The Borough Council of King's Lynn and West Norfolk confirms that there are no relevant bus stations in the Local Authority area.

4 Other Transport Sources

4.1 Airports

The Borough Council of King's Lynn and West Norfolk confirms that there are no airports in the Local Authority area.

4.2 Railways (Diesel and Steam Trains)

The assessment for stationary trains considers SO₂ emissions, while the assessment for moving diesel trains considers NO₂ emissions. If there are no railways carrying diesel or steam trains in the local authority area, there is no need to proceed further with this section.

4.2.1 Stationary Trains

The Borough Council of King's Lynn and West Norfolk confirms that there are no locations where diesel or steam trains are regularly stationary for periods of 15 minutes or more, with potential for relevant exposure within 15m.

4.2.2 Moving Trains

Railway lines with a heavy traffic of diesel passenger trains are listed within the Defra Technical Guidance TG(09).

The Borough Council of King's Lynn and West Norfolk confirms that there are no locations with a large number of movements of diesel locomotives, and potential long-term relevant exposure within 30m.

4.3 Ports (Shipping)

Defra Technical Guidance TG(09) states that ports should be assessed where there are between 5,000 and 15,000 movements per year taking place and there is exposure within 250m, or where there are over 15,000 movements per year and exposure within 1km.

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The Borough Council of King's Lynn and West Norfolk confirms that there are no ports or shipping that meet the specified criteria within the Local Authority area.

5 Industrial Sources

5.1 Industrial Installations

5.1.1 New or Proposed Installations for which an Air Quality Assessment has been Carried Out

The Borough Council of King's Lynn and West Norfolk confirms that there are no new or proposed industrial installations for which planning approval has been granted within its area or nearby in a neighbouring authority.

5.1.2 Existing Installations where Emissions have Increased Substantially or New Relevant Exposure has been Introduced

The Borough Council of King's Lynn and West Norfolk confirms that there are no industrial installations with substantially increased emissions or new relevant exposure in their vicinity within its area or nearby in a neighbouring authority.

5.1.3 New or Significantly Changed Installations with No Previous Air Quality Assessment

The Borough Council of King's Lynn and West Norfolk has assessed new or significantly changed industrial installations with no previous air quality assessment, and concluded that it will not be necessary to proceed to a Detailed Assessment.

5.2 Major Fuel (Petrol) Storage Depots

GB Oil operate a petrol storage terminal on Estuary Road. The terminal has recently been demolished and rebuilt with horizontal storage tanks as opposed to the previous vertical storage tanks. The volume of the facility is estimated at less than 500m³. The terminal does not appear in the list of major storage sites as defined by the HSE and therefore has not been subjected to an assessment as part of this report.

There are no major fuel (petrol) storage depots within the Local Authority area.

5.3 Petrol Stations

The specific criteria for petrol stations that require assessment as stated within Defra Technical Guidance TG(09) is a petrol station with the following:

- An annual throughput of more than 2,000m³ of petrol; and
- A busy road nearby, one with more than 30,000 vehicles per day.

The Borough Council of King's Lynn and West Norfolk confirms that there are no petrol stations meeting the specified criteria.

5.4 Poultry Farms

Studies have been conducted by the Environmental Agency, Department for Environmental Northern Ireland and a Local Authority. From the studies completed the following guidance has been produced to screen the requirement for assessment of poultry farms:

- Farms housing in excess of:
 - 400,000 birds if mechanically ventilated;
 - 200,000 birds if naturally ventilated; and
 - 100,000 birds for any turkey unit.
- Relevant exposure within 100m of the poultry units.

There are two poultry related developments in the Council area which it may be necessary to assess in future:

- Humans Farm, Market Lane, Walpole St Andrew - Retention and completion of Poultry Shed: and
- Didlington Farm, Norfolk - Environmental permit application. Large poultry farm.

However, it is recognised that the screening criteria in TG(09) have been based on limited data, and it was stated that further information would be provided as and when new information became available. To assist this process, three local authorities in England have been awarded Air Quality Grant funding in order to carry out studies at the poultry farms they have identified, in order to assess both the local

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risk of exceedences of the air quality objectives, and to provide additional information to verify, or amend if necessary, the current screening criteria.

Until this assessment work is completed, there is no requirement for local authorities to move forward to a Detailed Assessment at this time.

The Borough Council of King's Lynn and West Norfolk confirms that there are no poultry farms meeting the specified criteria.

6 Commercial and Domestic Sources

6.1 Biomass Combustion – Individual Installations

The following biomass facilities have been commissioned since the last round of review and assessment:

- **52 Baptist Road, Upwell** – Lean-to extension to existing biomass boiler building, plus additional biomass boilers and oil fired boiler with associated stacks. The applicant submitted a D1 stack height assessment as required by the condition. The assessment indicates that a stack height of 13m is required for all the discharge stacks (for both straw and oil burning boilers) to adequately disperse emissions. Details of monitoring positions were also agreed.
- **Reeve, Rollesby Road, Hardwick Industrial Estate** – Extension to existing store room to provide biomass plant room and biomass fuel store. As information was not provided in advance of the decision it was recommended that a condition be included on any consent to ensure that prior to commencement of development a stack height calculation be provided for approval (in accordance with D1 or other appropriate methodology). Installation is to be carried out to the approved calculated height and design.
- **Queen Elizabeth Hospital, Gayton Road, King's Lynn** – Replace existing CHP plant with 2 new 500kW CHP units. The applicant provided a technical description of the proposed plant, a dispersion modelling report and a D1 stack height calculation report. The dispersion modelling report took account of nearby sensitive receptors and calculates potential levels of NO₂ attributable to the proposed CHP. The D1 calculation concluded that the minimum height for each CHP stack should be 10m above ground level. Permission was granted including a condition requiring that the development included stacks of the agreed height.

The Borough Council of King's Lynn and West Norfolk has assessed the biomass combustion plant, and concluded that it will not be necessary to proceed to a Detailed Assessment.

6.2 Biomass Combustion – Combined Impacts

The Borough Council of King's Lynn and West Norfolk has assessed the biomass combustion plant, and concluded that it will not be necessary to proceed to a Detailed Assessment.

6.3 Domestic Solid-Fuel Burning

The Borough Council of King's Lynn and West Norfolk confirms that there are no areas of significant domestic fuel use in the Local Authority area.

7 Fugitive or Uncontrolled Sources

The assessment of fugitive and uncontrolled sources considers the PM₁₀ objectives; this includes considerations to quarries, landfill sites, opencast coal mining, waste transfer sites and materials handling (i.e. ports, major construction sites). Only locations not covered by the previous rounds of review and assessment, or where there is new relevant exposure, require consideration. In the case of proposed new sources, these are only required to be considered if planning approval has been granted.

The following planning applications have the potential to result in emissions of fugitive or uncontrolled sources and have been commissioned since the last round of review and assessment:

- **Home Brink Farm, Thornham Road, Methwold** – Agricultural building for the purposes of storing and drying combinable crops. Dust mitigation measures agreed.
- **Anglia Fallen Stock, Cliffe en Howe Road, Pott Row** – Planning appeal for retrospective planning permission for portacabin, two additional incinerators and replacement of previously approved incinerator cremator. Variation of conditions to increase throughput to 500 tonnes of waste carcasses per annum. To expand the business activities to include the cremation of equine/pet remains. This appeal was dismissed. However operations are continuing on this site and no information has been supplied on emissions. A planning enforcement notice has been served. The site is subject to an abatement notice regarding odour.
- **Land off Church Lane, Tottenhill** – Request for a Screening and/or Scoping Opinion for proposed extension to quarry. The Council have requested further details are submitted regarding mitigation measures to protect residents from any adverse impact from dust and to demonstrate compliance with relevant technical guidance under the National Planning Policy Framework (NPPF). Additionally the Council have requested an Environmental Statement to assess the potential for the development to cause a breach of National Air Quality Objectives for particulates (PM₁₀) at sensitive receptors.

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- **Quarry, Grange Farm, Lynn Road, Crimplesham** – Variation of conditions to regulate existing plant site layout arrangements. The layout includes screen bunds constructed from overburden from operational area. In order to reduce the potential for fugitive dust emissions the Council have recommended that stockpiles should not extend higher than the bund height.
- **William George Recycling Limited, Mill Drove, Blackborough End** – Proposed storage of empty skips, building materials, equipment and lorry parking. This proposal has the potential to create dust from storage, loading and un-loading of materials. There are residential receptors within 200m of the development. A dust management plan has been submitted and agreed.
- **Glazewing Ltd, Glazewing, Station Road, West Dereham** – Erection of a building to house a replacement waste baler and generator. The applicant submitted an Assessment of Environmental Dust/Air Quality. The nearest receptors are reported as located 345m from the site. The report concluded that there will be no significant decrease in local air quality due to the proposed baler building. The Council recommended that the proposed Dust Management Plan be formally adopted by the applicant.
- **British Sugar, Wissington** – Scoping request for bio-energy facility. The Council reviewed the Scoping request and previous approval. The proposed approach to air quality is to utilise existing data to create a revised air dispersion model and findings. It was requested that the applicant establishes contact with the Council beforehand to check what new data is available; updated or recent data should be used together with any revised emission factors.

The Borough Council of King's Lynn and West Norfolk confirms that there are no potential sources of fugitive particulate matter emissions in the Local Authority area.

8 Conclusions and Proposed Actions

8.1 Conclusions from New Monitoring Data

The review of 2014 monitoring data found that there were two NO₂ diffusion tube locations where the annual mean NO₂ objective was exceeded, one of which was inside the existing Town Centre AQMA. The remaining site was located at the Bus Station monitoring location. This site is not relevant of public exposure with regards to the annual mean NO₂ objective. From the 2014 data it is unlikely that the hourly NO₂ objective would be exceeded at this location as the annual mean is less than 60 µg/m³.

Automatic monitoring of PM₁₀ in 2014 revealed that the annual mean and the 24-hour mean PM₁₀ objectives continued to be met at both the North Lynn TEOM monitoring location and all four Osiris sites.

8.2 Conclusions from Assessment of Sources

8.2.1 Commercial and Domestic Sources

The Council have considered three biomass facilities within the Council area and following review of assessments undertaken by the operators concluded that it will not be necessary to proceed to a Detailed Assessment.

8.2.2 Fugitive or Uncontrolled Sources

The Council have considered a number of planning applications that have the potential to result in emissions of fugitive or uncontrolled sources and concluded that there are no potential sources of fugitive particulate matter emissions in the Local Authority area that require assessment.

8.3 Proposed Actions

The proposed actions from the 2015 Updating and Screening Assessment are as follows:

- Continue NO₂ diffusion tube and continuous monitoring in the Borough to identify future changes in pollutant concentrations;

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- Undertake further monitoring at relevant receptors in the areas of Stoke Ferry and Page Stair Lane, King's Lynn, using a Defra approved method to confirm existing concentrations; proceed to a monitoring based Detailed Assessment in these areas;
- Proceed to an Annual Progress Report in 2016.

9 References

- Local Air Quality Management Technical Guidance LAQM.TG(09). February 2009. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland
- Local Air Quality Management Policy Guidance LAQM.PG(09). February 2009. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland
- National Diffusion Tube Bias Adjustment Spreadsheet, version 03/15 published in March 2015
- [http://laqm.defra.gov.uk/documents/LAQM-WASP-Rounds-121--124-and-AIR-PT-Rounds-1-3-4-6-\(April-2013--February-2015\)-NO2-report.pdf](http://laqm.defra.gov.uk/documents/LAQM-WASP-Rounds-121--124-and-AIR-PT-Rounds-1-3-4-6-(April-2013--February-2015)-NO2-report.pdf)
- Biomass Calculator Tool, available at <http://laqm.defra.gov.uk/review-and-assessment/tools/emissions.html#biomass>
- EPUK Biomass Unit Conversion and Screening Tool, available at <http://iaqm.co.uk/guidance/>
- King's Lynn and West Norfolk Borough Council 2012 Updating and Screening Assessment
- King's Lynn and West Norfolk Borough Council 2014 Annual Progress Report

Appendices

Appendix A: QA/QC Data

Appendix B: Diffusion Tube Monitoring Data

Appendix A: QA/QC Data

Data have been corrected using a bias adjustment factor, which is an estimate of the difference between diffusion tube concentrations and continuous monitoring, the latter assumed to be a more accurate method of monitoring. The technical guidance LAQM.TG (09) provides guidance with regard to the application of a bias adjustment factor to correct diffusion tubes. Triplicate co-location studies can be used to determine a local bias factor based on the comparison of diffusion tube results with data from NO_x / NO₂ continuous analysers. Alternatively, the national database of diffusion tube co-location surveys provides bias factors for the relevant laboratory and preparation method.

Diffusion Tube Bias Adjustment Factors

Diffusion tube data obtained for the year 2014 was supplied and analysed by Gradko, the tubes were prepared using the 20% triethanolamine (TEA) in water preparation method. The bias adjustment factor for Gradko is 0.91 (based on 21 studies, version 06_15) as derived from the national bias adjustment calculator².

Factor from Local Co-location Studies

The Borough Council of King's Lynn and West Norfolk operate a continuous analyser and have triplicate co-located tubes. The Local Bias Adjustment Factor is 0.73.

The survey had good precision and good data capture for the 12 periods of data used. Therefore the bias adjustment factor was calculated using 12 periods of data.

Location	Diffusion Tube Data capture	Continuous Monitor Data Capture	Diffusion Tube Annual Mean (µg/m ³)	Continuous Monitor Annual Mean (µg/m ³)	Ratio
Southgates Park, King's Lynn	91.7%	98.6%	29.2	21.2	0.73

Short to Long Term Adjustment

Annualisation was required for three diffusion tube monitoring sites 71, 83 and 84. This is shown in the table below.

² National Diffusion Tube Bias Adjustment Factor Spreadsheet, version 03/15 published in March 2015.

Borough Council of King's Lynn and West Norfolk

Diffusion Tube Site	Leicester University AF	Market Harborough AF	Norwich Lakenfields AF	Northampton Kingsthorpe AF	Average AF	Bias Unadjusted Annual Mean Concentration ($\mu\text{g}/\text{m}^3$)	Bias Adjusted Annual Mean Concentration ($\mu\text{g}/\text{m}^3$)	Bias Adjusted & Annualised Annual Mean Concentration ($\mu\text{g}/\text{m}^3$)
71	1.054	1.110	1.056	1.043	1.066	19.0	20.2	18.4
83	1.097	1.371	1.179	1.222	1.217	12.1	14.8	13.4
84	1.097	1.371	1.179	1.222	1.217	10.0	12.2	11.1

Discussion of Choice of Factor to Use

The National Bias Adjustment factor of 0.91 has been used in the main body of this report. Although the local co-location bias adjustment factor of 0.73 showed good precision and data capture, and despite a local co-location factor having been used in the 2013 monitoring report, it's use would have resulted in a large reduction at all monitoring locations. It was therefore considered that the use of the National Bias Adjustment factor would represent more realistic trends at the monitoring locations. Pollutant concentrations calculated using the local co-location bias adjustment factor of 0.73 are presented in the appendix for comparison.

For previous data, years 2008 to 2013, the bias adjustment factors have been taken from the Council's previous LAQM annual reports. The factors used were 0.88 (2008), 0.97 (2009), 0.88 (2010), 0.89 (2011), 0.84 (2012) and 0.90 (2013).

2013 Diffusion Tube Results – National Bias Adjustment Factor

Site ID	Site Type	Within AQMA?	Annual Mean Concentration ($\mu\text{g}/\text{m}^3$) - Adjusted for Bias	
			2014 (National Bias Adjustment Factor = 0.91)	2014 (Local Bias Adjustment Factor = 0.73)
1	Kerbside	Y – Town Centre	38.2	30.6
2	Roadside	Y – Town Centre	47.1	37.8
3	Roadside	Y – Town Centre	39.6	31.8
5	Roadside (Bus Station)	N	46.0	36.9
6,7,8	Roadside	Y – Town Centre	26.6	21.3
9	Roadside	N	21.2	17.0
10	Roadside	Y	38.1	30.6
11	Roadside	Y – Town Centre	30.4	24.4
12	Roadside	Y – Town Centre	34.5	27.7
13	Roadside	Y – Town Centre	31.5	25.3
14	Roadside	Y – Town Centre	35.0	28.1
15	Roadside	Y – Town Centre	38.5	30.9
18	Roadside	N	26.6	21.4
19	Roadside	N	23.6	19.0
20	Kerbside	Y – Town Centre	33.0	26.5
22	Roadside	Y – Town Centre	34.1	27.4
23	Roadside	Y – Town Centre	35.2	28.2
24	Roadside	Y – Town Centre	32.2	25.8
25	Urban Background	N	16.3	13.1
26	Roadside	Y – Town Centre	36.1	28.9
27	Roadside	Y – Town Centre	30.1	24.1
28	Roadside	Y – Town Centre	30.1	24.1
29	Kerbside	N	17.5	14.0

Borough Council of King's Lynn and West Norfolk

Site ID	Site Type	Within AQMA?	Annual Mean Concentration ($\mu\text{g}/\text{m}^3$) - Adjusted for Bias	
			2014 (National Bias Adjustment Factor = 0.91)	2014 (Local Bias Adjustment Factor = 0.73)
30	Kerbside	N	21.3	17.1
31	Kerbside	Y – Town Centre	30.8	24.7
32	Roadside	Y – Town Centre	31.0	24.8
33	Kerbside	N	29.8	23.9
34	Roadside	Y – Town Centre	32.1	25.7
35	Roadside	Y – Town Centre	28.9	23.2
36	Roadside	Y – Town Centre	29.2	23.5
37	Roadside	Y – Town Centre	33.0	26.5
38	Roadside	Y – Town Centre	35.1	28.2
39	Roadside	N	26.8	21.5
40	Roadside	Y – Gaywood Clock	32.7	26.2
41	Roadside	Y – Gaywood Clock	35.2	28.2
42	Roadside	Y – Gaywood Clock	29.7	23.8
43	Roadside	Y – Gaywood Clock	30.8	24.7
44	Roadside	Y – Gaywood Clock	36.5	29.3
45	Roadside	N	26.9	21.6
46	Roadside	N	26.1	20.9
47	Roadside	Y – Town Centre	34.9	28.0
48	Roadside	Y – Town Centre	32.0	25.7
51	Roadside	N	19.0	15.3
52	Roadside	N	28.7	23.0
58	Roadside	N	28.9	23.2
61	Roadside	N	14.7	11.8
62	Roadside	N	16.6	13.3
63	Roadside	N	10.4	8.4
64	Roadside	N	11.1	8.9
66	Urban Background	N	18.7	15.0
67	Urban Background	N	16.8	13.4
68	Urban Background	N	19.5	15.6
69	Urban Background	N	14.1	11.3
70	Urban Background	N	13.9	11.2
71	Urban Background	N	17.3	13.9
72	Roadside	N	13.1	10.5
73	Urban Background	N	24.2	19.4
74	Roadside	N	14.8	11.9
75	Roadside	Y	35.2	28.2
76	Roadside	N	19.1	15.3
77	Near-Road	N	16.9	13.6
78	Urban background	N	17.9	14.4
79	Roadside	N	34.5	27.7
80	Rural	N	8.9	7.1
81	Rural	N	10.7	8.6
82	Suburban	N	11.8	9.4
83	Suburban	N	11.0	8.9
84	Suburban	N	9.1	7.3
85	Suburban	N	11.4	9.2

PM Monitoring Adjustment

Particulate monitoring adjustment is completed by Air Quality Data Management (AQDM).

QA/QC of Diffusion Tube Monitoring

Gradko is a UKAS accredited laboratory and participates in the AIR-PT Scheme (a continuation of the Workplace Analysis Scheme for Proficiency (WASP))³ for NO₂ tube analysis and the Annual Field Inter-Comparison Exercise. These provide strict performance criteria for participating laboratories to meet, thereby ensuring NO₂ concentrations are reported to a high level of accuracy. The laboratory follows the procedures as outlined within its Harmonisation Practical Guidance.

In the 2014 WASP/AIR-PT results, rounds WASP 124 (January to March 2014), AIR-PT AR001 (April to May 2014), AR003 (June to July 2014) and AR004 (October to November 2014) Gradko has scored 100%. The percentage score reflects the results deemed to be satisfactory based upon the z-score of $< \pm 2$.

³ <http://laqm.defra.gov.uk/documents/LAQM-WASP-Rounds-121--124-and-AIR-PT-Rounds-1-3-4-6-%28April-2013--February-2015%29-NO2-report.pdf>

Appendix B: Diffusion Tube Monitoring Data

Table B1: Monthly NO₂ Concentrations - Diffusion Tube Sites (2014)

Site ID	NO ₂ Concentrations (µg/m ³)												% Data Capture	Average Concentration (µg/m ³)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
1	46.5	43.3	45.7	37.7	34.8	36.6	34.4	39.6	40.1	50.5	51.2	43.6	100.0	42.0
2	61.1	48.7	51.7	46.4	46.3	40.7	44.7	58.6	48.3	58.4	60.4	55.5	100.0	51.7
3	44.6	37.7	45.5	42.4	41.4	42.1	38.8		53.6	44.9		44.3	83.3	43.5
5	79.2	45.0	49.5	43.8	50.2	37.4	39.8	53.6	41.1	53.3	60.9	52.9	100.0	50.6
6	37.5	29.4	30.3	29.3	23.6	23.9	26.7	27.8	28.0	31.8	31.8	34.9	100.0	29.6
7	31.5	29.7	30.5	28.8	22.6	23.3	28.3	28.0	29.9	31.8	32.8	31.8	100.0	29.1
8		28.1	30.7			23.9	26.0	23.4	28.1	29.4	34.4	34.7	75.0	28.7
9	31.5	22.8	26.4	23.6	18.6	18.2	19.3	18.3	24.9	25.1	27.1	23.9	100.0	23.3
10	47.7	41.3	44.1	39.2	34.9	41.4	38.3	38.8	36.9	41.9	46.7	51.5	100.0	41.9
11	35.2	37.1	36.4	32.8	32.3	30.4	29.1	31.5	27.8	38.6	37.4	32.9	100.0	33.4
12	44.4	39.0		32.5	35.2	32.6	32.1	43.0	32.7	39.7	40.6	45.6	91.7	37.9
13	37.4	36.0	36.8	31.1	31.2	27.6	31.2	34.4	29.0	39.9	38.9	42.3	100.0	34.6
14	41.4	36.7	43.2	34.2	24.9	33.1	35.7	47.9	37.3	36.8	42.5	47.5	100.0	38.4
15	43.3	33.9	44.2	45.2	36.0	42.5	40.7	43.6	47.4	40.8	45.7	44.1	100.0	42.3
18	35.1	25.3	33.0	27.3	24.7	23.9	19.4	28.4	28.9	34.4	35.9	34.9	100.0	29.3
19	29.8	28.2	31.0	24.2	22.1	21.6	22.8	22.3	24.4	20.7	32.2	32.3	100.0	26.0
20	38.1	33.8	39.3	33.2	35.8	34.9	32.2	30.5	43.8	39.5	39.6	35.0	100.0	36.3
22	40.9	38.2		39.8	34.5	34.3	34.7	30.2	40.2	40.8	41.7	37.0	91.7	37.5
23	40.8	31.2	39.9	44.2	36.6	41.1	42.7	29.4	44.5	34.6	45.5	33.2	100.0	38.7
24	33.1	29.7	38.4	37.5	37.3	38.4	37.1	29.4	40.9	32.9	39.2	30.3	100.0	35.3
25	25.4	20.7	20.3	15.4	13.0	12.0	11.5		13.4	18.9	22.5	24.1	91.7	17.9
26	34.3		41.0	39.2	38.9	42.2	37.8	35.8	46.1	39.7	44.4	36.4	91.7	39.6
27	30.4	27.2	37.1	31.8	28.4	34.4	33.0	30.2	40.0	31.5	36.4	36.6	100.0	33.1
28	32.1	31.7	39.4	30.0	30.4	35.2	31.9	30.9	32.0	36.3	33.7		91.7	33.0
29	26.1	24.9	3.5	21.3	17.8	0.3	17.0		20.4	24.1	28.7	27.4	75.0	23.1
30	24.8	23.2	29.5	22.0	19.7	19.1	21.1	19.5	25.0	23.2	30.7		91.7	23.4
31	38.0	36.6	38.2	33.3	31.1	32.6	19.7	26.2	33.9	39.4	43.6	33.9	100.0	33.9
32	34.2	33.8	35.4	33.1		29.7	26.9	26.1	36.5	38.2	44.3	36.3	91.7	34.0

Borough Council of King's Lynn and West Norfolk

Site ID	NO ₂ Concentrations (µg/m ³)												% Data Capture	Average Concentration (µg/m ³)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
33	36.1	33.4	38.3	32.2	27.0	27.1	25.4	29.3	31.8	36.8	39.9	36.0	100.0	32.8
34	37.1	35.6	41.3	31.6	31.0	30.4	29.2	30.6	33.6	42.1	39.2	41.2	100.0	35.2
35	31.7	32.0	38.5	31.1	27.3	28.8	31.2	29.1	33.0	32.9	30.2	35.8	100.0	31.8
36	31.9		37.7	32.0	28.5	26.2	25.8	28.9	31.1	36.4	37.4	37.7	91.7	32.1
37	49.7	48.1	37.5	39.2	31.1	33.1	33.8	26.3	36.1	29.3	37.6	33.6	100.0	36.3
38	32.0		46.0	30.9	36.3			33.0	36.4	47.7	45.2	39.6	75.0	38.6
39	29.8	32.7	34.2	28.1	26.9	27.0	24.0	24.2	26.2	34.6	36.0	29.8	100.0	29.4
40	40.1	39.5	41.3	34.9	32.5	31.1	30.5	31.3	29.9	41.5	35.5	43.0	100.0	35.9
41	39.4	35.3	47.9	39.8	35.4	26.8	36.2	32.6	39.8	44.0	47.5	38.9	100.0	38.6
42	35.7	33.5	37.4	31.5	31.2	25.1	32.0	29.8	32.6	32.1	31.6	39.4	100.0	32.7
43	34.5	31.2	38.0	30.1	28.7	37.7	38.3	27.5	38.6	30.2	36.8	34.7	100.0	33.9
44	36.6	37.8	44.1	42.4	38.7	40.8	39.0	31.3	44.7	37.0	46.0	42.8	100.0	40.1
45	26.2	27.3	38.0	32.5	27.8	30.2	26.0	24.4	34.2	24.3	33.4	30.2	100.0	29.5
46	30.7	27.7	32.8	28.7	25.9	24.0	27.1	24.0	30.2	27.4	34.6	31.4	100.0	28.7
47	39.7	36.1	47.4	40.5	33.2	33.8	31.3	28.1	40.8	40.6	47.4	40.6	100.0	38.3
48	39.2	43.1	43.7		29.3	27.1	25.5	30.8	28.0	42.5	38.0	39.7	91.7	35.2
51	27.4	25.2	24.6	18.4	17.6	15.3	14.2	17.6	18.3	23.4	24.2	24.6	100.0	20.9
52	33.8	29.7	34.5	32.4	27.7	31.1	33.0	26.2	30.2	30.3	35.9	34.1	100.0	31.6
58	39.4	34.1	35.0	36.9	30.1	26.7	24.0	23.8	35.8	35.3	29.3	31.1	100.0	31.8
61	22.7	19.4	20.7	15.5	12.6	11.5	8.9	14.4	15.4	19.6	23.8	8.9	100.0	16.1
62	23.1	22.3	22.6	16.1	12.7	11.2	11.4	14.7	15.0	21.0	25.9	22.4	100.0	18.2
63	15.1	12.0	14.1	11.1	7.8	6.4	6.4	9.9	9.9	10.2	19.0	16.0	100.0	11.5
64	15.4	12.5	14.7	11.8	9.3	7.7	7.6	8.8	12.1	11.5	20.2	15.2	100.0	12.2
66	28.9	23.2	27.2		18.8	0.3	2.2	19.8	22.3	25.6	28.6	29.3	75.0	24.8
67	27.8	21.9	21.6	15.8	12.1	11.7	12.1	16.2	15.0	19.4	24.1	23.5	100.0	18.4
68	24.0	29.5	21.8	20.1	16.7	16.9	21.2	18.6	18.4	22.0	26.2		91.7	21.4
69	19.6	17.4	17.4	12.8	9.8	9.1	10.1		15.1	16.7	22.9	19.1	91.7	15.5
70	10.2	18.3	20.8	13.4	9.8	9.0		10.6		18.9	24.9	17.1	83.3	15.3
71		21.5		18.1		12.7	12.7		19.5	22.9	25.6		58.3	19.0
72	19.5		19.4	11.4	8.4	8.5	7.3		12.8	16.9	22.4	17.4	83.3	14.4
73	23.4	23.9			23.5	27.7	25.3	20.1	33.7	23.9	41.5	23.0	83.3	26.6
74	19.0	16.3	21.2	15.1	11.6	11.0	11.3	12.5	16.9	14.4	24.4	21.5	100.0	16.3
75	38.7	38.9	43.4	34.0	33.3	37.7		29.2	38.2		51.2	41.8	83.3	38.6

Borough Council of King's Lynn and West Norfolk

Site ID	NO ₂ Concentrations (µg/m ³)												% Data Capture	Average Concentration (µg/m ³)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
76	29.8	25.7	25.8	19.1	18.8	0.4	16.3	21.5	15.3	27.9	26.2	24.9	91.7	22.8
77	25.7	19.9	23.2	16.6	16.4	13.0	12.3	15.2	16.1	21.1	22.6	20.9	100.0	18.6
78	19.7												8.3	19.7
79			39.7	34.0	31.7	32.6	35.4	33.8	43.2	40.4	46.6	41.9	83.3	37.9
80	12.3	8.7	15.2	9.9	6.1	4.8	5.4	7.2	7.2	8.6	15.7	15.8	91.7	10.2
81	18.4	12.8	16.7	10.1	7.3	5.4	6.2	7.8	6.0	11.6	17.5	20.8	91.7	12.3
82		12.9	21.0	12.6	11.5	2.9	10.4	11.4	18.7	12.7	13.3	14.9	83.3	13.9
83								8.4	11.4	16.7			25.0	12.1
84								6.9	10.0	13.1			25.0	10.0
85												12.5	8.3	12.5

Value = Outliers removed from the dataset prior to processing.