Borough Council of King's Lynn & West Norfolk
Annual Status Report 2017

Bureau Veritas

August 2017

Move Forward with Confidence

Document Control Sheet

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Borough Council of
King's Lynn &
West Norfolk

2017 Air Quality Annual Status Report (ASR)

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

August 2017

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This report was submitted to the Director of Public Health for Norfolk County Council on 2 October 2017 and an email confirming their sign-off of the report was received on 26 October 2017.

Executive Summary: Air Quality in Our Area

Air Quality in Borough Council of King's Lynn & West Norfolk

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 borough of King's Lynn and West Norfolk is located in Norfolk. The air quality in the borough is generally good however the two main pollutants of concern are nitrogen dioxide (NO_2) and particulate matter (PM_{10}). The main source of NO_2 in the borough is from road traffic emissions, notably at Gaywood Clock junction (Lynn Road, Gayton Road and Wootton Road) and in King's Lynn town centre (London Road leading to the one way system at Railway Road, Blackfriars and Austin Street). Other pollution sources, including commercial, industrial and domestic sources also contribute to background NO_2 concentrations. As a result of monitoring in these sensitive areas, two Air Quality Management Areas (AQMAs) have been declared in King's Lynn, where exceedances of the annual mean objective for NO_2 were reported. An Air Quality Action Plan was adopted by The Council in 2015 and a source apportionment study undertaken in 2008. Recent monitoring however has shown there has been an overall reduction in measured NO_2 levels across the borough.

Two exceedances of the annual mean NO_2 air quality objective were reported inside the AQMAs at the Gaywood Automatic Station and the Railway Road 4 diffusion tube. The Gaywood Automatic Station did not represent relevant exposure and

[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

therefore was distance corrected. After correction, the annual mean NO_2 concentration fell below the 40µg/m^3 air quality objective.

The main source of PM_{10} concentrations have been identified as industrial processes. Monitoring is carried out in the North Lynn area of King's Lynn and the village of Stoke Ferry. Concentrations in these areas have remained below the annual mean and 24-hour mean air quality objectives for PM_{10} since 2013.

Actions to Improve Air Quality

The declaration of the two AQMAs (Gaywood Clock and the Town Centre) and the adoption of the Council's Air Quality Action Plan (AQAP) have driven the actions being taken to improve air quality in the borough. The AQAP comprises Policy, Road Traffic and Emissions actions to help reduce pollutant levels. The measures are wide ranging and include considerations of air quality impacts within the planning process by commenting on specific planning applications as well as making sure air quality is embedded within local policies. On-going actions include implementation of urban traffic control systems, promotion of public transport and electric vehicle charging. A full list of measures is detailed in Table 2.2.

Conclusions and Priorities

In 2016, after distance correction for relevant exposure has been taken into consideration, there was only 1 reported exceedance of the annual mean NO_2 air quality objective at the Railway Road 4 diffusion tube site. The site is located within the Town Centre AQMA, which was extended in 2007 to encompass the wider road network. As no further exceedances were reported in 2016 a review of the AQMAs currently declared within the borough has been commissioned to evaluate whether any amendments can be made to the AQMA boundaries. An updated source apportionment study will be carried out to estimate the population exposed to exceedances of AQS objectives within the two AQMAs and identify the need to carry out additional monitoring, if necessary.

The main priorities for The Council in 2017 are to:

- Investigate the possibility of amending/revoking the current Town Centre and Gaywood Clock AQMAs based on evidence that NO_2 concentrations are continuing to decline and outcomes of the source apportionment study.

- Continue to monitor NO_2 and PM_{10} concentrations at existing locations throughout the borough.
- Undertake an updated dispersion modelling and source apportionment study to inform decisions with regards to new monitoring locations to ensure no sensitive areas are ignored.
- Take the AQAP forward via the continued implementation of outstanding measures and review whether the measures are still valid as a result of the source apportionment study.
- Begin detailed data collection to provide evidence in support of AQAP measures to be reported in the 2018 ASR.
- Relocation of the TEOM particulate monitor to Stoke Ferry to provide PM_{10} data for a Detailed Assessment to be undertaken.

Local Engagement and How to get Involved

Information on air quality in the borough is available on The Council's website (https://www.west-norfolk.gov.uk/info/20137/air_quality/170/air_quality_ management _areas) and a wider view of air quality in the Norfolk region can be viewed at http://www.norfolkairquality.net/ where live data from the Council's continuous monitoring stations is published.

The following are suggested as alternatives to private travel that would contribute to improving the air quality in the borough:

- Use public transport where available – This reduces the number of private vehicles in operation reducing pollutant concentration through the number of vehicles and reducing congestion;
- Walk or cycle if your journey allows – From choosing to walk or cycle for your journey the number of vehicles is reduced and also there is the added benefit of keeping fit and healthy;
- Car/lift sharing – Where a number of individuals are making similar journeys, such as travelling to work or to school car sharing reduces the number of vehicles on the road and therefore the amount of emissions being released. This can be promoted via personal travel plans which can be obtained from

Norfolk Country Council here https://www.norfolk.gov.uk/roads-and-transport /alternative-ways-to-travel/travel-plans; and

- Alternative fuel / more efficient vehicles – Choosing a vehicle that meets the specific needs of the owner, fully electric, hybrid fuel and more fuel efficient cars are available and all have different levels benefits by reducing the amount of emissions being released.
- Turning engines off where possible – Reduce the amount of idling vehicles, for example when dropping children at school or waiting at level crossings, will help reduce harmful emissions from vehicle exhausts.

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1 Local Air Quality Management

This report provides an overview of air quality in Borough Council of King's Lynn and West Norfolk (The 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 a statutory duty 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 The 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 and all 2016 planning applications where air quality was considered can be found in Appendix F.

2 Actions to Improve Air Quality

2.1 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 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 The Council can be found in Table 2.1. Further information related to declared or revoked AQMAs, including maps of AQMA boundaries are available online https://www.west-norfolk.gov.uk/info/20137/ air_quality/170/ air_quality_management_areas. Alternatively, see Appendix D: Maps of Monitoring Locations and AQMAs, which provides for a map of air quality monitoring locations in relation to the AQMAs.

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	
Gaywood Clock	Declared: 01/04/2009	NO_2 Annual Mean	King's Lynn	An area encompassing a number of properties at the junction of the A148 (Lynn Road/Wootton Road) and A1076 (Gayton Road).	No	Wootton Road 2 (41): 45.1µg/m³	Wootton Road 2 (41): 32.2µg/m³	Borough Council of King's Lynn & West Norfolk Air Quality Action Plan Plan 2015 Version 10
Town Centre	Declared: 01/11/2003 Amended: 01/02/2007	NO_2 Annual Mean	King's Lynn	A 'P' shaped area encompassing a number of properties comprising the main road to/from the town centre of King's Lynn (London Road and St James' Road) and the town centre one way system (Railway Road, Austin Street and Blackfriars Road)	No	Railway Road 4 (2): 55µg/m³	Railway Road 4 (2): 44.6µg/m³	Borough Council of King's Lynn & West Norfolk Air Quality Action Plan Plan 2015 Version 10

☒ **Borough Council of King's Lynn & West Norfolk confirm the information on UK-Air regarding their AQMA(s) is up to date**
*** Reported concentrations derived from diffusion tube data at the site**

2.2 Progress and Impact of Measures to address Air Quality in Borough Council of King's Lynn & West Norfolk

The current AQAP is planned to be updated in 2017-2018. Defra's appraisal of last year's ASR concluded that the report was well structured, detailed and provided the information specified in the guidance. The following comments were made, which have been taken into consideration within the 2017 ASR:

1. *"The local authority has recorded concentrations above the annual mean NO_2 objective in 2015 at three sites within the AQMAs. These sites are not located directly at the façade of properties, and they should ensure that they distance correct the concentrations to the nearest façade of a property in future reports."*

Distance correction was carried out on the data reported from any monitoring location exceeding the relevant air quality objective to ensure the concentrations reported were representative of exposure. The NO_2 fall-off with distance calculator was used to estimate the NO_2 concentration at the nearest sensitive receptor.

2. *"It is noted that the action plan was produced in 2015 but there are a number of measures that were already in place before this action plan was produced, and these are now complete. Future updates should focus on reporting on those measures that are currently active and funded."*

The progress on measures to improve air quality table has been updated to show the progress made on all the active measures that are still being funded and are yet to be completed.

3. *"It is unclear in the report whether the measures within the action plan focus on the issues within the two AQMAs. This should be clearly explained in future updates."*

The measures listed in Table 2.2 have been designed to improve the localised air quality issues within the AQMAs as well as within the borough as a whole. Measures 3, 5 and 6, in particular, focus on specific issues surrounding air quality in the AQMAs. The AQAP is due to be updated in 2017/18 to improve the measures previously implemented in order to focus on issues directly affecting the AQMAs.

Improvements will be based on a source apportionment study which is due to be undertaken in 2017.

4. *"The local authority is to collect further data to assist them to monitor the progress made with their action plan. This is supported and further details should be provided in their 2017 ASR."*

The borough has commissioned Bureau Veritas to undertake a dispersion modelling study, including source apportionment, within the two AQMAs in order to address the following:

- Estimate the population exposed to exceedances of AQS objectives within the two AQMAs;
- Estimate the date by when air quality levels are likely to comply with the AQS objectives;
- Identify the need to carry out additionally monitoring if necessary – including continuous monitoring and diffusion tubes;
- Help validate the implemented measures within the AQAP; and
- Review of the current AQMAs to assess whether amendments are required.

The Council has taken forward a number of direct measures during the current reporting year of 2017 in pursuit of improving local air quality. Details of all measures in progress or planned are set out in Table 2.2.

More detail on these measures can be found in the Council's Air Quality Action Plan. A list of measures completed prior to 2016 can be found in the 2016 ASR.

The Council expects work to continue on the following measures over the course of the next reporting year, subject to the review of the AQAP:

- Measure 4: Development Parking Management Plan;
- Measure 6: Incentivise the use of public transport;
- Measure 16: Traffic Management at Gaywood Clock; and
- Measure 20: Quality bus partnerships and contracts.

The AQAP is due to be updated with more focused measures addressing the key issues driving the high concentrations seen within the AQMAs. The current measures

which are still on-going will also be refined from the improved knowledge and understanding of pollution and traffic behaviour as a result of the study.

The TEOM particulate monitor was due to be relocated to Stoke Ferry in 2016, as stated in the 2016 ASR. However, limited availability within the council hindered the changeover. The relocation has now begun.

Whilst the measures stated above and in Table 2.2 will help to contribute towards compliance, the Council anticipates that refinement of the measures will be required to achieve compliance and enable the revocation of the Gaywood Clock and Town Centre AQMAs.

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	Consideration of Air Quality Impacts when providing comments on planning applications within an AQMA or where an AQMA could be impacted or created.	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	Borough Council (LPA & Env Quality Team)	On-going	On-going	Number of pre application discussions and planning applications responded to	Up to 1	In 2016 over 30 applications were commented upon which had potential air quality impacts. They were screened according to Environmental Protection UK (EPUK) & Institute of Air Quality Management (IAQM) guidance and air quality assessments required where appropriate. Best practice measures were also recommended.	N/A – an on-going measure	This will always be an on-going measure as long as relevant planning application are received
2	With regard to National Planning Policy Framework, include air quality considerations in the Local Plans and adopt an air quality Development Management Policy.	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	Borough Council (LPA & Env Quality Team)	Completed	2014	Production of documents	Up to 1	Completed	Completed	The King's Lynn and West Norfolk Local Plan - Site Allocations & Development Management Policies (SADMP) Plan was formerly adopted on 29 September 2016. This includes policy DM15 Environment, Design and Amenity.

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
4	Develop Parking Management Plan	Transport Planning and Infrastructure	Other	County Council/ Borough Council	2014	On-going	Publication of and implementation of plan	Up to 2	Business Rates Pool application for funding study	2017/18	On-going discussions have taken place as to how this can be linked to other measures and taken forward.
5	New access road from Wisbech Road through Friars to Boal Street.	Traffic Management	UTC, Congestion management, traffic reduction	County Council/ Borough Council	2010	December 2011	Continued air quality monitoring. Bus flow counts on London Road and new route	2-3	The new access road has been completed and is well used by Stagecoach buses.	2018/19	Permission has been given to open up part of this route to all traffic.
6	Incentivise the use of public transport.	Alternatives to private vehicle use	Other	County Council	2014	2015	Continued air quality monitoring. Bus usage figures	Up to 1	The King's Lynn Transport Interchange has been completed making a physically nicer environment for public transport users. Modern air conditioned train carriages being introduced on services between King's Lynn and Cambridge from end of May 2017.	2017	This is under discussion.
13	Support the use of West Lynn ferry	Promoting Travel Alternatives	Promote use of rail and inland waterways	Borough Council	2012	On-going	Number of passengers using ferry	Up to 1	BCKLWN has provided funding for the West Lynn ferry.	On-going	The ferry service is well used, but is currently for sale. This measure may need reviewing in future depending on the outcome of the sale.
14	Changes to the Road Layout within the King's Lynn Gyratory as proposed by KLATS	Traffic Management	UTC, Congestion management, traffic reduction	County Council	2011 (Linked to measure 3)	On-going	Continued air quality monitoring. Daily traffic flow data and queue lengths.	2-10	Business Rates Pool application for funding to allow study.	2019	This is under discussion.

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
16	Traffic Management at Gaywood clock	Traffic Management	UTC, Congestion management, traffic reduction	County Council	2014	2015	Continued air quality monitoring. Traffic que lengths.	1-5	Partial completion.	2017	SCOOT control on the corridor through Gaywood Clock has recently been revalidated to improve performance.
17	Promotion of travel plans, school travel plans and promotion of car sharing	Promoting Travel Alternatives	Personalised Travel Planning	County Council/ Borough Council	2014	On-going	Continued air quality monitoring. Number of travel plans.	Up to 1	Travel plans are requested by BCKLWN and County Council in response to relevant planning applications.	On-going	Information on Travel Plans is available on the County Council website.
18	Improved cycling and walking provision	Promoting Travel Alternatives	Promotion of cycling	County Council/ Borough Council	2014	On-going	Cycle usage and walking provision. Number of cycle/foot path improvements.	Up to 1	The BCKLWN has increased provision for cycle parking. A County Council Walking and Cycling Action Plan being developed, BCKLWN provided comment.	On-going	Sustrans looking at joining up cycle Route 1 through King's Lynn town centre as currently bikes have to be pushed through pedestrian areas.
19	Investigate feasibility and if viable, provide Electric vehicle charging points in car parks and in new developments	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	Borough Council	2014	On-going	Number & use of EV charging points installed	Up to 1	Some charging points have been installed in King's Lynn town centre car park and Hunstanton. Charging points are requested on new development as a mitigation measure in line with IAQM guidance.	On-going	This is under discussion.
20	Quality Bus Partnerships and contracts	Promoting Low Emission Transport	Public Vehicle Procurement -Prioritising uptake of low emission vehicles	County Council	2014	On-going	Continued air quality monitoring. % buses Euro 3 or better. Installation of SVD	Up to 1	A quality bus partnership is in place but there are still a high number of older vehicles used on King's Lynn Town Centre routes.	2017	This measure is to be taken further at future Air Quality Steering Group meetings.

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

The Council does not currently undertake any monitoring of $PM_{2.5}$. However, PM_{10} monitoring is undertaken in the borough and can therefore be used to estimate $PM_{2.5}$ concentrations, as recommended in Box 7.7 of LAQM.TG(16). The national factor of 0.7 was applied to the 2016 PM_{10} annual mean concentration reported at the North Lynn to estimate the $PM_{2.5}$ annual mean concentration. The calculated $PM_{2.5}$ annual mean concentration was 12.6µg/m^3 for 2016 which is well below the $PM_{2.5}$ obligatory standard of 25µg/m^3.

The Public Health Outcomes Framework[4] data tool complied by Public Health England quantifies the mortality burden of $PM_{2.5}$ within England on a county and local authority scale. The 2015 fraction of mortality attributable to $PM_{2.5}$ pollution across England is 4.7%, and in contrast the fraction within The Council is also 4.7%. This is lower than the fraction of mortality attributable to $PM_{2.5}$ pollution in the East of England region which was estimated to be 5.1%.

Nonetheless, the measures already being undertaken in the Council's AQAP have been reviewed against the Toolbox in Annex II of TG(16) to determine which can have an effect on reducing $PM_{2.5}$ emissions. It was determined that in particular, measures 6, 7, 8, 13, 15, 16, 17, 18 and 20 will also have an impact on reducing $PM_{2.5}$ emissions.

In addition to these measures, there are other actions that The Council is undertaking to address $PM_{2.5}$.

- Providing comments to Norfolk County Council's 'Silica sand review' which forms part of their Mineral Plan. The entire silica sand resource is within the

[4] Public Health Outcomes Framework, Public Health England. data tool available online at http://www.phoutcomes.info/publichealth-outcomes-framework#page/0/gid/1000043/pat/6/par/E12000009/ati/102/ are/E06000028

borough and comments were made on the appropriateness of each site and the likely impact on nearby residential receptors. The Council will continue to provide comments on any planning applications relating to search areas/sites to ensure that there are no adverse effects on air quality.

- Where there is potential for a construction site to impact on the local amenity by way of dust emissions a Construction Management Statement is requested as a pre-commencement planning condition. The statement has to include methods used and the measures taken to control the emission of dust and therefore minimise potential short term exposure to $PM_{2.5}$.

The Council is not required to monitor for $PM_{2.5}$ as there is no statutory requirement to do so. Instead the UK government has a network of air quality monitoring stations across the UK which monitors levels of $PM_{2.5.}$ The results show that the UK currently complies with the 25µg/m^3 limit value set by the EU air quality directive.

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.

The Council undertook automatic (continuous) monitoring at seven sites during 2016, two for NO_2 and five for PM_{10}. Table A.1 in Appendix A shows the details of the sites. National monitoring results are available at https://uk-air.defra.gov.uk/latest/.

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

The Council undertook non- automatic (passive) monitoring of NO_2 at 65 sites during 2016. 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)

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.

In 2016 there were two monitoring locations where the annual mean objective for NO_2 was exceeded. These sites are the automatic monitoring station at Gaywood (in the Gaywood Clock AQMA) and the diffusion tube at site location Railway Road 4 (in the Town Centre AQMA). The diffusion tube at site location Railway Road 4 represented relevant exposure for the annual mean objective. However, the Gaywood automatic monitoring station required adjustment to represent the conditions at relevant exposure. The NO_2 fall-off with distance calculator was used to estimate the NO_2 concentration at the nearest location with relevant exposure. Following distance correction, the annual mean NO_2 concentration at the Gaywood automatic monitoring station fell below the annual mean NO_2 AQS objective.

The annual mean NO_2 concentration was not greater than 60µg/m^3 at any non-automatic monitoring site. In particular, the diffusion tube located at Site 5 (Bus Station - Shelters, Bay D) reported concentrations below 60µg/m^3, which is where short term exposure is most relevant. Therefore exceedances of the 1-hour mean objective are unlikely at all monitoring locations. Furthermore, there were no exceedances of the 1-hour mean NO_2 objective reported at either of the continuous monitoring stations.

Figure A.1, Figure A.2 and Figure A.3 present trends in the measured annual mean NO_2 concentrations over the past five years for continuous monitoring and diffusion tube sites, inside and outside the AQMAs.

There has been a slight increase in annual mean NO_2 concentrations at both continuous monitoring sites when compared to 2015 values. Despite the increase reported at the Southgates site, the concentration is well below the annual mean AQS objective for NO_2. Generally there has been an overall decrease in annual mean NO_2 concentrations reported at the diffusion tube sites both inside and outside the AQMAs however, 21 of the 61 diffusion tubes (34%) reported a slight increase in NO_2 annual mean concentrations when compared to 2015. The increased concentrations were evenly split between diffusion tubes inside and outside of the AQMAs and no diffusion tubes where an increase was reported exceeded the annual mean NO_2 AQS.

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.

PM_{10} is monitored by a TEOM and four Osiris dust monitors at five different sites within the borough. There were no exceedances of the annual mean objective at any of the monitoring sites, nor was the PM_{10} 24-hour mean objective (50µg/m^3 not to be exceeded more than 35 times a year) exceeded.

Figure A.4 in Appendix A shows trends in annual mean PM_{10} concentrations measured at the five automatic monitoring sites. It can be seen that overall the annual mean PM_{10} concentration has remained steady since 2013 with slight fluctuations year on year. Since 2013 the annual mean PM_{10} concentration has not exceeded 21µg/m^3 at any monitoring site.

Figure A.5 in Appendix A shows the number of exceedances of the PM_{10} daily mean air quality objective of 50µg/m^3 at the five automatic monitoring sites. It can be seen that the number of exceedances have declined signficiantly at the Stoke Ferry, Furlong Road site since 2012. A slight increase in the number of exceedances were reported at the North Lynn and Paige Stair Lane stations when compared to 2015 concentrations. Nonetheless, at all five sites, the number of exceedances were well below the limit of 35 exceedances a year for 2016.

4 Conclusions and Priorities

It was concluded that after distance correction for relevant exposure has been taken into consideration, there was only 1 reported exceedance of the annual mean NO_2 air quality objective at the Railway Road 4 diffusion tube site. The site is located within the Town Centre AQMA, which was extended in 2007 to encompass the wider road network. As no further exceedances were reported in 2016 a review of the AQMAs currently declared within the borough has been commissioned to evaluate whether any amendments can be made to the AQMA boundaries. An updated source apportionment study will be carried out to estimate the population exposed to exceedances of AQS objectives within the two AQMAs and identify the need to carry out additional monitoring, if necessary.

The main priorities for The Council in 2017 are to:

- Investigate the possibility of amending/revoking the current Town Centre and Gaywood Clock AQMAs based on evidence that NO_2 concentrations are continuing to decline and outcomes of the source apportionment study.
- Continue to monitor NO_2 and PM_{10} concentrations at existing locations throughout the borough.
- Undertake an updated dispersion modelling and source apportionment study to inform decisions with regards to new monitoring locations to ensure no sensitive areas are ignored.
- Take the AQAP forward via the continued implementation of outstanding measures and review whether the measures are still valid as a result of the source apportionment study.
- Begin detailed data collection to provide evidence in support of AQAP measures to be reported in the 2018 ASR.
- Relocation of the TEOM particulate monitor to Stoke Ferry to provide PM_{10} data for a Detailed Assessment to be undertaken.

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)
Southgates	Southgates Park, King's Lynn	Roadside	562225	319191	NO_2	YES	Chemiluminescent	N/A	5	1.7
Gaywood	Gaywood, King's Lynn	Roadside	563437	320472	NO_2	YES	Chemiluminescent	5	1	1.7
North Lynn	North Lynn, King's Lynn	Industrial	562086	321325	PM10	NO	TEOM	35	17	3
Page Stair Lane	Page Stair Lane, King's Lynn	Industrial	561527	320437	PM10	NO	Osiris	5	3.3	3.5
Stoke Ferry, Furlong Road	Furlong Road, Stoke Ferry	Industrial	570339	300083	PM10	NO	Osiris	5	1	3.5
Estuary Road	Estuary Road, King's Lynn	Industrial	561593	321466	PM10	NO	Osiris	2	1	3.5
Stoke Ferry, Wretton Road	Wretton Road, Stoke Ferry	Industrial	570438	299905	PM10	NO	Osiris	24	19	3.5

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)
1	Railway Road 1	Roadside	562073	320304	NO_2	YES	2	2	NO	2.5
2	Railway Road 4	Roadside	562100	320222	NO_2	YES	0	2	NO	2.4
3	Railway Road 5	Roadside	562117	320095	NO_2	YES	0	1.5	NO	2.4
5	Bus Station - Shelters, Bay D	Roadside	562003	320099	NO_2	NO	N/A	N/A	NO	2.2
6,7,8	Southgates Monitoring Station	Roadside	562226	319191	NO_2	YES	No but property façade 4m from kerb further north	5	YES	3.2
9	Mill Fleet	Roadside	561912	319711	NO_2	NO	0	4	NO	2.5
10	London Road 1	Roadside	562101	319679	NO_2	YES	2.5	3	NO	1.4
11	London Road 2	Roadside	562165	319575	NO_2	YES	0	3	NO	2.2
12	London Road 3	Roadside	562243	319452	NO_2	YES	1	3	NO	2.1
13	London Road 4	Roadside	562264	319375	NO_2	YES	0	4.5	NO	2.2
14	London Road 5	Roadside	562227	319266	NO_2	YES	0.5	4	NO	2.2
15	Southgates	Roadside	562190	319102	NO_2	YES	1	0.5	NO	2.4
18	Hardwick Rd	Roadside	562266	319043	NO_2	NO	0	7	NO	1.6
19	Vancover Avenue	Roadside	562277	319098	NO_2	NO	0	6	NO	1.5
20	London Road 10	Roadside	562244	319261	NO_2	YES	0	3.5	NO	2.2

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)
22	London Road 6	Roadside	562285	319386	NO_2	YES	0	5	NO	1.3
23	London Road 7	Roadside	562162	319614	NO_2	YES	0	4.5	NO	2.1
24	London Road 8	Roadside	562136	319651	NO_2	YES	0	5.5	NO	2.2
25	The Walks	Roadside	562191	319695	NO_2	NO	0	75	NO	1.7
26	Railway Road 7	Roadside	562131	319996	NO_2	YES	0	2	NO	2.3
27	St John's Terrace	Roadside	562178	319999	NO_2	YES	3	2	NO	2.1
28	St John's Terrace/Blackfriar's	Roadside	562253	320015	NO_2	YES	0	1.5	NO	2.6
29	Waterloo Street	Kerbside	562175	320055	NO_2	NO	2.5	1	NO	1.6
30	Portland Street	Kerbside	562204	320108	NO_2	NO	2.5	1	NO	2.4
31	Railway Road 2	Roadside	562129	320132	NO_2	YES	0	2	NO	2.3
32	Railway Road 3	Roadside	562119	320216	NO_2	YES	0	2	NO	2.4
33	Wellsley Street	Roadside	562203	320159	NO_2	NO	2.5	0.5	NO	2.4
34	Blackfriars 2	Roadside	562244	320129	NO_2	YES	0	2.5	NO	2.4
35	Blackfriars 1	Roadside	562245	320238	NO_2	YES	3	1.5	NO	2.3
36	Norfolk Street	Roadside	562219	320319	NO_2	YES	0	2	NO	2.2
37	Blackfriars 3	Roadside	562254	320259	NO_2	YES	0	2	NO	2.5
38	Littleport Street	Roadside	562257	320323	NO_2	YES	0	2.5	NO	2.4
39	Gaywood Road 2	Roadside	562822	320427	NO_2	NO	0	7	NO	5
40	The Swan (1) Gayton Road	Roadside	563490	320469	NO_2	YES	0	2	NO	2.5
41	Wootton Road 2	Roadside	563478	320515	NO_2	YES	0	2	NO	3.4

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)
42	Wootton Road 1	Roadside	563480	320582	NO_2	YES	0	3	NO	1.7
43	Lynn Road 1	Roadside	563412	320477	NO_2	YES	0	5	NO	3.4
44	Lynn Road 2	Roadside	563377	320484	NO_2	YES	0	2	NO	3.4
45	Gaywood Road 3	Roadside	563202	320488	NO_2	NO	0	4.5	NO	2.2
46	Gaywood Road 1	Roadside	562565	320509	NO_2	NO	0	6.5	NO	2.09
47	Austin Street 1	Roadside	562186	320376	NO_2	YES	0.5	1	NO	1.7
48	Austin Street 2	Roadside	562180	320365	NO_2	YES	0	2	NO	2.6
51	Wootton Road 3	Roadside	563521	320628	NO_2	NO	6	1.5	NO	1.8
52	Lynn Road 3	Roadside	563289	320504	NO_2	NO	5.5	1	NO	1.6
58	NORR	Roadside	562171	319019	NO_2	NO	18	2	NO	2.5
66	Gaywood Road	Urban Background	562595	320527	NO_2	NO	0	N/A	NO	2.4
67	Greyfriars , London Road	Urban Background	562236	319579	NO_2	NO	0	N/A	NO	2.3
68	Nursery, London Road	Urban Background	562143	319838	NO_2	NO	0	N/A	NO	1.6
69	Whitefriars 1, Whitefriars Road	Urban Background	561994	319395	NO_2	NO	0	N/A	NO	2.2
70	Whitefriars 2, Whitefriars Road	Urban Background	561930	319355	NO_2	NO	0	N/A	NO	2.4
75	The Swan (2) Gayton Road	Roadside	563469	320469	NO_2	YES	0	2	NO	2.8
76	Hardwick Road	Roadside	562597	318740	NO_2	NO	1	8	NO	1.58

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)
79	Tennyson Ave	Roadside	562804	320423	NO_2	NO	0	2	NO	3.8
86	Bus Station - Taxi Rank	Other	562019	320139	NO_2	NO	0	N/A	NO	2.2
87	Albion Street	Roadside	562103	320164	NO_2	NO	0	2.6	NO	2.1
88	Tennyson Avenue (2)	Roadside	562795	320290	NO_2	NO	0	7.4	NO	2
89	Whitefriars Terrace	Roadside	561888	319467	NO_2	NO	0	1	NO	2.4
90	Spenser Road	Roadside	563366	322065	NO_2	NO	0	8	NO	1.8
91	Reid Way	Roadside	563255	321613	NO_2	NO	0	8	NO	2.5
92	Garden Court	Roadside	563256	321589	NO_2	NO	0	16	NO	2
93	Front Way	Roadside	563213	321283	NO_2	NO	0	9.7	NO	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 ($\mu g/m^3$) (3)				
					2012	2013	2014	2015	2016
Southgates	Roadside	Automatic	95.3	95.3	25	26	21	21	25
Gaywood	Roadside	Automatic	99.5	99.5	33	39	36	**42**	**45**
1	Roadside	Diffusion Tube	100	100	**40.3**	37.1	38.2	36.6	35.5
2	Roadside	Diffusion Tube	100	100	**45.1**	**47.1**	**47**	**46.6**	**44.6**
3	Roadside	Diffusion Tube	92	92	**40.6**	**42.2**	39.7	36.9	38.6
5	Roadside	Diffusion Tube	92	92	**43.6**	**43.9**	**46**	**53**	32.4
6,7,8	Roadside	Diffusion Tube	100	100	24.6	26.2	26.7	25.2	24.6
9	Roadside	Diffusion Tube	92	92	20	22.9	21.2	20.3	20.8
10	Roadside	Diffusion Tube	100	100	38.6	35.1	36.7	37.8	36.3
11	Roadside	Diffusion Tube	100	100	30	28.4	30.4	28.5	27.9
12	Roadside	Diffusion Tube	100	100	32.8	33.5	34.7	33.1	32
13	Roadside	Diffusion Tube	100	100	31.7	30.8	31.5	30.3	31
14	Roadside	Diffusion Tube	100	100	**50.4**	34.4	35	33.1	33.1
15	Roadside	Diffusion Tube	100	100	37.4	36.7	38.4	37.2	35.4
18	Roadside	Diffusion Tube	100	100	26.4	26.4	26.5	25.8	24.5
19	Roadside	Diffusion Tube	100	100	25	24.8	23.6	23.7	23
20	Roadside	Diffusion Tube	100	100	29.5	33.5	33.1	30.8	30.6
22	Roadside	Diffusion Tube	100	100	32.1	33.3	34.2	31.4	32.6
23	Roadside	Diffusion Tube	100	100	32.7	36.2	35.3	31.6	32.5
24	Roadside	Diffusion Tube	100	100	31.4	32.5	32	28.7	28.9
25	Roadside	Diffusion Tube	83	83	17.4	16.4	16.3	15	14.4

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2016 (%) [2]	NO_2 Annual Mean Concentration ($\mu g/m^3$) [3]				
					2012	2013	2014	2015	2016
26	Roadside	Diffusion Tube	92	92	36.7	37.2	36	33.8	31.5
27	Roadside	Diffusion Tube	100	100	31.3	30.4	30	27.5	28.5
28	Roadside	Diffusion Tube	100	100	29.5	32.1	30	30.2	30
29	Kerbside	Diffusion Tube	100	100	21.6	21.8	19.1	18.6	18.3
30	Kerbside	Diffusion Tube	100	100	22.9	22.8	21.3	21.4	20.4
31	Roadside	Diffusion Tube	100	100	36	32.7	30.9	30.4	28.2
32	Roadside	Diffusion Tube	100	100	30.7	30.6	30.9	27.7	29
33	Roadside	Diffusion Tube	100	100	28.3	26.9	29.7	27.4	26.1
34	Roadside	Diffusion Tube	92	92	31.4	31.3	32.1	30.1	28.7
35	Roadside	Diffusion Tube	100	100	30.6	29.9	29	28.5	27.2
36	Roadside	Diffusion Tube	100	100	31.1	28.6	29.2	27.9	27.3
37	Roadside	Diffusion Tube	100	100	29	35.2	33.1	27.3	26.5
38	Roadside	Diffusion Tube	100	100	35.7	31.7	35.1	32.5	31.5
39	Roadside	Diffusion Tube	100	100	26	27.5	26.8	24.3	24.1
40	Roadside	Diffusion Tube	100	100	34.2	31.7	32.8	31.2	30.2
41	Roadside	Diffusion Tube	100	100	33.7	37.1	35.2	31.2	32.2
42	Roadside	Diffusion Tube	100	100	32.3	30.8	29.7	29.8	29.3
43	Roadside	Diffusion Tube	100	100	30.6	30.6	30.9	28.7	30
44	Roadside	Diffusion Tube	92	92	34.3	35.5	36.6	31.8	32.8
45	Roadside	Diffusion Tube	92	92	29.9	31.5	26.8	26	27
46	Roadside	Diffusion Tube	100	100	24.4	26.3	26.2	23.8	24
47	Roadside	Diffusion Tube	100	100	35.5	33.9	34.9	29.6	30.3

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2016 (%) [2]	NO_2 Annual Mean Concentration ($\mu g/m^3$) [3]				
					2012	2013	2014	2015	2016
48	Roadside	Diffusion Tube	100	100	30.6	30.2	32.1	28.4	26.8
51	Roadside	Diffusion Tube	100	100	19.7	19.6	19	17.3	18.3
52	Roadside	Diffusion Tube	100	100	30	29.4	28.7	27.2	27.3
58	Roadside	Diffusion Tube	100	100	24.8	30.1	28.9	26.7	28.2
66	Urban Background	Diffusion Tube	92	92	22.6	22.3	22.6	20.9	20.4
67	Urban Background	Diffusion Tube	100	100	18.2	18.2	16.8	16.4	15.7
68	Urban Background	Diffusion Tube	83	83	22.9	21	19.4	18.8	19
69	Urban Background	Diffusion Tube	100	100	15.3	13.8	14.1	12.8	12.7
70	Urban Background	Diffusion Tube	100	100	12.4	12.5	13.9	12.4	12.3
75	Roadside	Diffusion Tube	100	100	34.1	34.8	35.1	33	32.2
76	Roadside	Diffusion Tube	100	100	-	20.1	20.8	18.8	18.2
79	Roadside	Diffusion Tube	100	100	-	35.2	34.7	34	34.6
86	Other	Diffusion Tube	92	92	-	-	-	27.6	27.7
87	Roadside	Diffusion Tube	100	100	-	-	-	28.7	30.5
88	Roadside	Diffusion Tube	100	100	-	-	-	18.9	18.3
89	Roadside	Diffusion Tube	100	100	-	-	-	13.3	13
90	Roadside	Diffusion Tube	100	50[4]	-	-	-	-	14.0
91	Roadside	Diffusion Tube	100	50[4]	-	-	-	-	13.6
92	Roadside	Diffusion Tube	100	50[4]	-	-	-	-	12.9
93	Roadside	Diffusion Tube	83	42[4]	-	-	-	-	13.1

☒ **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.

(4) Low data capture as diffusion tubes were deployed part way through the year.

Figure A.1 – Trends in Annual Mean NO_2 Concentrations (Automatic Stations)

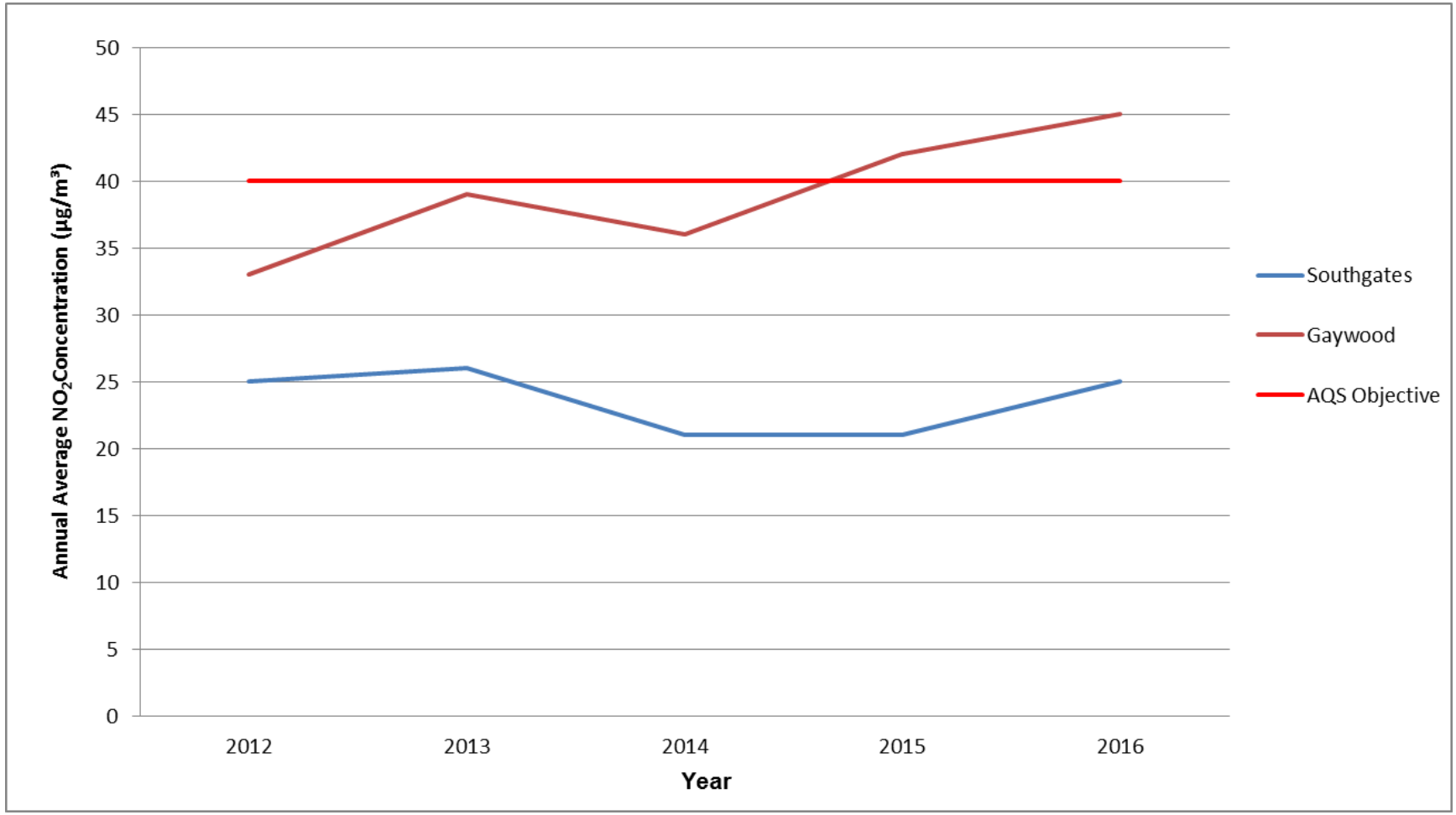


Figure A.2 – Trends in Annual Mean NO_2 Concentrations (Inside AQMAs)

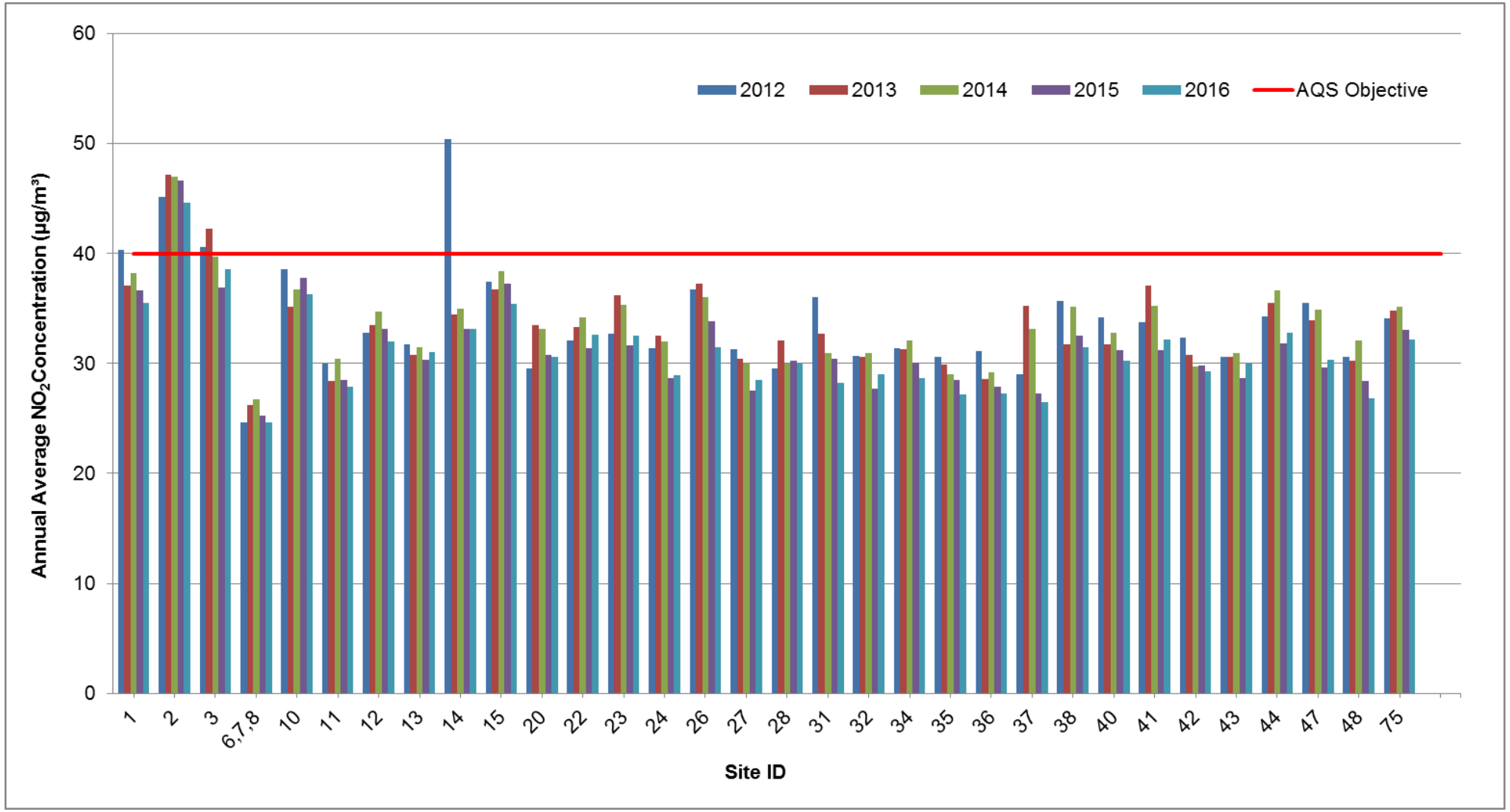


Figure A.3 – Trends in Annual Mean NO_2 Concentrations (Outside AQMAs)

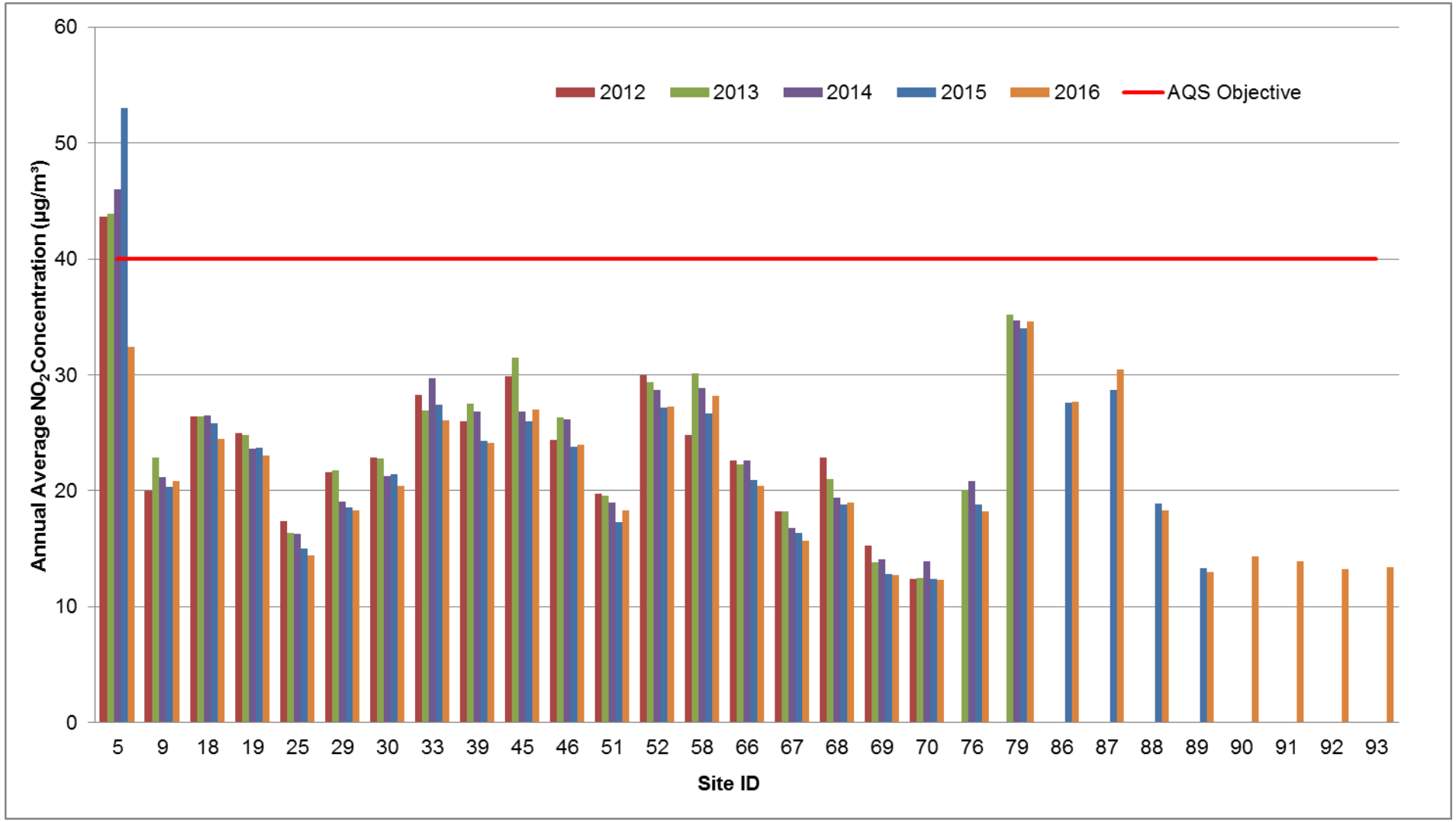


Table A.4 – 1-Hour Mean NO_2 Monitoring Results

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
Southgates	Roadside	Automatic	95.3	95.3	0	0	0	0	0
Gaywood	Roadside	Automatic	99.5	99.5	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
North Lynn	Industrial	97.8	97.8	-	23	18	18	18
Page Stair Lane	Industrial	92.1	92.1	23	20	19	19	21
Stoke Ferry, Furlong Road	Industrial	82.3	82.3	**70**	17	18	16	21
Estuary Road	Industrial	99.9	99.9	-	18	16	20	15
Stoke Ferry, Wretton Road	Industrial	97.4	7.2(4)	-	-	-	-	16

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

Notes:

Exceedances of the PM_{10} annual mean objective of 40µg/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.

(4) Low data capture due to monitoring starting in December 2016.

Figure A.4 – Trends in Annual Mean PM_{10} Concentrations

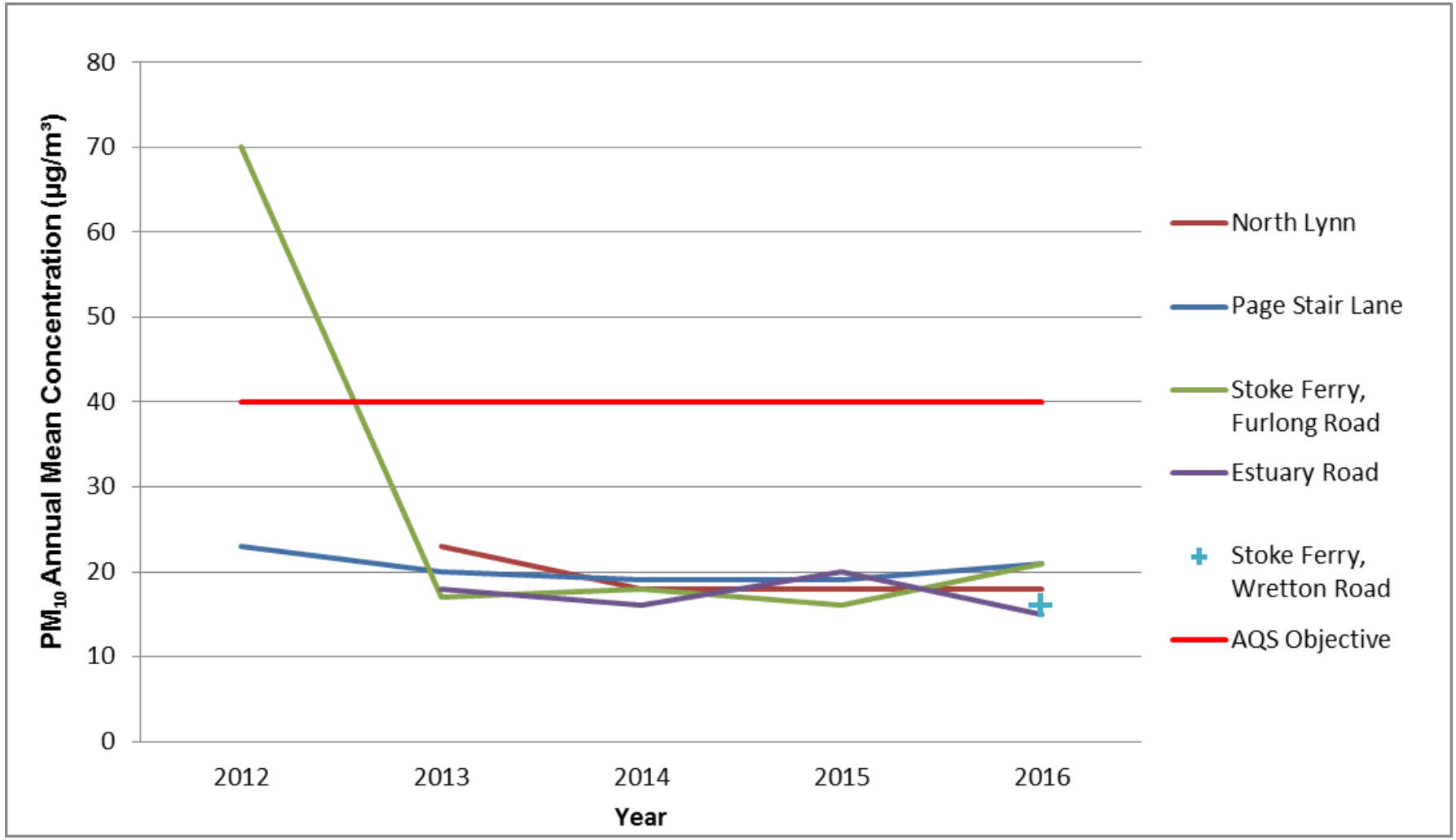


Table A.6 – 24-Hour Mean PM_{10} Monitoring Results

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
North Lynn	Industrial	97.8	97.8	-	1	4	3	5
Page Stair Lane	Industrial	92.1	92.1	16	6	7	4	9
Stoke Ferry, Furlong Road	Industrial	82.3	82.3	**193**	20	3	9	3
Estuary Road	Industrial	99.9	99.9	-	1	2	8	2
Stoke Ferry, Wretton Road	Industrial	97.4	7.2(4)	-	-	-	-	0

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.**

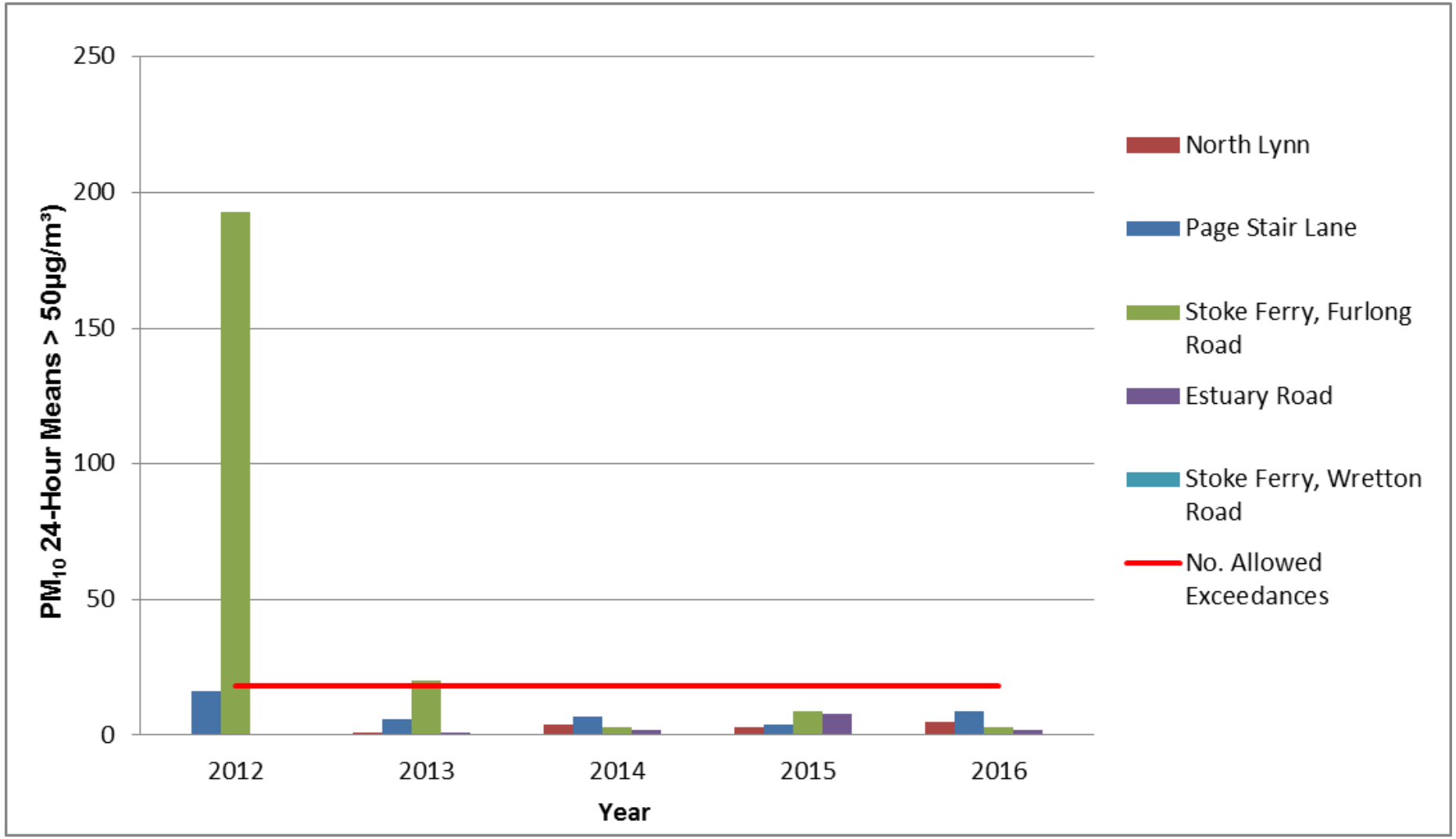
(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(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.

(4) Low data capture due to monitoring starting in December 2016.

Figure A.5 – Trends in Number of 24-Hour Mean PM_{10} Results >50µg/m^3



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 (µg/m^3)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean		
													Raw Data	Bias Adjusted (0.85) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
1	49	43	46	38	29	34	35	34	41	45	51	56	42	36	N/A
2	63	52	49	49	43	42	48	44	52	57	62	68	52	**45**	N/A
3	53	42	47	-	38	38	39	38	43	50	59	52	45	39	N/A
5	44	42	41	47	33	33	30	33	34	-	33	49	38	32	N/A
6,7,8	34	33	32	25	22	21	23	24	27	31	36	39	29	25	N/A
9	25	27	26	21	20	19	16	-	23	27	32	33	24	21	N/A
10	50	45	45	39	39	36	35	37	41	41	53	52	43	36	N/A
11	37	32	32	31	30	27	26	30	35	35	39	40	33	28	N/A
12	43	41	37	35	32	27	38	35	37	34	46	47	38	32	N/A
13	42	41	36	35	31	27	36	35	32	35	43	45	37	31	N/A
14	42	41	37	34	35	29	34	37	37	40	46	55	39	33	N/A
15	45	42	43	40	38	38	36	41	34	51	46	46	42	35	N/A
18	30	31	28	25	26	24	26	28	28	29	37	34	29	25	N/A
19	27	29	25	24	23	20	26	31	27	28	32	33	27	23	N/A
20	35	41	39	33	33	31	28	33	35	38	44	42	36	31	N/A

Site ID	NO_2 Mean Concentrations (µg/m^3)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean		
													Raw Data	Bias Adjusted (0.85) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
22	38	40	40	37	39	34	29	34	36	42	40	51	38	33	N/A
23	31	39	40	37	37	41	26	34	39	49	42	44	38	33	N/A
24	30	33	35	34	33	37	27	32	34	41	35	37	34	29	N/A
25	-	14	18	15	12	10	15	-	17	16	25	27	17	14	N/A
26	36	39	-	38	33	34	32	35	37	47	38	39	37	32	N/A
27	29	34	35	34	31	30	29	33	33	36	39	39	34	29	N/A
28	36	39	34	34	25	28	30	46	34	38	41	39	35	30	N/A
29	23	25	22	16	16	14	16	22	21	23	27	33	22	18	N/A
30	27	26	24	21	20	18	18	22	22	29	28	33	24	20	N/A
31	37	35	32	27	26	30	25	30	33	37	42	44	33	28	N/A
32	37	37	34	32	27	29	27	29	38	38	41	41	34	29	N/A
33	37	34	29	24	26	22	28	28	30	31	33	47	31	26	N/A
34	39	35	32	26	29	27	-	30	32	34	41	46	34	29	N/A
35	36	36	33	30	28	24	28	33	29	33	35	39	32	27	N/A
36	36	34	28	26	28	24	28	30	32	32	39	48	32	27	N/A
37	29	34	35	33	27	25	23	27	31	38	33	39	31	27	N/A
38	48	36	34	32	34	28	30	36	40	36	38	53	37	32	N/A
39	33	29	27	28	25	24	24	28	29	27	29	37	28	24	N/A
40	35	39	32	36	33	30	37	33	35	33	39	45	36	30	N/A

Site ID	NO_2 Mean Concentrations (µg/m^3)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean		
													Raw Data	Bias Adjusted (0.85) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
41	38	38	38	40	34	35	32	34	39	38	42	47	38	32	N/A
42	37	38	34	33	28	28	33	33	34	31	42	43	35	29	N/A
43	31	37	34	35	33	36	31	33	35	38	41	39	35	30	N/A
44	37	40	40	-	35	35	31	36	39	43	41	47	39	33	N/A
45	29	32	32	35	30	32	-	25	31	33	32	38	32	27	N/A
46	28	31	30	29	26	25	22	23	27	32	30	36	28	24	N/A
47	37	41	34	37	32	27	28	31	36	37	41	47	36	30	N/A
48	35	39	26	29	26	22	29	29	34	29	37	44	32	27	N/A
51	26	25	21	21	17	15	16	19	21	22	25	31	22	18	N/A
52	30	30	36	37	29	30	29	29	30	33	34	38	32	27	N/A
58	31	37	33	35	30	26	22	25	31	37	42	49	33	28	N/A
66	29	29	22	23	-	17	20	20	23	23	27	31	24	20	N/A
67	24	22	17	15	14	11	15	15	19	14	25	30	18	16	N/A
68	27	26	-	-	18	17	19	19	23	19	26	30	22	19	N/A
69	19	18	14	13	11	9	10	11	15	14	20	25	15	13	N/A
70	19	18	14	13	10	8	8	9	14	14	19	28	15	12	N/A
75	37	40	37	44	34	25	35	37	40	44	38	44	38	32	N/A
76	27	24	19	20	18	15	20	20	25	18	25	26	21	18	N/A
79	43	43	38	43	37	34	38	41	42	44	41	45	41	35	N/A

Site ID	NO_2 Mean Concentrations (µg/m^3)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean		
													Raw Data	Bias Adjusted (0.85) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
86	32	36	32	32	28	24	33	32	33	32	-	45	33	28	N/A
87	34	42	39	36	30	35	28	33	33	45	34	41	36	31	N/A
88	27	26	21	21	18	15	17	16	21	20	28	28	22	18	N/A
89	20	19	16	14	11	9	7	9	15	16	21	26	15	13	N/A
90	-	-	-	-	-	-	10	15	17	15	19	25	17	14	N/A
91	-	-	-	-	-	-	8	12	14	16	22	26	16	14	N/A
92	-	-	-	-	-	-	7	11	13	15	21	26	16	13	N/A
93	-	-	-	-	-	-	8	12	16	13	-	30	16	13	N/A

☒ **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.

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

Diffusion Tube Bias Adjustment Factors

The diffusion tubes were supplied and analysed by Gradko utilising the 20% triethanolamine (TEA) in water preparation method. A bias adjustment factor of 0.92 for the year 2016 (based on 27 studies) has been derived from the national bias adjustment calculator (June 2017 version).

For previous data, years 2012 to 2015, the bias adjustment factors have been taken from the Council's previous LAQM annual reports. The factors used were 0.84 (2012), 0.90 (2013), 0.73 (2014) and 0.88 (2015).

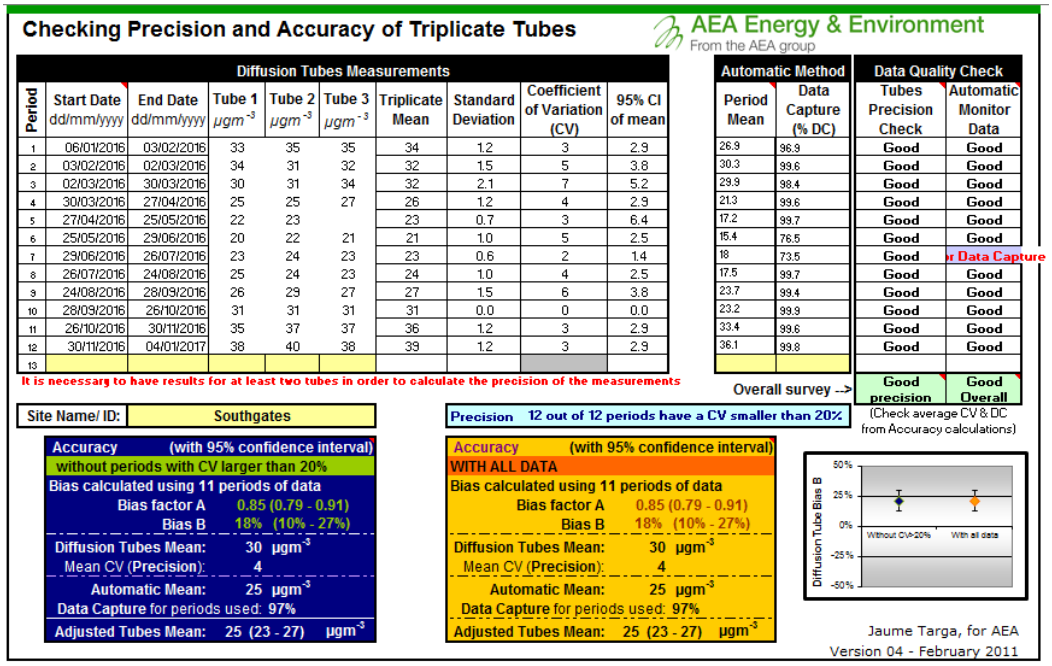
Factor from Local Co-Location Studies

The Council operates one continuous analyser (Southgates) with triplicate collocated tubes at the site.

Table C.1 – Local Bias Factors

Site ID	Diffusion Tube Data Capture	Continuous Monitor Data Capture for Periods Used	Diffusion Tube Annual Mean (µg/m^3)	Continuous Monitor Annual Mean (µg/m^3)	Bias Factor A	Bias Factor B
Southgates	Industrial	97%	30	25	0.85	18%

Figure C.1 – Southgates Automatic Monitor



Discussion of Choice of Factor to Use

A local bias adjustment factor has been applied to the data, which is calculated using the results of the Local Bias Adjustment Factor Tool. The technical guidance LAQM.TG(16) provides guidance with regard to the calculation of the local bias correction factor and 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/NO_2 continuous analysers. Alternatively, the national database of diffusion tube co-location surveys provides bias adjustment factors for the relevant laboratory and preparation method.

With regard to the application of a bias adjustment factor for the diffusion tubes, the technical guidance LAQM.TG(16) and LAQM Helpdesk recommends use of a local bias adjustment factor where available and relevant to diffusion tube sites.

The local bias adjustment factor was calculated as 0.85. The site had good data capture for the period and the tubes had good precision throughout.

For comparison, the national bias adjustment factor for the laboratory and tube preparation method for 2016 was 0.92 based on 27 studies (June 2017).

Short-term to Long-term Data Adjustment

Data capture at all sites which recorded less than 75% data capture during 2016 has been annualised according to the method set out in LAQM.TG(16) Box 7.9. The details of the annualisation have been provided in Table C.2 below.

Table C.2 – Short-term to Long-term Monitoring Data Adjustment

Site	Uncorrected Mean (µg/m^3)	Lincoln Ratio (AM/PM)	Market Harborough Ratio (AM/PM)	St Osyth Ratio (AM/PM)	Average Ratio (AM/PM)	Annualised Data Average (µg/m^3)	Annualised Bias Adjusted Concentration (µg/m^3)
Diffusion Tubes							
90	16.8	0.997	0.950	0.983	0.9767	16.4	14
91	16.3					16	13.6
92	15.5					15.1	12.9
93	15.8					15.4	13.1

QA/QC of Automatic Monitoring

Automatic

Data from the automatic monitoring stations is collected by Air Quality Data Management (AQDM) on behalf of the Council. The TEOM data has VCM for Indicative Gravimetric Equivalent applied. The Osiris data has a gravimetric factor of 1.3 for Indicative Gravimetric Equivalent applied. Both the TEOM and the NO_x analysers are serviced biannually by Air Monitors. Calibration data is collected fortnightly from NO_x analysers by council officers and passed to AQDM who carry out any adjustment of data. Both the TEOM and the NO_x analysers were inspected in January 2017 by the National Physical Laboratory (an independent organisation) for the purposes of performing QA/QC checks to ISO17025:2005. No problems were found. The Osiris instruments are serviced and calibrated annually by Turnkey Instruments.

Non-Automatic

The diffusion tube were supplied and analysed by Gradko. Gradko is a UKAS accredited laboratory and participates in the AIR-PT Scheme (a continuation of the Workplace Analysis Scheme for Proficiency (WASP)) for NO_2 tube analysis and the Annual Field Inter-Comparison Exercise. These provide strict performance criteria for participating laboratories to meet, thereby ensuring NO_2 concentrations are reported to a high level of accuracy. The laboratory follows the procedures as outlined within its Harmonisation Practical Guidance.

In the 2016 WASP/AIR PT results, rounds AIR PT AR012 (January – February 2016), AIR PT AR013 (April – May 2016), AIR PT AR015 (July – August 2016) and AIR PT AR016 (September – October 2016) Gradko scored 100%. This is the percentage of results submitted which were subsequently determined to be satisfactory based upon a z-score of ≤±2.

Fall-off with Distance Correction of Sites Exceeding the NO_2 Annual Mean Objective

The two monitoring sites (Gaywood Automatic Station and Railway Road 4) which exceeded the NO_2 AQS objective were located within an AQMA. The Railway Road 4 diffusion tube site was representative of exposure. Therefore, the NO_2 fall-off with distance calculator was used to estimate the NO_2 concentration at the nearest

location with relevant exposure for the Gaywood Automatic Station site. The calculations are shown in Figure C.2.

Figure C.2 – Fall-off Distance Correction of the Gaywood Automatic Station Site

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Enter data into the red cells

Step 1	How far from the KERB was your measurement made (in metres)?	1	metres
Step 2	How far from the KERB is your receptor (in metres)?	6	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	14	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	45	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	33.8	µg/m^3

Appendix D: Maps of Monitoring Locations and AQMAs

Figure D.1 – Map of Non-Automatic and Automatic Monitoring Stations within Close Proximity of the Town Centre AQMA

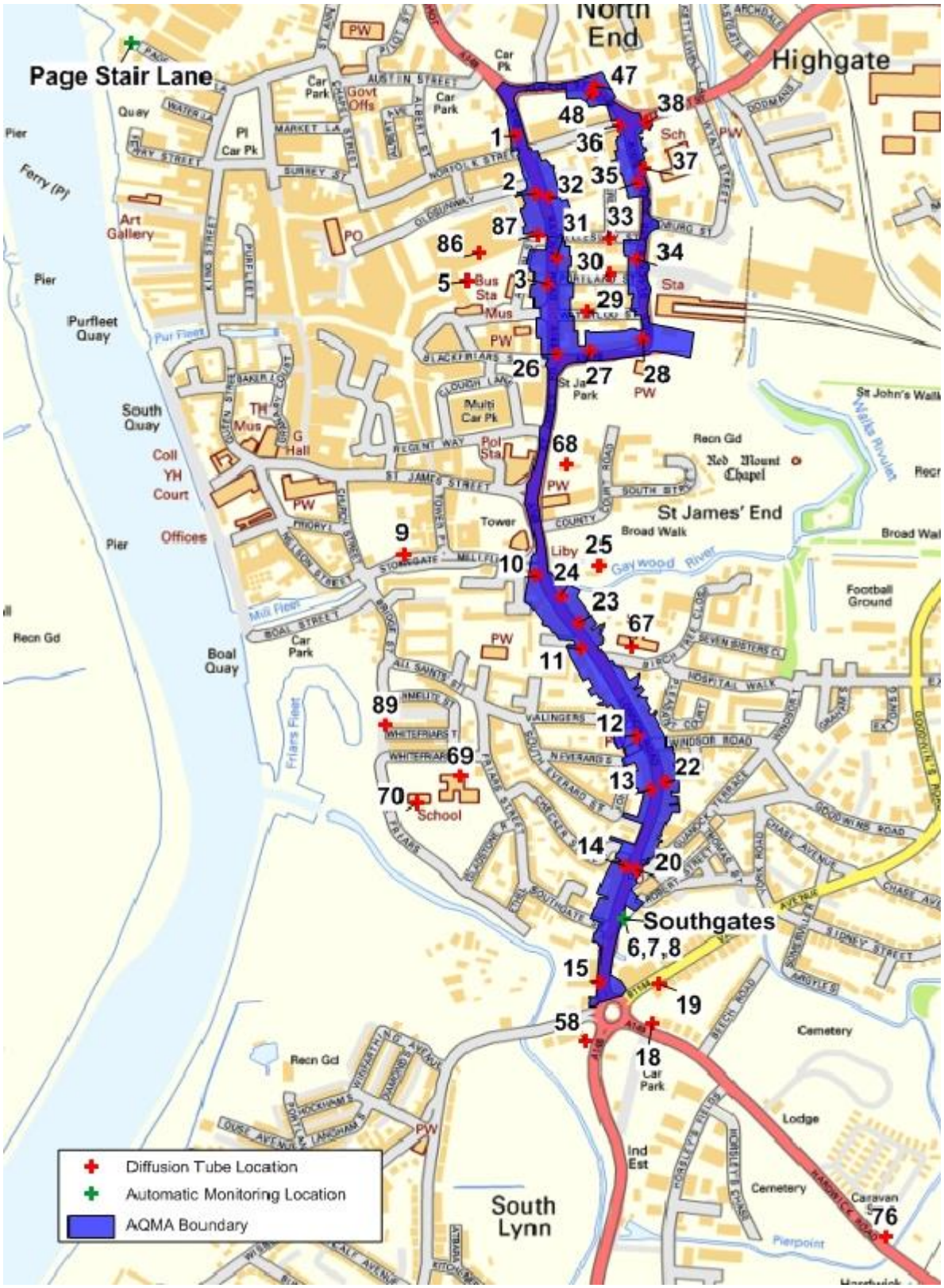

Figure D.2 – Map of Non-Automatic and Automatic Monitoring Stations within Close Proximity of the Gaywood Clock AQMA

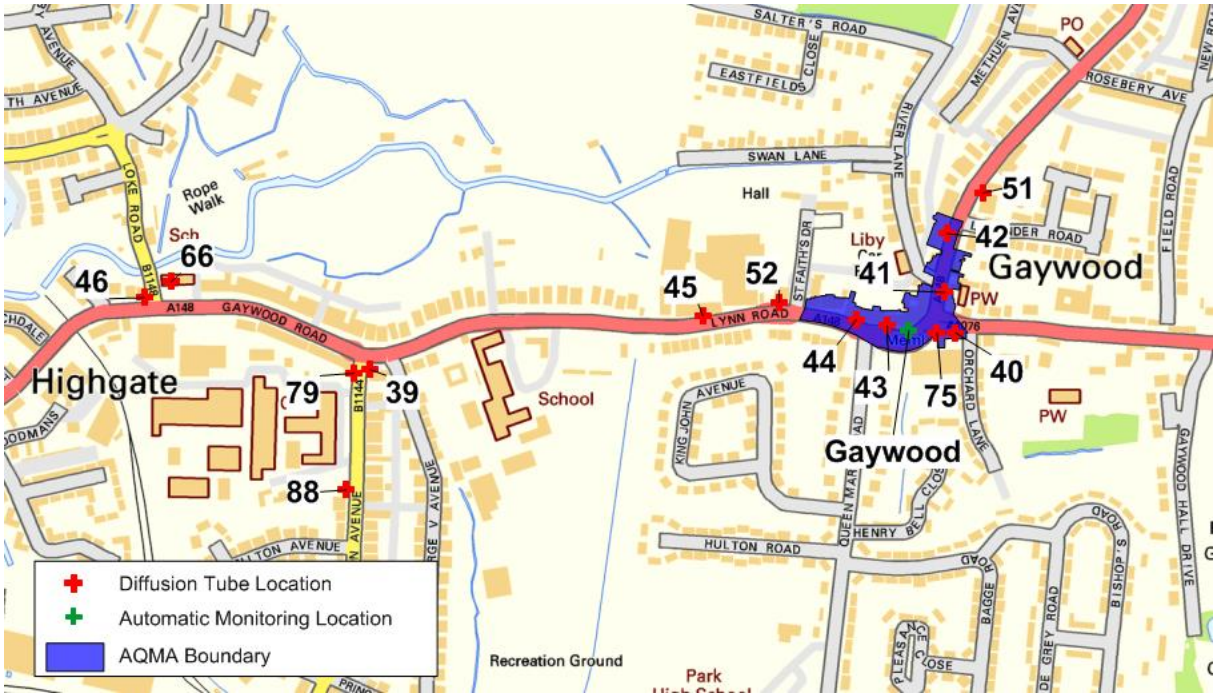

Figure D.3 – Map of Non-Automatic and Automatic Monitoring Stations outside the AQMAs

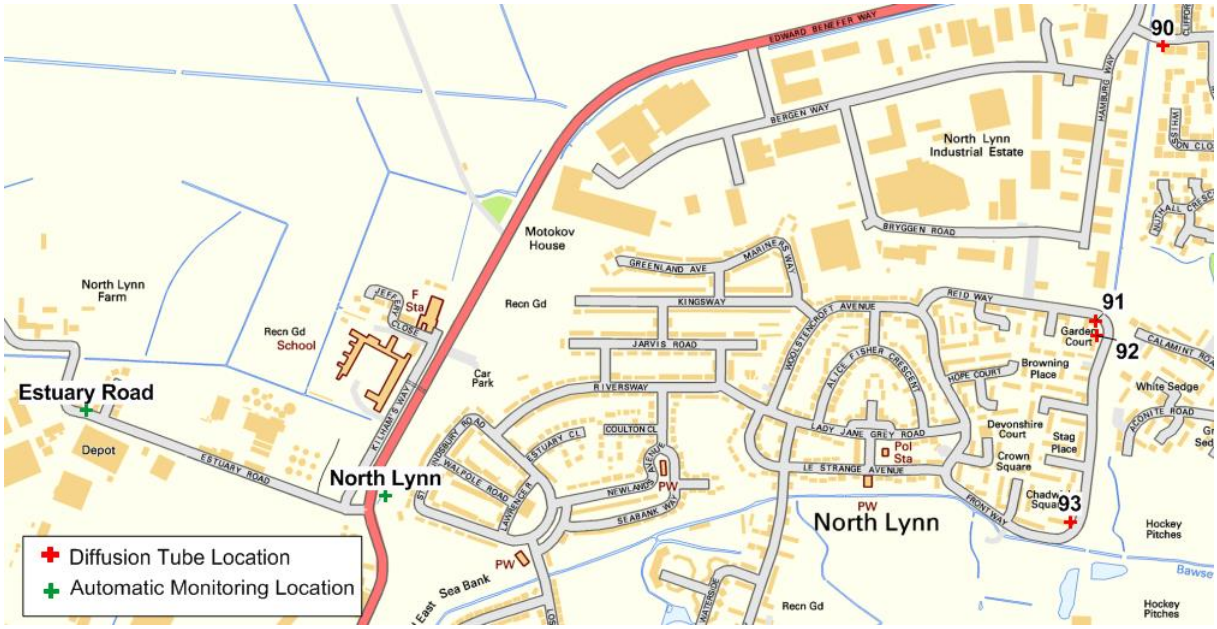

Figure D.4 – Map of Automatic Monitoring Stations at Stoke Ferry

Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England

Pollutant	Air Quality Objective[5]	
	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

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

Appendix F: Summary of Planning Applications Commented Upon in 2016

In 2016 the Environmental Quality Team commented on over 34 applications which had air quality issues. They were screened according to EPUK & IAQM guidance and air quality assessments required where appropriate. Best practice measures were also recommended.

Table F.1 – Summary of Planning Applications with Air Quality Assessments or those within/adjacent to an AQMA

Industrial	Note on potential impact
Extension of Air Cooled Condenser (ACC) structure and Air Inlet Filter House (AIFH) at King's Lynn Power Station, Willow Road, PE34 3RD.	The application included an air quality assessment. The ACC and AIFH are not likely to contribute to the emissions to air from the power station. Therefore the report focused on the proposed replacement of the gas turbine which is scheduled to be carried out alongside the extension works. Worst case pollutant concentrations were considered in the surrounding area and at specific locations including the nearby AQMA and a local caravan site. Both human and ecological receptors were assessed. The assessment considers the cumulative impact with the boiler, sludge combustor and consented CCGT at Palm Paper, and also included the proposed Kings Lynn B power station. The impact of the new Kings Lynn A, in isolation, is predicted to be less than the existing plant because of an increase in operating efficiency, together with the lower Emission Limit Value that will be required by the environmental permit from the Environment Agency. When considered in conjunction with the proposed King's Lynn B development and the other major industrial emissions sources the process contributions of the new turbine will be within the Air Quality Standard (AQS) and the below the short-term process contribution secondary screening limit.
Residential	
Conversion of Retail (Class A1) to three residential units and demolition at 5A, Albion Street, PE30 INJ.	The site is adjacent to the Kings Lynn AQMA. NO_2 concentrations above the AQS in the vicinity due to traffic emissions were measured. Due to the size of the development it is unlikely to have a significant impact on traffic. The location of the street frontage is set back slightly from Albion Street and some distance from the main bus stops in the bus station. Therefore there was no objection in principle regarding air quality impacts from or on this proposal. The EPUK & IAQM Guidance, Planning for Air Quality recommends that development should be 'designed to minimise public exposure to pollution sources' e.g. by locating habitable rooms away from pollution sources. The ground floor living room has windows facing Albion Street. Consideration will be given to providing alternative ventilation for this room for days when air quality is poor.
24 flats at site on Wisbech Road, PE30 5JL.	This site is adjacent to the King's Lynn AQMA. The development includes parking spaces but it is unclear how many additional traffic movements are expected daily and how many would enter the AQMA. On-going monitoring of NO_2 in the vicinity has indicated elevated levels of NO_2 near residential façades but an exceedance of the health based AQS has not been recorded. An air quality screening assessment is currently being prepared.

Industrial	Note on potential impact
Demolition of existing derelict shop and erection of proposed shop with 3 flats above at 102-103 London Road, PE30 5ES.	Proposed shop with flats at first floor level. Set well back from road with parking to front so unlikely to be exposed to poor air quality from traffic. No objections.
Conversion of existing building to provide 3 dwellings and construction of 8 new dwellings at 44 London Road, PE30 5QH.	The site is located within the Kings Lynn AQMA. The development includes 11 parking spaces. This is likely to generate well below 100 additional traffic movements daily. This is not a significant change in an AQMA, based on criteria in the EPUK/IAQM Planning for Air Quality guidance. On-going monitoring of NO_2 in the vicinity has indicated elevated levels of NO_2 near residential façades but an exceedance of the health based AQS has not been recorded. Therefore there was no objection in principle regarding the impact on air quality from additional traffic movements in the operational phase. In the absence of an air quality screening assessment and to reduce any potential adverse effects of poor air quality the 'Good practice measures set out under 'Operational Phase' in chapter 5 of the EPUK/IAQM Guidance will be included in the design stage. Where habitable rooms are ventilated with windows opening onto London Road, consideration will be given to an alternative means of ventilation to further reduce adverse effects on occupiers on days when air quality may be poor.
Ground and first floor extension to create 3 apartments at 126 London Road, PE30 5ES.	Conversion of rear of building. In AQMA but no exceedances measured here by diffusion tube. There is a building between this site and the road. Not a significant increase in AADT. No concerns with regards to air quality.
Up to 500 dwellings with a local centre and associated infrastructure and access at land south of Denver Hill, Downham Market.	Comments on earlier submissions at this site have been made and discussion with the applicant's consultant with regards to the approach of the air quality assessment has been carried out as the application has the potential to cause a change in traffic flows of more than 500 annual average daily traffic (AADT). The applicant submitted a screening level air quality assessment (AQA) with reference to EPUK IAQM guidance on planning for air quality. The AQA considered that the proposed development is unlikely to increase exposure of future receptors to nitrogen dioxide, or particulate concentrations that exceed air quality objectives, particularly as background concentrations in this area are low. The AQA concludes that the proposed development is unlikely to be adversely affected by, or have a significant impact on local air quality. The information provided supported this conclusion. The AQA acknowledges that the development has the potential to create a short term impact on air quality due to dust from construction therefore it is recommended that a Construction Environmental Management Plan is required by condition to mitigate this impact.

Industrial	Note on potential impact
Conversion into 6 town houses and demolition of outbuildings to the rear AT 49-51 Railway Road, PE30 1NE.	The development is within the King's Lynn AQMA close to a location where exceedances of the annual air quality standard for NO_2 have been measured. The air quality assessment considers air quality both during the construction and operational phases. As the development has no parking spaces it is unlikely to be a source of additional pollution from traffic so the report focuses on the impact of existing air quality on future occupants. The report makes reference to the Councils monitoring data but also considers the likely 'fall-off with distance' of NO_2 concentrations. This indicates the potential for exceedances of the annual AQS at the front facades (facing Railway Road) but not at the rear. To protect future occupants from poor air quality the report recommends that a mechanical ventilation system is installed to serve all rooms with road-facing windows and that these road-facing windows are non-openable. The mechanical ventilation system will draw air from a 'clean' area (i.e. the non road-facing facades). It is recommended that this ventilation system be included in the design. However, current best practice suggests that windows can be openable so that residents have the option to use them on days when air quality is not poor.
Redevelopment of part of the existing car park for 10 new dwellings with car parking at 1-5 Lynn Road, PE30 4PR.	10 proposed houses will generate 80 additional annual average daily traffic movements. The site is in an area where background pollution is predicted to be 16µg/m^3 NO_2 [according to the DEFRA's Background Mapping data for local authorities]. However the site is adjacent to the Gaywood AQMA where NO_2 has been measured above the AQS. This is not indicative of the need for an air quality assessment (according to table 6.2 of the EPUK & IAQM Guidance, Planning for Air Quality, January 2017). However, in order to mitigate the cumulative effect of this and other nearby development it is recommend that good practice measures set out under 'Operational Phase' in chapter 5.10 of the EPUK & IAQM Guidance be included in design and required by condition.

Table F.2 – Summary of all Other Planning Applications

Industrial	Note on potential impact
Variation of condition 2 of planning permission (C/2/2006/2032) to extend the duration of extraction at Beech Farm Bungalow (Middleton Aggregates Ltd.).	Fugitive PM_{10} emissions deemed not significant
Erection of anaerobic digestion facility (to process up to 14,000 tonnes of biomass/slurry) and CHP at site on Cross Bank Road, PE30 2HD.	Fugitive PM_{10} and emissions from flare stack. Planning application was refused.
Installation of anaerobic digester plant and associated infrastructure at Wellington Lodge Farm, Thetford Road, IP26 5NP.	Emissions from flare stack deemed not significant
Commercial/Communal	
Partial demolition of existing buildings and erection of extra care accommodation including communal facilities, landscaping and car park at Eastland House, PE36 5EW.	NO_2 from traffic deemed not significant
Demolition of existing building and construction of a Class A1 (retail) food store together with access, car parking, landscaping and associated engineering works at site on Lynn Road, PE31 7HU.	NO_2 from traffic deemed not significant
Agricultural/Animals	

Industrial	Note on potential impact
Retention of mobile low capacity incinerator for the disposal of waste cat litter and small animal incineration at Country Lodge Cattery, PE14 7RD.	Emissions from stack deemed not significant
Poultry unit at former RAF Methwold, Brandon Road, IP26 4RL.	Fugitive PM_{10} emissions deemed not significant
Residential	
Residential development of 50 dwellings at West Lynn Primary School, PE34 3JL.	NO_2 from traffic deemed not significant
Residential development to provide 26 dwellings with public open space and visitors car park at land between 102 and 116 Nursery Lane South.	NO_2 from traffic deemed not significant
Residential development of up to 17 dwellings at 19 Foresters Avenue, PE38 OJU.	NO_2 from traffic deemed not significant
Residential development for 18 dwellings at 118 Bexwell Road, PE38 9LI.	NO_2 from traffic deemed not significant
Construction of 11 dwellings 16 Lynn Road, Great Bircham.	NO_2 from traffic deemed not significant
Construction of up to 10 dwellings at land east of Air Training Corps Hut, Loke Road.	NO_2 from traffic deemed not significant
Construction of at least 10 dwellings at School Road, Runcton Holme.	NO_2 from traffic deemed not significant
Residential development including construction of village store and post office at Tamar Nurseries School Road, West Walton, PE14 7DS.	NO_2 from traffic deemed not significant
Erection of at least 35 dwellings at land west of 23-37 Benns Lane, Terrington.	NO_2 from traffic deemed not significant
Construction of 15 new dwellings and 2 barn conversions at 3 Church View, PE32 1PY.	NO_2 from traffic deemed not significant
33 new dwellings with means of access from the public highway from Pound Lane and a pedestrian route off Well Street at land on north side of High Street, Docking.	NO_2 from traffic deemed not significant
Erection of 10 dwellings on Hillgate Street, PE34 4NS.	NO_2 from traffic deemed not significant
Construction of up to 16 dwellings at land north of Abbey Road, Great Massingham.	NO_2 from traffic deemed not significant
Residential development for 10 dwellings at Hollies Farm, PE33 9BA.	NO_2 from traffic deemed not significant
Demolition of No 28 - 30 and Coal Yard bungalow and development of approximately 27 dwellings along with access road at 28 Long Lane, P26 4BJ.	NO_2 from traffic deemed not significant
Residential development of up to 133 dwellings at land northeast of Cheney Hill, Heacham.	NO_2 from traffic deemed not significant
The construction of 89 dwellings, associated access roads, footways and new access of public open space and associated external works on Greenpark Avenue, King's Lynn.	NO_2 from traffic deemed not significant

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

Local Air Quality Management Technical Guidance (TG16), April 2016, published by Defra.

Local Air Quality Management Policy Guidance (PG16), April 2016, published by Defra.

National Diffusion Tube Bias Adjustment Spreadsheet, version 07_17

Borough Council of King's Lynn & West Norfolk Annual Status Report 2016

Borough Council of King's Lynn & West Norfolk Air Quality Action Plan 2015 version 10