Air Quality CONSULTANTS

2014 Progress Report, 2015 Updating and Screening Assessment, 2016 Air Quality Annual Status Report (ASR): Winchester City Council

August 2016

Experts in air quality management & assessment

Document Control

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Job Number	J2494

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Document Status and Review Schedule

Report No.	Date	Status	Reviewed by
J2494 /1/F1	9 August 2016	Final Report	Penny Wilson (Principal Consultant)

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Executive Summary: Air Quality in Our Area

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.

This document is Winchester City Council's Annual Status Report (ASR) for 2016. Results from monitoring by the Council are presented and sources of air pollution are identified. The ASR determines those changes since the last assessment that could lead to the risk of an air quality objective being exceeded.

This Annual Status Report confirms that concentrations within the Air Quality Management Area (AQMA) within the centre of Winchester continue to exceed the relevant annual mean air quality objective.

No significant changes in existing emissions sources within Winchester have been identified. Furthermore, there have been no new relevant industrial installations and no new significant commercial, domestic or fugitive sources of emissions.

Air Quality in Winchester

Air pollution is associated with a number of adverse health impacts. It is recognised as having a significant impact on human health, including premature mortality, allergic reactions, and cardiovascular diseases. 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 (Wheeler BW, 2005) and (Defra, 2006)

The annual health cost to society of the impacts of particulate matter alone in the UK is estimated to be around £16 billion (Defra, 2013).

Winchester City Council's administrative area comprises the city of Winchester and wider district area of which over 40% lies within the South Downs National Park. Approximately 36% of the population lives in Winchester itself, but the city provides 50% of the total employment provision. This results in the commuting in and out of Winchester for work. Car ownership is high with the number of households with two or more cars approximately 50% higher than the national average. High car ownership provides more freedom of choice in terms of access to goods and services but also has a negative impact on the District's carbon footprint and air quality within the city centre (Winchester City Council, 2013).

The main source of air pollution in the borough is road traffic emissions from major roads, notably the M3, A34, A31 and A303. Other pollution sources, including commercial, industrial and domestic sources, also make a contribution to background pollution concentrations.

Pollutant concentrations within the wider district are all below the national air quality objectives, however concentrations within the centre of Winchester remain above the objectives. An Air Quality Management Area was designated in 2003 for exceedances of the annual mean nitrogen dioxide objectives and 24-hr PM_{10} objectives.

The 24-hr PM_{10} AQMA was revoked in 2010 after a number of years of measured concentrations remaining below objective levels.

The 2013 Progress Report identified the potential for exceedances of the nitrogen dioxide 1-hour mean objectives based on monitoring of concentrations greater than 60µg/m^3. Additional monitoring sites were installed on Romsey Road and St George's Street and a Detailed Assessment was undertaken in February 2015. This confirmed the potential for exceedances of the 1-hour mean nitrogen dioxide objective and recommended the declaration of three AQMAs in the areas of St George's Street, Chesil Street and Romsey Road. The council is currently reviewing the options as to how best to proceed with designation of an additional AQMA.

There is a downward trend in measured concentrations, indicating that air quality conditions within the borough are improving. Further data will be needed to confirm this as a trend over a longer time period.

Actions to Improve Air Quality

Winchester adopted an Air Quality Action Plan in April 2006 following consultation with stakeholders. It outlines 21 measures aimed at improving air quality in order to work towards the relevant air quality objectives. It is recognised that the main source of the pollution within the AQMA is road traffic, in particular arising from congestion and the topography of the main streets. As such, improvement options are related to transport, in particular reducing the reliance on private car use through the promotion of alternatives (walking, cycling and public transport), trying to reduce congestion in the city centre and lowering emissions of vehicles.

A number of measures included within the plan have been completed including Park and Ride facilities, Variable Message Signs for car parks in Winchester and on approach roads into the city, and most recently upgrading the Park and Ride bus fleet to Euro VI vehicles. There are a number of on-going actions, in particular those relating to reducing congestion (mainly delivered through the Winchester Town Access Plan, WTAP), encouraging public transport use, and taking action to increase public awareness of air quality.

The WTAP focuses on 'improving accessibility and air quality, reducing the level of traffic in the city centre and therefore improving the situation in terms of localised congestion'. It has four aims, two of which relevant to air quality:

- to lead a transition to cycling, walking, public transport and low-carbon modes of travel, including low emission private and commercial vehicles; and
- to reduce the negative effects of transport-related carbon emissions on all neighbourhoods, including the Town's historic environment, particularly in relation to air quality and the safety of pedestrians and cyclists.

Additionally Winchester protects air quality in its borough by using Core Strategy Policy WT1 to encourage sustainable transport provision to reduce pollution and carbon emissions. The main source of pollution within the borough is road traffic emissions, and the Local Transport Plan for Hampshire (Hampshire County Council, 2014) sets out policies to improve transport, and encourage sustainable transport within the borough.

Local Priorities and Challenges

Winchester is a city in which most of the services are focused in the city centre. The city centre is characterised by narrow streets and footways with limited room to allow improvements to road infrastructure. Traffic volume and deliveries can be a cause of traffic congestion.

The priority for the district is to work towards sustainable development through the provision of better accessibility and sustainable transport provision, resulting in a reduction in pollution and carbon emissions.

How to Get Involved

Members of the public can help improve air quality in the borough by travelling using sustainable transport options, such as walking, running, cycling and public transport. Winchester Council encourages the promotion of air quality, and education material relating to air quality can be provided.

Winchester's air quality monitoring data is hosted on UK Air Quality net http://www.ukairquality.net/ which allows access to existing and historical air quality levels. Further information on local air quality can also be obtained via the UBreathe app for iPhone and Android, which provides air pollution health advice where you need it.

Contents

Tables

Figures

Winchester City Council agrees with the conclusions and recommendations presented in this report.

1 Local Air Quality Management

This report provides an overview of air quality in Winchester during 2013, 2014 and 2015. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995) (HMSO, 1995) and the relevant Policy and Technical Guidance documents.

The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where an exceedance is considered likely, the local authority must declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives. This report represents the 2014 Progress Report, 2015 Updating and Screening Assessment and 2016 Annual Status Report (ASR). The report is an annual requirement showing the strategies employed by Winchester City 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 A5.1 in Appendix A5.

2 Actions to Improve Air Quality

2.1. Air Quality Management Areas

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

Winchester City Council has one AQMA within the city centre in respect to the annual mean nitrogen dioxide objective. This is described as the '*area surrounded by the town centre one way system and the town centre end of the major roads feeding into it*.'

An AQMA with the same extent, designated in respect to the particulate matter 24-hr mean objective, was revoked in 2010. A Detailed Assessment undertaken in 2015 recommended the designation of three additional AQMA's within the centre, for exceedances of the nitrogen dioxide hourly mean objective. The Council are currently reviewing the options as to how to proceed with designation. This is likely to comprise one of the following options;

- amend the existing AQMA designation;
- designate a new AQMA covering the geographic extent of the modelled exceedances; or
- review 2016 monitoring data to determine whether designation is still likely to be required, given the reduction in concentrations.

An Air Quality Action Plan was produced in 2006 detailing measures to improve air quality (Winchester City Council, 2006). Progress on measures included within this plan are detailed in section 2.2.

Further information related to declared or revoked AQMAs, including maps of AQMA boundaries are available online at https://uk-air.defra.gov.uk/aqma/details?aqma_id=144.

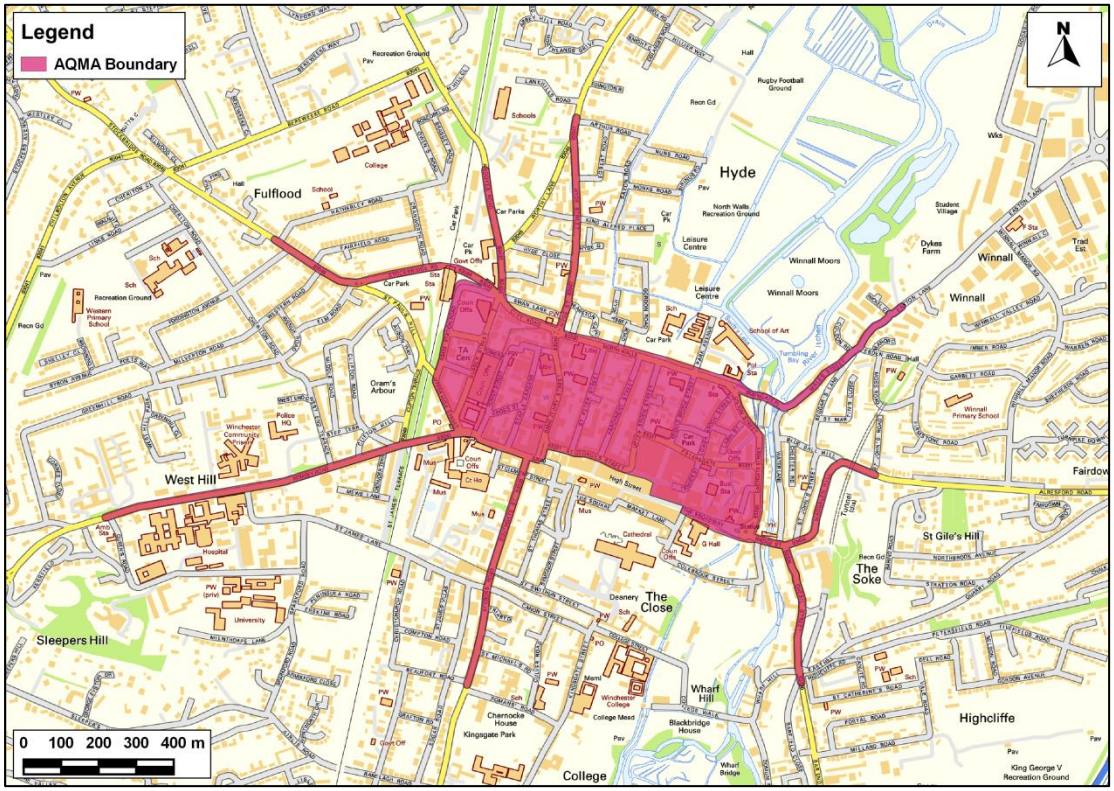

Figure 1: AQMA Boundary

2.2. Progress and Impact of Measures to address Air Quality in Winchester

Winchester City Council has taken forward a number of measures during the reporting years 2013-2015 in pursuit of improving local air quality.

A key measure undertaken since the 2013 Progress Report is a review of potential benefits of upgrading the bus fleet; considering two possible scenarios. The first scenario (SC1) considered the effects of replacing only those buses that currently operate on the Park and Ride route with Euro VI vehicles, and the second (SC2) considered the effects of replacing all buses operated by Stagecoach in the Council area, with Euro VI standard vehicles. The outcome of the review was the implementation of a Park and Ride bus fleet upgrade (SC1) to Euro VI vehicles which is likely to be fully complete in June 2016. Stagecoach has also voluntarily decided to upgrade their buses on all city centre routes to Euro VI vehicles.

A review of car parking pricing strategy within the city centre is undertaken annually, which takes into account the air quality impacts, to discourage use of vehicles within the city centre. The council also plans to review car parking further by considering the benefits of reducing spaces within the city centre during the coming year.

Winchester City Council has mostly completed all viable actions within their Air Quality Action Plan. Therefore additional actions are now required and thus the priority for the coming year is for the Action Plan to be reviewed and updated. Alongside this, a review of automatic monitoring sites is to be undertaken. This will involve the purchasing of new equipment and re-location of the existing monitors. The greatest air quality concern is likely to be focused on Romsey Road as well as the city centre, particularly due to the increased proportion of buses using this road. It is proposed the St George Street monitor will be repositioned towards St Jewry Street. In addition, a potential new site for the second monitor on Romsey Road or Chesil Street is being considered. The monitoring strategy will assist in evaluating the impacts of the forthcoming revised Action Plan.

2.3. $PM_{2.5}$: Local Authority Approach to Reducing Emissions and Concentrations

As detailed in Policy Guidance LAQM.PG16 Chapter 7 (Defra, 2016a), 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.

Winchester City Council is taking a number of measures to address $PM_{2.5}$. Measures to reduce other pollutants will also address $PM_{2.5}$.

Winchester City Council is working with Public Health colleagues to prioritise action on air quality in its local area to help reduce the health burden from air pollution. The Public Health Outcomes Framework (PHOF) is a Department of Health data tool for England, intended to focus public health action on increasing healthy life expectancy and reducing differences in life expectancy between communities. The PHOF includes an indicator, based on the effect of particulate matter ($PM_{2.5}$) on mortality. The approach used in partnership with Public Health colleagues, includes the encouragement of active travel, such as the Feet First campaign, which will also have wider public health benefits captured in other indicators such as increased physical activity (indicator 2.13) and reducing excess weight at various ages (indicators 2.6 & 2.12).

The Local Transport Plan (Hampshire County Council, 2014) for Hampshire sets out the transport strategy for the County for the period 2011-2031. Road traffic is one of the main sources of $PM_{2.5}$, improving transport within the borough is therefore of key importance. The Local Transport Plan proposes a number of strategies to improve transport within the County including measures to reduce the need to travel, widen travel choice and reduce dependence on the private car, alongside investment in low-carbon vehicle technologies and increasing active travel. The Local Transport Plan has considered the health impacts of policies and measures, such as the health benefits of physical activity and changes to air quality, noise and traffic accident numbers considering the Department of Health guidance on Transport and Health Resource (Department for Transport, 2011).

Planning policy is also a particularly important mechanism for controlling $PM_{2.5}$ emissions and Winchester City Council is focussed through its planning policy on preventing particulate matter concentrations being inadvertently increased. Policy WT1 within the Core Strategy states that '*the spatial planning vision for Winchester town will be achieved through:- (…) implementation of the Winchester Access Plan and the Winchester Air Quality Action Plan to ensure that transport provision and access to and within the town provides opportunities for sustainable transport provision and reduces pollution and carbon emissions"*.

Saved Policy DMP10 states "*Development which may generate air, land, light, surface water or groundwater pollution, and which accords with other relevant policies of this Plan, will only be*

permitted where the Local Planning Authority is satisfied that it has been designed to reduce the impact to an acceptable level. Proposals should comply with statutory standards of environmental quality and environmental protection policies required by the pollution control authorities, and include a statement setting out how the requirements have been met in designing the proposal."

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

3.1. Summary of Monitoring Undertaken

This section sets out the monitoring that has taken place since the 2013 Progress Report and how the results for 2013, 2014 and 2015 compare with objectives.

3.1.1. Automatic Monitoring Sites

Until recently, Winchester City Council operated two automatic monitoring sites. An urban background monitoring site, located at Godson House near Friarsgate, monitoring nitrogen dioxide (and PM_{10} until 2013), and a roadside monitoring site at the Echo Office in St George Street, monitoring nitrogen dioxide and PM_{10}. Monitoring at Godson House ceased in March 2015 due to limited resources. All data is ratified by AQDM Ltd.

3.1.2. Non-Automatic Monitoring Sites

Winchester City Council undertook non-automatic (passive) monitoring of nitrogen dioxide at 26 sites during 2013-2015 within the city and 8 monitoring sites within the wider district area. Ten additional temporary monitoring sites were installed between February 2014 and March 2015 on St George Street and Romsey Road to inform a Detailed Assessment (Winchester City Council, February 2016). Table A1.2 in Appendix A1 shows the details of the sites.

Maps showing the location of the monitoring sites are provided in Appendix A4. Further details on Quality Assurance/Quality Control (QA/QC) and bias adjustment for the diffusion tubes are included in Appendix A3.

3.2. Individual Pollutants

The air quality monitoring results presented in this section are, where relevant, annualised and bias adjusted. Further details on adjustments are provided in Appendix A3.

3.2.1. Nitrogen Dioxide (NO_2)

Table A1.3 and Table A1.5 in Appendix A1 compares the ratified and adjusted monitored annual mean and 1-hr nitrogen dioxide concentrations for the past 5 years, with the air quality objectives of 40 µg/m^3 and 200µg/m^3, respectively. The full 2013, 2014 and 2015 dataset is provided in Appendix A2.

There are a number of exceedances of the annual mean air quality objective, which are largely confined to the AQMA adjacent to main roads. Measured concentrations in 2015 are lower than previous years. Measured concentrations during 2013 and 2014 at the diffusion tube monitoring

Site 16 Alresford Road were above the annual mean objective. Concentrations reduced below the objective within 2015. This monitoring location is outside the designated AQMA, adjacent to the M3. It is located within close proximity to the M3 and Alresford Road, with the nearest relevant exposure 24 m to the west of the monitoring location, further from the M3 motorway. Therefore concentrations at the nearest receptors will be lower. It is recommended the monitoring site be relocated closer to the nearest property on Alresford Road, or adjacent to receptors on Limetree Walk which are closer to the M3 motorway to determine relevant exposure concentrations.

All measured concentrations for 2015 are below 60 µg/m^3; the criteria above which exceedances of the 1-hour mean objective are likely to occur. This represents a large reduction in concentrations compared those measured in 2013.

Within the wider district all concentrations are below the objectives.

Historically concentrations at the Echo Office roadside automatic monitor have been above the objectives but the most recent results for 2015 are below the annual mean and 1-hour air quality objectives.

Measured annual mean concentrations for the past 5 years at diffusion tube sites are presented in Table A1.4. There is a downwards trend in measured concentrations over this period, indicating that air quality conditions within the borough are improving. Further data will be needed to confirm this as a trend.

3.2.2. Particulate Matter (PM_{10})

Table A1.6 and Table A1.7 in Appendix A1 compares the ratified and adjusted monitored PM_{10} annual mean and 24-hr mean concentrations for the past 5 years with the air quality objectives of 40 µg/m^3 and 50µg/m^3, respectively. The results show that there are no exceedences of either objective at either site within Winchester.

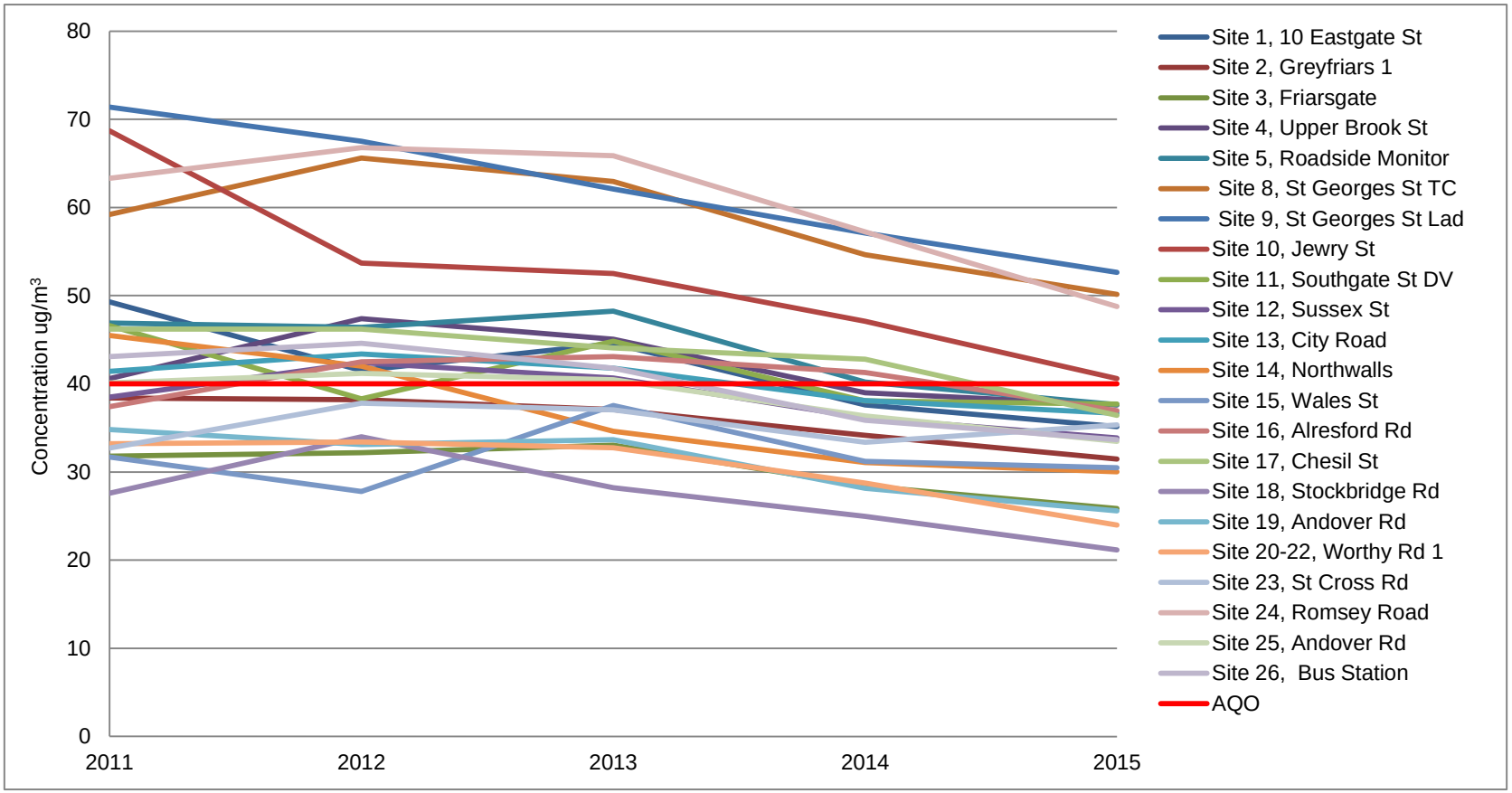

Figure 2: Trends in Annual Mean Nitrogen Dioxide Concentrations measured at the City Study Diffusion Tube Monitoring Sites

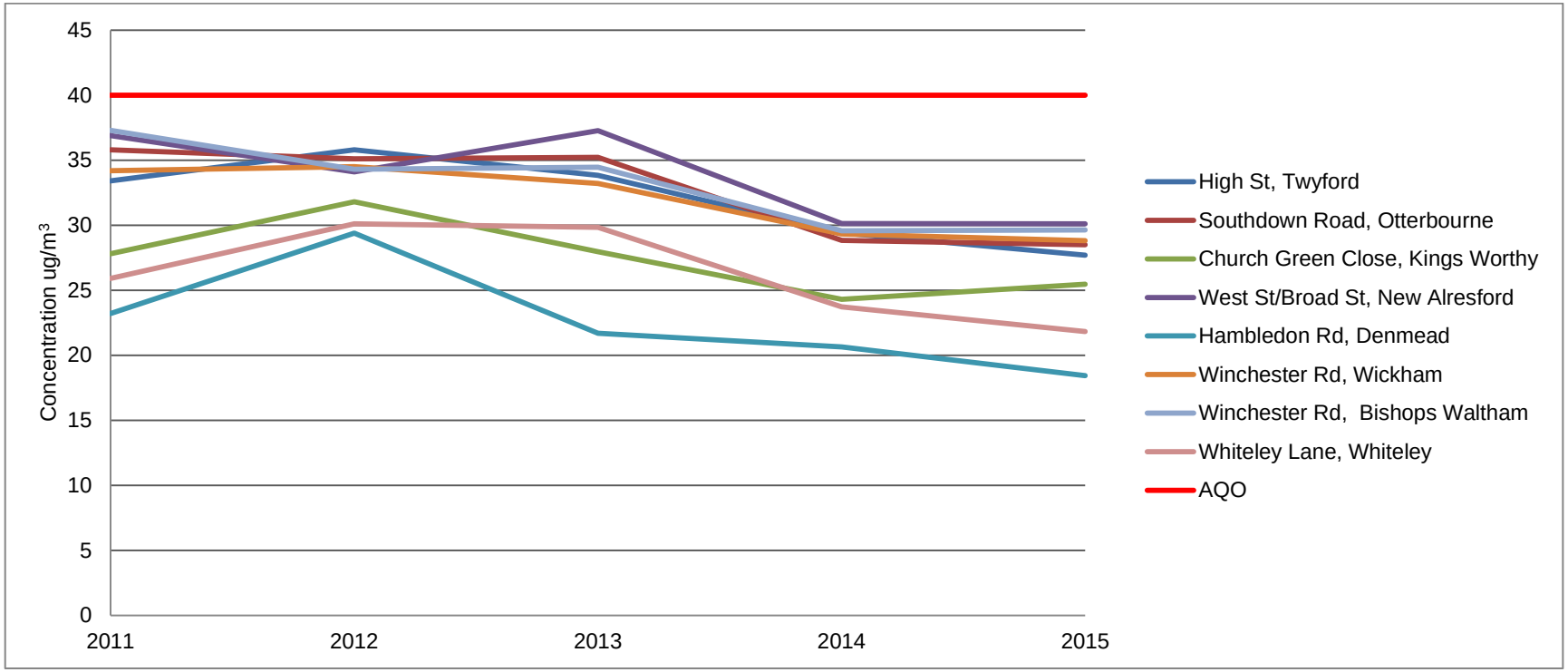

Figure 3: Trends in Annual Mean Nitrogen Dioxide Concentrations measured at the District Study Diffusion Tube Monitoring Sites

Appendices

A1 Appendix A: Monitoring Results

Monitoring Site Details

Table A1.1: Details of Automatic Monitoring Sites

Site ID	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) [a]	Distance to kerb of nearest road (m)	Inlet Height (m)
Echo Offices	Roadside	448212	129510	NO_2; PM_{10}	Y	Chemiluminescent; BAM	N/A	2.75	2.65
Godson House	Urban Background	448509	129539	NO_2	Y	Chemiluminescent	N/A	18	2.80

[a] N/A if not applicable or available

Table A1.2: Details of Non-Automatic Monitoring Sites- City Study

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) [a]	Distance to kerb of nearest road (m) [b]	Tube Collocated with a Continuous Analyser	Height (m)
Site 1	10 Eastgate St	Roadside	448563	129391	NO_2	Y	0	5.55	N	1.70
Site 2	Greyfriars 1	Roadside	448566	129560	NO_2	Y	0	9.70	N	1.75
Site 3	Friarsgate	Roadside	448426	129523	NO_2	Y	4.6	4.25	N	2.40
Site 4	Upper Brook St	Roadside	448227	129504	NO_2	Y	9.2	8.00	N	2.45
Site 5-7 (Triplicate)	Roadside Monitor	Roadside	448213	129504	NO_2	Y	N/A	3.10	Y	1.70
Site 8	St Georges St TC	Roadside	448106	129541	NO_2	Y	N/A	4.05	N	2.45
Site 9	St Georges St Lad	Roadside	448163	129512	NO_2	Y	N/A	3.60	N	2.40

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) [a]	Distance to kerb of nearest road (m) [b]	Tube Collocated with a Continuous Analyser	Height (m)
Site 10	Jewry St	Roadside	448046	129692	NO_2	Y	N/A	4.05	N	2.40
Site 11	Southgate St DV	Roadside	447918	129413	NO_2	Y	0	3.65	N	2.60
Site 12	Sussex St	Roadside	447804	129741	NO_2	Y	2.4	3.60	N	2.60
Site 13	City Road	Roadside	447963	129875	NO_2	Y	0	6.55	N	3.00
Site 14	Northwalls	Roadside	448297	129789	NO_2	Y	10.2	3.70	N	2.30
Site 15	Wales St	Roadside	448842	129820	NO_2	Y	0	1.70	N	2.45
Site 16	Alresford Rd	Other (Motorway)	449563	129439	NO_2	Y	24	35m(M3)	N	1.50
Site 17	Chesil St	Roadside	448679	129068	NO_2	Y	0	1.30	N	2.60
Site 18	Stockbridge Rd	Roadside	447534	130006	NO_2	Y	10	5.40	N	2.00
Site 19	Andover Rd	Roadside	447745	130456	NO_2	Y	0	6.50	N	2.30
Site 20-Site 22	Worthy Rd	Roadside	448092	130411	NO_2	Y	3.7	2.20	N	2.50
Site 23	St Cross Rd	Roadside	447842	129050	NO_2	Y	6	2.40	N	2.20
Site 24	Romsey Road	Roadside	447495	129511	NO_2	Y	0	1.10	N	2.50
Site 25	Andover Rd	Roadside	447898	130065	NO_2	Y	0	4.20	N	2.15
Site 26	Bus Station	Other (Bus)	448427	129401	NO_2	Y	N/A	N/A	N	2.40
XDT9	63 Romsey Road	Roadside	447246	129401	NO_2	Y	N/A	2.00	N	1.30
XDT10	Romsey Road Police HQ	Roadside	447344	129479	NO_2	Y	N/A	2.10	N	1.50
XDT8	Romsey Road Pump House Mews	Roadside	447501	129513	NO_2	Y	N/A	2.80	N	1.50

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) [a]	Distance to kerb of nearest road (m) [b]	Tube Collocated with a Continuous Analyser	Height (m)
XDT11	St. James Terrace (Romsey Road)	Roadside	447620	129549	NO_2	Y	N/A	1.95	N	2.45
XDT12	Romsey Road Re-Dress	Roadside	447730	129584	NO_2	Y	N/A	2.20	N	1.10
XDT1	McDonalds	Roadside	448223	129486	NO_2	Y	N/A	2.20	N	1.20
XDT3	Toy Cupboard	Roadside	448194	129499	NO_2	Y	N/A	2.00	N	2.00
XDT5	Café Centro	Roadside	448158	129526	NO_2	Y	N/A	2.10	N	1.20
XDT7	The Royal Oak	Roadside	448038	129544	NO_2	Y	N/A	2.30	N	1.00
XDT13	Tony & Guy	Roadside	448014	129591	NO_2	Y	N/A	N/A	N	N/A

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

[b] N/A if not applicable or available

Table A1.3: Details of Non-Automatic Monitoring Sites -District Wide Study

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) [a]	Distance to kerb of nearest road (m) [b]	Tube Collocated with a Continuous Analyser	Height (m)
Site 1	High St, Twyford	Roadside	449443	128927	NO_2	N	N/A	0.9	N	N/A
Site 2	Southdown Road, Otterbourne	Other (M3)	446537	124704	NO_2	N	N/A	N/A	N	N/A
Site 3	Church Green Close, Kings Worthy	Other (A34)	446659	124655	NO_2	N	N/A	N/A	N	N/A
Site 4	West St/Broad St, New	Roadside	446414	124279	NO_2	N	N/A	Centre of Road	N	N/A

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) [a]	Distance to kerb of nearest road (m) [b]	Tube Collocated with a Continuous Analyser	Height (m)
	Alresford									
Site 5	Hambledon Rd, Denmead	Roadside	446030	123672	NO_2	N	N/A	1.2	N	N/A
Site 6	Winchester Rd, Wickham	Roadside	445920	123331	NO_2	N	N/A	0.8	N	N/A
Site 7	Winchester Rd, Bishops Waltham	Roadside	445505	122345	NO_2	N	N/A	1.0	N	N/A
Site 8	Whiteley Lane, Whiteley	Other (M27)	446694	124642	NO_2	N	N/A	N/A	N	N/A

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

[b] N/A if not applicable or available

Monitoring Results

Table A1.4: Annual Mean Nitrogen Dioxide Monitoring Results

Site ID	Site Name	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period 2015 (%) [a]	Valid Data Capture 2015 (%) [b]	Valid Data Capture for Monitoring Period 2014 (%) [a]	Valid Data Capture 2014 (%) [a]	Valid Data Capture 2013 (%) [a]	NO_2 Annual Mean Concentration ($\mu g/m^3$)				
									2011	2012	2013[c]	2014[c]	2015[c]
Automatic Monitoring Sites													
Echo Offices	Echo Offices	Roadside	Automatic	91.7	91.7	86.4	86.4	96.4	**46**	**46**	**47**	**41**	38
Godson House	Godson House	Urban Background	Automatic	100	17.1	99.7	99.7	99.5	25	26	25	24	20[c]
City Study Diffusion Tube Monitoring Sites													
Site 1	10 Eastgate St	Roadside	Diffusion Tube	92	92	100	100	82	**49.3**	**41.5**	**44.6**	37.6	35.1
Site 2	Greyfriars 1	Roadside	Diffusion Tube	92	92	90	90	91	38.4	38.2	37.1	34.1	31.5
Site 3	Friarsgate	Roadside	Diffusion Tube	100	100	100	100	100	31.8	32.2	33.0	28.4	25.9
Site 4	Upper Brook St	Roadside	Diffusion Tube	100	100	100	100	100	**40.6**	**47.4**	**45.1**	39.0	37.6
Site 5-7 (Triplicate)	Roadside Monitor	Roadside	Diffusion Tube	100	100	100	100	100	**46.9**	**46.4**	**47.6**	**40.3**	38.2
Site 8	St Georges St TC	Roadside	Diffusion Tube	100	100	100	100	100	**59.2**	**65.6**	**63.0**	**54.7**	**50.2**
Site 9	St Georges St Lad	Roadside	Diffusion Tube	100	100	90	90	100	**71.5**	**67.5**	**62.1**	**57.1**	**52.6**
Site 10	Jewry St	Roadside	Diffusion Tube	75	75	100	100	100	**68.7**	**53.7**	**52.5**	**47.1**	**40.6**
Site 11	Southgate St DV	Roadside	Diffusion Tube	100	100	90	90	100	**46.6**	38.3	**44.8**	38.0	37.7
Site 12	Sussex St	Roadside	Diffusion Tube	92	92	100	100	91	38.5	**42.4**	**40.6**	36.1	33.9
Site 13	City Road	Roadside	Diffusion Tube	100	100	100	100	100	**41.4**	**43.4**	**41.8**	38.1	36.7

Site ID	Site Name	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period 2015 (%) [a]	Valid Data Capture 2015 (%) [b]	Valid Data Capture for Monitoring Period 2014 (%) [a]	Valid Data Capture 2014 (%) [a]	Valid Data Capture 2013 (%) [a]	NO_2 Annual Mean Concentration (µg/m^3)				
									2011	2012	2013[c]	2014[c]	2015[c]
Site 14	Northwalls	Roadside	Diffusion Tube	100	100	100	100	100	**45.5**	**42.0**	34.6	31.1	30.0
Site 15	Wales St	Roadside	Diffusion Tube	100	100	100	100	100	31.7	27.8	37.5	31.2	30.5
Site 16	Alresford Rd	Other (Motorway)	Diffusion Tube	92	92	90	90	100	37.4	**42.5**	**43.1**	**41.3**	37.0
Site 17	Chesil St	Roadside	Diffusion Tube	100	100	100	100	100	**46.2**	**46.2**	**44.1**	**42.8**	36.4
Site 18	Stockbridge Rd	Roadside	Diffusion Tube	92	92	100	100	82	27.6	34.0	28.2	25.0	21.2
Site 19	Andover Rd	Roadside	Diffusion Tube	100	100	90	90	82	34.8	33.1	33.7	28.2	25.6
Site 20-Site 22	Worthy Rd	Roadside	Diffusion Tube	100	100	100	100	100	33.2	33.4	33.2	29.3	24.2
Site 23	St Cross Rd	Roadside	Diffusion Tube	83	83	80	80	91	32.7	37.8	37.0	33.4	35.3
Site 24	Romsey Road	Roadside	Diffusion Tube	92	92	100	100	100	**63.3**	**66.8**	**65.9**	**57.2**	**48.8**
Site 25	Andover Rd	Roadside	Diffusion Tube	100	100	90	90	100	**40.1**	**41.2**	**40.5**	36.4	33.5
Site 26	Bus Station	Other (Bus)	Diffusion Tube	92	92	90	90	100	**43.1**	**44.6**	**41.8**	35.9	33.7
Additional City Study Diffusion Tube Monitoring Sites													
XDT9	63 Romsey Road	Roadside	Diffusion Tube	33	8	78	70	-	-	-	-	**43.9**	36.0
XDT10	Romsey Road Police HQ	Roadside	Diffusion Tube	67	17	89	80	-	-	-	-	25.7	31.7
XDT8	Romsey Road Pump House Mews	Roadside	Diffusion Tube	100	25	78	70	-	-	-	-	**61.6**	**53.2**
XDT11	St. James	Roadside	Diffusion	100	25	78	70	-	-	-	-	38.1	33.5

Site ID	Site Name	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period 2015 (%) [a]	Valid Data Capture 2015 (%) [b]	Valid Data Capture for Monitoring Period 2014 (%) [a]	Valid Data Capture 2014 (%) [a]	Valid Data Capture 2013 (%) [a]	NO_2 Annual Mean Concentration (µg/m^3)				
									2011	2012	2013[c]	2014[c]	2015[c]
	Terrace (Romsey Road)		Tube										
XDT12	Romsey Road Re-Dress	Roadside	Diffusion Tube	0	0	78	70	-	-	-	-	**51.5**	**-**
XDT1	McDonalds	Roadside	Diffusion Tube	100	25	78	70	-	-	-	-	**45.7**	**41.7**
XDT3	Toy Cupboard	Roadside	Diffusion Tube	100	25	100	90	-	-	-	-	**52.2**	**50.8**
XDT5	Café Centro	Roadside	Diffusion Tube	100	25	89	80	-	-	-	-	**46.1**	**41.4**
XDT7	The Royal Oak	Roadside	Diffusion Tube	100	25	89	80	-	-	-	-	**57.4**	**44.6**
XDT13	Tony & Guy	Roadside	Diffusion Tube	100	25	56	50	-	-	-	-	**41.4**	38.4
District Study Diffusion Tube Monitoring Sites													
Site 1	High St, Twyford	Roadside	Diffusion Tube	100	100	90	90	100	33.4	35.8	33.8	29.4	27.7
Site 2	Southdown Road, Otterbourne	Other (M3)	Diffusion Tube	100	100	100	100	100	35.8	35.1	35.2	28.8	28.5
Site 3	Church Green Close, Kings Worthy	Other (A34)	Diffusion Tube	100	100	90	90	91	27.8	31.8	28.0	24.3	25.5
Site 4	West St/Broad St, New Alresford	Roadside	Diffusion Tube	75	75	90	90	82	36.9	34.1	37.3	30.1	30.1
Site 5	Hambledon Rd, Denmead	Roadside	Diffusion Tube	100	100	80	80	100	23.2	29.4	21.7	20.6	18.4

Site ID	Site Name	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period 2015 (%) [a]	Valid Data Capture 2015 (%) [b]	Valid Data Capture for Monitoring Period 2014 (%) [a]	Valid Data Capture 2014 (%) [a]	Valid Data Capture 2013 (%) [a]	NO_2 Annual Mean Concentration (µg/m^3)				
									2011	2012	2013[c]	2014[c]	2015[c]
Site 6	Winchester Rd, Wickham	Roadside	Diffusion Tube	92	92	90	90	91	34.2	34.5	33.2	29.3	28.8
Site 7	Winchester Rd, Bishops Waltham	Roadside	Diffusion Tube	92	92	100	100	100	373.3	34.3	34.4	29.6	29.6
Site 8	Whiteley Lane, Whiteley	Other (M27)	Diffusion Tube	100	100	80	80	45	25.9	30.1	29.9	23.7	21.8

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

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

For 2014 and 2015 national bias adjustment factor from spreadsheet version 03/16 used. For 2013 local bias adjustment factor applied. For 2013-2015 time weighted average has been used, resulting in marginally different results from previously reported.

XDT tubes and Godson House automatic monitor had very poor data capture in 2015 as monitoring ceased in March and therefore caution should be applied to 2015 annualised results.

District and City diffusion tube monitoring sites have different monitoring periods and therefore not directly comparable.

[a] data capture for the monitoring period, in cases where monitoring was only carried out for part of the year. (e.g. if monitoring was carried out for 3 months and results were available for all three monthly tubes then the data capture is 100%).

[b] data capture for the full calendar year

[c] Annual means have been "annualised" as per Technical Guidance LAQM.TG16 where valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Table A1.5: 1-Hour Mean Nitrogen Dioxide Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for 2015 Monitoring Period (%) [a]	Valid Data Capture 2015 (%) [b]	Valid Data Capture 2014 (%)	Valid Data Capture 2013 (%) [b]	NO_2 1-Hour Means > 200µg/m^3 [c]				
							2011	2012	2013	2014	2015
Echo Offices	Roadside	Automatic	91.7	91.7	86.4	96.4	0	0	1	0	1
Godson House	Urban	Automatic	17.1	17.1	99.7	99.5	0	0	0	0	0 (50)

Site ID	Site Type	Monitoring Type	Valid Data Capture for 2015 Monitoring Period (%) [a]	Valid Data Capture 2015 (%) [b]	Valid Data Capture 2014 (%)	Valid Data Capture 2013 (%) [b]	NO_2 1-Hour Means > 200µg/m^3 [c]				
							2011	2012	2013	2014	2015
	Background										

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**.

[a] data capture for the monitoring period, in cases where monitoring was only carried out for part of the year. (e.g. if monitoring was carried out for 3 months and results were available for all three monthly tubes then the data capture is 100%).

[b] 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%).

[c] period of valid data is less than 85%, the 99.8th percentile of 1-hour means is provided in brackets.

Table A1.6: Annual Mean PM_{10} Monitoring Results

Site ID	Site Type	Valid Data Capture 2015 (%)[a]	Valid Data Capture 2014 (%)[a]	Valid Data Capture 2013 (%)[a]	PM_{10} Annual Mean Concentration (µg/m^3)				
					2011	2012	2013	2014	2015
Echo Offices	Roadside	97.8	99.3	97.5	27	29	31	29	32
Godson House	Urban Background	N/A	16.1	95.6	20	20	23	18[b]	-

Notes: Exceedances of the PM_{10} annual mean objective of 40µg/m^3 are shown in **bold**.

[a] 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%).

[b] Means have been "annualised" as per Technical Guidance LAQM.TG16 as valid data capture for the full calendar year is less than 75%. See Appendix C for details. Godson House automatic monitor had very poor data capture in 2014 and therefore caution should be applied to 2014 annualised results.

Table A1.7: 24-Hour Mean PM_{10} Monitoring Results

Site ID	Site Type	Valid Data Capture 2015 (%) [a]	Valid Data Capture 2014 (%) [a]	Valid Data Capture 2013 (%) [a]	PM_{10} 24-Hour Means > 50µg/m^3				
					2011	2012	2013	2014	2015
Echo Offices	Roadside	97.8	99.3	97.5	9	16	15	19	23
Godson House	Urban Background	N/A	16.1	95.6	3	1	3	1 (38)[b]	-

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**.

[a] 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%).

[b] period of valid data is less than 85%, the 90.4th percentile of 24-hour means is provided in brackets.

A2 Appendix B: Full Monthly Diffusion Tube Results

Table A2.1: Nitrogen Dioxide Monthly Diffusion Tube Results City Study 2015

Site ID	NO_2 Mean Concentrations (µg/m^3)														
	15/12/14-28/01/15	28/01/15 - 25/02/15	25/02/15 - 24/03/15	24/03/15 - 29/04/15	29/04/15 - 28/05/15	28/05/15 - 24/06/15	24/06/15 - 23/07/15	23/07/15 - 28/08/15	28/08/15 - 29/09/15	29/09/15 - 23/10/15	23/10/15 - 27/11/15	27/11/15 - 31/12/15	Annual Mean [a]		
													Raw Data	Annual ised	Bias Adjusted (0.91)
Site 1, 10 Eastgate St	38.4	32.8	35.0	34.4	-	41.3	49.8	31.4	33.7	38.4	32.8	35.0	38.6	-	35.1
Site 2, Greyfriars	27.9	31.0	30.9	36.9	34.3	31.9	44.0	33.9	30.7	27.9	31.0	30.9	34.6	-	31.5
Site 3, Friarsgate	27.7	21.3	21.6	25.9	27.7	26.5	30.4	29.7	26.1	27.7	21.3	21.6	28.4	-	25.9
Site 4, Upper Brook St (Echo)	42.2	38.4	35.6	36.8	38.1	42.9	52.6	40.6	30.2	42.2	38.4	35.6	41.3	-	37.6
Site 5-7, Roadside Monitor (Average)	41.4	52.4	49.4	43.7	38.5	43.4	38.1	40.5	43.8	54.3	37.1	27.2	41.9	-	38.2
Site 8, St Georges St Bed	57.4	53.5	59.0	49.8	55.4	57.4	69.3	45.5	28.9	57.4	53.5	59.0	55.1	-	**50.2**
Site 9, St Georges St Lad	59.4	55.5	50.8	53.4	58.1	49.5	56.3	58.4	52.4	59.4	55.5	50.8	57.8	-	**52.6**
Site 10, Jewry St	-	34.1	34.9	-	48.5	42.7	51.9	50.7	42.1		34.1	34.9	44.6	-	**40.6**
Site 11, Southgate St	44.1	35.4	37.7	37.2	40.2	41.4	52.4	34.6	33.8	44.1	35.4	37.7	41.4	-	37.7

Site ID	NO_2 Mean Concentrations (µg/m^3)														
	15/12/14-28/01/15	28/01/15 - 25/02/15	25/02/15 - 24/03/15	24/03/15 - 29/04/15	29/04/15 - 28/05/15	28/05/15 - 24/06/15	24/06/15 - 23/07/15	23/07/15 - 28/08/15	28/08/15 - 29/09/15	29/09/15 - 23/10/15	23/10/15 - 27/11/15	27/11/15 - 31/12/15	Annual Mean [a]		
													Raw Data	Annual ised	Bias Adjusted (0.91)
Site 12, Sussex St	39.7	29.7	32.1	36.5	-	36.8	49.6	33.6	35.7	39.7	29.7	32.1	37.2	-	33.9
Site 13, City Road	40.6	38.9	32.8	41.4	37.9	36.0	36.9	39.5	38.8	40.6	38.9	32.8	40.3	-	36.7
Site 14, 74 Northwalls	32.1	29.0	26.5	30.2	34.5	30.7	31.7	35.6	33.4	32.1	29.0	26.5	33.0	-	30.0
Site 15, Wales St	33.6	25.4	20.9	29.4	29.5	31.4	38.4	37.6	33.7	33.6	25.4	20.9	33.5	-	30.5
Site 16, Alresford Rd (M3)	44.2	36.4	-	40.0	35.3	31.6	52.7	42.2	32.4	44.2	36.4	-	40.6	-	37.0
Site 17, Chesil St	38.2	33.6	27.8	35.5	36.8	38.0	45.1	46.2	44.1	38.2	33.6	27.8	40.0	-	36.4
Site 18, Stockbridge Rd	25.3	17.9	18.8	19.2	20.8	-	31.4	21.5	17.2	25.3	17.9	18.8	23.2	-	21.2
Site 19, Andover Rd (JF)	29.6	20.4	21.3	22.8	24.1	26.6	37.1	31.5	26.1	29.6	20.4	21.3	28.1	-	25.6
Site 20-22, Worthy Rd (Average)	33.6	37.3	31.6	28.5	23.1	19.4	21.1	23.0	23.6	28.1	25.3	23.3	26.6	-	24.2
Site 23, St Cross Rd		32.2	29.7	31.6	31.2	63.6	31.4	35.4	33.4	-	32.2	29.7	38.8	-	35.3
Site 24, Romsey Road	51.9	57.9	54.8	64.0	52.3	36.2	-	57.5	51.3	51.9	57.9	54.8	53.6	-	**48.8**
Site 25,	35.1	30.5	27.6	35.3	37.1	32.4	41.5	35.3	37.2	35.1	30.5	27.6	36.8	-	33.5

Site ID	NO_2 Mean Concentrations (µg/m^3)														
	15/12/14-28/01/15	28/01/15 - 25/02/15	25/02/15 - 24/03/15	24/03/15 - 29/04/15	29/04/15 - 28/05/15	28/05/15 - 24/06/15	24/06/15 - 23/07/15	23/07/15 - 28/08/15	28/08/15 - 29/09/15	29/09/15 - 23/10/15	23/10/15 - 27/11/15	27/11/15 - 31/12/15	Annual Mean [a]		
													Raw Data	Annual ised	Bias Adjusted (0.91)
Andover Rd															
Site 26, Bus Station	34.7	28.9	31.8	34.9	36.7	33.0	43.4	38.3	-	34.7	28.9	31.8	37.0	-	33.7
XDT9, 63 Romsey Road	51.1	-	-	-	-	-	-	-	-	-	-	-	51.1	39.6	36.0 [b]
XDT10, Romsey Road Police HQ	40.1	52.6	-	-	-	-	-	-	-	-	-	-	45.0	34.8	31.7 [b]
XDT8, Romsey Road Pump House Mews	76.1	75.3	74.7	-	-	-	-	-	-	-	-	-	75.5	58.4	**53.2** [b]
XDT11, St. James Terrace (Romsey Road)	42.2	55.6	48.0	-	-	-	-	-	-	-	-	-	47.6	36.8	33.5 [b]
XDT1, McDonalds	56.9	62.9	58.9	-	-	-	-	-	-	-	-	-	59.1	45.8	**41.7** [b]
XDT3, Toy Cupboard	83.2	67.7	58.9	-	-	-	-	-	-	-	-	-	72.2	55.9	**50.8** [b]
XDT5, Café Centro	54.2	63.7	61.1	-	-	-	-	-	-	-	-	-	58.8	45.5	**41.4** [b]
XDT7, The Royal Oak	62.0	68.6	60.2	-	-	-	-	-	-	-	-	-	63.4	49.0	**44.6** [b]
XDT13,Tony & Guy	48.9	57.1	60.9	-	-	-	-	-	-	-	-	-	54.5	42.2	38.4 [b]

[a] See Appendix A3 for details on annualisation and bias adjustment.

[b] Poor data capture in 2015 as monitoring ceased in March and therefore caution should be applied to 2015 annualised results.

Table A2.2: Nitrogen Dioxide Monthly Diffusion Tube Results District Study 2015

Site ID	NO_2 Mean Concentrations (µg/m^3)													
	17/12/14 - 29/01/15	29/01/15 - 26/02/15	26/02/15 - 25/03/15	25/03/15 - 27/04/15	27/04/15 - 29/05/15	29/05/15 - 23/06/15	23/06/15 - 11/07/15	22/07/15 - 27/08/15	27/08/15 - 30/09/15	30/09/15 - 22/10/15	22/10/15 - 26/11/15	26/11/15 - 29/12/15	Annual Mean [a]	
													Raw Data	Bias Adjusted (0.91)
High St, Twyford	27.8	38.4	35.0	30.1	22.9	23.3	27.4	27.7	28.8	38.3	34.7	32.8	30.4	27.7
Southdown Road, Otterbourne	38.5	41.7	39.5	31.6	27.3	28.4	25.7	28.7	24.2	38.4	28.6	23.6	31.3	28.5
Church Green Close, Kings Worthy	29.2	37.6	32.2	24.4	21.1	18.3	25.1	25.1	36.3	26.4	28.6	28.9	28.0	25.5
West St/Broad St, New Alresford	33.0	45.3	-	31.9	-	31.8	31.7	28.9	22.3	42.3	35.2	-	33.1	30.1
Hambledon Rd, Denmead	23.3	27.5	23.4	31.9	15.0	13.6	15.5	14.8	14.8	17.5	23.0	19.1	20.2	18.4
Winchester Rd, Wickham	40.5	-	35.2	31.1	24.9	28.3	27.2	28.5	31.1	37.5	32.1	28.8	31.6	28.8
Winchester Rd, Bishops Waltham	38.7	-	34.0	33.5	26.6	25.4	28.6	32.9	30.7	37.0	36.6	30.2	32.6	29.6
Whiteley Lane, Whiteley	31.9	33.2	26.6	22.6	18.9	18.3	20.7	22.0	19.1	24.3	25.0	22.0	24.0	21.8

[a] See Appendix A3 for details on bias adjustment

Table A2.3: Nitrogen Dioxide Monthly Diffusion Tube Results City Study 2014

Site ID	NO2 Mean Concentrations (µg/m^3)												
	02/01/14 - 11/02/14	11/02/14 - 12/03/14	12/03/14 - 16/04/14	16/04/14- 27/05/14	27/05/14 - 18/06/14	18/06/14- 23/07/14	23/07/14 - 27/08/14	27/08/14 - 08/10/14	08/10/14 - 18/11/14	18/11/14 - 15/12/14	Annual Mean [a]		
											Raw Data	Annual ised	Bias Adjusted (0.92)
Site 1, 10 Eastgate St	35.4	45.4	42.0	34.7	37.6	35.7	42.9	45.2	41.2	51.5	40.9	-	37.6
Site 2, Greyfriars	35.7	43.2	35.5		31.4	32.5	34.9	39.0	40.2	40.8	37.1	-	34.1
Site 3, Friarsgate	35.3	23.1	32.3	28.1	23.9	27.3	24.0	34.9	35.9	40.8	30.9	-	28.4
Site 4, Upper Brook St (Echo)	36.0	43.7	45.2	42.9	38.7	40.4	37.5	47.7	44.9	45.9	42.4	-	39.0
Site 5-7 Roadside Monitor (Average)	36.2	43.2	43.1	43.3	46.3	41.3	45.5	50.2	42.2	48.3	43.8	-	**40.3**
Site 8, St Georges St Bed	45.8	56.6	59.5	60.1	61.9	57.0	56.8	76.3	59.0	60.5	59.4	-	**54.7**
Site 9, St Georges St Lad	65.1		54.3	67.4	58.5	57.1	56.1	63.3	78.7	49.6	62.1	-	**57.1**
Site 10, Jewry St	49.4	56.3	47.1	49.6	49.9	43.2	40.7	59.4	61.3	52.9	51.2	-	**47.1**
Site 11, Southgate St DV	-	45.7	44.1	38.8	35.0	40.8	45.2	32.5	42.8	49.5	41.4	-	38.0
Site 12, Sussex St	37.5	41.0	36.6	38.9	39.5	30.5	29.2	53.0	41.6	43.4	39.3	-	36.1

Site ID	NO2 Mean Concentrations (µg/m^3)												
	02/01/14 - 11/02/14	11/02/14 - 12/03/14	12/03/14 - 16/04/14	16/04/14- 27/05/14	27/05/14 - 18/06/14	18/06/14- 23/07/14	23/07/14 - 27/08/14	27/08/14 - 08/10/14	08/10/14 - 18/11/14	18/11/14 - 15/12/14	Annual Mean [a]		
											Raw Data	Annual ised	Bias Adjusted (0.92)
Site 13, City Road	46.9	42.3	41.0	42.2	32.9	35.5	37.7	40.0	48.9	41.8	41.4	-	38.1
Site 14, 74 Northwalls	36.9	34.2	35.4	30.3	26.3	27.2	31.4	35.1	39.8	38.4	33.8	-	31.1
Site 15, Wales St	31.2	41.5	33.7	30.0	34.9	29.6	27.5	40.1	35.9	36.7	33.9	-	31.2
Site 16, Alresford Rd (M3)	38.2	-	42.9	45.5	45.3	46.3	40.8	50.6	47.7	46.3	44.9	-	**41.3**
Site 17, Chesil St	49.4	45.9	37.9	41.2	43.2	41.4	39.8	53.3	59.2	50.5	46.5	-	**42.8**
Site 18, Stockbridge Rd	28.6	28.7	23.7	25.1	23.9	21.8	19.8	38.1	28.5	30.9	27.1	-	25.0
Site 19, Andover Rd (JF)	34.2	37.0	28.6	28.3	27.4	24.9	21.1	-	37.5	36.6	30.6	-	28.2
Site 20-22, Worthy Rd 1 (Average)	36.4	39.0	29.3	28.4	25.0	24.4	25.0	34.3	38.5	35.9	31.8	-	29.3
Site 23, St Cross Rd	32.6	46.6	36.3	-	35.4	35.4	30.9	38.0	-	36.7	36.3	-	33.4
Site 24, Romsey Road	60.0	71.6	64.4	41.8	58.0	58.8	63.4	71.2	66.4	69.5	62.2	-	**57.2**
Site 25, Andover Rd	40.8	51.1	25.5	38.6	33.2	32.2	-	43.9	44.6	45.0	39.5	-	36.4
Site 26, Bus	39.4	41.1	39.9	35.2	36.7	-	35.1	42.0	39.0	42.7	39.0	-	35.9

Site ID	NO2 Mean Concentrations (µg/m^3)												
	02/01/14 - 11/02/14	11/02/14 - 12/03/14	12/03/14 - 16/04/14	16/04/14- 27/05/14	27/05/14 - 18/06/14	18/06/14- 23/07/14	23/07/14 - 27/08/14	27/08/14 - 08/10/14	08/10/14 - 18/11/14	18/11/14 - 15/12/14	Annual Mean [a]		
											Raw Data	Annual ised	Bias Adjusted (0.92)
Station													
XDT9, 63 Romsey Road	-	62.9	42.3	-	47.0	-	39.9	63.2	63.0	65.4	50.2	47.7	**43.9**
XDT10, Romsey Road Police HQ	-	38.0	33.6	28.2	-	24.0	20.1	33.4	40.6	34.6	28.7	27.9	25.7
XDT8, Romsey Road Pump House Mews	-	81.0	73.9	-	69.3	71.3	73.6	-	73.6	72.3	67.0	67.0	**61.6**
XDT11, St. James Terrace (Romsey Road)	-	45.7	42.0	-	41.0	44.5	38.1	47.2	48.3	-	40.2	41.4	38.1
XDT12, Romsey Road Re-Dress	-	57.3	55.0	58.7	60.5	54.1	52.8	73.3	-	-	53.9	56.0	**51.5**
XDT1, McDonalds	-	60.8	58.3	58.1	50.7			55.7	61.9	60.6	53.0	49.6	**45.7**
XDT3, Toy Cupboard	-	69.2	65.6	66.5	55.4	29.2	59.2	62.4	84.4	64.1	56.8	-	**52.2**
XDT5, Café Centro	-	52.8	59.6		66.3	30.2	53.6	70.0	53.8	64.6	51.0	50.1	**46.1**
XDT7, The Royal Oak	-	72.6	62.4	66.8	59.8	28.0	51.3		101.7	99.8	61.8	62.4	**57.4**
XDT13,Tony & Guy	-				53.2	24.0		58.0	58.2	56.4	45.5	45.0	**41.4**

[a] See Appendix A3 for details on annualisation and bias adjustment.

Table A2.4: Nitrogen Dioxide Monthly Diffusion Tube Results District Study 2014

Site ID	NO_2 Mean Concentrations (µg/m^3)											
	09/01/14 - 17/02/14	17/02/14 - 18/03/14	18/03/14 - 23/04/14	23/04/14 - 29/05/14	29/05/14 - 19/06/14	19/06/14 - 25/07/14	25/07/14 - 28/08/14	28/08/14 - 10/10/14	10/10/14 - 14/11/14	14/11/14 - 17/12/14	Annual Mean [a]	
											Raw Data	Bias Adjusted (0.92)
High St, Twyford	-	35.8	26.9	31.3	28.1	28.6	24.6	34.9	36.5	39.9	32.0	29.4
Southdown Road, Otterbourne	24.6	36.8	31.6	29.2	33.4	27.2	33.8	35.0	26.0	38.1	31.3	28.8
Church Green Close, Kings Worthy	-	34.9	25.1	23.1	20.7	19.2	24.8	26.3	33.1	30.2	26.4	24.3
West St/Broad St, New Alresford	28.5	38.6	34.4	32.7	26.3	25.7	29.4	40.0	36.4	-	32.7	30.1
Hambledon Rd, Denmead	23.6	27.9	21.0	16.6	13.4	-	17.6	-	27.9	29.2	22.4	20.6
Winchester Rd, Wickham	29.5	42.4	30.5	29.6	24.7	26.1	28.9	-	39.5	35.1	31.9	29.3
Winchester Rd, Bishops Waltham	30.3	31.3	20.4	33.2	26.0	30.1	31.7	36.2	39.1	40.5	32.1	29.6
Whiteley Lane, Whiteley	-	40.4	30.5	19.4	18.4	14.9	-	25.0	30.2	27.6	25.8	23.7

[a] See Appendix A3 for details on bias adjustment.

Table A2.5: Nitrogen Dioxide Monthly Diffusion Tube Results City Study 2013

Site ID	NO2 Mean Concentrations (µg/m^3)												
	04/12/12 - 30/01/13	30/01/13 - 28/02/13	28/02/13 - 27/03/13	27/03/13 - 01/05/13	01/05/13 - 03/06/13	03/06/13- 09/07/13	09/07/13 - 23/08/13	23/08/13 - 25/09/13	25/09/13 - 24/10/13	24/10/13 - 22/11/13	22/11/13 - 02/01/14	Annual Mean [a]	
												Raw Data	Bias Adjusted (1.04)
Site 1, 10 Eastgate St	-	48.5	38.5	35.7	41.7	35.1	-	44.0	39.1	46.2	55.0	42.9	**44.6**
Site 2, Greyfriars	41.1	35.1	39.2	26.9	33.2	30.4	-	36.2	28.9	36.7	43.9	35.7	37.1
Site 3, Friarsgate	36.8	32.2	40.6	25.4	23.6	26.4	30.2	28.9	31.6	33.4	38.2	31.8	33.0
Site 4, Upper Brook St (Echo)	45.8	40.5	50.7	33.1	47.9	39.9	41.8	44.6	42.5	44.8	45.5	43.3	**45.1**
Site 5-7 Roadside Monitor (Average)	45.9	51.3	57.3	40.1	41.7	41.4	47.1	44.5	42.3	44.2	48.7	45.7	**47.6**
Site 8, St Georges St Bed	60.5	64.4	74.9	48.1	54.1	60.3	64.7	63.3	58.9	62.4	57.4	60.5	**63.0**
Site 9, St Georges St Lad	64.9	61.2	59.4	54.9		53.7	58.6	52.5	56.1	68.2	64.8	59.7	**62.1**
Site 10, Jewry St	52.8	47.5	55.0	42.2	43.8	42.9	51.4	50.6	52.4	48.3	64.4	50.5	**52.5**
Site 11, Southgate St DV	47.5	45.2	47.4	37.3	43.6	35.9	41.0	41.6	37.1	44.0	50.8	43.1	**44.8**
Site 12,	44.0	43.5	49.0	35.2	37.9	19.6	37.7	37.6	34.9	40.5	48.8	39.1	**40.6**

Site ID	NO2 Mean Concentrations (µg/m^3)												
	04/12/12 - 30/01/13	30/01/13 - 28/02/13	28/02/13 - 27/03/13	27/03/13 - 01/05/13	01/05/13 - 03/06/13	03/06/13- 09/07/13	09/07/13 - 23/08/13	23/08/13 - 25/09/13	25/09/13 - 24/10/13	24/10/13 - 22/11/13	22/11/13 - 02/01/14	Annual Mean [a]	
												Raw Data	Bias Adjusted (1.04)
Sussex St													
Site 13, City Road	44.3	41.3	43.4	34.6	34.5	34.6	41.6	37.7	36.0	40.3	49.0	40.2	**41.8**
Site 14, 74 Northwalls	41.5	38.1	33.8	29.0	27.3	27.9	30.5	31.4	30.0	37.7	35.0	33.3	34.6
Site 15, Wales St	40.5	36.4	47.4	26.1	30.6	29.9	31.9			38.7	43.5	36.1	37.5
Site 16, Alresford Rd (M3)	39.6	48.1			32.2	35.9	51.0	44.8	41.3	36.6	41.9	41.4	**43.1**
Site 17, Chesil St	50.1	41.5	47.2	38.5	33.4	19.5	49.6	40.0	38.4	42.2	56.7	42.4	**44.1**
Site 18, Stockbridge Rd	30.6	31.5	38.5		20.1	20.0	25.0	23.7	26.1	28.1	28.8	27.1	28.2
Site 19, Andover Rd (JF)	32.5	32.9	39.4	24.2	27.5	28.3	39.5	34.5	23.5	33.5	37.7	32.4	33.7
Site 20-22, Worthy Rd 1 (Average)	37.4	31.0	38.2	24.3	25.2	25.8	30.8	28.4	28.9	35.8	41.4	31.9	33.2
Site 23, St Cross Rd	43.1	35.6	44.3	21.0	27.8		33.2		31.7	35.0	44.2	35.6	37.0
Site 24, Romsey Road	65.8	69.1	74.5	48.5	57.4	61.4		65.5	49.8	63.4	75.4	63.3	**65.9**
Site 25,	43.4	34.7	48.5	31.7	32.4	33.2	39.5	34.5	36.9	38.1	50.7	38.9	**40.5**

Site ID	NO2 Mean Concentrations (µg/m^3)												
	04/12/12 - 30/01/13	30/01/13 - 28/02/13	28/02/13 - 27/03/13	27/03/13 - 01/05/13	01/05/13 - 03/06/13	03/06/13- 09/07/13	09/07/13 - 23/08/13	23/08/13 - 25/09/13	25/09/13 - 24/10/13	24/10/13 - 22/11/13	22/11/13 - 02/01/14	Annual Mean [a]	
												Raw Data	Bias Adjusted (1.04)
Andover Rd													
Site 26, Bus Station	41.5	44.5	54.2	34.0	39.5	34.3	41.1	38.0	35.3	43.2	39.1	40.2	**41.8**

[a] See Appendix A3 for details on annualisation and bias adjustment.

Table A2.6: Nitrogen Dioxide Monthly Diffusion Tube Results District Study 2013

Site ID	NO_2 Mean Concentrations (µg/m^3)													
	09/01/13 - 13/02/13	13/02/13 - 13/03/13	13/03/13 - 11/04/13	11/04/13 - 15/05/13	15/05/13 - 19/06/2013	19/06/2013 - 19/07/2013	19/07/2013 - 28/08/13	28/08/13 - 01/10/13	01/1013 - 30/10/13	30/10/13 - 06/12/13	06/12/13- 09/01/14	Annual Mean [a]		
												Raw Data	Annualised	Bias Adjusted (1.04)
High St, Twyford	37.6	33.0	34.0	25.8	35.0	28.1	25.8	29.1	26.6	42.6	37.6	32.5	-	33.8
Southdown Road, Otterbourne	38.6	34.2	30.0	31.0	33.0	33.2	24.6	33.8	29.0	49.9	27.2	33.9	-	35.2
Church Green Close, Kings Worthy	31.3	28.7	23.6	24.2	19.7	24.1	23.8	27.2	26.3	36.5	-	26.9	-	28.0
West St/Broad St, New Alresford	35.8	37.1	30.6	28.2	33.5	34.2	-	35.9	34.9	47.2	-	35.8	-	37.3
Hambledon Rd, Denmead	29.2	23.3	17.3	18.1	14.2	16.4	16.6	19.9	20.3	27.3	25.8	20.9	-	21.7
Winchester Rd, Wickham	36.5	35.0	26.5	26.8	29.9	31.5	28.2	31.1	28.7	41.3	-	31.9	-	33.2
Winchester Rd, Bishops Waltham	36.1	33.9	31.2	31.6	15.4	35.1	31.1	32.7	36.8	41.2	39.4	33.1	-	34.4
Whiteley Lane, Whiteley	31.8	25.4	-	33.6	29.0	-	-	-	22.0	-	-	28.7	28.7	29.9

[a] See Appendix A3 for details on bias adjustment and annualisation

A3 Appendix C: Supporting Technical Information/ Air Quality Monitoring Data QA/QC

Supporting Technical Information

Changed and new sources of pollution have been investigated and any changes to existing sources, or new sources are listed below:

Table A3.1: Changed and New Sources

New or Existing Source	Screening Assessment Required?
Narrow Congested Streets with residential properties close to the kerb	No
Busy Streets where people may spend 1-hour or more close to traffic	No
Roads with a high flow of buses and/or HGV	No
Junctions	No
New roads constructed since the last round of Review and Assessment	No
New roads constructed since the last round of Review and Assessment	No
Bus and coach stations	No
Railway (diesel and steam trains)	No
Industrial installations (new installations and those with significantly increased emissions)	No
Major petrol storage depots	No
Petrol Stations	No
Poultry farms	No
Biomass combustion (including domestic solid-fuel burning for PM_{10})	No
CHP installations	No
Domestic solid-fuel burning (SO_2)	No
Quarries, landfill sites, opencast coal mining, waste transfer sites, materials handling (i.e. ports, major construction sites)	No
New Developments	Three developments which are discussed further below; North Whitely, Silverhill, Barton Farm

North Whitely

Outline planning permission was approved in 2015 for a 3,500 home scheme at North Whitely. An air quality assessment was undertaken in December 2014 using the ADMS Roads dispersion model. The air quality assessment concluded the effects on existing residential receptors to be insignificant while predicted concentrations at proposed receptor locations were below the air quality objectives.

Silver Hill Redevelopment

This proposed development is a long term redevelopment within Winchester which includes the bus station, Friarsgate medical centre, Kingswalk and Friarsgate Carpark. The project is currently on hold while Winchester reviews how to proceed with the development. Once plans restart this will need considering within the next ASR.

Barton Farm Park

Barton Farm Park is a large mixed use development between Winchester and Kingsworthy comprising around 2,000 houses which gained outline permission in 2012. An application for reserved matters for phase 1 of the development, for 423 homes, was approved in 2013. An air quality assessment and review of this assessment was undertaken within the 2012/13 USA and Progress Report. This recommended that the Local Authority review current and future monitoring locations to ensure the impact from the development is monitored, at receptor locations where there is the potential for future exceedences, (which has yet to be actioned).

Winchester Detailed Assessment

Winchester City Council has undertaken a Detailed Assessment following monitoring results in 2013 which indicated the potential for an exceedance of the hourly mean AQS objectives for nitrogen dioxide within St George's Street and Romsey Road. The recommendations from the Detailed Assessed advised the declaration of three AQMAs in relation to the 1-hour mean objectives for nitrogen dioxide, in St Georges Street, Romsey Road and Chesil Street. These locations are within the existing AQMA boundary and the Council is reviewing the options.

The Detailed Assessment also considered the impacts of two options for bus fleet upgrade. The first scenario (SC1) considered the effects of replacing only those buses that currently operate on the Park and Ride route with Euro VI vehicles, and the second (SC2) considered the effects of replacing all buses operated by Stagecoach in the Council area, with Euro VI standard vehicles.

It was concluded that both scenarios would result in a reduction in nitrogen dioxide concentrations, with SC2 resulting in the largest beneficial magnitude of change.

Automatic Monitoring Data Annualisation

Data capture for the urban background monitor for nitrogen dioxide in 2015 and particulate matter in 2014 were below 75% and therefore annualisation of the data has been undertaken using the factors derived in Table A3.2 The closest continuous monitoring background sites within 50 miles, with 85% data capture have been selected.

Table A3.2: Continuous Monitor Annualisation Factors

		Bournemouth[a]	Portsmouth[b]	Southampton	Reading New Town
2015 Nitrogen Dioxide	Annual Mean (µg/m^3)	12.2	18.8	32.0	22.2
	Period Mean(µg/m^3)	17.7	26.2	35.8	30.8
	Ratio	0.69	0.72	0.89	0.72
	Annualisation Factor	**0.76**			
2014 Particulate Matter	Annual Mean(µg/m^3)	-	-	21.0	14.0
	Period Mean(µg/m^3)	-	-	25.1	18.3
	Ratio	-	-	0.84	0.77
	Annualisation Factor	**0.80**			

[a] PM_{10} not measured

[b] Poor PM_{10} data capture

Diffusion Tube Data Annualisation

A number of diffusion tubes have lower than 75% data capture. Annualisation for 2015 has been undertaken using the continuous monitoring site approach detailed within Box 7.9 within LAQM TG16 (Defra, 2016b). The monitoring period ceased in March 2015, so results are available for a continuous time period. The factor applied is detailed within Table A3.3.

Table A3.3: 2015 Diffusion Tube Annualisation

	Bournemouth	Southampton Centre	Portsmouth	Reading New Town
Annual Mean(µg/m^3)	12.2	18.8	32.0	22.2
Period Mean(µg/m^3)	17.8	25.6	35.2	28.9
Ratio	0.69	0.73	0.91	0.77
Annualisation Factor	**0.77**			

Annualisation of 2014 and 2013 diffusion tube data has been undertaken using the method within Box 7.10 within LAQM TG16, due to the variability in months with missing data. Site specific annualisation factors are detailed within Table A3.4 and Table A3.5.

Table A3.4: 2014 Diffusion Tube Annualisation

Site ID	Number of Months Data	Period Mean µg/m^3	Ratio [a]	Period Mean µg/m^3	Ratio [a]	Period Mean µg/m^3	Ratio [a]	Average Annualisation Factor
		Bournemouth		Southampton Centre		Reading New Town		
63 Romsey Road	**7**	14.8	0.9	22.0	0.9	27.9	0.95	**0.94**
Romsey Road Police HQ	**8**	14.1	0.9	21.5	0.9	27.2	0.97	**0.97**
Romsey Road Pump House Mews	**7**	13.6	1.0	22.0	0.9	26.5	1.00	**1.00**
St. James Terrace (Romsey Road)	**7**	11.9	1.1	19.7	1.0	25.7	1.03	**1.07**
Romsey Road Re-Dress	**7**	11.6	1.1	19.5	1.0	25.5	1.04	**1.08**
McDonalds	**7**	14.2	0.9	22.7	0.9	28.3	0.94	**0.94**
Café Centro	**8**	13.8	1.0	21.1	1.0	27.0	0.98	**0.99**
The Royal Oak	**8**	13.2	1.0	21.7	0.9	26.3	1.01	**1.01**
Tony & Guy	**5**	13.7	1.0	19.6	1.0	26.8	0.99	**1.00**

[a] Annual means for 2014 of 13.2 µg/m^3, 31.6 µg/m^3 and 26.5 µg/m^3 for Bournemouth, Southampton Centre, and Reading New Town respectively.

Table A3.5: 2013 Diffusion Tube Annualisation

Site ID	Number of Months Data	Period Mean (µg/m^3)	Ratio [a]	Period Mean (µg/m^3)	Ratio [a]	Period Mean (µg/m^3)	Ratio [a]	Average Annualisation Factor
		Bournemouth		Southampton Centre		Reading New Town		
Site 8 – Whiteley Lane	**5**	14.8	1.02	30.7	0.98	26.7	**1.0**	**1.00**

[a] Annual means for 2013 of 14.5 µg/m^3, 31.3 µg/m^3 and 26.6 µg/m^3 for Bournemouth, Southampton Centre and Reading New Town respectively.

Diffusion Tube Bias Adjustment Factors

Winchester City Council operate a co-location study at the Winchester Roadside monitoring site using a triplicate set of diffusion tubes.

Within 2014 and 2015 the automatic monitoring site lost a significant amount of data in one or two months. Therefore, the bias factor has been taken from the spread sheet of national comparison studies. This has given a bias-adjustment factor for 2015 of 0.91 and 2014 of 0.92 taken from spreadsheet version 03/16. Therefore this may result in slightly different results than previously published. For comparison the local bias adjustment factors (with poor data capture in one or two months) for 2014 and 2015, were 0.96 and 0.91 respectively. 2013 results have been adjusted used the calculated local bias adjustment factor of 1.04. The national bias adjustment factor for comparison was 0.95. The bias adjustment factors for previous years were 1.02 in 2011 and 1.06 in 2012.

QA/QC of Monitoring Data

Calibration visits are undertaken approximately every 2 weeks at the automatic monitoring stations. The NOx instruments are checked using independently certified NO gas. A six monthly service is undertaken by ESU1. Monitoring results are ratified by AQDM Ltd.

Nitrogen dioxide analysis procedures are compliant with the Diffusion Tubes for Ambient NO_2 Monitoring: Practical Guidance for users and laboratories (February 2008). The diffusion tubes are supplied and analysed by Gradko International Ltd utilising the 20% triethanolamine (TEA) in water preparation method. Gradko International Ltd is a UKAS accredited laboratory which participates in the AIR-PT scheme. Air is an independent analytical proficiency-testing (PT) scheme, operated by LGC Standards and supported by the Health and Safety Laboratory (HSL). AIR PT is a new scheme, started in April 2014, which combines two long running PT schemes: LGC Standards STACKS PT scheme and HSL WASP PT scheme. AIR offers a number of test samples designed to test the proficiency of laboratories undertaking analysis of chemical pollutants in ambient indoor, stack and workplace air. One such sample is the AIR NO_2 test sample type that is distributed to participants in a quarterly basis. AIR NO_2 PT forms an integral part of the UK NO_2 Network's QA/QC.

A4 Appendix D: Map of Monitoring Locations

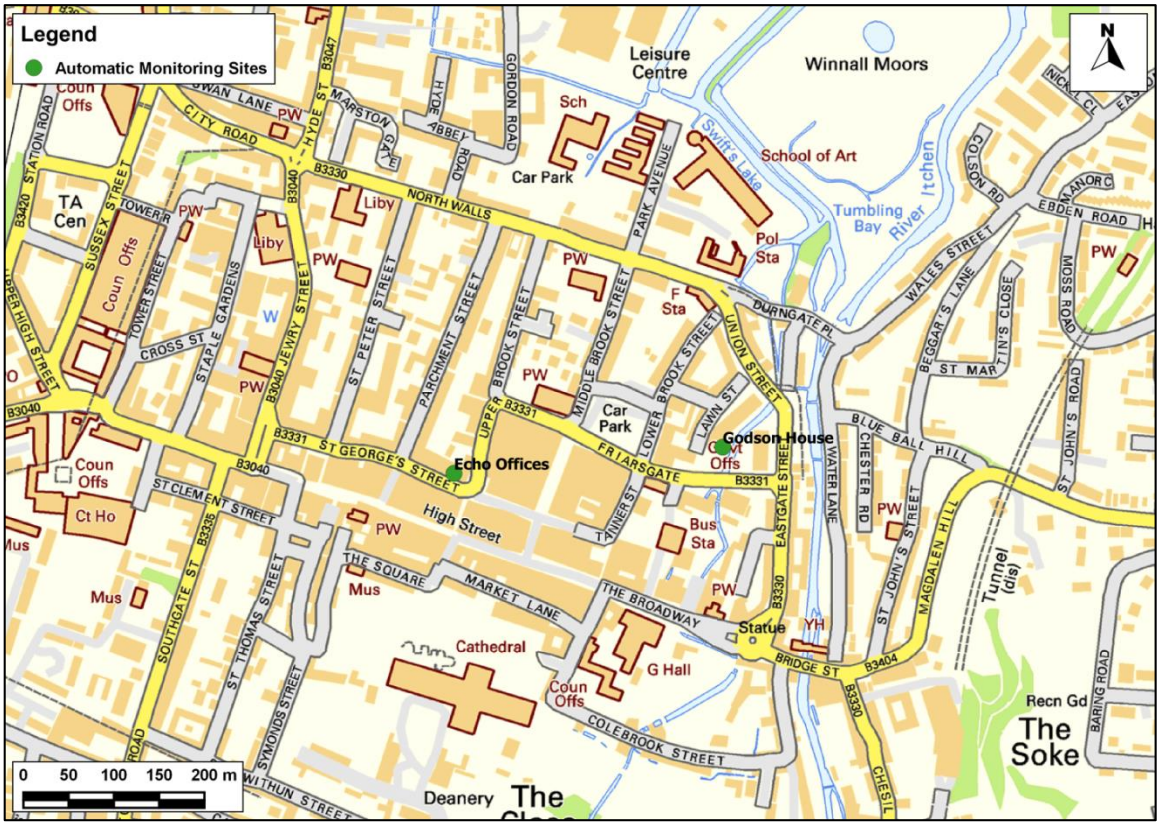

Figure A4.1 Automatic Monitoring Locations

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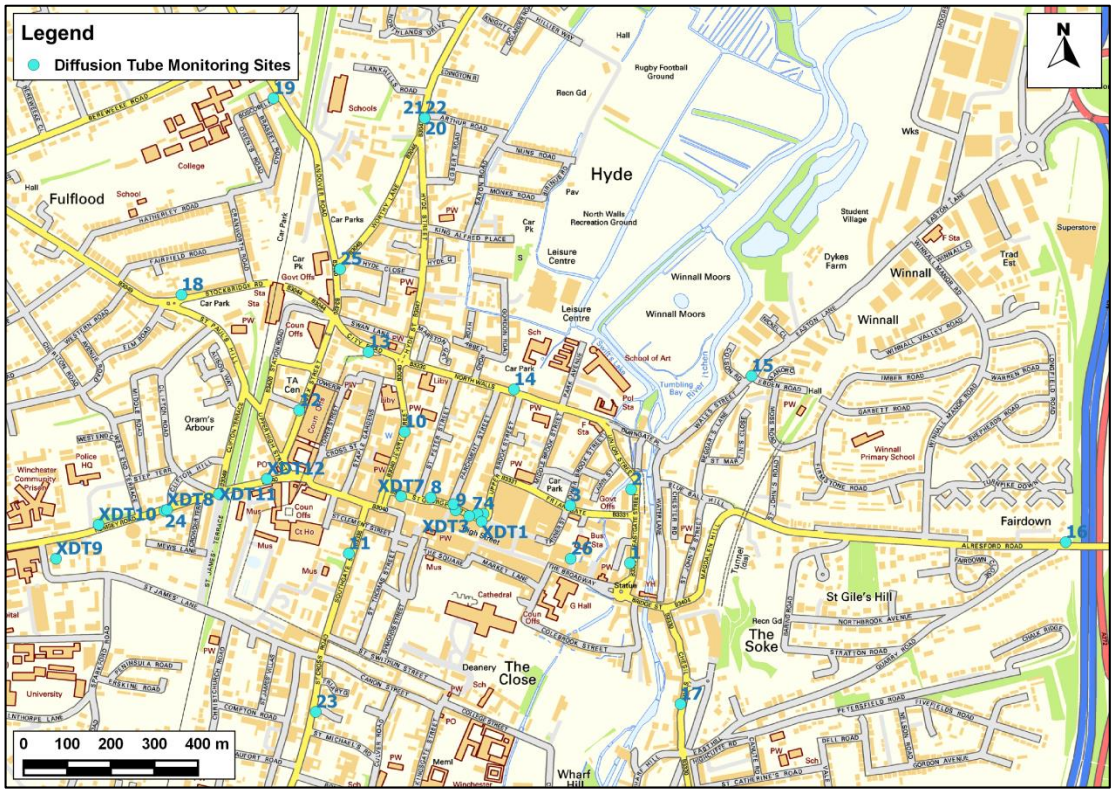

Figure A4.2: Map of City Non-Automatic Monitoring Sites

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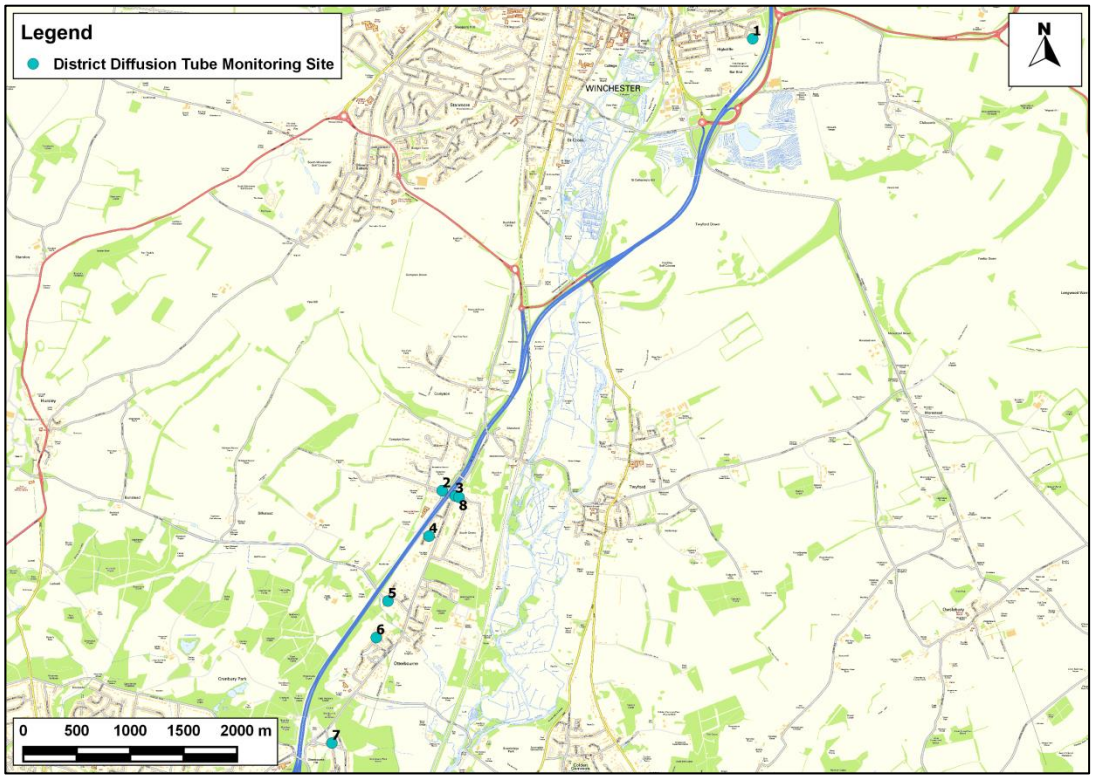

Figure A4.3: Map of District Non-Automatic Monitoring Sites

A5 Appendix E: Summary of Air Quality Objectives in England

Table A5.1: Air Quality Objectives in England

Pollutant	Air Quality Objective [a]	
	Objective	**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
Fine Particles (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

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

Glossary of Terms

AQC	Air Quality Consultants
AQMA	Air Quality Management Area
Defra	Department for Environment, Food and Rural Affairs
Exceedence	A period of time when the concentration of a pollutant is greater than the appropriate air quality objective. This applies to specified locations with relevant exposure
LAQM	Local Air Quality Management
$\mu g/m^3$	Microgrammes per cubic metre
NO	Nitric oxide
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides (taken to be NO_2 + NO)
Objectives	A nationally defined set of health-based concentrations for nine pollutants, seven of which are incorporated in Regulations, setting out the extent to which the standards should be achieved by a defined date. There are also vegetation-based objectives for sulphur dioxide and nitrogen oxides
PM_{10}	Small airborne particles, more specifically particulate matter less than 10 micrometres in aerodynamic diameter
$PM_{2.5}$	Small airborne particles less than 2.5 micrometres in aerodynamic diameter
Standards	A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal

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