# 2018 Air Quality Annual Status Report (ASR)

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

April, 2018

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| Local Authority Officer | David Ingram |
| Department | Environmental Health & Licensing |
| Address | Winchester City Council<br>City Offices<br>Colebrook St<br>Winchester<br>HANTS<br>SO23 9LJ |
| Telephone | 01962 848479 |
| E-mail | dingram@WINCHESTER.GOV.UK |
| Report Reference number | - |
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# Executive Summary: Air Quality in Our Area

## Air Quality in Winchester

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].

Winchester City Council's administrative area comprises the city of Winchester and wider district area. The main source of air pollution in the borough is road traffic emissions from major roads, including the M3, A34, A31 and A303. Other pollution sources, including commercial, industrial and domestic sources, also make a contribution to background pollution concentrations.

The main pollutant of concern in Winchester is nitrogen dioxide ($NO_2$), which currently exceeds the annual mean air quality objective close to busy roads within the city centre. In 2003 an Air Quality Management Area (AQMA) was designated for exceedances of the annual mean $NO_2$ objective and 24-hr $PM_{10}$ objective. The 24-hr $PM_{10}$ AQMA was later revoked in 2013 after a number of years of measured concentrations remaining below objective levels. Details of the current AQMA are available online at https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=314.

Winchester City Council currently monitors $NO_2$ concentrations at various locations throughout Winchester. Results from the monitoring network of diffusion tubes show that there are still areas adjacent to the main roads within the AQMA that fail to meet the UK annual mean objective. These exceedances are centred within the one way system around the city centre and on Romsey Road.

Between the years 2012-2017, a decreasing trend in $NO_2$ concentrations has been observed at all monitoring locations. There are some year-to-year variations in

[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

concentrations, which are likely due to meteorological influences. In 2017, there was a reduction in concentrations at all sites compared to 2016.

At present, no monitoring of the particulate pollutants; $PM_{10}$ and $PM_{2.5}$ is carried out within Winchester but the Council plan to re-instate monitoring within the AQMA on Romsey Road using low cost monitoring devices.

In the wider district, pollutant concentrations are all below the national air quality objectives.

In May 2017 Winchester City Council issued a new Air Quality Action Plan, with the aim of tackling the remaining hotspots in the city centre. This action plan replaces the previous action plan which ran from 2006 to 2016.

## Actions to Improve Air Quality

The 2017 Air Quality Action Plan (AQAP) outlines nine high impact core actions aimed at improving air quality and working towards meeting the relevant air quality objectives within Winchester district. Due to the main source of pollution within the AQMA being road traffic, some of the key actions in the new AQAP aim to reduce congestion and vehicle emissions in the city centre, with the focus on improving $NO_2$ concentrations.

The core actions are:

1. Review current car parking charges and increase the cost to park in central car parks;
2. Review and consider introducing restrictions of delivery vehicles by time of day;
3. Introduce a Park and Ride site in the North of Winchester;
4. Introduce new parking charges to limit diesel and high polluting petrol cars parking in central car parks;
5. Reduce emissions from lorries and buses in the city centre by 2020;
6. Reduce emissions from all Council owned, leased or contracted vehicles by 2020;
7. Put in place requirements to integrate air quality fully into the planning process;
8. Continue to work with and lobby Hampshire County Council to identify and deliver additional projects;

9. Monitor the performance of the plan and reassess the need to introduce additional measures to achieve the objective

There is also a range of complementary measures that mainly relate to the continued support for ongoing softer measures such as supporting walking, cycling and travel plan initiatives.

Two new air quality monitoring sites are now in place in St George's Street and Chesil Street. Currently these sites have equipment in place to monitor $NO_2$. These new sites will contribute to the review of measures in the AQAP.

Hampshire County Council is the lead local authority for transport in Winchester District. Policies to improve transport, and encourage sustainable transport have been set out within the Local Transport Plan for Hampshire[4]. Winchester City Council is working with the County to deliver measures in their AQAP and conduct a Movement Study to gather the required data to monitor progress. The draft study is expected to be issued for public consultation in Summer 2018.

## Conclusions and Priorities

This Annual Status Report confirms that concentrations within the AQMA within the centre of Winchester continue to exceed the $NO_2$ annual mean air quality objective. No significant changes in emissions sources within the Council's area have been identified in the last year.

The priorities for the coming year will be to deliver progress on the core measures outlined within the new AQAP and to progress the development of parallel strategies for delivering identified number of complementary measures.

## Local Engagement and How to get Involved

Members of the public can take simple measures to help improve air quality, the main ones being, where possible, making short trips and journeys on foot or by bike instead of by car. Traffic congestion can further be reduced by the general public car sharing or by using public transport including the park and ride buses to access the city centre. A new Winchester car share club has recently been launched and is currently being actively promoted. Members of the public are also encouraged to get

[4] Hampshire County Council LTP Implementation Plan 2014-2017 https://www.hants.gov.uk/transport/strategies/transportstrategies

involved in local events within the district, such as the UK's first ever National Clean Air Day which took place 15th June 2017 and returning on 21st June 2018 this year.

Winchester City Council provides information on air quality on their website http://www.winchester.gov.uk/environment/air-quality/ and air quality monitoring data from Winchester can be viewed on UK Air Quality net http://www.ukairquality.net/.

Further information on air quality can be found on Defra's Local Air Quality Management (LAQM) website[5].

[5] Defra LAQM website: http://laqm.defra.gov.uk/

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# 1 Local Air Quality Management

This report provides an overview of air quality in Winchester during 2017. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995) and the relevant Policy and Technical Guidance documents.

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

# 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 compliance with the objectives.

Winchester City Council has declared one AQMA, summary details can be found in Table 2.1. Further information related to declared or revoked AQMAs, including maps of AQMA boundaries are available online at https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=314 . Alternatively, see Appendix D: Maps of Monitoring Locations and AQMAs, which provides a map of air quality monitoring locations in relation to the AQMA.

The current designated AQMA is in respect to the annual mean nitrogen dioxide ($NO_2$) objective. An AQMA with the same extent, designated in respect to the particulate matter 24-hr mean objective, was revoked in 2013. A Detailed Assessment undertaken in 2015 recommended the designation of additional AQMA's at a number of roadside locations within the centre, for exceedances of the nitrogen dioxide hourly mean objective. The data collected at Chesil Street shows that this site is not exceeding the hourly mean objective value and therefore there is no requirement to declare an AQMA here. The Council will monitor at Romsey Street to determine whether the hourly objective value is likely to be exceeded at this site.

## 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 | |
| Winchester Town Centre AQMA | Declared 14/11/2003 | $NO_2$ Annual Mean | Winchester | Area surrounded by the town centre one way system and the town centre end of the major roads feeding into it. | NO | >40µg/$m^3$ at multiple locations | 50.8µg/$m^3$ at Diffusion tube site 24, Romsey Rd | Winchester City Council Air Quality Action Plan , 2006, http://www.winchester.gov.uk/environment/air-quality/historical-air-quality-reports-government/<br><br>Winchester City Council Air Quality Action Plan, 2017, https://winchester.citizenspace.com/licensing/air-quality/supporting_documents/Winchester%20AQAP_Final%20Draft_16012017.pdf |

☒ **Winchester City Council confirm the information on UK-Air regarding their AQMA(s) is up to date**

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

Defra's appraisal of last year's ASR concluded that the conclusions reached were acceptable for all sources and pollutants. In 2017, Winchester City Council purchased new automatic monitoring equipment and they will complete the review to determine whether an AQMA needs to be declared for the hourly mean $NO_2$ objective in Romsey Road. Following Defra's comments, Winchester City Council have reviewed the distance to relevant exposure of sites and have distance corrected concentrations where appropriate in Table B1.

Winchester City 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 completed, in progress or planned are set out in Table 2.2.

Winchester City Council's priorities for the coming year are to continue to deliver progress on the nine core measures outlined within their current AQAP and to progress the development of parallel strategies for delivering the additional nine complementary measures. Progress has already been made on a number of these core measures including;

- Adopting new car parking charges in city centre, inner and outer car parks;
- Conducting an options appraisal to consider providing incentives for less polluting and ultra low emission vehicles (ULEVs);
- Joint working with neighbouring authorities to consider policies related to Clean Air Zones, writing supplementary planning guidance and launching a Clean Air Network[6];
- Commissioning an electric vehicle charging study to consider future provision and infrastructure in the district; and
- Procedural changes to ensure that air quality is a material consideration in contracts to encourage procurement of low emission vehicles.

To complement the plan, Hampshire County Council, as the Transport Authority is working with the City Council to develop a Transport Movement Study for Winchester

[6] http://www.southampton.gov.uk/environmental-issues/pollution/air-quality/working-together-for-cleaner-air.aspx

and data is currently being collected to assess the numbers of vehicles travelling into and through the city. The draft study will be out for consultation in summer 2018.

Whilst the measures stated above and in Table 2.2 will help to contribute towards compliance, Winchester City Council anticipates that further additional measures not yet prescribed maybe required in subsequent years to achieve compliance and enable the revocation of Winchester AQMA.

## 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 | Build on existing car park pricing differentiation strategy | Traffic Management | Other | WCC - Engineering & Transport & Parking Services | 2017 | May-17 | 1. Annual mean $NO_2$<br>2. Car park patronage<br>3. Preferential responses | 2% reduction in NOx emissions | New fees and charges for city centre, inner and outer car parks were adopted on 1st May 2017. Data will be gathered for a year to consider impacts but indications so far suggest the pricing strategy is having an effect. Further assessment will clarify if further price changes may be required | Charges introduced and will be reviewed after one year | Consider integration into the new Parking Strategy to be developed in 2018/19 |
| 2 | Review enforcement of goods deliveries by time of day and enforce | Freight and Delivery Management | Quiet & out of hours delivery | WCC - Parking Services | 2017 | Apr-18 | 1. Annual mean $NO_2$<br>2. PCNs issued<br>3. Change in delivery hours | 2% reduction in NOx emissions | Currently collecting and analysing data such as local delivery surveys and reviewing best practice measures to inform whether new/additional measures are required. Considering appropriate enforcement strategies including for existing restrictions. | Ongoing | |
| 3 | Introduce a Park and Ride site in the north of Winchester | Alternatives to private vehicle use | Bus based Park & Ride | WCC but informed by City of Winchester Movement Strategy | 2017 | tbc | 1. Bus patronage<br>2. Traffic flow<br>3. Use and satisfaction of P&R | 3% reduction in NOx emissions | Implementation will be determined by the outcomes of the Winchester Movement Study due for completion late 2018. This will help to clarify likely level of demand and where | tbc | P&R lite already proposed for Barton Farm |

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | this could best be met. | | |
| 4 | Introduce new parking charges/incentives to reduce diesel car parking and high pollution petrol cars (older than Euro 4) from parking in central car parks in favour of low emission vehicles | Traffic Management | Emission based parking or permit charges | WCC - Parking Services Engineering & Transport | 2017/2018 | Jun-18 | 1. Traffic flow and speed<br>2. Increase in petrol /ULEVs using car parks<br>3. Preferential responses | 10% reduction in NOx emissions | The Air Quality Steering Group is undertaking an options appraisal and costing assessment for implementation, including intelligent ticket machines which can allocate ticket tariffs based on vehicle types. Focus is on incentives for smaller sized vehicles and ULEVs. | Apr-19 | Additional resources will be needed to provide appropriate technology and infrastructure. Also need to take account of data which shows real world vehicle performance/emissions differ significantly from Euro standards. |
| 5 | Ensure that all heavy duty vehicles that enter the AQMA meet Euro VI Stage II standard by 2020 | Promoting Low Emission Transport | Low Emission Zone (LEZ) | WCC | 2017 | 2020 | 1. Annual mean $NO_2$<br>2. Number of Euro VI entering AQMA<br>3. PCNs issued | 10% reduction in NOx emissions | The Air Quality Steering Group will commission a study on costs to deliver a charging CAZ for HGVs, working with neighbouring authorities. | Ongoing | Considering a CAZ charging strategy |
| 6 | Ensure that all Council-owned, leased, contracted or influence | Promoting Low Emission Transport | Company Vehicle Procurement - Prioritising uptake of low emission vehicles | WCC | 2017 | 2020 | 1. Low emission vehicles in fleet<br>2. Number of trips entering AQMAS | 2% reduction in NOx emissions | WCC is currently reviewing the staff car leasing spring. Work to be finished by Spring 2018. Taxi licensing policy also to be reviewed in 2018 and this will | 2019-2020 | |

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | vehicles that enter the AQMA meet the OLEV standards for ULEVs and are not diesel fuelled by 2020 | | | | | | | | consider vehicle emissions | | |
| 7 | Development of air quality supplementary planning document (SPD) | Policy Guidance and Development Control | Air Quality Planning and Policy Guidance | WCC | 2017 | 2017 | 1. Annual mean $NO_2$<br>2. Planning applications showing regard for SPG | N/A | WCC is working with a group of neighbouring authorities with air quality issues to commission a consultant to write a draft SPD. Awaiting outcome of application to JAQU to fund this work. | 2018 | |
| 8 | Continue to work with and lobby Hampshire County Council to identify projects to improve air quality | Policy Guidance and Development Control | Regional Groups Co-ordinating programmes to develop Area wide Strategies to reduce emissions and improve air quality | WCC/HCC | 2017 | tbc | 1. Annual mean $NO_2$ | N/A | WCC is currently working with HCC on the detailed delivery of the Movement Strategy for Winchester which will consider air quality. | Draft strategy to be consulted Summer 2018 | |
| 9 | Monitor the performance of the action plan and reassess whether additional measures | Public Information | Other | WCC | 2017 | 2018 | 1. Annual mean $NO_2$<br>2. Modelling of actual emissions reductions | See Core Actions | To be undertaken as part of annual reporting requirements and data from monitoring at static monitoring sites | Ongoing | |

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | are required to meet the objective | | | | | | | | | | |
| 10 | Work with authorities towards adoption of a regional LES | Policy Guidance and Development Control | Regional Groups Co-ordinating programmes to develop Area wide Strategies to reduce emissions and improve air quality | WCC with SCC, EBC | 2017 | 2020 | 1. Adoption of strategy | N/A | Southampton City Council has launched a Clean Air Network (CAN) to provide a consistent approach to air quality. WCC will be an active member of the CAN. | Ongoing | |
| 11 | Seek to commit to introduce more electric vehicle charging points within car parks | Promoting Low Emission Transport | Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging | WCC | 2017 | 2017 & beyond | 1. Number of points installed | N/A | WCC is working with a consultant to provide an Electric Vehicle Charging Strategy for the district to consider infrastructure, locations and costs. Study to report in June 2018. | 2019/2020 | Implementation of the strategy will require additional resources in terms of providing new infrastructure which need to be considered in due course |
| 12 | Ensure that air quality is a standard consideration as part of procurement practice and is reflected in the Council's Procurement Policy; | Promoting Low Emission Transport | Company Vehicle Procurement - Prioritising uptake of low emission vehicles | WCC | 2017 | 2018 | 1. Adoption of procurement policy<br>2. Uptake of LEVs (as per core action) | See core action 6 | WCC is undergoing a procedural change to ensure air quality is a material consideration in contracts. | Ongoing | |

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 13 | Continue to improve public access to live parking information and signage and better signage to encourage drivers to use the car park best suited to their journey. | Public Information | Via other mechanisms | WCC/HCC | 2017 | Apr-19 | 1. Utilisation of central car parks | N/A | Planning phase delayed until after the outcome of the Hampshire Movement Study. | Ongoing | These messaging signs are already in place for central car parks |
| 14 | To continue to work on the delivery and promotion of car club schemes operating in the city | Alternatives to private vehicle use | Car Clubs | WCC | 2017 | Apr-18 | 1. Number of car club members | N/A | WCC now has a Car Club Scheme in city centre provided by Enterprise Car Club. | 2018 | |
| 15 | Consider the introduction and promotion of additional cycle stands, in consultation with local cycling | Promoting Travel Alternatives | Promotion of cycling | WCC | 2017 | 2017 | 1. Number of cycle parking 2. Number of cyclists as a modal share (through surveys) | N/A | WCC is entering into an arrangement with Bespoke Biking to provide for the hire of the Council's cycle fleet previously administered by the Tourist Information Office and this will better promote cycle use by residents, visitors and tourists | tbc | Progress to be made in 2018/19. |

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | groups, as part of planned developments in the AQMA | | | | | | | | | | |
| 16 | Work with stakeholder organisations and maintain a programme of regular communication to encourage behavioural change | Promoting Travel Alternatives | Other | WCC | 2017 | 2017 | tbc | N/A | Planning phase tbc | tbc | Progress to be made in 2018/19. |
| 17 | Review and refresh the Council Travel Plan to promote more sustainable travel for staff | Promoting Travel Alternatives | Workplace Travel Planning | WCC | 2017 | Apr-18 | 1. Number of staff travelling to work by car (surveys) | N/A | Planning phase tbc | tbc | Progress to be made in 2018/19. |
| 18 | Provide web based information and sign posting to resources that will assist and encourage workplace | Promoting Travel Alternatives | Workplace Travel Planning | WCC | 2017 | Apr-18 | 1. Number of travel plans adopted | N/A | Planning phase tbc | tbc | Progress to be made in 2018/19. |

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | s and schools in the City to adopt Travel Plans | | | | | | | | | | |

## 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.

Winchester City Council is taking a number of measures to address $PM_{2.5}$. Measures include working with Public Heath colleagues, adopting transport initiatives included in The Local Transport Plan for Hampshire and local planning policies supporting the implementation of the Winchester Air Quality Action Plan. These measures were reviewed in the Council's 2016 ASR[7] and no additional measures have been introduced this year.

Defra mapped background $PM_{2.5}$ concentrations in Winchester district in 2017 were between 7.3 µg/$m^3$ and 10.7 µg/$m^3$. Therefore $PM_{2.5}$ concentrations would be expected to be well below the limit proposed by the EU Ambient Air Quality Directive[8]. The Council has recently installed low cost air quality monitors which measure both $PM_{10}$ and $PM_{2.5}$ concentrations in Romsey Road and these concentrations will be reported in future reports.

All measures outlined in Table 2.2 that aim to reduce $NO_x$ and $PM_{10}$ will also have a beneficial impact on $PM_{2.5}$.

[7] Winchester City Council 2016 Annual Status Report, www.winchester.gov.uk/assets/files/28866/Winchester-2016-ASR-J2494-F2.pdf
[8] Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe

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

## 3.1 Summary of Monitoring Undertaken

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

### 3.1.1 Automatic Monitoring Sites

Winchester City Council undertook automatic (continuous) monitoring at two sites during 2017. The roadside sites were installed in March 2017 to monitor $NO_2$ only. The locations for these sites are on St George's Street and on Chesil Street by Station Approach. Both sites have room for a particulate matter monitor, should future resources and demand dictate.

The previous roadside site at the Echo Office in St George's Street was decommissioned in May 2017, as the area was marked for improvement as part of a refurbishment scheme. Until 2015, Winchester City Council operated an additional automatic monitoring site at Godson House. Table A.1 in Appendix A shows the details of the sites. National monitoring results are available at http://www.ukairquality.net/.

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

Winchester City Council undertook non-automatic (passive) monitoring of $NO_2$ at 34 sites during 2017, 26 of these were within the city and eight monitoring sites were within the wider district area. Monitoring at Site 3 within the district study was relocated after three months, and the remainder of the monitoring in 2017 took place at the new site. 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. There have been two site location changes. In 2015, site 19 was relocated from Andover Road to Burma Road following concerns expressed regarding traffic congestion between the hospital and university. More recently, in 2017, site 3 within the District

Wide Study was relocated from Church Street Close to Martyr Worthy Road on 24th March 2017 and are referred to as site 3 OLD and site 3 NEW in the report.

Further details on Quality Assurance/Quality Control (QA/QC) for the diffusion tubes, including bias adjustments and any other adjustments applied 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 2017 dataset of monthly mean values is provided in Appendix B.

The new roadside automatic monitoring sites at St. George's Street and Chesil Street are in compliance with the annual mean $NO_2$ objectives in 2017.

The diffusion tube results show that three sites recorded exceedances of the annual mean $NO_2$ objective in 2017 at sites 8, 9 and 24. These sites are all located within the current AQMA within the one way system around the city centre and Romsey Road.

Sites 8 and 9 are located on St George's Street. Exceedances at these sites have occurred over the last 5 years, however a trend in decreasing concentrations is evident and measured concentrations in 2017 are lower than those measured in 2016.

Measured concentrations at site 24 located on Romsey Road show a decrease compared to 2016, and site 10 no longer exceeds the annual mean $NO_2$ objective in 2017.

These diffusion tubes are located on building facades and are representative of relevant exposure. The new AQAP aims to tackle these remaining hotspots.

All diffusion tube measured concentrations for 2017 are below 60 µg/m$^3$; the criteria above which exceedances of the 1-hour mean objective are likely to occur.

Table A.4 in Appendix A compares the ratified continuous monitored $NO_2$ hourly mean concentrations for the past 5 years with the air quality objective of 200µg/m$^3$, not to be exceeded more than 18 times per year. This objective has been met in each of these years.

The district wide diffusion tube sites remain in compliance with the annual mean $NO_2$ objective. Measured concentrations in 2017 have generally lowered since a previous general increase in 2016, and therefore support the decreasing trend noted in previous years until 2016 (see Figure A1.2 in Appendix A). Further data will be needed to confirm any long term trend changes.

### 3.2.2 Particulate Matter ($PM_{10}$)

Table A.5 in Appendix A compares the ratified and adjusted monitored $PM_{10}$ annual mean concentrations until 2016 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 until 2016 with the air quality objective of 50µg/m$^3$, not to be exceeded more than 35 times per year.

Monitored $PM_{10}$ concentrations are no longer available due to the decomissioning of the Echo Office automatic monitoring site in May 2017.

# 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| Echo Office | Echo Office | Roadside | 448212 | 129510 | $NO_2$; $PM_{10}$ (until May 2017) | YES | Chemiluminescent; BAM | N/A | 2.75 | 2.7 |
| Godson House | Godson House | Urban Background | 448509 | 129539 | $NO_2$ (until March 2015); $PM_{10}$ (until 2014) | YES | Chemiluminescent | N/A | 18 | 2.8 |
| St George's Street | St George's Street | Roadside | 448062 | 129537 | $NO_2$ (from March 2017) | YES | Chemiluminescent | 0 | 2.25 | 2.2 |
| Station Approach (Chesil Street) | Station Approach (Chesil Street) | Roadside | 448664 | 129257 | $NO_2$ (from March 2017) | YES | Chemiluminescent | 0 | 4.6 | 2.2 |

**Notes:**

(1) 0 m 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 or available.

## 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| Site 1 (City Study) | 10 Eastgate St | Roadside | 448563 | 129391 | $NO_2$ | YES | 0 | 5.55 | NO | 1.7 |
| Site 2 (City Study) | Greyfriars | Roadside | 448566 | 129560 | $NO_2$ | YES | 0 | 9.7 | NO | 1.75 |
| Site 3 (City Study) | Friarsgate | Roadside | 448426 | 129523 | $NO_2$ | YES | 4.6 | 4.25 | NO | 2.4 |
| Site 4 (City Study) | Upper Brook St (Echo) | Roadside | 448227 | 129504 | $NO_2$ | YES | 9.2 | 8 | NO | 2.45 |
| Site 5 (City Study) | Roadside Monitor | Roadside | 448213 | 129504 | $NO_2$ | YES | 0 | 3.1 | YES | 1.7 |
| Site 6 (City Study) | Roadside Monitor | Roadside | 448213 | 129504 | $NO_2$ | YES | 0 | 3.1 | YES | 1.7 |
| Site 7 (City Study) | Roadside Monitor | Roadside | 448213 | 129504 | $NO_2$ | YES | 0 | 3.1 | YES | 1.7 |
| Site 8 (City Study) | St Georges St Bed | Roadside | 448106 | 129541 | $NO_2$ | YES | 0 | 4.05 | NO | 2.45 |
| Site 9 (City Study) | St Georges St Lad | Roadside | 448163 | 129512 | $NO_2$ | YES | 0 | 3.6 | NO | 2.4 |
| Site 10 (City Study) | Jewry St | Roadside | 448046 | 129692 | $NO_2$ | YES | 0 | 4.05 | NO | 2.4 |
| Site 11 (City Study) | Southgate St DV | Roadside | 447918 | 129413 | $NO_2$ | YES | 0 | 3.65 | NO | 2.6 |
| Site 12 (City Study) | Sussex St | Roadside | 447804 | 129741 | $NO_2$ | YES | 2.4 | 3.6 | NO | 2.6 |
| Site 13 (City Study) | City Road | Roadside | 447963 | 129875 | $NO_2$ | YES | 0 | 6.55 | NO | 3 |
| Site 14 (City Study) | 74 Northwalls | Roadside | 448297 | 129789 | $NO_2$ | YES | 10.2 | 3.7 | NO | 2.3 |
| Site 15 (City Study) | Wales St | Roadside | 448842 | 129820 | $NO_2$ | YES | 0 | 1.7 | NO | 2.45 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Site 16 (City Study) | Alresford Rd (M3) | Other | 449563 | 129439 | $NO_2$ | NO | 24 | N/A (M3) | NO | 1.5 |
| Site 17 (City Study) | Chesil St | Roadside | 448679 | 129068 | $NO_2$ | YES | 0 | 1.3 | NO | 2.6 |
| Site 18 (City Study) | Stockbridge Rd | Roadside | 447534 | 130006 | $NO_2$ | YES | 10 | 5.4 | NO | 2 |
| Site 19 (City Study) | Burma Road | Roadside | 447025 | 129222 | $NO_2$ | NO | N/A* | N/A | NO | 1.8 |
| Site 20 (City Study) | Worthy Rd 1 | Roadside | 448092 | 130411 | $NO_2$ | YES | 3.7 | 2.2 | NO | 2.5 |
| Site 21 (City Study) | Worthy Rd 2 | Roadside | 448092 | 130411 | $NO_2$ | YES | 3.7 | 2.2 | NO | 2.5 |
| Site 22 (City Study) | Worthy Rd 3 | Roadside | 448092 | 130411 | $NO_2$ | YES | 3.7 | 2.2 | NO | 2.5 |
| Site 23 (City Study) | St Cross Rd | Roadside | 447842 | 129050 | $NO_2$ | YES | 6 | 2.4 | NO | 2.2 |
| Site 24 (City Study) | Romsey Road | Roadside | 447495 | 129511 | $NO_2$ | YES | 0 | 1.1 | NO | 2.5 |
| Site 25 (City Study) | Andover Rd | Roadside | 447898 | 130065 | $NO_2$ | YES | 0 | 4.2 | NO | 2.15 |
| Site 26 (City Study) | Bus Station | Other | 448427 | 129401 | $NO_2$ | YES | N/A** | N/A | NO | 2.4 |
| Site 1 (District Study) | High St, Twyford | Roadside | 448046 | 124296 | $NO_2$ | NO | 0 | 0.9 | NO | N/A |
| Site 2 (District Study) | Southdown Road, Otterbourne | Other | 446680 | 124644 | $NO_2$ | NO | N/A*** | N/A | NO | N/A |
| Site 3 OLD (District Study) | Church Green Close, Kings Worthy | Other | 449162 | 132293 | $NO_2$ | NO | N/A*** | N/A | NO | N/A |
| Site 3 NEW (District Study) | Martyr Worthy Rd, Kings Worthy | Other | 449647 | 132669 | $NO_2$ | NO | N/A*** | 0.5 | NO | N/A |
| Site 4 (District Study) | West St/Broad St, New | Roadside | 458826 | 132719 | $NO_2$ | NO | N/A*** | Centre of Road | NO | N/A |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Alresford | | | | | | | | | |
| Site 5 (District Study) | Hambledon Rd, Denmead | Roadside | 465917 | 112050 | $NO_2$ | NO | N/A*** | 1.2 | NO | N/A |
| Site 6 (District Study) | Winchester Rd, Wickham | Roadside | 457199 | 111391 | $NO_2$ | NO | N/A*** | 0.8 | NO | N/A |
| Site 7 (District Study) | Winchester Rd, Bishops Waltham | Roadside | 455330 | 117406 | $NO_2$ | NO | N/A*** | 1 | NO | N/A |
| Site 8 (District Study) | Whiteley Lane, Whiteley | Other | 453680 | 108312 | $NO_2$ | NO | N/A*** | N/A | NO | N/A |

**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 or available. * Burma Rd was installed at a location where there is no close long term exposure location for annual mean. It is being used as an indicator of hourly mean exposure for students. ** Site 26 is for an indication of hourly mean exposure at the bus station. ***A number of the district wide sites are measuring roadside locations as a worst case scenario for comparison of trends.

## 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 2017 (%) [2] | $NO_2$ Annual Mean Concentration (µg/m$^3$) [3] | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2013 | 2014 | 2015 | 2016 | 2017 |
| Echo Office | Roadside | Automatic | 0 | 0 | **47.0** | **41.0** | 38.0 | 38.0 | - |
| Godson House | Urban Background | Automatic | 0 | 0 | 25 | 24 | 20 | - | - |
| St George's Street | Roadside | Automatic | 77 | | - | - | - | - | 38.5 |
| Station Approach (Chesil Street) | Roadside | Automatic | 78 | | - | - | - | - | 29.7 |
| Site 1 (City Study) | Roadside | Diffusion Tube | 50 | 50 | **41.5** | **44.6** | 37.6 | 36.8 | 30.9 |
| Site 2 (City Study) | Roadside | Diffusion Tube | 92 | 92 | 37.1 | 34.1 | 31.5 | 30.0 | 27.5 |
| Site 3 (City Study) | Roadside | Diffusion Tube | 100 | 100 | 33 | 28.4 | 25.9 | 26.9 | 23.9 |
| Site 4 (City Study) | Roadside | Diffusion Tube | 92 | 92 | **45.1** | 39 | 37.6 | 37.1 | 33.0 |
| Site 5 (City Study) | Roadside | Diffusion Tube | 100 | 100 | **47.6** | **40.3** | 38.2 | 37.2 | 32.1 |
| Site 6 (City Study) | Roadside | Diffusion Tube | 100 | 100 | **47.6** | **40.3** | 38.2 | 38.6 | 31.7 |
| Site 7 (City Study) | Roadside | Diffusion Tube | 92 | 92 | **47.6** | **40.3** | 38.2 | 37.7 | 31.9 |
| Site 8 (City Study) | Roadside | Diffusion Tube | 100 | 100 | **63** | **54.7** | **50.2** | **49.8** | **46.8** |
| Site 9 (City Study) | Roadside | Diffusion Tube | 100 | 100 | **62.1** | **57.1** | **52.6** | **48.9** | **46.5** |
| Site 10 (City Study) | Roadside | Diffusion Tube | 75 | 75 | **52.5** | **47.1** | **40.6** | **41.7** | 38.7 |
| Site 11 (City | Roadside | Diffusion | 92 | 92 | **44.8** | 38 | 37.7 | 37 | 31.6 |

| Site ID | Site Type | Monitoring Type | Valid Data Capture for Monitoring Period (%) [1] | Valid Data Capture 2017 (%) [2] | $NO_2$ Annual Mean Concentration (µg/m$^3$) [3] | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2013 | 2014 | 2015 | 2016 | 2017 |
| Study) | | Tube | | | | | | | |
| Site 12 (City Study) | Roadside | Diffusion Tube | 83 | 83 | **40.6** | 36.1 | 33.9 | 37.3 | 28.0 |
| Site 13 (City Study) | Roadside | Diffusion Tube | 100 | 100 | **41.8** | 38.1 | 36.7 | 33.8 | 31.6 |
| Site 14 (City Study) | Roadside | Diffusion Tube | 100 | 100 | 34.6 | 31.1 | 30 | 29.7 | 28.2 |
| Site 15 (City Study) | Roadside | Diffusion Tube | 75 | 75 | 37.5 | 31.2 | 30.5 | 31.5 | 29.8 |
| Site 16 (City Study) | Other | Diffusion Tube | 83 | 83 | **43.1** | **41.3** | 37 | 38.4 | 33.0 |
| Site 17 (City Study) | Roadside | Diffusion Tube | 75 | 75 | **44.1** | **42.8** | 36.4 | 39.9 | 37.6 |
| Site 18 (City Study) | Roadside | Diffusion Tube | 100 | 100 | 28.2 | 25 | 21.2 | 24.8 | 23.7 |
| Site 19 (City Study) | Roadside | Diffusion Tube | 100 | 100 | N/A | N/A | N/A | 19.3 | 19.4 |
| Site 20 (City Study) | Roadside | Diffusion Tube | 92 | 92 | 33.2 | 29.3 | 24.2 | 22.8 | 21.5 |
| Site 21 (City Study) | Roadside | Diffusion Tube | 92 | 92 | 33.2 | 29.3 | 24.2 | 23.8 | 22.2 |
| Site 22 (City Study) | Roadside | Diffusion Tube | 83 | 83 | 33.2 | 29.3 | 24.2 | 22.9 | 20.4 |
| Site 23 (City Study) | Roadside | Diffusion Tube | 58 | 58 | 37 | 33.4 | 35.3 | 33.4 | 32.5 |
| Site 24 (City Study) | Roadside | Diffusion Tube | 92 | 92 | **65.9** | **57.2** | **48.8** | **56.6** | **50.8** |
| Site 25 (City Study) | Roadside | Diffusion Tube | 100 | 100 | **40.5** | 36.4 | 33.5 | 32.9 | 32.4 |
| Site 26 (City Study) | Other | Diffusion Tube | 67 | 67 | **41.8** | 35.9 | 33.7 | 30.4 | 28.0 |

| Site ID | Site Type | Monitoring Type | Valid Data Capture for Monitoring Period (%) (1) | Valid Data Capture 2017 (%) (2) | $NO_2$ Annual Mean Concentration ($\mu g/m^3$) (3) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2013 | 2014 | 2015 | 2016 | 2017 |
| Site 1 (District Study) | Roadside | Diffusion Tube | 83 | 83 | 33.8 | 29.4 | 27.7 | 28.4 | 24.0 |
| Site 2 (District Study) | Other | Diffusion Tube | 83 | 83 | 35.2 | 28.8 | 28.5 | 29.4 | 27.1 |
| Site 3 OLD (District Study) | Other | Diffusion Tube | 25 | 25 | 28 | 24.3 | 25.5 | 25.5 | 20.9 |
| Site 3 NEW (District Study) | Roadside | Diffusion Tube | 67 | 67 | N/A | N/A | N/A | N/A | 56.0 |
| Site 4 (District Study) | Roadside | Diffusion Tube | 92 | 92 | 37.3 | 30.1 | 30.1 | 33.8 | 28.9 |
| Site 5 (District Study) | Roadside | Diffusion Tube | 92 | 92 | 21.7 | 20.6 | 18.4 | 19.9 | 17.9 |
| Site 6 (District Study) | Roadside | Diffusion Tube | 92 | 92 | 33.2 | 29.3 | 28.8 | 30.6 | 27.5 |
| Site 7 (District Study) | Roadside | Diffusion Tube | 92 | 92 | 34.4 | 29.6 | 29.6 | 32.5 | 29.8 |
| Site 8 (District Study) | Other | Diffusion Tube | 83 | 83 | 29.9 | 23.7 | 21.8 | 22.6 | 22.8 |

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

☒ **Annualisation has been conducted where data capture is <75% (note data capture was above this value for all sites)**

**Notes:**

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

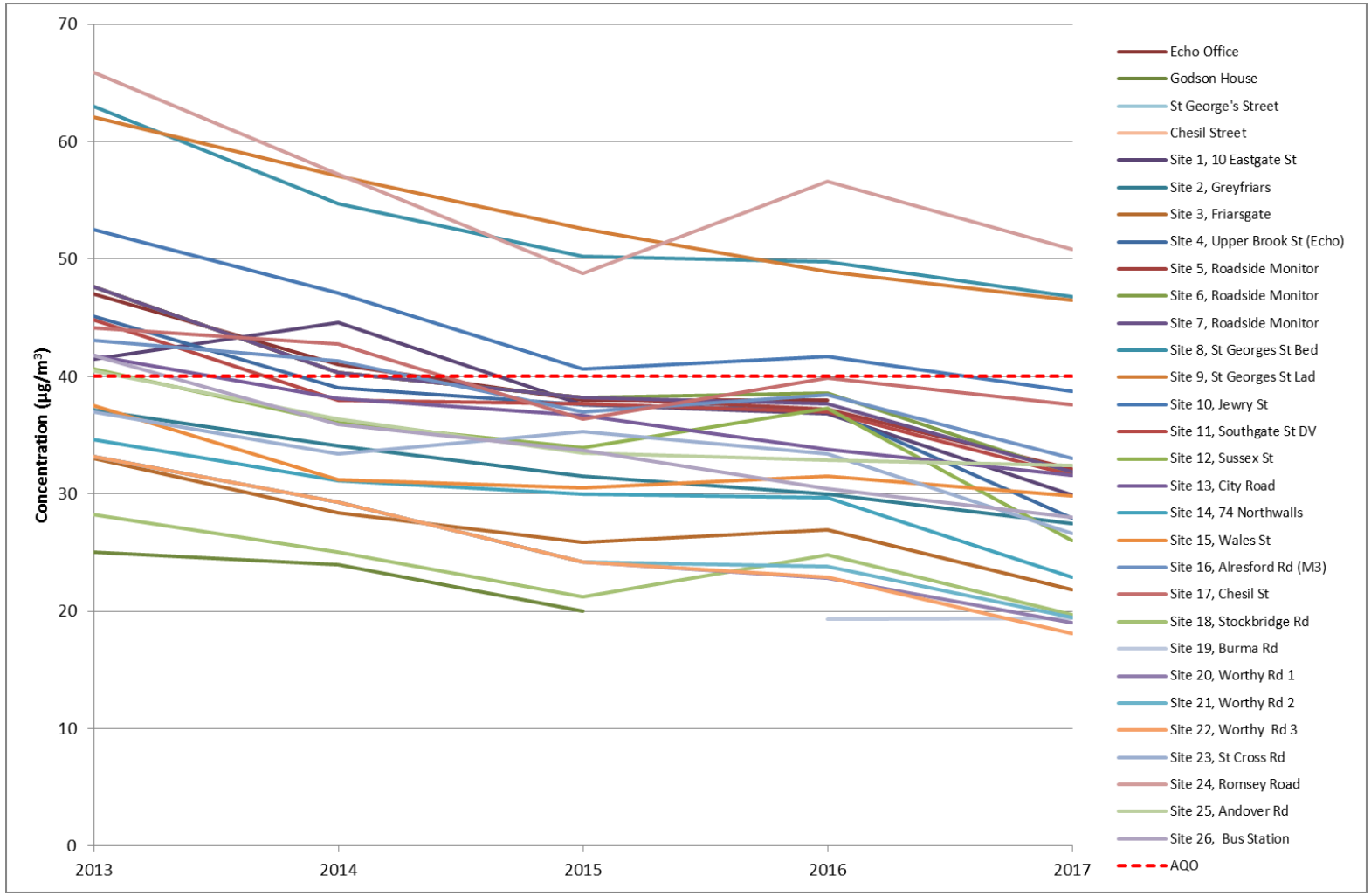
$NO_2$ annual means exceeding 60µg/$m^3$, indicating a potential exceedance of the $NO_2$ 1-hour mean objective are shown in **bold and underlined.**

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

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

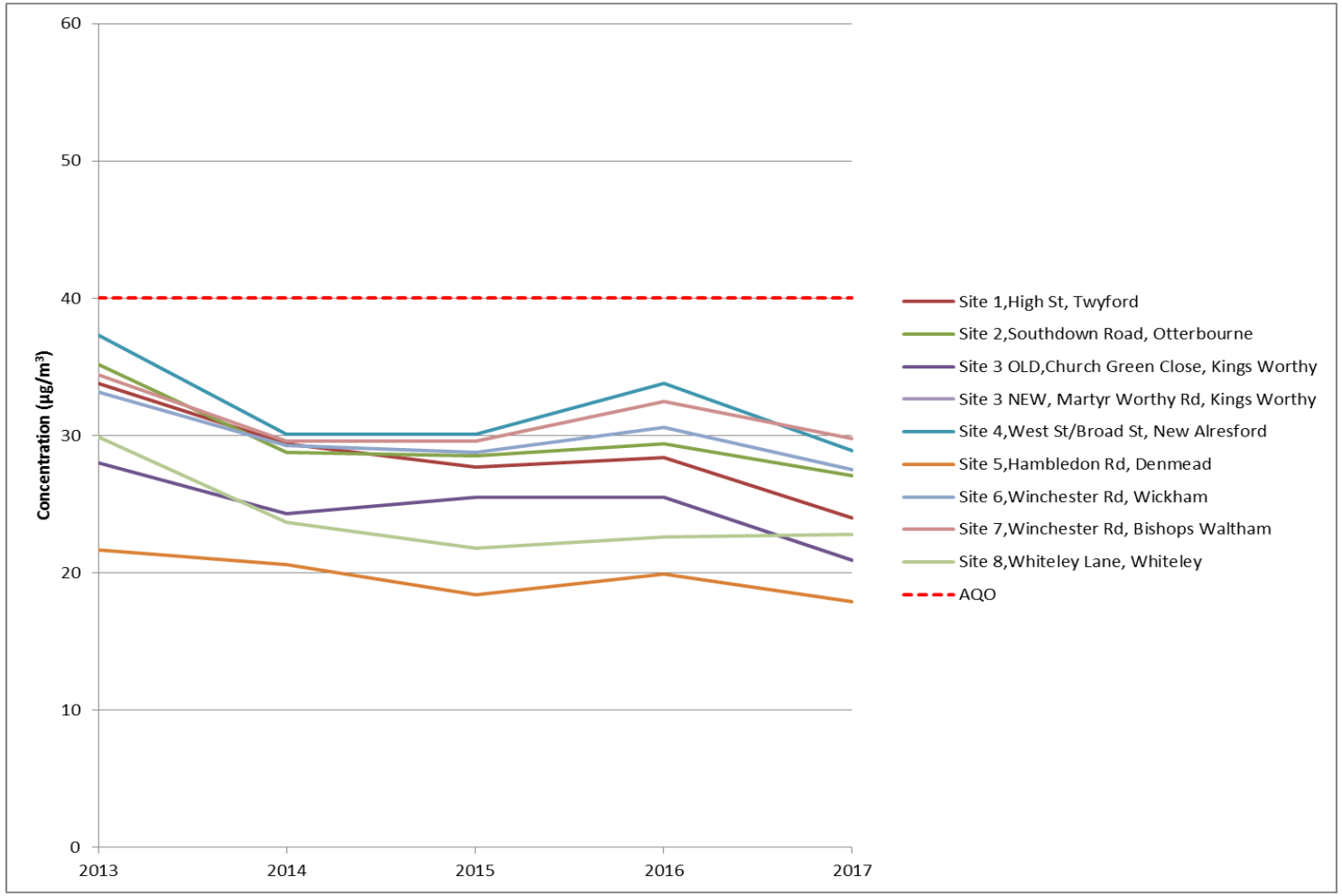
(3) Means for diffusion tubes have been corrected for bias. All means have been "annualised" as per Boxes 7.9 and 7.10 in LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

## Figure A.1 – Trends in Annual Mean $NO_2$ Concentrations – City wide DT study and automatic monitoring sites




AQO = Air Quality Objective. Note Site St. George's Street and Chesil Street are not shown on graph as data is only available for 2017.

## Figure A.2 – Trends in Annual Mean $NO_2$ Concentrations – District wide DT study




AQO = Air Quality Objective. Note Site 4 NEW is not shown on graph as data is only available for 2017.

## 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 2017 (%) (2) | $NO_2$ 1-Hour Means > 200µg/m$^3$ (3) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2013 | 2014 | 2015 | 2016 | 2017 |
| Echo Office | Roadside | Automatic | N/A | N/A | 1 | 0 | 1 | 1 | - |
| Godson House | Urban Background | Automatic | - | - | 0 | 0 | 0 (50) | - | - |
| St George's Street | Roadside | Automatic | 77 | | - | - | - | - | 0 (125) |
| Station Approach (Chesil Street) | Roadside | Automatic | 78 | | - | - | - | - | 0 (100) |

**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 99.8$^{th}$ 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 2017 (%) (2) | $PM_{10}$ Annual Mean Concentration ($\mu g/m^3$) (3) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 2013 | 2014 | 2015 | 2016 | 2017 |
| Echo Office | Roadside | N/A | N/A | 31 | 29 | 32 | 31 | - |
| Godson House | Urban Background | - | - | 23 | 18 | - | - | - |

☒ **Annualisation has been conducted where data capture is <75% (note data capture was above this value for all sites)**

**Notes:**

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

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

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

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

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

| Site ID | Site Type | Valid Data Capture for Monitoring Period (%) (1) | Valid Data Capture 2017 (%) (2) | $PM_{10}$ 24-Hour Means > 50µg/m$^3$ (3) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 2013 | 2014 | 2015 | 2016 | 2017 |
| Echo Office | Roadside | N/A | N/A | 15 | 19 | 23 | 26 | - |
| Godson House | Urban Background | - | - | 3 | 1 (38) | - | - | - |

**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 90.4$^{th}$ percentile of 24-hour means is provided in brackets.

# Appendix B: Full Monthly Diffusion Tube Results for 2017

## Table B.1 – $NO_2$ Monthly Diffusion Tube Results - 2017

| 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 (0.94) and Annualised (1) | Distance Corrected to Nearest Exposure (2) |
| Site 1 (City Study) | 40.0 | | | | | | 34.5 | 28.2 | 30.4 | 31.4 | | 30.2 | 32.4 | 30.9 | 29.9 |
| Site 2 (City Study) | 35.2 | 33.4 | 30.6 | 25.7 | 29.3 | 26.9 | 26.8 | 26.8 | 25.5 | 27.4 | 32.2 | 22.9 | 28.7 | 27.5 | N/A |
| Site 3 (City Study) | 36.8 | 32.0 | 27.3 | 21.7 | 26.7 | 19.2 | 21.1 | 19.9 | 21.8 | 23.5 | 29.5 | 26.2 | 25.5 | 23.9 | 21.8 |
| Site 4 (City Study) | 41.3 | 34.8 | 38.4 | 38.2 | 39.4 | 30.8 | 27.4 | 27.4 | 32.2 | 31.4 | 37.6 | 27.5 | 34.4 | 33.0 | 27.9 |
| Site 5 (City Study) | 44.1 | 38.4 | 35.2 | 34.4 | 37.0 | 33.4 | 31.7 | 25.6 | 30.6 | 30.8 | 34.7 | 23.9 | 33.3 | 32.1 | N/A |
| Site 6 (City Study) | 41.2 | 37.4 | 37.1 | 30.6 | 37.9 | 30.7 | 32.4 | 28.5 | 31.5 | 30.5 | 33.1 | 26.3 | 33.1 | 31.7 | N/A |
| Site 7 (City Study) | 43.9 | 39.8 | | 33.5 | 38.3 | 32.3 | 33.1 | 27.1 | 29.1 | 31.2 | 31.5 | 26.0 | 33.2 | 31.9 | 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 (0.94) and Annualised (1) | Distance Corrected to Nearest Exposure (2) |
| Site 8 (City Study) | 50.8 | 58.8 | 51.1 | 57.3 | 55.4 | 45.9 | 59.7 | 32.8 | 41.3 | 39.8 | 54.3 | 37.6 | **48.7** | **46.8** | **N/A** |
| Site 9 (City Study) | 50.8 | 52.3 | 46.9 | 53.3 | 52.3 | 53.4 | 51.9 | 42.5 | 42.6 | 48.5 | 49.0 | 38.3 | **48.5** | **46.5** | **N/A** |
| Site 10 (City Study) | 50.6 | 47.1 | 40.2 | 35.7 | 43.5 | 37.6 | | | | 36.1 | 38.8 | 26.2 | 39.5 | 38.7 | N/A |
| Site 11 (City Study) | 46.5 | 40.4 | 36.8 | 36.2 | 35.2 | | 32.5 | 26.1 | 14.1 | 31.8 | 36.4 | 26.6 | 33.0 | 31.6 | N/A |
| Site 12 (City Study) | 45.7 | | 34.0 | 17.6 | 39.1 | 27.5 | 30.9 | 26.0 | 9.7 | 27.5 | 39.8 | | 29.8 | 28.0 | 26.0 |
| Site 13 (City Study) | 41.5 | 37.7 | 29.8 | 34.8 | 32.0 | 34.4 | 37.9 | 28.4 | 23.2 | 35.1 | 34.6 | 26.0 | 33.0 | 31.6 | N/A |
| Site 14 (City Study) | 35.3 | 37.1 | 35.4 | 32.3 | 28.9 | 27.1 | 27.9 | 23.8 | 21.8 | 27.7 | 32.4 | 25.0 | 29.6 | 28.2 | 22.9 |
| Site 15 (City Study) | 40.0 | 43.0 | 32.6 | | 33.4 | | 25.0 | 23.7 | 27.0 | 29.1 | 31.8 | | 31.7 | 29.8 | N/A |
| Site 16 (City Study) | | 43.1 | 39.3 | 40.5 | 43.0 | | 36.8 | 17.6 | 28.5 | 33.2 | 33.9 | 28.1 | 34.4 | 33.0 | 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 (0.94) and Annualised (1) | Distance Corrected to Nearest Exposure (2) |
| Site 17 (City Study) | 52.4 | 36.6 | | | | 26.4 | 43.5 | 35.2 | 30.5 | 45.7 | 49.7 | 33.5 | 39.3 | 37.6 | N/A |
| Site 18 (City Study) | 58.6 | 29.9 | 22.9 | 20.0 | 23.7 | 16.8 | 17.9 | 15.3 | 26.6 | 20.1 | 26.2 | 18.1 | 24.7 | 23.7 | 19.7 |
| Site 19 (City Study) | 29.3 | 27.1 | 20.0 | 38.0 | 17.5 | 12.9 | 11.3 | 10.4 | 20.4 | 15.5 | 24.7 | 18.7 | 20.5 | 19.4 | N/A |
| Site 20 (City Study) | 30.6 | 29.0 | 25.7 | 20.0 | 20.5 | 19.1 | 19.0 | 15.4 | 18.1 | | 31.6 | 26.0 | 23.2 | 21.5 | 19.0 |
| Site 21 (City Study) | 40.4 | 30.5 | 23.0 | 22.6 | 20.8 | 18.1 | 19.5 | 16.3 | 17.1 | | 28.4 | 22.3 | 23.5 | 22.2 | 19.5 |
| Site 22 (City Study) | 30.9 | 28.3 | 24.7 | 20.6 | 19.9 | 18.2 | 19.2 | 15.7 | 18.1 | | | 22.5 | 21.8 | 20.4 | 18.1 |
| Site 23 (City Study) | 40.1 | | 32.6 | 32.9 | 33.3 | 31.3 | 26.6 | 24.9 | | | | | 31.7 | 32.5 | 26.6 |
| Site 24 (City Study) | 61.8 | 62.4 | 48.4 | 57.7 | | 51.3 | 58.4 | 35.8 | 67.0 | 47.6 | 50.0 | 35.8 | **52.4** | **50.8** | **N/A** |
| Site 25 (City Study) | 40.5 | 43.7 | 35.3 | 32.0 | 36.1 | 32.0 | 31.9 | 28.3 | 31.9 | 30.6 | 36.8 | 27.8 | 33.9 | 32.4 | 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 (0.94) and Annualised (1) | Distance Corrected to Nearest Exposure (2) |
| Site 26 (City Study) | 37.0 | 30.9 | 27.1 | 34.6 | 31.5 | 24.2 | | | 30.4 | 23.4 | | 24.2 | 29.1 | 28.0 | N/A |
| Site 1 (District Study) | 37.4 | 36.0 | 22.4 | 28.3 | 28.3 | 22.3 | 24.3 | 24.0 | 25.2 | 27.0 | | | 27.5 | 24.0 | N/A |
| Site 2 (District Study) | | 36.8 | 31.4 | 37.3 | 28.6 | 24.6 | 27.0 | 28.3 | 25.2 | 27.2 | | 29.5 | 29.6 | 27.1 | N/A |
| Site 3 OLD (District Study) | 34.0 | 34.0 | 27.3 | | | | | | | | | | 31.8 | 20.9 | N/A |
| Site 3 NEW (District Study) | | | | 51.2 | 51.9 | 54.2 | 52.4 | 42.4 | 45.5 | 44.9 | | 39.2 | **47.7** | **56.0** | N/A |
| Site 4 (District Study) | 38.8 | 43.0 | 29.9 | 34.1 | 34.5 | 28.1 | 31.1 | 23.7 | 32.7 | 31.2 | | 29.4 | 32.4 | 28.9 | N/A |
| Site 5 (District Study) | 28.5 | 34.2 | 21.3 | 19.5 | 17.6 | 15.8 | 15.5 | 15.3 | 20.0 | 21.0 | | 23.0 | 21.1 | 17.9 | N/A |
| Site 6 (District Study) | 42.7 | 43.1 | 29.1 | 34.2 | 32.7 | 26.4 | 29.0 | 24.0 | 22.9 | 30.7 | | 31.5 | 31.5 | 27.5 | N/A |
| Site 7 | 43.5 | 46.4 | 33.1 | 28.1 | 33.1 | 30.3 | 29.2 | 27.0 | 34.0 | 34.0 | | 34.0 | 33.9 | 29.8 | 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 (0.94) and Annualised (1) | Distance Corrected to Nearest Exposure (2) |
| (District Study) | | | | | | | | | | | | | | | |
| Site 8 (District Study) | 31.9 | 32.1 | 25.8 | 34.4 | 21.7 | 21.2 | 19.3 | 17.7 | 27.7 | 24.5 | | | 25.6 | 22.8 | N/A |

☒ **Local bias adjustment factor used**

☐ **National bias adjustment factor used**

☒ **Annualisation has been conducted where data capture is <75% (note data capture was above this value for all sites)**

**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. Distance corrections may be not applicable (marked N/A) as explained in Table A.2.

Exposure periods are slightly different from the suggested LAQM calendar for Jan - Apr. Periods are as follows:

Jan 31/12/15 - 29/01/16, Feb 29/01/16 - 26/02/16, Mar 26/02/16 - 24/03/2016, Apr 24/03/16 - 29/04/16, May 29/04/16 - 26/05/16, Jun 26/05/16 - 28/06/16, Jul 28/06/16 - 26/07/16, Aug 26/07/16 - 26/08/16, Sep 26/08/16 - 28/09/16, Oct 28/09/16 - 27/10/16, Nov 27/10/16 - 30/11/16, Dec 30/11/16 - 20/01/17

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

### Automatic Monitoring Data

The data collection efficiency for the roadside $NO_2$ automatic monitoring stations in 2017 was greater than the required 75% (77% for St. George's Street and 78% for Chesil Street). Therefore no annualisation of data was required.

The $PM_{10}$ automatic monitoring site was decommissioned in May 2017. All data from previous years $PM_{10}$ results used an unheated BAM 1024 analyser and have therefore had a correction factor applied as recommended, data being divided by 1.21.

All results have been zero and span corrected with readings taken approximately every 2 weeks in accordance with Defra guidance. All gases used for calibration have been independently certified. All instruments were fully serviced every six months by external contractors (ESU1). All real data was polled and ratified by an external air quality consultant (Air Monitors).

### Diffusion Tube Data

All diffusion tubes were from Gradko and used a mixture of 20% TEA in water preparation method. Gradko International Ltd is a UKAS accredited laboratory. Gradko participates in the AIR Proficiency Testing (PT) scheme for diffusion tubes, operated by LGC Standards and supported by the Health and Safety Laboratory (HSL), which provides a Quality Assurance / Quality Control (QA/QC) framework for local authorities carrying out diffusion tube monitoring as a part of their local air quality management process. The percentage of results submitted by Gradko International Ltd that were subsequently determined to be satisfactory was 100% for all tests in AIR-PT Rounds 12-22 (January 2016 - October 2017)[9].

The results have been adjusted by using a local bias adjustment factor using the procedure detailed in DEFRA guidance document Technical Guidance LAQM TG(16).[10] This was calculated by locating three diffusion tubes adjacent to the

[9] https://laqm.defra.gov.uk/assets/airptrounds12to22jan2016oct20171.pdf

[10] Defra LAQMTG(16). Available at https://laqm.defra.gov.uk/documents/LAQM-TG16-April-16-v1.pdf

roadside real time analyser and comparing results. The local bias adjustment factor calculated and used was 0.94.

The national bias adjustment factor was also calculated in accordance with LAQM TG(16). The factor for 2017 was found to be 0.89 and would therefore provide lower adjusted results if applied. As the co-location site was found to have 'good' precision for the diffusion tubes, the local bias adjustment factor was deemed suitable for all tubes in Winchester as for previous years.

Data capture for most diffusion tube sites was greater than 75%. Site 1 and site 23 within the City Study and Site 3 OLD and Site 3 NEW within the District Wide Study had a data capture of less than 75% and therefore annualisation of results was necessary.

Distance correction was carried out for those sites where the site was known to be situated a set distance away from relevant exposure. The $NO_2$ concentration at the nearest location relevant for exposure was estimated using the $NO_2$ fall-off with distance calculator available on the LAQM Support website[11].

[11] http://laqm.defra.gov.uk/tools-monitoring-data/no2-falloff.html

# Appendix D: Maps of Monitoring Locations and AQMAs

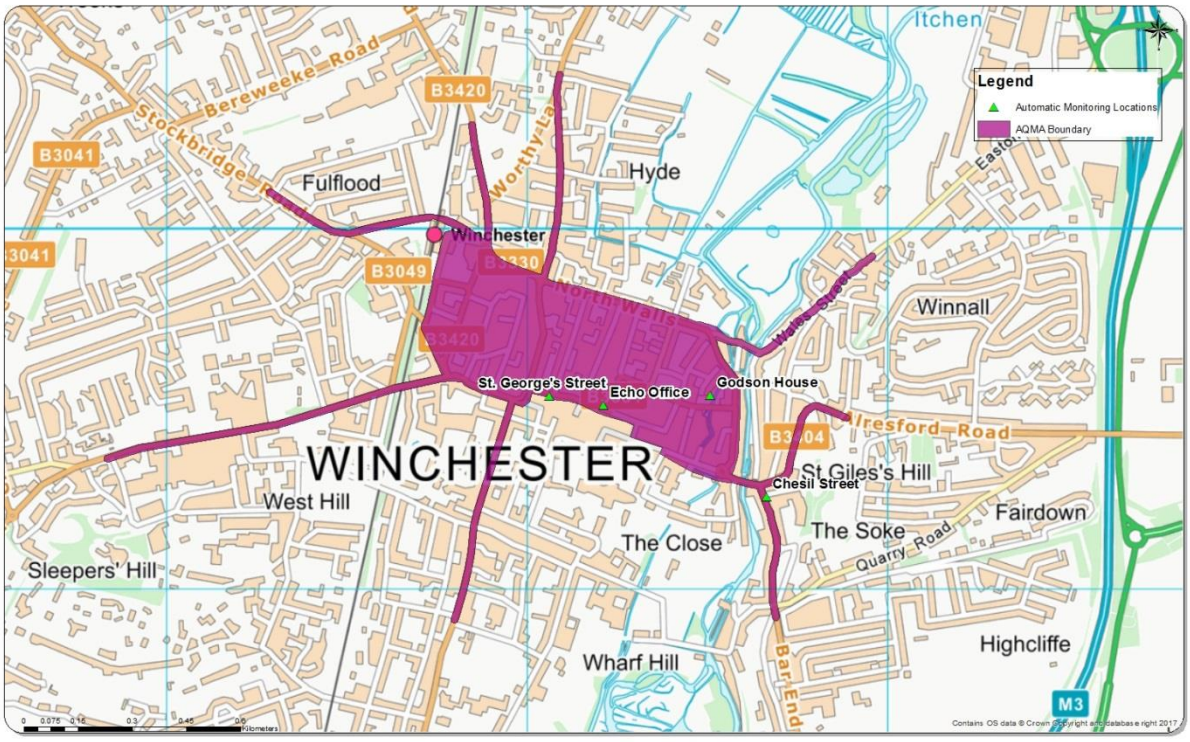



**Figure 1: Map of Automatic Monitoring Sites & AQMA Boundary**

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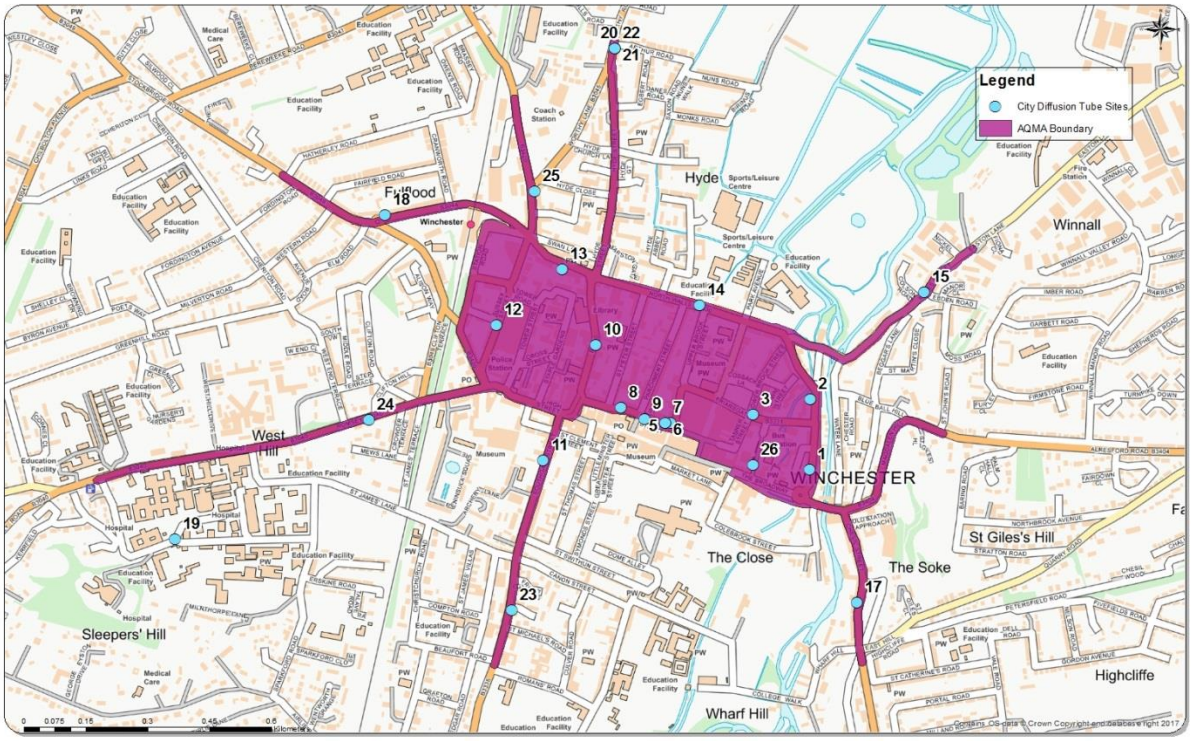


## Figure 2: Map of City wide Diffusion Tube Sites & AQMA Boundary

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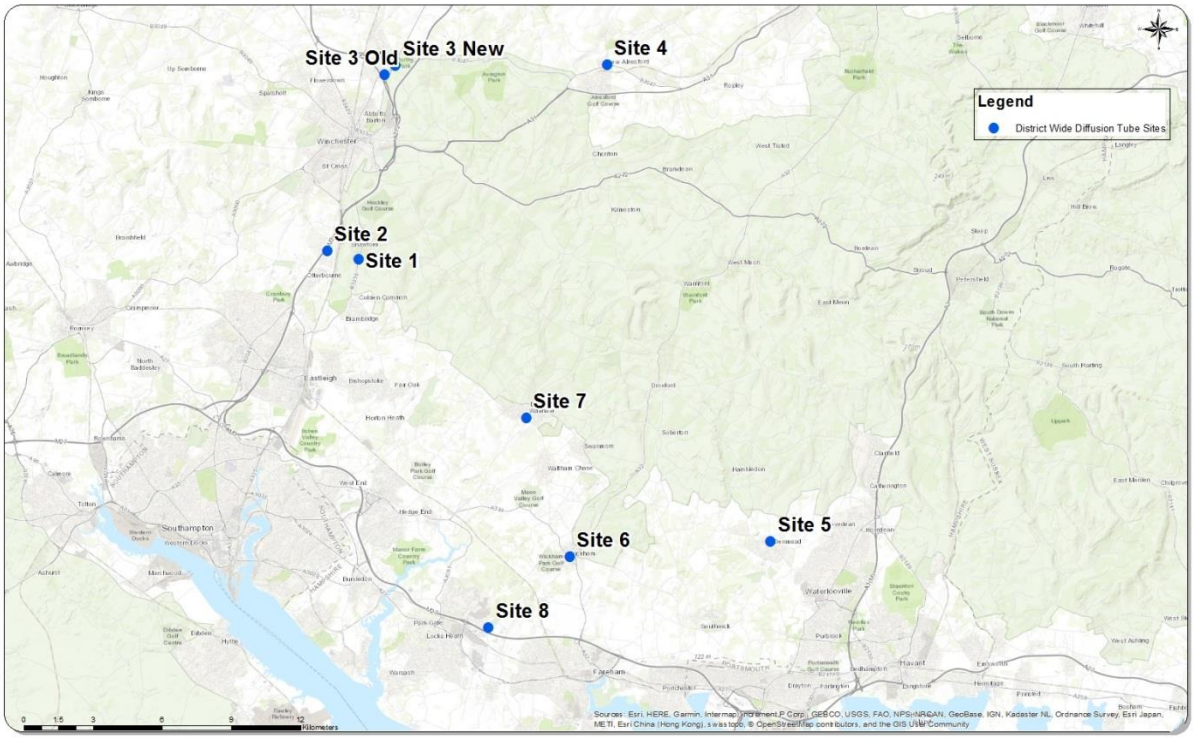


## Figure 3: Map of District wide Diffusion Tube Sites

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# Appendix E: Summary of Air Quality Objectives in England

### Table E.1 – Air Quality Objectives in England

| Pollutant | Air Quality Objective[12] | |
|---|---|---|
| | 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 |

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

# Glossary of Terms

| Abbreviation | Description |
|---|---|
| AQAP | Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the local authority intends to achieve air quality limit values' |
| AQMA | Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives |
| ASR | Air Quality Annual Status Report |
| BAM | Beta attenuation monitoring - a widely used air monitoring technique |
| 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 |
| HCC | Hampshire County Council |
| 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 |
| WCC | Winchester City Council |

# References


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4. Hampshire County Council Local Transport Plan - Implementation Plan 2014-2017. Available for download at: https://www.hants.gov.uk/transport/strategies/transportstrategies
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7. Winchester City Council 2017 Air Quality Action Plan, http://www.winchester.gov.uk/environment/air-quality/historical-air-quality-reports-for-government
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11. Department for Environment, Food and Rural Affairs. $NO_2$ fall off with distance calculator http://laqm.defra.gov.uk/tools-monitoring-data/no2-falloff.html