Gloucester City Council

Transforming Your City

2019 Air Quality Annual Status Report (ASR)

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

June 2019

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Report Reference number	ASR 2019
Date	June 2019

Executive Summary: Air Quality in Our Area

Air Quality in Gloucester City Council

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].

Gloucester is a small city (population circa 130,000) situated on the eastern bank of the tidal River Severn and backed by the Cotswold escarpment. The prevailing winds are predominantly from the southwest and follow a passage up the river, channelled by the hills in the distance to either side. The M5 motorway forms the eastern boundary of the majority of Gloucester which is densely populated in comparison to its surrounding neighbouring District Councils (Stroud District Council, Forest of Dean District Council and Tewkesbury Borough Council), which are predominantly rural.

The main source of air pollution within Gloucester that gives rise to concern for compliance is road traffic emissions from major roads, notably the A417, A430 and the A38 which connect Gloucester with the main highway network in Gloucestershire. In addition the local traffic within the centre of Gloucester causes rise to increased pollutant concentrations.

Three Air Quality Management Areas (AQMAs) have been declared within Gloucester due to exceedances of the 40µg/m^3 annual mean objective for NO_2; Barton Street AQMA (in the city centre) and Priory Road AQMA (on the A417) both declared in 2005, and Painswick Road AQMA (in the city centre, consisting of a further section of Barton Street) declared in 2007.

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[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

Monitoring of NO_2 is completed throughout Gloucester City Council using a network of passive diffusion tubes. During 2018 there were thirty four monitoring locations where diffusion tubes were deployed, the number of locations has not changed since 2017.

Out of the thirty four monitoring sites that monitored in both 2017 and 2018, twenty two reported a decrease in concentration, eleven reported an increase in concentration and one site remained at the same concentration (Site 5). Exceedances of the annual mean NO_2 objective of 40µg/m^3 were reported at four locations during 2018, and all four locations were within the existing AQMAs.

Actions to Improve Air Quality

The Gloucester City Council AQAP published in 2008, and revised in 2011 contains the actions that have been approved in relation to reducing NO_2 concentrations. In addition to the AQAP measures, an additional six measures were included in 2017 and progress on these during 2018 is included below:

- Measure 12 – The introduction of air quality measures into Gloucester City Council Taxi Licensing Policy. Update in Dec 2018; a new rule book for the taxi trade was introduced as part of the Gloucester City Council Taxi Licensing Policy. Within the rule book, conditions are applied to vehicle age and testing. Full details are in Table 2.2.

- Measure 13 – Promoting low emission transport within the Council's commercial fleet. No further update at time of reporting.

- Measure 14 – Promoting low emission transport within the Council's pool car fleet. Update in 2018; in partnership with Amey, Gloucester City Council has added 14 recycling and 4 new street cleaning vehicles which are all Euro 6 compliant into its fleet.

- Measure 15 – Introducing smart technology to measure air pollution and vehicle numbers entering Barton Street with the idea of influencing traffic movement at times of peak pollution levels. Update in 2018; GCC is continuing to research options available for appropriate technology and potential funding for this.

- Measure 16 – Promoting the issue of air quality through the national Clean Air Day. Update in 2018; GCC staff participate in clean air events – a project is underway to reduce the incidence of burning/bonfires in partnership with social

housing providers in the city. Social media communications was used on clean air day to educate about domestic bonfires

- Measure 17 – Liaising with the planning team to develop criteria for air quality in relation to major planning applications.

All measures are presented in Table 2.2.

Additional informal air quality measures that Gloucester City Council have taken in 2018 include:

Officers are being trained in the awareness of measures and are identifying where air quality can be improved in respect to informal and formal action being taken e.g. a local business has had a noise abatement notice served and it was identified that the measures put in place to abate the noise nuisance will also improve the air quality, not only for the employees but for the local area (changing from diesel fork lift trucks to electric to reduce noise). This business was advised to ensure they update their own environmental policies.

Gloucester City Council has relocated out of the energy inefficient warehouses in the Docks. The move to Shire Hall has seen a change to agile working for staff, with the introduction of new technology, there is the opportunity to work from home, therefore reducing car use and office space. This has also introduced the opportunity for staff to work more closely and alongside other departments in the city and county council (i.e. more conversation with departments such as planning and housing).

GCC has adopted a green travel plan and in June 2019 an updated report will go to cabinet to expand this – the plan will adopt a fleet of ULEVs in partnership with the County Council who already have electric vehicles there is also an opportunity to bring in electric bikes for shorter journeys. It has been identified that the implementation of the green travel plan has saved 3 million tonnes of CO_2 since its introduction in 2017.

Conclusions and Priorities

There were no exceedances of the NO_2 annual mean objective recorded by the network of diffusion tubes outside any of the existing AQMAs during 2018. The following has been recommended in relation to the three existing AQMAs:

- Priory Road AQMA – To remain in force due to exceedances of the annual mean objective at the three monitoring sites located within the AQMA boundary;

- Barton Street AQMA – One monitoring site (of the eight monitoring sites) recorded an exceedance of the annual mean objective in 2018. The four diffusion tubes located within the southern section of the AQMA (10, 11, 16 and 17) have not exceeded the NO_2 annual mean objective over the past five years, therefore consideration can be made as to the possibility for reducing the AQMA boundary; and

- Painswick Road AQMA – There were no exceedances at this AQMA in 2018. All monitoring sites have been within the objective level for the past 5 years and therefore consideration as to whether the AQMA can be revoked will be considered.

Gloucester City Council are due to complete a new air quality action plan, which has been reviewed over 2018. The council has been working with partners to ensure that the right contacts at the County level are engaged to shape this. Gloucester City Council has also recently recruited a new manager who has considerable experience in air quality which will be an asset when developing the plan.

In terms of new developments a new bus station has been completed and in use. This will improve access to public transport and is in close proximity to major transport routes.

The Black Dog Way site is a roadside development of 95 apartments which will potentially introduce hundreds of new sensitive receptors along this stretch. Consequently, the council will review the evidence with the view to set up monitoring sites in this location to determine if there is an air quality issue. This development is not in an AQMA, although the Priory Road AQMA is situated approximately 200 metres from this site.

A development of 400+ housing and flats is being built along the canal side at Bakers Quay. There are no AQMAs in the vicinity however air quality will be considered during the planning stages to ensure impacts have been assessed appropriately.

Local Engagement and How to get Involved

A 'How can you help' section on the Gloucester City Council website
https://www.gloucester.gov.uk/environment-waste-recycling/pollution/air-quality/
provides information on a number of simple things that can be done at an individual level to help improve air quality in Gloucester:

- **Car sharing** – go shopping with friends or neighbours, take a colleague to work, or join a car share club or lift share;

- **Travel smarter/ Using Public transport** – follow the link to Think Travel website - http://www.thinktravel.info/;

- **Switch off your engine when stationary** – if stuck in traffic or stopping more than a minute. Idling engines make sitting in jams even more unpleasant. Do not run the engine unnecessarily, drive off soon after starting (in some areas it may be an offence to leave the engine running);

- **Walking and cycling** – follow link to You Tube video on Air Pollution Exposure Experiment by Camden Council and Kings College London https://www.youtube.com/watch?v=KyxbSxpA-E4;

- **Garden bonfires contribute to poor air quality locally** – use alternative methods of disposal i.e. Hempsted Recycling Centre or sign up to the green garden waste collection service; and

- **Maintaining your vehicle** – check tuning, tyre pressure, brakes and fuel consumption – regular servicing helps keep your car efficient and saves fuel.

  Other car related tips include:

- **Avoid using cars for short journeys** – combine trips or, alternatively, walk, cycle, or take a bus;

- **Lighten up** – roof rakes add drag and other unnecessary weight increases fuel consumption;

- When your tyres need replacing consider **low rolling resistance** replacements – ask your tyre fitter for advice;

- **Drive gently** – racing starts and sudden stops increase fuel consumption. Use higher gears when traffic conditions allow;

- **Steady your speed** – at around 50mph emissions will be lowest, rising dramatically above 70mph;

- **Air conditioning and on board electrical** devices increase fuel consumption – only use them when really necessary;

- **Investigate alternatives** – if you're looking for a new car there are a number of different technologies and fuels available, existing cars can also be adapted to give off lower emissions.

Table of Contents

List of Figures

1 Local Air Quality Management

This report provides an overview of air quality in Gloucester City Council during 2018. 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 Gloucester 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.

A summary of AQMAs declared by Gloucester City Council 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://www.gloucester.gov.uk/environment-waste-recycling/pollution/air-quality/

Alternatively, see Appendix D: Maps of Monitoring Locations and AQMAs, which provides for a map of air quality monitoring locations in relation to the AQMAs.

Table 2.1 – Declared Air Quality Management Areas

AQMA Name	Date of Declaration	Pollutants and Air Quality Objectives	City / Town	One Line Description	Is air quality in the AQMA influenced by roads controlled by Highways England?	Level of Exceedance (maximum monitored/modelled concentration at a location of relevant exposure)		Action Plan		
						At Declaration	Now	Name	Date of Publication	Link
Painswick Road AQMA	October 2007	NO2 Annual Mean	Gloucester	An area encompassing a number of properties on either side of Painswick Road, Gloucester.	NO	48µg/m^3	35.6µg/m^3	Gloucester AQAP 2008 (2011 Review)	2011	https://www.gloucester.gov.uk/environment-waste-recycling/pollution/air-quality/
Barton Street AQMA	August 2005	NO2 Annual Mean	Gloucester	An area encompassing Barton Street, Gloucester from its junction with Trier Way/Bruton Way to the north west and Upton Street to the south east.	NO	41 - 47µg/m^3	42.4µg/m^3	Gloucester AQAP 2008 (2011 Review)	2011	https://www.gloucester.gov.uk/environment-waste-recycling/pollution/air-quality/
Priory Road AQMA	August 2005	NO2 Annual Mean	Gloucester	An area encompassing the junction of St Oswalds Road and Priory Road.	NO	41 - 48µg/m^3	47.4µg/m^3	Gloucester AQAP 2008 (2011 Review)	2011	https://www.gloucester.gov.uk/environment-waste-recycling/pollution/air-quality/

☒ **Gloucester City Council confirm the information on UK-Air regarding their AQMAs is up to date**

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

Defra's appraisal of last year's ASR concluded the following:

"The report is well structured, details and provides the information specified in the Guidance, using the latest reporting template. The following commentary is provided to help inform future reports.

1. *The latest monitoring results continue to demonstrate exceedances of the annual mean NO_2 objective within Barton Street and Priory Road AQMAs, with 1 and 3 sites exceeding respectively.*

2. *There have been no exceedances within the Painswick AQMA for the last five years; however concentrations at site 9 remain within 10% of the objective level. The Local Authority plan to review the Painswick AQMA, and continue monitoring in the Barton Street and Priory Road AQMAs, which is supported.*

3. *The Local Authority also plans to review and update the AQAP in 2018. This is also supported, and it is suggested that careful consideration be given to including additional measures within the AQAP which could specifically target hotspots within each AQMA. The new AQAP measures should be developed in line with Chapter 2 of the Technical Guidance TG(16).*

4. *The Local Authority draws links between PM2.5 and the Public Health Outcomes Framework, demonstrating the Council's commitment towards mitigating PM2.5. However, no measures are included which specifically address improvements in PM2.5 emissions and concentrations within the City. The Local Authority may therefore wish to consider developing such measures in their new AQAP.*

5. *The Local Authority has made some good progress with their AQAP in the last year. Specific implementation and estimated/actual completion dates should be provided for AQAP measures. Pollution reduction targets should be developed (where possible) for the new measures added to the AQAP in 2017.*

6. *QA/QC procedures have been applied correctly for bias adjustment; annualisation and distance, with details provided which is useful and encouraged."*

The comments made within the appraisal report, as shown above, have been taken into account for the completion of the 2019 ASR.

Gloucester City Council has taken forward a number of direct measures during the current reporting year of 2018 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2.

More detail on these measures can be found in the 2008 Gloucester Air Quality Action Plan. Gloucester City Council are due to complete a new action plan, which has been reviewed over 2018.

Progression on the measures during 2018 was as follows

- Measure 12 – The introduction of air quality measures into Gloucester City Council Taxi Licensing Policy. A new rule book for the taxi trade was introduced as part of the Gloucester City Council Taxi Licensing Policy. Within the rule book, conditions are applied to vehicle age and testing. Full details are in table 2.2.

- Measure 14 – Promoting low emission transport within the Council's pool car fleet. In partnership with Amey, Gloucester City Council has added 14 recycling and 4 new street cleaning vehicles which are all Euro 6 compliant into its fleet.

- Measure 15 – Introducing smart technology to measure air pollution and vehicle numbers entering Barton Street with the idea of influencing traffic movement at times of peak pollution levels. GCC is continuing to research options available for appropriate technology and potential funding for this.

- Measure 16 – Promoting the issue of air quality through the national Clean Air Day. GCC staff participate in clean air events – a project is underway to reduce the incidence of burning/bonfires in partnership with social housing providers in the city. Social media communications was used on clean air day to educate about domestic bonfires

Additional informal air quality measures that Gloucester City Council have taken in 2018 include:

Officers are being trained in the awareness of measures and are identifying where air quality can be improved in respect of informal and formal action being taken e.g. a local business has a noise abatement notice served and it was identified that the

measures put in place to abate the noise nuisance will also improve the air quality, not only for the employees but for the local area (changing from diesel fork lift trucks to electric to reduce noise). This business was advised to ensure they update their own environmental policies.

GCC has adopted a green travel plan and in June 2019 an updated report will go to cabinet to expand this – the plan will adopt a fleet of ULEVs in partnership with the County Council who already have electric vehicles. There is also an opportunity to bring in electric bikes for shorter journeys. It has been identified that the implementation of the green travel plan has saved 3 million tonnes of CO_2 since its introduction in 2017.

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

Table 2.2 – Progress on Measures to Improve Air Quality

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
1	Enforce the existing HGV ban on Painswick Road North/Chequers Bridge/Barton Street except for buses and access	Freight and Delivery Management	Route Management Plans/ Strategic routing strategy for HGV's	Gloucestershire Police	2011 - 2015	On-going	Number of HGVs on named roads	0.2 - 1µg/m3	HGV ban continues to be enforced	On-going	-
2	Improve Bus Service	Transport Planning and Infrastructure	Public transport improvements- interchanges stations and services	Gloucester City Council, Gloucestershire Highways and bus companies	2015-2031	On-going	New bus station Improved transport facilities Increased mode share of sustainable travel Improved greenhouse gas emission quality	0.2 - 1µg/m3	Bus station has been completed and is in use.	Completed	
3	Variable Message Signs (VMS)	Traffic Management	Other	Gloucestershire County Council	2011 - 2016	-	Number of VMS signs	> 0.2µg/m3	Currently no funding available	-	No funding identified
4	Improvements/Control of the signals	Traffic Management	UTC, Congestion management, traffic reduction	Gloucestershire County Council	A new county maintenance contract	-	N/A	< 0.2µg/m3	No planned improvements for the foreseeable future.	-	Construction of the Central Transport Hub is affecting the network of signals around the inner ring road from

					was procured in 2017. There are no planned improvements in Gloucester for the forseeable future.						Hare Lane to Gloucester Park. This means the network cannot currently operate at maximum efficiency. The SCCT network will be looked at as a whole once construction is complete.
5	Promote alternatives through a 'TravelSmart' intervention	Promoting Travel Alternatives	Other	Gloucestershire County Council	Completed	Completed	Increased walking and cycling	> 0.2 dependant on size of scheme	The Thinktravel Transition Year project has come to an end. The evaluation report was produced in July 2017 to form an evidence base to inform future funding opportunities.	Completed	No further funding is available at this time.
6	Promote the use of alternative modes through School Travel Plans	Promoting Travel Alternatives	School Travel Plans	Gloucestershire County Council There is no longer a school travel plan team, although LSTF are running a project in some schools, the future of this measure is subject to funding.	Completed	Completed	Increased walking and cycling	> 1µg/m3	The Thinktravel Transition Year project has come to an end. The evaluation report was produced in July 2017 to form an evidence base to inform future funding opportunities.	Completed	No further funding is available at this time.
7	Promote the use of alternative modes and alternative routes through Business / Employer Travel Plans	Promoting Travel Alternatives	Workplace Travel Planning	Gloucestershire County Council However there is no longer a travel plan team in place.	2011	Completed	Change in % transport used	0.2 - 1µg/m3	The Thinktravel Transition Year project has come to an end. The evaluation report was produced in July 2017 to form an evidence base to inform future funding opportunities.	Completed	No further funding is available at this time.

8	Greater restriction and better timing of deliveries	Freight and Delivery Management	Route Management Plans/ Strategic routing strategy for HGV's	Gloucestershire County Council	2011 - 2014	On-going	Number of HGVs on named roads	< 0.2µg/m3	Currently deliveries are banned from 8-9am and 5-6pm	On-going	No further update available at this time
9	Encourage bus company to buy new vehicles to provide the bus services	Vehicle Fleet Efficiency	Promoting Low Emission Public Transport	Gloucester City Council and Gloucestershire County Council	2011	On-going	Number of new vehicles	< 0.2µg/m3	Continued promotion and information on council website. Meeting with Stagecoach at the end of 2017 revealed that their bus fleet is renewed on a countywide basis and is related to ages of vehicles.	On-going	No further update available at this time
10	Upgrade existing bus fleet	Vehicle Fleet Efficiency	Vehicle Retrofitting programmes	Bus companies	2011	On-going	Number of buses retrofitted	< 0.2µg/m3	On-going	On-going	No further update available at this time
11	Reduce illegal parking	Traffic Management	UTC, Congestion management, traffic reduction	Gloucestershire County Council	2011	On-going	Reduction in illegal parking and less parking on city centre roads.	< 0.2µg/m3	Controlled zones established and Civil Enforcement Officer's in place to enforce zones.	On-going	No further update available at this time
12	Introduce air quality measures into Gloucester City Council Taxi Licensing Policy	Promoting Low Emission Transport	Taxi Licensing conditions	Gloucester City Council	2018	On-going	Improvement in age and euro standard of vehicles within the taxi fleet		December 18 saw introduction of new rule book where vehicles must comply with specific condition in relation to the age and length of service, e.g. Euro 6 compliant by 2023	On-going	Gloucester City Council Taxi Licensing Committee have approved rule book
13	Amey Fleet	Promoting Low Emission Transport	Company Vehicle Procurement - Prioritising uptake of low emission vehicles	Gloucester City Council/ Amey	2018	Completed	Improvements in age and euro standard of vehicles within Amey fleet		14 recycling and 4 street cleaning vehicles that are Euro 6 compliant have been added to the fleet	On-going	No further update available at this time

14	Pool Vehicles	Promoting Low Emission Transport	Company Vehicle Procurement - Prioritising uptake of low emission vehicles	Gloucester City Council	2018	Completed	Improvement in age and euro standard of vehicles used for council business use		Pool vehicles utilised by all staff from January 2018	Completed	-
15	Smart City Pilot- Smart technology measuring air pollution and vehicle numbers entering Barton Street with the idea of influencing traffic movement at times of peak pollution levels	Traffic Management	UTC, Congestion management, traffic reduction	Gloucester City Council/ Gloucestershire County Council	2018	On-going	% of vehicles travelling through Barton Street AQMA		Liaison with Private Company and Gloucestershire Highways to implement technology. GCC is continuing to research options and potential funding for this	On-going	Funding required to develop options further
16	Improvement in Planning Application Validation Requirements	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	Gloucester City Council	2018	On-going	Increase in air quality assessments being received with the submission of applications for major developments		Liaison with Planning Department to provide criteria for air quality in relation to major developments. Applications are not validated until all information is received.	On-going	-

Note: Gloucester City Council are due to complete a new action plan, which has been reviewed over 2018

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.

Currently there is no monitoring of PM$_{2.5}$ or PM$_{10}$ completed within Gloucester City Council, therefore no concentration values can be reported or estimated using the method described in Box 7.7 of LAQM.TG(16).

The current Defra 2018 background maps for Gloucester City Council (2017 based[4]) show that all background concentrations of PM$_{2.5}$ are far below the 2020 annual mean AQS objective for PM$_{2.5}$. The highest concentration is predicted to be 10.1µg/m^3 within the 1 x 1km grid square with the centroid grid reference of 387500, 217500. This is an area to the southeast of Gloucester that contains the M5, A417 junction.

The Public Health Outcomes Framework data tool[5] compiled by Public Heath England quantifies the mortality burden of PM$_{2.5}$ within England on a county and local authority scale. The 2017 fraction of mortality attributable to PM$_{2.5}$ pollution across England is 5.1%, and the fraction within Gloucester City Council is at the National average of 5.1% however it is below the South West region average of 4.4%.

LAQM.TG(16) Table A.1 Action toolbox presents a list of measures that can be implemented to help reduce concentrations of PM$_{2.5}$.

Where required Gloucester City Council will review any proposed actions to be implemented with the County Council Public Health team to consider the potential impact of the actions and whether any further action is required.

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[4] Defra Background Mapping data for local authorities (2017-based), available online at https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2017
[5] Public Health Outcomes Framework, Public Health England. data tool available online at http://www.phoutcomes.info/public-health-outcomes-framework#page/0/gid/1000043/pat/6/par/E12000009/ati/102/are/E06000028

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

Gloucester City Council did not carry out any automatic monitoring of pollutants during 2018.

3.1.2 Non-Automatic Monitoring Sites

Gloucester City Council undertook non- automatic (passive) monitoring of NO_2 at 34 sites during 2018. There was no change in the number of sites from 2017. Table A.1 in Appendix A shows the details of the monitoring sites.

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

3.2 Individual Pollutants

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

3.2.1 Nitrogen Dioxide (NO_2)

Table A.2 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 $40\mu g/m^3$.

For diffusion tubes, the full 2018 dataset of monthly mean values is provided in Appendix B.

Data capture for one of the diffusion tubes was below 75%, therefore annualisation (short-term to long-term adjustment) has been completed in line with LAQM.TG(16) using data from background automatic monitoring stations within 50 miles of the diffusion tube locations.

The NO$_2$ results for 2018 have been bias adjusted using a national bias adjustment factor of 0.93. Full details of the bias adjustment and QA/QC monitoring procedures are provided in Appendix C.

The annual mean NO$_2$ concentration was not greater than 60µg/m^3 at any diffusion tube monitoring site, as per LAQM.TG(16) guidance, it is unlikely there were any exceedances of the NO$_2$ 1-hour mean objective at any monitoring site.

The analysis of the 2018 monitoring data is completed below in relation to the designated AQMAs within Gloucester City Council. The concentrations presented have not been distance corrected.

Priory Road AQMA

Monitored concentrations are presented in Table A.2 and Figure A.1.

There are three diffusion tube locations within the Priory Road AQMA, sites 23, 24 and 25. Site 24 is a duplicate location consisting of two diffusion tubes.

The NO$_2$ concentration at the three monitoring locations within the Priory Road AQMA exceeded the annual mean objective of 40µg/m^3 in 2018. All locations have exceeded this objective for the previous five years.

Concentrations at the three sites have increased in 2018 when compared to 2017, and 2014 still remains the peak year for NO$_2$ concentrations. Due to the continued high concentrations that are in exceedance of the annual mean objective, the AQMA should remain in force.

Barton Street AQMA

Monitored concentrations are presented in Table A.2 and Figure A.2.

There are eight diffusion tube locations within the Barton Street AQMA, all sites had a data capture of 75% or more therefore annualisation was not required at any location.

The 2018 NO$_2$ concentration at one monitoring site (site 14) within the Barton Street AQMA exceeded the annual mean objective of 40µg/m^3; this is unchanged when compared to 2017, though the measured concentration has decreased. The concentrations recorded in 2018 decreased at all monitoring sites apart from sites 12 and 13 where a slight increase was experienced.

Concentrations continue to be lower at the southern end of the AQMA at site 10, 11, 16 and 17. Compared with 2017, site 17 concentration has decreased and is no longer

within 10% of the annual mean objective, however site 14 continues to demonstrate exceedances of the objective and has done so for the past five years, therefore at the current time the AQMA should remain in force.

Painswick Road AQMA

Monitored concentrations are presented in Table A.2 and Figure A.3.

There are five diffusion tube locations within the Painswick Road AQMA, all sites had a data capture of 75% or more therefore annualisation was not required at any location.

There were no exceedances of the 40µg/m^3 annual mean objective during 2018 at the five monitoring locations within the Painswick Road AQMA. The concentrations at all sites decreased between 2017 and 2018 and have remained relatively constant across all sites. The highest concentration recorded was at site 9 (35.6µg/m^3). The site is located at the southern end of the AQMA close to the roundabout with the A38 where traffic decelerates and there can be congestion during peak times.

Within the past five years there have not been any exceedances of the annual mean objective at any of the five sites. Although there has not been any exceedances over the past five years, site 9 has been within 10% of the objective for the previous four years before 2018. Due to this the AQMA should remain in place, but a review to the boundary of the AQMA is to be completed and the monitoring locations reviewed to ensure that complete monitoring coverage of the AQMA is maintained.

Diffusion Tubes Outside of Existing AQMAs

Monitored concentrations are presented in Table A.2 and Figure A.4.

There are eighteen diffusion tube monitoring sites located outside of the existing AQMAs. Nine of these have been monitoring for at least five years whilst the later nine have been monitoring for two or three years. Site 21 had a data capture of less than 75% and therefore this site was annualised.

There were no exceedances of the NO$_2$ annual mean objective during 2018 at any of the nine older monitoring sites outside of the existing AQMAs, there has not been an exceedance at any site for the past 5 years. Of the nine newer sites, there has been once exceedance measured over the past two to three years i.e. site 28 in 2016. In comparison to 2017 concentrations, eight sites experienced an increase in concentration, and ten sites experienced a decrease in concentration. Due to all

monitoring locations reporting concentrations below the annual mean objective, no further AQMAs need to be designated within Gloucester City Council.

There were no exceedances of the NO_2 annual mean objective at any of the nine new diffusion tube locations that have been introduced since 2016. Concentrations at site 28 (38.1µg/m^3) and site 34 (37.1µg/m^3) were within 10% of the annual mean objective, therefore the fall-off with distance calculator has been used to estimate the NO_2 concentration at the nearest location with relevant exposure.

Following this process the concentrations fell to 24.8µg/m^3 at site 28 and 28.8µg/m^3 at site 34. Therefore there are no exceedances of the annual mean objective at relevant exposure locations. Monitoring is to continue at these locations so trend analysis over a long term period can be completed.

3.2.2   Particulate Matter (PM$_{10}$)

Gloucester City Council does not carry out any routine monitoring of PM$_{10}$.

3.2.3   Particulate Matter (PM$_{2.5}$)

Gloucester City Council does not carry out any routine monitoring of PM$_{2.5}$

3.2.4   Sulphur Dioxide (SO$_2$)

Gloucester City Council does not carry out any routine monitoring of SO$_2$.

Appendix A: Monitoring Results

Table A.1 – Details of Non-Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) [1]	Distance to kerb of nearest road (m) [2]	Tube collocated with a Continuous Analyser?	Height (m)
1	57 Bristol Rd (façade)	Roadside	382690	217440	NO$_2$	NO	0	4.8	NO	2.5
2	157 Bristol Rd	Roadside	382410	217013	NO$_2$	NO	0	7	NO	2.6
3	35 Buscombe Gardens	Roadside	387670	217250	NO$_2$	NO	0	26.8	NO	2.6
4	12 Caravan Site	Urban Background	387250	216530	NO$_2$	NO	0	49.2	NO	2.5
5	97 Painswick Rd	Roadside	384558	216946	NO$_2$	YES	0	4.6	NO	2.57
6	65 Painswick Rd	Roadside	384512	217023	NO$_2$	YES	0	4.5	NO	2.54
7	76 Painswick Rd	Roadside	384490	217027	NO$_2$	YES	0	3.5	NO	2.7
8	88 Painswick Road	Roadside	384509	216998	NO$_2$	YES	0	3.5	NO	2.5
9	106 Painswick Rd	Roadside	384550	216932	NO$_2$	YES	0	2.9	NO	2.7
10	301 Barton St	Roadside	384182	217533	NO$_2$	YES	0	4.3	NO	2.7

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)
11	Opp 250 Barton St	Roadside	384090	217731	NO_2	YES	0.3	1.7	NO	2.6
12	219A Barton St (post)	Roadside	384000	217863	NO_2	YES	0	2	NO	2.6
13	99 Barton St	Roadside	383717	218094	NO_2	YES	0	2	NO	2.5
14	124 Barton St	Roadside	383726	218074	NO_2	YES	0	1.5	NO	2.6
15	196 Barton St (Lamppost)	Roadside	383989	217857	NO_2	YES	0	2.5	NO	2.6
16	240 Barton Street	Roadside	384081	217725	NO_2	YES	0	1.9	NO	2.6
17	316 Barton St	Roadside	384175	217501	NO_2	YES	0	2.3	NO	2.6
18	79 Millbrook Road	Roadside	384190	218160	NO_2	NO	0	1	NO	2.6
19	61 Barnwood Rd	Roadside	385130	218585	NO_2	NO	0	5	NO	2.6
20	53 Barnwood Rd	Roadside	385113	218595	NO_2	NO	0	2.3	NO	2.53
21	Elmbridge Road Junior School	Urban Background	385430	218870	NO_2	NO	9.5	101.6	NO	2.6
22	Gloucester Guildhall	Urban Background	383243	218489	NO_2	NO	0	106.7	NO	5

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)
23	46 Priory Rd	Roadside	382898	219029	NO$_2$	YES	0	4.5	NO	2.45
24	56 Priory Rd (Duplicate)	Roadside	382921	219034	NO$_2$	YES	0	4.4	NO	2.54
25	66 Priory Rd	Roadside	382950	219040	NO$_2$	YES	0	5.4	NO	2.65
26	16 London Rd	Roadside	383560	218775	NO$_2$	NO	30	2.7	NO	2.5
27	Gloucester Academy	Roadside	384967	216252	NO$_2$	NO	23	3	NO	2.5
28	GL1	Roadside	383619	218162	NO$_2$	NO	27	2	NO	2.5
29	Park End Cross Roads	Roadside	383238	217349	NO$_2$	NO	16	3	NO	2.5
30	126 Painswick Rd	Roadside	384607	216841	NO$_2$	NO	6	2	NO	2.5
31	94 Barnwood Rd	Roadside	385499	218350	NO$_2$	NO	10	2	NO	2.5
32	26 Farriers End	Roadside	380958	214385	NO$_2$	NO	8	2.3	NO	2.5
33	45 Eastern Avenue	Roadside	384638	217325	NO$_2$	NO	19	1.3	NO	2.5
34	102 Eastern Avenue	Roadside	384671	217296	NO$_2$	NO	7.5	1.4	NO	2.5

Notes:

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

(2) N/A if not applicable.

Table A.2 – Annual Mean NO₂ Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2018 (%) [2]	NO₂ Annual Mean Concentration (µg/m³) [3]				
					2014	2015	2016	2017	2018
1	Roadside	Diffusion Tube	92	92	27.6	25.9	27.2	25	23.0
2	Roadside	Diffusion Tube	92	92	26.9	25.3	26.2	23.9	23.2
3	Roadside	Diffusion Tube	92	92	27.9	25.5	27.9	24	23.7
4	Urban Background	Diffusion Tube	92	92	22.59	20.4	22.7	19.6	19.4
5	Roadside	Diffusion Tube	92	92	32.4	30.5	33.2	29.6	29.6
6	Roadside	Diffusion Tube	92	92	28.7	26.7	31.1	26.4	24.9
7	Roadside	Diffusion Tube	92	92	36	33.5	33.6	32.1	29.8
8	Roadside	Diffusion Tube	92	92	35.8	35.5	36.7	35.2	33.7
9	Roadside	Diffusion Tube	92	92	39	38.8	39.7	38.3	35.6
10	Roadside	Diffusion Tube	92	92	24.9	23.3	25.7	24	21.5
11	Roadside	Diffusion Tube	92	92	33.2	25.1	31.4	27.8	26.8
12	Roadside	Diffusion Tube	92	92	**43.6**	35.8	**40.1**	36.5	36.8
13	Roadside	Diffusion Tube	92	92	23.58	35.8	39.1	35	37.6
14	Roadside	Diffusion Tube	92	92	**49.7**	**46.6**	**47.4**	**48.1**	**42.4**
15	Roadside	Diffusion Tube	92	92	**42.8**	38.3	**42.9**	39.3	38.4

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2018 (%) [2]	NO$_2$ Annual Mean Concentration (µg/m^3) [3]				
					2014	2015	2016	2017	2018
16	Roadside	Diffusion Tube	92	92	35.5	32.5	35.1	33	32.1
17	Roadside	Diffusion Tube	92	92	25.4	35.8	38	35.2	32.7
18	Roadside	Diffusion Tube	83	83	31.3	29.2	31.3	30.2	29.1
19	Roadside	Diffusion Tube	92	92	39.4	33.7	37.2	34.1	35.4
20	Roadside	Diffusion Tube	92	92	37.9	35	36.5	36.5	33.0
21	Urban Background	Diffusion Tube	67	67	17.5	17.4	15.2	17.6	17.5
22	Urban Background	Diffusion Tube	83	83	18.7	18.7	18.6	17.3	18.1
23	Roadside	Diffusion Tube	92	92	**<u>60.5</u>**	**40.3**	**44.9**	**42.8**	**46.3**
24	Roadside	Diffusion Tube	92	92	**<u>70.7</u>**	**43**	**51.1**	**48.3**	**47.4**
25	Roadside	Diffusion Tube	92	92	**58.5**	**49.2**	**52.1**	**46.7**	**47.1**
26	Roadside	Diffusion Tube	83	83			30.7	30.4	33.4
27	Roadside	Diffusion Tube	92	92			30.3	24.5	26.4
28	Roadside	Diffusion Tube	92	92			**42.4**	36.8	38.1
29	Roadside	Diffusion Tube	92	92			30.8	26.6	28.4
30	Roadside	Diffusion Tube	83	83			31.3	32.5	30.6
31	Roadside	Diffusion Tube	92	92			34.4	28.9	30.7

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2018 (%) [2]	NO$_2$ Annual Mean Concentration (µg/m^3) [3]				
					2014	2015	2016	2017	2018
32	Roadside	Diffusion Tube	92	92			30.9	29.9	29.0
33	Roadside	Diffusion Tube	92	92				34.5	33.1
34	Roadside	Diffusion Tube	92	92				38.7	37.1

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

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

Notes:

Exceedances of the NO$_2$ annual mean objective of 40µg/m^3 are shown in **bold**.

NO$_2$ annual means exceeding 60µg/m^3, indicating a potential exceedance of the NO$_2$ 1-hour mean objective are shown in **bold and underlined.**

(1) 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.

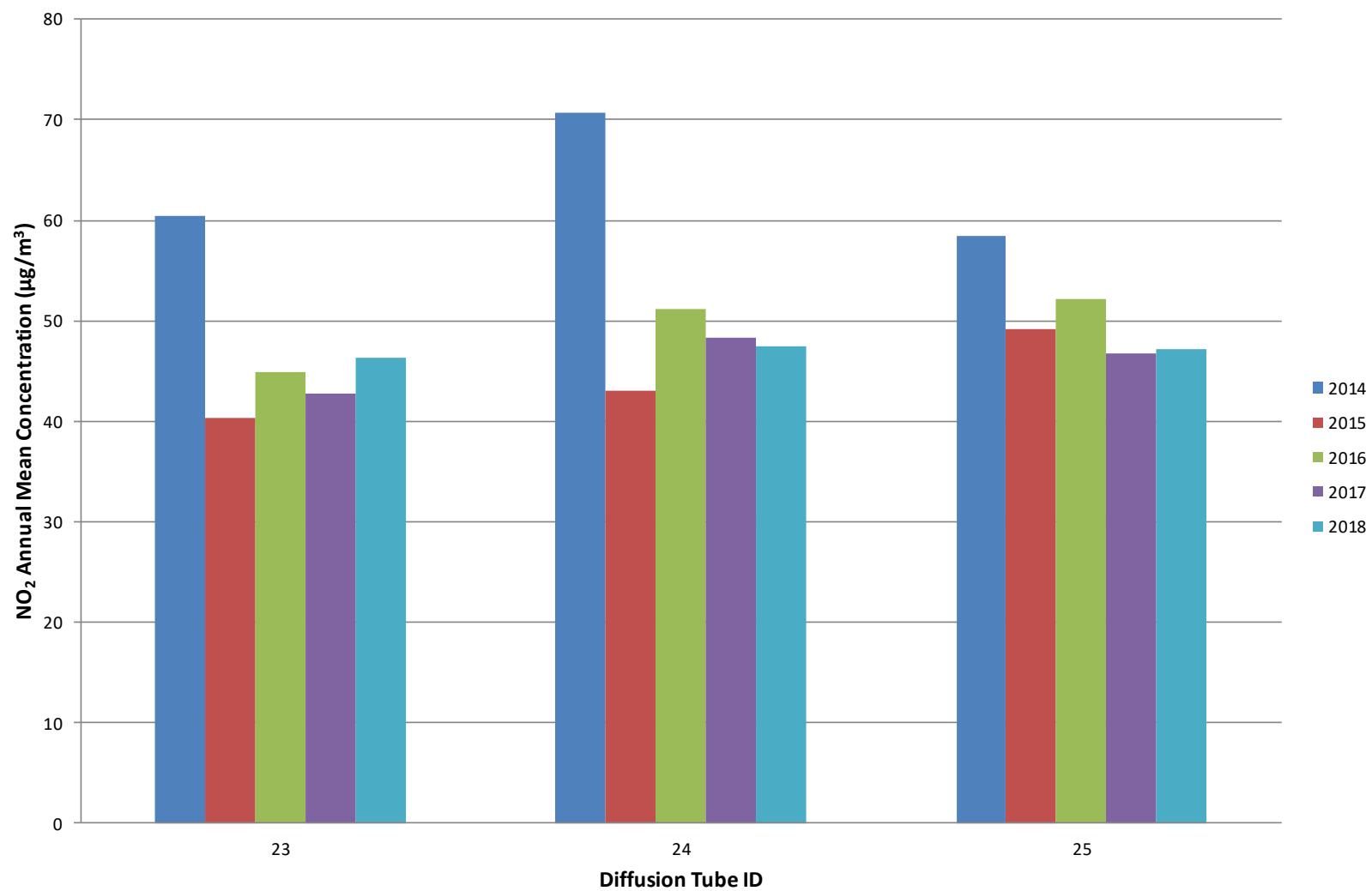**Figure A.1 – Trends in Annual Mean NO$_2$ Concentrations: Priory Road AQMA**

Figure A.2 – Trends in Annual Mean NO₂ Concentrations: Barton Street AQMA
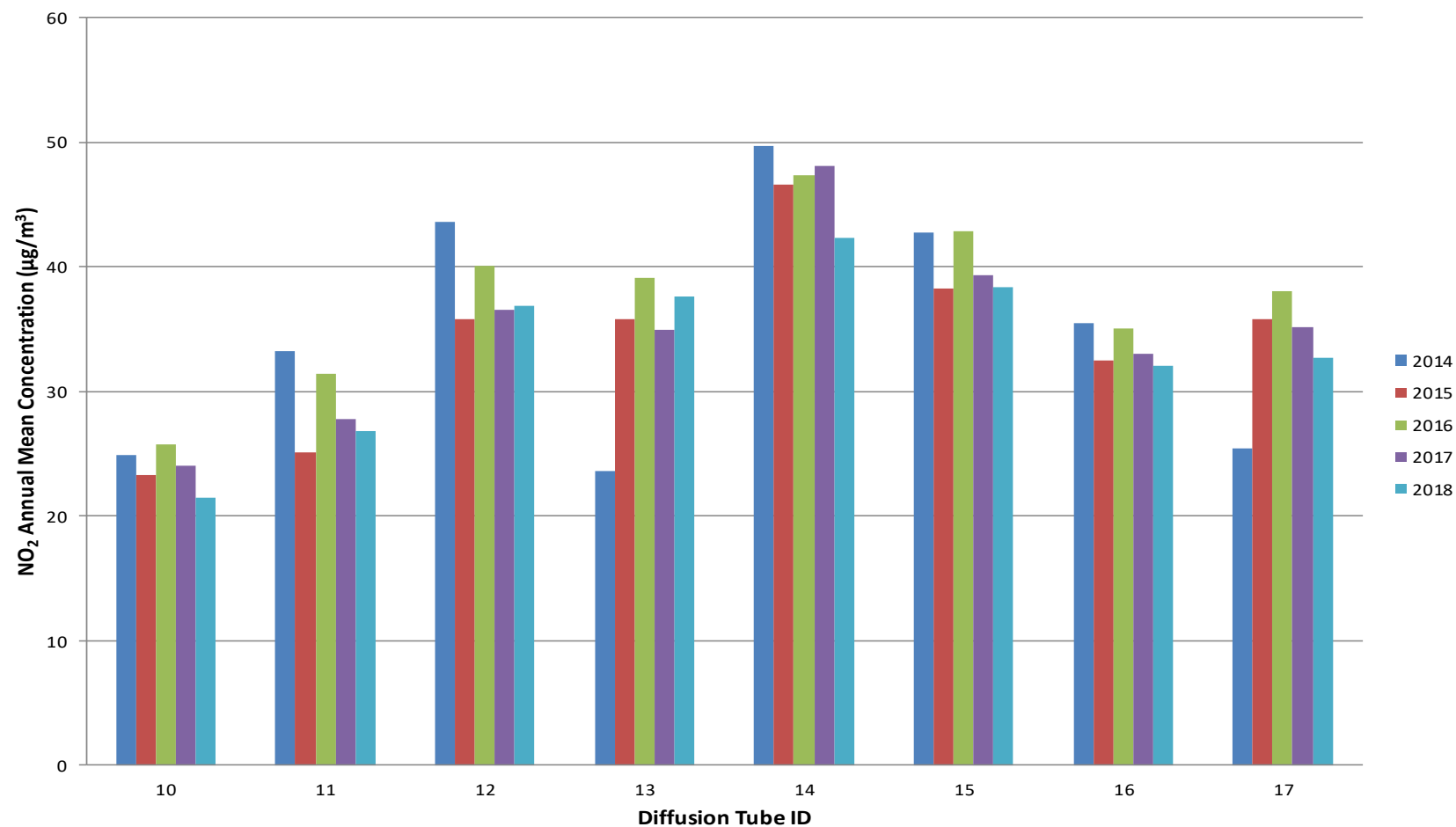
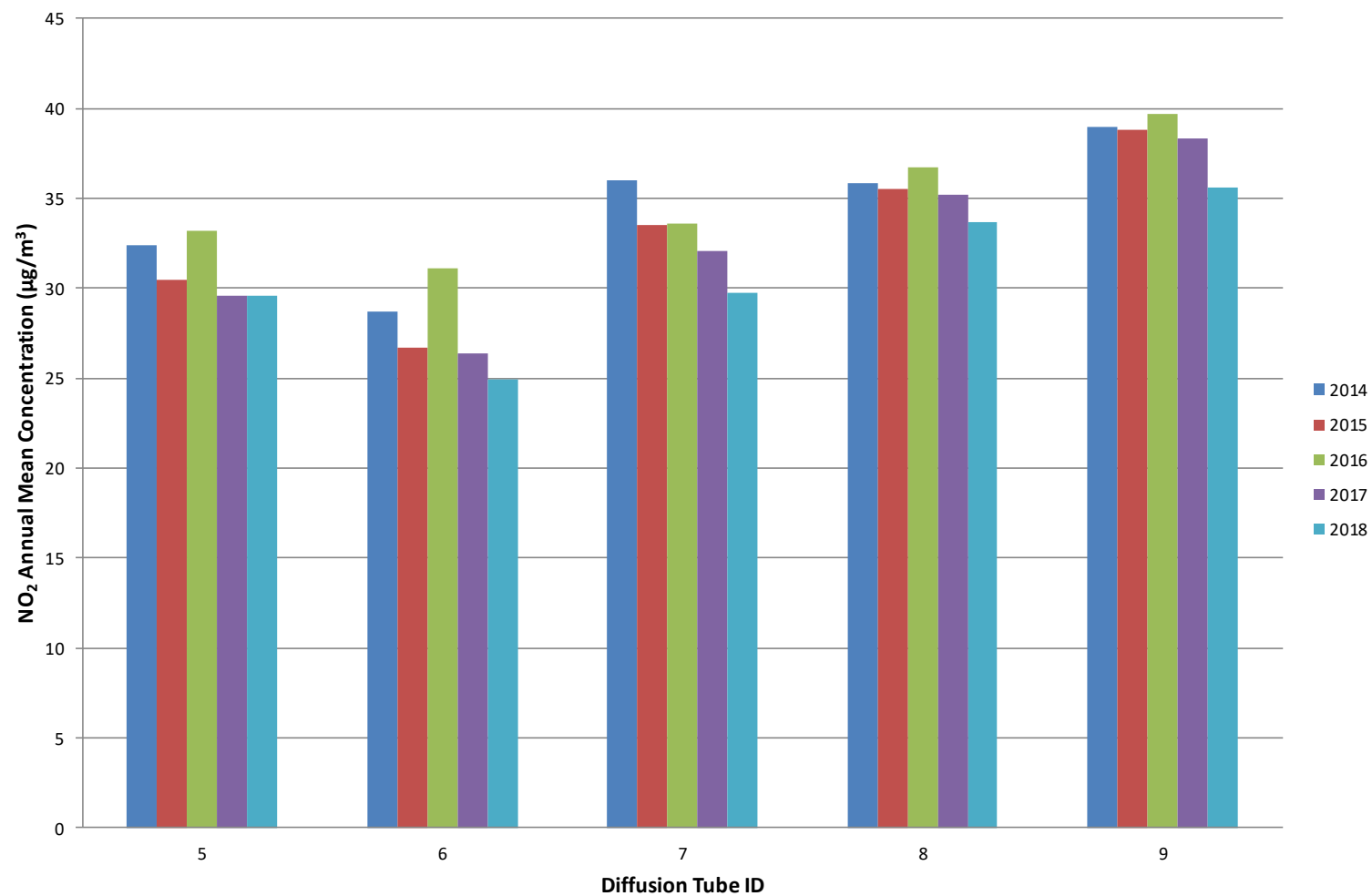## Figure A.3 – Trends in Annual Mean NO₂ Concentrations: Painswick Road AQMA

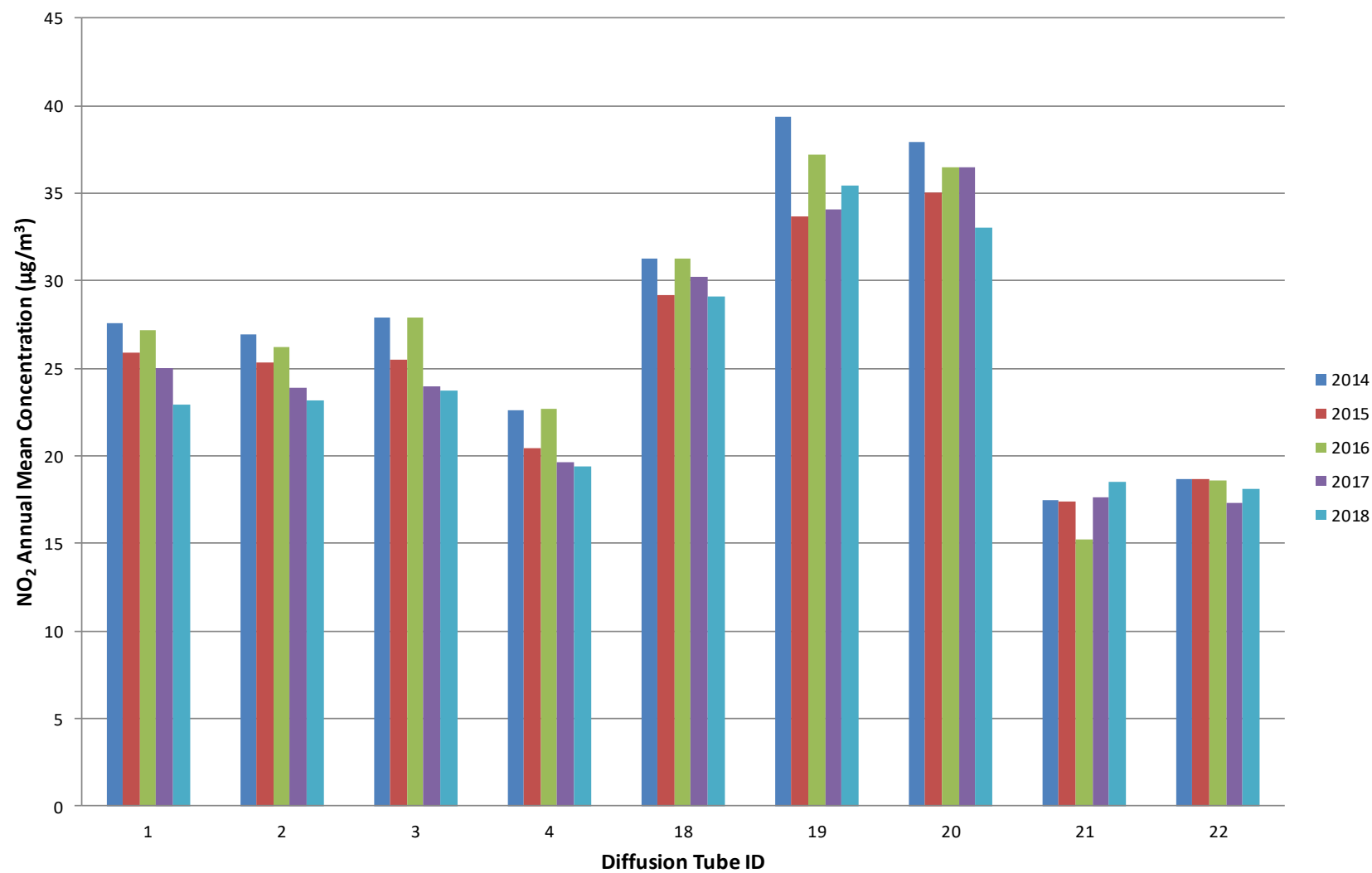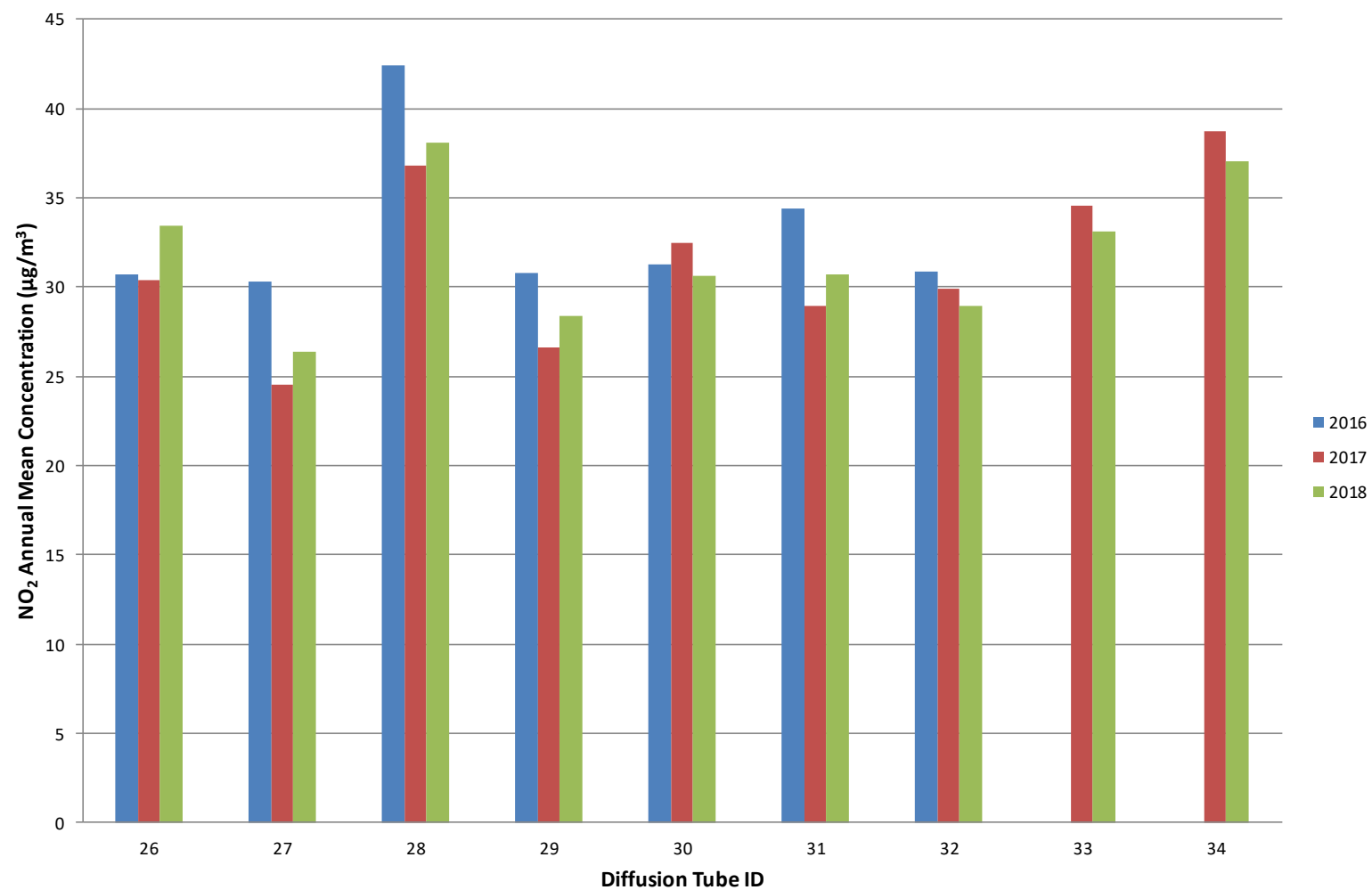**Figure A.4 – Trends in Annual Mean NO₂ Concentrations: Outside of AQMAs**

Figure A.5 – Trends in Annual Mean NO₂ Concentrations: New Monitoring Sites

Appendix B: Full Monthly Diffusion Tube Results for 2018

Table B.1 – NO$_2$ Monthly Diffusion Tube Results - 2018

| Site ID | NO$_2$ Mean Concentrations (µg/m^3) | | | | | | | | | | | | Annual Mean | | |
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Raw Data	Bias Adjusted (0.93) and Annualised [1]	Distance Corrected to Nearest Exposure [2]
1	31.3	31.4	27.5	26.8	23.6	22.5	24.7	20.5	23.4	22.7		16.9	24.7	23.0	
2	28.5	29.2	26.0	28.4	23.3	22.3	22.4	21.0	23.4	26.8		22.8	24.9	23.2	
3	29.3	25.2	29.8	27.9	20.6	21.4	23.5	21.1	26.8	26.7		28.1	25.5	23.7	
4	25.1	22.7	25.6	19.8	18.1	16.4	19.1	15.4	18.9	22.6		25.9	20.9	19.4	
5	29.0	36.2	37.5	30.4	34.2	32.7	32.3	20.7	29.1	32.5		35.5	31.8	29.6	
6	9.2	32.0	33.2	29.8	27.1	26.2	28.7	19.4	26.3	29.8		32.9	26.8	24.9	
7	32.5	37.1	36.1	32.2	29.4	26.2	28.2	26.9	32.1	35.2		36.0	32.0	29.8	
8	44.7	39.8	37.5	37.2	28.7	36.3	34.0	29.2	37.0	38.1		35.8	36.2	33.7	
9	42.8	42.2	40.7	40.9	35.5	32.9	41.0	37.5	40.0	42.4		25.6	38.3	35.6	
10	26.9	28.3	28.0	25.1	22.9	22.0	23.1	16.9	23.7	24.2		12.9	23.1	21.5	
11	31.1	34.6	32.5	27.5	30.8	29.9	33.0	21.4	27.5	33.9		14.4	28.8	26.8	
12	38.1	39.5	40.9	37.3	43.0	42.7	45.8	31.1	38.3	40.9		38.0	39.6	36.8	
13	40.1	42.5	36.3	35.5	37.5	43.3	47.5	31.1	38.3	43.8		49.2	40.5	37.6	
14	53.7	45.9	43.3	39.4	45.1	41.1	44.2	41.1	49.9	46.8		50.7	45.6	**42.4**	

Site ID	NO₂ Mean Concentrations (µg/m³)												Annual Mean		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Raw Data	Bias Adjusted (0.93) and Annualised [1]	Distance Corrected to Nearest Exposure [2]
15	45.7	41.2	41.7	43.2	37.3	36.6	38.6	37.0	45.1	38.3		49.5	41.3	38.4	
16	37.1	37.9	36.3	31.9	31.6	29.6	30.1	28.3	35.7	39.5		41.7	34.5	32.1	
17	35.1	42.8	39.9	36.7	33.8	30.9	36.2	26.9	39.9	37.1		27.6	35.2	32.7	
18	33.7	38.5	30.9	28.5	28.0	32.1	35.1	23.7	29.3			32.9	31.3	29.1	
19	37.9	42.7	37.3	40.2	39.0	41.6	47.0	27.7	34.8	37.0		34.0	38.1	35.4	
20	38.8	44.1	34.2	32.4	33.3	32.9	35.7	29.1	31.0	34.9		44.3	35.5	33.0	
21		23.3	20.1	17.3	13.4	11.6	11.7	13.2	16.9				16.0	17.5	
22		24.2	24.4	19.9	17.6	13.8	15.6	12.8	17.2	24.6		24.5	19.5	18.1	
23	52.4	47.9	55.5	54.4	48.0	46.3	50.1	45.9	52.0	43.9		51.3	49.8	**46.3**	
24 (1)	55.0	54.8	57.2	53.1	54.6	52.5	60.7	46.1	53.9	42.0		50.3	52.7	**49.1**	
24 (2)	30.2	46.2	52.4	50.7	52.3	54.1	59.5	50.1	52.5	45.1		48.2	49.2	**45.8**	
25	53.3	53.8	57.6	55.6	46.9	54.0	64.3	47.5	49.4	45.9		28.3	50.6	**47.1**	
26	49.4	43.5	41.5	37.3	25.9	24.8		33.0	35.8	34.2		34.0	36.0	33.4	
27	28.7	32.5	33.1	32.2	30.1	25.3	25.2	19.3	26.1	30.8		28.5	28.3	26.4	
28	44.0	46.1	48.5	42.3	38.4	41.7	42.1	31.1	38.2	41.1		36.6	40.9	38.1	24.8
29	32.9	38.6	36.9	32.6	27.4	27.3	27.8	20.6	27.4	31.0		33.3	30.5	28.4	
30	33.3		35.6	31.7	32.5	30.5	32.0	28.5	34.3	38.0		32.9	32.9	30.6	
31	38.9	42.6	33.7	29.9	29.1	32.9	35.9	26.7	30.2	31.3		31.8	33.0	30.7	
32	40.3	35.6	34.8	34.3	25.1	23.3	24.3	23.6	28.1	32.7		40.7	31.2	29.0	
33	36.6	38.6	42.6	36.1	34.4	33.1	35.9	23.1	37.9	35.8		37.3	35.6	33.1	

	NO$_2$ Mean Concentrations (µg/m^3)														
													Annual Mean		
Site ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Raw Data	Bias Adjusted (0.93) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
34	41.0	41.0	38.0	40.0	45.2	40.3	44.1	33.0	32.2	45.7		37.8	39.8	37.1	28.8

☐ **Local bias adjustment factor used**

☒ **National bias adjustment factor used**

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

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

Notes:

Exceedances of the NO$_2$ annual mean objective of 40µg/m^3 are shown in **bold**.

NO$_2$ annual means exceeding 60µg/m^3, indicating a potential exceedance of the NO$_2$ 1-hour mean objective are shown in **bold and underlined.**

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

(2) Distance corrected to nearest relevant public exposure.

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

Sources of Pollution

Gloucester City Council have not identified any potential **new sources** within the district as described in Chapter 7, Section 1 of Defra LAQM.TG(16).

Diffusion Tube Bias Adjustment Factor

The diffusion tube data has been corrected using a bias adjustment factor, which is an estimate of the difference between diffusion tube concentration and continuous monitoring, the latter assumed to be a more accurate method of monitoring. The Defra LAQM.TG(16) provides guidance with regard to the application of a bias adjustment factor to correct diffusion tube monitoring. Triplicate co-location studies can be used to determine a local bias factor based on the comparison of diffusion tube results with data taken from NO_x/NO_2 continuous analysers. Alternatively, the national database of diffusion tube co-location surveys provides bias factors for the relevant laboratory and preparation method.

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

Gloucester City Council do not operate any continuous NO_2 monitoring stations within the District and therefore a co-location study is not available to derive a local bias factor, thus the national bias adjustment factor spreadsheet[6] has been used.

Diffusion tubes for Gloucester City Council are supplied and analysed by Gradko International Ltd. The tubes were prepared using the 20% TEA in water preparation method. The national bias adjustment factor for Gradko 20% TEA in water is 0.93 for the year 2018 (based on 30 studies) as derived from the national bias adjustment factor spreadsheet.

QA/QC of Diffusion Tube Monitoring

The diffusion tubes for the year 2018 were supplied and analysed by Gradko International Ltd, the tubes were prepared using the 20% TEA in water preparation

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[6] National Diffusion Tube Bias Adjustment Factor Spreadsheet version 03/19 available at https://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html

method. All results have been bias adjusted and annualised where required before being presented in Table A.2.

Gradko is a UKAS accredited laboratory and participates in the new AIR-PT Scheme (a continuation of the Workplace Analysis Scheme for Proficiency (WASP)) for NO_2 tube analysis and the Annual Field Inter-Comparison Exercise. These provide strict performance criteria for participating laboratories to meet, thereby ensuring NO_2 concentrations reported are of a high calibre. The lab follows the procedures set out in the Harmonisation Practical Guidance. In the latest available AIR-PT results, AIR-PT AR 0024 (January to February 2018), AIR-PT AR025 (April to May 2018), AIR-PT AR027 (July to August 2018), AIR-PT AR028 (September to October 2018) and AIR-PT AR030 (January to February 2019). Gradko has scored 100% on all results apart from PTAR030, where a 75% score was reported. The percentage score reflects the results deemed to be satisfactory based upon the z-score of $< \pm 2$.

Twenty nine out of the thirty local authority co-location studies in 2018 were rated as 'good' (tubes are considered to have "good" precision where the coefficient of variation of duplicate or triplicate diffusion tubes for eight or more periods during the year is less than 20%). The remaining location was a single tube and therefore a rating was not applicable.

Short-term to Long-term Data Adjustment

In regards to the 2018 diffusion tube data set, annualisation was required at one diffusion tube location due to data capture being below 75%. Annualisation has been completed in line with Box 7.9 and Box 7.10 within LAQM.TG(16) and full working details are presented in Table C.2.

In completing the annualisation process, data has been taken from a number of automatic monitoring sites that are part of the AURN. In line with LAQM.TG(16) the monitoring sites that have been used lie within a radius of approximately 50 miles of the sites to be annualised.

All monitoring stations that were used are background monitoring stations and as such are not influenced by local sources of air pollution such as road traffic emissions at roadside monitoring sites. The monitoring sites that were used are listed in Table C.1.

Table C.1 – AURN Monitoring Stations Used for Annualisation

Pollutant	Background AURN Sites used for Annualisation
NO$_2$	• Swindon Walcot – Urban Background • Cwmbran – Urban Background • Leamington Spa – Urban Background

Distance from Road Correction

In line with LAQM.TG(16) distance correction has been applied to NO$_2$ monitoring sites that have recorded an annual mean concentration above the annual mean objective, or within 10% of the annual mean objective. There were two sites within Gloucester's NO$_2$ monitoring network that were within 10% of the NO$_2$ annual mean objective in 2018; Site 28 and Site 34.

The NO$_2$ Fall-Off with Distance Calculator (v4.2)[7] has been used to derive the NO$_2$ concentration at a location of relevant exposure; the results of the calculations are presented in Table C.3.

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[7] NO$_2$ Fall-Off with Distance Calculator (Version 4.2), available online at https://laqm.defra.gov.uk/tools-monitoring-data/no2-falloff.html

Table C.2 – Diffusion Tube Short Term to Long Term Monitoring Data Adjustment

Site ID	Unadjusted Diffusion Tube Mean (µg/m³)	Annualisation Factor Swindon Walcot	Annualisation Factor Cwmbran	Annualisation Factor Leamington Spa	Average Annualisation Factor	Annualised & Bias Adjusted (0.93) Concentration (µg/m³)
Site 21	16.0	1.153	1.209	1.184	1.182	17.5

Table C.3 – NO₂ Fall-Off With Distance Calculations

Site ID	Distance (m)		NO₂ Annual Mean Concentration (µg/m³)		
	Monitoring Site to Kerb	Receptor to Kerb	Background [1]	Monitored*	Predicted at Receptor*
Site 28	2.0	29.0	16.8	38.1	24.8
Site 34	1.4	8.8	16.1	37.1	28.8
*bias adjusted values					

Appendix D: Maps of Monitoring Locations and AQMAs

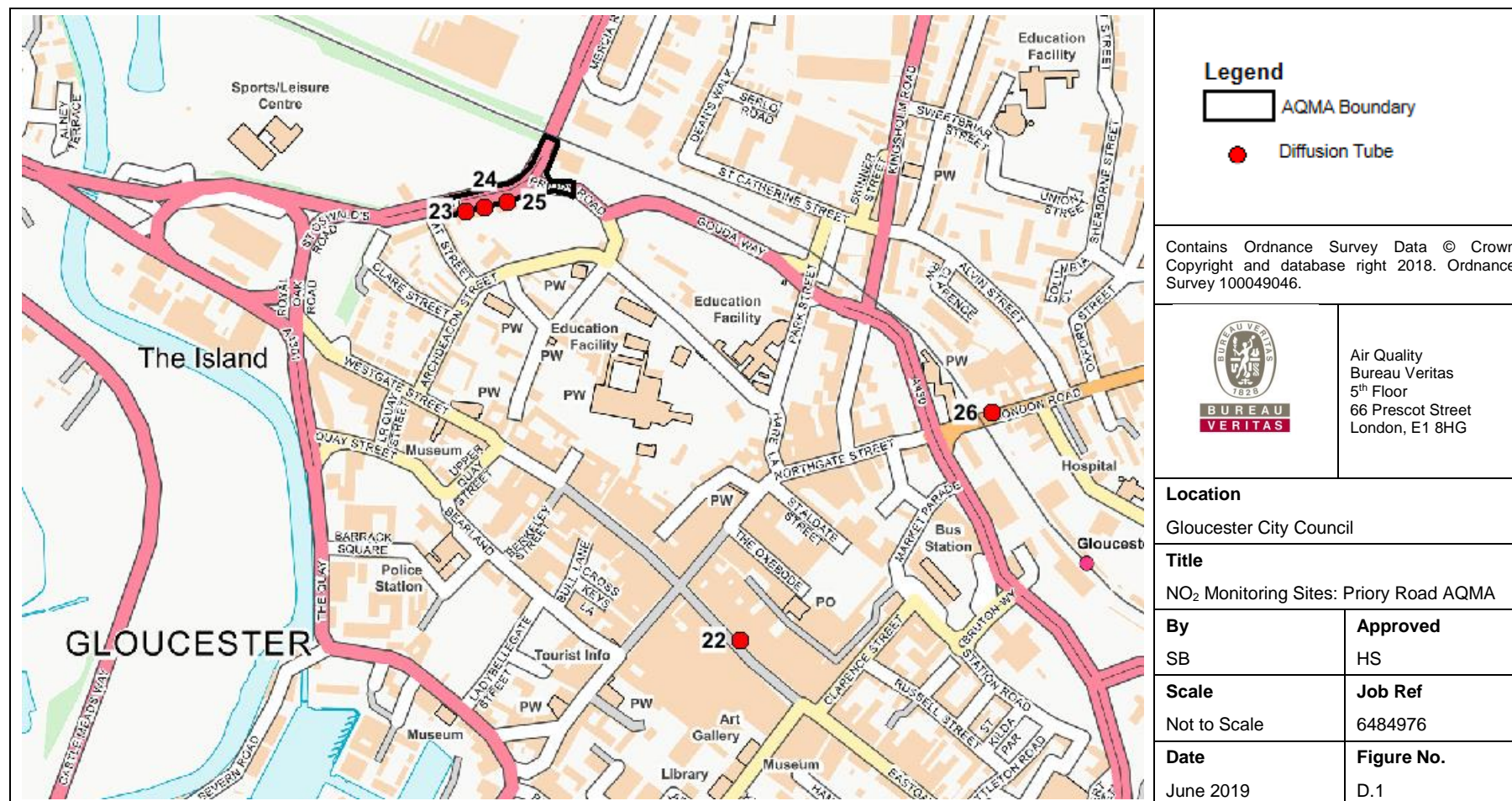**Figure D.1 – NO₂ Diffusion Tube Monitoring Locations: Priory Road AQMA**

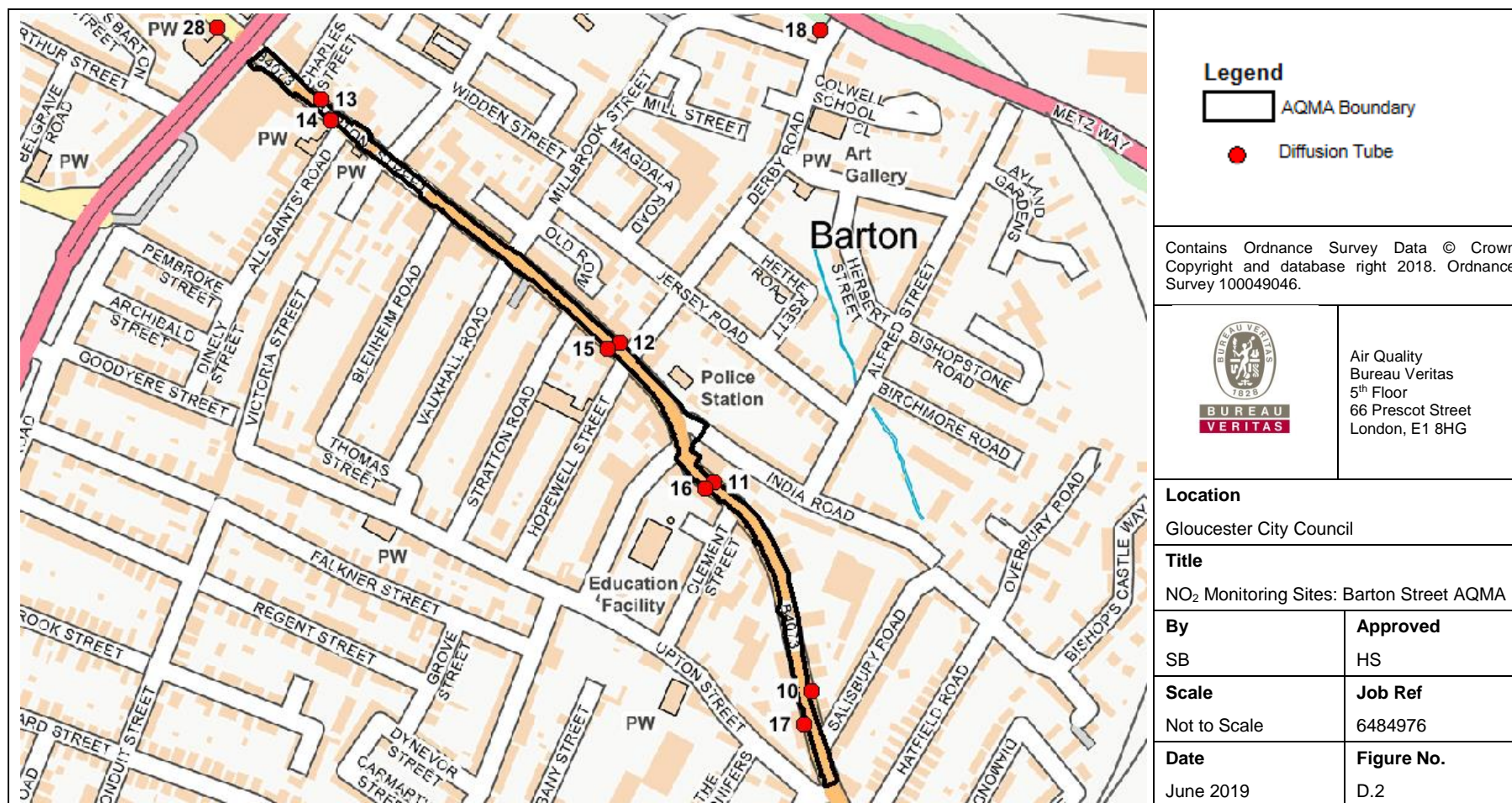**Figure D 2 – NO₂ Diffusion Tube Monitoring Locations: Barton Street AQMA**

Figure D.3 – NO₂ Diffusion Tube Monitoring Locations: Painswick Road AQMA
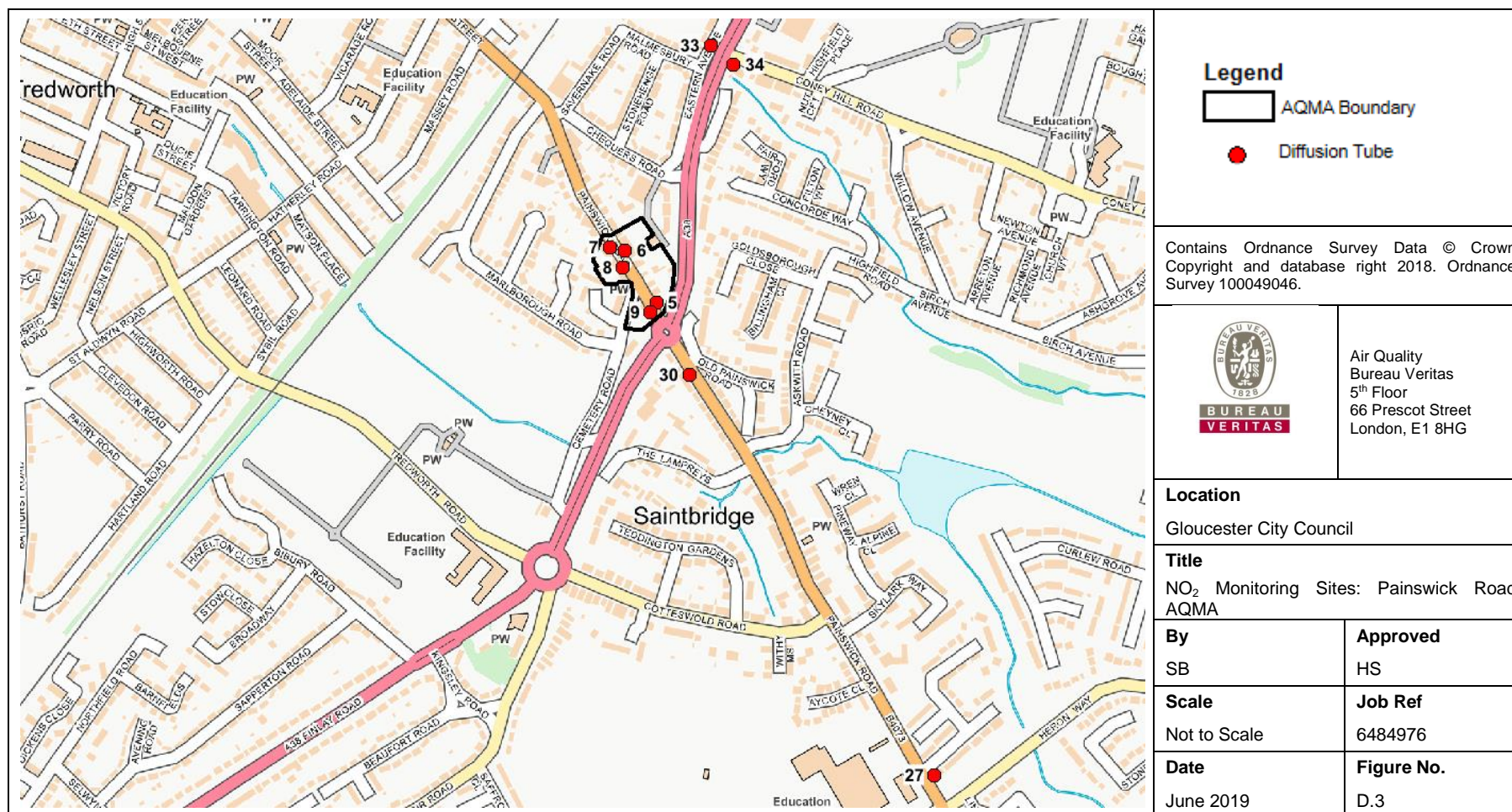
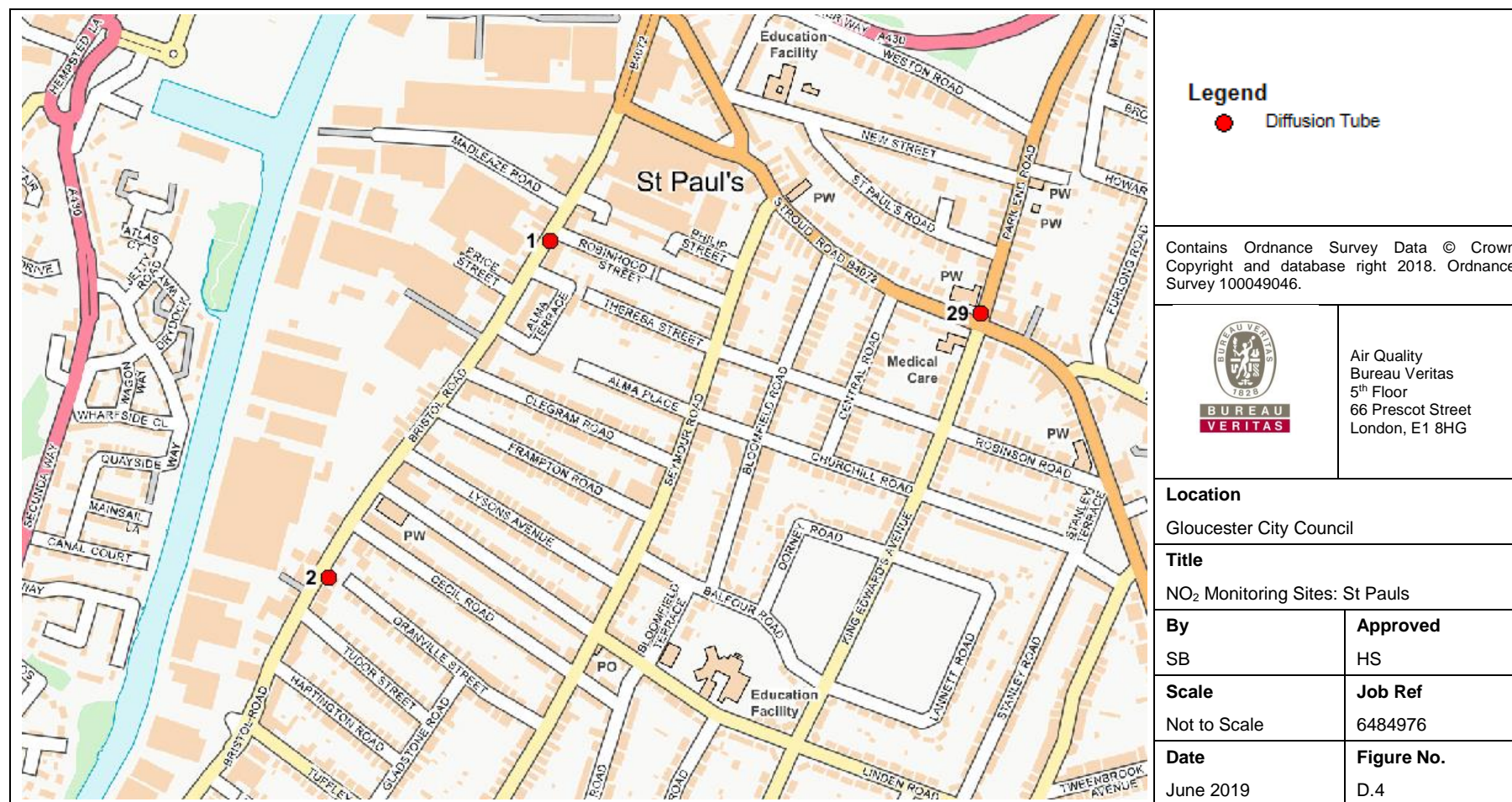**Figure D.4 – NO₂ Diffusion Tube Monitoring Locations: St Pauls**

Gloucester City Council

Figure D.5 – NO₂ Diffusion Tube Monitoring Locations: M5
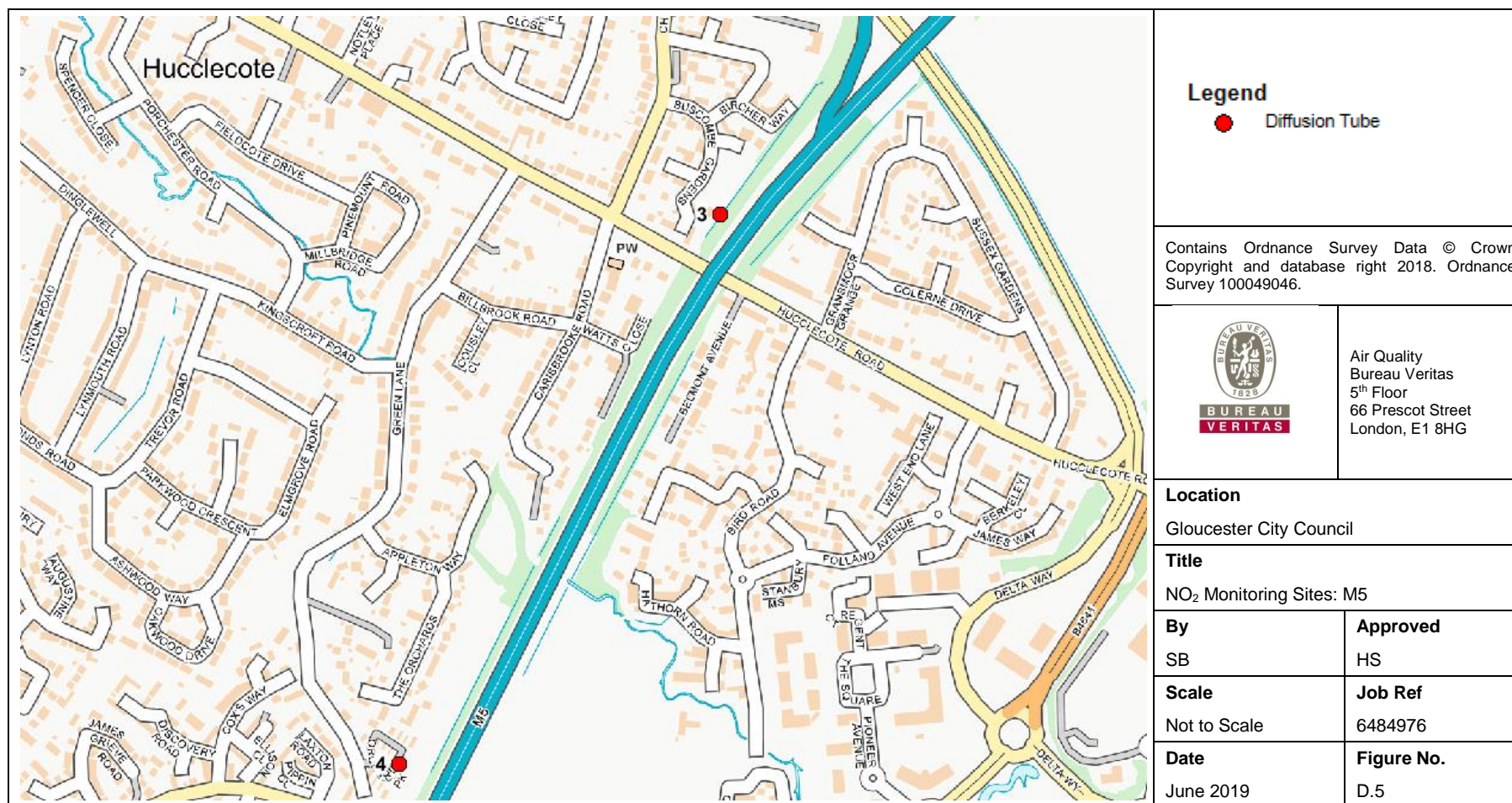
Figure D.6 – NO₂ Diffusion Tube Monitoring Locations: Barnwood/Elmbridge

Legend	
●	Diffusion Tube

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Location	
Gloucester City Council	
Title	
NO₂ Monitoring Sites: Barnwood/Elmbridge	
By	**Approved**
SB	HS
Scale	**Job Ref**
Not to Scale	6484976
Date	**Figure No.**
June 2019	D.6

Figure D.7 – NO₂ Diffusion Tube Monitoring Locations: Farriers End
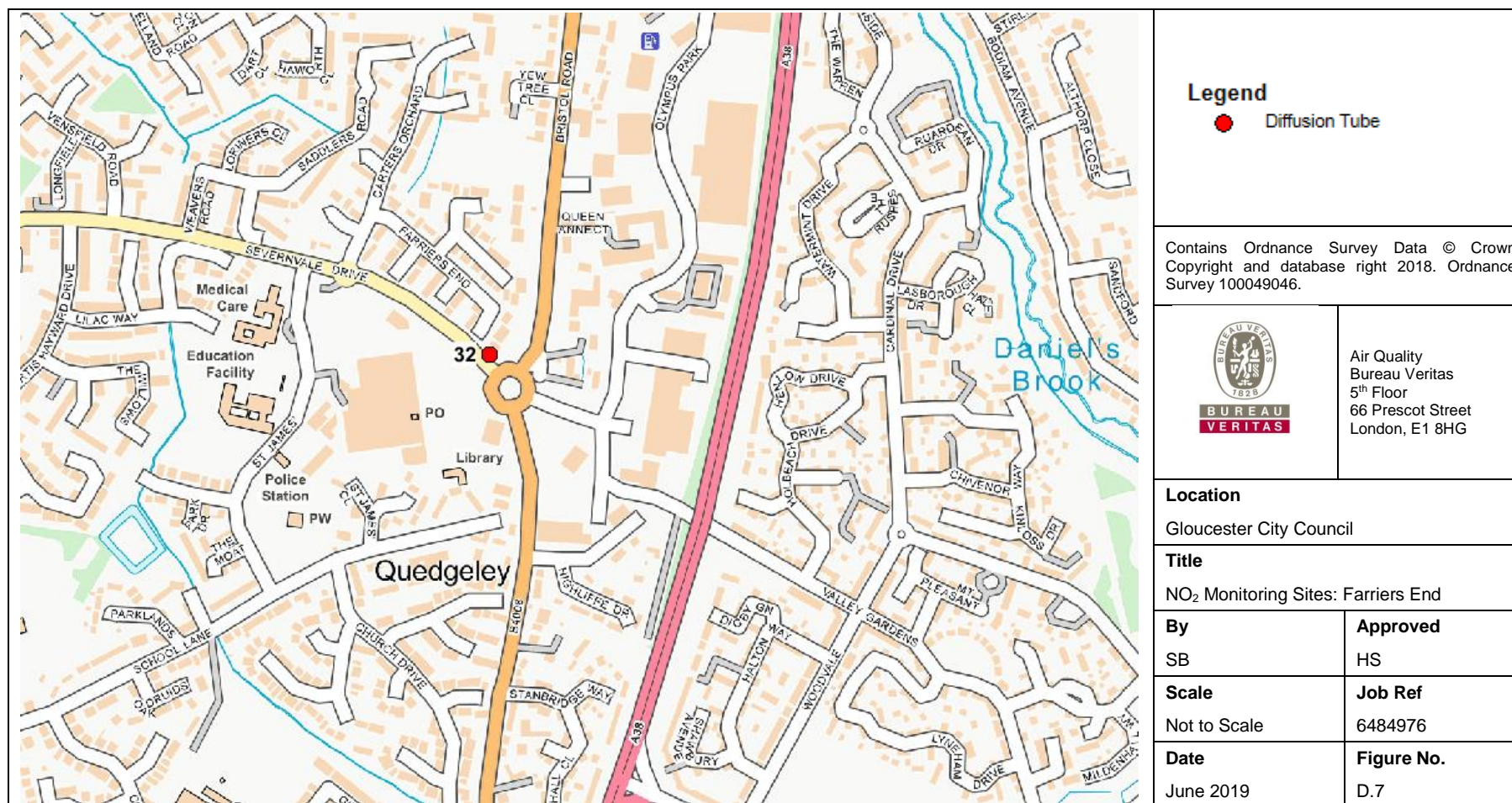
Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England

| Pollutant | Air Quality Objective[8] | |
	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

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

Glossary of Terms

Abbreviation	Description
ANPR	Automatic Number Plate Recognition
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the local authority intends to achieve air quality limit values'
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
ASR	Air quality Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
EU	European Union
GCC	Gloucester City 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

References

- Local Air Quality Management Technical Guidance LAQM.TG(16). May 2016. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.

- Local Air Quality Management Policy Guidance LAQM.PG(16). May 2016. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.

- Gloucester City Council 2018 Annual Status Report.

- Gloucester City Council 2017 Annual Status Report.

- Gloucester Air Quality Action Plan 2008 (2011 Review).

- National Diffusion Tube Bias Adjustment Factor Spreadsheet, version 03/18 published in March 2018.

- Thinktravel Smarter Choices Evaluation, Gloucestershire County Council, July 2017