Gloucester City Council
Annual Status Report 2020

Bureau Veritas

July 2020

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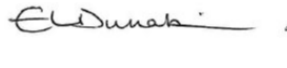
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2020 Air Quality Annual Status Report (ASR)

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

July 2020

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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. Prevailing winds are predominantly from the southwest, following the river valley. 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 city with the main highway network in Gloucestershire. In addition, the local traffic within the centre of Gloucester can give rise to increased pollutant concentrations.

Three Air Quality Management Areas (AQMAs) have been declared within Gloucester due to exceedances of the 40 µg/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 2019 there were thirty four monitoring locations where diffusion tubes were deployed, the number of locations has not changed since 2018.

Out of the thirty four monitoring sites that monitored concentrations of NO_2 in 2019, half of these recorded a decrease in concentrations when compared with 2018 data and half recorded an increase. Exceedances of the annual mean NO_2 objective of 40 µg/m³ were reported at five locations during 2019, all located within the existing AQMAs.

Actions to Improve Air Quality

The Gloucester City Council Air Quality Action Plant (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, the measures implemented and/or progressed through 2019 are:

- Measure 12 – The introduction of air quality measures into Gloucester City Council Taxi Licensing Policy. In December 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. Update for 2019: Gloucester City Council Taxi Licensing Committee have now approved this rulebook. Full details are in Table 2.2.

- Measure 19 – Gloucester City Council, using funding from the Defra Air Quality Grant, have been prioritising the uptake of low emission vehicles within the procurement of company vehicles, including electric and hybrid vehicles. The first phase has been successful, the second phase is on-going.

- GCC have commissioned a review of the current AQMAs and work on a new AQAP. This includes air quality modelling of key road transport routes both within the current AQMAs and around Gloucester City Centre. As part of the detailed modelling the existing AQMA declarations will be reviewed against the predicted NO_2 concentrations. Source apportionment will be carried out in order to evaluate which sectors are the most polluting in Gloucester City Centre and new measures will be informed from this analysis.

All measures are presented in Table 2.2.

Additional informal air quality measures that Gloucester City Council have taken in 2019 include:

- A Climate Change Manager has been appointed, who will feed into the air quality plan to ensure that any potential interactions between air quality and climate change are considered; and

- Gloucester City Council has ended its consultation on the Gloucester City Plan which includes actions on air quality in relation to development until 2031. The Council are now preparing the GCP for submission, for more detail, see here: https://www.gloucester.gov.uk/planning-development/planning-policy/city-plan/

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 2019. 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 all 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 2019. 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. This will further be informed once the air quality modelling assessment has been completed to support the revised AQAP; and

- Painswick Road AQMA – There were no exceedances at this AQMA in 2019, although the concentration at one monitoring site was within 10% of the annual mean NO_2 objective. All monitoring sites have been within the objective level for the past five years and therefore consideration as to whether the AQMA can be revoked will be considered. Again, further information will be collated as part of the air quality modelling study for the revised AQAP which will inform this consideration.

As highlighted above, Gloucester City Council are currently undertaking substantial works to inform a new air quality action plan, following the recruitment of a new Community Wellbeing Manager in 2019. The AQAP is due to be completed this year.

Upon a review of new local developments which have the potential to impact on local air quality, the Black Dog Way site is a roadside development of 95 apartments which will potentially introduce new sensitive residential receptors along this stretch of the A430. 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. The findings of the detailed modelling study currently being undertaken will be used to support this review. This development is not located within an AQMA, although the Priory Road AQMA is situated approximately 200 metres from this site. In addition, there are proposals for the development of a number of 2 and 3 storey houses planned along Llanthony Road and Hempsted Lane. The Council have reviewed the Air Quality Impact Assessments that were compiled for each of these planning applications, which demonstrated that impacts from these developments would be negligible in terms of air quality.

Local Engagement and How to get Involved

In order to raise public awareness of air pollution and how it can be reduced, a "Beat the Street" challenge was carried out in summer 2019. Running from 26 June – 7 August, Beat the Street was a free, fun challenge where people were rewarded with points and prizes for exploring their city on foot or bicycle. Beat the Street was the first project of Gloucestershire Moves, a new, county-wide initiative to get people moving more.

There were 71 special sensors called 'Beat Boxes' across the city. Players tapped the Beat Boxes with cards and fobs to track their journey and earn points for themselves and their team – the more Beat Boxes people swiped the more points they earned.

In addition, a 'How You Can 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.

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1 Local Air Quality Management

This report provides an overview of air quality in Gloucester City Council during 2019. 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://uk-air.defra.gov.uk/aqma/local-authorities?la_id=111 or see the full list at https://uk-air.defra.gov.uk/aqma/list.

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	NO$_2$ Annual Mean	Gloucester	An area encompassing a number of properties on either side of Painswick Road, Gloucester.	NO	48	µg/m^3	31.5	µg/m^3	Gloucester AQAP 2008 (2011 Review)	2011	https://www.gloucester.gov.uk/environment-waste-recycling/pollution/air-quality/
Barton Street AQMA	August 2005	NO$_2$ 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 – 47	µg/m^3	34.6	µg/m^3	Gloucester AQAP 2008 (2011 Review)	2011	https://www.gloucester.gov.uk/environment-waste-recycling/pollution/air-quality/
Priory Road AQMA	August 2005	NO$_2$ Annual Mean	Gloucester	An area encompassing the junction of St Oswalds Road and Priory Road.	NO	41 - 48	µg/m^3	42.4	µg/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, detailed, and provides the information specified in the Guidance. The following comments are designed to help inform future reports.

Guidance. The following comments are designed to help inform future reports.

1. *The report is thorough, comprehensive and follows the most recent template.*

2. *There is extensive discussion on QC/QC of monitoring data, and supporting evidence is provided for bias factor derivation, distance-correction calculation, and annualisation.*

3. *The Council intend to review the monitoring locations within the Painswick Road AQMA to ensure complete monitoring coverage. This is supported. The Council are also encouraged to undertake a full review of their monitoring network to ensure the capture of all hotspot locations.*

4. *Gloucester City Council do not currently undertake continuous monitoring of any pollutant. The Council are therefore encouraged to consider introducing at least one automatic NO_2 monitor to their monitoring network to gain a better insight into local air quality. It would also be beneficial for the Council to begin monitoring of particulates, given the adverse health impacts of exposure.*

5. *The Council are set to introduce a new AQAP in 2019. Progress on these measures is expected to be reported on in their 2020 ASR.*

6. *It is encouraging to see the council responding to the comments raised in the previous reporting year.*

7. *The Council has listed a number of priorities for the next year and the council should provide an update on the progress of these in the next reporting year."*

The comments made within the appraisal report, as shown above, have been taken into account for the completion of the 2020 ASR.

Gloucester City Council has taken forward a number of direct measures during the current reporting year of 2019 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 expects the following measures to be completed over the course of the next reporting year:

- Measure 21 – promoting active travel and low emission transport, a pop-up cycle route will be added on London Road in Gloucester City – this is currently on-going.

In addition, Gloucester City Council's priority for the coming year is to update the AQAP in its entirety. Work is currently on-going and includes the air quality modelling of key road transport routes both within the current AQMAs, and around Gloucester City Centre. As part of the detailed modelling the existing AQMA declarations will be reviewed against the predicted NO_2 concentrations. Source apportionment will be carried out as part of this work in order to evaluate which sectors are the most polluting in Gloucester City Centre and targeted measures will be informed from this analysis.

The principal challenges and barriers to implementation that Gloucester City Council anticipates facing are lack of available funding, lengthy timescales for delivery/implementation and on-going restrictions due to COVID-19.

Progress on the following measures has been slower than expected:

- Measure 3 – Variable Message Signs (VMS), due to lack of available funding;

- Measure 4 – improvements/control of signals. A county maintenance contract was procured in 2017 but, to-date, there are no planned improvements in Gloucester.

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	Date Measure Introduced	Organisations involved	Funding Source	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	2011	Gloucestershire Police	Police force budget	Number of HGVs on named roads	0.2 – 1 µg/m³	HGV ban continues to be enforced	Completed	-
3	Variable Message Signs (VMS)	Traffic Management	Other	2011	Gloucestershire County Council	No further funding is available at this time.	Number of VMS signs	> 0.2 µg/m³	Currently no funding available	-	No funding identified
4	Improvements/Control of the signals	Traffic Management	UTC, Congestion management, traffic reduction	2017	Gloucestershire County Council	Gloucestershire County Council	N/A	< 0.2 µg/m³	No planned improvements for the foreseeable future.	-	The Central Transport Hub is now complete, however there are works being undertaken around the railway station, such as facilities for car parking. The network will be looked at again once these works are complete.
8	Greater restriction and better timing of deliveries	Freight and Delivery Management	Route Management Plans/ Strategic routing strategy for HGV's	2011	Gloucestershire County Council	No additional funding required.	Number of HGVs on named roads	< 0.2 µg/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	2011	Gloucester City Council and Gloucestershire County Council	Central government funding and incentives	Number of new vehicles	< 0.2 µg/m^3	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	2011	Bus companies	Bus companies	Number of buses retrofitted	< 0.2 µg/m^3	On-going	On-going	No further update available at this time
11	Reduce illegal parking	Traffic Management	UTC, Congestion management, traffic reduction	2011	Gloucestershire County Council	No additional funding required.	Reduction in illegal parking and less parking on city centre roads.	< 0.2 µg/m^3	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	2018	Gloucestershire County Council	No additional funding required.	Improvement in age and euro standard of vehicles within the taxi fleet	Reduced vehicle emissions	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	Completed	Gloucester City Council Taxi Licensing Committee have approved rule book. No further update available at this time

13	Amey Fleet	Promoting Low Emission Transport	Company Vehicle Procurement - Prioritising uptake of low emission vehicles	2018	Gloucester City Council/ Amey	No additional funding required.	Improvements in age and euro standard of vehicles within Amey fleet	Reduced vehicle emissions	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
16	Improvement in Planning Application Validation Requirements	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	2018	Gloucester City Council	Building developers.	Increase in air quality assessments being received with the submission of applications for major developments	Construction dust emissions controlled during the construction phase and NO2 controlled during the operational phase.	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	-
17	Low Emission	Promoting Low Emission Transport	Other	2017	Local Authority Planning	Building developers	Diffusion tube data	Reduced vehicle emissions	New developments - to install electric charging points where possible. In the JCS.	Ongoing	Developers refusal/ reluctance
18	Low Emission	Promoting Low Emission Transport	Taxi emission incentives	2018	Local taxi drivers	Taxi drivers	Diffusion tube data	Reduced vehicle emissions	Currently 1 electric taxi in city	Completed	Electric cars expensive / no scrappage scheme
19	Low Emission	Promoting Low Emission Transport	Company Vehicle Procurement - Prioritising uptake of low emission vehicles	2019	Gloucester City Council	Local Authority, Funding: Defra Air Quality Grant	Diffusion tube data	Reduced vehicle emissions	Implementation - on-going	Ongoing	First phase successful, second phase on-going
20	Improve Air Quality	Public Information	Via leaflets	2020	Gloucester City Council	No additional funding required.	Smoke control zone	Visible smoke plumes. Reduction	Encouraging residents not to burn waste.	Ongoing	Resident refusal

							in complaints.			
21	Active Travel	Promoting Low Emission Transport	Taxi Licensing conditions	2020	Gloucester City Council and Gloucestershire County Council	Gloucestershire County Council	Diffusion tube data	Reduced vehicle emissions	Adding a pop-up cycle route into the city on London Road.	Ongoing	-
22	Improve Air Quality – Beat the Street initiative	Public Information		2018	Gloucester City Council	No additional funding required	Annual report that tracks mileage	Reduced vehicle emissions	Initiative carried out successfully in 2019 and looking to carry out on an annual basis	Ongoing	-

Note: Gloucester City Council are due to compile a new action plan in 2020, Table 2.2 will be updated within the 2021 ASR.

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 2.5 µm 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 either 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 2019 background maps for Gloucester City Council (2017 based[4]) show that all background concentrations of PM$_{2.5}$ are below the 2020 annual mean AQS objective for PM$_{2.5}$. The highest concentration across Gloucester is predicted to be 9.8 µg/m^3 within the 1 x 1 km 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 2018 fraction of mortality attributable to PM$_{2.5}$ pollution across England is 5.2%, and the fraction within Gloucester City Council is below the national average of 4.9%, however this is higher than 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$_{2.5}$.

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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 https://fingertips.phe.org.uk/search/air%20quality#page/1/gid/1/pat/6/par/E12000009/ati/202/are/E10000013/cid/4/page-options/ovw-do-0

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.

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 (continuous) monitoring of pollutants during 2019.

3.1.2 Non-Automatic Monitoring Sites

Gloucester City Council undertook non-automatic (passive) monitoring of NO_2 at 34 sites during 2019. There was no change in the number of sites from 2018. **Error! Reference source not found.** 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[6], "annualisation" (where the data capture falls below 75%), and distance correction[7]. Further details on adjustments are provided in Appendix C.

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[6] https://laqm.defra.gov.uk/bias-adjustment-factors/bias-adjustment.html
[7] Fall-off with distance correction criteria is provided in paragraph 7.77, LAQM.TG(16)

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 five years with the air quality objective of 40 µg/m^3. Note that the concentration data presented in Table A.2 represents the concentration at the location of the monitoring site, following the application of bias adjustment and annualisation, as required (i.e. the values are exclusive of any consideration to fall-off with distance adjustment).

For diffusion tubes, the full 2019 dataset of monthly mean values is provided in Appendix B. Note that the concentration data presented in Table B.1 includes distance corrected values, only where relevant.

Data capture for two of the diffusion tube sites 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 2019 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 60 µg/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 2019 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 **Error! Reference source not found.** and Figure A.1. The concentrations in the Figure are compared against the annual mean objective (AQO) value for NO$_2$.

There are three diffusion tube locations within the Priory Road AQMA, sites 23, 24 and 25, all with good data capture thrhough 2019. 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 40 μg/m^3 in 2019. All locations have exceeded this objective for the previous five years.

The concentrations recorded in 2019 are lower at all sites when compared with the same data from 2018 and, on average, the highest concentration at each location in the last five years were recorded in 2016. Due to the continued high concentrations that are in exceedance of the annual mean objective, the AQMA should currently remain in force.

Barton Street AQMA

Monitored concentrations are presented in **Error! Reference source not found.** and

Figure A.2. The concentrations in the Figure are compared against the annual mean objective (AQO) value for NO_2.

There are eight diffusion tube locations within the Barton Street AQMA, the majority sites had a data capture of 75% or more therefore annualisation was not required at any location. However, annaulisation was required at site 13.

The 2019 NO_2 concentration at one monitoring site (site 14) within the Barton Street AQMA exceeded the annual mean objective of 40 µg/m^3. This follows the same pattern from 2018. The concentrations recorded in 2019 increased at all monitoring sites apart from sites 12 and 16 where a slight (less than 1 µg/m^3) increases were experienced.

Concentrations continue to be lower at the southern end of the AQMA at site 10, 11, 16 and 17. Since two of the monitoring locations are within 10% of the annual mean NO_2 objective, and site 14 continues to demonstrate exceedances of the objective, at the current time it is considered that the AQMA should remain in force.

Painswick Road AQMA

Monitored concentrations are presented in **Error! Reference source not found.** and Figure A.3. The concentrations in the Figure are compared against the annual mean objective (AQO) value for NO_2.

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 40 µg/m^3 annual mean objective during 2019 at the five monitoring locations within the Painswick Road AQMA, however there was a slight increase in 2019 concentrations when compared with 2018. The exception was at site 5, where a decrease of 2.7 µg/m^3 from 2018 to 2019 was recorded. Site 5 also recorded the lowest concentration of any of the Painswick Road AQMA monitoring sites. The highest concentrations within the AQMA were recorded at site 9, which was within 10% of the annual mean NO_2 objective (37.6 µg/m^3). This monitoring 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. Distance correction did

not need to be utilised here as the monitoring site is located at a point of relevant exposure.

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 four out of five years covering the 2015 – 2019 period. As a result, the AQMA should remain in place, but a review to the boundary of the AQMA is to be completed as part of the AQAP update, with the monitoring locations reviewed to ensure that complete monitoring coverage of the AQMA is maintained.

Diffusion Tubes Outside of Existing AQMAs

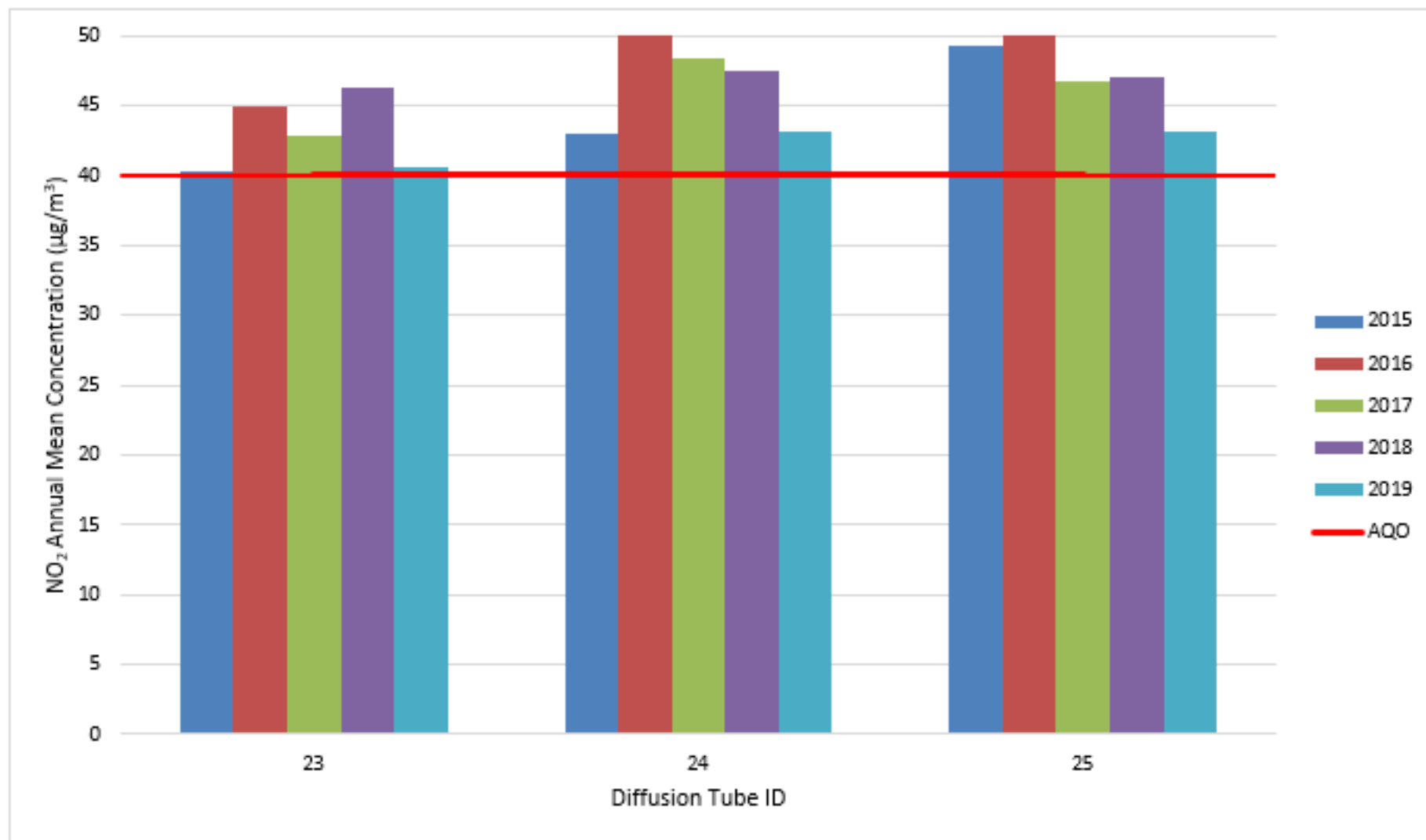Monitored concentrations are presented in **Error! Reference source not found.** and Figure A.4. The concentrations in the Figure are compared against the annual mean objective (AQO) value for NO_2.

There are 18 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 between three or four years.

In terms of data processing, site 27 (Gloucester Academy) had a data capture of less than 75% and, therefore, data for this site was annualised. Additionally, the raw concentration at site 28 (37.4 $\mu g/m^3$) was within 10% of the annual mean objective, therefore the fall-off with distance calculator was used to estimate the NO_2 concentration at the nearest location with relevant exposure.

Outisde of the existing AQMAs, NO_2 concentrations are compliant and there were no exceedances of the NO_2 annual mean objective during 2019 at any of these monitoring sites. In fact, over the past five years, only site 28 has recorded an exceedance, which occurred in 2016.

When 2019 data is compared with data from 2018, 11 of the monitoring sites outside of AQMAs recorded a lower concentration of NO_2 in 2019. Where increases in concentration occurred over this period, the largest increase was observed at site 1 (57 Bristol Road), where the 2019 annual mean concentration was 25.7 $\mu g/m^3$.

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Due to all monitoring locations reporting concentrations below the annual mean objective, no further AQMAs need to be designated within Gloucester City Council at the current time. As detailed earlier within the ASR a detailed modelling study to review the current AQMA boundaries is currently being undertaken as part of the AQAP process, this assessment will help to inform if any amendements and/or recovations are required.

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 (Easting)	Y OS Grid Ref (Northing)	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
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

Site ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	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)
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
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

Site ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	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)
34	102 Eastern Avenue	Roadside	384671	217296	NO$_2$	NO	7.5	1.4	NO	2.5

Notes:

(1) 0 m 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 NO$_2$ Monitoring Results

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	NO$_2$ Annual Mean Concentration (μg/m^3) (3) (4)				
							2015	2016	2017	2018	2019
1	382690	217440	Roadside	Diffusion Tube	100%	100%	25.9	27.2	25.0	23.0	25.7
2	382410	217013	Roadside	Diffusion Tube	100%	100%	25.3	26.2	23.9	23.2	22.9
3	387670	217250	Roadside	Diffusion Tube	100%	100%	25.5	27.9	24.0	23.7	24.3
4	387250	216530	Urban Background	Diffusion Tube	92%	92%	20.4	22.7	19.6	19.4	17.4
5	384558	216946	Roadside	Diffusion Tube	100%	100%	30.5	33.2	29.6	29.6	27.3
6	384512	217023	Roadside	Diffusion Tube	100%	100%	26.7	31.1	26.4	24.9	26.4
7	384490	217027	Roadside	Diffusion Tube	100%	100%	33.5	33.6	32.1	29.8	31.9
8	384509	216998	Roadside	Diffusion Tube	100%	100%	35.5	36.7	35.2	33.7	34.2
9	384550	216932	Roadside	Diffusion Tube	83%	83%	38.8	39.7	38.3	35.6	37.6
10	384182	217533	Roadside	Diffusion Tube	100%	100%	23.3	25.7	24.0	21.5	23.2
11	384090	217731	Roadside	Diffusion Tube	100%	100%	25.1	31.4	27.8	26.8	28.5
12	384000	217863	Roadside	Diffusion Tube	100%	100%	35.8	**40.1**	36.5	36.8	36.2
13	383717	218094	Roadside	Diffusion Tube	50%	50%	35.8	39.1	35.0	37.6	37.2
14	383726	218074	Roadside	Diffusion Tube	100%	100%	**46.6**	**47.4**	**48.1**	**42.4**	**43.9**
15	383989	217857	Roadside	Diffusion Tube	100%	100%	38.3	**42.9**	39.3	38.4	39.7

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	NO$_2$ Annual Mean Concentration (µg/m^3) (3) (4)				
							2015	2016	2017	2018	2019
16	384081	217725	Roadside	Diffusion Tube	83%	83%	32.5	35.1	33.0	32.1	31.2
17	384175	217501	Roadside	Diffusion Tube	100%	100%	35.8	38.0	35.2	32.7	35.5
18	384190	218160	Roadside	Diffusion Tube	100%	100%	29.2	31.3	30.2	29.1	29.4
19	385130	218585	Roadside	Diffusion Tube	75%	75%	33.7	37.2	34.1	35.4	34.1
20	385113	218595	Roadside	Diffusion Tube	100%	100%	35.0	36.5	36.5	33.0	34.7
21	385430	218870	Urban Background	Diffusion Tube	75%	75%	17.4	15.2	17.6	17.5	17.7
22	383243	218489	Urban Background	Diffusion Tube	100%	100%	18.7	18.6	17.3	18.1	17.7
23	382898	219029	Roadside	Diffusion Tube	92%	92%	**40.3**	**44.9**	**42.8**	**46.3**	**40.5**
24	382921	219034	Roadside	Diffusion Tube	100%	100%	**43.0**	**51.1**	**48.3**	**47.4**	**43.0**
25	382950	219040	Roadside	Diffusion Tube	100%	100%	**49.2**	**52.1**	**46.7**	**47.1**	**43.2**
26	383560	218775	Roadside	Diffusion Tube	100%	100%	-	30.7	30.4	33.4	33.9
27	384967	216252	Roadside	Diffusion Tube	67%	67%	-	30.3	24.5	26.4	25.5
28	383619	218162	Roadside	Diffusion Tube	92%	92%	-	**42.4**	36.8	38.1	24.2
29	383238	217349	Roadside	Diffusion Tube	92%	92%	-	30.8	26.6	28.4	27.2
30	384607	216841	Roadside	Diffusion Tube	83%	83%	-	31.3	32.5	30.6	28.2

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	NO$_2$ Annual Mean Concentration (µg/m^3) (3) (4)				
							2015	2016	2017	2018	2019
31	385499	218350	Roadside	Diffusion Tube	100%	100%	-	34.4	28.9	30.7	29.7
32	380958	214385	Roadside	Diffusion Tube	100%	100%	-	30.9	29.9	29.0	24.7
33	384638	217325	Roadside	Diffusion Tube	100%	100%	-	-	34.5	33.1	34.3
34	384671	217296	Roadside	Diffusion Tube	100%	100%	-	-	38.7	37.1	33.3

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

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

☒ **Reported concentrations are those at the location of the monitoring site (bias adjusted and annualised, as required), i.e. prior to any fall-off with distance adjustment**

Notes:

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

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

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

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

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

(4) Concentrations are those at the location of monitoring and not those following any fall-off with distance adjustment.

Figure A.1 – Trends in Annual Mean NO₂ Concentrations: Priory Road AQMA
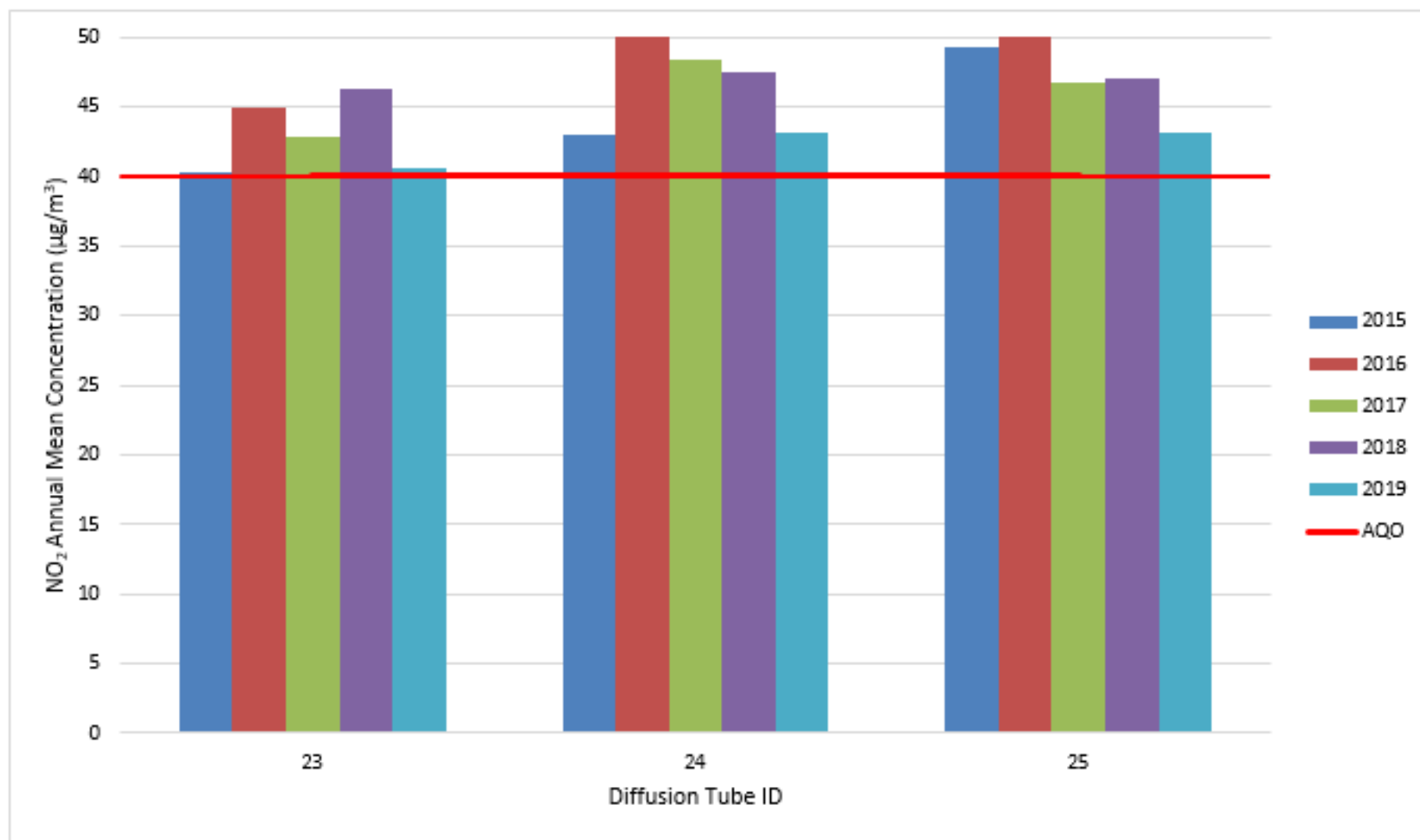
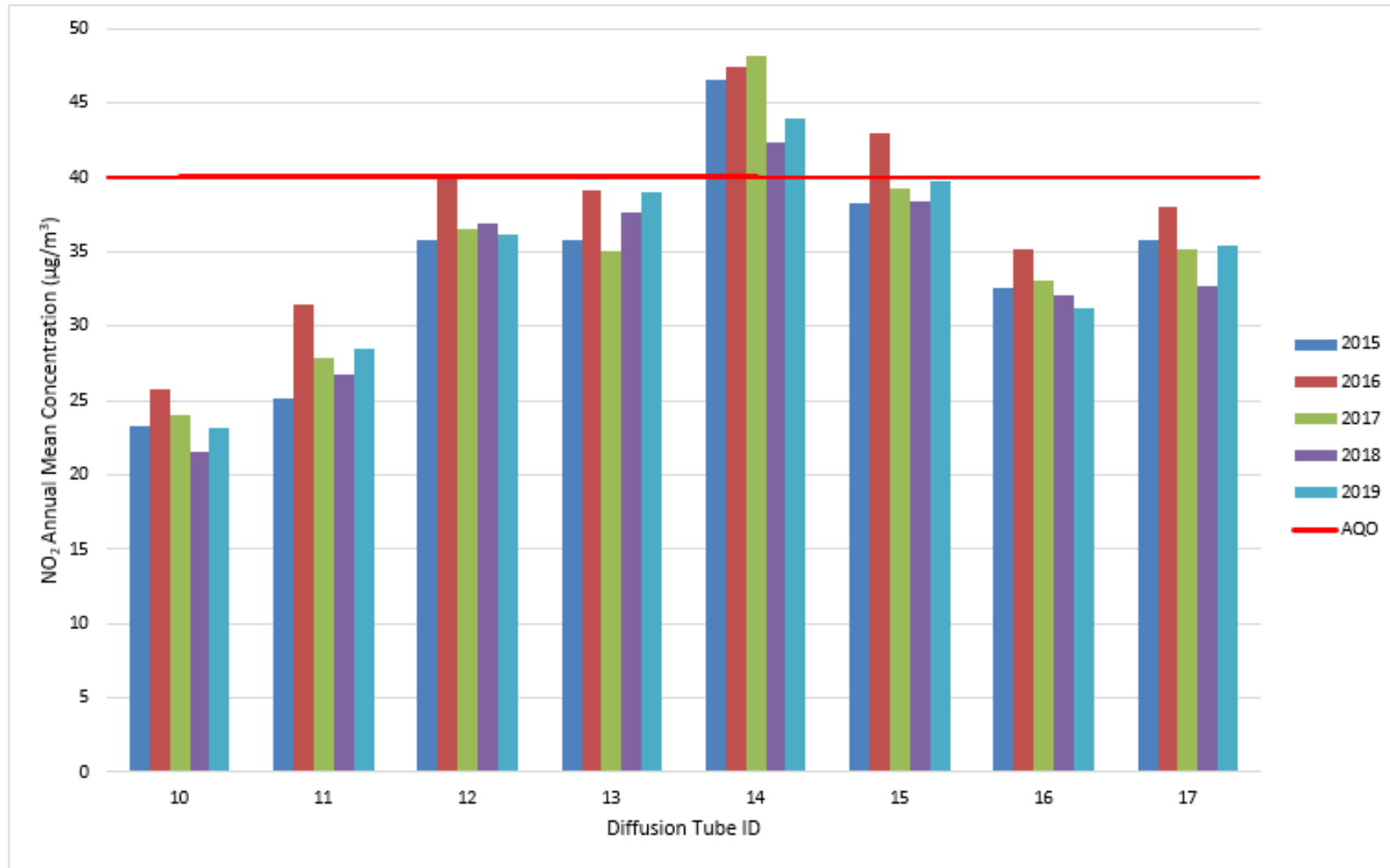**Figure A.2 – Trends in Annual Mean NO₂ Concentrations: Barton Street AQMA**

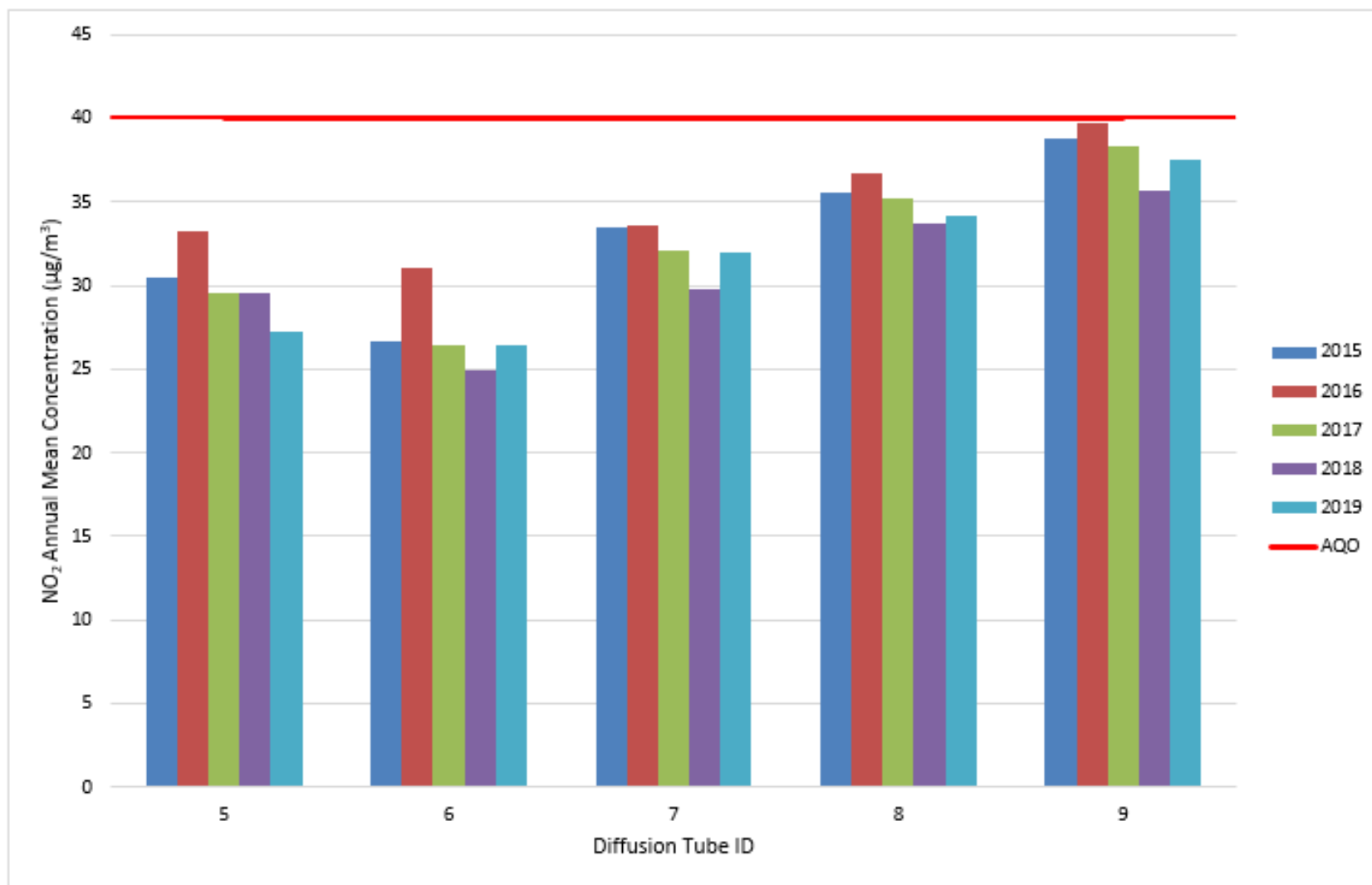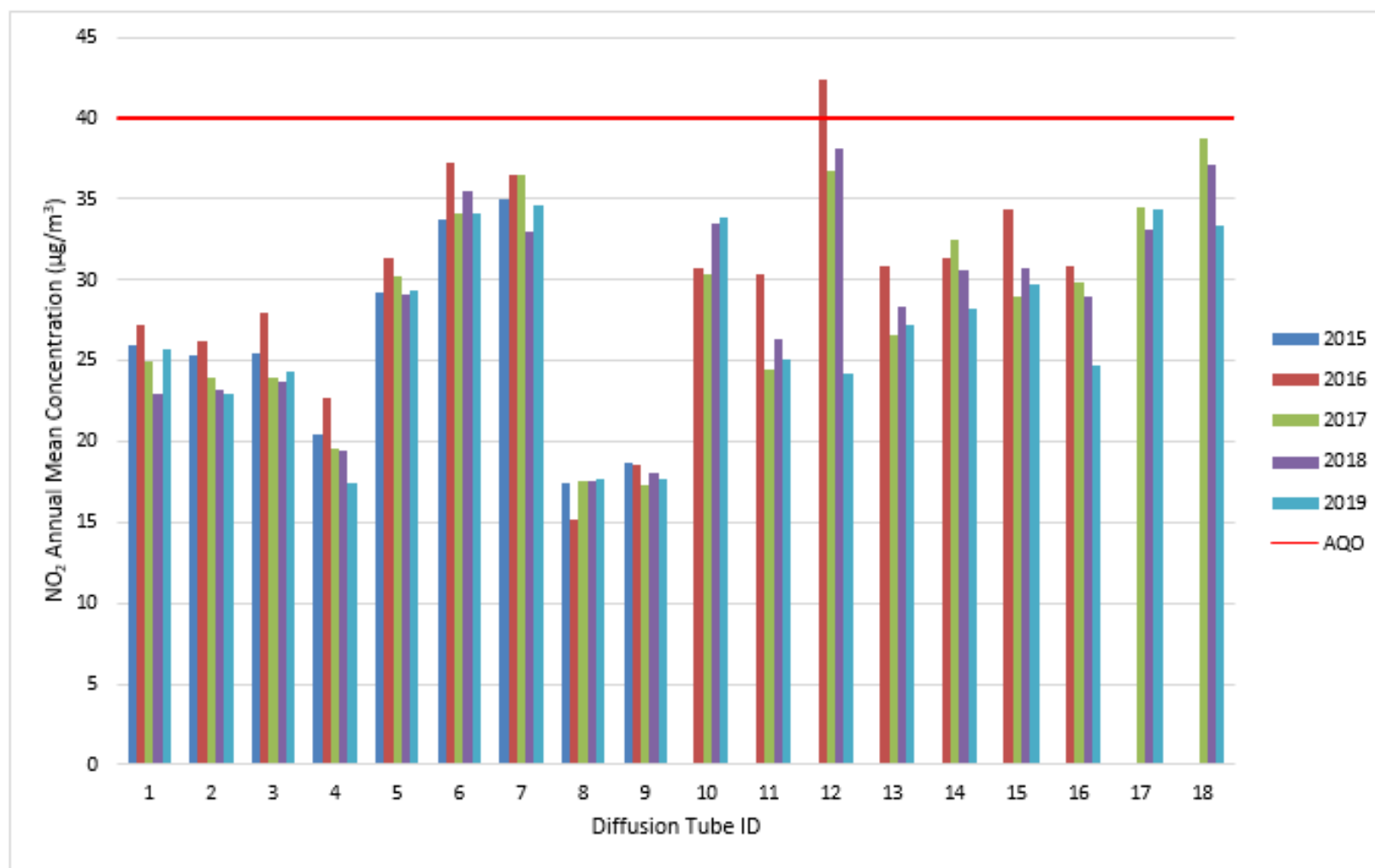**Figure A.3 – Trends in Annual Mean NO₂ Concentrations: Painswick Road AQMA**

Figure A.4 – Trends in Annual Mean NO$_2$ Concentrations: Outside of AQMAs

Appendix B: Full Monthly Diffusion Tube Results for 2019

Table B.1 – NO₂ Monthly Diffusion Tube Results - 2019

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	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]
1	382690	217440	36.6	33.1	27.6	29.4	24.4	23.2	20.8	19.9	25.6	26.6	33.0	31.8	27.7	25.7	-
2	382410	217013	35.8	32.0	22.4	24.6	20.7	21.1	18.7	17.1	23.6	22.4	29.7	27.3	24.6	22.9	-
3	387670	217250	33.2	30.0	23.3	28.0	22.7	24.8	21.0	20.1	26.5	28.1	27.6	28.4	26.1	24.3	-
4	387250	216530	26.9	24.6	20.3	23.0	17.4	16.5	14.9	12.9	17.3	10.5	-	21.1	18.7	17.4	-
5	384558	216946	37.2	34.6	28.4	30.4	30.7	27.3	26.0	21.0	27.7	22.5	40.9	25.4	29.3	27.3	-
6	384512	217023	33.6	30.5	25.3	38.0	29.1	23.9	22.4	19.7	28.5	25.6	37.0	26.9	28.4	26.4	-
7	384490	217027	43.1	40.3	32.9	33.0	31.2	29.6	28.0	31.8	32.9	31.9	41.4	36.0	34.3	31.9	-
8	384509	216998	47.3	44.8	36.5	34.3	37.1	33.9	36.0	36.2	39.5	21.5	41.1	32.5	36.7	34.2	-
9	384550	216932	53.0	44.7	42.0	35.5	42.1	-	41.3	36.7	39.5	25.3	-	43.8	40.4	37.6	-
10	384182	217533	30.9	26.7	24.6	30.8	23.7	23.0	22.0	16.2	23.3	18.8	31.4	27.7	24.9	23.2	-
11	384090	217731	39.8	32.4	28.0	38.0	30.8	28.8	27.3	19.9	29.4	24.7	42.9	25.9	30.7	28.5	-
12	384000	217863	49.2	39.3	42.2	44.4	40.2	38.1	37.6	30.7	37.2	27.9	44.4	35.5	38.9	36.2	-
13	383717	218094	47.8	40.1	38.4	44.1	43.2	38.0	-	-	-	-	-	-	41.9	37.2	-
14	383726	218074	55.6	52.4	47.5	40.9	49.8	46.8	51.0	37.0	50.0	40.9	49.2	45.2	47.2	**43.9**	-
15	383989	217857	50.7	51.0	39.3	42.6	40.3	35.9	38.1	35.9	41.6	39.9	53.2	43.7	42.7	39.7	-
16	384081	217725	46.1	41.2	34.8	34.8	30.6	30.2	28.2	27.0	35.4	27.1	-	-	33.5	31.2	-

17	384175	217501	44.7	46.6	36.9	33.4	38.7	33.1	30.1	34.1	37.3	42.6	42.3	37.7	38.1	35.5	-
18	384190	218160	40.5	37.6	33.0	33.6	32.9	28.4	28.2	23.3	29.3	21.9	42.0	28.1	31.6	29.4	-
19	385130	218585	44.8	36.3	34.1	47.5	38.2	37.0	36.2	22.8	32.9	-	-	-	36.7	34.1	-
20	385113	218595	46.5	43.5	35.7	42.9	37.3	35.6	33.2	27.4	34.2	26.5	47.7	36.6	37.3	34.7	-
21	385430	218870	26.6	26.0	16.8	14.7	12.5	13.3	-	-	-	14.9	25.4	21.1	19.0	17.7	-
22	383243	218489	25.4	23.1	17.3	23.1	15.5	15.5	12.3	11.9	17.8	16.3	29.8	20.1	19.0	17.7	-
23	382898	219029	45.6	53.6	45.9	-	44.6	45.2	43.0	36.2	38.5	30.9	56.1	39.9	43.6	**40.5**	-
24 (1)	382921	219034	49.2	55.3	48.5	53.1	48.5	47.6	43.0	38.7	41.6	29.4	56.4	45.4	46.4	**43.1**	-
24 (2)	382921	219034	53.7	54.3	42.3	49.0	49.1	48.5	41.1	38.9	43.6	40.0	51.6	42.1	46.2	**42.9**	-
25	382950	219040	54.4	53.6	48.4	52.1	43.9	48.0	37.0	34.7	43.4	40.6	52.1	48.9	46.4	**43.2**	-
26	383560	218775	43.3	46.3	35.6	33.1	29.6	32.6	33.7	32.4	33.1	27.9	45.3	44.0	36.4	33.9	-
27	384967	216252	33.2	30.2	-	-	25.9	22.6	21.9	15.6	25.4	-	40.9	-	26.9	25.5	-
28	383619	218162	48.9	46.7	40.6	41.3	35.5	41.3	36.9	31.2	40.1	25.5	54.8	-	40.2	37.4	24.2
29	383238	217349	39.0	31.3	24.6	32.8	24.4	25.0	-	19.1	28.0	24.1	42.7	30.7	29.2	27.2	-
30	384607	216841	37.0	34.5	34.2	29.2	28.2	31.0	32.7	27.8	29.7	18.5	-	-	30.3	28.2	-
31	385499	218350	40.9	32.8	33.0	35.3	30.6	31.4	29.5	21.5	32.2	29.9	39.3	27.4	32.0	29.7	-
32	380958	214385	37.8	37.4	25.6	25.2	20.2	23.4	19.5	21.4	25.9	15.3	30.0	37.3	26.6	24.7	-
33	384638	217325	48.0	44.8	36.2	35.3	35.4	34.9	32.0	24.9	36.9	35.5	43.0	36.0	36.9	34.3	-
34	384671	217296	42.1	43.0	34.0	41.1	30.7	33.7	24.1	30.6	33.6	30.2	49.5	36.8	35.8	33.3	-

☐ **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.

Dashed lines in the Jan – Dec data represent missing diffusion tubes.

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

New Sources of Pollution and Planning Applications

Gloucester City Council have identified the following potential new sources within the district as described in Chapter 7, Section 1 of Defra LAQM.TG(16).

Table C.1 – Planning Applications

Application Ref No.	Address	Proposal	AQA Undertaken?
19/01141/FUL	Land At Secunda Way, Secunda Way, Gloucester	Construction of 4 three-storey buildings comprising 36 apartments (33 x two bedroomed and 3 x one bedroomed) with associated car parking, bin/recycling and cycle storage.	Yes
20/00368/OUT	Land North Of Rudloe Drive, Rudloe Drive, Kingsway, Quedgeley Gloucester	Residential development (up to 150 dwellings), associated infrastructure, ancillary facilities, open space and landscaping. Outline application with all matters reserved. Framework Plan 5 FP5.	Yes
18/01454/FUL	Kings Quarter, Kings Square, Gloucester	Mixed use development comprising a new multi-storey car park (sui generis); residential dwellings (C3) (101 units); commercial retail (A1,A2) / food and drink (A3,A4) / office space (B1); refurbishment of Kings House to provide a new creative hub (B1) with ancillary exhibition space (D1) and food-hall (A3).	Yes
20/00390/FUL	Sanctus House, 1 Olympus Park Business Centre, Olympus Park, Quedgeley, Gloucester GL2 4DH	Installation of a Bio Mass Boiler system within a 40ft container with external fuel store.	No
20/00315/OUT	Land At Hill Farm, Hempsted Lane, Gloucester	Outline application for the erection of up to 245 dwellings with public open space, structural planting and landscaping, surface water flood mitigation and attenuation and vehicular access point from Hempsted Lane. All matters reserved except for means of vehicular access.	Yes

With regard to new sources in the area, the Javelin Park Energy from Waste (EfW) plant is now operational, which is located approximately 8.5 km southwest of Gloucester city centre, near junction 12 of the M5. Environmental impacts from the plant are regulated by the Environment Agency under an Environmental Permit (reference EPR/CP3535CK), more details can be viewed here: https://www.ubbgloucestershire.co.uk/supporting-documents

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. Defra's 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[8] 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 2019 (based on 27 studies) as derived from the national bias adjustment factor spreadsheet. The bias adjustment factors utilised for the past five years are presented in Table C.2.

Table C.2 – Bias Adjustment Factors

Year	Bias Adjustment Factor
2015	0.91
2016	0.94
2017	0.89
2018	0.93
2019	0.93

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

QA/QC of Diffusion Tube Monitoring

The diffusion tubes for the year 2019 were supplied and analysed by Gradko International Ltd, the tubes were prepared using the 20% TEA in water preparation method. All results have been bias adjusted and annualised where required before being presented in **Error! Reference source not found.**.

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 AR030 (January – February 2019), AIR-PT AR031 (April – May 2019), AIR-PT AR033 (July – August 2019) and AIR-PT AR034 (September – November 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 $< \pm 2$.

25 out of the 27 local authority co-location studies in 2019 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%).

Short-term to Long-term Data Adjustment

In regards to the 2019 diffusion tube data set, annualisation was required at two diffusion tube locations 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 using the Annualisation Tool Version 1[9].

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

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[9] Annualisation Tool Version 1, available at: https://laqm.defra.gov.uk/tools-monitoring-data/annualisation.html

roadside monitoring sites. The monitoring sites that were used are listed in Table C.3. Full working details are presented in Table C.4.

Table C.3 – AURN Monitoring Stations Used for Annualisation

Pollutant	Background AURN Sites used for Annualisation
NO$_2$	• Swindon Walcot – Urban Background • Newport – 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 was one site within Gloucester's NO$_2$ monitoring network that was within 10% of the NO$_2$ annual mean objective in 2019, at Site 28.

The NO$_2$ Fall-Off with Distance Calculator (v4.2)[10] 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.5.

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[10] 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.4 – Diffusion Tube Short Term to Long Term Monitoring Data Adjustment

Site ID	Unadjusted Diffusion Tube Mean (µg/m³)	Annualisation Factor Swindon Walcot	Annualisation Factor Newport	Annualisation Factor Cwmbran	Annualisation Factor Leamington Spa	Average Annualisation Factor	Annualised & Bias Adjusted (0.93) Concentration (µg/m³)
Site 13	41.9	0.92	0.97	0.95	0.97	0.95	37.2
Site 27	26.9	1.03	1.03	1.01	0.99	1.02	25.5

Table C.5 – NO$_2$ Fall-Off With Distance Calculations

Site ID	Distance (m)		NO$_2$ Annual Mean Concentration (µg/m³)		
	Monitoring Site to Kerb	Receptor to Kerb	Background [1]	Monitored*	Predicted at Receptor*
Site 28	2.0	29.0	16.3	37.4	24.2
*bias adjusted values					

Appendix D: Maps of Monitoring Locations and AQMAs

Figure D.1 – NO₂ Diffusion Tube Monitoring Locations: Priory Road AQMA
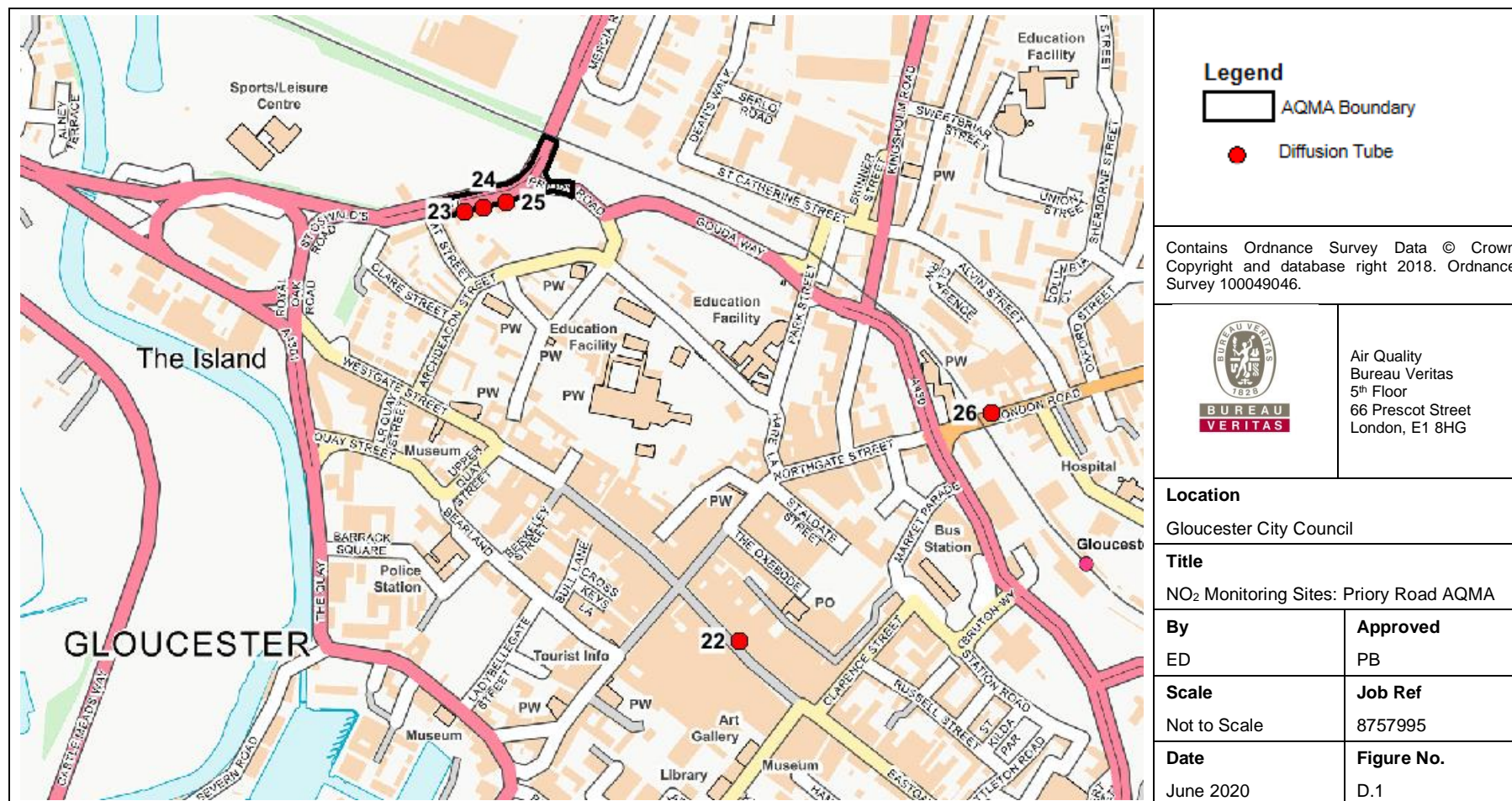
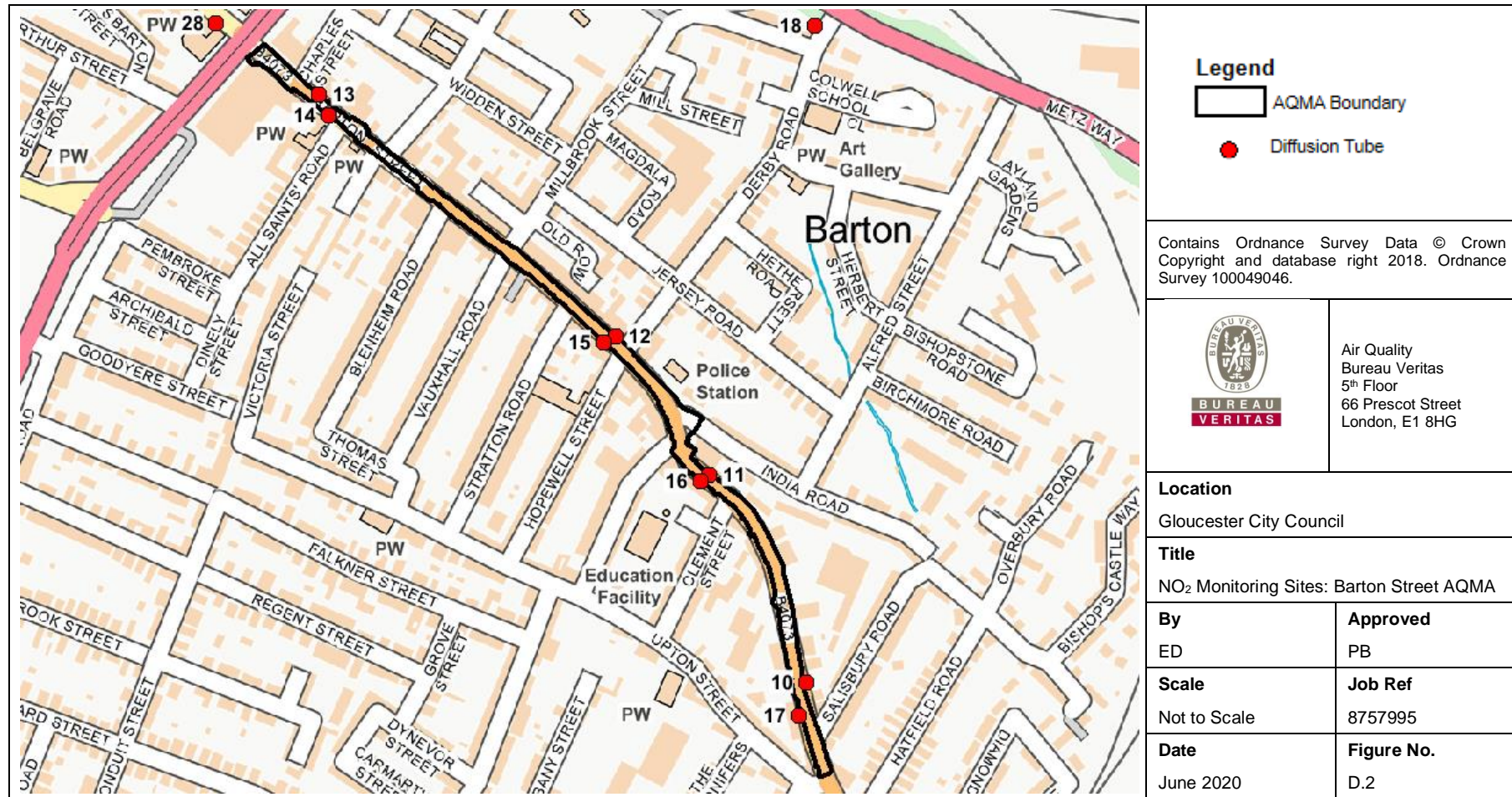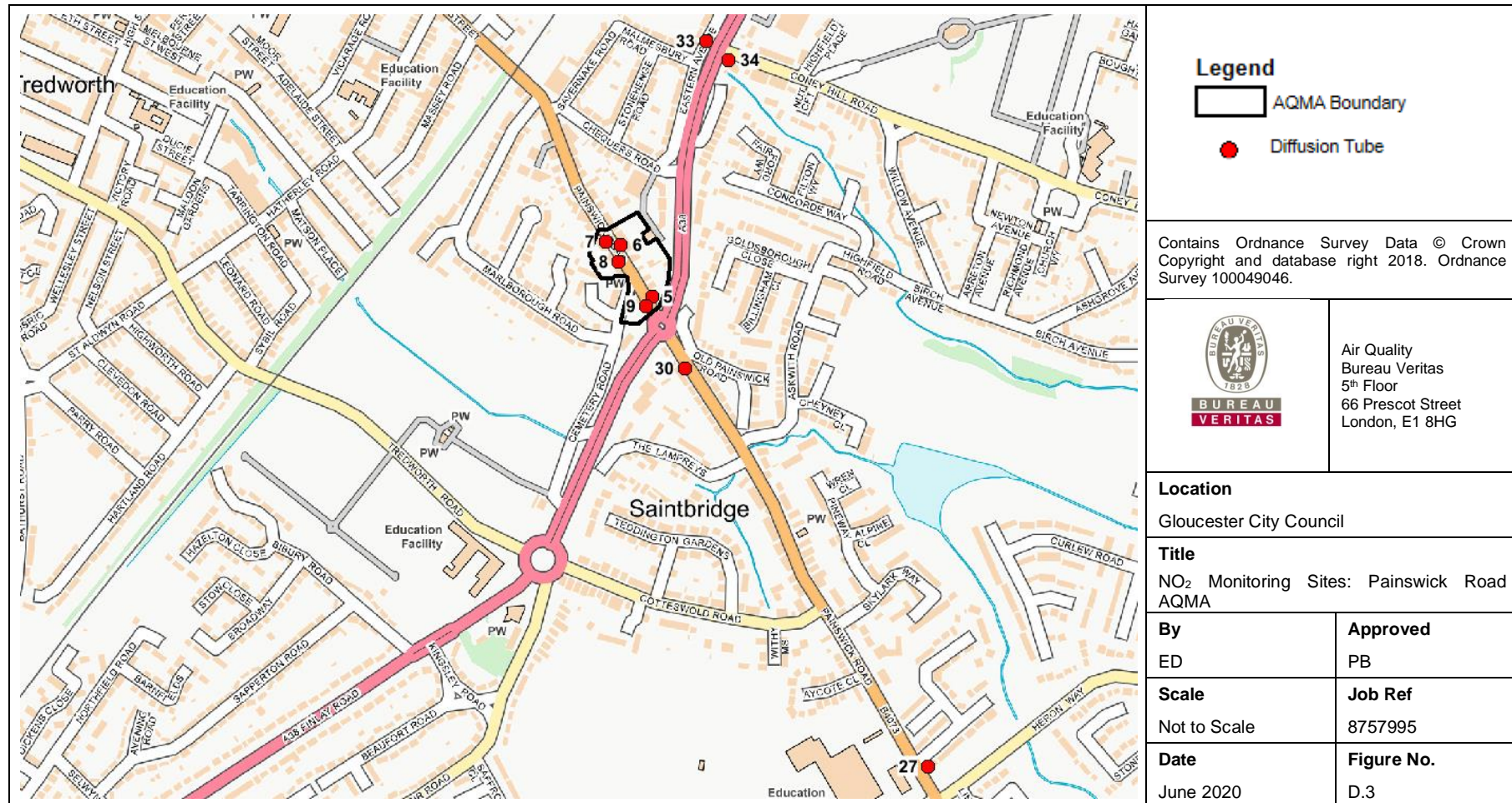**Figure D 2 – NO₂ Diffusion Tube Monitoring Locations: Barton Street AQMA**

Figure D.3 – NO₂ Diffusion Tube Monitoring Locations: Painswick Road AQMA

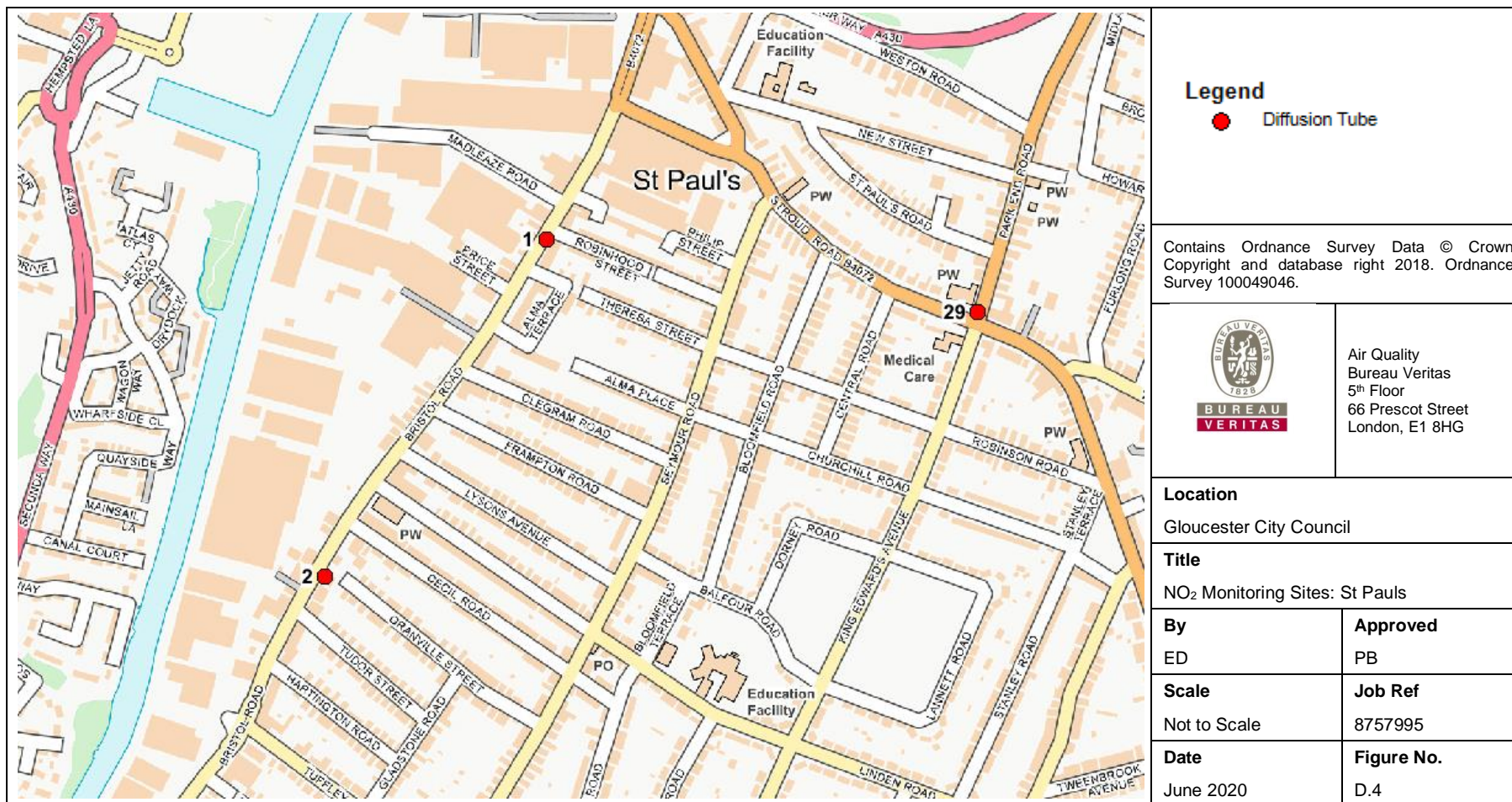**Figure D.4 – NO₂ Diffusion Tube Monitoring Locations: St Pauls**

Figure D.5 – NO₂ Diffusion Tube Monitoring Locations: M5

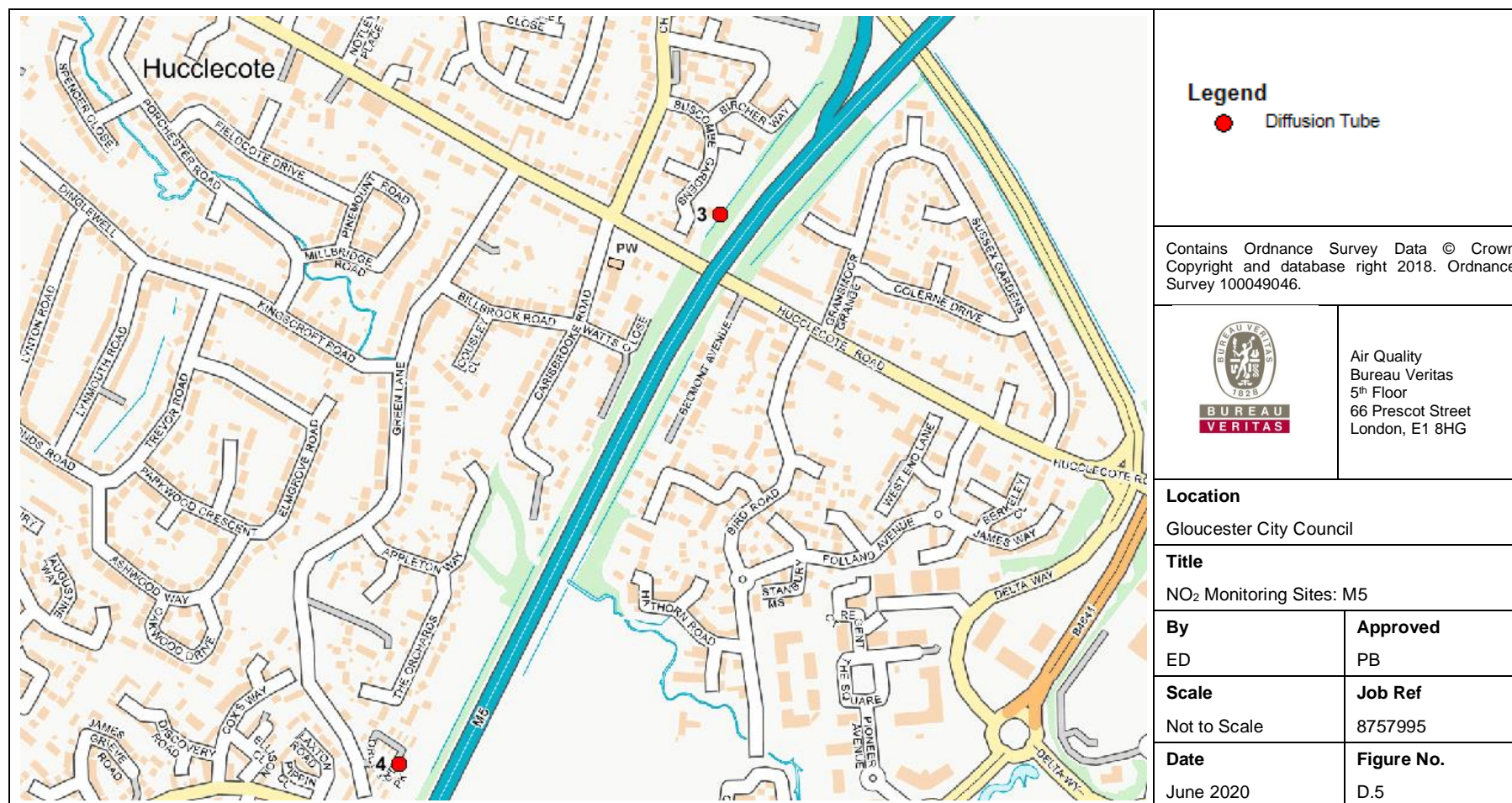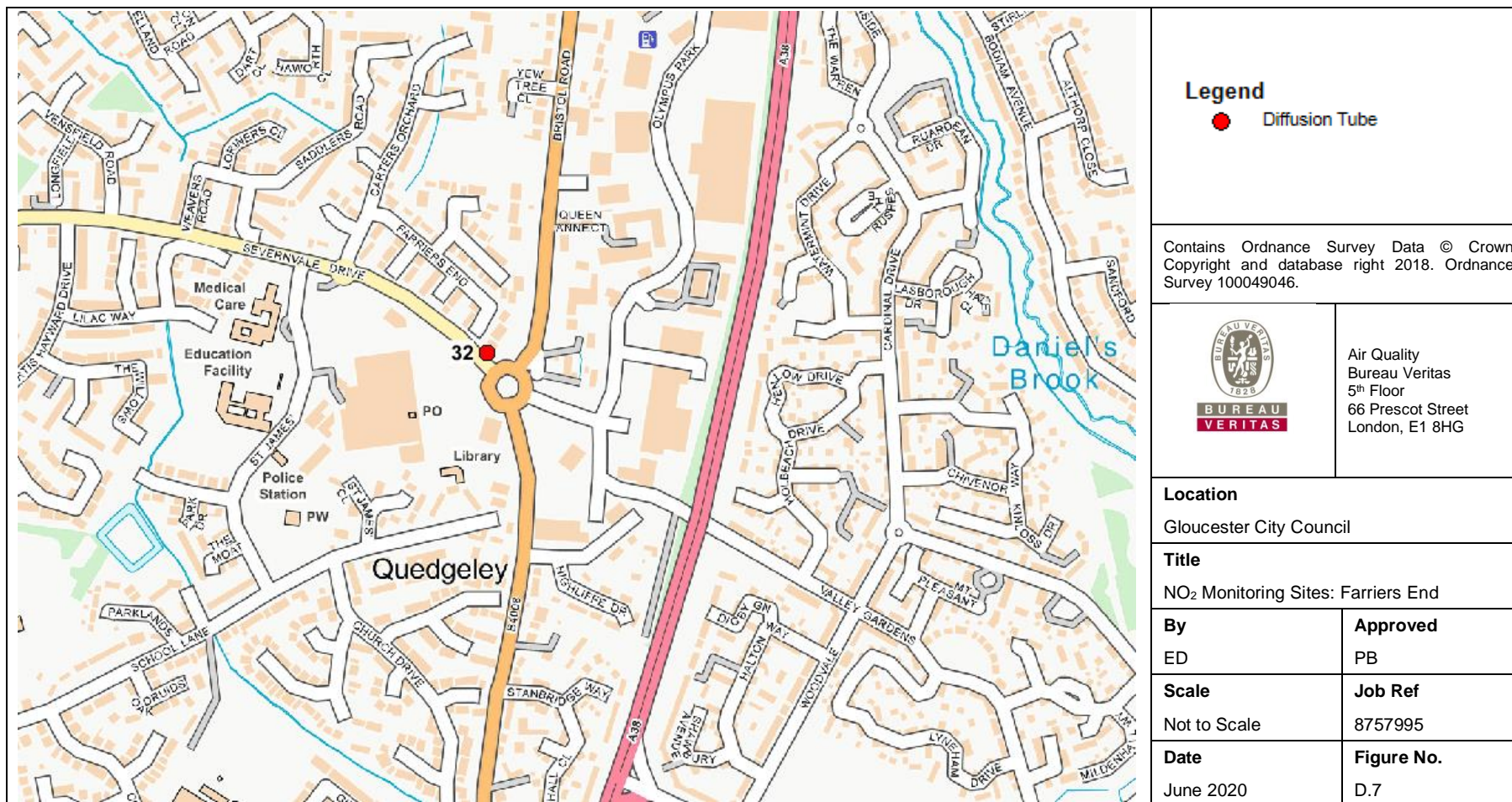**Figure D.6 – NO₂ Diffusion Tube Monitoring Locations: Barnwood/Elmbridge**

Legend	
● Diffusion Tube	

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	Air Quality
BUREAU VERITAS	Bureau Veritas
	5th Floor
	66 Prescot Street
	London, E1 8HG

Location

Gloucester City Council

Title

NO₂ Monitoring Sites: Barnwood/Elmbridge

By	Approved
ED	PB
Scale	**Job Ref**
Not to Scale	8757995
Date	**Figure No.**
June 2020	D.6

Figure D.7 – NO₂ Diffusion Tube Monitoring Locations: Farriers End

Gloucester City Council

Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England

Pollutant	Air Quality Objective[11]	
	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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[11] 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.

- Gloucester City Council 2019 Annual Status Report.

- Gloucester City Council 2018 Annual Status Report.

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

- National Diffusion Tube Bias Adjustment Factor Spreadsheet, published March 2020.

- Thinktravel Smarter Choices Evaluation, Gloucestershire County Council.

- Nitrogen Dioxide fall off with distance calculator version 4.2 March 2018, Defra.

- Annualisation Tool version 1 June 2020, Defra.