Stratford-on-Avon District Council

Annual Status Report 2023

Bureau Veritas

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2023 Air Quality Annual Status Report (ASR)

In fulfilment of Part IV of the Environment Act 1995 Local Air Quality Management, as amended by the Environment Act 2021

Date: June, 2023

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Executive Summary: Air Quality in Our Area

Air Quality in Stratford-on-Avon

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, the elderly, and those with existing heart and lung conditions. There is also often a strong correlation with equalities issues because areas with poor air quality are also often less affluent areas[1,2].

The mortality burden of air pollution within the UK is equivalent to 29,000 to 43,000 deaths at typical ages[3], with a total estimated healthcare cost to the NHS and social care of £157 million in 2017[4].

Actions to Improve Air Quality

Whilst air quality has improved significantly in recent decades, there are some areas where local action is needed to protect people and the environment from the effects of air pollution.

The Environmental Improvement Plan[5] sets out actions that will drive continued improvements to air quality and to meet the new national interim and long-term $PM_{2.5}$ targets. The National Air Quality Strategy, due to be published in 2023, will provide more information on local authorities' responsibilities to work towards these new targets and reduce $PM_{2.5}$ in their areas. The Road to Zero[6] details the approach to reduce exhaust emissions from road transport through a number of mechanisms; this is extremely

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[1] Public Health England. Air Quality: A Briefing for Directors of Public Health, 2017

[2] Defra. Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006

[3] Defra. Air quality appraisal: damage cost guidance, January 2023

[4] Public Health England. Estimation of costs to the NHS and social care due to the health impacts of air pollution: summary report, May 2018

[5] Defra. Environmental Improvement Plan 2023, January 2023

[6] DfT. The Road to Zero: Next steps towards cleaner road transport and delivering our Industrial Strategy, July 2018

important given that the majority of Air Quality Management Areas (AQMAs) are designated due to elevated concentrations, heavily influenced by transport emissions.

The Council continues to be a member of the Coventry and Warwickshire Air Quality Alliance (AQA), which was established in December 2015. The Alliance's intention is to take collaborative and collective action against poor air quality, whereby officers from Environmental Health, Transport, Planning and Public Health departments meet with representatives from Public Health England to work towards the development of a shared document repository and forum for exchange of information and ideas. The Alliance's work programme includes joint support for Active Travel/Healthy Travel Choice campaigns linked with national initiatives; joint work on transport projects (e.g. cycle network bids) and the sharing of planning guidance related to Air Quality. The aim to create a common approach to planning across Coventry and Warwickshire.

In 2022, Stratford-on-Avon District Council purchased two AQMesh air quality sensors to enable monitoring of different areas of concern within the Studley and Stratford-on-Avon AQMAs. The monitors are solar powered units that measure nitrogen dioxide, humidity, temperature and particulate matter. The locations were chosen to target areas where air pollution is expected to be high, such as an area that experiences heavy traffic. A live stream of monitoring data is available to view on their website, with the aim of promoting public involvement and awareness of air quality issues.

Following on from the adoption of the Air Quality and Planning Guidance in 2019, the Council has now fully adopted the Developer Requirements Supplementary Planning Document, including an air quality chapter (Part R) and associated guidance.

Conclusions and Priorities

The conclusions and priorities for the council in addressing and managing air quality within Stratford-on-Avon District Council in the coming year include:

- Annual mean NO_2 concentrations at all monitoring sites operated by Stratford-on-Avon District Council are well below the AQS objective of 40 µg/m^3;
- Overall there is a downward trend in annual mean NO_2 concentrations;
- Continue to promote clean air initiatives via press releases and Facebook;
- Continue to review the monitoring network and AQMesh sensor data;

- Work together with developers to improve sustainable transport links serving new developments and promote the inclusion of electric charging points for electric/hybrid vehicles at new development sites;
- Consider revocation of the Stratford-on-Avon and Studley AQMAs and the implementation of a District-wide Air Quality Strategy.

Local Engagement and How to get Involved

As the main source of air pollution within Stratford-on-Avon is from transport emissions, the public can get involved in improving their local air quality by looking into alternative ways to travel.

The following are suggested alternatives to private travel that would contribute to improving air quality within Stratford-on-Avon:

- Public transport – The use of the bus and train facilities, which in turn reduces pollutant concentration by reducing the number of vehicles on the road, this also helps to reduce congestion;
- Walk or cycle if your journey allows – From choosing to walk or cycle the number of vehicles is reduced and also there is the added benefit of keeping fit and healthy;
- Car/lift sharing – Where a number of individuals are making similar journeys, such as travelling to work or to school, car sharing reduces the number of vehicles on the roads and therefore reduces road traffic emissions. This can be promoted via travel plans through the workplace and also within schools and;
- Alternative fuel / more efficient vehicles – Choosing a vehicle that meets the specific needs of the owner; fully electric, hybrid fuel and more fuel-efficient cars are available and all have different levels benefits by reducing the amount of emissions being released.

The Stratford-on-Avon District Council website contains information on local air quality for those wishing to find out more and get involved. The installation of AQMesh sensors within the Studley and Stratford-on-Avon AQMAs means that live monitoring data is now publicly available online. The website has also been updated this year to include additional information for the public on wood burners and clean burning.

Local Responsibilities and Commitment

This ASR was prepared by the Environmental Health and Licensing Department of Stratford-on-Avon District Council with the support and agreement of the following officers and departments:
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This ASR has been approved by:

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1 Local Air Quality Management

This report provides an overview of air quality in Stratford-on-Avon during 2022. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995), as amended by the Environment Act (2021), 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 order to achieve and maintain the objectives and the dates by which each measure will be carried out. This Annual Status Report (ASR) is an annual requirement showing the strategies employed by Stratford-on-Avon to improve air quality and any progress that has been made.

The statutory air quality objectives applicable to LAQM in England are presented in Table E.1.

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 should prepare an Air Quality Action Plan (AQAP) within 18 months. The AQAP should specify how air quality targets will be achieved and maintained and provide dates by which measures will be carried out.

A summary of AQMAs declared by Stratford-on-Avon can be found in Table 2.1. The table presents a description of the Stratford-on-Avon and Studley AQMAs that are currently designated within Stratford-on-Avon District. Appendix D: Map(s) of Monitoring Locations and AQMAs provides maps of AQMAs and the air quality monitoring locations in relation to the AQMAs. The air quality objectives pertinent to the current AQMA designations are as follows:

- NO_2 annual mean.

Stratford-on-Avon District Council will consider revocation of the Stratford-on-Avon and Studley AQMAs in 2023. Revocation of the Stratford-on-Avon AQMA had previously been postponed due to the consideration of 2020 as an anomalous year due to the impact of the COVID-19 pandemic on emissions. However, compliance has been maintained in 2021 and 2022 for both AQMAs, and so revocation can be considered in line with Section 3.54 of the LAQM Technical Guidance (August 2022), which states that "*where 2020 is one of many consecutive years of compliance, this may be considered for revocation".*

Table 2.1 – Declared Air Quality Management Areas

AQMA Name	Date of Declaration	Pollutants and Air Quality Objectives	One Line Description	Is air quality in the AQMA influenced by roads controlled by Highways England?	Level of Exceedance: Declaration	Level of Exceedance: Current Year	Number of Years Compliant with Air Quality Objective	Name and Date of AQAP Publication	Web Link to AQAP
Studley AQMA	08/03/2006	Nitrogen dioxide NO_2	An area encompassing part of Alcester Road, Studley.	NO	62 µg/m^3	27.7 µg/m^3	6 years*	AQAP for Studely AQMA, published 2008	Visit the AQAP for the Studley AQMA
Stratford upon Avon District Council no 1 2010	22/01/2010	Nitrogen dioxide NO_2	The whole town of Stratford upon Avon and some surrounding areas.	NO	45 µg/m^3	28.1 µg/m^3	5 Years*	None currently published	-

* Including 2020 and 2021, which are thought to be anomalous due to the impact of the COVID-19 pandemic and national lockdowns on emissions.

☒ **Stratford-on-Avon confirm the information on UK-Air regarding their AQMA(s) is up to date.**

☒ **Stratford-on-Avon confirm that all current AQAPs have been submitted to Defra.**

2.2 Progress and Impact of Measures to address Air Quality in Stratford-on-Avon

Defra's appraisal of last year's ASR concluded that Stratford-on-Avon's 2022 ASR *'provides all of the information specified in the Guidance'*. The following comments were also made to inform the completion of future reports:

1. *Diffusion tube mapping is robust and clearly demonstrates the extend of the Council's monitoring network.*

There were no changes to the monitoring network in 2022.

2. *AQMA declaration dates noted in Table 2.1 do not match the information on the LAQM Portal and UK-AIR. Please confirm that the information on UK-AIR is correct.*

The information on UK-AIR and the LAQM Portal is correct at the time of reporting.

3. *The Council's decision to postpone revocation of the Stratford-upon Avon AQMA is supported, however a revised AQAP is encouraged to be developed whilst the AQMA remains in force.*

Given the ongoing compliance observed for both Studley and Stratford AQMAs in 2022, Stratford-on-Avon District Council intends to progress with revocation in 2023. This is in-line with the LAQM Technical Guidance (August 2022).

4. *Further to the above, there is limited evidence of progress made against AQAP measures in 2021. However, it is acknowledged that resourcing constraints post-covid have contributed significantly to the Council's ability to progress actions, and it is anticipated that the Council will be more able to progress measures in the next reporting year. It is however encouraging to see the Council have been actively and regularly facilitating discussions on emissions and concentrations of $PM_{2.5}$ and ways to reduce these.*

5. *The Council's NO_2 monitoring network is extensive, however the Council are encouraged to commence automatic monitoring of particulate matter if practicable in order to better inform decisions on tackling $PM_{2.5}$ pollution in particular.*

The establishment of AQMesh sensors within each AQMA has allowed for indicative measurements of PM_{10} and $PM_{2.5}$ for the monitoring year of 2022. These are outlined in the following section and discussed in further detail for $PM_{2.5}$ in Section 2.3.

6. *Comments from last year's ASR have been included and addressed. This is welcomed, and is encouraged in future ASRs.*
7. *Once again, the report is detailed, concise and satisfies the criteria of relevant standards. The Council should continue their good work.*

Stratford-on-Avon has taken forward a number of direct measures during the current reporting year of 2023 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2. Six measures are included within Table 2.2, with the type of measure and the progress Stratford-on-Avon have made during the reporting year of 2023 presented. Where there have been, or continue to be, barriers restricting the implementation of the measure, these are also presented within Table 2.2.

More detail on these measures can be found in the respective Action Plan: https://www.stratford.gov.uk/doc/206373/name/Draft%20Action%20Plan%20for%20Studley%20Oct%202008.pdf.

During the reporting year of 2023, Stratford-on-Avon purchased and installed two AQMesh sensors to enable monitoring of different areas of concern within the district. The AQMesh sensors are solar powered units that measure temperature and humidity and provide indicative measurements of NO_2 and particulate matter. One AQMesh sensor is located along Birmingham Road, (within the existing Stratford-on-Avon AQMA) and the other along Alcester Road (within the existing Studley AQMA). The locations were chosen to target areas where pollution is expected to be high, such as an area that experiences heavy traffic. The Council has also begun to live stream data from the sensors, which is available to view on their website at: https://www.stratford.gov.uk/environment/air-quality-monitors.cfm.

Over the course of the next reporting year, Stratford-on-Avon expects to continue the enabling of live stream of data on the internet to promote air quality issues, and the enhancement of Council webpage on air quality to include additional information for public on wood burners and clean burning.

Stratford-on-Avon's priorities for the coming year are to continue implementing and progressing measures where possible, but to also to make progress towards revocation of the Stratford-upon-Avon and Studley AQMAs.

Stratford-on-Avon worked to implement these measures in partnership with the following stakeholders during 2022:

- Local Authority Environmental Health;
- Local Authority Transport Department; and,
- Neighbouring local authorities who are members of the Coventry and Warwickshire Air Quality Alliance.

The principal challenges and barriers to implementation that Stratford-on-Avon District Council anticipates facing are continued constraints on resourcing.

Stratford-on-Avon District Council anticipates that the measures stated above and in Table 2.2 will help maintain and achieve compliance in both the Stratford-upon-Avon and Studley AQMAs.

Table 2.2 – Progress on Measures to Improve Air Quality

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
1	Adoption of Developer Requirements SPD including AQ chapter (Part R) an associated guidance	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	2019	2026	Stratford on Avon District Council	N/A	NO	Not Funded	-	Implementation	N/A	N/A	Implementation on going	-
2	Member of Coventry and Warwickshire Air Quality Alliance	Public Information	Via television		2015	Local Authority Environmental Health, Local Authority Transport Dept.	N/A	YES	Not Funded	-	Implementation	N/A	N/A	Implementation on-going	-
3	Enhancement of council webpage on AQ to include additional information for public on wood burners and clean burning etc	Public Information	Via the Internet	2022	2024	Stratford on Avon District Council	N/A	NO	Not Funded	-	Implementation	N/A	N/A	Implementation on-going	-
4	Purchase of AQMesh sensors to enable monitoring of different areas of concern within the district.	Public Information	Other	2022	2023	Stratford on Avon District Council	N/A	NO	Not Funded	-	Completed	N/A	N/A	Completed	-
5	Enabling of live stream of data on internet to promote AQ issues	Public Information	Via the Internet	2022	2023	Stratford on Avon District Council	N/A	NO	Not Funded	-	Implementation	N/A	N/A	Implementation on-going	-
6	Promote clear air initiatives via press releases and facebook	Public Information	Via other mechanisms	2022	2025	Stratford on Avon District Council	N/A	NO	Not Funded	-	Planning	N/A	N/A	Implementation on-going	-

2.3 $PM_{2.5}$ – Local Authority Approach to Reducing Emissions and/or Concentrations

As detailed in Policy Guidance LAQM.PG22 (Chapter 8), local authorities are expected to work towards reducing emissions and/or concentrations of $PM_{2.5}$ (particulate matter with an aerodynamic diameter of 2.5µm or less). There is clear evidence that $PM_{2.5}$ has a significant impact on human health, including premature mortality, allergic reactions, and cardiovascular diseases.

The Public Health Outcomes Framework data tool compiled by Public Health England quantifies the mortality burden of $PM_{2.5}$ (indicator D01) within England on a county and local authority scale. The 2021 fraction of mortality attributable to $PM_{2.5}$ pollution across England is 5.5%, as is the regional average for the West Midlands. In contrast, the fraction within the Stratford-on-Avon District Council is below both the national and regional average at 5.0%, which is slightly higher than the 2020 fraction of 4.9%. The 2021 fraction of mortality has been used as opposed to the 2022 fraction as the data has not been made available at the time of writing.

Stratford-on-Avon District Council has been following discussions relating to the updated WHO guidance levels for $PM_{2.5}$ and recent consultation documents from Defra in regard to the Environmental Targets. Stratford-on-Avon District Council remains part of the Coventry and Warwickshire Air Quality Alliance, where discussions on $PM_{2.5}$ have been part of the regular meetings. Two AQ Mesh monitoring pods have been purchased which measure and provide indicative $PM_{2.5}$ hourly and daily concentrations.

LAQM.TG(22) Table A.1 Action toolbox presents a list of measures that can be implemented to help reduce concentrations of $PM_{2.5}$. Measures which focus on improving vehicle flow, reducing car usage, and promoting the uptake of alternative fuels will likely lead to a reduction of both NO_x and $PM_{2.5}$ emissions.

Where required, Stratford on Avon District 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.

Although Stratford-on-Avon District Council does not have any smoke control areas, some guidance in relation to bonfires is provided on their website. The Council will also respond to nuisance complaints where an individual may be affected by smoke.

Indicative Measurements of $PM_{2.5}$ Concentrations Using Defra Background Maps

Defra 2021 background maps (based on 2018 monitored concentrations) can be used to identify the predicted background $PM_{2.5}$ concentrations across the UK. For Stratford-on-Avon District, all predicted $PM_{2.5}$ background concentrations are well below the indicative annual mean objective for $PM_{2.5}$ (20µg/m^3). The maximum predicted concentration is 10.9 µg/m^3, located within the 1 x 1km grid square with the centroid grid reference of 435500, 255500. This is an area to the east of the district, near to the B4100 and located east of the Lighthorne Heath industrial area. The industrial nature of this area will likely lead to higher $PM_{2.5}$ concentrations compared to the rest of the district. This is indicated in the background maps, whereby industrial sources are predicted to account for 2.4 µg/m^3 of the background concentration within this grid square, compared to the average of 0.01 µg/m^3 for the district. The main source contribution within this grid square is secondary PM (5.4 µg/m^3), which forms following reactions of other gaseous pollutants in the atmosphere, such as Nitrogen Oxides (NO_x) and Ammonia (NH_3). Ammonia in particular is likely to occur from agriculture, which is to be expected based on the rural nature of the surrounding areas.

Indicative Measurements of $PM_{2.5}$ from Monitoring Using AQMesh Sensors

Currently, the only monitoring of PM_{10} or $PM_{2.5}$ undertaken within Stratford-on-Avon District Council is by the recently established AQMesh sensors, which provide indicative measurements of $PM_{2.5}$ only.

During the 2022 monitoring year, the AQMesh sensors located within Stratford and Studley AQMAs were operational from the 11th April 2022 and the 17th August 2022 respectively.

For indicative measurement of $PM_{2.5}$ concentrations, only hourly recorded concentration values where the PM state was reported to be ‘OK’ were considered. Annual average $PM_{2.5}$ concentrations reported by the AQMesh sensors in Stratford and Studley were 5.05 µg/m^3 and 6.04 µg/m^3 respectively.

Figures A.3 and A.4 in Appendix A show the daily timeseries for indicative measurements of $PM_{2.5}$ and PM_{10} concentrations recorded by each AQMesh sensor. 24-hour averages were calculated from the reported hourly average concentrations, and were only included in the timeseries where daily data capture was greater than 85%.

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

This section sets out the monitoring undertaken within 2022 by Stratford-on-Avon District Council and how it compares with the relevant air quality objectives. In addition, monitoring results are presented for a five-year period between 2018 and 2022 to allow monitoring trends to be identified and discussed.

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

Stratford-on-Avon did not undertake any automatic (continuous) monitoring during 2022.

3.1.2 Non-Automatic Monitoring Sites

Stratford-on-Avon undertook non-automatic (i.e. passive) monitoring of NO_2 at 18 sites during 2022. Table A.1 in Appendix A presents the details of the non-automatic 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.

Maps showing the location of the monitoring sites are provided in Appendix D: Map(s) of Monitoring Locations and AQMAs.

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 (where the annual mean data capture is below 75% and greater than 25%), 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 non-automatic 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 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 2022 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.

All 2022 annual mean NO_2 concentrations reported in Stratford-on-Avon District were well below the annual mean NO_2 AQS objective of 40 µg/m^3, with the maximum annual mean reported being 28.1 µg/m^3 at DT ID 7 (located along Alcester Road in Stratford-on-Avon). The majority of sites (14 of 18) reported decreases in annual mean concentrations when compared with 2021 data, with an average decrease across all sites of 1.0 µg/m^3. The largest reported increase was 1.7 µg/m^3 at DT ID 15 (Stratford Background) and the largest decrease was 2.5 µg/m^3 at DT ID 5 (located along Alcester Road in Studley).

Fall-off with distance corrections have not been carried out at any site due to all monitoring locations reporting a concentration below 36 µg/m^3. Additionally, whilst no automatic monitoring of NO_2 is conducted within Stratford-on-Avon District, no diffusion tube monitoring location has reported a concentration greater than 60 µg/m^3. As per LAQM.TG(22), an annual average concentration of 60 µg/m^3 can be used as a proxy to identify areas where an exceedance of the 1-hour mean objective is likely to occur. As such, this indicates that there is unlikely to be any exceedances of the 1-hour mean objective within Stratford-on-Avon District at the monitored locations.

Studley AQMA

Within Studley AQMA, all sites reported decreases in annual mean NO_2 compared to 2021 data, with an average decrease of 1.6 µg/m^3. The highest concentration reported was 27.7 µg/m^3 at DT ID 6. This site is located next to a junction and traffic lights, so congestion in this area is likely the reason for increased NO_2 concentrations at this location, although the annual mean concentration remains well below the AQS objective. Excluding the years 2020 and 2021, which are considered anomalies due to the impact of the COVID-19 pandemic and nationally imposed lockdowns on emissions, this is the third year that

compliance has been maintained in Studley AQMA. According to the LAQM TG(22) Section 3.57, revocation of an AQMA based on diffusion tube monitoring should be considered after three consecutive years of annual mean NO_2 concentrations being lower than 36 µg/m^3 (i.e. within 10% of the annual mean NO_2 objective) to account for the inherent uncertainty associated with the monitoring method. Excluding 2020, which is considered an anomalous year due to the impact of the COVID-19 pandemic and nationally imposed lockdowns on emissions, this is the second year that Studley has reported no exceedances within 10% of the annual mean NO_2 objective. However, the LAQM.TG(22) Section 3.54 now states that "w*here 2020 is one of many consecutive years of compliance, this may be considered for revocation".* Including 2020, this is the third consecutive year that *c*ompliance with the 36 µg/m^3 objective has been maintained, and therefore revocation should be considered in 2023.

Stratford-on-Avon AQMA

Besides DT ID 15 (Stratford Background), only two sites reported small increases in annual mean NO_2 when compared to 2021 data: 0.2 µg/m^3 at DT ID 9 (Montague House) and 0.3 µg/m^3 at DT ID 14 (Windsor Street). All other sites reported decreases compared to 2021, with an average decrease of 1.3 µg/m^3. There have been no exceedances of the annual mean NO_2 AQS objective within this AQMA for the past five years, with concentrations being below 10% of the AQS objective (36 µg/m^3) for the past three years. Including the year 2020, this is the third consecutive year that *c*ompliance with the 36 µg/m^3 objective has been maintained, and therefore revocation should be considered in 2023.

Appendix A: Monitoring Results

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

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube Co-located with a Continuous Analyser?	Tube Height (m)
1	Studley Background	Roadside	407270	263025	NO_2	No	5.0	2.3	No	2.2
2	Studley 1	Roadside	407300	263989	NO_2	Y - Studley AQMA	0.0	2.5	No	2.5
3	Studley 2	Roadside	407301	263914	NO_2	Y - Studley AQMA	0.0	1.4	No	2.5
4	Studley 4	Roadside	407297	263850	NO_2	Y - Studley AQMA	0.0	1.5	No	2.5
5	Studley 11	Roadside	407297	263864	NO_2	Y - Studley AQMA	2.8	0.0	No	2.3
6	Studley 12	Roadside	407297	263838	NO_2	Y - Studley AQMA	1.5	2.0	No	1.8
7	Alcester Road 2	Roadside	419705	255022	NO_2	Y - Stratford Upon Avon AQMA (No 1)	4.6	3.0	No	2.5
8	Tiddington Rd	Roadside	420727	254826	NO_2	Y - Stratford Upon Avon AQMA (No 1)	0.0	1.7	No	2.2
9	Montague House	Roadside	420202	255101	NO_2	Y - Stratford Upon Avon AQMA (No 1)	3.8	2.5	No	2.0
10	Greenhill St 2	Roadside	419794	255014	NO_2	Y - Stratford Upon Avon AQMA (No 1)	2.0	3.0	No	2.2
11	Grove Road 2	Roadside	419757	254918	NO_2	Y - Stratford Upon Avon AQMA (No 1)	0.0	1.4	No	2.5
12	Evesham Place	Roadside	419685	254604	NO_2	Y - Stratford Upon Avon AQMA (No 1)	0.0	3.0	No	1.8
13	Arden Street 2	Roadside	419797	255178	NO_2	Y - Stratford Upon Avon AQMA (No 1)	2.0	2.2	No	2.0
14	Windsor Street	Roadside	419923	255076	NO_2	Y - Stratford Upon Avon AQMA (No 1)	0.0	5.0	No	1.8

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube Co-located with a Continuous Analyser?	Tube Height (m)
15	Stratford Background	Roadside	418820	255117	NO_2	Y - Stratford Upon Avon AQMA (No 1)	3.0	2.0	No	2.2
16	Birmingham Road 3	Roadside	419816	255601	NO_2	Y - Stratford Upon Avon AQMA (No 1)	3.0	1.5	No	2.2
17	Birmingham Road 7	Roadside	419828	255576	NO_2	Y - Stratford Upon Avon AQMA (No 1)	0.0	7.0	No	1.7
18	Birmingham Road 8	Roadside	419813	255611	NO_2	Y - Stratford Upon Avon AQMA (No 1)	0.0	7.0	No	1.7

Notes:

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

(2) N/A if not applicable

Table A.2 – Annual Mean NO_2 Monitoring Results: Non-Automatic Monitoring (µg/m^3)

Diffusion Tube ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
1	407270	263025	Roadside	99.5	99.5	13.5	12.6	9.3	9.4	9.4
2	407300	263989	Roadside	99.5	99.5	31.0	31.1	22.9	24.2	22.5
3	407301	263914	Roadside	99.5	99.5	32.3	30.2	22.4	24.9	23.2
4	407297	263850	Roadside	99.5	99.5	38.0	37.6	26.7	27.6	26.6
5	407297	263864	Roadside	99.5	99.5	-	-	25.1	29.2	26.7
6	407297	263838	Roadside	99.5	99.5	-	-	27.0	29.0	27.7
7	419705	255022	Roadside	99.5	99.5	-	35.0	26.1	29.5	28.1
8	420727	254826	Roadside	91.8	91.8	33.7	33.3	22.5	23.8	22.1
9	420202	255101	Roadside	99.5	99.5	-	-	16.9	19.1	19.3
10	419794	255014	Roadside	99.5	99.5	-	-	21.4	23.4	22.3
11	419757	254918	Roadside	91.5	91.5	33.5	34.3	23.6	24.2	22.9
12	419685	254604	Roadside	99.5	99.5	-	-	17.7	18.9	18.2
13	419797	255178	Roadside	99.5	99.5	-	-	20.3	22.0	20.1
14	419923	255076	Roadside	99.5	99.5	-	-	13.1	14.6	14.9
15	418820	255117	Roadside	99.5	99.5	12.8	11.5	8.7	9.3	11.0
16	419816	255601	Roadside	99.5	99.5	37.2	37.1	26.0	28.4	28.0
17	419828	255576	Roadside	99.5	99.5	-	-	19.7	22.1	21.3
18	419813	255611	Roadside	80.5	80.5	-	-	19.9	22.5	20.3

☐ **Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG22.**

☒ **Diffusion tube data has been bias adjusted.**

☒ **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 correction.**

Notes:

The annual mean concentrations are presented as µg/m^3.

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**.

Means for diffusion tubes have been corrected for bias. All means have been “annualised” as per LAQM.TG22 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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

(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%).

Figure A.1 – Trends in Annual Mean NO_2 Concentrations: Stratford-on-Avon

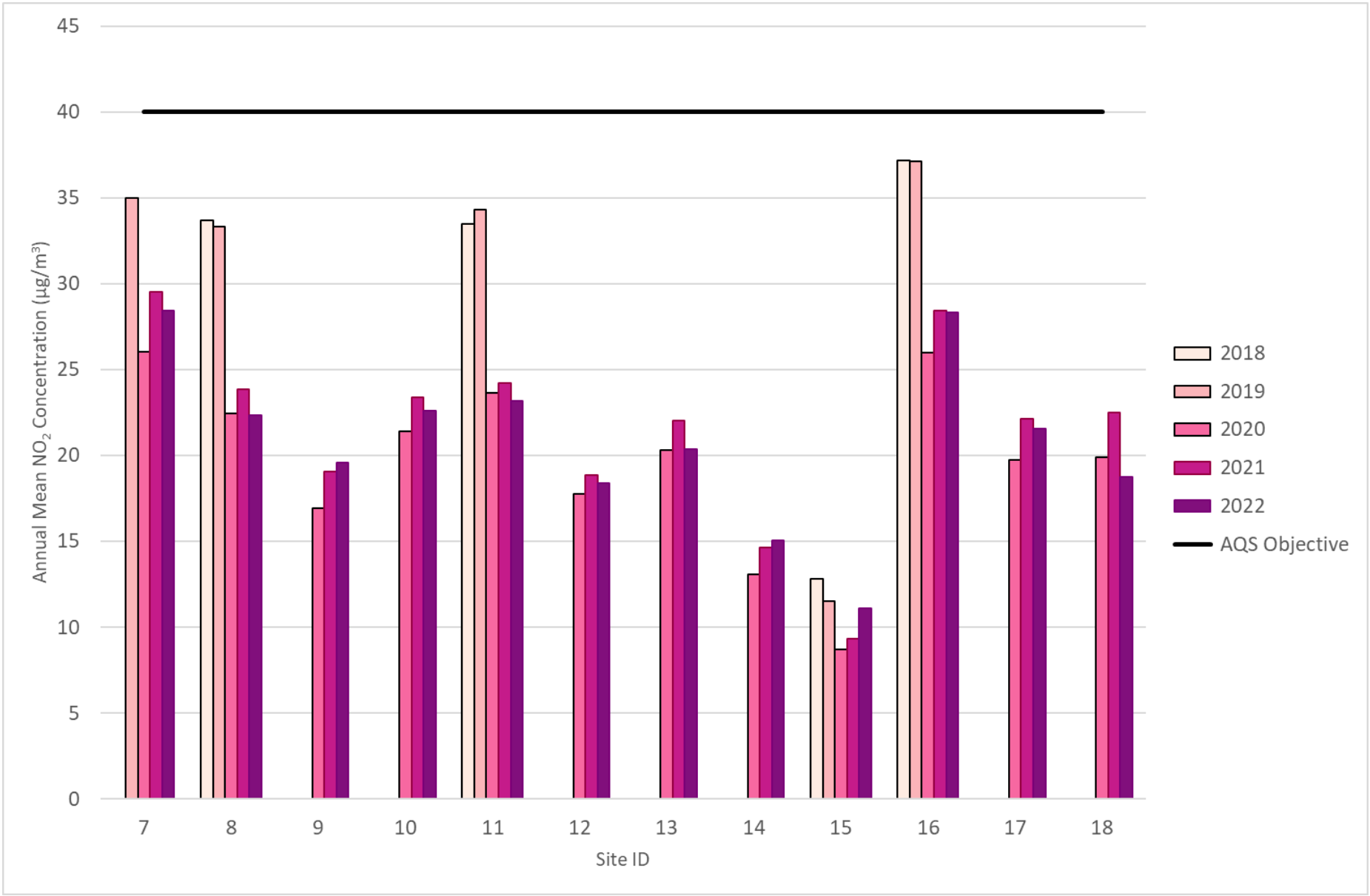


Figure A.2 – Trends in Annual Mean NO_2 Concentrations: Studley

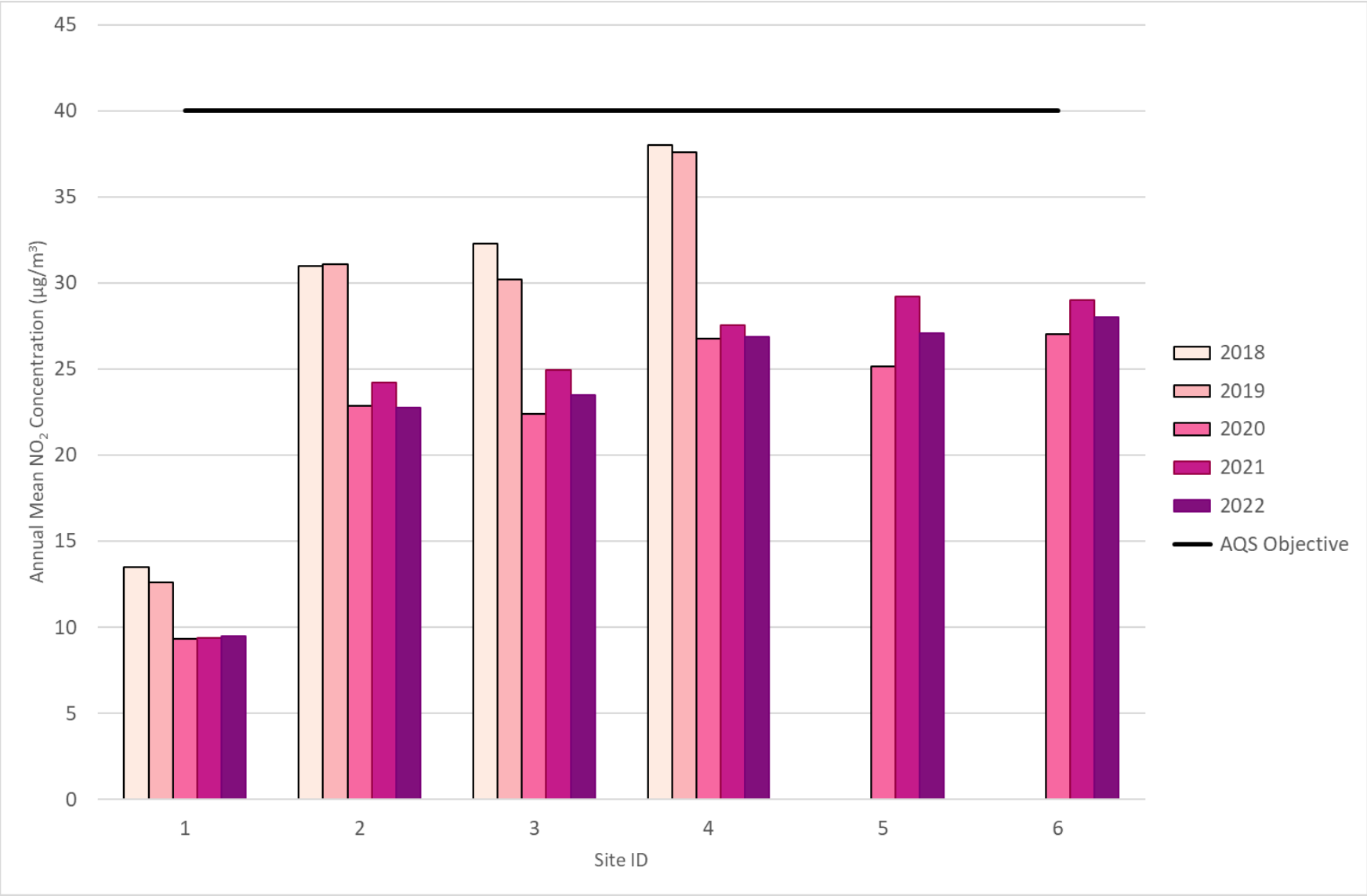


Figure A.3 – Daily Indicative Timeseries for PM_{10} and $PM_{2.5}$ recorded by Studley AQMesh Sensor

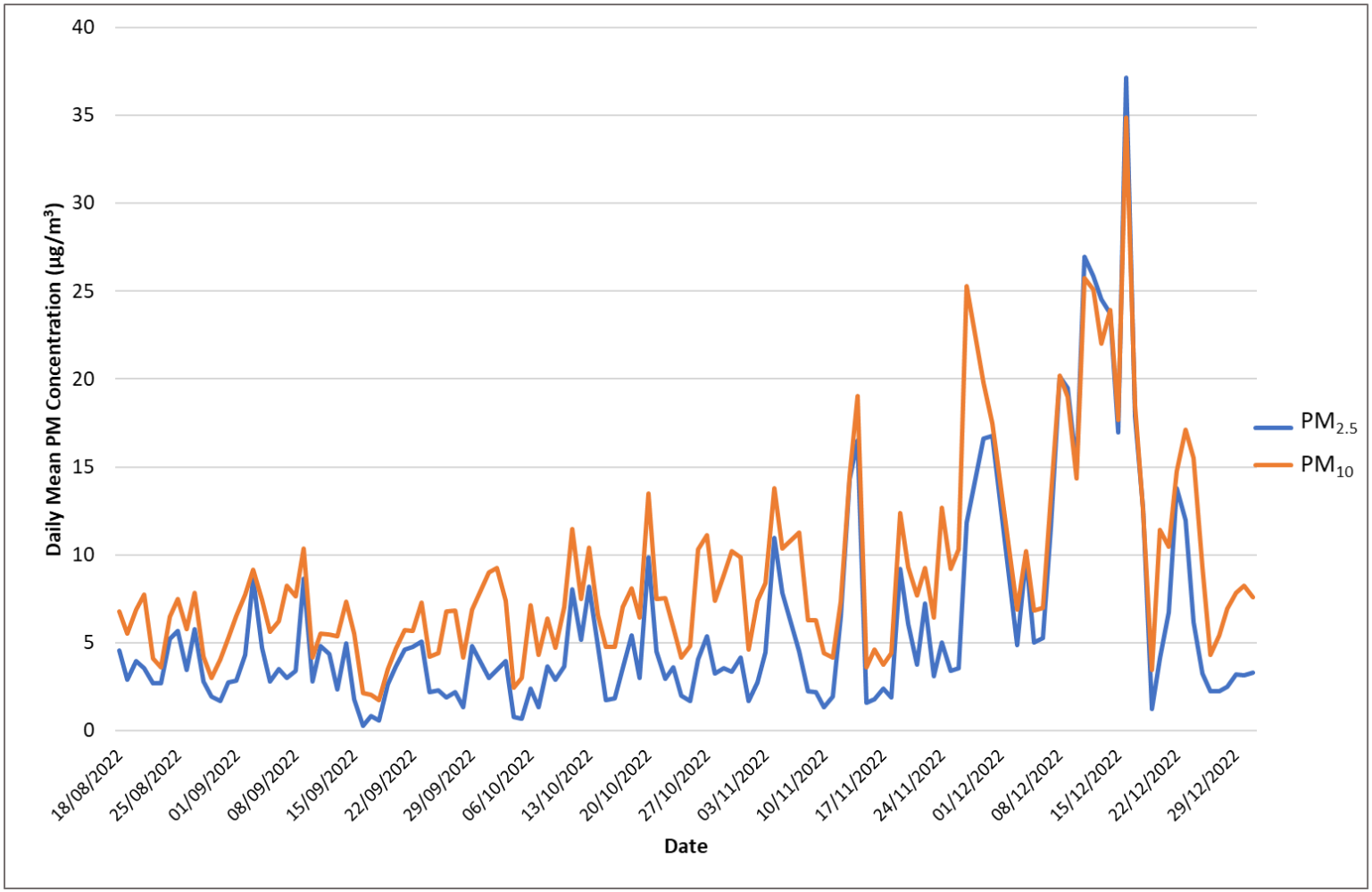


Figure A.4 – Daily Indicative Timeseries for PM_{10} and $PM_{2.5}$ recorded by Studley AQMesh Sensor

Appendix B: Full Monthly Diffusion Tube Results for 2022

Table B.1 – NO_2 2022 Diffusion Tube Results (µg/m^3)

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted (0.83)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
1	407270	263025	18.6	7.8	16.7	9.1	6.2	7.0	5.4	10.7	11.5	9.3	12.3	21.1	11.3	9.4	-	
2	407300	263989	33.2	19.3	34.6	26.2	23.9	24.0	18.2	31.4	30.1	25.7	28.3	30.4	27.1	22.5	-	
3	407301	263914	35.9	23.2	36.3	27.5	23.9	24.0	16.2	30.1	29.7	24.8	30.6	33.4	28.0	23.2	-	
4	407297	263850	35.4	23.2	**41.3**	33.7	26.9	27.8	17.3	36.5	35.0	32.1	34.8	39.9	32.0	26.6	-	
5	407297	263864	39.4	23.3	**44.9**	33.2	26.0	26.4	19.0	33.9	35.9	31.2	32.8	**40.6**	32.2	26.7	-	
6	407297	263838	**40.5**	22.9	**47.2**	35.1	27.3	26.6	17.3	**40.1**	35.7	30.5	34.7	**42.6**	33.4	27.7	-	
7	419705	255022	**41.2**	29.5	38.6	32.7	24.7	34.9	24.2	37.8	**40.4**	31.9	31.2	39.2	33.9	28.1	-	
8	420727	254826	36.3	23.5	32.3	26.4	16.9	25.4		30.7	10.5	27.3	30.0	33.7	26.6	22.1	-	
9	420202	255101	31.5	17.0	31.1	19.6	27.3	15.2	12.5	21.2	32.9	20.1	22.3	28.9	23.3	19.3	-	
10	419794	255014	35.3	24.6	23.0	23.9	24.6	27.3	18.8	25.9	22.4	28.6	31.8	36.4	26.9	22.3	-	
11	419757	254918	**40.2**	27.0	28.6	24.5	19.8	24.5	17.1	27.0		30.8	26.1	38.2	27.6	22.9	-	
12	419685	254604	35.9	10.3	23.5	20.4	24.9	17.0	13.7	20.4	26.0	20.9	21.4	28.2	21.9	18.2	-	
13	419797	255178	36.2	21.6	31.5	22.2	15.0	16.2	19.0	24.0	23.8	24.1	24.8	32.8	24.3	20.1	-	
14	419923	255076	25.9	15.7	21.5	15.5	5.6	14.3	11.2	16.3	25.4	19.8	19.2	24.7	17.9	14.9	-	
15	418820	255117	19.5	9.7	15.0	8.9	27.6	5.1	6.1	8.7	18.5	8.9	11.5	19.1	13.2	11.0	-	
16	419816	255601	**45.0**	27.6	**43.0**	33.3	19.6	26.7	21.3	39.3	39.5	33.7	35.3	40.5	33.7	28.0	-	
17	419828	255576	32.2	18.4	30.4	21.5	**40.5**	17.4	15.5	26.5	25.9	24.9	25.1	29.8	25.7	21.3	-	
18	419813	255611	30.2	18.7	33.1			19.6	14.3	25.1	25.6	23.4	26.5	28.6	24.5	20.3	-	

☒ **All erroneous data has been removed from the NO_2 diffusion tube dataset presented in Table B.1.**

☒ **Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG22.**

☐ **Local bias adjustment factor used.**

☒ **National bias adjustment factor used.**

☒ **Where applicable, data has been distance corrected for relevant exposure in the final column.**

☒ **Stratford-on-Avon confirm that all 2022 diffusion tube data has been uploaded to the Diffusion Tube Data Entry System.**

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**.

See Appendix C for details on bias adjustment and annualisation.

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

New or Changed Sources Identified Within Stratford-on-Avon District During 2023

Stratford-on-Avon have identified a number of previously approved large developments that have now commenced which have the potential to impact air quality:

- 18/01061/REM - Land to the North and West of Bishopton Lane, Stratford upon Avon - erection of 500 dwellings.
- 19/02827/REM - 381 dwellings.
- 18/01892/OUT - Long Marston Airfield, 3100 new homes, 2 x schools, mixed use employment land.
- Gaydon/Lighthorne Heath - 3000 houses.
- Stratford upon Avon Canal Quarter - 500 houses.

Additional Air Quality Works Undertaken by Stratford-on-Avon District Council During 2023

Stratford-on-Avon has not completed any additional works within the reporting year of 2023.

QA/QC of Diffusion Tube Monitoring

Stratford-on-Avon District Council's diffusion tubes were supplied and analysed by Gradko International Ltd during 2022, using the 20% Triethanolamine (TEA) in water preparation method. Gradko's laboratory is UKAS accredited, participating in the AIR-PT Scheme (a continuation of the Workplace Analysis Scheme for Proficiency (WASP)) for NO_2 tube analysis and the Annual Field Inter-Comparison Exercise. These provide strict performance criteria for participating laboratories to meet, thereby ensuring NO_2 concentrations reported are of a high caliber. The lab follows the procedures set out in the Harmonisation Practical Guidance. During 2022 Gradko participated in the AIR PT programme and obtained a 100% rating for AIR-PT AR049 (January – February 2022) and a 100% rating for AIR-PT AR050 (May – June 2022). The July 2022 – December 2022

results have not yet been published at the time of writing. Results for the AIR-PT programme can be found at: https://laqm.defra.gov.uk/wp-content/uploads/2022/07/LAQM-NO2-Performance-data_Up-to-June-2022_V2.1.pdf.

All 27 local authority co-location studies which use tubes supplied by Gradko with the 20% TEA in water preparation method in 2022 were rated as 'good', as shown by the precision summary results. This precision reflects the laboratory's performance and consistency in preparing and analysing the tubes, as well as the subsequent handling of the tubes in the field. Tubes are considered to have a "good" precision where the coefficient of variation of duplicate or triplicate diffusion tubes for eight or more monitoring periods during a year is less than 20%.

Diffusion tube monitoring during 2022 was undertaken in line with the Diffusion Tube Monitoring Calendar and recommended exposure period (5 weeks (+/- 4 days)).

Diffusion Tube Annualisation

All diffusion tube monitoring locations operated by Stratford-on-Avon District Council recorded data capture of at least 75% therefore it was not required to annualise any monitoring data. In addition, any sites with a data capture below 25% do not require annualisation.

Diffusion Tube Bias Adjustment Factors

The diffusion tube data presented within the 2023 ASR have been corrected for bias using an adjustment factor. Bias represents the overall tendency of the diffusion tubes to under or over-read relative to the reference chemiluminescence analyser. LAQM.TG22 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.

Stratford-on-Avon District Council have applied a national bias adjustment factor of 0.83 to the 2022 monitoring data. A summary of bias adjustment factors used by Stratford-on-Avon District Council over the past five years is presented in Table C.1.

Table C.1 – Bias Adjustment Factor

Monitoring Year	Local or National	If National, Version of National Spreadsheet	Adjustment Factor
2022	National	03/23	0.83
2021	National	03/22	0.84
2020	National	03/21	0.81
2019	National	03/20	0.93
2018	National	03/19	0.93

National Diffusion Tube Bias Adjustment Factor Spreadsheet

National Diffusion Tube Bias Adjustment Factor Spreadsheet — Spreadsheet Version Number: 03/23

Follow the steps below **in the correct order** to show the results of **relevant** co-location studies
Data only apply to tubes exposed monthly and are not suitable for correcting individual short-term monitoring periods
Whenever presenting adjusted data, you should state the adjustment factor used and the version of the spreadsheet
This spreadhseet will be updated every few months: the factors may therefore be subject to change. This should not discourage their immediate use.

This spreadsheet will be updated at the end of June 2023
LAQM Helpdesk Website

The LAQM Helpdesk is operated on behalf of Defra and the Devolved Administrations by Bureau Veritas, in conjunction with contract partners AECOM and the National Physical Laboratory.

Spreadsheet maintained by the National Physical Laboratory. Original compiled by Air Quality Consultants Ltd.

Step 1: Select the Laboratory that Analyses Your Tubes from the Drop-Down List
If a laboratory is not shown, we have no data for this laboratory.

Step 2: Select a Preparation Method from the Drop-Down List
If a preparation method is not shown, we have no data for this method at this laboratory.

Step 3: Select a Year from the Drop-Down List
If a year is not shown, we have no data[2]

Step 4:
Where there is only one study for a chosen combination, you should use the adjustment factor shown with caution.
Where there is more than one study, use the overall factor[3] shown in blue at the foot of the final column.
If you have your own co-location study then see footnote[4]. If uncertain what to do then contact the Local Air Quality Management Helpdesk at LAQMHelpdesk@bureauveritas.com or 0800 0327953

Analysed By[1]	Method (To undo your selection, choose (All) from the pop-up list)	Year[2] (To undo your selection, choose (All))	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) (µg/m³)	Automatic Monitor Mean Conc. (Cm) (µg/m³)	Bias (B)	Tube Precision[4]	Bias Adjustment Factor (A) (Cm/Dm)
Gradko	20% TEA in water	2022	R	Blackburn With Darwen Bc	12	26	19	35.0%	G	**0.74**
Gradko	20% TEA in water	2022	R	Gedling Borough Council	12	31	26	19.9%	G	**0.83**
Gradko	20% TEA in water	2022	R	Ards And North Down Borough Council	12	33	22	49.4%	G	**0.67**
Gradko	20% TEA in water	2022	R	Bath & North East Somerset	12	30	25	19.0%	G	**0.84**
Gradko	20% TEA in water	2022	R	Birmingham City Council	11	32	24	36.8%	G	**0.73**
Gradko	20% TEA in water	2022	UB	East Devon District Council	12	8	7	23.6%	G	**0.81**
Gradko	20% TEA in water	2022	R	Gateshead Council	11	23	20	14.2%	G	**0.88**
Gradko	20% TEA in water	2022	R	Gateshead Council	12	23	21	12.7%	G	**0.89**
Gradko	20% TEA in water	2022	R	Gateshead Council	12	25	23	10.1%	G	**0.91**
Gradko	20% TEA in water	2022	R	Gateshead Council	11	30	23	29.0%	G	**0.77**
Gradko	20% TEA in water	2022	R	Gateshead Council	9	31	36	-14.0%	G	**1.16**
Gradko	20% TEA in Water	2022	R	Lisburn & Castlereagh City Council	12	24	19	23.7%	G	**0.81**
Gradko	20% TEA in Water	2022	R	Monmouthshire County Council	12	35	28	23.8%	G	**0.81**
Gradko	20% TEA in water	2022	KS	Marylebone Road Intercomparison	12	52	42	22.8%	G	**0.81**
Gradko	20% TEA in Water	2022	UB	Plymouth City Council	12	18	18	3.2%	G	**0.97**
Gradko	20% TEA in water	2022	UC	Belfast City Council	12	26	20	30.7%	G	**0.76**
Gradko	20% TEA in water	2022	R	Belfast City Council	12	47	36	28.1%	G	**0.78**
Gradko	20% TEA in water	2022	R	Belfast City Council	12	25	22	14.0%	G	**0.88**
Gradko	20% TEA in water	2022	R	Belfast City Council	12	36	28	29.0%	G	**0.78**
Gradko	20% TEA in water	2022	R	Brighton & Hove City Council	10	37	23	62.8%	G	**0.61**
Gradko	20% TEA in water	2022	UB	Hertsmere Borough Council	12	16	15	7.1%	G	**0.93**
Gradko	20% TEA in water	2022	R	Southampton City Council	12	36	28	30.6%	G	**0.77**
Gradko	20% TEA in water	2022	UC	Southampton City Council	12	28	24	15.4%	G	**0.87**
Gradko	20% TEA in water	2022	R	Southampton City Council	12	34	31	8.4%	G	**0.92**
Gradko	20% TEA in water	2022	R	Worcestershire	11	13	12	4.2%	G	**0.96**
Gradko	20% TEA in water	2022	R	Lancaster City Council	13	34	27	25.8%	G	**0.79**
Gradko	20% TEA in water	2022	R	Lancaster City Council	12	28	24	15.2%	G	**0.87**
Gradko	20% TEA in water	2022		**Overall Factor[3] (27 studies)**				Use		**0.83**

NO_2 Fall-off with Distance from the Road

Wherever possible, monitoring locations are representative of exposure. However, where this is not possible, the NO_2 concentration at the nearest location relevant for exposure has been estimated using the Diffusion Tube Data Processing Tool/NO_2 fall-off with

distance calculator available on the LAQM Support website. Where appropriate, non-automatic annual mean NO_2 concentrations corrected for distance are presented in Table B.1.

No diffusion tube NO_2 monitoring locations within Stratford-on-Avon required distance correction during 2022, as all annual mean bias adjusted NO_2 concentrations were below 36 µg/m^3 (10% of the AQS Objective).

Appendix D: Map(s) of Monitoring Locations and AQMAs

Figure D.1 – Map of Non-Automatic Monitoring Sites: Stratford-on-Avon

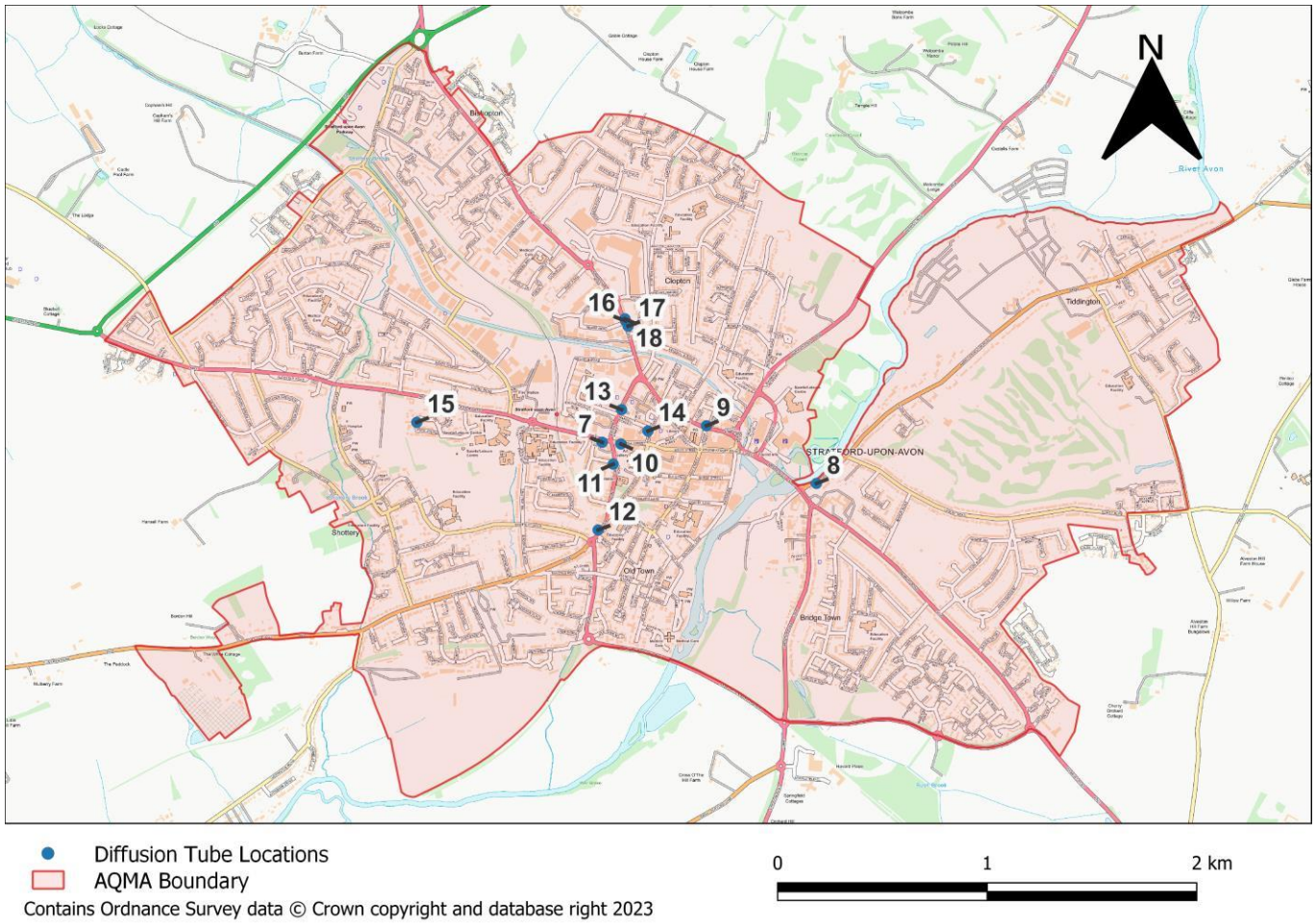
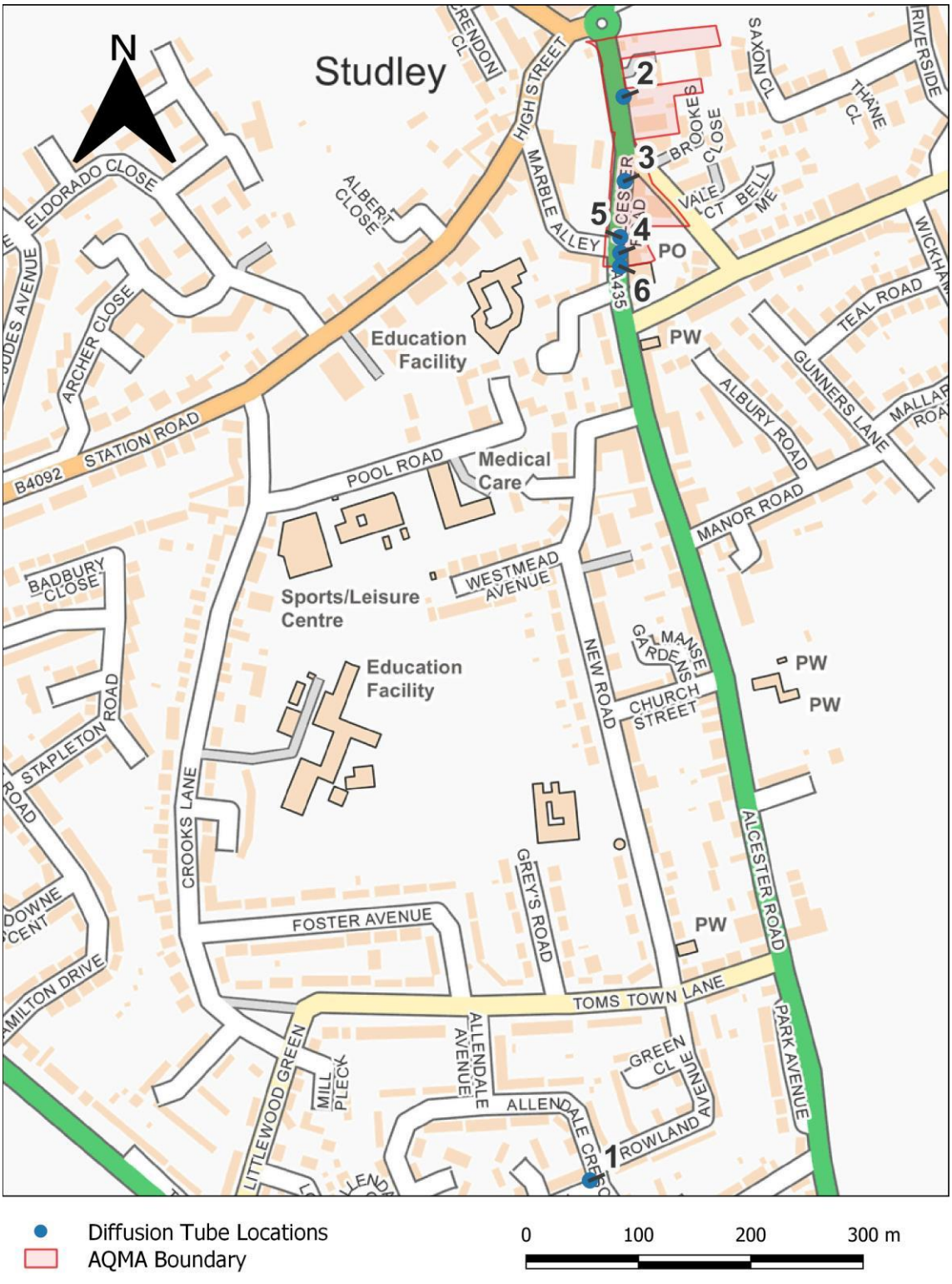


Figure D.2 – Map of Non-Automatic Monitoring Sites: Studley



Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England[7]

Pollutant	Air Quality Objective: Concentration	Air Quality Objective: Measured as
Nitrogen Dioxide (NO_2)	200µg/m^3 not to be exceeded more than 18 times a year	1-hour mean
Nitrogen Dioxide (NO_2)	40µg/m^3	Annual mean
Particulate Matter (PM_{10})	50µg/m^3, not to be exceeded more than 35 times a year	24-hour mean
Particulate Matter (PM_{10})	40µg/m^3	Annual mean
Sulphur Dioxide (SO_2)	350µg/m^3, not to be exceeded more than 24 times a year	1-hour mean
Sulphur Dioxide (SO_2)	125µg/m^3, not to be exceeded more than 3 times a year	24-hour mean
Sulphur Dioxide (SO_2)	266µg/m^3, not to be exceeded more than 35 times a year	15-minute mean

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

Glossary of Terms

Abbreviation	Description
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the local authority intends to achieve air quality limit values'
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
ASR	Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by National Highways
EU	European Union
FDMS	Filter Dynamics Measurement System
LAQM	Local Air Quality Management
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
PM_{10}	Airborne particulate matter with an aerodynamic diameter of 10µm or less
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
QA/QC	Quality Assurance and Quality Control
SO_2	Sulphur Dioxide

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