Stratford-on-Avon District Council

Annual Status Report 2022

Bureau Veritas

June 2022

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Document Control Sheet

Identification	
Client	Stratford-on-Avon District Council
Document Title	2022 Annual Status Report
Bureau Veritas Ref No.	14595301/UK/v1.0

Contact Details		
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Configuration				
Version	**Date**	**Author**	**Reason for Issue/Summary of Changes**	**Status**
V1.0	18/05/2022	A Smith	Draft for comment	Draft

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2022 Air Quality Annual Status Report (ASR)

In fulfilment of Part IV of the Environment Act 1995

Local Air Quality Management

Date: June, 2022

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Date	June 2022

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 28,000 to 36,000 deaths at typical ages[3], with a total estimated healthcare cost to the NHS and social care of £157 million in 2017[4].

During 2021, no exceedances of the annual mean NO_2 Air Quality Strategy (AQS) objective were reported at any of the monitoring locations operated by Stratford-on-Avon District Council, nor were any of the annual mean NO_2 concentrations within 10% of the objective (36µg/m^3). The maximum reported concentration was 29.5µg/m^3 at Alcester Road 2.

Where monitoring data is available for more than two years, annual mean NO_2 concentrations show an overall decreasing trend. Concentrations at all sites are higher than what was reported in 2020, however this is to be expected due to the easing of UK Government enforced COVID-19 restrictions.

Compliance continues to be maintained for at least five years, where no exceedances of the annual mean NO_2 AQS objective have been reported within the Stratford-upon-Avon AQMA. Concentrations within the Studley AQMA have remained to be below the annual mean NO_2 AQS objective for the past four years. As 2020 was an atypical year, and one

[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, July 2021

[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

site (Studley 4) was reporting concentrations within 10% of the AQS objective in 2018 and 2019. This will remain under review.

Actions to Improve Air Quality

Whilst air quality has improved significantly in recent decades, and will continue to improve due to national policy decisions, there are some areas where local action is needed to improve air quality further.

The 2019 Clean Air Strategy[5] sets out the case for action, with goals to reduce exposure to harmful pollutants. The Road to Zero[6] sets out the approach to reduce exhaust emissions from road transport through a number of mechanisms; this is extremely 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. In addition there is an aim is to create a common approach to planning across Coventry and Warwickshire. Discussions on emissions and concentrations of $PM_{2.5}$ and ways to reduce these have been regularly discussed within these meetings during 2021.

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 includes:

[5] Defra. Clean Air Strategy, 2019

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

- Annual mean NO_2 concentrations at all monitoring sites operated by Stratford-on-Avon District Council are well below the AQS objective of 40µg/m^3;
- Overall there is a downward trend in annual mean NO_2 concentrations;
- Reviewing the 2022 monitoring data once available
- Continue to monitor NO_2 within the current AQMAs, so any future changes in NO_2 concentration can be observed;
- Continue to review the monitoring network and deploy new diffusion tube monitoring sites in areas where elevated NO_2 concentrations could potentially be; and
- 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.

Local Engagement and How to get Involved

As the main source of air pollution within Stratford-on-Avon is from transport sources, a way for the public to get involved with helping improving air quality within the area would be to look at alternatives to the way they travel.

The following are suggested alternatives to private travel that would help contribute to improving the air quality within the district of 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 road and therefore the amount of emissions being released. 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 Council participated in Clean Air Day 2021. As part of this, two new AQMesh pods were installed at the Thomas Jolyffe Primary School in Stratford-upon-Avon. This was used to demonstrate to students and their parents how pollution levels can vary throughout the day, and to encourage alternative and sustainable modes of transport. Stratford-on-Avon District Council have published a news article on the events.

Local Responsibilities and Commitment

This ASR was prepared by the Bureau Veritas on behalf of the Environmental Health Department of Stratford-on-Avon District Council with the support and agreement of the following officers and departments:

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Benjamin Ellis

This ASR has been approved by: 

Paul Reid, Licensing and Environmental Health Manger

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1 Local Air Quality Management

This report provides an overview of air quality in Stratford-on-Avon District during 2021. 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 Stratford-on-Avon District Council 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..

A summary of AQMAs declared by Stratford-on-Avon District Council can be found in Table 2.1. The table presents a description of the 2 AQMAs that are currently designated within Stratford-on-Avon District. Appendix D: Maps of Monitoring Locations and AQMAs provides maps of AQMAs and also the air quality monitoring locations in relation to the AQMAs. Information on the AQMAs is also available on the UK-AIR website. The air quality objectives pertinent to the current AQMA designations are as follows:

- NO_2 annual mean.

We propose to continue to monitor to see whether revocation of the AQMA is appropriate given the A-typical data from the last couple of years.

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 National Highways?	Level of Exceedance: Declaration	Level of Exceedance: Current Year	Name and Date of AQAP Publication	Web Link to AQAP
Studley AQMA	Declared 23rd February 2006	NO2 Annual Mean	A number of properties along a 200m stretch of Alcester Road from the junction with High Street.	NO	62µg/m^3	29.2µg/m^3	AQAP, published 2008	Visit the AQAP for the Studley AQMA
AQMA Stratford Upon Avon	Declared 21st January 2010	NO2 Annual Mean	An area encompassing most developed areas of Stratford Upon Avon and Tiddington.	NO	45µg/m^3	29.5µg/m^3	No AQAP currently published	-

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

☒ **Stratford-on-Avon District Council 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:

1. Robust and accurate QA/QC procedures were applied. Calculations for bias adjustment and annualisation factors were outlined.
2. The Council has included discussion and review of its AQMAs and clear table of the monitoring strategy, including removed and new locations in 2020, in the district. We welcome the reviewing of the tubes to expand the monitoring network to provide data. This demonstrates the Councils proactive and dedicated approach to improving air quality across the area.
3. Comments from last year's ASR have been mentioned and addressed. This is welcomed, and we encourage this to continue in future ASRs.
4. However, the need for an updated AQAP was mentioned in last 2 years' ASR appraisal, and we note that some progress has been made on this, although it has been delayed due to Covid-19. The Council is encouraged to adopt the revised AQAP in the next reporting year.
5. It is recommended that the Stratford upon Avon AQMA should be revoked as soon as possible. All monitoring sites indicate that concentrations are far below objective levels and have been for more than five years. This revocation is supported.
6. The Council has an extensive NO_2 monitoring strategy. Monitoring of other pollutants, while not compulsory, could be considered to better inform how to tackle $PM_{2.5}$ pollution particularly.
7. The Public Health Outcomes Frameworks was mentioned. The Council have referred specifically to indicator D01, which is the fraction of mortality attributable to particulate air pollution, and this is encouraged.
8. Council have provided a clear map of the diffusion tube monitoring network; trends are displayed and discussed in the report, this is welcomed.
9. Overall the report is detailed, concise and satisfies the criteria of relevant standards. The Council should continue their good and thorough work.

Stratford-on-Avon District Council intends to maintain the standard of reporting that has been achieved in previous years. Revoking the AQMA has not been perused during 2021.

Due to constraints on the Council's resources and a shift in Council priorities following the COVID-19 pandemic, progress on measures to improve air quality has been limited. Details of all measures completed, in progress or planned are set out in Table 2.2. 5 measures are included within Table 2.2, with the type of measure and the progress Stratford-on-Avon District Council have made during the reporting year of 2022 presented. Where there have been, or continue to be, barriers restricting the implementation of the measure, these are also presented within Table 2.2.

Stratford-on-Avon District Council's Air Quality Supplementary Planning Document (SPD) continues to be implemented, providing guidance for developments on how to reduce and minimise emissions, and where necessary, offset the impact on the environment. The Council is also planning on enhancing the air quality webpage to include additional information for the public on green transport, EV charging points, wood burners and clean burning, etc. Alongside this, AQMesh sensors have been purchased to enable indicative monitoring of pollutants in areas of different concern within the district. Live data is also intended to be published on the website to promote air quality issues.

Stratford-on-Avon District Council expects the enhancement of the air quality webpages to be completed over the course of the next reporting year and display live data as reported form the AQMeshes. Stratford-on-Avon District Council's priorities for the coming year are to continue implementing and progressing measures where possible.

Stratford-on-Avon District Council worked to implement these measures in partnership with the following stakeholders during 2021:

- Warwickshire County Council; 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	Estimated / Actual Completion Year	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	Implementation of AQ SPD	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	Funding and changing of priorities/resourcing because of the COVID-19 pandemic
2	Adoption of Developer Requirements SPD including AQ chapter (Part R)	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	-	2019	Stratford-on-Avon District Council	N/A	No	Not funded	-	Completed	N/A	N/A	Fully adopted and ongoing implementatiion	-
3	Member of Coventry and Warwickshire Air Quality Alliance	Policy Guidance and Development Control	Regional Groups Co-ordinating programmes to develop Area wide Strategies to reduce emissions and improve air quality	-	2026	Warwickshire County Council Public Health.	N/A	No	Not funded	-	Implementation	N/A	N/A	Implementation on-going	Funding and changing of priorities/resourcing because of the COVID-19 pandemic
4	Enhancement of council webpage on AQ to include additional information for public on green transport, EV charging points, wood burners and clean burning etc	Public Information	Via the Internet	2021	2022	Stratford-on-Avon District Council	N/A	NO	Not Funded	-	Planning	N/A	N/A	Planning	-
5	Purchase of AQMesh sensors to enable monitoring of different areas of concern within the district. Will also enable live stream of data on internet to promote AQ issues	Public Information	Via the Internet	2021	2027	Stratford-on-Avon District Council	Developers Infrastructure Funding	NO	Fully funded	-	Implementation	-	-	Implementation on-going	IT support to get information on the website

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

As detailed in Policy Guidance LAQM.PG16 (Chapter 7), local authorities are expected to work towards reducing emissions and/or concentrations of $PM_{2.5}$ (particulate matter with an aerodynamic diameter of 2.5µm or less). There is clear evidence that $PM_{2.5}$ has a significant impact on human health, including premature mortality, allergic reactions, and cardiovascular diseases.

Currently, there is no monitoring of PM_{10} or $PM_{2.5}$ undertaken within Stratford-on-Avon District Council. Therefore, no monitored or estimated concentrations can be reported on. Although the new AQMESH pods will provide some indicative data for next years report.

The 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 11.1µg/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 2.4µg/m^3 of the background concentration within this grid square, compared to the average of 0.01µg/m^3 for the district. The main source contribution within this grid square is secondary PM (5.5µg/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.

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 2020 fraction of mortality attributable to $PM_{2.5}$ pollution across England is 5.6%, slightly higher than the regional average for the West Midlands (5.4%). In contrast, the fraction within the Stratford-on-Avon District Council is below both the national and regional average at 4.9%. This is slightly higher than the 2019 fraction of

4.8%. The 2020 fraction of mortality has been used as opposed to the 2021 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 still remains to be 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 $PM_{2.5}$ concentrations.

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

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

This section sets out the monitoring undertaken within 2021 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 2017 and 2021 to allow monitoring trends to be identified and discussed.

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

Stratford-on-Avon District Council did not undertake and automatic (continuous) monitoring during 2021.

3.1.2 Non-Automatic Monitoring Sites

Stratford-on-Avon District Council undertook non- automatic (i.e. passive) monitoring of NO_2 at 18 sites during 2021. Table A.1 in Appendix A presents the details of the non-automatic sites. One site, Alcester 3, was discontinued during 2020 due to housing renovations taking place. It was intended that this site would be re-instated during 2021 once these had been completed, however these were not completed until mid-2021 by which point a full year's data would not have been gained. This site will be redeployed in 2022.

Stratford-on-Avon District Council carries out a review of the monitoring network each year, and it was decided that no changes to any other sites are required in 2021. This was chiefly due to the uncertainty around the impact of the COVID-19 pandemic on the 2020 monitoring data.

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

3.2 Individual Pollutants

The air quality monitoring results presented in this section are, where relevant, adjusted for bias, annualisation (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 monitored NO_2 annual mean concentrations for the past five years with the air quality objective of 40µg/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 2021 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 2021 annual mean NO_2 concentrations reported in Stratford-on-Avon District are well below the annual mean NO_2 AQS objective of 40µg/m^3. All monitoring locations have reported an increase when compared to the 2020 concentrations, by an average of 1.8µg/m^3. The minimum increase is 0.1µg/m^3 at the Studley Background site and the maximum is 4.1µg/m^3 at Studley 11. This is to be expected, as due to the COVID-19 pandemic, traffic flows were observed to have decreased significantly during 2020. Despite this, all monitoring locations continue to report annual mean NO_2 concentrations lower than that observed prior to 2020 (where monitoring sites were present). This continues to fit the observation that NO_2 concentrations have been continually decreasing across the district over the past five years.

Within the declared AQMAs specifically, the maximum reported annual mean NO_2 concentration in the Stratford-on-Avon AQMA in 2021 is 29.5µg/m^3 at Alcester Road 2. This site also reported the maximum annual mean NO_2 concentration in 2020 (26.1µg/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 (36µg/m^3) for the past two years.

Within the Studley AQMA, the maximum reported annual mean NO_2 concentration is 29.2µg/m^3 at Studley 11. Studley 4 had reported the maximum annual mean NO_2

concentration in 2020 (26.7µg/m^3), and until 2021, had historically reported the maximum annual mean NO_2 concentration within this AQMA. Despite this, no exceedance has been reported for the past four years, and concentrations have been below 10% of the AQS objective (36µg/m^3) for the past two years.

Fall-off with distance corrections have not been carried out at any site due to all monitoring locations reporting a concentration below 36µg/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 60µg/m^3. As per LAQM.TG(16), an annual average concentration of 60µg/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.

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)
Studley Background	-	Roadside	407270	263025	NO_2	No	5.0	2.3	No	2.2
Studley 1	-	Roadside	407300	263989	NO_2	Y - Studley AQMA	0.0	2.5	No	2.5
Studley 2	-	Roadside	407301	263914	NO_2	Y - Studley AQMA	0.0	1.4	No	2.5
Studley 4	-	Roadside	407297	263850	NO_2	Y - Studley AQMA	0.0	1.5	No	2.5
Studley 11	-	Roadside	407297	263864	NO_2	Y - Studley AQMA	2.8	0.0	No	2.3
Studley 12	-	Roadside	407297	263838	NO_2	Y - Studley AQMA	1.5	2.0	No	1.8
Alcester Road 2	-	Roadside	419705	255022	NO_2	Y - Stratford Upon Avon AQMA (No 1)	4.6	3.0	No	2.5
Tiddington Rd	-	Roadside	420727	254826	NO_2	Y - Stratford Upon Avon AQMA (No 1)	0.0	1.7	No	2.2
Montague House	-	Roadside	420202	255101	NO_2	Y - Stratford Upon Avon AQMA (No 1)	3.8	2.5	No	2.0
Greenhill St 2	-	Roadside	419794	255014	NO_2	Y - Stratford Upon Avon AQMA (No 1)	2.0	3.0	No	2.2

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)
Grove Road 2	-	Roadside	419757	254918	NO_2	Y - Stratford Upon Avon AQMA (No 1)	0.0	1.4	No	2.5
Evesham Place	-	Roadside	419685	254604	NO_2	Y - Stratford Upon Avon AQMA (No 1)	0.0	3.0	No	1.8
Arden Street 2	-	Roadside	419797	255178	NO_2	Y - Stratford Upon Avon AQMA (No 1)	2.0	2.2	No	2.0
Windsor Street	-	Roadside	419923	255076	NO_2	Y - Stratford Upon Avon AQMA (No 1)	0.0	5.0	No	1.8
Stratford Background	-	Roadside	418820	255117	NO_2	Y - Stratford Upon Avon AQMA (No 1)	3.0	2.0	No	2.2
Birmingham Road 3	-	Roadside	419816	255601	NO_2	Y - Stratford Upon Avon AQMA (No 1)	3.0	1.5	No	2.2
Birmingham Road 7	-	Roadside	419828	255576	NO_2	Y - Stratford Upon Avon AQMA (No 1)	0.0	7.0	No	1.7
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 2021 (%) [2]	2017	2018	2019	2020	2021
Studley Background	407270	263025	Roadside	89.5	89.5	-	13.5	12.6	9.3	9.4
Studley 1	407300	263989	Roadside	97.2	97.2	30.3	31.0	31.1	22.9	24.2
Studley 2	407301	263914	Roadside	97.2	97.2	32.3	32.3	30.2	22.4	24.9
Studley 4	407297	263850	Roadside	89.3	89.3	**40.3**	38.0	37.6	26.7	27.6
Studley 11	407297	263864	Roadside	89.5	89.5	-	-	-	25.1	29.2
Studley 12	407297	263838	Roadside	88.2	88.2	-	-	-	27.0	29.0
Alcester Road 2	419705	255022	Roadside	78.2	78.2	-	-	35.0	26.1	29.5
Tiddington Rd	420727	254826	Roadside	81.8	81.8	34.0	33.7	33.3	22.5	23.8
Montague House	420202	255101	Roadside	84.8	84.8	-	-	-	16.9	19.1
Greenhill St 2	419794	255014	Roadside	97.2	97.2	-	-	-	21.4	23.4
Grove Road 2	419757	254918	Roadside	97.2	97.2	33.2	33.5	34.3	23.6	24.2
Evesham Place	419685	254604	Roadside	97.2	97.2	-	-	-	17.7	18.9
Arden Street 2	419797	255178	Roadside	79.6	79.6	-	-	-	20.3	22.0

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 2021 (%) (2)	2017	2018	2019	2020	2021
Windsor Street	419923	255076	Roadside	97.2	97.2	-	-	-	13.1	14.6
Stratford Background	418820	255117	Roadside	97.2	97.2	-	12.8	11.5	8.7	9.3
Birmingham Road 3	419816	255601	Roadside	97.2	97.2	-	37.2	37.1	26.0	28.4
Birmingham Road 7	419828	255576	Roadside	97.2	97.2	-	-	-	19.7	22.1
Birmingham Road 8	419813	255611	Roadside	97.2	97.2	-	-	-	19.9	22.5

☒ **Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG16.**

☒ **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.TG16 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-upon-Avon

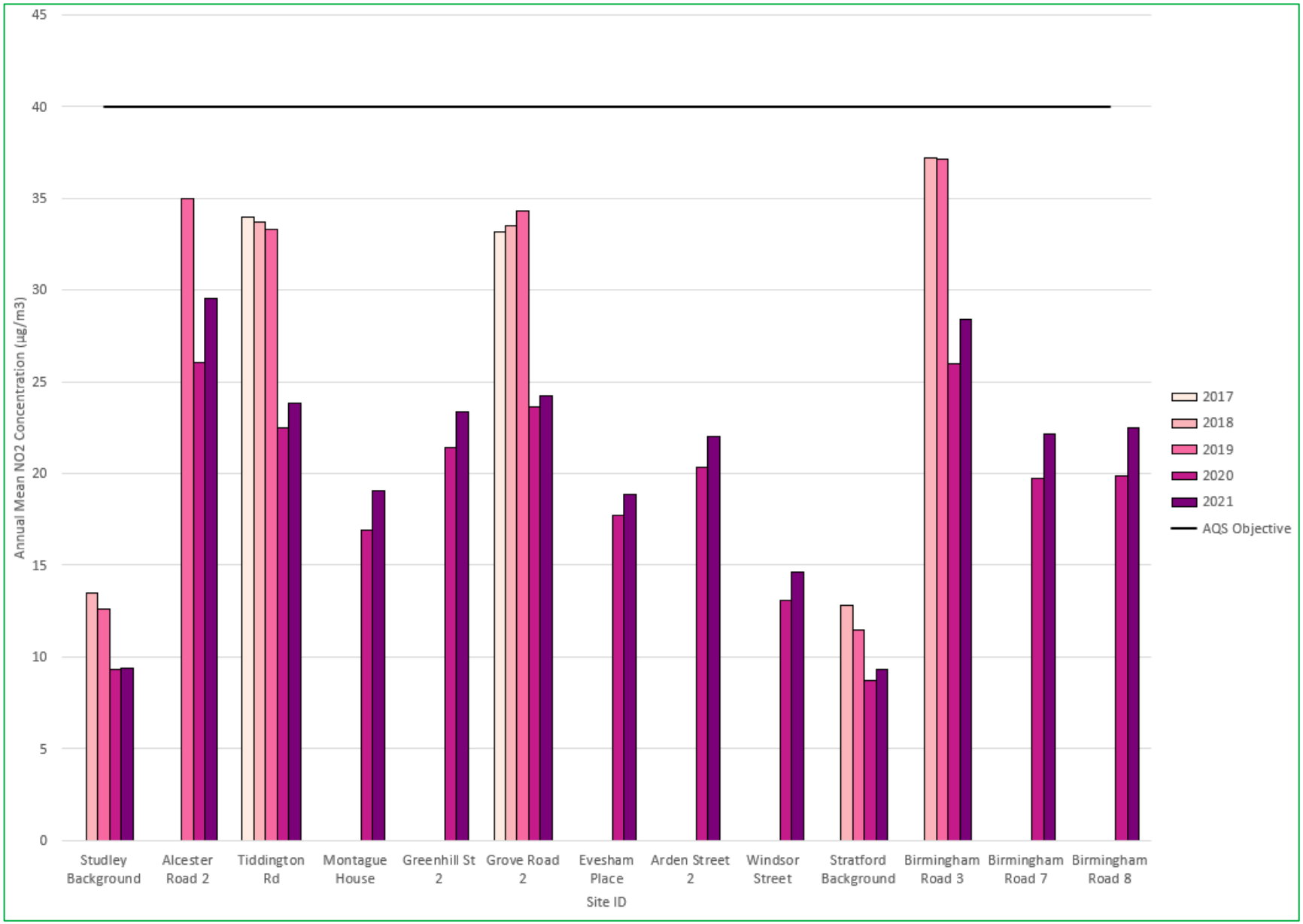
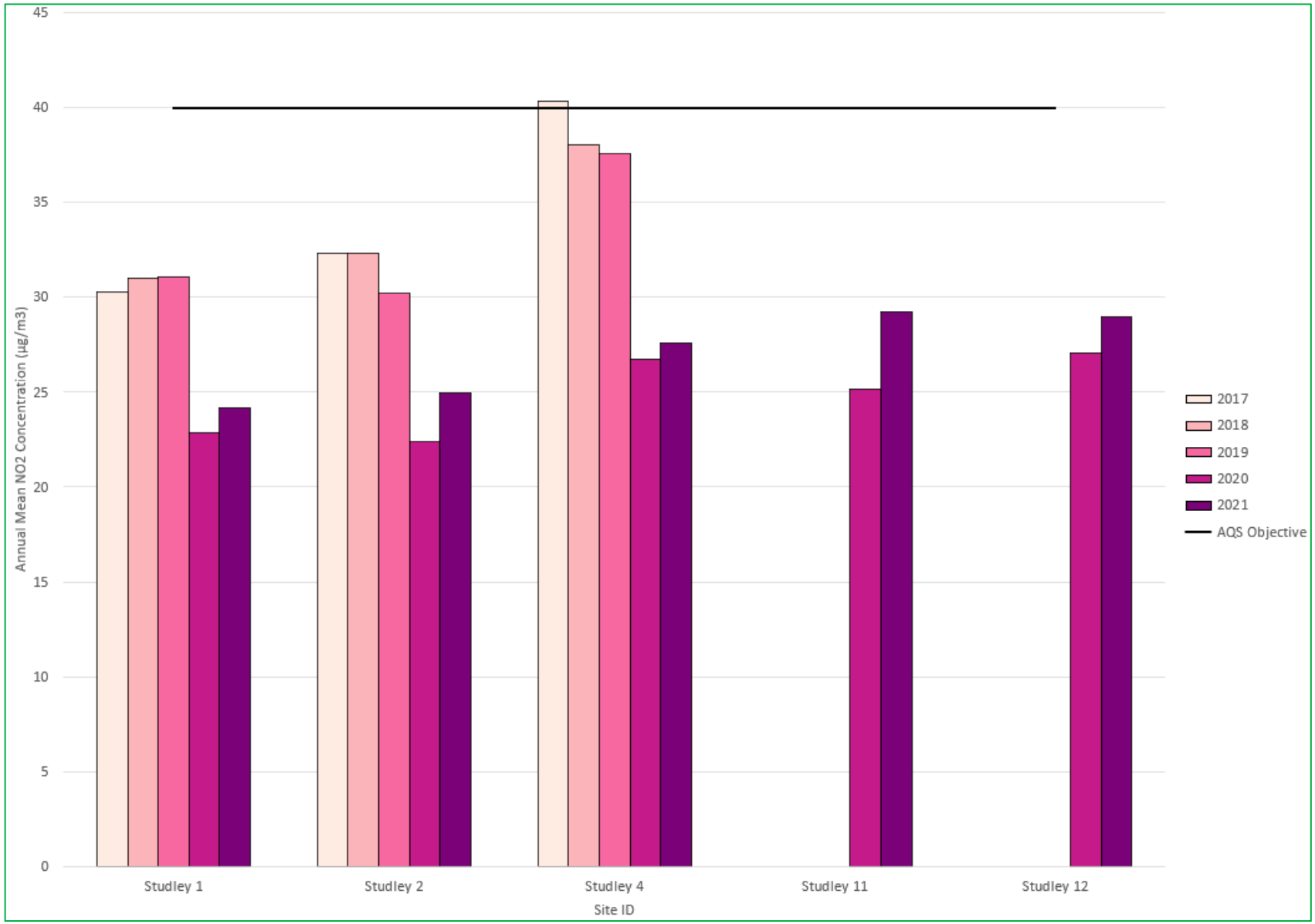


Figure A.2 – Trends in Annual Mean NO_2 Concentrations – Studley



Appendix B: Full Monthly Diffusion Tube Results for 2021

Table B.1 – NO_2 2021 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[1]	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted (0.84)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
Studley Background	407270	263025	15.4	13.6	12.7	15.0	8.1		8.5	7.4	-	9.5	15.5	9.2	11.2	9.4	-	
Studley 1	407300	263989	29.7	29.9	25.1	29.1	31.2	26.1	30.2	29.7	-	27.5	31.6	26.3	28.8	24.2	-	
Studley 2	407301	263914	32.2	31.2	28.5	31.3	30.4	25.9	30.4	28.1	-	28.7	32.3	28.1	29.7	24.9	-	
Studley 4	407297	263850	12.2		34.1	42.4	36.0	31.1	35.4	30.1	-	33.6	38.1	32.7	32.8	27.6	-	
Studley 11	407297	263864	35.5	37.5	32.6	37.3	38.4		35.8	32.5	-	32.6	35.9	31.1	34.8	29.2	-	
Studley 12	407297	263838	30.0	37.8	34.3	38.9	35.6	31.7	35.3	33.4	-		34.2	33.4	34.5	29.0	-	
Alcester Road 2	419705	255022	35.6	36.5	33.8	36.5	35.5	31.3		33.8	-		40.1	33.8	35.2	29.5	-	
Tiddington Rd	420727	254826			22.2	28.4	30.7	28.0	31.2	29.0	-	27.1	28.2	29.1	28.4	23.8	-	
Montague House	420202	255101	25.8	22.5	26.1	23.3	20.9	17.0	18.7		-	21.2	28.6	23.9	22.7	19.1	-	
Greenhill St 2	419794	255014	31.9	27.3	26.1	22.6	31.2	24.6	26.5	23.2	-	30.2	34.7	30.8	27.8	23.4	-	
Grove Road 2	419757	254918	27.9	25.4	27.2	24.7	28.8	27.5	26.3	29.5	-	29.8	37.5	32.7	28.8	24.2	-	
Evesham Place	419685	254604	25.7	20.9	23.9	21.1	21.5	21.5	20.1	19.3	-	23.3	29.0	23.2	22.5	18.9	-	
Arden Street 2	419797	255178	29.8	27.3	24.2			20.9	27.5	22.9	-	24.7	32.0	28.2	26.2	22.0	-	
Windsor Street	419923	255076	20.1	15.9	16.0	15.4	16.1	15.7	16.8	12.3	-	19.8	24.7	20.8	17.4	14.6	-	
Stratford Background	418820	255117	15.6	14.5	12.2	12.3	7.4	7.7	6.8	9.0	-	9.3	16.1	13.3	11.1	9.3	-	
Birmingham Road 3	419816	255601	38.8	37.9	33.8	32.2	35.9	32.1	34.8	22.1	-	35.3	41.2	34.5	33.8	28.4	-	
Birmingham Road 7	419828	255576	29.8	32.1	25.3	28.3	24.7	23.3	21.2	23.7	-	25.4	31.2	27.4	26.4	22.1	-	
Birmingham Road 8	419813	255611	28.4	28.4	24.6	24.3	24.5	21.6	24.1	35.7	-	25.1	28.2	26.2	26.8	22.5	-	

☒ **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.TG16.**

☐ **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 District Council confirm that all 2021 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.

(1) The diffusion tubes for the August monitoring period were left over-exposed for a total of 45 days compared to what is recommended by the LAQM Diffusion Tube Calendar (28 days). As a result, no tubes were deployed in September. These concentrations have been included in the calculation of annual averages as they appear to representative of concentrations in these locations reported in previous monitoring years.

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

New or Changed Sources Identified Within Stratford-on-Avon District During 2022

Stratford-on-Avon District Council has not identified any new sources relating to air quality within the reporting year of 2022. It should however be noted that developments which have been approved in previous years are now under construction.

Additional Air Quality Works Undertaken by Stratford-on-Avon District Council During 2022

Stratford-on-Avon has not completed any additional works within the reporting year of 2022.

QA/QC of Diffusion Tube Monitoring

Stratford-on-Avon District Council's diffusion tubes were supplied and analysed by Gradko International Ltd during 2021, 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. In the latest available AIR-PT results, AIR PT AR042 (January – March 2021), Gradko scored 25%. Currently no additional results have been published for 2021. The percentage score reflects the results deemed to be satisfactory based upon the z-score of $< \pm 2$.

All 32 local authority co-location studies which use tubes supplied by Gradko with the 20% TEA in water preparation method in 2021 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%.

Monitoring in 2021 had largely been completed in adherence with the 2021 Diffusion Tube Monitoring Calendar, whereby most changeovers were completed within ±2 days of the specified date. The only deviation from this was in August and September, whereby the August tubes were left over exposed until the 20th of September (the LAQM Diffusion Tube Calendar recommends a changeover on the 1nd of September 2021), and as a result no tubes were deployed in September. The changeover was missed due to staff absences. Despite this, the annual averages have been calculated using the LAQM Diffusion Tube Data Processing Tool (DTDPT) which calculates a time-weighted average of when the tubes have been exposed rather than being calculated based on the discrete individual monthly periods.

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 2022 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.TG16 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 0.84 to the 2021 monitoring data (from the National Diffusion Tube Bias Adjustment Factor Spreadsheet, version 03/22). This factor is based on 32 co-location studies, all of which are reported to have good data precision. Stratford-on-Avon District Council does not conduct any co-location studies; therefore a local factor cannot be derived.

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
2021	National	03/22	0.84
2020	National	03/21	0.81
2019	National	03/20	0.93
2018	National	03/19	0.93
2017	National	03/18	0.89

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 2021, as all annual mean bias adjusted NO_2 concentrations were below 36µg/m^3 (10% of the AQS Objective).

Appendix D: Maps of Monitoring Locations and AQMAs

Figure D.1 – Map of Monitoring Sites in the Stratford-upon-Avon AQMA

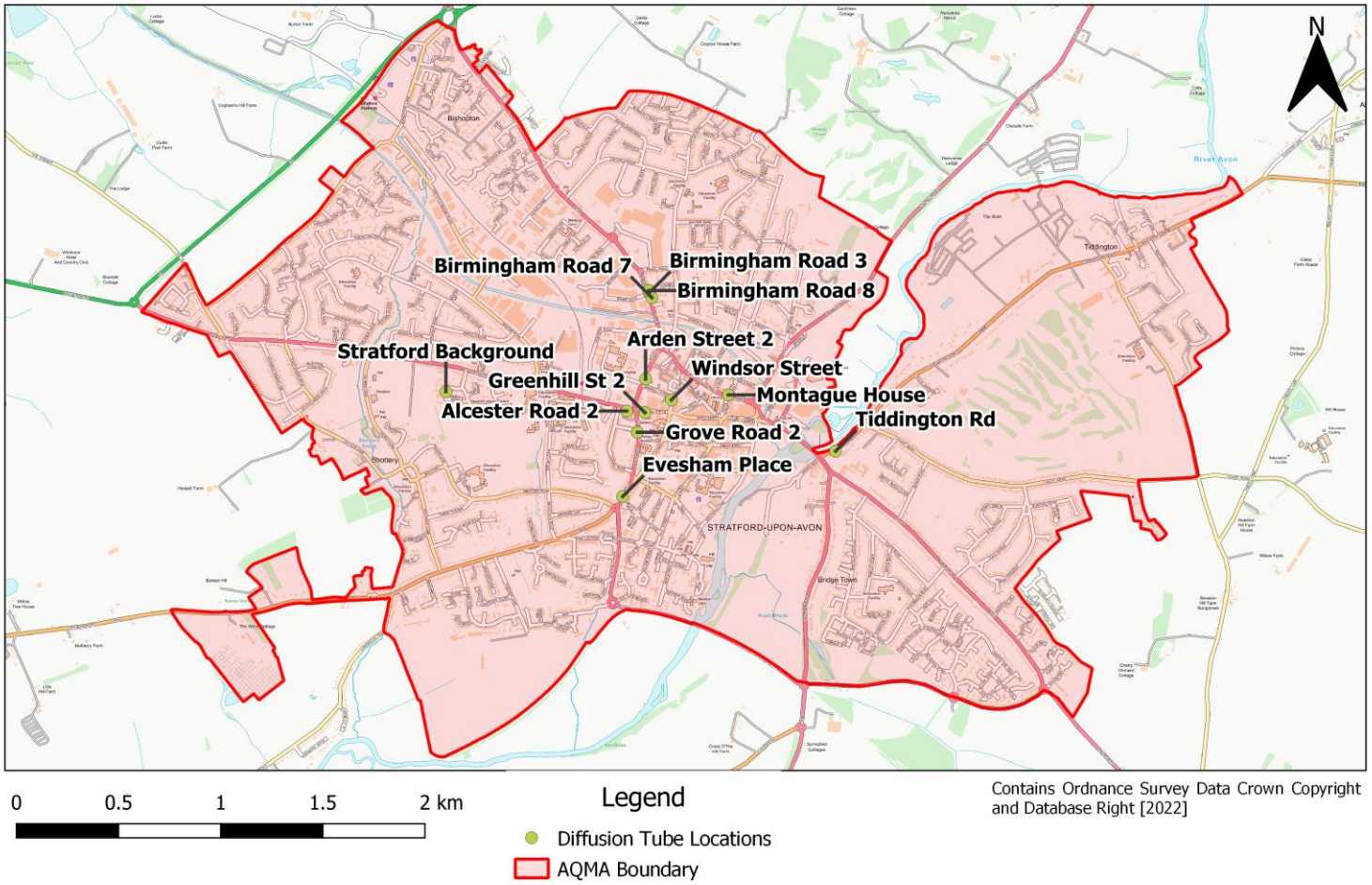
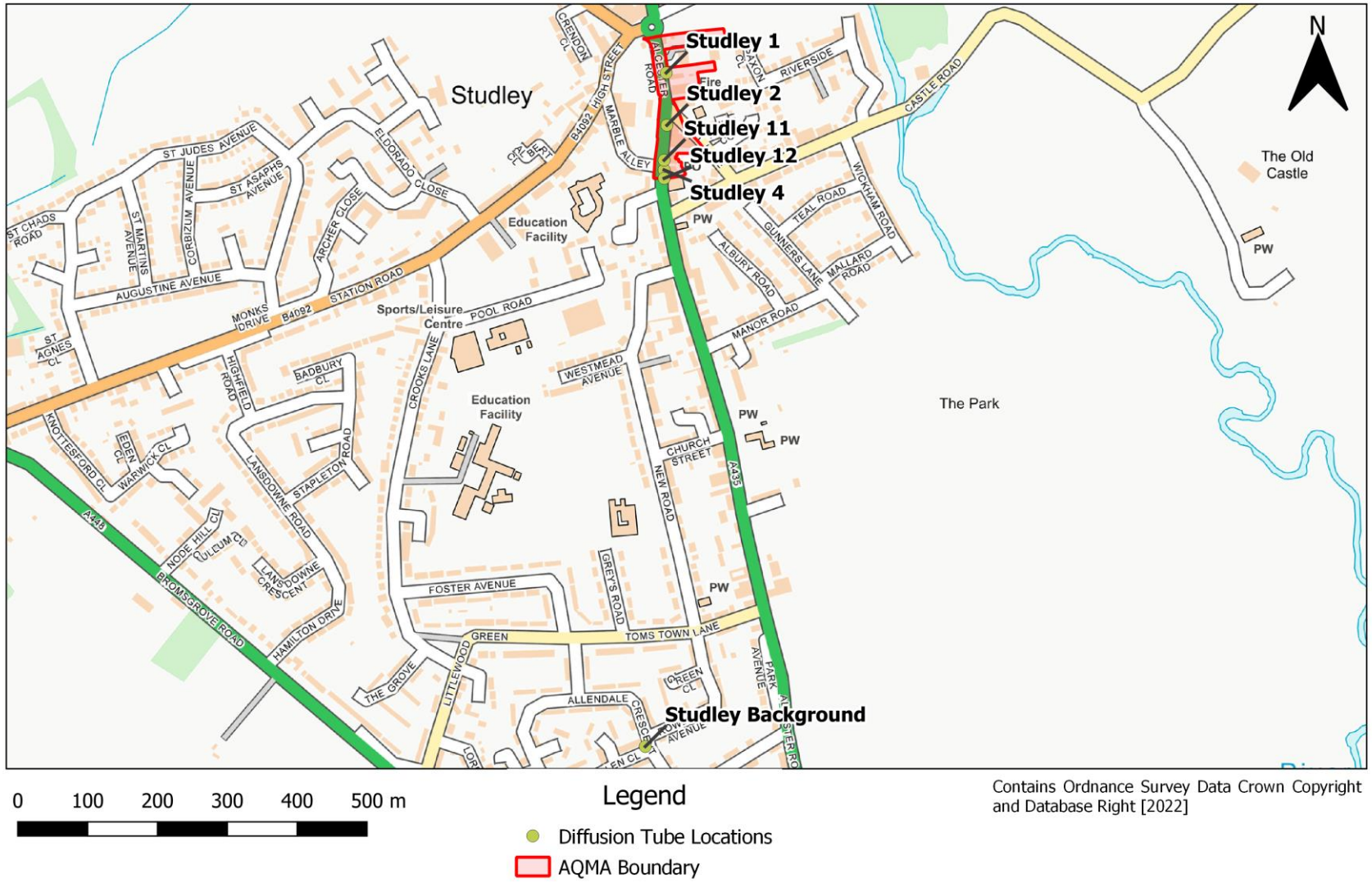


Figure D.2 – Map of Monitoring Sites and the AQMA boundary within Studley



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

References

- Local Air Quality Management Technical Guidance LAQM.TG16. April 2021. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.
- Local Air Quality Management Policy Guidance LAQM.PG16. May 2016. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.
- Stratford on Avon District Council, 2008 Draft Air Quality Action Plan.
- Stratford on Avon District Council 2021 Annual Status Report.
- Stratford on Avon District Council 2020 Annual Status Report.
- Stratford on Avon District Council 2019 Annual Status Report.
- Stratford on Avon District Council 2018 Annual Status Report.
- National Diffusion Tube Bias Adjustment Factor Spreadsheet, version 03/22 published in March 2022.