BEDFORD BOROUGH COUNCIL

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 Bedford

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].

Air quality in Bedford Borough is mostly very good, however, there are locations where pollutants build up and are slow to disperse due to traffic volumes and road traffic routes with unfavourable layouts/local geography.

The main pollutant of concern in Bedford Borough is Nitrogen dioxide (NO_2), the primary source of which is road traffic emissions. Bedford has several strategic transport routes including the A1, A421 and A6 which carry high levels of traffic. Traffic routes are constrained in and around the town centre by river, road and rail bridges, and one-way traffic systems have evolved in response to pinch points created by these constraints. This combined with high levels of car ownership and use results in congestion hotspots.

In 2022, Bedford Borough Council were undertaking air quality monitoring for NO_2 at two automatic sites and at 51 passive diffusion tube sites. The 2022 monitoring results have determined that there are no exceedances of the annual mean NO_2 objective at diffusion tube sites within the Borough, with 42 diffusion tube results lower than those in 2021 and seven showing an increase. The increases can be explained in part by the High Street

[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

being re-opened following its closure for a large part of 2021 which had resulted in lower levels than usual for that year which increased again in 2022 once re-opened.

Two Earthsense Zephyr air quality monitors have been situated on Ampthill Rd since 2021 just outside the AQMA (locations indicated on the maps in Appendix D). It is understood that results from such monitors should not be included within the formal reporting for this return however these can provide indicative data for particulate matter in the area.

The annual mean during 2022 for PM10 at the monitor closest to the AQMA (Britannia Rd) was 11.6 µg/m^3 and PM2.5 annual average 7.9 µg/m^3. The second monitor measured PM10 of 12.9 µg/m^3 with a single 24 hour mean (PM10) over 50 µg/m^3 with PM2.5 annual mean of 8.4 µg/m^3.

The current air quality objective for PM10 is an annual mean of 40 µg/m^3 with an additional 24-hour mean requirement that 50 µg/m^3 is not to be exceeded more than 35 times a year. Therefore, the indicative data does not suggest an exceedance of either of these objectives for PM10. The current objectives for England do not contain a specified level for PM2.5 but require Local Authorities to work towards reducing fine particulate matter.

Bedford Borough Council has one AQMA - AQMA 5 Bedford Town Centre - AQMA Details - Defra, UK

The results from 2022 and the previous 5 years have been reviewed and provide some evidence to support considerations for reducing the size of the current AQMA. The only data within 10% of the annual mean objective for NO_2 has been in the centre of the AQMA and the areas to the East, North and South have not been within 10% for a number of years. Due to the impact of the Covid 19 pandemic on air quality data, during 2020 and 2021, it will be necessary to obtain robust data to support any decisions relating to the size of the current AQMA and therefore data will continue to be gathered during 2023 with a view to further considering options during 2024 as part of the ASR process.

In 2022 the Covanta Resource Recovery Facility located at Rookery Pit, Stewartby on the border of Bedford Borough and Central Bedfordshire became operational. This is an Environment Agency permitted activity with limits on emissions from the stack set as conditions within the permit for the site, and compliance regulated by the Environment Agency. The air quality with respect to NO_2 in this area is good and located approximately 10 Kilometres away from AQMA 5, with modelling accepted by the Environment Agency indicating no significant impact on levels within the AQMA. A diffusion tube previously located outside of the site entrance, to consider potential air quality impacts relating to

vehicle movements, in 2021 showed the annual average NO_2 data remained significantly below the current government objective of 40 µg/m^3 at 13.6 µg/m^3, and 13.5 µg/m^3 in 2022. A diffusion tube measuring background levels in Stewartby was established at the same time which measured 10.8 µg/m^3 in 2022 reducing from 11.4 µg/m^3 in 2021.

Bedford Borough Council has now published an updated Air Quality Action Plan for the AQMA 5 Bedford Town Centre which was accepted by DEFRA in 2021. The Council is also working in close partnership with Transport, Public Health, Planning and other council departments to continue to identify pollution hotspots and key sources of pollution across the Borough, and opportunities and actions to improve local air quality.

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

Data relating to the continuous monitor situated on Lurke Street was reviewed during 2022, this identified results from the monitor as being well below 40 µg/m^3 (not above 30 µg/m^3 for the last 5 years) with no exceedances of the 1-hour objective. During 2022 the annual average NO_2 concentration was 21 µg/m^3, therefore the decision was made to cease operation of the monitor in December 2022. Diffusion tubes remain in place at the location in order that NO_2 concentrations can continue to be monitored and considered.

[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

Bedford Borough Council has published an updated Air Quality Action Plan for the Town Centre AQMA 5 in 2021 covering the years 2021 to 2026, with the ultimate aim to achieve stable and compliant air quality concentrations across the Borough and allow for the consideration of reduction of the Town Centre AQMA 5 by 2026.

Bedford has seen an overall decrease in measured NO_2 levels over the past five years which is due to a number of measures implemented as well as a general increase in the use of less polluting vehicles.

Transporting Bedford 2020 was an £18 million investment to tackle traffic congestion across the town centre with a number of aspects of the project completed during 2022. The High Street has been reduced to a single lane with the aim to reduce overall traffic and congestion. Major improvements were carried out on Ampthill Road to reduce congestion and improve road safety. During these works, the road was widened creating a second northbound lane which provides restricted use for buses and Ultra Low Emission Vehicles, enabling people to continue benefiting from the bus lane and encouraging the use of electric vehicles as they become more common. Works were also delivered to separate turning traffic along the road from the main flow of traffic in order to improve vehicle flow and reduce stationary vehicles idling.

Bedford Borough Council were awarded a DEFRA air quality grant in 2020, to support implementation of a School Streets project aimed at educating pupils and parents around air quality impacts associated to school travel, promoting alternative school travel options with a number of schools being supported to introduce road closures as part of the project. This grant was applied for again in 2022 as well as an additional application to support a behavioural change project aimed at educating residents further around the domestic burning of solid fuels and impacts on PM2.5.

Conclusions and Priorities

This Annual Status Report identifies that the annual mean objective for Nitrogen dioxide (NO_2) was not exceeded at any locations across the Borough during 2022. This is a reduction from last year from one exceedance. There was one diffusion tube result within 10% of the 40 µg/m^3 limit situated in the AQMA. This exceedance was on Prebend Street at 39.1 µg/m^3. This is the first time this location has fallen below 40 µg/m^3 (annual mean) since measurements began at this location, this can be partly due to the work to reduce congestion and idling traffic in this area as part of a wider works to transport infrastructure

within the area of Bedford town, an increase in less polluting vehicles and possible residual behavioural changes following the Covid-19 pandemic etc.

Current priorities include continuing actions within the AQAP, monitoring data in order to consider opportunities to reduce the size of the AQMA. Priorities include the delivery of project work relating to DEFRA bids associated to education and behavioural change initiatives to increase awareness of sources of PM2.5 and education and promotional activities and 'Air Care Journeys will continue in wards within and in close proximity to the AQMA over the course of 2023.

Local Engagement and How to get Involved

The air quality webpages have been updated on the Councils website and include historic Annual Status Reports and the Air Quality Action Plan, and members of the public are also able to report air quality issues via contact details provided on these pages. The air quality webpage can be accessed here –

https://www.bedford.gov.uk/environmental-issues/noise-nuisances-and-pollution/air-quality/

Information relating to the air care journeys project has been made available on the Councils webpages, providing details on what the council is currently doing to improve air quality and advice on what the residents can do:

- Drive less - for shorter trips try to walk or cycle.
- Stop car idling (an idling vehicle is one that has its engine running without moving anywhere).
  - Idling car fumes are more harmful inside than outside a car.
  - Idling vehicles create as much, or even more, carbon emissions and air polluting emissions than moving vehicles.
  - It is illegal leave a vehicle's engine running unnecessarily while that vehicle is stationary on a public road..
  - If you will be somewhere for more than 30 seconds – turn your engine off.
- At home, avoid using wood burning stoves and open fires (If it is essential, only burn dry, well-seasoned or 'Ready-to-Burn' labelled wood, or smokeless fuel). Avoid burning household and garden waste: take it to the tip instead.
- Talk to your friends and family about air pollution, just because you can't see it, doesn't mean it's not affecting us all.

Social Media has been and will be used to support National Clean Air Day reiterating messaging around the domestic burning of solid fuels and promoting alternative transport choices.

DEFRA funded project work was also delivered during 2022, engaging with communities and schools to educate and promote air quality matters.

Local Responsibilities and Commitment

This ASR was prepared by the Regulatory Services department of Bedford Borough Council with the support and agreement of the following departments:

- Transport
- Highways
- Public Health
- Planning
- Transport Policy
- Planning Policy

This ASR has been signed off by:

Vicky Head, Director of Public Health.

If you have any comments on this ASR, please send them to: ehadmin@bedford.gov.uk at: Regulatory Services, Borough Hall. Cauldwell Street, Bedford, MK42 9AP - 01234 718099.

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1 Local Air Quality Management

This report provides an overview of air quality in Bedford 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 Bedford Borough 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. 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 Bedford Borough Council can be found in Table 2.1. The table presents a description of the AQMA that is currently designated within Bedford Borough. Appendix D: Map(s) of Monitoring Locations and AQMAs provides maps of the AQMA and also the air quality monitoring locations in relation to the AQMA. The air quality objectives pertinent to the current AQMA designation are as follows:

- NO_2 annual mean

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
AQMA 5 Bedford Town Centre	06/11/2009	NO2 Annual Mean	An area encompassing the majority of properties within Bedford town centre, and incorporating the 2 previous AQMAs in the town centre	NO	Annual mean NO2 concentration 59µg/m3	Annual mean NO2 concentration 39µg/m3	1	AQAP for AQMA 5 August 2021	Air Quality Action Plan 2021-2026 (bedford.gov.uk)

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

☒ **Bedford Borough Council confirm that all current AQAPs have been submitted to Defra.**

2.2 Progress and Impact of Measures to address Air Quality in Bedford Borough

Defra's appraisal of last year's ASR was mostly positive but actions to consider were:

1. A number of figures are provided which include the relevant information and highlight the monitoring sites within the Borough. However, it is not clear which label corresponds to which monitoring site, particularly with continuous monitoring locations. The Council could add arrows to the labels to make this clear or include maps of a smaller scale. A label for a monitoring site in Kempston also appears to be missing in the figure on page 41.
2. A number of screenshots have been included to demonstrate where appropriate data has been obtained from. This should be continued in future reports. However, these screenshots appear to include search-bars from the internet browser. The screenshot on page 33 includes the author's name. These screenshots should be cropped to remove any personal information and to make the images look professional.

These points have been addressed in this year's report.

Bedford Borough Council has taken forward a number of direct measures during the current reporting year of 2022 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2. Eight measures are included within Table 2.2, with the type of measure and the progress Bedford Borough 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.

More detail on these measures can be found in their respective Action Plans.

Key completed measures are:

- Transporting Bedford: Work on the final phase of construction which includes widening Clapham Road and installing traffic lights at the Great Ouse Way and Shakespeare Road roundabouts was completed in spring 2022.
- Urban traffic management control and technology: Updating of traffic signal hardware and software to provide significant improvements in reducing congestion and improving journey time for all road users.
- Ongoing school streets project work including education and air quality measurements using indicative monitors
- Tree planting continuing throughout 2022
- Indications in the Borough of PM2.5 levels from monitoring equipment

- DEFRA air quality bid submitted for project to highlight and educate residents on PM2.5 including solid fuel burning and a review of the smoke control areas.

Bedford Borough Council expects the following measures to be completed over the course of the next reporting year:

- If successful implement DEFRA bid PM2.5 project
- If successful implement DEFRA lot 1 project bid in relation to engaging with community groups and schools within 5 identified wards to educate on sources air pollution and measures to reduce exposure and impacts on local air quality.
- Cease operation of the continual NO_2 monitor on Lurke street and assess diffusion tube data over the course of the year to confirm removal of monitor.
- Review and assess monitoring locations and the potential for a new continuous monitor at another location within the Borough

Bedford Borough Council's priorities for the coming year are improving air quality, education of residents through project work, continuing to encourage electric and low emission vehicle use and highlighting areas of congestion.

To continue air quality monitoring in order to assess results over 2023 and consider potential for reduction to size of the current AQMA.

The Air Quality Action Plan 2021-2026 provides details of further activities to manage local air quality and will be subject to update during 2023.

Bedford Borough Council worked to implement these measures in partnership with the following stakeholders during 2022:

- Public Health
- Transport Policy
- Sustainable Transport
- Planning Development
- Planning Strategy
- Highways

The principal challenges and barriers to implementation that Bedford Borough Council anticipates facing are:

- Possible funding changes
- Increase in demands associated to high priority service delivery.
- Maintaining Staffing resource

Whilst the measures stated above and in Table 2.2 will help to contribute towards compliance, Bedford Borough Council anticipates that further additional measures not yet prescribed will be required in subsequent years to achieve compliance and enable the revocation of AQMA 5, although it is envisaged that a reduction to the size of the current AQMA may be feasible based on recent data and will be considered in 2024.

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	School streets project - (pedestrian and cycling zones)	Traffic Management	Anti-idling enforcement	2022	2023	Local Authority Environmental Health, Local Authority Transport Dept.	Defra and LA	YES	Fully funded	£100k - £500k	Implementation	not yet known	reduction of car journeys and anti-idling	Funding secured, implementation of school streets and monitors in use	Report on progress for 2023
2	Ampthill road smart corridor including bus lanes, cycle lanes	Traffic Management	Strategic highway improvements, Re-prioritising road space away from cars, including Access management, Selective vehicle priority, bus priority, high vehicle occupancy lane	2021	2023	Local Authority Environmental Health, Local Authority Transport Dept.		NO	Funded	£1 million - £10 million	Implementation		Ampthill Rd NO2 to remain below 36 ug/m3	work completed	
3	tree planting	Other	Other	2021	2022	Local authority		NO			Implementation	immeasurable	10 000 trees planted 2021-2022		
4	Air quality action plan for next 5 years	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	2019	2022	Local authority		NO	Not Funded		Completed	immeasurable	action plan published	action plan published	
5	Enforcement of solid fuel regulations	Policy Guidance and Development Control	Low Emissions Strategy	2021	2022	Local authority		NO	Not Funded		Implementation		reduction in non-compliant solid fuel burning	information sent to local businesses	
6	Funding application for PM2.5 education project	Public Information	Other	2022	2024	DEFRA and Local Authority	Defra and LA	YES	Funded	£10k - 50k	Planning	PM 2.5	greater awareness of PM2.5 and behaviour changes for reduction	Application for funding submitted to DEFRA for grant	
7	New train station - Wixams	Promoting Travel Alternatives	Promote use of rail and inland waterways	2022	2025	Local authority , Network rail		NO	Funded		Planning	reduction in car use may lead to a NO2 reduction		Planning granted	

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
8	Electric car fleet for Bedford Borough Council	Promoting Low Emission Transport	Company Vehicle Procurement - Prioritising uptake of low emission vehicles	2022	2023	Local authority	LA	NO			Planning	reduction in car use may lead to a NO2 reduction	Pool cars used	Implementation due early 2023	

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.

Bedford Borough Council is taking the following measures to address $PM_{2.5}$:

In Bedford in 2021 (most current data at the time of writing) the fraction of mortality attributable to particulate air pollution (new method) was 5.5% according to the public health outcomes framework. This value is the same as the East of England and England. The overall trend is a decrease since 2020.

Public Health Outcomes Framework - Data - OHID (phe.org.uk)

Bedford Borough Council does not currently monitor PM2.5 concentrations via reference standard monitoring equipment, however, two Zephyr air quality monitors have been in place on Ampthill Rd since in 2021 and for 2022 which have provided indicative annual means of 7.9 µg/m^3 and 8.4 µg/m^3.

Modelled PM2.5 background data from DEFRA for 2021 (Background Mapping data for local authorities - 2018 - Defra, UK) show the maximum background level of 10.9 µg/m^3 at Elstow Interchange, Elstow, Kempston at a roundabout on the A421, some distance from residential properties or pedestrians. The second highest is Abbeyfields, close to the A421 with a value of 10.31 µg/m^3. The averaged modelled background PM2.5 value for Bedford Borough in 2022 was 8.9 µg/m^3, a slight reduction from 2021 which was 9.0 µg/m^3.

Wood burning guidance has been published on the Bedford Borough Council website to advise and educate residents regarding appliances used to burn solid fuels such as wood. Education alongside the actions detailed for NO_2 are anticipated to support the management of local sources of PM2.5, within the limited fraction that can be impacted by actions within the Borough (traffic sources and wood burning etc.). Industrial sources will be controlled by the permitting process which limits emissions as required in the permitting legislation. In 2021, the government released its Heat and Buildings Strategy, and from 2025, gas boilers will be banned from all new builds which may result in gradual reductions from this source.

A bid for DEFRA funding has been submitted that will focus on PM2.5 – the project will seek to educate residents and businesses about Particulate matter and how changes in behaviour can reduce the impact, such as the burning of domestic solid fuels. The project will also consider smoke control areas in Bedford Borough and seek to gain insight from residents around the burning of solid fuels.

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

This section sets out the monitoring undertaken within 2022 by Bedford Borough 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

Bedford Borough Council undertook automatic (continuous) monitoring at 2 sites during 2022. Table A.1 in Appendix A shows the details of the automatic monitoring sites. The Hertfordshire and Bedfordshire - Air Quality monitoring service (airqualityengland.co.uk) page presents automatic monitoring results for Bedford, with automatic monitoring results also available through the UK-Air website .

Maps showing the location of the monitoring sites are provided in Appendix D. Further details on how the monitors are calibrated and how the data has been adjusted are included in Appendix C.

Due to results from the automatic reference standard monitor on Lurke Street being well below the current 40 µg/m^3 objective for NO_2 (not above 30 µg/m^3 for the last 5 years) with no 1-hour exceedances, the monitor was taken out of use at the end of December 2022. During 2022 a number of faults in the equipment were also identified and due to the significant reductions at the location over the last 12 years repair/replacement was not considered to be a priority, diffusion tubes continue to monitor at the location with results continuing to show levels to be well below current objectives.

3.1.2 Non-Automatic Monitoring Sites

Bedford Borough Council undertook non- automatic (i.e. passive) monitoring of NO_2 at 51 sites during 2022. Table A.2 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.

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.3 and Table A.4 in Appendix A compare 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 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.

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

In 2022 there were no exceedances of the annual mean NO2 objective of 40µg/m^3 after bias adjustment and annualisation.

This was lower than the number of exceedances in 2021 which was at a single location.

There was one diffusion tube result within 10% of the 40 µg/m^3 limit situated in the AQMA. This exceedance was on Prebend Street at 39.1 µg/m^3. This is the first time this location has fallen below 40 µg/m^3 (annual mean) since measurements began, this can be partly due to the work to reduce congestion and idling traffic in this area as part of a wider remit.

Compared to 2021, only 7 locations increased and 42 decreased.

There were no exceedances of the hourly objective for the sixth year running.

Justification for the use of the national bias adjustment factor is provided below, however for context should the local factor have been used there would have been a minor change to these headline observations with three sites over 40 µg/m^3 at two locations.

Appendix A: Monitoring Results

Table A.1 – Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Inlet Height (m)
CM1	Prebend street	Roadside	504496	249625	NO2	YES AQMA 5	Chemiluminescent	1	4.2	1.5
CM2	Lurke street	Roadside	505044	249980	NO2	YES AQMA 5	Chemiluminescent	3.5	7.5	1.5

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 – 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)
DT5	Bromham Road, Bedford	Roadside	503819	250060	NO2	No	15.0	3.1	No	2.5
DT7	4 Bunyan Road, Kempston	Roadside	503160	247751	NO2	No	1.8	1.4	No	2.5
DT10	1 Kirkstall Close, Bedford	Other	505425	247063	NO2	No	5.0	2.0	No	2.5
DT12	8 The Lane, Wyboston	Roadside	516345	256592	NO2	No	10.0	2.7	No	3.0
DT13	Gt Nth Road, Wyboston - A1 South	Other	516420	256552	NO2	No	8.0	2.6	No	3.0
DT14	Horne Lane, Bedford	Roadside	504857	249652	NO2	Yes - AQMA 5	2.6	2.7	No	2.4
DT16	Kempston Road ,Bedford	Roadside	504585	249003	NO2	Yes - AQMA 5	6.0	3.9	No	2.2
DT17	Ampthill Road , Bedford	Roadside	504783	248711	NO2	Yes - AQMA 5	4.0	4.4	No	2.5
DT19	Kimbolton Road ,Bedford	Roadside	505551	250584	NO2	Yes - AQMA 5	9.0	1.1	No	2.5
DT20	Prebend Street ,Bedford	Roadside	504486	249616	NO2	Yes - AQMA 5	0.1	2.0	No	2.5
DT25	London Road crossroad	Roadside	505389	248858	NO2	Yes - AQMA 5	2.9	2.4	No	3.0

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)
DT28	Prebend St corner of commercial road	Roadside	504576	249501	NO2	Yes - AQMA 5	2.8	2.5	No	2.4
DT29	Goldington Road opp Uni	Roadside	506630	250274	NO2	Yes - AQMA 5	4.0	2.5	No	2.0
DT30	High St Barovic jewellers	Urban Centre	505020	250044	NO2	Yes - AQMA 5	2.0	1.4	No	2.3
DT31	High St, luddingtons	Urban Centre	505060	249766	NO2	Yes - AQMA 5	0.1	2.0	No	3.0
DT33	Shakespeare Road/Bromham Rd Junction	Roadside	504100	250142	NO2	Yes - AQMA 5	5.0	2.6	No	3.0
DT34	St Marys St kings' arms PH	Roadside	505102	249411	NO2	Yes - AQMA 5	0.5	2.4	No	3.0
DT35	Prebend St, crown quay	Roadside	504599	249432	NO2	Yes - AQMA 5	3.0	3.3	No	2.2
DT36	37 Ashburnham Road	Roadside	504289	249711	NO2	Yes - AQMA 5	2.0	2.0	No	3.0
DT40	YMCA, Tavistock St	Roadside	504808	250232	NO2	Yes - AQMA 5	6.0	2.1	No	2.5
DT42	28 St Johns St	Roadside	505143	249299	NO2	Yes - AQMA 5	9.0	3.3	No	2.5
DT43	45 Dame Alice St	Roadside	504913	250038	NO2	Yes - AQMA 5	0.6	2.3	No	3.0
DT44	Midland Road-outside No.137,139A	Roadside	504423	249647	NO2	Yes - AQMA 5	0.2	2.4	No	2.0

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)
DT46	Midland Rd-outside Beegees opp Priory St	Urban Centre	504635	249724	NO2	Yes - AQMA 5	1.4	1.2	No	3.0
DT47	On corner Harpur St – opp 51A	Urban Background	504894	250049	NO2	Yes - AQMA 5	8.0	2.7	No	2.0
DT48	Outside Sound & Vision –Tavistock St	Urban Centre	504903	250199	NO2	Yes - AQMA 5	3.0	1.9	No	2.5
DT50	Outside John Bull – St Peters St	Urban Centre	505190	250075	NO2	Yes - AQMA 5	0.3	1.9	No	3.5
DT53	Outside Longstaff Gentle & Co – 59-61 Harpur St	Roadside	504907	250084	NO2	Yes - AQMA 5	1.9	2.5	No	2.5
DT54	Outside 63 – Union St	Roadside	504505	250361	NO2	Yes - AQMA 5	1.7	2.3	No	3.0
DT55	Opp urban & Rural on corner – Bromham Rd	Roadside	504475	250123	NO2	Yes - AQMA 5	4.0	2.4	No	2.5
DT57	Outside 110 - Newnham Av	Roadside	506626	250226	NO2	Yes - AQMA 5	2.4	1.2	No	2.2
DT61	Outside 185 Goldington Rd	Kerbside	506588	250254	NO2	Yes - AQMA 5	5.0	0.9	No	2.2
DT62	Outside 139 Goldington Rd	Kerbside	506390	250243	NO2	Yes - AQMA 5	6.0	1.0	No	2.2
DT65	Outside no.43 London Rd	Roadside	505438	248793	NO2	Yes - AQMA 5	3.0	1.5	No	2.5
DT66, DT67, DT68	Monitoring station	Roadside	504495	249622	NO2	Yes - AQMA 5	1.7	3.7	Yes	2.0

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)
DT69	River Street, opposite chinese	Urban Centre	504734	249689	NO2	Yes - AQMA 5	0.3	3.8	No	3.0
DT70	Outside bus station	Urban Centre	504706	249860	NO2	Yes - AQMA 5	5.0	2.5	No	2.0
DT71	174 Ampthill Road ,Bedford	Roadside	504625	248169	NO2	No	3.0	4.4	No	2.5
DT72	150 Ampthill Road ,Bedford	Roadside	504648	248257	NO2	No	3.0	2.3	No	2.5
DT73	112 Ampthill Road ,Bedford	Kerbside	504684	248388	NO2	No	8.0	1.0	No	2.5
DT74, DT75, DT76	LS Monitor	Roadside	505044	249980	NO2	Yes - AQMA 5	2.0	5.0	Yes	1.5
DT 77	Green lane, Stewartby	Roadside	501574	242181	NO2	No	250.0	2.3	No	3.0
DT 78	Churchill close, Stewartby	Suburban	501878	242176	NO2	No	5.0	1.9	No	2.5
DT 80	Shakespeare Rd/Clapham Rd junction	Roadside	503946	250765	NO2	No	5.0	1.8	No	2.5
DT 81	Brooklands avenue - Wixams	Suburban	505273	245175	NO2	No	4.0	1.7	No	3.0
DT 82	32 Fields Rd, Wootton	Roadside	500968	244911	NO2	No	5.0	1.6	No	2.5
DT 83	37 Cemetery Road, off Branston way	Suburban	501595	247537	NO2	No	7.0	1.7	No	2.5

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)
DT 85	Rope Walk/Cardington Rd	Roadside	505493	249254	NO2	No	10.0	1.5	No	2.5
DT 86	Outside 33 Goldington Rd	Roadside	505464	250142	NO2	Yes - AQMA 5	2.0	1.5	No	2.5
DT 89	St Peters St/High St junction	Roadside	505046	250040	NO2	Yes - AQMA 5	2.0	1.9	No	2.5
DT 91	High St Debenhams	Roadside	505034	249844	NO2	Yes - AQMA 5	15.0	2.0	No	3.5

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.3 – Annual Mean NO_2 Monitoring Results: Automatic Monitoring (µg/m^3)

Site 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
CM1	504496	249625	Roadside		92	29	32	26	32	34
CM2	505044	249980	Roadside		87	26	30	21	18	21

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

☒ **Reported concentrations are those at the location of the monitoring site (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**.

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%).

Table A.4 – 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
DT5	503819	250060	Roadside	100	100.0	30.0	22.9	17.9	22.8	20.4
DT7	503160	247751	Roadside	100	100.0	25.0	25.7	23.2	24.6	22.5
DT10	505425	247063	Other	100	100.0	24.0	21.7	19.3	18.9	17.9
DT12	516345	256592	Roadside	100	59.6	21.0	18.2	14.6	16.1	14.1
DT13	516420	256552	Other	100	67.3	23.0	21.8	21.6	22.5	18.2
DT14	504857	249652	Roadside	100	82.7	31.0	32.6	22.0	25.5	24.2
DT16	504585	249003	Roadside	100	51.9	28.0	26.7	21.1	26.0	23.8
DT17	504783	248711	Roadside	100	82.7	33.0	31.0	23.8	27.7	25.4
DT19	505551	250584	Roadside	100	92.3	26.0	24.8	21.1	21.4	19.4
DT20	504486	249616	Roadside	100	100.0	**44.0**	**47.4**	**41.3**	**43.3**	39.4
DT25	505389	248858	Roadside	100	92.3	39.0	34.6	30.6	34.0	29.8
DT28	504576	249501	Roadside	100	92.3	34.0	32.4	27.3	31.5	28.9

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
DT29	506630	250274	Roadside	100	92.3	38.0	35.5	26.4	30.7	28.2
DT30	505020	250044	Urban Centre	100	100.0	**41.0**	38.8	31.4	27.8	31.9
DT31	505060	249766	Urban Centre	100	100.0	**40.0**	38.8	28.2	24.0	33.8
DT33	504100	250142	Roadside	100	84.6	38.0	36.3	27.5	34.1	30.2
DT34	505102	249411	Roadside	100	92.3	**42.0**	38.4	30.1	31.2	31.4
DT35	504599	249432	Roadside	100	92.3	36.0	36.3	29.1	32.0	28.3
DT36	504289	249711	Roadside	100	100.0	36.0	33.5	26.8	30.1	27.0
DT40	504808	250232	Roadside	100	90.4	25.0	25.1	20.6	21.2	21.4
DT42	505143	249299	Roadside	100	84.6	39.0	38.8	30.1	35.0	30.8
DT43	504913	250038	Roadside	100	100.0	**40.0**	31.5	22.9	28.5	25.6
DT44	504423	249647	Roadside	100	100.0	**42.0**	**40.2**	33.3	35.8	30.5
DT46	504635	249724	Urban Centre	100	100.0	34.0	36.6	32.1	33.8	29.2
DT47	504894	250049	Urban Background	100	100.0	30.0	32.5	21.2	24.1	23.7
DT48	504903	250199	Urban Centre	100	100.0	37.0	36.0	29.6	31.4	29.3

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
DT50	505190	250075	Urban Centre	100	92.3	**43.0**	**43.6**	36.1	38.1	35.8
DT53	504907	250084	Roadside	100	100.0	33.0	31.0	25.7	27.5	26.5
DT54	504505	250361	Roadside	100	100.0	31.0	30.0	24.2	27.1	24.4
DT55	504475	250123	Roadside	100	71.2	33.0	29.9	22.5	27.1	25.6
DT57	506626	250226	Roadside	100	100.0	33.0	31.5	25.2	27.3	26.6
DT61	506588	250254	Kerbside	100	100.0	34.0	33.3	27.9	29.3	25.6
DT62	506390	250243	Kerbside	100	100.0	27.0	26.6	21.7	23.2	23.1
DT65	505438	248793	Roadside	100	90.4	31.0	34.3	26.3	25.6	25.8
DT66, DT67, DT68	504495	249622	Roadside	100	90.4	30.3	33.8	28.0	30.9	27.4
DT69	504734	249689	Urban Centre	100	82.7	30.0	32.3	24.0	26.5	25.2
DT70	504706	249860	Urban Centre	100	57.7	32.0	33.6	24.6	28.0	27.0
DT71	504625	248169	Roadside	100	100.0	32.0	30.6	26.7	29.2	26.3
DT72	504648	248257	Roadside	100	90.4	36.0	32.2	28.6	31.0	27.0
DT73	504684	248388	Kerbside	100	100.0	33.0	33.9	27.3	29.7	26.9

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
DT74, DT75, DT76	505044	249980	Roadside	100	100.0	28.3	27.5	21.5	18.0	19.8
DT 77	501574	242181	Roadside	100	92.3	19.0	18.5	12.6	13.6	13.5
DT 78	501878	242176	Suburban	100	100.0	15.0	15.1	10.4	11.4	10.8
DT 80	503946	250765	Roadside	100	82.7		33.9	27.1	29.9	27.3
DT 81	505273	245175	Suburban	100	100.0		16.6	15.2	17.2	14.6
DT 82	500968	244911	Roadside	100	92.3		17.8	14.6	15.4	14.9
DT 83	501595	247537	Suburban	100	82.7		22.1	18.4	19.9	18.7
DT 85	505493	249254	Roadside	100	92.3			23.7	26.2	24.7
DT 86	505464	250142	Roadside	100	92.3			23.4	25.6	23.6
DT 89	505046	250040	Roadside	100	82.7					36.6
DT 91	505034	249844	Roadside	100	57.7					22.7

☒ **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

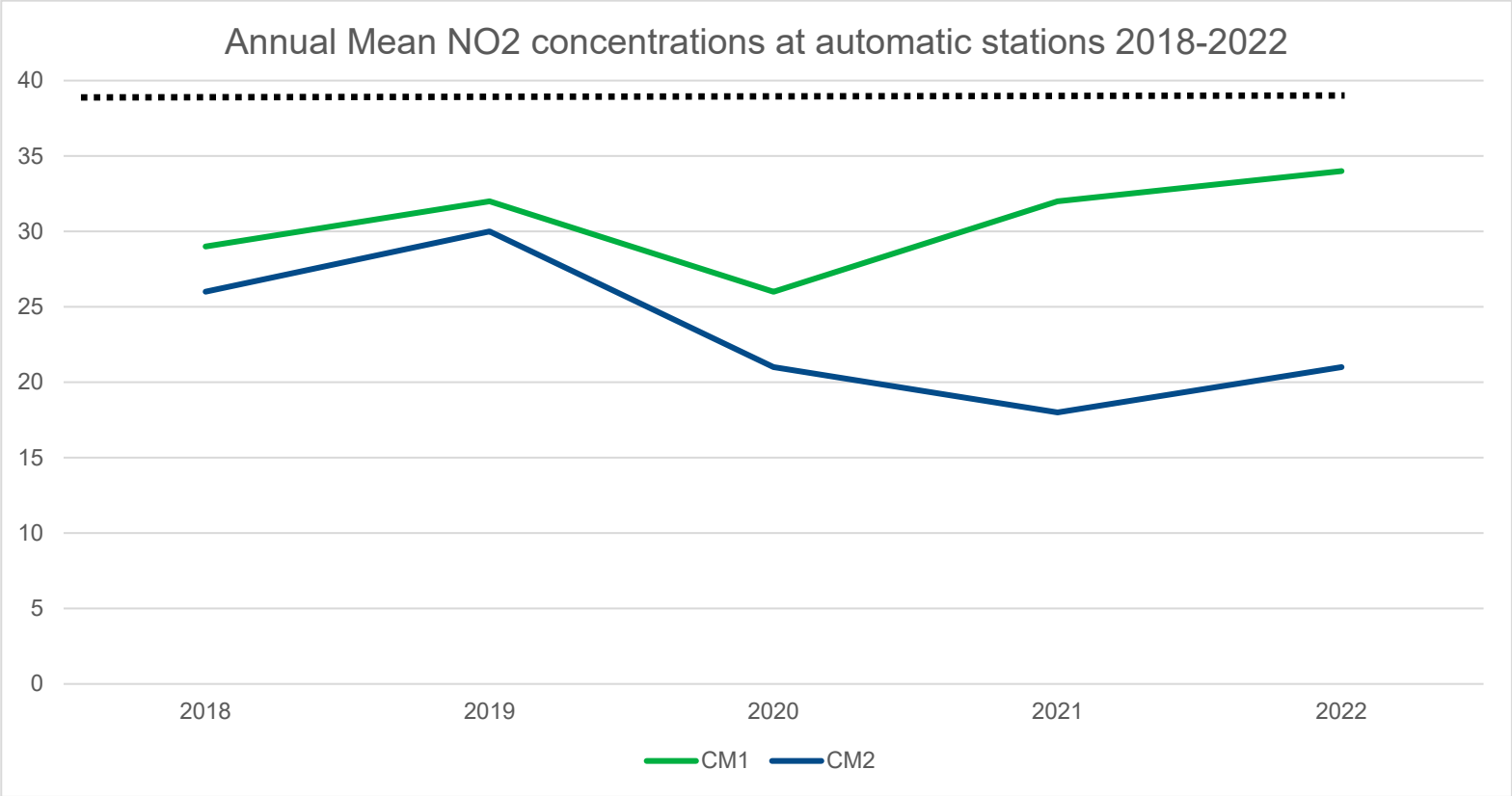


Figure A.2 – Annual Mean NO_2 Concentrations at Diffusion Tubes Located inside the AQMA

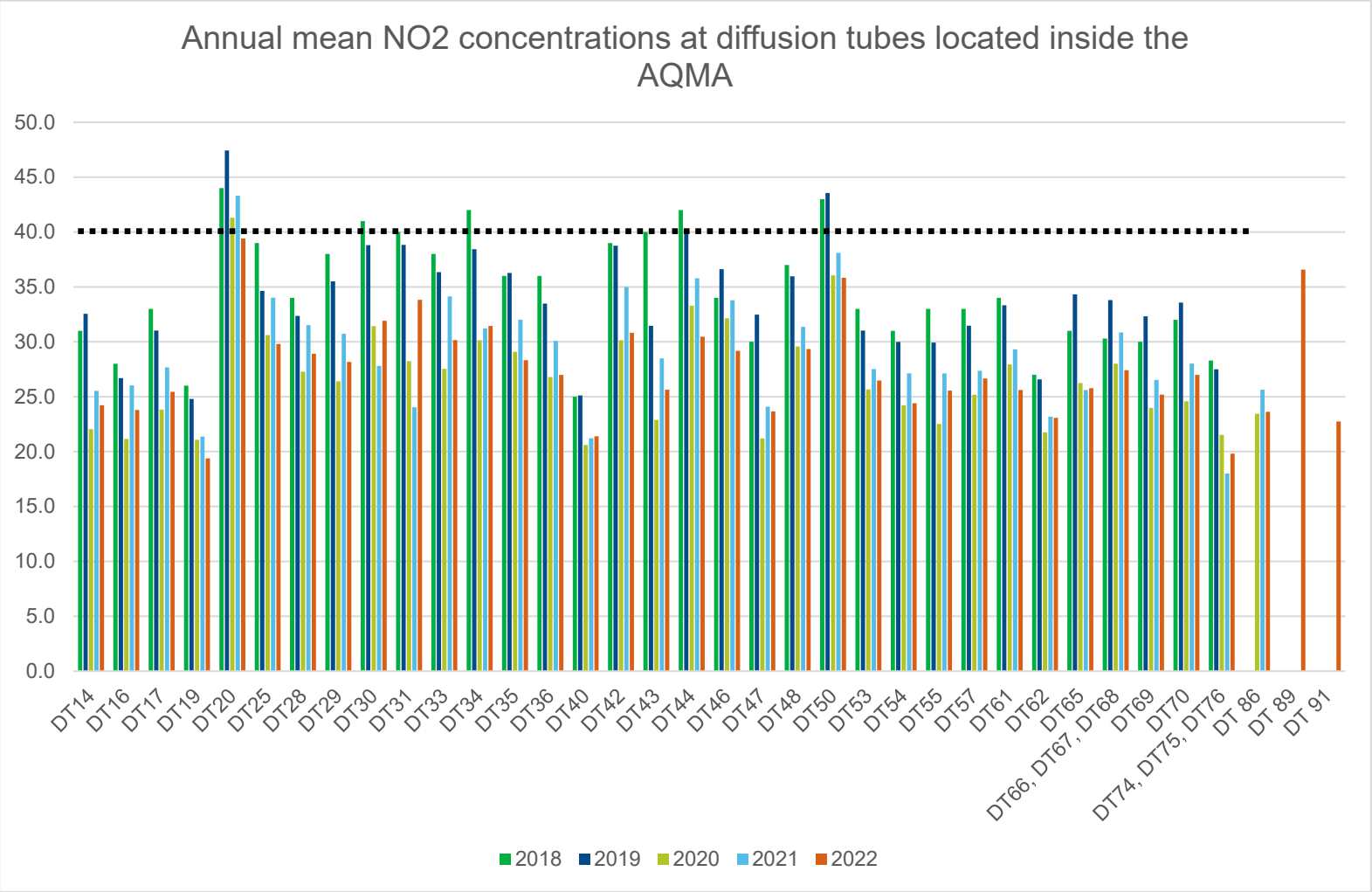


Figure A.3 – Annual Mean NO_2 Concentrations at Diffusion Tubes Located outside the AQMA

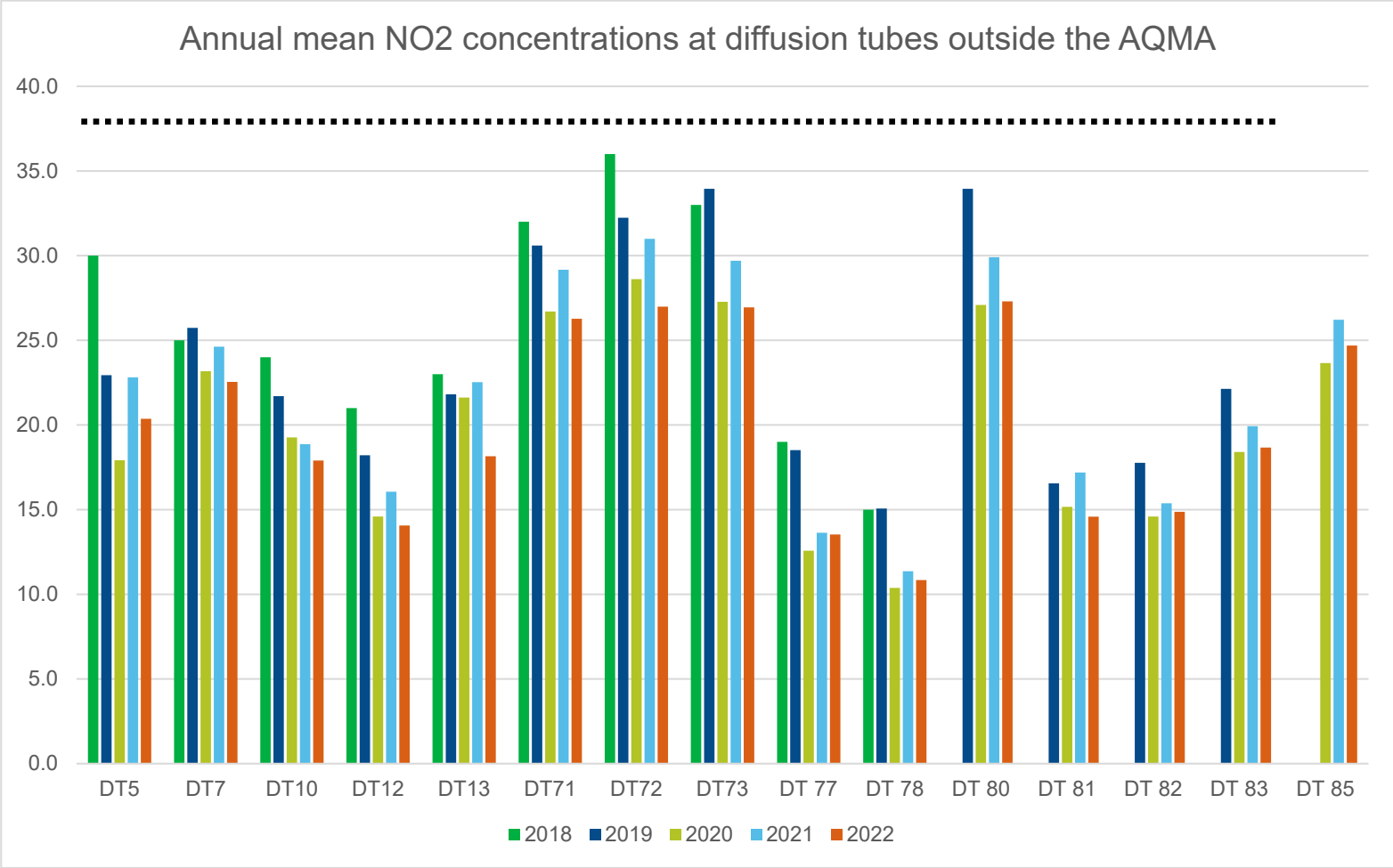


Table A.5 – 1-Hour Mean NO_2 Monitoring Results, Number of 1-Hour Means > 200µg/m^3

Site 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
CM1	504496	249625	Roadside		92	0	0	0	0	0
CM2	505044	249980	Roadside		87	0	0	0	0	0

Notes:

Results are presented as the number of 1-hour periods where concentrations greater than 200µg/m^3 have been recorded.

Exceedances of the NO_2 1-hour mean objective (200µg/m^3 not to be exceeded more than 18 times/year) are shown in **bold**.

If the period of valid data is less than 85%, the 99.8th percentile of 1-hour means is provided in brackets.

(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%).

Appendix B: Full Monthly Diffusion Tube Results for 2022

Table B.1 – NO_2 2022 Diffusion Tube Results ($\mu g/m^3$)

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 <(.83)>	Annual Mean: Distance Corrected to Nearest Exposure	Comment
DT5	503819	250060	34.0	24.0	32.8	19.6	18.3	17.9	19.6	18.4	23.3	26.6	28.2	31.7	24.5	20.4	-	
DT7	503160	247751	37.0	25.0	33.8	22.4	22.6	20.8	23.2	23.5	26.9	27.5	31.2	32.0	27.2	22.5	-	
DT10	505425	247063	32.0	21.0	29.4	16.5	16.0	15.8	15.2	16.4	18.7	23.8	25.6	28.4	21.6	17.9	-	
DT12	516345	256592		16.0	23.0	14.0	12.9	12.4	12.7			18.1			15.6	14.1	-	
DT13	516420	256552	34.0	23.0	18.5	15.7	18.8	19.8	18.0			25.8			21.7	18.2	-	
DT14	504857	249652	37.0	26.0	34.5	24.3	25.2	24.7	27.3	29.0	30.8	33.1			29.2	24.2	-	
DT16	504585	249003					21.7	20.6			28.0	30.0	31.8	34.4	27.8	23.8	-	
DT17	504783	248711	41.0		35.6	31.1	26.8	24.6	29.5	18.6	35.1	29.4	34.8		30.7	25.4	-	
DT19	505551	250584	34.0		26.4	16.3	19.5	18.6	18.1	15.9	22.8	25.2	28.7	31.4	23.4	19.4	-	
DT20	504486	249616	64.0	43.0	42.4	33.7	43.4	41.8	48.9	42.7	50.4	54.0	56.7	48.8	47.5	39.4	39.1	
DT25	505389	248858	52.0		42.0	30.0	35.4	32.9	37.5	34.0	29.3	28.5	29.7	43.7	35.9	29.8	-	
DT28	504576	249501	41.0		42.7	32.8	26.2	26.3	31.9	34.7	39.6	34.1	33.8	40.0	34.8	28.9	-	
DT29	506630	250274	48.0	29.0	37.7	28.3	27.4	27.7	30.9	31.6		33.7	39.1	40.0	33.9	28.2	-	
DT30	505020	250044	54.0	44.0	31.7	29.7	32.2	33.7	38.1	34.4	43.6	39.7	39.2	41.1	38.5	31.9	-	
DT31	505060	249766	51.0	38.0	46.5	37.2	36.1	31.5	38.0	41.5	43.6	40.8	41.3	43.6	40.8	33.8	-	
DT33	504100	250142	42.0	36.0	38.8	30.1	29.4	32.7	34.9			38.4	40.6	40.4	36.3	30.2	-	
DT34	505102	249411	42.0		44.9	37.3	28.8	33.7	35.3	35.1	40.7	36.5	39.2	43.2	37.9	31.4	-	
DT35	504599	249432	44.0	35.0	33.0	23.8	30.3		34.0	29.7	34.6	36.1	35.5	39.4	34.1	28.3	-	
DT36	504289	249711	45.0	30.0	37.7	28.0	25.6	28.5	27.9	29.1	32.9	33.3	33.1	39.0	32.5	27.0	-	

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 <(.83)>	Annual Mean: Distance Corrected to Nearest Exposure	Comment
DT40	504808	250232	36.0	22.0	26.7	18.2		17.2	18.1	20.8	24.9	38.1	28.1	33.5	25.8	21.4	-	
DT42	505143	249299	51.0	31.0	40.9	37.5	36.1	30.3	37.8		28.3	33.9		44.5	37.1	30.8	-	
DT43	504913	250038	42.0	30.0	33.9	28.5	22.8	24.4	28.7	31.0	32.8	29.2	30.9	36.4	30.9	25.6	-	
DT44	504423	249647	48.0	34.0	37.2	35.3	32.9	27.4	33.7	38.2	38.8	35.7	36.5	42.8	36.7	30.5	-	
DT46	504635	249724	47.0	34.0	37.4	30.0	28.6	28.5	33.3	32.4	34.2	38.7	36.8	41.0	35.2	29.2	-	
DT47	504894	250049	36.0	27.0	33.9	23.4	20.2	20.4	23.3	26.4	29.1	34.1	34.2	34.0	28.5	23.7	-	
DT48	504903	250199	49.0	35.0	39.9	31.2	29.4	27.4	33.3	36.7	38.6	26.5	37.7	39.5	35.4	29.3	-	
DT50	505190	250075	56.0	46.0	42.5	33.8	39.1	39.4	44.1	41.9		46.2	40.9	45.0	43.2	35.8	-	
DT53	504907	250084	40.0	29.0	40.9	29.9	23.2	23.2	29.7	35.2	34.3	29.0	31.5	36.9	31.9	26.5	-	
DT54	504505	250361	37.0	28.0	35.0	24.3	25.1	22.8	26.3	28.3	31.2	31.9	28.6	34.2	29.4	24.4	-	
DT55	504475	250123	40.0	28.0	34.8			25.2	25.8	26.8	31.0	31.1	34.5		30.8	25.6	-	
DT57	506626	250226	44.0	31.0	32.1	24.5	27.0	27.2	28.0	26.1	31.4	34.2	37.8	42.0	32.1	26.6	-	
DT61	506588	250254	42.0	26.0	34.3	26.7	27.3	27.0	27.3	28.0	25.0	35.3	37.7	33.7	30.9	25.6	-	
DT62	506390	250243	39.0	29.0	31.2	19.6	20.2	20.8	21.6	21.0	32.1	28.7	30.9	39.5	27.8	23.1	-	
DT65	505438	248793	40.0	24.0	33.7	25.8	23.4	20.1	26.4	25.1	39.0	40.6	43.5		31.1	25.8	-	
DT66	504495	249622	43.0	28.0	36.2	28.6	28.2	27.6	32.5	31.2	35.5	35.1	34.7		-	-	-	Triplicate Site with DT66, DT67 and DT68 - Annual data provided for DT68 only
DT67	504495	249622	46.0	31.0	35.0	29.2	29.4	28.1	32.4	30.7	35.1	35.2	35.5		-	-	-	Triplicate Site with DT66, DT67 and DT68 - Annual data provided for DT68 only
DT68	504495	249622	45.0	31.0	34.5	28.7	25.6	26.9	31.7	30.6	36.3	36.0	35.8		33.0	27.4	-	Triplicate Site with DT66, DT67 and DT68 - Annual data provided for DT68 only
DT69	504734	249689	39.0	28.0	32.1	25.8	25.3		28.8	29.8	32.6	31.6	30.5		30.4	25.2	-	
DT70	504706	249860	45.0	31.0			26.4		29.2	27.4	31.5	34.6			32.2	27.0	-	
DT71	504625	248169	37.0	24.0	40.6	29.5	22.5	23.6	23.5	30.2	28.0	31.3	42.4	47.3	31.7	26.3	-	

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 <(.83)>	Annual Mean: Distance Corrected to Nearest Exposure	Comment
DT72	504648	248257	43.0	27.0	39.4		24.9	26.8	27.7	28.5	33.4	34.3	37.1	35.6	32.5	27.0	-	
DT73	504684	248388	45.0	33.0	36.5	24.4	28.2	29.2	31.9	33.5	31.1	32.9	28.6	35.3	32.5	26.9	-	
DT74	505044	249980	35.0	24.0	24.7	17.2	19.1	19.6	19.7	18.4	24.0	27.5	26.6	30.3	-	-	-	Triplicate Site with DT74, DT75 and DT76 - Annual data provided for DT76 only
DT75	505044	249980	36.0	25.0	24.3	18.4	19.7	19.1	19.7	18.3	24.9	26.6	26.7	30.4	-	-	-	Triplicate Site with DT74, DT75 and DT76 - Annual data provided for DT76 only
DT76	505044	249980	33.0	23.0	26.4	18.1	19.8	19.3	19.5	18.8	24.3	26.7	26.8	28.8	23.9	19.8	-	Triplicate Site with DT74, DT75 and DT76 - Annual data provided for DT76 only
DT 77	501574	242181	27.0	15.0	17.7	12.0	13.3		12.3	11.4	16.0	16.1	17.9	20.7	16.3	13.5	-	
DT 78	501878	242176	23.0	10.0	16.6	9.4	8.7	7.5	7.7	9.2	12.6	13.5	15.3	23.2	13.1	10.8	-	
DT 80	503946	250765	40.0	26.0			22.8	25.0	28.1	38.3	38.0	33.1	36.1	41.5	32.9	27.3	-	
DT 81	505273	245175	30.0	15.0	20.4	14.1	13.1	11.8	13.1	14.2	17.9	18.2	19.2	23.9	17.6	14.6	-	
DT 82	500968	244911	27.0	14.0	23.4	13.1	10.9		12.5	12.5	16.9	16.2	17.7	32.9	17.9	14.9	-	
DT 83	501595	247537	31.0	17.0			15.8	17.0	21.3	20.3	27.0	22.5	25.0	28.0	22.5	18.7	-	
DT 85	505493	249254	37.0	26.0	41.8	24.1	22.8	22.5	24.8	29.0		30.3	33.4	35.5	29.7	24.7	-	
DT 86	505464	250142	43.0	28.0	33.4	17.0	21.9	22.0		22.1	24.7	31.1	33.7	36.2	28.5	23.6	-	
DT 89	505046	250040	55.0		45.7		38.4	37.6	45.9	40.1	35.0	46.1	47.8	49.1	44.1	36.6	31.9	
DT 91	505034	249844						18.2	21.4	23.4	28.9	28.6	30.6	34.0	26.4	22.7	-	

☒ **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**

☒ **Bedford Borough Council 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 Bedford Borough During 2022.

Planning permission has been granted for a new train station at Wixams (a new settlement 6km south of Bedford) this will provide an alternative transport link to the main Bedford Midland station in close proximity to the main Bedford bypass (A421) to the south of Bedford and Kempston and would be anticipated to reduce vehicle journeys to attend the Bedford Station in the centre of town and within the current AQMA.

During 2022, the finalised route for the East West Rail project had not been determined, with this anticipated to receive further clarity during 2023. The authority will consider East West Rail in more detail as more developed plans are made available and supporting information such as Environmental Impact reports.

Additional Air Quality Works Undertaken by Bedford Borough During 2022

Bedford Borough Council has not completed any additional works within the reporting year of 2022, other than the production and submission.

QA/QC of Diffusion Tube Monitoring

The diffusion tubes used by Bedford Borough Council were analysed by Gradko International ltd using a preparation method of 20% TEA in water. The laboratory is UKAS accredited, ensuring conformance with the requirements of ISO/IEC 17025.

The monitoring was undertaken in adherence to the 2022 diffusion tube monitoring calendar.

Diffusion Tube Annualisation

Annualisation was required for five diffusion tubes, 2 situated on the A1 due to works being carried out these tubes were not able to be retrieved over some months. Two were due to the tubes going missing on a regular basis and the one situated on the High Street was due to this location beginning in June. Annualisation was carried out as detailed in TG22

using continuous monitoring data from the two sources available in the Borough. The Annual Mean/Period Mean ratios are calculated (Am/Pm) and averaged to provide an annualisation factor for each site requiring annualisation. These and the final annualised average NO2 concentrations for each of the diffusion tube sites are presented in table C2 below.

Table C.1 – Annualisation Summary (concentrations presented in µg/m^3)

Site ID	Annualisation Factor Lurke St	Annualisation Factor Prebend St	Annualisation Factor <Site 3 Name>	Annualisation Factor <Site 4 Name>	Average Annualisation Factor	Raw Data Annual Mean	Annualised Annual Mean
DT12	1.0530	1.1216			1.0873	15.6	16.9
DT13	0.9567	1.0590			1.0078	21.7	21.9
DT16	1.0789	0.9864			1.0326	27.8	28.7
DT70	0.9678	1.0546			1.0112	32.2	32.5
DT 91	1.0926	0.9804			1.0365	26.4	27.4

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.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.

Bedford Borough Council have applied a national bias adjustment factor of 0.83 to the 2022 monitoring data. A summary of bias adjustment factors used by Bedford Borough Council over the past five years is presented in

Table C.2 – Bias Adjustment Factor

Monitoring Year	Local or National	If National, Version of National Spreadsheet	Adjustment Factor
2022	National	03/23	0.83
2021	Local	-	0.91
2020	Local	-	0.86
2019	National	03/20	0.93
2018	National	03/19	0.93

The national bias adjustment factor was 0.83 using version 03/23 using 27 studies, see table C.3 below. The local bias adjustment gave good overall precision but poor overall data capture for the Lurke Street monitoring station due to technical problems with the monitor. In addition, the diffusion tube data for the triplicate sites were not available for December so this data was also missing. For this reason, it was decided that the national bias adjustment factor would be used, however information has been provided within this report to provide context should the local Bias Adjustment factor have been used.

Table C.3 – National Diffusion Tube Bias Adjustment Factor

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 spreadsheet 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

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 shown in blue at the foot of the final column.

If you have your own co-location study then see footnote. If uncertain what to do then contact the Local Air Quality Management Helpdesk at LAQMHelpdesk@bureauveritas.com or 0800 0327953

Analysed By	Method	Year	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	Bias Adjustment Factor (A) (Cm/Dm)
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 (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.

Two sites were calculated for distance correction DT20 and DT89.

Table C.4 – NO_2 Fall off With Distance Calculations (concentrations presented in $\mu g/m^3$)

Site ID	Distance (m): Monitoring Site to Kerb	Distance (m): Receptor to Kerb	Monitored Concentration (Annualised and Bias Adjusted	Background Concentration	Concentration Predicted at Receptor	Comments
DT20	2.0	2.1	39.4	13.2	*39.1*	*Predicted concentration at Receptor within 10% the AQS objective.*
DT 89	1.9	3.9	36.6	8.7	31.9	

QA/QC of Automatic Monitoring

In 2022 Bedford Borough Council have a service and maintenance contract for both monitoring stations with ESU1, which includes 2 scheduled on-site services per annum. There is also have a 48hour call out for any problems that may occur.

Monthly calibrations are carried out by the local authority and results sent to Ricardo

Air quality measurements from automatic instruments were validated and ratified to the standards described in the Local Air Quality Management – Technical Guidance LAQM TG (16) by Ricardo. Current readings and historic data are available at: https://www.airqualityengland.co.uk/local-authority/?la_id=408

Automatic Monitoring Annualisation

All automatic monitoring locations within Bedford recorded data capture of greater than 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.

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 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 automatic NO_2 monitoring locations within Bedford required distance correction during 2022.

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

Figure D.1 – Map of Non-Automatic Monitoring Site Showing Bedford Borough boundary and diffusion tube locations indicated

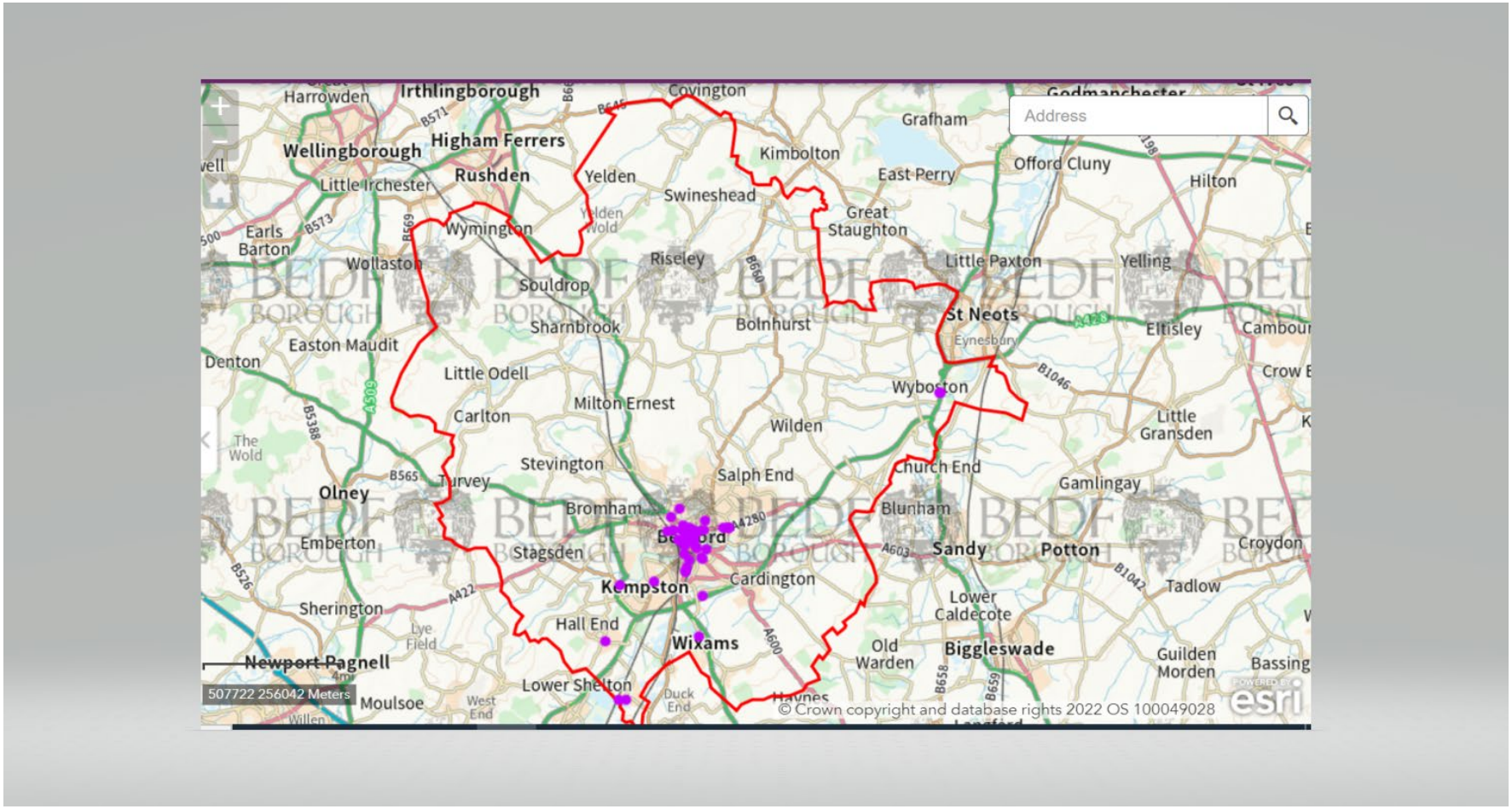


Figure D.2 – Map indicating diffusion tubes south of Bedford Town Centre

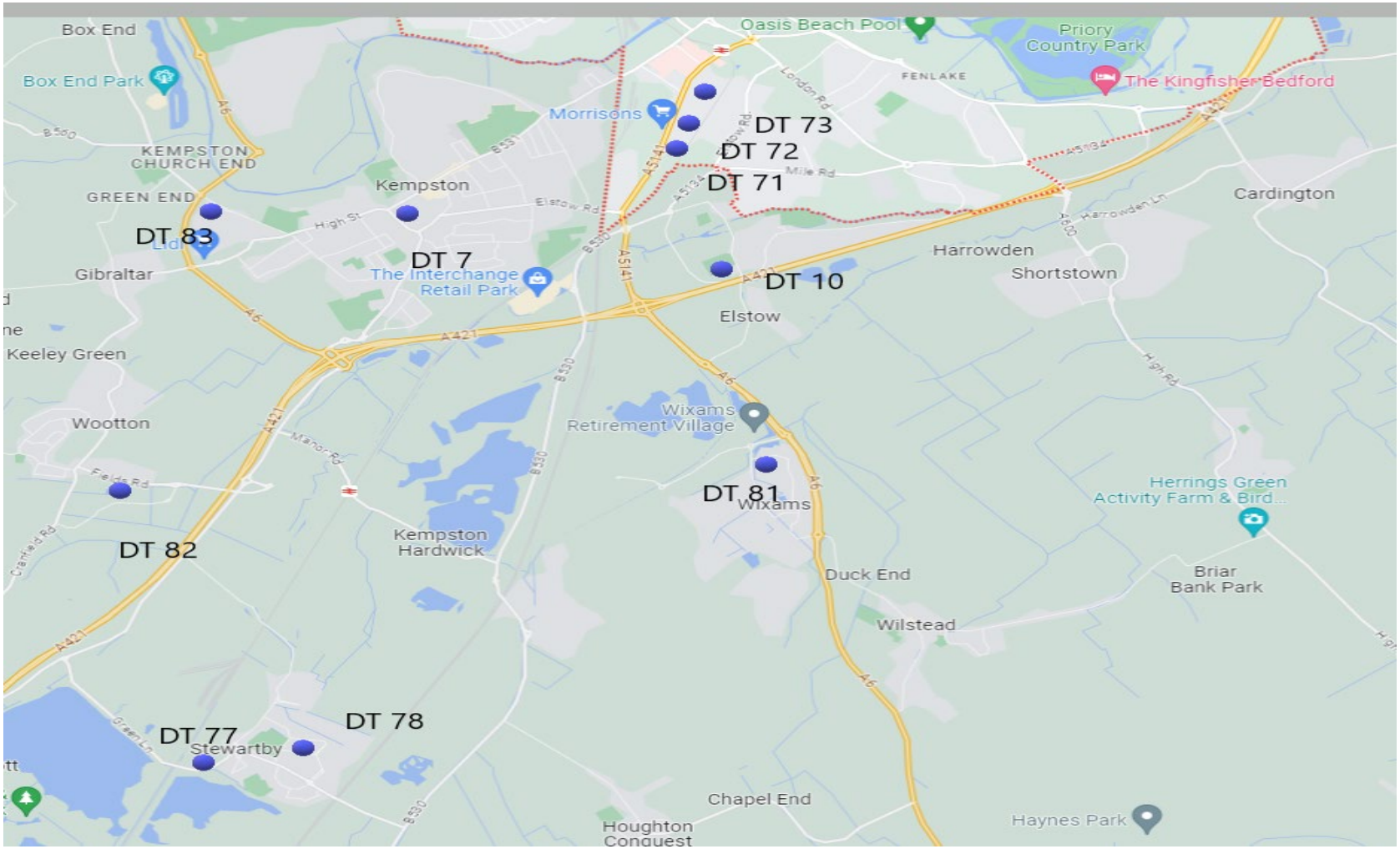


Figure D.2(a) – Additional map indicating diffusion tubes south of Bedford Town Centre

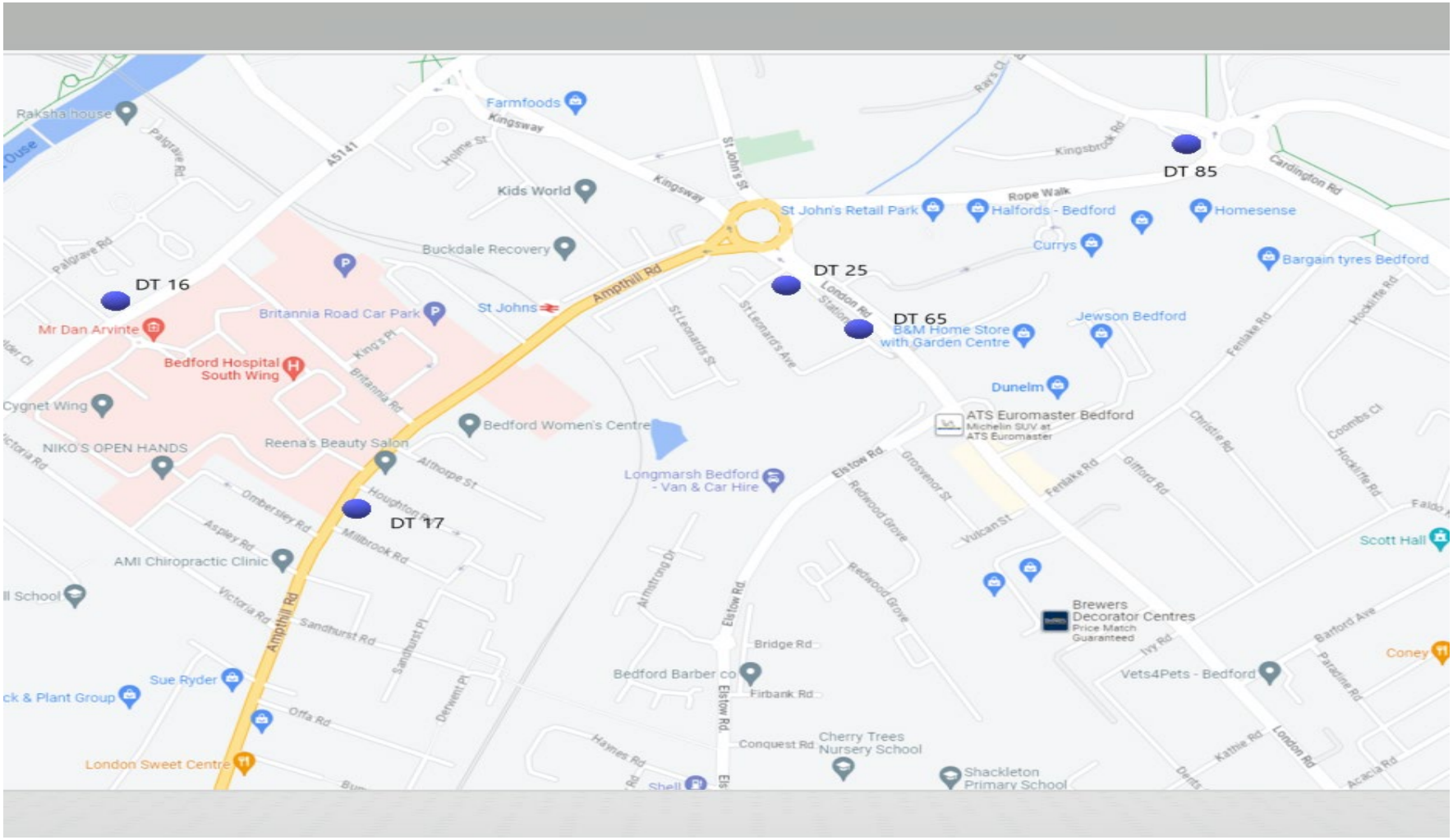


Figure D.3 – Map of diffusion tube locations Bedford Town Centre

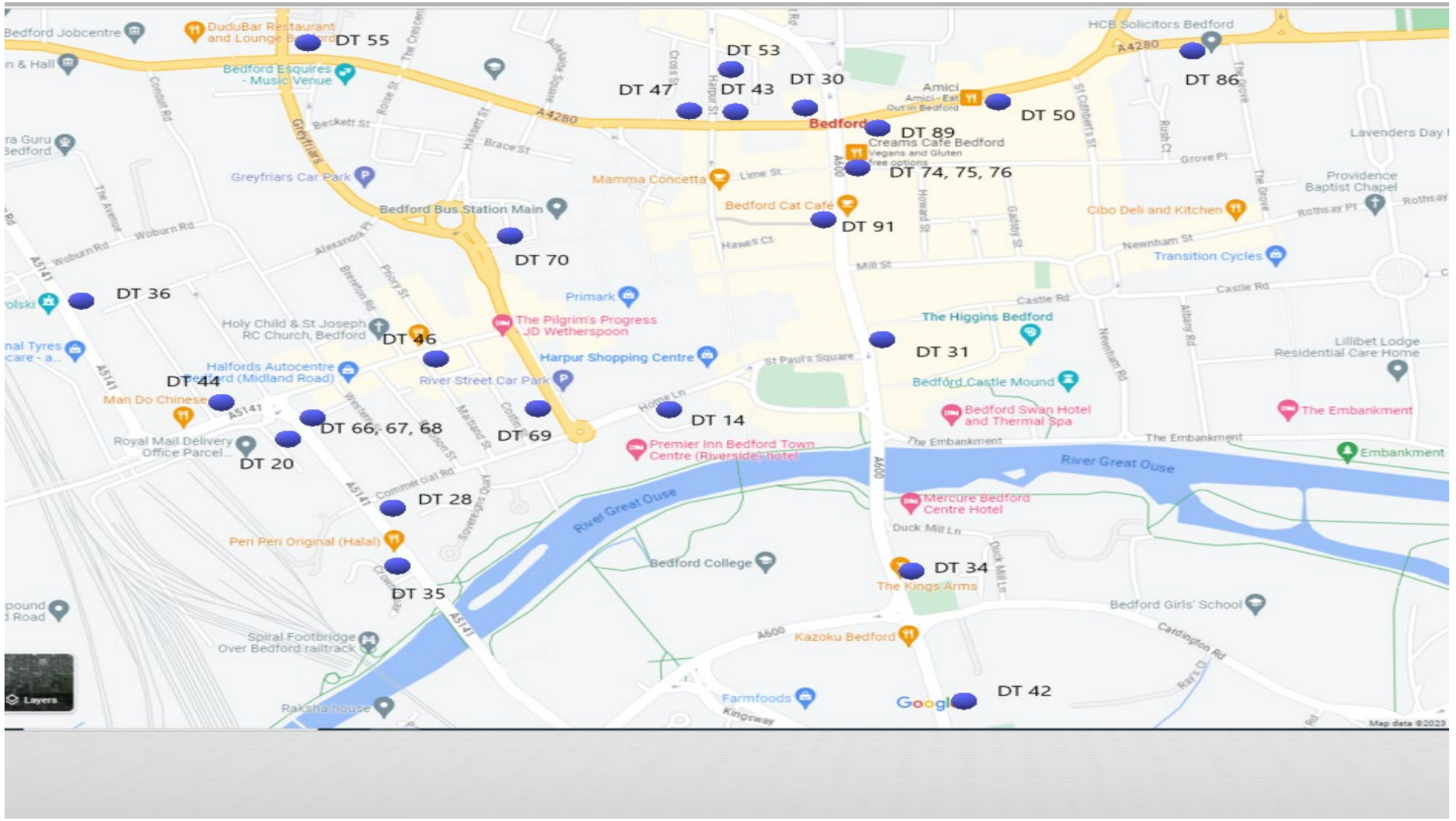
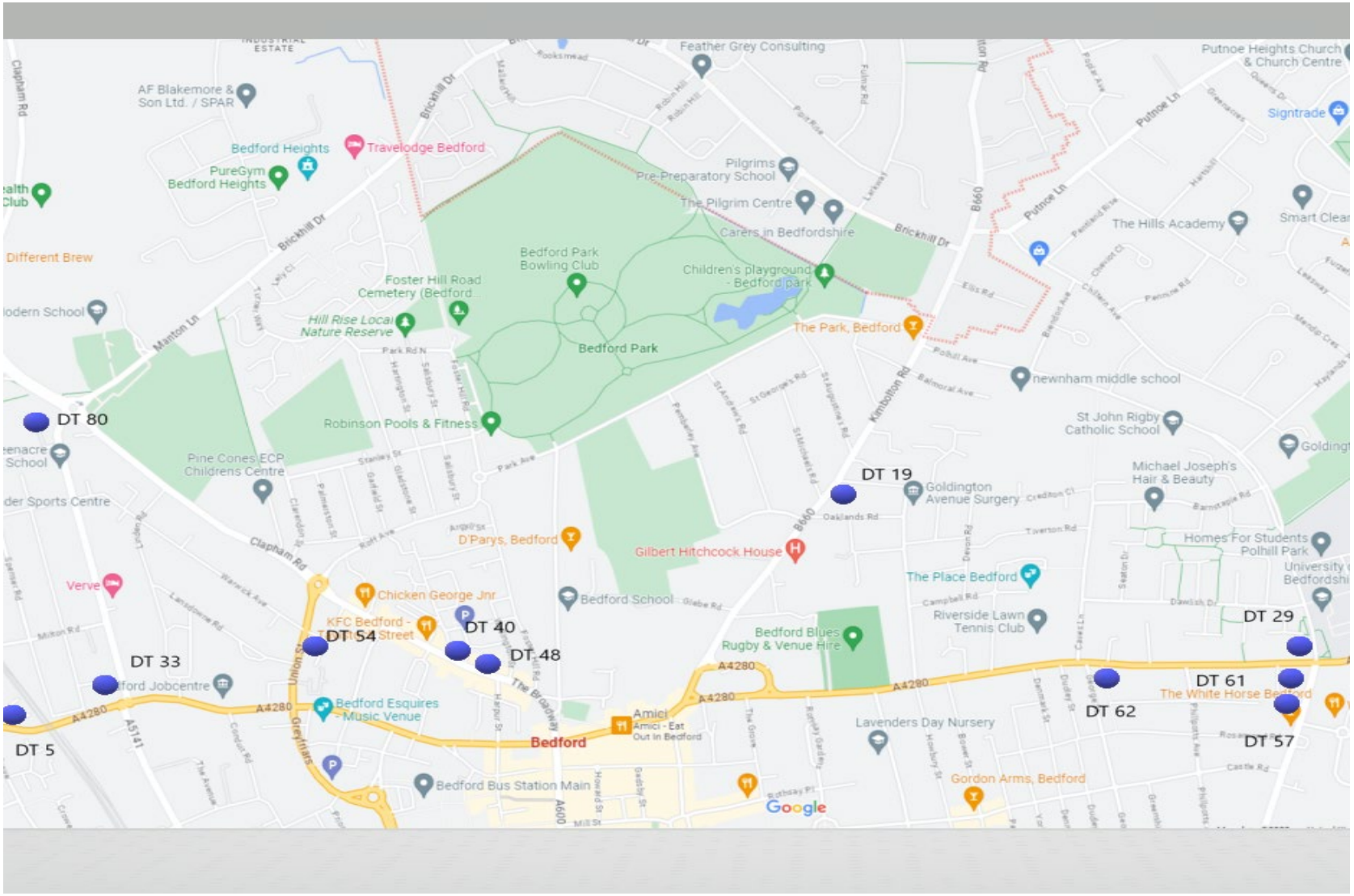


Figure D.4 – Map of diffusion tube locations North of Bedford Town Centre



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.TG22. August 2022. 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.PG22. August 2022. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.