2020 Air Quality Annual Status Report (ASR)

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

July 2020

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Executive Summary: Air Quality in Our Area

Air Quality in Carlisle City Council

Air pollution is associated with a number of adverse health impacts. It is recognised as a contributing factor in the onset of heart disease and cancer. Additionally, air pollution particularly affects the most vulnerable in society: children and older people, and those with heart and lung conditions. There is also often a strong correlation with equalities issues, because areas with poor air quality are also often the less affluent areas[1,2].

The annual health cost to society of the impacts of particulate matter alone in the UK is estimated to be around £16 billion[3].

Air quality has been monitored in Carlisle and the surrounding district as part of the local authority review and assessment process since 1996. In addition to nitrogen dioxide, other pollutants measured include particulate matter (in two size ranges; $PM_{2.5}$ and PM_{10}) and benzene (measured as part of Defra's Non-Automatic Hydrocarbon Network). However, as local authorities are no longer required to report benzene concentrations we are not reporting these in this Annual Status Report.

Monitoring has shown that air quality within Carlisle City Council is generally good but there were small pockets within the city where the annual mean objective (40 μg m^{-3}) for nitrogen dioxide (NO_2) was regularly exceeded, mainly due to road traffic sources. To improve air quality, the review and assessment process initially resulted in declaration of six Air Quality Management Areas (AQMA) between 2005 and 2008. One of these (AQMA 3) was later extended to incorporate more properties along Wigton Road to the Caldewgate roundabout and properties in Caldcotes.

Due to measures introduced by Carlisle City Council, nitrogen dioxide concentrations have tended to decrease at all locations throughout the local authority. However, current pollution concentrations suggest that the following AQMAs should remain:

- AQMA 1 (A7):

[1] Environmental equity, air quality, socioeconomic status and respiratory health, 2010
[2] Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006
[3] Defra. Abatement cost guidance for valuing changes in air quality, May 2013

- AQMA 2 (Currock Street);
- AQMA 4 (Bridge Street);
- AQMA 5 (Dalston Road);

AQMA 1[4] was significantly reduced in size; it no longer includes the area along the A7 from Hardwicke Circus to Junction 44 of the M6 instead it includes just an area extending for approximately 100 m from the Stanwix Bank junction (A7) along Brampton Road including properties 1 to 17 on Brampton Road. The order came into force on 25th July 2019.

The orders for revocation of AQMA 3[5] and AQMA 6[6] came into force on 3rd July 2019. Copies of the orders can be obtained from www.carlisle.gov.uk (see footnotes below).

They can be viewed on the Department for Environment, Food and Rural Affairs (Defra) website: https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=48

Actions to Improve Air Quality

Carlisle City Council has taken forward a number of measures during the current reporting year of 2019 in pursuit of improving local air quality. Key local measures continue to support improvements in local air quality and the City Council continues to work on:

- Carlisle Northern Development Route, continues to be monitored to assess the impact of traffic on air quality. Plans to extend the bypass are currently in development, as part of the 'Garden City' project.
- Bus infrastructure improvements: Ongoing improvements to bus services with new shelters and raised kerbs continues. In addition, plans for large new housing developments will include public transport provision.

[4] https://www.carlisle.gov.uk/Portals/0/Documents/Residents/Environment/Air%20Quality%20Management%20Order%20No%201%20.pdf

[5] https://www.carlisle.gov.uk/Portals/0/Documents/Residents/Environment/AL517%20-%20Order%20Revoking%20Air%20Quality%20Management%20Order%20Area%20No%203.pdf

[6] https://www.carlisle.gov.uk/Portals/0/Documents/Residents/Environment/AL517%20-%20Order%20Revoking%20Air%20Quality%20Management%20Order%20.pdf

- Cycling: Works on a pedestrian crossing on Castle Way incorporating Smart Signalling from the main Hardwicke Circus roundabout is complete, linking the city centre to Carlisle Castle.
- Low Carbon Carlisle: A bid for ERDF funding has been submitted with a value of £4m. The scheme has 14 elements including improving the existing cycleways, creating new sections of cycle track and installing vehicle charging points.
- A scheme to introduce 21 vehicle charging points on council owned land is to be introduced during 2020-21. The scheme is aimed at residential properties which have no access to off street parking.

Conclusions and Priorities

In conclusion, monitoring of pollutants over the last 5 years has shown a gradual but steady decline in nitrogen dioxide (NO_2) and particulate (PM_{10} and $PM_{2.5}$) concentrations. Although particulate measurements are well below the air quality objectives, some locations across the city still exceed or are just below the air quality objectives for NO_2. As a result, Carlisle City Council is to retain four of the six AQMAs. Of these four, AQMA 1 has been significantly reduced in size.

AQMA 3 (Wigton Road) and AQMA 6 (London Road) were revoked in July 2019.

Carlisle City Council's priorities for the coming year are:

- Revise the Air Quality Action Plan. Drive forward on actions identified in the Action Plan;
- Promote travel plans and introduction of green spaces for all new housing developments – look to introduce zero and near zero emission vehicle uptake as part of new residential development
- Continue to work with businesses to promote more widespread use of alternative transport.

Local Engagement and How to get Involved

There are a number of ways in which the public can get involved with improving air quality:

- Taking part in Green Travel Plan arrangements with their employer.

- Joining local cycle groups and walk to school/work groups.
- Become involved other community groups such as the Waverly Viaduct Trust which is currently working to reopen the Waverly Viaduct Bridge. The Local Enterprise Partnership (LEP) also works to secure government grant funding for local projects.
- The City council website can be used to view all previous air quality review and assessment reports as well as real time monitoring data and advice on how to reduce emissions to air.

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1 Local Air Quality Management

This report provides an overview of air quality in Carlisle City Council during 2019. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995) and the relevant Policy and Technical Guidance documents.

The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where an exceedance is considered likely the local authority must declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives. This Annual Status Report (ASR) is an annual requirement showing the strategies employed by Carlisle City Council to improve air quality and any progress that has been made.

The statutory air quality objectives applicable to LAQM in England can be found in Table E.1 in Appendix E.

2 Actions to Improve Air Quality

2.1 Air Quality Management Areas

Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely exceedance of an air quality objective. After declaration, the authority must prepare an Air Quality Action Plan (AQAP) within 12-18 months setting out measures it intends to put in place in pursuit of compliance with the objectives.

A summary of AQMAs declared by Carlisle City Council can be found in Table 2.1. Further information related to declared or revoked AQMAs, including maps of AQMA boundaries are available online at https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=48. Appendix D: Map(s) of Monitoring Locations and AQMAs, provides a series of maps showing the location of air quality monitoring locations in relation to the AQMA(s).

Table 2.1 – Declared Air Quality Management Areas

Pollutants and Air Quality Objectives	City / Town	One Line Description	Is air quality in the AQMA influenced by roads controlled by Highways England?	Level of Exceedance (maximum monitored/modelled concentration at a location of relevant exposure)		Name	Date of publication	Link
				At Declaration	Now (2019)			
NO_2 Annual Mean	Carlisle	AQMA 1 Amended 25th July 2019 to include just 100 m Section along B6264 Brampton Road.	YES	45.3	34.9	2012 Air Quality Action Plan for CCC	2012	Amended 25th July 2019
NO_2 Annual Mean	Carlisle	AQMA 2 Currock Street and the properties immediately to the west of it, between the junction with James St/Water St and Crown St.	NO	44.6	38.1	2012 Air Quality Action Plan for CCC	2012	https://www.carlisle.gov.uk/LinkClick.aspx?fileticket=r3R76WJIhuI%3D&tabid=729&portalid=0&mid=2838
NO_2 Annual Mean	Carlisle	AQMA 3 Wigton Road between Crummock Street and Caldewgate roundabout as well as	NO	40	32.0	2012 Air Quality Action Plan for CCC	2012	Revoked 3rd July 2019

		properties on Caldcotes.						
NO_2 Annual Mean	Carlisle	AQMA 4 North side of the A595 at Bridge Street, northbound from the junction with Shaddongate.	NO	43.9	42.7	2012 Air Quality Action Plan for CCC	2012	https://www.carlisle.gov.uk/LinkClick.aspx?fileticket=r3R76WJIhuI%3D&tabid=729&portalid=0&mid=2838
NO_2 Annual Mean	Carlisle	AQMA 5 Junction of Dalston Road and Junction Street	NO	48	38.7	2012 Air Quality Action Plan for CCC	2012	https://www.carlisle.gov.uk/LinkClick.aspx?fileticket=r3R76WJIhuI%3D&tabid=729&portalid=0&mid=2838
NO_2 Annual Mean	Carlisle	AQMA 6 London Road and properties on either side near the junction with Blake Street	NO	43.3	35.4	2012 Air Quality Action Plan for CCC	2012	Revoked 3rd July 2019

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

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

Defra's appraisal of last year's ASR concluded that the report was well structured, detailed, and provides the information specified in the Guidance. With regards to the main comments made by the appraisal:

1. *The report submission website (RSW) has not been updated with the revocation of AQMA 3 and 6 and the amendment of AQAM 1.*

We will update the RSW when we submit this year's ASR.

2. *The Council are commended on their inclusion of Table 3-2. It provides useful information regarding the NO_2 concentrations within each AQMAs and also presents the Council's recommendation for the designation of each AQMA. It is encouraged that the Council includes this AQMA in all future ASRs.*

We have updated Table 3.2 with recommendations about the designation of each AQMA.

3. *The current action plan is now 7 years old. It is recommended that the Council update their AQAP in light of the recent changes made to the AQMA designations as soon as possible.*

The action plan has been updated and is in draft format for review by stakeholders.

4. *The Council provide good measures that relate to $PM_{2.5}$ however it would be useful in future reports for the Council to compare the PHOF '3.01 - Fraction of mortality attributable to particulate air pollution indicator' value for Carlisle City to nearby LAs and National indicator values. This value can be found in the link below. https://fingertips.phe.org.uk/profile/public-health-outcomes-framework/data#page/0/gid/1000043/pat/6/par/E12000005/ati/101/are/E07000194*

The comparison with PHOF was included in the draft AQAP and is reproduced in this year's ASR.

5. *It may not be possible for the Council to include a single map which displays all the diffusion tube locations (due to distance from one another and inherent difficultly in labelling), however it would be beneficial if the Council were to provide a map which shows the study 'Areas' (Areas A-H)*

so that the reader can understand where these areas are in relation to one another.

The maps showing monitoring locations and air quality management areas have been redrawn. Some of these areas are included within air quality management areas while others are used to assess air quality within specific areas. These areas included the city centre, areas that were previously border line for inclusion in an AQMA, areas on the outskirts of the city, main arterial roads and the Carlisle Northern Development Route.

Now that the number of sites has reduced by nearly fifty percent these study areas will not be used to categorize the CCC diffusion tube network in future annual status reports.

Carlisle City Council has taken forward a number of direct measures during the current reporting year of 2019 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2.

Key completed measures are:

- Completion of Carlisle Northern Development Route with demonstrable decrease on nitrogen dioxide concentration within AQMA 1 (along A7 and at sampling site on Brampton Road) and AQMA 5 (Dalston Road).
- Effective traffic measurement and Smart Signalling from the main Hardwick Circus roundabout.

The updated Action Plan showed that the NOx emissions from Bridge Street needs to reduce by just 2.7 % to achieve compliance. Source apportionment showed that emissions from diesel vehicles dominated NOx emissions. A breakdown in NOx emissions, in terms of vehicle types, is as follows:

- Rigid HGVs 33.8 %;
- Diesel Cars 26.8 %;
- Buses/Coaches 13.7 %;
- Artic HGVs 12.4 %;
- Diesel LGVs 9.4 %;
- Petrol Cars 3.2 %;
- Motorcycles 0.30 %;
- Hybrids 0.29 %

- Petrol LGVs 0.02 %

Clearly reducing the proportion of diesel vehicles on Bridge Street would reduce NOx emissions. Increasing traffic flow through the traffic lights would also be beneficial.

The impact of increasing traffic speed on oxide of nitrogen emissions was investigated using the emission factor toolkit (EFT2019_v9.0)[7]. Traffic speeds were increased at 5 kph increments within the same model domain considered in the Air Quality Action Plan[8]. For the base case, NOx emissions were calculated to be 15.2 tonnes. Increasing the speed by 5 kph would cause a reduction of 17 % in NOx emissions easily exceeding the 2.7 % reduction required to achieve compliance of 40 µg m^{-3}. Emissions at the other speeds are given below:

	NOx emissions, tonnes / year	Percentage reduction, %
Base	15.2	
Base + 5 kph	12.7	17.0
Base + 10 kph	11.0	27.9
Base + 15 kph	9.9	35.1

Carlisle City Council will work with partners to implement actions to improve traffic flow along Bridge Street.

Carlisle City Council expects the following measures to be completed over the course of the next reporting year:

- Improve signalling to reduce standing and stop and start traffic at pedestrian crossing on Bridge Street
- Progress made on plans for southern bypass project which is now in the procurement stage of the project.

Carlisle City Council's priorities for the coming year are to:

- Continue to work with the planning department to ensure air quality implications are taken into account in the planning process.

[7] https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html
[8] The Air Quality Action Plan has been updated as a draft and is currently under review by the Steering Body.

- Improve cycle links
- Signal improvements to improve traffic flow at traffic lights on Bridge Street
- Progress plans for the southern bypass project which is now in the procurement stage of the project.

The principal challenges and barriers to implementation that Carlisle City Council anticipates facing is the bus fleet not being ungraded, as the decision to invest in the fleet would be made by commercial operators.

Progress on the following measures has been slower than expected due to budget and time constraints:

- Public promotion of air quality
- The implementation of a 'Transport Overview and Joint Parking Policy' has been abandoned.

Carlisle City Council anticipates that the measures stated above and in Table 2.2 will achieve compliance in AQMA 4.

Table 2.2 – Progress on Measures to Improve Air Quality

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
1	'Carlisle Northern Development Route,' to the west of the City will remove up to 25% of through traffic.	Traffic Management	Other	Cumbria County Council & Carlisle City Council	Complete	2007-2012.	Reduced NO_2 levels at monitoring locations and within AQMA's.	Anticipate approx 25% reduction in NO_2 in city centre.	CNDR operational. Monitoring at receptors on new road revealed consistently low NO2 levels, monitoring locations subsequently reduced in 2018. Further evidence of NO2 improvements and traffic reduction in the city centre. Several new cycle links from arterial routes to CNDR complete. Plans for future improvements	Ongoing	Plans now being developed for a further 'Southern Bypass' as part of the Garden Village project This would extend the existing CNDR and link both ends of the bypass to the M6 Motorway, around the City Centre. The southern bypass project is now in the procurement stage and it is expected that works will begin in the next few years.
2	Effective traffic management measures will be implemented to improve the existing road network and incorporate new developments.	Traffic Management	UTC, Congestion management, traffic reduction	Cumbria County Council & Carlisle City Council	Ongoing	Ongoing	Reduced NO_2 levels and standing traffic within AQMA's.	Not calculated See above for modelling undertaken at Bridge street AQMA.	Completed works on pedestrian crossing on Castle Way incorporating Smart Signalling from the main Hardwicke Circus roundabout. Ongoing work to improve traffic flow Modelling working as part of AQAP has shown that emissions from diesel vehicles dominate emissions Emissions factor toolkit has been used to show increased traffic speeds would reduce oxide of nitrogen emissions within Bridge Street. Work will continue to improve traffic management in this area.	Ongoing.	Such projects require significant investment.
3	Environmental Health will continue to work with the Planning Department with regard to new developments and ensure that air quality implications are taken into consideration in the planning process.	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	Carlisle City Council	Ongoing	Ongoing	Improved links between EH and Planning. AQIA's submitted as necessary. Early consultation with applicants.	Not calculated	Environmental Health is consulted on all proposed developments which may impact on air quality. Responses are aimed at minimising AQ impacts. This currently includes many large residential developments on fringe of city. Recommendations made for car charging points on all new residential properties with parking/garage provision.	Ongoing	Environmental Health comment on all potentially polluting developments. The outcome depends on Planning Department and current policy
4	Upgrade of passenger transport infrastructure to make it more convenient and widely accessible across the County. Arrangements for sustainable transport systems will be integrated into major new and proposed developments	Transport Planning and Infrastructure	Bus route improvements	Cumbria County Council	Ongoing	Ongoing	Improved bus service. Increased use of transport provided. Reduced NO_2 along main routes	Not calculated	Ongoing improvements to bus services with new shelters and raised kerbs. Plans for large new housing developments include public transport provision and/or sustainable transport options.	Ongoing	Success is dependent on public uptake of sustainable transport options. No real control over the improvement of vehicle fleet.
5	Cycling and walking will be encouraged through reducing the impact of vehicle traffic in key areas of the city. New and improved pedestrian and cycle links including the Caldew and Lowry Hill Cycle ways and the River Petteril shared cycle/footway will be provided.	Transport Planning and Infrastructure	Cycle network	Cumbria County Council	Ongoing	Ongoing	Completion of proposed works and ongoing improvement of the cycle and pedestrian route network.	Not calculated	The pedestrian crossing on Castle way incorporating Smart Signalling is complete. Pedestrian/cycle bridge connecting Currock and Denton Holme, over the railway line are complete. Ongoing applications for government funding for schemes that aim to improve the existing cycleways, creating new sections of cycle track and installing vehicle charging points. Extensive plans to increase the cycle path network are now in place.	Ongoing	Ongoing plans associated with improved pedestrian and cycle connections to the CNDR. Plans still being developed for a new cycle/footway connecting Etterby area in the north of the city to the west. This will utilise an existing disused railway bridge, over the river Eden. Funding required to accelerate major improvements.
6	Travel plans will be required to be implemented and monitored through S106 agreements for all new developments that meet the criteria. Existing businesses will be encouraged to implement, monitor and review travel plans.	Promoting Travel Alternatives	Workplace Travel Planning	Cumbria County Council & Carlisle City Council	Ongoing	Ongoing	Increased number of participant businesses and more widespread use of alternative transport.	Not calculated	All schools within the city now have travel plans. New developments likely to result in increased highway usage must submit a travel plan for approval when making an application.	Ongoing	Difficult to quantify the impact of Travel Plans.
7	The City Council and the County Council will develop and implement a comprehensive 'Transport Overview and Joint Parking Policy'.	Policy Guidance and Development Control	Regional Groups Co-ordinating programmes to develop Area wide Strategies to reduce emissions and improve air quality	Cumbria County Council & Carlisle City Council	<2015	Date not yet confirmed	Approval and adoption of Transport Overview and Joint Parking Policy.	Not calculated	No progress to date	Closed	This measure is unlikely to be implemented. A long time has passed since work began on the draft document. To be taken out of revised action plan

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
8	The City Council will continue to provide comprehensive control over emissions from all Part A2 and B Processes located within the local authority area.	Environmental Permits	Other measure through permit systems and economic instruments	Carlisle City Council	Ongoing	Ongoing	Risk based inspections showing that emission limits are being met and efforts are being made to improve on national objectives.	Not calculated	All processes which fall under part B & A2 processes are permitted by Carlisle CC. There were 3 A2 ad 41 part B processes in 2019. No recent enforcement action required during 2019 in relation to emissions.	Ongoing	No new major polluting processes in previous year.
9	The City Council will continue to investigate complaints of black smoke and smoke nuisance as well as managing smokeless zones. Enforcement action will be taken as necessary.	Public Information	Other	Carlisle City Council	Ongoing	Ongoing	Reduction in the number of complaints from members of the public. Reduction in repeat offenders.	Not calculated	There is information on website. Environmental Health provide advice and enforcement as required. Smoke complaints are responded to involving domestic fires, bonfires, trade waste, industrial and dark smoke. 47 complaints specifically relating to Domestic burning, bonfires and burning of trade waste during 2019. Recent advice leaflet printed for all cases of domestic burning.	Ongoing	Increase in enquiries and uptake of log burners and multi fuel stoves. Advice given to minimise potential for smoke issues and ensure compliance with smokeless zones. The Air Quality Strategy[9] set out a goal to cut public exposure to particulate matter pollution. The aim is to reduce by half the number of people in the United Kingdom exposed to the WHO guideline concentration of 10 µg m^{-3} by 2025. The measures set out here will contribute to this target.
10	Energy savings advice and subsidised home insulation improvements will continue to be provided to the public. Uptake will be monitored.	Public Information	Other	Carlisle City Council	Ongoing	Ongoing	Number of properties taking up schemes, resulting in Improved energy efficiency of housing stock.	Cumbria Warm Homes Project (CWHP) delivered a reduction of 317296 lifetime carbon tonnes.	Carlisle CC Home Improvement Agency is currently delivering Health through Warmth Scheme, supported by the Energy Companies Obligation. This includes boiler upgrades and home insulation. Safe and warm grants are provided by the council to deliver up to £7,500 to enable low income homes to carry out minor repairs and energy efficiency measures to their homes. Work has begun on enforcing the Minimum Energy Efficiency Standards, specifically aimed at private rented sector properties. New energy efficiency grants are now available up to £3000 through council grant scheme.	Ongoing	Carlisle CC have now revised Housing Renewal Assistance Policy under the Regulatory Reform Order 2002. This covers all grants involving housing and energy efficiency measures.
11	Environmental Health will work alongside the Neighbourhoods and Green Spaces team to investigate and implement the effective use of trees and green areas to offset traffic derived emissions in existing AQMA's and in new development areas.	Public Information	Other	Cumbria County Council & Carlisle City Council	Ongoing	Ongoing	Increase in trees and vegetation in visible locations. Increased public interest.	Not calculated	Carlisle City Council continues to manage and maintain trees in parks and green spaces, including some additional planting, of mainly mixed broadleaf species, where necessary. Planting of green areas is an essential part of many new developments, including residential.	Ongoing	Limitations to planting options in busy urban areas. Parks and open spaces do not have significant air quality issues. Green Spaces continue to have a positive public impact.
12	Joint working will be extended in order to include air quality improvement in all relevant City Council and County Council policies and strategies.	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	Cumbria County Council & Carlisle City Council	Ongoing	Ongoing	Increased awareness of air quality issues and consideration given by more council departments.	Not calculated	Included air quality links within most major relevant policies including Local Transport Plan (LTP 3) (2011-26) and The Carlisle District Local Plan (2015-30). New schemes being developed to deliver improved cycling routes and vehicle charging infrastructure. The draft 'Carlisle Local Environment (Climate Change) Strategy' is now in the public consultation phase.	Ongoing	Air Quality considerations are put forward during discussion and consultation stages of policy development.
13	The City Council will promote air quality and sustainable transport issues. Up to date air quality information and monitoring data will be provided to the public.	Public Information	via the Internet	Carlisle City Council/ PH	Ongoing	Work closely with DPH and multi-agency partners to raise awareness and AQ issues	Increased public awareness and participation in improving air quality.	Not calculated	Air quality info and real time monitoring data is available on the website. Monitoring data shows continued improvement in most areas. Carlisle CC is actively supporting and promoting Clean Air Day, utilising Social Media and our website, as part of the Global Action Plan. Previous Clean Air Day included a competition, for all local primary schools. Prizes awarded including bikes and cycling equipment. Cumbria's bid for £2.5 million of National Lottery funding to cut carbon emissions in the county has been successful. The project aims to raise ambition to tackle climate change and sharing learning and resources. The public will be able to influence and drive climate action through citizens' juries and other projects, with community groups steering the programme.	Ongoing	Difficult to quantify any improvement as a direct result of promotional work or providing monitoring data.

[9] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/770715/clean-air-strategy-2019.pdf

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.

Carlisle City Council is taking the following measures to address $PM_{2.5}$:

- Carlisle City Council has monitored $PM_{2.5}$ levels at Paddy's Market AQMS since 2009 as part of the AURN. This is a busy city centre junction between two AQMA's. The annual mean concentrations, since 2012, are consistently well below the objective at around 9-12 µg m^3 at this location (see Figure A.4), however ongoing efforts are being made to reduce these levels.
- Carlisle City Council will continue to work in partnership with Cumbria County Council as the highways authority and also in relation to any planning applications with significant air quality implications. The Environmental Health department will continue to work with the City Council Planning Department with regard to new local developments and ensure that air quality implications and mitigation measures are taken into consideration in the planning process.
- We will continue to work alongside the Neighbourhoods and Green Spaces team to investigate and implement the effective use of trees and green areas to offset traffic derived emissions in existing AQMA's and in new development areas.
- The City Council will also continue to provide comprehensive control over emissions from all Part A2 and B Processes located within the local authority area. We will work closely with the operators of these installations to continuously monitor and improve on their emissions to air as part of the permitting process. In line with measures 2, 3, 6, 8, 11 and 12 of the above Action Plan.

Carlisle City Council has four designated smoke control areas. The locations of the smoke control areas within Carlisle are highlighted on our online mapping tool (http://maps.carlisle.gov.uk/MyCarlisle.aspx) or can be downloaded as a map (http://www.carlisle.gov.uk/LinkClick.aspx?fileticket=9E67HYHexDw%3d&tabid=729&portalid=0&mid=2838).

Work carried out by Public Health England as part of the Public Health Outcomes Framework (PHOF) shows that the mortality associated with particulate air pollution within Carlisle City Council is 3.4%. This information is available from the following web link:

https://fingertips.phe.org.uk/profile/public-health-outcomes-framework/data#page/1/gid/1000043/pat/6/par/E12000002/ati/101/are/E07000028/cid/4/page-options/ovw-do-0

and displayed in Figure 2-1 against the values calculated for north west England (4.3%) and England (5.2%).

Figure 2-1 Fraction of mortality attributed to particulate air pollution in Carlisle City Council

Indicator	Period	Carlisle			Region	England	England		
		Recent Trend	Count	Value	Value	Value	Worst/ Lowest	Range	Best/ Highest
D01 - Fraction of mortality attributable to particulate air pollution New data	2018	–	-	3.4%	4.3%	5.2%	7.3%		2.9%

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

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

This section sets out what monitoring has taken place and how it compares with objectives.

Carlisle City Council undertook automatic (continuous) monitoring at one site during 2019. Table A.1 in Appendix A shows the details of the sites. NB. Local authorities do not have to report annually on the following pollutants: 1,3 butadiene, benzene, carbon monoxide and lead, unless local circumstances indicate there is a problem. National monitoring results are available at https://uk-air.defra.gov.uk/data/data_selector.

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.

3.1.2 Non-Automatic Monitoring Sites

Carlisle City Council undertook non- automatic (passive) monitoring of NO_2 at 30 sites during 2019. Table A.2 in Appendix A shows the details of the 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[10], “annualisation” (where the data capture falls below 75%), and distance correction[11]. Further details on adjustments are provided in Appendix C.

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

3.2.1 Nitrogen Dioxide (NO_2)

Automatic monitoring of nitrogen dioxide concentrations began in 2006 at Paddy's Market (PM1), while monitoring began at Stanwix Bank in 2007. Figure 3-1 compares the annual mean concentration at both sites with the annual mean objective concentration (40 µg m^{-3}). Monitored NO_2 concentrations at Paddy's Market and Stanwix Bank automatic monitoring stations have been consistently below the objective concentrations since 2011. Monitoring at the Stanwix Bank site has now ceased. Monitoring data from these sites are also presented in Table A.3.

Figure 3-1: Automatic monitoring data (2006 – 2019)

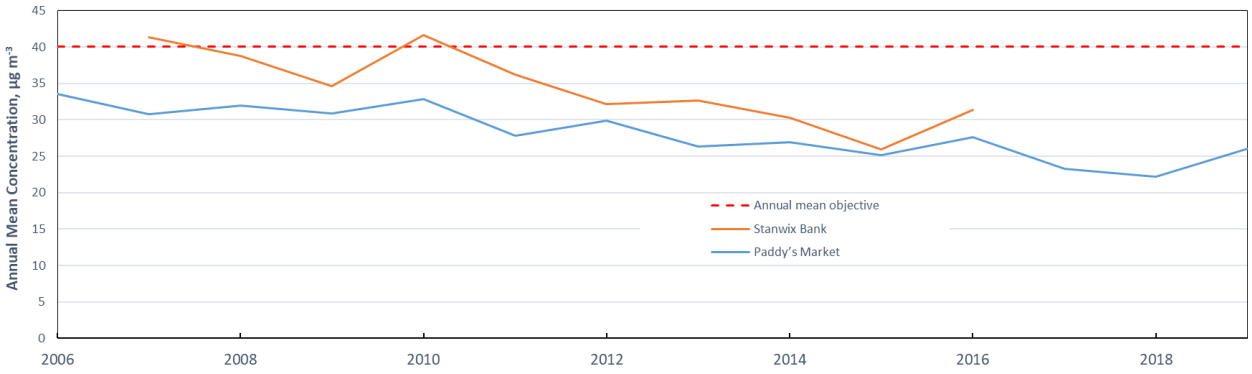


Table A.3 in Appendix A compares all of the ratified and adjusted monitored NO_2 annual mean concentrations since 2015 with the air quality objective of 40 µg m^{-3}.

Note that the concentration data presented in Table A.3 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).

Table A.4 in Appendix A compares the ratified continuous monitored NO_2 hourly mean concentrations for the past 5 years with the air quality objective of 200 µg m^{-3}, not to be exceeded more than 18 times per year. There were no exceedances of the 200 µg m^{-3} threshold in 2019.

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

Figure A.1 also within the Appendix shows:

- For sites situated along the A7 (sites named with prefix A) nitrogen dioxide concentrations decreased or remained at similar levels to recent years
- For sites in city centre and within AQMA 2 and AQMA 5 (sites named with prefixes B, C and D) nitrogen dioxide concentrations decreased or remained at similar levels to recent years
- For sites situated along Wigton Road and Bridge Street (sites named with prefix E) nitrogen dioxide concentrations decreased or remained at similar levels to recent years
- For sites situated along London Road (sites prefixed with F including revoked AQMA 6), along the Carlisle Northern Development Route (G4) and at a number of locations to the south of city centre e and at the airport (prefixed by H) the concentrations have remained more or less constant.

Figure 3-2 shows the change in nitrogen dioxide concentration within each of the AQMAs since 2006. The following observations can be made:

- AQMA 1: Brampton Road: concentrations have decreased steadily since 2006. There appears to have been a step change down in concentrations after 2012 (by about fourteen percent). This may be attributed to the opening of the Carlisle Northern Development Route. Concentrations are currently around 32 μg m^{-3}.
- AQMA 2: Currock Street: concentrations have decreased gradually since 2006 and since 2013 have been less than the annual objective concentration. However, concentrations remain close to the annual objective- 38.1 μg m^{-3}.
- AQMA 5: Dalston Road: there is step down in concentration from 2012 to 2013 (about 28 %) which may be attributed to the completion of the Carlisle Northern Development Route. Concentrations remain close to the annual objective- 38.7 μg m^{-3}.
- AQMA 4: Bridge Street: concentrations decreased steadily from 2006 to 2014 but have plateaued since then and remain above 40 μg m^{-3}.

Figure 3-2 Nitrogen dioxide concentrations measured within each AQMA from 2006 to 2019

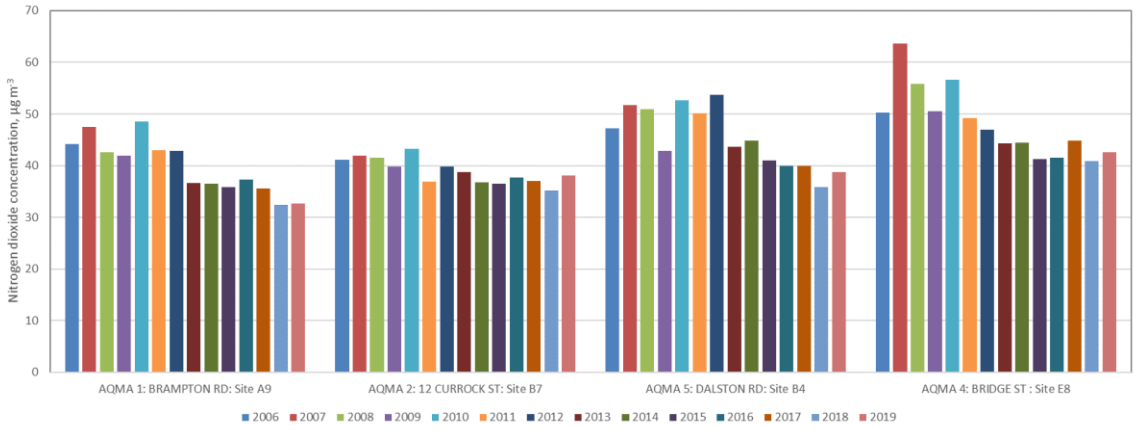


Table 3-1 presents the annual mean concentrations measured at monitoring stations within the current AQMAs. Recommendations for retaining, amending or revoking the AQMA's are also evidenced in Table 3-1

Table 3-1 Nitrogen dioxide concentrations measured by diffusion tube within each air quality management area (see Figure D-3)

Site ID	Site Name	NO_2 Annual Mean Concentration (µg/m^3)						Recommendation
		AQMA	2015	2016	2017	2018	2019	
A9	AQMA 1 BRAMPTON RD	1	35.9	37.4	35.5	32.4	32.7	No exceedances of annual objective within AQMA 1 Monitoring to continue. Consider revocation if concentrations remain at current levels
B7	AQMA 2 CURROCK ST	2	36.5	37.7	37.0	35.2	38.1	While no exceedances measured in last five years concentrations are sufficiently high to suggest there may be a risk of exceedance in future years ***Keep AQMA***
B4	AQMA 5 DALSTON RD	5	41.0	40.0	39.9	35.8	38.7	Not exceeding air quality objective since 2015 but concentration within10 % of objective ***Keep AQMA***
E8	AQMA 4 BRIDGE ST	4	41.2	41.5	44.9	40.8	42.7	Still exceeding air quality objective ***Keep AQMA***

3.2.2 Particulate Matter (PM_{10})

Table A.5 in Appendix A and Figure A.2 compares the ratified and adjusted monitored PM_{10} annual mean concentrations for the past 5 years with the air quality objective of 40 µg m^{-3}. Annual mean PM_{10} concentrations increased by more than 2 µg m^{-3} compared to 2018 but remain less than fifty percent of the air quality objective.

Table A.6 and Figure A.3 in Appendix A compares the ratified continuous monitored PM_{10} daily mean concentrations for the past 5 years with the air quality objective of 50 µg m^{-3}, not to be exceeded more than 35 times per year.

There are no exceeedances of the air quality objectives for PM_{10}.

3.2.3 Particulate Matter ($PM_{2.5}$)

Table A.7 and Figure A.4 in Appendix A presents the ratified and adjusted monitored $PM_{2.5}$ annual mean concentrations for the past 5 years.

Monitored $PM_{2.5}$ annual mean results over the last 5 years show that the concentrations in 2019 are the highest over the five year period and more 2 µg m^{-3} greater than the concentration measured in 2018. $PM_{2.5}$ concentrations should be monitored to ensure they do not increase in future years.

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?	Monitoring Technique	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Inlet Height (m)
PM1	Paddy's Market	Roadside	339467	555974	NO_2	NO	Chemiluminescence	42	4	3
PM1	Paddy's Market	Roadside	339467	555974	PM_{10}	NO	FIDAS	42	4	3
PM1	Paddy's Market	Roadside	339467	555974	$PM_{2.5}$	NO	FIDAS	42	4	3

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

Site ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
A1	45 SCOTLAND RD	Roadside	339995	557188	NO2	No	4.5	1.5	NO	3.05
A10	STANWIX BANK	Roadside	340008	556842	NO2	No	1.5	1.5	NO	2.95
A12	14 ETTERBY ST	Roadside	339935	557125	NO2	No	0	3	NO	2.8
A5	37 KINGSTOWN RD	Roadside	339758	558059	NO2	No	0	4	NO	2.8
A7	282 KINGSTOWN RD	Roadside	339526	559285	NO2	No	7.5	4	NO	2.7
A9	BRAMPTON RD	Roadside	340028	556833	NO2	Yes (1)	0	1.5	NO	2.75
B4	DALSTON RD	Roadside	339434	555638	NO2	Yes (5)	0	3.5	NO	2.8
B7	12 CURROCK ST	Roadside	340205	555198	NO2	Yes (2)	0	3	NO	3.05
C1	LOWTHER ST	Roadside	340216	556131	NO2	No	0	3	NO	2.85
C2	TOURIST INFO	Urban Centre	340069	555955	NO2	No	N/A	N/A	NO	2.7
C3	DEVONSHIRE ST	Roadside	340218	555768	NO2	No	0	3	NO	2.85
D12	POST OFFICE	Kerbside	340307	555718	NO2	No	N/A	5	NO	2.95
D7	282 WARWICK RD	Roadside	341593	555893	NO2	No	0	7	NO	2.8
E22	FINKLE ST	Roadside	339834	556137	NO2	No	0	12	NO	2.8
E12	3 WIGTON RD	Roadside	339225	555821	NO2	No	2	2.5	NO	2.95
E15	22 WIGTON RD	Roadside	339091	555736	NO2	No	0	4.5	NO	3.9
E16	JOVIAL SAILOR	Roadside	339141	555900	NO2	No	0	2.5	NO	2.7
E19	49 WIGTON RD	Roadside	338953	555610	NO2	No	0	2.5	NO	3.1

E6	PADDY'S MARKET 1	Roadside	339467	555974	NO2	No	N/A	9	YES	3
E6	PADDY'S MARKET 2	Roadside	339467	555974	NO2	No	N/A	9	YES	3
E6	PADDY'S MARKET 3	Roadside	339467	555974	NO2	No	N/A	9	YES	3
E8	BRIDGE ST	Roadside	339516	556024	NO2	Yes (4)	0	4	NO	3.05
F10	155 BOTCHERGATE	Roadside	340600	555349	NO2	No	0	3	NO	2.7
F7	24 LONDON RD	Roadside	340708	555240	NO2	No	0	4.5	NO	2.7
F9	129 LONDON RD	Kerbside	341099	554931	NO2	No	0	0.5	NO	2.95
G4	THE HOBBIT	Rural	336905	554036	NO2	No	0	19	NO	2.85
H5	WIGTON RD	Roadside	337643	554100	NO_2	No	0	1.5	NO	2.4
H6	PETER LANE	Roadside	337962	553220	NO2	No	0	4	NO	2.4
H7	DALSTON RD	Roadside	338282	553396	NO2	No	0	6.5	NO	2.4
H8	AIRPORT	Other	347874	561254	NO2	No	0	2	NO	2.4

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

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	NO_2 Annual Mean Concentration (µg/m^3) (3) (4)				
							2015	2016	2017	2018	2019
PM1	339467	555974	Roadside	Automatic	96.3	96.3	25.1	27.6	23.3	22.1	26.0
A1	339995	557188	Roadside	Diffusion tube	91.7	91.7	35.6	33.7	31.7	30.1	31.7
A10	340008	556842	Roadside	Diffusion tube	91.7	91.7	37.4	42.6	36.4	37.6	36.7
A12	339935	557125	Roadside	Diffusion tube	91.7	91.7	15.8	18.7	28.6	28.2	28.7
A5	339758	558059	Roadside	Diffusion tube	75.0	75.0	32.8	32.1	32.5	29.2	31.5
A7	339526	559285	Roadside	Diffusion tube	91.7	91.7	25.4	24.9	23.4	21.2	20.7
A9	340028	556833	Roadside	Diffusion tube	91.7	91.7	35.9	37.4	35.5	32.4	32.7
B4	339434	555638	Roadside	Diffusion tube	91.7	91.7	**41.0**	**40.0**	39.9	35.8	38.7
B7	340205	555198	Roadside	Diffusion tube	91.7	91.7	36.5	37.7	37.0	35.2	38.1
C1	340216	556131	Roadside	Diffusion tube	91.7	91.7	27.6	27.9	27.2	27.4	27.6
C2	340069	555955	Urban Centre	Diffusion tube	91.7	91.7	17.9	18.7	19.3	20.2	17.8
C3	340218	555768	Roadside	Diffusion tube	91.7	91.7	29.3	29.5	25.5	24.4	27.5
D12	340307	555718	Kerbside	Diffusion tube	91.7	91.7	36.1	36.8	34.4	30.4	32.7
D7	341593	555893	Roadside	Diffusion tube	91.7	91.7	33.2	30.8	32.1	28.0	28.3
E22	339834	556137	Roadside	Diffusion tube	83.3	83.3	30.9	31.5	30.5	29.1	31.4
E12	339225	555821	Roadside	Diffusion tube	91.7	91.7	34.0	35.7	33.5	31.9	33.9
E15	339091	555736	Roadside	Diffusion tube	75.0	75.0	29.8	32.0	30.2	28.4	29.2
E16	339141	555900	Roadside	Diffusion tube	83.3	83.3	30.4	32.7	31.4	31.7	32.0
E19	338953	555610	Roadside	Diffusion tube	83.3	83.3	33.0	34.8	31.5	30.6	31.2
E6_1	339467	555974	Roadside	Diffusion tube	91.7	91.7	29.3	29.3	28.0	28.8	26.3

E6_2	339467	555974	Roadside	Diffusion tube	91.7	91.7	29.1	29.2	26.9	28.5	26.5
E6_3	339467	555974	Roadside	Diffusion tube	91.7	91.7	29.8	28.6	27.4	27.6	26.5
E8	339516	556024	Roadside	Diffusion tube	91.7	91.7	**41.2**	**41.5**	**44.9**	**40.8**	**42.7**
F10	340600	555349	Roadside	Diffusion tube	91.7	91.7	34.7	35.8	36.3	35.3	34.4
F7	340708	555240	Roadside	Diffusion tube	75.0	75.0	35.5	34.1	33.8	32.2	35.4
F9	341099	554931	Kerbside	Diffusion tube	91.7	91.7	29.0	32.4	30.4	30.3	31.4
G4	336905	554036	Rural	Diffusion tube	83.3	83.3	12.5	13.0	12.0	12.6	12.1
H5	337643	554100	Roadside	Diffusion tube	91.7	91.7	15.7	16.1	16.6	15.7	14.1
H6	337962	553220	Roadside	Diffusion tube	91.7	91.7	9.8	12.0	9.4	11.4	10.1
H7	338282	553396	Roadside	Diffusion tube	91.7	91.7	15.4	17.0	15.1	18.7	15.1
H8	347874	561254	Other	Diffusion tube	91.7	91.7	7.7	8.0	7.5	8.2	6.9

☒ **Diffusion tube data has been bias corrected (confirm by selecting in box)**

☒ **Annualisation has been conducted where data capture is <75% (confirm by selecting in box)**

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

Notes:

Exceedances of the NO_2 annual mean objective of 40µg/m^3 are shown in **bold**.

NO_2 annual means exceeding 60µg/m^3, indicating a potential exceedance of the NO_2 1-hour mean objective are shown in **bold and underlined.**

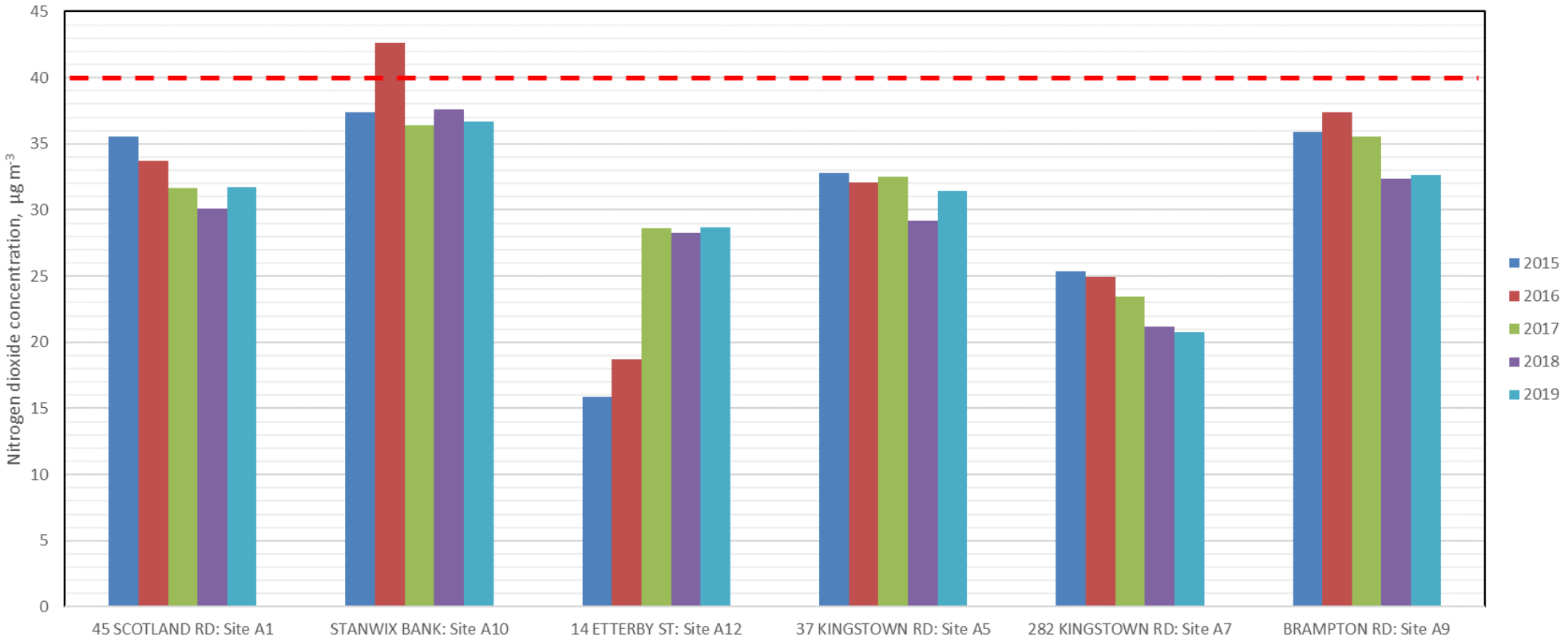
(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

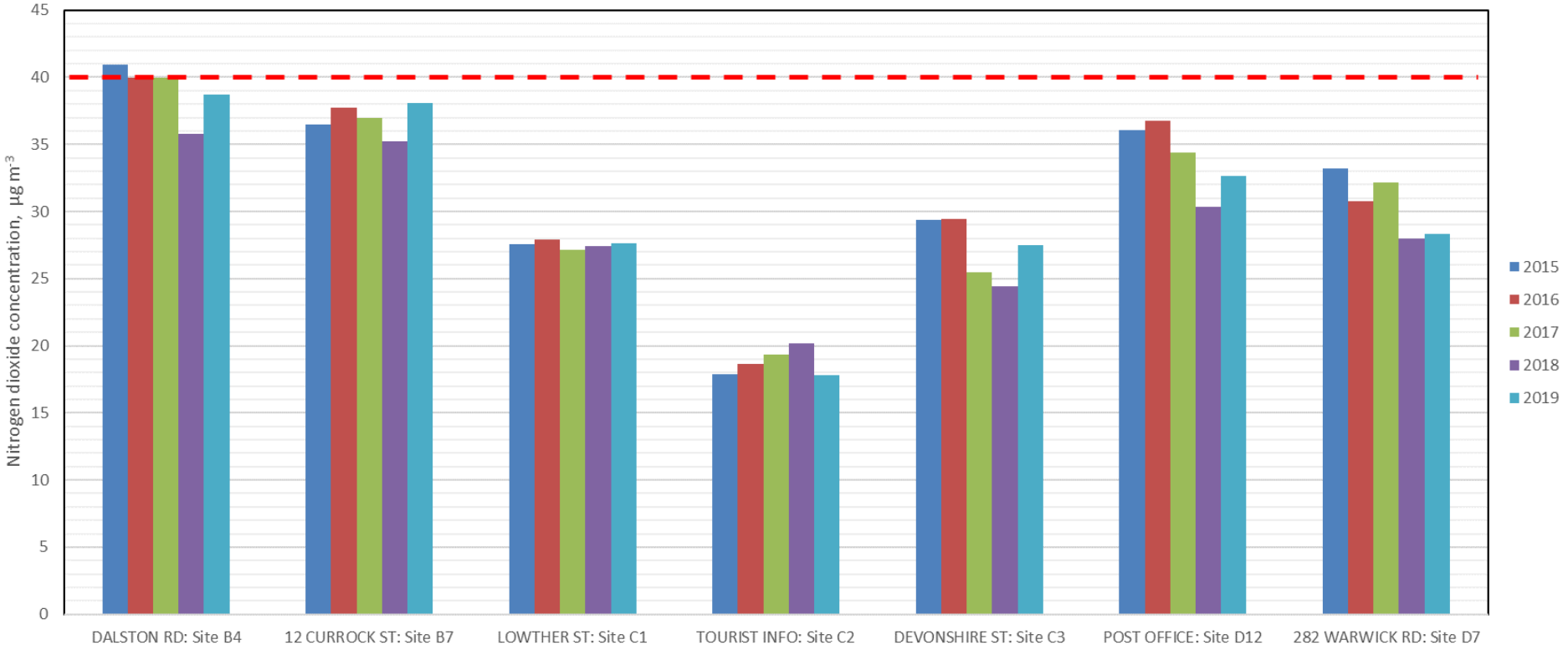
(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

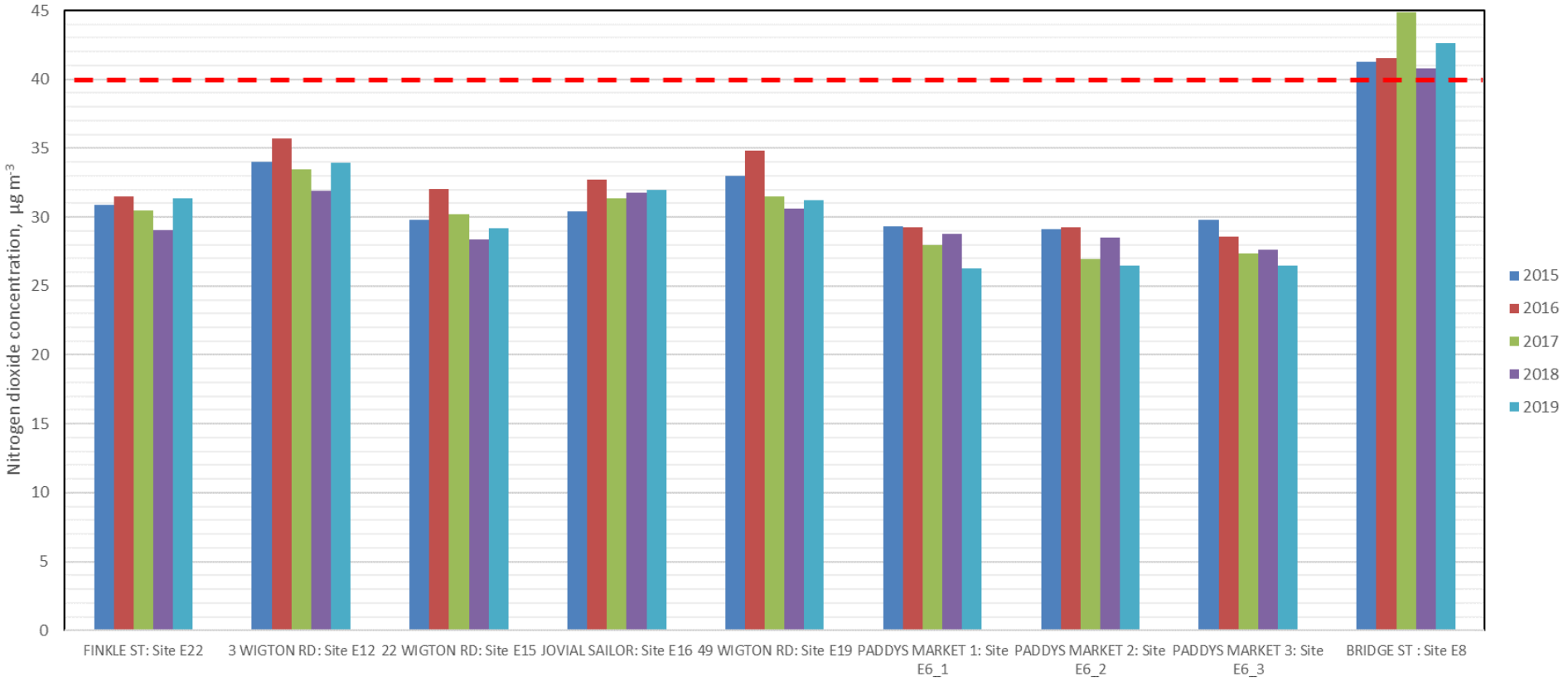
(3) Means for diffusion tubes have been corrected for bias. All means have been "annualised" as per Boxes 7.9 and 7.10 in LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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

Figure A.1 – Trends in Annual Mean NO_2 Concentrations




45
40
35
30
25
20
15
10
5
0
Nitrogen dioxide concentration, µg m-3
DALSTON RD: Site B4
12 CURROCK ST: Site B7
LOWTHER ST: Site C1
TOURIST INFO: Site C2
DEVONSHIRE ST: Site C3
POST OFFICE: Site D12
282 WARWICK RD: Site D7
2015
2016
2017
2018
2019


45
40
35
30
25
20
15
10
5
0
Nitrogen dioxide concentration, µg m-3
2015
2016
2017
2018
2019
FINKLE ST: Site E22
3 WIGTON RD: Site E12
22 WIGTON RD: Site E15
JOVIAL SAILOR: Site E16
49 WIGTON RD: Site E19
PADDYS MARKET 1: Site E6_1
PADDYS MARKET 2: Site E6_2
PADDYS MARKET 3: Site E6_3
BRIDGE ST : Site E8

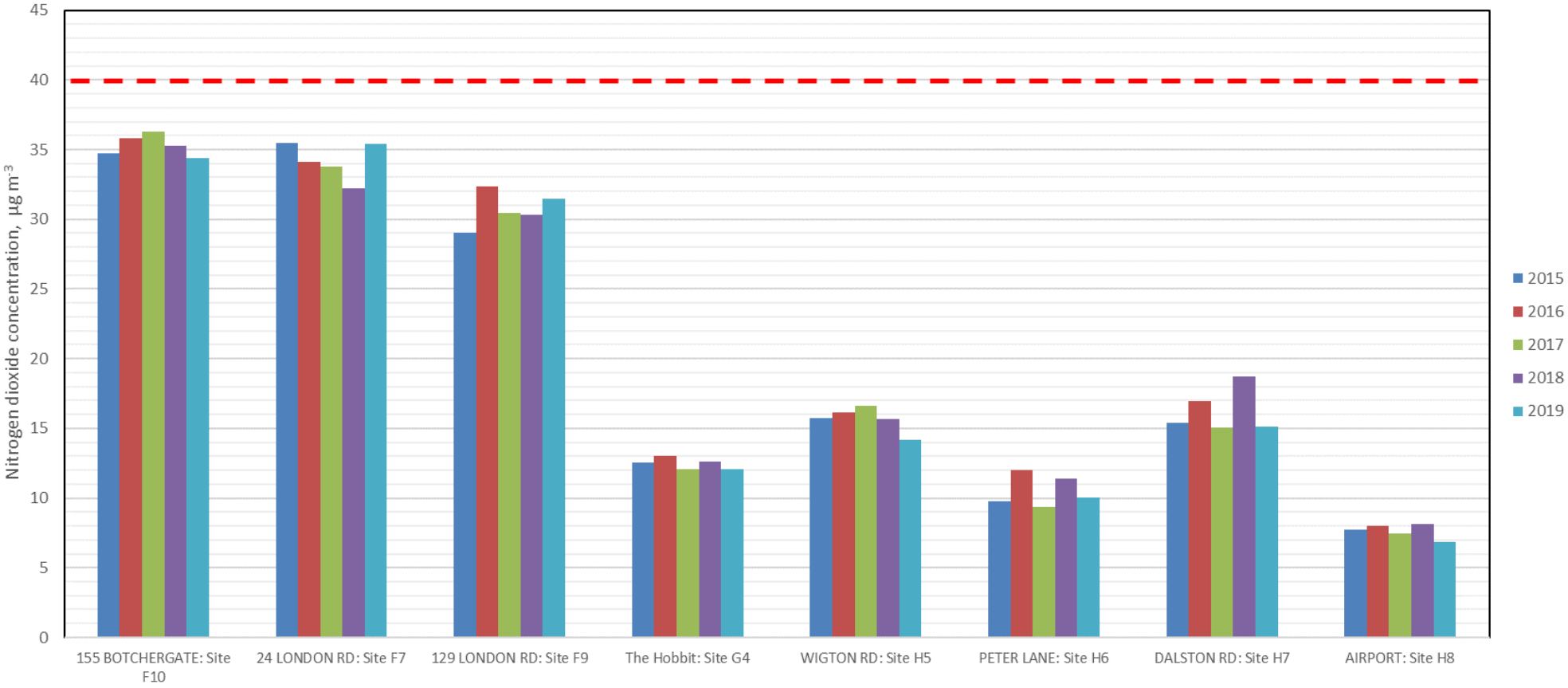

45
40
35
30
25
20
15
10
5
0
Nitrogen dioxide concentration, µg m-3
155 BOTCHERGATE: Site F10
24 LONDON RD: Site F7
129 LONDON RD: Site F9
The Hobbit: Site G4
WIGTON RD: Site H5
PETER LANE: Site H6
DALSTON RD: Site H7
AIRPORT: Site H8
2015
2016
2017
2018
2019

Table A.4 – 1-Hour Mean NO_2 Monitoring Results

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	NO_2 1-Hour Means > 200µg/m^3 (3)				
							2015	2016	2017	2018	2019
PM1	339467	555974	Roadside	Automatic	96.3	96.3	0	0	0	0	0

Notes:

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.**

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

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

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

Table A.5 – Annual Mean PM_{10} Monitoring Results

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	PM_{10} Annual Mean Concentration (µg/m³) (3)				
						2015	2016	2017	2018	2019
PM1	339467	555974	Roadside	94.8	94.8	16.2	13.6	14.6	16.2	18.6

☐ **Annualisation has been conducted where data capture is <75%** **(confirm by selecting in box)**

Notes:

Exceedances of the PM_{10} annual mean objective of 40µg/m³ are shown in **bold.**

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

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

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

Figure A.2 – Trends in Annual Mean PM_{10} Concentrations

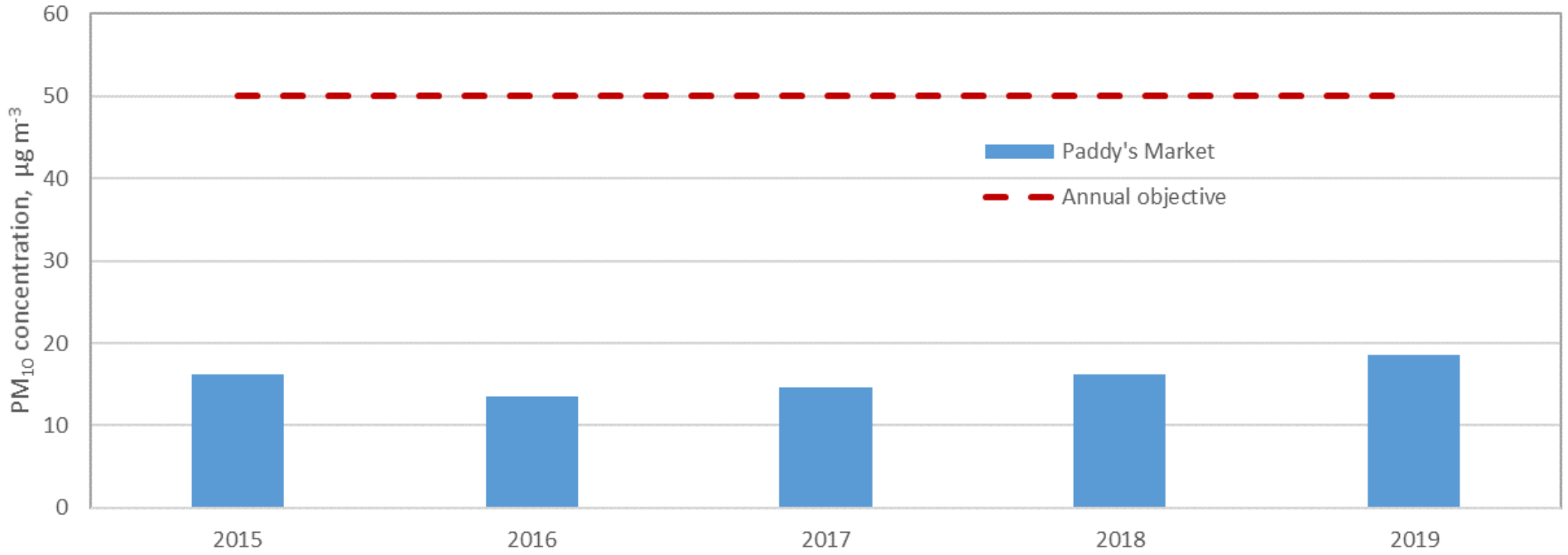


Table A.6 – 24-Hour Mean PM_{10} Monitoring Results

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	PM_{10} 24-Hour Means > 50µg/m^3 (3)				
						2015	2016	2017	2018	2019
PM1	339467	555974	Roadside	94.8	94.8	5	0	1	0	5

Notes:

Exceedances of the PM_{10} 24-hour mean objective (50µg/m^3 not to be exceeded more than 35 times/year) are shown in **bold.**

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

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

(3) If the period of valid data is less than 85%, the 90.4th percentile of 24-hour means is provided in brackets.

Figure A.3 – Trends in Number of 24-Hour Mean PM_{10} Results >50µg/m^3

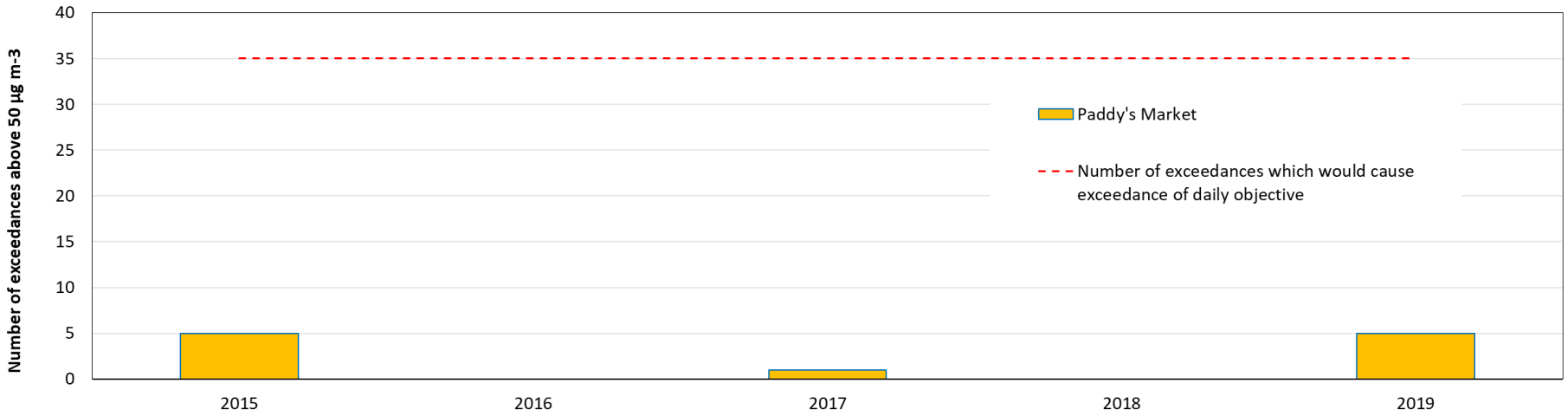


Table A.7 – $PM_{2.5}$ Monitoring Results

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	$PM_{2.5}$ Annual Mean Concentration ($\mu g/m^3$) (3)				
						2015	2016	2017	2018	2019
PM1	339467	555974	Roadside	94.1	94.1	10.2	9.9	8.58	8.6	10.8

☐ **Annualisation has been conducted where data capture is <75%** **(confirm by selecting in box)**

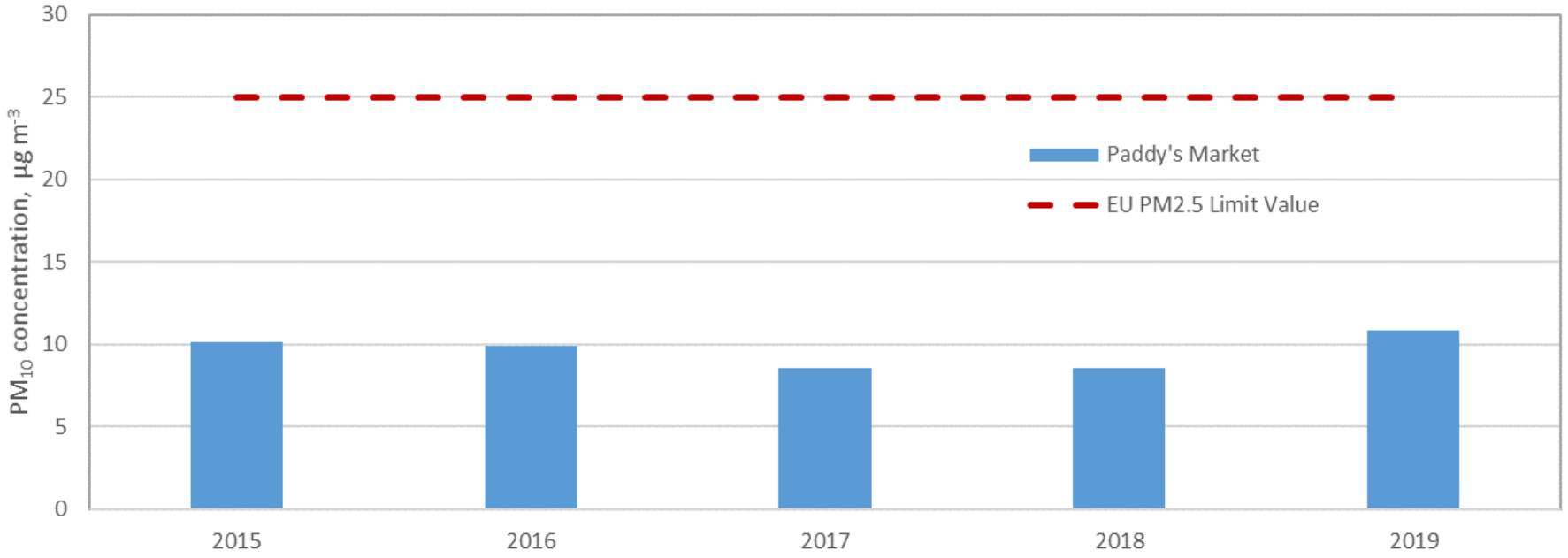
Notes:

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

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

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

Figure A.4 – Trends in Annual Mean $PM_{2.5}$ Concentrations



Appendix B: Full Monthly Diffusion Tube Results for 2019

Table B.1 - NO_2 Monthly Diffusion Tube Results - 2019

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	NO_2 Mean Concentrations ($\mu g/m^3$)														
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean		
															Raw Data	Bias Adjusted (0.93) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
A1	339995	557188	42.8	46.9	36.4	25.4	31.6	26.5	23.0	31.0	38.1	31.4	a	42.1	34.1	31.7	24.2
A10	340008	556842	51.4	47.6	29.3	50.1	41.4	31.2	36.5	29.5	32.8	46.7	a	37.0	39.4	36.7	32.6
A12	339935	557125	32.8	41.8	32.8	28.3	26.8	27.1	28.1	26.1	31.7	32.0	a	31.7	30.8	28.7	
A5	339758	558059	44.2	44.6	34.4	24.3	30.0	26.2	a	30.8	a	31.4	a	38.5	33.8	31.5	
A7	339526	559285	31.0	32.3	21.1	14.9	19.7	17.3	20.1	18.6	22.2	21.8	a	26.3	22.3	20.7	17.3
A9	340028	556833	44.8	44.2	36.8	28.3	39.3	27.0	35.6	31.1	36.4	28.4	a	34.7	35.1	32.7	
B4	339434	555638	48.7	53.9	40.7	34.3	41.3	34.9	37.5	40.2	41.3	40.5	a	44.4	41.6	38.7	
B7	340205	555198	51.1	53.6	38.2	39.0	35.6	33.0	33.5	37.1	39.5	41.1	a	48.8	40.9	38.1	
C1	340216	556131	35.6	39.6	28.4	31.2	25.8	22.1	24.6	23.9	27.5	29.6	a	38.5	29.7	27.6	
C2	340069	555955	24.9	28.1	17.4	19.5	14.0	11.9	12.3	17.6	16.3	22.7	a	26.3	19.2	17.8	
C3	340218	555768	32.5	35.1	27.2	33.1	31.1	27.9	26.4	23.8	27.8	28.9	a	31.2	29.5	27.5	
D12	340307	555718	46.5	47.1	37.2	18.5	31.1	27.3	30.1	32.9	35.0	37.7	a	42.9	35.1	32.7	
D7	341593	555893	37.1	38.9	33.9	14.4	30.6	25.4	27.2	30.6	30.5	31.6	a	35.0	30.5	28.3	
E22	339834	556137	38.6	46.3	32.2	31.2	28.2	a	27.8	30.0	30.3	33.4	a	39.5	33.7	31.4	
E12	339225	555821	39.7	48.0	30.6	32.4	37.1	34.6	32.8	33.5	37.3	35.5	a	39.6	36.5	33.9	30.6

E15	339091	555736	36.6	34.6	31.0	a	a	27.3	27.8	24.2	31.2	32.1	a	37.5	31.4	29.2	
E16	339141	555900	a	41.2	29.9	47.9	34.5	32.9	30.0	24.1	32.5	36.0	a	34.8	34.4	32.0	
E19	338953	555610	38.8	44.8	28.5	a	30.4	30.5	29.6	24.7	31.8	37.1	a	39.8	33.6	31.2	
E6_1	339467	555974	30.6	32.3	31.4	32.4	26.5	24.8	26.0	19.8	25.0	30.6	a	31.6	28.2	26.3	
E6_2	339467	555974	33.9	35.0	26.6	32.8	27.3	24.4	25.6	20.0	27.2	29.2	a	31.2	28.5	26.5	
E6_3	339467	555974	31.6	34.0	28.3	33.6	27.3	21.8	26.1	20.4	26.6	30.6	a	33.3	28.5	26.5	
E8	339516	556024	44.4	52.4	43.2	60.2	45.8	40.2	41.8	39.2	43.5	47.5	a	46.5	45.9	**42.7**	
F10	340600	555349	44.1	42.9	31.6	43.8	38.4	31.1	34.5	26.5	35.1	39.4	a	39.2	37.0	34.4	
F7	340708	555240	42.5	46.8	35.5	33.3	36.1	29.9	33.1	a	a	38.6	a	46.7	38.1	35.4	
F9	341099	554931	39.7	36.8	27.8	39.6	33.5	29.7	33.0	27.3	33.6	38.7	a	32.3	33.8	31.4	
G4	336905	554036	17.9	18.1	12.9	11.6	a	8.1	9.3	9.0	11.4	15.2	a	16.3	13.0	12.1	
H5	337643	554100	22.3	24.2	16.2	13.7	10.0	10.4	10.4	10.9	13.2	17.2	a	18.9	15.2	14.1	
H6	337962	553220	12.8	13.7	7.9	16.2	15.9	8.9	6.6	4.6	8.4	14.0	a	9.9	10.8	10.1	
H7	338282	553396	21.6	21.7	15.2	18.4	9.2	15.4	11.8	10.5	16.2	20.6	a	18.6	16.3	15.1	
H8	347874	561254	10.9	11.4	6.9	7.7	5.1	5.0	5.5	5.3	7.2	8.1	a	8.3	7.4	6.9	

☒ **Local bias adjustment factor used (confirm by selecting in box)**

☒ **National bias adjustment factor used (confirm by selecting in box)**

☐ **Annualisation has been conducted where data capture is <75% (confirm by selecting in box)**

☒ **Where applicable, data has been distance corrected for relevant exposure in the final column (confirm by selecting in box)**

Notes:

Exceedances of the NO_2 annual mean objective of 40µg/m^3 are shown in **bold**.

NO_2 annual means exceeding 60µg/m^3, indicating a potential exceedance of the NO_2 1-hour mean objective are shown in **bold and underlined.**

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

(2) Distance corrected to nearest relevant public exposure.

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

QA/QC of automatic monitoring data

Paddy's Market (PM1), which monitors PM_{10}, NO_2 and $PM_{2.5}$, is part of the AURN and the network quality assurance and control procedures are implemented.

To ensure optimum data quality and capture, a three-tier system of calibration and analyser test procedures is employed in the AURN. The major components of this system are briefly described below.

a) Daily automatic IZS checks - these allow instrumental drifts to be examined, and act as a daily check on instrument performance.

b) Fortnightly manual calibrations - these are performed by the local site operators and are used by management unit to scale raw pollution data.

c) 6 monthly network inter-calibrations - these exercises are performed by the QA/Qc Unit every 6 months to ensure that all measurements from all network stations are completely representative and intercomparable. The inter calibrations will also act as an independent audit of the system at the site.

Data ratification is undertaken at 3 monthly intervals. This involves a critical review of all information relating to the data set to verify, amend or reject the data. The ratified data represents the final data set in the review & assessment process.

Stanwix Bank (SB1) monitoring unit was decommissioned in April 2017.

Diffusion Tube Bias Adjustment Factors

Diffusion tube precision can be described as the ability of a measurement to be consistently reproduced, i.e. how similar the results of duplicate or triplicate tubes are to each other. Accuracy represents the ability of the measurement to represent the 'true' value, which, in this case, is defined as the result from the automatic analyser. When averaged over a number of sets of results bias can be evident. This represents the overall tendency of the diffusion tubes to depart from the 'true' value, i.e. to systematically over or under-read when compared against the reference method.

Once identified, bias can be adjusted for in order to improve the accuracy of diffusion tube results. This is done using bias adjustment factors, which have been found to be specific to a laboratory and tube preparation method.

As a result of the considerable difference in the performance of tubes prepared by different labs, government guidance recommends that a bias adjustment factor is determined and applied to the data. Technical guidance gives a method for this, which involves the co-location of these tubes with a chemiluminescent NOx analyser.

Authorities are asked to report the adjustment factor from their own co-location study, where available. The national bias adjustment factor is then determined by collating and assessing data from NO_2 co-location studies across the UK. Full details of both the national and local bias adjustment factors used to adjust data and details of data precision are provided below.

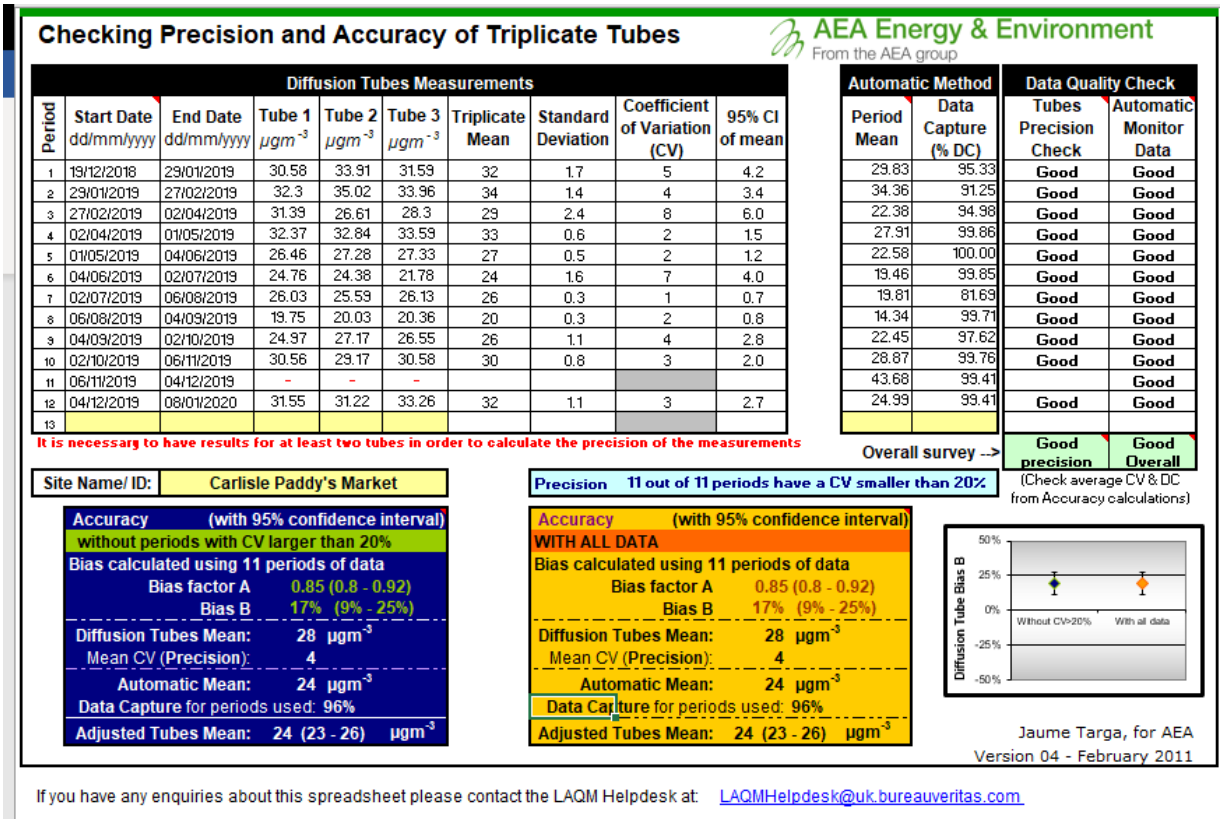
Factor from Local Co-location Study

Carlisle City Council utilises NO_2 diffusion tubes prepared with 20% TEA in water, these are prepared and analysed by Gradko Environmental Ltd.

A local bias adjustment factor was derived from the diffusion tubes co-located with the automatic analyser at the Paddy's Market monitoring station for 2019. This is a roadside location, not representative of public exposure, located close to two air quality management areas.

The local bias adjustment factor was calculated using the RICARDO-AEA Spreadsheet for checking the precision and accuracy of triplicate tubes, found on the Defra Local Air Quality Management (LAQM) website. The following screen print shows the results of the data that was input into the spreadsheet (Figure C.1):

Figure C.1: Co-location precision and accuracy spreadsheet for Paddy's Market AQMS, Carlisle.



Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements

Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 µgm⁻³	Tube 2 µgm⁻³	Tube 3 µgm⁻³	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1	19/12/2018	29/01/2019	30.58	33.91	31.59	32	1.7	5	4.2
2	29/01/2019	27/02/2019	32.3	35.02	33.96	34	1.4	4	3.4
3	27/02/2019	02/04/2019	31.39	26.61	28.3	29	2.4	8	6.0
4	02/04/2019	01/05/2019	32.37	32.84	33.59	33	0.6	2	1.5
5	01/05/2019	04/06/2019	26.46	27.28	27.33	27	0.5	2	1.2
6	04/06/2019	02/07/2019	24.76	24.38	21.78	24	1.6	7	4.0
7	02/07/2019	06/08/2019	26.03	25.59	26.13	26	0.3	1	0.7
8	06/08/2019	04/09/2019	19.75	20.03	20.36	20	0.3	2	0.8
9	04/09/2019	02/10/2019	24.97	27.17	26.55	26	1.1	4	2.8
10	02/10/2019	06/11/2019	30.56	29.17	30.58	30	0.8	3	2.0
11	06/11/2019	04/12/2019	-	-	-				
12	04/12/2019	08/01/2020	31.55	31.22	33.26	32	1.1	3	2.7
13									

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
29.83	95.33	Good	Good
34.36	91.25	Good	Good
22.38	94.98	Good	Good
27.91	99.86	Good	Good
22.58	100.00	Good	Good
19.46	99.85	Good	Good
19.81	81.69	Good	Good
14.34	99.71	Good	Good
22.45	97.62	Good	Good
28.87	99.76	Good	Good
43.68	99.41		Good
24.99	99.41	Good	Good
Overall survey -->		Good precision	Good Overall

(Check average CV & DC from Accuracy calculations)

Site Name/ ID: Carlisle Paddy's Market

Precision: 11 out of 11 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval) without periods with CV larger than 20%
Bias calculated using 11 periods of data
Bias factor A: 0.85 (0.8 - 0.92)
Bias B: 17% (9% - 25%)
Diffusion Tubes Mean: 28 µgm⁻³
Mean CV (Precision): 4
Automatic Mean: 24 µgm⁻³
Data Capture for periods used: 96%
Adjusted Tubes Mean: 24 (23 - 26) µgm⁻³

Accuracy (with 95% confidence interval) WITH ALL DATA
Bias calculated using 11 periods of data
Bias factor A: 0.85 (0.8 - 0.92)
Bias B: 17% (9% - 25%)
Diffusion Tubes Mean: 28 µgm⁻³
Mean CV (Precision): 4
Automatic Mean: 24 µgm⁻³
Data Capture for periods used: 96%
Adjusted Tubes Mean: 24 (23 - 26) µgm⁻³

Jaume Targa, for AEA
Version 04 - February 2011

If you have any enquiries about this spreadsheet please contact the LAQM Helpdesk at: LAQMHelpdesk@uk.bureauveritas.com

Tube precision is separated into two categories good or poor. Tubes are considered to have good precision where the coefficient of variation (CV) of duplicate or triplicate diffusion tubes for eight or more periods during the year is less than 20%, and the average CV of all monitoring periods is less than 10%. Tubes are considered to have poor precision where the CV of four or more periods is greater than 20% and/or the average CV is greater than 10%. All of the 12 diffusion tube study periods shown above had a CV of below 20% (good precision).

The data capture from the automatic analyser for 2019 was good overall. The local bias adjustment factor was calculated as follows:

Diffusion tubes annual mean: **28 µg/m^3**

Automatic monitoring station mean: **24 µg/m^3**

Local bias adjustment factor: **0.85**

Factor from National Co-location Studies

A national bias adjustment factor of 0.93 was calculated using the bias adjustment factor spreadsheet version 03/20 from the Defra LAQM website. This adjustment factor is based on 27 other co-location studies nationwide. All of the studies were analysed by Gradko for the method 20% TEA in water during 2019.

National Diffusion Tube Bias Adjustment Factor Spreadsheet — Spreadsheet Version Number: 03/20

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 2020
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 the 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@uk.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)	Bias (B)	Tube Precision	Bias Adjustment Factor (A) (Cm/Dm)
Gradko	20% TEA in water	2019	R	Blackburn with darwen Borough Council	10	29	21	36.9%	G	0.73
Gradko	20% TEA in water	2019	R	Cheshire West and Chester	12	39	38	2.0%	G	0.98
Gradko	20% TEA in water	2019	R	Cheshire West and Chester	11	34	34	-2.1%	G	1.02
Gradko	20% TEA in water	2019	R	Gedling Borough Council	12	32	30	7.3%	G	0.93
Gradko	20% TEA in water	2019	R	NOTTINGHAM CITY COUNCIL	10	37	40	-7.0%	G	1.07
Gradko	20% TEA in water	2019	R	Bedford Borough Council	11	29	29	-1.0%	G	1.01
Gradko	20% TEA in water	2019	R	Bedford Borough Council	12	37	32	13.0%	G	0.89
Gradko	20% TEA in water	2019	R	Gateshead Council	12	30	25	18.1%	G	0.85
Gradko	20% TEA in water	2019	R	Gateshead Council	10	32	34	-7.2%	G	1.08
Gradko	20% TEA in water	2019	R	Gateshead Council	12	34	27	23.7%	P	0.81
Gradko	20% TEA in water	2019	R	Gateshead Council	11	40	44	-10.5%	G	1.12
Gradko	20% TEA in water	2019	KS	Marylebone Road Intercomparison	12	85	65	30.1%	G	0.77
Gradko	20% TEA in water	2019	R	Borough Council of King's Lynn and West No	9	27	21	28.4%	G	0.78
Gradko	20% TEA in water	2019	R	Lancaster City Council	13	40	34	16.4%	G	0.86
Gradko	20% TEA in water	2019	R	Lancaster City Council	12	31	31	1.6%	G	0.98
Gradko	20% TEA in Water	2019	R	Monmouthshire County Council	12	39	39	1.3%	G	0.99
Gradko	20% TEA in water	2019	UC	Belfast City Council	10	29	24	21.8%	G	0.82
Gradko	20% TEA in water	2019	R	Dudley MBC	12	33	32	4.5%	G	0.96
Gradko	20% TEA in water	2019	R	Dudley MBC	12	44	42	3.9%	G	0.96
Gradko	20% TEA in water	2019	UB	Dudley MBC	12	23	19	19.8%	G	0.83
Gradko	20% TEA in water	2019	UB	Eastleigh Borough Council	12	24	26	-7.1%	G	1.08
Gradko	20% TEA in water	2019	R	Gateshead Council	12	34	27	23.7%	P	0.81
Gradko	20% TEA in water	2019	R	Gateshead Council	11	40	44	-10.5%	G	1.12
Gradko	20% TEA in water	2019	R	Gateshead Council	10	32	34	-7.2%	G	1.08
Gradko	20% TEA in water	2019	R	Gateshead Council	12	30	25	18.1%	G	0.85
Gradko	20% TEA in water	2019	R	Thurrock Borough Council	12	29	24	21.6%	G	0.82
Gradko	20% TEA in water	2019	R	Brighton & Hove City Council	11	45	50	-9.3%	G	1.10
Gradko	20% TEA in water	2019		Overall Factor (27 studies)				Use		0.93

For Casella Stanger/Bureau Veritas (NOT Bureau Veritas Labs) use Gradko 50% TEA in Acetone.
For Casella Seal/GMSS/Casella CRE/Bureau Veritas Labs/Eurofins/ use Environmental Scientific Groups.
From 2011 for Environmental Scientific Groups use ESG Glasgow.
From 2011 for Harwell Scientific Services use ESG Didcot.
For 2017 for SOCOTEC use ESG Didcot, as name changed mid year.
For 2018 SOCOTEC entered as Didcot and Glasgow. Glasgow analysis lab moved to Didcot mid 2018.

Collocation Data | Revisions

Discussion of Choice of Factor to Use

It was decided that the national bias adjustment factor would be the most appropriate to use. This factor is the higher of the two so it would give the worst case results when multiplied with the raw monitoring data. It was also considered that a correction factor derived from 27 co-location studies would incorporate variation from many different types of monitoring site. This would reflect the wide range of locations in

which we expose our 30 diffusion tubes across the district, some of which differ considerably from our own co-location site.

The annual mean for each diffusion tube location has therefore been adjusted using the national bias adjustment factor of 0.93.

QA/QC of national diffusion tube monitoring

AIR is an independent analytical proficiency-testing (PT) scheme, operated by LGC Standards and supported by the Health and Safety Laboratory (HSL). AIR PT started in April 2014, which combined two long running PT schemes: LGC Standards STACKS PT scheme and HSL WASP PT scheme.

Defra and the Devolved Administrations advise that diffusion tubes used for LAQM should be obtained from laboratories that have demonstrated satisfactory performance in the AIR NO_2 PT scheme. The Proficiency Testing Scheme ishow that Gradko achieved the following percentage (%) of results through 2019, which were subsequently determined to be **satisfactory** based upon a z-score of ≤ ± 2:

AIR PT Round	AIR PT AR030	AIR PT AR031	AIR PT AR033	AIR PT AR034
Round conducted in the period	January – February 2019	April – May 2019	July – August 2019	September – November 2019
Gradko International	75 %	100 %	100 %	100 %

(Reference:

https://laqm.defra.gov.uk/assets/laqmno2performancedatauptonovember2019v1.pdf

Annualisation of measurements

No annualisation was required for the automatic or passive measurement of NO_2, PM_{10} or $PM_{2.5}$ as the data capture was greater than 75 %.

Distance correction for NO_2 measurements

Distance correction of NO_2 diffusion tube measurements used the NO_2 fall-off with distance calculator available on the LAQM website and discussed in Paragraphs 7.77-7.79 of LAQM.TG16.

Background concentrations were obtained from the LAQM website https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2015 (file downloaded 48-no2-

201.csv). Table C.4 presents the parameters used as input to distance correct the concentrations at the sensitive receptors.

Table C.4 Input parameters used in the distance corrected concentrations

	Site name	Easting	Northing	Distance of DT from kerb, m	Distance of receptor from kerb, m	Looked up NO_2 map value, µg m^{-3}	Measured concentration (bias corrected), µg m^{-3}	Concentration predicted at receptor, µg m^{-3}
A1	45 SCOTLAND RD	339995	557188	1.5	6.0	7.16	31.72	24.2
A10	STANWIX BANK	340008	556842	1.5	3.0	9.79	36.65	32.6
A7	282 KINGSTOWN RD	339526	559285	4.0	11.5	8.94	20.75	17.3
E12	3 WIGTON RD	339225	555821	2.5	4.5	11.40	33.91	30.6

Table B.1 presents the 2019 NO_2 diffusion tube measurements as distance corrected to the nearest exposure

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

Figure D-1 Location of diffusion tubes within Carlisle City Council area

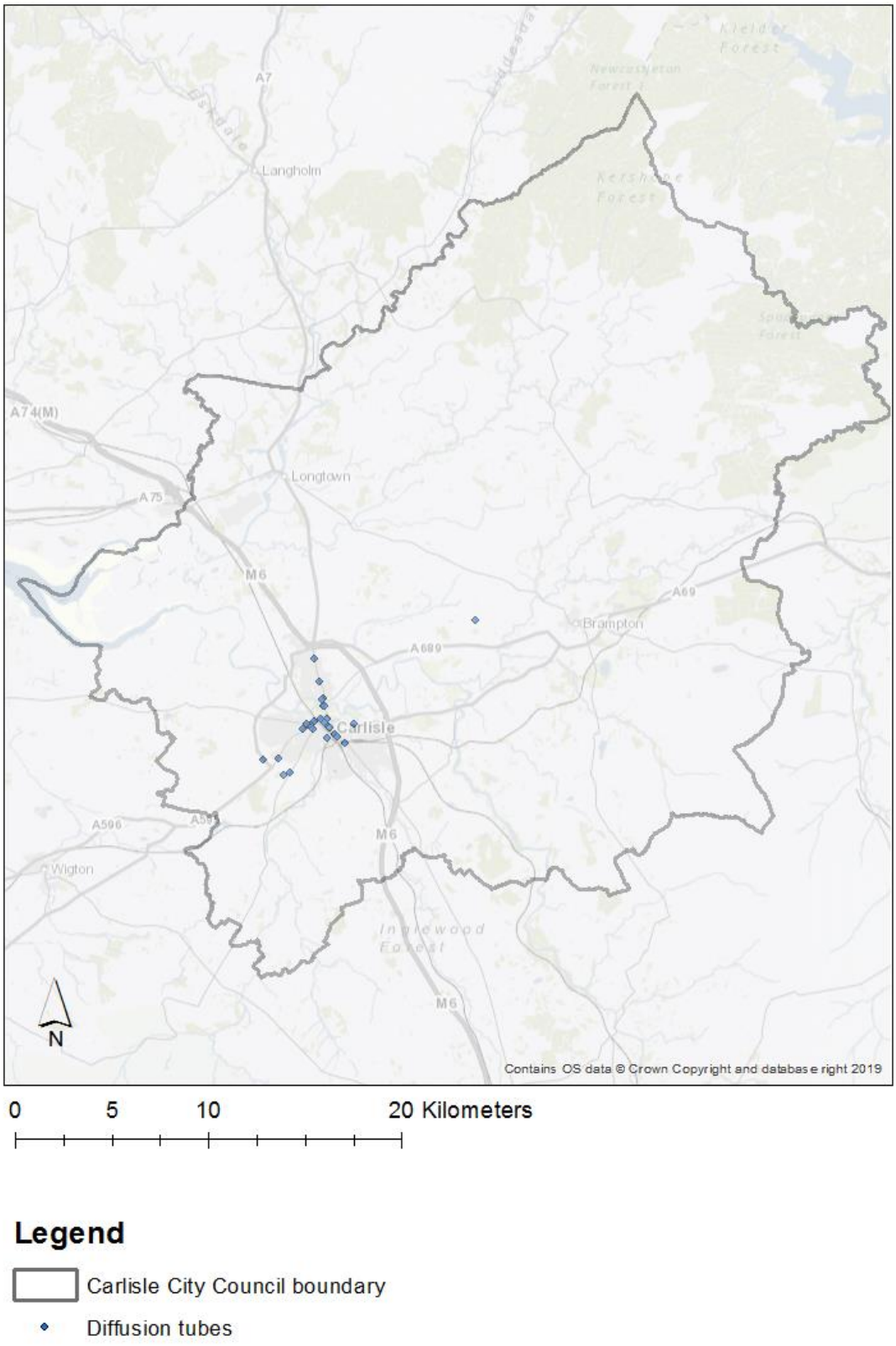


Figure D-2 Location of diffusion tubes within Carlisle City Council area (with Site IDs)

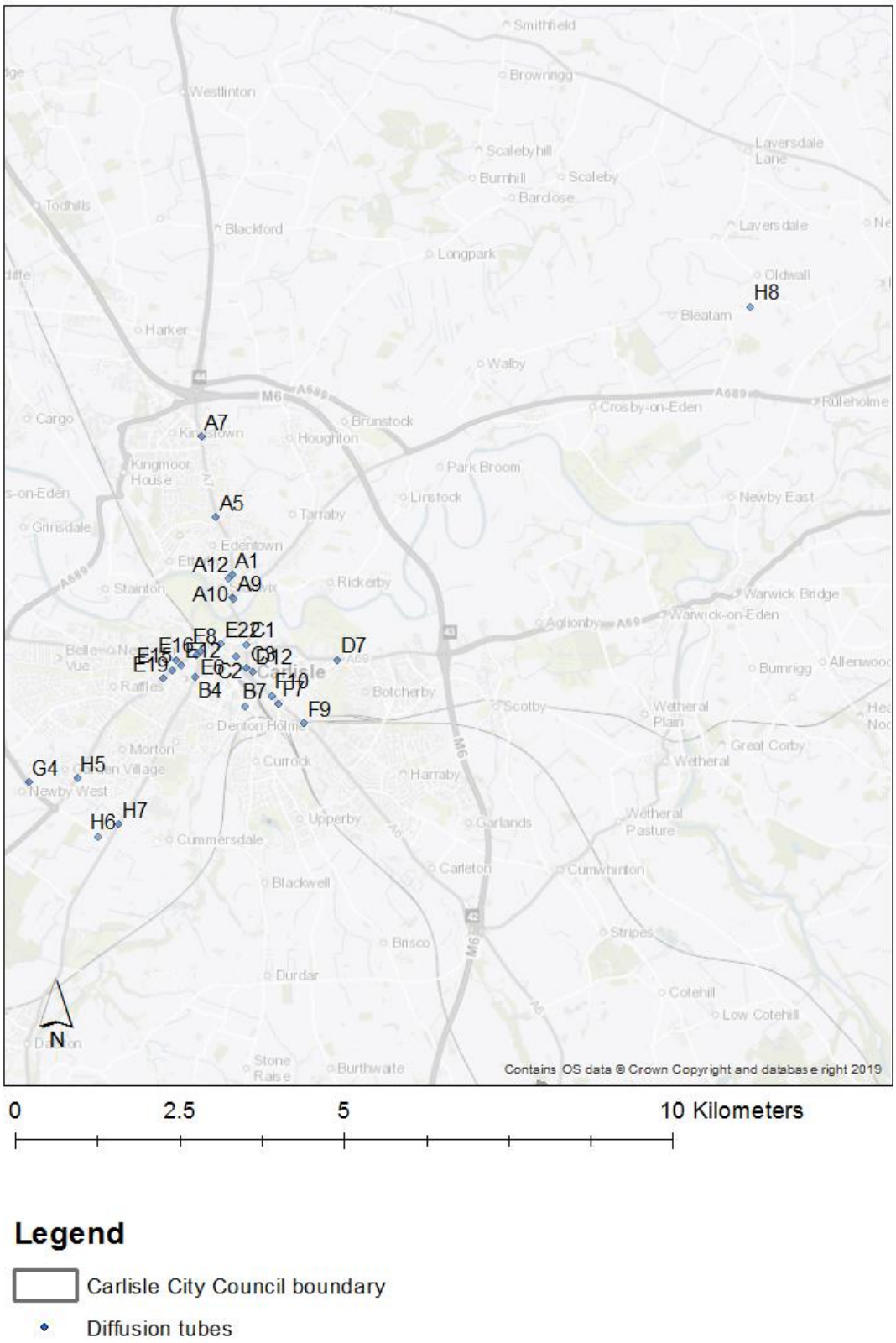


Figure D-3 Location of air quality management areas and diffusion tube locations

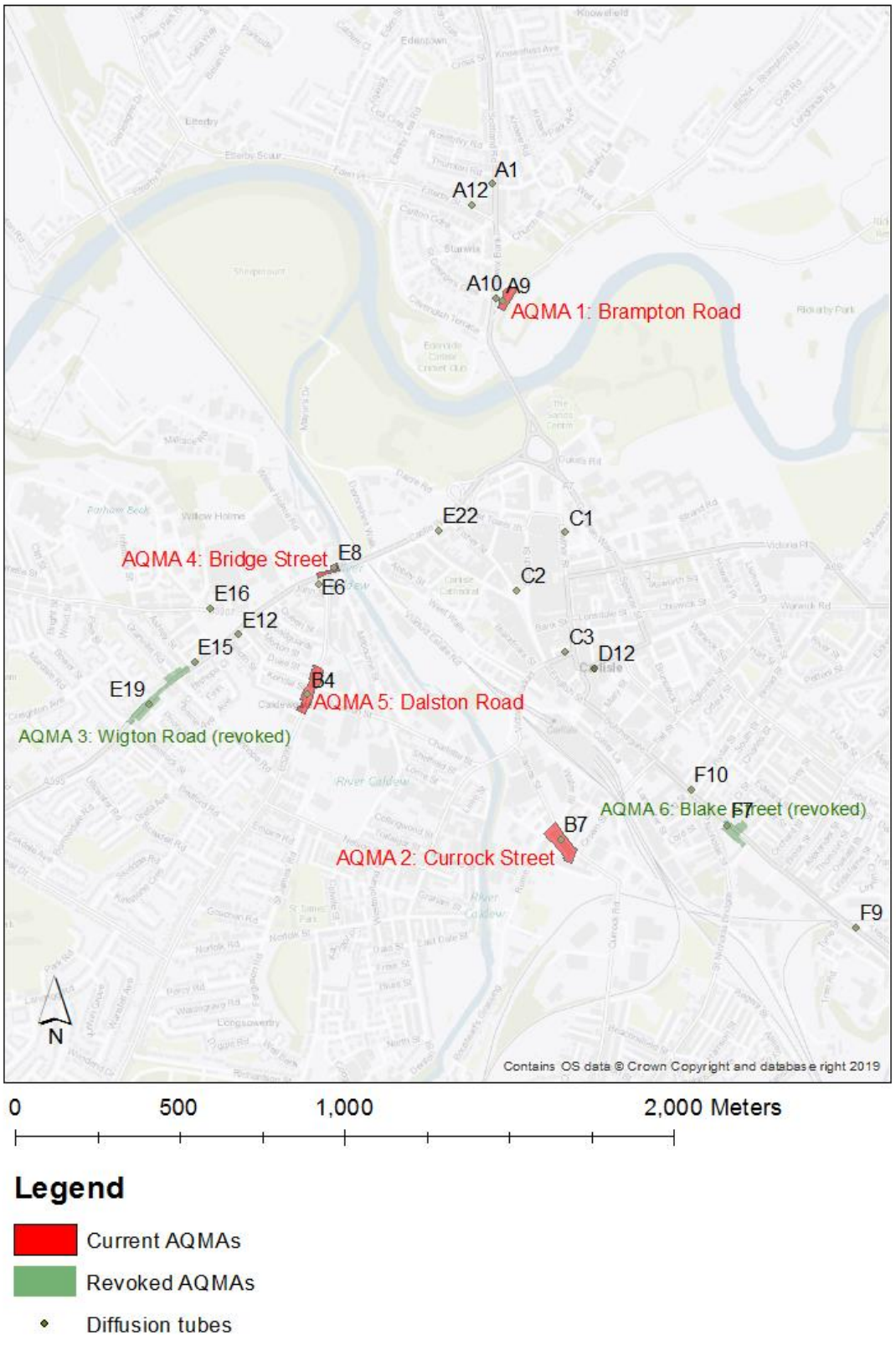
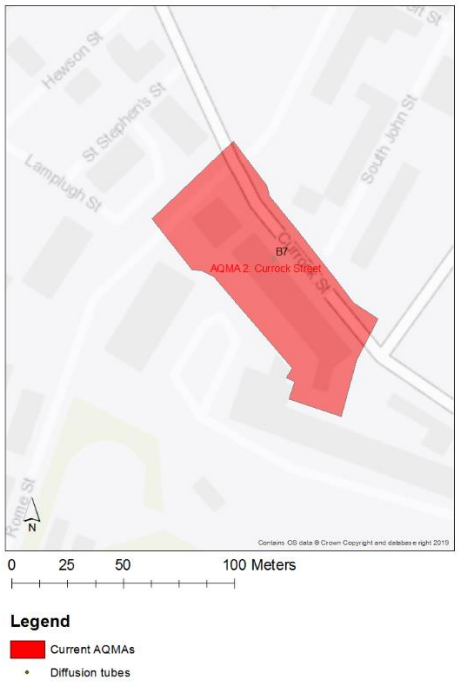


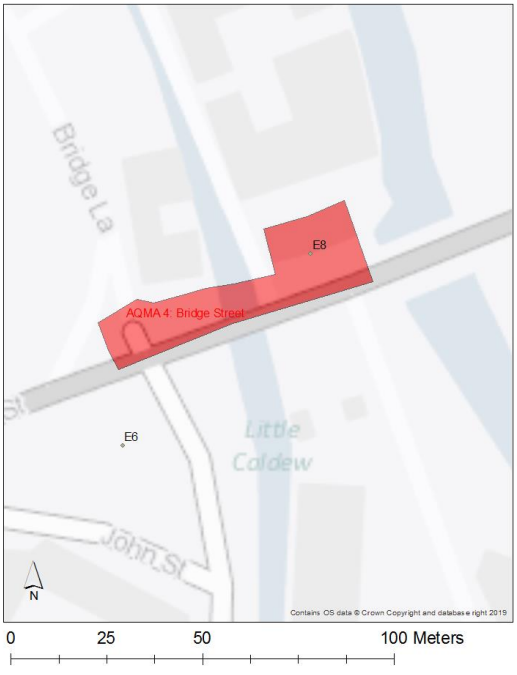
Figure D-4 Location of air quality management areas

AQMA 1: Brampton Road

AQMA 2: Currock Street

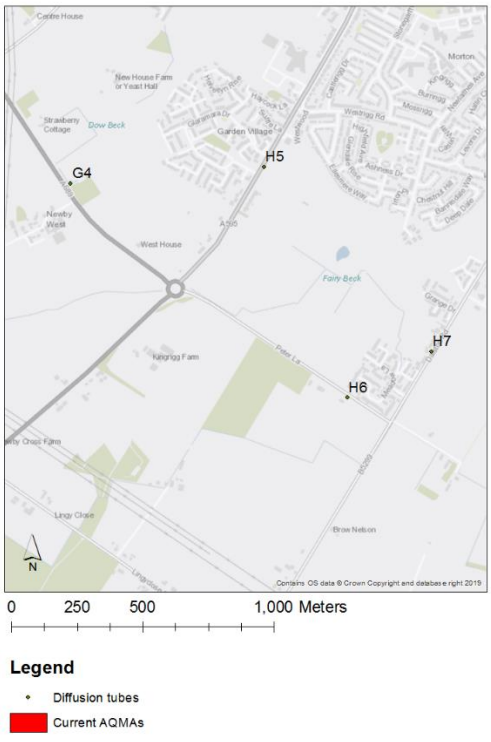


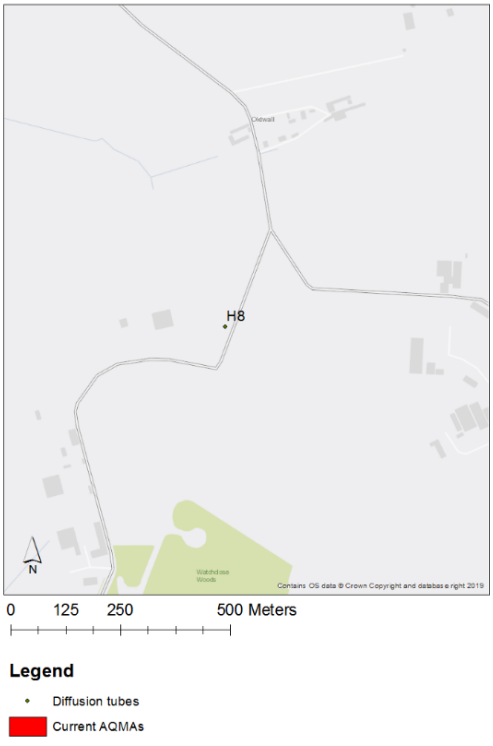
AQMA 4: Bridge Street



AQMA 5: Dalston Road

Figure D-5 Location of diffusion tubes in outlying areas





Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England

Pollutant	Air Quality Objective[12]	
	Concentration	Measured as
Nitrogen Dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean
	40 µg/m^3	Annual mean
Particulate Matter (PM_{10})	50 µg/m^3, not to be exceeded more than 35 times a year	24-hour mean
	40 µg/m^3	Annual mean
Sulphur Dioxide (SO_2)	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean
	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean
	266 µg/m^3, not to be exceeded more than 35 times a year	15-minute mean

[12] 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	Air quality Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by Highways England
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 (micrometres or microns) or less
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
QA/QC	Quality Assurance and Quality Control
SO_2	Sulphur Dioxide

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