Worcestershire
Regulatory Services
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2017 Air Quality Annual Status Report (ASR)

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

May 2018

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Executive Summary: Air Quality in Our Area

Air Quality in Worcester City

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].

Worcestershire Regulatory Services (WRS) is a shared service formed from the Environmental Health and Licensing departments of the six Worcestershire District Councils. Responsibility for managing (monitoring and reporting of) local air quality transferred from the partnership councils to WRS in April 2011.

Monitoring results within Worcester City Council area demonstrate a slight rise in concentrations at the majority of monitoring locations in 2016 but overall a reduction from highs measured in 2013 consistent with trends across Worcestershire.

Three Air Quality Management Areas (AQMA) were declared by Worcester City Council in 2009 for exceedances of the annual average mean objective for nitrogen dioxide (NO_2):

- Dolday/Bridge Street AQMA declared 1st March 2009;
- Lowesmoor/Rainbow Hill AQMA declared 1st March 2009; and
- Newtown Road AQMA declared 1st March 2009.

[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

There have been no measured exceedances of NO_2 in the Newtown Road AQMA since 2007, and the AQMA was revoked by the council on 30th July 2014.

A further AQMA was declared by the council for the St Johns area of Worcester for exceedance of the annual mean objective for NO_2 on 26th September 2014.

Details of declaration and plans of the AQMAs can be found on the following pages of WRS website: http://www.worcsregservices.gov.uk/pollution/air-quality/air-quality-management-areas.aspx

In 2016, there continue to be exceedances of the annual average mean objective for NO_2 within all three AQMAs which therefore must remain in place. In addition to the three AQMAs outlined above, there are two study areas WRS have been assessing on behalf of Worcester City Council to determine if further action is required:

- London Road and Sidbury study area
- The Foregate, The Butts and The Tything combined study area

A detailed assessment of the London Road and Sidbury, Worcester study area was completed by Air Quality Consultants (AQC) on behalf of Worcester City Council in July 2017. The AQC report concluded that an area at the western end of London Road should be declared as an AQMA. A copy of AQC (July 2017) 'Detailed Assessment of Air Quality along London Road, Worcester' (ref: J2829A/1/F1) is available to download from WRS website at http://www.worcsregservices.gov.uk/pollution/air-quality/local-air-quality-progress-reports.aspx. Section 3.2.1.6 of the main report details trends in monitoring data in the study area and a map is included as Figure D.7 in Appendix D.

Long term trend measurements and automatic analyser results in 2016 within The Foregate, The Butts and The Tything study area indicate that requirement for a new AQMA declaration of the combined study area would likely be confirmed by detailed assessment. Following the fast track AQMA declaration option set out in Defra

LAQM 2016 Policy Guidance LAQM.PG(16) Worcester City Council consider it appropriate to move directly onto options for declaration of AQMA in this study area.

On the 11th September 2017 Worcester City Council asked WRS to prepare a report with potential options for declaration of a single AQMA to cover, as a minimum, existing and recently identified areas of poor air quality as described above.

WRS produced a report with 5 potential options for AQMA areas in the city for consideration by Worcester City Council. On the 8th January 2018 the Council's Environment & Licensing committee took the decision to declare the whole district as an AQMA.

The decision has been followed by a period of public consultation prior to drawing up the AQMA order. The results of the public consultation and confirmation of the legal AQMA order will be discussed in the next Annual Status Report, 2018.

Like many parts of the UK, poor air quality in Worcester City is linked to areas with high volumes of traffic, congestion and ‘street canyon’ landscapes (where height of buildings is greater than width of road). Worcestershire County Council has responsibility for strategic transport issues in the county and has published the fourth Local Transport Plan following consultation in 2017. WRS continues to liaise with the County Council in the development of countywide plans to ensure that remediation of the AQMAs remain a strategic transport priority. Over the past five years WRS has experienced closer working ties with the County Council’s Strategic Transport Team and it is anticipated that collaboration on their strategic policies and improvement schemes at the early planning stages will ensure that air quality improvements remain a priority across all of Worcestershire infrastructure. WRS has also experienced increased liaison with the Director of Public Health department within the County Council in the last 12 months including assisting with air quality aspects of the ‘Health and Well Being Plan for Worcester City’ - https://www.worcester.gov.uk/health-and-well-being.

Actions to Improve Air Quality

In 2013, WRS produced a countywide Air Quality Action Plan (AQAP) for Worcestershire which was adopted by Worcester City Council on 13th November 2013. WRS have produced two updates to the AQAP, the latest in September 2016. A copy of 'Air Quality Action Plan Progress Report for Worcestershire April 2015-2016', the previous update and the AQAP is available to download via

http://www.worcsregservices.gov.uk/pollution/air-quality/air-quality-action-plan.aspx

A summary of measures to improve air quality completed in 2016-17 as follows:

- Variable Messaging Systems (VMS) – VMS ring around City completed in 2016 designed to re-route unnecessary journeys around the City and subsequently reduce traffic flows through AQMAs.
- Produce Air Quality Supplementary Planning Document – Draft 'Technical Guidance for Planners v4.0' completed in 2017 provided to Worcester City Council planning officers for consideration. Aim to reduce specific and cumulative impact on local air quality from new development.
- Flexible Working Arrangements – Superfast Worcestershire advise 94% Superfast Broadband coverage across County with 69,212 properties now able to access superfast broadband. 96% expected to be connected by end of 2019.
- Worcestershire Local Transport Plan 4 (2017 – 2030) – finalised in 2017 outlines a number of planned 'active corridors' in Worcester City.
- Personalised Travel Planning - Worcestershire County Council is delivering PTP services on behalf of developers. Building on best practice developed by the Council this proven tool encourages modal shift in new developments towards more sustainable and space efficient forms of transport.
- Provide links to real time information - System put in place at WRS to tweet alerts when Air pollution > 3 (Low) in any given 5 day forecast on Defra Daily Air Quality Index.

A full update on measures to improve air quality is provided within section 2.2 of this report.

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

- Adoption of Supplementary Planning Document – Aim is to reduce additional specific and cumulative impact on local air quality from new development and help accelerate the transition to a Low Emission Economy in Worcester City.
- Public information including smarter driving tips on WRS air quality webpages - Created for all groups affected by and impacting air quality to be launched before Clean Air Day 21st June 2018.

Significant work has been undertaken in 2016-17 to determine the future of AQMA(s) in Worcester City and towards strategic plans for improving air quality – see Conclusions and Priorities below.

Conclusions and Priorities

Exceedances of the annual average air quality objective for nitrogen dioxide of 40μg/m^3 (micrograms per metre cubed) were recorded in 2016 in all three existing AQMAs and within two study areas. No exceedances of any air quality objectives were recorded outside these areas. Measured concentrations across the district demonstrate a general 5 year trend of a reduction from 2013 highs with a slight rise in concentrations between 2015 and 2016.

A detailed assessment of London Road, Worcester and measured concentrations and trends within The Foregate, The Butts and The Tything (southern part) combined study area confirm that these two areas should be declared as AQMA(s). On the 8th January 2018 the Council's Environment & Licensing committee took the decision to declare the whole district as an AQMA. The results of the subsequent public

consultation and confirmation of the legal AQMA order will be discussed in the next Annual Status Report, 2018.

WRS completed the 'Source Apportionment of Local Emissions of Nitrogen Dioxide in St Johns Air Quality Management Area' (ref: StJSA FINAL) in March 2017. A copy of this report is available for download from WRS website at http://www.worcsregservices.gov.uk/pollution/air-quality/local-air-quality-progress-reports.aspx. Cost benefit analysis was undertaken in July 2017 to determine the priority measures to reduce nitrogen dioxide emissions and improve air quality within the St Johns AQMA.

However, in line with Defra LAQM Policy Guidance (LAQM:PG(16)) the current Worcestershire AQAP (2013) should be considered for revision after 5 years i.e. 2018. Additionally, it is recognised there is a need for a strategic plan such as a Lowering Emission Strategy linked to the emerging city centre Masterplan and transport strategy for the whole inner city area in Worcester, as discussed in previous annual status reports in 2015 and 2016 available to view at http://www.worcsregservices.gov.uk/pollution/air-quality/local-air-quality-progress-reports.aspx.

Worcester City Council has commissioned the development of a Masterplan for its City Centre, to drive regeneration, economic diversification and growth. The Masterplan is focussed on supporting intensification of land uses, and improving access. Worcestershire County Council will develop a complementary transport strategy for the City Centre. It is anticipated improving air quality in the city will formulate part of the Masterplan.

On 26th July 2017 Worcester City Council Environmental and Licensing Group voted to set up a Task and Finish Group to look into actions to improve air quality in the city. The formative meeting of the group was held on 8th January 2018 to be followed by three technical meetings. The work and outcomes of the group will discussed further in the next Annual Status Report, 2018.

Work will begin on producing a new AQAP for Worcester City following completion of the Task and Finish Group work and recommendations, and declaration of a district wide AQMA in 2018.

Worcester City Council's priorities for 2018 are:

- Following public consultation and consideration of responses, raise legal order for city wide AQMA and revoke existing AQMAs in St Johns, Dolday/Bridge Street and Lowesmoor/Rainbow Hill.
- Complete Task and Finish Group technical review of priority measures for improving poor air quality in the city and provide a summary report of recommendations to Worcester City Council Environmental and Licensing Committee.
- Start work on a single AQAP for Worcester City following completion of Task and Finish Group process considering group recommendations and committee decisions.
- Produce a new City Centre Masterplan and Transport Strategy.

WRS on behalf of Worcester City Council continue to monitor existing locations in 2017-18 to assess any improvements or degradation in NO_2 concentrations. Further update on monitoring, improving actions and strategic plans progress will be provided in 2018 Annual Status Report.

The principal challenges and barriers to implementation that Worcester City anticipates facing are resourcing and funding sources for potential significant actions and measures such as implementation of a Lowering Emission Strategy.

The 2017 'UK plan for tackling roadside nitrogen dioxide' outlines Government's approach and preferred options for mitigation of national areas of poor air quality detailing 28 local authorities required to produce strategies to accelerate compliance

with the air quality objectives in their areas. A further 33 local authorities have since been required to produce feasibility studies on accelerating compliance following a High Court order. In autumn budget 2017, the chancellor announced a £220 million Clean Air Fund to support those local authorities and the people and businesses affected by these local plans. Worcester City Council is not one of these named councils and therefore has not been prioritised for access to that funding.

Local Engagement and How to get Involved

WRS have held position of Air Quality Technical Coordinator for Midland Joint Advisory Council (MJAC) for Environmental Protection since mid 2014. MJAC is comprised of, and represents, environmental health and pollution regulatory professionals from local authorities in Warwickshire, Herefordshire, Worcestershire, Staffordshire, Shropshire and the Metropolitan Authorities of the West Midlands. MJAC promotes understanding, consistency and uniformity of action, dissemination of information and advice, and responding to Government consultations between representatives of member authorities. More information is available at http://www.mjac.org.uk/We%20Are%20MJAC.html.

WRS is also a member of Central England Environmental Protection Managers Group (CEEPG) which provides a strategic overview and direction for the delivery of Environmental Protection Services across the area of Central England covered by participating authorities. CEEPG responsibilities covers all environmental health matters regarding air quality, noise, contaminated land and LAPPC/IPPC including cooperation and coordination with the Environment Agency and Public Health England.

Following direct contact WRS were invited by Defra LAQM Team to join their Local Authority Air Quality Advisory Group, formed in 2017. The group consists of a network of local authority officials acting as an informal sounding board by Defra to enable development of better informed strategy and policy proposals across the two areas of work in air quality- local authorities and domestic combustion. It is an advisory body and not a decision-making body.

There are a number of ways members of the public can help to improve local air quality:

- **Walk or cycle, leave you car at home:** Leaving your car at home and walking or cycling instead will benefit in three ways - increased exercise, reduced pollution exposure and will reduce individual's pollution emissions;
- Worcestershire County Council have launched a car sharing website, **LiftShare**, to help people find others journeying to the same destinations to share journeys and costs, and reduce traffic and emissions. Visit this link for more information https://worcestershire.liftshare.com/;
- Contact Worcestershire County Council for help and advice on a **Travel Plan** for your business. General travel planning advice is available on Worcestershire County Council's website (including walking, cycling and bus maps and timetables);
- **Hold meetings by Conference Call** by phone or Skype rather than driving to meetings. This reduces fuel and other travel costs, vehicle maintenance and hire cost, increases productivity through reduction in hours lost through unnecessary travel;
- Facilitate **Flexible Working Arrangements** for non-front line staff to work remotely from home or nearer home facilities for one or more days a week thus removing or reducing any journey to work. This reduces congestion which has beneficial impacts for delivery times, reduced business costs and thus economic benefits. Additionally, provides social benefits through improved work life balance for employees, reduces local air quality and reduced emergency vehicle response times.
- **Switch Fleet to Low Emission Vehicles**: The government is providing £80m funding to encourage installation of EV charging points. Eligible businesses, charities and public sector organisations with off street parking for staff or vehicles fleets can apply for vouchers to redeem costs of electric vehicle charge-points. There is a limit of 1 voucher per applicant; however, applicants with a 'franchise' may apply for up to 20 franchisees. There is an approved charge points list and a list of authorised installers.

https://www.gov.uk/government/collections/government-grants-for-low-emission-vehicles#workplace-charging-scheme

- If you have to drive follow fuel efficient driving advice, often known as '**Smarter Driving Tips'**, to save on fuel and reduce your emissions. A number of websites promote such advice including:
  - http://www.energysavingtrust.org.uk/travel/driving-advice
  - http://www.theaa.com/driving-advice/fuels-environment/drive-smart
  - http://www.dft.gov.uk/vca/fcb/smarter-driving-tips.asp

Air pollution can affect all of us over our lifetime however certain groups will be more sensitive to the effects of air pollution. Vulnerable groups include adults and children with lung or heart conditions such as asthma, chronic bronchitis, emphysema and chronic obstructive lung disease (COPD)[4,5]. Senior citizens are more likely to be affected by respiratory diseases and children are more likely to be affected by air pollution due to relatively higher breathing and metabolic rates as well as a developing lung and immune system.

Vulnerable individuals and groups can keep informed of:

- Current levels and forecasts of air pollution from Defra at https://uk-air.defra.gov.uk/.
- If you are sensitive to the effects of air pollution, it may be appropriate to limit the length of time spent in areas of local poor air quality – see advice from Defra at https://uk-air.defra.gov.uk/air-pollution/daqi.
- If you are on social media, sign up to the WRS Twitter feed. From March 2017 WRS will tweet when pollution is forecasted by Defra to be moderate to very high.

Further information for the general public on reducing your family's exposure to poor air quality in Worcestershire and how individuals, business and schools can assist

[4] http://www.breathelondon.org/

[5] https://www.londonair.org.uk/LondonAir/guide/MyActionsForMe.aspx

with reducing their impact on local air quality can currently be found at http://www.worcsregservices.gov.uk/pollution/air-quality/public-advice.aspx. Please note this webpage is currently under construction and works should be completed in the next few months.

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1 Local Air Quality Management

This report provides an overview of air quality in Worcester City Council during 2016. 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 Worcester 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 Worcester 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 http://www.worcsregservices.gov.uk/pollution/air-quality/air-quality-management-areas.aspx.

Maps of Worcester City Council's monitoring locations are available in Appendix D: Map(s) of Monitoring Locations and AQMAs.

Table 2.1 – Declared Air Quality Management Areas

AQMA Name	Date of Declaration	Pollutants and Air Quality Objectives	City / Town	One Line Description	Is air quality in the AQMA influenced by roads controlled by Highways England?	Level of Exceedance (maximum monitored/modelled concentration at a location of relevant exposure)		Action Plan (Inc. date of publication)
						At Declaration	Now	
Bridge Street/Dolday AQMA	20/03/2009	NO2 Annual Mean	Worcester City	City Centre one way system	NO	39.3 µg/m^3	47.97 µg/m^3	AQAP Progress Report April 2015-16 http://www.worcsregservices.gov.uk/pollution/air-quality/air-quality-action-plan.aspx
Lowesmoor/Rainbow Hill AQMA	20/03/2009	NO2 Annual Mean	Worcester City	A key bus and commuter corridor into City	NO	44.3 µg/m^3	40.41 µg/m^3	AQAP Progress Report April 2015-16 http://www.worcsregservices.gov.uk/pollution/air-quality/air-quality-action-plan.aspx
St Johns AQMA	26/09/2014	NO2 Annual Mean	Worcester City	Key corridor on west side of city and River Severn	NO	43.0 µg/m^3	44.21 µg/m^3	AQAP Progress Report April 2015-16 http://www.worcsregservices.gov.uk/pollution/air-quality/air-quality-action-plan.aspx

☒ **Worcester 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 Worcester City

Defra's appraisal of last year's ASR concluded the following:

The report is well structured, detailed, and provides the information specified in the Guidance. The delivery of a co-ordinated Countywide Action Plan is welcomed and the evidence from long term monitoring suggests it is contributing to some reductions in pollution levels, although there appears to be areas of persistent exceedances in other areas.

1. It is noted that the City Council are continuing to carry out routine monitoring with the use of passive diffusion tubes for nitrogen dioxide at 37 sites across the City, with some results remaining consistently above objective levels.
2. Pollution levels monitored over the last 5 years within the current AQMA's show some evidence of improvement, such that there are now exceedances at two AQMA's and two further locations outside an AQMA at Foregate Street area, and London Road/Sidbury Area.. The exceedances outside of the AQMA, are currently being investigated, suggesting that further monitoring may be required to identify the extent of additional sites of relevant exposure.
3. The Council may wish to consider the fast track procedure for declaring further AQMA's if required, on completion of the current monitoring studies. The details of the procedure can be found in the latest Technical Guidance LAQM TG(16).
4. There is no current exceedance recorded for the Lowesmoor/Rainbow Hill AQMA, but results are close to objective levels, and should remain under review, until levels are consistently below the objectives.
5. The Council may wish to consider reviewing the current action plan in light of these results, and consider developing measures in line with the latest Technical Guidance from Defra LAQM TG(16), based upon source apportionment and targeting measures to reduce emissions at hotspot locations.
6. We acknowledge that the Worcestershire approach providing a centralised AQAP, co-ordinated for each district is a cost effective approach to local air quality management, and there is clear evidence of significant progress in developing action plans.
7. However, in order to fulfil the requirements of the annual reports submitted to DEFRA as Annual Status Reports (ASR), we must emphasise that the expectation within ASR's is that the measures table is used to provide a

> straightforward summary of measures the Council has been delivering and expects to deliver in future to improve air quality in hotspot locations. We fully understand that Worcestershire have produced a Countywide Action Plan, with measures designed for each AQMA that have been updated within the Progress Report. However this information for each district needs to be presented each year, within the ASR in Table 2.2 in the ASR Template.

The above comments from Defra are acknowledged. Worcester City Council has taken forward a number of direct measures during the current reporting year of 2017 in pursuit of improving local air quality. Details of current AQAP measures completed, in progress or planned are set out in Table 2.2. More detail on these measures can be found in the Worcestershire Air Quality Action Plan and updates at http://www.worcsregservices.gov.uk/pollution/air-quality/air-quality-action-plan.aspx.

Key completed measures are:

- **Alteration to traffic light phasing - Lowesmoor Improvement scheme**. Renewed enforcement of an existing Traffic Regulation Order restricting all vehicles, with the exception of buses at certain times of day. Reduced traffic flows through AQMA.
- **Variable Messaging Systems (VMS)** - City is now ringed with VMS, and the A4440 Southern Link Road has a full 'set A4440 Southern Link Road. To re-route unnecessary journeys around the City and subsequently reduce traffic flows through AQMAs.
- **Alteration to phasing of traffic light systems/Junction review (Dolday).** Improve traffic flows.
- **Produce Air Quality Supplementary Planning Document** – Draft 'Technical Guidance for Planner v4.0' completed and with Worcester City Council planning officers for consideration. Reduce specific and cumulative impact on local air quality from new development. A copy can be found at http://www.worcsregservices.gov.uk/pollution/planning-and-pollution.aspx
- **Travel Planning** - Worcestershire County Council is delivering Personalised Travel Planning services on behalf of developers. This encourages modal shift

in new developments towards more sustainable and space efficient forms of transport.

- **Car sharing** - Liftshare Scheme launched autumn 2015 by Worcestershire County Council. Increase in number of people car sharing

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
NAWC1	Develop and implement Worcester City Centre Masterplan and combined Low Emission Strategy	Traffic Manage-ment	UTC, Congestion management, traffic reduction	Worcestershire County Council, Worcester City Council, WRS	2015 - 18	Unknown	Formal adoption and implementation of City Centre Masterplan and Low Emission Strategy	up to 70%	Initial Worcester City Masterplan working group meeting in late 2017. Worcester City Task & Finish Group set up in Jan 2018 to determine AQ improving measures required, likely to be enshrined in LES, for consideration by Environmental and Licensing Committee.	Not determined	At early stages. Long time to implementa-tion
5.2.10	Installing electric vehicle charging points	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	Worcester City Council, Worcestershire County Council	2013 - 2019	2014 onwards	Increase in availability of EV charging points and corresponding increase in use of electric vehicles	up to 40%	Recommendations for installation of EV Charging Points on relevant planning consents formalised in draft SPD currently with City Council planning authority for consideration. Additional strategies to increase EV charging under review by City Council Task & Finish Group	Estimate SPD adoption 2018. Task & Finish Group considering longer term strategies - unknown	Lack of prioritisation for funding opportunities for EV charging infrastructure for authorities unnamed in Gov't AQAP
5.2.1	Bus Quality Partnership	Promoting Low Emission Transport	Public Vehicle Procurement - Prioritising uptake of low emission vehicles	Worcester City Council / Worcestershire County Council, First & other Local Bus Companies. Finding CBTF	2016-19	2018 onwards	Replacement of lower Euro standard buses on key city centre routes.	up to 36%	None	Currently unknown	Poor relationship with local bus companies. No interest from bus companies in participating in CBTF scheme.
5.2.2	Freight Quality Partnership – work with satellite navigation companies to route HGVs around AQMAs	Traffic Manage-ment	UTC, congestion management, traffic reduction	Worcestershire County Council	Completed 2014 - 15	On-going.	Fewer HGVs travelling through AQMA	up to 30%	Ongoing	On-going duty under Traffic Management	Can take time for information to filter down to users

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
LRH7 / 5.1.1	Alteration to traffic light phasing - Lowesmoor Improvement scheme. Renewed enforcement of an existing TRO restricting all vehicles, with the exception of buses at certain times of day	Traffic Manage-ment	Strategic highway improvements and congestion reduction	Worcestershire County Council,(MTE - self funding)	2013 - 14	completed Jan 2015	Improved flow of traffic through Lowesmoor. Reduced congestion. Reduced volume of traffic.	<1 - 10%	Implemented January 2015. Initial data indicated a 74% reduction in non-permitted vehicles travelling along AQMA during restricted peak times. County Council currently exploring a number of approaches to deliver Moving Traffic Enforcement (MTE) in a number of places including Lowesmoor	No date currently for enforcement cameras	
5.3.4	Promote flexible working arrangements	Promoting travel alternatives	Encourage/facilitate home-working	Worcestershire County Council, Superfast Worcestershire	N/A	On-going	Increase in number of people able to work from home	Reduce emissions	94% Superfast Broadband coverage across County. 69,212 properties able to access superfast broadband	96% coverage by Dec 2019	Potential reticence from companies to allow employees to WFH. Further actions on hold to prioritise emerging strategic plans and strategies.
5.1.7	Signage to avoid AQMA	Traffic Manage-ment	Other	Worcestershire County Council	Phase 4 of A4440 works 2017-2019	2019-2021	Decrease in number of strategic journeys through AQMA	Reduce emissions	Phase 3 of A4440 works due completion 2018. VMS around City completed 2016	2021	Lengthy timeline to implement
5.1.4	Variable Message Systems	Traffic Manage-ment	Other	Worcestershire County Council	2015	2015 - 2016	Decrease in traffic movements through AQMA	Reduce emissions	Completed	2016	
5.1.1	Major signalling infrastructure updates at St Johns, St	Traffic Manage-ment	UTC, Congestion management, traffic reduction	Worcestershire County Council, National Productivity Investment Fund	2017	2017-2019	Improve network efficiency and accessibility for all modes of transport	Reduce emissions	Funding secured	2021	

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
	Clements, Croft Road, Dolday, Sidbury, Commandery Road and London Road										
5.1.5 /LRH5	Loading and unloading restrictions during peak traffic times (Lowesmoor/ Rainbow Hill)	Traffic Manage-ment	Workplace Parking Levy, Parking Enforcement on highway	Worcester City Council	2015-2016	2018-2019	Reduced incidence of loading and unloading during peak times	Reduce emissions	None	2019	Requires introduction and implementation of TRO. On hold to prioritise emerging strategic plans and strategies
5.1.1/DD 3	Alteration to phasing of traffic light systems/Junction review (Dolday)	Traffic Manage-ment	Strategic highway improvements, Re-prioritising road space away from cars, including Access management, Selective vehicle priority, bus priority, high vehicle occupancy lane	Worcestershire County Council, Superfast Worcestershire	2013 - 14	Completed 20/04/2015	Improved Traffic Flow	Reduce emissions	Completed.	Completed	
5.5.1	Produce Air Quality Supplementary Planning Document	Policy Guidance and Develop-ment	Air quality planning and policy guidance	WRS and Worcester City Council	2016-2017	2017 2018	Formally adoption and utilised by Worcester City Council planning authority	Reduced emissions from new Develop-ments	SPD drafted by WRS and provided to City Council late 2017. Currently being considered by planning authority.	Amendments following consultation followed by formal adoption by City Council 2018	Varying views on SPD from 6 different local authorities could hamper adoption of single SPD
5.2.5	Greening Council Fleets	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low	Worcester City Council, Worcestershire County Council	2018-19	2019 Onwards	Increase in number of Council fleet and contractors vehicles of	Reduced emissions	Options for measure being considered in 2018 by Task & Finish group.	Unknown	

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
			Emission Vehicles, EV recharging, Gas fuel recharging				higher Euro Standard and/or utilising alternative fuels				
5.3.6	Improve cycling and walking routes in local areas	Promoting Travel Alternatives	Promotion of cycling	Worcestershire County Council, Worcestershire Network Efficiency Programme, National Productivity Investment Fund	2017	2017-2019	Uptake in commuter journeys undertaken by cycle or walking	Reduce emissions	LTP4 (2017-2030) outlines a number of planned active corridors in Worcester City. Worcestershire County Council has secured funding from the NPIF to fund systemic enhancement of the main east-west corridor through Worcester City Centre (A44) including major investment in the St Johns area of the city, and infrastructure updates at Dolday, Sidbury and London Road to improve network efficiency and accessibility for all modes of transport.	2020 for east west corridor	Effectiveness depends on individual motivation to modal shift
5.3.1	Travel Planning	Promoting Travel Alternatives	Personalised travel planning	Worcestershire County Council	2016	2017	Increased uptake of alternative modes of transport	Reduced emissions	Worcestershire County Council is delivering PTP services on behalf of developers. Building on best practice developed by the Council this proven tool encourages modal shift in new developments towards more sustainable and space efficient forms of transport.	On-going	
5.3.2	Car Sharing	Alternatives to private car use	Car and lift sharing schemes	Worcestershire County Council	2014 – 2015 COMPLETED	Liftshare Scheme launched Autumn 2015	Increase in number of people car sharing	<1%	Liftshare Scheme launched in Autumn 2015	Liftshare website scheme launched Autumn 2015. Currently operating	Following an initial surge in interest from public, use of service has slowed down

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
5.6.3	Air Quality Networks	Policy Guidance and Develop-ment Control	Regional Groups Co-ordinating programmes to develop Area wide Strategies to reduce emissions and improve air quality	WRS, Central England Environmental Protection Group (CEEPG), LAQAG/Defra LAQM Team	2017	2017 onwards	Improved cross boundary working between local authorities in West Midlands	Reduce emissions	WRS are member of regional environmental protection managers group (CEEPG) and member of Defra LAQM Team Local Authority Air Quality Advisory Group, both formed in 2017.	On-going.	Differing AQ issues, priorities and resources in regional authorities
5.4.1	Smarter Driving Tips	Public Information	Via the Internet	WRS and Worcestershire County Council	2017	2017	Increase in website hits	Reduce emissions	New advice page created for all groups affected by and impacting air quality and shared with County Public Health. Activation on WRS webpages held up by website platform changes and security issues caused by outside links requiring significant additional work to web design.	2018-19	Effectiveness depends on behavioural change
5.45	Raise the profile and increase awareness of air quality within the region	Other	Other	WRS, Midland Joint Advisory Council (MJAC), Central England Environmental Protection Group (CEEPG), LAQAG/Defra LAQM Team	2014	2014 onwards	Improved cross boundary knowledge sharing between local authorities in West Midlands	Reduce emissions	WRS hold position of Air Quality technical coordinator for MJAC, member of CEEPG and member of Defra LAQM Team Local Authority Advisory Group both formed in 2017.	WRS has been MJAC AQ Technical Coordinator since 2014. MJAC/CEEPG Knowledge Hub group set up in 2017 delivered by joint working between WRS and Cannock Chase DC. Member of LA advisory group to Defra LAQM team following	Reduced AQ officers in regional authorities and resource

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
										invitation 2017.	
5.6.8	Forge closer links with local health agencies	Other	Other	WRS and Worcestershire County Council	N/A	On-going	Increase participation of Public Health in Worcestershire Air Quality issues and action groups	0	WRS officers have met with the Director of Public Health at Worcestershire County Council to highlight the air quality agenda in relation to NO2 and PM2.5. Assisted DoPH Worcester City Council representative in AQ elements of Health Plan for City	On-going	Slow or limited engagement in air quality matters from Worcestershire DoPH, increased participation in 2017.
5.4.2	Provide link to real time air quality information	Public Information	Via the Internet	WRS and Worcestershire County Council	2017	2017	Increase in WRS Twitter subscribers	0	System put in place at WRS to tweet alerts when Air pollution > 3 (Low) in any given 5 day forecast on Defra Daily Air Quality Index and shared with County Public Health representative	On-going	Limited to Twitter users
5.4.4	Make air quality information more available and accessible	Public Information	Via the Internet	WRS	2012	2012-2016	Website hits and enquiries for information	0	All existing LAQM reports and details of AQMAs are available to public on WRS website.	On-going	

2.2.1 Actions undertaken since previous ASR - December 2016 to January 2018

2.2.1.1 St Johns Source Apportionment and Prioritisation

Following declaration of the St Johns AQMA in 2014 a traffic study was undertaken in 2016 as part of a source apportionment study to inform future action planning. WRS completed the 'Source Apportionment of Local Emissions of Nitrogen Dioxide in St Johns Air Quality Management Area' (ref: StJSA FINAL) in March 2017. A copy of this report is available for download from WRS website at http://www.worcsregservices.gov.uk/pollution/air-quality/local-air-quality-progress-reports.aspx.

Subsequently work was undertaken in July 2017 to determine the most appropriate measures to reduce nitrogen dioxide emissions and improve air quality within the AQMA. This included an assessment of possible measures identified from the existing county wide Worcestershire Air Quality Action Plan and additional measures outlined within Defra LAQM Technical Guidance 2016 (LAQM.TG(16)) and a detailed prioritisation process involving:

Step 1. Identification of possible options from existing county wide AQAP and updates, and LAQM.TG16 Annex A TableA.1 Action Toolbox;

Step 2. Shortlisting of actions from 83 to 36 for further cost benefit analysis; removal of actions technically unfeasible in St Johns area, actions already completed in the City or across the County, or considered unlikely to deliver any significant benefits in the St Johns area from WRS experience; and

Step 3. Cost benefits analysis (CBA) of remaining measures to determine priority measures for action within St Johns area. CBA consisted of a likely degree of impact (preferentially weighted), financial cost to LA, financial cost to society, social-political concerns, ease/feasibility of inputting measure, and timescale to completion of measure to maximum impact.

The previous cost benefit analysis used in 2013 countywide AQAP to determine priority actions across the county was improved and re-designed following a similar criteria and process to that outlined within Defra and DfT (May 2017) 'Draft UK Air Quality Plan for tackling nitrogen dioxide: Technical Report'. The following priority actions were determined as likely having the most benefit in St Johns AQMA:

Table 2.3 - St Johns AQMA Cost Benefit Analysis AQAP Priority Measures

Measure Ref	Measure	EU measure Category	EU measure Classification	Total CBA score
5.6.9	Development of a Low Emission Strategy for Worcestershire	Policy Guidance and Development Control	Low Emissions Strategy	26
NAWC1	Develop and implement Worcester City Masterplan and combined Low Emission Strategy	Policy Guidance and Development Control	Low Emissions Strategy	25
5.2.6	Charging Clean Air Zone	Promoting Low Emission Transport	Low Emission Zone (LEZ)	24
5.2.6	Non Charging Clean Air Zone	Promoting Low Emission Transport	Low Emission Zone (LEZ)	20
5.2.1	Bus Quality Partnership	Promoting Low Emission Transport	Public Vehicle Procurement - Prioritising uptake of low emission vehicles	19
TG16.21	Public Vehicle retrofitting	Vehicle Fleet Efficiency	Vehicle Retrofitting programmes	19
5.2.10	Installing electric vehicle charging points	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	19

The next planned stage was to produce an AQAP for St Johns to be incorporated into the existing countywide AQAP. However, prior to production of an AQAP for St Johns AQMA, consideration was given to other requirements in the city such as: London Road AQMA declaration, Foregate Street detailed assessment/AQMA declaration, and potential revision of the countywide AQAP in 2018 – see New Worcester City Air Quality Action Plan below. These considerations subsequently superseded potential works on a separate AQAP for St Johns AQMA.

2.2.1.2 London Road Detailed Assessment

In February 2017, WRS on behalf of Worcester City Council commissioned Air Quality Consultants (AQC) to undertake a detailed assessment including traffic survey of the London Road/Sidbury study area – see section 3.2.1.6 for details of trends in monitoring data in the study area and Figure D.7 in the appendices for a map of study area. The assessment was delayed until May 2017 due to utility services roadworks stalling required traffic survey and was completed in July 2017. A copy of AQC (July 2017) 'Detailed Assessment of Air Quality along London Road, Worcester' (ref: J2829A/1/F1) is being provided to Defra with this 2017 ASR report and can also be downloaded from WRS website at http://www.worcsregservices.gov.uk/pollution/air-quality/local-air-quality-progress-reports.aspx. The AQC report concluded that an area at the western end of London Road should be declared as an AQMA. Subsequent action by Worcester City Council is discussed below.

2.2.1.3 The Foregate, The Butts & The Tything combined Study Area

Additional diffusion tube monitoring locations and an automatic analyser were emplaced within The Foregate in 2016 for the purposes of undertaking a detailed assessment of this study area in 2017. However, following other works undertaken in 2017, as described above, WRS considered appropriate to move directly onto options for declaration of AQMA in this study area for the following reasons:

- Long term trend measurements and automatic analyser results indicate that requirement for an AQMA declaration would likely be confirmed by detailed assessment ;
- Updated Defra LAQM 2016 Policy Guidance LAQM.PG(16) introduced the option to fast track AQMA declaration without need to undertake detailed assessment;
- Declaration of an additional AQMA in London Road is required following detailed assessment and potential option for combining existing inner city AQMAs and new areas into a single AQMA could be beneficial;

Subsequent action by Worcester City Council is discussed below.

2.2.1.4 New Worcester City Air Quality Action Plan

Including requirements for St Johns AQMA and potential declaration of two new AQMAs in the city (London Road and an area encompassing The Foregate, The Butts and southern part of The Tything) in August 2017 WRS considered the implications of potentially producing three new AQAPs in the following 12 months. WRS concluded that it would be beneficial to produce a single new AQAP for Worcester City covering the existing and any additional AQMAs declared in the near future, for the following reasons:

- Resource implications - efficacy of limited resources in producing a single action plan instead of three separate action plans
- Same priority measures likely to apply to all or most of the individual areas of concern
- In line with Defra LAQM Policy Guidance (LAQM:PG(16)) the current Worcestershire AQAP (2013) should be considered for revision after 5 years i.e. 2018.

- Opportunity to update AQAP with new measures that have been developed nationally since production of 2013 countywide AQAP, for example Clean Air Zones.
- Change in Defra policy guidance (LAQM:PG(16)) rendered a significant benefit of a single countywide AQAP irrelevant e.g. separate annual AQAP progress reports to Defra no longer required
- The need for a strategic plan for the whole inner city area in Worcester as recognised by Worcester Urban (Air Quality) Steering Group and discussed in previous annual status reports in 2015 and 2016 available to view at http://www.worcsregservices.gov.uk/pollution/air-quality/local-air-quality-progress-reports.aspx.

WRS approached Worcester City Council in August 2017 regarding following requirements:

- Declaration of new AQMA areas;
- AQAP implications and requirements; and
- Potential for single AQMA covering existing and new areas of concern.

Subsequent action by Worcester City Council is discussed below.

2.2.1.5 District wide AQMA declaration

On the 11th September 2017 Worcester City Council asked WRS to prepare a report with potential options for declaration of a single AQMA to cover existing and potential individual AQMAs as well as other areas where air quality is a concern.

WRS produced a report with 5 potential options for AQMA areas in the city for consideration by Worcester City Council. On the 8th January 2018 the Council's Environment & Licensing committee took the decision to declare the whole district as an AQMA.

The decision has been followed by a period of public consultation prior to drawing up the AQMA order. The results of the public consultation and confirmation of the legal AQMA order will be discussed in the next Annual Status Report, 2018.

2.2.1.6 Formation of Air Quality Task and Finish Group

On 26th July 2017 Worcester City Council Environmental and Licensing Group voted to set up a Task and Finish Group to look into actions to improve air quality in the city. Following determination of council Members assigned to the group, WRS were approached by Worcester City Council in autumn 2017 to facilitate the group and assist with technical aspects. The formative meeting of the group was held on 8th January 2018 to be followed by three technical meetings. The work and outcomes of the group will discussed further in the next Annual Status Report, 2018.

2.2.1.7 Worcester City Centre Masterplan

The Worcester City Plan 2016 -2021 (November 2016) provided the starting point for an updated master plan and new transport strategy. Section 3 outlines the “Healthy and Active City” goals of the Worcester City Plan as ” transportation improved, reducing congestion, improving air quality, increased cycling and walking, enhancements to the City’s ring and radial routes, good links to Worcester Parkway Station, (including rail links) and the development of “rail and ride”. A copy of the Worcester City Plan can be found here https://www.worcester.gov.uk/cityplan.

In March 2017, Worcester City Council commissioned the development of a Masterplan for its City Centre, to drive regeneration, economic diversification and growth. This plan is focussed on supporting intensification of land uses, and improving access to and through the historic central core. Worcestershire County Council will develop a transport strategy for the City Centre to complement the wider development vision.

The City Council has undertaken a procurement exercise to appoint consultants with the expertise to deliver the following Masterplan work packages:

A. **Spatial & Economic Assessment of the City and its Centre** and the setting of a Boundary for the City Centre Master Plan. The Assessment will test a range of growth options for the City Centre, impacts and necessary transport infrastructure.

B. **Transport Assessment and Strategy** – working with the County Council to produce a strategy for the city centre.

C. **Site Development and Opportunity Areas** - the identification of opportunity areas and new sites for redevelopment.

D. **Urban Design Framework for the City Centre** that could link development sites to open spaces, pedestrian routes and transport infrastructure.

E. **Area and Site Delivery Mechanisms** – processes, funding and timescales that will set out how sites will come forward.

F. Production of a Draft and a Final Spatial Master Plan

The Master Plan process is anticipated to take 6 to 7 months from appointment of consultants, Node, in October 2017 to complete.

2.2.2 Worcestershire County Council Highways Improvements

2.2.2.1 Worcestershire Local Transport Plan (LTP4)

The fourth Worcestershire Local Transport Plan (LTP4) was adopted on 11th November, 2017. LTP4 represents an ambitious demand management transport strategy, which seeks to make the most efficient use of existing transport assets. This includes a Worcestershire Rail Investment Strategy, which sets out a long-term investment plan to upgrade Worcestershire's rail infrastructure and services to support and enable the County's economic and growth ambitions. All documents can be accessed here: www.worcestershire.gov.uk/LTP

2.2.2.2 A4440 Worcester Southern Link Road (WSLR) Phases 2 and 3

Delivery of the WSLR Phases 2 and 3 is well underway, with Norton Junction now complete to dual carriageway standard, and amendments to the Whittington Junction completed to provide a full length slip road from the A44 (M5 Junction 7 approach) to

the A4440 WSLR. The replacement of the Battenhall Railway Bridge is underway, and will be delivered 26th – 28th May 2018, with completion of the dual carriageway through that section following shortly after, delivering a continuous dual carriageway route between M5 Junction 7 and the Ketch (junction with the A38). Further details can be viewed here: www.worcestershire.gov.uk/info/20254/major_infrastructure_and_improvement_schemes/1017/the_a4440_worcester_southern_link_road_improvements

2.2.2.3 A4440 Worcester Southern Link Road (WSLR) Phase 4

Planning permission has now been granted (27th March, 2018) for the dualling of the A4440 from the Ketch to Powick Hams. This will be programmed and delivered over the next couple of years, with an anticipated opening in March 2021.

2.2.2.4 National Productivity Investment Fund – Worcestershire 'Axis West-East' Corridor

Worcestershire County Council has recently been successful in securing funding from the National Productivity Investment Fund to fund systemic enhancement of the main east-west corridor through Worcester City Centre (A44). The scheme includes major investment in the St Johns area of the city, major signalling infrastructure updates at St Clements, Croft Road, Dolday, Sidbury, Commandery Road and London Road to improve network efficiency and accessibility for all modes of transport. Further details can be viewed here: www.worcestershire.gov.uk/NPIF.

2.2.3 Future work

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

- Adoption of Supplementary Planning Document – Aim is to reduce additional specific and cumulative impact on local air quality from new development and help accelerate the transition to a Low Emission Economy in Worcester City.

- Public information including smarter driving tips on WRS air quality webpages - Created for all groups affected by and impacting air quality to be launched before Clean Air Day 21st June 2018.

Worcester City Council's priorities for 2018 are:

- Following public consultation and consideration of responses, raise legal order for city wide AQMA and revoke existing AQMAs in St Johns, Dolday/Bridge Street and Lowesmoor/Rainbow Hill.
- Complete Task and Finish Group technical review of priority measures for improving poor air quality in the city and provide a summary report of recommendations to Worcester City Council Environmental and Licensing Committee.
- Start work on a single AQAP for Worcester City following completion of Task and Finish Group process considering group recommendations and committee decisions.
- Produce a new City Centre Masterplan and Transport Strategy.

The principal challenges and barriers to implementation that Worcester City anticipates facing are resourcing and funding sources for potential significant actions and measures such as implementation of a Lowering Emission Strategy, Clean Air Zones (CAZ) for example.

In July 2017 Defra and DfT Joint Air Quality Unit (JAQU) published their detailed 'UK plan for tackling roadside nitrogen dioxide'. Within this plan, and the previous 2015 plan, 5 authorities were mandated to implement a CAZ and a further 23 local authorities were required to produce strategies to accelerate compliance with the air quality objectives in their areas following the governments preferred options for mitigation e.g. CAZ Framework.

A further 33 local authorities have since been required to produce feasibility studies on accelerating compliance following a High Court order. In the autumn budget 2017,

the chancellor announced a £220 million Clean Air Fund to support those local authorities and the people and businesses affected by these local plans.

Worcester City Council is not one of these named councils and therefore has not been prioritised for access to that funding. There is no comparable funding for local authorities not named in those UK plans that have similar, sometimes even worse, areas of poor air quality identified under the LAQM regime. However, the most effective solutions to resolving areas of poor air quality within these non-mandated local authority boundaries, such as Worcester City, are likely to be the same as outlined in UK plans requiring significant resource to enact. For example a Lowering Emission Strategy or Clean Air Zone will require a working group to implement these projects, and potentially sub groups working on specific actions drawing on expertise and interest from many local authority disciplines (such as highways, planning, environmental, sustainability) and local businesses and affected groups contributing such as bus companies, taxi companies, freight representatives, retailers, and residential representatives. These are significant projects requiring significant resource including funding.

Progress on the following measures has been slower than expected due to:

- Public Information including smarter driving tips - New advice page created for all groups affected by and impacting air quality delayed by website platform changes and security issues caused by outside links requiring significant additional work to web design in 2017.

Whilst the measures stated above and in Table 2.2 will help to contribute towards compliance, Worcester City Council anticipates that further additional measures to be determined by the Task & Finish Group work will be required in subsequent years to achieve compliance and enable the revocation of the AQMA(s).

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.

WRS has reviewed the Defra national background maps to determine projected $PM_{2.5}$ concentrations with Worcester City for the 2016 calendar year. The average total $PM_{2.5}$ at 31 locations (centre points of 1km x 1km grids) across Worcester City is 8.78µg/m^3, with a minimum concentration of 8.10µg/m^3 and a maximum concentration of 10.27µg/m^3. This indicates that $PM_{2.5}$ concentrations within Worcester City are well below the annual average EU limit value for $PM_{2.5}$ of 25µg/m^3.

In light of the above no additional actions are currently planned by Worcester City Council in relation to the reduction of $PM_{2.5}$ levels. However it is anticipated that the following planned measures to improve NO_2 levels across the district will likely result in a linked improvement in $PM_{2.5}$ levels:

Table 2.4 - Measures to Improve $PM_{2.5}$

Measure No.	Measure
NAWC1	Develop and implement Worcester City Centre Masterplan and combined Low Emission Strategy
5.2.10	Installing electric vehicle charging points
5.2.1	Bus Quality Partnership
5.2.2	Freight Quality Partnership – work with satellite navigation companies to route HGVs around AQMAs
5.3.4	Promote flexible working arrangements
5.1.7	Signage to avoid AQMA
5.1.4	Variable Message Systems
5.2.5	Greening Council Fleets

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.

Worcester City Council undertook automatic (continuous) monitoring at one site during 2016. Table A.1- in Appendix A shows the details of the site. There are no national monitoring network sites, such as the Defra Automatic Urban and Rural Network (AURN), operating within Worcestershire.

A map showing the location of the monitoring site is provided as Figure D.2 in Appendix D. Further details on how the monitor was calibrated and how the data has been adjusted are included in Appendix C3.

3.1.2 Non-Automatic Monitoring Sites

Worcester City Council undertook non- automatic (passive) monitoring of NO_2 at 38 sites during 2016. 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: Map(s) of Monitoring Locations and AQMAs. Further details on Quality Assurance/Quality Control (QA/QC) for the diffusion tubes, including bias adjustments and any other adjustments applied (e.g. “annualisation” and/or distance correction), are included in Appendix C: Supporting Technical Information / Air Quality Monitoring Data QA/QC.

3.2 Individual Pollutants

The air quality monitoring results presented in this section are, where relevant, adjusted for bias, “annualisation” and distance correction. Further details on adjustments are provided in Appendix C: Supporting Technical Information / Air Quality Monitoring Data QA/QC.

3.2.1 Nitrogen Dioxide (NO_2)

Table A.3 in Appendix A compares the ratified and adjusted monitored NO_2 annual mean concentrations for the past 5 years with the air quality objective of 40µg/m^3.

For diffusion tubes, the full 2016 dataset of monthly mean values is provided in Appendix B: Full Monthly Diffusion Tube Results for 2016.

Table A.4 in Appendix A compares the ratified continuous monitored NO_2 hourly mean concentrations for 2016 with the air quality objective of 200µg/m^3, not to be exceeded more than 18 times per year. There have been no recorded exceedances of this objective in 2016.

3.2.1.1 Trends in NO_2 Monitoring Data

Figure A.1 in Appendix A shows the five year trend for NO_2 concentrations, annualised, adjusted for bias and calculated back to relevant exposure where applicable at all monitoring locations. The figure demonstrates there have been increases in NO_2 at 75% of locations across the district between 2015 and 2016.

Table 3.1 below provides a summary of measured exceedances or concentrations recorded within 5% of the air quality objective (AQO) for nitrogen dioxide in 2016 following adjustments for annualisation and/or distance to relevant exposure where necessary and indicates if within an existing AQMA as of 2016 or not.

The table indicates there have been exceedances of the annual average air quality objective (AQO) for NO_2 or recorded concentrations within 5% of the AQO at 17 of the 38 monitoring locations in 2016. NB Loc. AQM and AQ1/2/3 are co-located at the same location in The Foregate. Of these:

- 6 locations are within existing AQMA's;
- 7 are located in a city centre area (Foregate/The Tything/The Butts) that is subject of a potential Detailed Assessment/AQMA declaration;
- 3 locations are in London Road study area that was subject to a Detailed Assessment in 2017; and

- Dd1 is located just outside the Dolday/Bridge Street AQMA.

More details on trends within existing AQMAs, detailed assessment study areas and subsequent actions are provided below.

No annual means greater than 60µg/m^3 have been recorded at non automatic monitoring locations indicating it is unlikely there have been any exceedances of the 1-hour mean objective at these sites.

Table 3.1 - Summary of measured exceedances of AQO and borderline results in 2016

Site ID	Within AQMA Y/N	AQMA or Detailed Study Area	Bias Adjusted Measurement (µg/m^3)(1)
But1	N	The Butts/The Tything/The Foregate Study area	**52.18**
But2	N	The Butts/The Tything/The Foregate Study area	**55.03**
Dd1	N	Near Dolday/Bridge Street AQMA	39.60(2)
DDASH	Y	Dolday/Bridge Street AQMA	**40.90**
BrS	Y	Dolday/Bridge Street AQMA	38.60
BrS2	Y	Dolday/Bridge Street AQMA	**47.97**
Tyn2	N	The Butts/The Tything/The Foregate Study area	**48.60**
Tyn	N	The Butts/The Tything/The Foregate Study area	**47.26**
Fos	N	The Butts/The Tything/The Foregate Study area	**43.6**
Crs1	N	The Butts/The Tything/The Foregate Study area	39.41
Lwm1	Y	Lowesmoor/Rainbow Hill AQMA	**40.41**
StJ1	Y	St Johns AQMA	**44.21**
Ast3	Y	Lowesmoor/Rainbow Hill AQMA	38.00
LR2	N	London Road Study Area	39.80
LR3	N	London Road Study Area	**40.90**
LR5	N	London Road Study Area	**45.97**
AQ1/2/3	N	The Butts/The Tything/The Foregate Study area	**48.95(3)**
AQM	N	The Butts/The Tything/The Foregate Study area	**42.00**

(1) Annualised and calculated back to relevant receptor where appropriate. Exceedances shown in bold
(2) No relevant receptor
(3) Average of triplicate location

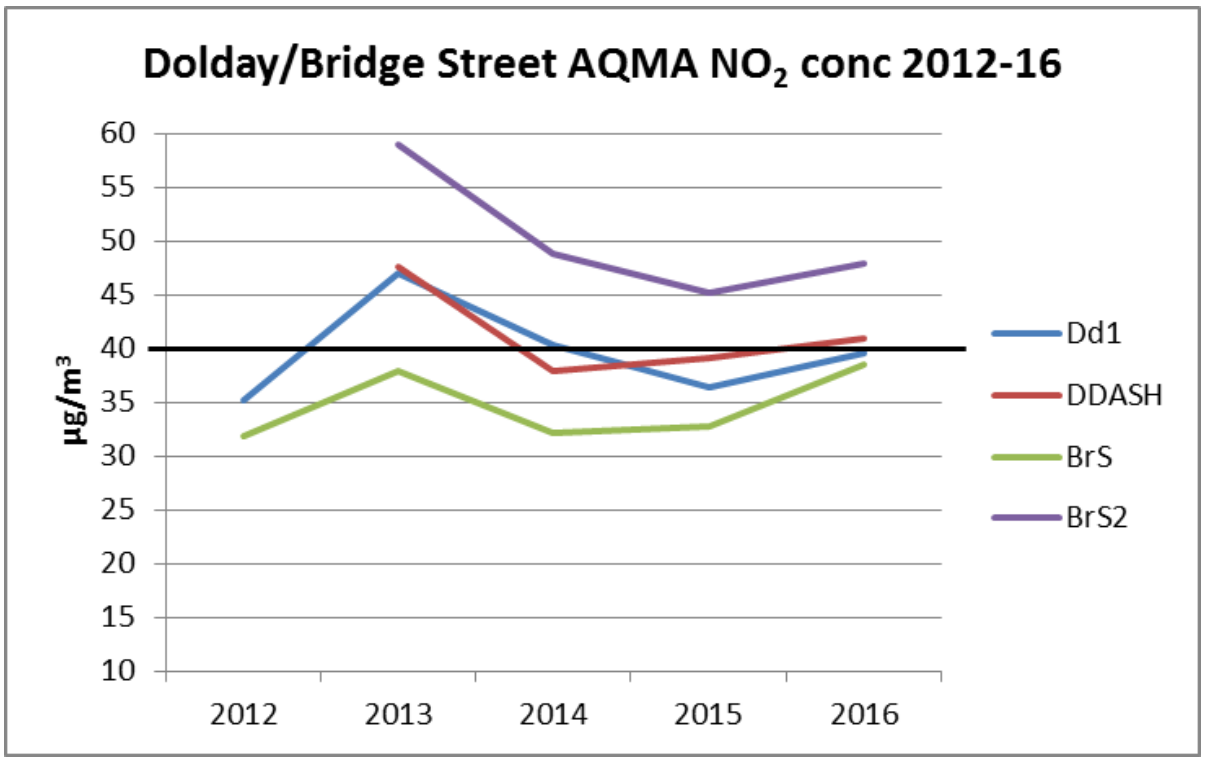
3.2.1.2 Dolday/Bridge Street AQMA

Exceedances have been recorded at two of the three monitoring locations within the AQMA in 2016 following caluclations to relevant exposure where appropriate. NO_2 concentrations at relevant exposure when calculated back from the third monitoring Loc. BrS remain within 5% of the AQO.

Figure 3.1 below demonstrates the five year trend for NO_2 concentrations within the AQMA and including Dd1 located just outside the boundary, following adjustment for bias and calculated back to relevant exposure where applicable.

Concentrations within the AQMA demonstrate a similar picture to the overall trend across the district, a reduction from 2013 highs with a marginal rise in concentrations between 2015 and 2016. The measured concentrations confirm the AQMA should remain in place at this time. There have been no changes to monitoring strategy within the AQMA in 2017.

Figure 3.1 - Long Term Trend Graph of NO2 concentrations in Dolday/Bridge Street AQMA



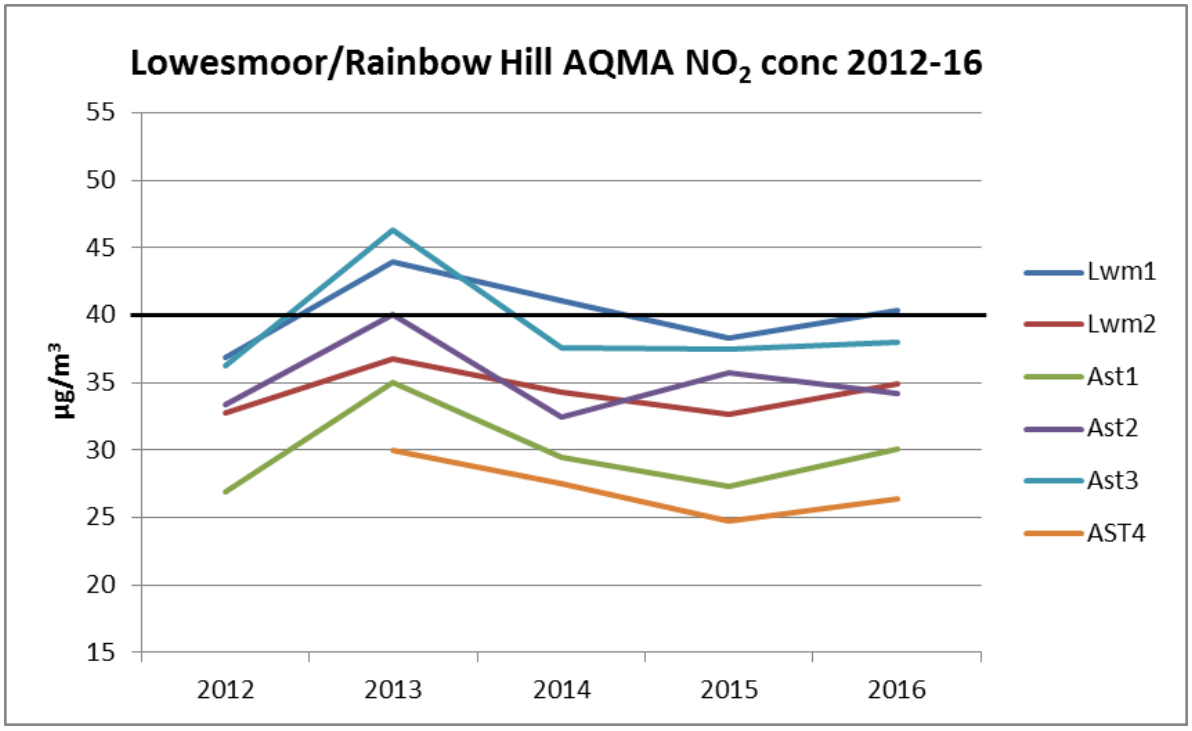
3.2.1.3 Lowesmoor/Rainbow Hill AQMA

A marginal exceedance has been recorded at Loc Lwm1 within this AQMA in 2016. Loc. Ast3 recorded concentration of 38.00µg/m^3, 5% below AQO, when taking concentrations at nearest releveant receptor into consideration.

Figure 3.2 below demonstrates the five year trend for NO_2 concentrations within the AQMA following adjustment for bias and calculated back to relevant exposure where applicable. This demonstrates a general reduction from highs recorded in 2013 to 2015 with a marginal rise in concentrations at 4 out of the 6 monitoring locations within the AQMA in 2016. The measured concentrations confirm the AQMA should remain in place at this time.

Due to changes to street furniture Loc. Ast1 was replaced with Ast1B in 2017. There have been no other changes to monitoring strategy within the AQMA in 2017.

Figure 3.2 - Long Term Trend Graph of NO_2 concentrations in Lowesmoor/Astwood Road AQMA

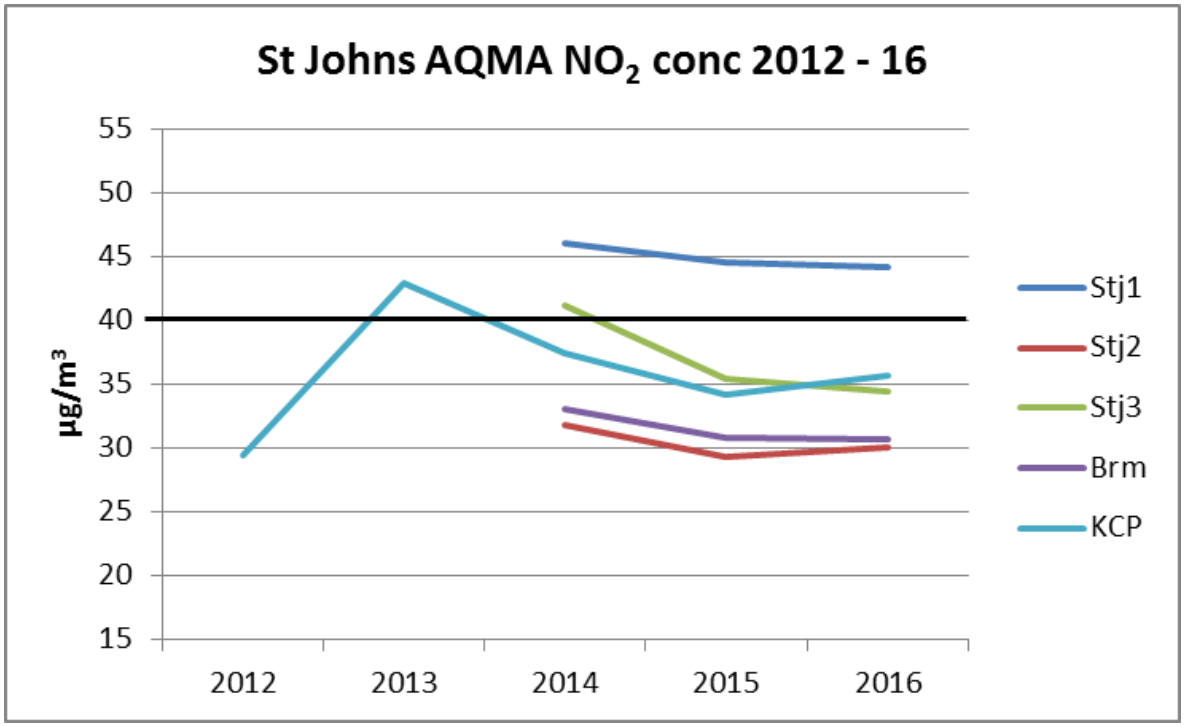


3.2.1.4 St Johns AQMA

One of the five monitoring locations, Loc. StJ1, within the St Johns AQMA measured an exceedance in 2016.

Figure 3.3 shows NO_2 concentrations within the AQMA following adjustment for bias and calculated back to relevant exposure where applicable. The data demonstrates a reduction from measured concentrations of NO_2 in 2014 at all five locations within the AQMA. However, the measured concentrations confirm the AQMA should remain in place at this time. There have been no changes to monitoring strategy within the AQMA in 2017.

Figure 3.3 - Long Term Trend Graph of NO_2 concentrations in St Johns AQMA



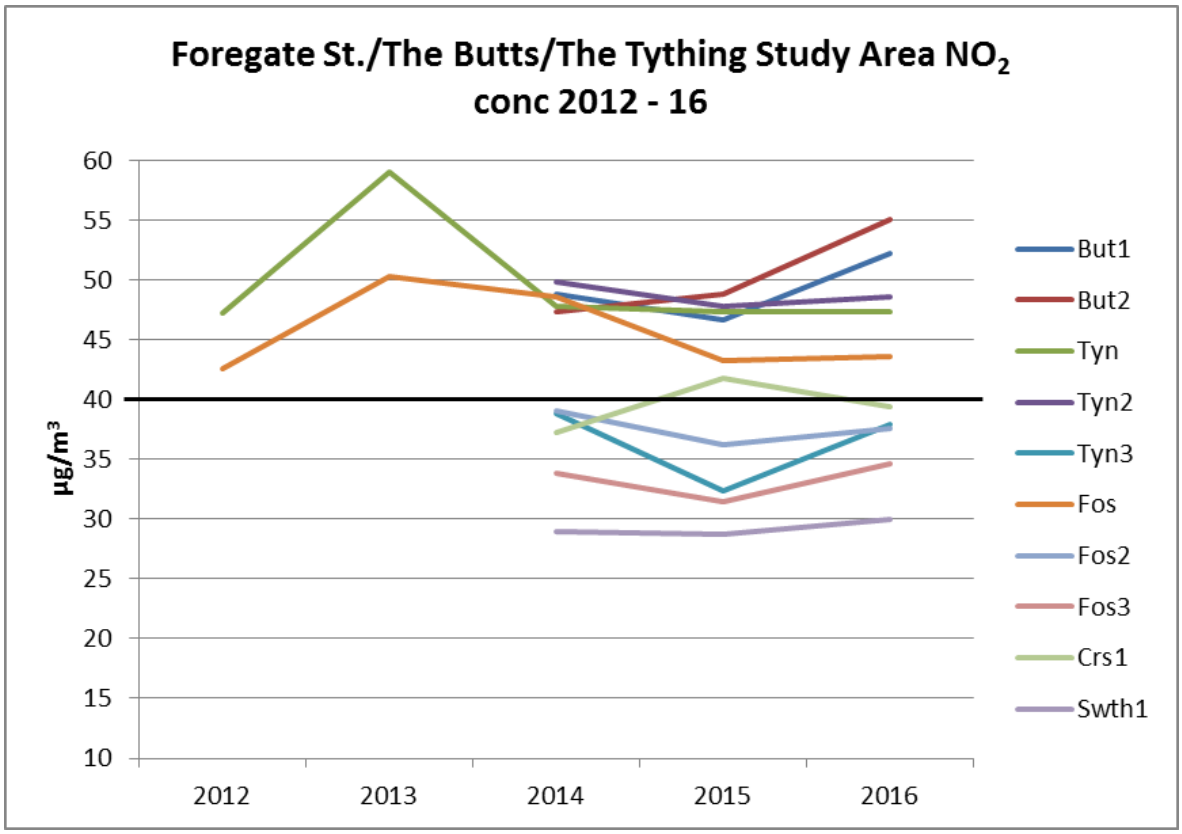
3.2.1.5 The Foregate, The Butts and The Tything, Worcester Combined Study Area

Eight new monitoring locations were erected in 2014 for the purposes of undertaking a detailed assessment of this study area which was to be completed in 2017. Figure 3.4 below demonstrates the five year trend for NO_2 concentrations within the study area following adjustment for bias and calculated back to relevant exposure where applicable. The data demonstrates a slight rise in concentrations between 2015 and 2016 within the study area consistent with the general trend across the district.

Of the current ten locations within the study area, five demonstrated exceedances of the AQO in 2016 and one other location, Crs1 measured concentrations just below the AQO, when proximity to nearest receptors is taken into consideration. However, it should be noted 3 of the recorded exccedances are measurements at ground floor level with nearest receptors at first floor level. There have been no changes to non automatic monitoring strategy within the the study area in 2017. The automatic analyser was decommissioned at the end of 2016.

The 2016 diffusion tube data and results from automatic analyser were originally to be used within a detailed assessment of the study area. However given requirements for declaration of AQMA in other parts of the city, necessary update to 2013 countywide AQAP, the need for a strategic plan for the inner city area in Worcester and the implications of the long term trend measurements and automatic analyser it has been considered more appropriate to move directly onto options for declaration of AQMA in this study area. More information on subsequent actions in respect of this study area is provided in ‘Actions undertaken since previous report Dec 2016 to Jan 2018’ section 2.2.1.3 in Chapter 2.

Figure 3.4 - Long Term Trend Graph of NO_2 concentrations within the Foregate St./The Butts/The Tything Study Area



3.2.1.6 London Road/Sidbury Study Area

Three of the six monitoring locations in London Road/Sidbury measured an exceedance or concentration within 5% of the AQO in 2016 when distance to relevant exposure is taken into consideration.

Figure 3.5 - Long Term Trend Graph of NO_2 concentrations within the London Road/Sidbury Study Area

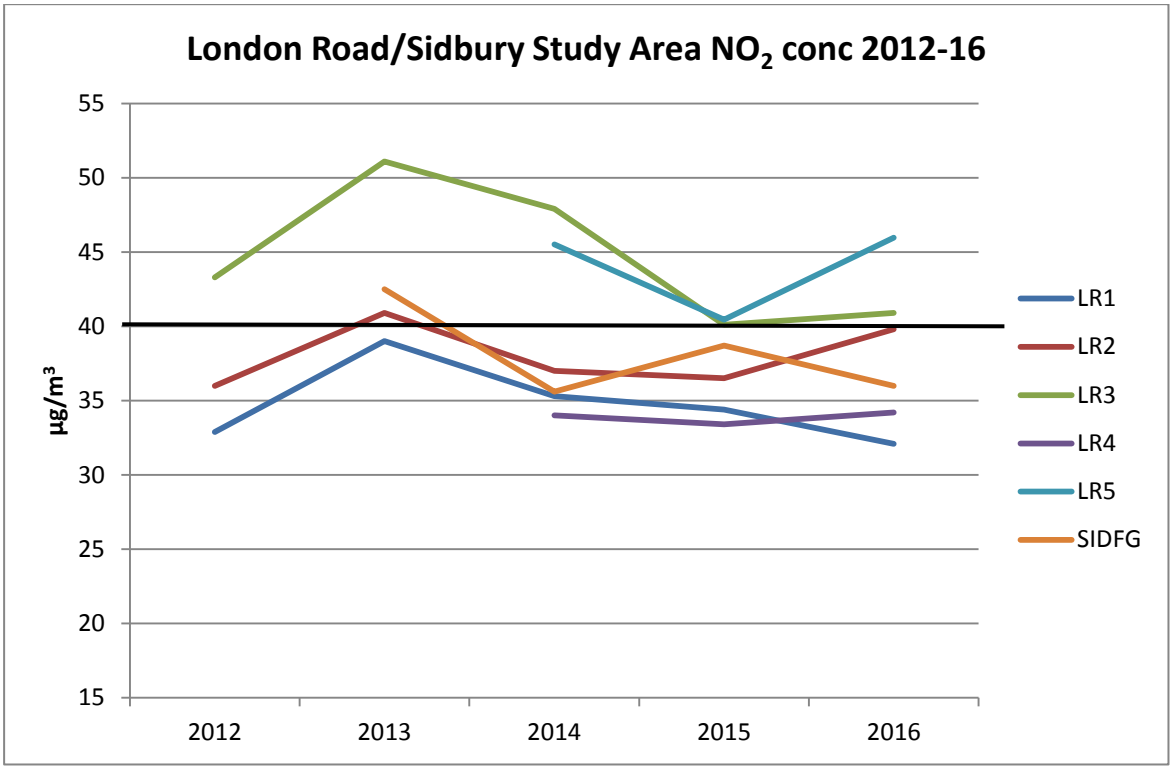


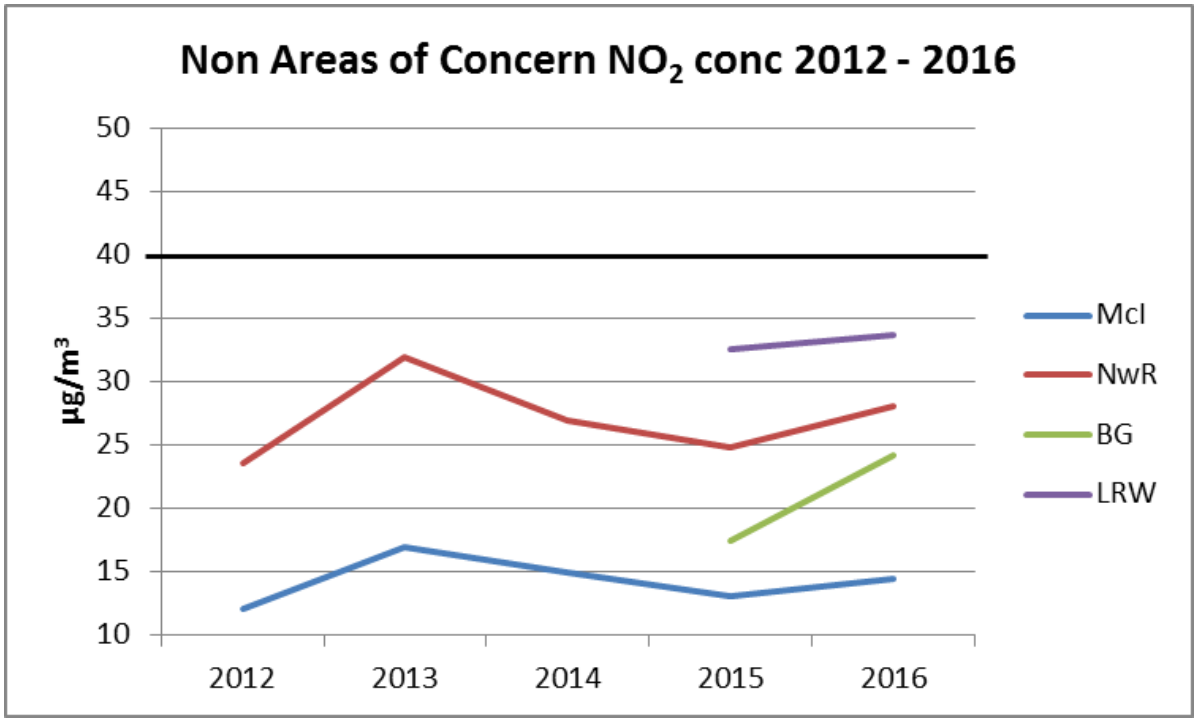
Figure 3.5 above demonstrates the five year trend for NO_2 concentrations within the AQMA following adjustment for bias, annualisation and calculated back to relevant exposure where applicable. There is no discernable trend in concentrations within the study area. There have been no changes to monitoring strategy within the study area in 2017.

The study area was subject to a detailed assessment in 2017 which determined that an Air Quality Management Area should be declared in the London Road area, more information is provided in 'London Road Detailed Assessment' section in Chapter 2.

3.2.1.7 Monitoring outside's AQMA and Areas of Concern

Figure 3.6 below demonstrates the five year trend for NO_2 concentrations at other monitoring locations following adjustment for bias, annualisation and calculated back to relevant exposure where applicable. The data demonstrates a slight increase in measured concentrations of NO_2 from 2015 to 2016 consistent with general trend across the district.

Figure 3.6 - Long Term Trend Graph of NO_2 concentrations outside AQMA's and other areas of concern



In addition to to changes within AQMA and study areas outlined above there has been one other change to monitoring strategy in 2017:

Loc. NwR was replaced with Loc.Oak due to vegetation interfering with access and relocation to façade of a relevant receptor.

Appendix A: Monitoring Results

Table A.1- Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Inlet Height (m)
AQM	The Foregate	Roadside	384947	255117	NO2	NO	Chemiluminescent	0.25	3.5m	1.4

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.2 - Details of Non-Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1,2)	Distance to kerb of nearest road (m) (3)	Tube collocated with a Continuous Analyser?	Height (m)
But1	Magdala Court, The Butts	Roadside	384776	255107	NO_2	NO	0	1.15	NO	2.5
But2	Magdala Court, The Butts	Roadside	384724	255086	NO_2	NO	0	1.67	NO	2.38
Dd1	Ambirak, Dolday 1 opposite bus station	Roadside	384652	254986	NO_2	YES	N/A	2.18	NO	2.17
DDASH	Dolday lamppost opp All Saints House	Roadside	384682	254924	NO_2	YES	2	2.33	NO	2.13
BrS	Bridge Street lamppost outside John Gwen House	Kerbside	384666	254818	NO_2	YES	2	0.66	NO	2.21
BRS2	Bridge Street Sign Opposite John Gwyne House	Roadside	384695	254840	NO_2	YES	1	1.96	NO	2.06
Tyn3	No. 26 Upper Tything (LP opp KwikFit)	Roadside	384679	255998	NO_2	NO	0.1	2	NO	2.22
Tyn2	Lamp & Flag PH Upper Tything (LP) 934	Roadside	384767	255606	NO_2	NO	FF 1.29	2.28	NO	2.21
Tyn	925 - HAMMERCHILDS, Castle Street/The Tything	Roadside	384833	255461	NO_2	NO	FF 1.29	1.63	NO	2.21
Fos2	Hewitt Recruitment, 35 Foregate Street	Roadside	384866	255367	NO_2	NO	FF 1.36	3.2	NO	2.14

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) [1,2]	Distance to kerb of nearest road (m) [3]	Tube collocated with a Continuous Analyser?	Height (m)
Fos3	Café Mela, 22 Foregate Street (downpipe)	Roadside	384899	255329	NO_2	NO	FF 1.03	2.21	NO	2.47
Fos	Foregate Street at junction with Shaw Street (WR1 3QQ)	Kerbside	384941	255140	NO_2	NO	FF 1.19	1	NO	2.47
Crs1	My Coffee, 29 The Cross (downpipe)	Roadside	384967	255012	NO_2	NO	FF 1.33	3.35	NO	2.17
Swth1	Scope shop, St. Swithin's Street (downpipe	Roadside	385013	254987	NO_2	NO	FF 1.33	2.06	NO	2.17
Lwm2	Lowesmoor 2 Town End. Adj private shop	Roadside	385164	255134	NO_2	YES	FF 1	1.86	NO	2.5
Lwm1	Lowesmoor 1 Rainbow Hill End outside 4 Seasons	Roadside	385268	255191	NO_2	YES	FF 1	1.43	NO	2.56
Stj1	Scott of Tattoo, 1A St. Johns (downpipe)	Roadside	384137	254510	NO_2	YES	FF 1.48	2.7	NO	2.02
Brm	10 Bromyard Road (downpipe)	Urban Background	383967	254481	NO_2	NO	0m	8.8	NO	1.9
KCP	King Charles Place outside bakery Lamppost 5372 (WR2 5AJ)	Roadside	384016	254399	NO_2	YES	FF 1.41	2.2	NO	2.09
Stj2	The Fortune House, 65 St. Johns (downpipe)	Roadside	384013	254356	NO_2	YES	FF 1.53	2.22	NO	1.97
Stj3	The Bell, 35 St. Johns (downpipe)	Roadside	384046	254424	NO_2	YES	FF 1.53	2.05	NO	1.97

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) [1,2]	Distance to kerb of nearest road (m) [3]	Tube collocated with a Continuous Analyser?	Height (m)
McI	McIntyre Road lamppost outside last house before cemetery	Urban Background	383454	254606	NO_2	NO	4.5	1.24	NO	2.28
AST4	246 Astwood Road	Roadside	386097	256565	NO_2	NO	0	9.85	NO	2
Ast2	Astwood Road 2 lamppost between Green Lane/Church St	Roadside	385990	256365	NO_2	YES	4	1.4	NO	3.66
Ast1	Astwood Road 1 lamppost 125 at cemetery at junction New Chequers/Tintern	Roadside	386064	256518	NO_2	NO	2	1.53	NO	2.5
Ast3	Astwood Road 3 Rainbow Hill (WR3 8EU)	Roadside	385764	255968	NO_2	YES	6.62	1.68	NO	2.26
NwR	Newtown Road 1 lamppost (7570) (WR5 1SL)	Roadside	387867	254973	NO_2	NO	2.02	2.48	NO	2.46
LRW	Cromwell Crescent Corner, London Road opp Waitrose	Kerbside	386654	253761	NO_2	NO	4	0.5	NO	1.85
LR1	London Road Lamppost 6569 by Bargain Booze (WR5 1EY)	Roadside	385636	254158	NO_2	NO	2.9	1.63	NO	2.12
LR2	London Road Lamppost 6561 by Royal Court (WR5	Roadside	385428	254238	NO_2	NO	3	1.45	NO	2.2

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) [1,2]	Distance to kerb of nearest road (m) [3]	Tube collocated with a Continuous Analyser?	Height (m)
	2DL)									
LR3	London Road traffic sign 572 for A58(City) (WR5 2DL)	Roadside	385357	254272	NO_2	NO	0.5	1.77	NO	2.31
LR5	London Road Bus stop SL6554 opp Bath Road (WR1 2HY)	Roadside	385325	254329	NO_2	NO	0.25	1.45	NO	2.22
LR4	London Road SL6565 adj No 61 (WR5 2DU)	Roadside	385525	254219	NO_2	NO	3.1	1.86	NO	2.06
SIDFG	Sidbury Street Sign outside Fisher German Estate Agents (WR1 2NT)	Roadside	385146	254474	NO_2	NO	FF 3.94	2.3	NO	2.16
BG	West View Broomhall Green, Norton roundabout	Suburban	386297	252150	NO_2	NO	0	36	NO	1.9
BG2	Post adjacent to 17 Broomhall Green, Broomhall, Worcester, WR5 2PG	Roadside	386165	252146	NO_2	NO	5.3	5.1	NO	2.3
RH	Lamppost 5196 - LHS Nursery Rainbow Hill	Roadside	385420	255413	NO_2	NO	7.8	1.45	NO	2.43
AQ1	Air Quality Monitor, The Foregate	Roadside	384947	255117	NO_2	NO	0.25	3.5m	YES	1.37m

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) [1,2]	Distance to kerb of nearest road (m) [3]	Tube collocated with a Continuous Analyser?	Height (m)
AQ2	Air Quality Monitor, The Foregate	Roadside	384947	255117	NO_2	NO	0.25	3.5m	YES	1.37m
AQ3	Air Quality Monitor, The Foregate	Roadside	384947	255117	NO_2	NO	0.25	3.5m	YES	1.37m

Notes:

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

(2) FF = First Floor Receptor

(3) N/A if not applicable.

Table A.3– Annual Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2016 (%) [2]	NO_2 Annual Mean Concentration ($\mu g/m^3$) [3]				
					2012	2013	2014	2015	2016
But1	Roadside	Diffusion Tube	100	100	-	-	**48.74**	**46.59**	**52.18**
But2	Roadside	Diffusion Tube	92	92	-	-	**47.36**	**48.75**	**55.03**
Dd1	Roadside	Diffusion Tube	75	75	35.2	**47**	**40.39**	36.44	39.60
DDASH	Roadside	Diffusion Tube	83	83	-	**47.7**	37.88	39.2	**40.9**
BrS	Kerbside	Diffusion Tube	75	75	31.8	38	32.1	32.8	38.6
BRS2	Roadside	Diffusion Tube	92	92	-	**59**	**48.92**	**45.26**	**47.97**
Tyn3	Roadside	Diffusion Tube	92	92	-	-	38.82	32.35	37.90
Tyn2	Roadside	Diffusion Tube	100	100	-	-	**49.8**	**47.8**	**48.6**
Tyn	Roadside	Diffusion Tube	100	100	**47.2**	**59**	**47.71**	**47.31**	**47.26**
Fos2	Roadside	Diffusion Tube	100	100	-	-	39.05	36.24	37.58
Fos3	Roadside	Diffusion Tube	83	83	-	-	33.84	31.38	34.63
Fos	Kerbside	Diffusion Tube	100	100	**42.5**	**50.3**	**48.6**	**43.2**	**43.6**
Crs1	Roadside	Diffusion Tube	92	92	-	-	37.24	**41.72**	39.41
Swth1	Roadside	Diffusion Tube	92	92	-	-	28.98	28.69	30.00
Lwm2	Roadside	Diffusion	100	100	32.8	36.8	34.32	32.63	34.92

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring	Valid Data Capture 2016 (%) (2)	NO_2 Annual Mean Concentration ($\mu g/m^3$) (3)				
		Tube							
Lwm1	Roadside	Diffusion Tube	100	100	36.9	**44**	**41.09**	38.34	**40.41**
Stj1	Roadside	Diffusion Tube	100	100	**-**	**-**	**46.06**	**44.55**	**44.21**
Brm	Urban Background	Diffusion Tube	100	100	**-**	**-**	33.13	30.85	30.76
KCP	Roadside	Diffusion Tube	92	92	29.4	**43**	37.45	34.17	35.67
Stj2	Roadside	Diffusion Tube	83	83	**-**	**-**	31.85	29.31	30.06
Stj3	Roadside	Diffusion Tube	92	92	**-**	**-**	**41.18**	35.42	34.48
McI	Urban Background	Diffusion Tube	100	100	12.1	17	14.99	13.08	14.46
AST4	Roadside	Diffusion Tube	100	100	-	30	27.47	24.78	26.36
Ast2	Roadside	Diffusion Tube	100	100	33.4	**40**	32.50	35.74	34.17
Ast1	Roadside	Diffusion Tube	100	100	26.9	35	29.43	27.34	30.06
Ast3	Roadside	Diffusion Tube	100	100	36.2	**46.3**	37.6	37.5	38
NwR	Roadside	Diffusion Tube	100	100	23.6	31.9	27	24.8	28.1
LRW	Kerbside	Diffusion Tube	100	100	-	-	-	32.6	33.7
LR1	Roadside	Diffusion Tube	92	92	32.9	39	35.3	34.4	32.1
LR2	Roadside	Diffusion Tube	50	50	36	**40.9**	37	36.5	39.8
LR3	Roadside	Diffusion Tube	100	100	**43.3**	**51.1**	**47.9**	**40.1**	**40.9**

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring	Valid Data Capture 2016 (%) (2)	NO_2 Annual Mean Concentration ($\mu g/m^3$) (3)				
LR5	Roadside	Diffusion Tube	100	100	-	-	**45.51**	**40.46**	**45.97**
LR4	Roadside	Diffusion Tube	92	92	-	-	34	33.4	34.2
SIDFG	Roadside	Diffusion Tube	100	100	-	**42.5**	35.6	38.7	36
BG	Suburban	Diffusion Tube	83	83	-	-	-	17.41	24.26
BG2	Roadside	Diffusion Tube	100	100	-	-	-	-	28.6
RH	Roadside	Diffusion Tube	92	92	-	-	-	-	29.3
AQ1	Roadside	Diffusion Tube	92	92	-	-	-	-	**47.77**
AQ2	Roadside	Diffusion Tube	100	100	-	-	-	-	**49.59**
AQ3	Roadside	Diffusion Tube	100	100	-	-	-	-	**49.49**
AQM	Roadside	Automatic	99.6	96.9	-	-	-	-	**42**

☒ **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)**

☒ **If applicable, all data has been distance corrected for relevant exposure (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.

Figure A.1 - Trends in Annual Mean NO_2 Concentrations

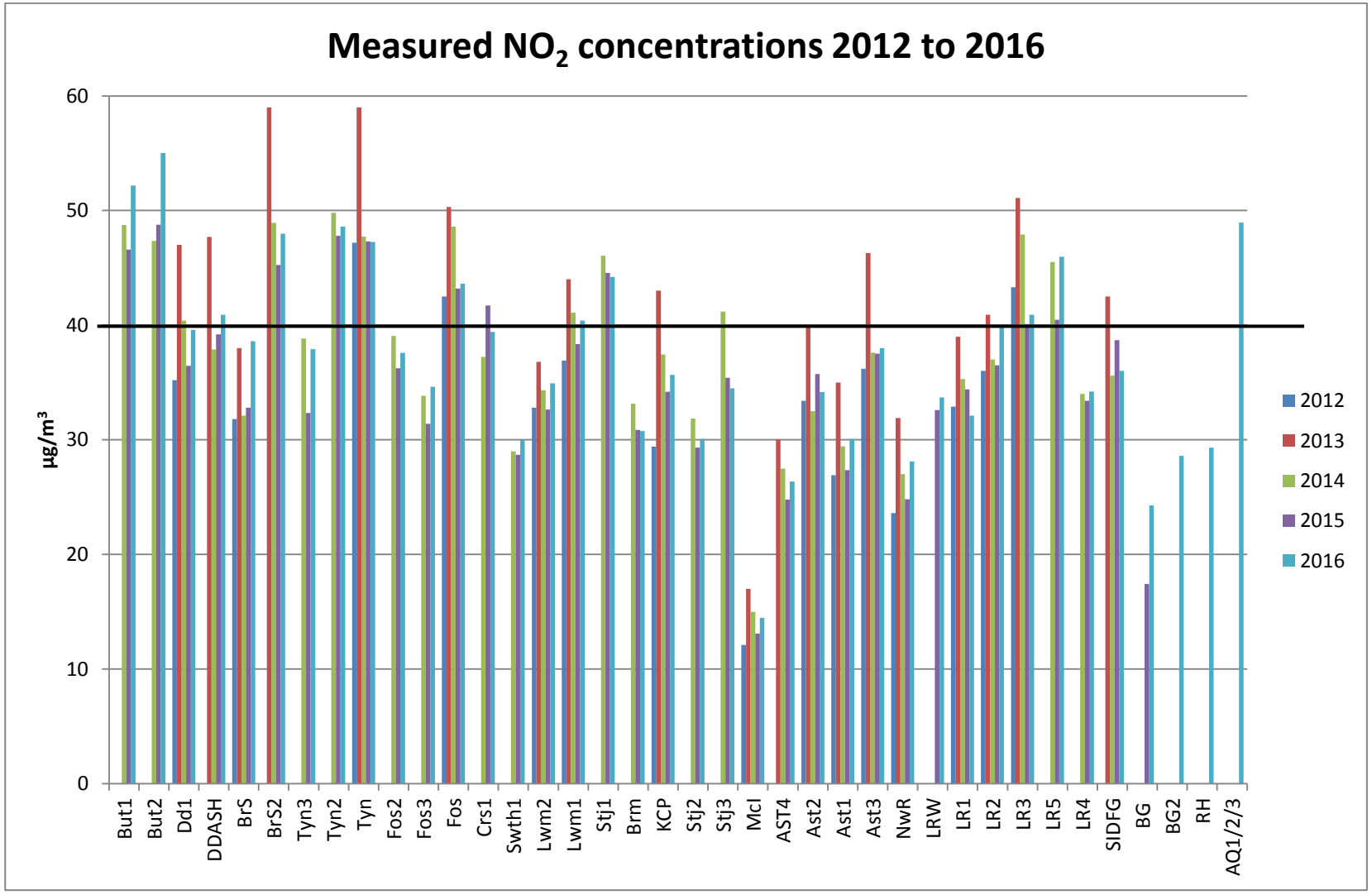


Table A.4– 1-Hour Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	NO_2 1-Hour Means > 200µg/m^3 (3)				
					2012	2013	2014	2015	2016
AQM	Roadside	Automatic	99.6	96.9	-	-	-	-	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.

Appendix B: Full Monthly Diffusion Tube Results for 2016

Table B.1– NO_2 Monthly Diffusion Tube Results - 2016

Site ID	NO_2 Mean Concentrations (µg/m^3)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean		
													Raw Data	Bias Adjusted (0.89) and Annualised (1)	Distance Corrected to Nearest Exposure (2,3)
But1	53.12	63.84	67.31	52.49	59.05	62.69	47.29	48.90	49.31	63.12	75.76	60.62	58.63	**52.18**	**52.2**
But2	57.94	49.14	66.81	59.79	56.70	68.22	55.77	53.35	-	64.24	77.26	70.91	61.83	**55.03**	**55.0**
Dd1	37.85	40.04	49.99	36.60	50.04	48.42	-	33.56	-	50.44	53.51	-	44.50	39.60	N/A
DDASH	58.74	48.30	50.44	50.43	47.24	52.80	49.26	-	44.01	45.63	-	62.60	50.94	**45.34**	**40.9**
BrS	43.36	44.02	60.93	-	46.67	56.73	-	33.56	-	59.01	61.80	63.74	52.20	**46.46**	38.6
BrS2	49.44	48.71	62.19	52.67	54.74	62.55	43.46	44.52	46.20	60.19	68.19	-	53.90	**47.97**	**48.0**
Tyn3	42.16	43.13	-	44.90	42.99	46.48	26.50	32.97	36.43	47.09	54.81	51.02	42.59	37.90	37.9
Tyn2	64.88	55.04	63.71	57.20	51.69	53.74	53.91	48.67	50.87	52.03	59.97	57.99	55.81	**49.67**	**48.6**
Tyn	62.07	48.18	56.88	53.31	50.42	54.39	54.31	50.74	51.21	48.97	46.74	60.04	53.10	**47.26**	**47.3**
Fos2	47.72	40.04	44.62	39.78	36.38	38.67	36.43	34.10	37.50	42.10	46.03	63.27	42.22	37.58	37.6
Fos3	38.94	35.28	-	34.72	41.40	39.71	26.15	30.25	34.19	65.65	42.77	-	38.91	34.63	34.6
Fos	56.96	48.48	67.00	57.55	58.16	54.04	45.84	48.01	47.56	45.57	57.81	55.17	53.51	**47.63**	**43.6**
Crs1	55.93	48.65	54.80	45.96	40.32	30.96	35.44	37.71	38.32	46.16	-	52.79	44.28	39.41	39.4
Swth1	33.49	34.81	42.16	36.07	34.03	35.38	19.76	22.01	27.77	39.05	-	46.27	33.71	30.00	30.0
Lwm2	42.39	39.15	43.67	35.78	41.65	36.78	28.12	31.25	34.58	44.04	44.39	49.08	39.24	34.92	34.9

Site ID	NO_2 Mean Concentrations (µg/m^3)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean		
													Raw Data	Bias Adjusted (0.89) and Annualised (1)	Distance Corrected to Nearest Exposure (2,3)
Lwm1	48.76	42.06	54.10	47.19	46.29	40.76	37.88	35.87	39.30	51.32	49.37	51.92	45.40	**40.41**	**40.4**
StJ1	57.84	49.02	51.05	48.09	54.69	44.59	45.63	45.78	47.75	46.24	52.10	53.34	49.68	**44.21**	**44.2**
Brm	43.18	38.31	40.78	35.46	31.12	23.63	27.51	26.76	28.33	34.41	40.96	44.26	34.56	30.76	30.8
KCP	42.47	39.62	47.33	40.83	-	34.33	32.21	32.02	35.23	40.57	47.30	48.96	40.08	35.67	35.7
StJ2	35.11	34.80	40.48	32.62	-	30.40	20.87	22.34	28.29	39.97	-	52.92	33.78	30.06	30.1
StJ3	-	38.49	44.32	37.67	42.59	37.36	28.56	27.49	34.94	43.88	48.60	42.26	38.74	34.48	34.5
McI	18.44	17.46	19.71	13.00	14.78	13.22	8.02	10.51	13.85	18.94	25.11	21.93	16.25	14.46	14.5
Ast4	32.23	29.77	36.53	26.25	30.15	27.64	16.05	21.73	25.43	32.43	38.35	38.87	29.62	26.36	26.4
Ast2	44.11	35.59	41.25	35.40	37.23	34.62	31.29	33.48	36.95	42.22	40.22	48.36	38.39	34.17	34.2
Ast1	35.73	39.80	34.40	30.35	30.53	29.37	26.08	25.25	28.56	35.62	50.57	39.10	33.78	30.06	30.1
Ast3	60.92	59.68	58.31	57.62	56.32	39.69	42.83	45.80	50.62	58.00	71.88	61.71	55.28	**49.20**	38.0
NwR	36.99	39.39	40.01	38.24	38.05	33.62	21.98	26.16	27.65	35.24	46.42	43.66	35.62	31.70	28.1
LRW	46.76	53.61	62.50	56.04	50.06	47.40	43.51	46.84	51.32	55.08	62.81	54.83	52.56	**46.78**	33.7
LR1	49.07	38.31	48.47	36.00	41.78	36.93	30.77	32.59	40.17	44.10	-	54.56	41.16	36.63	32.1
LR2	-	48.18	48.53	41.13	48.07	44.89	42.46	-	-	-	-	-	45.54	**47.24**	39.8
LR3	48.62	43.61	45.50	41.31	44.26	47.82	41.13	37.17	47.51	58.72	58.56	57.08	47.61	**42.37**	**40.9**
LR5	43.24	47.12	58.50	49.97	55.81	59.11	30.42	37.88	46.54	61.30	69.23	60.67	51.65	**45.97**	**46.0**
LR4	39.52	45.99	52.32	40.84	45.34	46.88	32.68	34.44	42.07	51.79	-	54.01	44.17	39.31	34.2
SidFG	49.59	46.41	50.61	47.26	45.46	47.72	40.96	40.67	43.24	46.45	56.48	53.12	47.33	**42.12**	36.0
BG	36.47	36.13	36.17	30.42	21.52	20.42	16.68	21.66	24.10	29.03	-	-	27.26	24.26	24.3

Site ID	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 (0.89) and Annualised (1)	Distance Corrected to Nearest Exposure (2,3)
BG2	41.35	42.58	48.16	42.85	47.02	43.70	33.98	36.09	33.77	39.91	42.41	47.00	41.57	37.00	28.6
RH	43.25	37.48	43.36	33.54	35.43	-	28.65	28.23	30.84	35.00	43.60	46.89	36.93	32.87	29.3
AQ1	54.09	51.83	66.38	49.08	56.32	51.85	49.67	47.01	50.09	-	54.41	59.64	53.67	**47.77**	**47.8**
AQ2	55.18	50.05	63.27	54.67	58.10	52.99	52.40	48.96	52.13	59.66	58.73	62.53	55.72	**49.59**	**49.6**
AQ3	54.66	52.83	66.63	54.26	55.94	51.65	49.26	52.99	49.70	58.78	57.46	63.13	55.61	**49.49**	**49.5**

☒ **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)**

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.

(3) N/A is not applicable

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

A copy of WRS (Mar 2017) 'Source Apportionment of Local Emissions of Nitrogen Dioxide in St Johns Air Quality Management Area' (ref: StJSA FINAL) can be downloaded from the air quality pages of the WRS website at http://www.worcsregservices.gov.uk/pollution/air-quality/local-air-quality-progress-reports.aspx

A copy of AQC (July 2017) 'Detailed Assessment of Air Quality along London Road, Worcester for Worcester City Council' (ref: J2829A/1/F1) has been provided to Defra with the final version of this Annual Status Report and can be downloaded from the air quality pages of the WRS website at http://www.worcsregservices.gov.uk/pollution/air-quality/local-air-quality-progress-reports.aspx

C1. QA/QC of Diffusion Tube Monitoring

The following UKAS accredited company provides Worcester City Council with nitrogen dioxide diffusion tubes and analysis:

Somerset Scientific Services,
The Crescent
County Hall
Taunton
TA1 4DY
0300 123 2224
somersetscientific@somerset.gov.uk

The 20% Triethanolamine (TEA) / De-ionised Water preparation method is used.

Under the WASP scheme Somerset Scientific Services performed 100% satisfactory for all periods between January 2016 and February 2017. Tube precision was “Good” throughout 2016.

C2. Bias adjustment

The bias adjustment factor applied to the results in 2016 is 0.89 which has been derived from a local co-location study at Worcester Road, Wychbold. The co-location study was undertaken in accordance with LAQM.TG16 and the local bias-adjustment factor calculated using the AEA Environment & Technology spreadsheet tool provided by DEFRA, see Figure C.1 below. The national bias-adjustment factor published by DEFRA in April 2017 (spreadsheet version number 03/17 V2) is 0.88 indicating good agreement between the national bias-adjustment figure and that calculated following the local co-location study at Worcester Road, Wychbold. The local bias-adjustment factor of 0.89 is considered to be more conservative than the national figure and has therefore been adopted for use across Worcestershire for bias-adjustment of 2016 diffusion tube data.

Figure C.1 - Short-term to Long-term Data Adjustment – Annualisation of Automatic Monitor

WyAQCM				
Site	Site Type	2016 Annual Mean	Period Mean	Ratio
Birmingham Acocks Green	Urban Background	21	15.7	1.3
Birmingham Tyburn	Urban Background	29	22.3	1.3
Coventry Allesley	Urban Background	22	16.7	1.3
Leamington Spa	Urban Background	21	15	1.4
			Adjsutment factor	1.3
			Wy AQCM result	51
			Wy AQCM result annualised	66.3

Figure C.2 - Local Bias-adjustment factor calculation

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	95% CI of mean
1	26/04/2016	25/05/2016	59.4	57.4	55.5	57	1.9	3	4.8
2	25/05/2016	28/06/2016	60.4	62.6	61.6	62	1.1	2	2.8
3	28/06/2016	26/07/2016	50.0	55.2	58.6	55	4.4	8	10.8
4	26/07/2016	23/08/2016	47.9	51.3	50.9	50	1.8	4	4.5
5	23/08/2016	27/09/2016	56.1	52.9	54.4	54	1.6	3	3.9
6									
7									
8									
9									
10									
11									
12									
13									

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

Automatic Method

Period Mean	Data Capture (% DC)
53	96.4
57	96.4
53	96.4
41	96.4
44	96.4

Data Quality Check

Tubes Precision Check	Automatic Monitor Data
Good	Good
Good	Good
Good	Good
Good	Good
Good	Good

Overall survey -->

Good precision	Good Overall DC

(Check average CV & DC from Accuracy calculations)

Site Name/ ID:	Wychbold

Precision 5 out of 5 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval) without periods with CV larger than 20%

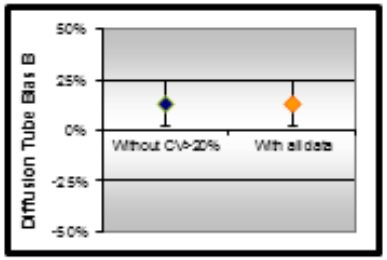
Bias calculated using 5 periods of data

Bias factor A	0.89 (0.81 - 0.99)
Bias B	12% (1% - 23%)
Diffusion Tubes Mean:	56 µgm^{-3}
Mean CV (Precision):	4
Automatic Mean:	50 µgm^{-3}
Data Capture for periods used:	96%
Adjusted Tubes Mean:	49 (45 - 55) µgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA

Bias calculated using 5 periods of data

Bias factor A	0.89 (0.81 - 0.99)
Bias B	12% (1% - 23%)
Diffusion Tubes Mean:	56 µgm^{-3}
Mean CV (Precision):	4
Automatic Mean:	50 µgm^{-3}
Data Capture for periods used:	96%
Adjusted Tubes Mean:	49 (45 - 55) µgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

C3. Automatic Air Quality Monitoring Data QA/QC

A chemiluminescent automatic analyser was installed in The Foregate and operated between 18th November 2015 and 21st December 2016. The monitor was used to continuous monitor levels of nitrogen dioxide (NO_2) and is based on the chemiluminescent reaction between nitrogen oxide (NO) and ozone (O_3). Calibration was undertaken by officers at Worcestershire Regulatory Services and data management by Air Quality Data Management (AQDM) Ltd, shown below.

Air Quality Report

Produced by AQDM on behalf of Worcestershire

WORCESTER FOREGATE 2016

These data have been fully ratified by AQDM to the LAQM TG(16) standards
Site closed 21st December 2016

Site Environment and Description

ROADSIDE: The Foregate, Worcester

Statistical Summary Report

This 2016 report contains all the statistics required for the LAQM reporting.

First table – Air Quality Statistics

The top four lines show the duration within the bands of the Daily Air Quality Index (DAQI). This was introduced by Defra on January 2012 and revised April 2013. The number of occasions within each band is summarised as follows.

DAQI Pollutant	Moderate	High	Very High
NO_2	0 hours	0	0

The annual data captures are shown on the bottom line. These were above the 85% target.

Second table – Air Quality Exceedences

NO_2

The annual mean was 42 µg m^{-3} which exceeded the 40 µg m^{-3} Objective.

The maximum hourly mean was 174 µg m^{-3} so there were no exceedences of the NO_2 hourly limit of 200 µg m^{-3}. There is an annual allowance of 18 hours so this Objective was not exceeded.

AQDM
Air Quality Data Management

Air Quality Report

WORCESTER FOREGATE 2016

Air Quality Statistics

Pollutant	NO_2	NO	NO_x
Number Very High #	0	-	-
Number High #	0	-	-
Number Moderate #	0	-	-
Number Low #	8514	-	-
Maximum 15-min mean	411 µg m^{-3}	736 µg m^{-3}	1262 µg m^{-3}
Maximum hourly mean	174 µg m^{-3}	673 µg m^{-3}	1155 µg m^{-3}
Maximum running 8-hr mean	104 µg m^{-3}	426 µg m^{-3}	745 µg m^{-3}
Maximum running 24-hr mean	85 µg m^{-3}	304 µg m^{-3}	542 µg m^{-3}
Maximum daily mean	84 µg m^{-3}	301 µg m^{-3}	535 µg m^{-3}
Average	42 µg m^{-3}	52 µg m^{-3}	122 µg m^{-3}
Data capture	96.9 %	96.9 %	96.9 %
Data capture to 21st December	99.6 %	99.6 %	99.6 %

Daily Air Quality Index (DAQI) as defined by COMEAP January 2012 and revised April 2013
Mass units for the gases are at 20'C and 1013mb
NO_x mass units are NO_x as NO_2 µg m^{-3}

Air Quality Exceedences

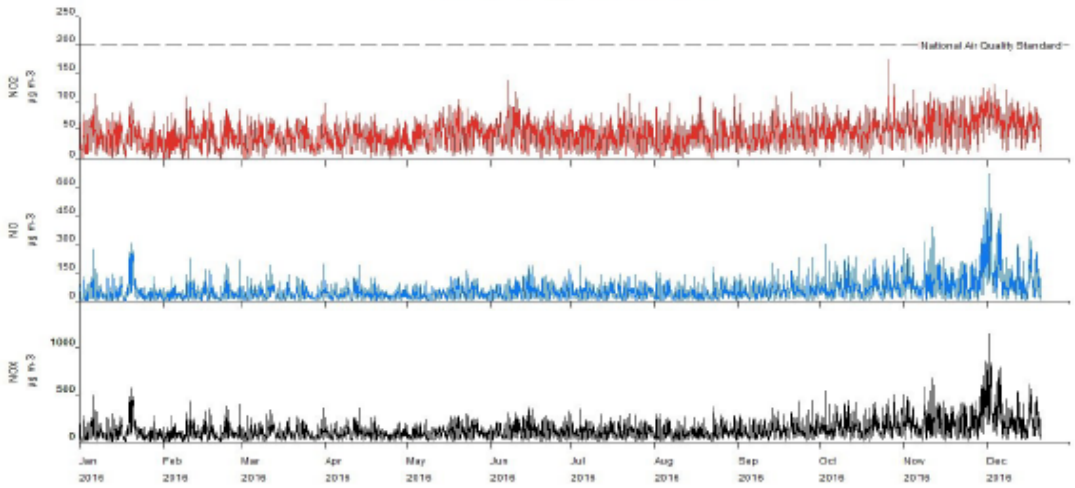
Pollutant	Air Quality (England) Regulations 2000 & (Amendment) Regulations 2002	Max Conc	Number	Days	Allowed	Exceeded
Nitrogen Dioxide	Annual mean > 40 µg m^{-3}	42 µg m^{-3}	1	-	-	Yes
Nitrogen Dioxide	Hourly mean > 200 µg m^{-3}	174 µg m^{-3}	0	0	18 hours	No

AQDM
Air Quality Data Management

Air Quality Report

WORCESTER FOREGATE 2016

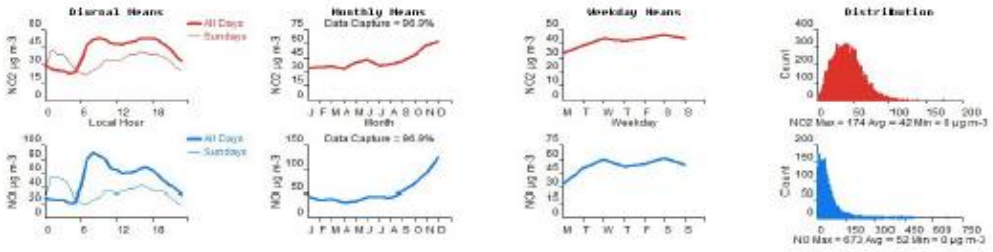
Hourly Means



AQDM
Air Quality Data Management

Air Quality Report

WORCESTER FOREGATE 2016



Worcester Foregate Air Quality Report produced by:
Geoff Broughton
Air Quality Data Management (AQDM)
Tel: 01235 559761
Geoff.Broughton@aqdm.co.uk
http://www.aqdm.co.uk
http://uk.linkedin.com/pub/geoff-broughton/22/187/87/
http://www.UKAirQuality.net

AQDM
Air Quality Data Management

C4. Annualisation

Table C.1 - Annualisation calculations for monitoring location LR2 London Road

Site	Site Type	Annual Mean	Period Mean	Ratio
Birmingham Acocks Green	Background Urban	21.3114417	19.1978077	1.11009768
Walsall Woodlands		18.40294354	15.12106231	1.217040388
Leamington Spa Rugby Road	Urban Traffic	21.38872513	18.28628299	1.169659528
			Average	1.165599197
			LR2 result	40.53
			LR2 annualised	**47.24**

C5. Estimates of concentrations at the nearest receptor

If an exceedance is measured at a monitoring site (or close to the air quality objective) which is not representative of public exposure, Defra advise the procedure specified in Technical Guidance LAQM.TG(16) should be used to estimate the concentration at the nearest receptor where applicable. For consistency and purposes of demonstrating long term trends this procedure has been adopted for *all* monitoring locations which are not representative of public exposure. The results are presented in Figures C.3 to C.16 below and summarised in **Error! Reference source not found.**and in Section 3 of the report.

Figure C.3 - Loc. DDASH - Distance from road to relevant exposure calculation

Enter data into the red cells

Step 1	How far from the KERB was your measurement made (in metres)?	2.33	metres
Step 2	How far from the KERB is your receptor (in metres)?	4.33	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	15.947928	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	45.34	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	40.9	µg/m^3

Figure C.4 - Loc.BrS - Distance from road to relevant exposure calculation

Enter data into the red cells

Step 1	How far from the KERB was your measurement made (in metres)?	0.66	metres
Step 2	How far from the KERB is your receptor (in metres)?	2.66	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	15.947928	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	46.46	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	38.6	µg/m^3

Figure C.5 - Loc.Tyn2 - Distance from road to relevant exposure calculation

Enter data into the red cells

Step 1	How far from the KERB was your measurement made (in metres)?	2.28	metres
Step 2	How far from the KERB is your receptor (in metres)?	2.61	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	16.572752	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	49.67	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	48.6	µg/m^3

Figure C.6 - Loc.Fos - Distance from road to relevant exposure calculation

Enter data into the red cells

Step 1	How far from the KERB was your measurement made (in metres)?	1	metres
Step 2	How far from the KERB is your receptor (in metres)?	1.9	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	16.572752	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	47.63	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	43.6	µg/m^3

Figure C.7 - Loc.Ast3 - Distance from road to relevant exposure calculation

Enter data into the red cells

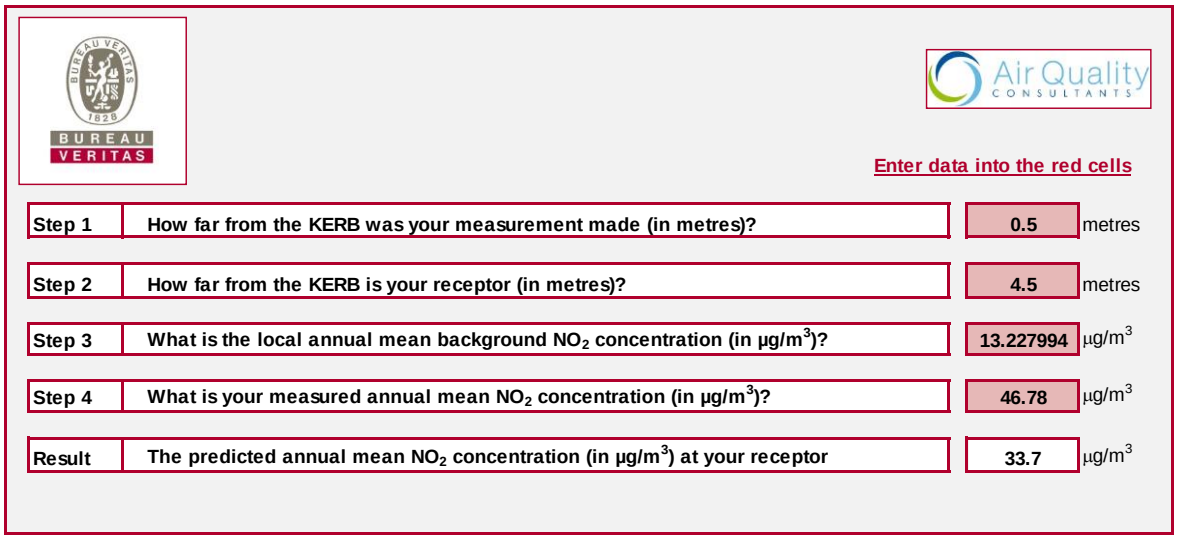
Step 1	How far from the KERB was your measurement made (in metres)?	1.68	metres
Step 2	How far from the KERB is your receptor (in metres)?	8.3	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	17.977666	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	49.2	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	38.0	µg/m^3

Figure C.8 - Loc.NwR - Distance from road to relevant exposure calculation

Enter data into the red cells

Step 1	How far from the KERB was your measurement made (in metres)?	2.48	metres
Step 2	How far from the KERB is your receptor (in metres)?	5.5	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	13.276002	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	31.7	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	28.1	µg/m^3

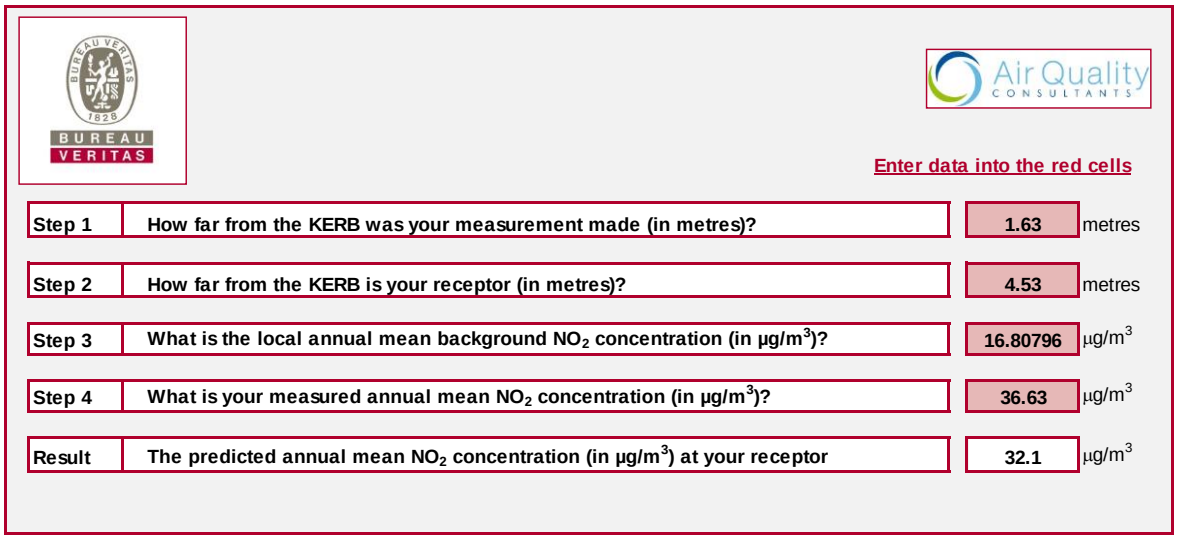
Figure C.9 - Loc.LRW - Distance from road to relevant exposure calculation



Enter data into the red cells

Step 1	How far from the KERB was your measurement made (in metres)?	0.5	metres
Step 2	How far from the KERB is your receptor (in metres)?	4.5	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	13.227994	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	46.78	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	33.7	µg/m^3

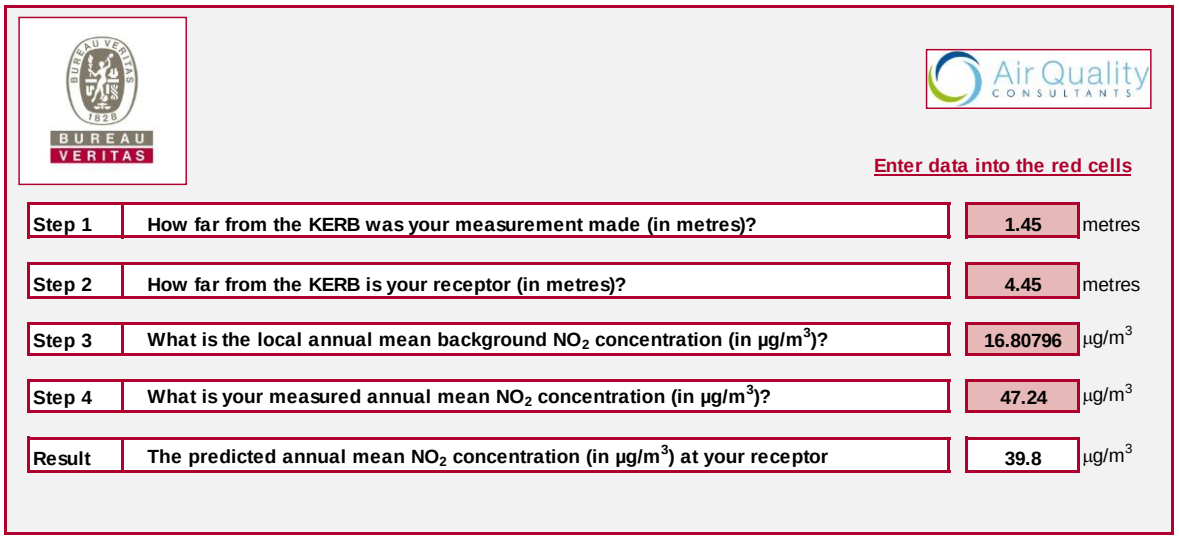
Figure C.10 - Loc.LR1 - Distance from road to relevant exposure calculation



Enter data into the red cells

Step 1	How far from the KERB was your measurement made (in metres)?	1.63	metres
Step 2	How far from the KERB is your receptor (in metres)?	4.53	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	16.80796	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	36.63	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	32.1	µg/m^3

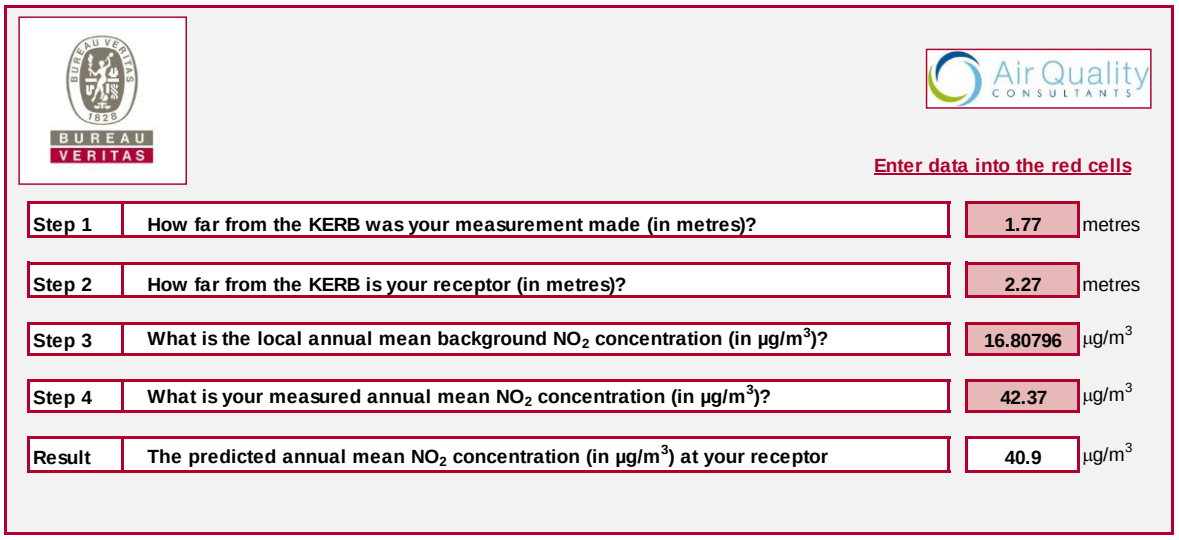
Figure C.11 - Loc.LR2 - Distance from road to relevant exposure calculation



Enter data into the red cells

Step 1	How far from the KERB was your measurement made (in metres)?	1.45	metres
Step 2	How far from the KERB is your receptor (in metres)?	4.45	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	16.80796	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	47.24	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	39.8	µg/m^3

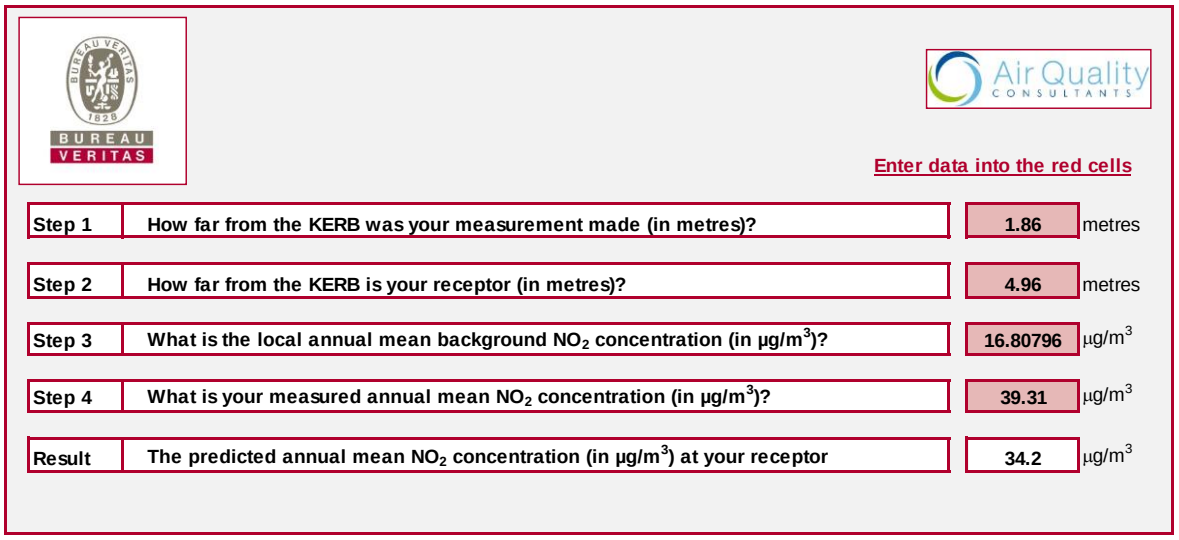
Figure C.12 - Loc.LR3 - Distance from road to relevant exposure calculation



Enter data into the red cells

Step 1	How far from the KERB was your measurement made (in metres)?	1.77	metres
Step 2	How far from the KERB is your receptor (in metres)?	2.27	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	16.80796	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	42.37	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	40.9	µg/m^3

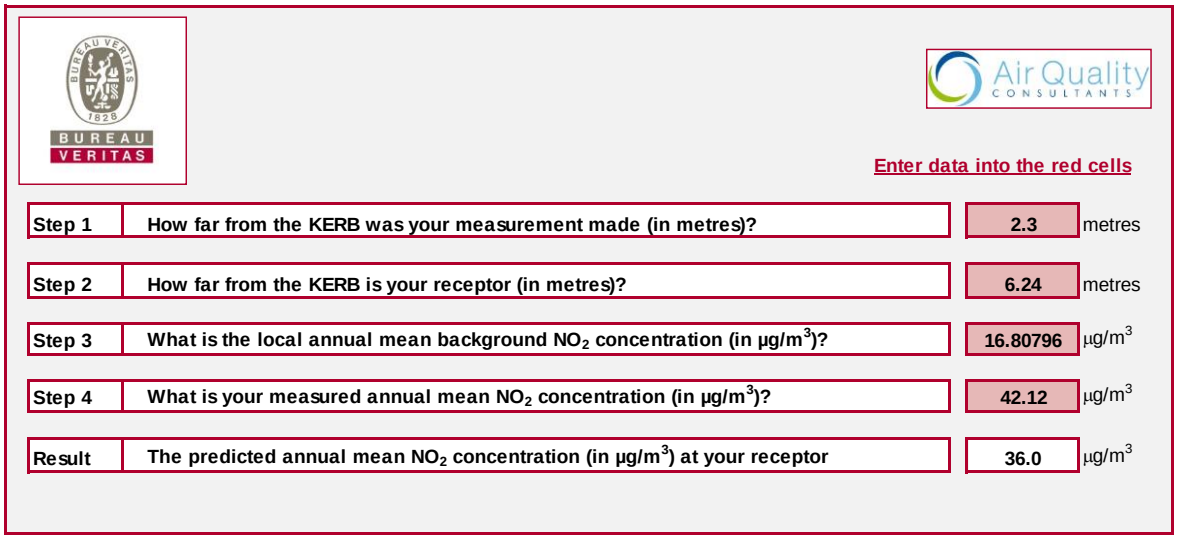
Figure C.13 - Loc.LR4 - Distance from road to relevant exposure calculation



Enter data into the red cells

Step 1	How far from the KERB was your measurement made (in metres)?	1.86	metres
Step 2	How far from the KERB is your receptor (in metres)?	4.96	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	16.80796	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	39.31	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	34.2	µg/m^3

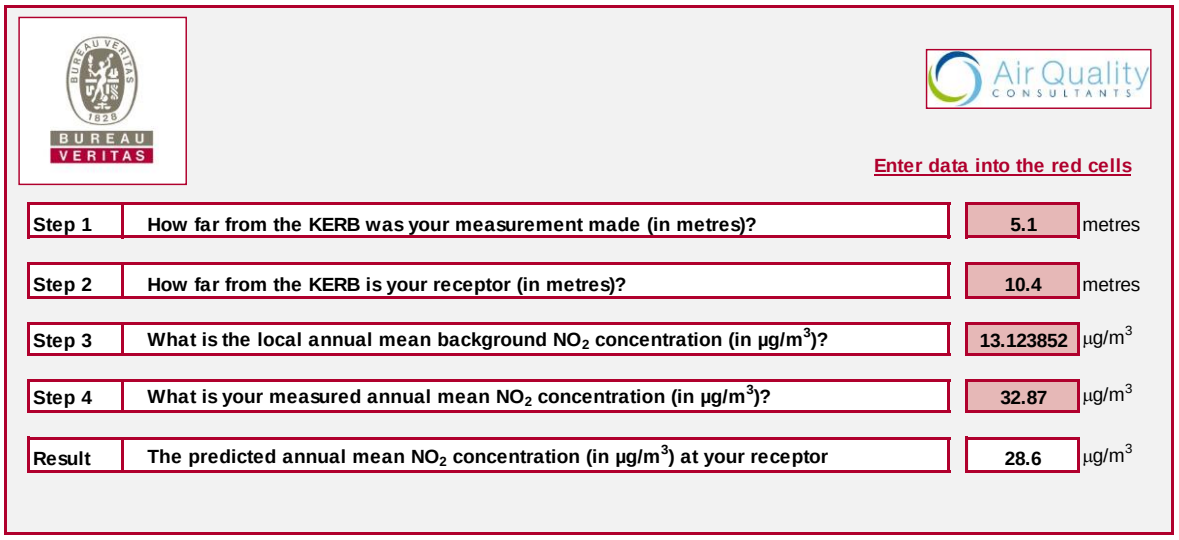
Figure C.14 - Loc.SidFG - Distance from road to relevant exposure calculation



Enter data into the red cells

Step 1	How far from the KERB was your measurement made (in metres)?	2.3	metres
Step 2	How far from the KERB is your receptor (in metres)?	6.24	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	16.80796	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	42.12	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	36.0	µg/m^3

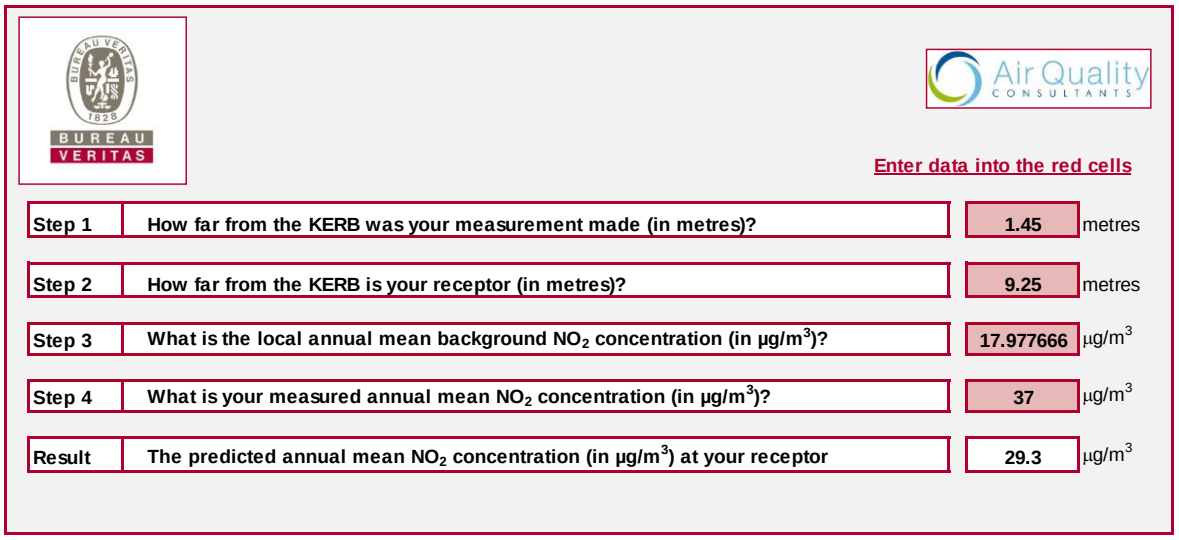
Figure C.15 - Loc.BG2 - Distance from road to relevant exposure calculation



Enter data into the red cells

Step 1	How far from the KERB was your measurement made (in metres)?	5.1	metres
Step 2	How far from the KERB is your receptor (in metres)?	10.4	metres
Step 3	What is the local annual mean background NO_2 concentration (in $\mu g/m^3$)?	13.123852	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	32.87	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	28.6	$\mu g/m^3$

Figure C.16 - Loc.RH - Distance from road to relevant exposure calculation



Enter data into the red cells

Step 1	How far from the KERB was your measurement made (in metres)?	1.45	metres
Step 2	How far from the KERB is your receptor (in metres)?	9.25	metres
Step 3	What is the local annual mean background NO_2 concentration (in $\mu g/m^3$)?	17.977666	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	37	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	29.3	$\mu g/m^3$

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

Figure D.1 - Overview of AQMAs and inner city monitoring locations

Figure D.2 - Dolday/Bridge Street AQMA and The Foregate monitoring locations

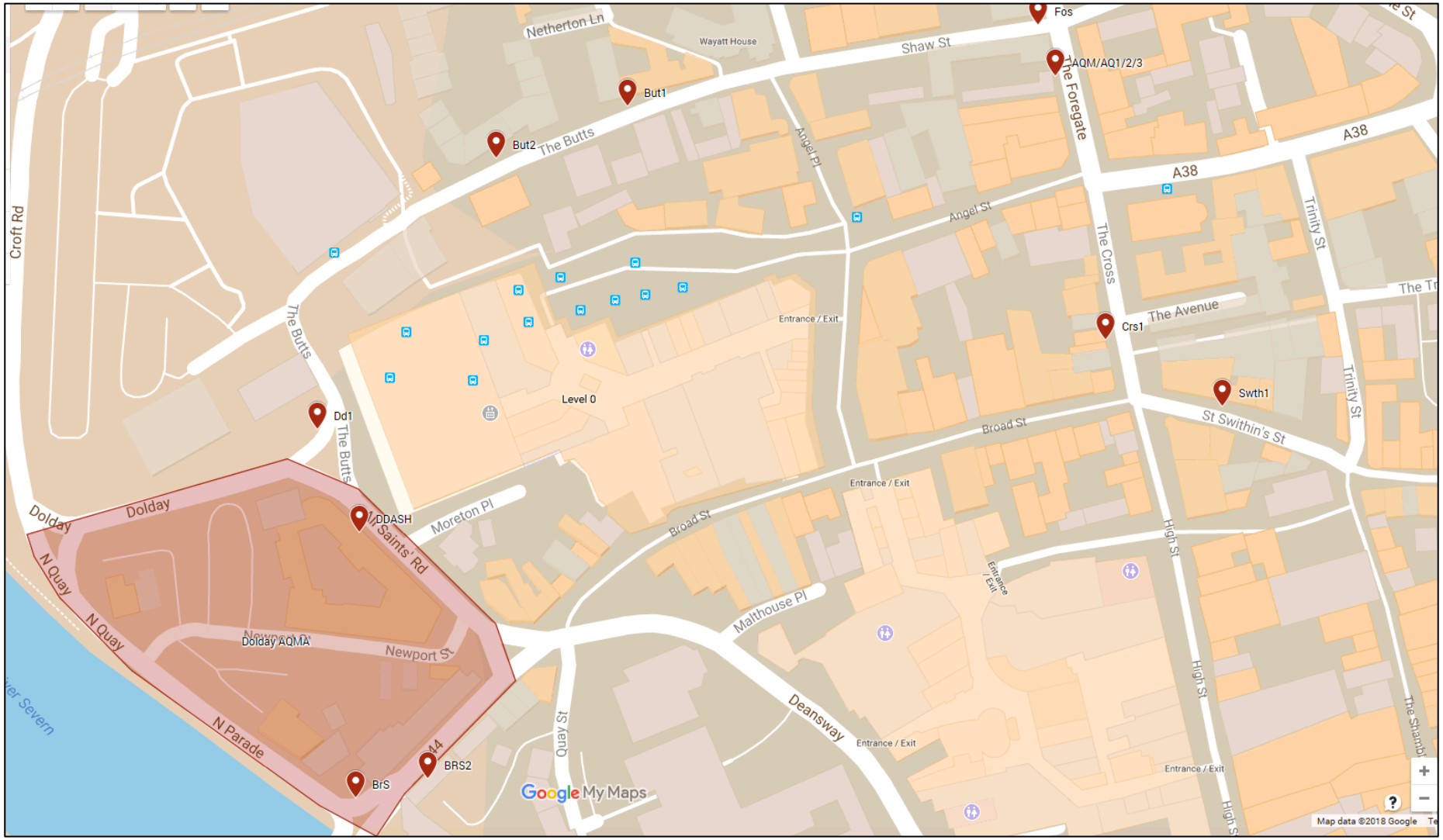


Figure D.3 - St Johns AQMA and McIntyre Road monitoring location

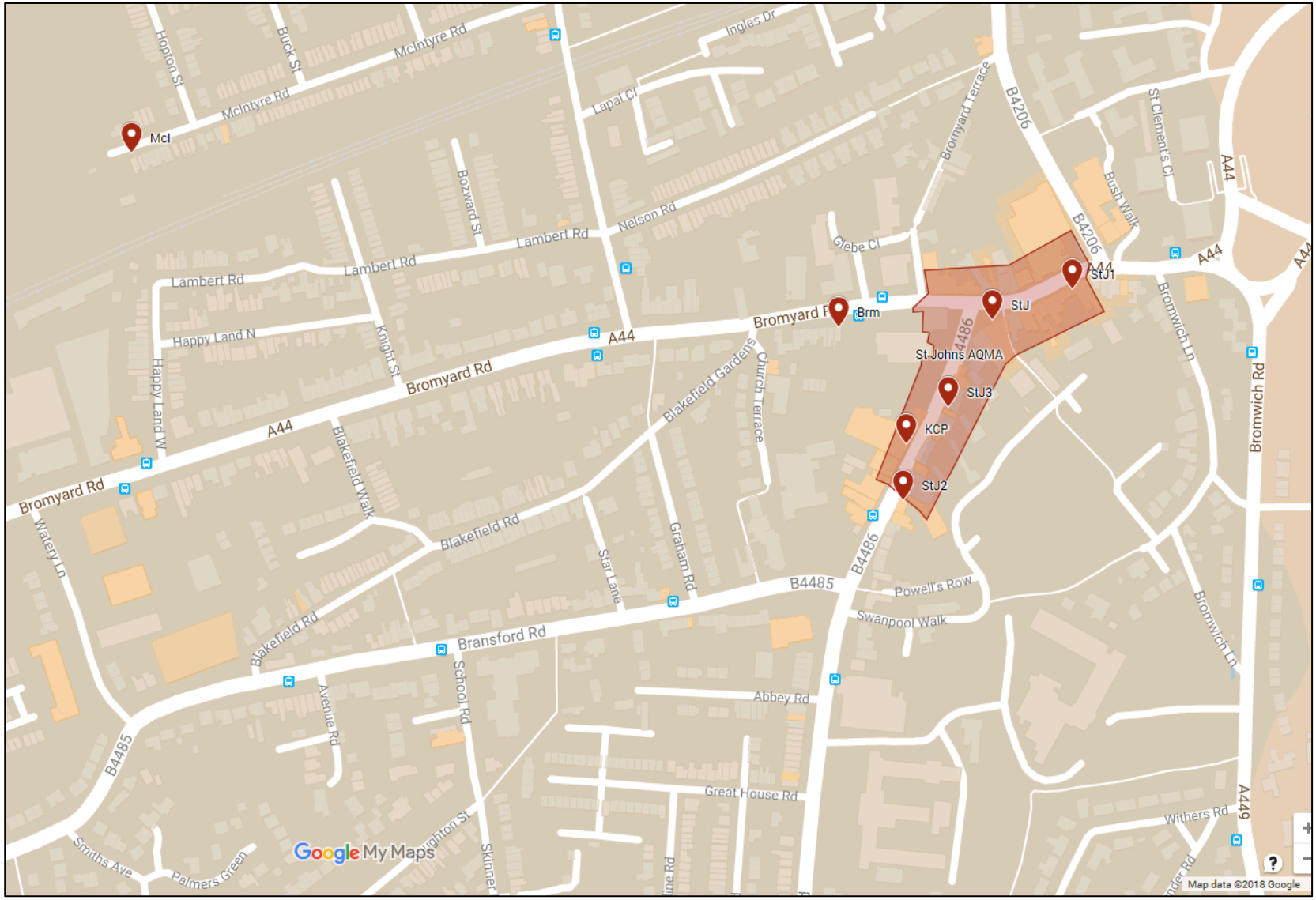


Figure D.4 - The Tything and The Foregate monitoring locations

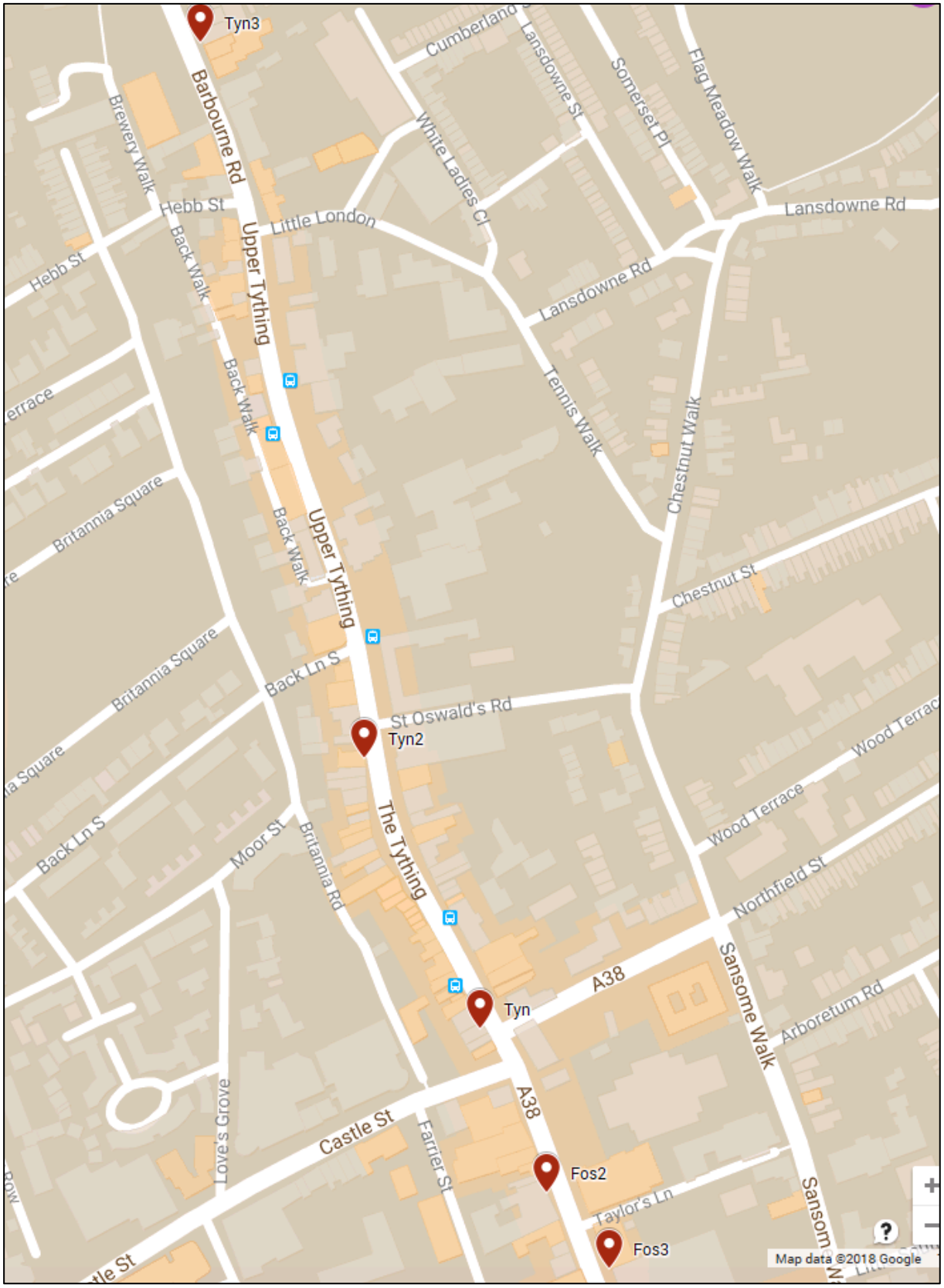


Figure D.5 - Astwood Road (north part of Rainbow Hill/Lowesmoor AQMA)

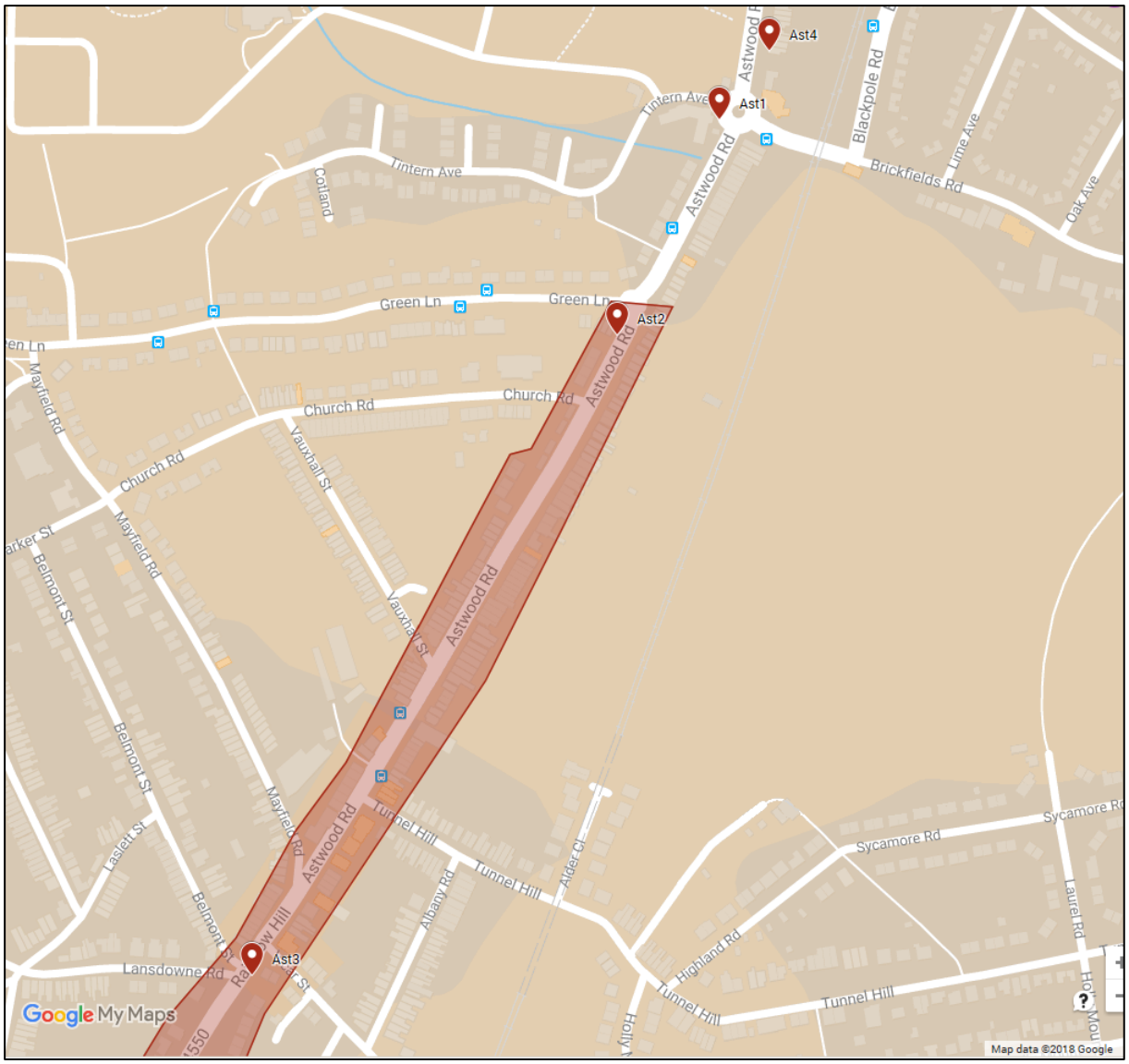


Figure D.6 - Southern part of Rainbow Hill/Lowesmoor AQMA monitoring locations

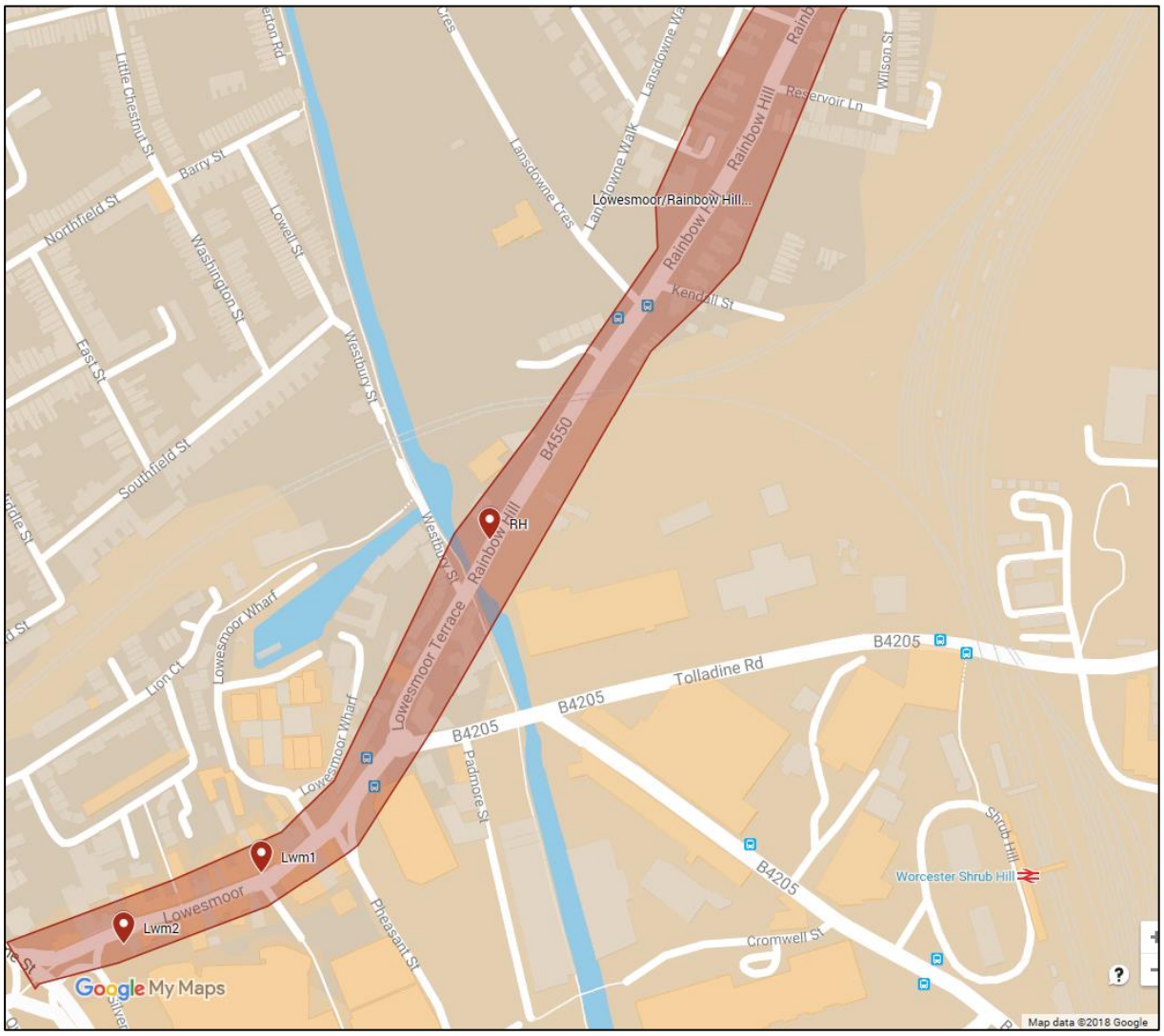


Figure D.7 - London Road/Sidbury monitoring locations

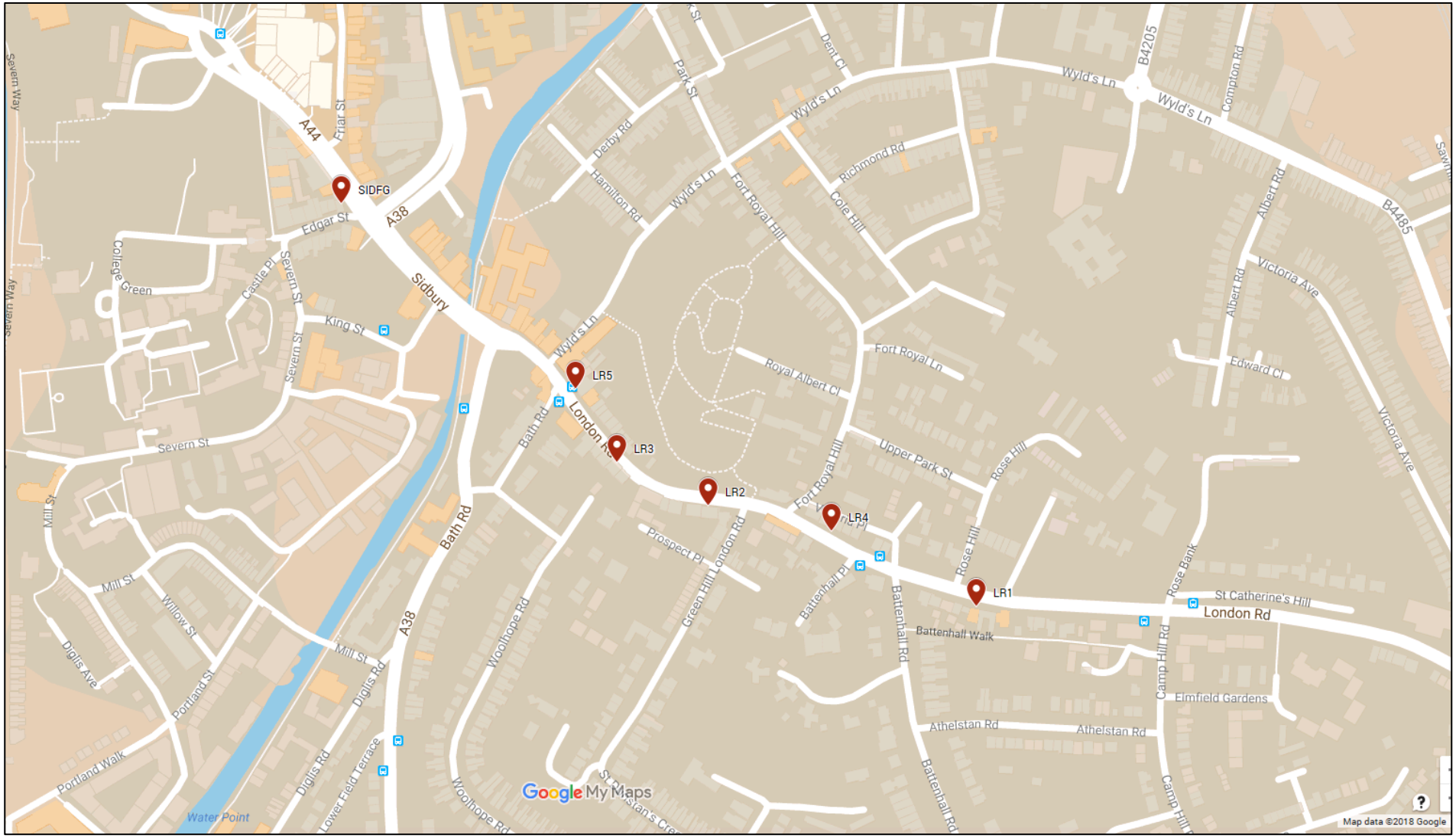


Figure D.8 - London Road (Waitrose) and Newtown Road monitoring locations

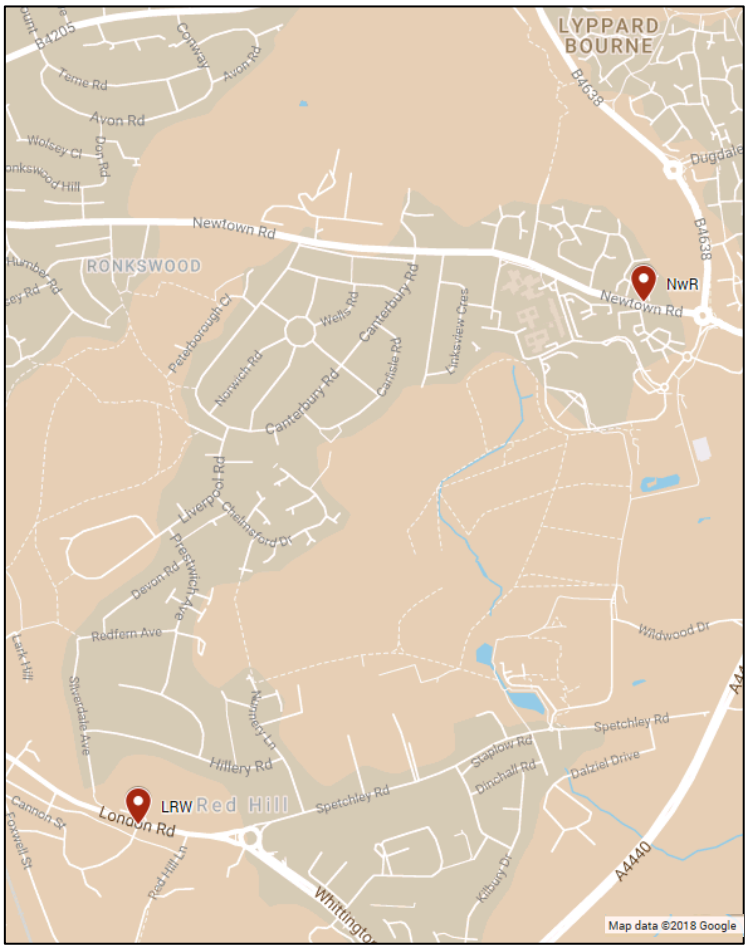
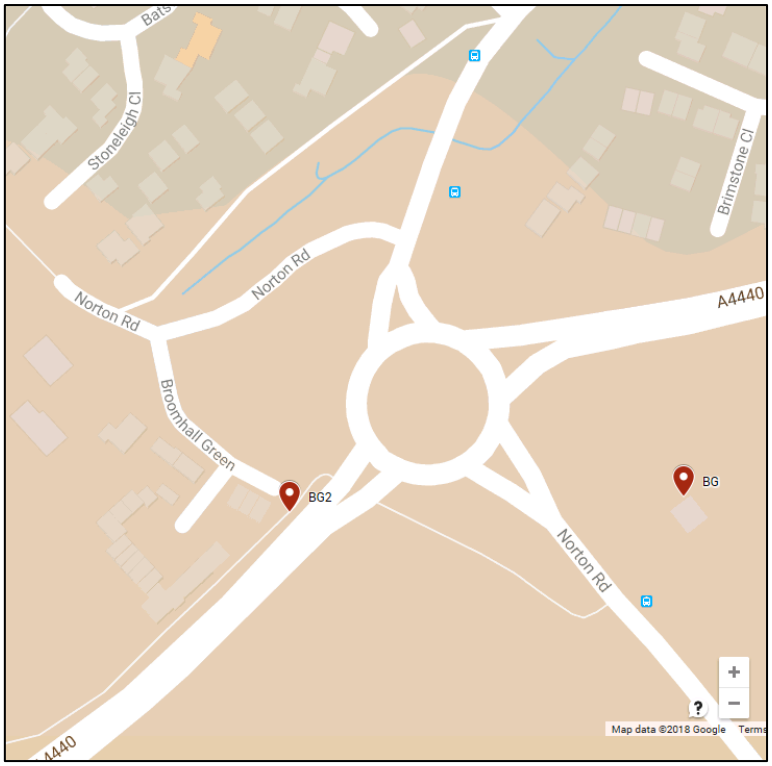


Figure D.9 - Broomhall monitoring locations



Appendix E: Summary of Air Quality Objectives in England

Table E.1 - Air Quality Objectives in England

Pollutant	Air Quality Objective[6]	
	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

[6] The units are in micrograms 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
AQO	Air Quality Objective
ASR	Air quality Annual Status Report
AURN	Automatic Urban and Rural Network
CAZ	Clean Air Zone
CBTF	Clean Bus Technology Fund
CEEPG	Central England Environmental Protection Managers Group
DA	Detailed Assessment
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DoPH	Director of Public Health, Worcestershire County Council
EU	European Union
EV	Electric Vehicle
HGV	Heavy Goods Vehicle
IPPC	Integrated Pollution Prevention and Control
LAPPC	Local Authority Pollution prevention and Control
LAQAG	Local Authority Air Quality Advisory Group to Defra
LAQM	Local Air Quality Management
LES	Lowering Emission Strategy

LTP4	Worcestershire County Council's fourth edition of the Local Transport Plan for the county
$\mu g/m^3$	Micrograms per metre cubed
MJAC	Midland Joint Advisory Council
MTE	Moving Traffic Enforcement
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
NPIF	National Productivity Investment Fund
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
PTP	Personalised Travel Plan(ning)
QA/QC	Quality Assurance and Quality Control
TRO	Traffic Regulation Order
UTC	Urban Traffic Control
VMS	Variable Messaging System
WFH	Working from home
WRS	Worcestershire Regulatory Services
WSLR	A4440 Worcester Southern Link Road

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