2018 Air Quality Annual Status Report (ASR)

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

December 2018

Worcester City Council

Local Authority Officer	Christopher Poole
Department	Land and Air Quality Team
Address	Worcestershire Regulatory Services Wyre Forest House Finepoint Way Kidderminster Worcestershire DY11 7WF
Telephone	01905 822799
E-mail	enquiries@worcsregservices.gov.uk
Report Reference number	WCC/ASR2018 v1
Date	December 2018

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.

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There have been no measured exceedances of NO_2 in the Newtown Road AQMA since 2007, and the AQMA was revoked by the council on 30th July 2014.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

A Detailed Assessment of an area within London Road and Sidbury, Worcester 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.

Long term trend measurements and automatic analyser results up to 2017 within Foregate Street, The Butts and The Tything, Worcester indicate that requirement for a new AQMA declaration of this combined study area would likely be confirmed by Detailed Assessment. Worcester City Council has chosen to move directly onto options for declaration of AQMA in this study area in line with Defra 2016 Policy Guidance LAQM.PG(16).

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 decided in favour of declaration of the whole district as an AQMA.

A public consultation period on the proposal for a district wide AQMA was undertaken between February and April 2018.

The draft legal declaration order for a district wide AQMA and order for revocation of the existing AQMAs were approved by Worcester City Council Environmental and Licensing committee on 10th December 2018. The orders will be formalised and provided to Defra in due course.

Monitoring results within Worcester City Council area demonstrate a significant decrease in concentrations at all monitoring locations in 2017, consistent with trends across Worcestershire. This is attributed to the low bias adjustment factor of 0.77 applied to raw NOx tube data as required.

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 published the fourth Local Transport Plan 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 seven 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 (DoPH) department within the County Council in the last 18 months including assisting with air quality aspects of the 'Health and Well Being Plan for Worcester City' (see link below) and the Worcester City Task and Finish Group.

https://www.worcester.gov.uk/documents/10499/8372623/WCC+Health+and+Wellbeing+Plan.pdf/edb68e3c-731b-c1f3-d22b-5a7868204e0d

Actions to Improve Air Quality

Key measures progressed since ASR 2017 (May 2018) are:

1. City Centre Masterplan

Worcester City Council has commissioned the development of a Masterplan for its City Centre, to drive regeneration, economic diversification and growth. Following stakeholder engagement in autumn 2017, a draft Masterplan has been produced by consultants Node on behalf of the council. A public consultation on the draft Masterplan was undertaken from 15th October to 12th November 2018. Details of the draft plan can be found via the following link:
https://www.worcester.gov.uk/masterplan.

Addressing congestion and movement issues within the city, which impact on local air quality, are at the core of the Masterplan ambitions. The geographical area of the Masterplan boundary encompasses the Dolday AQMA, Lowesmoor and The Butts, Foregate Street and The Tything area. Rainbow Hill, London Road and St Johns areas are outside the boundary of the Masterplan.

In general, potential beneficial actions on local air quality within the Masterplan are considered to be:

- development opportunities that include the replacement of numerous surface level car parks with multi storey car parking at strategic points; and

- development opportunities and public realm enhancements supporting more active movements around the city e.g. walking and cycling.

As St Johns area, Rainbow Hill and London Road are not within the Masterplan boundary additional measures will be required. However, the absence of public transport improvements, technical innovations to support alternatively fuelled vehicle evolution, and potential impacts of some proposed developments within the draft

Masterplan highlight the requirement for an ambitious complimentary Lowering Emissions Strategy for Worcester City Council to be able to bring about the required betterment in air quality.

2. Worcester City Council Task & 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. The group comprised council members from three political parties, council officers, representatives of the Director of Public Health and Worcestershire County Council Highways. WRS Technical Services officers provided technical advice and expertise on air pollution and potential measures to the group.

The group met four times between January and July 2018 and discussed options for improving air quality in the following subjects:

- Lowering Emission Strategy

- Improving Emissions from Taxis

- Electric Vehicles and Charging Infrastructure

- Clean Air Zones (Charging and Non Charging)

- A Strategy for Freight in the City

- A Bus Quality Partnership - Prioritising uptake of low emission vehicles

- Future car parking strategy - Promotion of public transport and centre fringe car parks

A summary report of Task and Finish Group work which will include recommendations for future air quality improving actions within the city is currently being prepared by WRS on behalf of Worcester City Council. The final report is due to be presented to Worcester City Council Environment and Licensing Committee in February 2019. It is anticipated the recommendations of the report will form much of

the content of a new Air Quality Action Plan for Worcester City following formal declaration of the city wide boundary AQMA.

Worcestershire County Council Highways Improvements

- **LTP4 Worcester schemes from National Productivity Investment Fund (NPIF)** – A detailed design for the St Johns Scheme has now been completed, and a project manager has been appointed to pursue delivery of this scheme in 2019. St Clements, Croft Road and Dolday signal upgrades have now been designed and procured. A project manager has been appointed for these, and delivery is currently being programmed to commence in early 2019. London Road improvements at the Wylds Lane/Sebright Junction and Waitrose Junction have now been completed, which have involved equipment upgrades and full revalidation of both junctions to optimise efficiency. A detailed design has now been identified for the Sidbury/Commandery Junction. A project manager is yet to be appointed to commission delivery of this major intervention, but delivery will be completed by the end of 2019/20, as required by the terms of the funding agreement.

- **Local Transport Plan Scheme W1 (Worcester Rainbow Hill/Astwood Road/Bilford Road/Blackpole Road Key Corridor of Improvement)** – Worcestershire County Council is currently looking to bring forward this scheme in early 2019. This will initially involve a full study of this congested corridor, which includes Lowesmoor and Rainbow Hill. It is expected that this study will identify a number of schemes to improve traffic flow, which should act to mitigate unreliable journey times and poor air quality along this corridor. This study will be commissioned in early 2019, and is expected to report in the Spring. Delivery of resultant schemes will be pursued upon study completion, later in 2019.

- **Electric Vehicle Infrastructure Strategy** – Worcestershire County Council are currently considering introduction of an EV strategy for Worcestershire. This will consider all ULEVs including electric, hydrogen, and Compressed

Natural Gas (CNG). It is anticipated that WCC will consult with stakeholders such as WRS and the district councils on requirements and potential policy in 2019.

Conclusions and Priorities

Worcester City Council undertook non- automatic (passive) monitoring of NO_2 at 38 sites during 2017. Three monitoring locations within The Butts/Foregate Street/Tything study area recorded exceedances of the long term objective for NO_2 in 2017, with two further locations, in the same study area and the Dolday AQMA, recording less than 1µg/m^3 below the objective.

Monitoring results demonstrate decreases in NO_2 at all locations across the district between 2016 and 2017, consistent with trends across Worcestershire. This is attributed to the low bias adjustment factor of 0.77 applied to raw NOx tube data as required.

WRS are aware that Defra published national bias adjustment factors for 2017 are significantly lower than in previous years. Consequently this significantly reduces adjusted measurements of local nitrogen dioxide tubes well below local trends. No satisfactory explanation has been provided to WRS as to why this is the case and it does not provide confidence in the adjusted 2017 results. Therefore, in WRS opinion, the adjusted 2017 data should not be relied upon as indicative of local trends.

Worcester City Council's priorities for 2019 are:

- Declare council boundary wide AQMA and revoke existing AQMA's.

- Finalise City Centre Masterplan and Transport Strategy.

- Determine priority measures for improving poor air quality in the district for inclusion within Task and Finish Group summary report and adoption of the final report recommendations.

- Work will begin on producing a new Air Quality Action Plan (AQAP) for Worcester City following declaration of a district wide AQMA and completion of the Task and Finish Group work and recommendations.

WRS on behalf of Worcester City Council continue to monitor existing locations in 2018-19 to assess any improvements or degradation in NO_2 concentrations. Further update on monitoring, improving actions and strategic plans progress will be provided in 2019 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 (LES).

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

Following direct contact WRS were invited by Defra LAQM Team to join their Local Authority Air Quality Advisory Group (LAQAG), 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.

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.

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/.

---

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

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

- 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. WRS tweet when pollution is forecast 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 with reducing their impact on local air quality can currently be found at http://www.worcsregservices.gov.uk/pollution/air-quality/public-advice.aspx .

Table of Contents

List of Tables

1   Local Air Quality Management

This report provides an overview of air quality in Worcester City Council during 2017. 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.

A Detailed Assessment of an area within London Road and Sidbury, Worcester 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.

Long term trend measurements and automatic analyser results up to 2017 within Foregate Street, The Butts and The Tything, Worcester indicate that requirement for a new AQMA declaration of this combined study area would likely be confirmed by Detailed Assessment. Following the fast track AQMA declaration option set out in Defra 2016 Policy Guidance LAQM.PG(16) Worcester City Council considered it appropriate to move directly onto options for declaration of AQMA in this study area.

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 decided in favour of declaration of the whole district as an AQMA.

A public consultation period on the proposal for a council boundary wide AQMA was undertaken between February and April 2018. Two responses were received within the consultation period: from Worcestershire County Council Highways department and Highways England.

The draft legal declaration order for a district wide AQMA and order for revocation of the existing AQMAs were approved by Worcester City Council Environmental and Licensing committee on 10th December 2018. The orders will be formalised and provided to Defra in due course.

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		
						At Declaration	Now	Name	Date of Publication	Link
Bridge Street / Dolday AQMA	20/03/2009	NO_2 Annual Mean	Worcester City	City Centre one way system	NO	39.3 $\mu g/m^3$	39.2 $\mu g/m^3$	Air Quality Action Plan for Worcestershire	Sep-13	http://www.worcsregservices.gov.uk/pollution/air-quality/air-quality-action-plan.aspx
Lowesmoor/ Rainbow Hill AQMA	20/03/2009	NO_2 Annual Mean	Worcester City	A key bus and commuter corridor into City	NO	44.3 $\mu g/m^3$	33.4 $\mu g/m^3$	Air Quality Action Plan for Worcestershire	Sep-13	http://www.worcsregservices.gov.uk/pollution/air-quality/air-quality-action-plan.aspx
St Johns AQMA	26/09/2014	NO_2 Annual Mean	Worcester City	Key corridor on west side of city and River Severn	NO	43 $\mu g/m^3$	36 $\mu g/m^3$	AQAP Progress Report April 2015-16	Sep-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.

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. All three current AQMA's are demonstrating exceedances of the nitrogen dioxide annual mean objective, with eight further locations of exceedance outside of AQMAs: two locations on The Tything, two on Foregate Street, two on The Butts, and two on London Road/Sidbury Area.

3. A Detailed Assessment carried out for London Road, Worcester, and measured concentrations and trends within The Foregate, The Butts and The Tything (southern part), indicate that these areas should be declared as AQMAs.

4. The Detailed Assessment for London Road/Sidbury area has been submitted together with the 2017 ASR to Defra. If the Local Authority would like an appraisal of the Detailed Assessment, they should submit this separately to Defra via the RSW.

5. On the 8th January 2018 the Council's Environment & Licensing committee took the decision to declare the whole district as an AQMA. This decision is currently undergoing public consultation.

6. We acknowledge it is appropriate further action be taken in declaring either additional or one district-wide AQMA, given the results of the Detailed Assessment, and the increasing NO_2 concentrations within the borough.

7. We would also suggest that it may be suitable for the Local Authority extend their current monitoring programme. It would be useful to introduce new monitoring sites where exceedances may be occurring with relevant exposure, to help further determine and monitor the extent of exceedances across the city.

8. The Council may wish to consider the fast track procedure for declaring further AQMA's, or one district-wide AQMA as required, on completion of the public consultation. The details of the procedure can be found in the latest Technical Guidance LAQM TG(16).

9. If a new AQMA is declared, the Council will need to provide details of this to Defra, and prepare an AQAP within 12 months of declaration. Once a draft has been prepared, the AQAP should be submitted to Defra for initial appraisal, and once the AQAP is finalised, it should be submitted again to Defra for approval.

10. The AQAP measures should be developed 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.

11. We acknowledge that the Worcestershire approach providing a centralised AQAP, and there is clear evidence of progress in developing the current action plan and implementing measures.

12. A Local Bias Adjustment figure of 0.89 has been applied to the data, based off a local co-location study at Worcester Road, Wychbold (Wychavon District Council). This co-location study has been calculated using only five months of monitoring at Worcester Road.

13. The Technical Guidance TG(16) states that national bias adjustment factors are more suitable than local factors "where the co-location study is for less than nine months, although the diffusion tube monitoring is for a longer period" – i.e., a co-location factor based on less than 9 months of monitoring should not be applied to diffusion tube data that has been collected over a year (in this case, 2016).

14. It would have been more appropriate therefore, for the Local Authority to use the National Bias Adjustment Factor of 0.88.

15. We acknowledge that these two factors are so close together, that no significant change would be made to the data should the report be resubmitted using the national factor. However, in future reports the Local Authority should consider carefully which factor is most appropriate to use, following the guidance provided in Box 7.11 of TG(16).

16. It is unclear whether annualisation has been applied to site LR2 which has a data capture rate of 50% for the year. Annualisation should be undertaken for all sites with a data capture rate of less than 75%. Details of annualisation for all sites should be included in Appendix C.

17. In section 2.3, the Local Authority provides details of measures they are undertaking to reduce $PM_{2.5}$ concentrations. It would be useful if the Local Authority could also provide details in this section of how they are working with Public Health England to address $PM_{2.5}$, with reference to the Public Health Outcomes Framework.

WRS on behalf of Worcester City Council acknowledge the above comments. In respect of widening current monitoring network (Point 7) one new site has been identified where suspected exceedances may be occurring with relevant exposure and a new monitoring location will be located in George Street, Worcester for 2019.

WRS can confirm Worcester City Council are adopting the fast track procedure for declaration of a district-wide AQMA (Point 8) rather than awaiting outcome of Detailed Assessment of the Tything/Butts/Foregate area.

With reference to Point 16, the Annualisation calculation for monitoring position LR2 is detailed in Table C.1, section C4, on page 56 of the submitted ASR 2017.

In respect of point 17, WRS assume the comments are referring to the local Director of Public Health (DoPH), rather than Public Health England (PHE). As Worcestershire is a two tier authority the Public Health Outcomes Framework is not a District Council function hence $PM_{2.5}$ is not a current priority for Worcester City Council. This situation is unlikely to change unless the authority is mandated to undertake monitoring paired with prioritised funding to deliver the government's ambitions on $PM_{2.5}$.

Nevertheless there has been a significant improvement in engagement from Worcestershire DoPH team on air quality matters in the last 18 months through the Worcester City Health and Well Being Plan and the Task and Finish group work. WRS and DoPH have recently discussed potential formation of a county wide air quality alliance in 2019. Due to the embryonic state of the alliance WRS are unable to outline the aims and objectives at this point in time and if this will specifically target $PM_{2.5}$. Further information will be provided in future ASRs when more detail is known.

Worcester City Council has taken forward a number of direct measures during the current reporting year of 2018 in pursuit of improving local air quality. Details of all measures completed to date, 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 measures progressed since ASR 2017 (May 2018) are:

1. City Centre Masterplan

Worcester City Council has commissioned the development of a Masterplan for its City Centre, to drive regeneration, economic diversification and growth. Following stakeholder engagement in autumn 2017, a draft Masterplan has been produced by consultants Node on behalf of the council. A public consultation on the draft Masterplan was undertaken from 15th October to 12th November 2018. Details of the draft plan can be found via the following link:
https://www.worcester.gov.uk/masterplan.

Addressing congestion and movement issues within the city, which impact on local air quality, are at the core of the Masterplan ambitions. The geographical area of the Masterplan boundary encompasses the Dolday AQMA, Lowesmoor and The Butts, Foregate and The Tything area. Rainbow Hill, London Road and St Johns areas are outside the boundary of the Masterplan.

In general, potential beneficial actions on local air quality within the Masterplan are considered to be:

- development opportunities that include the replacement of numerous surface level car parks with multi storey car parking at strategic points; and
- development opportunities and public realm enhancements supporting more active movements around the city e.g. walking and cycling.

As St Johns area, Rainbow Hill and London Road are not within the Masterplan boundary additional measures will be required. However, public transport improvements, technical innovations to support alternatively fuelled vehicle evolution, and potential impacts of some proposed developments within the draft Masterplan highlight the requirement for an ambitious complimentary Lowering Emissions Strategy for Worcester City Council to be able to bring about the required betterment in air quality.

2. Worcester City Council Task & 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. The group comprised council members from three political parties, council officers, representatives of the DoPH and Worcestershire County Council Highways.

WRS Technical Services officers facilitated the group, and provided technical advice and expertise on air pollution and potential measures to the group. This included significant review of latest literature and developments in each subject area, and presentation of available data and potential impacts of various measures in the context of local areas.

The group met four times between January and July 2018 and discussed options for improving air quality in the following subjects:

- Lowering Emission Strategy

- Improving Emissions from Taxis

- Electric Vehicles and Charging Infrastructure

- Clean Air Zones (Charging and Non Charging)

- A Strategy for Freight in the City

- A Bus Quality Partnership - Prioritising uptake of low emission vehicles

- Future car parking strategy - Promotion of public transport and centre fringe car parks

A summary report of Task and Finish Group work which will include recommendations for future air quality improving actions within the city is currently being prepared by WRS on behalf of Worcester City Council. The final report is due to be presented to Worcester City Council Environment and Licensing Committee in February 2019. It is anticipated the recommendations of the report will form much of the content of a new AQAP for Worcester City following formal declaration of the city wide boundary AQMA.

Worcester City Council's priorities for the next 12 months are:

- Declare council boundary wide AQMA and revoke existing AQMA's.

- Finalise City Centre Masterplan and Transport Strategy.

- Determine priority measures for improving poor air quality in the city for inclusion within Task and Finish Group summary report and adoption of the final report recommendations.

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

The principal challenges and barriers to implementation that Worcester City anticipates facing are resourcing and funding sources for potential significant improving 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.

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 outcomes of the Task & Finish Group work will be required in subsequent years to achieve compliance and enable the revocation of the proposed district wide AQMA.

2.2.1 Worcestershire County Council Highways Improvements

- **LTP4 Worcester NPIF schemes (Measure 5.1.1)** – A detailed design for the St Johns Scheme has now been completed, and a project manager has been appointed to pursue delivery of this scheme in 2019. St Clements, Croft Road and Dolday signal upgrades have now been designed and procured. A project manager has been appointed for these, and delivery is currently being programmed to commence in early 2019. London Road improvements at the Wylds Lane/Sebright Junction and Waitrose Junction have now been completed, which have involved equipment upgrades and full revalidation of both junctions to optimise efficiency. A detailed design has now been identified for the Sidbury/Commandery Junction. A project manager is yet to be appointed to commission delivery of this major intervention, but delivery will be completed by the end of 2019/20, as required by the terms of the funding agreement.

- **LTP4 Scheme W1 (Worcester Rainbow Hill/Astwood Road/Bilford Road/Blackpole Road Key Corridor of Improvement) (Measure 5.3.6)** – Worcestershire County Council is currently looking to bring forward this scheme in early 2019. This will initially involve a full study of this congested corridor, which includes Lowesmoor and Rainbow Hill. It is expected that this study will identify a number of schemes to improve traffic flow, which should act to mitigate unreliable journey times and poor air quality along this corridor. This study will be commissioned in early 2019, and is expected to report in the Spring. Delivery of resultant schemes will be pursued upon study completion, later in 2019.

- **Electric Vehicle Infrastructure Strategy** – Worcestershire County Council are currently considering introduction of an EV strategy for Worcestershire. This will consider all ULEVs including electric, hydrogen, and Compressed Natural Gas (CNG). It is anticipated that WCC will consult with stakeholders such as WRS and the district councils on requirements and potential policy in 2019.

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 Management	UTC, Congestion management, traffic reduction	Worcestershire County Council, Worcester City Council, WRS	2015 - 18	Unknown	Masterplan - potentially reduced vehicle movements in some key areas through car parking provision strategy. Uptake of LEV/ULEV through implementation of LES	0 -50%	Consultation on Draft Masterplan for Worcester City ended 12/11/18. Worcester City Task & Finish Group technical meetings Jan - July 2018 to determine AQ improving measures required, potentially enshrined in LES. Report of T&F group recommendations being completed by end of 2018 for consideration by Environmental and Licensing Committee in early 2019.	Not determined	At early stages. Long time to implementation
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 SPD currently with City Council planning authority for consideration. Additional strategies to increase Ev charging under consideration by City Council Task & Finish Group review	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 Govt AQAP
5.2.1	Bus Quality Partnership	Promoting Low Emission Transport	Public Vehicle Procurement - Prioritising uptake of low emission	Worcester City Council / Worcestershire County Council, First & other	2016-19	2018 onwards	Replacement of lower Euro standard buses on key city centre	up to 36%	Meetings with First Bus group July 2018	Currently unknown	Worcester is non profitable area for bus companies proving barrier to LEV investment locally.

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
			vehicles	Local Bus Companies. Finding CBTF			routes.				Requires LA subsidisation and/or enforcement.
5.2.2	Freight Quality Partnership – work with satellite navigation companies to route HGVs around AQMAs	Traffic Management	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
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 Management	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. Could occur as part of Masterplan implementation of revised strategic road network	

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
5.3.4	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 Management	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 early spring 2019. VMS around City completed 2016	2021	Lengthy timeline to implement
5.1.4	Variable Message Systems	Traffic Management	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 Clements, Croft Road, Dolday, Sidbury, Commandery Road and London Road	Traffic Management	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	
5.1.5 /LRH5	Loading and unloading restrictions during peak traffic times (Lowesmo	Traffic Management	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

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
	or/ Rainbow Hill)										
5.1.1/DD 3	Alteration to phasing of traffic light systems/Junction review (Dolday)	Traffic Management	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 Development	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 Developments	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 hampering adoption of single SPD by LAs
5.2.5	Greening Council Fleets	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	Worcester City Council, Worcestershire County Council	2018-19	2019 Onwards	Increase in number of Council fleet and contractors vehicles of higher Euro Standard and/or utilising alternative fuels	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
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. The draft Masterplan includes 17 Public Realm enhancements including corridors and spaces, plazas, parks, bridges and crossings designed to make the city more walking and cycling friendly.	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	On-going	

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
									towards more sustainable and space efficient forms of transport.		
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
5.6.3	Air Quality Networks	Policy Guidance and Development Control	Regional Groups Co-ordinating programmes to develop Area wide Strategies to reduce emissions and improve air quality	Worcestershire Regulatory Services, Central England Environmental Protection Group (CEEPG), 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 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.	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), DEFRA LAQM Team	2014	2014 onwards	Improved cross boundary knowledge sharing between local authorities in West Midlands	Reduce emissions	WRS held position of Air Quality technical coordinator for MJAC 2014-17, member of CEEPG and member of Defra LAQM Team Local Authority Advisory Group both formed in 2017.	WRS was MJAC AQ Technical Coordinator 2014-17. MJAC/CEEPG Knowledge Hub group set up in 2017 delivered by joint working between WRS and Cannock Chase DC. Member of LA advisory group	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
										to Defra LAQM team following invitation 2017.	
5.1.13	Alteration to Parking Provision	Traffic Management	UTC, Congestion management, traffic reduction	Worcester City Council, Worcestershire County Council	2018 - 2019	2019 - 2029	reduced traffic movements and congestion in inner city	Reduced emissions	Draft Masterplan Proposal: consolidate existing multiple single level surface car parking into fewer multi story car parks at strategic points	2029	Congestion may increase in interim period between sale of existing car park land and implementation of replacement multi storey car parks
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 including Worcester City Task & Finish group	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 and 2018.
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	

2.3 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 2017 calendar year. The average total PM$_{2.5}$ at 31 locations (centre points of 1km x 1km grids) across Worcester City is 8.67μg/m^3, with a minimum concentration of 8.00μg/m^3 and a maximum concentration of 10.14μg/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 and the average is below World Health Organisation limits also. The whole district area of Worcester City is a Smoke Control Area.

As outlined in Policy Guidance LAQM.PG16 WRS have discussed the role of the DoPH, and the details of PM$_{2.5}$ levels across the County, with the DoPH at Worcestershire County Council. The DoPH has not confirmed to WRS that they are advocating or supporting any specific actions to reduce PM$_{2.5}$ concentrations across the County at this time.

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 2.3 - 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
5.3.6	Improving cycling and walking routes in local areas
5.4.1	Smarter Driving Tips
5.1.13	Alteration to Parking Provision

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 did not undertake any automatic (continuous) monitoring during 2017.

3.1.2 Non-Automatic Monitoring Sites

Worcester City Council undertook non- automatic (passive) monitoring of NO_2 at 38 sites during 2017.Table A.1 in Appendix A shows the details of the sites.

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

3.2 Individual Pollutants

The air quality monitoring results presented in this section are, where relevant, adjusted for bias, "annualisation" and distance correction. Further details on adjustments are provided in Appendix C.

3.2.1 Nitrogen Dioxide (NO_2)

Table A.2 in Appendix A compares the ratified and adjusted monitored NO_2 annual mean concentrations for the past 5 years with the air quality objective of 40μg/m^3.

For diffusion tubes, the full 2017 dataset of monthly mean values is provided in Appendix B.

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

Table B.1 shows the bias adjusted results and results calculated for distance back to nearest sensitive receptor where monitoring positions are not representative of locations appropriate to national objectives.

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 2017 following adjustments for annualisation and/or distance to relevant exposure where necessary and indicates if within an existing AQMA as of 2017 or not.

Table 3.1 - Summary of measured exceedances of AQO and borderline results in 2017

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	**40.3**
But2	N	The Butts/The Tything/The Foregate Study area	**42.8**
BrS2	Y	Dolday/Bridge Street AQMA	39.2
Tyn2	N	The Butts/The Tything/The Foregate Study area	39.7
Tyn	N	The Butts/The Tything/The Foregate Study area	**40.3**

(1)   Annualised and calculated back to relevant receptor where appropriate. Exceedances shown in bold

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 decreases in NO_2 at all locations across the district between 2016 and 2017, consistent with trends across Worcestershire. This is attributed to the low bias adjustment factor of 0.77 applied to raw NOx tube data as required.

Following discussion with other Local Authorities and the National Physics Laboratory, WRS are aware that Defra published national bias adjustment factors for 2017 are significantly lower than in previous years. Consequently this significantly reduces adjusted measurements of local nitrogen dioxide tubes well below local trends. No satisfactory explanation has been provided to WRS as to why this is the case and it does not provide confidence in the adjusted 2017 results. Therefore, in WRS opinion, the 2017 data should not be relied upon as indicative of local trends.

3.2.1.2 Dolday/Bridge Street AQMA

No exceedances have been recorded within the AQMA in 2017 following calculations to relevant exposure where appropriate. NO_2 concentrations at relevant exposure when calculated back from monitoring Loc. BrS2 remain just below the AQO at 39.2µg/m^3.

Concentrations within the AQMA demonstrate a similar picture to the overall trend across the district, a significant reduction from 2016 measured data due to the low bias adjustment factor for 2017 as outlined above.There have been no changes to monitoring strategy within the AQMA in 2017.

The Dolday/Bridge Street AQMA will be revoked and replaced with a council boundary wide AQMA following Worcester City Councils decision in 2018.

3.2.1.3 Lowesmoor/Rainbow Hill AQMA

No exceedances have been recorded within the AQMA in 2017 following calculations to relevant exposure where appropriate. NO_2 concentrations at relevant exposure when calculated back from monitoring Loc.Ast3 remain just below the AQO at 39.14μg/m^3.

Concentrations within the AQMA demonstrate a similar picture to the overall trend across the district, a significant reduction from 2016 measured data due to the low bias adjustment factor for 2017 as outlined above. There has been one change to the monitoring network within the AQMA at the beginning of 2017: location Ast1 was replaced with Ast1b due to overgrown foliage obstructing the former monitoring position.

The Lowesmoor/Rainbow Hill AQMA will be revoked and replaced with a council boundary wide AQMA following Worcester City Councils decision in 2018.

3.2.1.4 St Johns AQMA

No exceedances have been recorded within the AQMA in 2017 following bias adjustment.

Concentrations within the AQMA demonstrate a similar picture to the overall trend across the district, a significant reduction from 2016 measured data due to the low bias adjustment factor for 2017 as outlined above. There have been no changes to monitoring strategy within the AQMA in 2017.

The St Johns AQMA will be revoked and replaced with a council boundary wide AQMA following Worcester City Councils decision in 2018.

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

Of the current eleven locations within the study area, three demonstrated exceedances of the AQO in 2017 and one other location, Tyn2, measured concentrations just below the AQO, when proximity to nearest receptors is taken into consideration. However, it should be noted 2 of these recorded measurements are at ground floor level with nearest receptors at first floor level.

Concentrations within the study area demonstrate a similar picture to the overall trend across the district, a significant reduction from 2016 measured data due to the low bias adjustment factor for 2017 as outlined above. There have been no changes to monitoring strategy within the AQMA in 2017.

The proposed council boundary wide AQMA will encompass this area.

3.2.1.6 London Road/Sidbury Study Area

No exceedances have been recorded within the London Road/Sidbury area in 2017 following bias adjustment.

Concentrations within the study area demonstrate a similar picture to the overall trend across the district, a significant reduction from 2016 measured data due to the low bias adjustment factor for 2017 as outlined above. There have been no changes to monitoring strategy within the London Road/Sidbury area in 2017.

The proposed council boundary wide AQMA will encompass this area.

3.2.1.7 Monitoring outside's AQMA and Areas of Concern

No exceedances have been recorded at monitoring locations outside of current AQMA's and areas of concern in 2017 following bias adjustment.

Concentrations at these locations demonstrate a similar picture to the overall trend across the district, a significant reduction from 2016 measured data due to the low bias adjustment factor for 2017 as outlined above. There has been one change to the monitoring network outside of current AQMA's and study areas at the beginning of 2017: location NwR was replaced with Oak which provides additional benefit of being located at a sensitive receptor.

Appendix A: Monitoring Results

Table A.1 – 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 (opp Bus Station)	Roadside	384652	254986	NO_2	Yes	N	2.18	No	2.17
DDASH	All Saints House	Roadside	384682	254924	NO_2	Yes	2	2.33	No	2.13
BrS	Bridge Street, John Gwen House	Kerbside	384666	254818	NO_2	Yes	2	0.66	No	2.21
BRS2	Bridge Street	Roadside	384695	254840	NO_2	Yes	1	1.96	No	2.06
Tyn3	No. 26 Upper Tything	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, Upper 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
Fos3	Café Mela, 22 Foregate Street	Roadside	384899	255329	NO_2	No	FF 1.03	2.21	No	2.47
Fos	Foregate Street junction with Shaw	Kerbside	384941	255140	NO_2	No	FF 1.19	1	No	2.47

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)
	Street									
Crs1	29 The Cross	Roadside	384967	255012	NO_2	No	FF 1.33	3.35	No	2.17
Swth1	St. Swithin's Street	Roadside	385013	254987	NO_2	No	FF 1.33	2.06	No	2.17
Lwm2	Lowesmoor 2 (City Walls Road end)	Roadside	385164	255134	NO_2	Yes	FF 1	1.86	No	2.5
Lwm1	Lowesmoor 1 Rainbow Hill End	Roadside	385268	255191	NO_2	Yes	FF 1	1.43	No	2.56
Stj1	1A St. Johns	Roadside	384137	254510	NO_2	Yes	FF 1.48	2.7	No	2.02
Brm	10 Bromyard Road	Urban Background	383967	254481	NO_2	No	0	8.8	No	1.9
KCP	King Charles Place	Roadside	384016	254399	NO_2	Yes	FF 1.41	2.2	No	2.09
Stj2	The Fortune House, 65 St. Johns	Roadside	384013	254356	NO_2	Yes	FF 1.53	2.22	No	1.97
Stj3	The Bell, 35 St. Johns	Roadside	384046	254424	NO_2	Yes	FF 1.53	2.05	No	1.97
McI	McIntyre Road	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	Roadside	385990	256365	NO_2	Yes	4	1.4	No	3.66
AST1b	LP5129 170/172 Astwood Road	Roadside	386022	256401	NO_2	Yes	5.5	3.5	No	2.05
Ast3	Astwood Road 3 Rainbow Hill	Roadside	385764	255968	NO_2	Yes	6.62	1.68	No	2.26
OAK	22 Oaklands		387810	254993	NO_2	No	0	7	No	1.85

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)
LRW	London Road Waitrose	Kerbside	386654	253761	NO_2	No	4	0.5	No	1.85
LR1	London Road Bargain Booze LP 6569	Roadside	385636	254158	NO_2	No	2.9	1.63	No	2.12
LR2	London Road Royal Court LP 6561	Roadside	385428	254238	NO_2	No	3	1.45	No	2.2
LR3	London Road Commandery Road Junction	Roadside	385357	254272	NO_2	No	0.5	1.77	No	2.31
LR5	London Road Bus stop SL6554 opp Bath Road	Roadside	385325	254329	NO_2	No	0.25	1.45	No	2.22
LR4	London Road SL6565 adj No 61	Roadside	385525	254219	NO_2	No	3.1	1.86	No	2.06
SIDFG	Sidbury Street o/s Fisher German Estate Agents	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	Near 17 Broomhall Green, Broomhall	Roadside	386165	252146	NO_2	No	5.3	5.1	No	2.3
RH	Nursery Rainbow Hill LP5196	Roadside	385420	255413	NO_2	Yes	7.8	1.45	No	2.43
AQ1	(Former) Air Quality Monitor, The Foregate	Roadside	384947	255117	NO_2	No	0.25	3.5	NO	1.37
AQ2	(Former) Air Quality Monitor,	Roadside	384947	255117	NO_2	No	0.25	3.5	NO	1.37

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)
	The Foregate									
AQ3	(Former) Air Quality Monitor, The Foregate	Roadside	384947	255117	NO_2	No	0.25	3.5	NO	1.37

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 if sensitive receptor at first floor

(3) N/A if not applicable.

Table A.2 – Annual Mean NO$_2$ Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2017 (%) [2]	NO$_2$ Annual Mean Concentration (µg/m^3) [3]				
					2013	2014	2015	2016	2017
But1	Roadside	Diffusion Tube	100	100	-	**48.74**	**46.59**	**52.18**	**40.32**
But2	Roadside	Diffusion Tube	92	92	-	**51.13**	**48.75**	**55.03**	**42.80**
Dd1	Roadside	Diffusion Tube	100	100	47.00	40.39	36.44	39.60	31.12
DDASH	Roadside	Diffusion Tube	92	92	53.00	41.86	43.25	45.34	37.75
BrS	Kerbside	Diffusion Tube	92	92	45.00	38.41	38.47	46.46	32.68
BRS2	Roadside	Diffusion Tube	75	75	59.00	48.92	45.26	47.97	39.18
Tyn3	Roadside	Diffusion Tube	92	92	-	38.82	32.35	37.90	30.23
Tyn2	Roadside	Diffusion Tube	100	100	-	**50.98**	**48.86**	**49.67**	40.61
Tyn	Roadside	Diffusion Tube	100	100	59.00	**47.71**	**47.31**	**47.26**	40.28
Fos2	Roadside	Diffusion Tube	100	100	-	39.05	36.24	37.58	31.26
Fos3	Roadside	Diffusion Tube	92	92	-	33.84	31.38	34.63	25.94
Fos	Kerbside	Diffusion Tube	100	100	55.00	**53.61**	**47.08**	**47.63**	40.19
Crs1	Roadside	Diffusion Tube	100	100	-	37.24	**41.72**	39.41	33.18
Swth1	Roadside	Diffusion Tube	100	100	-	28.98	28.69	30.00	23.75
Lwm2	Roadside	Diffusion	100	100	35.00	34.32	32.63	34.92	28.88

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2017 (%) [2]	NO$_2$ Annual Mean Concentration (µg/m^3) [3]				
					2013	2014	2015	2016	2017
		Tube							
Lwm1	Roadside	Diffusion Tube	92	92	**44.00**	**41.09**	38.34	**40.41**	33.39
Stj1	Roadside	Diffusion Tube	100	100	-	**46.06**	**44.55**	**44.21**	35.99
Brm	Urban Background	Diffusion Tube	83	83	-	33.13	30.85	30.76	27.40
KCP	Roadside	Diffusion Tube	92	92	**43.00**	37.45	34.17	35.67	27.60
Stj2	Roadside	Diffusion Tube	100	100	-	31.85	29.31	30.06	22.05
Stj3	Roadside	Diffusion Tube	100	100	-	**41.18**	35.42	34.48	27.93
McI	Urban Background	Diffusion Tube	92	92	17.00	14.99	13.08	14.46	11.63
AST4	Roadside	Diffusion Tube	100	100	30.00	27.47	24.78	26.36	21.26
Ast2	Roadside	Diffusion Tube	100	100	**40.00**	32.50	35.74	34.17	24.63
AST1b		Diffusion Tube	100	100	-	-	-	-	27.32
Ast3	Roadside	Diffusion Tube	92	92	**61.00**	**50.32**	**48.10**	**49.20**	39.14
OAK	Roadside	Diffusion Tube	83	83	-	**-**	-	-	16.58
LRW	Kerbside	Diffusion Tube	83	83	-	**-**	43.61	**46.78**	36.44
LR1	Roadside	Diffusion Tube	100	100	**45.00**	**41.30**	36.85	36.63	32.75
LR2	Roadside	Diffusion Tube	75	75	**48.00**	**44.14**	**42.68**	**40.53**	34.96

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2017 (%) [2]	NO$_2$ Annual Mean Concentration (µg/m^3) [3]				
					2013	2014	2015	2016	2017
LR3	Roadside	Diffusion Tube	100	100	**53.00**	**44.82**	**41.44**	**42.37**	36.09
LR5	Roadside	Diffusion Tube	92	92	-	**45.51**	**40.46**	**45.97**	35.45
LR4	Roadside	Diffusion Tube	100	100	-	39.58	38.08	39.31	31.98
SIDFG	Roadside	Diffusion Tube	100	100	50.00	42.13	39.11	**42.12**	35.73
BG	Suburban	Diffusion Tube	75	75	-	-	17.41	24.26	22.28
BG2	Roadside	Diffusion Tube	83	83	-	-	-	37.00	21.27
RH	Roadside	Diffusion Tube	100	100	-	-	-	32.87	29.45
AQ1	Roadside	Diffusion Tube	83	83	-	-	-	**47.77**	38.26
AQ2	Roadside	Diffusion Tube	83	83	-	-	-	**49.59**	37.79
AQ3	Roadside	Diffusion Tube	83	83	-	-	-	**49.49**	37.54

☒ **Diffusion tube data has been bias corrected**

☒ **Annualisation has been conducted where data capture is <75%**

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 NO₂ Concentrations
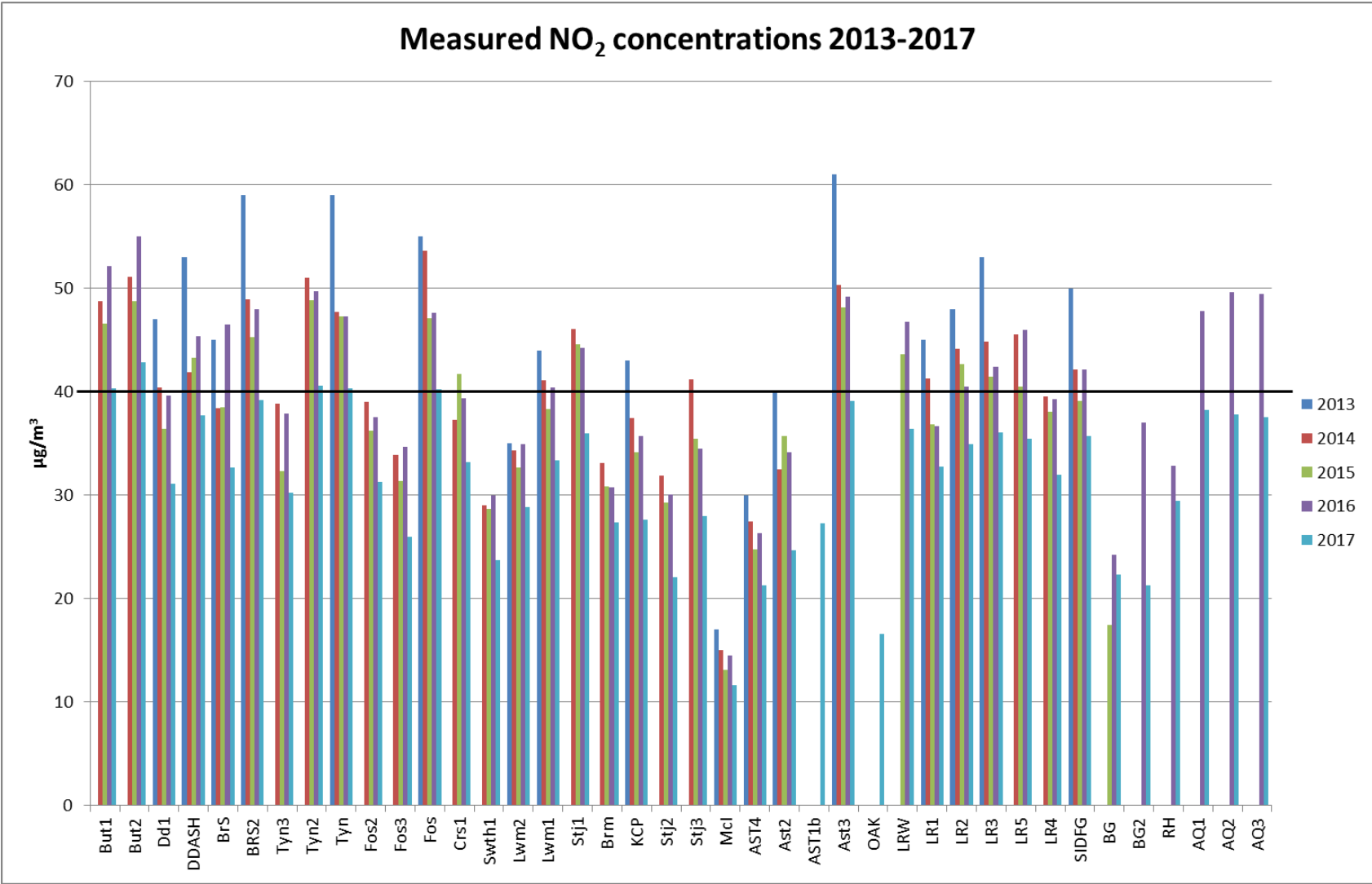
Table A.3 – 1-Hour Mean NO$_2$ Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2017 (%) [2]	NO$_2$ 1-Hour Means > 200µg/m^3 [3]				
					2013	2014	2015	2016	2017
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 99.8[th] percentile of 1-hour means is provided in brackets.

Appendix B: Full Monthly Diffusion Tube Results for 2017

Table B.1 – NO₂ Monthly Diffusion Tube Results - 2017

| Site ID | NO₂ Mean Concentrations (µg/m³) | | | | | | | | | | | | Annual Mean | | |
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Raw Data	Bias Adjusted (0.77) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
But1	65.99	55.28	55.35	60.32	47.21	42.38	43.21	42.37	49.68	50.98	61.29	54.36	52.37	**40.3**	**40.3**
But2	67.16	63.11	59.34	64.94	53.99	48.85	48.99	53.52	34.32	58.66	58.61	-	55.59	**42.8**	**42.8**
Dd1	45.94	45.43	41.69	40.47	48.65	33.33	32.53	29.13	43.20	37.49	43.25	43.90	40.42	31.1	31.1
DDASH	62.20	52.39	54.18	49.53	42.34	45.83	40.11	42.01	41.75	53.72	-	55.19	49.02	37.7	34.1
BrS	52.45	-	45.41	46.38	44.49	33.07	35.67	33.38	41.92	39.27	47.14	47.71	42.44	32.7	27.8
BrS2	60.51	53.27	53.65	48.91	59.28	39.05	-	42.37	46.00	-	-	54.88	50.88	39.2	39.2
Tyn3	56.42	47.12	37.99	35.29	44.80	-	28.22	26.43	33.25	35.29	43.35	43.65	39.26	30.2	30.2
Tyn2	68.10	58.16	51.11	49.88	49.88	38.87	42.08	46.51	49.24	54.15	59.47	65.38	52.74	**40.6**	39.7
Tyn	62.20	54.90	48.83	56.13	48.19	43.73	47.69	47.11	49.24	53.48	54.62	61.69	52.32	**40.3**	**40.3**
Fos2	55.54	47.44	38.64	36.70	36.59	31.17	30.46	30.93	37.84	42.97	44.21	54.67	40.60	31.3	31.3
Fos3	-	43.24	35.24	30.73	36.89	27.42	27.19	26.37	32.92	31.93	38.20	40.39	33.68	25.9	25.9
Fos	63.13	64.81	54.22	52.69	56.35	42.44	41.50	43.57	48.40	49.16	55.53	54.55	52.20	**40.2**	36.8
Crs1	53.33	48.44	41.39	40.41	39.97	34.25	33.42	37.10	36.94	43.84	51.71	56.33	43.09	33.2	33.2
Swth1	49.71	34.46	29.97	28.42	27.40	21.45	24.39	23.67	28.67	25.32	37.73	38.97	30.85	23.8	23.8
Lwm2	50.41	42.73	37.87	36.31	37.00	29.80	30.37	28.47	34.04	37.40	42.44	43.28	37.51	28.9	28.9
Lwm1	54.55	49.38	45.38	39.85	41.72	39.79	36.65	36.80	40.30	44.26	48.36	-	43.37	33.4	33.4

Site ID	NO$_2$ Mean Concentrations (µg/m^3)												Annual Mean		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Raw Data	Bias Adjusted (0.77) and Annualised [1]	Distance Corrected to Nearest Exposure [2]
StJ1	54.15	54.80	47.50	41.51	44.84	42.73	40.51	43.03	46.04	51.49	46.17	48.17	46.75	36.0	36.0
Brm	51.37	44.00	36.91	29.15	26.74	-	25.08	27.31	33.10	40.46	41.76	-	35.59	27.4	27.4
KCP	45.25	40.98	36.18	35.62	30.32	30.17	28.62	31.68	34.65	38.33	42.50	-	35.85	27.6	27.6
StJ2	43.14	34.45	31.17	24.25	30.04	22.05	20.64	22.13	23.26	30.17	29.73	32.65	28.64	22.1	22.1
StJ3	50.58	44.00	36.35	33.05	36.92	31.18	28.76	29.99	30.61	39.48	36.43	37.97	36.28	27.9	27.9
McI	25.09	21.39	15.23	9.31	12.61	8.41	8.44	-	11.19	16.33	17.51	20.62	15.10	11.6	11.6
Ast4	36.66	32.80	26.23	24.13	25.52	22.05	20.57	21.75	23.89	31.01	31.64	35.07	27.61	21.3	21.3
Ast2	40.47	36.64	35.85	29.15	28.39	28.26	24.12	25.58	27.26	35.08	35.85	37.17	31.98	24.6	24.6
AST1b	50.10	41.87	37.14	31.89	36.69	28.96	24.06	27.68	27.26	38.51	41.91	39.64	35.47	27.3	23.8
Ast3	69.05	58.57	52.25	52.83	46.44	48.75	43.35	44.19	30.55	57.09	56.14	-	50.84	39.1	30.9
OAK	31.21	26.81	22.71	16.66	17.41	14.12	14.75	15.68	-	-	25.85	30.13	21.53	16.6	16.6
LRW	62.21	54.37	46.73	52.31	42.81	42.92	-	42.32	43.16	33.56	52.88	-	47.33	36.4	27.0
LR1	56.30	49.93	57.38	42.44	34.58	32.22	32.79	32.78	33.41	41.58	48.26	48.65	42.53	32.7	28.7
LR2	49.28	51.37	51.76	-	41.15	41.64	38.76	37.28	-	44.05	53.33	-	45.40	35.0	30.0
LR3	59.16	47.24	52.40	45.65	40.08	38.19	38.94	38.54	46.12	49.00	54.91	52.29	46.88	36.1	34.9
LR5	67.63	47.80	46.13	48.07	44.44	-	36.88	34.70	37.83	39.17	53.63	50.13	46.04	35.4	35.4
LR4	54.61	41.35	45.90	47.79	33.04	34.68	33.78	31.35	43.49	37.94	49.84	44.70	41.54	32.0	28.1
SidFG	58.81	48.30	49.59	50.50	39.41	33.63	39.30	38.66	46.45	43.54	56.63	51.98	46.40	35.7	30.7
BG	38.96	47.38	-	-	-	17.13	14.97	19.04	22.92	23.47	35.74	40.81	28.94	22.3	22.3
BG2	42.23	39.98	31.72	-	25.11	21.23	18.27	23.44	19.38	-	29.67	25.17	27.62	21.3	19.1

Site ID	NO$_2$ Mean Concentrations (µg/m^3)												Annual Mean		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Raw Data	Bias Adjusted (0.77) and Annualised (1)	Distance Corrected to Nearest Exposure (^{2})
RH	48.01	42.05	37.93	32.65	34.58	34.12	30.78	40.22	34.99	36.39	42.44	44.88	38.25	29.5	24.1
AQ1	57.32	54.40	49.41	49.13	47.42	47.24	46.80	44.89	46.50	53.76	-	-	49.69	38.3	38.3
AQ2	61.32	50.82	45.61	50.59	46.34	48.04	44.83	43.87	43.42	55.88	-	-	49.07	37.8	37.8
AQ3	63.08	49.44	50.59	48.29	46.29	45.45	43.84	46.75	39.51	54.24	-	-	48.75	37.5	37.5

☐ **Local bias adjustment factor used**

☒ **National bias adjustment factor used**

☒ **Annualisation has been conducted where data capture is <75%**

☒ **Where applicable, data has been distance corrected for relevant exposure**

Notes:

Exceedances of the NO$_2$ annual mean objective of 40µg/m^3 are shown in **bold**.

NO$_2$ annual means exceeding 60µg/m^3, indicating a potential exceedance of the NO$_2$ 1-hour mean objective are shown in **bold and underlined.**

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

(2) Distance corrected to nearest relevant public exposure.

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

QA/QC of Diffusion Tube Monitoring

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

Somerset Scientific Services,
Unit 2A,
Westpark 26
Chelston
Wellington
Somerset
TA21 9AD

01823 355906

sssmailbox@somerset.gov.uk

The 20% Triethanolamine (TEA) / De-ionised Water preparation method is used. Under the AIR NO_2 PT (formerly WASP) Scheme Somerset Scientific Services performed 100% satisfactory for the period January to August 2017 and 75% for the period September to October 2017 (no data for the period November to December 2017). Tube precision was 'Good' throughout 2017.

Bias adjustment

The bias adjustment factor applied to the results in 2017 was 0.77 which were derived from the national studies (Spreadsheet Version No. 09/18).

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.1 to C.14 below and summarised in Table B.1.

Figure C.1 - Loc. DDASH - Distance from road to relevant exposure calculation

		Enter data into the pink 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)?**	13.76861	μg/m^3
Step 4	**What is your measured annual mean NO$_2$ concentration (in μg/m^3)?**	37.75	μg/m^3
Result	**The predicted annual mean NO$_2$ concentration (in μg/m^3) at your receptor**	34.1	μg/m^3

Figure C.2 - Loc. BrS - Distance from road to relevant exposure calculation

		Enter data into the pink 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)?**	13.76861	μg/m^3
Step 4	**What is your measured annual mean NO$_2$ concentration (in μg/m^3)?**	32.68	μg/m^3
Result	**The predicted annual mean NO$_2$ concentration (in μg/m^3) at your receptor**	27.8	μg/m^3

Figure C.3 - Loc. Tyn2 - Distance from road to relevant exposure calculation

Enter data into the pink 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 $\mu g/m^3$)?	14.15297	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	40.61	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	39.7	$\mu g/m^3$

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

Enter data into the pink 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 $\mu g/m^3$)?	14.15297	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	40.19	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	36.8	$\mu g/m^3$

Figure C.5 - Loc. Ast1b - Distance from road to relevant exposure calculation

			Enter data into the pink cells
Step 1	How far from the KERB was your measurement made (in metres)?	3.5	metres
Step 2	How far from the KERB is your receptor (in metres)?	9	metres
Step 3	What is the local annual mean background NO_2 concentration (in $\mu g/m^3$)?	13.7022	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	27.3	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	23.8	$\mu g/m^3$

Figure C.6 - Loc. Ast3 - Distance from road to relevant exposure calculation

			Enter data into the pink 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 $\mu g/m^3$)?	16.10747	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	39.14	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	30.9	$\mu g/m^3$

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

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 $\mu g/m^3$)?	12.21759	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	36.44	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	27.0	$\mu g/m^3$

Enter data into the pink cells

Figure C.8 - Loc. LR1 - Distance from road to relevant exposure calculation

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 $\mu g/m^3$)?	14.82953	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	32.75	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	28.7	$\mu g/m^3$

Enter data into the pink cells

Figure C.9 - Loc. LR2 - Distance from road to relevant exposure calculation

		Enter data into the pink 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 $\mu g/m^3$)?	14.82953	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	34.96	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	30.0	$\mu g/m^3$

Figure C.10 - Loc. LR3 - Distance from road to relevant exposure calculation

		Enter data into the pink 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 $\mu g/m^3$)?	14.82953	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	36.09	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	34.9	$\mu g/m^3$

Figure C.11 - Loc. LR4 - Distance from road to relevant exposure calculation

Enter data into the pink 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 $\mu g/m^3$)?	14.82953	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	31.98	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	28.1	$\mu g/m^3$

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

Enter data into the pink 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 $\mu g/m^3$)?	14.82953	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	35.73	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	30.7	$\mu g/m^3$

Figure C.13 - Loc. BG2 - Distance from road to relevant exposure calculation

		Enter data into the pink 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 $\mu g/m^3$)?	11.231	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	21.27	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	19.1	$\mu g/m^3$

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

		Enter data into the pink 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 $\mu g/m^3$)?	16.10747	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	29.45	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	24.1	$\mu g/m^3$

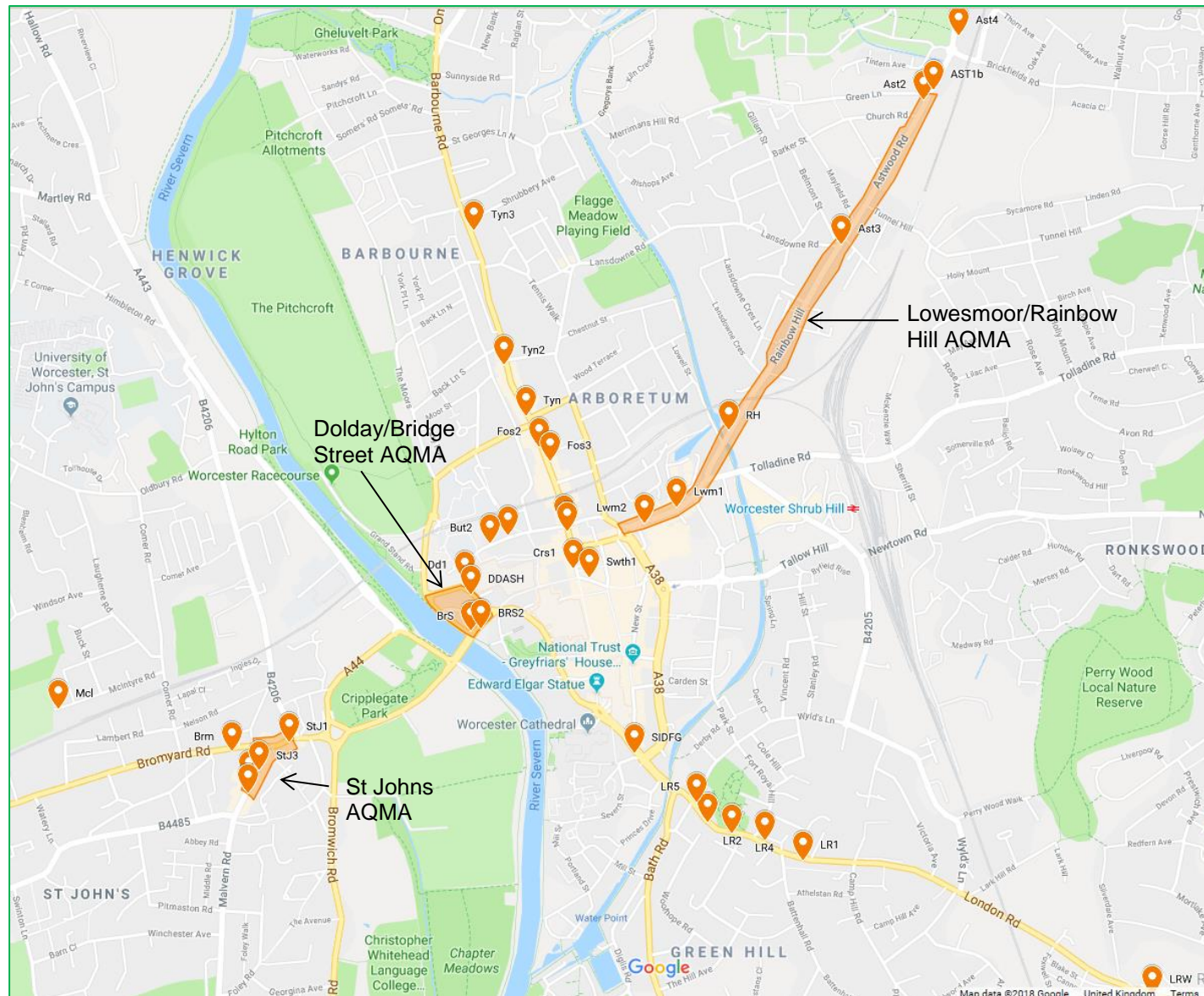# Appendix D: Map(s) of Monitoring Locations and AQMAs

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

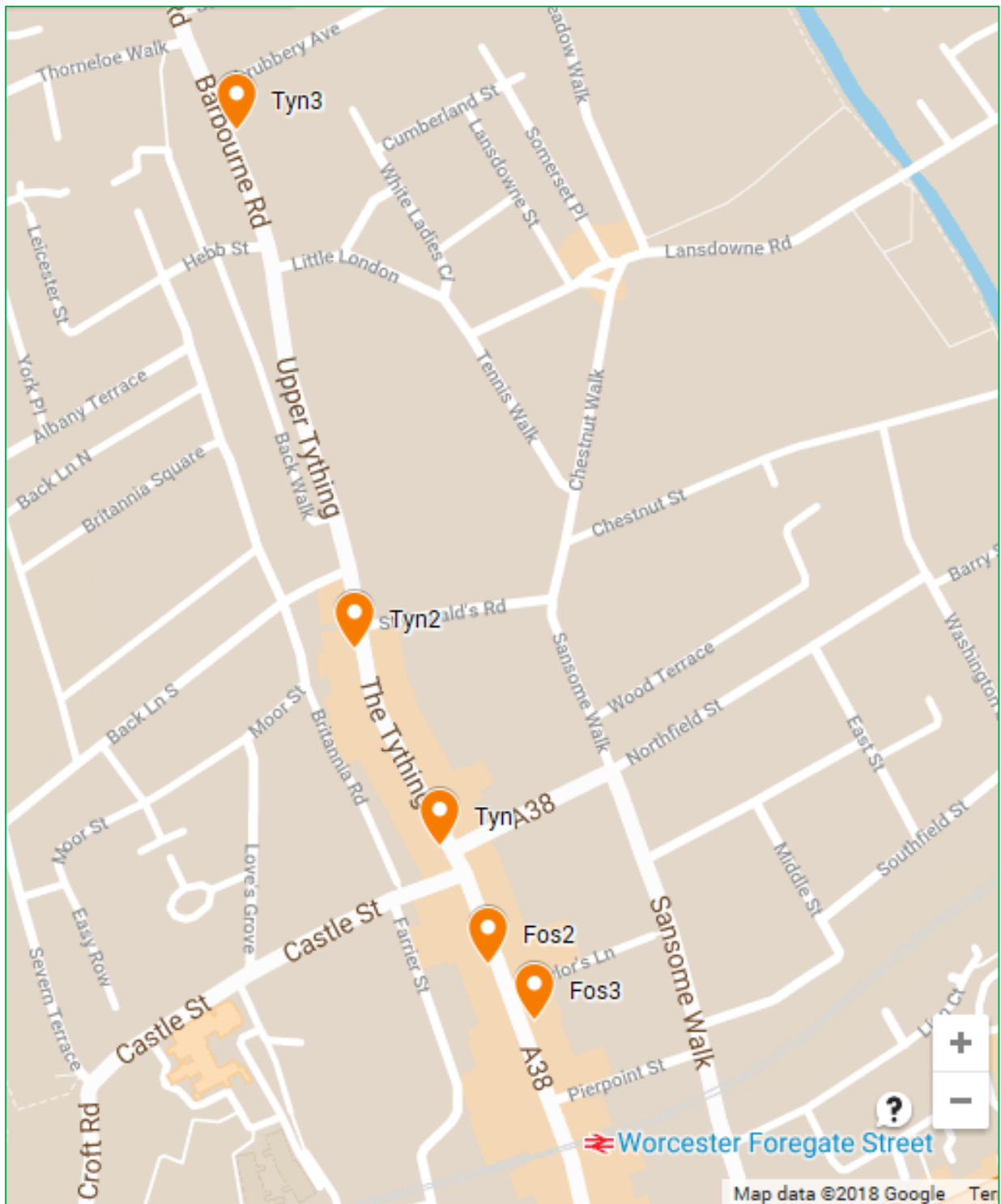**Figure D.2 - The Tything and The Foregate monitoring locations**

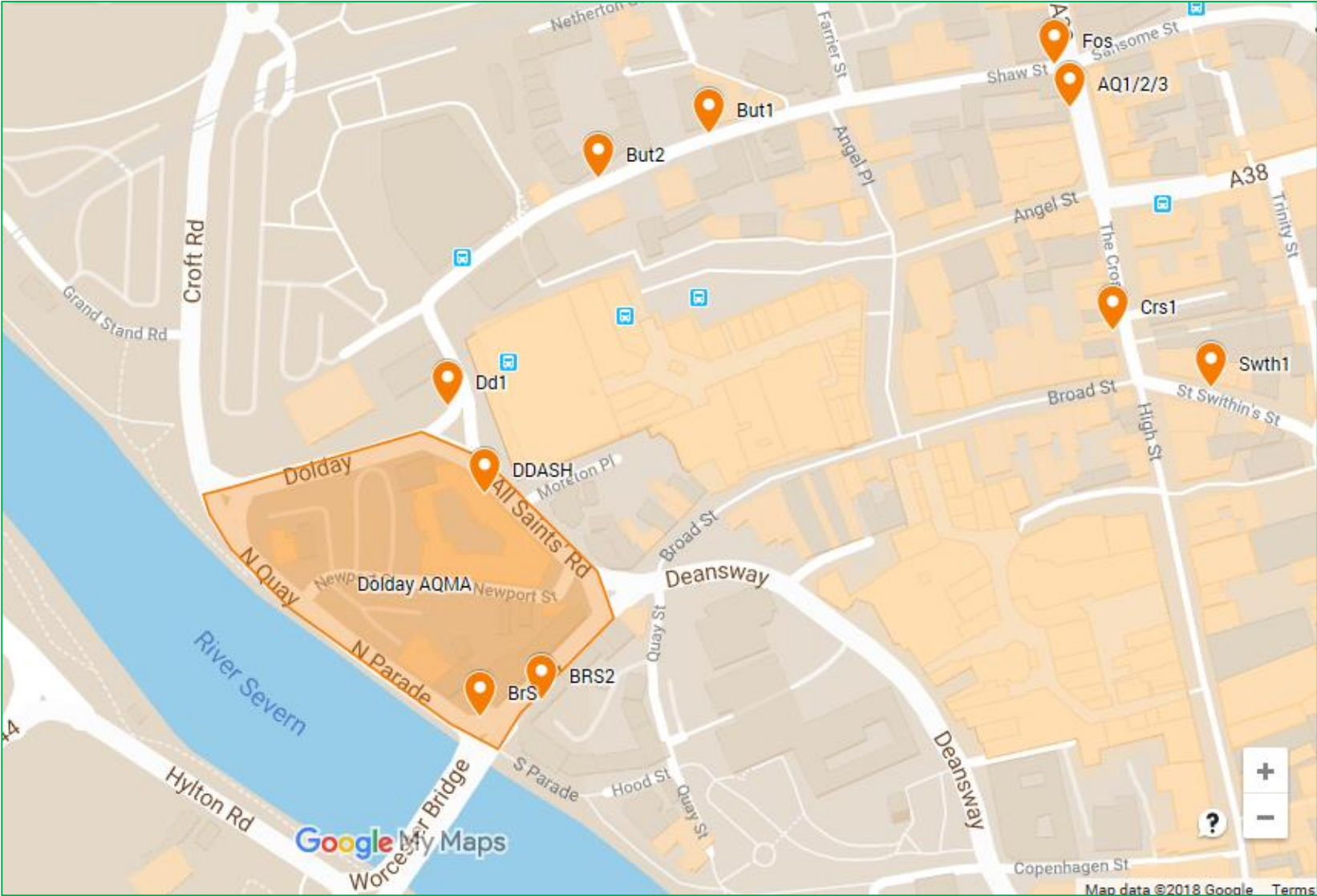**Figure D.3 - Dolday/Bridge Street AQMA and The Foregate monitoring locations**

Figure D.4 - St Johns AQMA and McIntyre Road monitoring location

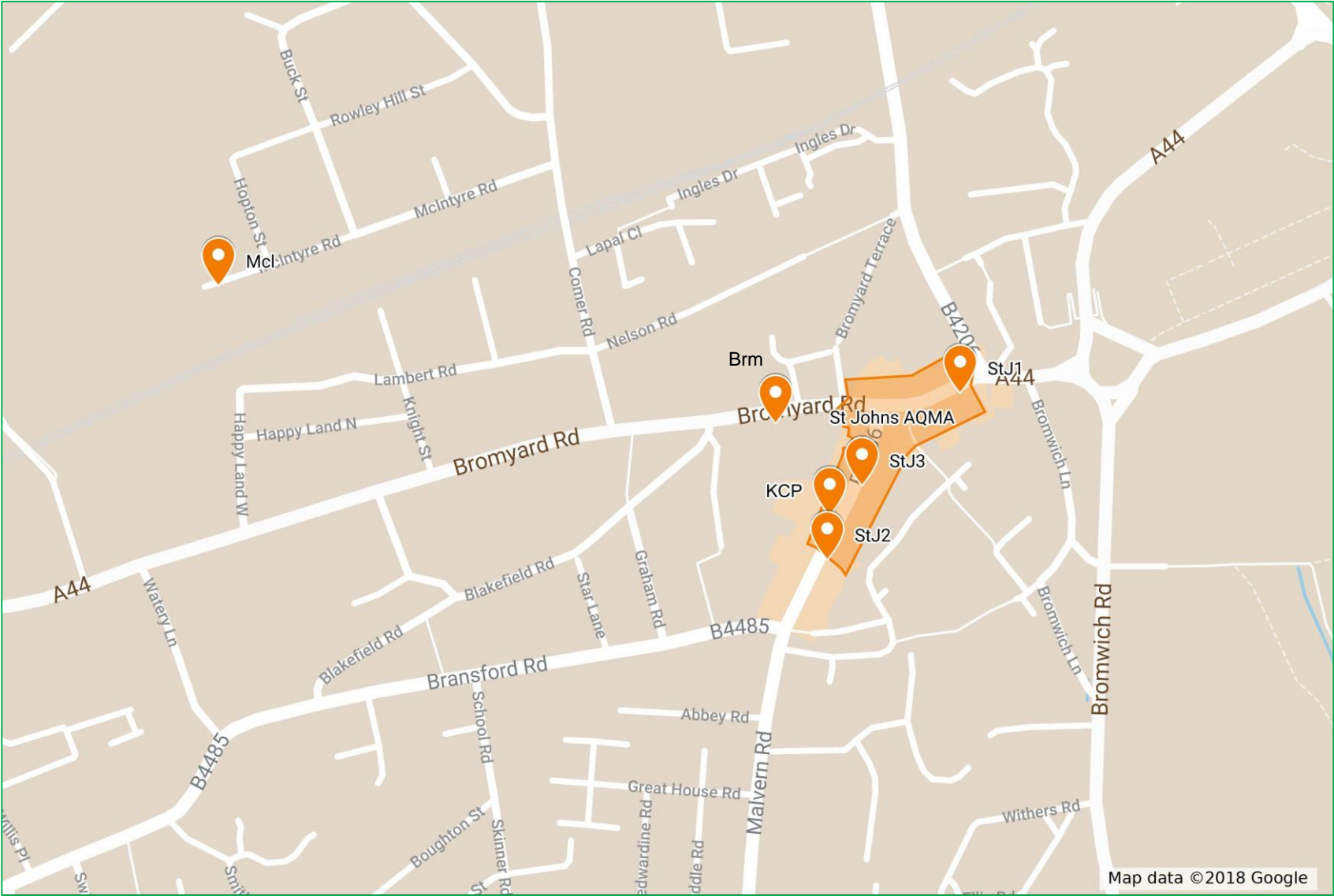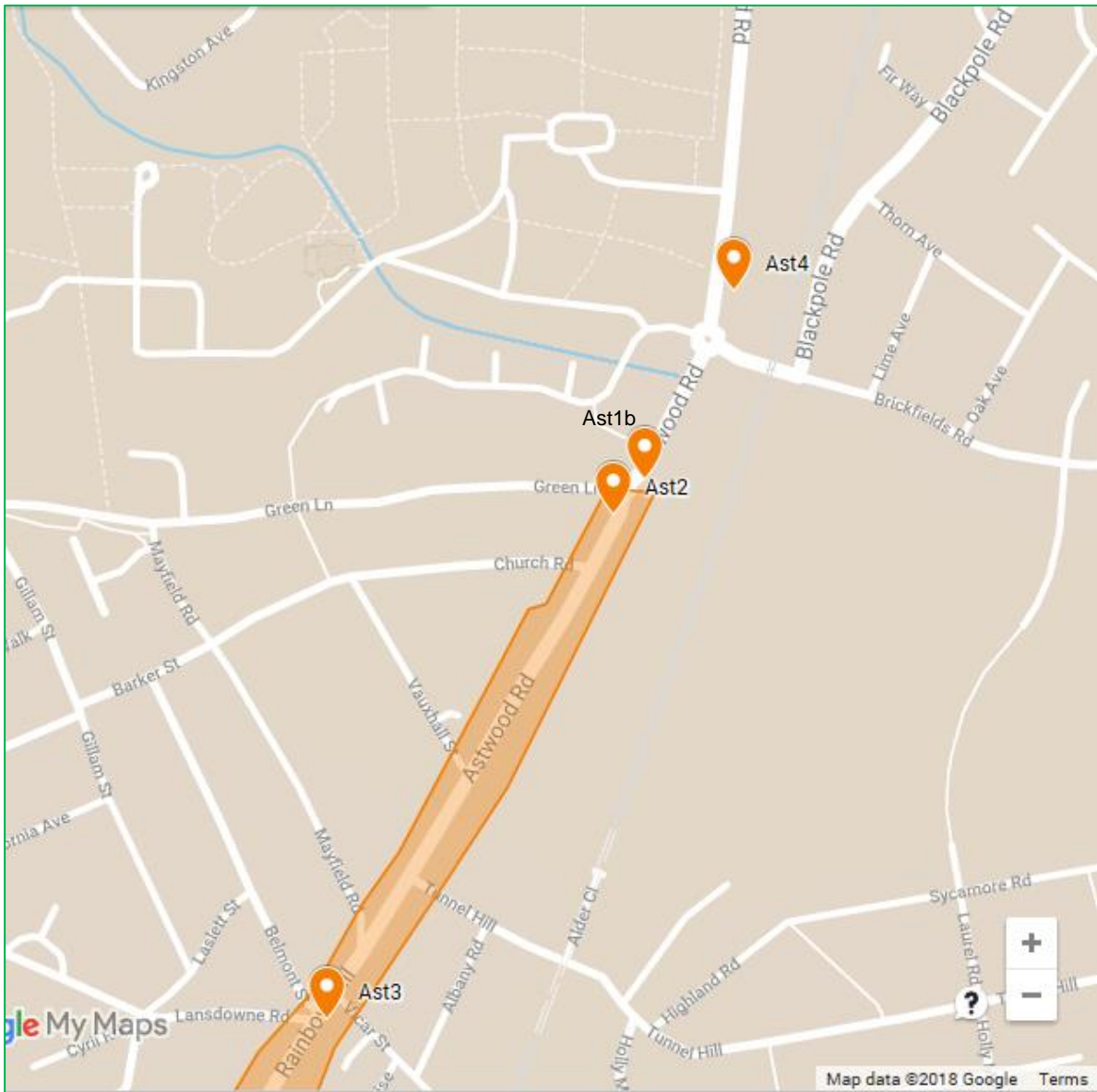**Figure D.5 - Astwood Road (north part of Rainbow Hill/Lowesmoor AQMA)**

Figure D.6 - Southern part of Rainbow Hill/Lowesmoor AQMA monitoring locations
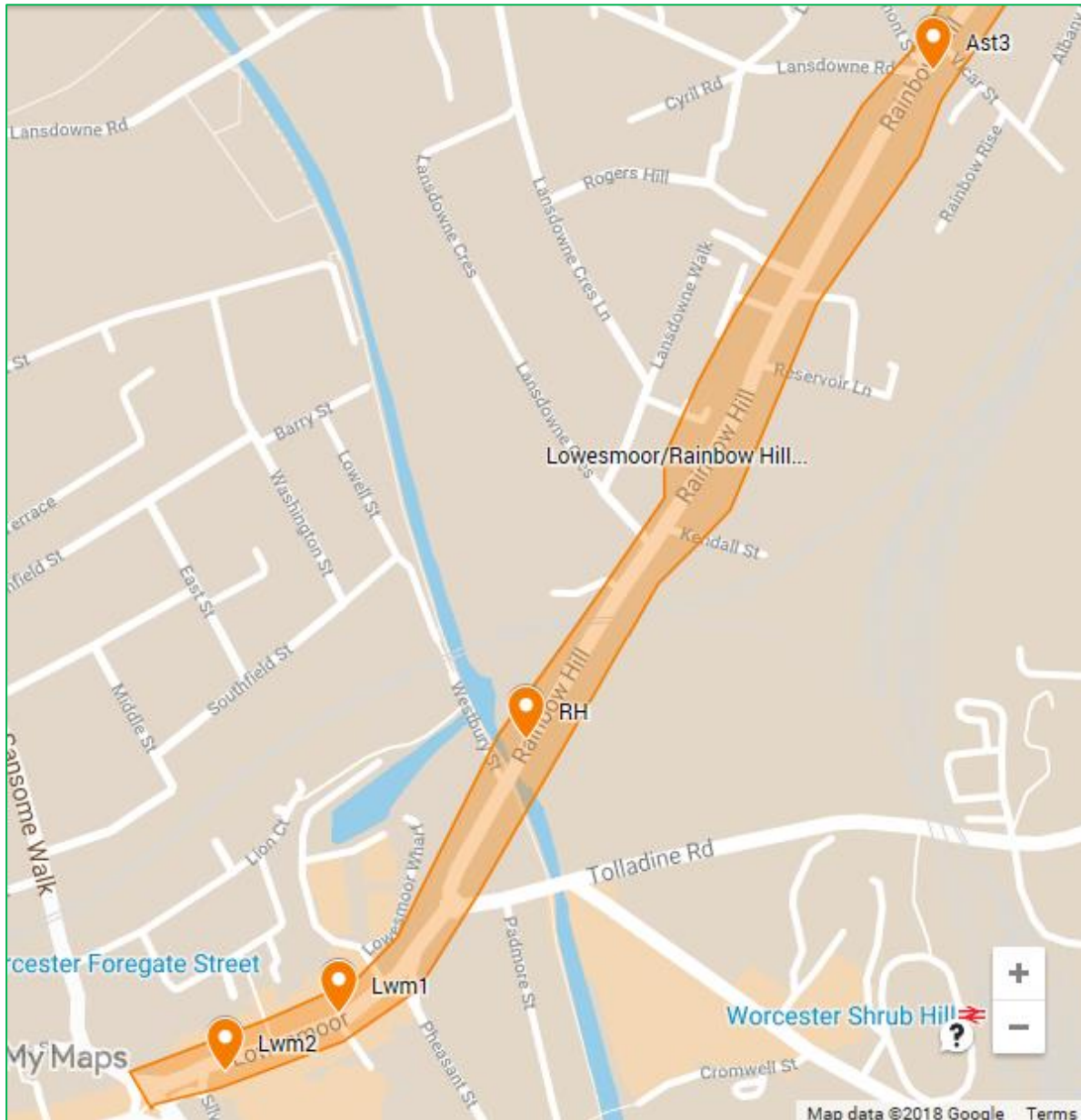
Figure D.7 - London Road/Sidbury monitoring locations
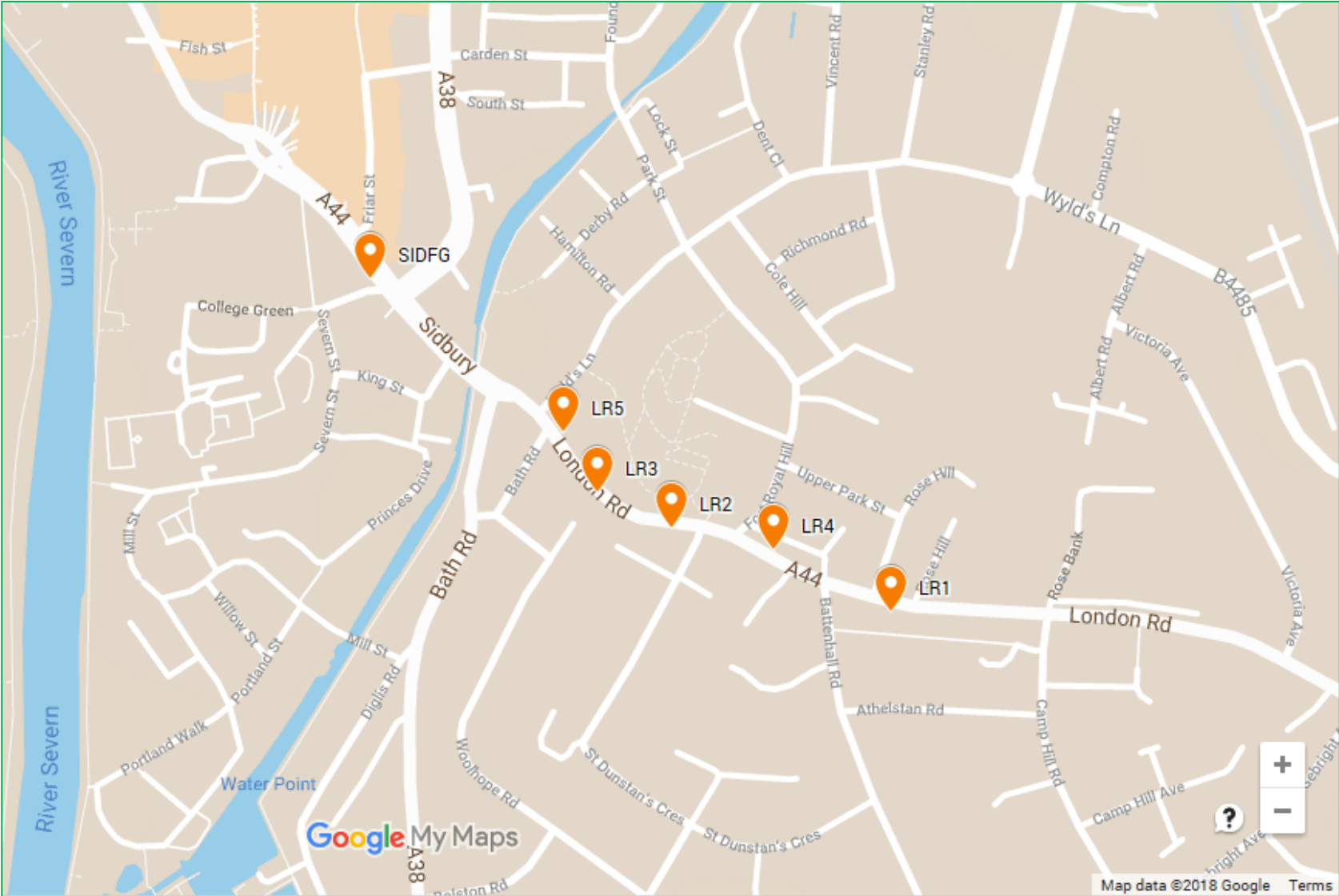
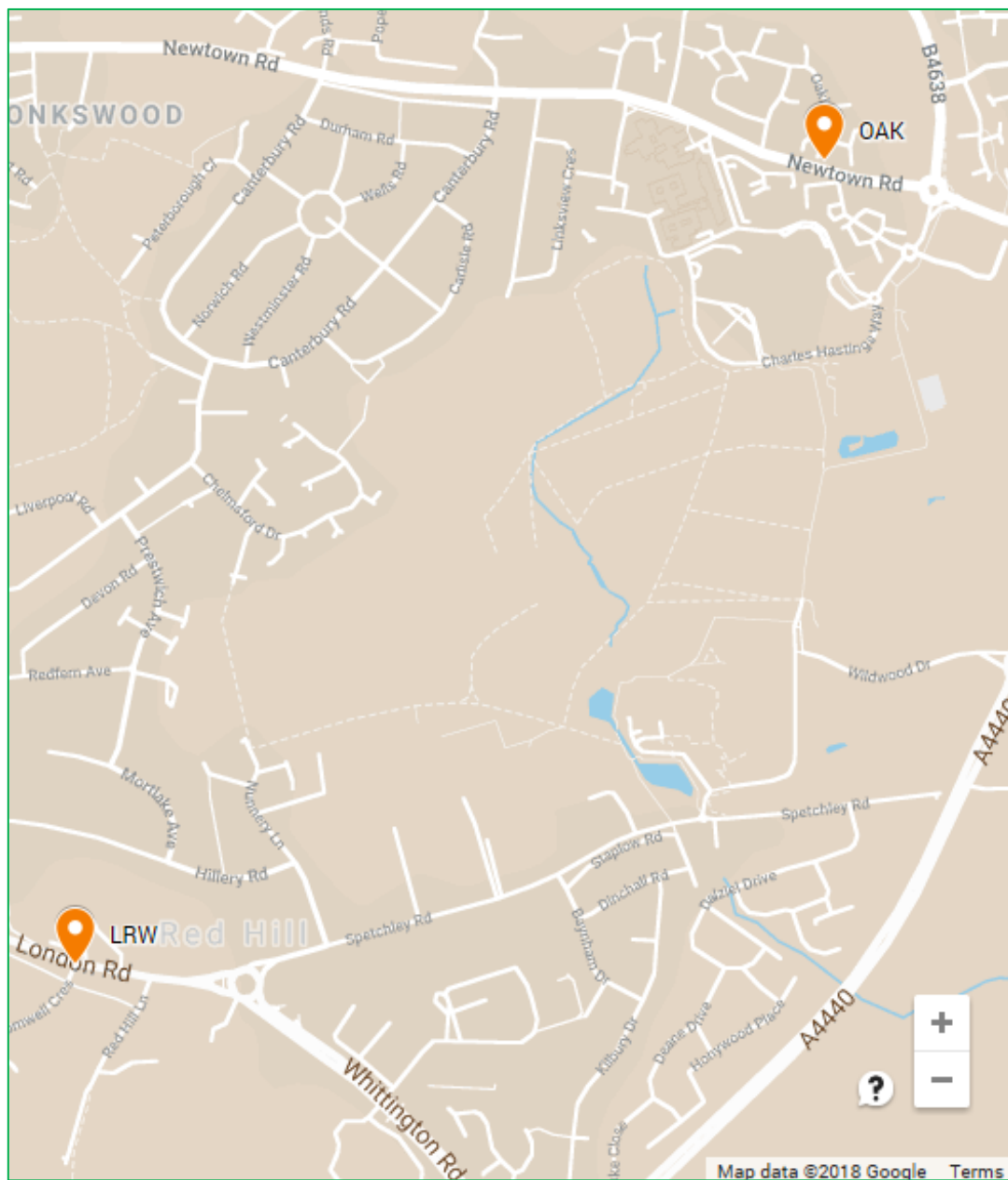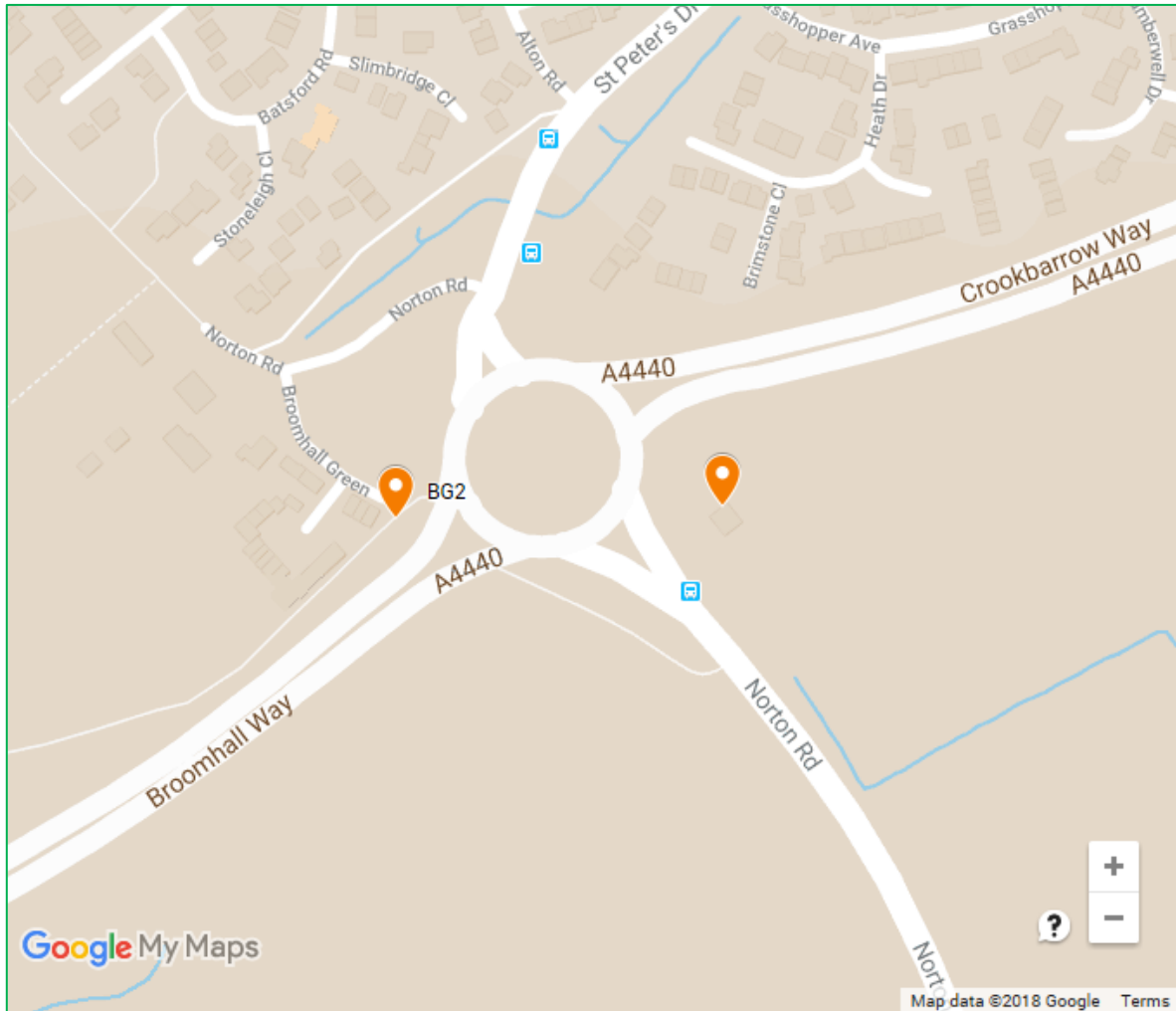**Figure D.8 - London Road (Waitrose) and Oaklands monitoring locations**

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 microgrammes of pollutant per cubic metre of air (µg/m^3).

Glossary of Terms

Abbreviation	Description
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the local authority intends to achieve air quality limit values'
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
AQC	Air Quality Consultants (private consultancy)
AQO	Air Quality Objective
ASR	Air quality Annual Status Report
CAZ	Clean Air Zone
CBTF	Clean Bus Technology Fund
CEEPG	Central England Environmental Protection Managers Group
CNG	Compressed Natural Gas
COPD	Chronic Obstructive Lung Disease
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
LAQM.PG(16)	Defra 2016 Local Air Quality Management Policy Guidance
LAQM.TG(16)	Defra 2016 Local Air Quality Management Technical Guidance
LES	Lowering Emissions 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 Planning
QA/QC	Quality Assurance and Quality Control
SPD	Supplementary Planning Document
TRO	Traffic Regulation Order
ULEV	Ultra Low Emission Vehicle
UTC	Urban Traffic Control
VMS	Variable Messaging System
WFH	Working from home
WRS	Worcestershire Regulatory Services

References

1. AQC (July 2017) 'Detailed Assessment of Air Quality along London Road, Worcester' ref: J2829A/1/F1

2. Defra (2016) 'Local Air Quality Management Policy Guidance LAQM PG.(16)'

3. Defra (2016) 'Local Air Quality Management Technical Guidance LAQM TG.(16)'

4. Defra and DfT (2017) 'Draft UK Air Quality Plan for tackling nitrogen dioxide: Technical Report'

5. Defra and DfT (2017) 'UK plan for tackling roadside nitrogen dioxide'

6. Worcester City Council (2016) 'Worcester City Plan 2016-2021'

7. Worcester City Council/Worcestershire County Council (2017) 'Worcester City Health and Well-being Plan 2017-2019'

8. Worcester City Council (Oct 2018) 'A Vision for Worcester – Masterplan Consultation'

9. Worcestershire County Council (2017) 'Worcestershire's Local Transport Plan (LTP) 2018 – 2030'

10. WRS (Sept 2013) 'Air Quality Action Plan for Worcestershire' ref: AQAP Doc version 2.2

11. WRS (2016) 'Air Quality Action Plan Progress Report for Worcestershire April 2015 – March 2016'

12. WRS (2017) 'Source Apportionment of Local Emissions of Nitrogen Dioxide in St. Johns Air Quality Management Area' (ref: StJSA FINAL)

13. WRS (2017) 'Technical Guidance Note for Planning V.4.0'