Worcestershire
Regulatory Services
Supporting and protecting you

2018 Air Quality Annual Status Report (ASR)

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

December 2018

Local Authority Officer	Laura Carradine
Department	Land & Air Quality Team
Address	Wyre Forest House Finepoint Way Kidderminster Worcestershire DY11 7WF
Telephone	01905 822799
E-mail	wrsenquiries@worcsregservices.gov.uk
Report Reference number	WDC/ASR/2018
Date	December 2018

Executive Summary: Air Quality in Our Area

Air Quality in Wychavon District

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.

Monitored levels of NO_2 observed across the Wychavon District area in 2017 show a significant decrease at all monitoring locations in 2017. This is consistent with trends across Worcestershire. This decrease is discussed further below and in Section 3.2.1.

A single Air Quality Management Area (AQMA) was declared by Wychavon District Council in 2007 for exceedences of the annual average mean objective for nitrogen dioxide (NO_2). The AQMA is known as the Port Street, Evesham AQMA.

[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

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

It should be noted that the Port Street, Evesham AQMA was active during the 2017 reporting year. However at the time of the writing of this report the Port Street, Evesham AQMA has been revoked. The AQMA was formally revoked by Wychavon District Council on 1st May 2018 following completion of a Screening Assessment, a copy of which is available to view online at http://www.worcsregservices.gov.uk/media/3332956/Port-Street-Revocation-Screening-Assessment-FINAL.pdf

Air Quality in the Port Street, Evesham area in 2017

In 2017 there have been no exceedences of the annual average mean objective for NO_2 in the Port Street AQMA. In addition, in 2017 no concentrations of NO_2 were within 5% of the annual average mean objective for NO_2 in the Port Street AQMA.

In 2017 a detailed Revocation Screening Assessment of monitoring data gathered over the ten year period 2006 to 2016 has been carried out. This Revocation Screening Assessment is available to view online at http://www.worcsregservices.gov.uk/media/3332956/Port-Street-Revocation-Screening-Assessment-FINAL.pdf **Please note that this Screen Assessment was also submitted with the 2017 ASR for Wychavon and as such has previously been reviewed by DEFRA.**

The Screening Assessment determined that over the ten year period assessed levels of NO_2 have generally followed a downward trend in the locality of Port Street. Over the same period there have been three marginal exceedances of the Objective at relevant exposure.

There has been no exceedance of the Objective at relevant exposure in the past four years.

Based on the conclusions of the Screening Assessment Wychavon District Council took the decision to revoke the Port Street AQMA. This decision was subject to consultation until 2nd March 2018. Formal revocation of the AQMA came into effect on 1st May 2018.

Air Quality in the Worcester Road, Wychbold area in 2017

No exceedences of the annual mean objective for NO_2 have been recorded at relevant exposure in the Worcester Road, Wychbold area in 2017. As discussed above WRS have attributed these low results to the low national bias-adjustment factor (0.77) applied to raw data in accordance with the requirements of the LAQM regime. Therefore WRS believe that the 2017 monitoring results should not be relied upon as indicative of local trends.

In 2017 Wychavon District Council completed a Dispersion Modelling Assessment for the Wychbold area to confirm that an AQMA is required and to determine the necessary geographical extent of that AQMA. A copy of this Dispersion Modelling Assessment can be viewed at http://www.worcsregservices.gov.uk/media/3332953/Worcester-Rd-Wychbold-Dispersion-Modelling-Assessment-October-2017-FINAL.pdf **Please note that this Dispersion Modelling Assessment was also submitted with the 2017 ASR for Wychavon and as such has previously been reviewed by DEFRA.**

Based on the conclusions of the Dispersion Modelling Assessment, including monitored levels between 2012 and 2016, Wychavon District Council took the decision to declare an AQMA at Worcester Road Wychbold. This decision was subject to consultation until 2nd March 2018.

On 1st May 2018 Wychavon District Council formally declared an AQMA at Worcester Road, Wychbold. A copy of the formal order is available to view at http://www.worcsregservices.gov.uk/media/3697283/Worcester-Road-Wychbold-declaration-order.pdf

In 2018 development of an Action Plan for the area has commenced. A Source Apportionment exercise for the A38 has been completed. This exercise has been undertaken following guidance laid out in LAQM Technical Guidance 16. It aims to identify and quantify the emission sources which contribute to the exceedance of the nitrogen dioxide annual mean objective in the area. This will allow the Action Plan to focus on those emission sources which contribute the most in terms of emissions. For further details see Section 2.2 below.

Other areas across the District in 2017

No exceedences of the annual mean objective for NO_2, or any concentrations within 5% of that objective, have been recorded at any other location in the District in 2017.

A full list of declared and revoked AQMAs can be viewed at

http://uk-air.defra.gov.uk/aqma/list

Actions to Improve Air Quality

No direct measures to address air quality in relation to the Port Street, Evesham AQMA have been pursued in 2017. This is due to the decision to revoke the Port Street, Evesham AQMA. This decision has been based on the conclusions of the 2017 Revocation Screening Assessment for the AQMA. The AQMA was formally revoked by Wychavon District Council on 1st May 2018.

No direct measures to address air quality in relation to Worcester Road, Wychbold have been undertaken in 2017. During 2017 a Detailed Dispersion Modelling Assessment was undertaken to confirm the requirement for an AQMA and inform the decision as to the geographical extent of the AQMA. The AQMA for formally declared by Wychavon District Council on 1st May 2018. Following this declaration work towards developing an Air Quality Action Plan for the area has commenced, this has included:

- Initial engagement with key stakeholders including Highways England, Worcestershire County Council Highways, local district Councillors and the local Parish Council.
- Completion of a Source Apportionment exercise to inform the development of the Action Plan.

Conclusions and Priorities

The main conclusions of the 2017 ASR are:

- The Port Street, Evesham AQMA was revoked on 1st May 2018.
- A new AQMA was declared at Worcester Road, Wychbold on 1st May 2018.
- In general there has been a downward trend in nitrogen dioxide levels between 2016 and 2017 across the district. There is no discernible upward or downward trend in levels over the five year period 2013-2017.

Priorities for addressing air quality in Wychavon across the coming year are:

- Launch of Steering Group to work towards developing and delivering Action Plan for Worcester Road, Wychbold.
- Development of a draft Action Plan for the new Worcester Road, Wychbold AQMA. It is anticipated that the key challenge in developing the Action Plan

will be in relation to securing engagement and involvement of key stakeholders.

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/.
- 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 .

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

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

Table of Contents

List of Tables

List of Figures

1 Local Air Quality Management

This report provides an overview of air quality in Wychavon District 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 Wychavon District 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 Wychavon District Council in 2017 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 – see full list at http://uk-air.defra.gov.uk/aqma/list. Alternatively, see Appendix D which provides for a map of air quality monitoring locations in relation to the AQMA(s).

It should be noted that the Port Street, Evesham AQMA was active during the 2017 reporting year. However at the time of the writing of this report the Port Street, Evesham AQMA has been revoked. The AQMA was formally revoked by Wychavon District Council on 1st May 2018 following completion of a Screening Assessment, a copy of which is available to view online at http://www.worcsregservices.gov.uk/media/3332956/Port-Street-Revocation-Screening-Assessment-FINAL.pdf

Table 2.1 – Declared Air Quality Management Areas (active in 2017)

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
Port Street Evesham AQMA	Declared 22nd August 2007 (Still active for reporting year 2017 however REVOKED 1st MAY 2018)	NO2 Annual Mean	Evesham	Mixed residential and retail street canyon along main route into town centre from the east	No	40	µg/m3	30.1	µg/m3	Air Quality Action Plan for Worcestershire (2013) and subsequent 2015 and 2016 AQAP Progress Reports.	2013	http://www.worcsregservices.gov.uk/pollution/air-quality/air-quality-action-plan.aspx

☒ **Wychavon District 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 Wychavon District

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

1. We agree with the outcome of the revocation screening assessment, that it is appropriate to revoke the Port Street Evesham AQMA. Once the completion of the consultation is complete and the revocation is approved, the Council should notify Defra formally via the RSW. **Wychavon District Council has completed consultation. Formal revocation of the Port Street, Evesham by took place on 1st May 2018. Defra have been formally notified via the RSW.**

2. We consider the Council should continue to monitor in this area for a period following revocation to confirm the pollution levels remain within objective levels. **Wychavon District Council continue to monitor levels of nitrogen dioxide in the Port Street, Evesham area.**

3. We agree with the outcome of the dispersion modelling assessment for Worcester Road Wychbold, that it is appropriate to declare an AQMA as detailed in the modelling assessment. **The Worcester Road, Wychavon AQMA was formally declared by Wychavon District Council on 1st May 2018.**

4. Paragraph 3.41 of the Technical Guidance LAQM TG(16) details the options for declaring an AQMA, including the fast-track process, with additional guidance on the LAQM website. **Noted, the Worcester Road, Wychavon AQMA was formally declared by Wychavon District Council on 1st May 2018.**

5. The results of modelling appear to suggest that the boundary of the AQMA will need to include locations that have not been subject to monitoring, particularly locations closest to the Motorway junction. This

suggests that the monitoring programme should be reviewed to incorporate new sites identified within modelling, where exceedance of the objectives are predicted. **The nitrogen dioxide diffusion tube network in the Worcester Road, Wychbold AQMA has been extended to include properties where modelled exceedances exist along the A38 and as close to residential properties near to the M5 as possible.**

6. Once the AQMA has been formally declared the details of the new AQMA should be uploaded to the Defra LAQM Report Submission Website. **The Worcester Road, Wychbold AQMA was formally declared by Wychavon District Council on 1st May 2018. Defra have been formally notified via the RSW.**

7. As the report acknowledges, a draft Action Plan will be required within 12 months of the declaration of the new AQMA. **In 2018 a source apportionment exercise has been completed. This will be used to develop a draft Action Plan for the new Worcester Road, Wychbold AQMA. Initial consultation with several key stakeholders has taken place including Highways England, Worcestershire County Council Highways, the local District Councillor and Dodderhill Parish Council.**

Port Street, Evesham AQMA

No direct measures to address air quality in relation to the Port Street, Evesham AQMA have been pursued in 2017. This is due to the decision to revoke the Port Street, Evesham AQMA. This decision has been based on the conclusions of the 2017 Revocation Screening Assessment for the AQMA. The AQMA was formally revoked by Wychavon District Council on 1st May 2018.

Going forward Wychavon District Council and WRS will continue to promote improvements to air quality in the area through various mechanisms including:

- Continued monitoring of NO_2 levels in the area
- Continued partnership working with Worcestershire County Council, including participation in the upcoming Transport Strategy Steering Group for Evesham and development of the Evesham Town Transport Strategy.
- Continued detailed review of the area when new planning applications are received through continued use of WRS existing Air Quality Planning Consultation Zones. These are zones in which planning authorities are advised to consult more thoroughly with WRS due to presence of existing or former AQMAs and areas of emerging poor air quality.

Worcester Road, Wychbold

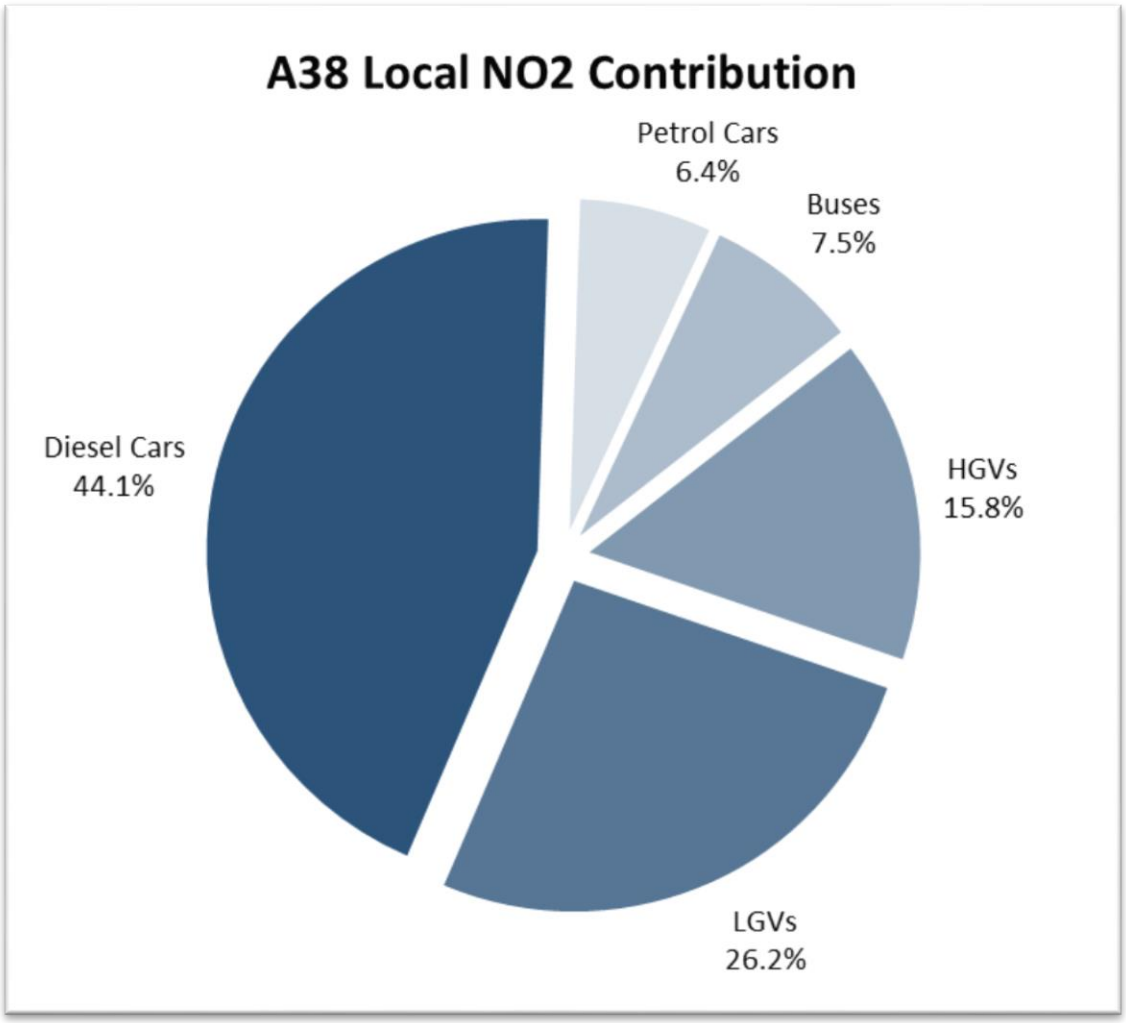
During 2017 a Detailed Dispersion Modelling Assessment was undertaken to confirm the requirement for an AQMA and inform the decision as to the geographical extent of the AQMA. The AQMA for formally declared by Wychavon District Council on 1st May 2018. A copy of the formal order can be viewed at http://www.worcsregservices.gov.uk/media/3697283/Worcester-Road-Wychbold-declaration-order.pdf

Following this declaration work towards developing an Air Quality Action Plan for the area has commenced. There are currently no agreed deadlines for the completion of this work at the time of the writing of this report due to the number of key stakeholders i.e. Highways England, County Highways.

In 2018 a Source Apportionment exercise for the A38 has been completed. This exercise has been undertaken following guidance laid out in LAQM Technical Guidance 16. A copy is attached as part of Appendix C. Source apportionment has been undertaken to inform the development of the draft Action Plan. It aims to identify and quantify the emission sources which contribute to the exceedance of the nitrogen dioxide annual mean objective in the area. This will allow the Action Plan to focus on those emission sources which contribute the most in terms of emissions.

The exercise concludes that the three main contributors to emissions within the AQMA are diesel cars (contributing 43.9%), diesel LGVs (contributing 26.0%) and HGVs (contributing 15.7%). Figure 2.1 below provides a graphical representation of the contribution of each vehicle category to local NO_2 concentrations.

Figure 2.1 – Contribution to Local NO_2 emissions A38 (Source Apportionment)



In addition background concentration contributes a significant proportion of the overall concentration of NO_2 measured within the AQMA (36.87%).

Cars, which make up the largest proportion of traffic volume (81%), contribute approximately 50% of local traffic emissions within the AQMA with diesel cars in particular responsible for a large proportion (approximately 44%). LGVs contribute approximately 26% of local traffic emission and HGVs approximately 16%.

The results of Source Apportionment suggest that targeting individual types of vehicles on the A38 in isolation would not lead to the annual mean objective being achieved, unless the reductions are very large, for example an approximately reduction of 55% in emissions from cars would be required. However a reduction in total vehicle emissions of approximately 25% to 30% would potentially be effective in achieving the annual mean objective.

The findings of this source apportionment exercise will be used to inform the development of the draft Action Plan for the area.

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.

There are currently no automatic $PM_{2.5}$ monitoring stations in Worcestershire. The nearest AURN $PM_{2.5}$ monitoring station is the Birmingham Acocks Green site approximately 32 miles to the north east of the Wychavon District.

WRS has reviewed the 2015 based DEFRA national background maps to determine projected $PM_{2.5}$ concentrations with the Wychavon District for the 2017 calendar year. The average total $PM_{2.5}$ at 657 locations (centre points of 1km x 1km grids) across the Wychavon District is 8.66ug/m3, with a minimum concentration of 7.61ug/m3 and a maximum concentration of 10.78ug/m3.

This indicates that $PM_{2.5}$ concentrations within the Wychavon District are well below the annual average EU limit value for $PM_{2.5}$ of 25ug/m3.

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 Director of Public Health 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 Wychavon District Council in relation to the reduction of $PM_{2.5}$ levels. However it is anticipated that any

actions taken to improve NO_2 levels across the District will likely result in a linked improvement in $PM_{2.5}$ levels.

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.

Wychavon District Council has not undertaken any automatic monitoring in 2017.

3.1.2 Non-Automatic Monitoring Sites

Wychavon District Council undertook non- automatic (passive) monitoring of NO_2 at twenty three 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.

Figure A.1 in Appendic A shows the five year trend for NO_2 concentrations at all diffusion tube locations across the Wychavon District.

There have been no exceedances of the NO_2 annual mean objective across the Wychavon District in 2017. This decrease is attributed to the low national bias-adjustment factor (0.77) applied to raw data as required by the LAQM regime.

Following discussion with other Local Authorities and the National Physics Laboratory, WRS are aware that Defra's 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 long term annual trends. WRS has been unable to obtain any satisfactory explanation as to why this is the case and therefore has little confidence in the adjusted 2017 annual nitrogen dioxide results. Therefore, in WRS opinion, the 2017 data should not be relied upon as indicative of local trends.

3.2.2 Particulate Matter (PM_{10})

PM_{10} is not monitored within the Wychavon District.

3.2.3 Particulate Matter ($PM_{2.5}$)

PM2.5 is not monitored within the Wychavon District.

3.2.4 Sulphur Dioxide (SO_2)

Sulphur Dioxide is not monitored within the Wychavon District.

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)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
EPS8	40 High Street Street Light 8, Pershore	Roadside	395048	245527	NO2	NO	2	0.5	NO	2.27
EPS9	St. Andrews Road Street light 139, Pershore	Suburban	394571	245377	NO2	NO	6	2.98	NO	2.26
EPS14	Port Street Road Sign, Evesham	Kerbside	404128	243630	NO2	YES	1.7	0.73	NO	2.35
EPS14a	Port Street Road Sign, Evesham	Kerbside	404128	243630	NO2	YES	1.7	0.73	NO	2.35
EPS14b	Port Street Road Sign, Evesham	Kerbside	404128	243630	NO2	YES	1.7	0.73	NO	2.35
EPS27	Worcester Rd, Wychbold	Roadside	392031	265624	NO2	NO	15.5	2.31	NO	2.13
EPS28	Worcester Rd, Wychbold	Roadside	392031	265624	NO2	NO	15.5	2.31	NO	2.13
EPS29	Worcester Rd, Wychbold	Roadside	392031	265624	NO2	NO	15.5	2.31	NO	2.13
EPS33	High Street Street light	Roadside	403753	244068	NO2	NO	2.5	3.5	NO	2.3

	LP 32, Evesham									
EPS43	Long Stay opp cinema, Port St, Evesham	Roadside	404222	243598	NO2	YES	0	1.85	NO	2.35
EPS44	Camera Post opp 33, Port St, Evesham	Roadside	404183	243611	NO2	YES	2.6	1.18	NO	2.45
EPS52	The Bungalow, Whittington	Roadside	387598	252511	NO2	NO	0	12	NO	1.99
EPS53	Hillview Cottage, Whittington	Suburban	387595	252533	NO2	NO	0	22	NO	1.68
EPS56	Post Office, Worcester Rd, Wychbold	Roadside	391983	265688	NO2	NO	0	8.08	NO	2.13
EPS58	2 Rose Villas, Worcester Road, Wychbold S14	Roadside	392034	265762	NO2	NO	9	3	NO	2.27
EPS60	Corner of Rynal Street & De La Bere Close, Evesham SL2	Roadside	403914	244046	NO2	NO	5.5	1.1	NO	2.13
EPS61	1-6 The Old Dairy, Swan Lane, Evesham	Roadside	403796	244006	NO2	NO	0	1.9	NO	2
EPS62	Bengal Dreams No 53 Façade,	Roadside	403729	243971	NO2	NO	1.32	5.38	NO	2.18

	Evesham									
EPS63	60 Mayflower Road, Droitwich	Roadside	390708	262863	NO2	NO	0	2.46	NO	1.93
WMD1	Walk Mill Drive, Wychbold LP363	Roadside	392050	265790	NO2	NO	4.94	2.3	NO	2.14
WyAQ1	Rose Dene, Worcester Road, Wychbold	Roadside	392019	265736	NO2	NO	9.91	1.93	YES	2.22
WyAQ2	Rose Dene, Worcester Road, Wychbold	Roadside	392019	265736	NO2	NO	9.91	1.93	YES	2.22
WyAQ3	Rose Dene, Worcester Road, Wychbold	Roadside	392019	265736	NO2	NO	9.91	1.93	YES	2.22

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) 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 ($\mu g/m^3$) [3]				
					2013	2014	2015	2016	2017
EPS8	Roadside	Diffusion Tube	92	92	27.4	21.8	21.7	22.6	22.31
EPS9	Suburban	Diffusion Tube	92	92	16.2	14.3	11.5	11.9	10.46
EPS14	Kerbside	Diffusion Tube	92	92				34.3	35.24
EPS14a	Kerbside	Diffusion Tube	92	92				35.2	37
EPS14b	Kerbside	Diffusion Tube	92	92				35	36.23
Average EPS14/a/b	Kerbside	Diffusion Tube	92	92	**41.7**	34.1	30.3	34.7	36.2
EPS27	Roadside	Diffusion Tube	100	100				30.1	40.5
EPS28	Roadside	Diffusion Tube	100	100				29.4	40.1
EPS29	Roadside	Diffusion Tube	100	100				29.6	38
Average EPS27/28/29	Roadside	Diffusion Tube	100	100	36.6	30.4	28.9	29.7	39.5
EPS33	Roadside	Diffusion Tube	92	92	31.1	27.8	27.5	29.3	24.49
EPS43	Roadside	Diffusion Tube	83	83	39	31.7	31.2	33.78	27.3
EPS44	Roadside	Diffusion Tube	83	83	33.6	26.3	26.6	29.63	28.44
EPS52	Roadside	Diffusion Tube	83	83	39	32.81	31.1	33.78	30.81
EPS53	Suburban	Diffusion Tube	100	100	34	30	29.35	29.99	25.75

EPS56	Roadside	Diffusion Tube	100	100	**52**	**45.38**	**45.12**	**45.56**	36.4
EPS58	Roadside	Diffusion Tube	92	92	-	**42.5**	**46**	**46.4**	**52.8**
EPS60	Roadside	Diffusion Tube	92	92	-	16	14.8	14.1	15.32
EPS61	Roadside	Diffusion Tube	92	92	-	29.9	30.01	29.63	27.2
EPS62	Roadside	Diffusion Tube	100	100	-	30.89	33.47	34.37	29.56
EPS63	Roadside	Diffusion Tube	92	92	-		24.54	24.87	18.9
WMD1	Roadside	Diffusion Tube	100	100	-			38	**40.2**
WyAQ1	Roadside	Diffusion Tube	75	75	-			35.7	**42.2**
WyAQ2	Roadside	Diffusion Tube	92	92	-			37.1	**44.36**
WyAQ3	Roadside	Diffusion Tube	100	100	-			36.3	**46**
Average WyAQ1/2/3	Roadside	Diffusion Tube	89	89	-			36.3	**44.2**

☒ **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**.

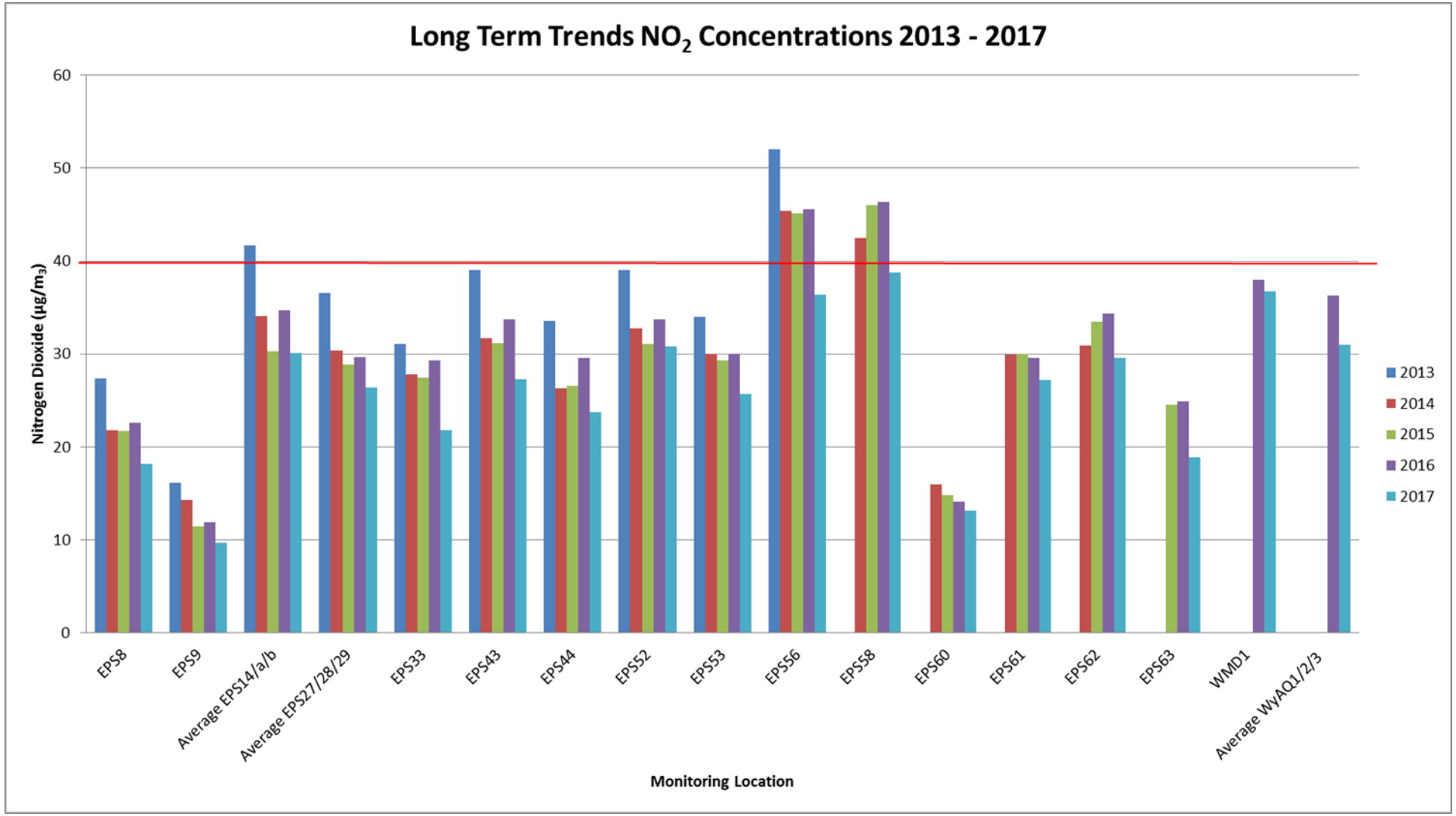
NO_2 annual means exceeding 60µg/m^3, indicating a potential exceedance of the NO_2 1-hour mean objective are shown in **bold and underlined.**

(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 NO_2 Concentrations



Appendix B: Full Monthly Diffusion Tube Results for 2017

Table B.1 – NO_2 Monthly Diffusion Tube Results - 2017

Site ID	NO_2 Mean Concentrations (µg/m^3)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean		
													Raw Data	Bias Adjusted (0.77) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
EPS8	**42.9**	34.9	35.7	32.9		25.4	25.0	26.2	25.8	25.8	37.4	35.9	29.0	22.31	18.2
EPS9	25.2	16.7	13.6	9.0	17.5	7.5	8.4	9.7	10.7	12.0	19.2	-	13.6	10.5	9.7
EPS14	**51.75**	**45.57**	**49.71**	**45.97**	39.99	**46.18**	**35.56**	-	**40.37**	**48.36**	**48.34**	**51.63**	**45.8**	35.2	29.3
EPS14a	**56.04**	**50.82**	**51.64**	**47.06**	**41.3**	**48.85**	37.99	-	37.48	**49.73**	**54.93**	**54**	**48.1**	37.0	30.7
EPS14b	**56.82**	**48.52**	**50.5**	**48.52**	13.69	**48.66**	36.09	-	36.74	46.47	**50.52**	**53.44**	**47.1**	36.2	30.1
Average EPS14/a/b														36.1	30.1
EPS27	**56.74**	**55.29**	**53.95**	**74**	**42.43**	**47.22**	**42.24**	**43**	**44.27**	**52.7**	**61.35**	**57.38**	**52.5**	**40.5**	26.9
EPS28	**56.11**	**54.58**	**57.97**	**55.87**	**46.59**	**47.03**	**41.91**	**41.92**	**43.52**	**54.93**	**65.56**	**58.22**	**52.0**	**40.1**	26.7
EPS29	**52.47**	**53.77**	**55.29**	**51.46**	**40.84**	**44.09**	38.75	**44.79**	**40.81**	**53.86**	**61.11**	**54.87**	**49.3**	38.0	25.6
Average EPS27/28/29													51.3	39.5	26.4
EPS33	**46.56**	37.19	34.94	29.91	-	25.2	23.53	24.55	27.67	29.97	34.77	35.52	31.8	24.5	21.8
EPS43	53.78	38.95	37.53	35.9	27.12	31.33	29.36	18.53	-	-	**42.3**	39.69	35.5	27.3	27.3
EPS44	-	38.41	39.58	39.73	32.97	33.05	33.99	34.09	33.8	**44.28**	-	39.48	36.9	28.4	23.8
EPS52	**51.61**	-	-	**40.11**	30.28	33.07	29.17	38.43	**49.72**	**41.04**	**43.04**	**43.6**	**40.0**	30.8	30.8
EPS53	**43.86**	33.23	31.2	34.1	24.86	27.13	26.63	31.65	30.24	37.14	**40.64**	**40.13**	33.4	25.7	25.7

EPS56	**54.17**	**49.64**	**50.63**	**50.83**	38.13	**45.81**	**41.53**	**43.11**	39.01	**46.3**	**59.88**	**48.06**	**47.3**	**47.3**	36.4
EPS58	**86.42**	**67.72**	**78.06**	**70.79**	-	**63.92**	**57.63**	**59.48**	**56.55**	**69.09**	**74.56**	**70.36**	**68.6**	**52.8**	38.8
EPS60	32.2	23.18	20.95	16.94	13.69	11.97	12.07	-	16.64	19.57	27.27	24.32	19.9	15.3	13.2
EPS61	**42.22**	35.5	35.24	30.76	26.75	32.27	-	33.83	30.62	37.81	**40.75**	**42.86**	35.3	27.2	27.2
EPS62	**45.11**	36.37	39.4	38.7	23.89	36.61	31.69	35.39	33.8	**45.25**	**45.68**	**48.71**	38.4	29.6	29.6
EPS63	38.76	29.07	25.77	18.54	27.49	21.45	18.86	14.93	24.45	23.21	27.66	-	24.6	18.9	18.9
WMD1	**65.36**	**59.79**	**67.41**	**52.09**	**42.91**	**43.29**	**40.04**	**40.95**	39.01	**55.08**	**62.7**	**58.13**	**52.2**	**40.2**	36.7
WyAQ1	**57.5**	**57.35**	-	**56.72**	**50.11**	-	**51.42**	**50.19**	**46.6**	**55.54**	-	**68.3**	**54.9**	**42.2**	29.9
WyAQ2	**60.33**	**56.43**	**58.85**	**59.83**	**51.36**	-	**48.69**	**53.48**	**53.66**	**63.2**	**66.13**	**60.82**	**57.5**	**44.3**	31.1
WyAQ3	**61.46**	**61.15**	**62.05**	**65.63**	**49.29**	**54.6**	**53.52**	**53.86**	**56.67**	**65.89**	**73.14**	**60.1**	**59.8**	**46.0**	32.1
Average WyAQ1/2/3														**44.2**	31.0

☐ **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

Diffusion Tube Bias Adjustment Factors

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.

The bias-adjustment factor applied to 2017 nitrogen dioxide diffusion tube data (0.77) is the national figure published by DEFRA. Following discussion with other Local Authorities and the National Physics Laboratory, WRS are aware that Defra's 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 annual trends. WRS has been unable to obtain any satisfactory explanation as to why this is the case. Therefore has little confidence in the adjusted 2017 annual nitrogen dioxide results. Therefore, in WRS opinion, the 2017 data should not be relied upon as indicative of local trends.

Short-term to Long-term Data Adjustment - Annualisation

Annualisation calculations were not required for any monitoring locations in 2017.

Estimates of concentrations at nearest receptor

If an exceedence (or result close to an exceedence) is measured at a monitoring site which is not representative of public exposure, the procedure specified in Technical Guidance LAQM.TG(16) has been used to estimate the concentration at the nearest receptor where applicable. The results are presented below:

EPS8 – 40 High Street, Pershore

Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	0.5	metres
Step 2	How far from the KERB is your receptor (in metres)?	2.5	metres
Step 3	What is the local annual mean background NO_2 concentration (in $\mu g/m^3$)?	7.95	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	22.31	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	18.2	$\mu g/m^3$

EPS 9 – St. Andrew's Road, Pershore

Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	2.98	metres
Step 2	How far from the KERB is your receptor (in metres)?	8.98	metres
Step 3	What is the local annual mean background NO_2 concentration (in $\mu g/m^3$)?	7.95	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	10.46	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	9.7	$\mu g/m^3$

EPS14,14a,14b – Port Street road sign, Evesham

Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	0.73	metres
Step 2	How far from the KERB is your receptor (in metres)?	2.43	metres
Step 3	What is the local annual mean background NO_2 concentration (in $\mu g/m^3$)?	9.52	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	36.16	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	30.1	$\mu g/m^3$

EPS27/28/29 – Roundabout Worcester Road, Wychbold

Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	2.31	metres
Step 2	How far from the KERB is your receptor (in metres)?	17.81	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	12.98	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	39.53	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	26.4	µg/m^3

EPS33 – Hill View Cottage, Whittington

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)?	6	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	5.77	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	24.49	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	21.8	µg/m^3

EPS44 – Camera post, opposite 33 Port Street, Evesham

Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	1.18	metres
Step 2	How far from the KERB is your receptor (in metres)?	3.78	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	9.52	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	28.44	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	23.8	µg/m^3

EPS58 – 2 Rose Villas, Worcester Road, Wychbold

Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	1.73	metres
Step 2	How far from the KERB is your receptor (in metres)?	8.15	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	12.97	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	52.8	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	*38.8*	µg/m^3

EPS60 – Corner Rynal Street, Evesham

Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	1.1	metres
Step 2	How far from the KERB is your receptor (in metres)?	6.6	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	9.49	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	15.32	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	13.2	µg/m^3

WMD1 – Walkmill Drive junction, Worcester Road, Wychbold

Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	4.94	metres
Step 2	How far from the KERB is your receptor (in metres)?	7.6	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	12.97	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	40.2	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	*36.7*	µg/m^3

WyAQ1/2/3 – former automatic monitor triplicate

Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	1.93	metres
Step 2	How far from the KERB is your receptor (in metres)?	11.83	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	12.97	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	44.17	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	31.0	µg/m^3

Worcester Road, Wychbold
Source Apportionment Assessment 2018

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

October 2018

Local Authority Officer	Laura Carradine
Department	Land & Air Quality Team
Address	Wyre Forest House Finepoint Way Kidderminster Worcestershire DY11 7WF
Telephone	01905 822799
E-mail	wrsenquiries@worcsregservices.gov.uk
Report Reference number	WDC/WORCSRD/SA/2018
Date	October 2018

Table of Contents

Appendices

List of Tables

List of Figures

1.0 Introduction

This report fulfils the requirements of the Local Air Quality Management (LAQM) process as set out in Part IV of the Environment Act 1995, the Air Quality Strategy for England, Wales and Northern Ireland 2007 and the relevant Policy and Technical Guidance.

Policy Guidance (LAQM.PG16) requires a Local Authority to produce an Air Quality Action Plan (AQAP) following declaration of an Air Quality Management Area (AQMA). In order to develop an appropriate plan it is necessary to identify the emission sources contributing to the exceedance of the Objective.

2.0 Air Quality Objectives

The air quality objectives set out in the Air Quality (England) Regulations 2000, as amended by the Air Quality (England) (Amendment) Regulations 2002, provide the statutory basis for the air quality objectives under LAQM in England. The relevant objectives for the propose of this assessment are set out in Table 1 below.

Table 1 Nitrogen Dioxide AQOs

Pollutant	Objective	Averaging Period	Obligation
Nitrogen Dioxide	200µg/m^3	1-hour mean	All local authorities
	not to be exceeded more than 18 times a year		
	40µg/m^3	Annual mean	All local authorities

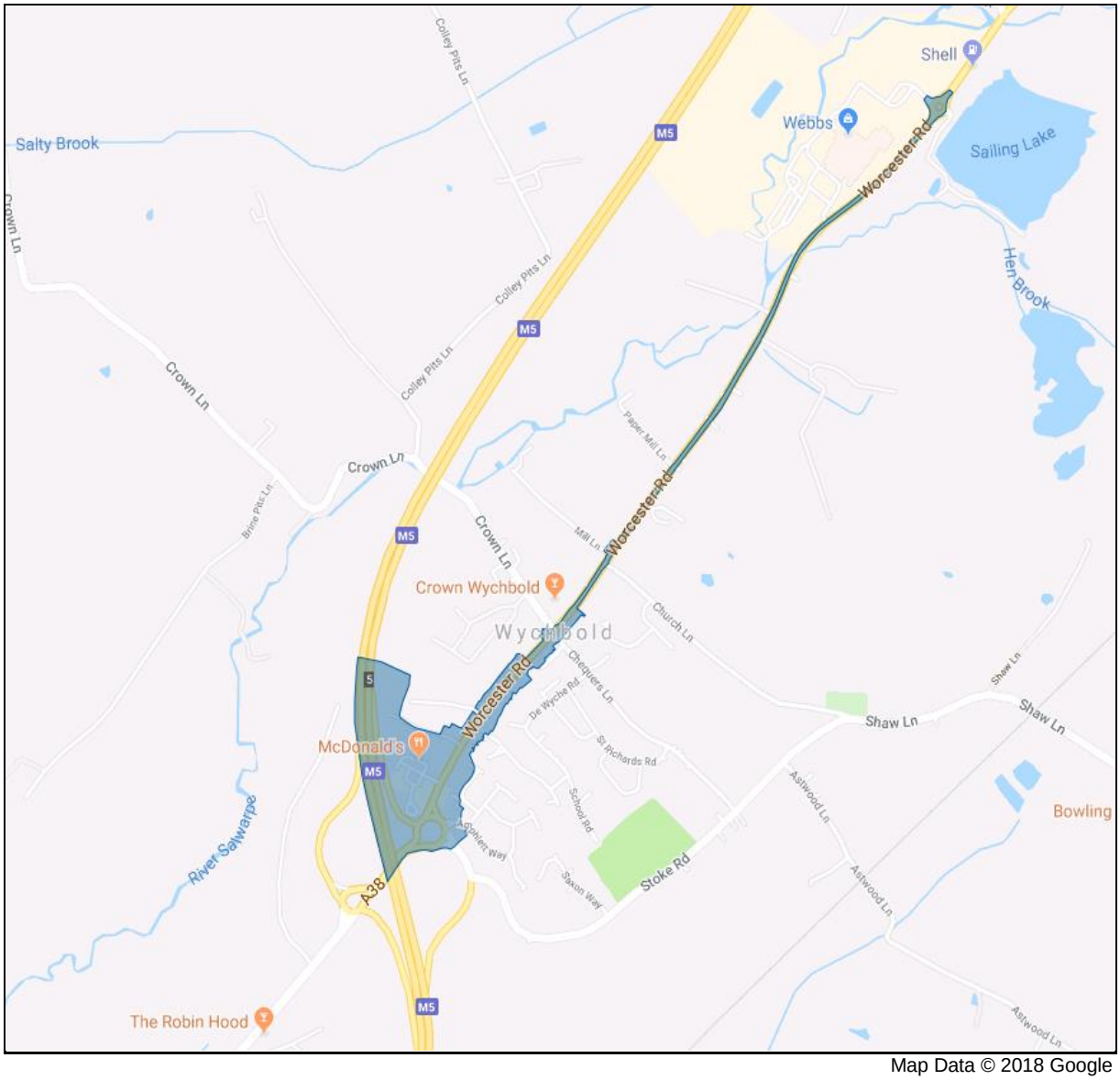
3.0 Declaration

Previous rounds of Local Authority Review and Assessment between 2012 and 2016 have highlighted exceedances of the nitrogen dioxide annual mean objective at Worcester Road, Wychbold. In 2017 a detailed review, including a detailed dispersion modelling exercise, was completed and confirmed that an Air Quality Management Area (AQMA) is required and determined the necessary minimum geographical extent of the AQMA. Further details can be found in the WRS Worcester Road, Wychbold Dispersion Modelling Assessment 2016 (October 2017, WDC/WORCSRD/DA/2017) available to view online at http://www.worcsregservices.gov.uk/media/3332953/Worcester-Rd-Wychbold-Dispersion-Modelling-Assessment-October-2017-FINAL.pdf

On 1st May 2018 Wychavon District Council declared an AQMA at Worcester Road, Wychbold. A plan of the proposed AQMA is provided below. The geographical area is based on predicted exceedances of the nitrogen dioxide annual mean objective and areas considered to be relevant in terms of the management of an AQMA i.e. the surrounding strategic road network.

The report details the first step in the process of developing an Action Plan for improving nitrogen dioxide levels within the AQMA. It identifies and aims to quantify the emission sources which contribute to the exceedance of the nitrogen dioxide annual mean objective in the area.

Figure 1 Worcester Road, Wychbold AQMA



Map Data © 2018 Google

4.0 Methodology and Input Data

This source apportionment assessment has been undertaken generally following the process outlined in Technical Guidance (LAQM.TG16). LAQM.TG16 (paragraph 7.100) advised that "source apportionment may be undertaken using a simple spreadsheet approach. For example, where road traffic emissions are the principal concern, the percentage contribution to NOX emissions may be calculated using the appropriate emissions factors".

Source apportionment has not been carried out using detailed dispersion modelling undertaken in 2017 in relation to the declaration of the AQMA. During the 2016 dispersion modelling assessment all reasonable steps were taken to minimise model uncertainty however an average error of approximately 6µg/m^3 persisted in the results. At the time advice in relation to this error was sought from Ricardo who advised that, given the magnitude of the concentrations modelled at receptors the error was not sufficient to materially change the conclusions of that work; that is that an AQMA was warranted and should be declared based on the modelling. However, Ricardo advised that the model should be revisited during any action planning process in order to narrow down the compliance gap as much as possible. In light of this it was decided to carry out source apportionment following the simple spreadsheet approach outlined in LAQM.TG16 in the interests of working towards the submission of an Air Quality Action Plan within 12 months of the declaration of the AQMA.

4.1 Emission Factor Toolkit

Source apportionment was undertaken using the most recent version of DEFRA's Emission Factor Toolkit (EfT v.8.0.1).

4.2 Traffic Data

Traffic Count Data

A 12 hour road traffic count was undertaken by Worcestershire County Council within the AQMA on the A38 Worcester Road on 15th February 2018. The traffic count data were scaled to 24hours using DfT Table TRA037. The traffic data and scaling calculations are provided in Appendix B.

Speed Data

Speed data for the A38 Worcester Road were derived from a basic speed survey carried out by Worcestershire Regulatory Services on Wednesday 25th January 2017. The survey was carried out using Android App "Speedometer GPS" which uses the inbuilt GPS of the smart phone to monitor and record journey statistics, including speed. These data are then displayed on a Google base map. The data are stored and can be reviewed at a later date. There is no function to export the data from the app and as such it is not possible to reproduce it in full as part of this report. However a summary of the information gathered is provided in Appendix B.

The surveys were undertaken during peak times between 0730 and 0930 and then again between 1630 and 1800. North bound and south bound speeds for specific points were extracted from the dataset. These were then averaged across the morning and evening peak time runs to give a single averaged speed for the area.

Bus Fleet Data

Worcestershire County Council provided WRS with local bus fleet composition for First Group and AT Group who, between them, operate the public bus services running along the A38 through Wychbold. The generalised Euro code compositions assumed in the EfT were amended to reflect the local fleet composition in order to provide a more accurate EfT output. A copy of the current bus fleet composition information is provided in Appendix B.

4.3 Diffusion Tube Data

Wychavon District Council monitors annual mean nitrogen dioxide concentrations using passive diffusion tubes located across the District. In 2016 there were six diffusion tube monitoring locations within the AQMA area. A plan showing the locations of diffusion tube monitoring locations is included in Appendix A.

LAQM.TG16 advises that as diffusion tubes are no the reference method for monitoring nitrogen dioxide, and passive diffusion typically results in a low accuracy, it is necessary to bias-adjust the results based upon local or national co-location studies with chemiluminescent analysers.

A bias-adjustment factor of 0.89 was applied to diffusion tubes for 2016. This was derived from a local co-location study undertaken in Wychbold between March and September 2016. The local bias-adjustment factor correlates with the National Diffusion Tube Bias Adjustment Factor Spreadsheet 09/16 which report 0.90.

It should be noted that 2016 diffusion tube data has been used in this source apportionment assessment. This decision was taken following the publication of very low national bias-adjustment factors for 2017. A 2017 national bias-adjustment factor of 0.77 was published for Somerset Scientific Services. It was noted that lower than usual bias-adjustment factors were published across the board in 2017. When this low bias-adjustment factor was applied to 2017 diffusion tube results the results dropped significantly in comparison with previous years. WRS made enquiries with the LAQM Helpdesk and directly with the National Physics Laboratory to further understand the drop in national bias-adjustment factors but were unable to obtain any satisfactory explanation. As a result WRS consider that the 2017 bias-adjusted diffusion tube results are not representative of the situation in Wychbold and as such this source apportionment assessment is based on the 2016 bias-adjusted diffusion tube results to ensure that the outcome of the assessment is as robust and relevant as possible. The 2016 results are reproduced in Table 2 below.

It should be noted that the diffusion tube monitoring network within the Wychbold AQMA has been expanded in 2017 and 2018.

Table 2 Annual mean nitrogen dioxide concentrations measured at diffusion tube locations along Worcester Road, Wychbold (µg/m^3)

Site	Description	2016[abc]
EPS27/28/29	Lamppost on roundabout, Worcester Road	30.1
EPS56	Façade of post office, Worcester Road	**45.57**
EPS58	Road sign outside 2 Rose Villas, Worcester Road	**46.4**
EPS59	Lamppost outside Weathervale, Worcester Road, Wychbold	37.1
WMD1	Lamppost at Walkmill Drive/Worcester Road junction	38
WyAQ1/2/3	Triplicate with automatic monitor lamppost outside Rose Dene, Worcester Road	36.3
Objective	40	

[a] *bias-adjusted using 2016 local factor 0.89*
[b] *annualised in accordance with DEFRA TG16*
[c] *calculated back to relevant exposure in accordance with DEFRA TG16*

5.0 Background and Local Contributions

Technical guidance (LAQM.TG16) advises that determining "…the apportionment for NO_2 is not straightforward due to the non-linear relationship between emissions of NO_2 and nitrous oxides (NO_X). This is additionally complicated by the different proportions of NO_2 in the NO_X emission for different sources, for example, petrol cars or diesel cars. The following advise therefore applies to NO_2 source apportionment:

- Background contributions: the national maps will give the total background NO_2 concentration. This should be apportioned to regional and local background using the ration of the background NO_X concentrations attributable to these two sources, which are also available in the national maps; and

- Local contributions: the local contribution to NO_2 is the difference between the total (measured or modelled) NO_2 and the total background NO_2. This is then apportioned to the local sources, for example, buses, HGVs, taxis, cars, using the relative contributions of these sources to the local NO_X concentration"

Regional and total background concentrations of NO_X and NO_2 for 2016, available from the DEFRA website, have been used to calculate the contribution of local NO_2 for the monitoring location with the highest measured level of NO_2 in 2016 (EPS58) following the procedure laid out in LAQM.TG16 Box 7.5. The local contribution has then been apportioned to each vehicle class according to the results of the EfT. Calculations are presented in Appendix C. The results are summarised in Tables 3 and 4 below.

Table 3 Measured NO_2 concentrations & contribution of each main source type

Annual Mean Concentration (µg/m^3)								
Site ID	Regional Background	Local Background	Cars	LGVs	HGVs	Buses	Motorcycles	Total
EPS58	17.12	2.06	13.77	7.11	4.28	2.04	0.03	46.41
% Contribution to Total								
Site ID	Regional Background	Local Background	Cars	LGVs	HGVs	Buses	Motorcycles	Total
EPS58	36.87	4.44	29.70	15.32	9.21	4.40	0.06	100.00

Background split determined following technical guidance in Defra (Oct 2016) 'Background Concentration Maps User Guide':

(1) Regional background includes emissions from sources not in LA control e.g. Motorways outside of study area, Industrial sources, Domestic properties, Railways, Rural sources, Others

(2) Local background includes emissions from sources LA have some influence over e.g. Primary A roads, Minor Roads and Point sources in and outside of study area

Table 3 above demonstrates that the main contributors to emissions within the Wychbold AQMA are regional background at 36.87% and diesel car emissions at 25.88%, followed by LGVs at 15.32% and HGVs at 9.21%.

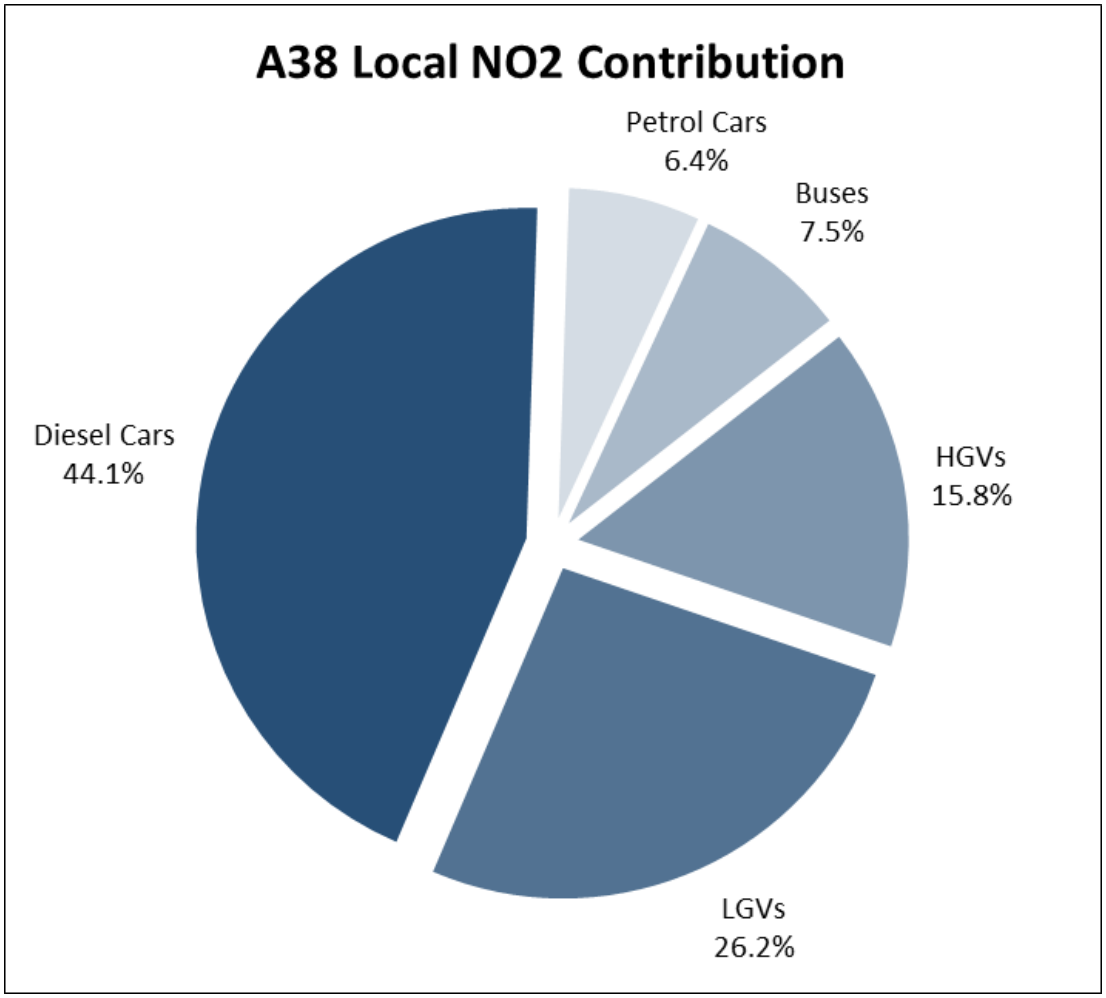
As the local authority is largely unable to influence regional background levels it is more useful to consider the source apportionment of the local traffic sources in isolation when developing actions for improving air quality. Table 4 below illustrates the local traffic contribution, excluding background concentrations, broken down into vehicle type.

Table 4 Concentrations & percentage contribution of emissions to local traffic sources

Annual Mean Concentration (µg/m^3)								
Site ID	Cars			LGVs		HGVs	Buses	Motorcycles	Total
	Petrol	Diesel	Other	Petrol	Diesel				
EPS58	1.74	11.95	0.08	0.03	7.08	4.28	2.04	0.03	27.23
% Contribution to Total									
Site ID	Cars			LGVs		HGVs	Buses	Motorcycles	Total
	Petrol	Diesel	Other	Petrol	Diesel				
EPS58	6.40	43.90	0.30	0.10	26.00	15.70	7.50	0.10	100.00

Table 4 illustrates that three main contributors to emissions within the AQMA are diesel cars (contributing 43.9%), diesel LGVs (contributing 26.0%) and HGVs (contributing 15.7%). Figure 2 below provides a graphical representation of the contribution of each vehicle category to local NO2 concentrations.

Figure 2 Contribution to Local NO2 emissions A38



6.0 Required Improvements

The improvement required to in order to achieve the annual mean objective for NO2 is represented by the difference between the highest measured or predicted concentration and the objective level (40µg/m^3).

Technical Guidance (LAQM.TG16) advises that it is most useful to consider required reductions in terms of nitrogen oxides (NOX). Therefore the road NOX reduction required for the objective to be achieved has been calculated in accordance with LAQM.TG16 Box 7.6 using DEFRAs NOX to NO2 Conversion Spreadsheet v6.1. The calculations are included as Appendix C.

It is generally accepted that the revocation of an AQMA is not appropriate unless measured concentrations are consistently below the objective to avoid 'bouncing' between revocation and re-declaration of borderline AQMAs. Therefore, the reduction in NOX required to achieve targets at 5% and 10% below the objective have also been calculated. Achieving these levels would provide greater confidence to the local authority that emissions of NO2 are unlikely to exceed the objective again. A summary of the required reductions in NOX and NO2 to achieve concentrations of 36µg/m^3, 38µg/m^3 and 40µg/m^3 at the worst-case receptor location (EPS58) is presented in Table 5 below.

Table 5 Required reduction in annual mean concentration at worst-case receptor EPS58

Required reduction in NO_X/NO_2 concentrations at worst-case receptor EPS58			
	Required NO_X reduction (µg/m^3)	Required NO_X reduction (% of local sources)	Equivalent NO2 reduction (µg/m^3)
Required reduction to Objective 40µg/m^3	15.21	25.98	7.08
Required reduction to 5% below Objective 38µg/m^3	19.76	33.75	9.19
Required reduction to 10% below Objective 36µg/m^3	24.22	41.37	11.27

Table 5 indicates that a reduction of 25.98% in emissions, or 7.08µg/m^3 is required to reduced levels of NO2 to the Objective level.

This report does not focus on how required reductions might be achieved. However, in order to inform the focus of potential measures for consideration as part of Action

Plan development Table 6 below demonstrates the reduction in emissions that could be expected to be achieved assuming stepped nominal emission reductions for each main vehicle category.

Table 6 Nominal Emissions Reduction per Vehicle Type

Reduction in Emissions (µg/m3)							
Vehicle Type	**25% reduction**	**30% reduction**	**35% reduction**	**40% reduction**	**45% reduction**	**50% reduction**	**55% reduction**
Cars	3.44	4.13	4.82	5.51	6.2	6.89	**7.58**
LGVs	1.78	2.13	2.49	2.84	3.2	3.55	3.91
HGVs	1.07	1.28	1.5	1.71	1.92	2.14	2.35
Buses	0.51	0.61	0.71	82	0.92	1.02	1.12
Total Vehicles	6.81	**8.17**	**9.53**	**10.89**	**12.25**	**13.62**	**14.98**

NB: Figures in **bold** indicate reductions that would achieve Objective

When compared with the equivalent NO2 reduction required demonstrated in Table 5, the results highlight that targeting individual types of vehicle using the A38 in isolation would not lead to the annual mean objective being achieve unless the reductions are very large. In reality actions to improve emissions are likely to target more than one type of vehicle. Table 6 illustrates that:

- Reducing total emissions from all vehicle types by between 25% and 30%, or targeting a combination of 35% cars and LGVs, would be potentially effective measures for achieving the Objective.
- Reducing total emissions from all vehicle types by around 35%, or targeting a combination of around 45% cars and LGVs, would be potentially effective for achieving concentrations 5% below the Objective.
- Reducing total emissions from all vehicles by between 40% and 45%, or targeting a combination of around 55% cars and LGVs, would be potentially effective measures for achieving concentrations 10% below the Objective.

7.0 Summary and Conclusions

Wychavon District Council declared the Worcester Road, Wychbold AQMA on 1st May 2018 following measured and modelling exceedances of the nitrogen dioxide annual mean objective.

Source apportionment of background and local sources has been undertaken to inform the development on an Air Quality Action Plan. The source apportionment exercise has been undertaken following guidance laid out in LAQM Technical Guidance 16.

The outcome of the source apportionment exercise shows that background concentration contributes a significant proportion of the overall concentration of NO2 measured within the AQMA (36.87%). Cars, which make up the largest proportion of traffic volume (81%) contribute approximately 50% of local traffic emissions iwthin the AQMA with diesel cars in particular responsible for a large proportion (approximately 44%). LGVs contribute approximately 26% of local traffic emission and HGVs approximately 16%.

Targeting individual types of vehicles on the A38 in isolation would not lead to the annual mean objective being achieved unless the reductions are very large, for example an approximately reduction of 55% in emissions from cars would be required. However a reduction in total vehicle emissions of approximately 25% to 30% would potentially be effective in achieving the annual mean objective.

Appendix A – AQMA & diffusion tube location plans

Figure A1: Worcester Road, Wychbold AQMA plan

Figure A2: 2016 diffusion tube location plan

Map Data © 2018 Google

Appendix B – EFT data inputs & outputs

Table B1: Traffic count data A38 Worcester Road, Wychbold

Hour Commencing		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Vehicles	caling fact	Scaled to	As % (for EFT)
Motor	To	0	5	1	2	0	1	1	6	3	5	3	3	1	0	0	0	31	1.28	40	
Cycles	From	0	3	0	1	0	1	0	6	2	2	1	3	3	0	0	0	22	1.28	28	
	Both	0	8	1	3	0	2	1	12	5	7	4	6	4	0	0	0	53	1.28	68	0.35
	To	0	567	587	426	336	353	401	526	607	597	754	1093	605	0	0	0	6852	1.28	8771	
Cars	From	0	602	592	478	388	365	386	430	391	393	517	547	393	0	0	0	5482	1.28	7017	
	Both	0	1169	1179	904	724	718	787	956	998	990	1271	1640	998	0	0	0	12334	1.28	15788	81.03
	To	0	7	5	7	6	4	6	7	5	4	7	5	3	0	0	0	66	1.28	84	
Buses	From	0	8	9	10	5	5	8	6	9	7	7	7	4	0	0	0	85	1.28	109	
	Both	0	15	14	17	11	9	14	13	14	11	14	12	7	0	0	0	151	1.28	193	0.99
Light	To	0	93	96	101	86	84	81	85	101	107	126	103	70	0	0	0	1133	1.28	1450	
Goods	From	0	104	94	90	62	48	43	50	47	71	77	57	48	0	0	0	791	1.28	1012	
Vehicles	Both	0	197	190	191	148	132	124	135	148	178	203	160	118	0	0	0	1924	1.28	2463	12.64
Smaller	To	0	5	4	7	4	6	4	10	8	8	9	9	4	0	0	0	78	1.28	100	
2-Axle	From	0	9	8	10	8	8	4	5	6	6	5	4	4	0	0	0	77	1.28	99	
Lorries	Both	0	14	12	17	12	14	8	15	14	14	14	13	8	0	0	0	155	1.28	198	1.02
Bigger	To	0	7	12	7	5	7	6	5	4	4	4	3	3	0	0	0	67	1.28	86	
2-Axle	From	0	6	11	14	9	9	5	6	5	4	5	3	1	0	0	0	78	1.28	100	
Lorries	Both	0	13	23	21	14	16	11	11	9	8	9	6	4	0	0	0	145	1.28	186	0.95
3-Axle	To	0	4	2	2	1	1	2	3	2	4	2	2	3	0	0	0	28	1.28	36	
Rigid/Artic	From	0	2	2	4	2	1	1	3	3	3	1	2	1	0	0	0	25	1.28	32	
	Both	0	6	4	6	3	2	3	6	5	7	3	4	4	0	0	0	53	1.28	68	0.35
4 Axles or	To	0	14	16	12	19	18	16	19	21	11	14	17	15	0	0	0	192	1.28	246	
more	From	0	28	18	22	26	17	21	21	14	15	12	14	7	0	0	0	215	1.28	275	
Rigid/Artic	Both	0	42	34	34	45	35	37	40	35	26	26	31	22	0	0	0	407	1.28	521	2.67
	NB	**0**	**702**	**723**	**564**	**457**	**474**	**517**	**661**	**751**	**740**	**919**	**1235**	**704**	**0**	**0**	**0**	8447	1.28	10812	100.00
Totals	**SB**	**0**	**762**	**734**	**629**	**500**	**454**	**468**	**527**	**477**	**501**	**625**	**637**	**461**	**0**	**0**	**0**	6775	1.28	8672	
	Both	**0**	**1464**	**1457**	**1193**	**957**	**928**	**985**	**1188**	**1228**	**1241**	**1544**	**1872**	**1165**	**0**	**0**	**0**	15222	1.28	19484	

Table B2: Bus fleet composition information

Bus Group/Company	Number of vehicles on route	Vehicle Type	Euro Class
First Group	12	Volvo-B7RLE	V
AT Group	3	Optare Metro City	V

Table B3: Traffic speed data

Location	Average speed across the day (km/h)
Exiting M5 roundabout	29
McDonalds junction	34
Walkmill Drive junction	46
New development turn	50
Opposite Wychbold Garage	50
Crown Lane junction	42
Crown Public House bus stop	51
BP Garage	55
Mill Lane junction	57
Paper Mill Lane junction	65
Average	**47.9**

Table B4: Emission Factor Toolkit v8.01 Input

Select Pollutants		Select Outputs		Additional Outputs	Advanced Options		Click the button to:
☑ NOx	☐ CO2	☐ Air Quality Modelling (g/km/s)		☐ Breakdown by Vehicle	☑ Euro Compositions	☐ NOx Annual Emissions Euro Split	Run EFT
☐ PM10	☐ PM2.5	☑ Emissions Rates (g/km)		☑ Source Apportionment	☐ Output % Contributions from Euro Classes	☐ PM10 Annual Emissions Euro Split	Clear Input Data
		☑ Annual Link Emissions		☐ PM by Source	☐ Primary NO2 Fraction	☐ PM2.5 Annual Emissions Euro Split	

Please Select from the Following Options:	
Area	England (not London)
Year	2018
Traffic Format	Detailed Option 2
Select 'Basic Split' or 'Detailed Option 1 to 3' or 'Alternative Technologies' above	

Export Outputs

☐ Save Output to New Workbook

File Name: Worcester Road, Wychbold 2018

SourceID	Road Type	Traffic Flow	% Car	% Taxi (black cab)	% LGV	% Rigid HGV	% Artic HGV	% Bus and Coach	% Motorcycle	Speed(kph)	No of Hours	Link Length (km)
A38 Worcs Rd	Urban (not London)	19511	81.03	0	12.64	1.97	3.02	0.99	0.35	48	24	1

Table B5: Emission Factor Toolkit v8.01 Output

Source Name	Pollutant Name	All Vehicles (g/km)	All LDVs (g/km)	All HDVs (g/km)	All LDVs (%)	All HDVs (%)	Petrol Cars (%)	Diesel Cars (%)	Taxis (%)	Petrol LGVs (%)	Diesel LGVs (%)	Rigid HGVs (%)	Artic HGVs (%)	Buses/Coaches (%)	Motorcycles (%)
A38 Worcs Rd	NOx	7,776.66864	5,969.99186	1,806.67678	76.8%	23.2%	6.4%	43.9%	-	0.1%	26.0%	7.3%	8.4%	7.5%	0.1%

Full Hybrid Petrol Cars (%)	Plug-In Hybrid Petrol Cars (%)	Full Hybrid Diesel Cars (%)	Battery EV Cars (%)	FCEV Cars (%)	E85 Bioethanol Cars (%)	LPG Cars (%)	Full Hybrid Petrol LGVs (%)	Plug-In Hybrid Petrol LGVs (%)
0.1%	0.0%	0.2%	-	-	-	-	-	-

Battery EV LGVs (%)	FCEV LGVs (%)	E85 Bioethanol LGVs (%)	LPG LGVs (%)	B100 Rigid HGVs (%)	B100 Artic HGVs (%)	B100 Buses (%)	CNG Buses (%)	Biomethane Buses (%)	Biogas Buses (%)	Hybrid Buses (%)	FCEV Buses (%)
-	-	-	-	-	-	-	0.0%	-	-	0.0%	-

B100 Coaches (%)	All Vehicles (Annual Emissions (kg/yr except CO2 tonnes/yr))	All LDVs (Annual Emissions (kg/yr except CO2 tonnes/yr))	All HDVs (Annual Emissions (kg/yr except CO2 tonnes/yr))
-	2,838.48406	2,179.04703	659.43703

Appendix C – Source Apportionment calculations

Table C1: The local contribution apportioned to vehicle class at EPS58 (calculated in accordance with LAQM.TG16 Box 7.5)

Box 7.5 calculation	Local Source (%)	NO2 (ug/m3)	Total %
T-NO2 (total monitored nitrogen dioxide)		46.40	
TB-NO2 (total background nitrogen dioxide[1])		19.17	
TB-Nox (total background nitrous oxides[1])		26.89	
RB-Nox (regional background nitrous oxides[1])		24.00	
Step 1: LB-NOx[2] = TB-NOx – RB-NOx		2.89	
Step2: RB-NO2[3] = TB-NO2 × (RB-NOx / TB-NOx)		**17.11**	36.87%
Step2: LB-NO2[4] = TB-NO2 × (LB-NOx / TB-NOx)		**2.06**	4.44%
Step3: L-NO2[5] = T-NO2 – TB-NO2		**27.23**	
Step4: % of vehicles from EfT			
Petrol Cars (%)	6.40%	1.74	
Diesel Cars (%)	43.90%	11.95	
Full Hybrid Petrol Cars (%)	0.10%	0.03	
Full Hybrid Diesel Cars (%)	0.20%	0.05	
Total cars	**50.60%**	**13.78**	**29.70%**
Petrol LGVs (%)	0.10%	0.03	
Diesel LGVs (%)	26.00%	7.08	
Total LGVs	**26.10%**	**7.11**	**15.32%**
Rigid HGVs (%)	7.30%	1.99	
Artic HGVs (%)	8.40%	2.29	
Total HGVs	**15.70%**	**4.28**	**9.21%**
Buses/Coaches (%)	7.50%	2.04	
CNG Buses (%)	0.00%	0.00	
Hybrid Buses (%)	0.00%	0.00	
Total Buses	**7.50%**	**2.04**	**4.40%**
Motorcycles (%)	**0.10%**	**0.03**	**0.06%**
	100.00%	27.23	100.00%

1. Data from DEFRA 2015 Background Maps for model year of 2016 for relevant local coordinates
2. Local Background nitrous oxides
3. Regional Background nitrogen dioxide contribution
4. Local Background nitrogen dioxide contribution
5. Local sources nitrogen dioxide contribution

Table C2: Defra's NOX to NO2 Conversion Spreadsheet v6.1 for LAQM.TG16 Box7.6 calculation for EPS58.

Local Authority:		Wychavon			Year: Traffic Mix:	
Site ID	Diffusion tube NO_2, µg m^{-3} µg m^{-3}	Background µg m^{-3}		Road NO_x, µg m^{-3}	Fraction emitted as NO_2 (fNO2)	Notes
		NO_x	NO_2			
EPS58	46.4		19.1698	58.54		
Limit	40		19.1698	43.33		
Minus 5%	38		19.1698	38.78		
Minus 10%	36		19.1698	34.32		

References

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

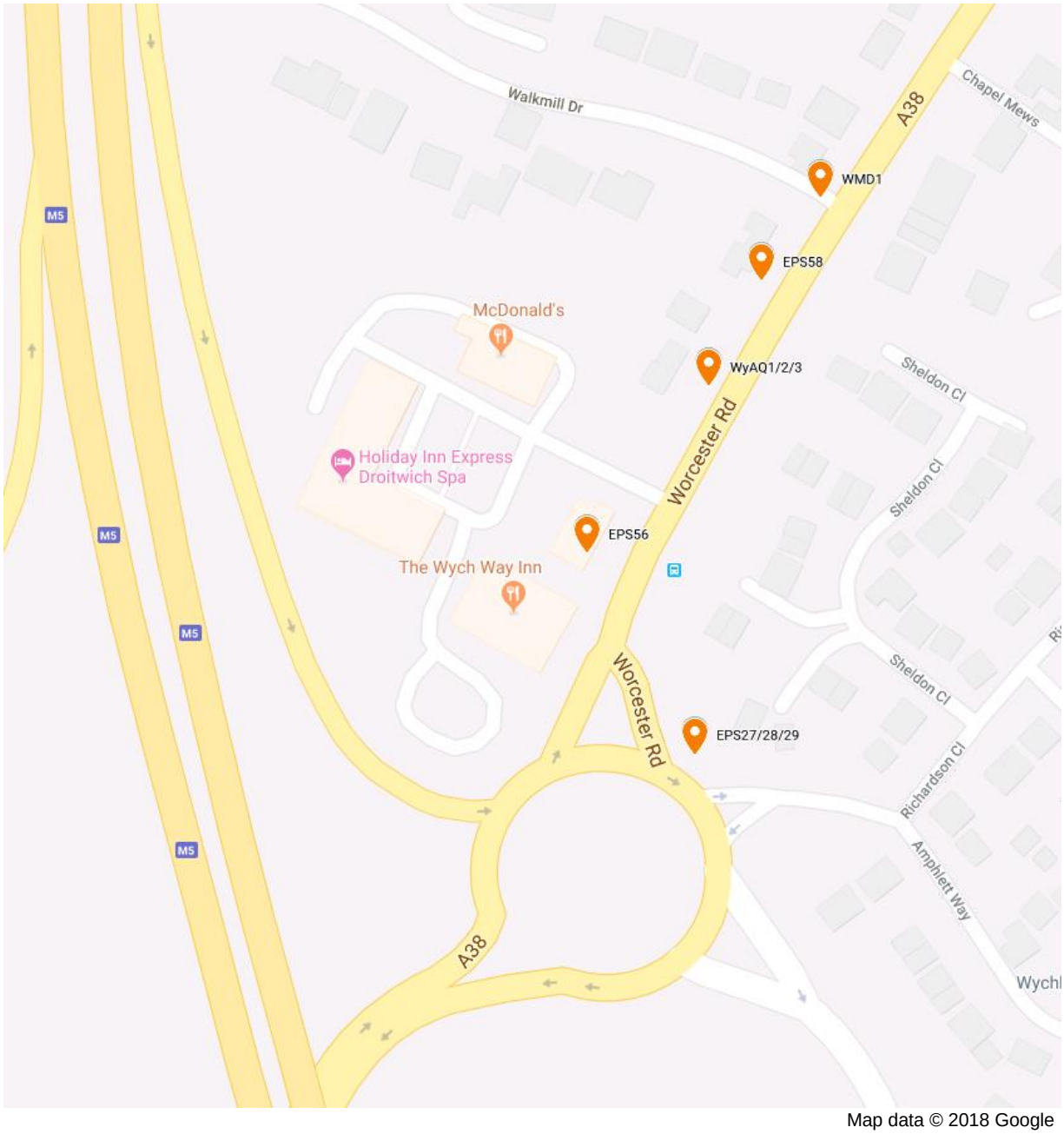
Defra (Oct 2016) Background Concentration Maps User Guide

Worcestershire Regulatory Services (2017) Worcester Road, Wychbold Dispersion Modelling Assessment 2016

Worcestershire Regulatory Services (2018) 2017 Air Quality Annual Status Report

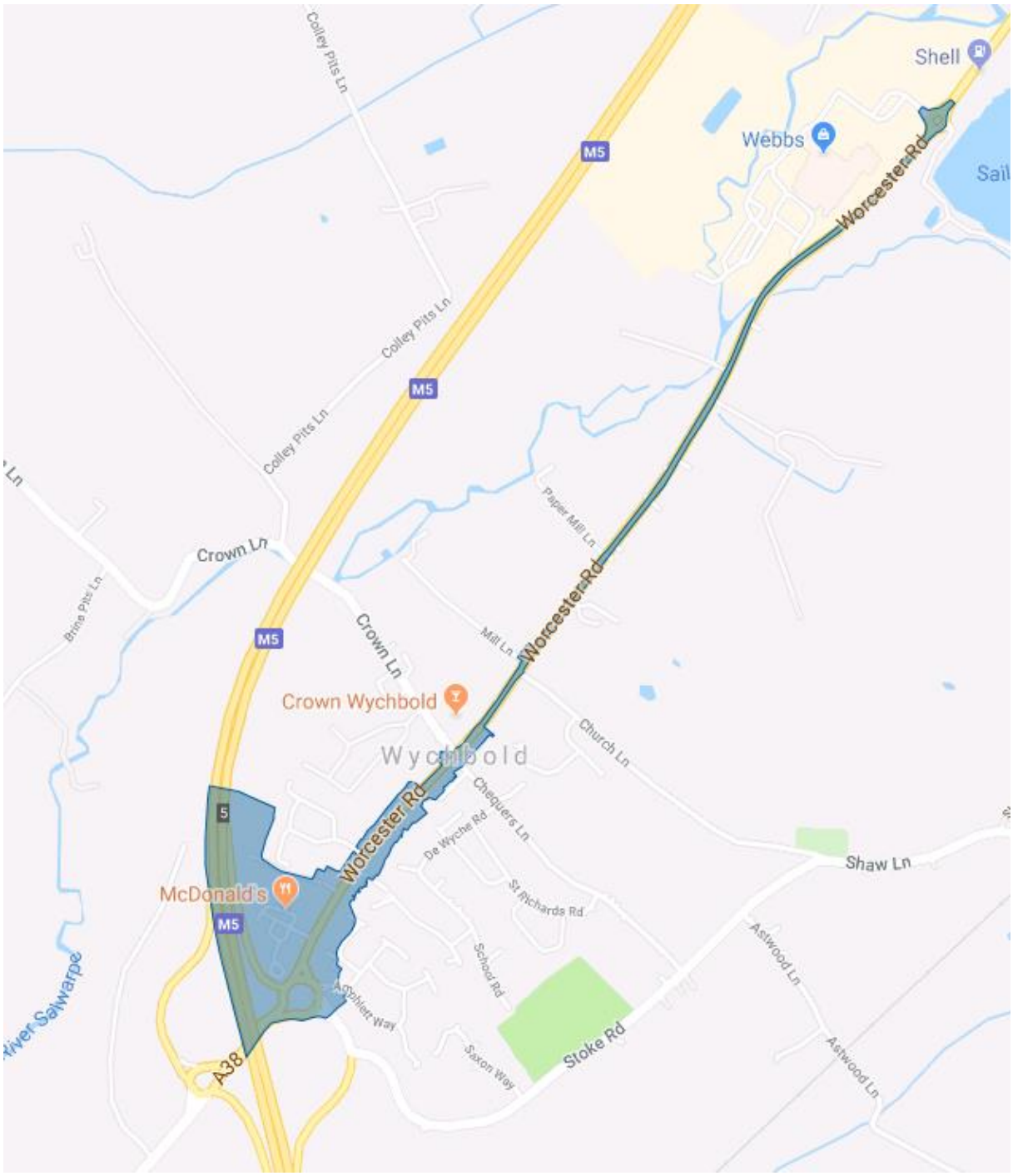
Appendix D: Map(s) of Monitoring Locations and AQMAs

Worcester Road, Wychbold AQMA Monitoring Locations

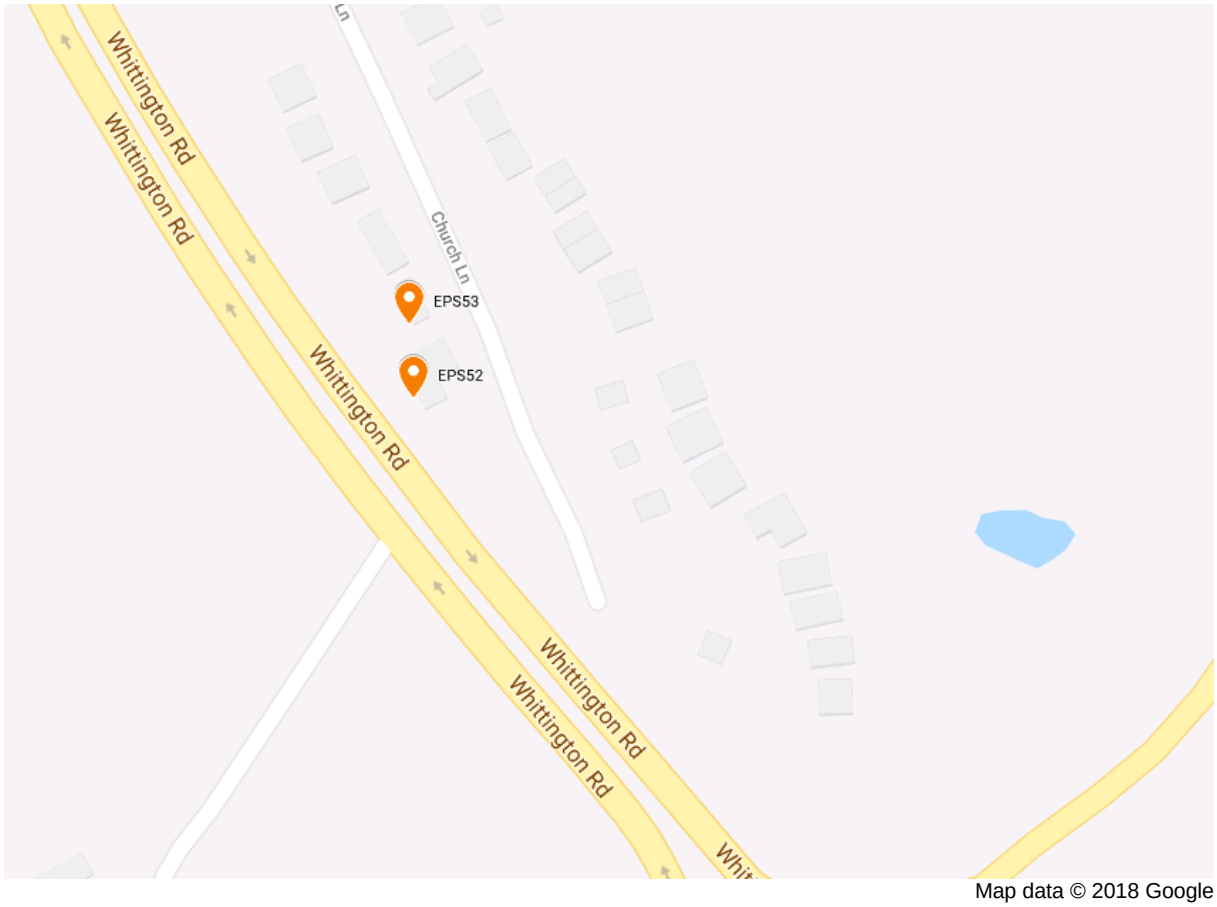


Map data © 2018 Google

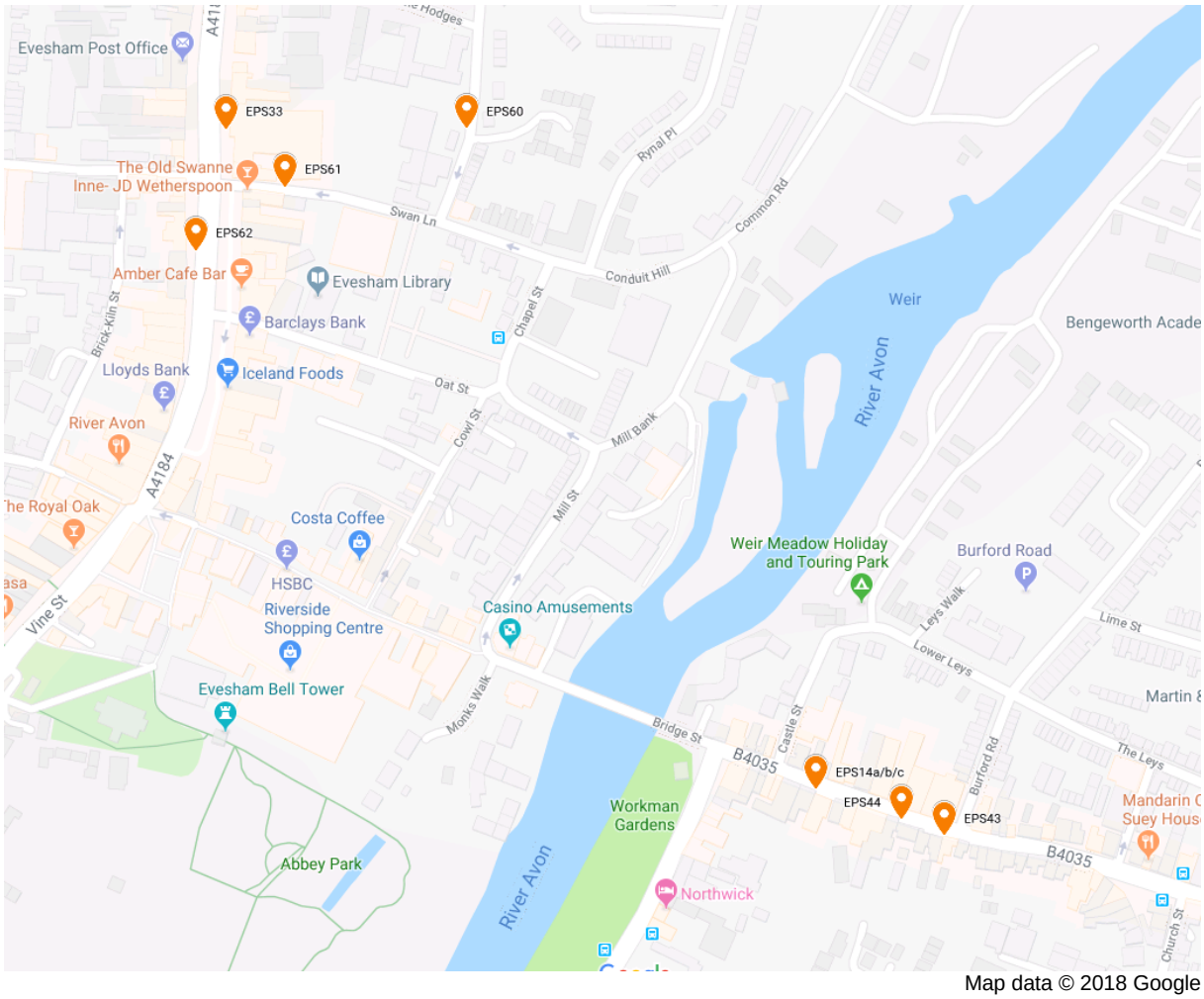
Worcester Road, Wychbold AQMA (declared 1st May 2018)



Whittington Monitoring Locations

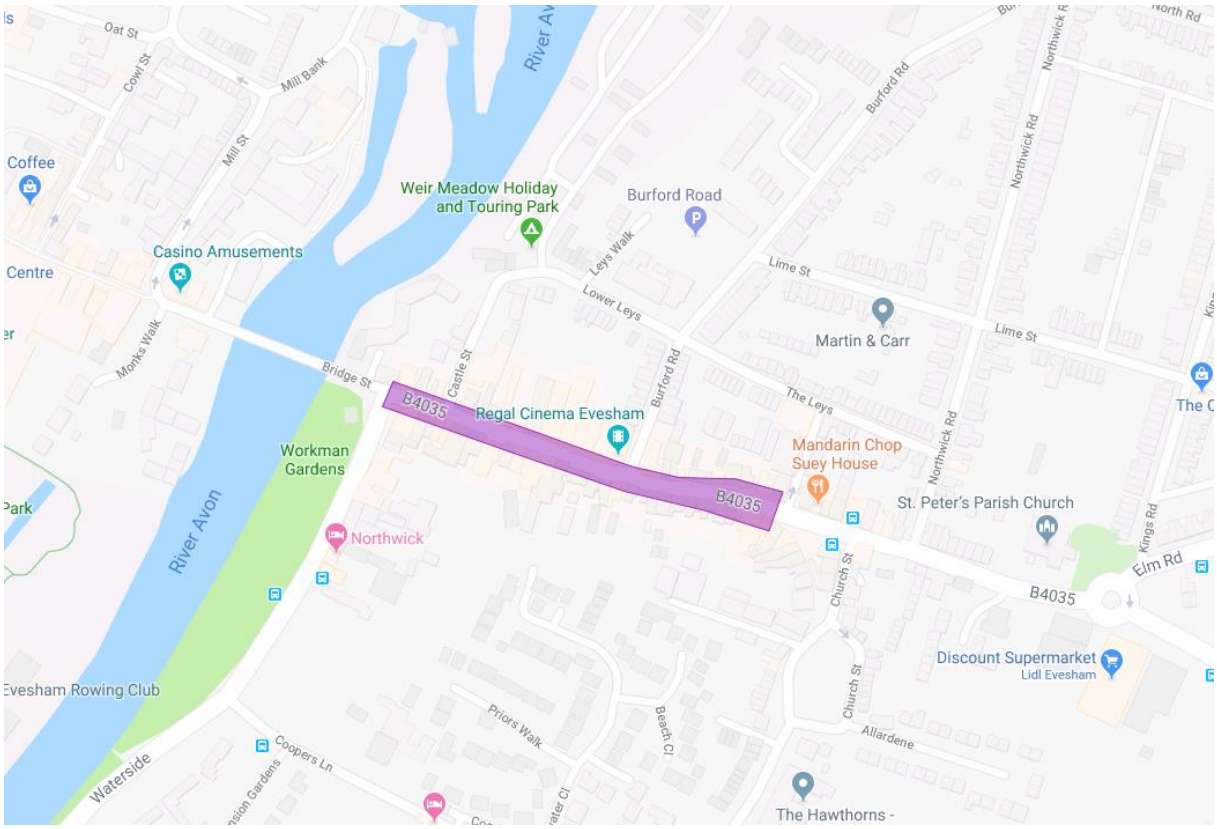


Evesham Monitoring Locations

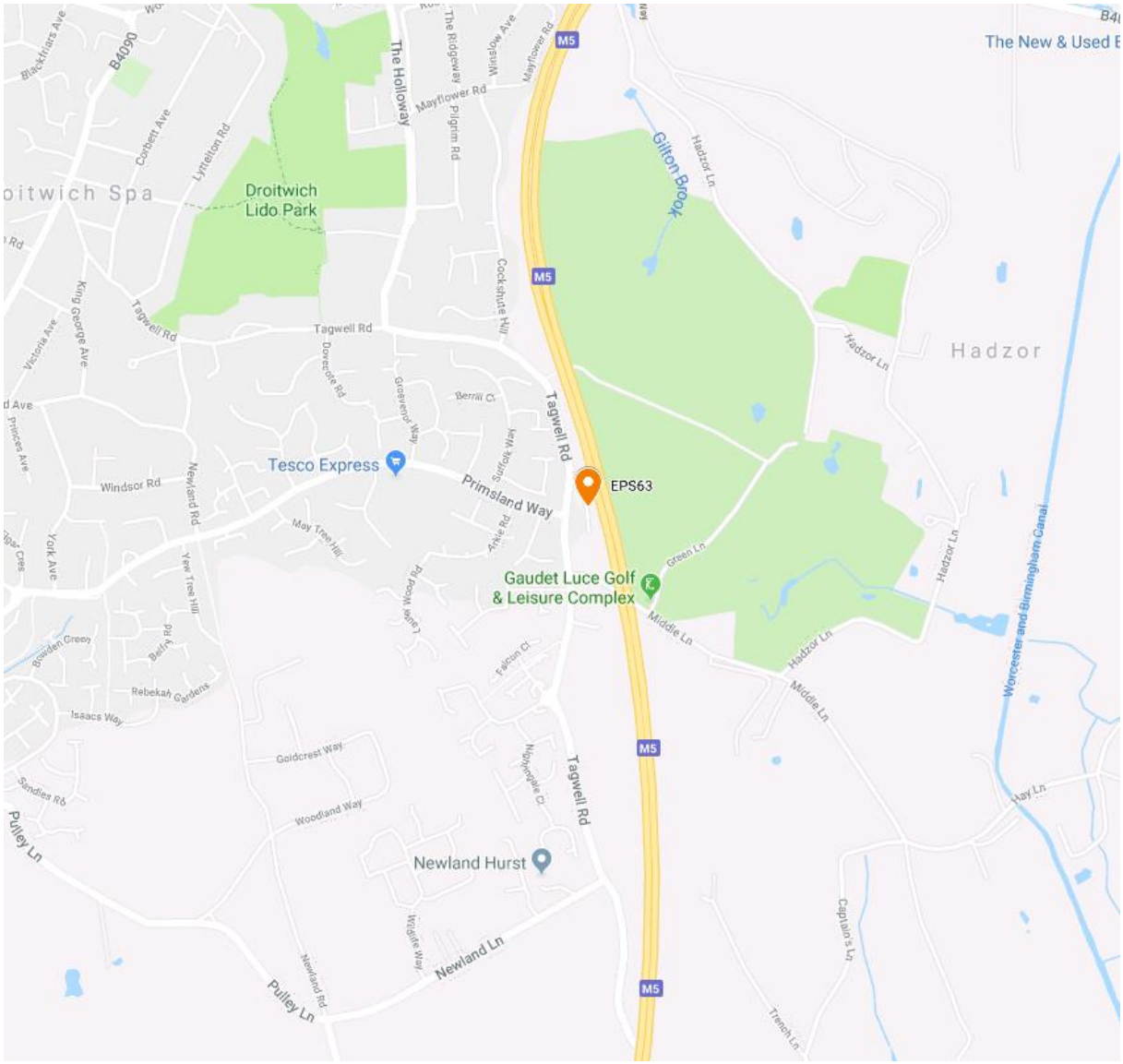


Map data © 2018 Google

Former Port Street, Evesham AQMA (revoked 1st May 2018)



Droitwich Monitoring Locations



Map data © 2018 Google

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
ASR	Air quality Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by Highways England
EU	European Union
FDMS	Filter Dynamics Measurement System
LAQM	Local Air Quality Management
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
PM_{10}	Airborne particulate matter with an aerodynamic diameter of 10µm (micrometres or microns) or less
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
QA/QC	Quality Assurance and Quality Control
SO_2	Sulphur Dioxide

References

DEFRA (2016) ‘Local Air Quality Management Policy Guidance LAQM PG.(16)’

DEFRA (2016) ‘Local Air Quality Management Technical Guidance LAQM TG.(16)’

Worcestershire Regulatory Services (2013) ‘Air Quality Action Plan for Worcestershire’

Worcestershire Regulatory Services (2015) ‘Air Quality Action Plan Progress Report for Worcestershire April 2013-April 2015’

Worcestershire Regulatory Services (2016) ‘Air Quality Action Plan Progress Report for Worcestershire April 2015 – March 2016’

Worcestershire Regulatory Services (2016) ‘2016 Annual Air Quality Status Report’ WDC/ASR/2016

Worcestershire Regulatory Services (2017) ‘Worcester Road, Wychbold Dispersion Modelling Assessment 2016’ WDC/WORCSRD/DA/2017

Worcestershire Regulatory Services (2017) ‘Port Street, Evesham AQMA Revocation Screening Assessment’ WDC/PORTST/REV/2017

Worcestershire Regulatory Services (2018) ‘2017 Annual Air Quality Status Report’ WDC/ASR/2017