2024 Air Quality Annual Status Report (ASR)

In fulfilment of Part IV of the Environment Act 1995 Local Air Quality Management, as amended by the Environment Act 2021

Date: June 2024

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Date	June 2024

Executive Summary: Air Quality in Our Area

Air Quality in Malvern Hills District Council Area

The Malvern Hills District generally experiences good levels of air quality. There have been no Air Quality Management Areas (AQMAs) declared in this district since the review and assessment process commenced. There have been no exceedances of the air quality objective for Nitrogen Dioxide (NO_2) recorded at any locations, where monitoring has been undertaken for a full 12 months, since monitoring began.

The site locations are regularly assessed and selected to represent the most likely worst-case conditions (with a background control area for contrast). The results show that the level of pollution in Malvern Hills district has generally been significantly below the national objective.

During 2023, concentrations of NO_2 were monitored at 8 locations across the Malvern District. The highest recorded mean concentrations were 26.1µg/m^3 at M11 (in Powick), 26.0µg/m^3 at UP1 and 25.6µg/m^3 at UP3 (both located in Old Street, Upton-upon-Severn).

The lowest concentration was 7.1µg/m^3 at M3N which is an urban background site in Teme Lane, Malvern. The results demonstrate that NO_2 concentrations within the Malvern Hills District area were significantly below the NO_2 air quality objective of 40µg/m^3 during 2023. With the sole exception of M11, concentrations have decreased in 2023 when compared to the previous year, 2022.

The impact of the restrictions on traffic and general commercial/social activity in response to Covid-19 upon NO_2 concentration levels within the 5-year period (2019-2023) are reflected in markedly lower concentrations levels for 2020/2021. In comparison with the results of 2022, during 2023 the only location that registered an increase (of 0.7µg/m^3) occurred at M11 and represents an increase of 2.7%. Across all locations, there is an average decrease of approximately 2.8% (excluding M20 for which there is no record before 2023).

Long term trend analysis over the 5-year period, 2019 to 2023, suggests concentrations from 2023 appear to be lower and following a broadly similar downward trend to the pre-pandemic levels recorded in 2019 following a marked reduction in years 2020 and 2021.

No annual mean averages greater than 60µg/m^3 have been recorded indicating that it is extremely unlikely that there have been any exceedances of the 1-hour mean objective for NO_2 at any monitoring sites. The 60µg/m^3 value is a surrogate figure to indicate exceedances of the 1-hour objective based on annual average concentrations. The concentrations recorded across the district in 2023 are below 50% of the surrogate figure.

Location TEN1 (in Tenbury) was decommissioned at the end of 2022 following an average concentration of 20µg/m^3 being recorded in the 4 years it was in operation. A new location (M20) has been established near to the signalised crossroads at Graham Road/Church Street, Great Malvern in early 2023 following concerns raised by members of the public that the busiest area in Malvern was not being monitored. Historical monitoring has taken place in that vicinity over a number of years and has not highlighted a problem. However, the last monitoring ceased in 2016 so has been reinstated to ascertain current conditions at the site. The annual mean concentration during 2023 at this new site (M20) was 18.8 µg/m^3.

Breathing in polluted air affects our health and costs the NHS and our society billions of pounds each year. Air pollution is recognised as a contributing factor in the onset of heart disease and cancer and can cause a range of health impacts, including effects on lung function, exacerbation of asthma, increases in hospital admissions and mortality. In the UK, it is estimated that the reduction in healthy life expectancy caused by air pollution is equivalent to 29,000 to 43,000 deaths a year[1].

Air pollution particularly affects the most vulnerable in society, children, the elderly, and those with existing heart and lung conditions. Additionally, people living in less affluent areas are more likely to be exposed to higher levels of air pollution[2].

[1] UK Health Security Agency. Chemical Hazards and Poisons Report, Issue 28, 2022.

[2] Defra. Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006

Table ES 1 provides a brief explanation of the key pollutants relevant to Local Air Quality Management and the kind of activities they might arise from.

Table ES 1 - Description of Key Pollutants

Pollutant	Description
Nitrogen Dioxide (NO_2)	Nitrogen dioxide is a gas which is generally emitted from high-temperature combustion processes such as road transport or energy generation.
Sulphur Dioxide (SO_2)	Sulphur dioxide (SO_2) is a corrosive gas which is predominantly produced from the combustion of coal or crude oil.
Particulate Matter (PM_{10} and $PM_{2.5}$)	Particulate matter is everything in the air that is not a gas. Particles can come from natural sources such as pollen, as well as human made sources such as smoke from fires, emissions from industry and dust from tyres and brakes. PM_{10} refers to particles under 10 micrometres. Fine particulate matter or $PM_{2.5}$ are particles under 2.5 micrometres.

Actions to Improve Air Quality

Whilst air quality has improved significantly in recent decades, there are some areas where local action is needed to protect people and the environment from the effects of air pollution.

The Environmental Improvement Plan[3] sets out actions that will drive continued improvements to air quality and to meet the new national interim and long-term targets for fine particulate matter ($PM_{2.5}$), the pollutant most harmful to human health. The National Air Quality Strategy[4] provides more information on local authorities' responsibilities to work towards these new targets and reduce fine particulate matter in their areas. The Road to Zero[5] details the Government's approach to reduce exhaust emissions from road transport through a number of mechanisms, in balance with the needs of the local community. This is extremely important given that cars are the most popular mode of personal travel, and

[3] Defra. Environmental Improvement Plan 2023, January 2023

[4] Defra. Air Quality Strategy – Framework for Local Authority Delivery, August 2023

[5] DfT. The Road to Zero: Next steps towards cleaner road transport and delivering our Industrial Strategy, July 2018

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

No specific actions have been progressed to improve air quality in the Malvern Hills district as there are currently no declared AQMAs in the area and there was no requirement to do so previously.

In 2013, WRS produced a countywide Air Quality Action Plan (AQAP) for Worcestershire. WRS have produced two updates to the AQAP, the latest in September 2016. For details of all measures completed, in progress or planned, please refer to the 'Air Quality Action Plan Progress Report for Worcestershire April 2015-2016'. A copy of this report is available to view or download at: Air Quality Action Plan Progress report for Worcestershire 2015/16

General actions to improve air quality detailed in the Air Quality Action Plan have applied across Worcestershire as a whole, including the Malvern Hills area.

Air Quality Actions Plan and Air Quality Strategy

The timeline for the various stages and delivery of a revised countywide AQAP, and establishment of a new countywide Air Quality Strategy, were set out in the ASR 2023. However, following the introduction of new enforcement policy by Defra in June 2023, it has been necessary to amend the previously published framework to prioritise production of a standalone AQAP for each district with an existing AQMA. As previously discussed, Malvern Hills District has no AQMAs therefore no individual Action Plan is required.

Following discussions with Defra LAQM Team in September 2023, 4 Worcestershire Councils were granted extensions to the timeline for delivery of the draft AQAPs. It is anticipated the countywide Air Quality Strategy will be developed further in 2025 following completion of these priority works. The timeline for the various stages and delivery of the Air Quality Strategy and Action Plan is set out in the main report below.

Real-time Air Quality Monitoring Project

In February 2023, WRS were successful in a bid to the Defra Air Quality Grant Scheme 2022/23 to establish an enhanced real-time air quality monitoring network across Worcestershire.

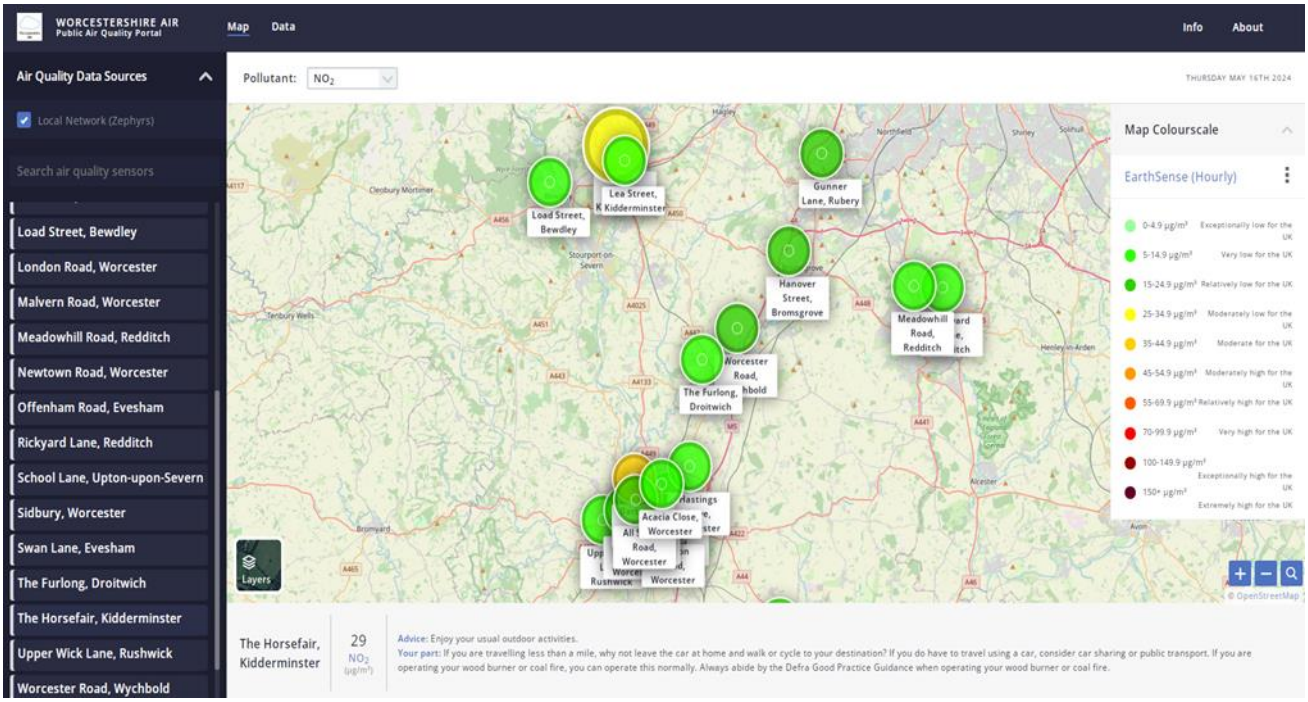
The scope of the bid was to establish a real-time air quality monitoring network across the main areas of air quality concern in Worcestershire for purposes of providing enhanced monitoring data on a range of pollutants. Additionally, the proposal included informing the public and vulnerable groups of the status of air pollution in real time to encourage behaviour change.

The sum of £248,400 was awarded to WRS from the AQ Grant Scheme. An additional £27,600 was contributed by the 6 district councils in Worcestershire, in accordance with the match-funding requirement of the scheme. This produced a total sum of £276,000 for the project.

The scheme has enabled the installation and operation of 26 ‘low-cost Air Quality Monitors’ which will measure NO_2, PM_{10}, $PM_{2.5}$ across the county for a period of 3 years (with EA MCERTS standard accreditation as indicative ambient particulate matter devices). The results of monitoring will be used to inform decision making and requirements for further action as necessary.

In 2023, the experienced sensor provider, Earthsense, were appointed as the successful supplier following a rigorous procurement process. The sensors (known as ‘Zephyrs’) are supplied, operated and serviced by Earthsense who also provide data access. Appropriate monitoring locations were determined by WRS in collaboration with Public Health, Worcestershire County Council Street Lighting team and Earthsense taking into consideration the requirements of Malvern Hills District Council.

The locations have been chosen to maximise data capture within locations proximal to vulnerable communities and/or a range of sources of air pollution including transport, solid fuel burning, industry and agriculture.



Three of the monitors have been deployed within the Malvern Hills District Council area in January 2024. Earthsense have designed a publicly accessible portal to the real-time monitoring data which launched in May 2024 and this can be viewed at the [Earthsense website for Air Quality across Worcestershire].

The monitor locations are listed below and can be seen on the map taken from the portal:-

- Barnards Green Road, Malvern
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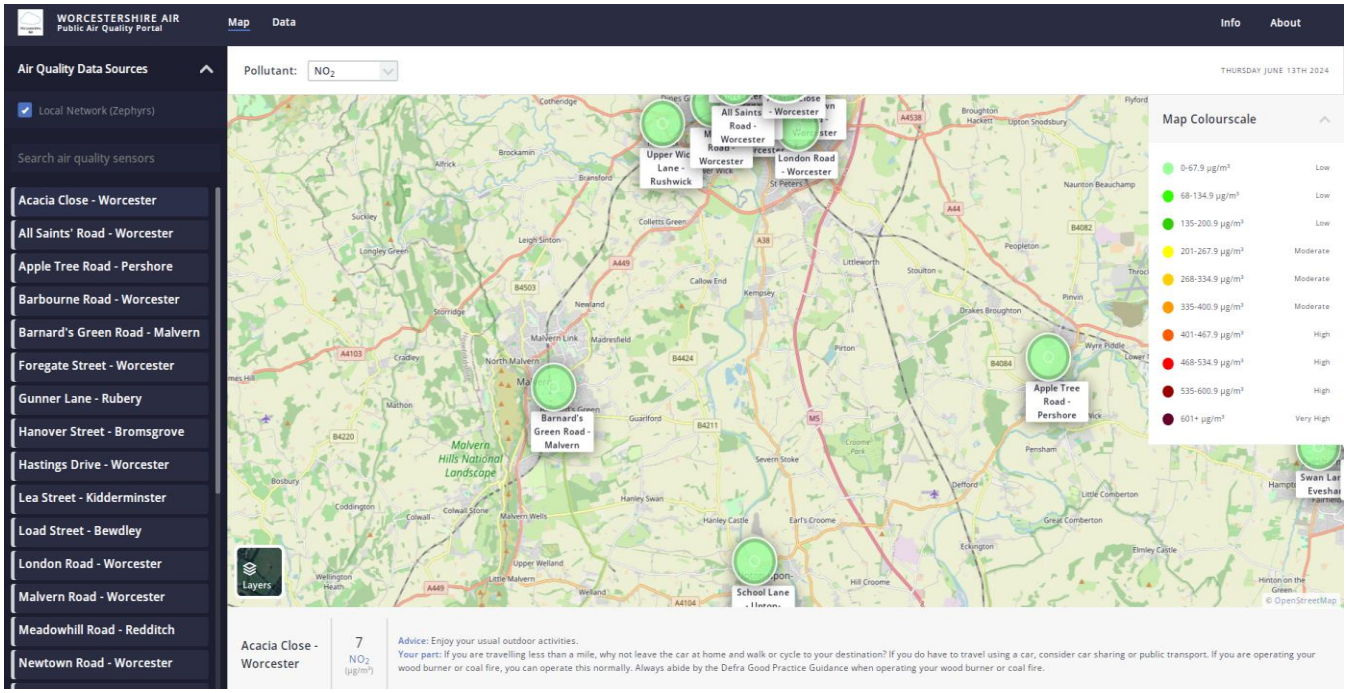
- Upper Wick Lane, Rushwick



Worcestershire County Council Highways Department have completed or introduced the following major scheme(s) in or around the Malvern Hills district during 2023:

Upton Crossroads A38/A4104 - The scheme provides a new 4-arm roundabout to replace the existing staggered junction arrangement, with the western A4104 approach from Upton realigned to tie into the proposed roundabout. Facilities for non-motorised users are improved with the provision of crossing locations on all arms of the roundabout and 3m wide shared footway/cycleways. The scheme was completed and opened in Feb 2023. The updated junction alleviates queuing during peak traffic time, provides more efficient traffic flows and provides a better junction for the users.

Worcestershire County Council - Major Infrastructure Improvements

The Malvern Local Cycling and Walking Infrastructure Plan (LCWIP) secured funding from Active Travel England and are due to be completed in 2025.

Local cycling and walking infrastructure plans (LCWIPs) | Worcestershire County Council

Southern Link Road A4440 improvements – Work to complete dualling of carriageway between the Ketch and Powick roundabouts, capacity improvements to those junctions, an additional bridge over River Severn, and new foot/cycle bridges has been completed and link road reopened in Autumn 2022. Increase in journey time reliability and reduction in congestion on the major route linking to Worcester and the strategic road network and to south Worcestershire and Herefordshire is expected. The county recently completed a survey to evaluate whether this scheme met objectives. The survey closed in April 2024 and the results are currently pending.

The A4440 Worcester Southern Link Road improvements | Worcestershire County Council

Passenger Transport - Bus ‘on demand’ services were added to a trial scheme in Malvern during 2023 and expanded during 2024.

On demand bus service launches in Malvern | Worcestershire County Council

Conclusions and Priorities

In conclusion, we would summarise the ASR as follows:

- Malvern Hills district continues to have relatively good air quality.
- There were no exceedances during 2023.
- The general trend continues to show an improvement in measured air quality, but meaningful data and trends have been skewed by the impact of Covid and disruptions to travel and commercial/social activity.
- There are no AQMAs in the district.
- Continue to monitor air quality by use of the diffusion tube network
- Utilise the data from the new real-time monitors to inform future steps in improving air quality across the district.
- Produce a countywide Air Quality Strategy to include the Malvern Hills district.

Local Engagement and How to get Involved

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

- **Walk or cycle around the District instead of driving**: Leaving your car at home and walking or cycling instead will benefit in three ways - increased exercise, reduced pollution exposure and will reduce your own pollution emissions.
- **Turn off your engine when stationary or parked,** don't 'idle', particularly outside sensitive receptors such as schools, hospitals, care homes and residential properties.
- **General travel planning advice** is available on Worcestershire County Council's website (including walking, cycling and bus maps and timetables) and Government website:

  Travel and Highways - Worcestershire County Council

  Smarter choices: changing the way we travel - GOV.UK (www.gov.uk)

- **Hold meetings by Conference Call** by phone or video conference via Teams, Zoom, Skype or Facetime 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 currently providing grants for up to 75% of Electric Vehicle (EV) charging points, up to 40 charge 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.

  Workplace Charging Scheme - GOV-UK Find a grant (find-government-grants.service.gov.uk)

- 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:

  Save money and emissions through ecodriving - Energy Saving Trust

  How to drive economically - Eco-driving tips | AA (theaa.com)

  Fuel Consumption & CO2 Databases | Vehicle Certification Agency (vehiclecertification-agency.gov.uk)

- **Reduce air pollution from open fires and wood-burning stoves**: Advice is available from Defra on choosing the right stove, using the right fuels and maintenance, enabling householders to reduce their impact on their health and air quality from open fires and wood burning stoves. Further information is available on the Smokeless Zones and Public Advice pages on WRS website.

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)[6,7]. 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.

WRS would highlight the Malvern Hills District Council's website and, most relevantly, the section entitled 'Tackling Climate Change' using the following link – Tackling Climate Change - Malvern Hills District Council

Vulnerable individuals and groups can keep informed of:

- Current levels and forecasts of air pollution from Defra at: UK Air and the Earthsense website for Air Quality across Worcestershire.
- 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 UK Air advice
- 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 is available at Protecting Me and Others from Air Pollution | Worcestershire Regulatory Services (worcsregservices.gov.uk)

Local Responsibilities and Commitment

This ASR was prepared by the Worcestershire Regulatory Services Technical Services Department on behalf of Malvern Hills District Council with the support and agreement of the following officers and departments:

- Worcestershire Regulatory Services
- Malvern Hills District Council
- Worcestershire County Council

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

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

This ASR has been submitted to the Director of Public Health for comment. No comments have been received for inclusion in this report prior to the deadline for submission.

If you have any comments on this ASR please send them to:

Technical Pollution Team

Worcestershire Regulatory Services

Wyre Forest House

Finepoint Way

Kidderminster

Worcestershire

DY11 7WF

Telephone - 01905 822799

Email - enquiries@worcsregservices.gov.uk

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1 Local Air Quality Management

This report provides an overview of air quality in Malvern Hills District Council during 2023. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995), as amended by the Environment Act (2021), and the relevant Policy and Technical Guidance documents.

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

The statutory air quality objectives applicable to LAQM in England are presented in Table E.1.

2 Actions to Improve Air Quality

2.1 Air Quality Management Areas

Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely exceedance of an air quality objective. After declaration, the authority should prepare an Air Quality Action Plan (AQAP) within 18 months. The AQAP should specify how air quality targets will be achieved and maintained and provide dates by which measures will be carried out.

Malvern Hills District Council (MHDC) currently does not have any declared AQMAs and there are no present plans to declare a new AQMA given the results of monitoring to date. Therefore, no specific action is required at this time.

A countywide Air Quality Strategy for improving air quality and public health, and reducing impacts across Worcestershire is currently at an early stage of development. It is anticipated the strategy will be progressed following the finalisation of required works in other parts of the County (see timeline below) and a draft will be published in 2025.

Concentrations of Nitrogen Dioxide in Malvern Hills district continue to fall significantly below the annual mean objective at the measured locations. Maps of the Malvern Hills District Council monitoring sites are available in Appendix D.

Malvern Hills District Council has a vision to become carbon neutral as soon as possible and by 2050 at the latest, targeting a minimum reduction of 50% to the district's carbon footprint by 2030. Their Destination Zero report and policies to tackle climate change, can be accessed on their website at:

Destination Zero Report

Tackling Climate Chance - Malvern Hills District Council

The plan commits to an annual progress review and the most recent annual update is available at:

Annual Progress Review

Key Progress in 2022/23

Malvern Hills District Council has:

- Promoted active travel and now have an Active Travel Coordinator in place. This includes offering more advice on active travel as well as adult bikeability courses – all aimed at getting people to drive less: Active Travel - Malvern Hills District Council
- Worked with the Midlands Net Zero Hub to have energy audits undertaken on Malvern Splash Leisure Centre and Malvern Theatres.
- Started implementing Hydrotreated Vegetable Oil in five of the waste fleet vehicles, saving approximately 113 tonnes of CO_2 and reducing the total fleet emissions by 10% with the intention of achieving 100% Hydrotreated Vegetable Oil (HVO) usage in suitable vehicles by 2025.
- Installed additional electric charging points at various sites.
- Refurbished the Grange Road/Teme Street toilet blocks to include integrated solar panels, a battery system, LED lights and low flush toilets.
- Completed the installation of energy efficiency works at the Malvern Theatres with funding obtained through the Public Sector Decarbonisation Scheme.
- Signed up for renewable electricity and green gas energy tariffs for 2023/24 for council energy use.
- Secured £2,772,000 for Malvern Hills district in additional funding through Home Upgrade Grant 2 to deliver further improvements to lower income households in the least energy efficient homes.
- Awarded 8 Sustainable Tourism Grants to local businesses to help fund measures that will reduce energy consumption and carbon emissions.

2.2 Progress and Impact of Measures to address Air Quality in Malvern Hills District

Defra's appraisal of ASR 2022 highlighted the following:

- The report is well structured, detailed and provides the necessary information required by the guidance.
- A local Air Quality Strategy was under development. It should be noted that progress has been deferred pending the approval of the new AQAP for Worcester City district presently progressing through committee.
- In February 2023, a realignment scheme for Upton Crossroads A38/A4104 was opened. Whilst NO_2 concentration levels for monitoring sites near Upton were lower in comparison to the previous year, further data is required to assess whether the development has caused or contributed to this reduction.
- Discussion of NO_2 data was welcomed.
- Installation of 3 real-time monitors was planned for 2023 as part of a wider particulate monitoring scheme across Worcestershire. The installation of 26 monitors has been completed with 3 located in the Malvern Hills district. Results of the data gathered by these monitors should be available in future ASRs.
- The Public Health Outcomes Framework was discussed in reference to the fraction of mortality attributable to particulate air pollution through comparison of the Worcestershire figure to the national and West Midlands figures. The report was signed off by the Director of Public Health and future referrals are encouraged.

Defra's appraisal of last year's ASR concluded '*On the basis of the evidence provided by the local authority the conclusions reached are accepted for all sources and pollutants. Following the completion of this report, Malvern Hills District Council should submit an Annual Status Report in 2024.'*

No specific actions have been progressed to improve air quality in the Malvern Hills district as there are currently no declared AQMAs in the area and there was no requirement to do so previously. However, the general actions to improve air quality detailed in the previous Air Quality Action Plan have applied across Worcestershire as a whole, including the Malvern Hills area. WRS continue to monitor for exceedances in Malvern Hills District and across Worcestershire on behalf of the six districts. An Air Quality Action Plan (AQAP) is presently being finalised for Worcester City Council. After completion of the AQAP, it is

expected that a countywide Air Quality Strategy will be developed covering the Malvern Hills district.

Air Quality Actions Plan and Air Quality Strategy

The timeline for the various stages and delivery of a revised countywide AQAP, and establishment of a new countywide Air Quality Strategy, were set out in the ASR 2023. However, following the introduction of new enforcement policy by Defra in June 2023, it has been necessary to amend the previously published framework to prioritise production of a standalone AQAP for each district with an existing AQMA. As previously discussed, Malvern Hills District has no AQMAs therefore no individual Action Plan is required.

Following discussions with Defra LAQM Team in September 2023, 4 Worcestershire Councils were granted extensions to the timeline for delivery of the draft AQAPs.

It is anticipated the countywide Air Quality Strategy will be developed further in 2025 following completion of these priority works. The timeline for the various stages and delivery of the Air Quality Strategy and district Action Plans is set out in Table 2.1 below provides a summary of the revised timetable.

Table 2.1 – Air Quality Action Plan and Strategy Works Timeline

Time	Phase
1st July 2024	Submission of Draft Worcester City AQAP to DEFRA
1st Nov 2024	Submission of Draft Bromsgrove and Wyre Forest District AQAPs to DEFRA
12th Dec 2024	Publication of Final Worcester City AQAP and submission to DEFRA
Jan – Feb 2025	Progress revocation of Lickey End and Redditch Road, Bromsgrove AQMAs
1st April 2025	Publication of Final Bromsgrove and Wyre Forest District AQAPs and submission to DEFRA
April – May 2025	Review of Wychbold, Wychavon AQMA - consideration of revocation or progress to AQAP if appropriate.
30th June 2025	Publication of Annual Status Report 2025 and submission to DEFRA
2025	Develop and publish draft of Worcestershire Air Quality Strategy

Real-time Air Quality Monitoring Project

In February 2023, WRS were successful in a bid to the Defra Air Quality Grant Scheme 2022/23 to establish an enhanced real-time air quality monitoring network across Worcestershire. The scope of the bid was to establish a real-time air quality monitoring network across the main areas of air quality concern in Worcestershire for purposes of providing enhanced monitoring data on a range of pollutants. Additionally, the proposal included informing the public and vulnerable groups of the status of air pollution in real time to encourage behaviour change.

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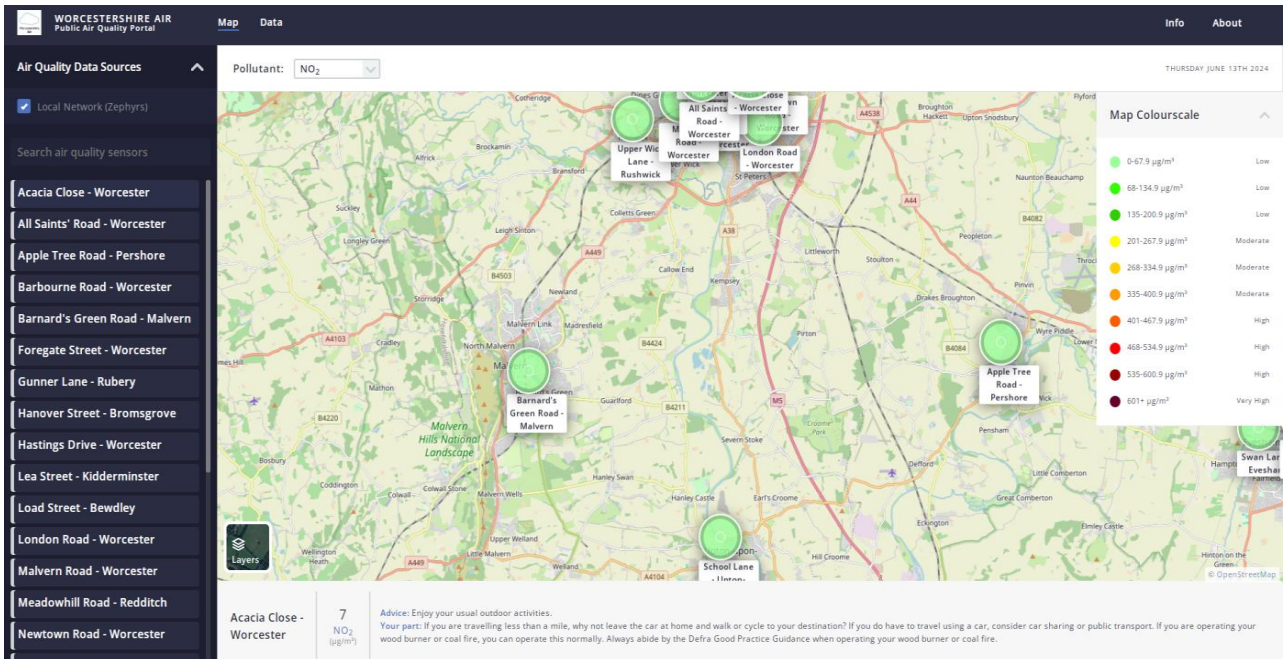

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The A4440 Worcester Southern Link Road improvements | Worcestershire County Council

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On demand bus service launches in Malvern | Worcestershire County Council

2.3 $PM_{2.5}$ – Local Authority Approach to Reducing Emissions and/or Concentrations

As detailed in Policy Guidance LAQM.PG22 (Chapter 8) and the Air Quality Strategy[8], local authorities are expected to work towards reducing emissions and/or concentrations of fine particulate matter ($PM_{2.5}$). There is clear evidence that $PM_{2.5}$ (particulate matter smaller than 2.5 micrometres) has a significant impact on human health, including premature mortality, allergic reactions, and cardiovascular diseases.

During 2023, there were no automatic $PM_{2.5}$ monitoring stations in Worcestershire that are recognised by Defra for measuring against ambient air quality directives. The nearest AURN $PM_{2.5}$ monitoring station is the Birmingham Ladywood site approximately 48km to the north-east of the Malvern Hills District. However, WRS have assisted the Defra AURN expansion project team with potential locations for two $PM_{2.5}$ monitors in Worcestershire, and it is hoped these will be in place within the next 6 to 12 months. These are expected to be sited in Worcester City and Redditch districts.

WRS has reviewed the 2018 based Defra national background maps to determine projected $PM_{2.5}$ concentrations with the Malvern Hills District for the 2023 calendar year. The average total $PM_{2.5}$ at 577 locations (centre points of 1km x 1km grids) across the Malvern Hills District is 7.08µg/m^3, with a minimum concentration of 6.31µg/m^3 and a maximum concentration of 8.88µg/m^3. This indicates that $PM_{2.5}$ concentrations within the Malvern Hills District are below the proposed annual average limit value for $PM_{2.5}$ target of 10µg/m^3 to be met across England by 2040.

The Air Quality Partnership led by the Director of Public Health (DoPH) at Worcestershire County Council, and supported by WRS, was set up in May 2019 to discuss potential actions to improve air quality across the County and determine an action plan for implementation. The group comprised officers from the County and District authorities from public health, air quality, strategic planning, sustainability, highways and transport disciplines, and also representatives from the NHS and Highways England. The work of the group, however, was postponed due to the Covid-19 pandemic. Work recommenced in summer 2022 when WRS met with colleagues from Public Health numerous times to discuss the ongoing situation with air quality, relevant changes, and workstreams going

[8] Defra. Air Quality Strategy – Framework for Local Authority Delivery, August 2023

forward. The DoPH represents a key partner in the ongoing development of the Air Quality Strategy and Action Plan work and has several representatives sitting on the steering group.

WRS has reviewed the fraction of mortality attributable to particulate air pollution (indicator D01) as published by Public Health England as part of the Public Health Outcomes Framework. The fraction of mortality attributable to particulate emissions in Malvern Hills District in 2022 (the most recent year available) was 4.7% MHDC. This falls below the national figure for England (5.8% in 2022) and below the figure for the West Midlands region (5.7% in 2022). Further information on the Public Health Outcomes Framework that examines indicators that help us understand trends in public health can be found at Public Health Outcomes Framework - OHID (phe.org.uk)

The successful bid for funding from the Defra Air Quality Grant 2022/23, to establish a real time monitoring network across Worcestershire, will allow for particulate monitoring in the district for the first time. There are 3 low-cost, real-time air quality monitors installed within the Malvern Hills District area at worst-case locations representative of heavy traffic, agriculture, solid fuel burning and other sources. The majority of the county's monitors are fully operational and real time data will be available to the public imminently and it is expected that such data may be incorporated within ASR 2025.

There are currently no declared smoke control areas operating within the Malvern District Council area. More information, maps and guides on the type of fuels that can be used can be found at: Smoke Control Areas | Worcestershire Regulatory Services (worcsregservices.gov.uk)

WRS hold no records of substantiated complaints of nuisance from smoke attributable to wood burning stoves in residential developments in Malvern Hills district in 2023.

In light of the above, no additional actions are currently planned by Malvern Hills District Council in relation to the reduction of $PM_{2.5}$ levels. However, it is anticipated that any action taken to improve NO_2 levels across the district, will likely result in a linked improvement in $PM_{2.5}$ levels. Additionally, an updated countywide Air Quality Strategy will pay due regard to the new responsibilities on local authorities for $PM_{2.5}$, outlined within the revised national Air Quality Strategy (25 August 2023) which can be found at National Air Quality Strategy.

The Environmental Targets (fine particulate matter) (England) Regulations 2023 set out two $PM_{2.5}$ targets to be met by 2040, these require that:

1. the annual mean concentration is 10µg m^3 or lower (with an interim target of 12µgm^3 by January 2028) and
2. the population exposure is reduced by 35% compared to 2018 levels (with an interim target of 22% by January 2028).

These targets will help drive reductions in the worst $PM_{2.5}$ hotspots across the country, whilst ensuring nationwide action to improve air quality for everyone.

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

This section sets out the monitoring undertaken within 2023 by Malvern Hills District Council and how it compares with the relevant air quality objectives. In addition, monitoring results are presented for a five-year period between 2019 and 2023 to allow monitoring trends to be identified and discussed.

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

Malvern Hills District Council did not undertake any automatic monitoring during 2023.

3.1.2 Non-Automatic Monitoring Sites

Malvern Hills District Council undertook non-automatic (i.e. passive) monitoring of NO_2 at 8 sites during 2023 Table A.1 in Appendix A presents the details of the non-automatic sites. One location for monitoring in Tenbury Wells was removed due to consistently low readings and an additional tube was added closer to the Malvern town centre where air quality was more likely to be a relevant consideration.

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.

The results of the 2023 monitoring have not increased the likelihood of an AQMA being declared in the Malvern Hills District and air quality remains comfortably within accepted levels.

3.2 Individual Pollutants

The air quality monitoring results presented in this section are, where relevant, adjusted for bias, annualisation (where the annual mean data capture is below 75% and greater than 25%), and distance correction. Further details on adjustments are provided in Appendix C.

3.2.1 Nitrogen Dioxide (NO_2)

Table A.2 in Appendix A compares the ratified and adjusted monitored NO_2 annual mean concentrations for the past five years with the air quality objective of 40µg/m^3. Note that the concentration data presented represents the concentration at the location of the monitoring site, following the application of bias adjustment and annualisation, as required (i.e. the values are exclusive of any consideration to fall-off with distance adjustment). For diffusion tubes, the full 2023 dataset of monthly mean values is provided in Appendix B. Note that the concentration data presented in Table B.1 includes distance corrected values, only where relevant.

During 2023, concentrations of NO_2 were monitored at 8 locations across the Malvern District. The highest recorded mean concentrations were 26.1µg/m^3 at M11 (in Powick), 26.0µg/m^3 at UP1 and 25.6µg/m^3 at UP3 (both located in Old Street, Upton-upon-Severn).

The lowest concentration was 7.1µg/m^3 at M3N which is an urban background site in Teme Lane, Malvern. The results demonstrate that NO_2 concentrations within the Malvern Hills District area are significantly below the NO_2 air quality objective of 40µg/m^3 during 2023. With the exception of M11, concentrations have decreased in 2023 when compared to the previous year, 2022.

The impact upon concentration levels, given the restrictions on traffic and general commercial/social activity that were in place due to Covid-19 within the 5-year period (2019-2023) are reflected in the lower concentrations levels for 2020/2021. In comparison with 2022, the only location that registered an increase (of 0.7 µg/m^3) occurred at M11 and represents an increase of 2.7%. Across all locations, there is an average decrease of approximately 2.8% (excluding M20 for which there is no record before 2023).

Long term trend analysis over the 5-year period, 2019 to 2023, suggest concentrations from 2023 appear to be broadly similar to the pre-pandemic levels recorded in 2019 following a reduction in years 2020 and 2021. No annual mean averages greater than 60µg/m^3 have been recorded indicating that it is extremely unlikely that there have been any exceedances of the 1-hour mean objective for NO_2 at any monitoring sites. The 60µg/m^3 value is a surrogate figure to indicate exceedances of the 1-hour objective based on annual average concentrations. The concentrations recorded across the district in 2023 are below 50% of the surrogate figure.

Location TEN1 was decommissioned at the end of 2022 following an average concentration of 20µg/m^3 being recorded in the 4 years it was in operation. A new location (M20) has been established near to the signalised crossroads at Graham Road/Church Street, Great Malvern in early 2023 following concerns raised by members of the public that the busiest area in Malvern was not being monitored. Historical monitoring has taken place in that vicinity over a number of years and has not highlighted a problem. However, the last monitoring ceased in 2016 so has been reinstated to ascertain current conditions at the site. The annual mean concentration during 2023 at this new site (M20) was 18.8µg/m^3.

3.2.2 Particulate Matter (PM_{10})

PM_{10} concentrations have not been monitored within the district in 2023.

3.2.3 Particulate Matter ($PM_{2.5}$)

$PM_{2.5}$ concentrations have not been monitored within the district in 2023.

3.2.4 Sulphur Dioxide (SO_2)

SO_2 concentrations have not been monitored within the district in 2023.

Appendix A: Monitoring Results

Table A.1 – Details of Non-Automatic Monitoring Sites

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube Co-located with a Continuous Analyser?	Tube Height (m)
UP1	2 Old Street, WR8 0HA	Roadside	385171	240555	NO_2	No	0.0	2.0	No	2.1
UP3	15 Old Street, Upton, WR8 0HN	Roadside	385157	240508	NO_2	No	0.0	1.3	No	2.0
M3N	Teme Avenue, WR14 2XA	Urban Background	379790	245677	NO_2	No	7.0	1.0	No	2.2
M2	Outside Santler Court, Howsell Road, Malvern Link, WR14 1US	Roadside	378320	247570	NO_2	No	5.0	1.0	No	2.2
M5N	Richmond Road, Malvern Link, WR14 1NE	Roadside	378520	247753	NO_2	No	0.1	4.5	No	2.3
M11	Old Post Office, Powick	Roadside	383231	251684	NO_2	No	7.0	2.1	No	2.1
M14	278 Worcester Road, Malvern, WR14 1BD on drainpipe next to bay window	Roadside	379156	248248	NO_2	No	0.0	5.9	No	3.2
M20	On sign o/s Koko Nail Boutique, Graham Road	Roadside	377701	246066	NO_2	No	0.0	2.0	No	2.2

Notes:

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

(2) N/A if not applicable.

Table A.2 – Annual Mean NO_2 Monitoring Results: Non-Automatic Monitoring (µg/m^3)

Diffusion Tube ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2019	2020	2021	2022	2023
UP1	385171	240555	Roadside	100	100.0	30.9	21.5	23.0	27.2	26.0
UP3	385157	240508	Roadside	100	100.0	26.3	20.9	22.7	27.4	25.6
M3N	379790	245677	Urban Background	100	100.0	8.2	6.6	6.5	7.7	7.1
M2	378320	247570	Roadside	100	100.0	19.1	15.7	17.3	20.2	19.6
M5N	378520	247753	Roadside	100	100.0	21.1	16.4	18.7	22.3	21.3
M11	383231	251684	Roadside	100	100.0	25.2	20.7	21.4	25.4	26.1
M14	379156	248248	Roadside	100	100.0	18.8	13.5	16.1	17.7	17.5
M20	377701	246066	Roadside	92.3	92.3	-	-	-	-	18.8

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

☒ **Diffusion tube data has been bias adjusted.**

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

Notes:

The annual mean concentrations are presented as µg/m^3.

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

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

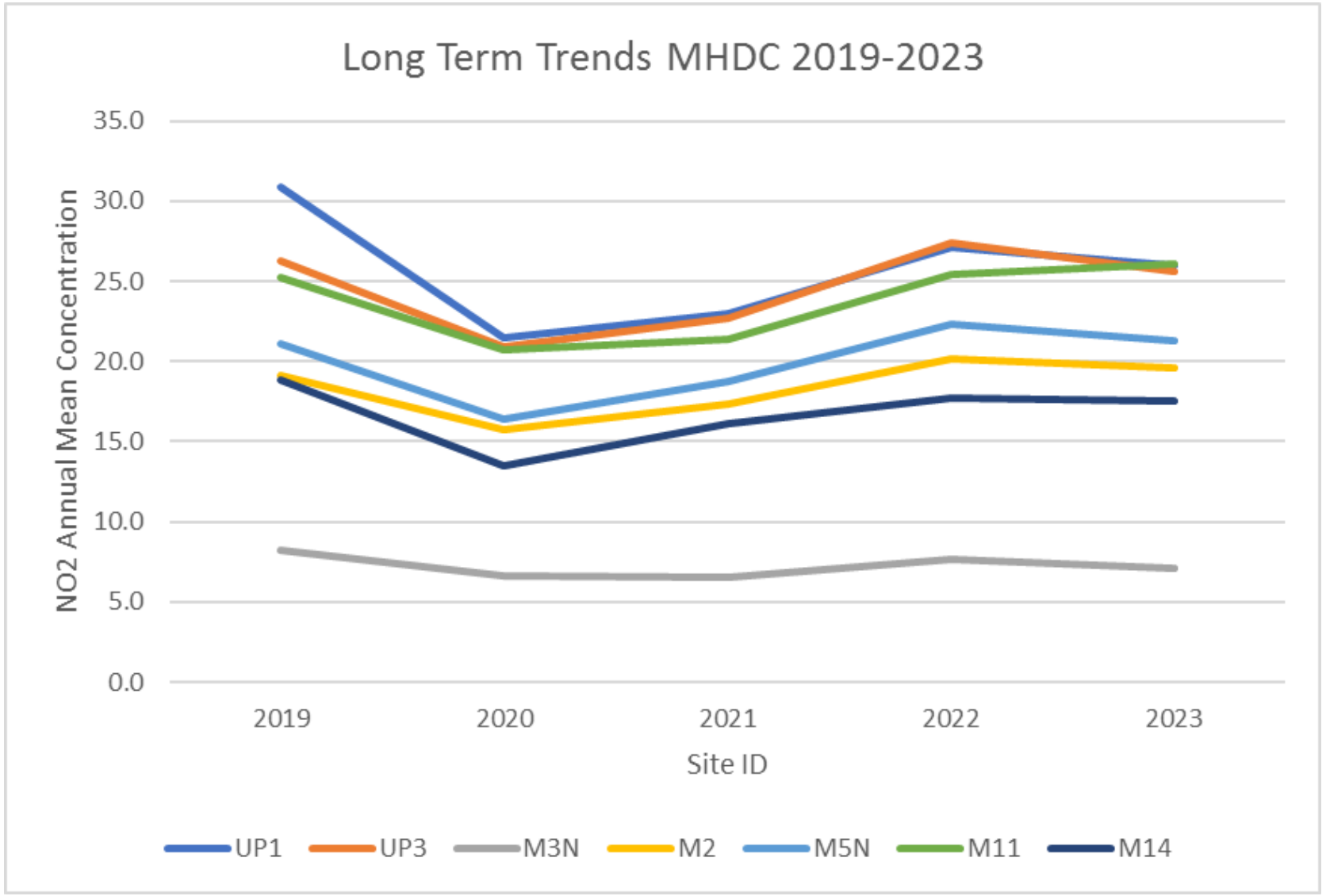
Means for diffusion tubes have been corrected for bias. All means have been “annualised” as per LAQM.TG22 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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

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

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

Figure A.1 – Trends in Annual Mean NO_2 Concentrations measured in µg/m3 for sites UP1 to M14 between years 2019 to 2023.



Appendix B: Full Monthly Diffusion Tube Results for 2023

Table B.1 – NO_2 2023 Diffusion Tube Results ($\mu g/m^3$)

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted (0.96)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
UP1	385171	240555	32.0	32.0	28.7	26.3	22.9	22.9	23.6	22.9	32.1	24.0	31.3	23.1	26.8	26.0	-	
UP3	385157	240508	27.0	32.4	27.3	29.1	28.8	26.6	18.6	22.6	30.3	29.3	26.8	17.8	26.4	25.6	-	
M3N	379790	245677	9.8	11.6	7.9	7.0	5.2	4.7	3.6	4.6	7.1	8.9	11.9	5.5	7.3	7.1	-	
M2	378320	247570	18.6	25.2	21.9	23.8	21.4	21.4	12.8	17.0	23.2	23.1	21.5	13.0	20.2	19.6	-	
M5N	378520	247753	24.8	27.0	22.7	22.7	17.2	19.1	17.8	19.1	23.7	24.0	25.2	19.9	21.9	21.3	-	
M11	383231	251684	27.4	33.4	28.0	26.3	24.7	25.1	20.4	20.3	30.7	31.7	31.2	23.4	26.9	26.1	-	
M14	379156	248248	16.7	23.4	20.0	22.1	18.4	16.8	11.1	14.4	19.6	20.4	20.7	13.2	18.1	17.5	-	
M20	377701	246066		23.2	21.2	20.0	16.4	19.5	14.7	16.9	21.6	23.1	20.8	16.2	19.4	18.8	-	

☒ **All erroneous data has been removed from the NO_2 diffusion tube dataset presented in Table B.1.**

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

☒ **Local bias adjustment factor used.**

☐ **National bias adjustment factor used.**

☒ **Where applicable, data has been distance corrected for relevant exposure in the final column.**

☒ **Malvern Hills District Council confirm that all 2023 diffusion tube data has been uploaded to the Diffusion Tube Data Entry System.**

Notes:

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

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

See Appendix C for details on bias adjustment and annualisation.

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

New or Changed Sources Identified Within Malvern Hills District Council Area During 2023

Malvern Hills District Council has not identified any new sources relating to air quality within the reporting year of 2023.

Additional Air Quality Works Undertaken by Malvern Hills District Council During 2023

Malvern Hills District has not completed any additional works within the reporting year of 2023.

QA/QC of Diffusion Tube Monitoring

The following UKAS accredited company provided Malvern Hills District Council with nitrogen dioxide diffusion tubes and analysis in 2023:

Gradko International Limited

St. Martins House

77 Wales Street

Winchester

SO23 0RH

diffusion@gradko.com

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

Gradko International Limited participate in the AIR NO_2 Proficiency Testing Scheme (AIR-PT). All monitoring undertaken has been completed in accordance with the 2023 Diffusion Tube Monitoring Calendar, i.e. on or within ± 2 days of the specified date.

Diffusion Tube Annualisation

All diffusion tube monitoring locations within Malvern Hills District recorded data capture in excess of 75% therefore it was not required to annualise any monitoring data. In addition, any sites with a data capture below 25% do not require annualisation.

Diffusion Tube Bias Adjustment Factors

The diffusion tube data presented within the 2023 ASR has been corrected for bias using an adjustment factor. Bias represents the overall tendency of the diffusion tubes to under or over-read relative to the reference chemiluminescence analyser. LAQM.TG22 provides guidance with regard to the application of a bias adjustment factor to correct diffusion tube monitoring. Triplicate co-location studies can be used to determine a local bias factor based on the comparison of diffusion tube results with data taken from NO_x/NO_2 continuous analysers. Alternatively, the national database of diffusion tube co-location surveys provides bias factors for the relevant laboratory and preparation method.

Malvern Hills District Council have applied a local bias adjustment factor of 0.97 to the 2023 monitoring data. A summary of bias adjustment factors used by Malvern Hills District Council over the past five years is presented in Table C.1. WRS has determined the appropriate local bias adjustment factor utilising the Diffusion Tube Data Processing Tool v4.0. The site used for the colocation study is at Wyre Forest House, Kidderminster. The local bias adjustment factor has been used as it is more conservative compared with the national bias adjustment factor (0.82, Defra published National Diffusion Tube Bias Adjustment Spreadsheet Version 03/24), following consultation with Defra LAQM helpdesk and technical guidance.

Table C.1 – Bias Adjustment Factor

Monitoring Year	Local or National	If National, Version of National Spreadsheet	Adjustment Factor
2023	Local	-	0.97
2022	Local	-	0.97
2021	National	03/22	0.84
2020	National	03/21	0.81
2019	National	03/20	0.78

Table C.2 – Local Bias Adjustment Calculation

	Local Bias Adjustment Input 1
Periods used to calculate bias	12
Bias Factor A	0.97 (0.93 - 1.01)
Bias Factor B	4% (-1% - 8%)
Diffusion Tube Mean (µg/m^3)	12.4%
Mean CV (Precision)	1.9%
Automatic Mean (µg/m^3)	11.9%
Data Capture	99%
Adjusted Tube Mean (µg/m^3)	12(11-12)

Notes:

A single local bias adjustment factor has been used to bias adjust the 2023 diffusion tube results.

NO_2 Fall-off with Distance from the Road

Wherever possible, monitoring locations are representative of exposure. However, where this is not possible, the NO_2 concentration at the nearest location relevant for exposure has been estimated using the Diffusion Tube Data Processing Tool/NO_2 fall-off with distance calculator available on the LAQM Support website. Where appropriate, non-automatic annual mean NO_2 concentrations corrected for distance are presented in Table B.1.

No diffusion tube NO_2 monitoring locations within Malvern Hills District required distance correction during 2023.

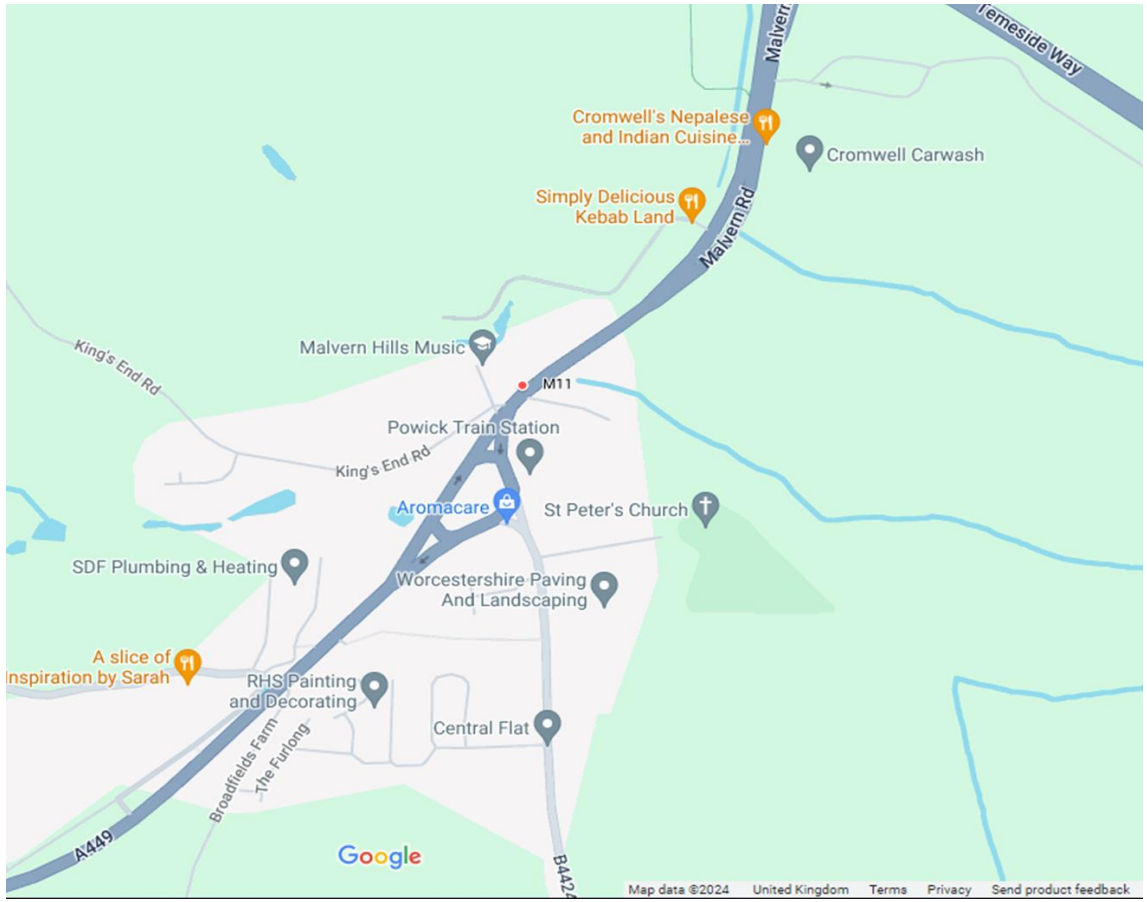
QA/QC of Automatic Monitoring

No automatic monitoring has been undertaken.

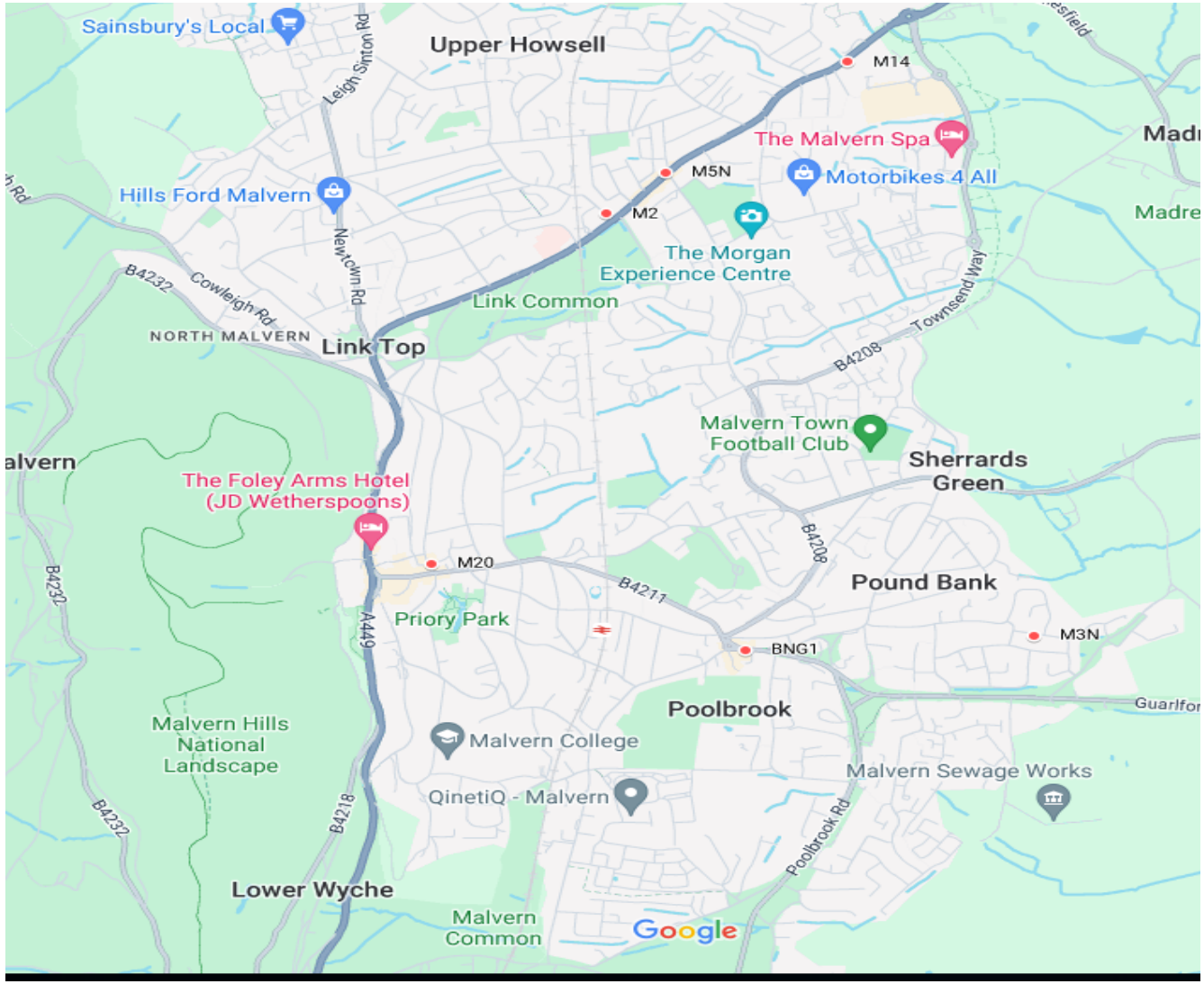
Appendix D: Map(s) of Monitoring Locations and AQMAs

Figure D.1 – Map of Non-Automatic Monitoring Site

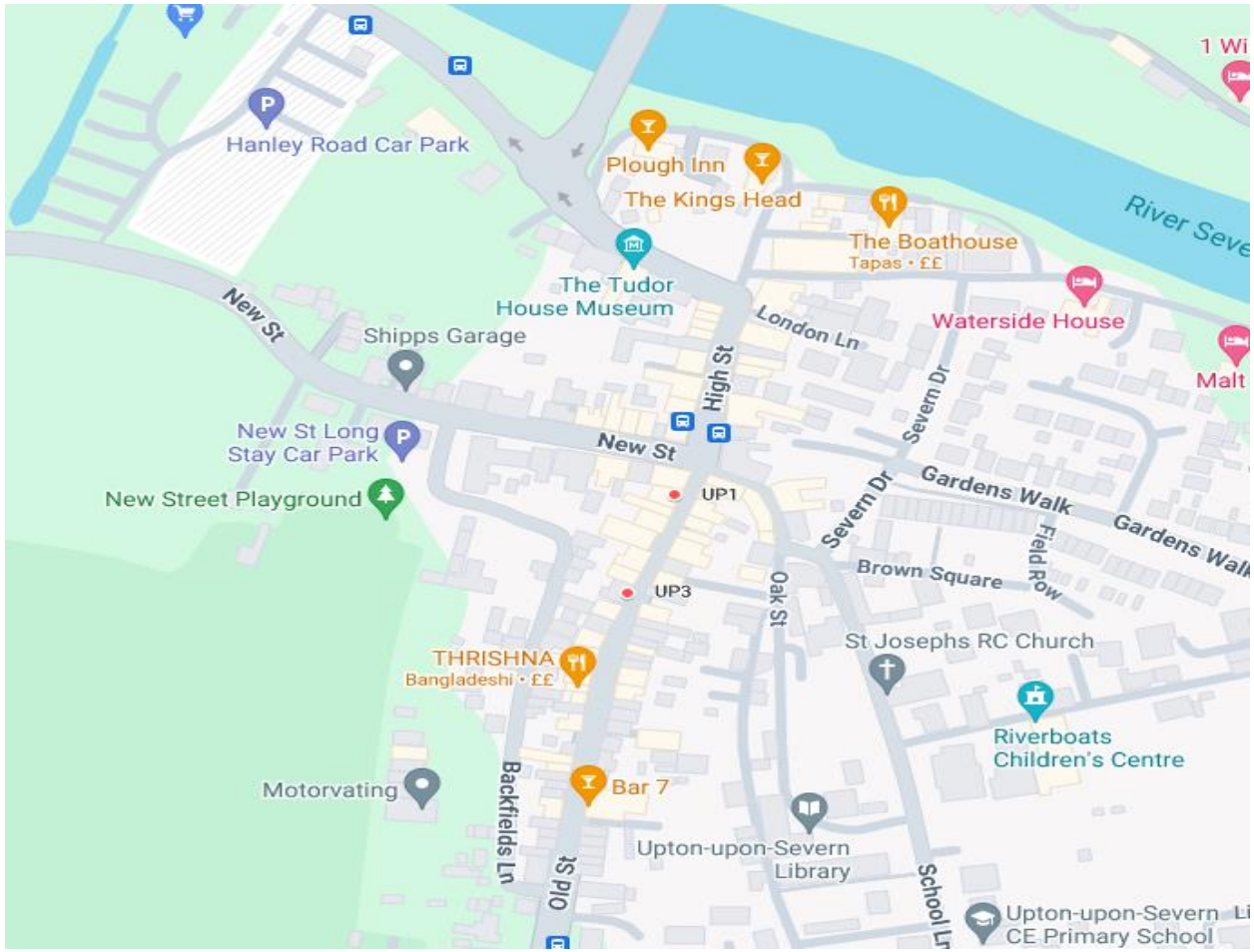
M11 is on Malvern Road near Powick and marked on the map below



M2, M3N, M5N, M14, M20 are located on the map below



UP1 and UP3 are positioned in Old Street, Upton and marked in the map below



Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England[9]

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

[9] 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
AQS	Air Quality Strategy
ASR	Annual Status Report
AURN	Automatic Urban and Rural Network
Defra	Department for Environment, Food and Rural Affairs
DoPH	Director of Public Health
EU	European Union
LAQM	Local Air Quality Management
MHDC	Malvern Hills District Council
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
PM_{10}	Airborne particulate matter with an aerodynamic diameter of 10µm or less
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
QA/QC	Quality Assurance and Quality Control
SO_2	Sulphur Dioxide
WRS	Worcestershire Regulatory Services

References

- Local Air Quality Management Technical Guidance LAQM.TG22. August 2022. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.
- Local Air Quality Management Policy Guidance LAQM.PG22. August 2022. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.
- Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995), as amended by the Environment Act (2021)
- Environment Act 2021 and revised guidance published in August 2022 (LAQM.TG22 and PG22)
- Environmental Targets (fine particulate matter) (England) Regulations 2023
- Chemical hazards and poisons report: Issue 28. June 2022. Published by UK Health Security Agency
- Air Quality Strategy – Framework for Local Authority Delivery. August 2023. Published by Defra.
- DEFRA National Diffusion Tube Bias Adjustment Factor Spreadsheet v.03/24
- DEFRA Background Mapping for Local Authorities
- DEFRA Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006
- DEFRA Environmental Improvement Plan 2023, January 2023
- Department for Transport The Road to Zero: Next steps towards cleaner road transport and delivering our Industrial Strategy, July 2018
- Worcestershire Regulatory Services (2013) ‘Air Quality Action Plan for Worcestershire’
- Worcestershire Regulatory Services (2016) ‘Air Quality Action Plan Progress Report for Worcestershire April 2015 – April 2016’
- Worcestershire Regulatory Services (2022) Air Quality Annual Status Report for Malvern Hills District Council