2023 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, 2023

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Executive Summary: Air Quality in Our Area

Air Quality in Watford

Watford is a concentrated urban area situated to the North West of London. The latest estimated population of Watford is 102,300 (2021) (Source: Office for National Statistics - Census 2021). It has a well-established regional shopping centre with major rail and road communication links. It has both mainline and underground train stations, the M1 lies along the northern boundary of the borough and the M25 is situated to the west. The Borough is also served by several major trunk roads, including the A41, A411, A412 and A405.

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, the elderly, and those with existing heart and lung conditions. There is also often a strong correlation with equalities issues because areas with poor air quality are also often less affluent areas[1,2].

The mortality burden of air pollution within the UK is equivalent to 29,000 to 43,000 deaths at typical ages[3], with a total estimated healthcare cost to the NHS and social care of £157 million in 2017[4].

Watford suffers from traffic congestion. The main pollutants of concern in the Borough are NO_2, PM_{10} and $PM_{2.5}$. These are mainly associated with road traffic. NO_2 is formed during the combustion process when Nitrogen in the air bonds with Oxygen. Road vehicles emit particulate matter from their exhaust and from non-exhaust sources such as brake, tyre and road surface wear and the resuspension of road dust.

[1] Public Health England. Air Quality: A Briefing for Directors of Public Health, 2017

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

[3] Defra. Air quality appraisal: damage cost guidance, January 2023

[4] Public Health England. Estimation of costs to the NHS and social care due to the health impacts of air pollution: summary report, May 2018

The latest monitoring data shows a general trend of decreasing concentrations of NO_2. This is in line with the national trend. Defra recently reported that "between 2007 and 2019 inclusive, the annual mean NO_2 concentration at roadside sites reduced by an average of 1.8 µg/m^3 each year. This reduction was observed at most long-running monitoring sites across the UK; which could be a consequence of the large reduction in road transport emissions of NO_2 over the same period in the UK, as newer vehicles subject to stricter emissions standards enter the transport fleet".

In 2022, NO_2 concentrations decreased at most sites (those sites that existed prior to 2022). There is a general trend of reduction over the last 5 years.

There were no exceedances of the air quality objectives for PM_{10} relating to both annual mean and daily mean objectives.

There were no exceedances of the Annual Mean Concentration Target for $PM_{2.5}$.

There are no new major sources of emissions in the Borough. The Council has not introduced any new AQMAs, Action Plans or strategies. The Council intends to draft a new AQAP in the coming year.

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[5] sets out actions that will drive continued improvements to air quality and to meet the new national interim and long-term $PM_{2.5}$ targets. The National Air Quality Strategy, due to be published in 2023, will provide more information on local authorities' responsibilities to work towards these new targets and reduce $PM_{2.5}$ in their areas. The Road to Zero[6] details the approach to reduce exhaust emissions from road transport through a number of mechanisms; this is extremely important given that the majority of Air Quality Management Areas (AQMAs) are designated due to elevated concentrations heavily influenced by transport emissions.

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

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

Watford Local Plan 2021-2038

The Watford Local Plan was adopted on 17th October 2022.

The Local Plan lists some objectives (Watford's society in 2038 – the sustainability objectives). The following objectives relates to local air quality:

Traffic congestion will be reduced and air quality improved, with priority given to public transport, shared car use, walking and cycling.

Traffic issues are discussed and the Council's AQMAs are considered. The Council's AQAP is mentioned, as are the air quality objectives.

Policy CC8.4 relates to managing air quality. The policy states that development will be supported where it minimises emissions that would contribute towards a worsening of existing air quality and seeks to improve air quality.

Air quality is mentioned in other policies, for example in respect of green infrastructure, sustainable transport, healthy communities etc.

Where site allocations and new development are discussed, the Council's AQMAs are mentioned.

Within the monitoring framework, the target for Policy CC8.4 is given as reduction in the number of AQMAs.

Sustainable Transport Strategy

Watford Borough Council's Cabinet have approved a strategy and 20-year programme to help transform how people travel to, from and around the town, with planned activities taking place over the next two years to start fulfilling the proposals to make it easier for people to walk, cycle and use public transport.

The programme of scheduled projects follows Watford Borough Council and Hertfordshire County Council's consultation on their 'Transforming Travel in Watford 2021-2041' strategy, which showed the majority of the 1,000 people who provided feedback were supportive of the need for change to the way people travel, as well as the proposals put forward to do so.

To start implementing the strategy, the key projects that will take place include relaunching an expanded 'Watford Car Club' to provide more residents with short-term car rental services without the hassle of owning a vehicle, as well as the implementation of further phases of public realm improvements in the town centre, starting with the bus gate to

reduce traffic entering High Street, and improvements to cycle and walking routes around the town centre.

Additional works that will also be taking place include continuing sustainable travel projects already underway, such as installing more electric vehicle chargers around the town to help the shift towards less polluting vehicles, and providing more cycle parking facilities to help people travel around the town more easily.

The coming years will also see further investigation into the future delivery of schemes such as new cycle infrastructure on key routes across the town, measures to reduce delays for buses at congestion hotspots such as the ring road, alternative uses of the disused railway line between Watford and Croxley, and also the introduction of 'Town Centre Sustainable Transport Hub' which will allow easy interchange between different types of transport.

The strategy is underpinned by six key themes including: increasing active travel opportunities, improving public transport for longer journeys, providing alternatives to petrol car, making the town centre more pedestrian and cycle friendly, supporting change and making moving goods more sustainable. For more information, including all the proposals within the 20-year programme, please visit www.watford.gov.uk/futuretravel.

Sustainability Strategy

The Council's Sustainability Strategy 2020 to 2023 contains 6 key strands. One of these strands is Improving Transport & Air Quality. The section of the strategy entitled Improving Transport & Air Quality, highlights the health impacts of air pollution and the cost to society, and describes the Council's LAQM activities and highlights of progress so far.

Local initiatives

Green Transport

EV charging points

There are now more than sixty electric vehicle charging points around the town where drivers can charge their vehicles.

E-car club

Residents can take advantage of the Council's Unbeego EV car sharing scheme.

Sustainable Business Grants

The Council's website provides information to business operators regarding a number of grants and schemes to help their businesses become more sustainable. These grants include the following Low Carbon Workspace Grant, Eastern New Energy Grant and Fully Funded Low Carbon Advice and Support, Fully funded training for workforce as part of Serco's Skills Support for the Workforce, eCargo Bike Grant Fund, Plug-in vehicle Grant, Workplace Charging Scheme, Electric taxi vehicles etc.

Cycling in Watford

Watford cycle hub

Watford cycle hub offers cycle repair services, maintenance courses and cycle training. It also accepts old bikes and recycles them.

Beryl bike hire scheme

The bikes and e-bikes are available to hire 24/7 (via Beryl Bays across Watford) all year round through a user friendly smartphone app.

ArrivaClick

Seven small fifteen-seater buses (accessible and DDA complaint) from ArrivaClick provide a flexible bus service that, unlike others does not follow a fixed route at fixed times – but responds to demand from the passengers and the routes they want to take.

Watford Travel app

Free to download and use, the travelWatford app, is available on IOS and Android. It brings together all of Watford's transport options and lets people choose the best options for a given journey based on cost, waiting time and environmental impact.

Conclusions and Priorities

NO_2 concentrations decreased at most sites (those sites that existed prior to 2022). There is a general trend of reduction over the last 5 years.

In AQMA 2, there were no exceedances of the annual mean objective. In AQMA 3A, a single exceedance of the annual mean objective was recorded at WF44 (Chalk Hill). Following fall-off with distance correction, this concentration is below the annual mean objective. The concentration is not within 10% of the annual mean objective.

There were no exceedances of the annual mean objective at the Council's new monitoring locations.

There were no exceedances of the 1-hour objective.

There were no exceedances of the air quality objectives for PM_{10} relating to both annual mean and daily mean objectives.

There were no exceedances of the Annual Mean Concentration Target for $PM_{2.5}$.

The Council commenced monitoring of $PM_{2.5}$ in 2015. The average annual mean concentration in the three-year period from 1st January 2016 to 31st December 2018 was 11 ug/m^3. There was a 31.57% reduction in concentrations between the baseline period and 2022. There is a general trend of reduction experienced at this site.

The previously drafted AQAP was not adopted in 2022, a decision was taken to re draft the AQAP based on 2022 monitoring results, this would include 12 months monitoring data from the Council's new monitoring locations and would be representative of local air quality following the COVID-19 pandemic.

Drafting a new AQAP is a priority for the coming year.

Local Engagement and How to get Involved

Residents, businesses and visitors to the Borough can play a role in improving air quality, for example, walking, cycling or using public transport instead of driving. For those who need to use a car, replacing it with a greener vehicle such as an electric one is a great way of improving air quality. If individuals or businesses are not ready to replace their existing vehicles, they should ensure that they are serviced regular and in particular, tyre pressures are at the appropriate level as doing so will help lower emissions as well as saving money.

Local Responsibilities and Commitment

This ASR was prepared by the Community & Environmental Services Team of Watford Borough Council

This ASR has not been signed off by a Director of Public Health.

If you have any comments on this ASR please send them to the Community & Environmental Services Team at:

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1 Local Air Quality Management

This report provides an overview of air quality in Watford during 2022. 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 Watford Borough 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

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.

A summary of AQMAs declared by Watford Borough Council can be found in Table 2.1. The table presents a description of the two AQMA(s) that are currently designated within Watford. Appendix D: Map(s) of Monitoring Locations and AQMAs provides maps of AQMA(s) and also the air quality monitoring locations in relation to the AQMA(s). The air quality objectives pertinent to the current AQMA designation(s) are as follows:

- NO_2 annual mean.

Table 2.1 – Declared Air Quality Management Areas

AQMA Name	Date of Declaration	Pollutants and Air Quality Objectives	One Line Description	Is air quality in the AQMA influenced by roads controlled by Highways England?	Level of Exceedance: Declaration	Level of Exceedance: Current Year	Number of Years Compliant with Air Quality Objective	Name and Date of AQAP Publication	Web Link to AQAP
AQMA 2 Vicarage Road	Declared 01/02/2006, Amended 10/04/2019	NO_2 Annual Mean	A predominately residential area with a cluster of commercial buildings within and as well as close to the vicinity. Queuing traffic.	NO	58	34.7	3	Watford Borough Council Air Quality Action Plan, 2011	https://www.airqualityengland.co.uk/local-authority/hnb-reports
AQMA 3A Aldenham Road, Chalk Hill	Declared 01/02/2006, Amended 10/04/2019	NO_2 Annual Mean	A combination or residential and commercial buildings along a main road within close proximity to Bushey Station. Queuing traffic.	NO	56.8	35.1	3	Watford Borough Council Air Quality Action Plan, 2011	https://www.airqualityengland.co.uk/local-authority/hnb-reports

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

☒ **Watford Borough Council confirm that all current AQAPs have been submitted to Defra.**

Progress and Impact of Measures to address Air Quality in Watford

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

The report is well structured, detailed, and provides the information specified in the Guidance. The following comments are designed to help inform future reports:

1. There is a detailed discussion of annual mean concentration trends across the district and the AQMAs, with reference to the COVID-19 pandemic. Observed trends are also presented clearly, this is encouraged.
2. The Council provide maps showing the location of the monitoring sites and maps centred around the AQMA boundaries, this could be extended to provide clearer, focussed maps showing the location of all the monitoring sites.
3. Some of the policy text, for example around the Environment Act, which was amended in 2021, is now outdated and so could be updated
4. It seems that robust and accurate QA/QC procedures have been used; the national bias adjustment has been determined. The Council could provide a screenshot of the National Diffusion Bias Adjustment Factor Spreadsheet to ensure accuracy.
5. Overall, this report is well detailed and concise. It is clear that Watford Borough Council is committed to maintaining good air quality, with plans to publish an AQAP in 2022. Further comments on the progress of this should be included in the 2023 ASR.

The Council has addressed the matters raised following Defra's appraisal:

2. Following the deployment of tubes at new locations around the Borough, new maps have been prepared.
3. This has been addressed in this year's report.
4. A screenshot of the National Diffusion Bias Adjustment Factor Spreadsheet has been included in this year's report.
5. The previously drafted AQAP was not adopted in 2022, a decision was taken to re draft the AQAP based on 2022 monitoring results, this would include 12

months monitoring data from the Council's new monitoring locations and would be representative of local air quality following the COVID-19 pandemic.

Watford Borough Council has taken forward a number of direct measures during the current reporting year of 2022 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2. Fifteen measures are included within Table 2.2, with the type of measure and the progress Watford Borough Council have made during the reporting year of 2022 presented. Where there have been, or continue to be, barriers restricting the implementation of the measure, these are also presented within Table 2.2.

More detail on these measures can be found in the Watford Borough Council Air Quality Action Plan 2011. Completed measures are:

- Implement the Intalink project Increase the integration of public and sustainable transport movements – on-going;
- Watford Junction interchange improvement Increase the accessibility of the rail station – on-going;
- Promotion of car sharing scheme. Increase car sharing to ease congestion – complete/on-going;
- Promotion of Travel Plans. Increase in sustainable transport - complete/on-going;
- Annual Council vehicle fleet review. Maintain clean Council vehicle fleet - complete/on-going;
- Promote air quality within the Borough. Increase awareness of AQ as a health issue - complete/on-going;
- Continue to monitor air quality. Maintenance of air quality monitors and data management - complete/on-going;
- Undertake feasibility studies. To investigate the air quality impact of any potential future schemes - complete/on-going;
- Enforcement of parking policy. Minimise emissions due to reduced traffic flow caused by obstructions - complete/on-going;
- Installation of EV charging points. Encourage the uptake of electric vehicles - complete/on-going;

- Implement bus strategy. Encourage the increase of bus patronage - complete/on-going;
- Promotion of TravelSmart. Personalised travel planning to reduce car use - complete/on-going;
- Promotion of cycling and walking. Increase sustainable transport - complete/on-going.

Watford Borough Council expects the following measures to be completed over the course of the next reporting year:

- Road Infrastructure Improvements Ease congestion in St Albans Road AQMA. Further improvements are recommended in the Congestion study - On-going
- Develop Supplementary Planning Document for Air Quality. Develop SPD on AQ for inclusion in the 2011 Development Plan Document – in progress

Watford Borough Council's priority for the coming year is to draft a new AQAP.

Whilst the measures stated above and in Table 2.2 will help to contribute towards compliance, Watford Borough Council anticipates that further additional measures not yet prescribed will be required in subsequent years to achieve compliance and enable the revocation of AQMA 2 and AQMA 3A.

Table 2.2 – Progress on Measures to Improve Air Quality

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
1	Road Infrastructure Improvements Ease congestion in St Albans Road AQMA. Further improvements are recommended in the Congestion study	Traffic Management	Strategic highway improvements, Re-prioritising road space away from cars, including Access management, Selective vehicle priority, bus priority, high vehicle occupancy lane	2011	2016	HCC/WBC	HCC/WBC	NO	Funded	£100k - £500k	Implementation	Ease congestion and reduce emissions	Schemes completed	On-going	WBC is investing £400,000 on new street furniture, improved paving, tree planting, more cycle friendly routes etc. Following the first phase of improvements to St Albans Road, WBC are now looking to transform further sections of the key thoroughfare, working out from Balmoral Road towards Bushey Mill Lane. The new phases will look to focus on the pavements and forecourts to improve the look and feel, with more green space, nicer materials and street furniture including cycle parking facilities.
2	Implement the Intalink project Increase the integration of public and sustainable transport movements	Transport Planning and Infrastructure	Public transport improvements-interchanges stations and services	2011	2016	HCC/WBC	HCC/WBC	NO	Funded	£100k - £500k	Implementation	Reduce private car use and so reduce emissions.	Bus and rail patronage, number of cyclists and pedestrians	On-going	The Herts Boroughs and Districts have agreed a Memorandum of Understanding setting out the roles of district and borough councils following establishment of the Intalink Enhanced Partnership Plan and Scheme for Hertfordshire. The Intalink Bus Strategy was published in February 2020.
3	Watford Junction interchange improvement Increase the accessibility of the rail station	Transport Planning and Infrastructure	Public transport improvements-interchanges stations and services	2011	2016	HCC/WBC	HCC/WBC	NO	Funded	£100k - £500k	Implementation	Medium impact.	Completed scheme	Complete /on-going	The upgrades to the Watford Junction station forecourt have been completed. Due to the impacts of the pandemic, the project is being reassessed. Passenger numbers have clearly changed compared to pre-2020, with many city workers adopting a hybrid model of working in the office and from home.
4	Promotion of car sharing scheme. Increase car sharing to ease congestion	Alternatives to private vehicle use	Car & lift sharing schemes	2011	2016	WBC	WBC	NO	Funded	£10k - 50k	Completed	Registered members on lift share. Number of private schemes	High in the vicinity of the junction	Complete / on-going	On going promotion through council's commuting officer
5	Promotion of Travel Plans. Increase in sustainable transport	Transport Planning and Infrastructure	Public transport improvements-interchanges stations and services	2011	2016	WBC	WBC	NO	Funded	£10k - 50k	Completed	Number of travel plans in schools and businesses	Low	Complete / on-going	On going promotion through council's commuting officer
6	Annual Council vehicle fleet review. Maintain clean Council vehicle fleet	Vehicle Fleet Efficiency	Fleet efficiency and recognition schemes	2011	2016	WBC	WBC	NO	Funded	£10k - 50k	Completed	Age and Euro standard of Council vehicle fleet	Low	Complete / on-going	Civil engineering contractors using vehicles of Euro 6 standard.
7	Promote air quality within the Borough. Increase awareness of AQ as a health issue.	Public Information	Other	2011	2016	WBC	WBC	NO	Funded	< £10k	Completed	"Hits" on Herts & Beds Air Quality website	Low	Complete / on-going	This is being considered across Hertfordshire and HCC Public Health Director has committed funding. We have worked with HCC and other LAs to draft a Hertfordshire Air Quality Strategy. http://www.hertfordshire.gov.uk/docs/pdf/a/airqualitystrategicplan.pdf
8	Continue to monitor air quality. Maintenance of air quality monitors and data management.	Public Information	Other	2011	2016	WBC	WBC	NO	Funded	£50k - £100k	Completed	Number of operational monitors	Low	Complete / on-going	Despite budgetary pressures Watford has continued to fund existing monitoring and has also funded the maintenance of new $PM_{2.5}$ monitors.
9	Undertake feasibility studies. To investigate the air quality impact of any potential future schemes	Policy Guidance and Development Control	Other policy	2011	2016	WBC	WBC	NO	Funded	£10k - 50k	Implementation	Not applicable	Low	Ongoing-	Site allocation traffic light system put in place with planning policy. Constraint information for developers included in planning information.
10	Enforcement of parking policy. Minimise emissions due to reduced traffic flow caused by obstructions.	Traffic Management	Other	2011	2016	WBC	WBC	NO	Funded	£50k - £100k	Completed	Number of warnings, fines and prosecutions for such offences	Not applicable	Complete / on-going	The Police have retained powers to issue Fixed Penalty Notices to vehicles causing an obstruction

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
11	Installation of EV charging points. Encourage the uptake of electric vehicles.	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	2011	2016	HCC/WBC	HCC/WBC	NO	Funded	£100k - £500k	Completed	Number of charging points installed	Low	Complete / on going	There are now more than 60 electric vehicle charging points across Watford.
12	Implement bus strategy. Encourage the increase of bus patronage.	Alternatives to private vehicle use	Other	2011	2016	HCC/WBC	HCC/WBC	NO	Funded	£50k - £100k	Completed	Bus patronage	Low	Complete / on-going	Local Sustainable Transport Fund. On-going partnerships and promotion with local bus companies through council.
13	Promotion of TravelSmart. Personalised travel planning to reduce car use.	Alternatives to private vehicle use	Other	2011	2016	WBC	WBC	NO	Funded	£10k - 50k	Completed	Uptake numbers.	Medium	Complete / on-going	Travelsmart continues to be promoted.
14	Promotion of cycling and walking. Increase sustainable transport.	Promoting Travel Alternatives	Promotion of walking	2011	2016	WBC/HCC	WBC/HCC	NO	Funded	£10k - 50k	Completed	Number of cyclists and pedestrians	Low	Complete / on-going	New cycle route along St. Albans Road. Ebury Road route planned. Grand union canal route planned. New road signs with pedestrian info being implemented. SW Herts cycling strategy. Permanent loop monitoring planned.
15	Develop Supplementary Planning Document for Air Quality. Develop SPD on AQ for inclusion in the 2011 Development Plan Document.	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	2011	2016	WBC	WBC	NO	Funded	< £10k	Implementation	Publication of SPD; Number of planning applications made using the guidance.	Low	Council to prepare SPD	HCC Public Health Director has expressed wish for there to be a county wide strategy. As part of the Local Plan Strategy we will be considering the need for supplementary planning guidance.

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

As detailed in Policy Guidance LAQM.PG22 (Chapter 8), 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.

Exposure to high concentrations of particulate matter can exacerbate lung and heart conditions, significantly affecting quality of life, increasing hospital admissions and deaths. Children, the elderly and those with pre-existing respiratory and cardiovascular disease, are known to be more susceptible to the health impacts from air pollution.

Inhalation of particulate matter can have adverse impacts on human health, the greatest impact is believed to be from long term exposure to $PM_{2.5}$, which increase age-specific mortality risk, particularly from cardiovascular causes.

The following is taken from the Hertfordshire Local Authorities Report on Particulate Matter ($PM_{2.5}$) in Ambient Air in 2021 for Hertfordshire County Council Public Health:

Poor air quality is considered to be the largest environmental risk to the public's health and contributes to all non-communicable disease, although most commonly referenced are:

- Cardiovascular disease;
- Lung cancer;
- Respiratory diseases;
- Increased chance of hospital admissions and visits to Emergency Departments.

Evidence also states that air pollution is a significant contributor to preventable ill health and early death.

Whilst legal limits are in place, evidence suggests that health effects occur significantly below these limits, as recognised by the 2021 WHO guideline value of 5ug/m^3.

The only specific indicator for air pollution is included within the Public Health Outcomes Framework and relates to particulate matter (PM) with a diameter of 2.5um or smaller (Public Health Outcome Indicator (PHOI) 3.01).

PHOI 3.01 is 'the fraction of annual all-cause mortality attributable to long-term exposure to current levels of anthropogenic particulate pollution.' The indicator is based on an estimated amount of $PM_{2.5}$ derived by Defra modelling from local measurement, including one site in Borehamwood, Hertfordshire and another in Sandy, Bedfordshire. That data is then adjusted by way of population to give a population weighted figure before its use in deriving the PHOI.

The $PM_{2.5}$ focussed PHOI reflects the adverse impact that this type of air pollution can have on public health as a result of the fine particles being carried deep into the lungs where they can cause inflammation and a worsening of heart and lung diseases.

However, it is important to recognise that the figures published for PHOI 3.01 are estimates and therefore cannot be used for performance monitoring; they can only provide an indication of the scale of the issue.

It is for this reason that this report no longer makes direct reference to the PHOI figures, but uses the population weighted Defra modelled $PM_{2.5}$ concentrations in their place.

The fraction of mortality attributable to particulate air pollution (new method) for England (2021) is 5.5%. The PHOF data is available at:

https://fingertips.phe.org.uk/profile/public-health-outcomes-framework/data#page/4/gid/1000043/pat/159/par/K02000001/ati/15/are/E92000001/iid/93861/age/230/sex/4/cat/-1/ctp/-1/yrr/1/cid/4/tbm/1/page-options/ovw-do-0_car-ao-1_car-do-0.

Watford Borough Council is taking the following measures to address $PM_{2.5}$:

The Council monitors $PM_{2.5}$ concentrations at its automatic monitoring station. Monitoring data is reported in the Council's Annual Status Report and in the Hertfordshire Local Authorities Report on Particulate Matter ($PM_{2.5}$) in Ambient Air.

An Officer of the Council attends the Hertfordshire and Bedfordshire Air Quality Forum.

The Council will ensure compliance with the Environmental Permitting Regulations to help reduce $PM_{2.5}$ concentrations.

Under the Clean Air Act 1993, Watford has been declared a Smoke Control Area.

It is anticipated that:

- Measures to reduce emissions of NO_x by encouraging a move away from internal combustion engine vehicles to ultra-low emission vehicles (ULEV) will reduce $PM_{2.5}$ emissions from exhausts;

- Measures to reduce road travel altogether will reduce $PM_{2.5}$ emissions from brake and tyre wear and dust re-suspension.

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

This section sets out the monitoring undertaken within 2022 by Watford Borough Council and how it compares with the relevant air quality objectives. In addition, monitoring results are presented for a five-year period between 2018 and 2022 to allow monitoring trends to be identified and discussed.

Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

Watford Borough Council undertook automatic (continuous) monitoring at one site during 2022. Table A.1 in Appendix A shows the details of the automatic monitoring sites. NB. Local authorities do not have to report annually on the following pollutants: 1,3 butadiene, benzene, carbon monoxide and lead, unless local circumstances indicate there is a problem. The https://www.airqualityengland.co.uk/local-authority/?la_id=408 page presents automatic monitoring results for Watford Borough Council.

Maps showing the location of the monitoring sites are provided in Appendix D. Further details on how the monitors are calibrated and how the data has been adjusted are included in Appendix C.

3.1.2 Non-Automatic Monitoring Sites

Watford Borough Council undertook non- automatic (i.e. passive) monitoring of NO_2 at thirty-two sites during 2022. Table A.2 in Appendix A presents the details of the non-automatic 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.

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.

3.1.3 Nitrogen Dioxide (NO_2)

Table A.3 and Table A.4 in Appendix A compare 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 2022 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.

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

Figure A.1 presents trends in NO_2 annual mean concentrations at diffusion tube sites WF02 to WF64 between the years 2018 to 2022. In 2022, a single exceedance of the annual mean objective was recorded at WF44. Over the last 5 years there has been a general trend of reduction experienced at most sites (those sites that existed prior to 2022).

Figure A.2 presents trends in NO_2 annual mean concentrations in AQMA 2 between the years 2018 to 2022. In 2022, there were no exceedances of the annual mean objective.

Figure A.3 presents trends in NO_2 annual mean concentrations in AQMA 3A between the years 2018 to 2022. In 2022, there were no exceedances of the annual mean objective at four locations. The annual mean objective was exceeded at WF44. There is a general trend of reduction experienced in AQMA 3A (at those sites that existed prior to 2022).

There were no exceedances of the 1-hour objective.

There will be no changes to existing AQMAs or the declaration of a new AQMA.

3.1.4 Particulate Matter (PM_{10})

Table A.6 in Appendix A: Monitoring Results compares the ratified and adjusted monitored PM_{10} annual mean concentrations for the past five years with the air quality objective of 40µg/m^3.

Table A.7 in Appendix A compares the ratified continuous monitored PM_{10} daily mean concentrations for the past five years with the air quality objective of 50µg/m^3, not to be exceeded more than 35 times per year.

Figure A.4 presents trends in PM_{10} annual mean concentrations at the Watford Town Hall roadside site between the years 2018 to 2022. There were no exceedances of the annual mean objective in 2022.

Figure A.5 presents trends in the number of 24-hour mean PM_{10} concentrations exceeding 50ug/m3 at the Watford Town Hall roadside site between the years 2018 to 2022. The number of exceedances increased in 2022, however, the objective was not exceeded.

There will be no changes to existing AQMAs or the declaration of a new AQMA.

There are no proposed changes to the monitoring network.

3.1.5 Particulate Matter ($PM_{2.5}$)

Table A.8 in Appendix A presents the ratified and adjusted monitored $PM_{2.5}$ annual mean concentrations for the past five years.

Figure A.7 presents trends in $PM_{2.5}$ annual mean concentrations at the Watford Town Hall roadside site between the years 2018 to 2022. There were no exceedances of the Annual Mean Concentration Target. The Council commenced monitoring of $PM_{2.5}$ in 2015. The average annual mean concentration in the three-year period from 1st January 2016 to 31st December 2018 was 11 ug/m^3. There was a 31.57% reduction in concentrations between the baseline period and 2022. There is a general trend of reduction experienced at the roadside site.

Appendix A: Monitoring Results

Table A.1 – Details of Automatic Monitoring Sites

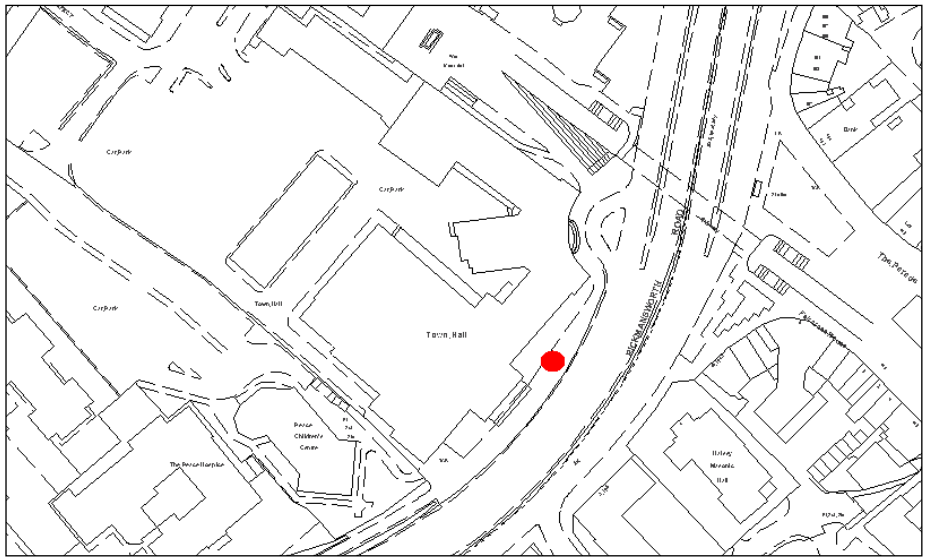
Site ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Inlet Height (m)
WF1	Watford Town Hall	Roadside	510540	1967870	NO_2, $PM_{2.5}$, PM_{10}	No	API M200E chemiluminescence $NO/NO_2/NO_X$ analyser and a Palas Fidas 200 for monitoring PM_{10} and $PM_{2.5}$	N/A	10m	1.5m

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

Location of Watford Town Hall Automatic Monitoring Site



Photograph showing the Automatic Monitoring Site at Watford Town Hall

Table A.2 – 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)
WF02	Grove Pumping Station	Urban Background	508700	198900	NO2	No - Tubes no longer deployed at this location	0.0	0.0	No	2.0
WF03	Hospital Vicarage Road	Kerbside	510600	195700	NO2	No	0.0	0.0	No	2.0
WF06	Woodside Playing Fields	Urban Background	511000	200700	NO2	No - Tubes no longer deployed at this location	0.0	0.0	No	3.0
WF29	Pinner Road	Kerbside	512000	195300	NO2	Yes - AQMA 3A	6.0	2.0	No	2.1
WF36	Ravenscroft	Industrial	512300	200100	NO2	No	8.0	0.0	No	2.2
WF37	o/S 358 St Albans Rd	Kerbside	511200	198100	NO2	No	5.0	1.0	No	2.4
WF38	A405 Horseshoe Lane	Kerbside	511700	200700	NO2	No	2.0	4.0	No	3.0
WF39	Balmoral Road	Kerbside	511000	198300	NO2	No	0.0	1.0	No	2.4
WF40	Salisbury Road	Kerbside	511000	198000	NO2	No	0.0	2.0	No	2.4
WF41	Leavesden Road	Kerbside	510900	197800	NO2	No	0.0	1.0	No	2.5
WF42	Queens Road	Kerbside	511200	197000	NO2	No	4.0	1.0	No	2.4

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)
WF43	Farraline Road	Kerbside	510800	196000	NO2	Yes - AQMA 2	4.0	2.0	No	2.4
WF44	Chalk Hill	Kerbside	512000	195500	NO2	Yes - AQMA 3A	6.0	2.0	No	2.1
WF45	Wellington Road	Kerbside	510800	197200	NO2	No	10.0	4.0	No	2.3
WF46a	Town Hall	Roadside	510565	196808	NO2	No	0.0	6.0	Yes	2.0
WF46b	Town Hall	Roadside	510565	196808	NO2	No	0.0	6.0	Yes	2.0
WF46c	Town Hall	Roadside	510565	196808	NO2	No	0.0	6.0	Yes	2.0
WF47	Willow Lane	Kerbside	510335	195610	NO2	No	3.0	1.0	No	2.4
WF48	High Street	Kerbside	511727	195610	NO2	Yes - AQMA 3A	4.0	1.0	No	2.4
WF49	Gammons Lane (o/s 67)	Kerbside	510499	198454	NO2	No	5.0	1.0	No	2.4
WF50	Eastbury Road (Oxhey Early Years)	Kerbside	511073	194940	NO2	No	0.0	2.7	No	2.9
WF51	Deacons Hill	Kerbside	511266	195050	NO2	No	8.0	3.0	No	2.4
WF52	Victoria PH	Kerbside	512034	195414	NO2	Yes - AQMA 3A	10.0	1.0	No	2.6
WF53	Villiers Road	Kerbside	512043	194963	NO2	Yes - AQMA 3A	4.0	1.0	No	2.6

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)
WF54	Water Lane	Kerbside	511381	196214	NO2	No	25.0	1.0	No	2.8
WF55	Vicarage Road	Kerbside	510985	196196	NO2	No	3.0	2.0	No	2.7
WF56	Wiggenhall Road	Kerbside	511053	195813	NO2	Yes - AQMA 2	3.0	2.0	No	3.2
WF58	Beechen Grove	Kerbside	510966	196665	NO2	No	10.0	0.0	No	2.8
WF59	Upton Road	Kerbside	510598	196482	NO2	Yes - AQMA 2	4.0	4.0	No	2.8
WF60	Merton Road	Kerbside	510827	196082	NO2	Yes - AQMA 2	6.0	0.0	No	2.7
WF61	Ladys Close	Urban Background	511141	196009	NO2	No	30.0	4.0	No	2.8
WF62	Hempstead Road	Kerbside	509814	197936	NO2	No	14.0	0.0	No	2.7
WF63	Purbrock Avenue	Kerbside	511113	199326	NO2	No	18.0	3.0	No	2.8
WF64	Rickmansworth Road	Kerbside	509721	196184	NO2	No	17.0	1.0	No	2.8

Notes:

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

(2) N/A if not applicable.

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

Site 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)	2018	2019	2020	2021	2022
WF1	510540	1967870	Roadside	95.22	95.22	32	30	21	21	21

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

☒ **Reported concentrations are those at the location of the monitoring site (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**.

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%).

Table A.4 – 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)	2018	2019	2020	2021	2022
WF02	508700	198900	Urban Background	15.4	15.4	16.0	13.5	10.9	13.2	-
WF03	510600	195700	Kerbside	84.6	84.6	30.6	28.9	21.9	23.3	21.5
WF06	511000	200700	Urban Background	15.4	15.4	18.2	18.8	14.9	13.7	-
WF29	512000	195300	Kerbside	100.0	100.0	38.6	34.7	26.1	32.0	30.0
WF36	512300	200100	Industrial	100.0	100.0	27.0	25.5	17.7	18.6	18.4
WF37	511200	198100	Kerbside	100.0	100.0	32.5	30.0	25.4	27.2	27.1
WF38	511700	200700	Kerbside	92.3	92.3	32.9	30.7	23.2	23.3	25.0
WF39	511000	198300	Kerbside	100.0	100.0	29.9	30.4	24.1	25.5	24.5
WF40	511000	198000	Kerbside	92.3	92.3	32.7	25.1	25.5	25.8	24.3
WF41	510900	197800	Kerbside	92.3	92.3	34.5	34.2	26.9	27.1	25.3
WF42	511200	197000	Kerbside	82.7	82.7	27.4	29.8	20.7	22.3	20.6
WF43	510800	196000	Kerbside	100.0	100.0	**51.1**	**42.2**	34.9	38.3	34.7
WF44	512000	195500	Kerbside	100.0	100.0	**53.2**	**49.0**	39.5	**45.6**	**44.6**

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)	2018	2019	2020	2021	2022
WF45	510800	197200	Kerbside	90.4	90.4	32.6	32.5	27.0	29.8	24.5
WF46a	510565	196808	Roadside	100.0	100.0	26.8	26.3	20.2	21.7	20.7
WF46b	510565	196808	Roadside	75.0	75.0					19.8
WF46c	510565	196808	Roadside	84.6	84.6					21.2
WF47	510335	195610	Kerbside	92.3	92.3	26.8	26.3	19.6	21.4	20.3
WF48	511727	195610	Kerbside	84.6	84.6	**42.3**	**41.7**	34.6	35.1	34.2
WF49	510499	198454	Kerbside	100.0	100.0	32.8	31.5	23.7	24.4	23.2
WF50	511073	194940	Kerbside	100.0	100.0	32.2	31.1	23.3	24.4	23.0
WF51	511266	195050	Kerbside	84.6	84.6					33.0
WF52	512034	195414	Kerbside	84.6	84.6					**40.0**
WF53	512043	194963	Kerbside	67.3	67.3					25.2
WF54	511381	196214	Kerbside	84.6	84.6					26.7
WF55	510985	196196	Kerbside	84.6	84.6					32.3
WF56	511053	195813	Kerbside	84.6	84.6					25.6

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)	2018	2019	2020	2021	2022
WF58	510966	196665	Kerbside	75.0	75.0					25.1
WF59	510598	196482	Kerbside	84.6	84.6					24.8
WF60	510827	196082	Kerbside	84.6	84.6					30.9
WF61	511141	196009	Urban Background	84.6	84.6					18.0
WF62	509814	197936	Kerbside	84.6	84.6					21.9
WF63	511113	199326	Kerbside	84.6	84.6					28.2
WF64	509721	196184	Kerbside	69.2	69.2					25.2

☒ **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

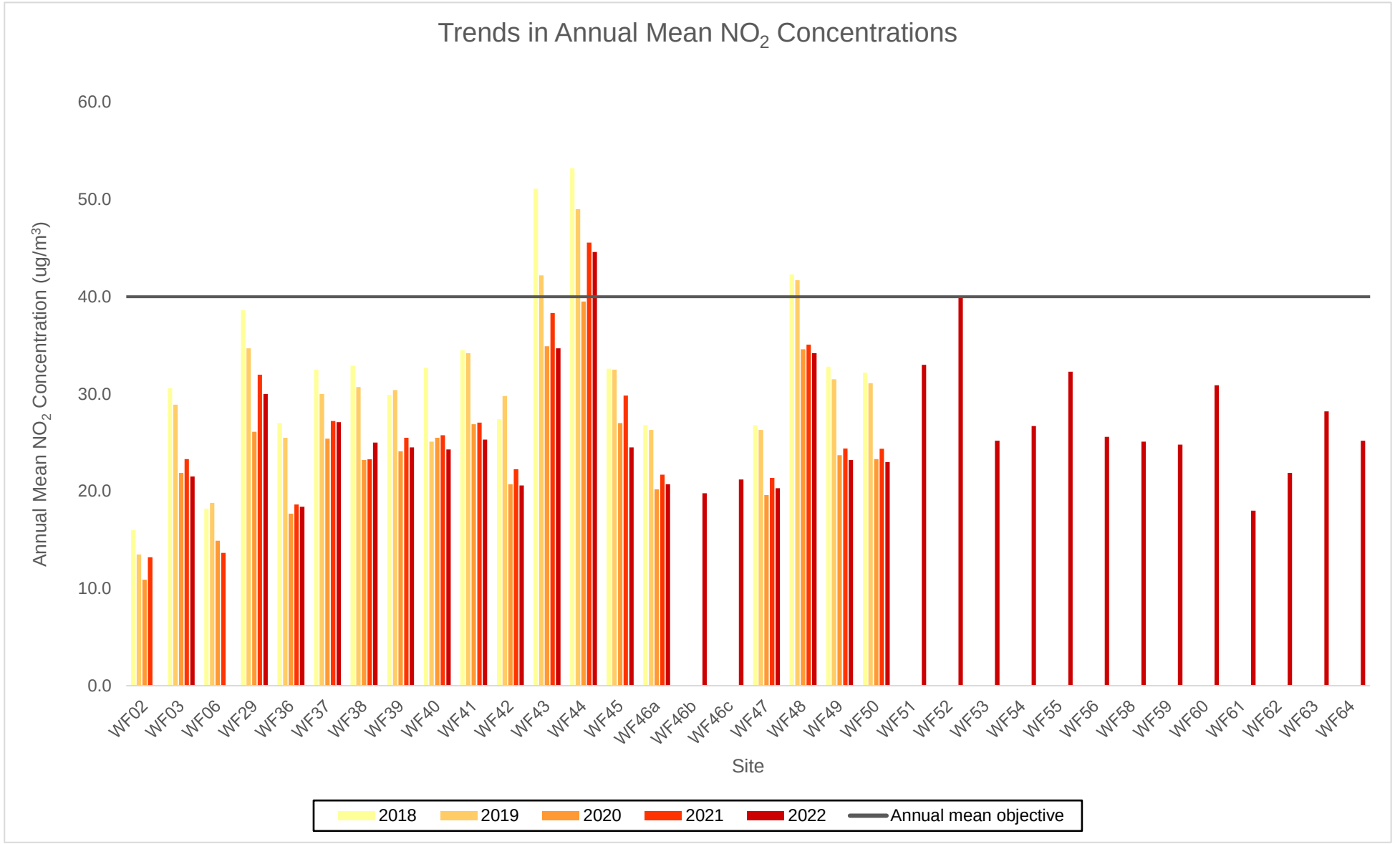


Figure A.2 – Trends in Annual Mean NO_2 Concentrations in AQMA 2

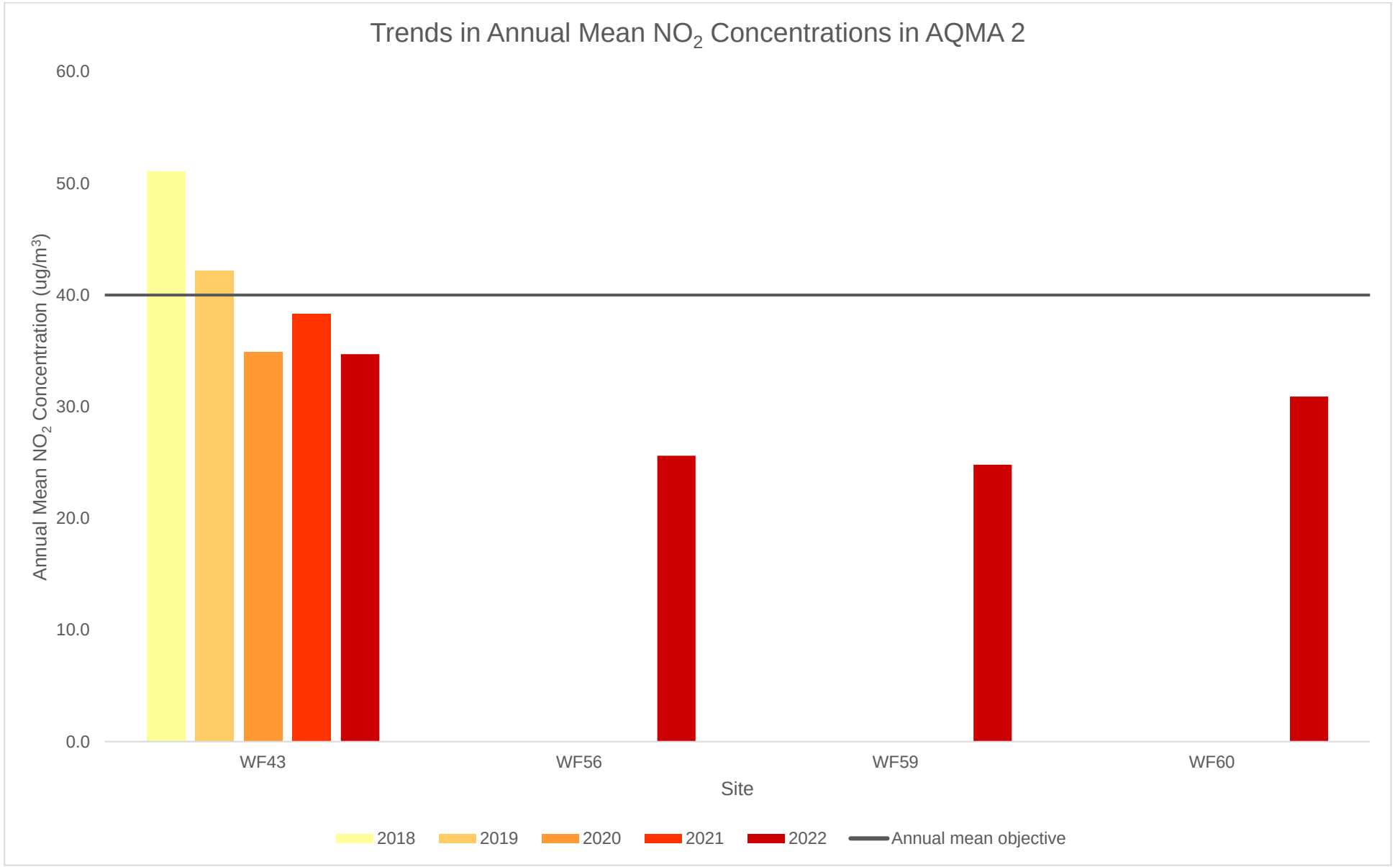


Figure A.3 – Trends in Annual Mean NO_2 Concentrations in AQMA 3A

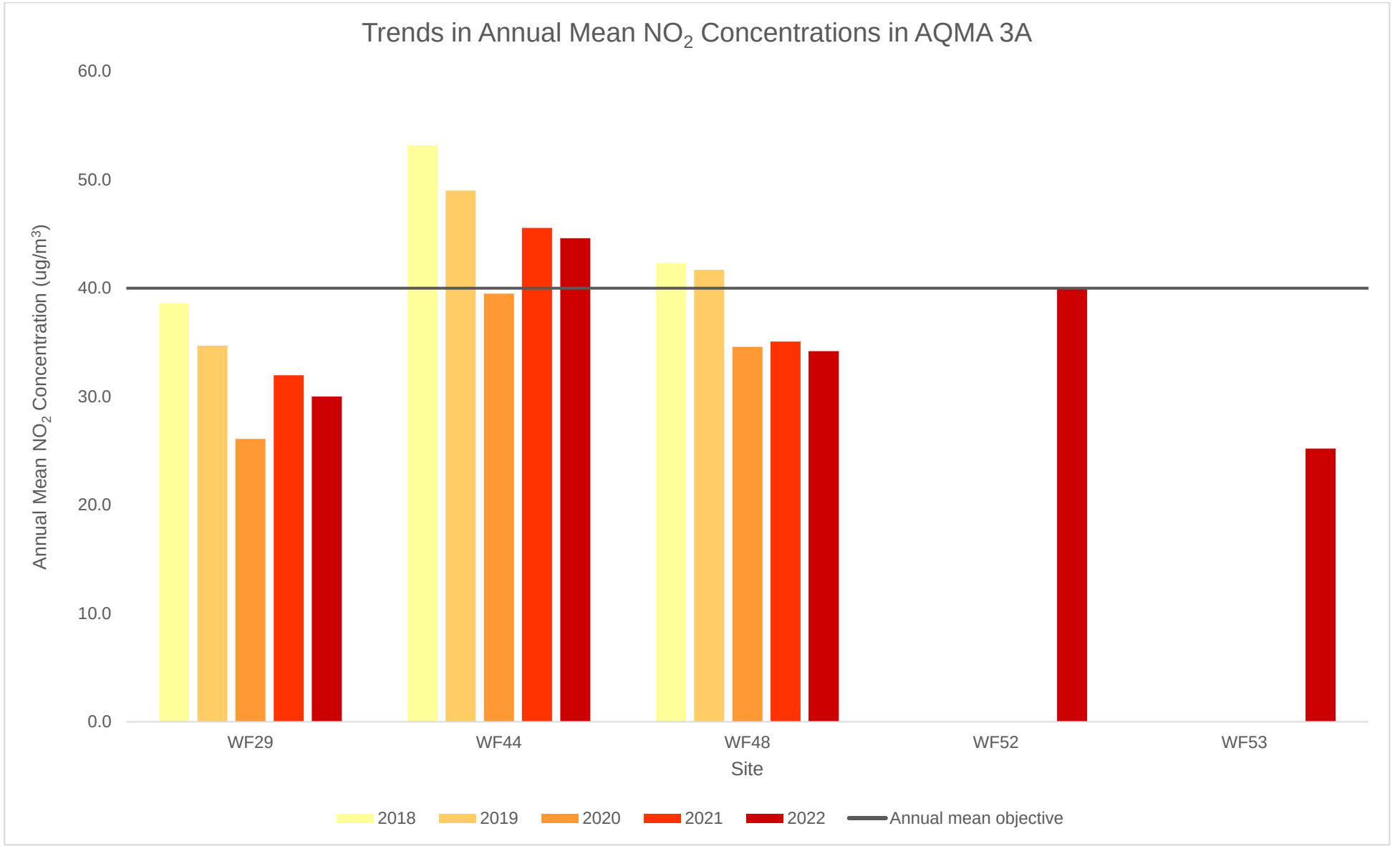


Table A.5 – 1-Hour Mean NO_2 Monitoring Results, Number of 1-Hour Means > 200µg/m^3

Site 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)	2018	2019	2020	2021	2022
WF1	510540	196780	Roadside	95.22	95.22	0	0	0	0	0

Notes:

Results are presented as the number of 1-hour periods where concentrations greater than 200µg/m^3 have been recorded.

Exceedances of the NO_2 1-hour mean objective (200µg/m^3 not to be exceeded more than 18 times/year) are shown in **bold**.

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

(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%).

Table A.6 – Annual Mean PM_{10} Monitoring Results ($\mu g/m^3$)

Site 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)	2018	2019	2020	2021	2022
WF1	510540	196780	Roadside	99.82	99.82	15	15	13	13	14

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

Notes:

The annual mean concentrations are presented as $\mu g/m^3$.

Exceedances of the PM_{10} annual mean objective of 40$\mu g/m^3$ are shown in **bold**.

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.

(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.4 – Trends in Annual Mean PM_{10} Concentrations

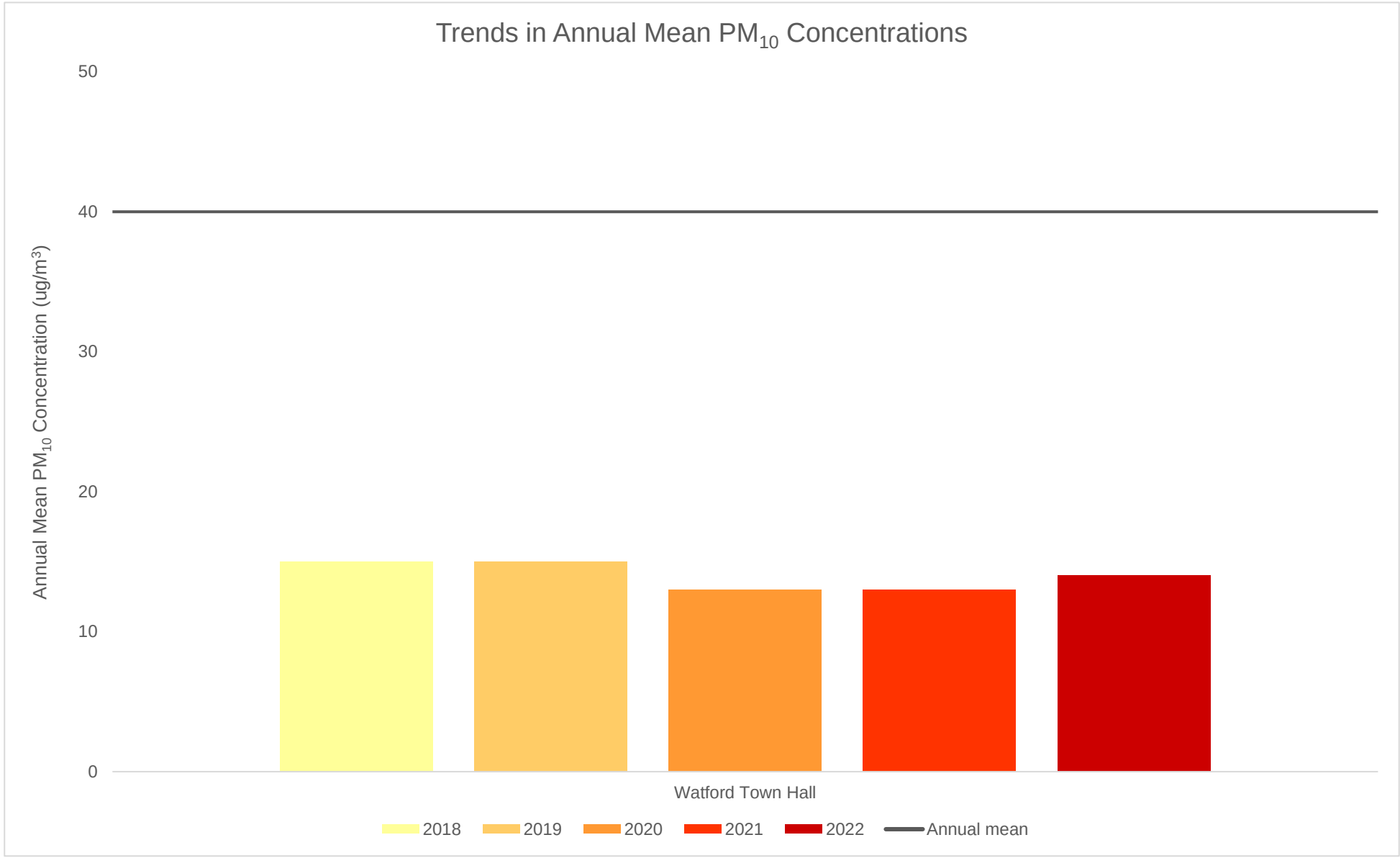


Table A.7 – 24-Hour Mean PM_{10} Monitoring Results, Number of PM_{10} 24-Hour Means > 50µg/m^3

Site 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)	2018	2019	2020	2021	2022
WF1	510540	196780	Roadside	99.82	99.82	1	4	0	0	3

Notes:

Results are presented as the number of 24-hour periods where daily mean concentrations greater than 50µg/m^3 have been recorded.

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

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

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

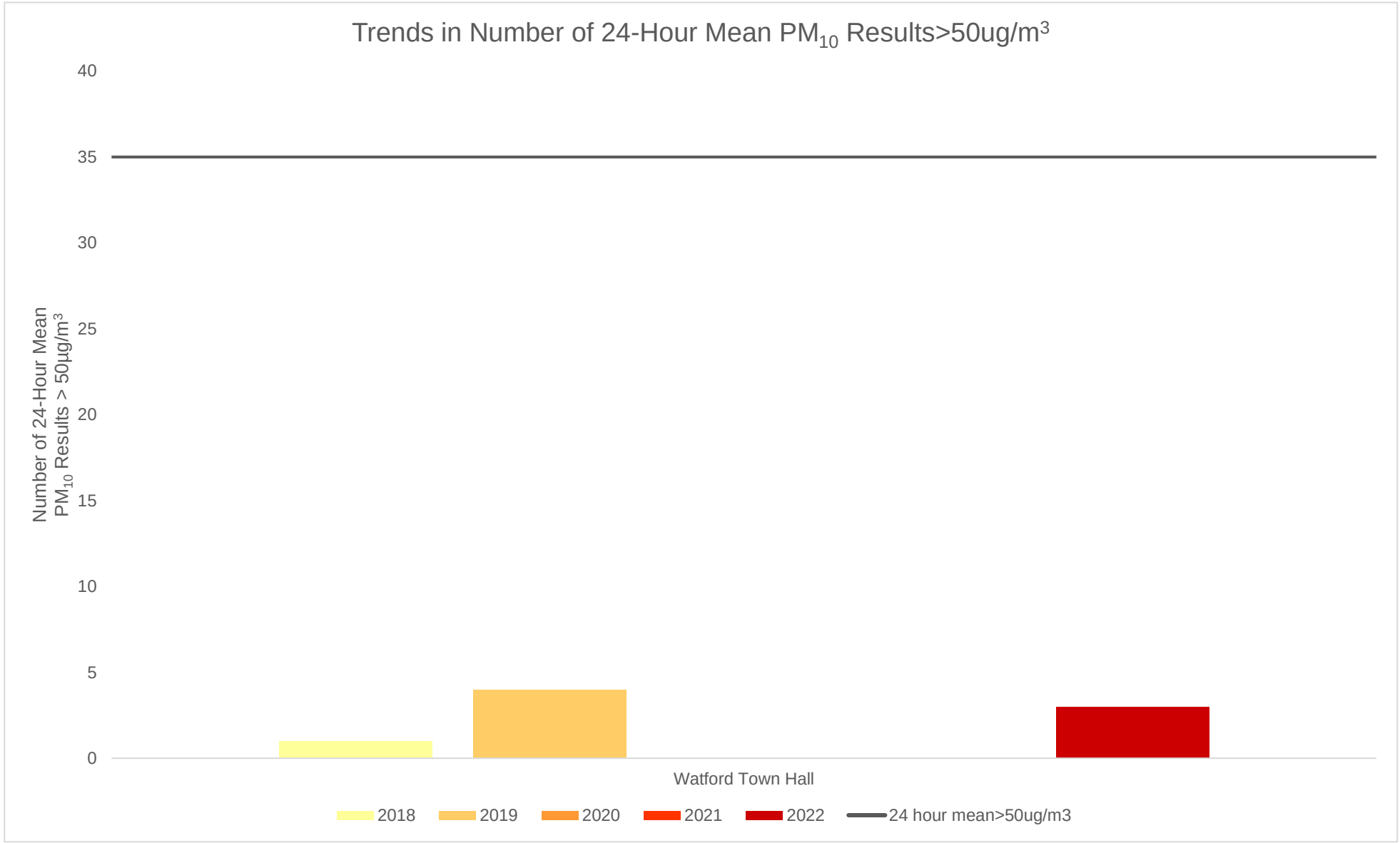


Table A.8 – Annual Mean $PM_{2.5}$ Monitoring Results ($\mu g/m^3$)

Site 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)	2018	2019	2020	2021	2022
WF1	510540	196780	Roadside	99.81	99.81	9	9	8	8	8

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

Notes:

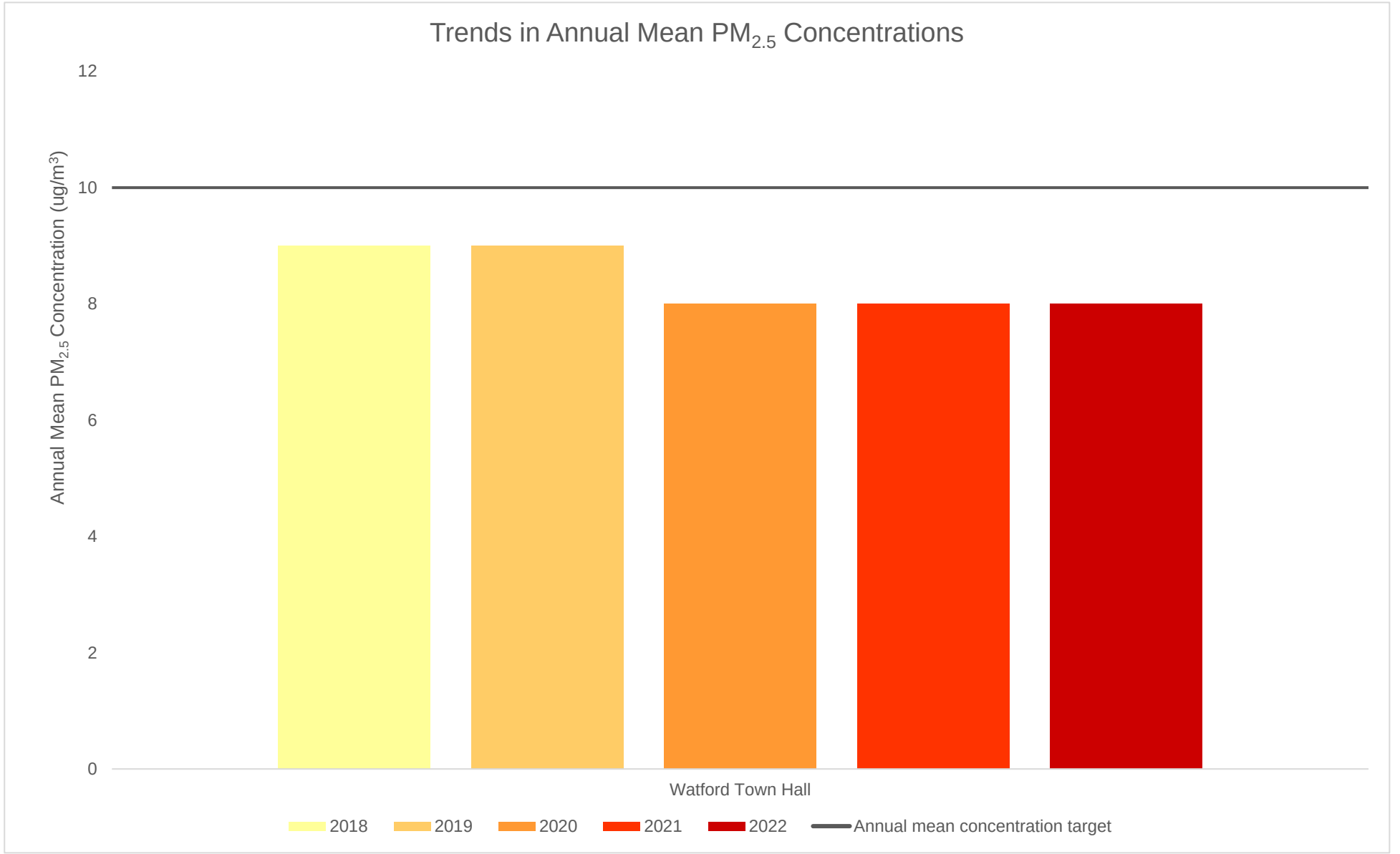
The annual mean concentrations are presented as $\mu g/m^3$.

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.

(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.6 – Trends in Annual Mean $PM_{2.5}$ Concentrations



Appendix B: Full Monthly Diffusion Tube Results for 2022

Table B.1 – NO_2 2022 Diffusion Tube Results (µg/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 (0.76)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
WF02	508700	198900	21.7	12.7											-	-	-	
WF03	510600	195700			39.5	28.5	27.8	23.8	21.0	25.2	25.8	28.0	27.5	36.2	28.3	21.5	-	
WF06	511000	200700	28.5	16.8											-	-	-	
WF29	512000	195300	54.8	36.0	53.6	43.4	33.6	35.6	34.6	40.6	43.3	39.5	11.1	47.3	39.5	30.0	-	
WF36	512300	200100	32.6	21.6	34.8	23.0	21.6	16.2	20.8	21.3	20.6	24.2	24.4	29.5	24.2	18.4	-	
WF37	511200	198100	47.0	28.4	47.7	32.3	29.0	26.1	29.5	31.6	36.2	36.8	37.1	45.5	35.6	27.1	-	
WF38	511700	200700	41.4	28.0	44.1	29.8	27.4	25.5		29.7	30.8	33.0	34.9	37.2	32.9	25.0	-	
WF39	511000	198300	42.6	33.0	43.1	31.5	28.3	26.0	28.2	27.9	31.5	32.7	34.2	27.7	32.2	24.5	-	
WF40	511000	198000	45.6		36.4	31.4	25.4	24.3	25.6	24.6	31.4	31.1	33.2	42.1	31.9	24.3	-	
WF41	510900	197800		18.2	42.9	33.5	32.0	30.8	31.4	30.8	33.4	38.0	33.6	42.0	33.3	25.3	-	
WF42	511200	197000	41.9		33.2	23.5	23.1	20.2	23.3	23.4	25.9	31.3	25.8		27.2	20.6	-	
WF43	510800	196000	60.3	43.9	53.5	45.0	45.2	40.0	36.6	42.1	46.6	42.1	44.0	49.0	45.7	34.7	-	
WF44	512000	195500	78.8	58.5	63.5	57.6	55.5	52.3	58.5	59.3	61.4	53.3	51.6	53.2	58.6	**44.6**	35.1	
WF45	510800	197200	46.5	30.2	42.4		27.2	23.9	29.5	26.5	36.5	31.7	17.2	43.5	32.3	24.5	-	
WF46a	510565	196808	38.9	27.3	34.3	23.4	20.6	18.5	22.3	18.9	27.9	27.4	33.0	34.1	27.2	20.7	-	
WF46b	510565	196808			34.6	21.4		19.5	21.4	21.3	27.5	29.6	27.2	32.5	26.1	19.8	-	
WF46c	510565	196808			33.8	44.4	22.1	19.8	21.7	20.6	27.0	28.2	29.2	32.6	27.9	21.2	-	
WF47	510335	195610	24.3		35.1	26.7	22.4	21.5	22.0	22.2	28.8	26.5	26.6	37.3	26.7	20.3	-	

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 (0.76)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
WF48	511727	195610			55.5	42.1	45.6	43.0	40.1	43.2	46.9	49.9	32.5	50.8	45.0	34.2	-	
WF49	510499	198454	46.8	31.0	41.3	26.1	29.1	25.6	29.1	24.3	29.6	34.7	10.4	37.9	30.5	23.2	-	
WF50	511073	194940	42.3	31.6	41.7	27.7	13.8	19.1	24.8	25.4	27.5	31.8	37.1	40.1	30.2	23.0	-	
WF51	511266	195050			55.9	45.6	41.2	35.4	40.1	42.7	44.0	43.6	39.7	46.0	43.4	33.0	-	
WF52	512034	195414			70.4	49.4	51.8	47.1	52.9	53.6	51.6	55.1	41.5	53.5	52.7	**40.0**	28.1	
WF53	512043	194963			34.0	29.5	28.8	27.7		28.0	32.2		37.3	37.4	31.9	25.2	-	
WF54	511381	196214			51.6	33.0	32.4	30.0	31.9	31.3	38.7	40.7	19.2	43.1	35.2	26.7	-	
WF55	510985	196196			51.6	40.7	40.5	36.0	37.6	42.1	40.8	42.3	43.9	49.4	42.5	32.3	-	
WF56	511053	195813			45.6	32.5	30.5	27.9	30.6	30.4	33.9	33.7	32.2	39.8	33.7	25.6	-	
WF58	510966	196665			42.5		28.7	25.3	32.6	32.4	37.1	31.5	28.8	38.9	33.1	25.1	-	
WF59	510598	196482			44.0	30.3	27.3	25.8	28.4	29.2	32.5	34.3	31.9	42.6	32.6	24.8	-	
WF60	510827	196082			54.2	31.9	37.0	33.7	35.0	40.1	42.1	45.2	41.5	45.9	40.7	30.9	-	
WF61	511141	196009			36.0	24.6	18.7	17.2	17.4	21.1	24.3	24.3	24.6	28.4	23.7	18.0	-	
WF62	509814	197936			43.4	27.6	24.3	22.4	25.3	24.7	28.0	29.2	31.8	30.8	28.8	21.9	-	
WF63	511113	199326			47.3	34.1	40.2	39.2	35.6	31.9	35.4	45.4	16.1	45.3	37.1	28.2	-	
WF64	509721	196184			41.4	29.6	28.6	27.7			28.9	34.9	35.7	41.2	33.5	25.2	-	

☒ **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.**

☒ **National bias adjustment factor used.**

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

☒ **Watford Borough Council confirm that all 2022 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 Watford Borough Council During 2022

Watford Borough Council has not identified any new sources relating to air quality within the reporting year of 2022.

Additional Air Quality Works Undertaken by Watford Borough Council During 2022

Watford Borough Council has not completed any additional works within the reporting year of 2022.

QA/QC of Diffusion Tube Monitoring

Diffusion tubes were supplied by SOCOTEC (Didcot laboratory) in 2022. The method of preparation used was 50% TEA (triethanolamine) in acetone.

SOCOTEC are UKAS accredited. Diffusion Tubes were analysed in accordance with SOCOTEC's standard operating procedure ANU/SOP/1015. This method meets the guidelines set out in DEFRA's 'Diffusion Tubes For Ambient NO_2 Monitoring: Practical Guidance.'

SOCOTEC participate in the AIR PT intercomparison scheme for comparing spiked Nitrogen Dioxide diffusion tubes. SOCOTEC currently holds the highest rank of a Satisfactory laboratory.

In the most recent round (AIR PT AR050 May – June 2022), 100% of results submitted were determined to be satisfactory.

SOCOTEC were considered to have good diffusion tube precision in 2022.

Monitoring was completed in adherence with the 2022 Diffusion Tube Monitoring Calendar.

Diffusion Tube Annualisation

Annualisation is required for any site with data capture less than 75% but greater than 25%. Annualisation was required for WF53 and WF64. Details of the calculation method undertaken are provided in Table C.1.

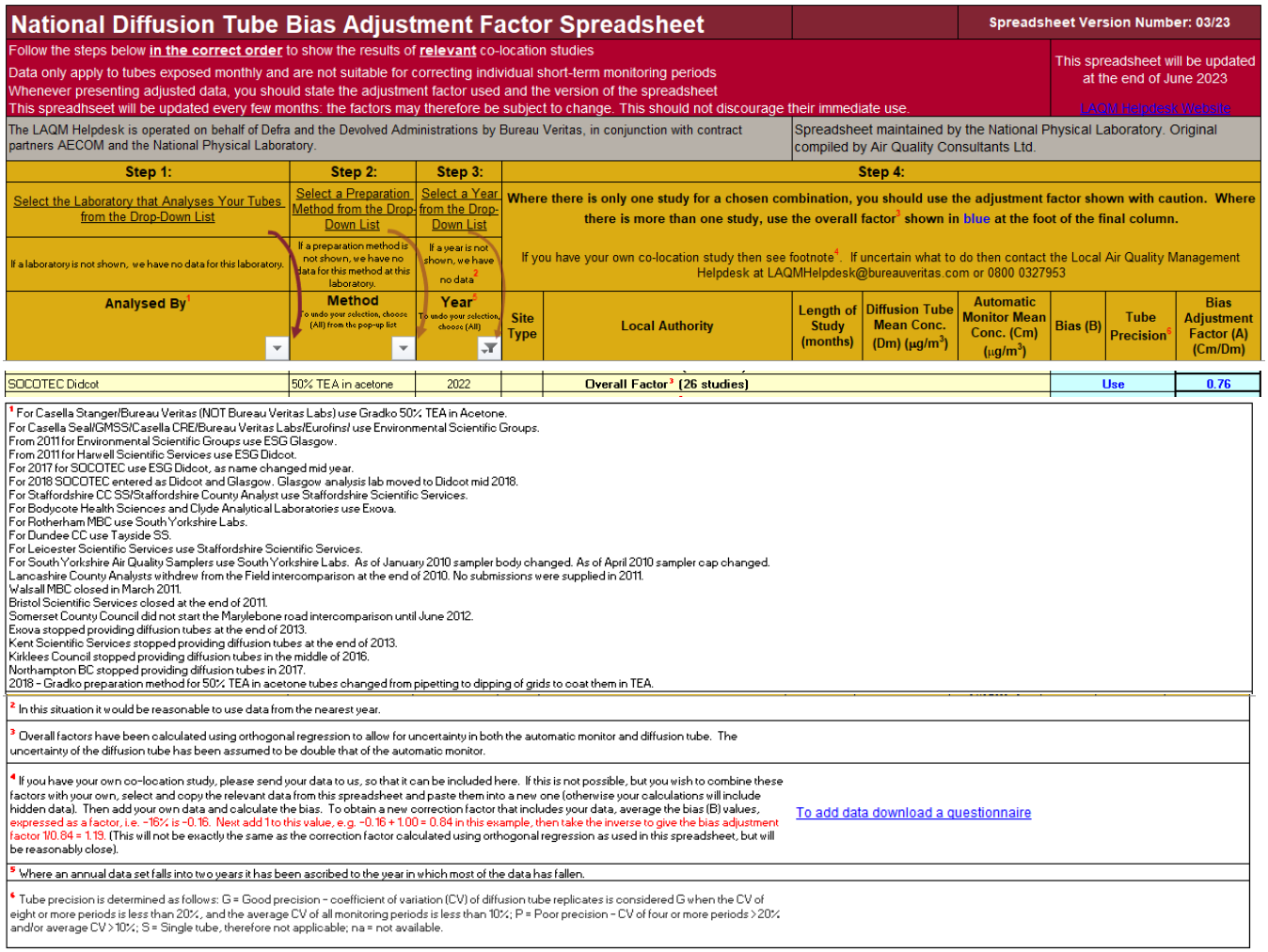
Table C.1 – Annualisation Summary (concentrations presented in µg/m^3)

Site ID	Annualisation Factor Boreham wood Meadow Park	Annualisation Factor London N. Kensington	Annualisation Factor Hillingdon	Annualisation Factor <Site 4 Name>	Average Annualisation Factor	Raw Data Annual Mean	Annualised Annual Mean
WF53	1.0383	1.0533	1.0362		1.0426	31.9	33.2
WF64	0.9763	1.0060	0.9886		0.9903	33.5	33.2

Diffusion Tube Bias Adjustment Factors

The diffusion tube data presented within the 2022 ASR have 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.

Watford Borough Council have applied a national bias adjustment factor of 0.76 to the 2022 monitoring data. A screenshot of the relevant sections of the National Diffusion Bias Adjustment Factor Spreadsheet is included below. A summary of bias adjustment factors used by Watford Borough Council over the past five years is presented in Table C.2.



National Diffusion Tube Bias Adjustment Factor Spreadsheet — Spreadsheet Version Number: 03/23

Follow the steps below **in the correct order** to show the results of **relevant** co-location studies
Data only apply to tubes exposed monthly and are not suitable for correcting individual short-term monitoring periods
Whenever presenting adjusted data, you should state the adjustment factor used and the version of the spreadsheet
This spreadhseet will be updated every few months: the factors may therefore be subject to change. This should not discourage their immediate use.

This spreadsheet will be updated at the end of June 2023

LAQM Helpdesk Website

The LAQM Helpdesk is operated on behalf of Defra and the Devolved Administrations by Bureau Veritas, in conjunction with contract partners AECOM and the National Physical Laboratory.

Spreadsheet maintained by the National Physical Laboratory. Original compiled by Air Quality Consultants Ltd.

Step 1:	Step 2:	Step 3:	Step 4:
Select the Laboratory that Analyses Your Tubes from the Drop-Down List	Select a Preparation Method from the Drop-Down List	Select a Year from the Drop-Down List	Where there is only one study for a chosen combination, you should use the adjustment factor shown with caution. Where there is more than one study, use the overall factor[3] shown in blue at the foot of the final column.
If a laboratory is not shown, we have no data for this laboratory	If a preparation method is not shown, we have no data for this method at this laboratory.	If a year is not shown, we have no data[2]	If you have your own co-location study then see footnote[4]. If uncertain what to do then contact the Local Air Quality Management Helpdesk at LAQMHelpdesk@bureauveritas.com or 0800 0327953

Analysed By[1]	Method (To undo your selection, choose (All) from the pop-up list)	Year[2] (To undo your selection, choose (All))	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) (µg/m³)	Automatic Monitor Mean Conc. (Cm) (µg/m³)	Bias (B)	Tube Precision[5]	Bias Adjustment Factor (A) (Cm/Dm)
SOCOTEC Didcot	50% TEA in acetone	2022		Overall Factor[3] (26 studies)				Use		0.76

[1] For Casella Stanger/Bureau Veritas (NOT Bureau Veritas Labs) use Gradko 50% TEA in Acetone.
For Casella Seal/GMSS/Casella CRE/Bureau Veritas Labs/Eurofins/ use Environmental Scientific Groups.
From 2011 for Environmental Scientific Groups use ESG Glasgow.
From 2011 for Harwell Scientific Services use ESG Didcot.
For 2017 for SOCOTEC use ESG Didcot, as name changed mid year.
For 2018 SOCOTEC entered as Didcot and Glasgow. Glasgow analysis lab moved to Didcot mid 2018.
For Staffordshire CC SS/Staffordshire County Analyst use Staffordshire Scientific Services.
For Bodycote Health Sciences and Clyde Analytical Laboratories use Exova.
For Rotherham MBC use South Yorkshire Labs.
For Dundee CC use Tayside SS.
For Leicester Scientific Services use Staffordshire Scientific Services.
For South Yorkshire Air Quality Samplers use South Yorkshire Labs. As of January 2010 sampler body changed. As of April 2010 sampler cap changed.
Lancashire County Analysts withdrew from the Field intercomparison at the end of 2010. No submissions were supplied in 2011.
Walsall MBC closed in March 2011.
Bristol Scientific Services closed at the end of 2011.
Somerset County Council did not start the Marylebone road intercomparison until June 2012.
Exova stopped providing diffusion tubes at the end of 2013.
Kent Scientific Services stopped providing diffusion tubes at the end of 2013.
Kirklees Council stopped providing diffusion tubes in the middle of 2016.
Northampton BC stopped providing diffusion tubes in 2017.
2018 - Gradko preparation method for 50% TEA in acetone tubes changed from pipetting to dipping of grids to coat them in TEA.

[2] In this situation it would be reasonable to use data from the nearest year.

[3] Overall factors have been calculated using orthogonal regression to allow for uncertainty in both the automatic monitor and diffusion tube. The uncertainty of the diffusion tube has been assumed to be double that of the automatic monitor.

[4] If you have your own co-location study, please send your data to us, so that it can be included here. If this is not possible, but you wish to combine these factors with your own, select and copy the relevant data from this spreadsheet and paste them into a new one (otherwise your calculations will include hidden data). Then add your own data and calculate the bias. To obtain a new correction factor that includes your data, average the bias (B) values, expressed as a factor, i.e. -16% is -0.16. Next add 1 to this value, e.g. -0.16 + 1.00 = 0.84 in this example, then take the inverse to give the bias adjustment factor 1/0.84 = 1.19. (This will not be exactly the same as the correction factor calculated using orthogonal regression as used in this spreadsheet, but will be reasonably close).

To add data download a questionnaire

[5] Where an annual data set falls into two years it has been ascribed to the year in which most of the data has fallen.

[6] Tube precision is determined as follows: G = Good precision - coefficient of variation (CV) of diffusion tube replicates is considered G when the CV of eight or more periods is less than 20%, and the average CV of all monitoring periods is less than 10%; P = Poor precision - CV of four or more periods >20% and/or average CV >10%; S = Single tube, therefore not applicable; na = not available.

Table C.2 – Bias Adjustment Factor

Monitoring Year	Local or National	If National, Version of National Spreadsheet	Adjustment Factor
2022	National	03/23	0.76
2021	National	03/22	0.78
2020	National	03/21	0.77
2019	National	Not recorded	0.75
2018	National	Not recorded	0.76

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.

Distance correction should be considered at any monitoring site where the annual mean is greater than 36ug/m3 and the monitoring site is not located at a point of relevant exposure (taking the limitations of the calculator into account).

Fall-off-with-distance calculations were required for WF44 and WF52. The output from the Diffusion Tube Data Processing Tool are presented in Table C.4.

Table C.4 – NO_2 Fall off With Distance Calculations (concentrations presented in µg/m^3)

Site ID	Distance (m): Monitoring Site to Kerb	Distance (m): Receptor to Kerb	Monitored Concentration (Annualised and Bias Adjusted	Background Concentration	Concentration Predicted at Receptor	Comments
WF44	2.0	8.0	44.6	15.4	35.1	None
WF52	1.0	11.0	40.0	15.4	28.1	None

QA/QC of Automatic Monitoring

Ricardo Energy & Environment complete data management and Local Site Operator (LSO) duties for the Council's automatic monitoring site.

Calibrations are carried out monthly, UKAS ISO 17025 QC audits are undertaken twice yearly. Servicing and maintenance is carried out by Enviro Technology Services Ltd.

Monitoring data is ratified in accordance with The Air Quality Data Validation and Ratification Process used for the UK Automatic Urban and Rural Monitoring Network (AURN). The monitoring data presented within the ASR is ratified.

Live and historic data is available at https://www.airqualityengland.co.uk/local-authority/?la_id=408.

PM_{10} and $PM_{2.5}$ Monitoring Adjustment

The type of PM_{10}/$PM_{2.5}$ monitor(s) utilised within Watford Borough Council do not require the application of a correction factor.

Automatic Monitoring Annualisation

All automatic monitoring locations within Watford Borough Council recorded data capture of greater than 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.

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 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 automatic NO_2 monitoring locations within Watford Borough Council required distance correction during 2022.

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

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

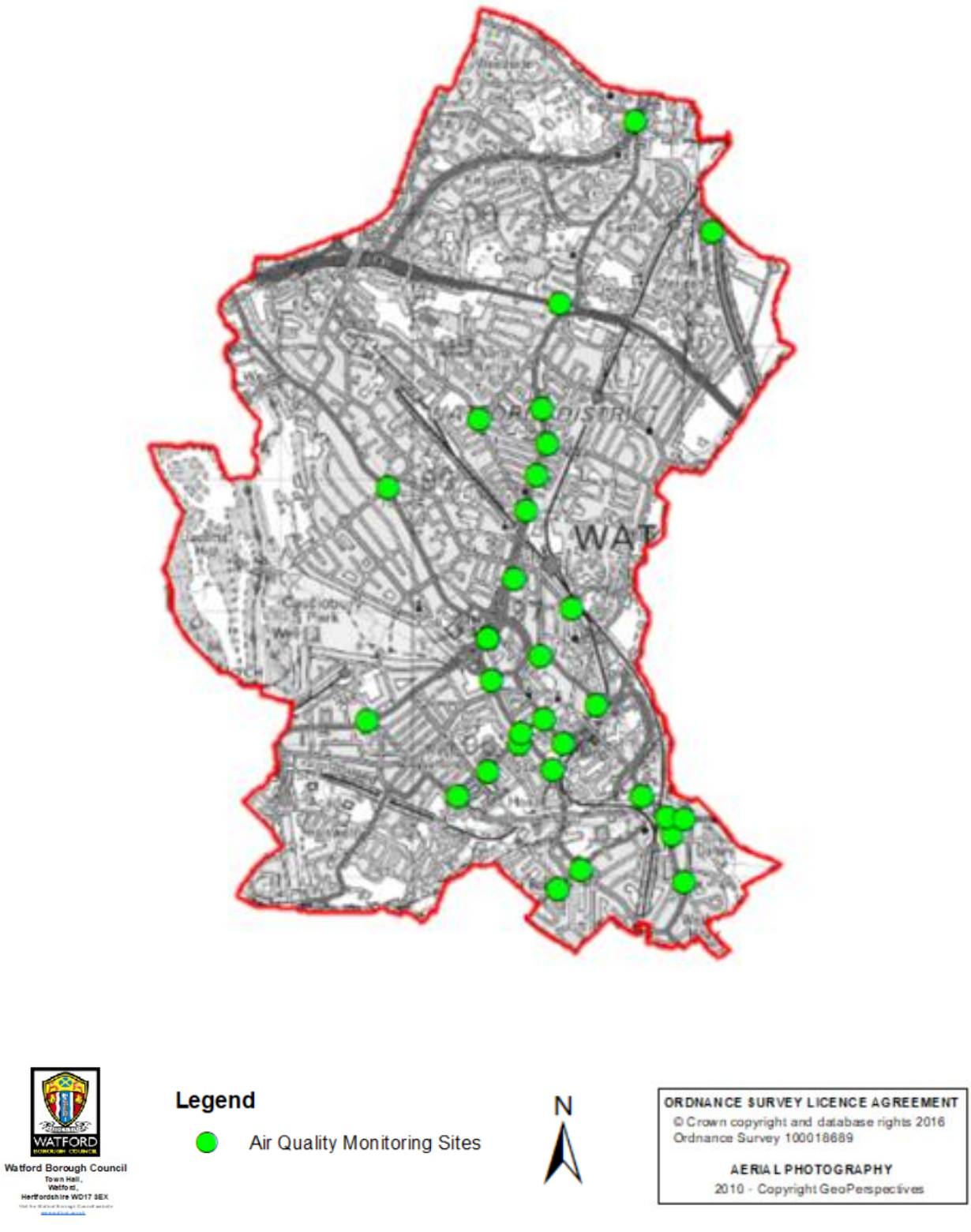


Figure D.2 - Map showing Non-Automatic Monitoring Sites in and around AQMA No. 2 (Vicarage Road)

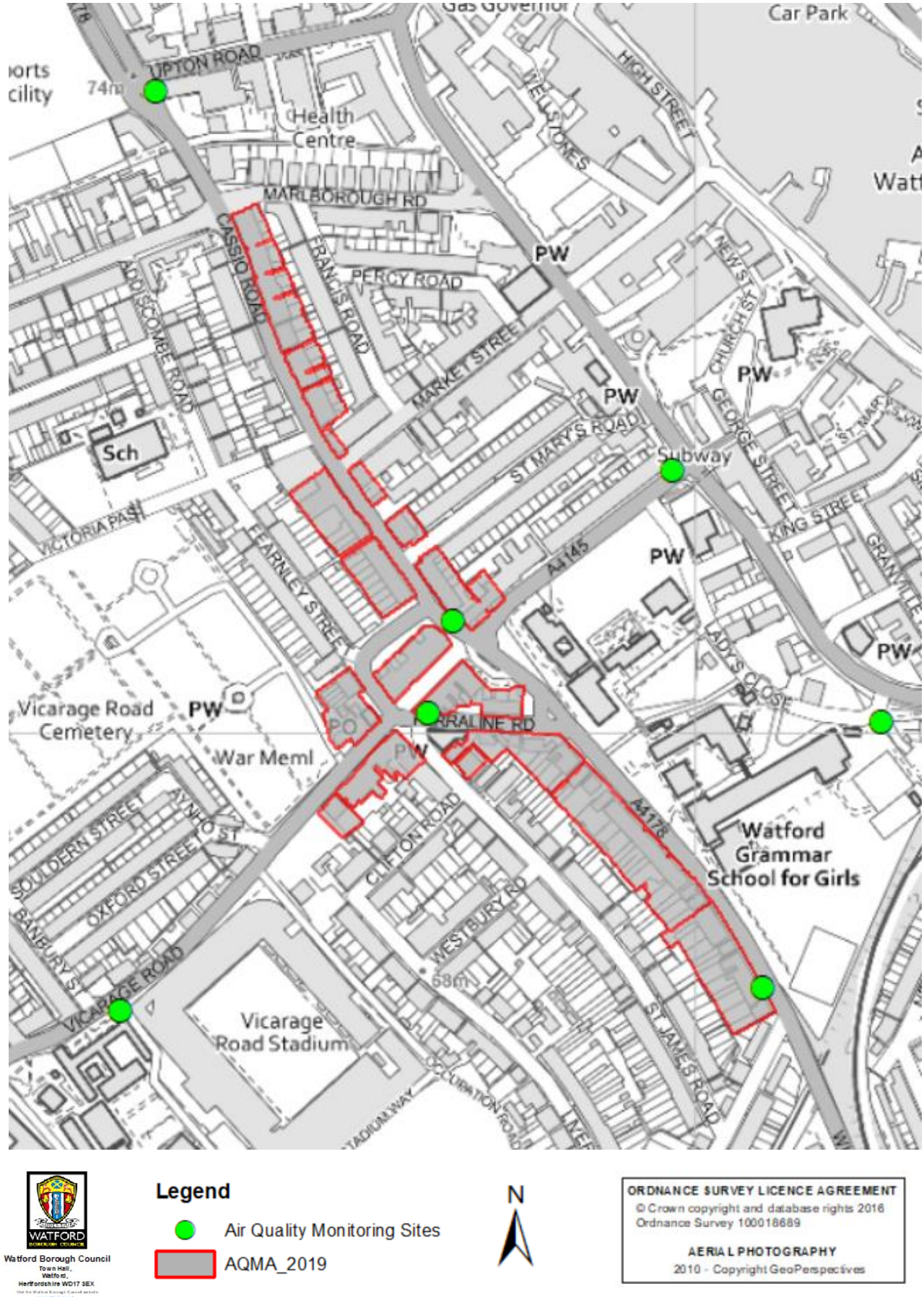


Figure D.3 - Map showing Non-Automatic Monitoring Sites in and around AQMA 3A (Pinner Road)

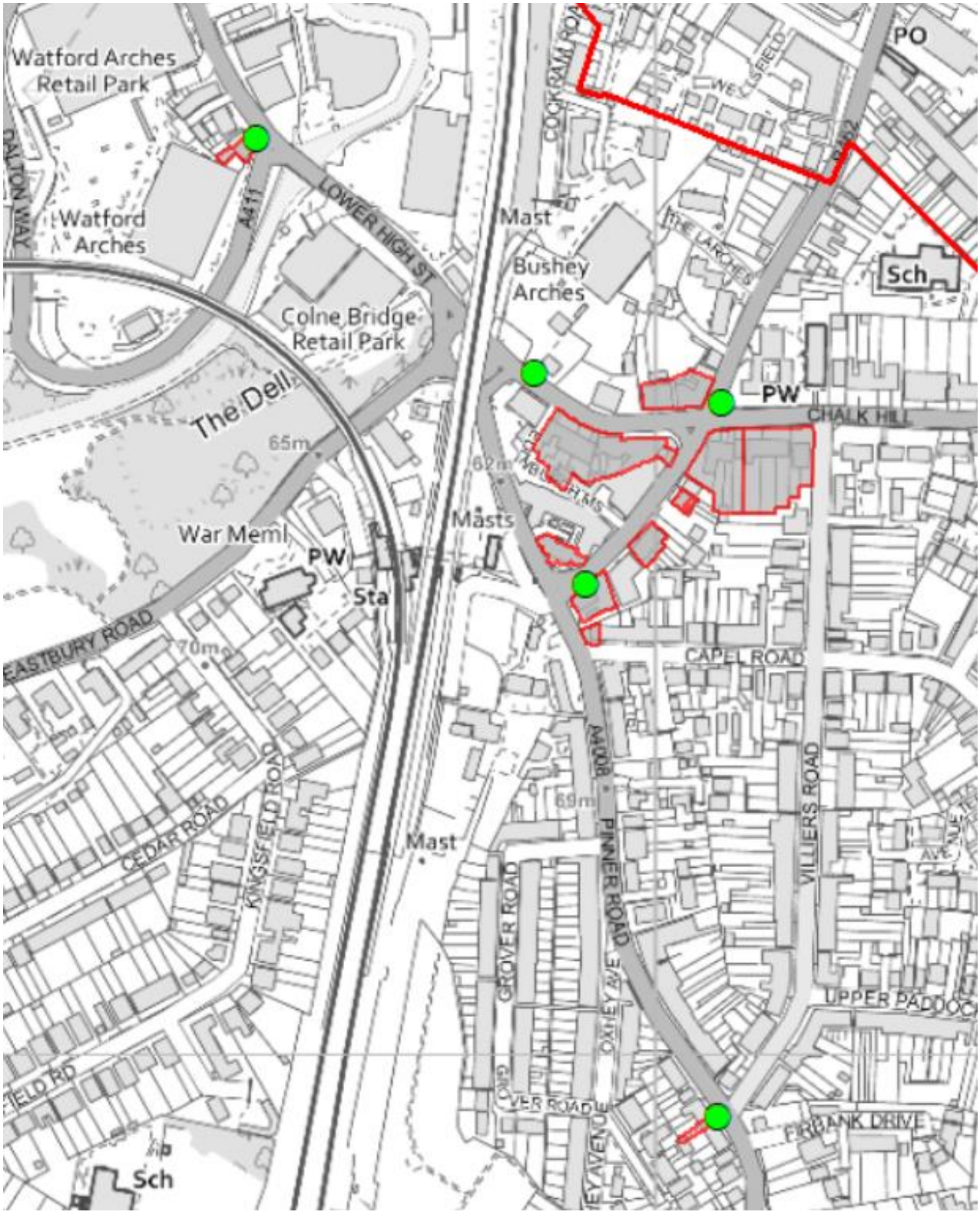
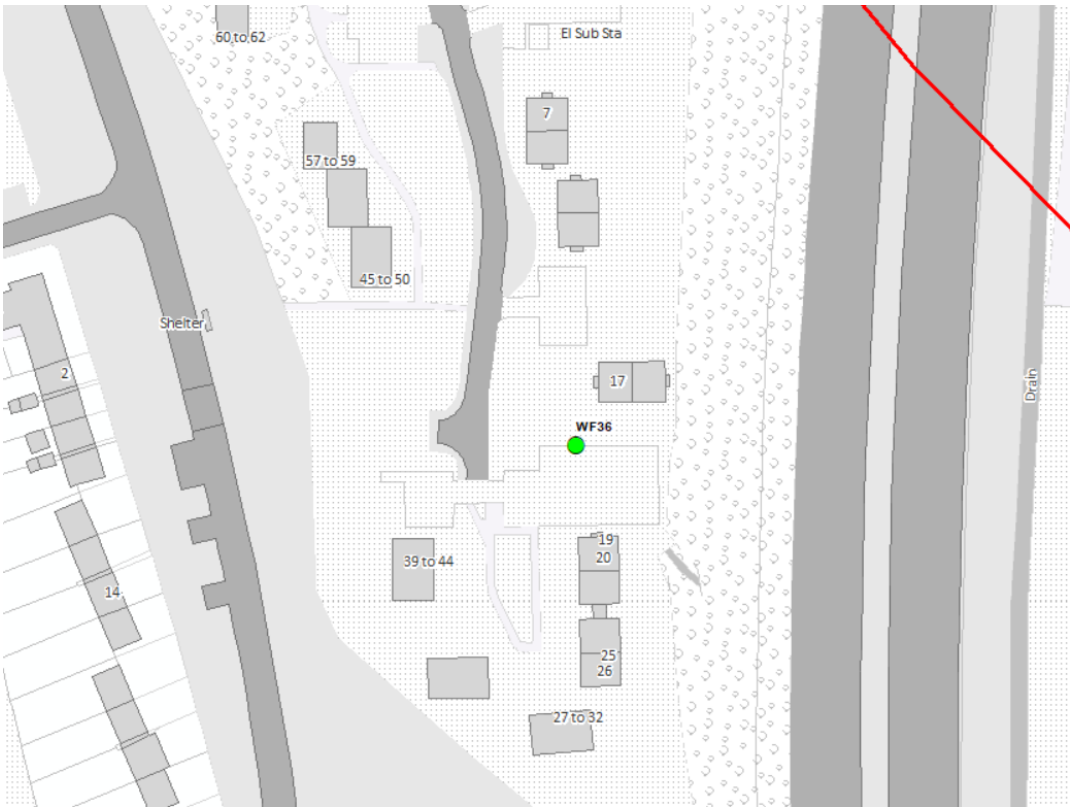


Figure D.4 - Maps showing Non-Automatic Monitoring Sites (from Woodside in the north to Oxhey in the south)

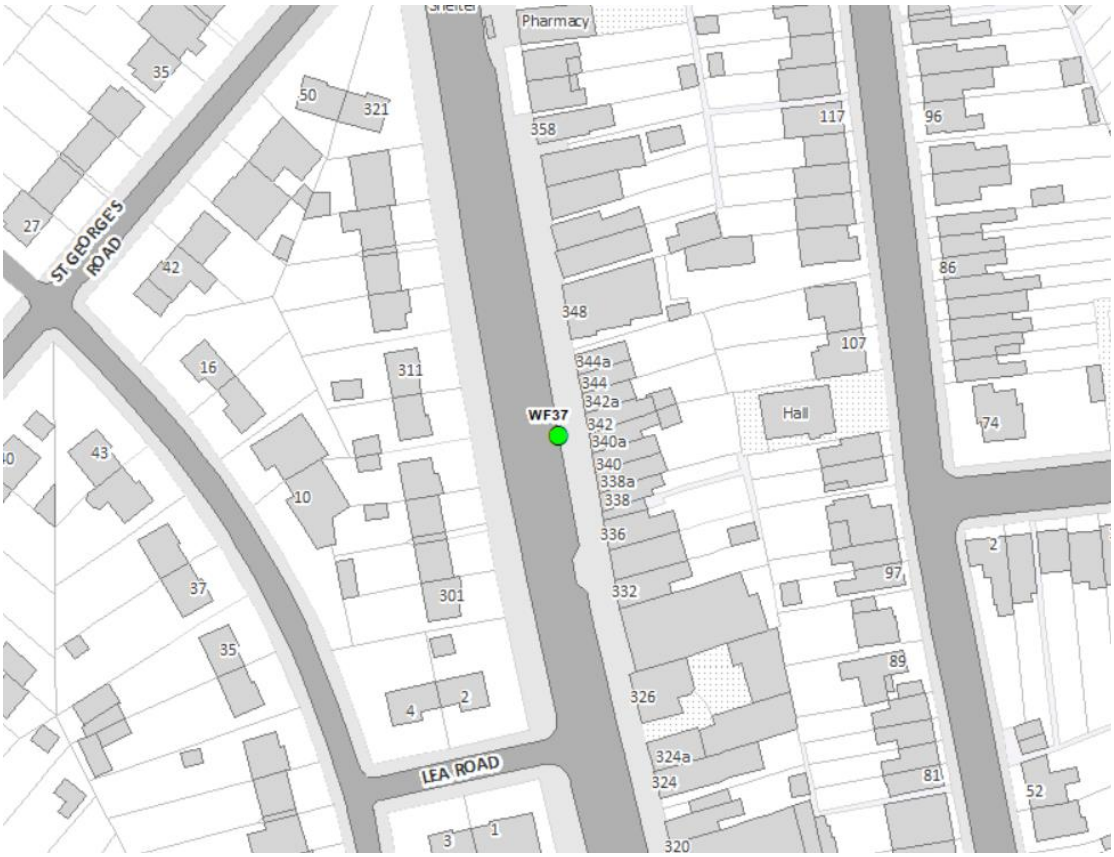
WF38 A405 Horseshoe Lane

WF36 Ravenscroft

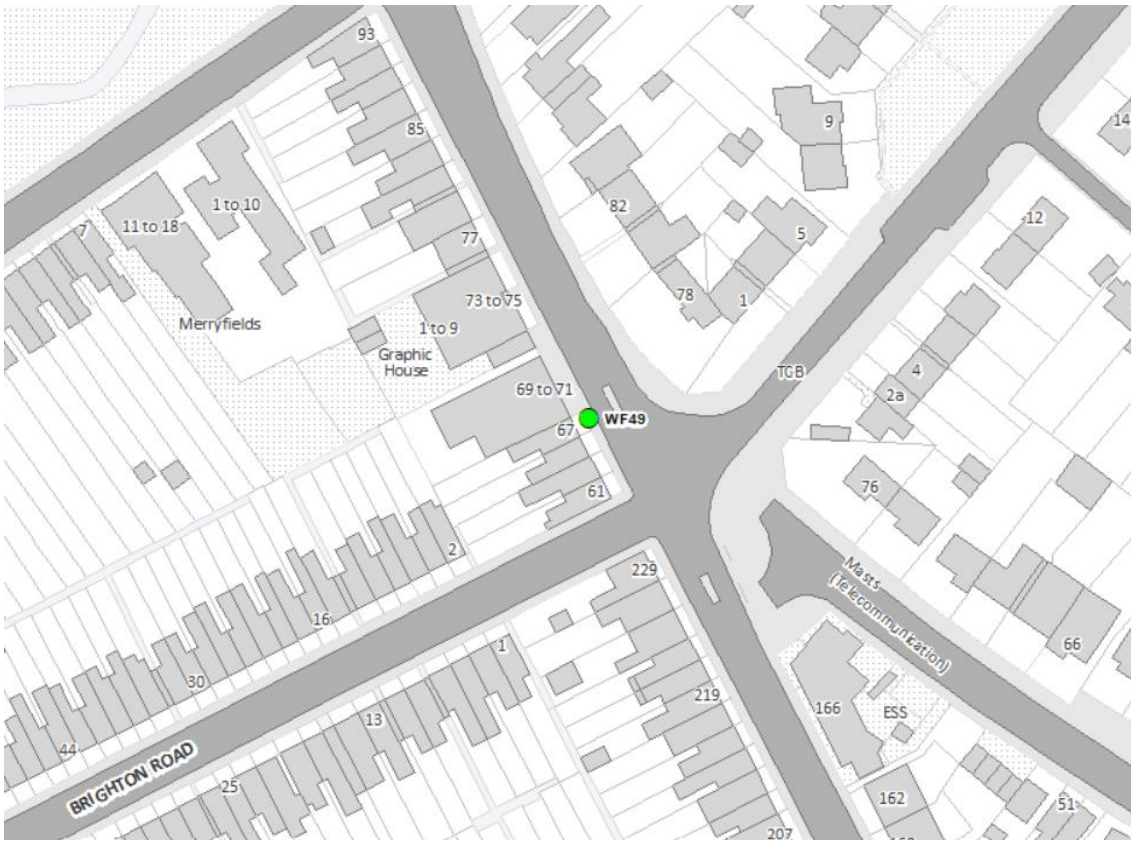


WF63 Purbrock Avenue

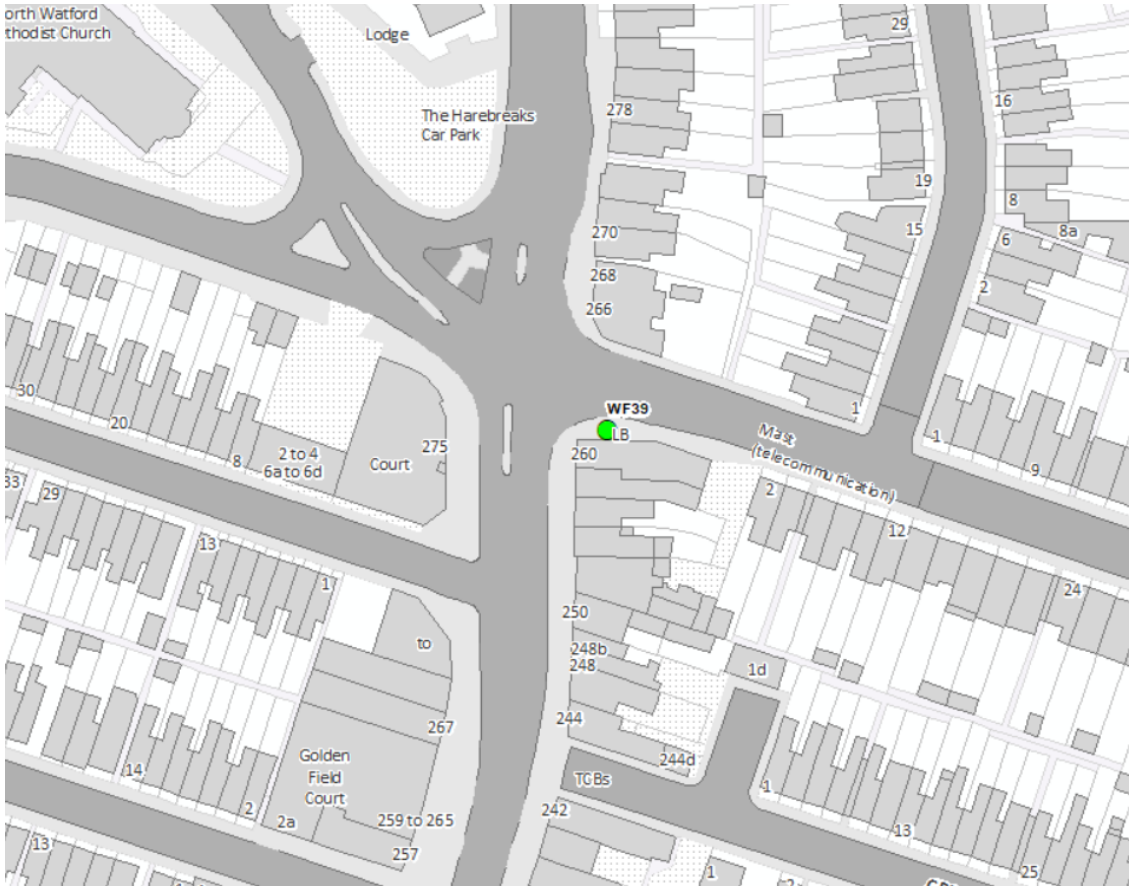
WF37 o/s 358 St Albans Road



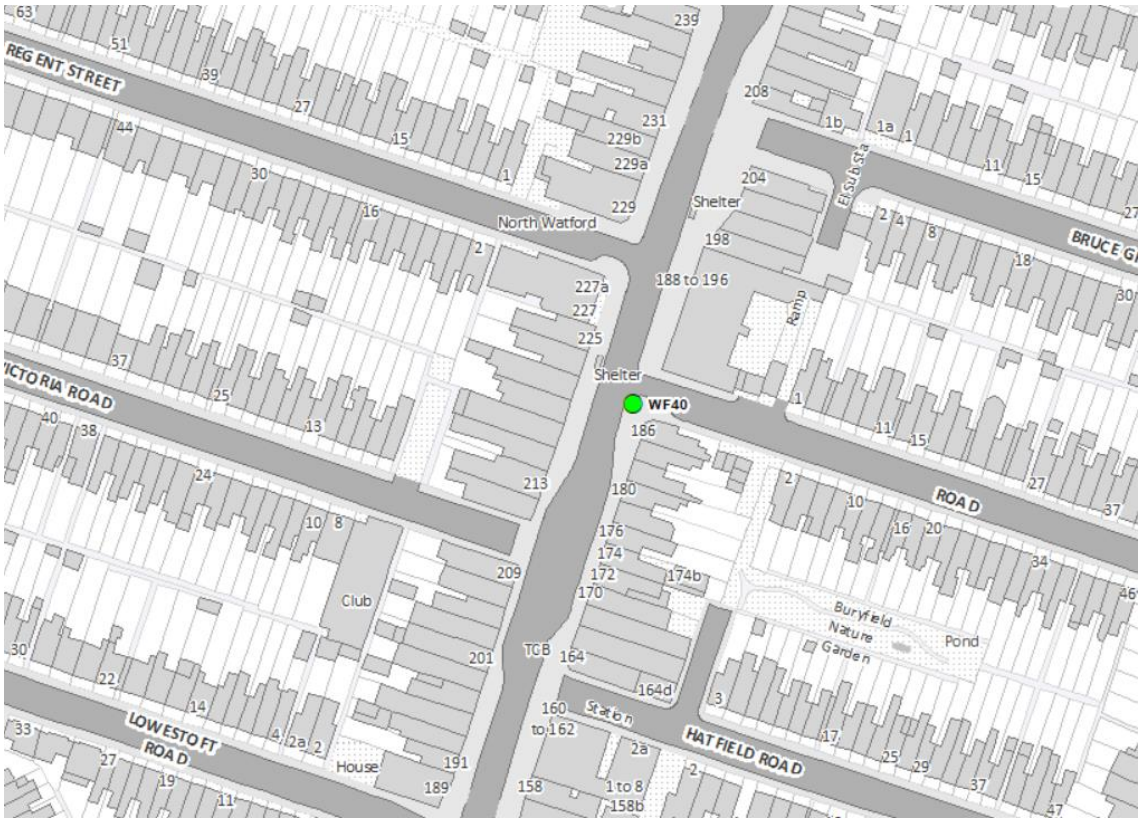
WF49 Gammons Lane (o/s 67)



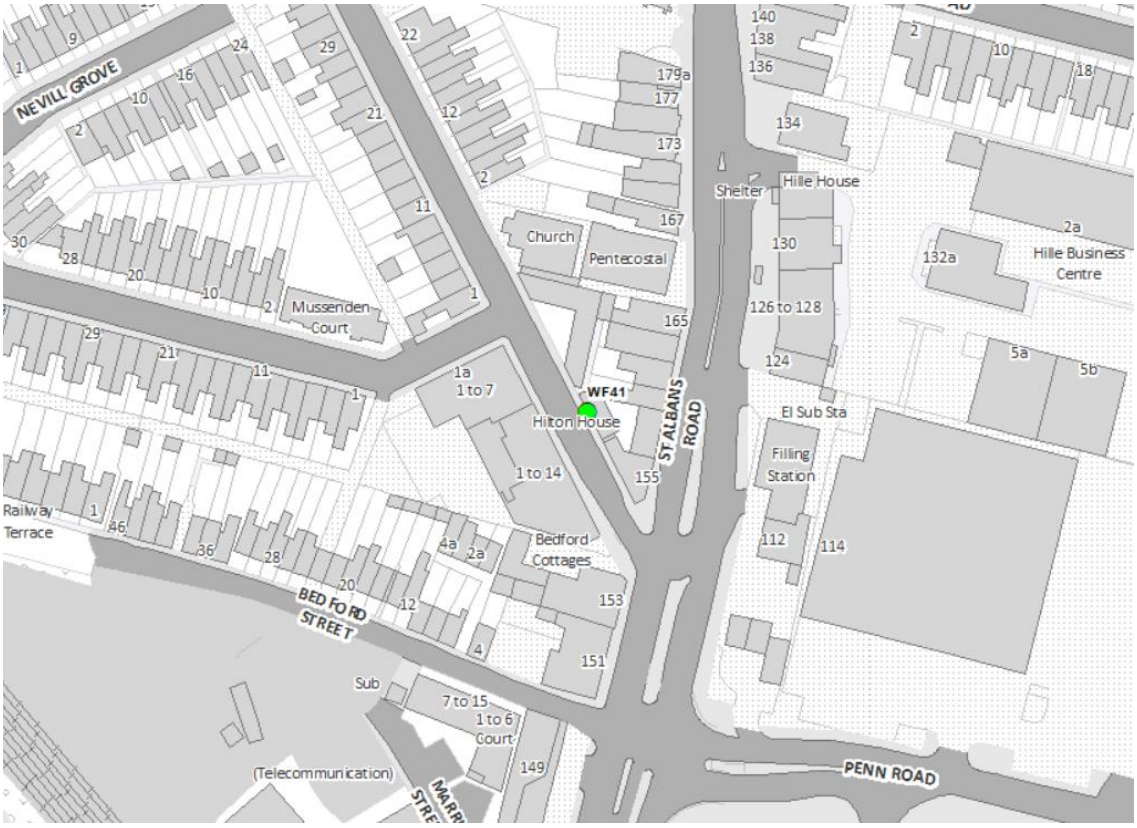
WF39 Balmoral Road



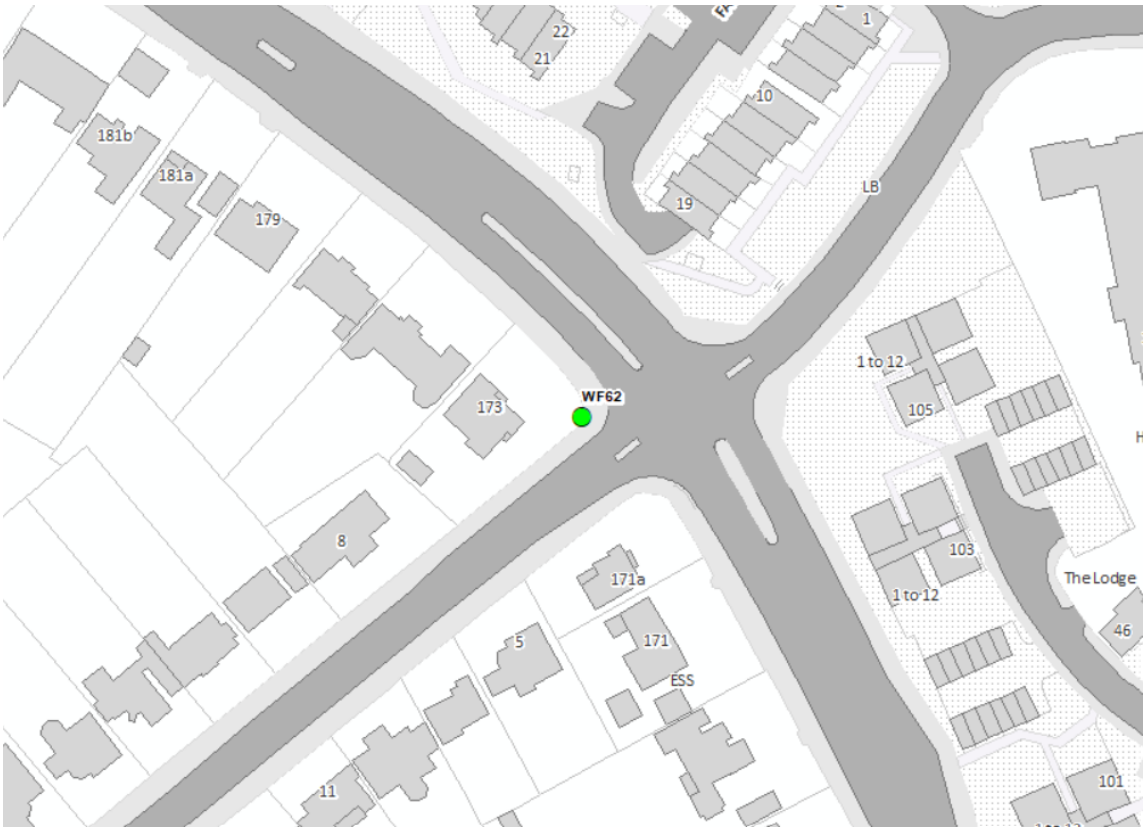
WF40 Salisbury Road



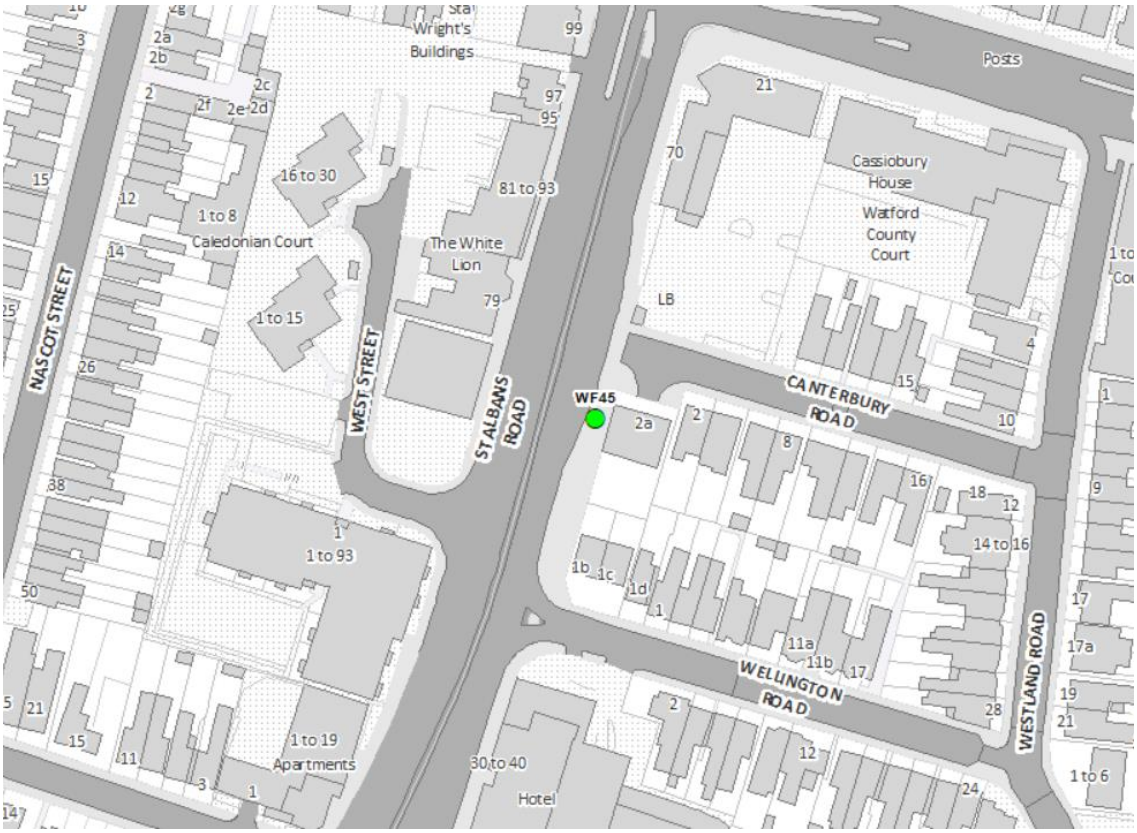
WF41 Leavesden Road



WF62 Hempstead Road

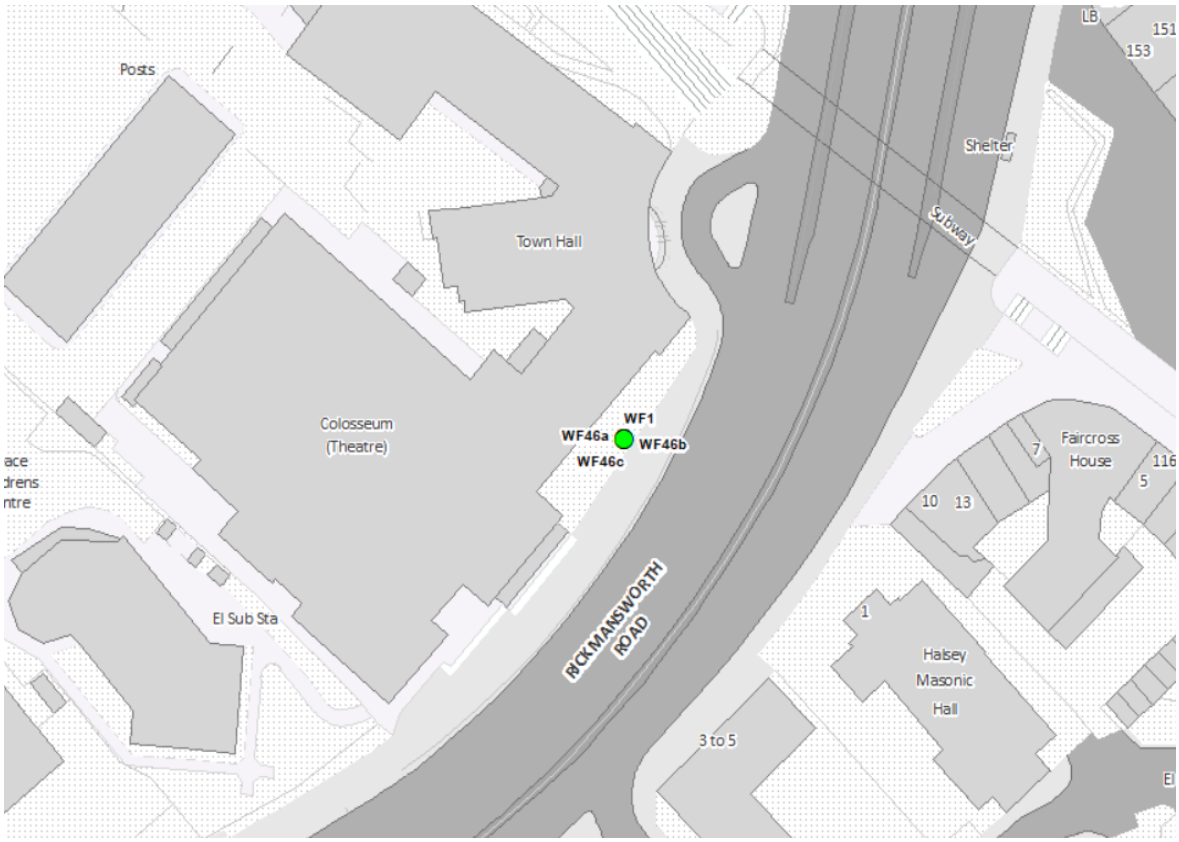


WF45 Wellington Road

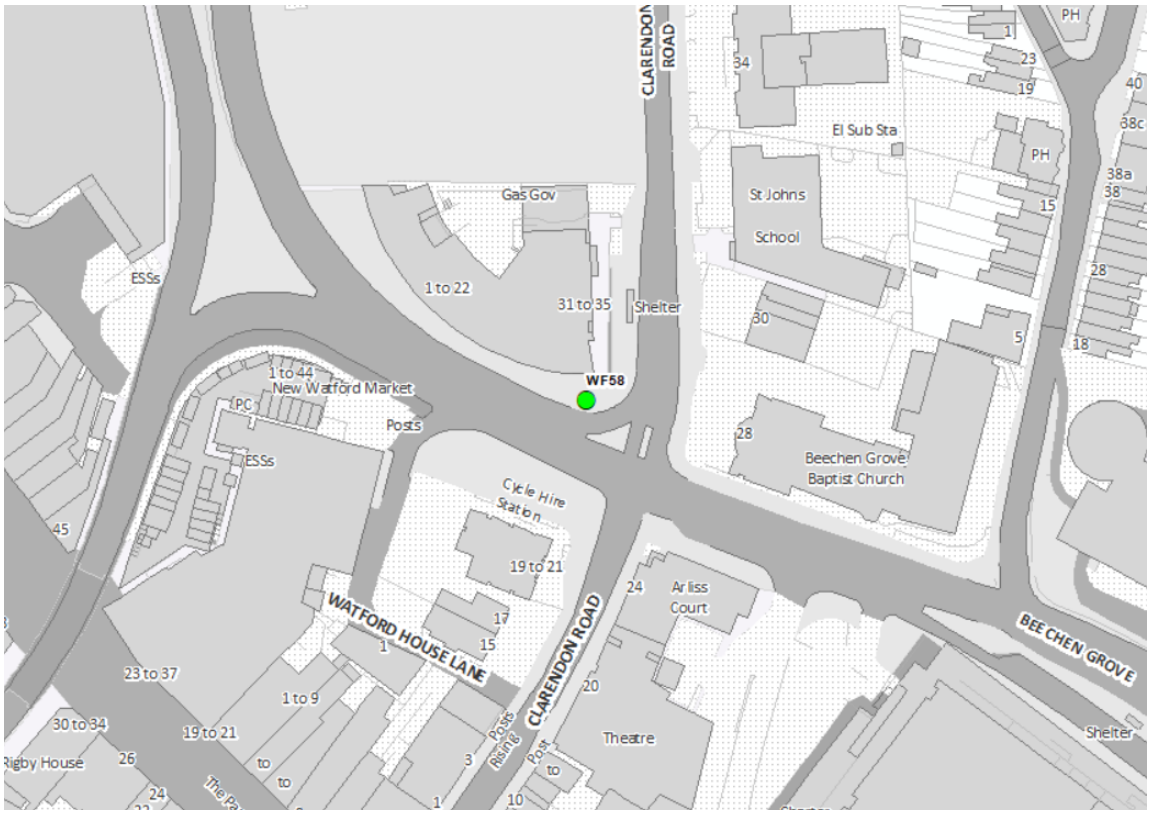


WF42 Queens Road

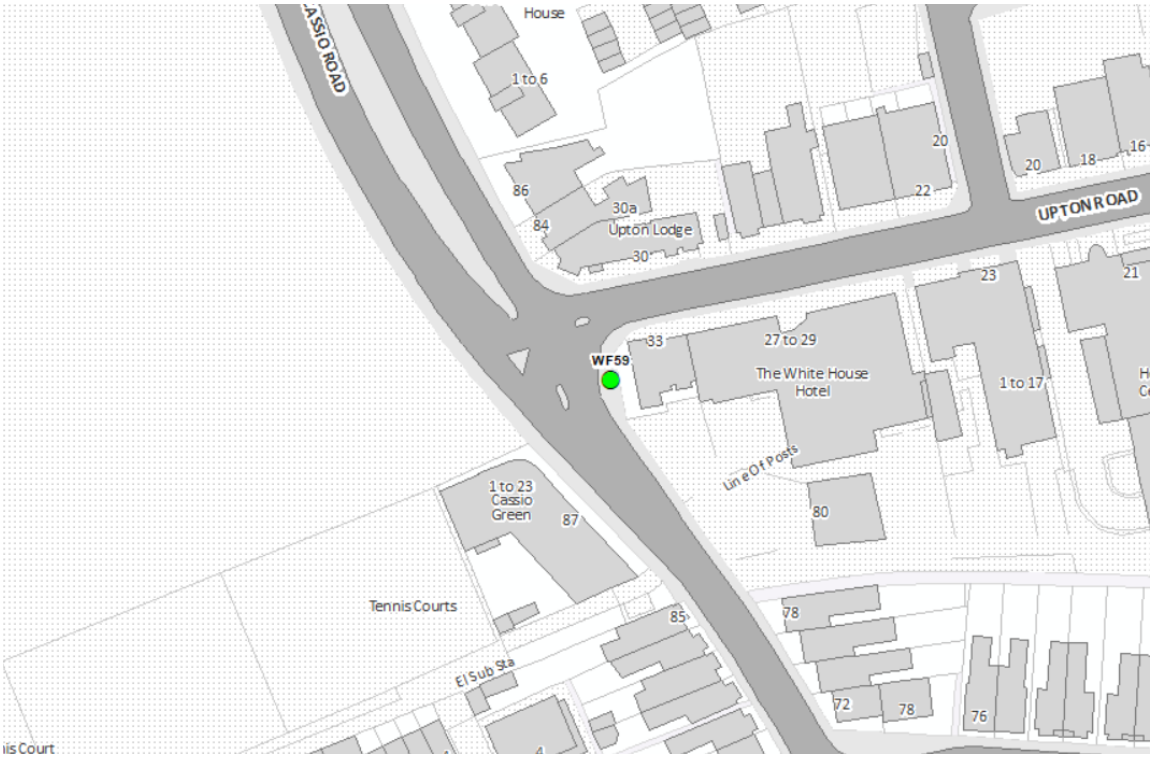
WF46a, WF46b, WF46c Town Hall (also the site of WF1 – Automatic Monitoring Site)



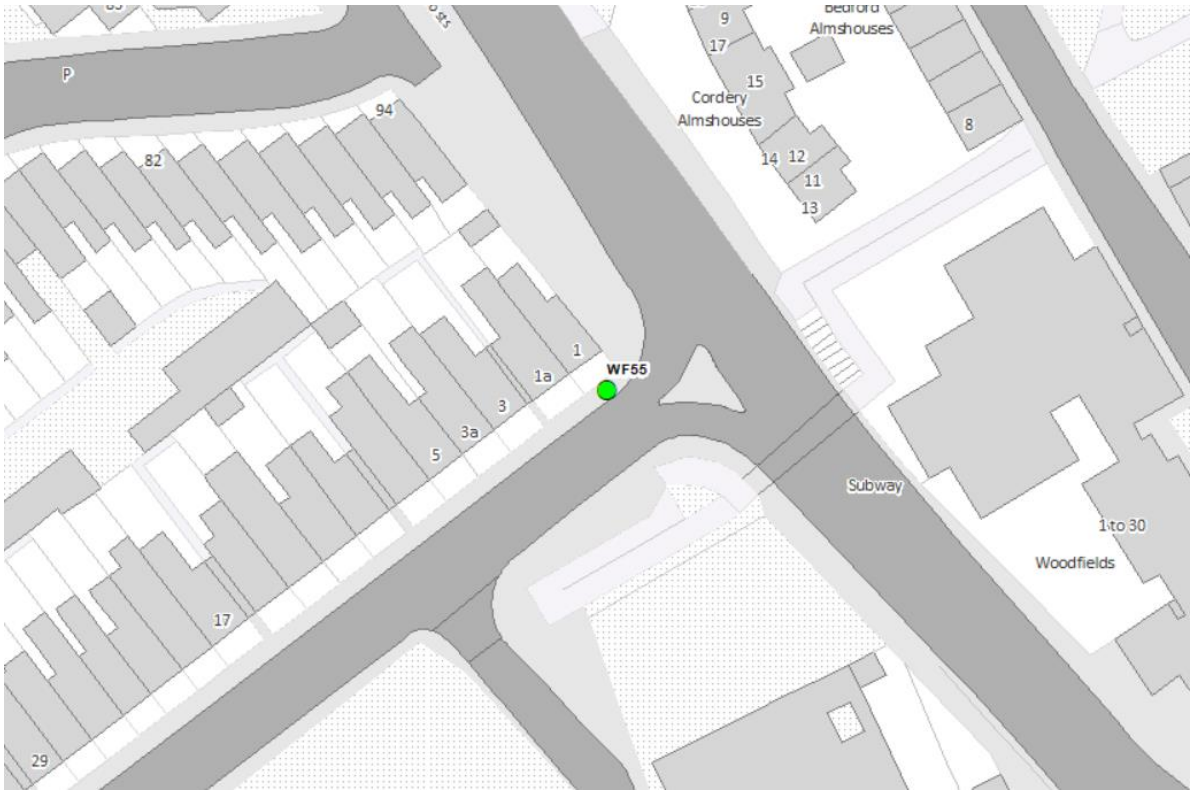
WF58 Beechen Grove



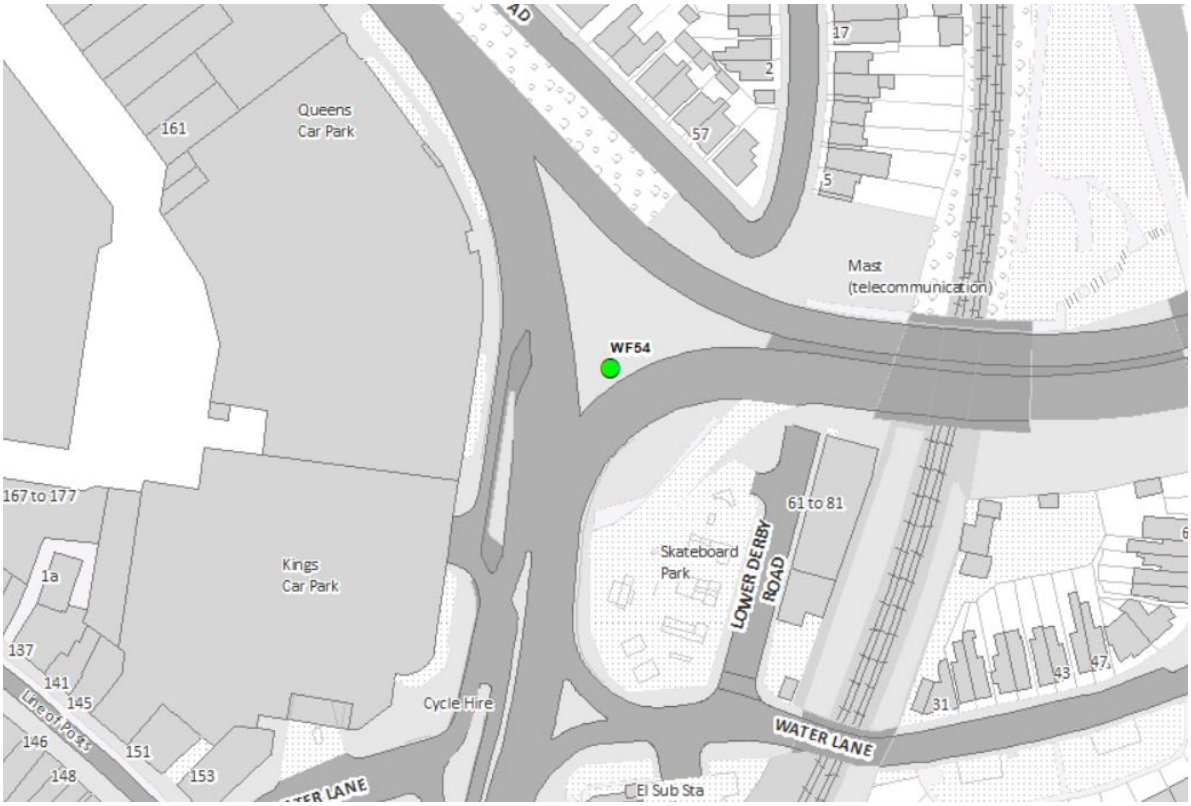
WF59 Upton Road



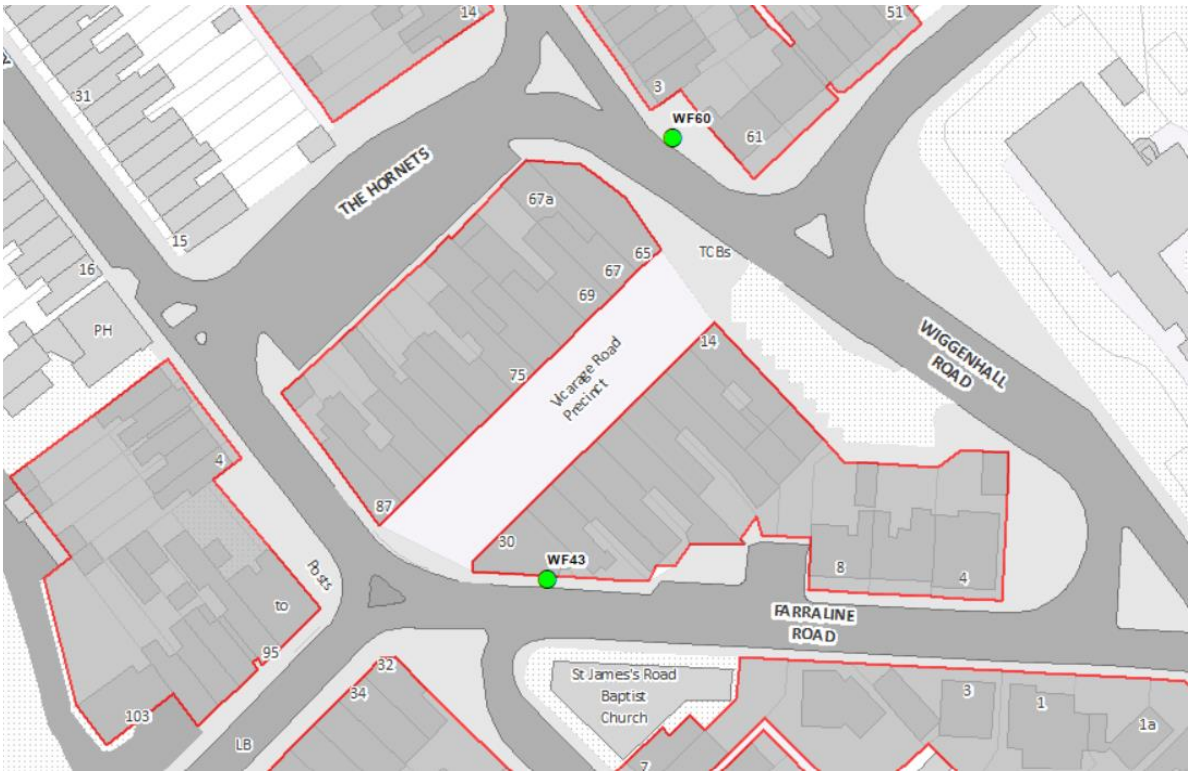
WF55 Vicarage Road



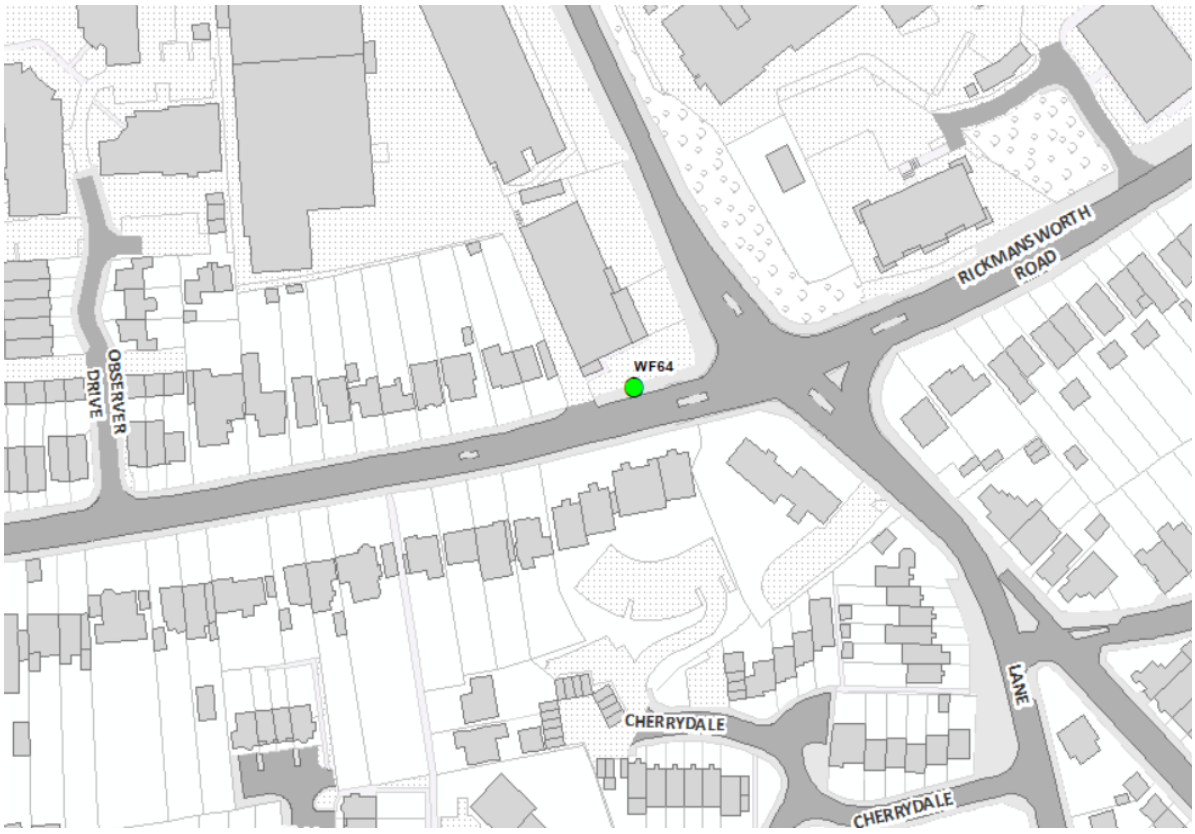
WF54 Water Lane



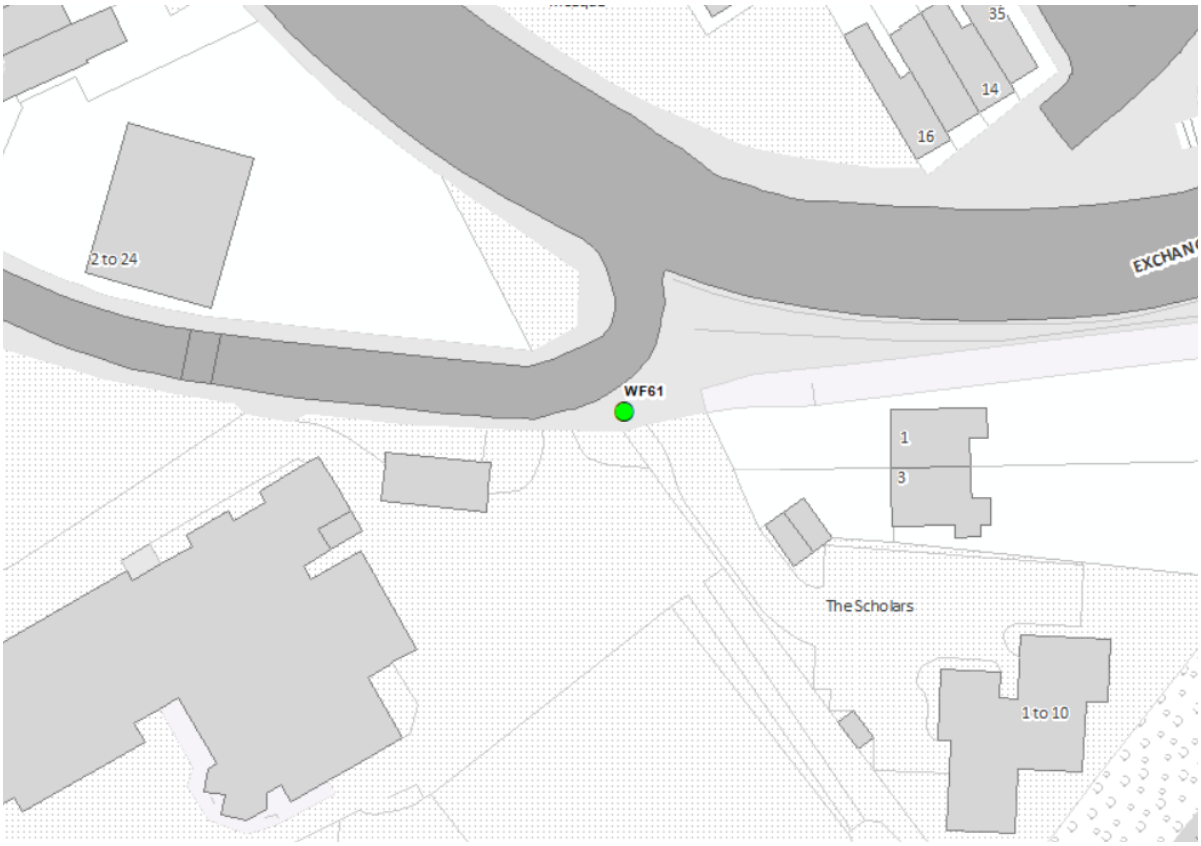
WF43 Farraline Road, WF60 Merton Road (AQMA 2)



WF64 Rickmansworth Road

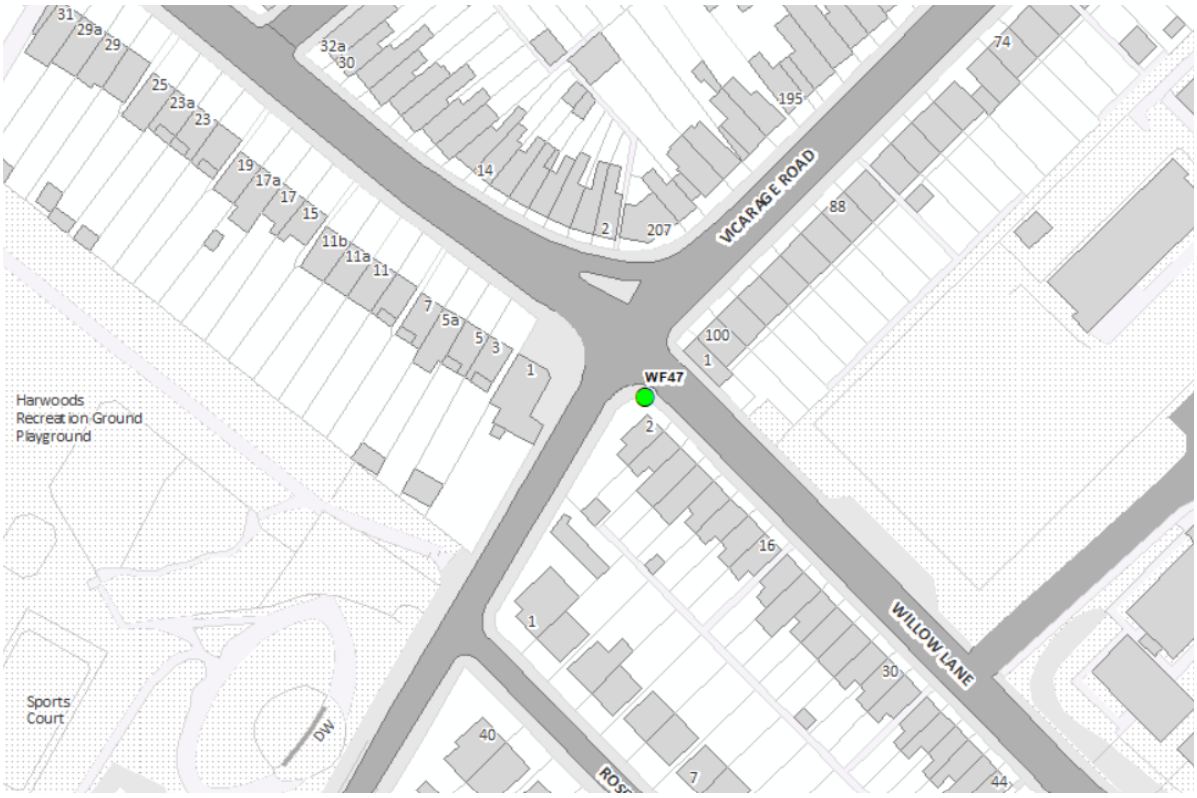


WF61 Ladys Close

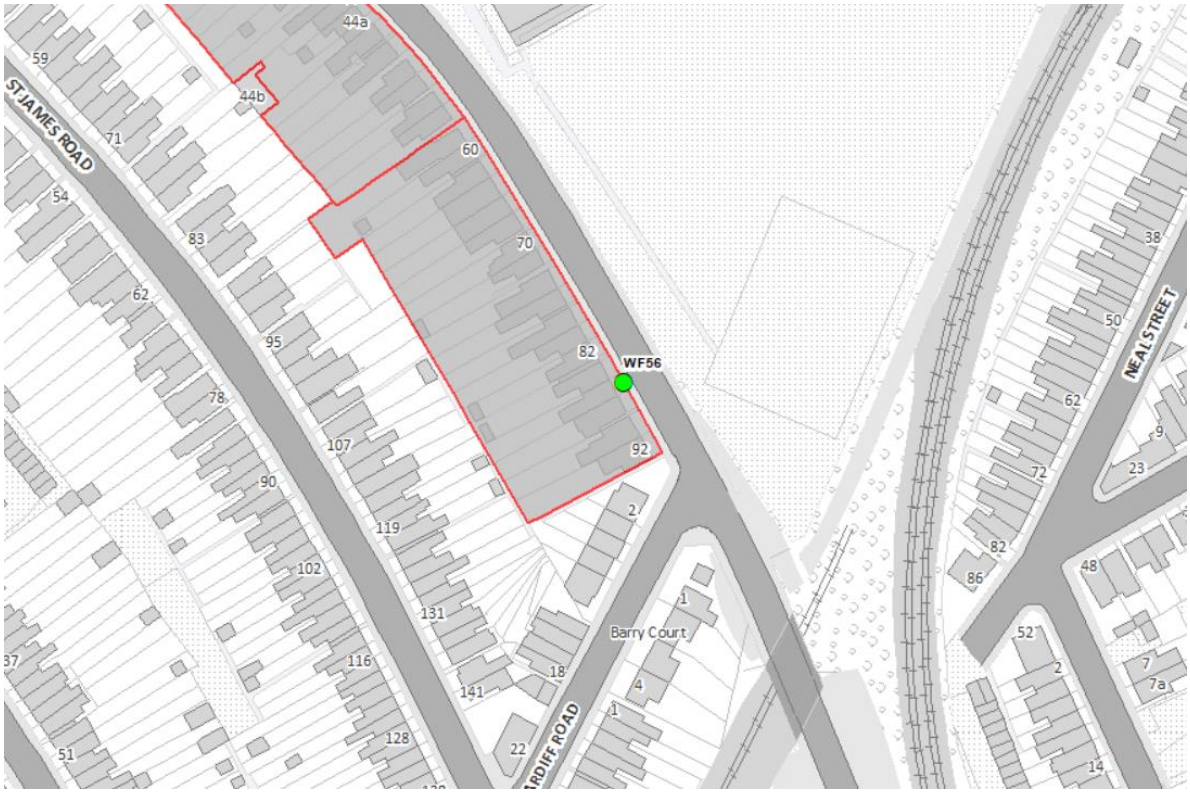


WF03 Hospital Vicarage Road

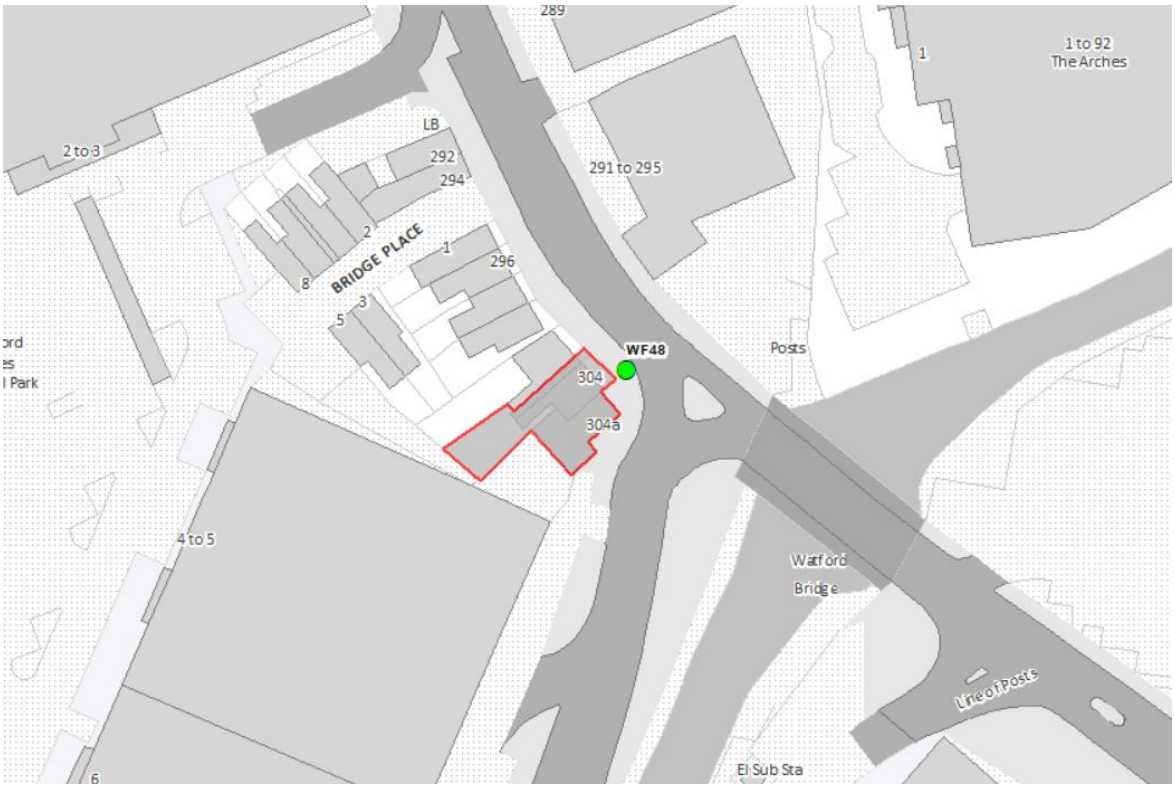
WF47 Willow Lane



WF56 Wiggenhall Road (AQMA 2)



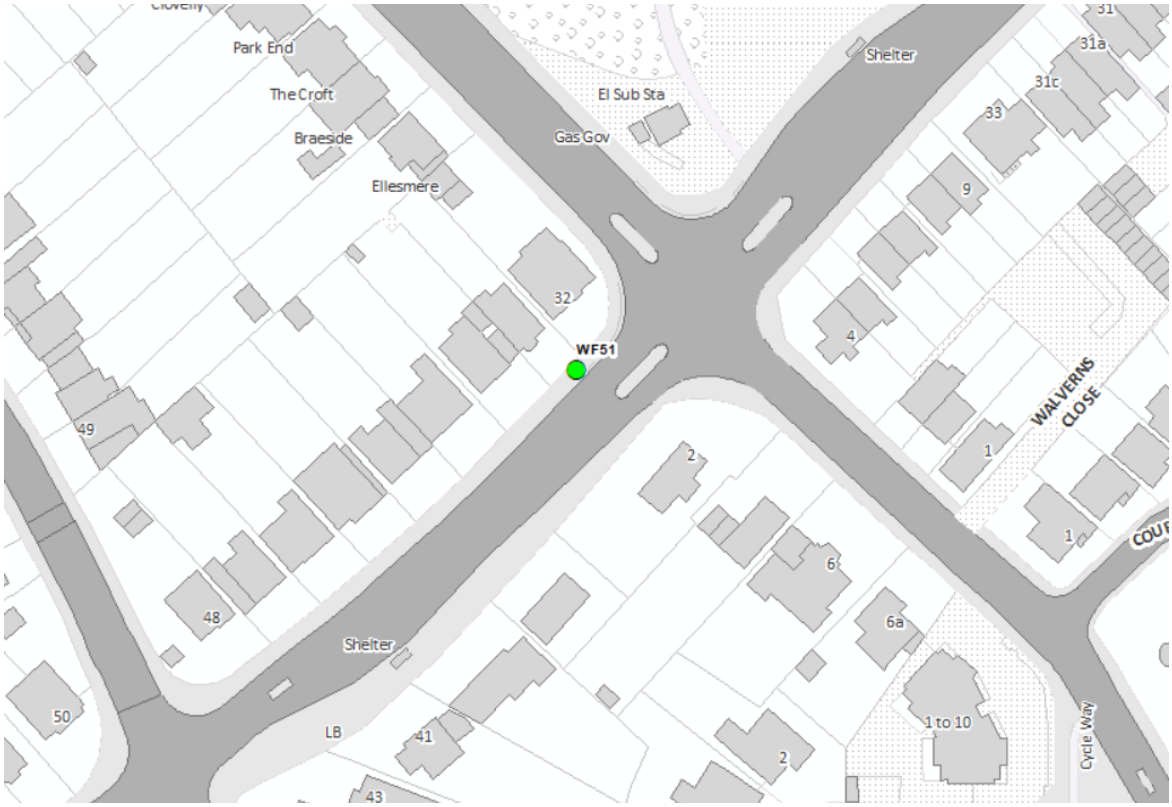
WF48 High Street (AQMA 3A)



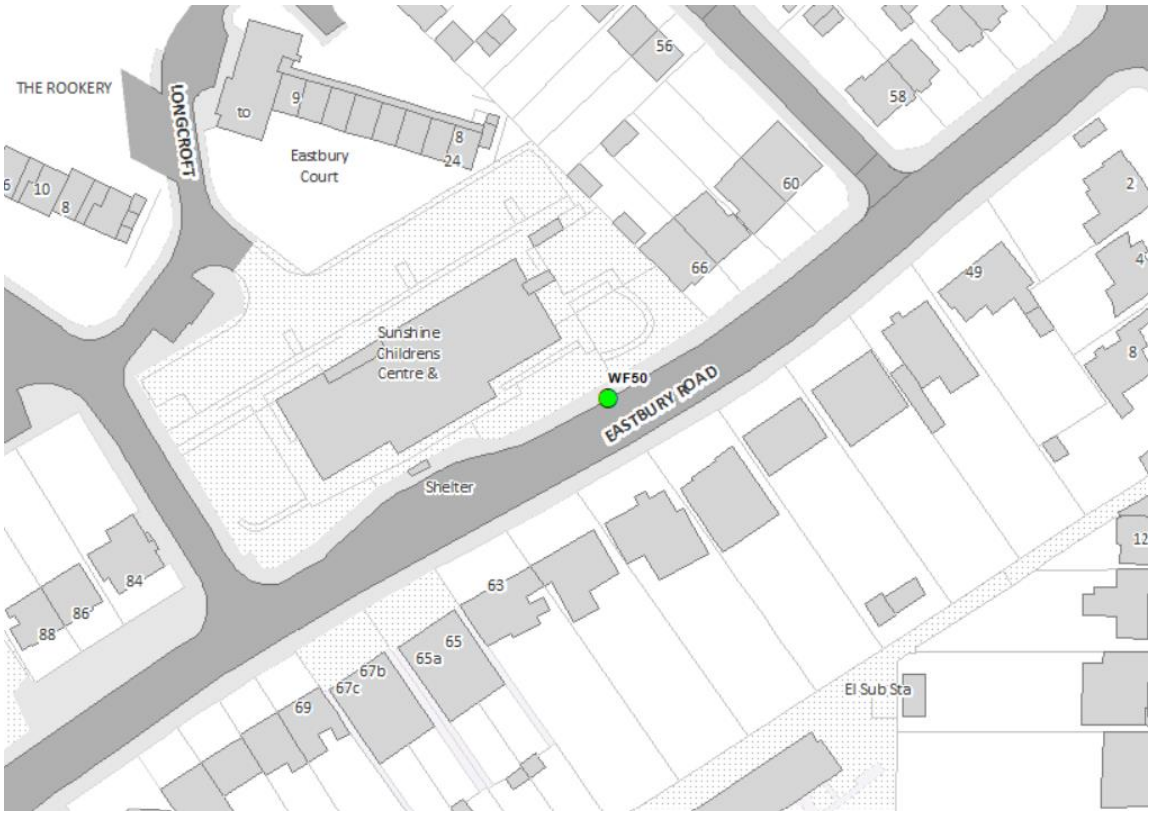
WF44 Chalk Hill, WF52 Victoria PH, WF29 Pinner Road (AQMA 3A)

WF53 Villiers Road (AQMA 3A)

WF51 Deacons Hill



WF50 Eastbury Road (Oxhey Early Years)



Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England[7]

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

*The Environment Act 2021 established a legally binding duty on Government to bring forward at least two new air quality targets in secondary legislation.

The Environmental Targets (Fine Particulate Matter) (England) Regulations 2023 introduced the following air quality targets:

Annual Mean Concentration Target for $PM_{2.5}$

The annual mean concentration target is that by the end of 31st December 2040 the annual mean level of $PM_{2.5}$ in ambient air must be equal to or less than 10 µg/m³ ("the target level").

Population exposure reduction target for $PM_{2.5}$

The population exposure reduction target is that there is at least a 35% reduction in population exposure by the end of 31st December 2040 ("the target date"), as compared with the average population exposure in the three-year period from 1st January 2016 to 31st December 2018 ("the baseline period"), determined in accordance with regulation 8.

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

References

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