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Bureau Veritas

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2022 Air Quality Annual Status Report (ASR)

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

Date: June, 2022

Information	Broxbourne Borough Council Details
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Executive Summary: Air Quality in Our Area

Air Quality in Broxbourne Borough Council

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 28,000 to 36,000 deaths at typical ages[3], with a total estimated healthcare cost to the NHS and social care of £157 million in 2017[4].

During 2021, one monitoring location (BB05) was decommissioned and replaced with a new site (BB52) which is located closer to relevant exposure. Two monitoring locations reported an annual mean NO_2 concentration exceeding the AQS objective of 40µg/m³. These were BB51 (41.3µg/m³), located within AQMA No.4, and BB28 (44.1µg/m³), located in AQMA 6. Alongside this, BB52 reported a concentration within 10% of the AQS objective (36.5µg/m³). BB51 and BB28 are not located at relevant exposure, therefore fall-off with distance calculations are required to predict the annual mean NO_2 concentration at the point of nearest relevant exposure. From doing this, neither of these sites were shown to be exceeding at the nearest relevant exposure; 35.3µg/m³ (BB51) and 32.4µg/m³ (BB28).

The majority of monitoring locations have reported 2021 annual mean NO_2 concentrations similar to that reported in 2020, with some showing slight increases and others showing slight decreases. Annual mean NO_2 concentrations at all sites are still reported to be below that reported in 2019, therefore suggesting that the impacts of the UK Government's

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[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, July 2021

[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

restrictions in response to COVID-19 may still be having an impact on NO_2 concentrations. Restrictions were still in place at the start of 2021, with the easing of these beginning in March 2021. It is therefore important to assess the 2022 monitoring concentrations next year in order to determine if these are likely to be longer term impacts.

No sites reported a concentration in excess of 60µg/m^3, in line with LAQM guidance t there was no risk of breaching the 1-hour NO_2 AQS objective in 2020.

Actions to Improve Air Quality

Whilst air quality has improved significantly in recent decades, and will continue to improve due to national policy decisions, there are some areas where local action is needed to improve air quality further.

The 2019 Clean Air Strategy[5] sets out the case for action, with goals to reduce exposure to harmful pollutants. The Road to Zero[6] sets out 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.

Key completed measures in 2021 are:

- Implementation of three Electric Vehicle (EV) chargers in:
  - Borough Offices Car Park
  - Windmill Lane Car Park
  - Newnham Parade Car Park
  - Waltham Cross High Street Car Park
  - Taverners Way North Car Park
- Recommencement of Broxbourne Borough Council's anti-idling campaign
- The Council has actively participated within the Herts & Beds & Neighbouring Authorities sub group and provided input further to the submission of the 2021 Defra Air Quality Grant. The overarching objectives are to increase knowledge on:
  1. How air pollution can impact resident's health,

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[5] Defra. Clean Air Strategy, 2019

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

2. How individuals can reduce their pollution footprint through positive air quality practice and,
3. How Hertfordshire residents can reduce personal exposure to air pollutants (focus on vulnerable groups/individuals)

Conclusions and Priorities

Whilst exceedances of the annual mean NO_2 AQS objective ($40\mu g/m^3$) were reported in AQMA No.4 and AQMA No.6 during 2021, it is predicted that concentrations are below this when considered at relevant exposure. Despite this, it is believed that there may be continued impacts on NO_2 concentrations following the UK Government's restrictions in response to the COVID-19 pandemic. The majority of monitoring locations have reported annual mean NO_2 concentrations for 2021 similar to that reported in 2020. As such, it will be important to assess 2022's monitoring data in order to determine whether concentrations will increase to that similar to 2019 and pre-COVID-19.

The Council's priorities for the next reporting year are to progress the Air Quality Action Plan (AQAP) so that a draft copy can be issued for public consultation. This will set out a series of new measures which the Council shall pursue in order to improve air quality across the borough. The Council is working with colleagues in Hertfordshire County Council and National Highways in developing this AQAP. A steering group meeting was held in June 2022 to provide the opportunity to discuss new ad emerging strategies which may compliment the AQAP's development. Members of Broxbourne Borough Council, Hertfordshire County Council, National Highways and Bureau Veritas were in attendance during this meeting.

Local Engagement and How to get Involved

Informing people about local air quality, in particular when pollution is elevated can help to protect those members of the community who are most sensitive to the health impacts associated with air pollution. Increasing public understanding of the sources and effects of air pollution can also motivate lifestyle changes which can help improve air quality, for example promoting sustainable travel as method of reducing air pollution.

Real-time monitoring data throughout Hertfordshire and Bedfordshire can be accessed via the Herts+Beds Air Quality Network. Free subscription to the Hertfordshire and Bedfordshire Air Pollution Alert System can also be carried out on the website, whereby

alert messages will be sent to registered users if the air pollution in their area is forecast or measured to be moderate, high, or very high (based upon the UK's Air Quality Banding System).

Further information on Air Quality within Broxbourne, but also the ability to submit a nuisance report, is available on the [Broxbourne Borough Council website](). Broxbourne Borough Council also operates a [Twitter account](), whereby live updates are frequently posted.

There are numerous simple measures which the public may adopt in order to improve the air quality around them. Such measures include:

- Making short trips and journeys on foot or by bike instead of by car, or using public transport;
- Car sharing with colleagues, or with other parents on the school run;
- Avoid Idling whilst your vehicle is stationary;
- Purchasing low-emission electric and/or hybrid vehicles, with [government funding and grants available]();
- Upgrading boilers to newest and most efficient gas condensing boilers with lowest NOx (and carbon) emissions;
- Conserving fuel efficiency of vehicles through ensuring correct tyre pressure is maintained;
- Ensuring your home is sufficiently insulated; and

Installing sources of renewable energy such as solar panel electricity systems, also known as solar photovoltaics or wind turbines.

Local Responsibilities and Commitment

This ASR was prepared by Bureau Veritas on behalf of the Environmental Health Department of Broxbourne Borough Council with the support and agreement of the following officers and departments:

List officers/departments involved in the preparation of the ASR

Craig Gent – Senior Environmental Health Officer

This ASR has been approved by:

Rebecca Broadbelt - Head of Environmental Health & Licensing

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 Environmental Health at:

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Telephone: 01992 785 555

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1 Local Air Quality Management

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

The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where an exceedance is considered likely the local authority must declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives. This Annual Status Report (ASR) is an annual requirement showing the strategies employed by Broxbourne 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

2.1 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 AQAP within 12 months setting out measures it intends to put in place in pursuit of compliance with the objectives.

Broxbourne Borough Council's existing AQAP was published in 2004, and only covers the existing declared AQMA No.1, and since then AQMA No.1 has been amended and two existing AQMAs have been declared. As such, the 2004 AQAP is considered to be out of date. A number of measures not detailed within the AQAP have been taken forwards to help improve air quality across the borough, and the Council is in progress with developing an updated single AQAP to cover the existing AQMAs and have relevant and focused measures included.

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

- NO_2 annual mean; and
- NO_2 1-hour 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 National Highways?	Level of Exceedance: Declaration	Level of Exceedance: Current Year	Name and Date of AQAP Publication	Web Link to AQAP
AQMA 1 Arlington Crescent to Abbey Road	Declared 04/02/2004 Amended 10/03/2016	NO$_2$ Annual Mean	Within a residential Cul-de-sac adjacent to the M25. The AQMA was further extended in March 2016 to include residential properties along Lodge Crescent, Abbey Rd and High Street.	YES	63µg/m^3	36.5µg/m^3	The Borough of Broxbourne's Single Air Quality Action Plan (in progress)	N/A
AQMA 4 Eleanor Cross Road/Monarchs Way	Declared 10/03/2016	NO$_2$ Annual Mean	An area encompassing residential properties on Abbey Rd, King's Rd and Queen's Rd and including the Monarch's Way and Eleanor Cross Rd roundabout.	NO	78µg/m^3	41.3µg/m^3	The Borough of Broxbourne's Single Air Quality Action Plan (in progress)	N/A
AQMA 6 Great Cambridge Road (A10) & College Road	Declared 05/05/2017	NO$_2$ 1 Hour Mean and Annual Mean	Encompassing dozens of residential properties and a school along the (A10) and College Rd, from Theobalds Lane junction up to the Brookfield Centre (B156 Flyover and B156/A10 Slip Rd.	NO	Exceedances of the 60µg/m^3 Hourly Mean and the 40µg/m^3 Annual Mean	44.1µg/m^3	The Borough of Broxbourne's Single Air Quality Action Plan (in progress)	N/A

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

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

2.2 Progress and Impact of Measures to address Air Quality in Broxbourne Borough Council

Defra's appraisal of last year's ASR concluded that "*the report is well structured, detailed, and provides the information specified in the Guidance. The following comments are designed to help inform future reports*". Additional commentary provided is as follows:

1. *The Council have provided a thorough report which contains the required content in a concise and easy to understand format.*

2. *The AQAP, which was postponed whilst other work was prioritised, is a priority for the coming year to ensure that appropriate measures are being taken within the Council's AQMAs.*

3. *It is encouraging to see the Council respond to comments raised during the previous appraisal which should be repeated in future reporting. The graphs and maps which have been included in response to the previous appraisal are of a high quality and greatly improve the understanding of the data. One additional improvement would be if the AQMAs were labelled by number within the maps.*

4. *The Council maintains a diffusion tube network with a good distribution across its jurisdiction. The Council might consider using some triplicate tubes at key locations as this can result in more robust data.*

5. *QA/QC was detailed, with evidence provided for all procedures applied. Monitoring data was presented in the correct format.*

6. *On p1 the report states "This report provides an overview of air quality in Broxbourne Borough Council during 2021", which should be amended to be 2020.*

Broxbourne Borough Council welcomes these comments and intends to continue reporting to the same level of detail and quality. The maps presented within this report shall be updated with labels to indicate which AQMA is which. Additionally, consultants at Bureau Veritas have been commissioned to assisted with the production of an updated AQAP. The initial modelling assessment of the AQMAs has been completed, with the draft AQAP being prepared in 2022. It is expected that this will be put out to public consultation before the end of 2022. The Council is working with colleagues in Hertfordshire County Council and National Highways in developing this AQAP. A steering group meeting was held in June 2022 to provide the opportunity to discuss new ad emerging strategies which may compliment the AQAP's development. Members of Broxbourne Borough Council, Hertfordshire County Council, National Highways and Bureau Veritas were in attendance during this meeting.

Broxbourne Borough Council's AQAP was published in 2004 and is therefore considered to be out of date, especially as it does not include two of the currently declared AQMAs. Since then, a number of direct measures have been developed and implemented which are not listed in the 2004 AQAP, a number of which have been taken forward during the current reporting year of 2021 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2. Seven measures are included within Table 2.2, with the type of measure and the progress Broxbourne 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.

Key completed measures are:

- Implementation of three EV chargers within each of the following car parks:
    - Borough Offices Car Park
    - Windmill Lane Car Park
    - Newnham Parade Car Park
    - Waltham Cross High Street Car Park
    - Taverners Way North Car Park
- Recommencement of Broxbourne Borough Council's anti-idling campaign
- The Council has actively participated within the Herts & Beds & Neighbouring Authorities sub group and provided input further to the submission of the 2021 Defra Air Quality Grant. The overarching objectives are to increase knowledge on:
    4. How air pollution can impact resident's health,
    5. How individuals can reduce their pollution footprint through positive air quality practice and,
    6. How Hertfordshire residents can reduce personal exposure to air pollutants (focus on vulnerable groups/individuals)

Broxbourne Borough Council expects the AQAP to be progressed significantly over the course of the next following year, which would identify new measures to further reduce air pollution within the borough.

Broxbourne Borough Council worked to implement these measures in partnership with the following stakeholders during 2021:

- Office for Low Emission Vehicles (OLEV);
- YES Energy Solutions; and

- Local Schools.

Broxbourne Borough Council's priorities for the coming year are to get the draft AQAP published and begin public consultation.

Table 2.2 – Progress on Measures to Improve Air Quality

Measure No.	Measure	Category	Classification	Year Measure Introduced	Estimated / Actual Completion Year	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	Disseminate up to date information about air quality.	Public Information	Via the Internet	-	-	Borough of Broxbourne	-	NO	Funded	-	Updated annually	N.A.	Number of visits to Broxbourne's air quality webpages and email and telephone queries.	Results of the NO$_2$ Diffusion tube network are updated annually on the air quality England website.	N.A.
2	Air Quality Action Plan	Other	Other	2017	2021	Borough of Broxbourne	-	NO	Funded	-	Planning	Reduced NO$_2$	Updated Air Quality Action Plan	The single AQAP which was being developed further to the declarations of AQMAs 6 & 7 in May 2017, was postponed in 2018 following two Ministerial Directions which required the Council to develop a Targeted Feasibility Study and a Local Plan for Air Quality.	N.A.
3	Draft Air Quality Planning Guidance Document (SPD) (to support the Local Plan),	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	2017	-	Borough of Broxbourne	-	NO	Funded	-	Planning	Reduced emissions of NO$_2$	Updated Planning Guidance	Ongoing	Model conditions revised during 2021, and new condition in relation to low NO$_x$ boilers within the new developments planned for 2022.
4	Replacement of Petrol/Diesel Pool Cars with EV	Promoting Low Emission Transport	Other	2021	2024	Local Authority	Borough of Broxbourne	NO	Funded	£10k - 50k	Implementation	Reduced vehicle emissions	Number of Bookings made	Implementation on-going	N.A.
5	Installation of EV Car Charging Points within Council car parks	Transport Planning and Infrastructure	Other	2021	2021	Local Authority & Office for Low Emission Vehicles (OLEV)	Office for Low Emission Vehicles (OLEV)	NO	Funded	£50k - £100k	Implementation	Reduced vehicle emissions	Installation of three Charging Points at five locations including the Council offices, Waltham Cross High Street and Eleanor Cross Road in Waltham Cross, Newnham Parade and Windmill Lane in Cheshunt	Implementation on-going. 3 chargers installed at: Borough Offices Car Park Windmill Lane Car Park Newnham Parade Car Park Waltham Cross High Street Car Park Taverners Way North Car Park	3 charges (2x 7kW, 1x 22kW) installed in: Borough Offices Car Park Windmill Lane Car Park Newnham Parade Car Park Waltham Cross High Street Car Park Taverners Way North Car Park In process of commissioning 3 additional chargers in 4 other Council carparks by the end of 2022
6	Development of a Service Level Agreement between the Borough of Broxbourne and Yorkshire Energy Services CIC T/A YES Energy Solutions in determining resident's eligibility for Grants for Insulation and Heating	Promoting Low Emission Plant	Other Policy	2020	2020	Borough of Broxbourne and YES Energy Solutions	Government's Energy Company Obligations (ECO) scheme.	NO	Funded	-	Implementation	Reduced emissions of NO$_2$	Reduced nitrogen dioxide	Ongoing	N.A.
7	Anti-Idling Campaign	Other	Other	2020	2022	Local Authority & Local Schools	The Borough of Broxbourne	NO	Funded	< £10k	Aborted	Reduced vehicle emissions	Reduced nitrogen dioxide	Ongoing – confirmed involvement with a school within Hoddesdon.	The Council recommended the anti-idling campaign in 2021. This involved 2 schools within Hoddesdon

Measure No.	Measure	Category	Classification	Year Measure Introduced	Estimated / Actual Completion Year	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
															and Cheshunt, main focus is to persuade parents not to idle. Intention to continue with the campaign in 2022 in conjunction with Clean Air Day.

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

As detailed in Policy Guidance LAQM.PG16 (Chapter 7), local authorities are expected to work towards reducing emissions and/or concentrations of PM$_{2.5}$ (particulate matter with an aerodynamic diameter of 2.5µm or less). There is clear evidence that PM$_{2.5}$ has a significant impact on human health, including premature mortality, allergic reactions, and cardiovascular diseases.

PM$_{2.5}$ can penetrate deep into the lungs, irritate and corrode the alveolar wall, and consequently impair lung function. It is believed there may also be a relationship between exposure to PM$_{2.5}$ and the impact of respiratory viruses, such as COVID-19.

Currently there is no monitoring of PM$_{2.5}$ or PM$_{10}$ completed within Broxbourne Borough Council, therefore no concentration values can be reported or estimated using the method as described in Box 7.7 of LAQM.TG(16), which provides a method for estimating PM$_{2.5}$ concentrations from PM$_{10}$ measurements.

The Defra 2021 background maps (based on 2018 monitored concentrations) can be used to identify the predicted background PM$_{2.5}$ concentrations across the UK. For Broxbourne Borough Council, all predicted PM$_{2.5}$ background concentrations are well below the Stage 2 indicative annual mean limit value for PM$_{2.5}$ (20µg/m^3). The maximum predicted concentration is 11.4µg/m^3, located within the 1 x 1km grid square with the centroid grid reference of 535500, 200500. This is an area to the southwest of Cheshunt and includes a section of the M25 and junction 25, the A10, some light industrial units, and a section of the West Anglia Main Line railway. It is important to note that these estimations do not take into consideration any impacts as a result of the COVID-19 pandemic. The background maps also provide a breakdown of sources. For this grid square, the majority of the PM$_{2.5}$ concentrations is estimated to arise from secondary PM$_{2.5}$ formation, which forms following chemical reactions of other gaseous atmospheric pollutants, such as NO$_x$, ammonia (NH$_3$), and volatile organic compounds (VOCs).

The Public Health Outcomes Framework data tool compiled by Public Health England quantifies the mortality burden of PM$_{2.5}$ within England on a county and local authority scale. The 2020 fraction of mortality attributable to PM$_{2.5}$ pollution (indicator D01) across England is 5.6%, and in contrast the fraction within Broxbourne is significantly above the national average at 6.1%. The regional average for the East of England is 5.9%. The 2020

fraction of mortality has been used as opposed to the 2020 fraction as the data has not been made available at the time of writing.

Measures to improve air quality often have shared wins with other public health indicators, a good example being the encouragement of active travel and commuting leading to increased physical activity and increased wellbeing.

LAQM.TG(16) Table A.1 Action toolbox presents a list of measures that can be implemented to help reduce concentrations of $PM_{2.5}$. Some of the actions carried out by Broxbourne Borough Council which are shown in Table 2.2, and will likely be updated and included within the forthcoming AQAP, focus on reducing traffic volumes, improving traffic flow, switching to alternative modes of transport, and promoting the uptake of alternative fuels. Although not designed specifically for the reduction of $PM_{2.5}$, improvements in NO_2 concentrations will lead to a net reduction of $PM_{2.5}$ concentrations from combustion-based sources where both pollutants arise.

Whilst no specific measures have been acted upon in 2021 specifically focusing on $PM_{2.5}$, the Council is looking to include a number of measures to address $PM_{2.5}$ concentrations within the updated AQAP.

The entire borough of Broxbourne is designated as a smoke control area. Smoke control areas are a defined geographical region within which smoke cannot be legally emitted from a chimney, unless using authorised fuels or using exempt appliances. The Council also provides guidance with regards to bonfires. Under new smoke control area rules, Broxbourne Borough Council is able to issue fixed penalty charge notices up to £300 to owners of chimneys where it is deemed too much smoke is being emitted, as well as issuing fines up to £1,000 where it is identified that unauthorised fuels are being burnt without an exempt appliance. The Defra has published a practical guide on these rules.

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

This section sets out the monitoring undertaken within 2021 by Broxbourne Borough Council and how it compares with the relevant air quality objectives. In addition, monitoring results are presented for a five-year period between 2017 and 2021 to allow monitoring trends to be identified and discussed.

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

Broxbourne Borough Council did not undertake any automatic monitoring during 2021.

3.1.2 Non-Automatic Monitoring Sites

Broxbourne Borough Council undertook non- automatic (i.e. passive) monitoring of NO_2 at 38 sites during 2021. Table A.1 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.

No monitoring results were available for the monitoring period January 2021 due to staff illness; therefore the diffusion tube changeover was not able to be completed.

One site, BB05, was removed in 2021 and replaced with a new site, BB52, which is in the same area as BB05 however located at a site more representative of relevant exposure.

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 (NO₂)

Table A.2 in Appendix A compares the ratified and adjusted monitored NO₂ 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 2021 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.

Monitoring was carried out at three locations within AQMA No.1 during 2021: BB11, BB48, and BB52 (a new monitoring location). All monitoring locations reported concentrations below the NO₂ annual mean AQS objective of 40µg/m^3, with the maximum reported being 36.5µg/m^3 at BB52 (within 10% of the objective). This site is located at a point of relevant exposure, therefore fall-off with distance correction calculations are not required. At BB11 and BB48, concentrations have decreased over the past five years, with a substantial decrease reported in 2020 and is attributed to the impacts of the COVID-19 pandemic. Annual mean concentrations at these sites have increased by approximately 1µg/m^3 in 2021 but are still below the concentrations reported in 2019.

There was only one monitoring site in operation during 2021 in AQMA No.4: BB51The annual mean NO₂ concentration reported at BB51 in 2021 is 41.3µg/m^3, above the AQS objective. This site is however not at a site of relevant exposure, and following fall-off with distance correction calculations, there is a predicted concentration of 35.3µg/m^3 (below the AQS objective) at the nearest relevant receptor. Similarly, to monitoring in AQMA No.1, this site has reported an increase in annual mean concentrations from 2020 to 2021, by 1.9µg/m^3.

Within AQMA No.6, there are 8 monitoring sites: BB09. BB28, BB34, BB35, BB39, BB40, BB41, and BB42. BB28 is the only location which reported an exceedance of the NO₂ annual mean AQS objective in 2021, with a concentration of 44.1µg/m^3. All other sites reported concentrations lower than 36µg/m^3 (10% of the objective). BB28 is not located at a site of relevant exposure, and following fall-off with distance correction calculations, there is a predicted concentration of 32.4µg/m^3 at the nearest relevant receptor. Annual mean concentrations reported are similar to that in 2020, with some sites showing a slight decrease (BB09, BB34, BB39, BB41 and BB42, up to 2.3µg/m^3) and other sites showing a

slight increase (BB28, BB35 and BB40, up to 1.4µg/m^3). Despite this, all concentrations reported in 2021 are below that reported in 2019.

At monitoring locations outside of any of the declared AQMAs, all NO$_2$ annual mean concentrations are below the AQS objective of 40µg/m^3, with the maximum being 34.4µg/m^3 reported at BB49. These all show a similar pattern to the other monitoring locations, whereby the annual mean NO$_2$ concentrations reported in 2021 are similar to that of 2020, and lower than that reported in 2019. This is however with the exception of BB43, whereby annual mean concentrations increased by 5.6µg/m^3 in 2021, and are only 0.8µg/m^3 lower than that reported in 2019.

It is hypothesised that the impacts of COVID-19 on traffic levels and local NO$_2$ concentrations are still present in 2021, especially as UK Government enforced restrictions were still in place in the first half of 2021. Care will be taken when assessing the 2022 monitoring data in order to determine whether these will be more long-standing impacts on local air quality.

As per LAQM.TG(16), an annual mean NO$_2$ concentration greater than 60µg/m^3 can be used as a proxy to indicate whether there is an exceedance of the NO$_2$ 1-hour mean AQS objective (no more than 18 hourly mean concentrations in exceedance of 200µg/m^3). None of the monitoring locations reported an annual mean concentration greater than 60µg/m^3, therefore it is not believed that there has been an exceedance of the hourly objective within Broxbourne.

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)
BB47	Turners Hill 2, Cheshunt	Kerbside	535924	202217	NO_2	No	8.0	0.9	No	2.3
BB04	43 Winford Drive	Urban Background	536954	206416	NO_2	No	5.0	2.0	No	2.3
BB52	27/28 Arlington Crescent, Waltham Cross	Roadside	536224	200027	NO_2	Y - AQMA 1 Arlington Crescent to Abbey Road	0	13.0	No	2.2
BB07	Molesworth Hoddesdon	Urban Background	537336	210497	NO_2	No	9.0	1.0	No	2.3
BB09	100 Great Cambridge Rd	Kerbside	535306	202351	NO_2	Y - AQMA 6 Great Cambridge Road	12.4	3.5	No	2.3
BB10	Teresa Gardens Waltham Cross	Urban Background	535392	200128	NO_2	No	5.0	69.0	No	2.3
BB11	35 High Street Waltham Cross	Kerbside	536051	200090	NO_2	Y - AQMA 1 Arlington Crescent to Abbey Road	6.5	7.8	No	2.3
BB12	15 High Rd Wormley	Kerbside	536608	205769	NO_2	No	12.5	2.0	No	2.3

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)
BB16	10 Colthurst Gardens	Urban Background	538548	209565	NO_2	No	7.0	1.0	No	2.3
BB48	Parkside, outside Greenwich Court (Flats 13-24),Waltham Cross	Urban Background	536214	200111	NO_2	Y - AQMA 1 Arlington Crescent to Abbey Road	7.0	22.7	No	2.2
BB18	20 Mylne Close Cheshunt	Urban Background	535505	203740	NO_2	No	8.5	2.5	No	2.3
BB19	10 Great Stockwood Road	Urban Background	532916	204110	NO_2	No	11.0	1.5	No	2.3
BB20	1 The Chase Goffs Oak	Urban Background	531955	203075	NO_2	No	10.0	0.3	No	2.3
BB51	28 Eleanor Cross Road Waltham Cross	Kerbside	536265	200375	NO_2	Y - AQMA 4 Eleanor Cross Road / Monarchs Way	4.6	2.5	No	1.8
BB22	Sturlas Way Waltham Cross	Kerbside	535999	200747	NO_2	No	3.0	3.0	No	2.3
BB23	Wickes Car Park	Urban Background	536002	200692	NO_2	No	13.0	20.0	No	2.4
BB49	Winston Churchill Way/High Street	Kerbside	536026	200819	NO_2	No	11.0	0.7	No	2.3
BB25	Jones Road	Kerbside	531543	200840	NO_2	No	68.0	41.0	No	2.3
BB27	59 College Road, Cheshunt	Kerbside	535730	202230	NO_2	No	3.0	1.5	No	2.3

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)
BB28	214 Cambridge Road, Cheshunt	Kerbside	535459	202978	NO_2	Y - AQMA 6 Great Cambridge Road	11.5	3.0	No	2.3
BB29	Brookfield Allotments, Halfhide Lane	Kerbside	535893	204228	NO_2	No	N/A	2.0	No	2.3
BB30	Winnipeg Way, Turnford	Kerbside	536014	204820	NO_2	No	24.0	1.0	No	2.3
BB31	Wormley Sports Club, Church Lane	Kerbside	536033	205804	NO_2	No	360.0	68.0	No	2.3
BB32	11 Baas Hill Close, Broxbourne	Kerbside	536039	206764	NO_2	No	14.0	1.0	No	2.3
BB33	High Leigh Farm, Box Lane	Kerbside	536189	208837	NO_2	No	22.0	4.0	No	1.0
BB34	Farm Close, Cheshunt	Kerbside	535332	202039	NO_2	Y - AQMA 6 Great Cambridge Road	5.8	16.0	No	2.3
BB35	86 College Road, Cheshunt	Kerbside	535571	202271	NO_2	Y - AQMA 6 Great Cambridge Road	10.0	3.5	No	2.3
BB36	Essex Rd at the rear of 6 Parrotts Field,	Roadside	537745	209049	NO_2	No	15.0	2.0	No	2.4
BB37	Junction of Burford St/Dinant Link Rd	Kerbside	537460	209109	NO_2	No	19.5	0.5	No	2.3

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)
BB39	College Rd/Goffs Churchgate Academy, Cheshunt	Kerbside	535107	202160	NO_2	Y - AQMA 6 Great Cambridge Road	40.5	1.0	No	2.4
BB40	A10/College Rd Junction, Cheshunt	Roadside	535314	202244	NO_2	Y - AQMA 6 Great Cambridge Road	6.5	2.0	No	2.3
BB41	37 Beltona Gardens, Cheshunt	Roadside	535910	203822	NO_2	Y - AQMA 6 Great Cambridge Road	4.0	17.0	No	2.5
BB42	48 Hobbs Close, Cheshunt	Kerbside	535516	202989	NO_2	Y - AQMA 6 Great Cambridge Road	3.0	22.0	No	2.3
BB43	24 Westside, Turnford	Roadside	536434	205004	NO_2	No	11.0	1.5	No	2.5
BB44	High Rd/Bell Lane Roundabout (163 High Rd) Broxbourne	Kerbside	536673	206608	NO_2	No	2.0	8.0	No	2.0
BB45	High Rd/Station Rd Junction, Broxbourne	Kerbside	536847	207237	NO_2	No	5.0	0.5	No	2.0
BB46	High Rd/Springfields Junction, Broxbourne	Kerbside	536883	207545	NO_2	No	5.9	1.3	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)
BB50	St Catherines School, Hoddesdon	Urban Background	537646	208979	NO_2	No	N/A	21.6	No	2.0

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 NO₂ Monitoring Results: Non-Automatic Monitoring (µg/m³)

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 2021 (%) (2)	2017	2018	2019	2020	2021
BB47	535924	202217	Kerbside	92.3	92.3	-	38.3	32.7	26.7	27.8
BB04	536954	206416	Urban Background	92.3	92.3	18.9	18.2	18.6	13.8	13.0
BB52	536224	200027	Roadside	92.3	92.3	-	-	-	-	36.5
BB07	537336	210497	Urban Background	92.3	92.3	20.5	19.4	18.0	14.8	13.9
BB09	535306	202351	Kerbside	92.3	92.3	**50.7**	**47.4**	**43.8**	34.5	34.2
BB10	535392	200128	Urban Background	92.3	92.3	33.7	30.1	28.5	22.3	21.0
BB11	536051	200090	Kerbside	92.3	92.3	**42.4**	**41.3**	39.2	30.3	31.2
BB12	536608	205769	Kerbside	92.3	92.3	37.9	33.2	31.7	24.6	26.9
BB16	538548	209565	Urban Background	92.3	92.3	22.2	20.5	20.3	16.2	15.4
BB48	536214	200111	Urban Background	92.3	92.3	-	39.0	34.1	25.5	26.5
BB18	535505	203740	Urban Background	92.3	92.3	19.6	18.3	17.4	13.3	13.0
BB19	532916	204110	Urban Background	92.3	92.3	20.5	21.5	19.1	14.0	13.2
BB20	531955	203075	Urban Background	75.0	75.0	20.5	19.3	18.5	14.0	13.7

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 2021 (%) [2]	2017	2018	2019	2020	2021
BB51	536265	200375	Kerbside	92.3	92.3	-	-	-	39.4	**41.3**
BB22	535999	200747	Kerbside	92.3	92.3	**42.6**	38.6	33.1	27.9	28.4
BB23	536002	200692	Urban Background	84.6	84.6	34.8	31.8	31.9	22.4	22.2
BB49	536026	200819	Kerbside	92.3	92.3	-	**46.9**	37.3	32.6	34.4
BB25	531543	200840	Kerbside	65.4	65.4	25.9	23.8	21.7	18.4	15.0
BB27	535730	202230	Kerbside	92.3	92.3	38.6	37.0	33.6	24.8	26.5
BB28	535459	202978	Kerbside	82.7	82.7	<u>71.2</u>	<u>63.3</u>	<u>61.8</u>	**43.2**	**44.1**
BB29	535893	204228	Kerbside	92.3	92.3	37.2	35.2	27.7	22.7	24.4
BB30	536014	204820	Kerbside	75.0	75.0	26.9	24.3	23.0	17.5	17.5
BB31	536033	205804	Kerbside	92.3	92.3	22.0	21.5	21.7	15.4	14.6
BB32	536039	206764	Kerbside	75.0	75.0	21.7	21.9	21.9	15.6	15.7
BB33	536189	208837	Kerbside	92.3	92.3	18.1	17.8	13.8	12.5	11.8
BB34	535332	202039	Kerbside	92.3	92.3	37.7	34.5	30.6	25.0	22.7
BB35	535571	202271	Kerbside	92.3	92.3	36.1	33.4	31.9	23.5	23.6

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 2021 (%) [2]	2017	2018	2019	2020	2021
BB36	537745	209049	Roadside	67.3	67.3	39.6	34.7	31.4	26.4	20.6
BB37	537460	209109	Kerbside	92.3	92.3	**54.2**	**46.9**	**42.0**	33.5	32.8
BB39	535107	202160	Kerbside	75.0	75.0	25.1	31.2	27.2	20.8	19.8
BB40	535314	202244	Roadside	92.3	92.3	**42.0**	**48.6**	**42.5**	33.7	35.1
BB41	535910	203822	Roadside	92.3	92.3	33.3	35.7	31.8	25.3	24.8
BB42	535516	202989	Kerbside	92.3	92.3	32.7	33.8	30.4	23.9	22.2
BB43	536434	205004	Roadside	92.3	92.3	38.1	35.3	32.5	26.0	31.7
BB44	536673	206608	Kerbside	92.3	92.3	27.0	30.3	27.1	21.5	21.5
BB45	536847	207237	Kerbside	92.3	92.3	26.0	30.2	26.4	21.4	22.8
BB46	536883	207545	Kerbside	92.3	92.3	30.0	35.6	29.1	26.5	26.0
BB50	537646	208979	Urban Background	76.9	76.9	-	-	-	18.6	20.2

☒ **Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG16.**

☒ **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 **<u>bold and underlined</u>**.

Means for diffusion tubes have been corrected for bias. All means have been "annualised" as per LAQM.TG16 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%).

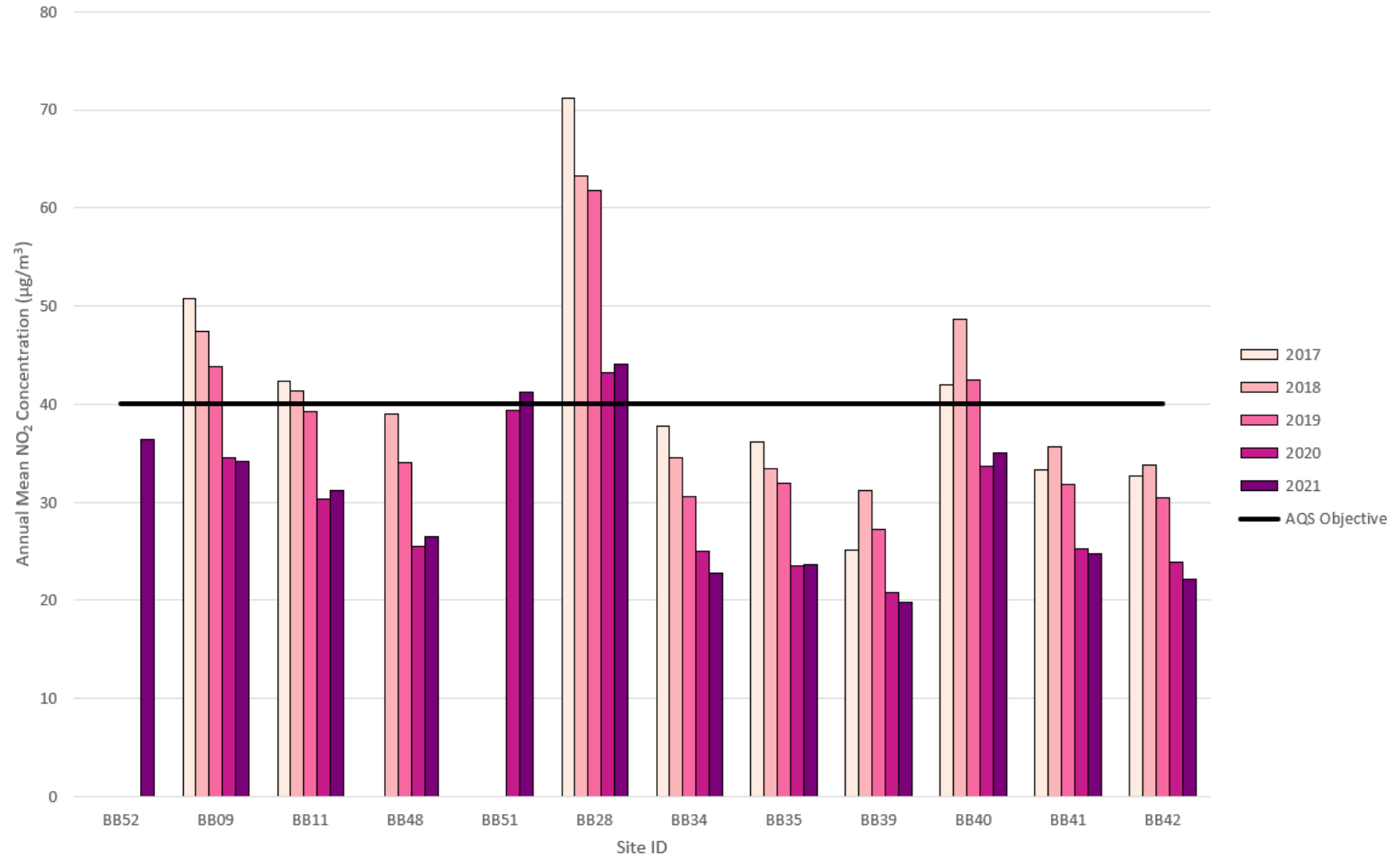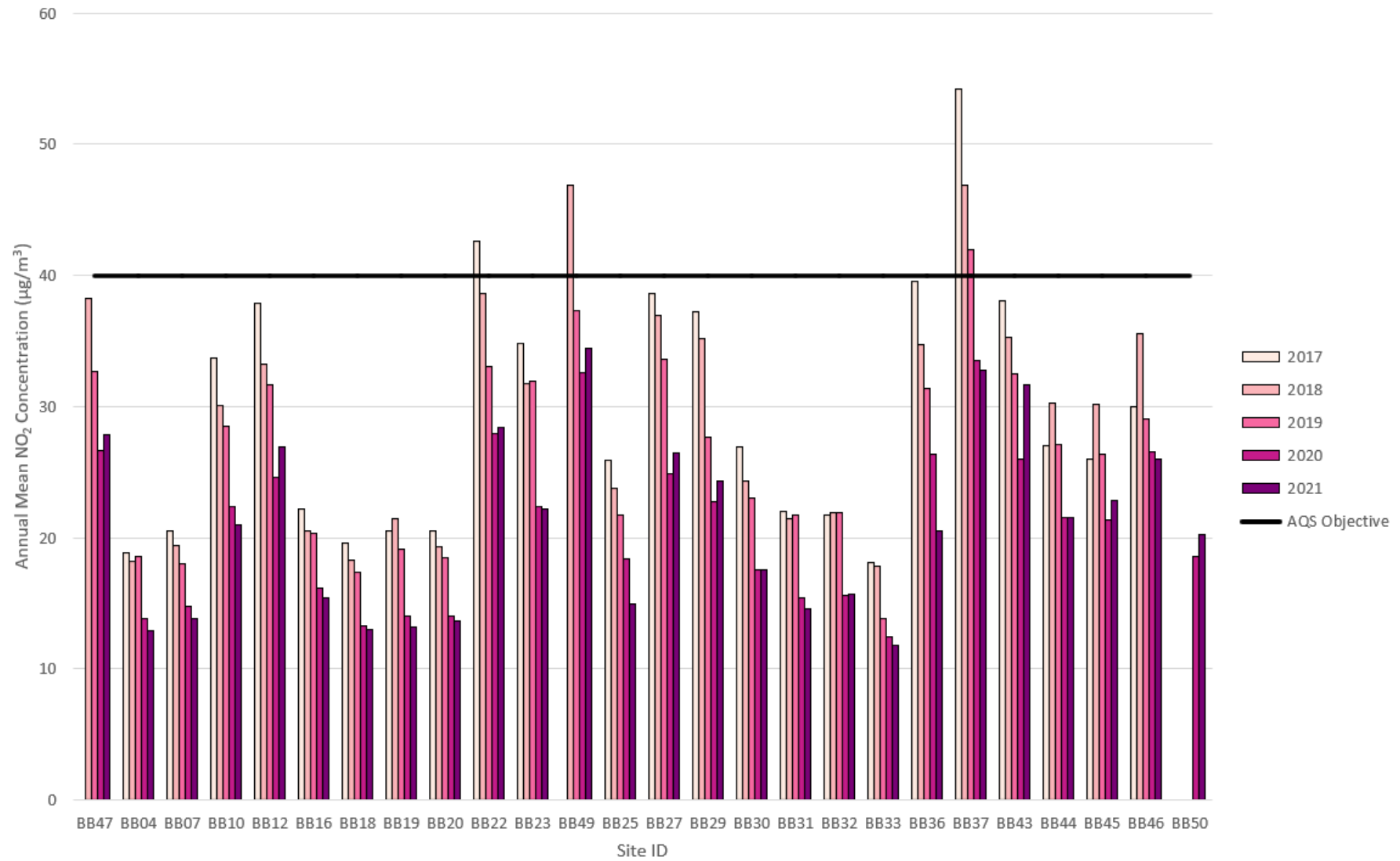**Figure A.1 – Trends in Annual Mean NO₂ Concentrations in AQMA No.1, No.4 and No.6**

Figure A.2 – Trends in Annual Mean NO₂ Concentrations Outside Any AQMA

Appendix B: Full Monthly Diffusion Tube Results for 2021

Table B.1 – NO₂ 2021 Diffusion Tube Results (µg/m³)

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 (0.84)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
BB47	535924	202217		41.6	33.4	30.9	31.6	28.6	27.2	27.7	35.4	36.1	38.0	34.0	33.1	27.8	-	
BB04	536954	206416		21.8	17.1	12.7	11.5	9.3	11.2	10.5	15.3	19.3	20.9	20.1	15.4	13.0	-	
BB52	536224	200027		58.3	48.0	39.3	44.2	36.6	35.3	36.4	47.4	47.2	42.5	42.4	43.4	36.5	-	
BB07	537336	210497		22.4	17.3	14.3	13.1	11.0	12.4	10.9	15.8	20.9	23.2	20.4	16.5	13.9	-	
BB09	535306	202351		42.0	34.2	44.7	42.9	37.1	38.4	35.3	49.5	44.6	42.1	36.5	40.7	34.2	-	
BB10	535392	200128		30.9	29.3	20.5	22.8	17.9	18.3	19.0	26.5	30.9	30.4	28.0	25.0	21.0	-	
BB11	536051	200090		50.4	36.5	33.3	36.1	31.6	31.7	27.6	44.7	39.6	40.5	36.5	37.1	31.2	-	
BB12	536608	205769		40.7	32.4	30.7	28.8	29.1	27.2	25.4	34.8	34.7	36.5	32.5	32.1	26.9	-	
BB16	538548	209565		25.5	18.1	14.4	15.6	12.1	14.4	12.7	18.2	25.4	22.5	22.6	18.3	15.4	-	
BB48	536214	200111		43.4	31.8	27.4	28.7	24.3	25.4	24.9	34.6	37.1	35.8	33.1	31.5	26.5	-	
BB18	535505	203740		24.8	16.1	13.8	12.9	10.5	11.0	9.7	15.0	18.2	18.2	19.9	15.4	13.0	-	
BB19	532916	204110		21.8	18.5	13.5	13.6	10.2	12.0	9.6	14.9	18.6	20.6	19.8	15.7	13.2	-	
BB20	531955	203075		22.9	16.2	11.9	12.3	9.3			16.6	18.5	19.5	19.1	16.3	13.7	-	
BB51	536265	200375		60.5	45.2	48.3	47.2	41.8	46.3	42.4	52.9	53.8	51.8	50.5	49.2	**41.3**	35.3	
BB22	535999	200747		46.0	31.4	27.7	33.7	29.4	30.1	26.3	36.6	38.9	39.3	32.4	33.8	28.4	-	
BB23	536002	200692			29.4	25.9	25.7	22.6	22.3	19.4	28.0	28.7	32.9	29.4	26.4	22.2	-	
BB49	536026	200819		49.6	43.7	43.1	38.3	38.4	35.5	34.3	45.4	41.8	45.9	34.9	41.0	34.4	-	
BB25	531543	200840		24.1	19.3	12.7	12.5	15.1			18.0	23.2	21.6		18.3	15.0	-	

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 (0.84)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
BB27	535730	202230		43.2	27.6	28.7	30.6	24.1	25.8	22.8	36.8	35.6	33.7	38.0	31.5	26.5	-	
BB28	535459	202978		66.6	53.1	54.9	51.9	49.7	50.2	39.4	53.8		54.0	51.5	52.5	**44.1**	32.4	
BB29	535893	204228		39.3	27.0	26.9	30.0	24.4	25.7	23.1	29.7	30.7	28.3	34.0	29.0	24.4	-	
BB30	536014	204820		27.3	21.4		17.9	12.9	15.5		20.5	23.3	24.8	24.4	20.9	17.5	-	
BB31	536033	205804		22.1	18.4	14.4	15.8	12.3	13.6	13.3	18.2	20.9	23.2	19.1	17.4	14.6	-	
BB32	536039	206764		23.3	19.6	16.4	13.7	12.1			18.7	21.4	21.3	21.3	18.6	15.7	-	
BB33	536189	208837		20.3	16.6	14.2	11.0	10.6	11.3	8.3	13.7	15.6	16.0	16.9	14.1	11.8	-	
BB34	535332	202039		34.7	33.8	26.7	25.7	25.4	21.8	7.6	27.6	30.9	34.1	29.3	27.1	22.7	-	
BB35	535571	202271		34.5	30.5	25.6	25.9	23.0	21.0	21.3	30.6	30.3	35.0	31.8	28.1	23.6	-	
BB36	537745	209049		35.2	24.6			15.7	16.7	15.0		27.7	27.2	26.5	23.6	20.6	-	
BB37	537460	209109		45.5	38.9	35.8	35.8	35.6	32.2	31.5	44.5	45.0	45.4	39.2	39.0	32.8	-	
BB39	535107	202160		30.1	26.0	24.9	12.5	22.7	21.4	19.1			30.3	25.5	23.6	19.8	-	
BB40	535314	202244		51.3	36.8	40.6	39.6	37.3	37.9	38.4	46.5	42.9	45.5	42.9	41.8	35.1	-	
BB41	535910	203822		33.0	35.8	25.7	28.0	24.5	24.2	25.2	29.2	35.2	34.7	28.9	29.5	24.8	-	
BB42	535516	202989		31.6	30.7	21.7	22.9	22.1	20.9	22.6	27.9	28.0	33.9	27.8	26.4	22.2	-	
BB43	536434	205004		37.4	32.1	25.1	109.3	23.0	23.6	22.4	29.6	36.4	40.1	36.2	37.7	31.7	-	
BB44	536673	206608		34.0	30.4	26.6	24.1	22.5	18.1	18.0	24.6	27.7	29.5	26.2	25.6	21.5	-	
BB45	536847	207237		35.0	27.2	25.0	24.3	20.4	21.2	18.0	33.5	29.5	33.1	31.5	27.1	22.8	-	
BB46	536883	207545		37.7	32.4	28.3	27.3	24.4	24.5	24.2	35.0	37.1	38.0	32.0	31.0	26.0	-	
BB50	537646	208979		27.9	24.7	24.3			20.5	15.9	26.3	25.2	26.8	25.0	24.1	20.2	-	

☒ **All erroneous data has been removed from the NO₂ diffusion tube dataset presented in Table B.1**.

☒ **Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG16.**

☐ **Local bias adjustment factor used.**

☒ **National bias adjustment factor used.**

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

☒ **Broxbourne Borough Council confirm that all 2021 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 Broxbourne Borough Council During 2021

Broxbourne Borough Council has not identified any new sources relating to air quality within the reporting year of 2021.

Additional Air Quality Works Undertaken by Broxbourne Borough Council During 2021

Broxbourne Borough Council has not completed any additional works within the reporting year of 2021.

QA/QC of Diffusion Tube Monitoring

Broxbourne Borough Council's diffusion tubes in 2021 were supplied and analysed by Gradko International Ltd., using the 20% Triethanolamine (TEA) in water preparation method. Gradko's laboratory is UKAS accredited, participating in the AIR-PT Scheme (a continuation of the Workplace Analysis Scheme for Proficiency (WASP)) for NO_2 tube analysis and the Annual Field Inter-Comparison Exercise. These provide strict performance criteria for participating laboratories to meet, thereby ensuring NO_2 concentrations reported are of a high caliber. The lab follows the procedures set out in the Harmonisation Practical Guidance. In the latest available AIR-PT results, AIR PT AR042 (January – March 2021), Gradko scored 25%. No results have been published for the rest of 2021 at the time of writing. The percentage score reflects the results deemed to be satisfactory based upon the z-score of $< \pm 2$.

All local authority 32 co-location studies which use tubes supplied by Gradko with the 20% TEA in water preparation method in 2021 were rated as 'good', as shown by the precision summary results. This precision reflects the laboratory's performance and consistency in preparing and analysing the tubes, as well as the subsequent handling of the tubes in the field. Tubes are considered to have a "good" precision where the coefficient of variation of

duplicate or triplicate diffusion tubes for eight or more monitoring periods during a year is less than 20%.

Monitoring in 2021 had largely been completed in adherence with the 2021 Diffusion Tube Monitoring Calendar, whereby most changeovers were completed within ±2 days of the specified date. The only deviation from this was in January where no tubes were deployed/collected for this monitoring period. This was due to the tubes not being collected as a result of officer sickness.

Diffusion Tube Annualisation

As per LAQM.TG(16), annualisation is required for any site with data capture less than 75% but greater than 25%. Two sites (BB25 and BB36) required annualisation in 2021 due to low data capture. Urban background AURN sites used to complete this were London Haringey Priory Park South, London Bloomsbury, and London North Kesteven. These were selected as they were the nearest AURN urban background monitoring locations with greater than 85% data capture in 2021. Annualisation was completed using the latest version of the LAQM Diffusion Tube Data Processing Tool, and the outputs are presented in Table C.2.

Diffusion Tube Bias Adjustment Factors

The diffusion tube data presented within the 2022 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.TG16 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.

Broxbourne Borough Council have applied a national bias adjustment factor of 0.84 to the 2021 monitoring data. A summary of bias adjustment factors used by Broxbourne Borough Council over the past five years is presented in Table C.1.

No co-location studies are carried out by Broxbourne Borough Council therefore a national factor has been used. The national factor for Gradko 20% TEA in water, as presented in the Diffusion Tube Bias Factors Spreadsheet v03_22, was 0.84 based on 32 studies.

Table C.1 – Bias Adjustment Factor

Monitoring Year	Local or National	If National, Version of National Spreadsheet	Adjustment Factor
2021	National	03/22	0.84
2020	National	03/21	0.81
2019	National	03/20	0.93
2018	National	09/19	0.92
2017	National	03/18	0.89

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.

Fall-off with distance calculations were required at two sites where annual mean NO$_2$ concentrations were greater than 36µg/m^3, and the sites are not located at relevant exposure – BB51 and BB28. This was completed using the latest version of the LAQM Diffusion Tube Data Processing Tool, and the output from this is presented in Table C.3.

Table C.2 – Annualisation Summary (concentrations presented in µg/m³)

Site ID	Annualisation Factor London Haringey Priory Park South	Annualisation Factor London Bloomsbury	Annualisation Factor London North Kensington	Average Annualisation Factor	Raw Data Annual Mean	Annualised Annual Mean	Comments
BB25	0.9837	0.9753	0.9580	0.9723	18.3	17.8	
BB36	1.0086	1.0485	1.0583	1.0385	23.6	24.5	

Table C.3 – NO₂ Fall off With Distance Calculations (concentrations presented in µg/m³)

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
BB51	2.5	7.1	41.3	17.9	35.3	
BB28	3.0	14.5	44.1	15.4	32.4	

Appendix D: Maps of Monitoring Locations and AQMAs

Figure D.1 – Map of Non-Automatic Monitoring Sites
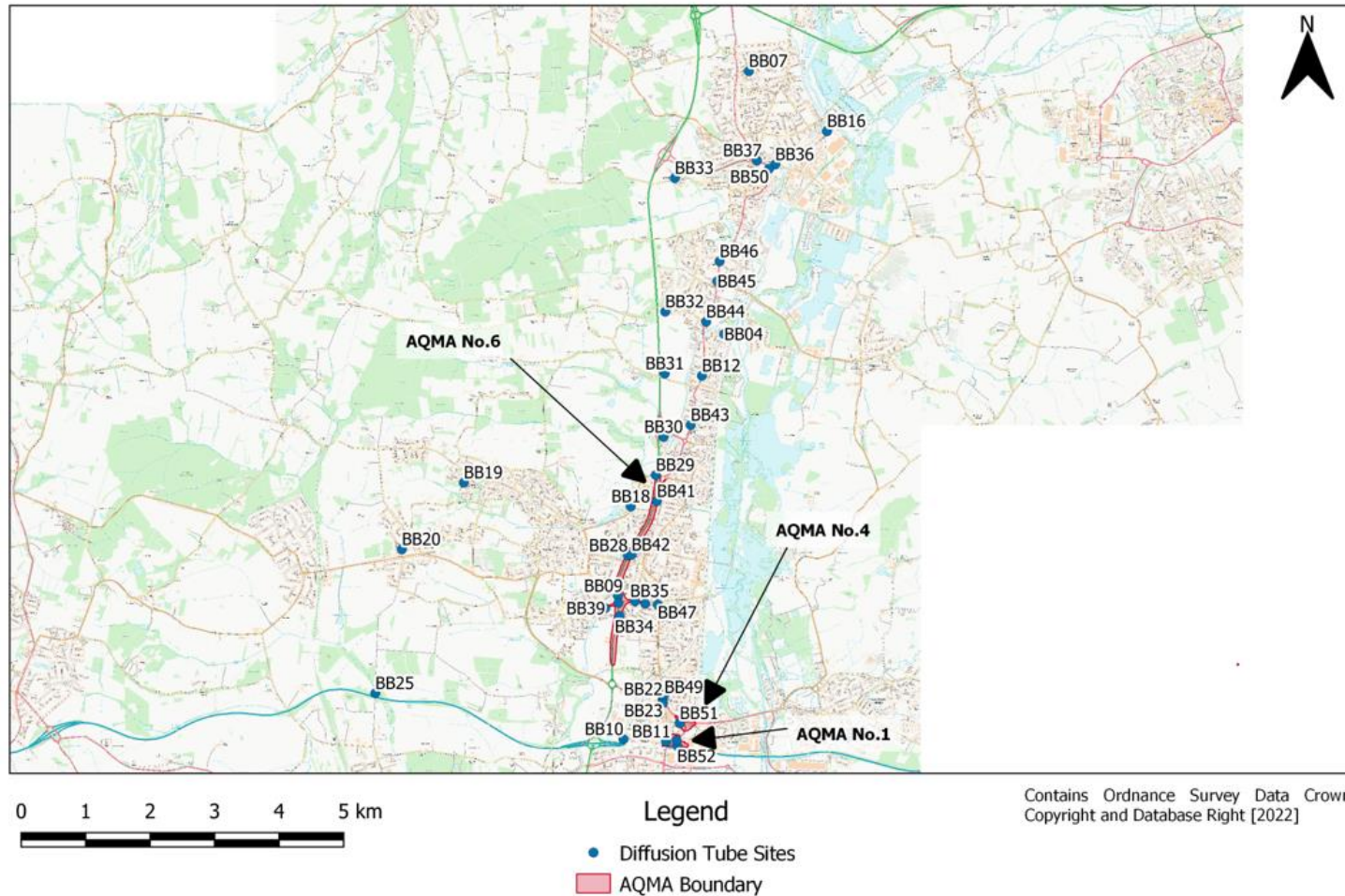
Figure D.2 – Map of Non-Automatic Monitoring Sites BB19 and BB20
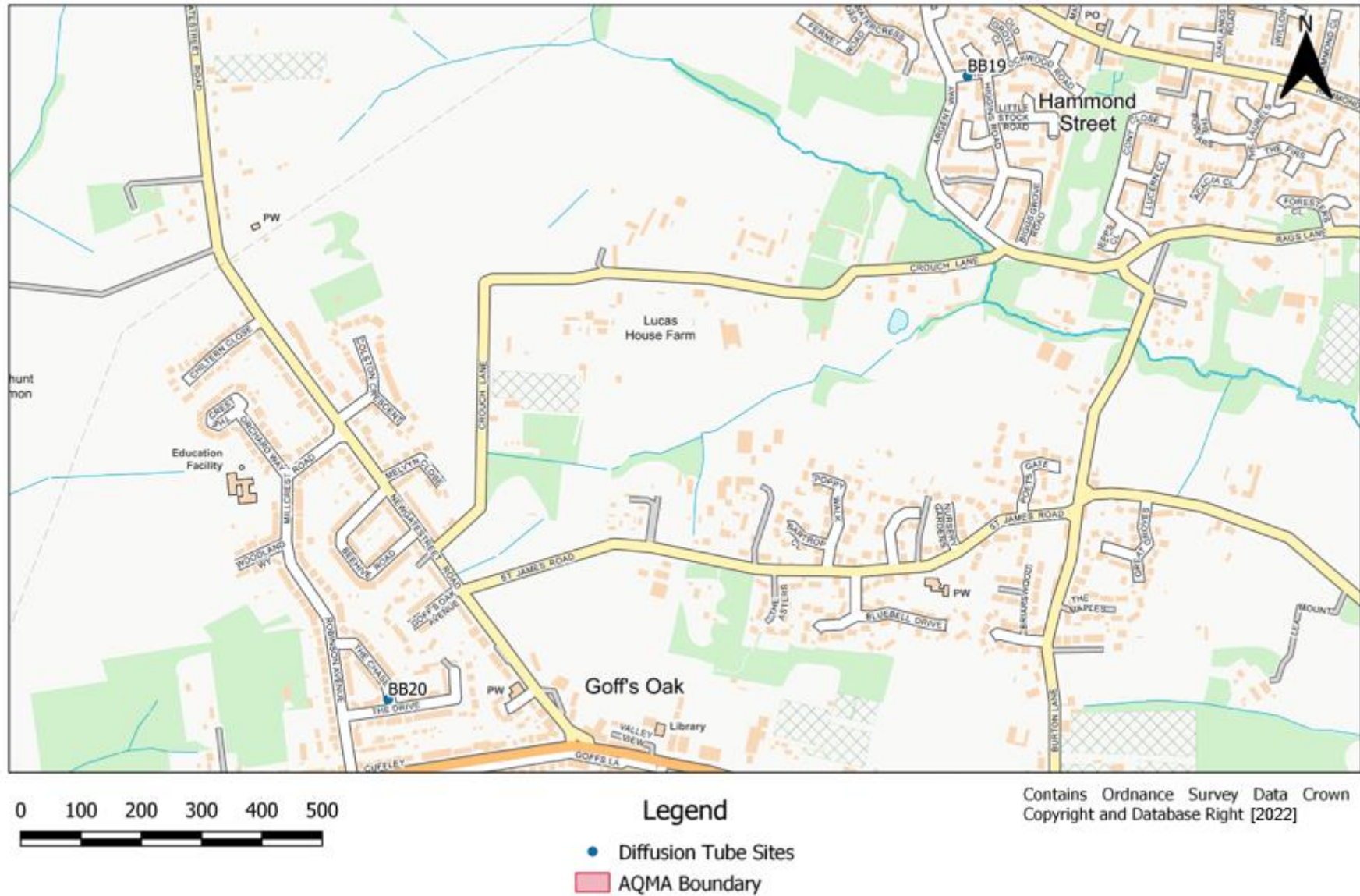
Figure D.3 – Map of Non-Automatic Monitoring Site BB25

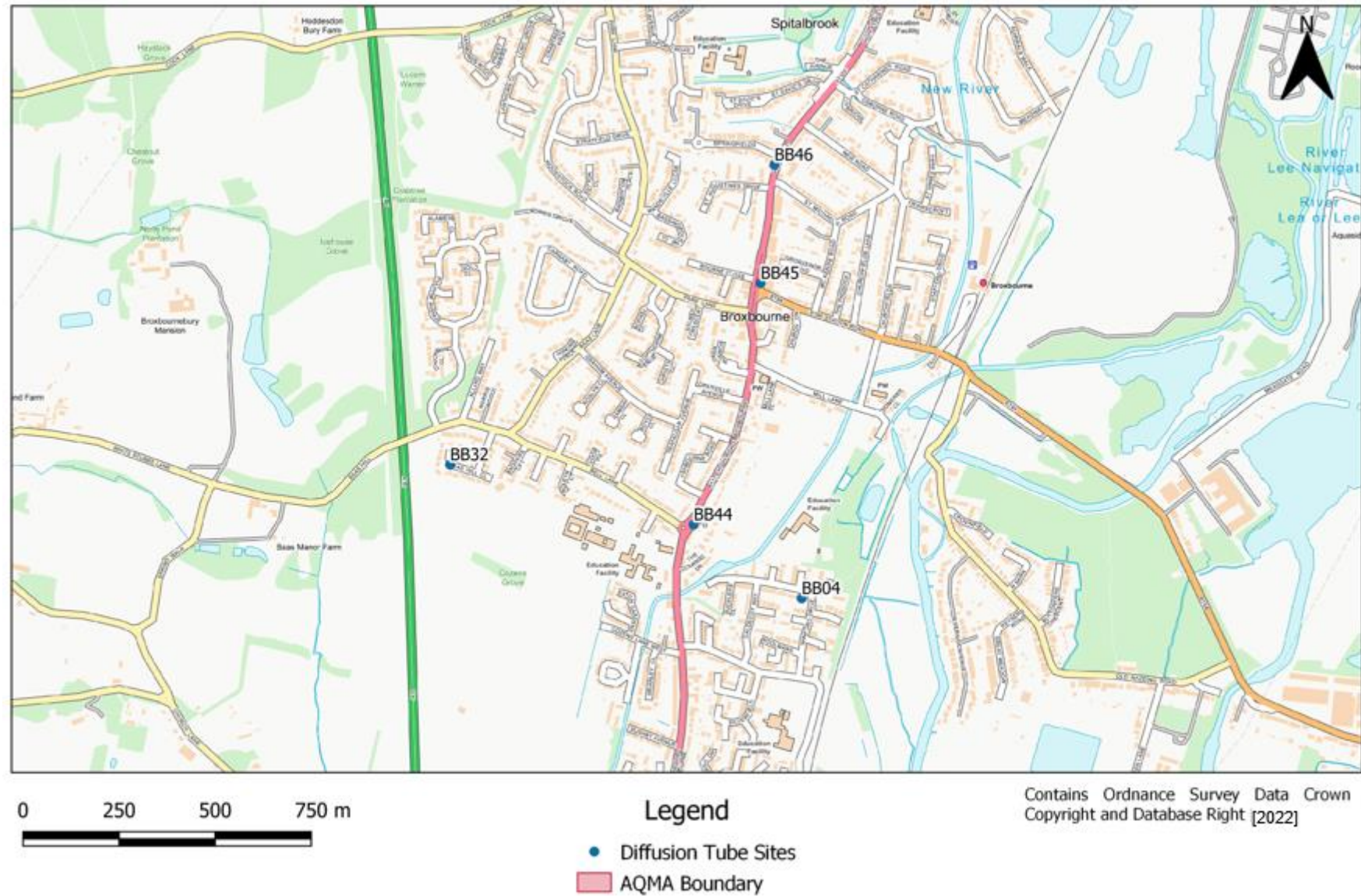**Figure D.4 – Map of Non-Automatic Monitoring Sites in Broxbourne**

Legend

• Diffusion Tube Sites

▮ AQMA Boundary

Contains Ordnance Survey Data Crown Copyright and Database Right [2022]

Figure D.5 – Map of Non-Automatic Monitoring Sites in North Cheshunt
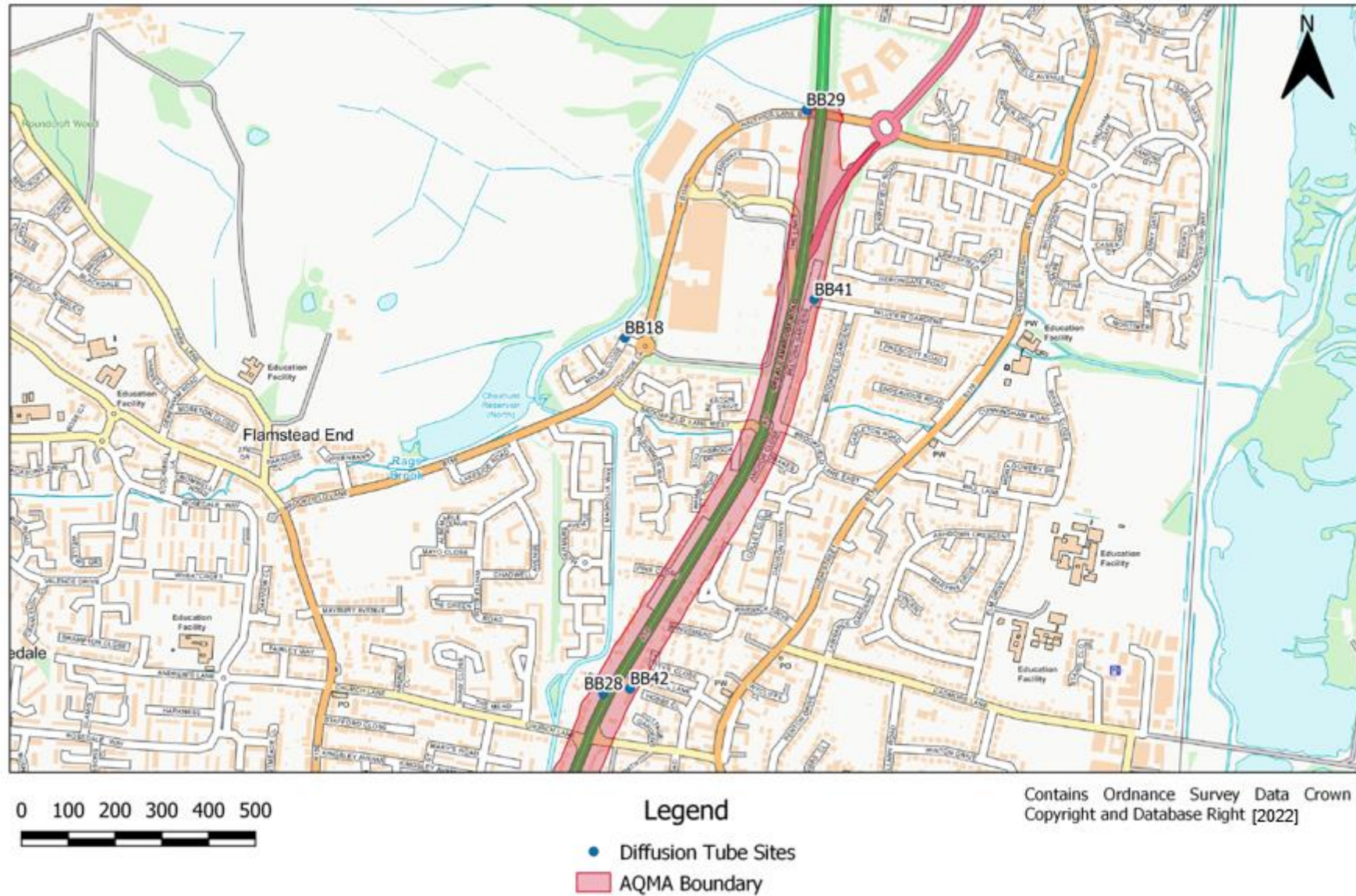
Figure D.6 – Map of Non-Automatic Monitoring Sites in South Cheshunt

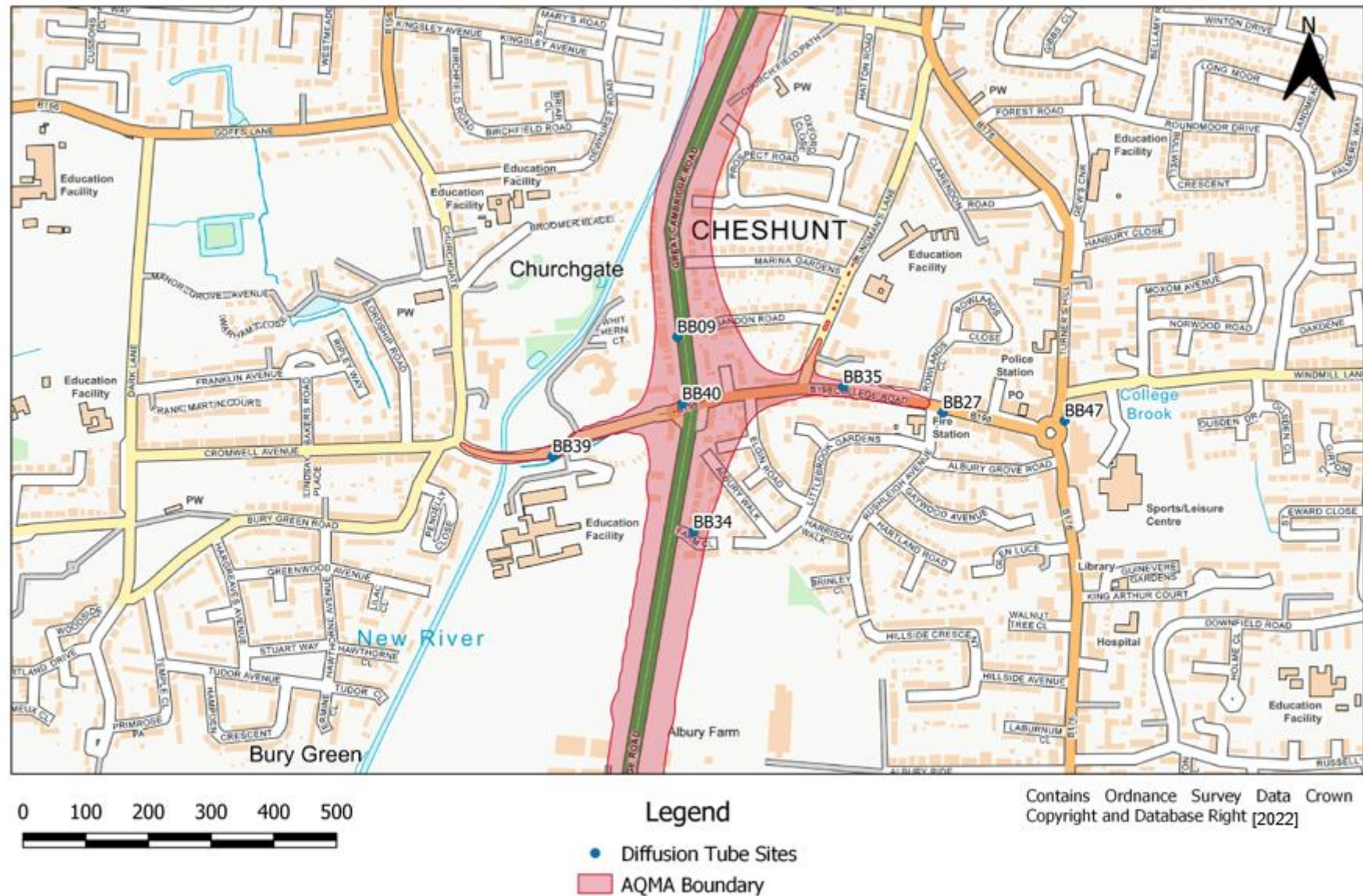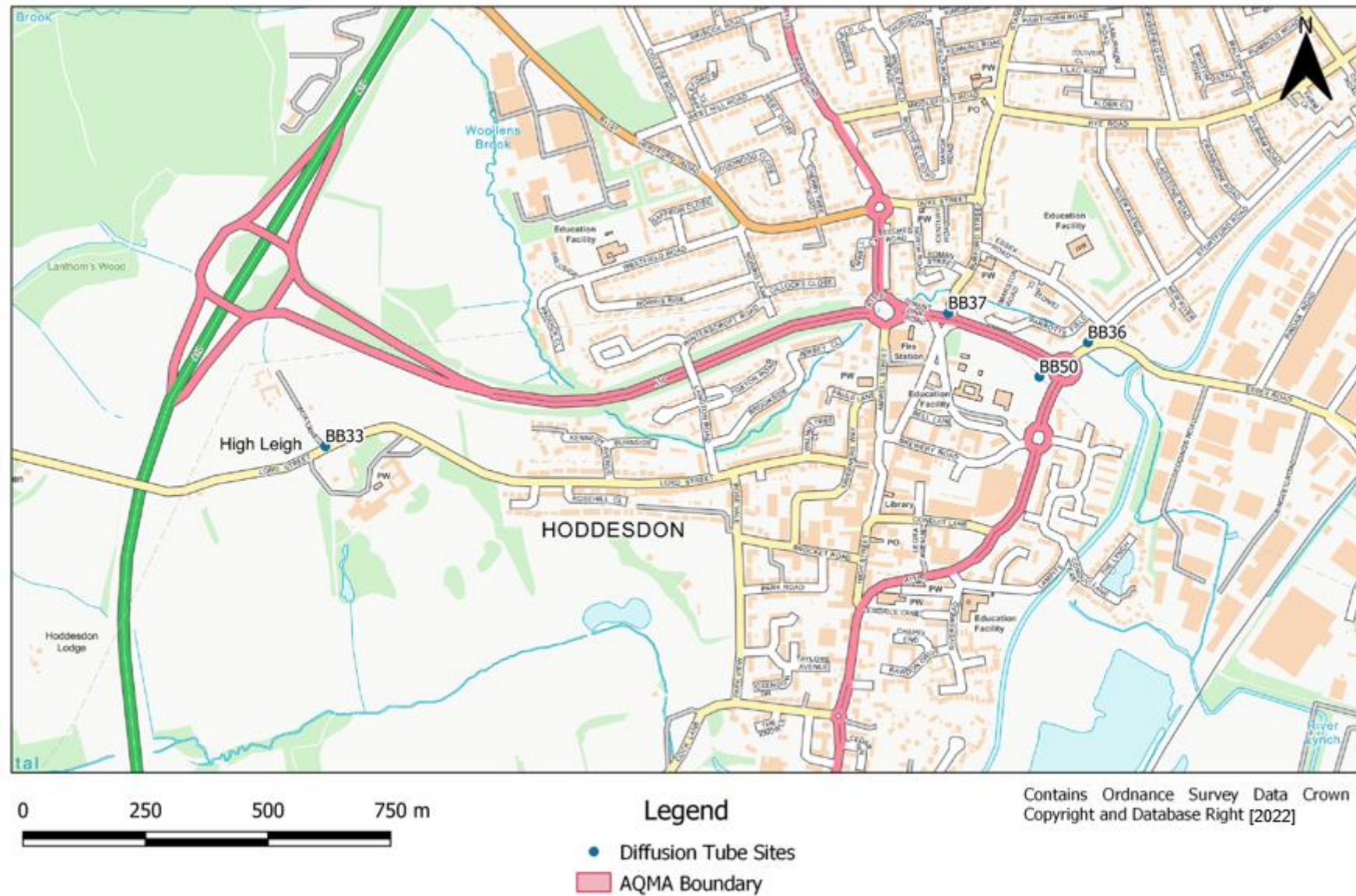**Figure D.7 – Map of Non-Automatic Monitoring Sites in Hoddesdon**

Legend

• Diffusion Tube Sites

▨ AQMA Boundary

Contains Ordnance Survey Data Crown Copyright and Database Right [2022]

Figure D.8 – Map of Non-Automatic Monitoring Sites in Rye Park

Legend
- Diffusion Tube Sites
- AQMA Boundary

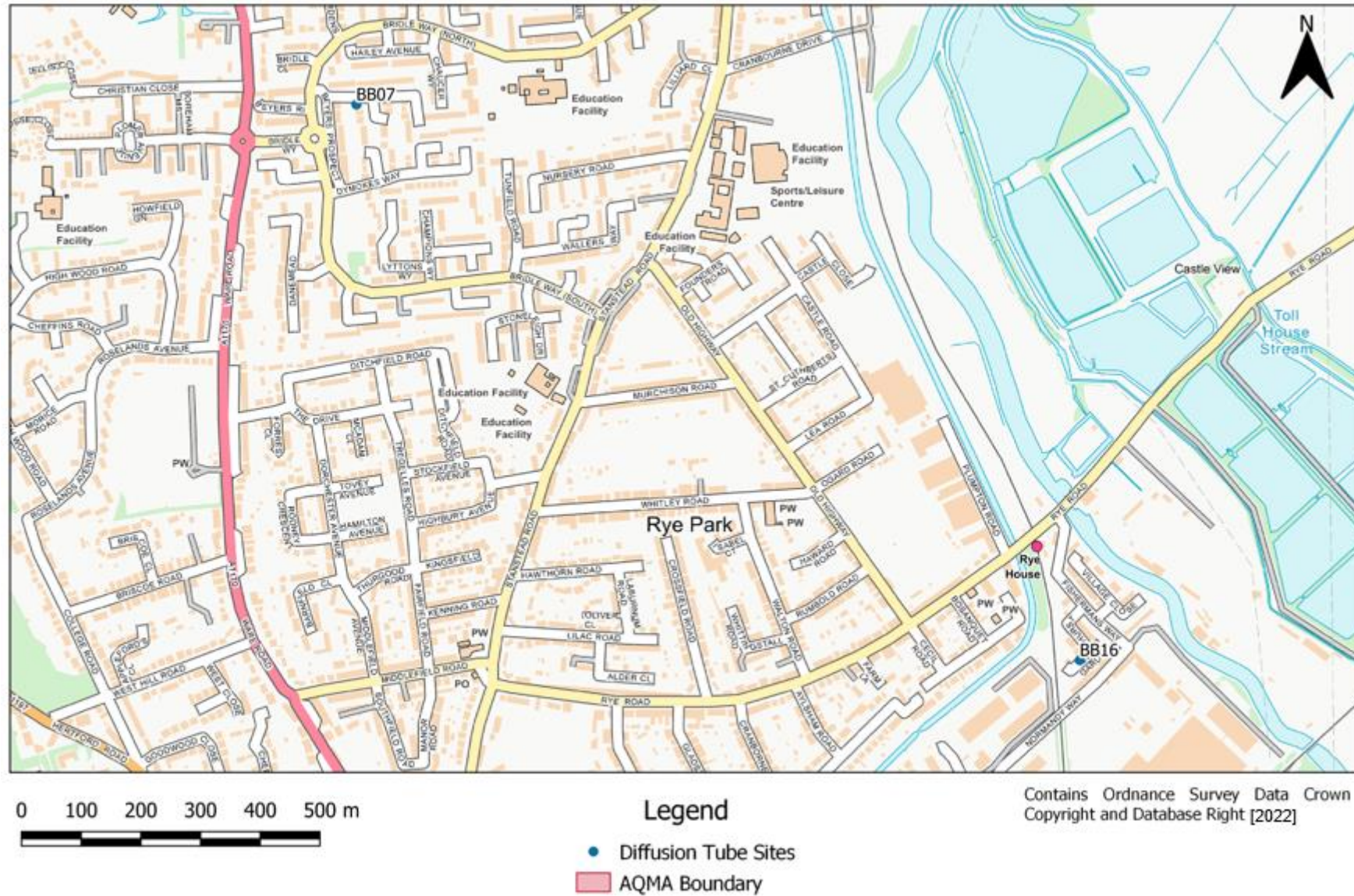Contains Ordnance Survey Data Crown Copyright and Database Right [2022]

Figure D.9 – Map of Non-Automatic Monitoring Sites in Waltham Cross
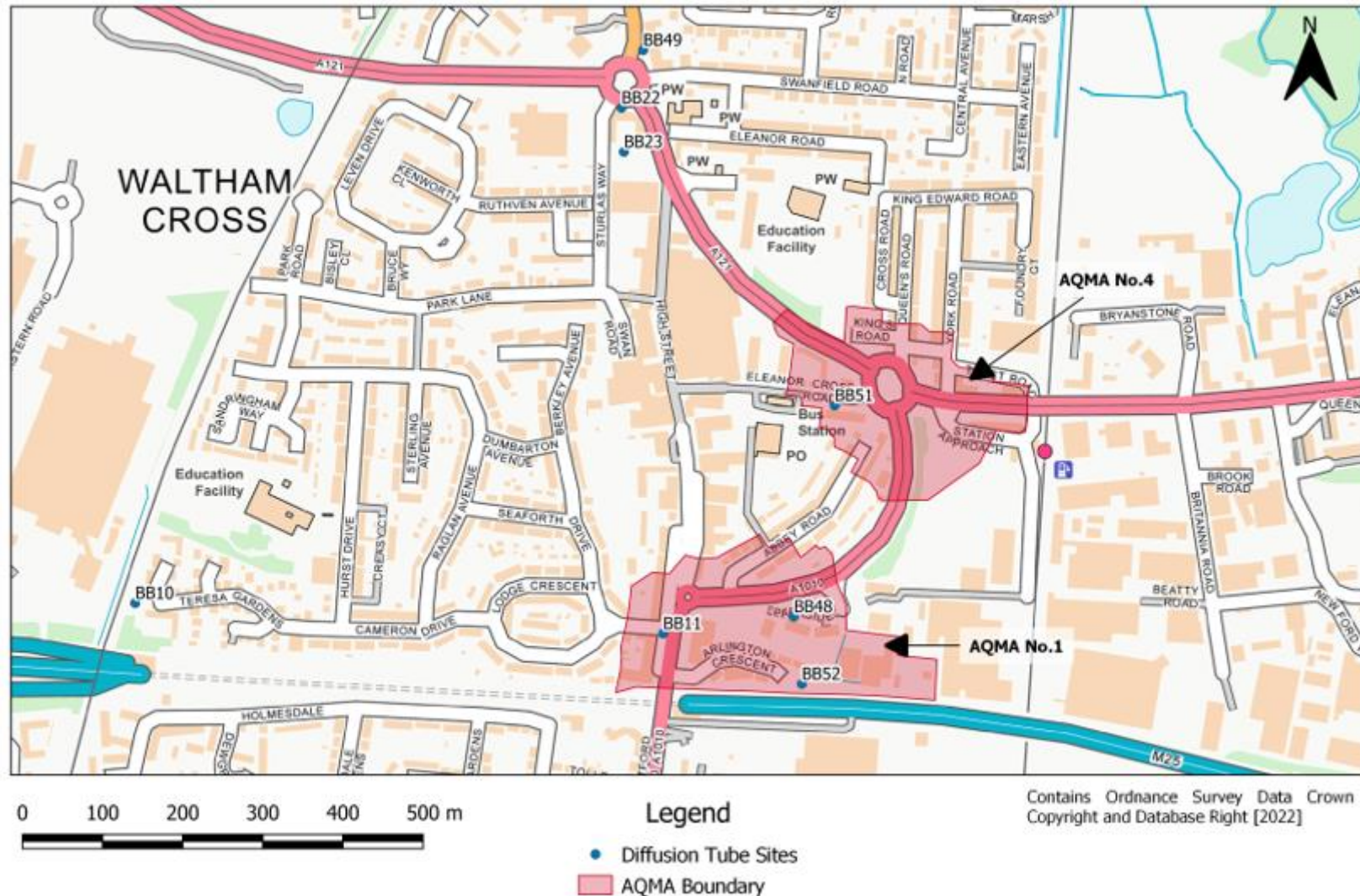
Figure D.10 – Map of Non-Automatic Monitoring Sites in Wormley

Contains Ordnance Survey Data Crown Copyright and Database Right [2022]

Legend
- Diffusion Tube Sites
- AQMA Boundary
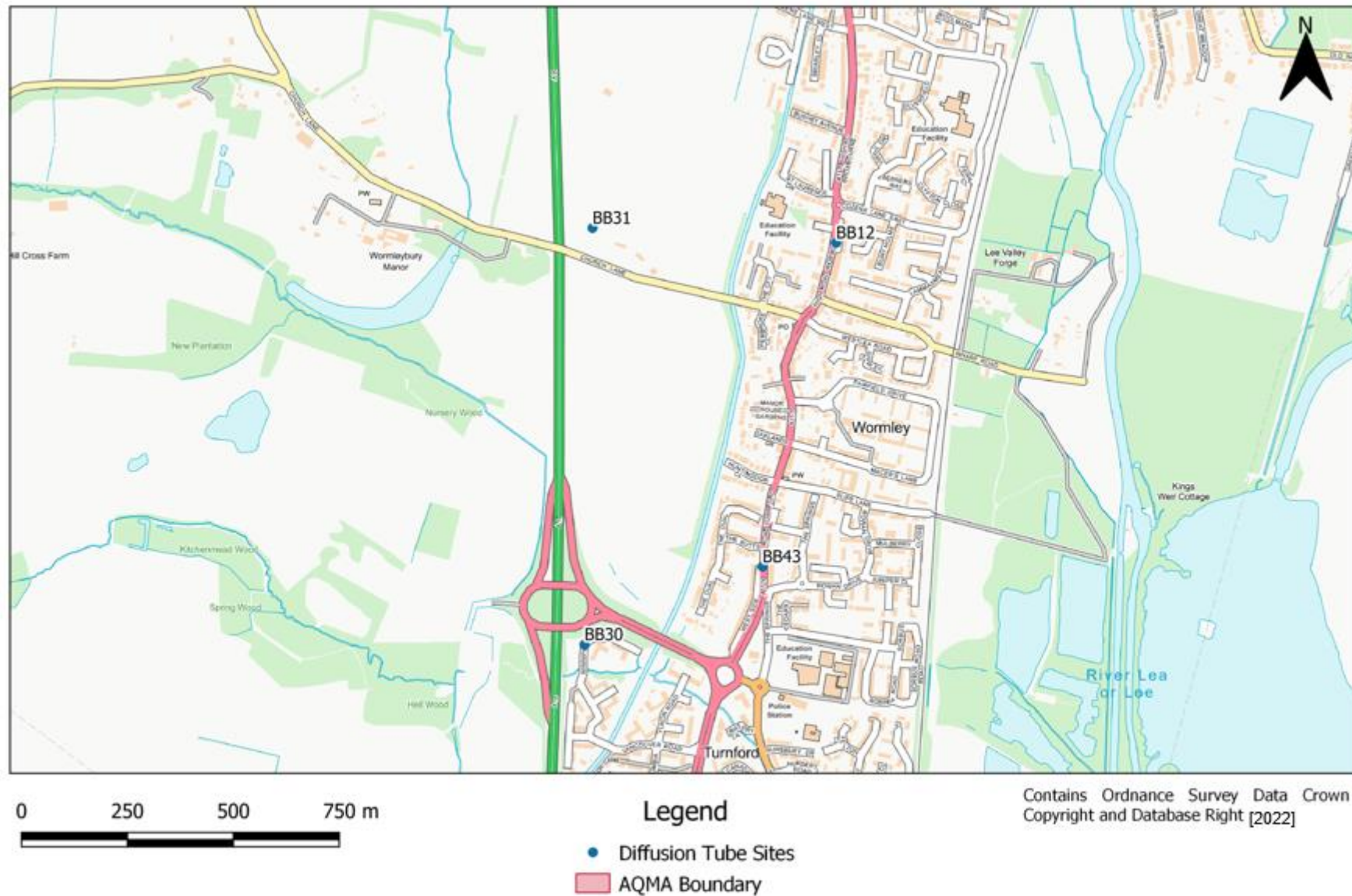
Appendix E: Summary of Air Quality Objectives in England

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
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

[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
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
SO_2	Sulphur Dioxide

References

- Local Air Quality Management Technical Guidance LAQM.TG16. April 2021. 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.PG16. May 2016. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.
- Broxbourne Borough Council Air Quality Reports – 2018, 2019, 2020, 2021 ASRs, available at: https://www.broxbourne.gov.uk/airquality
- Broxbourne Borough Council Local Plan 2018-2033, available at: https://ex.broxbourne.gov.uk/resident-planning-and-building-planning-policy/local-plan-2018-2033
- National Diffusion Tube Bias Adjustment Factor Spreadsheet, version 03/22 V1 published in April 2022.