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OXFORD CITY COUNCIL

2022 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

Information	Oxford City Council Details
Local Authority Officer	Pedro Abreu
Department	Environmental Sustainability
Address	Town Hall, St Aldates Oxford (OX1 1BX)
Telephone	01865 249811
E-mail	airquality@oxford.gov.uk
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Executive Summary

The Burden of Air Pollution

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 343,000 deaths at typical ages[3], with a total estimated healthcare cost to the NHS and social care of £157 million in 2017[4].

The Government's new Environmental Improvement Plan

At the end of January 2023, the Government published the UK's Environmental Improvement Plan 2023 (EIP), and which constitutes the first revision of the Governments 25 year Environment Plan (published originally in 2018).

The Plan sets out the actions that are expected to be taken to help restore nature, tackle environmental pollution and increase the UK's prosperity.

The Plan's Goal number 2 relates specifically with the Government's plans to achieve Clean Air. The following targets and commitments are included within the new Plan:

- A commitment to the existing national emissions reduction targets and air quality concentration targets;

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.

- Reaffirms the two long term targets for $PM_{2.5}$ set under the Environment Act 2021, setting out also interim targets for this pollutant:
  - A legal target to reduce population exposure to $PM_{2.5}$ by 35% in 2040 compared to 2018 levels, with a new interim target to reduce by 22% by the end of January 2028.
  - A legal target to require a maximum annual mean concentration of 10 micrograms of $PM_{2.5}$ per cubic metre ($\mu g/m^3$) by 2040, with a new interim target of 12 $\mu g/m^3$ by the end of January 2028.
- A five point delivery plan which draws in actions by other Departments and local authorities;
- The consideration of action, on key sources, including domestic burning, agriculture, industry and transport, including shipping.

New National and Local Air Quality Strategies

On the 28th April 2023 the UK Government published its revised Air Quality Strategy[5]. The new Strategy fulfils the statutory requirement of the Environment Act 1995 as amended by the Environment Act 2021, and which mandates the UK Government to publish an Air Quality Strategy setting out air quality standards, objectives, and measures for improving ambient air quality every 5 years.

The new national Air Quality Strategy also sets out the actions the government expects local authorities to take in support of achieving the UK Government's long-term air quality goals (including the new $PM_{2.5}$ targets that were developed as part the EIP). The strategy was written with the intent of providing a framework to enable local authorities to make the best use of their powers and deliver for their communities.

At a local level, Oxfordshire County Council has been mandated to develop an Air Quality Strategy, as part of changes to the Local Air Quality Management Regime (LAQM) brought in as part of the Environment Act 2021.

This change has been introduced with the intent of improving the current LAQM regime, by strengthening the responsibilities and level of collaboration required from local authorities

5 DEFRA's Air Quality Strategy, 28th April 2023

that do not have legal statutory duties on Air Quality – specifically County Councils and Transport Authorities. Responsibility for tackling local air pollution is now officially shared between designated relevant public authorities, all tiers of local government and neighbouring authorities.

Air Pollution Sources in Oxford

The city of Oxford, as with many urban areas throughout the United Kingdom, is subject to poor air quality, particularly in areas with high levels of road traffic. Nitrogen dioxide (NO_2) is still the pollutant of most concern, and the entire city of Oxford has been a designated Air Quality Management Area (AQMA) for NO_2 since 2010.

According to Oxford's most recent source apportionment study[6], the transport sector continues to be by far the largest contributor (68%) to total emissions of Nitrogen Oxides (NOx) in the city, followed by domestic combustion (19%), combustion from industry and services (12%) and others: waste, agriculture, solvents, nature (<1%).

The city's recent Air Quality Action Plan (AQAP)[7] sets out a list of actions that the city council and its partners have committed to deliver during the period 2021-2025 in pursuit of an improvement of air quality in the city. The city's action plan seeks to go further than the current UK legal annual mean limit value for NO_2 of 40 µg/m^3, by establishing a much more stringent local annual mean NO_2 target of 30 µg/m^3 to be achieved by 2025 in recognition that there's no safe level of air pollution.

The current status of Air Pollution in the City

NO_2

Throughout 2022, air quality (NO_2) was monitored at 127 sites across the city (126 with diffusion tubes, 3 with automatic monitors and 2 locations using both techniques). Thirty Seven (37) of those sites are new monitoring locations and the remaining ninety (90) are sites where air quality had been monitored in the previous year.

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6 Oxford City Council's Source Apportionment study, July 2020.

7 Oxford City Council's Air Quality Action Plan 2021-2025.

Only one legal breach of the UK's NO_2 annual mean limit value was observed in the city of Oxford at locations considered of relevant exposure in 2022 (*i.e. at any location where members of the public are likely to be regularly present for a period of time appropriate to the averaging period of the annual mean limit value*). The location of the breach was St Clements (The Plain) – the city's historic air quality hotspot, with an annual mean of NO_2 43 µg/m^3.

A further five monitoring locations measured NO_2 levels that were above the UK's limit value for this pollutant, but these locations are not considered to be representative of relevant exposure. The reason for this is that the purpose of measuring air quality at these locations is to establish an air quality baseline to assess the impacts (in terms of traffic displacement) of the introduction of future transport scheme. Four of these monitoring sites are located along Oxford's ring road with the last located at Headington Hill. Only one of these locations are near a residential area, which is located on the Southern Bypass. It is within an Air Quality Management Area that falls outside the jurisdiction of the City and is being managed by Vale of White Horse District Council and therefore not relevant for this annual status report.

Twelve locations within the city were above Oxford's local annual mean target of 30 µg/m^3 for NO_2 (a commitment laid out in the city's recent AQAP, and which is expected to be achieved across the city by 2025). These locations are: Cutteslowe Roundabout; St Aldates; High Street (2x); Long Wall St; St Clements (2x); Hollow Way Road; Worcester St., Park End St, Oxford Road (intersection with Newman's Road) and Oliver Road (facing Eastern bypass Road);

In 2022, we saw an average decrease in NO_2 levels in the city of 8%[8] compared with the previous monitoring year of 2021. From the 90 monitoring sites where air quality was available for comparison, the vast majority of them (80) have seen decreases in the levels measured, with only 10 reporting increases.

8 According to traffic data provided by Oxfordshire County Council, traffic levels have increased (on average) within the city of Oxford by 8,2% in 2022. NO_2 levels have therefore reduced in the city despite the observed traffic increases.

This average decrease of 8% is aligned with the UK's national trend[9] for this pollutant. In 2022, the average NO_2 concentration from all UK's AURN Roadside sites have decreased by 5%, when compared with the measurements obtained in the previous year.

Compared to the levels of NO_2 measured in 2019, the last pre-pandemic year, we see an average reduction of 24% of NO_2 levels in the city in 2022.

Particulate Matter

Analysis of data obtained in 2022 for Particulate Matter in all the city locations where these pollutants are being monitored shows the following:

Annual mean $PM_{2.5}$ levels were 7 µg/m^3 at Oxford St Ebbes, which is the same value that was measured at this location in 2020 and 2021. In 2022, $PM_{2.5}$ monitoring capability was added to the Oxford High Street automatic monitoring site. The annual mean obtained at this site for $PM_{2.5}$ was 6 µg/m^3. These annual means are both in compliance with the new UK annual mean concentration target and marginally above the annual mean of 5 µg/m^3 which is recommended by the WHO for this pollutant.

$PM_{2.5}$ measurements obtained in Oxford are also aligned with the UK's national trend for this pollutant. Analysis of the $PM_{2.5}$ UK national trend show that average concentrations rose slightly (by 5%) in 2022, from 2021 levels. At Oxford AURN St Ebbes, $PM_{2.5}$ rose by 4.7% in 2022 (moving from an average decimal value of 7.13 to 7.46 µg/m^3). However, this increase is not perceptible on the final mean, because it is a very small increase.

Annual mean PM_{10} levels have slightly increased at our monitoring sites in 2022. At AURN St Ebbes, the annual mean measured was 12 µg/m^3, 1 µg/m^3 above the measurement obtained in 2021. At Oxford High Street, the increase was of 2 µg/m^3, with the annual mean measured at 16 µg/m^3. Both values are well within compliance with the UK's annual mean limit value of 40 µg/m^3, and very close to the 15 µg/m^3 guideline value recommended by WHO for this pollutant. These increases are also aligned with the average PM_{10} increase of 1 µg/m^3 seen at a national level for this pollutant[10].

9 DEFRA's UK National Air Quality Statistics (NO_2)

10 DEFRA's UK National Air Quality Statistics (PM_{10} and $PM_{2.5}$)

Ozone

Ozone is measured at one site in Oxford and levels exceeded the AQS daily objective 159 times over a total of 24 days during the year. This represents a significant increase in the number of exceedances (99 more), and days (12 more), when compared with 2021.

Ozone is an area wide pollutant, and whilst monitoring sites are relatively sparse compared to those monitoring NO_2, they represent wider population exposure, so a single site may represent the ozone concentrations that hundreds of thousands of people have been exposed to. For this reason, local measures alone are not enough to tackle the problem and actions at different levels of governance (i.e. regionally and internationally) are required.

Recent actions to improve Air Quality in Oxford

Oxford's new Air Quality Action Plan 2021-2025 focusses on measures the City Council has the ability to address, but also includes measures that we can influence, or work in partnership with others to deliver. Effective action requires co-operation from all sectors including transport, construction, business and commerce, and daily choices made by every single transport user. Oxford's AQAP recognises that the City Council cannot act in isolation in order to deliver a comprehensive package of measures without engagement and delivery from a wide range of stakeholders.

The following are actions that Oxford City Council and its partners have taken over the last reporting year to improve air quality in the city. This AQ ASR reports on all the measures that were delivered by Oxford City Council and its partners, covering the period that goes from May 2022 to May 2023, as the report is prepared and submitted for appraisal to DEFRA every year in June. The list below is presented in chronological order:

May 2022 - Three low-traffic neighbourhoods (LTNs) in East Oxford implemented at: Divinity Road, St Clements, and St Mary's areas. The scheme was implemented through an experimental traffic regulation order (ETRO) which runs for a maximum of 18 months. A public consultation to gather views on the experimental trial of the East Oxford LTNs was open from 20th May until 30th November 2022, with a decision on the next steps for the scheme to be made by the County Council's cabinet later in 2023 – link to press release;

July 2022 – Inauguration of Oxford's Energy Super Hub at the Redbridge Park & Ride. Oxford City Council delivered 42 new fast and ultra-rapid charging points (powered entirely by renewable energy). The hub is also able to scale up with EV adoption to provide

charging for 400 vehicles, helping to support the estimated 36 million EVs expected on UK roads by 2040. In the first six months of opening, the Hub provided 25,000 charging sessions and powered about 2million electric miles – link to press release;

Photo description: Europe's most powerful EV charging hub in operation at the Redbridge Park and Ride in Oxford.

July 2022 – Oxford City Council's cabinet officially approved and published Oxford's Electric Vehicle Infrastructure Strategy[11], a document that now complements the already published Oxfordshire EV Infrastructure Strategy, and which was developed with the objective to address how the city can deliver EV infrastructure to meet its zero carbon oxford 2040 target in a fair and equitable way – link to press release;

November 2022 – Approval was granted at Oxfordshire County's cabinet meeting for a trial to install traffic filters on six roads in Oxford. Oxford City Council supported Oxfordshire County with these proposals. The traffic filters are traffic cameras that can read number plates and are intended to reduce traffic levels in Oxford by targeting unnecessary journeys by cars. The filters are due to be implemented in autumn 2024 - link to project info;

December 2022 – Oxford City Council finished the one year e-cargo bike trial at the Covered Market. The project was delivered in partnership with local cargo bike delivery company Pedal & Post, and have allowed Covered Market traders to make same day and

11 Oxford's Electric Vehicle Infrastructure Strategy, July 2022

next day zero emission deliveries, offering practical support to traders as they transition their deliveries to zero emission vehicles. The project saw up to 262 kg of CO_2 emissions saved, along with a total of 690 miles travelled by the e-cargo bikes – link to press release;

December 2022 – The 2022's edition of the EV Summit took place at the Said Business School on the 12th and 13th December in Oxford. The event was run in partnership between Green TV, Oxford City Council, Oxfordshire County Council, Oxford University and Oxford Brookes University. This year's focus was on innovation in electric vehicles and delivery of decarbonised transport in the UK and beyond – link to press release;

January 2023 – The deal to bring 159 electric buses (and the infrastructure to charge them) to Oxford was officially signed. This project was partly funded by the government's Zero Emission Bus Regional Areas (ZEBRA) scheme (£32.8 million), along with £6m from the council itself and £43.7m from bus companies Stagecoach and the Go-Ahead Group, which includes the Oxford Bus Company, Thames Travel, and City Sightseeing Oxford, bringing the total amount to £82.5 million. All buses are expected to arrive to Oxford by March 2024 – link to press release;

Photo description: From left, Rachel Geliamassi, Cllr Duncan Enright, Cllr Andrew Gant and Luke Marion.

February 2023 – Oxford City Council, in partnership with the Canal & River Trust, has been granted £192,993 from DEFRA's Air Quality Grant to deliver six "*eco-moorings*" at the towpath visitors' moorings of Aristotle Lane, on the Oxford Canal. The power points will be at these moorings to provide electrical power for up to six visiting boaters to reduce their reliance on diesel engines, generators and wood burners for their day-to-day energy needs –link to press release;

February 2023 – Oxford City Council has been granted £75,000 from the Net Zero Living Programme fund from Innovate UK (in partnership with Low Carbon Hub) to explore the

creation of a new *'one stop shop'* for residents and businesses seeking retrofit services for their homes and premises, while also strengthening the local supply chain - through an innovative "*FutureFit*" concept. This concept involves utilising smart technology and design, to make it easier for businesses and residents to make changes to help reduce energy consumption and reduce the impacts of climate change. – link to press release;

March 2023 - Oxford City Council and Oxford Direct Services (ODS) jointly operate a fleet of electric vehicles including 26 cars, 59 vans and 8 specialist EVs (including sweepers, a digger and a refuse collection vehicle). Oxford City Council now has a total of 27% of their fleet being fully electric, having therefore fully met Oxford City Council's original AQAP commitment of having 25% of its fleet fully electric by the end of 2023.

May 2023 - Oxford completed the last stage of T-GULO, a working driver focussed project to support the Oxford Hackney Carriage (HC) and Private Hire (PH) trades with electrification, delivering 9 rapid chargers dedicated to the taxi trades, as well as an emissions pathway to transition all HCs to ULEV by 2025, and an ESO funded e-taxi rental offer between 2021 and 2022 – link to project info;

Photo description: Electric Hackney in front of the old Bodleian Library in Oxford

May 2023 –Oxford City Council has organised "*EVs are for Everyone*". This was a free event to residents and businesses across Oxford and Oxfordshire with the aim to provide them with an opportunity to find out more about electric cars and vans in a relaxed and friendly way – link to press release;

Conclusions and Priorities

Oxford's 2022 air quality monitoring results show the following for **NO_2:**

- The legal annual mean objective of 40 µg/m^3 was exceeded at six (6) of the 126 diffusion tube monitoring locations that formed part of the air quality network. However, of those, only 1 (St Clements – The Plain, Oxford's historic air quality hotspot) is located in a place considered of relevant exposure in 2022 (*i.e. at any location where members of the public are likely to be regularly present for a period of time appropriate to the averaging period of the annual mean limit value*), with a measured NO_2 concentration of 43 µg/m^3. For the remaining five:
    - Three are located along the ring road (Northern, Eastern and Western Bypasses), in isolated locations where members of the public are not expected to be regularly present. These sites measured annual mean concentrations of 42, 43 and 42 µg/m^3 respectively and are labelled with the tube numbers TF27, TF31 and TF37;
    - One tube, (TF35) was installed at residential properties located by the ring road, on the Southern Bypass - south of Botley Interchange. This tube measured a concentration of 57 µg/m^3. However, this location falls outside the City Council's jurisdiction, and forms part of an existing AQMA that is being managed by Vale of the White Horse District Council;
    - One tube (TF19) is located on the kerb at Headington Hill, a non-residential area, directly on the road. This location is far from relevant exposure, and members of the public are not expected to be present at any time. The NO_2 annual mean concentration measured at this location was of 70 µg/m^3, (the highest measurement in 2022);

- For the sixth consecutive year, none of the city's NO_2 diffusion tube monitoring sites located in areas considered of relevant exposure, presented an annual mean NO_2 equal or above 60 µg/m^3. According to LAQM (TG22), this is an indication that exceedances of the hourly mean objective for NO_2 are also not likely to have occurred in those areas in 2022;

- In 2022, NO_2 levels decreased on average by 8.3% across the city, whilst average traffic levels within the city have increased by a similar proportion (8.2%)[12]. The most likely explanation for this relates to fleet renewal and upgrades, in particular the increase in the amount of EVs on our roads. According to DVLA data, Oxfordshire has some of the highest EV uptake figures for newly registered vehicles in the UK, with uptake consistently above 44% (and rising) from November 2022 onwards. The introduction of measures such as Oxford's ZEZ Pilot and plans for its future expansion, seem:
  - To have been driving companies such as DPD, Royal Mail, Tesco, to accelerate their fleet transition to electric in Oxford;
  - To have provided space for sustainable cargo bike delivery companies such as Pedal & Post, OxWash, Velocity to flourish across the city; and
  - To have led to an increase in EV infrastructure in the City (Oxford city has the fifth[13] highest number of electric vehicle charging devices per 100,000 people in England), which improves public confidence with the transition to EVs.

- In 2022 we saw an average reduction of 24% of NO_2 levels in the city when compared with the levels obtained in 2019 (pre-pandemic).

- Twelve locations within the city, were shown to be above Oxford's local annual mean target of 30 µg/m^3 for NO_2 (a commitment laid out in the city's recent AQAP, and which is expected to be achieved across the city by 2025). Those locations are: Cutteslowe Round abound; St Aldates; High Street (2x); Long Wall St; St Clements (2x); Hollow Way Rd; Worcester St, Park End St, Oxford Road (at the Cross with Newmans Road) and Oliver Road (facing Eastern bypass Road);

12 Oxford's traffic data figures for 2022 were provided to Oxford City Council by the Highways authority (Oxfordshire County Council)

13 ENDS Report, 17th May 2023

Impact of ZEZ

- The UK's first Zero Emission Zone (ZEZ) was launched in February 2022. All petrol and diesel vehicles, including hybrids, will incur a daily charge if they are driven in the zone between 7am and 7pm unless they have a 100 per cent discount or exemption. The zone was in operation for 10 months in 2022 and monitoring shows that:
  - Cornmarket St, St Michaels St and George St (Magdalen St side) , saw NO_2 reductions of 3µg/m^3, the equivalent to 14%, 18% and 12% reductions each;
  - George St (Gloucester Green side) and New Inn Hall St saw improvements in NO_2 levels measured at 2µg/m^3 (8% and 12% reductions) each;
  - NO_2 levels at Queen St (DT40), Bonn Square (DT41) and New Road (DT42) were practically unchanged from 2021. The NO_2 levels measured at Queen Street and Bonn Square have increased by 1 µg/m^3 (which is not statistically significant and well within the margin of error of the measurement technique), and have remained the same on New Road. Most of these areas are already heavily pedestrianised while they form part of the main city centre bus routes. Buses are the major emission source in these areas and continue to operate within the ZEZ, so no major air quality improvements were to be expected in these areas, as a result of the ZEZ scheme.

Impact of East Oxford Low Traffic Neighbourhoods

- The monitoring results from 2022 also allow assessment of the air quality impacts of East Oxford Low Traffic Neighbourhoods (LTNs) located on St Marys, St Clements and Divinity Road. The conclusions of the assessment are:
  - All the monitoring locations inside these LTNs showed a decrease in NO_2, with the greatest effects seen at 189 Divinity Rd (LT5) which saw a reduction in NO_2 of 6ug/m^3 equal to 33% and 26 Prince Street (LT1) which saw a reduction in NO_2 of 4 ug/m^3 equal to a 24% reduction. St Marys neighbourhoods (LT14 Howard St. and LT15 Hurst St.) both show decreases in NO_2 of 3 ug/m^3 or equal to a 19% reduction;
  - DT81 Cowley Road/Union Street showed a significant reduction (-11 µg/m^3 or -37%) when compared to 2021. However, monitoring data for the year 2021 should not be used for comparison purposes with 2022 in this location. This is because the measurement at this location was heavily influenced by external

factors through most of 2021. These relate with emissions resulting from the construction works at Tesco Express including the use of generators and associated HGV movements. The 2022 result is the same as the one obtained in 2020 (19 µg/m^3). This shows that there were no meaningful impacts of LTNs at this location, which might be explained by Union Street continuing to be used by drivers as a regular access route to the Union Street car park.

On the boundary roads the picture is more mixed:

- None of the above LTN's seem to have caused any perceptible negative traffic displacement impacts on Hollow Way Road and Oxford Road. The three diffusion tubes in this area: DT80 – Holloway Road/Bennett Crescent; DT7 – Oxford Road/In between Towns Road; and DT8 – Oxford Road/Cowley Police Station) all consistently show practically no changes in the NO_2 levels compared with 2021: DT80 - reduction of 1 µg/m^3 (from 35 to 34 µg/m^3); DT7 – same levels measured (30 µg/m^3); DT8 - same levels measured (29 µg/m^3);
- The NO_2 levels at Morrell Avenue (LT4) reduced by 3 µg/m^3 equivalent to 19%, which seem to indicate that no significant LTN impacts have been seen on this boundary road as a result;
- St Clements has seen increases in the NO_2 levels measured in 2022: St Clements 1 (DT55) saw an increase in NO_2 of 4 µg/m^3 equivalent to 10% and St Clements 2 (DT77) saw an increase in NO_2 of 5 µg/m^3 equivalent to 17%. This seems to indicate that this street has seen impacts of LTNs, via traffic displacement. St Clements (DT55) is historically the city's highest NO_2 hotspot. Annual mean concentration in 2022 was 43 µg/m^3 at this location, which brought back air pollution to levels slightly above the existing UK legal annual mean limit for this pollutant (40 µg/m^3);
- The monitoring site DT72 on Cowley Road (crossing with James Street) show the highest increase in NO_2 levels at the sites that were used to monitor the impacts of LTNs. The increase at this site was of 7 µg/m^3 equivalent to 35%, with an annual mean increasing from 20 to 27 µg/m^3. This increase if most likely the result of this being the only road that moves across the 3 LTN's, so it's very likely to have been impacted by traffic displacement caused the 3 LTN's in operation. However, despite the increase, NO_2 levels are still below the city's

annual mean local target for NO_2 and below the current UK legal limit value for this pollutant;

If you are interested to know more about the impact of East Oxford LTNs, please read the interim/snapshot evaluation report, which was published on the 5th June by Oxfordshire County Council on their website here.

Oxfordshire County Council is carrying out a full analysis of the LTNs over the summer which will be published to support the cabinet decision, expected in October, when a decision will be made on whether the LTNs should become permanent.

Particulate matter

- In 2022, Oxford High Street (roadside) registered a PM_{10} annual mean of 16 μgm^{-3} and AURN St. Ebbes (urban background) a PM_{10} annual mean of 12 $\mu g/m^3$. This represent increases of 2 and 1 $\mu g/m^3$ respectively, when compared with 2021. These values are still far away from the legal annual mean limit value for PM_{10} (40 $\mu g/m^3$), and only slightly above (AURN St Ebbes) of the recommended WHO annual mean (15 $\mu g/m^3$) for this pollutant. The annual mean PM_{10} concentration is higher at our roadside site, when compared to our urban background site, most likely due to the contribution of PM_{10} emissions from road transport sources, predominantly from non-exhaust sources (brakes, tyres and road wear), as well as the impact of resuspension due to vehicle movements.
- These increases are completely aligned with the average PM_{10} increase that we see at all monitoring sites across the UK for this pollutant[14]. With domestic combustion occupying up to 48% of all local emissions of this pollutant (and road transport only 10%)[15], it is a strong possibility for this increase to be related to an increase usage of wood burning stoves and fossil fuels such as coal and wood.
- The monitored annual mean of $PM_{2.5}$ that was obtained in 2022 was 7 $\mu g/m^3$ at AURN St. Ebbes and 6 $\mu g/m^3$ at Oxford High Street. The value obtained at AURN St Ebbes was the same as the one obtained in 2021. The value obtained at Oxford

14 National Statistics, Particulate Matter ($PM_{10}/PM_{2.5}$), DEFRA

15 Oxford's latest source apportionment study (2020)

High Street cannot be compared, as it was the first year that $PM_{2.5}$ was monitored at that location. These annual means are very similar, and both of them are in compliance with the new UK annual mean concentration target (a maximum annual mean concentration of 10 µg/m^3 to be achieved by 2040) and only slightly above the annual mean of 5 µg/m^3 recommended by the recently published WHO guidelines, for this pollutant.

- In 2022, AURN St Ebbes exceeded the AQ daily objective for Ozone 159 times, during a total of 24 days during the year. This represents a significant increase in the number of exceedances (99 more) and days (12 more), when compared with the results from 2021. AURN St. Ebbes has not met the AQ objectives for this pollutant in 2022. Ozone is an area wide pollutant, and whilst monitoring sites are relatively sparse compared to those monitoring NO_2, they represent wider population exposure, so a single site may represent the ozone concentrations that hundreds of thousands of people have been exposed to. For this reason, local measures alone are not enough to tackle the problem and actions at different levels of governance (i.e. regionally and internationally) are required.

Ozone

The data capture of O_3 at AURN St. Ebbes in 2022 was of 99.8%. In 2022, this site exceeded the AQ daily objective for ozone 159 times, during a total of 24 days during the year. This represents a significant increase in the number of exceedances (99 more) and days (12 more), when compared with the results from 2021. AURN St. Ebbes has not met the AQ objectives for this pollutant in 2022.

According to the London Air website (run by the Imperial College London), the entire South East of England has suffered from Moderate to High Ozone levels on the following periods:

- 3th and 4th June 2022;
- 14th and 15th June 2022;
- 16th to 19th July 2022;
- 10th to 15th August 2022.

All of these episodes are strongly linked with high pressure systems delivering high temperatures and sunshine – all the factors that act as catalysts on local and continental precursor emissions and hence are responsible from an increase of ground level ozone production.

All the dates above coincide with the periods where AURN St Ebbes measured its highest Ozone levels in 2022.

Priorities for 2023

Oxford City Council's priorities for the next reporting year are well defined. We will continue our partnership work with Oxfordshire County Council to progress the delivery of the transport and air pollution management schemes which we have already committed to: The implementation of a trial to test traffic filters, and we will continue to progress on the necessary work to see an expansion of our current ZEZ.

Overall, during the course of the next reporting year, Oxford City Council and its partners will continue to progress delivery of the air quality measures committed to in on our recent Air Quality Action Plan 2021-2025.

Local Engagement and How to get Involved

One key to changing the current threat of air pollution is educating the communities most impacted by it, providing them with the knowledge that allows them to make informed choices on how they can reduce their personal exposure to air pollution, and how they can contribute to the reduction of air pollution levels in the city.

Oxford City Council has taken significant action in recent years in raising air quality awareness in our communities and in primary schools, with several projects being delivered with that purpose, such as an air quality anti-idling campaign, air quality banner competition and STOP. This past year we have also launched *"Do You Fuel Good?"* - a city-wide awareness raising campaign on the negative impacts of wood burning, and in 2023 we plan to launch a new air quality website for Oxfordshire, a project that we are delivering together with Oxfordshire County Council and the districts in Oxfordshire.

Oxford City Council's communication team regularly publishes press releases and social media contents which relate to air quality news and projects that are being delivered in the city in order to raise awareness. We seek to ensure that the implementation of any major air quality management scheme in the city provides the public with opportunity to have their say and contribute with their own ideas and suggestions.

However, air pollution is not a problem that the City Council and its partners can solve alone - everyone deserves to breathe clean air, but it is important to highlight that

everyone also has a role to play in improving air quality levels, as our everyday decisions can have an impact on the air we breathe. Some of the questions to ask ourselves are:

- Do I burn inappropriate fuels or use inappropriate appliances at home?
- Do I take the car when I could have cycled or used public transport?
- Do I drive my children to school when I could have walked?

We all have a huge role to play and we can all be part of the solution. Encouraging walking and cycling in the city not only has a positive impact on air quality levels, but it also has multiple other benefits, including increasing the health of wellbeing of all those who live, work and visit Oxford.

Do you want to get involved?

- If you are a science teacher or a person responsible for running an environment club at your primary school, please have a look at our Air Quality Toolkit which contains a series of interesting scientific air quality activities, (linked with the national curricula), and which promote an understanding of the causes and impacts of air pollution with the aim to reduce children's exposure to air pollutants, within the school and through their travel;
- If you live in an area where idling of car engines is a concern, please have a look at the design resources that Oxford City Council has made available to the general public, and which you can download and use to run anti-idling campaigns in your local area;
- Do you have a wood burner or thinking of getting one? please have a look at our advice and our *"Do You Fuel Good?"* campaign materials , available here;
- If you are considering buying an Electric Vehicle and need to find out where to charge it, please register your interest in Oxford City Council's Go Ultra Low website (or if you are interested in a cable gully solution anywhere in Oxford register it at www.gul-e.co.uk/);
- Look out within your local communities for active groups which have specific interest in air quality matters (ex: Local Friends of the Earth);
- You can also contact Oxford City Council's air quality team directly at any time for any air quality related matter via the following email: airquality@oxford.gov.uk;

Full details of Oxford's air quality monitoring results, including real time data on pollutant levels and reference to the city's daily Air Quality Index (AQI), a metric on the daily levels

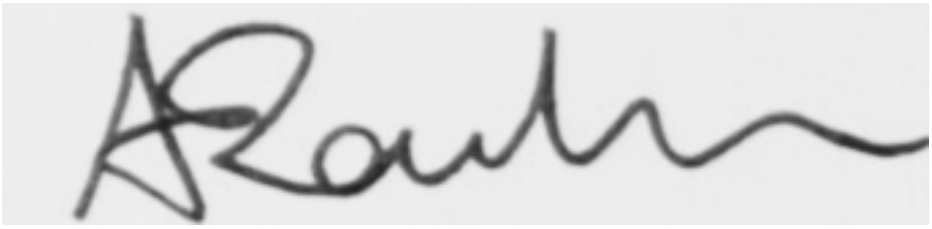
of air pollution, together with recommended actions and health advice is available on the Oxfordshire Air Quality website or alternatively on AQ England and UK-Air websites.

Relevant information with regards to Oxford City Council's air quality projects, current air quality management and other relevant air quality information can be found on the city council's website: https://www.oxford.gov.uk/info/20052/air_quality.

Local Responsibilities and Commitment

This ASR was prepared by members of the Environmental Sustainability Team of Oxford City Council, with the support and agreement of Oxfordshire County Council colleagues.

This ASR has been approved by:



Cllr Anna Railton

(Oxford City Council's Cabinet Member for Zero Carbon Oxford and Climate Justice).

Rosie Rowe

(Healthy Place Shaping Lead for Oxfordshire with the responsibility within the Public Health team for Air Quality).

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 Environmental Sustainability team at:

Town Hall, St Aldates – OX1 1BX (Oxford)

01865 249811 or email us at: airquality@oxford.gov.uk

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1 Local Air Quality Management

This report provides an overview of air quality in Oxford 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 Oxford and its partners to improve air quality and any progress that has been made.

The statutory air quality objectives applicable to LAQM in England are presented on Appendix E.

2 Actions to Improve Air Quality

2.1 Air Quality Management Areas

Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely exceedance of an air quality objective. After declaration, the authority 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 Oxford City Council can be found in Table 1. The table presents a description of the AQMA that is currently designated within Oxford City Council. Appendix D: Maps of Monitoring Locations and AQMAs of the city's AQMA. The air quality objectives pertinent to the current AQMA designation are as follows:

- NO_2 annual mean;
- NO2 hourly mean.

Table 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
The city of Oxford	Declared 2010	NO_2 annual and hourly mean	The whole of the administrative area of Oxford City Council	YES	78µg/m^3	43 µg/m^3	NO_2 hourly mean: 6 years NO_2 annual mean: 0 years	AQAP (2021-2025) January 2021	Visit the AQAP for Oxford's city-wide AQMA here

☒ **Oxford City Council confirm the information on UK-Air regarding their AQMA is up to date.**

☒ **Oxford City Council confirm that all current AQAPs have been submitted to Defra.**

2.2 Progress and Impact of Measures to address Air Quality in Oxford

Defra's appraisal of last year's ASR concluded that the report was very well written, structured, with enough level of detail and had provided all the information specified in the Guidance. No comments were made that needed addressing in time for submission of this ASR.

Oxford City Council has taken forward a number of direct measures during the current reporting year of 2022 in pursuit of improving local air quality. A complete list of thirty measures is included in Table 2, together with an update on the progress Oxford City Council and its partners have made during the reporting year of 2022 to deliver them. Where there have been, or continue to be, barriers restricting the implementation of the measure, these are also presented within this table. More detail on these measures can be found in Oxford City Council's current Air Quality Action Plan (2021-2025).

Oxford City Council's key completed measures since last year's ASR can be found in more detail in this report's section "Actions to Improve Air Quality" (pages vi to ix above).

Oxford City Council expects the following measures to be completed or progressed over the course of the next reporting year:

- To fully deliver a £162,500 DEFRA Air Quality Grant funded project for a new Air Quality Website for Oxfordshire, working in partnership with all the District Councils in Oxfordshire;
- To continue the roll out of EV chargers across the city, as part of the GULO project;
- To progress the delivery of a £200,000 DEFRA Air Quality Grant funded project aimed at facilitating Oxford's historic Covered Market to go electric through the provision of electric charging points, electric delivery vehicles and the delivery of an e-cargo bike pilot study to facilitate sustainable deliveries;
- To continue the expansion of the City Council's fleet of electric vehicles;
- To prepare the trial for the implementation of traffic filters;
- To continue preparation of ZEZ expansion, with the development of a comprehensive engagement programme with a wide range of stakeholders and resident groups across the city;
- To progress the delivery of six "eco-moorings" at the towpath visitors' moorings of Aristotle Lane, on the Oxford Canal;

- To finalise programme of works to decarbonise the Council's leisure centres, and to support local renewable energy production. The upgrade work has seen a significant proportion of the heating provided by gas boilers (86% on average) replaced with heat pumps that transfer heat from the air or water. The £14 million programme followed the award of £10.9m of Government funding under its Public Sector Decarbonisation Scheme. Leisure centres make up 40% of the Council's carbon footprint;
- For Oxford City Council, together with the Low Carbon Hub and consultancy Anthesis, to develop a programme of Authority Based Insetting – an innovative alternative to carbon offsetting. This programme aims to provide funding for a whole range of projects from solar panels on schools to natural habitat restoration. Trials will begin in 2023, which if successful will not only reduce Oxford's carbon emissions, but also provide other social and environmental benefits;
- To deliver 159 electric buses (and the infrastructure to charge them) to Oxford as part of the government's Zero Emission Bus Regional Areas (ZEBRA) scheme. All buses are expected to arrive in Oxford by March 2024;
- To progress delivery of a new 'one stop shop' for residents and businesses seeking retrofit services for their homes and premises, while also strengthening the local supply chain - through an innovative "FutureFit" concept, using £75,000 from the Net Zero Living Programme fund from Innovate UK in partnership with the Low Carbon Hub;
- To progress with the delivery of Clean Heat Streets, project to install up to 150 heat pumps in Rose Hill and Iffley, aiming to help residents in these areas to make the switch from polluting gas boilers to modern, energy saving, clean and sustainable heat pumps.

Oxford City Council's priorities for the next reporting year are well defined. We will continue our partnership work with Oxfordshire County Council to progress delivery of transport and air pollution management schemes already committed to: The expansion of our current Zero Emission Zone, and the acceleration of the measures that are included under the "*Central Oxfordshire Travel Plan*" for Oxford.

Overall, during the course of the next reporting year, Oxford City Council and its partners will continue to progress delivery of the air quality measures committed to in on our recent Air Quality Action Plan 2021-2025.

Oxford City Council has worked to implement the above actions in partnership with the following stakeholders during 2022:

- Neighbouring local authorities (South, Vale, Cherwell, and West Oxfordshire District Councils;
- Oxfordshire County Council (The Highways Authority);
- Local Friends of the Earth;
- Canal & River Trust;
- University of Birmingham;
- University of Oxford;
- Oxford Brookes University;
- Ricardo Energy & Environment;
- Oxford Direct Services;
- Local bus operators: Stagecoach and the Go-Ahead Group, which includes the Oxford Bus Company, Thames Travel, and City Sightseeing Oxford;
- Green TV;
- EDF Renewables
- Habitat Energy
- Kensa Contracting
- Invinity Energy Systems

The principal challenges and barriers to implementation that Oxford City Council and its partners anticipate facing are:

- The war in Ukraine leading to potential supply issues;
- Cost of living crisis due to raising energy, food and commodity prices.
- The closure of Botley Road (at the point the rail bridge crosses the road near Oxford station) to traffic from 11 April 2023 until the end of October 2023, to enable station and track improvements and highways redevelopment. This will cause a significant impact in the way traffic moves around the city, and is likely to result on traffic displacement to other entry points of the city, with direct changes on air quality levels in those areas as a result.

Table 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	Work with schools, vulnerable groups and hard to reach communities to raise awareness of air pollution and promote Active Travel	Public Information/ Promoting Travel Alternatives	Student Assemblies/ Air Quality campaigns/ Promotion of Cycling and Walking	2021	Annually 2021-2025	Oxford City Council + Oxfordshire County Council + Friends of the Earth	Active Travel Fund, LAs annual budget	NO	Fully Funded	< 5k (per year)	Implementation	NOx reduction not estimated, but increase of up to 23% in walking rates and reduction of up to 30% car journeys was observed with the delivery of the active travel programme WOW + communication campaigns can increase awareness of up to 12% and behaviour change of up to 6% (Clean Air Day)	Number of walking, cycling, scooting, car, and park & stride trips, Number of participating schools and deprived areas and of activities delivered	Oxford City Council's STOP Project remains active and is being delivered to Primary school upon request of teachers	Primary schools are very busy and it is difficult for teachers sometimes to find the time to embrace new projects
2	Support city wide events that aim to accelerate the uptake of sustainable transport	Public Information/ Promoting Low Emission Transport/ Freight and Delivery Management	Webinars/ Summits Physical Events	2021	Annually 2021-2025	Oxford City Council + Other Partners (ex :Green TV)	Sponsorship	NO	Fully Funded	Not estimated	Implementation	NOx reduction not estimated, but communication campaigns can increase awareness of up to 12% and behaviour change of up to 6% (Clean Air Day)	Total amount of attendees and Businesses participating, number of business adopting sustainable delivery options, number of business compliant with the ZEZ	The 2022's edition of the EV Summit took place at the Said Business School on the 12th and 13th December in Oxford. The event was run in partnership between Green TV, Oxford City Council, Oxfordshire County Council, Oxford University and Oxford Brookes University. This year's focus was on innovation in electric vehicles and delivery of decarbonised transport in the UK and beyond – link to press release; In May 2023 Oxford City Council organised "*EVs are for Everyone*". This was a free event for residents and businesses across Oxfordshire with the aim of provide them with an opportunity to find out more about electric cars and vans in a relaxed and friendly way – link to press release;	
3	Support projects that increase Oxford's Air Quality/AQ & Health evidence base	Public Information	Other	2021	Annually 2021-2025	Oxford City Council + Oxfordshire County Council (Public Health/Innovation Teams)	Several types of funding possible (Innovate UK, DEFRA AQ Grant, UKRI)	NO	Partially funded	Not estimated (Successful bids and projects will be added on a regular basis)	Implementation	Not directly applicable – NOx reduction not estimated	Total amount of partnerships created; amount of AQ/health studies delivered	Oxford City and County Councils continue to be active partners of the TRANSITION Clean Air Network undertaking innovative research to address emerging indoor/outdoor air quality challenges across UK surface transport. The network has contribute to the delivery of five Discovery and Innovation projects. Oxford City and County Councils are also partners for OxAria – a Natural Environment Research Council funded collaboration between the University of Birmingham and University of Oxford. The consortium also developed two policy briefing notes published for Clean Air Day on 16 June 2022:	In addition the TRANSITION partnership contributed to the academic publications: Exposures to Particles and Volatile Organic Compounds across Multiple Transportation Modes –Feb 2023 A negative emission internal combustion engine vehicle? –Feb 2023 Further funding (£13,300) was secured to support an academic secondment to Oxfordshire County Council through the NERC Discovery Science project "Applying data-driven solutions to contemporary urban transport challenges; a policy case study in Oxford, UK" for a 2-month period from Feb- April 2023. Research papers developed with input from staff and resources at Oxford and City Councils under OxAria include: - Impacts of emergency health protection measures upon air quality, traffic and public health, evidence from Oxford UK – published online 26 Nov 2021

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
														- Air quality sensing technology: opportunities and challenges for local applications - COVID-19 impacts on Oxford City	- Machine learning techniques to improve the field performance of low-cost air quality sensors – published online 1 June 2022 - The impact of COVID-19 public health restrictions on particulate matter pollution measured by a validated low-cost sensor network in Oxford, UK – published online 21 April 2023 - Impacts of ambient air quality on acute asthma hospital admissions during the COVID-19 pandemic in Oxford City, UK; a time series study – under review (BMJ Open) -The impact of a low traffic neighbourhood intervention on urban noise – under review (Transportation Research Part D)
4	Develop partnership work with NHS, commissioners, and providers to increase awareness of air pollution amongst patients and reduce their personal exposure to air pollution	Public Information	Via the Internet/ Via other mechanisms	2021	2021-2025	Oxford City Council + Oxfordshire County Council (Public Health Team)	LAs annual budget	NO	Not funded yet	Not estimated	Planning	NOx reduction not estimated, but communication campaigns can increase awareness of up to 12% and behaviour change of up to 6% (Clean Air Day)	Number of workshops /training sessions delivered, reduction in number of hospital admissions for COPD patients	Implementation on-going	Engagement with NHS professionals and public health started during phase 1 of the Oxfordshire air quality website – a series of phone interviews were conducted to NHS professionals and public health colleagues as part of the social user research to inform the type of tools that would be useful to see included in the website Engagement with NHS professionals will continue throughout the development of the website, and we also anticipate to be organising meetings and workshops to explain the new tools and functionalities of the website and how they can be useful to COPD and asthma patients once the website is launched.
5	Improve air quality communication on our website and associated websites to assist the public in accessing reliable information about air pollution	Public Information	Via the Internet	2021	Q1 2023	Oxford City Council + all other DCs in Oxfordshire + Oxfordshire County Council	DEFRA AQ Grant	YES	Fully Funded	£162,500	Implementation	NOx reduction not estimated, but communication campaigns can increase awareness of up to 12% and behaviour change of up to 6% (Clean Air Day)	Number of website visitors, Number of website downloads, Reduction of public requests for AQ information,	Website is expected to launched in July 2023	
6	Explore opportunities to use green infrastructure to reduce exposure to poor AQ levels	Public Information	Other	2021	2021-2025	Oxford City Council + Oxfordshire County Council + Highways England	LA annual budget + Other sources of funding (still to be identified)	NO	Partially funded	Not estimated (Successful bids and projects will be added on a regular basis)	Planning	Reduction of up to 50% in exposure to air pollution levels where green infrastructure is installed (Greater London Authority)	Air Quality data, number of species planted	Oxford City Council has published its Urban Forest Strategy in November 2021 Oxfordshire County Council promotes the use of tree planting and recognises the impact of correct choice of species to maximise air pollution improvements.	Defra acknowledges that vegetation can help to reduce air pollution in cities. However, they state this is primarily by affecting how these pollutants are dispersed and not by the removal of pollution. The delivery of the Urban Forest Strategy for Oxford, is likely to bring opportunities for the use of vegetation as air quality buffer which will contribute to a reduction of human exposure to air pollution.
7	Delivery of city-wide campaign on how to implement DEFRA's best practice on the use of open fires and wood burning stoves, and on how to reduce burning of inappropriate fuel	Public Information	Via Leaflets/ Via the Internet/ Via other mechanisms	2021	2022	Oxford City Council + Friends of the Earth+ River Trust	DEFRA AQ Grant	YES	Fully Funded	£45,000	Implementation/Partialy Delivered	NOx reduction not estimated, but communication campaigns can increase awareness of up to 12% and behaviour change of up to 6% (Clean Air Day)	Reduction of nuisance complaints, Reduction of NOx, PM_{10} and $PM_{2.5}$ concentrations	Oxford City Council, in partnership with the Canal and River Trust and local Friends of the Earth have launched the "Do You Fuel Good?" campaign in October 2022 More plans are being developed for a relaunch of this campaign in Winter 2023/2024	Oxford's "Do You Fuel Good?" campaign website available here
8	Work with the District and County Councils on a co-ordinated approach to public awareness and education	Public Information	Via Leaflets/ Via the Internet/ Via other mechanisms	2021	Annually 2021-2025	Oxford City Council + all other DCs in Oxfordshire + Oxfordshire County Council	LAs annual budget + Other sources of funding if required	NO	Fully Funded	Not estimated	Planning	NOx reduction not estimated, but communication campaigns can increase awareness of up to 12% and behaviour change of up to 6% (Clean Air Day)	Number of comms and other campaigns run together between all the District Councils in Oxfordshire	All the 4 District Councils in Oxfordshire together with Oxfordshire County continue to work together in the delivery of Oxfordshire Air Quality Website, which is expected to be launched in 2023	The Air Quality Officers of all the DCs in Oxfordshire and a representative from Oxfordshire County Council already met regularly to discuss air quality projects and opportunities for future partnership work and will continue to do so in 2023 as and when required
9	Introducing a Euro VI LEZ for buses in Oxford	Promoting Low Emission Transport	Low Emission Zone (LEZ) or Clean Air Zone (CAZ)	2021	2022	Oxford City Council + Oxfordshire	LAs annual budget, CBTF	NO	Fully Funded	Staff time only	On hold	Estimated reductions of between 5% to 12.8% of	LEZ Euro VI Approved bus database	Scheme has been on hold since March 2020	Due to ongoing bus industry challenges post Covid-19 and the success of the Oxfordshire ZEBRA bid, this project was

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
						County Council + local bus operators						total city Road NOx emissions (Ricardo's Source Apportionment Study)			superseded with a shift to zero emission buses – linking with measure 15 of the AQAP below Oxfordshire County is at the moment also in discussion with bus operators about expanded emissions requirements for buses, to formalise the zero emission requirement for buses operating wholly in the Smart Zone and expand Euro VI and Euro V requirements across the county. The (current) aim is for all new emissions requirements to come into effect by January 2025, when all the ZEBRA buses should be in operation.
10	Introducing Ultra Low emission standards for Hackney Carriage Vehicles	Promoting Low Emission Transport	Taxi Licensing conditions	2021	2025	Oxford City Council	LAs annual budget	NO	Fully Funded	Staff time only	Implementation	Up to 0.2% total city Road NOx emissions (Ricardo's Source Apportionment Study)	Amount of New HCV Applications, enforcement stats	Delivery planned and already in progress	T
11	Delivery of Zero Emission Zone (measures to incentivise zero emission vehicles or place restrictions on other vehicles in Oxford)	Promoting Low Emission Transport/ Traffic Management	Low Emission Zone (LEZ) or Clean Air Zone (CAZ) / Road User Charging (RUC)/ Congestion charging	2021	2021-2030	Oxford City Council + Oxfordshire County Council	LAs annual budget, DEFRA AQ Grant and other sources of funding	YES	Partially Funded	ZEZ Pilot - £267,400 ZEZ - £921,480	Implementation (ZEZ Pilot) Planning (ZEZ expansion)	By 2035 (after full implementation), up to 66% reduction in city-wide transport NOx emissions and of 100% transport NOx emissions in the city centre are expected	Behavioural responses, AQ monitoring, ANPR counts	The city centre ZEZ Pilot was launched on 28th February 2022. Details of this now active scheme can be found here A report with the evaluation of the 1st Year of the ZEZ Pilot is being prepared by Oxfordshire County Council and is expected to be released in Summer 2023 Oxford City and Oxfordshire County councils were awarded £970,700 in March 2022 from this year's air quality DEFRA grant to help support the expansion of Oxford's Zero Emission Zone	The pilot will allow both City and County councils to gain useful insights before introducing a larger ZEZ covering most of Oxford city centre, subject to further public consultation.
12	Increase the amount of EV charging infrastructure in the City	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructur to promote Low Emission Vehicles, EV recharging,	2021	2021-2025	Oxford City Council + Oxfordshire County Council	Innovate UK, AQ DEFRA Grant, OLEV Grant scheme, LAs budget	YES	Fully Funded	Not estimated	Implementation	NOx reduction not estimated	Number of EV Chargers Installed	Delivery in Progress Oxford completed the last stage of T-GULO, a working driver focussed project to support the Oxford Hackney Carriage (HC) and Private Hire (PH) trades with electrification, delivering 9 rapid chargers dedicated to the taxi trades, as well as an emissions pathway to transition all HCs to ULEV by 2025, and an ESO funded e-taxi rental offer between 2021 and 2022	A map of all EV charging point locations in Oxford can be found here The EST case study for the Gul-e project can be found here
13	Expansion of City Council's EV Fleet (Electrification of 25% of vehicle fleet)	Promoting Low Emission Transport	Company Vehicle Procurement - Prioritising uptake of low emission vehicles	2021	2023	Oxford City Council	Innovate UK, LAs annual budget	NO	Fully Funded	Not estimated	**Completed**	NOx reduction not estimated	Number of Electric vehicles purchased	Oxford City Council and Oxford Direct Services (ODS) jointly operate a fleet of electric vehicles including 26 cars, 59 vans and 8 specialist EVs (including sweepers, a digger and a refuse collection vehicle).	By March 2023, 27% of Oxford City Council's fleet was EV
14	Development of an EV Strategy for Oxfordshire	Policy Guidance and Development Control	Other Policy	2021	2021	Oxfordshire County Council + other DCs	LAs own budget	NO	Fully Funded	Not estimated	**Completed**	NOx reduction not estimated	Publication of EV strategy and adoption of Strategy by all District Councils	Oxfordshire EV Infrastructure Strategy (OEVIS) was adopted and published in March 21 In February 2023 Oxford City Council's cabinet have officially approved and published Oxford's Electric Vehicle Infrastructure Strategy[16],	

[16] Oxford's Electric Vehicle Infrastructure Strategy, July 2022

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
														a document that now complements the already published Oxfordshire EV Infrastructure Strategy, and which was developed with the objective to address how the city can deliver EV infrastructure to meet its zero carbon oxford 2040 target in a fair and equitable way – link to press release;	
15	Work with bus operators on the electrification of Oxford's Bus fleet	Promoting Low Emission Transport	Company Vehicle Procurement - Prioritising uptake of low emission vehicles	2021	2030 or sooner	Department for Transport + Oxfordshire County Council + local bus operators	Zero Emissions Buses Regional Area (ZEBRA) scheme: £32.8m Bus operators: £43.7m Oxfordshire CC: £6m	NO	Partly funded	No specific scheme estimate for complete electrification. ZEBRA: £82.5m	Implementation	Up to 32% of the city's total road NOx emissions (Ricardo's Source Apportionment Study)	% of bus fleet ZEV	The ZEBRA project is now confirmed. All new buses are expected to arrive by March 2024	(see this link for further details if needed)
16	Delivery of Oxford's Energy Super Hub (installation of more than 20 ultra-rapid + 30 fast vehicle EV chargers for the public use + provision of ground source heat pumps for more than 300 homes)	Promoting Low Emission Transport/ Promoting Low Emission Plant	Procuring alternative Refuelling infrastructu to promote Low Emission Vehicles, EV recharging Replacement of combustion sources	2021	2022	Oxford City Council + Partners	Innovate UK	NO	Fully Funded	£41 million	**Completed**	10,000 tonnes of CO2 per year saving by 2021, rising to 25,000 tonnes per year by 2032 + up to 22% reduction of NO2 emissions from transport by 2032	Number of EV chargers and Ground Source Heat Pumps (GSHP) installed, number of EVs purchased, AQ monitoring	Inauguration of Oxford's Energy Super Hub at the Redbridge Park & Ride. Oxford City Council delivered 42 new fast and ultra-rapid charging points (powered entirely by renewable energy). The hub is also able to scale up with EV adoption to provide charging for 400 vehicles, helping to support the estimated 36 million EVs expected on UK roads by 2040.	In the first six months of opening, the Hub provided 25,000 charging sessions and powered about 2million of electric miles – link to press release All relevant info about this project can be found at the ESO website here
17	Delivery of Air Quality Benefits through Planning System (Reduce amount of car parking in the city + increase EV charging infrastructure + require more efficient/less pollutant domestic heating technologies)	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance/ Other Policy	2021	Annually 2021-2036	Oxford City Council	LAs own budget	NO	Fully Funded	Not estimated	Implementation	NOx and PM reductions not estimated	Number of developments with EV chargers /number of EV chargers installed, number of Planning conditions discharged	Already being delivered through Oxford's Local Plan	Local air quality policies are being reviewed at the moment, as a result of a new local policy plan that is being developed
18	Explore opportunities for the delivery of electric infrastructure that could accelerate the uptake of electric boats and reduce their reliance on fossil fuel use for domestic heating	Promoting Low Emission Transport/ Promoting Low Emission Plant	Procuring alternative Refuelling infrastructu to promote Low Emission Vehicles, EV recharging, Replacement of combustion sources	2021	2025	Oxford City Council + Oxfordshire County Council +River trust + Environment Agency	DEFRA Air Quality Grant	YES	Fully Funded	£192,993	Planning/Implemenation	NOx and PM reductions not estimated	Number of installations delivered, number of boats relying on energy sources that are locally emissions free	In February 2023, Oxford City Council, in partnership with the Canal & River Trust, was granted £192,993 from DEFRA's Air Quality Grant to deliver six "*eco-moorings*" at the towpath visitors' moorings of Aristotle Lane, on the Oxford Canal. The power points at these moorings will provide electrical power for up to six visiting boaters to reduce their reliance on diesel engines, generators and wood burners for their day-to-day energy needs –link to press release	
19	Upgrade Energy Efficiency of City Council's Housing stock	Promoting Low Emission Plant	Other Policy	2021	Annually 2021-2025	Oxford City Council	LAs own budget	NO	Partially funded	Not estimated	Implementation	NOx and PM reductions not estimated	Number of boiler upgrades, insulations and high efficiency storage heaters installed per year	Implementation on-going	In 2022-23, Oxford City Council delivered a LAD1b project to 60 properties consisting of various Energy Efficiency measure, including: loft insulation, cavity wall insulation, external wall insulation, and ASHP. Oxford City Council also delivered a small ASHP trial to a further 5 properties. Additionally, the Social Housing Decarbonisation Fund (SHDF) has been secured for 2023-25, with an additional 316 properties due to be upgraded to an EPC C, with further plans to install ASHPs.
20	Provide Energy advice services: employ Energy advice Officers	Promoting Low Emission Plant	Other Policy	2021	Annually 2021-2025	Oxford City Council	LAs own budget	NO	Fully Funded	Not estimated	Implementation	NOx and PM reductions not estimated	Total amount of home visits and	A total of 582 advice calls/visits, including 196 extended calls/visits	The savings are increasingly challenging to assess, both due to the frequent and

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
	to visit Council homes and advise tenants, whilst also identifying energy saving improvements to the properties												of energy savings per year	(mostly over the telephone) were made in 2022-23, with 1494 recommendations given.	significant recent changes in energy costs, and due to a lack of recent energy saving measures. However, from the past year, the identified financial savings include: -Advising 113 tenants of their eligibility for the £150 Warm Home Discount, saving £16,950. -Issuing 95 emergency fuel vouchers, providing £5,366 towards energy costs. -Other savings, which are more difficult to quantify, include Water Help and Water Sure discounts with Thames Water, and support provided to tenants that were negotiating repayment schemes or grant applications for debt relief.
21	Use of central government's ECO Flexible Eligibility funding to identify and designate households as eligible under the Affordable Warmth Scheme	Promoting Low Emission Plant	Other Policy	2021	Annually 2021-2025	Oxford City Council	ECO Flexible Eligibility funding	NO	Partially funded	Not estimated	Implementation	NOx and PM reductions not estimated	Total amount of households being granted with energy efficiency improvements	Implementation on-going	Implementation of the programs ongoing – barriers to these include a lack of suppliers and a lack of information For households to apply. We are actively working with Naturel Energy Foundation to improve marketing and Supplier network via the Better Homes Better Health (BHBH) service. BHBH provides Oxford City Council with a quarterly update reporting the number of people that have been given advice: -In the year to date across Oxfordshire, the following have been completed: 2229 Warm and well assessments; 740 Partner referrals to BHBH; 302 BHBH+ visits; 1136 New incomes identified; 385 Energy efficiency referrals; 158 Energy efficiency installs; 451 PSR sign-ups; 616 Referrals into support organisations, health and social care partners; and 131 Switched energy suppliers/tariffs. -15 onward referrals came directly from Oxford City Council in Q4.
22	Review of Smoke Controlled Zones and implementation of revised government legislation for smoke nuisance	Promoting Low Emission Plant	Other Policy	2021	2021-2025	Oxford City Council	LAs own budget	NO	Not funded yet	Not estimated	Planning	NOx and PM reductions not estimated	Implementation of new enforcement methods/ reduction of the amount of nuisance complaints	Internal conversations are being held with several internal enforcement teams to discuss the implications of the new Environment Act and the actions that Oxford City Council will take as a result. Relevant news on this measure are expected around September 2023	
23	Encourage the development of local heat networks	Promoting Low Emission Plant	Other Policy	2021	Annually 2021-2025	Oxford City Council	LAs own budget	NO	Fully Funded	Not estimated	Implementation	NOx and PM reductions not estimated	Number of planning applications using heat networks	Already being encouraged and delivered (when feasible) through Oxford's Local Plan and Planning System	
24	Delivery of Oxford Core Transport Schemes (explore opportunities for implementation of Workplace Paring levy + introduction of Traffic Filters)	Traffic Management	Workplace Parking Levy/ Traffic Filters	2021	2023-2024	Oxford City Council + Oxfordshire County Council	LAs own budgets, Bus Service Improvement Plan (BSIP), future income raised by the WPL	NO	Partially funded	£5-8m (excludes funding for complimentary bus and walking and cycling improvements)	Planning	NOx and PM reductions have been estimated here	Traffic counts, numbers of people travelling by bus, cycling, or walking, number of businesses enrolled, enforcement stats. Reduction of NOx, PM_{10} and $PM_{2.5}$ concentrations	The traffic filters were approved in November 2022 and are due to be implemented as soon as the improvements to Oxford station are completed – expected to be autumn 2024.	More details on our traffic filters page.
25	Delivery of sustainable transport measures such as cycling improvements and bus priority lanes	Transport Planning and Infrastructure/ Traffic management	Cycle network/ Bus priority	2021	2021-2025	Oxford City Council + Oxfordshire County Council	DfT Active Tranche 2 & Growth Deal	NO	Fully funded	£44m approx. for sustainable transport schemes on three Oxford radial routes and other locations	Implementation	NOx and PM reductions not estimated	Local cycling and walking infrastructure plans (LCWIP) 50% increase by 2030 (Active Lives Survey)	Under tranche 2 funding, Oxfordshire County are delivering the LCWIP scheme. Quickway schemes along in (OXR B) Donnington Bridge Road, (OXR 17) Rose Hill-Iffley Road, (OXR 14) Oxford Road-Cowley Road, (OXR 7) Marston Road and St Clements. These include continuous cycle lanes and 20 mph speed limits	A number of schemes are in preparation vis ATF3 (OXR14 Between Towns Road junction) and OXR 13 Shotover Hill. Oxfordshire Council is about to review the TRO potentially to permit cycling through Queen Street and Cornmarket all day. Oxfordshire Council has funding to make pedestrians improvements on Banbury Rd (OXR4) and Iffley Road (OXR17)

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
														Quietway schemes via Cowley LTN and East Oxford LTN (OXR 16) from Cowley Road Littlemore – Rymers Lane, plus E2, E3, E4, E5, E6, E7 – these are low traffic roads and 2 way on Magdalen Road and Howard St Quietway scheme E9 Boundary Brook Way – path widening and resurfacing, and OXR 23 Willow Walk widened and resurfaced including new bridge	Lack of funding, staff resources and inter-relationship with Central Oxfordshire filters are the main on-going challenges
26	Roll-out of Controlled Parking Zones (CPZ) and Low Traffic Neighbourhoods (LTN)	Traffic Management	Traffic reduction	2021	2021-2023	Oxfordshire County Council	Department for Transport (Emergency Active Travel Fund); LAs own budget	NO	Fully Funded	£1m approx. for remaining CPZs £311,000 for LTNs	Implementation and Planning	NOx and PM reductions not estimated within 1st Cowley LTNs, but being measured for East Oxford. NOx being measured on boundary routes surrounding LTNs	Implementation of the new CPZs and LTNs	Cowley LTNs made permanent; full evaluation undertaken on NO2 in boundary roads, but not within LTNs, and taken to cabinet in July '22. East Oxford LTNs rolled out in May '22. Short report including NO2 analysis results both within and on roads surrounding LTNs to be provided in June '23 on impacts, with full reporting to cabinet in October '23 for decision on permanence. 5 new CPZ schemes were implemented in spring/summer 2022 (South Oxford, Old Marston, Hollow Way South, Florence Park and Temple Cowley), with a further two CPZs to be introduced summer 2023 (Donnington and Upper Wolvercote) The strategy is to roll out remaining CPZs - 10 areas in total – over the next few years and subject to consultation, final approval and funding	Strong public interest in LTNs with polarised opinion, means greater scrutiny and potential delays with future roll-out and making ETROs permanent.
27	Work with businesses to explore the inclusion of innovative sustainable travel modes into their current business models	Freight and Delivery Management	Delivery and Service plans/ Freight Partnerships f city centre deliveries	2021	Annually 2021-2025	Oxfordshire County Council + Oxford City Council	DEFRA AQ Grant; LAs own budget, Energy Saving Trust	YES	Partially funded	Not estimated	Implementation	NOx and PM reductions not estimated	Number of businesses adopting sustainable travel modes	Exploring opportunities (On-going) In March 2022 Oxfordshire County Council secured £71,000 of funding to expand the number of electric cargo (e-cargo) bikes used to deliver goods in an ultra-low emission way across Oxford. ~15 ecargo bikes will be offered through low-cost lease in a scheme administered by Pedal & Post. Cargo bikes are due to arrive in May 2023, with a public launch of the scheme in early summer 2023. Oxford City Council has finished the one year e-cargo bike trial at the Covered Market. The project was delivered in partnership with local cargo bike delivery company Pedal & Post, and have allowed Covered Market traders to make same day and next day zero emission deliveries, offering practical support to traders as they transition their	Covid-related supply chain issues have resulted in delays in implementation.

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
														deliveries to zero emission vehicles. The project saw up to 262 kg of CO2 emissions saved, along a total of 690 miles travelled by the e-cargo bikes	
28	Explore opportunities for implementation of consolidation centre to address city centre freight emissions	Freight and Delivery Management	Freight Consolidation Centre	2021	2026	Oxfordshire County Council + Oxford City Council+ Oxford University	LAs annual budget, and other sources of funding, Horizon Europe/Innovate UK	NO	Partially funded	Not estimated (pending feasibility)	Planning/Implementation	NOx reduction not estimated	Number of businesses enrolled to be developed	Exploring opportunities (On-going) Oxfordshire County Council is partner in the GreenLog project along with local patterns Pedal & Post, FEED, and University of Wolverhampton. The project, running from Jan 23-June 26, will develop a demonstration of a mobile delivery hub and modular micro consolidation hub in Oxford. Pilot will be tested Aug-Dec 2024 and Oct 25-Mar 26. This work will include site identification and partial funding to implement the micro consolidation hub	Although this work will contribute to a feasibility study, it will not completely fulfil this requirement. Focused on consumer delivery rather than B2B.
29	Work with schools to reduce exposure to air pollution by reducing the need to travel during drop off/pick up times (ex: School Streets)	Alternatives to private vehicle use/ Promoting Travel Alternatives	Other	2021	2025	Oxfordshire County Council	Active Travel fund for LAs in England	NO	Partially funded	£60,000 approx. for School Streets	Implementation and Planning	NOx reduction not estimated	Number of streets closed, schools enrolled	School Streets were made permanent under Traffic Regulation Orders (TROs) and enforced by ANPR cameras for the following schools in Oxford City; with cameras in operation since Spring 2023: Larkrise Primary School, Oxford St Ebbe's CE School, Oxford Windmill Primary School, Oxford	A public consultation was held in the summer of 2022 which asked for views and feedback on making School Streets during the operational hours permanent with enforcement by ANPR cameras. The consultation feedback was mostly very positive with 88% of responses supporting the proposals. For those schools outside the scheme a number of other initiatives have been underway to promote active travel to school including: Sign up to the digital app Street Tag to win points for your school by collecting digital tags on the walk/cycle to school (15 schools participating in Oxford) Provision of bike libraries to loan bikes, helmets and locks to low income families There are now 6 bike libraries in Oxford City at: Ready Set Go – Blackbird Leys St Frideswides Primary School Church Cowley St James Primary John Henry Newman Academy East Oxford Primary Provision of family training to increase parental confidence in cycling
30	Support Bikeability (free cycling lessons provided to pupils)	Promoting Travelling alternatives	Promotion of Cycling	2021	2021-2025	Oxfordshire County Council	DfT via The Bikeability Trust charity	NO	Partially funded	Not estimated	Implementation	NOx reduction not estimated	Number of schools enrolled	Implementation (On-going) In 2022/2023, a total of 880 children were trained under the Bikeability programme in Oxford 79 Children enrolled with "Oxfordshire Cycle Training" Scheme	On 9th April 2021, Transport Secretary has announced £18m for cycle training across the country to ensure children and their families have the confidence to choose active travel The complete Bikeability figures for the entire Oxfordshire in 2022/2023 are of 4111 children trained and 769 enrolled with "Oxfordshire Cycle Training" scheme

2.3 $PM_{2.5}$ – 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.

In Oxford, and according to the city's latest source apportionment study, domestic combustion is the biggest contributor to the local $PM_{2.5}$ emissions (66%), followed by transport (21%), with remaining contributors spread between production processes (4%) and 9% Others (nature, waste, solvents, agriculture).

Oxford currently has 23 active smoke control areas (SCAs). In a smoke control area you can generally only burn fuel from the list of DEFRA's authorised fuels, unless you're using an exempt appliance. For detailed information about all SCAs in Oxford, and information on good practice and advice, please visit the Council's air quality page. An interactive map of all the UK's existing Smoke Control Areas (including Oxford) is available at DEFRA's UK-air website.

The Public Health Outcomes is a framework developed by Public Health England to set out a vision for public health. The framework develops a list of indicators that provide useful insight on how well public health is being improved and protected and concentrates on two high-level outcomes (healthy life expectancy and differences in life expectancy and healthy life expectancy between communities) to be achieved across the public health system.

According to the latest version of this framework (which can be found on the interactive PHOF website here), 5.52% of deaths from all causes in those aged 30+ are attributable to $PM_{2.5}$ alone in Oxford.

Figures 1 and 2 below show the existing relationship between the level of mortality attributed to $PM_{2.5}$ and life expectancy at birth for males and females in Oxford. A comparison is also made in Figures 1 and 2, between Oxford's data and the data obtained for other District Councils (DCs) in Oxfordshire and for England.

Oxford's performance is, in general, worse when compared with the other DCs in Oxfordshire for these type of indicators, which is not a surprise, given the higher levels of domestic combustion and traffic in the city when in comparison with the rest of Oxfordshire which is much more rural in nature.

Figure 1 - Relationship between mortality attributable to $PM_{2.5}$ and male's life expectancy at birth.

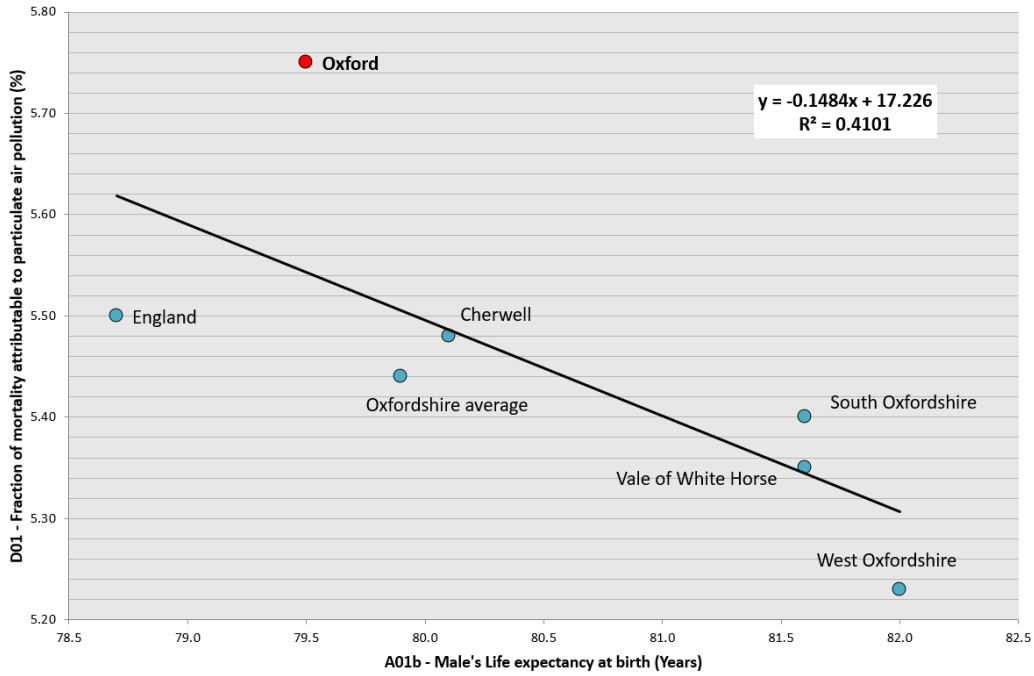
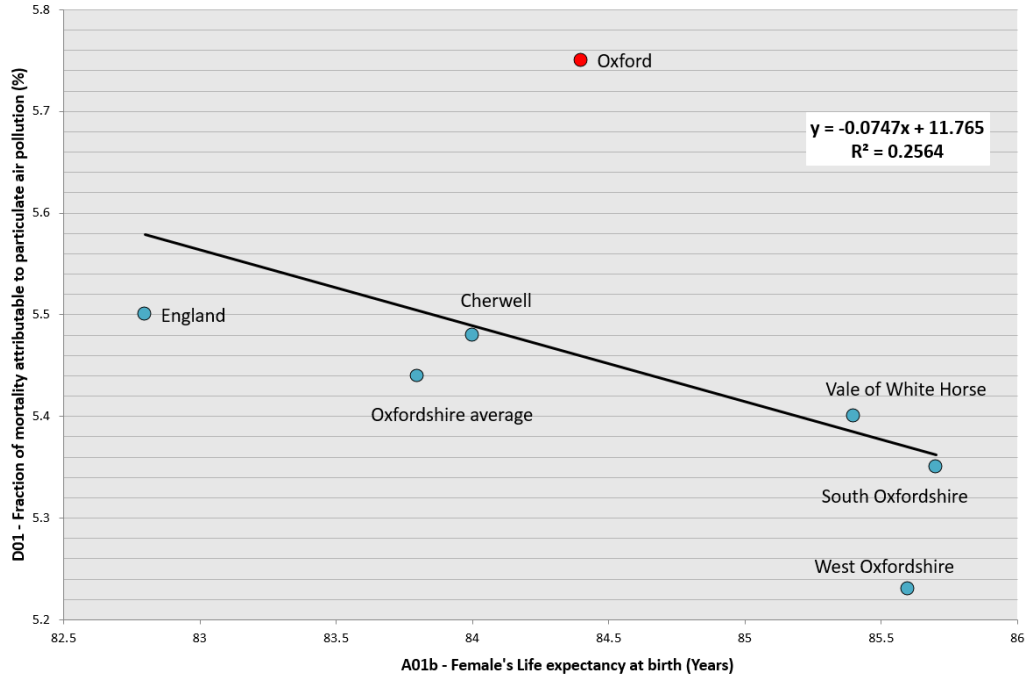


Figure 2 - Relationship between mortality attributable to $PM_{2.5}$ and female's life expectancy at birth.



Oxford City Council measures $PM_{2.5}$ at AURN St Ebbes urban background site and at High Street roadside site. In 2022 the $PM_{2.5}$ annual mean concentration was 7 and 6 µg/m^3 at these sites respectively. Oxford City Council considers that many of the measures designed to reduce levels of nitrogen dioxide set out in the city's recent AQAP will also contribute to reducing levels of $PM_{2.5}$. Table 3 below shows the current list of actions set out in the action plan which we believe to also contribute positively for the reductions of $PM_{2.5}$ levels in the city.

Table 3 - List of measures included in Oxford City Council's new Air Quality Action Plan (2021-2025) that will contribute to a reduction of $PM_{2.5}$ emissions in the city.

Measure	Reduces $PM_{2.5}$ emissions
Introducing Ultra Low emission standards for Hackney Carriage Vehicles	✓
Delivery of city-wide campaign on how to implement DEFRA's best practice on the use of open fires and wood burning stoves, and on how to reduce burning of inappropriate fuel	✓
Increase the amount of EV charging infrastructure in the City	✓
Expansion of City Council's EV Fleet (Electrification of 25% of vehicle fleet by 2023)	✓
Development of an EV Strategy for Oxford City	✓
Work with bus operators on the delivery of ZEBRA (electrification of Oxford's Bus fleet)	✓
Delivery of Oxford's Energy Super Hub (installation of more than 20 ultra-rapid + 30 fast vehicle EV chargers for the public use + provision of ground source heat pumps for more than 300 homes)	✓
Delivery of Air Quality Benefits through Planning System (Reduce amount of car parking in the city + Increase EV charging infrastructure + require more efficient/less pollutant domestic heating technologies)	✓
Upgrade Energy Efficiency of City Council's Housing stock and provision of energy advice services to city council's tenants, whilst identifying energy saving improvements to the properties	✓
Review of Smoke Controlled Zones and implementation of revised government legislation for smoke nuisance	✓
Encourage the development of local heat networks	✓

Delivery of sustainable transport measures such as cycling improvements and bus priority lanes	☑
Roll-out of Controlled Parking Zones (CPZ) and Low Traffic Neighbourhoods (LTN)	☑
Work with businesses to explore the inclusion of innovative sustainable travel modes into their current business models	☑
Explore opportunities for implementation of consolidation centre to address city centre freight emissions	☑
Work with schools to reduce exposure to air pollution by reducing the need to travel during drop off/ pick up times (ex: School Streets)	☑
Support Bikeability (free cycling lessons provided to pupils)	☑

In addition to the list of measures above, we are also working in partnership with Oxfordshire County Council on the delivery of two major transport management projects which are expected to result in significant reduction of air pollution levels in the city:

a) A Zero Emission Zone (ZEZ) in Oxford, to be rolled out in phases. The first phase has already been introduced, in February 2022, and future ZEZ expansion is being planned. The overall aim of this *'journey to zero'* is to largely eliminate transport *'tailpipe'* emissions in Oxford by 2035;

b) Central Oxfordshire Travel Plan Schemes, a set of proposals that will deliver a number of traffic restrictions in Oxford, such as the introduction of traffic filters to reduce the number of private cars moving around the city and allowing buses priority;

The Central Oxfordshire Travel Plan Schemes aim (amongst other things) to reduce motorised traffic levels within the city; the ZEZ aims to minimise emissions from the traffic that remains, and therefore both are expected to contribute to the reduction of $PM_{2.5}$ emissions.

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

This section sets out the monitoring undertaken in 2022 by Oxford City 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 for monitoring trends to be identified and discussed.

Maps showing the locations of the air quality monitoring (continuous and passive) conducted in 2022 and the levels measured can be found in Appendix D. Maps covering current and historic air quality monitoring locations are also provided on the Oxfordshire Air Quality website (https://oxfordshire.air-quality.info/). Further details on Quality Assurance/Quality Control (QA/QC), how the monitors are calibrated, how the data has been adjusted and the bias adjustment factors used for the diffusion tubes are included in Appendix C.

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

Oxford City Council undertook automatic (continuous) monitoring at three sites in 2022. Table 4 in Appendix A shows the details of the sites. National monitoring results and annual statistics of those sites are available at https://uk-air.defra.gov.uk/ and http://www.airqualityengland.co.uk/.

3.1.2 Non-Automatic Monitoring Sites

Oxford City Council undertook non-automatic (passive) monitoring of NO_2 at 126 sites in 2022. Table 5 in Appendix A shows the details of those sites.

For the purposes of deciding which locations to monitor, the City Council considers in the first instance locations where there is relevant public exposure. It is important that assessments focus on locations where members of the public are likely to be regularly present for a period of time appropriate to the averaging period of the objective. Monitoring is carried out in line with DEFRA's Technical Guidance LAQM.TG (22).

Approximately half of the monitoring locations are within central Oxford at locations where the City Council believes relevant exposure is most likely to be significant. The remaining

locations are outside of the central area, again prioritised by locations where relevant exposure is most likely.

Monitoring of NO_2 cannot be undertaken at every location on a continuous basis. The City Council therefore makes the most efficient use of available resources by implementing a rotational system on a percentage of monitoring sites every year, ensuring such sites are covered on average every 2 to 3 years.

One important aspect of monitoring is to be able to demonstrate trends in air quality over long time periods. In order to do so, the City Council continues monitoring at a number of the same sites year on year, so that the results reported can provide a strong basis for showing trends that are independent of location.

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. Details of the UK air quality objectives for protection of human health, as well as of WHO new recommended guideline levels can be found in Appendix E.

3.2.1 Nitrogen Dioxide (NO_2)

Combustion processes emit a mixture of nitrogen oxides – NO and NO_2 - collectively termed NO_X.

a) NO is described as a primary pollutant (meaning it is directly emitted from source). NO is not known to have any harmful effects on human health at ambient concentrations. However, it undergoes oxidation in the atmosphere to form the secondary pollutant NO_2.

b) NO_2 has a primary (directly emitted) component and a secondary component, formed by oxidation of NO. NO_2 is a respiratory irritant and is toxic at high concentrations. It is also involved in the formation of photochemical smog and acid rain and may cause damage to crops and vegetation.

NO_2 has been monitored at three locations in Oxford in 2022 by the use of automatic continuous monitors and at 126 locations using passive monitoring (diffusion tubes).

The annual mean AQ objective for NO_2 is 40 µg/m^3. In 2022, Oxford High Street measured annual mean for NO_2 was 31 µg/m^3 and AURN Oxford Centre Roadside 33 µg/m^3. At AURN St. Ebbes, the NO_2 annual mean was 12 µg/m^3. This objective was therefore met at all automatic monitoring stations in 2022.

Table 6 in Appendix A compares the ratified and adjusted automatic 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 of fall-off with distance adjustment).

Figure 3 (below) shows the 18 year long term trend for levels of measured NO_2 at Oxford's three automatic monitoring stations. The results are expressed in µg/m^3.

Figure 25 on Appendix F shows the historic annual mean concentrations of NO_2 in the UK, between 1990 and 2022 for comparison purposes with Figure 3.

Figure 3 - Long term trends of Annual Mean NO_2 (µg/m^3) at Oxford's continuous monitoring stations, 2004-2022

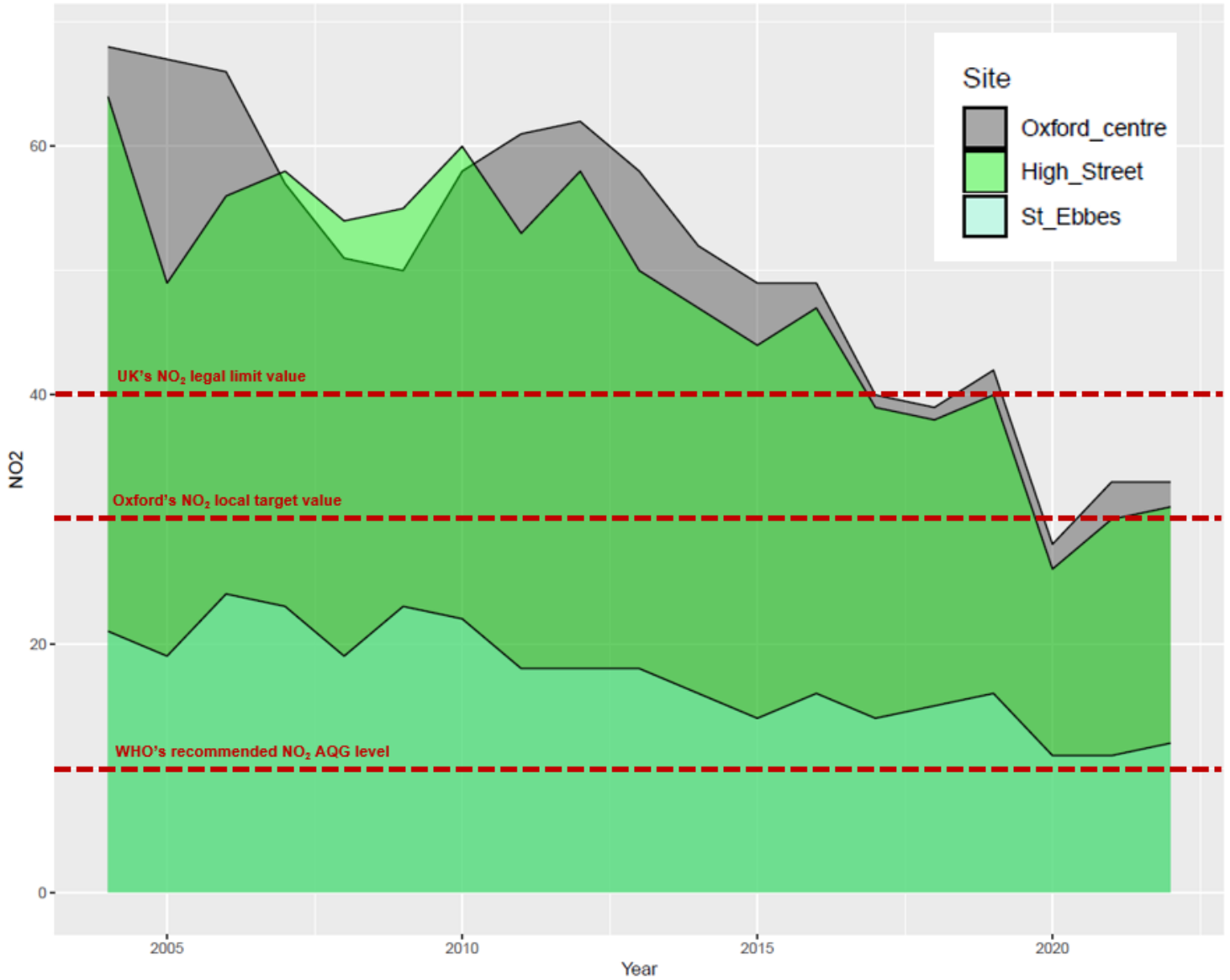


Figure 3 shows that NO_2 levels measured in Oxford at the locations of our automatic monitoring sites have generally been decreasing since 2004.

A significant reduction of NO_2 levels at all our automatic monitoring stations can be seen in 2020 as a result of the successive restrictions of movements caused by the COVID-19 pandemic, and which had a direct effect on the reduction of traffic levels in the city.

In 2021 we saw an increase of NO_2 concentrations as a result of the lifting of those restrictions and of the recovery of the economy. In 2022 levels seem to have stabilised at these sites, with only 1 ug/m^3 increases observed at AURN St Ebbes and Oxford High Street, in comparison with the previous monitoring year, and the exact same concentration being measured at AURN Oxford Centre.

It is also important to highlight that the NO_2 levels measured at these stations in 2022 are still significantly lower (by 23% on average) than the ones that were obtained in 2019 (the last pre-pandemic year). Significant changes in the way people work, such as the widespread implementation of remote working, which seem to be here to stay, coupled with increases in e-commerce and automation are the most likely reasons explaining why we have been able to maintain air pollution at levels below pre-pandemic levels.

For detailed information on time variations, daily means, and basic statistics of NO_2 at Oxford's three automatic monitoring stations please refer to Appendix F.

The AQ objective for hourly mean NO_2 concentration is 200 µg/m^3, and may be exceeded up to 18 times per calendar year. The time series of hourly averaged concentrations of NO_2 for the 3 automatic monitoring sites is compared against the UK's hourly mean limit value (dashed red line) in Figure 4 below. The results are expressed in µg/m^3.

Table 8 in Appendix A compares the ratified continuous monitored NO_2 hourly mean concentrations for the past five years with the air quality objective of 200 µg/m^3, not to be exceeded more than 18 times per year.

Figure 4 - Time series of hourly averaged concentrations of NO_2 (µg/m^3) at automatic monitoring sites, 2022.

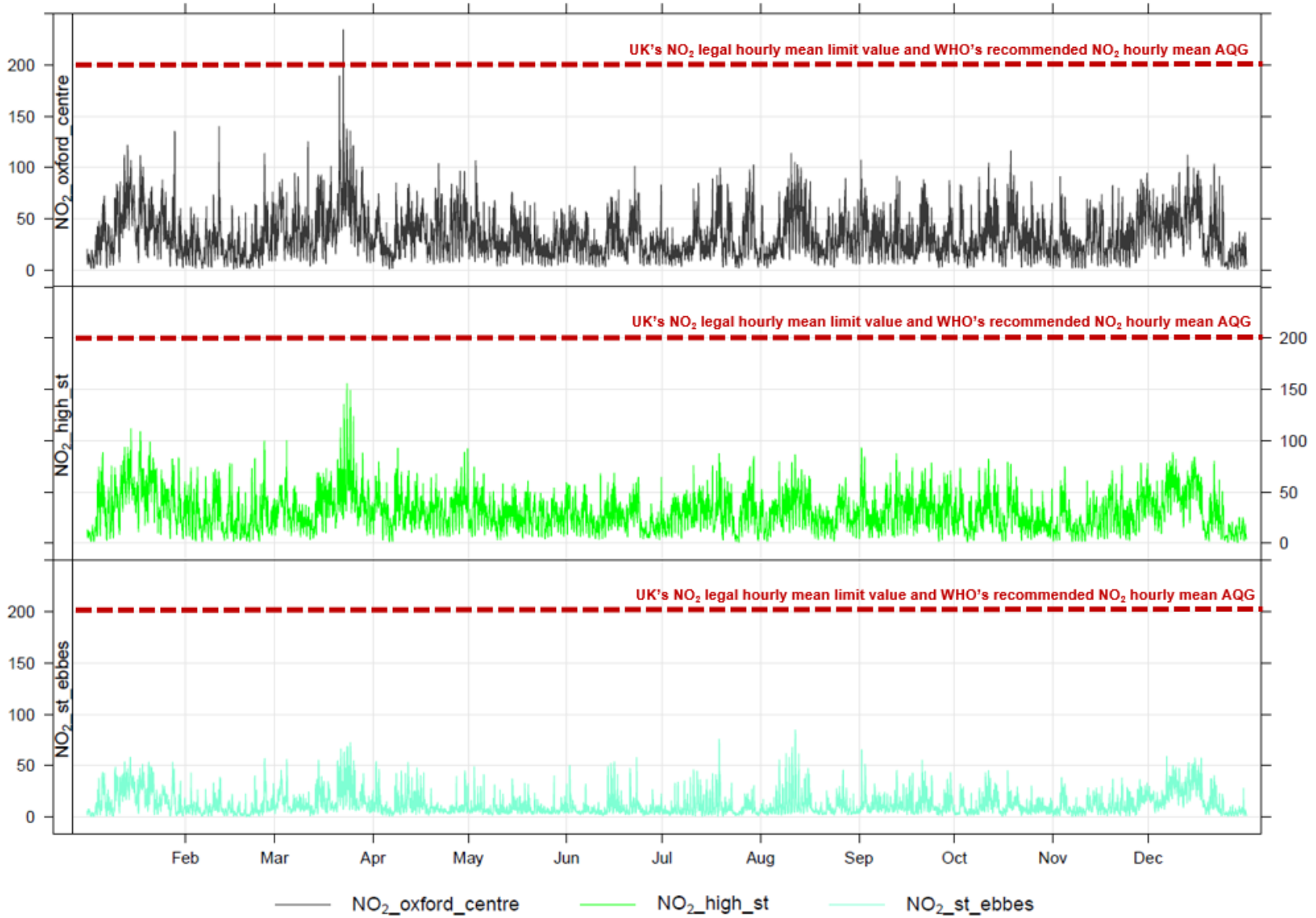


Figure 4 shows that there was only one hourly mean NO_2 measurement exceeding 200 µg/m^3 in 2022. The highest hourly mean NO_2 measured was of 234 µg/m^3 and was registered on the 22nd March at AURN Oxford Centre Roadside.

The threshold of the "Moderate" air quality index band as set out by DEFRA for the NO_2 hourly mean ranges from 201 to 400 µg/m^3. NO_2 levels at all 3 sites were recorded within the DEFRA "Low" Air Quality band in 2022, a part from the pollution spike highlighted above. As none of the automatic monitoring sites have registered more than 18 exceedances of the AQ hourly objective for NO_2, this objective was therefore fully met at all automatic monitoring sites in 2022.

Non-automatic monitoring using diffusion tubes took place at 126 Oxford locations in 2022. From those, eighty nine (89) sites correspond to areas where air quality was already being monitored in the previous year, for the purpose of assessing relevant exposure. In 2022, thirty seven (37) new sites have been added to the network at the request of Oxfordshire County Council, with the specific objective to assess the impact of the trial for the introduction of several traffic filters within the city. Some of these thirty seven sites were installed at locations of relevant exposure (where feasible). However, others were also installed in locations outside of the city's jurisdictional boundaries, and/or where members of the public are not regularly present, such as for example Oxford's ring road. The purpose for monitoring at those locations was solely to try to evaluate the possible impacts traffic filters can cause in terms of traffic displacement in those areas.

The main observations of the monitoring carried out in 2022 using non-automatic monitoring are as follow:

- The legal annual mean objective of 40 µg/m^3 was exceeded at six (6) of the 126 diffusion tube monitoring locations that formed part of the air quality network. From those:
    - Three are located along the ring road (Northern, Eastern and Western Bypasses), in isolated locations where members of the public are not expected to be regularly present. These sites measured annual mean concentrations of 42, 43 and 42 µg/m^3 respectively and are labelled with the tube numbers TF27, TF31 and TF37;
    - One tube, (TF35) was installed at the residential properties located by the ring road, on the Southern Bypass - south of Botley Interchange. This tube measured a concentration of 57 µg/m^3. However, this location falls outside the City Council's jurisdiction, and forms part of an existing

AQMA that is being managed by Vale of the White Horse District Council;

- One tube (DT55) is located at St Clements – The Plain, Oxford's highest historic air quality hotspot, with a measured a NO_2 concentration of 43 µg/m^3.
- One tube (TF19) is located on the kerb at Headington Hill, a non-residential area, directly on the road. This location is far from relevant exposure, and where members of the public are not expected to be present at any time. The NO_2 annual mean concentration measured at this location was of 70 µg/m^3, (the highest measurement of 2022);

- For the sixth consecutive year, none of the city's NO_2 diffusion tube monitoring sites located in areas considered of relevant exposure, presented an annual mean NO_2 equal or above 60 µg/m^3. According to LAQM (TG22), this is an indication that exceedances of the hourly mean objective for NO_2 are also not likely to have occurred in the city in 2022;

- In 2022, NO_2 levels decreased on average by 8.3% across the city, whilst average traffic levels within the city have increased by a similar proportion (8.2%)[17]. The most likely explanation for this relates to fleet renewal and upgrades, in particular the increase in the amount of EVs on our roads. According to DVLA data, Oxfordshire has some of the highest EV uptake figures for newly registered vehicles in the UK, with uptake consistently above 44% (and rising) from November 2022 onwards. The introduction of measures such as Oxford's ZEZ Pilot and plans for its future expansion, seem:
  - To have been driving companies such as DPD, Royal Mail, Tesco, to accelerate their fleet transition to electric in Oxford;
  - To have provided space for sustainable cargo bike delivery companies such as Pedal & Post, OxWash, Velocity to flourish across the city; and

17 Oxford's traffic data figures for 2022 were provided to Oxford City Council by the Highways authority (Oxfordshire County Council)

  - To have led to an increase in EV infrastructure in the City (Oxford city has the fifth[18] highest number of electric vehicle charging devices per 100,000 people in England), which improves public confidence with the transition to EVs.

- In 2022 we saw an average reduction of 24% of NO_2 levels in the city when compared with the levels obtained in 2019 (pre-pandemic).

- Twelve locations within the city, were shown to be above Oxford's local annual mean target of 30 µg/m^3 for NO_2 (a commitment laid out in the city's recent AQAP, and which is expected to be achieved across the city by 2025). Those locations are: Cutteslowe Round abound; St Aldates; High Street (2x); Long Wall St; St Clements (2x); Hollow Way Rd; Worcester St, Park End St, Oxford Road (at the Cross with Newmans Road) and Oliver Road (facing Eastern bypass Road);

Impact of ZEZ

- The UK's first Zero Emission Zone (ZEZ) was launched in February 2022. All petrol and diesel vehicles, including hybrids, will incur a daily charge if they are driven in the zone between 7am and 7pm unless they have a 100 per cent discount or exemption. The zone was in operation for 10 months in 2022 and monitoring shows that:
  - Cornmarket St, St Michaels St and George St (Magdalen St side) , saw NO_2 reductions of 3µg/m^3, the equivalent to 14%, 18% and 12% reductions each;
  - George St (Gloucester Green side) and New Inn Hall St saw improvements in NO_2 levels measured at 2µg/m^3 (8% and 12% reductions) each.
  - NO_2 levels at Queen St (DT40), Bonn Square (DT41) and New Road (DT42) where practically unchanged from 2021. The NO_2 levels measured at Queen Street and Bonn Square have increased by 1 µg/m^3 (which is not statistically significant and well within the margin of error of the measurement technique), and have remained the same on New Road. Most of these areas are already heavily pedestrianised while they form part of the main city centre bus routes.

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Buses are the major emission source in these areas and continue to operate within the ZEZ, so no major air quality improvements were to be expected in these areas, as a result of the ZEZ scheme;

Impact of East Oxford Low Traffic Neighbourhoods

- The monitoring results from 2022 also allow assessment of the air quality impacts of East Oxford Low Traffic Neighbourhoods (LTNs) located on St Marys, St Clements and Divinity Road. The conclusions of the assessment are:
  - All the monitoring locations inside these LTNs showed a decrease in NO_2, with the greatest effects seen at 189 Divinity Rd (LT5) which saw a reduction in NO_2 of 6ug/m^3 equal to 33% and 26 Prince Street (LT1) which saw a reduction in NO_2 of 4 ug/m^3 equal to a 24% reduction. St Marys neighbourhoods (LT14 Howard St. and LT15 Hurst St.) both show decreases in NO_2 of 3 ug/m^3 or equal to a 19% reduction;
  - DT81 Cowley Road/Union Street showed a significant reduction (-11 µg/m^3 or -37%) when compared to 2021. However, monitoring data for the year 2021 should not be used for comparison purposes with 2022 in this location. This is because the measurement at this location was heavily influenced by external factors through most of 2021. These relate with emissions resulting from the construction works at Tesco Express including the use of generators and associated HGV movements. The 2022 result is the same as the one obtained in 2020 (19 µg/m^3). This shows that there were no meaningful impacts of LTNs at this location, which might be explained by Union Street continuing to be used by drivers as a regular access route to the Union Street car park.

  On the boundary roads the picture is more mixed:

  - None of the above LTN's seem to have caused any perceptible negative traffic displacement impacts on Hollow Way Road and Oxford Road. The three diffusion tubes in this area: DT80 – Holloway Road/Bennett Crescent; DT7 – Oxford Road/In between Towns Road; and DT8 – Oxford Road/Cowley Police Station) all consistently show practically no changes in the NO_2 levels compared with 2021: DT80 - reduction of 1 µg/m^3 (from 35 to 34 µg/m^3); DT7 – same levels measured (30 µg/m^3); DT8 - same levels measured (29 µg/m^3);

- The NO_2 levels at Morrell Avenue (LT4) reduced by 3 µg/m^3 equivalent to 19%, which seem to indicate that no significant LTN impacts have been seen on this boundary road as a result;
- St Clements has seen increases in the NO_2 levels measured in 2022: St Clements 1 (DT55) saw an increase in NO_2 of 4 µg/m^3 equivalent to 10% and St Clements 2 (DT77) saw an increase in NO_2 of 5 µg/m^3 equivalent to 17%. This seems to indicate that this street has seen impacts of LTNs, via traffic displacement. St Clements (DT55) is historically the city's highest NO_2 hotspot. Annual mean concentration in 2022 was 43 µg/m^3 at this location, which brought back air pollution to levels slightly above the existing UK legal annual mean limit for this pollutant (40 µg/m^3);
- The monitoring site DT72 on Cowley Road (crossing with James Street) show the highest increase in NO_2 levels at the sites that were used to monitor the impacts of LTNs. The increase at this site was of 7 µg/m^3 equivalent to 35%, with an annual mean increasing from 20 to 27 µg/m^3. This increase if most likely the result of this being the only road that moves across the 3 LTN's, so it's very likely to have been impacted by traffic displacement caused the 3 LTN's in operation. However, despite the increase, NO_2 levels are still below the city's annual mean local target for NO_2 and below the current UK legal limit value for this pollutant;

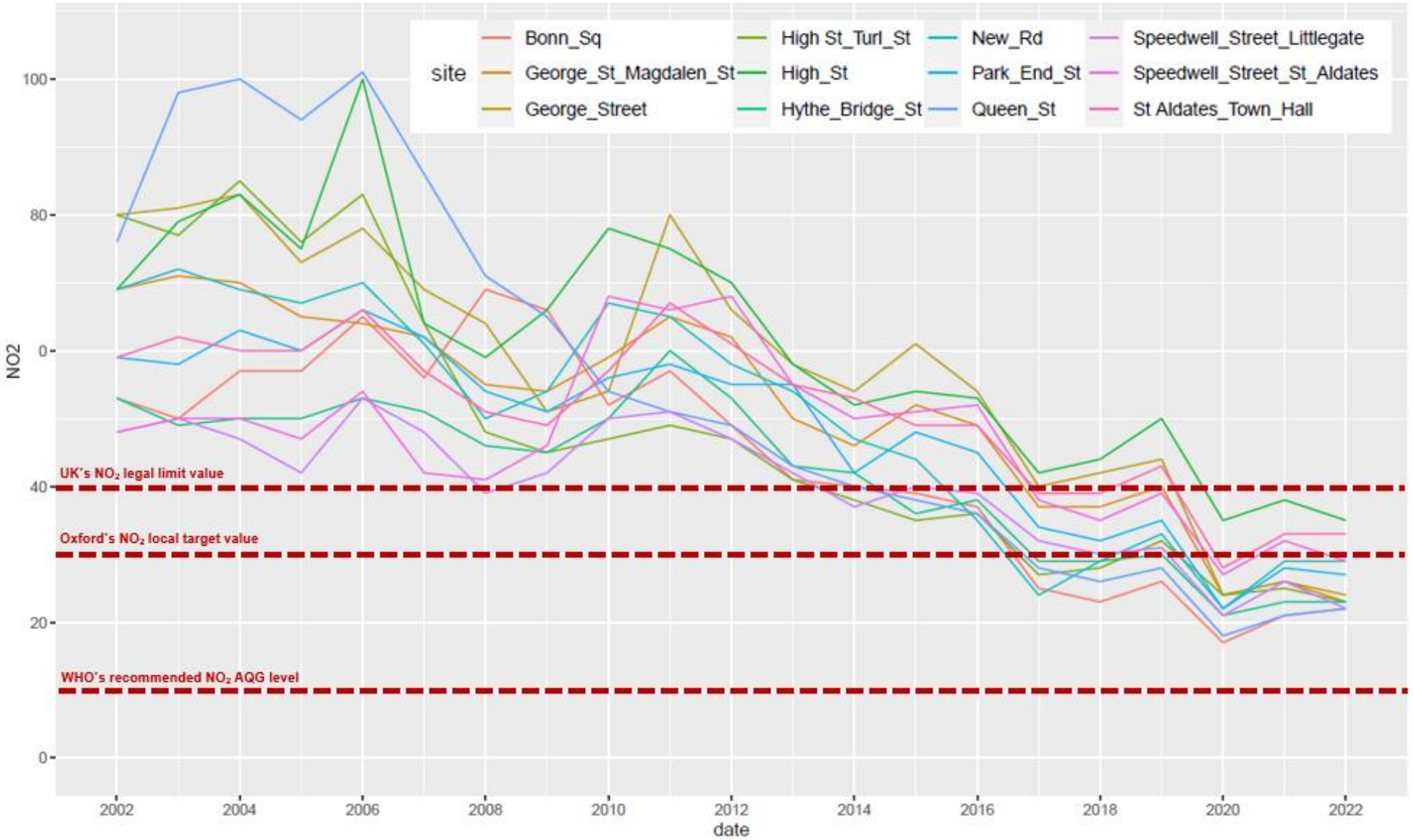
If you are interested to know more about the impact of East Oxford LTNs, please read the interim/snapshot evaluation report, which was published on the 1st June by Oxfordshire County Council on their website here.
Oxfordshire County Council is carrying out a full analysis of the LTNs over the summer which will be published to support the cabinet decision, expected in October, when a decision will be made on whether the LTNs should become permanent.

The full 2022 dataset of diffusion tube monthly mean values is provided in Appendix B. Figure 5 below shows the long term trend for levels of measured NO_2 at a number of historic diffusion tube monitoring stations. The results are expressed in µg/m^3.

It is quite clear that there has been a significant downward trend in measured levels of NO_2 at these historic monitoring locations since monitoring began in 2002.

In 2022, NO_2 levels have decreased (on average) by 8% at all the diffusion tube monitoring locations in the city, and these results now represent a 24% decrease in levels when compared with pre-pandemic times.

Figure 5 - Long Term Trends in Annual Mean NO_2 ($\mu g/m^3$) at Oxford's diffusion tube monitoring locations, 2003-2022.



3.2.2 Particulate Matter (PM_{10} and $PM_{2.5}$)

Airborne particulate matter varies widely in its physical and chemical composition, source and particle size. The terms PM_{10} and $PM_{2.5}$ are used to describe particles with an effective size less than 10 and 2.5 µm respectively. These are of concern with regard to human health, as they are small enough to penetrate deep into the lungs. They can cause inflammation and a worsening of the condition of people with heart and lung diseases. In addition, they may carry surface absorbed carcinogenic compounds into the lungs. Larger particles, meanwhile, are not readily inhaled, and are removed relatively efficiently from the air by sedimentation.

In 2022, PM_{10} and $PM_{2.5}$ data were monitored by automatic continuous monitors at AURN St. Ebbes and Oxford High Street

The annual mean AQ objective for PM_{10} is 40 µg/m^3. Table 9 in Appendix A compares the ratified and adjusted monitored PM_{10} annual mean concentrations for the past five years with the air quality objective of 40 µg/m^3. In 2022, Oxford High Street (roadside) registered a PM_{10} annual mean of 16 µg/m^3. AURN St. Ebbes (urban background) of 12 µg/m^3. The annual mean PM_{10} concentration is higher at our roadside site, when compared to our urban background site, most likely due to the contribution of PM_{10} emissions from road transport sources, predominantly from non-exhaust sources (brakes, tyres and road wear), as well as the impact of resuspension due to vehicle movements. This objective was fully met at both these monitoring sites in 2022.

Figure 6 below show the 11 year long term trend for levels of measured PM_{10} at continuous monitoring stations in Oxford, along with the current recommended WHO guideline value for this pollutant, which is significantly lower than the current UK legal limit value. The overall trend of PM_{10} levels measured at our 2 automatic monitoring sites has been generally going downward since 2011. However, in 2022 we can see a slight increase in the levels measured at St Ebbes and High Street (of 1 and 2 µg/m^3 respectively), when in comparison with the previous year.

These increases are aligned with the average PM_{10} increase seen at all monitoring sites across the UK for this pollutant[19]. In 2022, PM_{10} levels increased in the UK by 1 µg/m^3 on average.

19 National Statistics, Particulate Matter (PM_{10}/$PM_{2.5}$), DEFRA

It is difficult to attribute a specific cause to such a small increase which was observed both at our two monitoring sites and at national level. However, with domestic combustion occupying up to 48% of all local emissions of this pollutant in Oxford (and road transport only 10%)[20], it is a possibility that this increase could be caused by an increase usage of wood burning stoves and fossil fuels such as coal and wood, which generate a lot more PM than its gas counterparts. The cost of these fuel sources have been significantly more attractive than gas throughout 2022, and it's possible that more people are relying on these heating sources in an attempt to fight current inflation and the increase in cost of living.

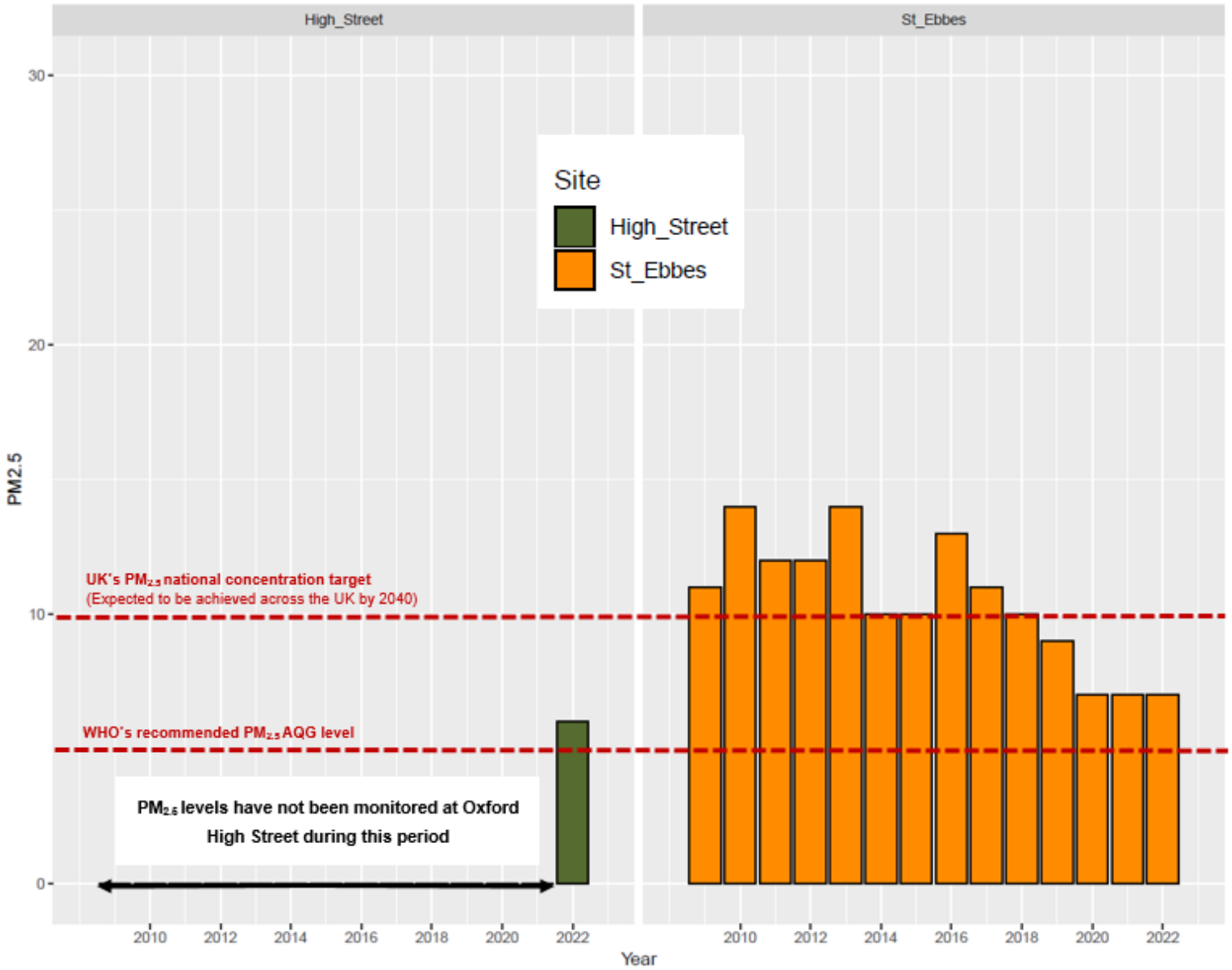
The short term AQ objective for PM_{10} is a maximum of 50 µg/m^3 for any 24h mean period, not to be exceeded more than 35 days a year. Table 10 in Appendix A compares the ratified continuous monitored PM_{10} daily mean concentrations for the past five years with the daily air quality objective of 50 µg/m^3, not to be exceeded more than 35 times per year.

The result of PM_{10} measurements in 2022 show two exceedances of the 50 µg/m^3 24h mean on High Street and none at AURN St Ebbes. The AQ objective for 24-hour mean PM_{10} was therefore fully met at these monitoring sites in 2022.

20 Oxford's latest source apportionment study (2020)

Figure 6 - Long term trends of Annual Mean PM_{10} ($\mu g/m^3$) at Oxford's continuous monitoring stations, 2011-2022.

Figure 7 - Long term trends of Annual Mean $PM_{2.5}$ ($\mu g/m^3$) at Oxford's continuous monitoring stations, 2009-2022



120

A new UK air quality target now exists for $PM_{2.5}$, as a result of the EIP official publication on the 31st January 2023. The legal target requires for a maximum annual mean concentration of 10 µg/m^3 to be achieved by 2040, with a new interim target of 12 µg/m^3 by the end of January 2028.

On the 11th May 2022, a FIDAS Instrument was installed at Oxford High Street, allowing for the first time roadside measurements of $PM_{2.5}$ to be undertaken from a reference automatic monitor in Oxford.

The monitored annual mean of $PM_{2.5}$ that was obtained in 2022 was of 7 µg/m^3 at AURN St. Ebbes and of 6 µg/m^3 at Oxford High Street. These annual means are very similar, and both of them are in compliance with the new UK annual mean concentration target and only slightly above the annual mean of the 5 µg/m^3 recommended by the recently published WHO guidelines, for this pollutant.

Figure 7 shows that the $PM_{2.5}$ concentrations measured at Oxford AURN St Ebbes have remained completely stable for the last three years, after a clear downward trend from 2016. This is also the first year we have an annual mean $PM_{2.5}$ measurement for Oxford High Street, so there are no elements for comparison for this site in 2022.

$PM_{2.5}$ measurements obtained in Oxford are aligned with the UK's national trend for this pollutant. Analysis of the $PM_{2.5}$ UK national trend show that average concentrations rose slightly (by 5%) in 2022, from 2021 levels. At Oxford AURN St Ebbes, $PM_{2.5}$ rose by 4.7% in 2022 (moving from an average decimal value of 7.13 to 7.46 µg/m^3). However, this increase was not big enough that it could alter the 2022 annual mean for this site.

Table 11 in Appendix A presents the ratified and adjusted monitored $PM_{2.5}$ annual mean concentrations at these sites for the past five years.

Table 17 in Appendix C details the annualisation procedure that had to be followed for to correct $PM_{2.5}$ data at Oxford High Street, as a result of the poor $PM_{2.5}$ data capture rates of this site in 2022.

3.2.3 Ozone (O_3)

Ozone (O_3) is not emitted directly into the atmosphere in significant quantities, but is a secondary pollutant produced by reaction between nitrogen dioxide (NO_2) and hydrocarbons, in the presence of sunlight. Whereas NO_2 contributes to ozone formation, nitrogen oxide (NO) destroys ozone and therefore acts as a local sink. For this reason,

ozone levels are not as high in urban areas (where NO is emitted from vehicles) as in rural areas.

Peak O_3 episodes are strongly linked to typical summer weather conditions (high temperatures, sunny weather and stagnant high pressure systems), giving rise to the so called "*summer smog*". Ozone is an area wide pollutant, and whilst monitoring sites are relatively sparse compared to those monitoring NO_2, they represent wider population exposure, so a single site may represent the ozone concentrations that hundreds of thousands of people have been exposed to. For this reason, local measures alone are not enough to tackle the problem and actions at different levels of governance (i.e. regionally and internationally) are required.

In Oxford, O_3 is measured at AURN St. Ebbes. The AQ objective for daily maximum on an 8 hour running mean is 100 µg/m^3 not to be exceeded more than 10 days a year.

The data capture of O_3 at AURN St. Ebbes in 2022 was of 99.8%. In 2022, this site exceeded the AQ daily objective for ozone 159 times, during a total of 24 days during the year. This represents a significant increase in the number of exceedances (99 more) and days (12 more), when compared with the results from 2021. AURN St. Ebbes has not met the AQ objectives for this pollutant in 2022.

According to the London Air website (run by the Imperial College London), the entire South East of England has suffered from Moderate to High Ozone levels on the following periods:

- 3th and 4th June 2022;
- 14th and 15th June 2022;
- 16th to 19th July 2022;
- 10th to 15th August 2022.

All of these episodes are strongly linked with high pressure systems delivering high temperatures and sunshine – all the factors that act as catalysts on local and continental precursor emissions and hence are responsible from an increase of ground level ozone production.

All the dates above coincide with the periods where AURN St Ebbes measured its highest Ozone levels in 2022.

Appendix A: Monitoring Results

Table 4 – 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)
CM1	AURN Oxford Centre	Roadside	451359	206157	NO_2	YES/Oxford city-wide AQMA	Chemiluminescence	1	3	2.5
CM2	Oxford High Street	Roadside	451677	206272	NO_2;$PM_{10;}$ $PM_{2.5}$	YES/Oxford city-wide AQMA	Chemiluminescence Gravimetric analysis	1	2	1.5
CM3	AURN St Ebbes	Urban Background	451118	205353	NO_2;PM_{10}; $PM_{2.5}$;O_3	YES/Oxford city-wide AQMA	Chemiluminescence Mass spectrometry UV Absorption	10	2	2.5

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 5 – 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) (2) (3)	Distance to kerb of nearest road (m) (2)	Tube Co-located with a Continuous Analyser?	Tube Height (m)
DT1	St Ebbe's	UB	451118	205353	NO_2	YES/Oxford city-wide AQMA	10	2	YES	2.5
DT2	Weirs Lne./Abingdon Rd. LP1	RS	451904	204215	NO_2	YES/Oxford city-wide AQMA	2	2	NO	3
DT3	LP 52 Abingdon Rd.	RS	451914	204154	NO_2	YES/Oxford city-wide AQMA	3	2	NO	3
DT4	Boundary Brook Rd/ Iffley Rd	RS	452961	204662	NO_2	YES/Oxford city-wide AQMA	3	2	NO	3
DT5	Lenthall Rd Allotments	UB	452818	203448	NO_2	YES/Oxford city-wide AQMA	5	N/A	NO	1.5
DT7	Oxford Rd/ Between Towns Rd	RS	454472	204246	NO_2	YES/Oxford city-wide AQMA	3	2	NO	3
DT8	Oxford Rd (Cowley) LP13	RS	454355	204296	NO_2	YES/Oxford city-wide AQMA	3	1	NO	3
DT14	Windmill Rd. W	RS	454554	207102	NO_2	YES/Oxford city-wide AQMA	0	2.5	NO	3
DT15	London Rd./BHF	RS	454433	207058	NO_2	YES/Oxford city-wide AQMA	0	2.5	NO	3
DT16	Headley Way/London Rd. LP2	RS	453982	206817	NO_2	YES/Oxford city-wide AQMA	1	2	NO	3
DT18	The Roundway	RS	455596	207367	NO_2	YES/Oxford city-wide AQMA	0	5	NO	3
DT20	Barton Lane LP2	RS	454999	207759	NO_2	YES/Oxford city-wide AQMA	3	1	NO	3
DT25	Cuttleslowe Rbout 3 Elsfield Rd.	RS	450419	210256	NO_2	YES/Oxford city-wide AQMA	5	2	NO	3
DT26	Cuttleslowe 3 Summers Place	RS	450389	210189	NO_2	YES/Oxford city-wide AQMA	1	2	NO	3
DT27	Wolvercote 78 Sunderland Ave.	RS	449824	210198	NO_2	YES/Oxford city-wide AQMA	1	1	NO	3
DT28	Wolvercote 51 Sunderland Ave	RS	449856	210162	NO_2	YES/Oxford city-wide AQMA	1	1	NO	3
DT29	Pear Tree P&R N Gateway	RS	449530	210734	NO_2	YES/Oxford city-wide AQMA	10	4	NO	3
DT30	Osney Lne/Hollybush Row	RS	450668	206053	NO_2	YES/Oxford city-wide AQMA	2	2	NO	3
DT31	Beckett St.	RS	450566	206227	NO_2	YES/Oxford city-wide AQMA	5	2	NO	3
DT32	Royal Oxford Hotel	RS	450674	206273	NO_2	YES/Oxford city-wide AQMA	0	2.5	NO	3
DT33	Botley RD/ Mill St	RS	450409	206224	NO_2	YES/Oxford city-wide AQMA	1	1	NO	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) (2) (3)	Distance to kerb of nearest road (m) (2)	Tube Co-located with a Continuous Analyser?	Tube Height (m)
DT35	Botley Rd /Hillview Rd	RS	450029	206207	NO_2	YES/Oxford city-wide AQMA	1	2	NO	3
DT36	Botley Rd N (Prestwich Place)	RS	449657	206245	NO_2	YES/Oxford city-wide AQMA	1	2	NO	3
DT39	St Aldate's	RS	451359	206157	NO_2	YES/Oxford city-wide AQMA	0	2	YES	2.5
DT40	Queen St.	RS	451270	206144	NO_2	YES/Oxford city-wide AQMA	0	2	NO	3
DT41	Bonn Square	RS	451216	206133	NO_2	YES/Oxford city-wide AQMA	0	2	NO	3
DT42	New Rd.	RS	451073	206191	NO_2	YES/Oxford city-wide AQMA	2	3.5	NO	3
DT43	Park End St.	RS	450885	206275	NO_2	YES/Oxford city-wide AQMA	2	1	NO	3
DT44	Hythe Bridge St.	RS	450795	206343	NO_2	YES/Oxford city-wide AQMA	0	2	NO	3
DT45	Worcester St.	RS	450942	206424	NO_2	YES/Oxford city-wide AQMA	2	2	NO	3
DT46	Beaumont St.	RS	451167	206519	NO_2	YES/Oxford city-wide AQMA	2	1	NO	3
DT47	George St. / Magdalen St.	RS	451222	206387	NO_2	YES/Oxford city-wide AQMA	2	0.5	NO	3
DT48	George St.	RS	450981	206344	NO_2	YES/Oxford city-wide AQMA	1	0.5	NO	3
DT49	Cornmarket St.	RS	451322	206242	NO_2	YES/Oxford city-wide AQMA	0	2	NO	3
DT50	High St. / Turl St.	RS	451467	206222	NO_2	YES/Oxford city-wide AQMA	1	2.5	NO	3
DT51	50 High St.	RS	451900	206250	NO_2	YES/Oxford city-wide AQMA	0	2.5	NO	3
DT52	Longwall St.	RS	451972	206283	NO_2	YES/Oxford city-wide AQMA	1	1	NO	3
DT53	Magdalen Bridge	RS	452099	206117	NO_2	YES/Oxford city-wide AQMA	10	2	NO	3
DT54	York Place	RS	452325	206015	NO_2	YES/Oxford city-wide AQMA	2	2	NO	3
DT55	St Clements	RS	452326	205992	NO_2	YES/Oxford city-wide AQMA	2	0.5	NO	3
DT56	High St.	RS	451576	206232	NO_2	YES/Oxford city-wide AQMA	2.5	0.2	NO	3
DT57	Speedwell St. / St. Aldate's	RS	451407	205807	NO_2	YES/Oxford city-wide AQMA	1	3	NO	3
DT58	Folly Bridge	RS	451437	205529	NO_2	YES/Oxford city-wide AQMA	1	1	NO	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) (2) (3)	Distance to kerb of nearest road (m) (2)	Tube Co-located with a Continuous Analyser?	Tube Height (m)
DT59	Thames St.	RS	451353	205643	NO_2	YES/Oxford city-wide AQMA	1	3	NO	3
DT60	New Butterwyke P./ Thames St.	RS	451248	205710	NO_2	YES/Oxford city-wide AQMA	5	2	NO	3
DT61	Friars Wharf	RS	451219	205707	NO_2	YES/Oxford city-wide AQMA	3	3	NO	3
DT64	Thames St. / Oxpens Rd.	RS	450887	205825	NO_2	YES/Oxford city-wide AQMA	5	1	NO	3
DT65	Speedwell St. / Littlegate	RS	451206	205780	NO_2	YES/Oxford city-wide AQMA	1	2	NO	3
DT68	Norfolk St.	RS	451030	205962	NO_2	YES/Oxford city-wide AQMA	0	1.5	NO	3
DT69	Paradise Square	RS	450982	205973	NO_2	YES/Oxford city-wide AQMA	0	1	NO	3
DT70	Castle St.	RS	451062	206067	NO_2	YES/Oxford city-wide AQMA	0	1.5	NO	3
DT71	BP City Motors	RS	449617	210216	NO_2	YES/Oxford city-wide AQMA	5	5	NO	3
DT72	Cowley Rd./ James Street	RS	452761	205745	NO_2	YES/Oxford city-wide AQMA	1	1	NO	3
DT73	Walton Street LP18	RS	450960	206590	NO_2	YES/Oxford city-wide AQMA	1	1	NO	3
DT76	St Gilles	RS	451226	206504	NO_2	YES/Oxford city-wide AQMA	0	2	NO	3
DT77	St Clements 2	RS	452451	205999	NO_2	YES/Oxford city-wide AQMA	0	1	NO	3
DT79	Old Abingdon Rd.	RS	451908	203919	NO_2	YES/Oxford city-wide AQMA	5	1.5	NO	3
DT80	Hollow way Road	RS	454651	204270	NO_2	YES/Oxford city-wide AQMA	4	1	NO	3
DT81	Cowley Rd/ Union Street	RS	452805	205731	NO_2	YES/Oxford city-wide AQMA	0	2	NO	3
DT82	Summertown Parade	RS	450806	208978	NO_2	YES/Oxford city-wide AQMA	2	1	NO	3
DT83	A44 Woodstock Rd.	RS	449681	210263	NO_2	YES/Oxford city-wide AQMA	8	0.5	NO	2
DT84	226 Botley Rd.	RS	449273	206274	NO_2	YES/Oxford city-wide AQMA	10	1.5	NO	3
DT85	St Clements 3	RS	452625	206068	NO_2	YES/Oxford city-wide AQMA	2.5	1	NO	3
DT86	72 Blackbird Leys	RS	455134	202841	NO_2	YES/Oxford city-wide AQMA	6	1.5	NO	2
DT87	New Inn Hall St	RS	451164	206246	NO_2	YES/Oxford city-wide AQMA	0	0.5	NO	2

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) (2) (3)	Distance to kerb of nearest road (m) (2)	Tube Co-located with a Continuous Analyser?	Tube Height (m)
DT88	St Michaels St	RS	451205	206341	NO_2	YES/Oxford city-wide AQMA	0	0.5	NO	2
DT89	Turl St/Market St	RS	451439	206330	NO_2	YES/Oxford city-wide AQMA	1	0.5	NO	2
DT90	Rose Hill (Ashhurst Way)	RS	453368	203323	NO_2	YES/Oxford city-wide AQMA	7	2	NO	2.5
DT91	Garsington Rd (Premier Place)	RS	455267	203719	NO_2	YES/Oxford city-wide AQMA	2	0.5	NO	2
DT92	BB Leys (Cuddesdon Way)	RS	455702	203062	NO_2	YES/Oxford city-wide AQMA	6	3	NO	2.5
DT93	Marston Ferry Rd	RS	451363	208785	NO_2	YES/Oxford city-wide AQMA	15	1	NO	2.5
DT94	Broad St LP6	RS	451360	206427	NO_2	YES/Oxford city-wide AQMA	4	0.1	NO	2.2
DT95	Broad S -Lbay	RS	451433	206438	NO_2	YES/Oxford city-wide AQMA	4	0.1	NO	2.2
LT1	26 Prince St	RS	452786	205860	NO_2	YES/Oxford city-wide AQMA	4	0.5	NO	2.5
LT2	1A Woodlands Rd	RS	453927	207068	NO_2	YES/Oxford city-wide AQMA	2	0.5	NO	2.5
LT3	47 Quarry Rd	RS	455310	206681	NO_2	YES/Oxford city-wide AQMA	4	2	NO	2.5
LT4	138-146 Morrell Av	RS	453575	206037	NO_2	YES/Oxford city-wide AQMA	4	2	NO	2.5
LT5	189 Divinity Rd	RS	453576	205938	NO_2	YES/Oxford city-wide AQMA	2	1	NO	2.5
LT6	St Christophers school	UB	454473	204588	NO_2	YES/Oxford city-wide AQMA	4	3	NO	2.5
LT7	126 The slade	RS	454930	206287	NO_2	YES/Oxford city-wide AQMA	3	0.5	NO	2.5
LT8	East Oxford Primary School	UB	452903	205776	NO_2	YES/Oxford city-wide AQMA	3	12	NO	2.5
LT9	4 Quarry school	RS	455447	206966	NO_2	YES/Oxford city-wide AQMA	4	1	NO	2.5
LT10	23 Gladstone Rd	RS	455243	207170	NO_2	YES/Oxford city-wide AQMA	6	1	NO	2.5
LT11	19 Wharton Rd	RS	454918	207054	NO_2	YES/Oxford city-wide AQMA	6	2.5	NO	2.5
LT12	Ruskin Hall	RS	454260	207741	NO_2	YES/Oxford city-wide AQMA	0	1	NO	2.5
LT13	21 Latimer Rd	RS	454221	206796	NO_2	YES/Oxford city-wide AQMA	6	2	NO	2.5
LT14	94 Howard St	RS	453138	204917	NO_2	YES/Oxford city-wide AQMA	3	1	NO	2.5

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) (2) (3)	Distance to kerb of nearest road (m) (2)	Tube Co-located with a Continuous Analyser?	Tube Height (m)
LT15	96 Valentia Rd	RS	454013	206437	NO_2	YES/Oxford city-wide AQMA	3	1	NO	2.5
LT16	103-139 Hurst St	RS	452985	205185	NO_2	YES/Oxford city-wide AQMA	4	1	NO	2.5
TF1	Oxey Mead Lake 1	UB	447817	210695	NO_2	NO	(2) (3)	19	NO	1.5
TF2	Oxey Mead Lake 2	RS	447945	210710	NO_2	NO	(2) (3)	6	NO	1
TF3	Oxey Mead Lake 3	RS	448247	210661	NO_2	NO	(2) (3)	1	NO	2
TF4	Wolvercote Village	RS	449145	209732	NO_2	YES/Oxford city-wide AQMA	10	2	NO	3
TF5	Wolvercote Primary School	RS	449740	209866	NO_2	YES/Oxford city-wide AQMA	8	2	NO	2.5
TF6	306 Woodstock Road	RS	450300	209379	NO_2	YES/Oxford city-wide AQMA	10	2	NO	3
TF7	339 Banbury Road	RS	450602	209634	NO_2	YES/Oxford city-wide AQMA	10	2	NO	3
TF8	191 Woodstock Road	RS	450695	208278	NO_2	YES/Oxford city-wide AQMA	9	2	NO	2.5
TF9	48 Woodstock Road	RS	451009	207199	NO_2	YES/Oxford city-wide AQMA	6	2	NO	2.5
TF10	99 Banbury Road	RS	451035	207953	NO_2	YES/Oxford city-wide AQMA	10	2	NO	2.5
TF11	9 S. Park Road	RS	451626	206893	NO_2	YES/Oxford city-wide AQMA	5	1	NO	2.5
TF12	15 Banbury Road	RS	451170	207087	NO_2	YES/Oxford city-wide AQMA	10	2	NO	3
TF13	Walton Street 76	RS	450625	207212	NO_2	YES/Oxford city-wide AQMA	2	1	NO	3
TF14	69 Kingston Road	RS	450545	207728	NO_2	YES/Oxford city-wide AQMA	3	1	NO	2.5
TF15	Park End Street	RS	450789	206269	NO_2	YES/Oxford city-wide AQMA	2	1	NO	2.5
TF16	St Aldates 61	RS	451420	205729	NO_2	YES/Oxford city-wide AQMA	1	0.5	NO	2
TF17	23 Iffley Rd/Stanley Rd	RS	452718	205090	NO_2	YES/Oxford city-wide AQMA	6	1	NO	2.5
TF18	143 Morrell Avenue	RS	453263	205962	NO_2	YES/Oxford city-wide AQMA	6	1	NO	2.5
TF19	HeadingtonHill/Headington Rd	RS	453248	206468	NO_2	YES/Oxford city-wide AQMA	(2) (3)	0.5	NO	2
TF20	Marston Rd/St Michaels Primary	RS	452853	206925	NO_2	YES/Oxford city-wide AQMA	10	1.5	NO	2.5
TF21	189 Headley Way	RS	453795	207074	NO_2	YES/Oxford city-wide AQMA	10	1	NO	2.5
TF22	255 London Rd/Gladstone Rd	RS	455154	207362	NO_2	YES/Oxford city-wide AQMA	10	1.5	NO	2.5

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) (2) (3)	Distance to kerb of nearest road (m) (2)	Tube Co-located with a Continuous Analyser?	Tube Height (m)
TF23	JR Hospital	RS	453861	207513	NO_2	YES/Oxford city-wide AQMA	5	1	NO	2
TF24	Marston Ferry Rd/Cherwell Drive	RS	452739	208351	NO_2	YES/Oxford city-wide AQMA	(2) (3)	1	NO	2.5
TF25	39 Marsh Lane	RS	453186	208209	NO_2	YES/Oxford city-wide AQMA	10	1.5	NO	2.5
TF26	Northway/Cutteslowe Park	RS	451091	210175	NO_2	YES/Oxford city-wide AQMA	(2) (3)	1	NO	1.5
TF27	Northern Bypass/Phillips Tyres	RS	452691	209225	NO_2	YES/Oxford city-wide AQMA	(2) (3)	0.5	NO	1.5
TF28	Horspath Driftway/Agwar Stone Rd	RS	455454	205164	NO_2	YES/Oxford city-wide AQMA	10	1	NO	2
TF29	109 Old Road	RS	455138	206375	NO_2	YES/Oxford city-wide AQMA	9	2	NO	2.5
TF30	99 Oliver Road	RS	455405	204262	NO_2	YES/Oxford city-wide AQMA	10	2.5	NO	2.5
TF31	Brasenose Farm/Eastern Bypass	RS	455602	204986	NO_2	YES/Oxford city-wide AQMA	(2) (3)	1	NO	2
TF32	22 Garsington Road	RS	454690	204160	NO_2	YES/Oxford city-wide AQMA	9	2	NO	3
TF33	119 Barns Road	RS	454490	203748	NO_2	YES/Oxford city-wide AQMA	4	1.5	NO	2.5
TF34	Oxford Road/Newmans Road	RS	453717	203250	NO_2	YES/Oxford city-wide AQMA	10	1	NO	2.5
TF35	67 Southern Bypass Road	RS	448957	205761	NO_2	NO	(2) (3)	2.5	NO	2.5
TF36	Wolvercote Meadows 1	RS	448095	208830	NO_2	NO	(2) (3)	1	NO	1.5
TF37	Wolvercote Meadows 2	RS	448688	210123	NO_2	NO	(2) (3)	1.5	NO	2

Notes:

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

(2) N/A if not applicable

(3) These sites have not been put in place to directly assess the level of human exposure to air pollution, but instead to measure the potential impact of future transport schemes on traffic displacement. They are located on isolated areas, (mostly around Oxford's ring road), t a considerable distance from residential zones, and hence they are not relevant for the direct purposes of the LAQM regime.

Table 6 - 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
CM1	451359	206157	Roadside	99.7	99.7	39	42	28	33	33
CM2	451677	206272	Roadside	99.6	99.6	38	40	26	30	31
CM3	451118	205353	Urban Background	99.6	99.6	15	16	11	11	12

☒ **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%).

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Table 7 - Annual Mean NO_2 Monitoring Results: Non-Automatic Monitoring (µg/m^3)

Diffusion Tube ID	Site name	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
DT1	St Ebbe's	451118	205353	UB	100	100	15	16	11	11	11
DT2	Weirs Lne./Abingdon Rd. LP1	451904	204215	RS	100	100	27	29	23	25	21
DT3	LP 52 Abingdon Rd.	451914	204154	RS	92	92	29	34	26	27	27
DT4	Boundary Brook Rd/ Iffley Rd	452961	204662	RS	92	92	27	28	23	26	27
DT5	Lenthall Rd Allotments	452818	203448	UB	100	100	14	14	10	11	10
DT7	Oxford Rd/ Between Towns Rd	454472	204246	RS	100	100	28	32	27	30	30
DT8	Oxford Rd(Cowley) LP13	454355	204296	RS	100	100	27	31	24	29	29
DT14	Windmill Rd. W	454554	207102	RS	100	100	32	35	28	30	28
DT15	London Rd./BHF	454433	207058	RS	92	92	25	27	21	23	23
DT16	Headley Way/London Rd. LP2	453982	206817	RS	100	100	25	27	19	22	21
DT18	The Roundway	455596	207367	RS	92	92	26	28	22	24	23
DT20	Barton Lane LP2	454999	207759	RS	100	100	27	28	22	23	20
DT25	Cuttleslowe Rbout 3 Elsfield Rd.	450419	210256	RS	100	100	35	35	26	28	25
DT26	Cuttleslowe 3 Summers Place	450389	210189	RS	75	75	**41**	**40**	31	34	32
DT27	Wolvercote 78 Sunderland Ave.	449824	210198	RS	100	100	29	29	22	22	20
DT28	Wolvercote 51 Sunderland Ave	449856	210162	RS	92	92	27	26	22	24	20
DT29	Pear Tree P&R N Gateway	449530	210734	RS	100	100	25	26	20	21	21
DT30	Osney Lne/Hollybush Row	450668	206053	RS	92	92	28	27	19	22	20
DT31	Beckett St.	450566	206227	RS	92	92	31	32	21	25	23
DT32	Royal Oxford Hotel	450674	206273	RS	100	100	31	32	24	27	25
DT33	Botley RD/ Mill St	450409	206224	RS	100	100	26	24	19	22	18
DT35	Botley Rd /Hillview Rd	450029	206207	RS	100	100	32	34	23	26	24
DT36	Botley Rd N (Prestwich Place)	449657	206245	RS	100	100	27	25	17	19	16
DT39	St Aldate's	451359	206157	RS	100	100	39	**43**	28	33	33
DT40	Queen St.	451270	206144	RS	100	100	26	28	18	21	22
DT41	Bonn Square	451216	206133	RS	92	92	23	26	17	21	22
DT42	New Rd.	451073	206191	RS	92	92	29	33	22	29	29
DT43	Park End St.	450885	206275	RS	100	100	32	35	22	28	27

Diffusion Tube ID	Site name	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
DT44	Hythe Bridge St.	450795	206343	RS	75	75	29	30	21	23	23
DT45	Worcester St.	450942	206424	RS	75	75	37	**40**	26	29	31
DT46	Beaumont St.	451167	206519	RS	92	92	31	31	20	24	22
DT47	George St. / Magdalen St.	451222	206387	RS	92	92	37	**40**	24	26	23
DT48	George St.	450981	206344	RS	83	83	**42**	**44**	24	26	24
DT49	Cornmarket St.	451322	206242	RS	100	100	24	26	18	21	18
DT50	High St. / Turl St.	451467	206222	RS	92	92	28	32	24	25	23
DT51	50 High St.	451900	206250	RS	100	100	33	37	25	35	31
DT52	Longwall St.	451972	206283	RS	100	100	38	**41**	30	34	32
DT53	Magdalen Bridge	452099	206117	RS	100	100	23	23	16	19	17
DT54	York Place	452325	206015	RS	100	100	23	26	18	20	19
DT55	St Clements	452326	205992	RS	100	100	**46**	**53**	36	39	**43**
DT56	High St.	451576	206232	RS	100	100	**44**	**50**	35	38	35
DT57	Speedwell St. / St. Aldate's	451407	205807	RS	100	100	35	39	27	32	29
DT58	Folly Bridge	451437	205529	RS	100	100	33	34	24	27	23
DT59	Thames St.	451353	205643	RS	100	100	27	26	18	22	19
DT60	New Butterwyke P./ Thames St.	451248	205710	RS	100	100	30	33	22	27	23
DT61	Friars Wharf	451219	205707	RS	100	100	19	20	14	17	14
DT64	Thames St. / Oxpens Rd.	450887	205825	RS	100	100	23	23	15	18	16
DT65	Speedwell St. / Littlegate	451206	205780	RS	100	100	30	31	21	26	22
DT68	Norfolk St.	451030	205962	RS	100	100	24	27	19	24	22
DT69	Paradise Square	450982	205973	RS	92	92	24	26	18	20	18
DT70	Castle St.	451062	206067	RS	100	100	29	29	22	27	22
DT71	BP City Motors	449617	210216	RS	100	100	38	**40**	28	28	27
DT72	Cowley Rd./ James Street	452761	205745	RS	92	92	29	31	22	20	27
DT73	Walton Street LP18	450960	206590	RS	100	100	26	24	15	18	18
DT76	St Gilles	451226	206504	RS	100	100	33	35	23	24	22
DT77	St Clements 2	452451	205999	RS	92	92	36	**42**	28	30	35
DT79	Old Abingdon Rd.	451908	203919	RS	92	92	NM	24	17	20	18
DT80	Hollow way Road	454651	204270	RS	83	83	NM	37	31	35	34
DT81	Cowley Rd/ Union Street	452805	205731	RS	100	100	NM	22	19	30	19
DT82	Summertown Parade	450806	208978	RS	92	92	NM	27	20	21	17
DT83	A44 Woodstock Rd.	449681	210263	RS	100	100	NM	**40**	30	32	30
DT84	226 Botley Rd.	449273	206274	RS	100	100	NM	27	18	20	18
DT85	St Clements 3	452625	206068	RS	100	100	NM	36	26	29	30
DT86	72 Blackbird Leys	455134	202841	RS	100	100	NM	NM	16	18	16

Diffusion Tube ID	Site name	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
DT87	New Inn Hall St	451164	206246	RS	92	92	NM	NM	15	17	15
DT88	St Michaels St	451205	206341	RS	100	100	NM	NM	15	17	14
DT89	Turl St/Market St	451439	206330	RS	83	83	NM	NM	17	19	15
DT90	Rose Hill (Ashhurst Way)	453368	203323	RS	92	92	NM	NM	NM	20	19
DT91	Garsington Rd (Premier Place)	455267	203719	RS	92	92	NM	NM	NM	36	28
DT92	BB Leys (Cuddesdon Way)	455702	203062	RS	92	92	NM	NM	NM	19	16
DT93	Marston Ferry Rd	451363	208785	RS	92	92	NM	NM	NM	15	13
DT94	Broad St LP6	451360	206427	RS	75	75	NM	NM	NM	NM	14
DT95	Broad S -Lbay	451433	206438	RS	75	75	NM	NM	NM	NM	14
LT1	26 Prince St	452786	205860	RS	92	92	NM	NM	NM	17	13
LT2	1A Woodlands Rd	453927	207068	RS	75	75	NM	NM	NM	12	10
LT3	47 Quarry Rd	455310	206681	RS	83	83	NM	NM	NM	15	13
LT4	138-146 Morrell Av	453575	206037	RS	92	92	NM	NM	NM	16	13
LT5	189 Divinity Rd	453576	205938	RS	100	100	NM	NM	NM	18	12
LT6	St Christophers school	454473	204588	UB	92	92	NM	NM	NM	13	12
LT7	126 The slade	454930	206287	RS	92	92	NM	NM	NM	26	22
LT8	East Oxford Primary School	452903	205776	UB	100	100	NM	NM	NM	15	13
LT9	4 Quarry school	455447	206966	RS	92	92	NM	NM	NM	13	13
LT10	23 Gladstone Rd	455243	207170	RS	83	83	NM	NM	NM	13	13
LT11	19 Wharton Rd	454918	207054	RS	83	83	NM	NM	NM	13	11
LT12	Ruskin Hall	454260	207741	RS	83	83	NM	NM	NM	18	16
LT13	21 Latimer Rd	454221	206796	RS	100	100	NM	NM	NM	13	12
LT14	94 Howard St	453138	204917	RS	92	92	NM	NM	NM	16	13
LT15	96 Valentia Rd	454013	206437	RS	92	92	NM	NM	NM	16	12
LT16	103-139 Hurst St	452985	205185	RS	92	92	NM	NM	NM	16	13
TF1	Oxey Mead Lake 1	447817	210695	UB	67	67	NM	NM	NM	NM	9
TF2	Oxey Mead Lake 2	447945	210710	RS	67	67	NM	NM	NM	NM	13
TF3	Oxey Mead Lake 3	448247	210661	RS	67	67	NM	NM	NM	NM	25
TF4	Wolvercote Village	449145	209732	RS	58	58	NM	NM	NM	NM	13
TF5	Wolvercote Primary School	449740	209866	RS	67	67	NM	NM	NM	NM	14
TF6	306 Woodstock Road	450300	209379	RS	67	67	NM	NM	NM	NM	15
TF7	339 Banbury Road	450602	209634	RS	67	67	NM	NM	NM	NM	23
TF8	191 Woodstock Road	450695	208278	RS	67	67	NM	NM	NM	NM	20
TF9	48 Woodstock Road	451009	207199	RS	67	67	NM	NM	NM	NM	20

Diffusion Tube ID	Site name	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
TF10	99 Banbury Road	451035	207953	RS	50	50	NM	NM	NM	NM	19
TF11	9 S. Park Road	451626	206893	RS	67	67	NM	NM	NM	NM	17
TF12	15 Banbury Road	451170	207087	RS	67	67	NM	NM	NM	NM	17
TF13	Walton Street 76	450625	207212	RS	67	67	NM	NM	NM	NM	20
TF14	69 Kingston Road	450545	207728	RS	33	33	NM	NM	NM	NM	15
TF15	Park End Street II	450789	206269	RS	67	67	NM	NM	NM	NM	36
TF16	St Aldates 61	451420	205729	RS	67	67	NM	NM	NM	NM	28
TF17	23 Iffley Rd/Stanley Rd	452718	205090	RS	67	67	NM	NM	NM	NM	26
TF18	143 Morrell Avenue	453263	205962	RS	58	58	NM	NM	NM	NM	16
TF19	Hadington Hill/Headington Rd	453248	206468	RS	67	67	NM	NM	NM	NM	**70**
TF20	Marston Rd/St Michaels Primary	452853	206925	RS	67	67	NM	NM	NM	NM	16
TF21	189 Headley Way	453795	207074	RS	67	67	NM	NM	NM	NM	22
TF22	255 London Rd/Gladstone Rd	455154	207362	RS	67	67	NM	NM	NM	NM	25
TF23	JR Hospital	453861	207513	RS	67	67	NM	NM	NM	NM	23
TF24	Marston Ferry Rd/Cherwell Drive	452739	208351	RS	67	67	NM	NM	NM	NM	16
TF25	39 Marsh Lane	453186	208209	RS	67	67	NM	NM	NM	NM	17
TF26	Northway/Cutteslowe Park	451091	210175	RS	67	67	NM	NM	NM	NM	23
TF27	Northern Bypass/Phillips Tyres	452691	209225	RS	67	67	NM	NM	NM	NM	**42**
TF28	Horspath Driftway/Agwar Stone Rd	455454	205164	RS	67	67	NM	NM	NM	NM	22
TF29	109 Old Road	455138	206375	RS	58	58	NM	NM	NM	NM	15
TF30	99 Oliver Road	455405	204262	RS	67	67	NM	NM	NM	NM	34
TF31	Brasenose Farm/Eastern Bypass	455602	204986	RS	67	67	NM	NM	NM	NM	**43**
TF32	22 Garsington Road	454690	204160	RS	67	67	NM	NM	NM	NM	20
TF33	119 Barns Road	454490	203748	RS	67	67	NM	NM	NM	NM	16
TF34	Oxford Road/Newmans Road	453717	203250	RS	58	58	NM	NM	NM	NM	35
TF35	67 Southern Bypass Road	448957	205761	RS	67	67	NM	NM	NM	NM	**57**
TF36	Wolvercote Meadows 1	448095	208830	RS	58	58	NM	NM	NM	NM	36
TF37	Wolvercote Meadows 2	448688	210123	RS	67	67	NM	NM	NM	NM	**42**

☒ **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%).

Table 8 - 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
CM1	451359	206157	Roadside	99.7	99.7	1	3	0	0	1
CM2	451677	206272	Roadside	99.6	99.6	0 (106)	2	1	0	0
CM3	451118	205353	Urban Background	99.6	99.6	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%).

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Table 9 - 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
CM2	451677	206272	Roadside	77.0	77.0	18	19	16	14	16
CM3	451118	205353	Urban Background	99.9	99.9	12	14	11	11	12

☒ **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%).

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Table 10 - 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
CM2	451677	206272	Roadside	77.0	77.0	0 (30)	7	0	0	2
CM3	451118	205353	Urban Background	99.9	99.9	1	5	0	1	0

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%).

Table 11 - 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
CM2	451677	206272	Roadside	64.3	41.0	NM	NM	NM	NM	6
CM3	451118	205353	Urban Background	99.9	99.9	10	9	7	7	7

☒ **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%).

NM – Not Monitored

Appendix B: Full Monthly Diffusion Tube Results for 2022

Table 12 – NO_2 2022 Diffusion Tube Results ($\mu g/m^3$)

DT ID	Site name	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 (0.74)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
DT1	St Ebbe's	451118	205353	24	13	18	14	10	11	12	12	14	13	14	20	14.5	11	*	
DT2	Weirs Lne./Abingdon Rd. LP1	451904	204215	44	25	36	29	23	23	24	27	29	27	23	35	28.6	21	*	
DT3	LP 52 Abingdon Rd.	451914	204154	51	36	40	NR	30	33	34	30	36	38	35	44	36.8	27	*	
DT4	Boundary Brook Rd/ Iffley Rd	452961	204662	52	37	42	NR	31	29	30	30	33	34	40	45	36.6	27	*	
DT5	Lenthall Rd Allotments	452818	203448	20	14	21	12	9	9	9	9	12	12	21	20	13.9	10	*	
DT7	Oxford Rd/ Between Towns Rd	454472	204246	54	45	40	34	38	40	37	31	35	43	46	41	40.3	30	*	
DT8	Oxford Rd(Cowley) LP13	454355	204296	50	42	47	35	33	32	34	33	38	34	42	48	38.9	29	*	
DT14	Windmill Rd. W	454554	207102	61	48	35	32	37	36	32	37	33	38	42	41	38.5	28	*	
DT15	London Rd./BHF	454433	207058	43	NR	38	29	26	26	27	25	28	33	33	32	24	23	*	
DT16	Headley Way/London Rd. LP2	453982	206817	42	25	35	30	23	20	24	28	26	23	24	34	27.8	21	*	
DT18	The Roundway	455596	207367	43	29	34	28	NR	23	28	27	33	26	32	36	30.7	23	*	
DT20	Barton Lane LP2	454999	207759	39	23	33	29	21	21	24	26	28	24	26	31	27.0	20	*	
DT25	Cuttleslowe Rbout 3 Elsfield Rd.	450419	210256	52	36	36	27	28	28	29	25	34	35	34	42	33.8	25	*	
DT26	Cuttleslowe 3 Summers Place	450389	210189	56	36	54	45	31	NR	NR	44	47	NR	39	41	43.4	32	*	
DT27	Wolvercote 78 Sunderland Ave.	449824	210198	41	33	29	22	23	24	24	20	23	28	30	31	27.3	20	*	
DT28	Wolvercote 51 Sunderland Ave	449856	210162	43	NR	33	21	23	25	22	24	32	24	30	20	27.0	20	*	
DT29	Pear Tree P&R N Gateway	449530	210734	40	34	27	23	22	25	23	20	26	32	35	30	28.0	21	*	
DT30	Osney Lne/Hollybush Row	450668	206053	37	NR	35	25	21	20	23	24	29	26	22	35	26.9	20	*	
DT31	Beckett St.	450566	206227	41	NR	38	27	25	23	31	31	36	30	27	32	30.9	23	*	
DT32	Royal Oxford Hotel	450674	206273	45	30	45	33	25	27	31	35	33	31	33	34	33.5	25	*	
DT33	Botley RD/ Mill St	450409	206224	34	20	37	30	19	16	18	26	21	17	22	32	24.3	18	*	
DT35	Botley Rd /Hillview Rd	450029	206207	43	31	39	28	27	28	31	28	30	32	35	31	32.0	24	*	

DT ID	Site name	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 (0.74)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
DT36	Botley Rd N (Prestwich Place)	449657	206245	32	21	27	17	17	16	19	18	24	20	25	23	21.6	16	*	
DT39	St Aldate's	451359	206157	49	38	57	45	37	36	41	45	40	44	50	51	44.5	33	*	
DT40	Queen St.	451270	206144	42	28	39	30	23	24	23	27	28	26	30	33	29.3	22	*	
DT41	Bonn Square	451216	206133	44	NR	34	28	25	25	23	24	28	27	28	35	29.1	22	*	
DT42	New Rd.	451073	206191	56	NR	50	41	36	36	36	39	37	34	32	35	39.2	29	*	
DT43	Park End St.	450885	206275	49	37	40	32	32	33	35	35	35	30	35	37	35.9	27	*	
DT44	Hythe Bridge St.	450795	206343	40	NR	34	30	27	27	28	NR	32	NR	30	27	30.5	23	*	
DT45	Worcester St.	450942	206424	46	NR	47	NR	38	NR	40	39	40	38	42	45	41.6	31	*	
DT46	Beaumont St.	451167	206519	44	29	36	NR	24	23	26	22	25	28	31	34	29.1	22	*	
DT47	George St. / Magdalen St.	451222	206387	42	31	33	26	24	28	27	24	29	NR	33	40	30.7	23	*	
DT48	George St.	450981	206344	43	34	NR	NR	28	29	29	27	26	34	41	38	32.9	24	*	
DT49	Cornmarket St.	451322	206242	36	25	31	20	19	20	21	17	23	27	27	33	24.7	18	*	
DT50	High St. / Turl St.	451467	206222	38	30	42	33	27	25	26	30	NR	32	27	38	31.5	23	*	
DT51	50 High St.	451900	206250	57	39	58	50	38	41	46	40	33	33	36	38	42.4	31	*	
DT52	Longwall St.	451972	206283	64	51	47	41	41	43	40	32	37	39	41	42	43.0	32	*	
DT53	Magdalen Bridge	452099	206117	35	19	29	24	19	17	21	23	23	20	22	28	23.4	17	*	
DT54	York Place	452325	206015	38	27	31	19	19	21	17	19	22	30	32	32	25.6	19	*	
DT55	St Clements	452326	205992	70	54	55	43	57	63	61	53	60	61	66	55	58.2	**43**	35	
DT56	High St.	451576	206232	61	51	51	35	47	44	45	43	43	51	49	46	47.1	35	*	
DT57	Speedwell St. / St. Aldate's	451407	205807	52	38	40	40	41	38	42	39	40	32	35	38	39.5	29	*	
DT58	Folly Bridge	451437	205529	41	28	37	27	27	28	28	30	33	31	30	34	31.2	23	*	
DT59	Thames St.	451353	205643	35	19	41	32	19	19	22	26	28	20	23	32	26.4	19	*	
DT60	New Butterwyke P./ Thames St.	451248	205710	36	28	37	32	27	24	29	30	34	27	29	36	30.7	23	*	
DT61	Friars Wharf	451219	205707	30	16	27	18	13	12	16	18	18	15	16	27	18.9	14	*	
DT64	Thames St. / Oxpens Rd.	450887	205825	30	16	28	21	19	16	20	23	25	17	16	27	21.4	16	*	
DT65	Speedwell St. / Littlegate	451206	205780	46	31	37	29	28	25	25	27	28	25	29	31	30.2	22	*	
DT68	Norfolk St.	451030	205962	42	34	34	32	24	24	23	27	26	26	30	30	29.3	22	*	
DT69	Paradise Square	450982	205973	32	NR	32	22	20	18	19	20	27	24	25	32	24.6	18	*	
DT70	Castle St.	451062	206067	44	27	36	30	26	26	26	28	28	22	24	33	29.1	22	*	

DT ID	Site name	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 (0.74)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
DT71	BP City Motors	449617	210216	50	36	43	32	30	32	35	34	35	38	33	36	36.1	27	*	
DT72	Cowley Rd./ James Street	452761	205745	51	36	46	NR	30	27	31	35	35	31	32	40	35.9	27	*	
DT73	Walton Street LP18	450960	206590	35	22	35	21	18	20	20	19	23	25	28	30	24.5	18	*	
DT76	St Gilles	451226	206504	43	34	30	26	25	24	25	20	27	30	31	37	29.3	22	*	
DT77	St Clements 2	452451	205999	55	NR	44	33	44	51	44	41	46	52	59	48	47.0	35	*	
DT79	Old Abingdon Rd.	451908	203919	30	22	26	21	18	33	NR	20	23	23	25	30	24.6	18	*	
DT80	Hollow way Road	454651	204270	68	51	NR	NR	41	43	40	35	44	45	47	43	45.7	34	*	
DT81	Cowley Rd/ Union Street	452805	205731	42	27	28	24	21	20	19	19	22	24	26	31	25.2	19	*	
DT82	Summertown Parade	450806	208978	38	NR	28	21	17	18	18	17	21	23	24	31	23.3	17	*	
DT83	A44 Woodstock Rd.	449681	210263	64	46	38	34	40	41	36	28	39	40	43	41	40.7	30	*	
DT84	226 Botley Rd.	449273	206274	37	26	25	20	20	21	20	21	21	27	29	29	24.6	18	*	
DT85	St Clements 3	452625	206068	54	33	45	43	39	38	36	44	42	39	36	44	41.1	30	*	
DT86	72 Blackbird Leys	455134	202841	37	22	26	23	14	16	16	17	21	21	22	31	22.2	16	*	
DT87	New Inn Hall St	451164	206246	33	21	27	18	16	NR	15	14	19	20	23	22	20.7	15	*	
DT88	St Michaels St	451205	206341	30	19	25	18	15	15	13	13	18	18	20	27	19.2	14	*	
DT89	Turl St/Market St	451439	206330	33	20	NR	NR	15	15	14	13	17	20	21	29	19.6	15	*	
DT90	Rose Hill (Ashhurst Way)	453368	203323	36	NR	33	24	19	19	19	22	22	25	26	32	25.0	19	*	
DT91	Garsington Rd (Premier Place)	455267	203719	56	NR	34	36	35	34	32	9	37	37	41	40	37.4	28	*	
DT92	BB Leys (Cuddesdon Way)	455702	203062	35	NR	26	22	16	15	16	17	20	18	22	26	21.1	16	*	
DT93	Marston Ferry Rd	451363	208785	29	NR	21	15	13	14	13	12	15	16	20	23	17.2	13	*	
DT94	Broad St LP6	451360	206427	NM	NM	NM	20	16	16	15	13	19	22	27	27	19.5	14	*	
DT95	Broad S - Lbay	451433	206438	NM	NM	NM	19	18	17	14	13	18	23	25	27	19.2	14	*	
LT1	26 Prince St	452786	205860	28	24	22	19	13	10	10	11	12	NR	20	25	17.6	13	*	
LT2	1A Woodlands Rd	453927	207068	NR	NR	NR	13	10	8	11	11	11	16	17	19	12.9	10	*	
LT3	47 Quarry Rd	455310	206681	27	NR	18	15	18	NR	12	11	16	16	18	24	17.4	13	*	
LT4	138-146 Morrell Av	453575	206037	27	NR	21	15	17	12	15	15	17	16	19	24	17.8	13	*	
LT5	189 Divinity Rd	453576	205938	29	28	25	16	15	8	11	9	10	13	17	20	16.7	12	*	
LT6	St Christophers school	454473	204588	25	NR	19	14	11	9	11	10	14	18	21	25	16.0	12	*	
LT7	126 The slade	454930	206287	40	34	29	24	26	NR	31	21	33	26	31	31	29.6	22	*	

DT ID	Site name	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 (0.74)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
LT8	East Oxford Primary School	452903	205776	32	24	14	16	12	8	12	11	13	18	23	25	17.3	13	*	
LT9	4 Quarry school	455447	206966	25	23	19	14	15	NR	11	11	15	16	19	21	17.3	13	*	
LT10	23 Gladstone Rd	455243	207170	25	NR	25	NR	11	9	11	10	13	15	20	22	16.0	13	*	
LT11	19 Wharton Rd	454918	207054	26	NR	NR	13	10	8	10	9	12	15	21	22	14.6	11	*	
LT12	Ruskin Hall	454260	207741	34	NR	NR	19	19	16	18	15	18	24	28	31	22.2	16	*	
LT13	21 Latimer Rd	454221	206796	25	23	17	14	11	10	16	11	14	16	19	26	16.8	12	*	
LT14	94 Howard St	453138	204917	30	NR	23	19	14	9	12	10	13	16	19	23	17.0	13	*	
LT15	96 Valentia Rd	454013	206437	24	22	16	14	11	NR	11	9	14	16	19	24	16.3	12	*	
LT16	103-139 Hurst St	452985	205185	30	NR	21	18	14	10	12	11	15	18	22	27	17.9	13	*	
TF1	Oxey Mead Lake 1	447817	210695	NM	NM	NM	NM	8	7	10	11	12	10	10	19	10.8	9	*	Monitoring not for LAQM (assessing human exposure) purposes but to assess potential AQ impacts from traffic displacement that result from future transport schemes
TF2	Oxey Mead Lake 2	447945	210710	NM	NM	NM	NM	11	10	16	19	19	12	13	21	15.1	13	*	Monitoring not for LAQM (assessing human exposure) purposes but to assess potential AQ impacts from traffic displacement that result from future transport schemes
TF3	Oxey Mead Lake 3	448247	210661	NM	NM	NM	NM	26	28	39	38	40	25	25	18	29.9	25	*	Monitoring not for LAQM (assessing human exposure) purposes but to assess potential AQ impacts from traffic displacement that result from future transport schemes
TF4	Wolvercote Village	449145	209732	NM	NM	NM	NM	10	10	12	15	17	NR	16	24	14.7	13	*	
TF5	Wolvercote Primary School	449740	209866	NM	NM	NM	NM	12	13	16	17	19	16	15	26	16.7	14	*	
TF6	306 Woodstock Road	450300	209379	NM	NM	NM	NM	13	14	17	14	19	19	21	25	17.7	15	*	
TF7	339 Banbury Road	450602	209634	NM	NM	NM	NM	22	24	25	24	28	28	34	36	27.5	23	*	
TF8	191 Woodstock Road	450695	208278	NM	NM	NM	NM	17	20	20	19	25	24	27	34	23.2	20	*	
TF9	48 Woodstock Road	451009	207199	NM	NM	NM	NM	20	20	22	17	23	28	29	33	24.1	20	*	
TF10	99 Banbury Road	451035	207953	NM	NM	NM	NM	NR	NR	23	20	24	24	28	28	24.7	19	*	
TF11	9 S. Park Road	451626	206893	NM	NM	NM	NM	15	17	17	17	19	24	26	26	20.1	17	*	
TF12	15 Banbury Road	451170	207087	NM	NM	NM	NM	14	12	16	17	20	22	24	32	19.7	17	*	
TF13	Walton Street 76	450625	207212	NM	NM	NM	NM	19	19	20	18	25	25	29	33	23.4	20	*	
TF14	69 Kingston Road	450545	207728	NM	NM	NM	NM	NR	12	15	NR	15	18	NR	NR	15.2	15	*	
TF15	Park End Street	450789	206269	NM	NM	NM	NM	39	39	42	47	46	38	40	44	41.8	36	*	
TF16	St Aldates 61	451420	205729	NM	NM	NM	NM	31	31	32	30	32	33	34	39	32.8	28	*	

DT ID	Site name	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 (0.74)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
TF17	23 Iffley Rd/Stanley Rd	452718	205090	NM	NM	NM	NM	25	26	27	26	34	32	35	37	30.2	26	*	
TF18	143 Morrell Avenue	453263	205962	NM	NM	NM	NM	16	14	14	NR	20	20	23	28	19.0	16	*	
TF19	Headinton Hill/Headington Rd	453248	206468	NM	NM	NM	NM	86	85	93	92	84	77	83	58	82.2	**70**	*	Monitoring not for LAQM (assessing human exposure) purposes but to assess potential AQ impacts from traffic displacement that result from future transport schemes
TF20	Marston Rd/St Michaels Primary	452853	206925	NM	NM	NM	NM	15	18	20	16	19	18	24	22	19.0	16	*	
TF21	189 Headley Way	453795	207074	NM	NM	NM	NM	20	20	22	18	25	27	33	41	25.5	22	*	
TF22	255 London Rd/Gladstone Rd	455154	207362	NM	NM	NM	NM	24	26	26	26	27	32	38	36	29.4	25	*	
TF23	JR Hospital	453861	207513	NM	NM	NM	NM	20	26	30	29	27	27	26	27	26.3	23	*	
TF24	Marston Ferry Rd/Cherwell Drive	452739	208351	NM	NM	NM	NM	14	13	15	13	18	22	25	27	18.3	16	*	Monitoring not for LAQM (assessing human exposure) purposes but to assess potential AQ impacts from traffic displacement that result from future transport schemes
TF25	39 Marsh Lane	453186	208209	NM	NM	NM	NM	15	14	17	17	20	21	27	33	20.5	17	*	
TF26	Northway/Cutteslowe Park	451091	210175	NM	NM	NM	NM	24	24	31	30	28	20	23	36	27.0	23	*	Monitoring not for LAQM (assessing human exposure) purposes but to assess potential AQ impacts from traffic displacement that result from future transport schemes
TF27	Northern Bypass/Phillips Tyres	452691	209225	NM	NM	NM	NM	42	47	51	48	51	46	54	54	49.1	**42**	*	Monitoring not for LAQM (assessing human exposure) purposes but to assess potential AQ impacts from traffic displacement that result from future transport schemes
TF28	Horspath Driftway/Agwar Stone Rd	455454	205164	NM	NM	NM	NM	20	23	25	21	22	29	33	33	25.5	22	*	
TF29	109 Old Road	455138	206375	NM	NM	NM	NM	14	NR	15	14	18	20	25	22	18.0	15	*	
TF30	99 Oliver Road	455405	204262	NM	NM	NM	NM	34	34	38	37	37	43	48	53	40.5	34	*	
TF31	Brasenose Farm/Eastern Bypass	455602	204986	NM	NM	NM	NM	47	46	55	54	53	47	50	51	50.3	**43**	*	Monitoring not for LAQM (assessing human exposure) purposes but to assess potential AQ impacts from traffic displacement that result from future transport schemes
TF32	22 Garsington Road	454690	204160	NM	NM	NM	NM	17	17	23	22	24	24	28	34	23.7	20	*	
TF33	119 Barns Road	454490	203748	NM	NM	NM	NM	14	15	19	20	18	21	25	33	20.6	16	*	
TF34	Oxford Road/Newmans Road	453717	203250	NM	NM	NM	NM	40	40	41	42	34	39	NR	48	40.6	35	*	
TF35	67 Southern Bypass Road	448957	205761	NM	NM	NM	NM	65	67	71	73	64	67	64	62	66.4	**57**	*	Monitoring not for LAQM (assessing human exposure) purposes but to assess potential AQ impacts from traffic displacement that result from future transport schemes
TF36	Wolvercote Meadows 1	448095	208830	NM	NM	NM	NM	39	41	48	43	43	NR	35	46	42.3	36	*	Monitoring not for LAQM (assessing human exposure) purposes but to assess potential AQ impacts from traffic displacement that result from future transport schemes

DT ID	Site name	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 (0.74)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
TF37	Wolvercote Meadows 2	448688	210123	NM	NM	NM	NM	42	52	55	55	45	52	52	42	49.5	**42**	*	Monitoring not for LAQM (assessing human exposure) purposes but to assess potential AQ impacts from traffic displacement that result from future transport schemes

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

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

☒ **Local bias adjustment factor used.**

☐ **National bias adjustment factor used.**

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

☒ **Oxford City 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.

NR – Not Recovered (Lost/damaged/Erroneous data)

NM – Not Monitored

(*) According to paragraph 7.84 of the LAQM TG(22), considerations should be given to distance correct all the diffusion tubes that are not representative of human exposure, and whose concentrations fall within 10% of the NO_2 annual mean objective (i.e. > 36 ugm^{-3}), to account for the inherent uncertainty in diffusion tube monitoring concentration data. In 2022, only 6 of the diffusion tube monitoring results showed NO_2 concentration levels > 36 ugm^{-3} - Diffusion tubes: DT55; TF19; TF27; TF31; TF35 and TF37

However,

Diffusion tubes TF19; TF27; TF31; TF35 and TF37 have been installed away from residential areas and hence away from receptors. This is because the nature of this monitoring work is completely different from the LAQM one – These tubes have not been installed to directly assess relevant human exposure to air pollution, but instead to assess the potential air quality impacts from traffic displacement, that may occur as a result of future traffic schemes that are being considered for implementation in Oxford city. As such, these tubes have not been corrected for distance.

The only tube that was corrected for distance in this AQ AS Report was DT 55 – St Clements

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

New or Changed Sources Identified Within Oxford during 2022

Oxford City Council has not identified any new sources relating to air pollution within the reporting year of 2022.

Additional Air Quality Works Undertaken by Oxford City Council during 2022

Oxford City Council has increased diffusion tube monitoring capability in 2022. Thirty Seven (37) extra new monitoring locations were added to the network, in order to increase our knowledge of air quality baseline levels across the city, and which will allow us to better estimate the potential impacts of future traffic related interventions in the city. Oxford City Council is now monitoring air quality at a total of 127 locations (126 with diffusion tubes, 3 with automatic monitors and 2 locations where both techniques are used).

QA/QC of Diffusion Tube Monitoring

Oxford City Council changed the laboratory for diffusion tube analysis in 2022, due to the fact that South Yorkshire Air Quality Samplers (our previous supplier) have ceased to operate.

As such, Oxford's diffusion tubes were supplied and analysed in 2022 by the accredited laboratory (SOCOTEC), using the 50% Triethanolamine (TEA) in Acetone method, and using a standard operating procedure (ANU/SOP/1015) that meets the guidelines set out in DEFRA's 'Diffusion Tubes for Ambient NO_2 Monitoring: Practical Guidance.

SOCOTEC is subject to quality assurance testing as part of their accreditation. This involves an independent comparison to other laboratories, under the independent AIR-PT scheme. The results of the latest inter-comparisons are publicly available for scrutiny.

All the diffusion tubes used in the 2022 monitoring campaign were replaced according to DEFRA's 2022 diffusion tube monitoring calendar and within the ± 2 days due date tolerance.

Diffusion Tube Annualisation

Thirty seven (37) diffusion tube monitoring locations had an annual data capture below 75% in 2022 due to the fact of these tubes only having been installed in May 2022. As such, annualisation was required at those sites. The annualisation procedures used were the ones detailed on LAQM TG 22 Box 7-10 for NO_2 monitoring diffusion tube data. Three AURN Urban background sites and one AURN Rural Background site were used for annualisation purposes: Oxford St Ebbes, Leamington Spa, Swindon Walcot, and Chilbolton Observatory. All these sites were chosen as each one of them have a percentage of data capture > 85% and also because they are both located at less than 50 miles away from our monitoring sites, as per the annualisation requirements. Table 13 (below) provides the summary of the annualisation procedure for these sites.

Table 13 - Annualisation Summary (concentrations presented in µg/m^3)

Site ID	Annualisation Factor AURN St Ebbes	Annualisation Factor AURN Swindon Walcot	Annualisation Factor AURN Leamington Spa	Annualisation Factor AURN Chilbolton Observatory	Average Annualisation Factor	Raw Data Annual Mean	Annualised Annual Mean *
TF1	1.11	1.21	1.13	1.15	1.15	11	12
TF2	1.11	1.21	1.13	1.15	1.15	15	17
TF3	1.11	1.21	1.13	1.15	1.15	30	34
TF4	1.10	1.20	1.14	1.13	1.14	15	17
TF5	1.11	1.21	1.13	1.15	1.15	17	19
TF6	1.11	1.21	1.13	1.15	1.15	18	20
TF7	1.11	1.21	1.13	1.15	1.15	28	32
TF8	1.11	1.21	1.13	1.15	1.15	23	27
TF9	1.11	1.21	1.13	1.15	1.15	24	28
TF10	1.02	1.09	1.04	1.08	1.06	25	26
TF11	1.11	1.21	1.13	1.15	1.15	20	23
TF12	1.11	1.21	1.13	1.15	1.15	20	23
TF13	1.11	1.21	1.13	1.15	1.15	24	27
TF14	1.20	1.42	1.34	1.28	1.31	15	20
TF15	1.11	1.21	1.13	1.15	1.15	42	48
TF16	1.11	1.21	1.13	1.15	1.15	33	38
TF17	1.11	1.21	1.13	1.15	1.15	30	35
TF18	1.11	1.19	1.09	1.16	1.14	19	22
TF19	1.11	1.21	1.13	1.15	1.15	82	95
TF20	1.11	1.21	1.13	1.15	1.15	19	22
TF21	1.11	1.21	1.13	1.15	1.15	26	30
TF22	1.11	1.21	1.13	1.15	1.15	29	34
TF23	1.11	1.21	1.13	1.15	1.15	27	30
TF24	1.11	1.21	1.13	1.15	1.15	18	21
TF25	1.11	1.21	1.13	1.15	1.15	21	24
TF26	1.11	1.21	1.13	1.15	1.15	27	31
TF27	1.11	1.21	1.13	1.15	1.15	49	56
TF28	1.11	1.21	1.13	1.15	1.15	26	30
TF29	1.07	1.14	1.09	1.10	1.10	18	20
TF30	1.11	1.21	1.13	1.15	1.15	41	47
TF31	1.11	1.21	1.13	1.15	1.15	50	58
TF32	1.11	1.21	1.13	1.15	1.15	24	27
TF33	1.11	1.21	1.13	1.15	1.15	19	21
TF34	1.11	1.22	1.17	1.13	1.16	41	47
TF35	1.11	1.21	1.13	1.15	1.15	67	77
TF36	1.10	1.20	1.14	1.13	1.14	42	48
TF37	1.11	1.21	1.13	1.15	1.15	49	57

* A bias adjustment factor still needs to be applied to this column, to arrive to the final annual mean NO_2 concentration for each site

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.

In 2022, Oxford City Council has conducted one local co-location study at roadside AURN Oxford Centre. The bias adjustment factor that was obtained from this study was **0.74**.

The average of the national bias correction factor for diffusion tubes from all the UK labs that tested using the same Acetone method (50% TEA) was of **0.80**, and can be found on the latest version of the National Diffusion Tube Bias Adjustment Factor spreadsheet (March 2023).

However, if we only consider the average of all the studies conducted by SOCOTEC Didcot (Oxford City Council's lab), the factor reduces to **0.76**.

Although recognising that this year's national bias factor is slightly higher than the local one, Oxford City Council decided to still use its local bias adjustment factor in this report, for a question of methodology and consistency with previous AQ ASRs, and also due to the fact that our local co-location studies have presented *"good"* precision for the diffusion tubes in 2022, together with high quality chemiluminescence results, and an extremely high data capture rate for NO_x (>99%) obtained from our AURN monitoring sites.

A summary of bias adjustment factors used by Oxford City Council over the past five years is presented in Table 14 below.

Table 15 (below) shows the accuracy of the local bias adjustment factors used in 2022, as well as the most relevant figures resulting for the calculation of the bias adjustment factor, and which have been obtained using DEFRA's approved bias adjustment factor spread sheet.

Table 14 - Bias Adjustment Factors

Monitoring Year	Local or National	If National, Version of National Spreadsheet	Adjustment Factor
2022	Local	NA	0.74
2021	Local	NA	0.98/0.98
2020	Local	NA	0.96/0.97
2019	Local	NA	0.94/1.05
2018	Local	NA	0.89/0.97

Table 15 - Local Bias Adjustment Calculations

	Local Bias Adjustment (AURN Oxford Centre)
Periods used to calculate bias	12
Bias Factor A	0.74 (0.7-0.79)
Bias Factor B	35% (27% - 43%)
Diffusion Tube Mean (µg/m^3)	44
Mean CV (Precision)	5
Automatic Mean (µg/m^3)	33
Data Capture	100%
Adjusted Tube Mean (µg/m^3)	33 (31-35)

Notes:

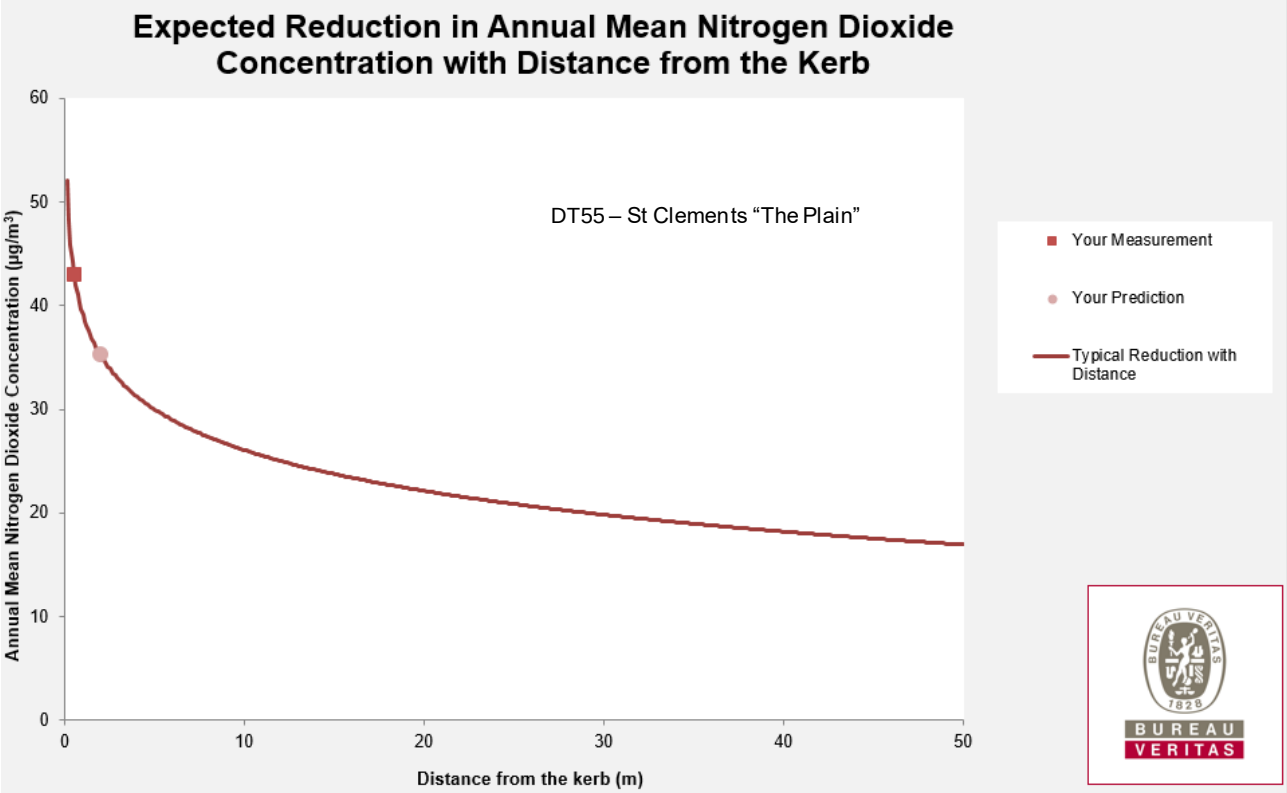
A single local bias adjustment factor has been used to bias adjust the 2022 diffusion tube results.

NO_2 Fall-off with Distance from the Road

Wherever possible, monitoring locations are representative of exposure. However, where this is not possible, the NO_2 concentration at the nearest location relevant for exposure has been estimated using the Diffusion Tube Data Processing Tool/NO_2 fall-off with distance calculator available on the LAQM Support website. Where appropriate, non-automatic annual mean NO_2 concentrations corrected for distance are presented on Table 16 (below).

Table 16 - NO_2 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
DT55	0.5	2	43	11	35.2	The Urban Background concentration value used for this correction was obtained from AURN St Ebbes



QA/QC of Automatic Monitoring

Oxford City Council currently operates three automatic monitoring sites. All routine calibration and maintenance is carried out by members of Oxford City Council's Environmental Quality team, and performed in accordance with manufacturers' and Automated Urban Monitoring Network site operators' manual. Instrument drift is routinely checked by:

- a daily internal instrument calibration which is carried out automatically using an electronic calibration check;
- every two weeks a manual external instrument calibration is carried out by Oxford City Council using gas cylinders that can be traced back to reference standards for each pollutant;
- every six months an audit of instrument response is carried out by an external organization using independent gas calibration standards.

The above checks enable data to be examined subsequently for instrument drift, which is expected, or for faulty data which is usually not expected. Before final publication of the air quality annual monitoring results for comparison against current legislation, the air quality data needs to be ratified.

Data Ratification is a detailed manual check of the data set carried out on a quarterly basis in all our automatic monitoring stations covered by the full QA/QC process. It requires a longer-term view of the dataset, incorporating the results from the independent QA/QC audits of the monitoring stations.

All the automatic monitoring data obtained in 2022 and presented within this ASR has been fully ratified by Ricardo Energy & Environment, following in full all the national AURN QA/QC procedures[21]. Live and Historic data from our 3 automatic monitoring sites can be found on the following websites:

- UK-Air
- AQ England
- Oxfordshire Air Quality Info

21 QA/QC Procedures for the UK Automatic Urban and Rural Air Quality Monitoring Network (AURN)

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

The instruments used at AURN St Ebbes and Oxford High Street to measure PM_{10} and $PM_{2.5}$ data (FIDAS), do not require the application of any correction factor.

Automatic Monitoring Annualisation

All automatic monitoring locations within Oxford City Council recorded data capture of greater than 75% for all pollutants, with the exception of $PM_{2.5}$ at Oxford High Street.

A FIDAS Instrument was installed at Oxford High Street on the 11th May 2022, allowing measurements of $PM_{2.5}$ to be undertaken for the first time at this monitoring site.

From the 23th September to the 14th December the FIDAS was not operational due to a series of software issues that led it to be shipped back to Germany for repair during this period. These two factors led for the complete data capture of $PM_{2.5}$ at this site to be of 41.04% in 2022. The $PM_{2.5}$ annual mean at Oxford High Street therefore had to be annualised.

The procedure followed was the one described in box 7-9 of the LAQM TG22 for the annualisation of continuous monitoring data. Table 17 below shows the annualisation procedure that was undertaken, and which includes reference to the sites used for this correction.

Table 17 - High Street $PM_{2.5}$ Annualisation Summary (means presented in µg/m^3)

AURN Urban Background Site	$PM_{2.5}$ Data Capture 2022 (%)	Distance to annualised site (Km)	Annual Mean $PM_{2.5}$ in 2022 (Am)	Period Mean 2022 (Pm)*	Ratio (Am/Pm)
Oxford St Ebbes	99.9	1	7.4	8.8	0.84
Reading New Town	95.7	39	7.9	9.3	0.85
Average Ratio					**0.85**
Oxford High Street $PM_{2.5}$ Raw Annual Mean					6.6
Oxford High Street $PM_{2.5}$ Annual Mean (Annualised)					**6**

*The period mean corresponds to the $PM_{2.5}$ averages that were obtained at the 2 AURN sites for the period that goes from 01/01/2022 to the 13/05/2022 16:00 and from 23/09/2022 07:00 to the 14/12/2022 16:00 – and correspond to the period where Oxford High Street was not monitoring $PM_{2.5}$

NO_2 Fall-off with Distance from the Road

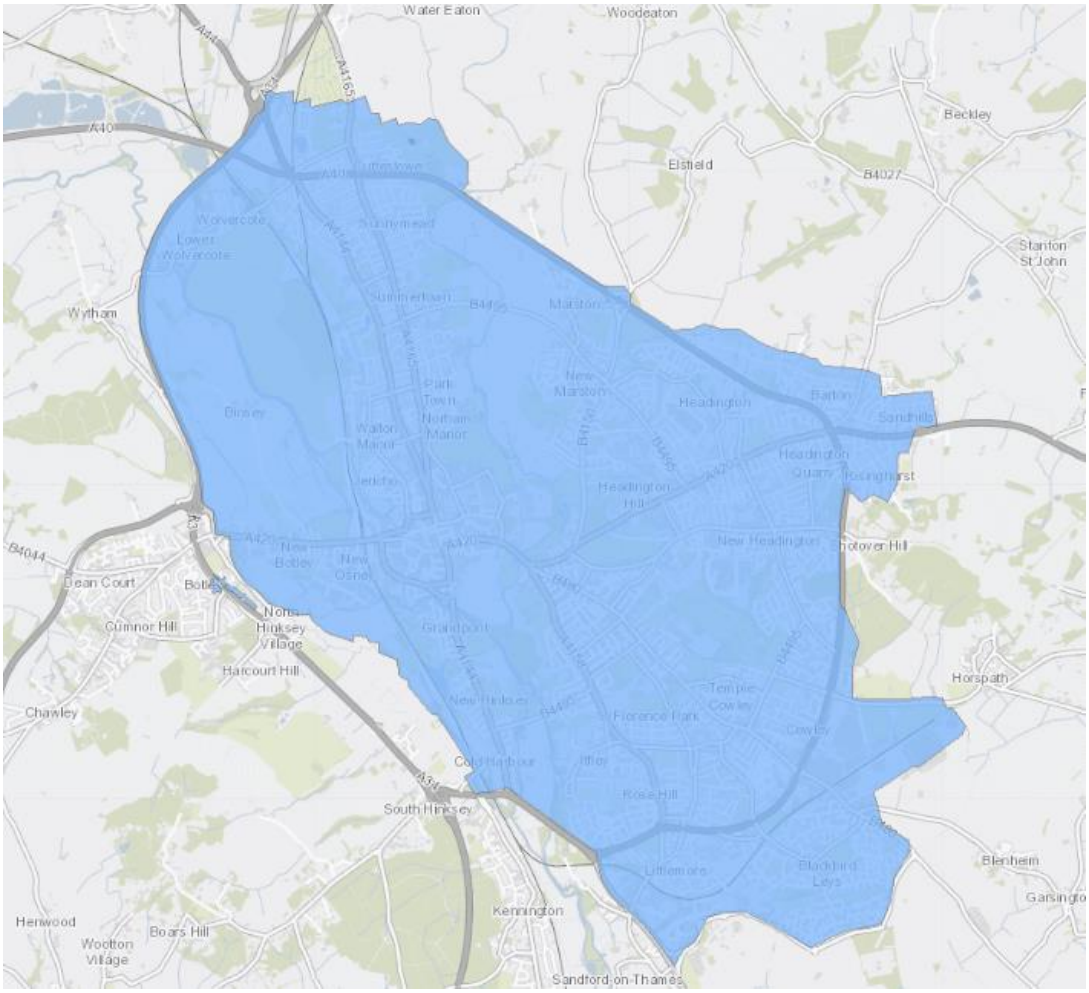
No automatic NO_2 monitoring locations within Oxford City Council required distance correction during 2022.

Appendix D: Maps of Monitoring Locations and AQMAs

The Council previously declared Air Quality Management Areas (AQMA's) in central Oxford (2003) and at Green Road roundabout (2005), as those were the locations where the UK nitrogen dioxide objectives were not being met at the time. Following further detailed assessments (2008 and 2009); several additional areas were identified where the nitrogen dioxide objectives were being breached.

As such, in September 2010 the City Council made an Air Quality Management Order declaring the whole city an AQMA for NO_2. Figure 8 below shows (in blue) the area of the city covered by the current AQMA for NO_2 and its boundaries. Figures 9 to 19 show the maps of the locations where air quality monitoring was conducted throughout 2022 and the levels of NO_2 measured. All the monitoring locations are within Oxford's current AQMA, with the exception of the locations of diffusion tubes TF1, TF2, TF3 and TF35.

Figure 8 - Boundary of Oxford's current city-wide AQMA for NO_2



Source: Defra's national AQMA Interactive map.

Figure 9 - Oxford's automatic and passive monitoring locations, 2022

Figure 10 - Oxford's diffusion tube locations by level of NO_2, 2022

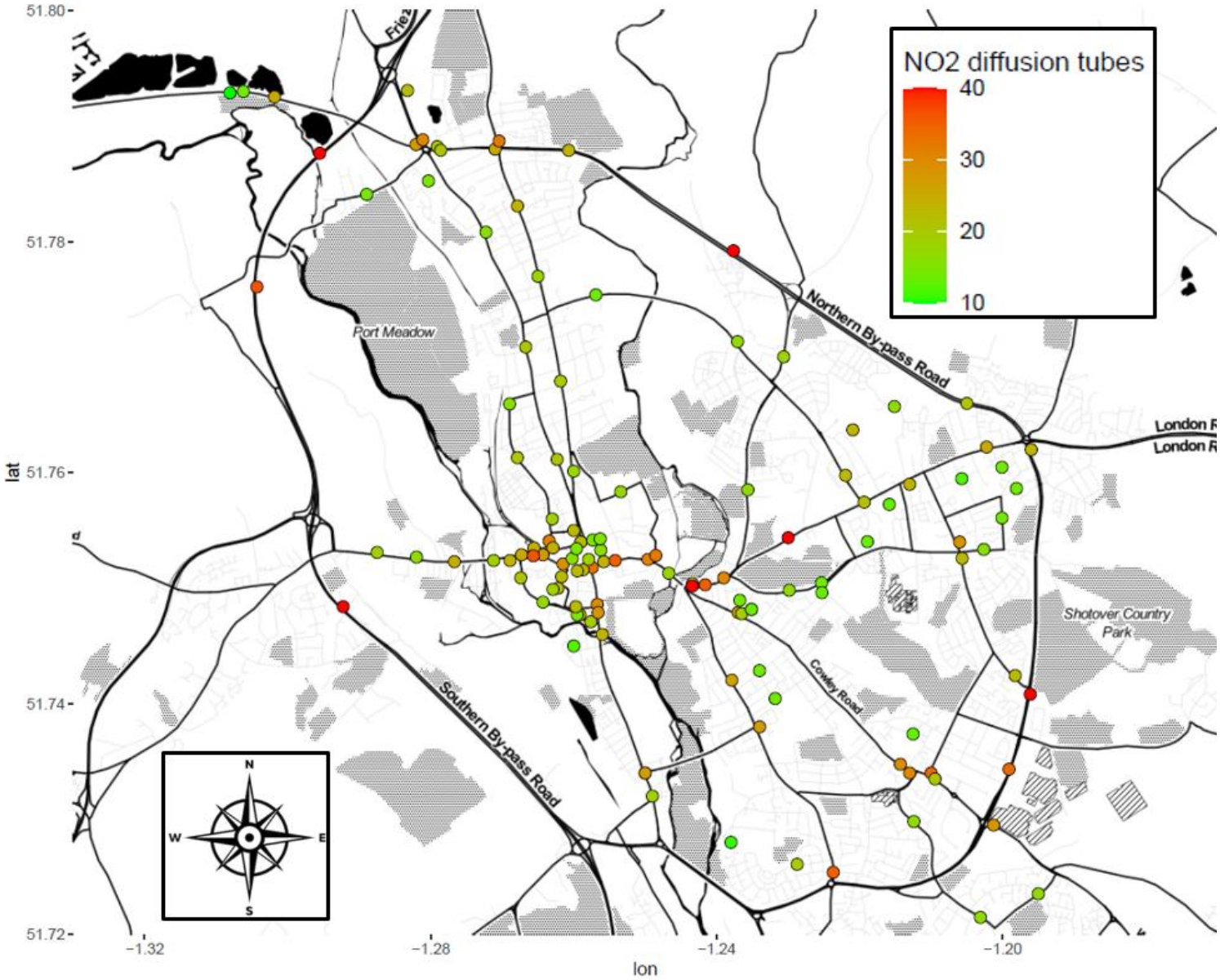


Figure 11 - Oxford City Centre area: diffusion tube locations by level of NO_2, 2022

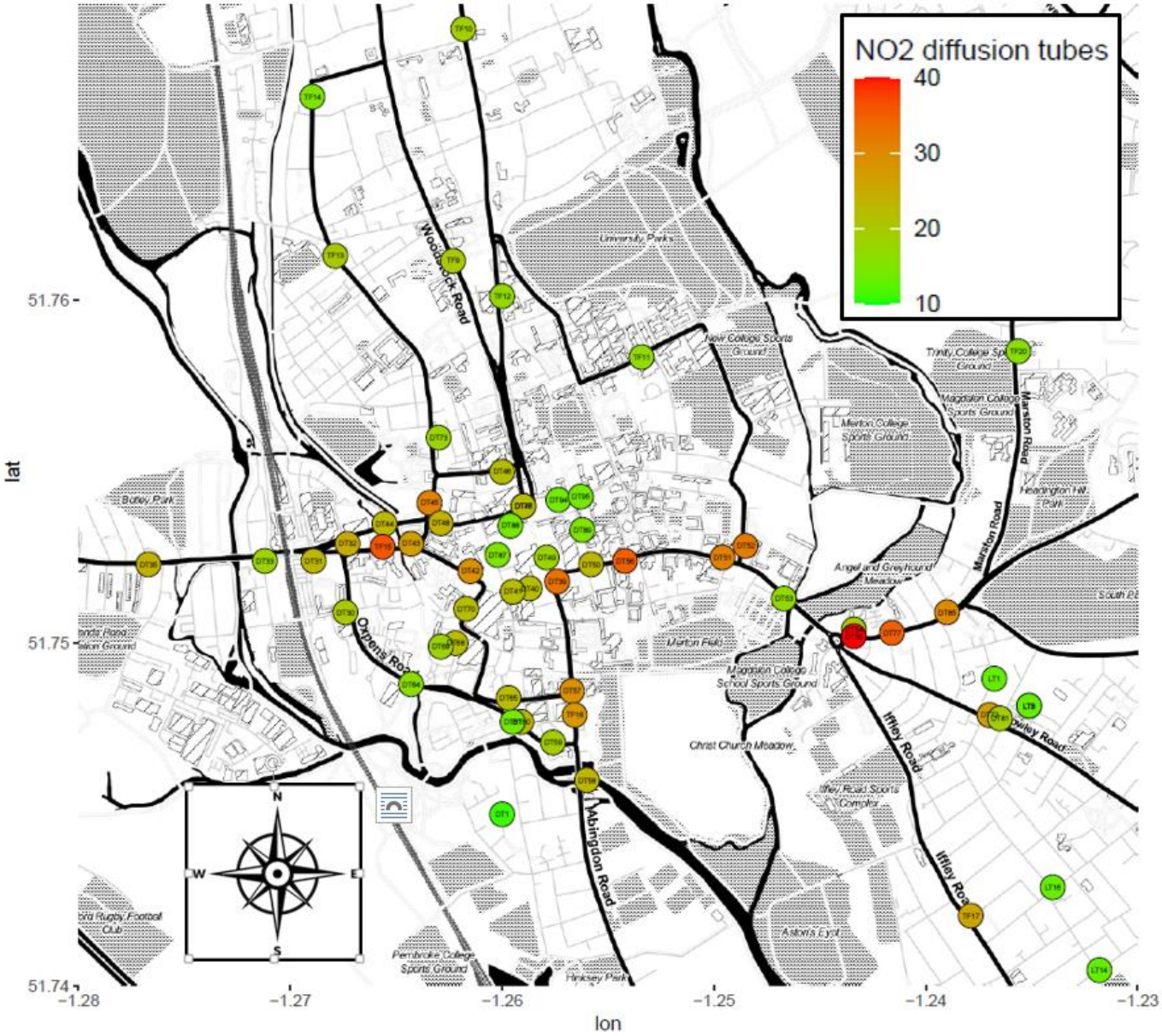


Figure 12 - Westgate area: diffusion tube locations by level of NO_2, 2022

Figure 13 - Botley area: diffusion tube locations by level of NO_2, 2022

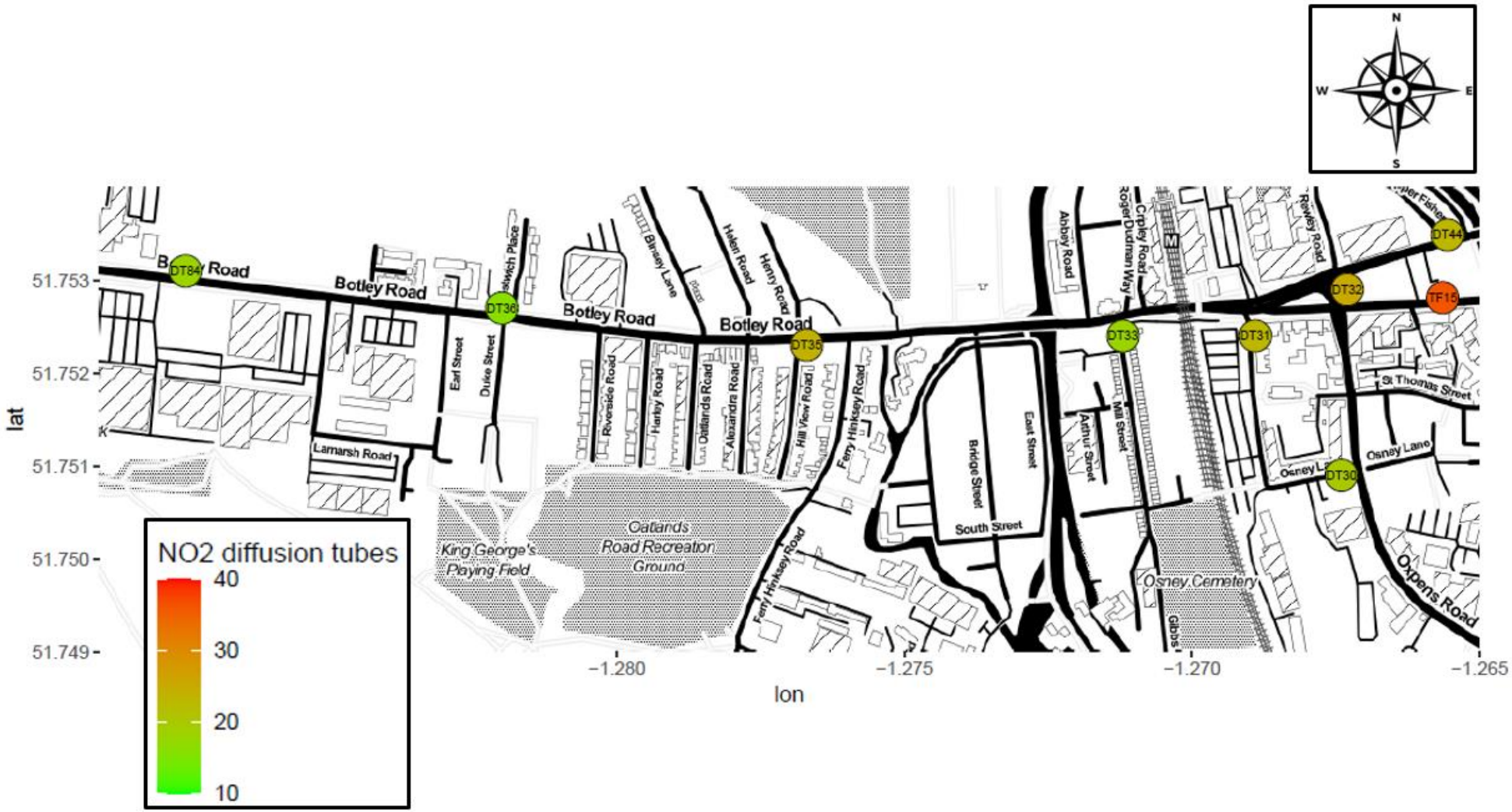


Figure 14 -St Clements area: diffusion tube locations by level of NO_2, 2022

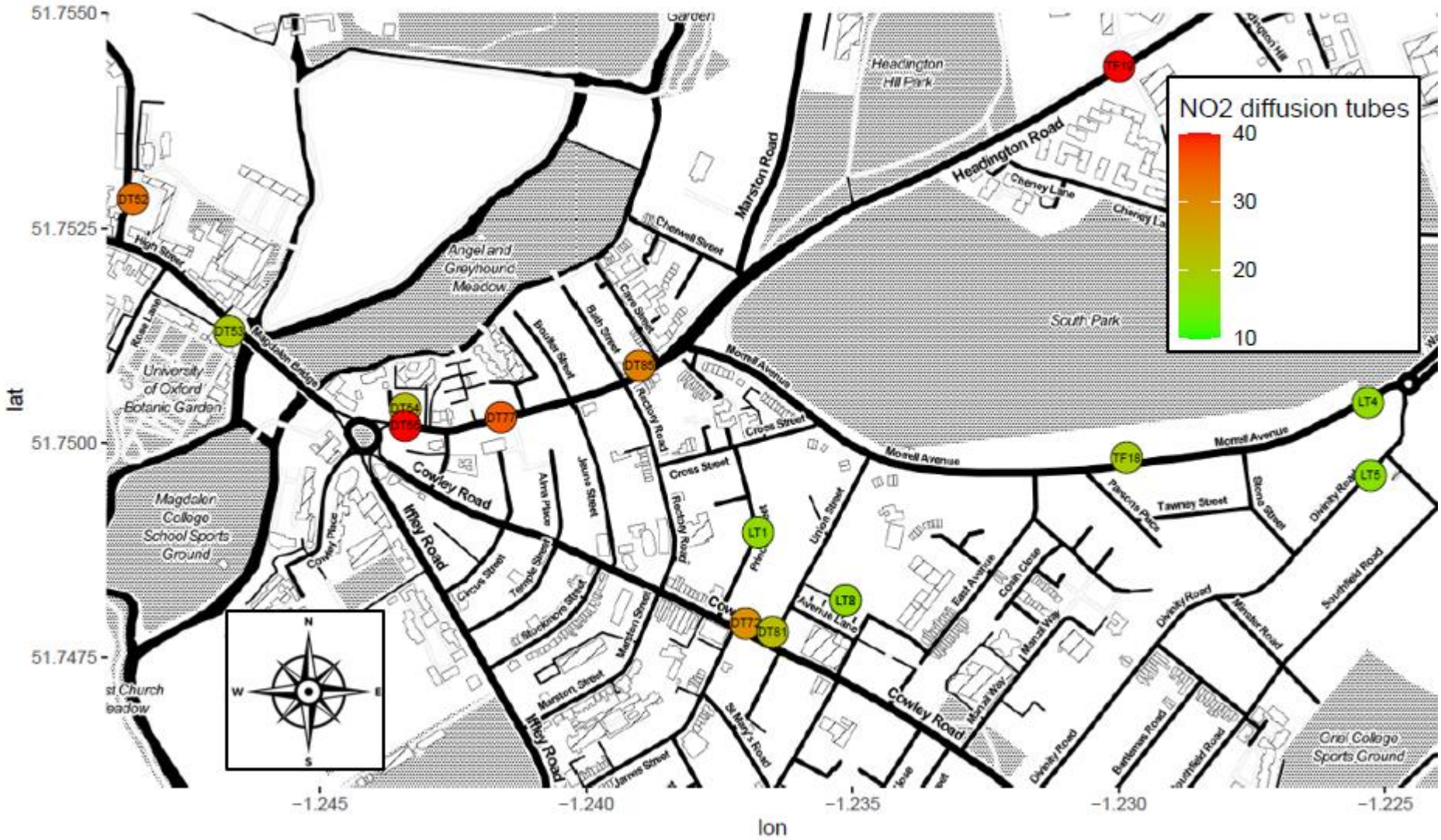


Figure 15 - George St and ZEZ Pilot areas: diffusion tube locations by level of NO_2, 2022

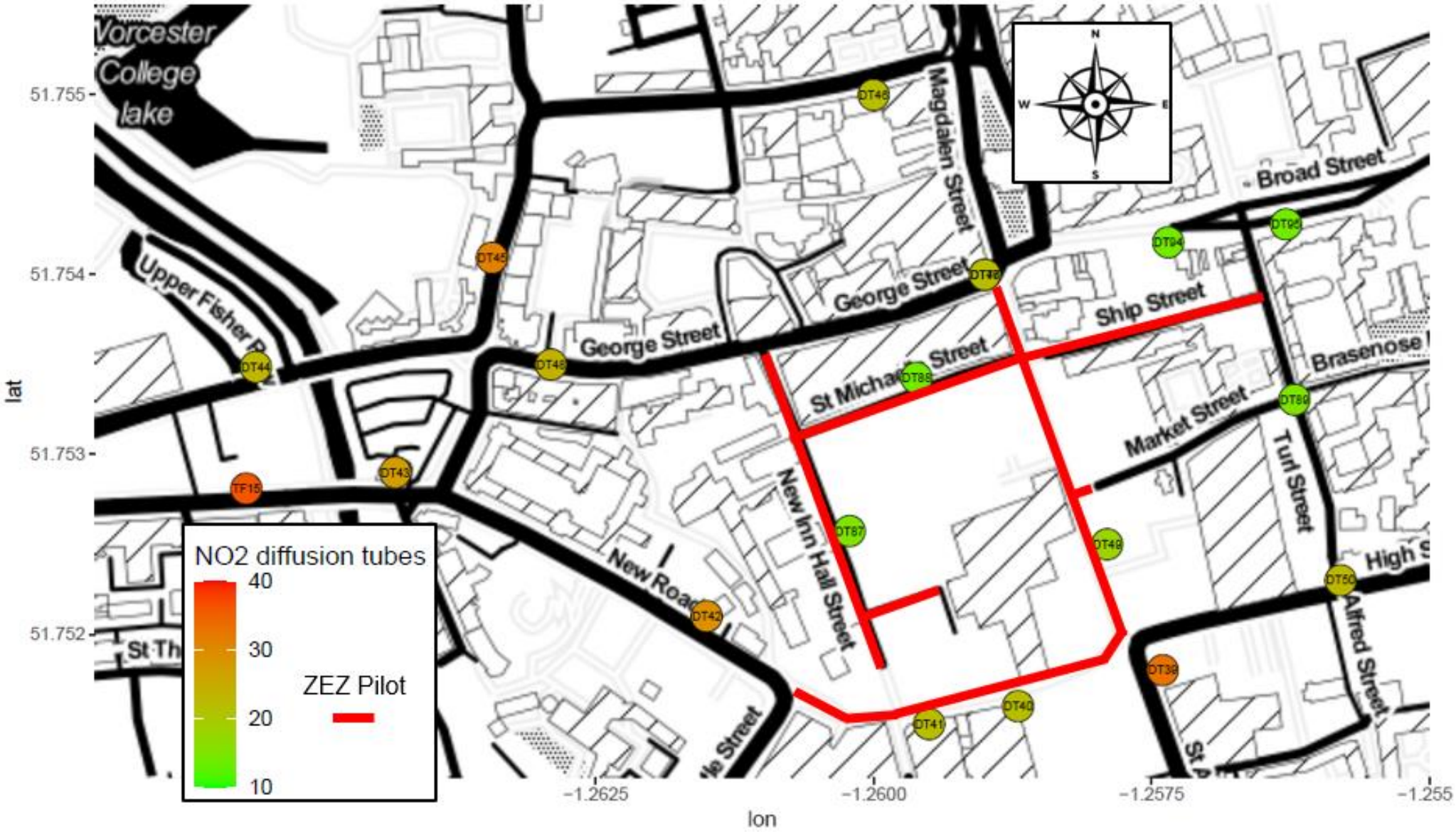


Figure 16 - High Street area: diffusion tube locations by level of NO_2, 2022

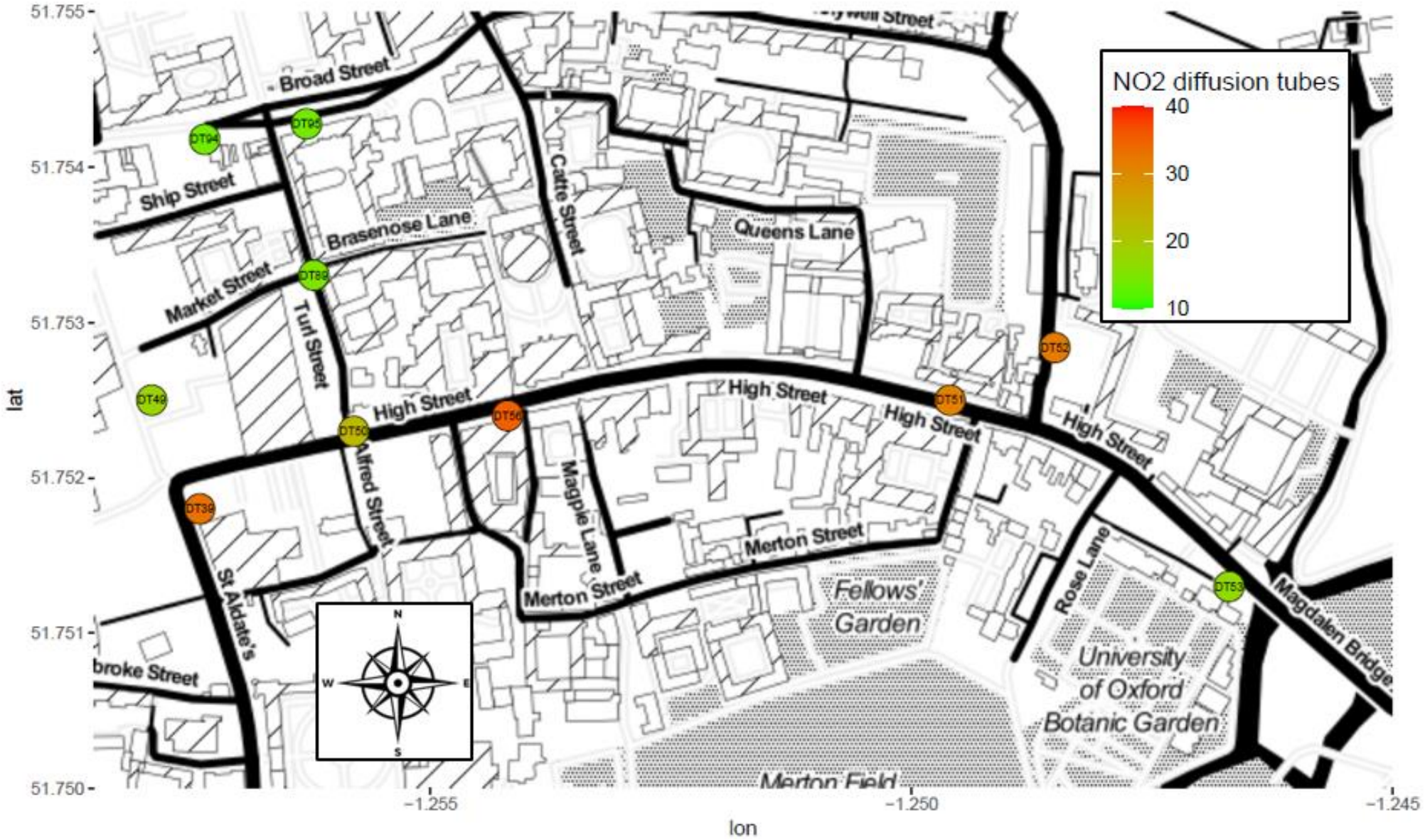


Figure 17 - Cutteslowe/Wolvercote area: diffusion tube locations by level of NO_2, 2022

Figure 18 - Black Bird Leys/ Rose Hill/ Garsington Road area: diffusion tube locations by level of NO_2, 2022

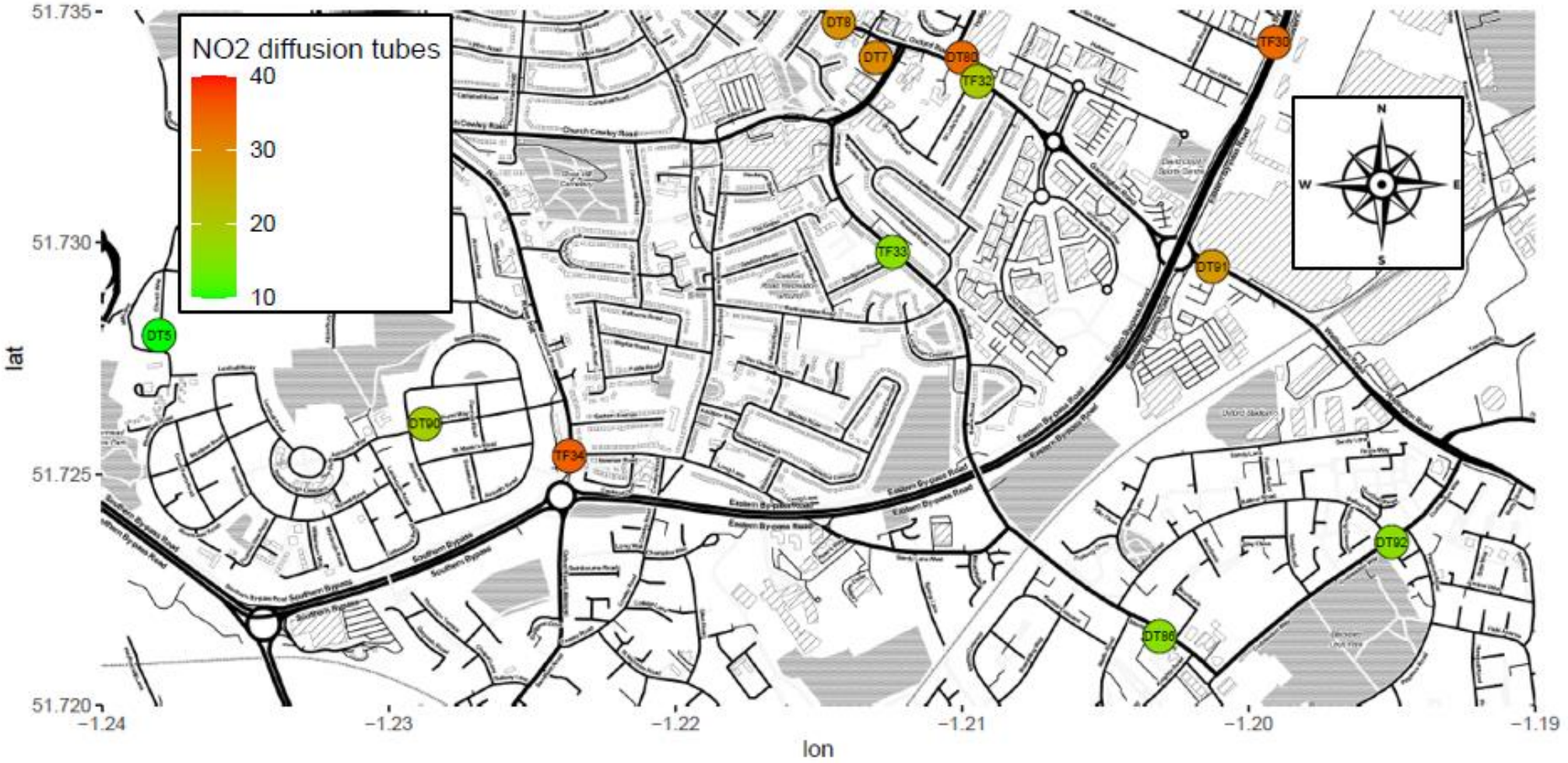
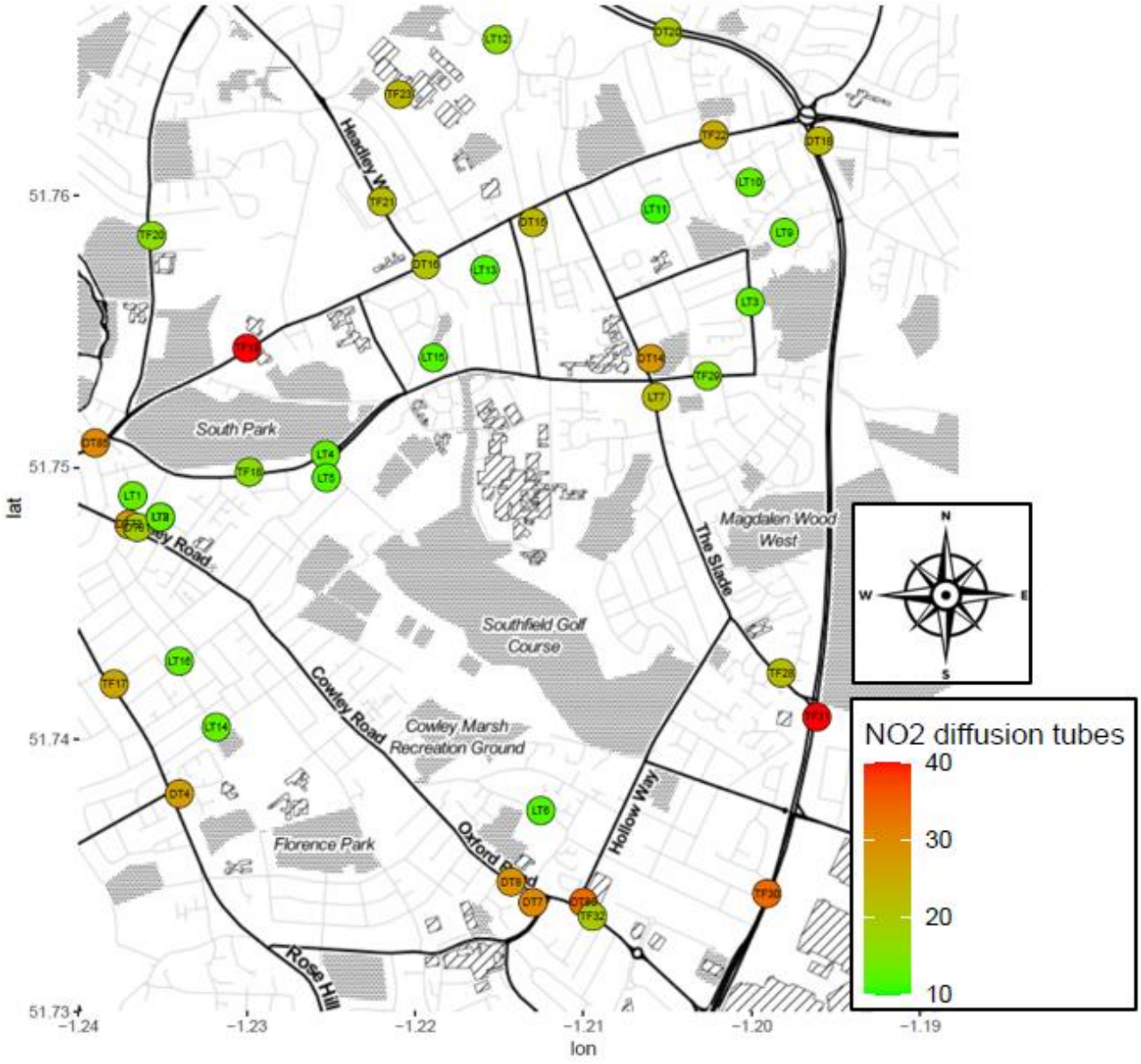


Figure 19 - East Oxford area: diffusion tube locations by level of NO_2, 2022



Appendix E: Summary of Air Quality Objectives and WHO recommended guidelines in England

Table 18 – Air Quality Objectives in England[22]

Pollutant	Air Quality Objective: Concentration	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
Particulate Matter ($PM_{2.5}$)	10 µg/m^3	Annual mean
Ozone (O_3)	100 µg/m^3 not to be exceeded more than 10 times a year	8 hour mean

Table 19 - New World Health Organisation recommended air pollution guidelines

	Recommended guidelines for each pollutant	
Pollutant	**Concentration (µg/m^3)**	**Measured as**
Nitrogen Dioxide (NO_2)	200	1-hour mean
Nitrogen Dioxide (NO_2)	25	24-hour mean
Nitrogen Dioxide (NO_2)	10	Annual mean
Particulate Matter (PM_{10})	45	24-hour mean
Particulate Matter (PM_{10})	15	24-hour mean
Particulate Matter ($PM_{2.5}$)	5	Annual mean
Particulate Matter ($PM_{2.5}$)	100	8 hour mean
Ozone (O_3)	60	Peak season[23]

22 The units are in microgrammes of pollutant per cubic metre of air (µg/m^3).

23 Average of daily maximum 8 hour mean O_3 concentration in the six consecutive months with the highest six month average O_3 concentration.

Appendix F: Time variations and calendar plots of Oxford's automatic monitoring

Figure 20 -NO_2 time variations at Oxford's automatic monitoring sites along calendar year 2022

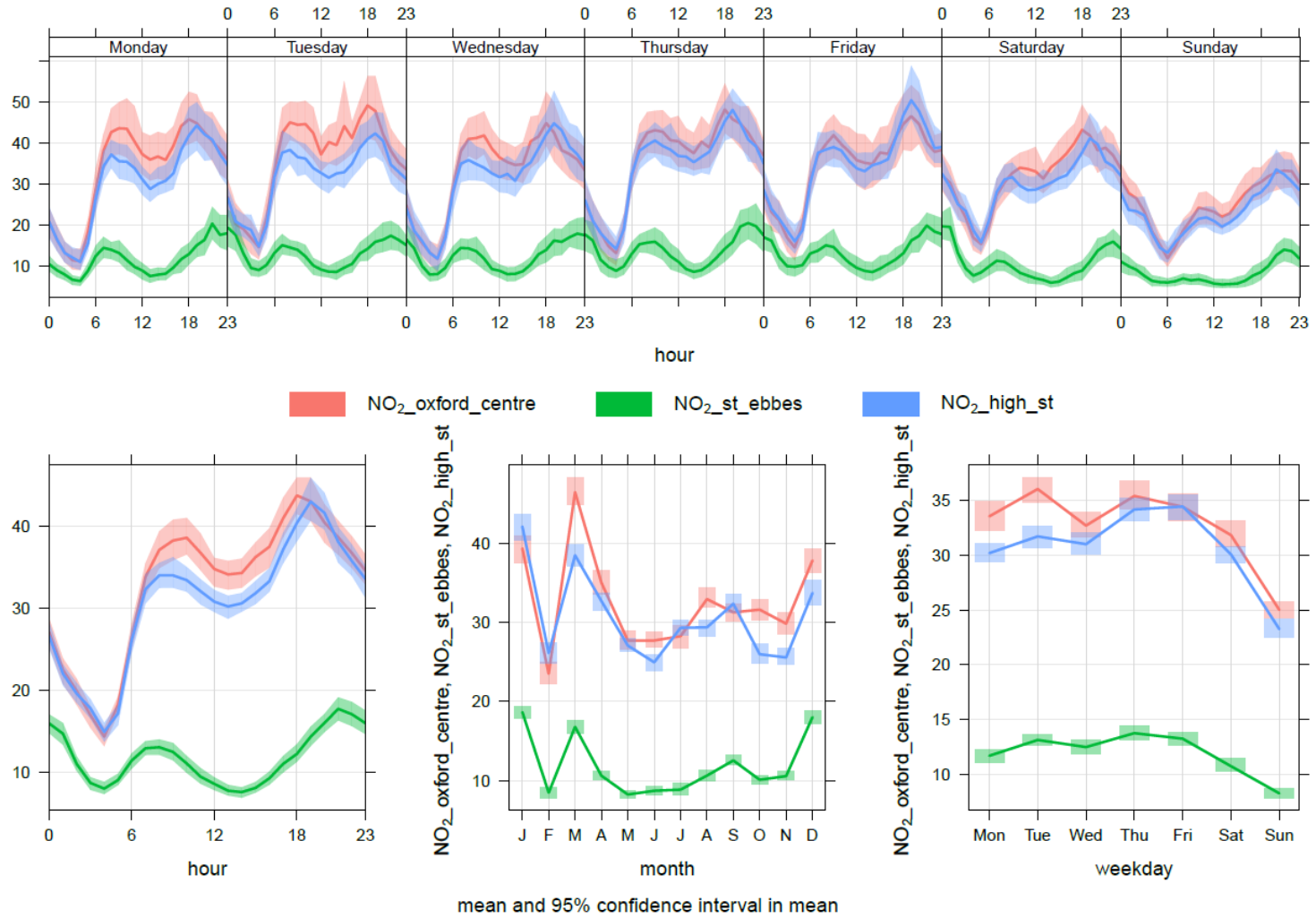


Figure 21 - Oxford's 3 NO_2 automatic monitoring sites (basic statistics 2022)

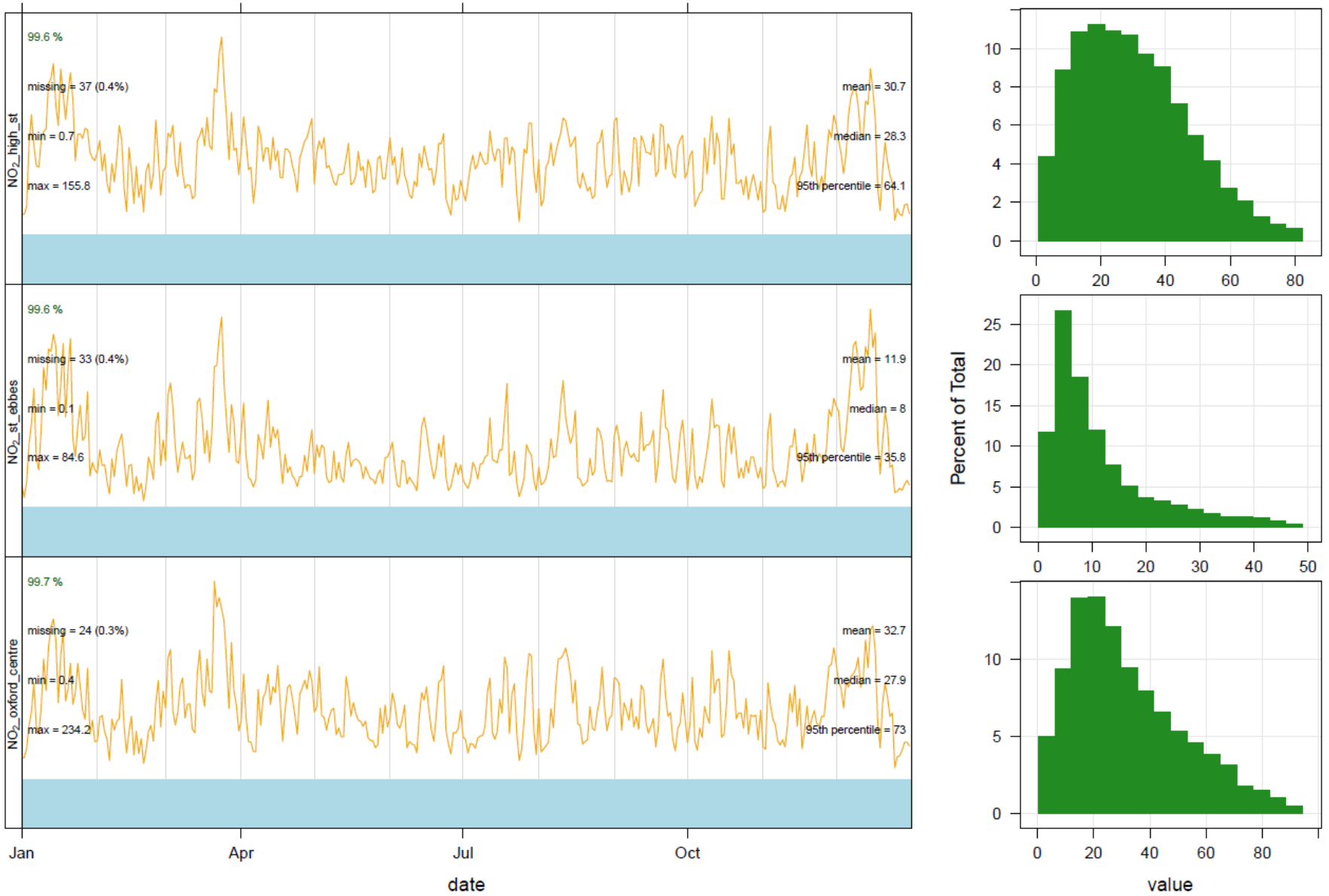


Figure 22 - Daily NO_2 averages at AURN Oxford Centre in 2022

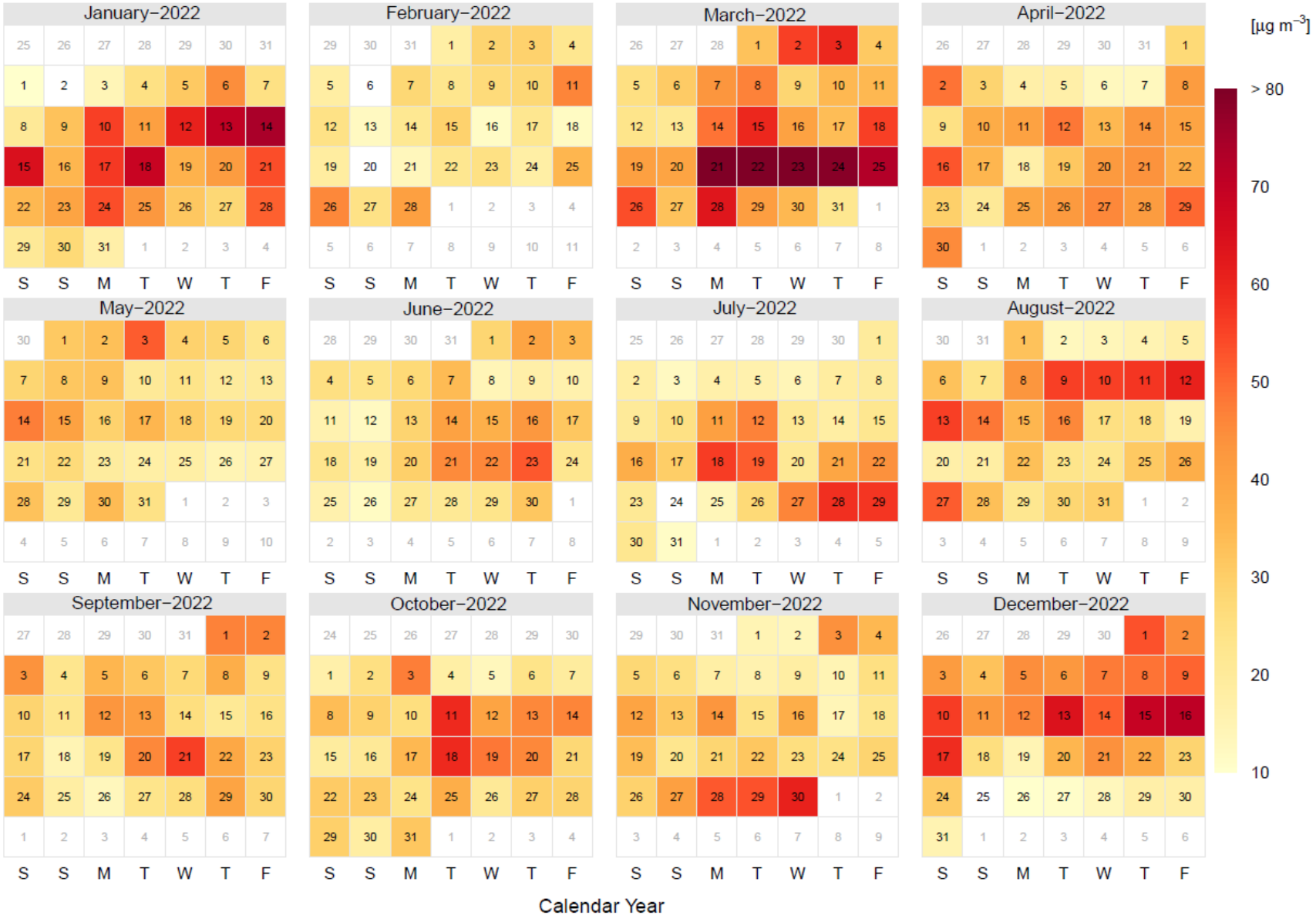


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Figure 23 -Daily NO_2 averages at AURN St Ebbes in 2022

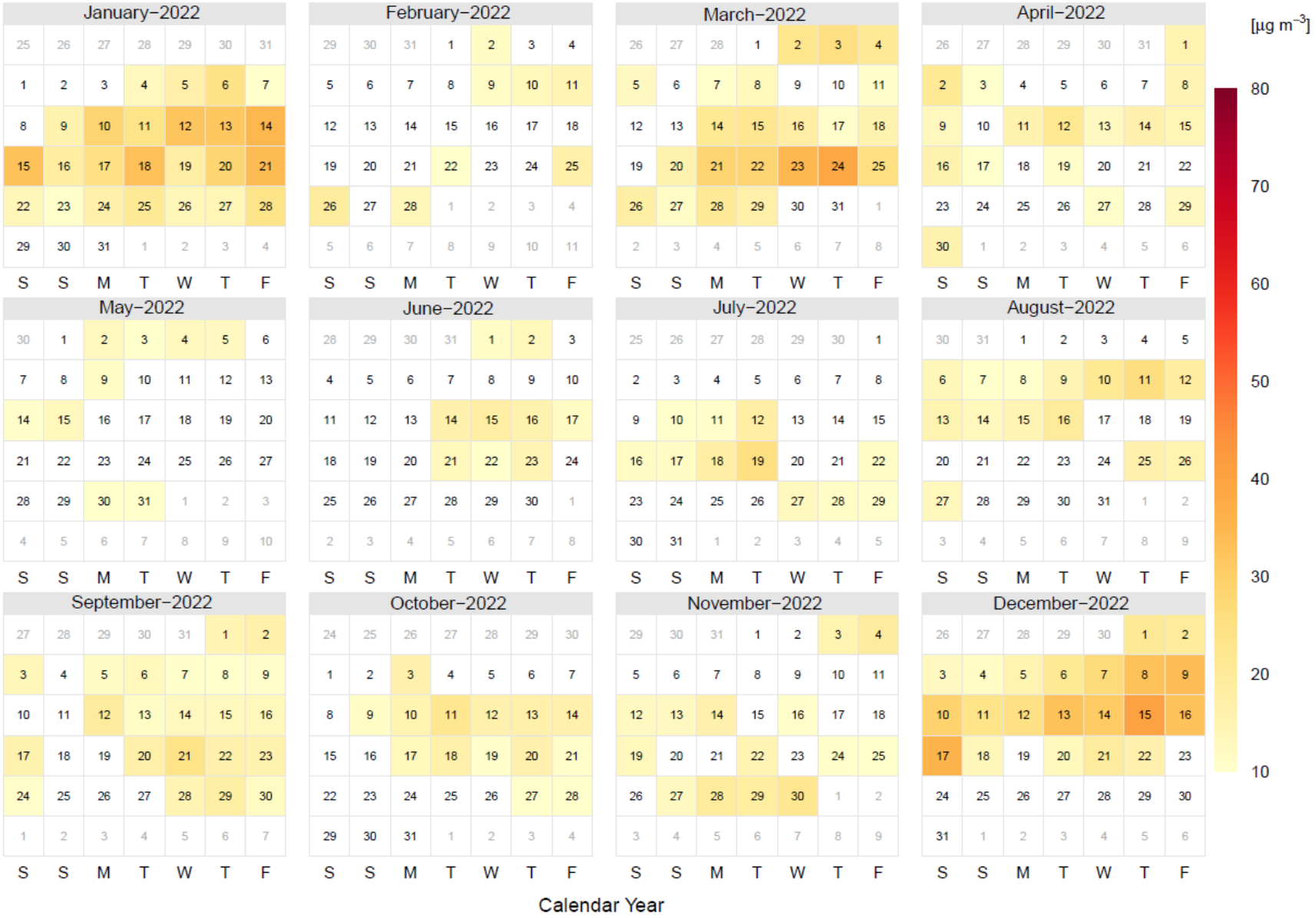


Figure 24 - Daily NO_2 averages at Oxford High Street in 2022

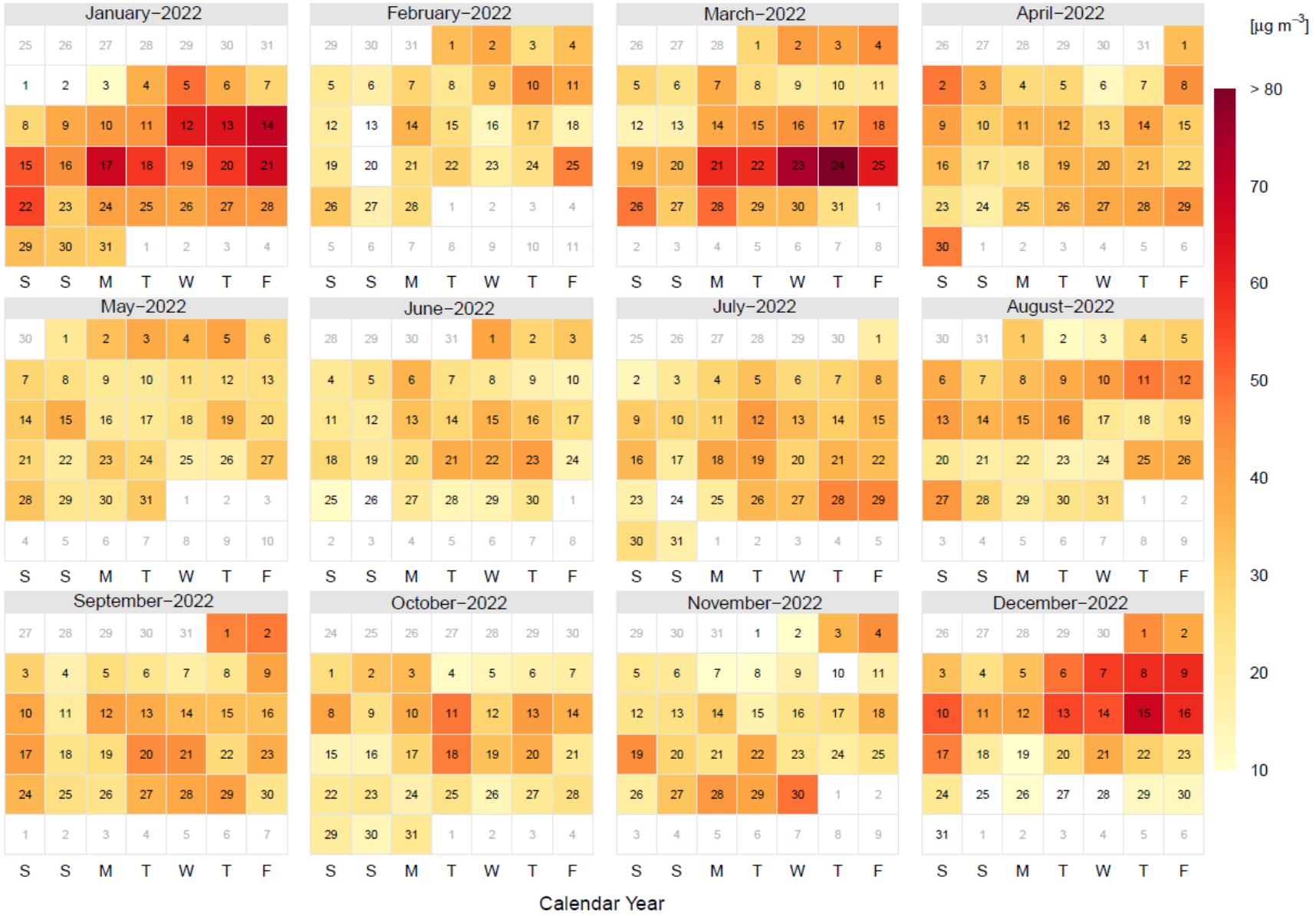
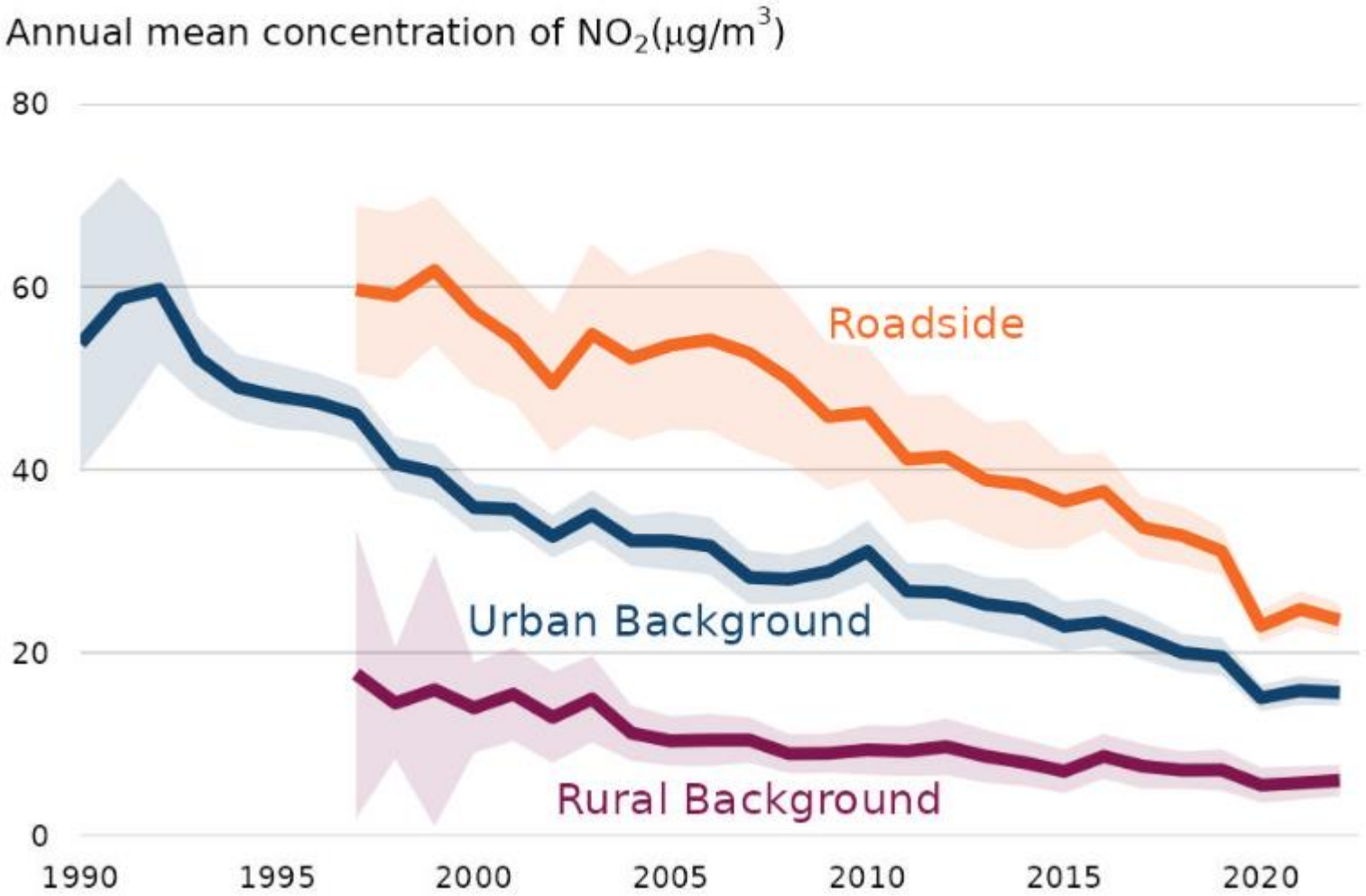


Figure 25 - Annual mean concentrations of NO2 in the UK, 1990 to 2022



In 2022, average NO_2 concentrations at UK's AURN Roadside and Urban Background sites have decreased (on average) by 5% and 1% respectively, when compared with the measurements obtained in the previous year.

Glossary of Terms

Abbreviation	Description
AADT	Annual Average Daily Traffic - (AADT) is the total volume of vehicle traffic on a highway or road for a year divided by 365 days.
AIR-PT	Independent analytical Proficiency Testing Scheme that offers a number of test samples designed to test the proficiency of laboratories undertaking analysis of chemical pollutants in ambient indoor, stack and workplace air.
ANPR	Automatic Number Plate Recognition technology.
AQ	Air Quality
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.
AQI	Air Quality Index – The AQI Tells you about levels of air pollution and provides recommended actions and health advice. The index is numbered 1-10 and divided into four bands, low (1) to very high (10).
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 –Document that reviews on an annual basis current and likely future air quality and assess whether air quality objectives are currently being achieved or are likely to be achieved.
AURN	Automatic Urban & Rural Network.
CAZ	Clean Air Zone.
COPD	Chronic obstructive pulmonary disease - a chronic inflammatory lung disease that causes obstructed airflow from the lungs. Symptoms include breathing difficulty, cough, mucus (sputum) production and wheezing.
COVID-19	Disease caused by a new strain of coronavirus. CO stands for corona, VI for virus, and D for disease.
CPZs	Controlled parking zones - areas where parking is only permitted in designated parking bays, and the rest of the kerbside space is restricted by yellow lines. Any illegally parked cars are issued with a parking ticket.
DCs	District Councils
DEFRA	Department for Environment, Food and Rural Affairs.
DfT	Department for Transport.
DT	Diffusion Tube.
DVLA	Driver and Vehicle Licensing Agency
EDF	*Électricité de France*

Abbreviation	Description
EIP	Government's Environmental Improvement Plan
ESO	Energy Super Hub Oxford
ETRO	Experimental traffic regulation order
EVs	Electric Vehicles.
FIDAS	Fine Dust Monitor System that uses optical light scattering to detect and measure aerosol particles.
FoE	Friends of the Earth.
GULO	Go Ultra Low Oxford project.
HC/HCV	Hackney Carriage/Hackney Carriage Vehicle
LAQM	Local Air Quality Management – A UK Government policy framework that requires local authorities to periodically review and assess the current and future air quality in their areas.
LAQM PG22	Local Air Quality Management Policy Guidance.
LAQM TG22	Local Air Quality Management Technical Guidance.
LAs	Local Authorities.
LCWIP	Local Cycling and Walking Infrastructure Plan.
LEVI	Local Electric Vehicle Infrastructure Strategy.
LEZ	Low Emission Zone - defined area where access by some polluting vehicles is restricted or deterred with the aim of improving air quality. This may favour vehicles such as (certain) alternative fuel vehicles, hybrid electric vehicles, plug-in hybrids, and zero-emission vehicles such as all-electric vehicles.
LTNs	Low Traffic Neighbourhoods –residential areas where vehicles not stopping in the area are prevented or discouraged from driving through them.
LV	Limit Value – Legally binding pollution levels that must not be exceeded. LVs are set for individual pollutants and are made up of a concentration value, an averaging time over which it is to be measured, the number of exceedances allowed per year, if any, and a date by which it must be achieved. Some pollutants have more than one limit value covering different endpoints or averaging times.
NHS	National Health System
NO	Nitric Oxide – Formed from nitrogen (N) in the atmosphere during high temperature combustion
NO_2	Nitrogen Dioxide – Formed in small amounts in the atmosphere during high temperature combustion, but the majority is formed in the atmosphere through conversion of nitric oxide (NO) in the presence of ozone (O_3)
NO_x	Nitrogen Oxides – collective term used to refer to nitric oxide (NO) and nitrogen dioxide (NO_2). Nitrogen oxides are produced from fuel combustion in mobile (eg. cars) and stationary (eg power plants) sources.

Abbreviation	Description
O_3	Ozone
ODS	Oxford Direct Services Limited commenced trading on 1st April 2018 and is wholly owned by Oxford City Council. The company brings together the majority of Oxford City Council's front line operational services.
OLEV	UK Government's Office for Low Emission Vehicles
PM	Particulate Matter.
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.
PH	Private Hire
PHOF	Public Health Outcomes Framework
QA/QC	Quality Assurance and Quality Control.
RUC	Road User Charging scheme.
SCAs	Smoke Control Areas – legally defined area where only approved solid fuels or exempted appliances can be used within buildings.
STOP	Schools Tackling Oxford's Air Pollution
TEA	Triethanolamine – Viscous organic compound that is used in diffusion tubes as an absorbent for NO_2.
TRIG	Transport Innovation Grant Fund
µg	Microgramme – One millionth of a gram
$\mu g/m^3$	Microgrammes per cubic metre of air – A unit for describing the concentration of air pollutants in the atmosphere, as a mass of pollutant per unit volume of clean air.
UK	United Kingdom.
WHO	World Health Organisation.
WOW	Year round walk to school programme
WPL	Workplace Parking Levy – Charge that a local authority can place on private business commuter parking to both manage peak time traffic congestion, improve air quality, and generate revenue for transport investment.
ZEBRA	Zero Emission Bus Regional Areas scheme.
ZEV	Zero Emission Vehicle
ZEZ	Zero Emission Zone – area designed to reduce traffic volumes, encourage the uptake of zero emission vehicles and lead to other positive behavioural changes; all of these would reduce vehicle emissions and hence air pollution whilst maintaining access for those who need it.

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