

WARRINGTON Borough Council



2022 Air Quality Annual Status Report (ASR)

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

Date: June, 2022

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Executive Summary: Air Quality in Our Area

Air Quality in Warrington

Air pollution is associated with a number of adverse health impacts. It is recognised as a contributing factor in the onset of heart disease and cancer. Additionally, air pollution particularly affects the most vulnerable in society: children, the elderly, and those with existing heart and lung conditions. There is also often a strong correlation with equalities issues because areas with poor air quality are also often less affluent areas^{1,2}.

The mortality burden of air pollution within the UK is equivalent to 28,000 to 36,000 deaths at typical ages³, with a total estimated healthcare cost to the NHS and social care of £157 million in 2017⁴.

In order to fulfil its statutory obligations, Warrington Borough Council undertakes monitoring of air quality across the Borough. This monitoring is in the form of real time and non-automatic/passive monitoring at various locations. The results are compared against national limits, known as objectives, which have been set based on health grounds. The monitoring programme is reviewed regularly to identify the areas most affected, with new developments or changes in traffic flow identified that might impact on an area or introduce new receptors close to a significant source.

As part of the reporting process, the Council must assess what actions they are taking now and what planned action, if any, should be taken in the future, within an Air Quality Action Plan (AQAP).

The principle pollutants of concern within Warrington are those mainly associated with road traffic, specifically Nitrogen Dioxide (NO₂), and Particulate Matter (PM).

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

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

³ Defra. Air quality appraisal: damage cost guidance, July 2021

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

There are two Air Quality Management Areas (AQMAs) within the Borough, which were declared because levels of NO₂ exceeded the national objective.

The predominant source of NO₂ at a local level relates to road transport. When considering vehicle miles travelled on Warrington roads, using the Department for Transport figures, traffic volumes remained relatively consistent between 2016 and 2019 for all vehicle types. Notably due to Covid impacts, the overall traffic volume reduced by 22% on average during 2020, and has remained 14% less during 2021 when compared to 2019 pre-pandemic levels.

Whilst air quality levels are compared against the national objectives, the Council recognises that health benefits can still be realised by reducing pollution levels below these limits.

Local priorities revolve around a successful economy, reducing deprivation and improving the health inequalities across the wards. The Health and Wellbeing Strategy 2019 sets out the priority “Housing and the environment enable people to make healthy choices” and acknowledges “to be a healthy town, our environment and infrastructure must protect and promote good health and wellbeing considering issues such as air quality”.

The Council recognises the need to deliver its ambitious plans for a strong local economy, and the need for new housing provision. The local authority has an ambition to do this within a sustainable framework and in line with its duty to improve the health of the people in its area which includes improving air quality.

The emerging Local Plan will set out the housing and employment need for the borough until 2038. Detailed work carried out by the Council shows that Warrington has a need to provide 14,688 new homes and 316.26 hectares of employment land by 2038, along with the required supporting infrastructure. The associated increase in traffic, has been assessed for any impact on air quality as part of the AQAP. This concluded that levels of NO₂ are expected to improve due to the increased uptake of low emission vehicles, but that PM_{2.5} concentrations will see less of an improvement and will remain of concern.

The Council is committed to working with relevant partners, for example the Highways Agency, to develop actions to further improve air quality, and with the UK Health Security Agency to gain health evidence and advice of health impacts at a local level.

The current AQMAs, air quality reports and air quality data is available to be viewed at <https://www.warrington.gov.uk/airquality>

Going forward the Council expects levels of NO₂ to continue to improve as long as actions within the AQAP and LTP4 are enacted and emissions from the transport sector are reduced. The same level of improvements are not expected for PM_{2.5} and the focus will need to change to concentrate on measures to reduce sources of this pollutant.

Actions to Improve Air Quality

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

The 2019 Clean Air Strategy⁵ sets out the case for action, with goals to reduce exposure to harmful pollutants. The Road to Zero⁶ sets out the approach to reduce exhaust emissions from road transport through a number of mechanisms; this is extremely important given that the majority of Air Quality Management Areas (AQMAs) are designated due to elevated concentrations heavily influenced by transport emissions.

The Warrington Air Quality Action Plan (AQAP) was formally adopted in April 2018, and revised in 2021 due to a number of actions being completed. The AQAP and related policies have been developed to ensure that measures aimed at reducing levels of NO₂ are complementary to reducing PM_{2.5}. The main priority is to try to tackle the exceedances of NO₂ and to improve air quality generally, not just within the AQMAs but across the wider borough.

An Air Quality Programme Board to oversee implementation of the AQAP has been set up, chaired by the Director of Public Health, and includes Directors and senior management that oversee planning and transport alongside Portfolio Council members and a representative from Public Health England. The AQAP sits alongside and informs major new Council policies, specifically the new emerging Local Plan and the updated Local Transport Plan (LTP4).

⁵ Defra. Clean Air Strategy, 2019

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

The focus has been on embedding air quality as a major aspect within the emerging Local Plan and the Local Transport Plan (LTP4). Actions have continued to aim at improving traffic flows, increasing cycling and use of travel planning.

Specific actions completed in 2021 are:

- A revised AQAP was approved in January 2022 following consultation in 2021
- Centre Park Link Road. The new bridge from Chester Road, within the AQMA, opened in 2021. This is designed to reduce through traffic within the town centre.
- Burtonwood to Omega Shared path. A new shared walking and cycleway path to a major employment area opened in 2021.

A successful bid was made for the Defra 2019/20 Air Quality Grant to run an electric taxi scheme in 2020. This project was partly delayed due to Covid. A new Taxi EV Strategy is being developed, and was to be published in the summer 2021. However, this has been put back due to capacity issues, until June 2022. The bid also included the purchase of an electric black cab to loan out to taxi operators for them to trial to encourage the uptake of electric taxis. This part of the project is no longer viable due to a lack of interest, partly due to the adverse impacts on the taxi trade during the pandemic. Defra approval is being sought for the funding underspend to be utilised on taxi EV charging points.

A further bid for the Defra 2020/21 Air Quality Grant for bus abatement retrofit linked to schools was unsuccessful.

The Council further submitted a bid for funding to the Department for Transport to become an all-electric bus town. Again this was bid unsuccessful. A subsequent bid under the Zero Emission Bus Regional Area (ZEBRA) fund was successful in 2021. This scheme will replace 120 diesel buses with electric ones, and is being linked in with a new bus depot with charging facilities, due to open in 2023.

The Council recognises the importance of improving indoor air quality, particularly in light of the need to improve ventilation to reduce the spread of COVID-19, and has included a focus on this within the revised AQAP.

Conclusions and Priorities

In 2021 the levels of NO₂ have increased compared to 2020, largely due to the easing of COVID-19 restrictions and subsequent increases in traffic. However, there has been a trend of gradual reduction in NO₂ levels over the last few years when compared to pre-pandemic. The levels of NO₂ at the majority of locations across the borough now meet the national objectives/standards, within and outside of the AQMAs.

Unlike the reduction in levels of NO₂, there has been only a slight improvement in PM levels (PM₁₀ and PM_{2.5}) compared to previous years. This indicates that particulates are less affected by traffic and there are alternative sources such as domestic burning and transboundary influences.

Further details on the results for 2021 are provided within Appendix A.

The AQAP was adopted in 2018 and will supplement the emerging Local Plan and the new Local Transport Plan (LTP4). The Council has recently prepared an updated AQAP which was published in January/February 2022, following consultation during 2021. The AQAP provides detail on all completed and ongoing actions. Progress with this revised version will be reported in the 2023 ASR.

The Council considers that actions contained within the AQAP should be prioritised and implemented, where possible, to improve air quality in order to meet the national objectives in the longer term. It is also acknowledged that actions to improve air quality have additional positive benefits by improving health and to deliver sustainable growth in the longer term. The focus of the AQAP is to improve air quality within the Warrington AQMA but also to improve concentration across the wider borough. Measures available to the Council to improve air quality though within the Motorway AQMA remain limited without support from Highways England.

Local Engagement and How to get Involved

Whilst the Council has a strategic position to improve air quality, there are many actions that can be taken individually by the public and private sector to reduce individual emissions. These include cycling and walking, improved driving style to reduce fuel cost and increased use of public transport. All these actions can have the additional benefit of improving health and wellbeing as well as making financial savings.

Additional information is available on the Council Website for Travel Warrington at: <https://www.warrington.gov.uk/travelwarrington>

Additional information on air quality, including advice on smoke control areas and monitoring data, is available on the Council website at: <https://www.warrington.gov.uk/airquality>

Further information on air quality and actions that can be taken is available by emailing the Environmental Protection team at: environmental.health@warrington.gov.uk

Local Responsibilities and Commitment

This ASR was prepared by the Environmental Protection Team of Warrington Borough Council with the support and agreement of the following officers and departments:

This ASR has been approved by:

The Air Quality Programme Board

This ASR has been signed off by a Director of Public Health.

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

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1 Local Air Quality Management

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

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

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

2 Actions to Improve Air Quality

2.1 Air Quality Management Areas

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 12 months setting out measures it intends to put

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

- NO₂ annual mean;

Table 2.1 – Declared Air Quality Management Areas

AQMA Name	Date of Declaration	Pollutants and Air Quality Objectives	One Line Description	Is air quality in the AQMA influenced by roads controlled by National Highways?	Level of Exceedance: Declaration	Level of Exceedance: Current Year	Name and Date of AQAP Publication	Web Link to AQAP
Motorway AQMA	Declared 2001	NO ₂ Annual Mean	An area 50m from roadside around the M62, M6 and M56	YES	47 µg/m ³	35.2 µg/m ³	Warrington Air Quality Action Plan 2022	www.warrington.gov.uk/airquality
Warrington AQMA	Declared 2016	NO ₂ Annual Mean	Around the town centre and major arterial roads	NO	54 µg/m ³	40 µg/m ³	Warrington Air Quality Action Plan 2022	www.warrington.gov.uk/airquality

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

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

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

Defra's appraisal of last year's ASR concluded "The report is well structured, detailed, and provides the information specified in the Guidance". A number of recommendations were made:

1. *The Council have provided a very good and detailed discussion of pollutant trends within the borough. In addition to this the Council have presented this in terms of location. This is welcomed as it makes it clearer and easier for the reader to understand pollutant trends within each AQMA. This approach is encouraged in future ASRs. **Noted.***
2. *Though the AQAP was published in 2018, and therefore does not require an update, the Council have stated that they have reviewed the AQAP in 2020, and plan to publish in 2021. This is welcomed considering pollutant concentrations within the borough had seen increases in some areas before the Covid-19 pandemic (i.e. increases in NO₂ concentrations at CM2 and PM concentrations from 2018 to 2019). An update on the progress of the new AQAP measures would be beneficial when it is published in the end of 2021. **This has been included within Section 2.2.***
3. *It is recommended that all graphs are to include a line to highlight the pollutant limit objective e.g. 40 µg/m³ on the Annual NO₂ graph. **A line is now included on each graph to indicate the objective.***
4. *There is a minor inconsistency between Tables A.1 and the declaration date in the Portal for Motorway AQMA. All AQMA information should be correct and up to date. **This has been amended accordingly.***
5. *Maps, Figures, Tables and graphs were all clear and legible with clear informative titles. This is commended and encouraged for all future reports. **Noted.***
6. *The Council could consider introducing SO₂ monitoring to highlight any potential hotspots within the Borough. This could be introduced via one of automatic monitoring locations. **The Council carried out SO₂ monitoring previously, however this was discontinued following the closure of Fiddlers Ferry coal power station, which was a major source of SO₂. The monitoring indicated negligible levels of SO₂ during this time.***

7. *A table which clearly lays out the monitoring locations which have been removed, added or re-located (maybe with a brief comment about why/where to) would make it easier for the reader to see any changes/updates to the monitoring strategy. This has been included within Section 3.1*

Warrington has taken forward a number of direct measures during the current reporting year of 2021 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2. Details of all measures are included within Table 2.2, with the type of measure and the progress Warrington Borough Council have made during the reporting year of 2021 presented. Where there have been, or continue to be, barriers restricting the implementation of the measure, these are also presented within Table 2.2. More detail on these measures can be found in the AQAP.

The Council has recently prepared an updated AQAP which was published in January/February 2022, following consultation during 2021. The AQAP provides detail on all completed and ongoing actions. Progress will be reported in the 2023 ASR.

Key completed measures are:

- **Sustainable Transport Strategies (Local Transport Plan 4)**

Following consultation, the Local Transport Plan (LTP4) was formally adopted by the Council in December 2019. This contains a number of policies which will improve air quality which will be further expanded upon in an update of the AQAP.

- **Procurement Strategies**

An updated Council Strategy was adopted in January 2019. This includes a specific consideration for “minimising environmental impact” including use of low and zero emission vehicles and plant.

- **Highways England/TfN Working Group**

Air quality was set up as a standing item on the agenda for the formal quarterly meetings undertaken with the Transport team. Highways England have confirmed though, that Defra do not require any actions or have any proposals to improve air quality for the Motorway network around Warrington. This remains a major barrier to try to improve air quality within the Motorway AQMNA.

- **Warrington Intelligent Transport System**

This project was established on the A49 Winwick Road to improve flows. This has seen a journey time saving of 30% in peak times, a 22% reduction in delays and a 13% increase in average speed.

- **Warrington West Railway Station**

The new railway station formally opened in December 2019. The car park serving the new railway station has 14 electric vehicle charging points to encourage uptake in low emission vehicles and significant cycle parking provision.

- **Clean Air Zone Feasibility Study.**

An initial feasibility scoping has been carried out as part of the Transformational Projects Study. At this stage within the LTP4, it is not proposed to take a Clean Air Zone forward due to the implementation cost compared to predicted benefit.

- **Air Quality Webpage**

The updated pages were published in July 2019. This now features interactive maps for Smoke Control Areas and the AQMAs plus information on health and for schools. This action is considered completed, but will remain under continuous review.

- **Chester Road cycle promenade**

The Chester Road cycleway was designed to provide an improved route between the Centre Park Link and Lower Bridge Street. The scheme involved widening the existing path, with new and modified crossings to encourage use by pedestrians and cyclists. The works began in 2019 and were completed in 2021.

- **Burtonwood/Omega shared use footpath**

The Burtonwood to Omega cycleway, named the Terry O'Neill Way', is a 1.5km tarmacadam pathway, for shared use by pedestrians and cyclists. The scheme also involved the placement of grass verges as well as new fencing and lighting. The works began in July 2020 and were completed in January 2021 with an official opening on 12 September 2021.

- **Centre Park Link Road**

A new bridge over the river Mersey and link road has been constructed to alleviate traffic congestion within the town centre namely the Bridgefoot gyratory and also Wilson Patten Street. The bridge formally opened in March 2021.

Warrington expects the following measures to be completed over the course of the next reporting year:

- **Environmental Protection Supplementary Planning Document (SPD)**

The current SPD was published in 2015 and is due to be updated in line with the emerging Local Plan to align with those policies. This will contain updated information for developers on how to consider air quality impacts from their developments.

- **School, Nursery, Care Home Action Group**

No formal group has been set up but meetings have been held with the Council's Schools advisor and travel planning team. Air quality monitoring has been carried out at one primary school as part of lesson plans. Anti-idling work is being undertaken by the Council's Travel choices team

- **PM_{2.5} Monitoring**

Additional PM_{2.5} monitoring has been undertaken on Sankey Way and this will continue. A new Earthsense Zephyr ® air quality sensor was acquired in March 2021. The sensor was placed near to the facility for 12 months but has since been relocated adjacent to a primary school (Alderman Bolton Primary School) to assess levels of NO₂ and PM, as part of the anti-idling campaign. Further funding remains critical to expand the monitoring programme.

Warrington Borough Council's priorities for the coming year are to focus on the revised measures in the updated AQAP.

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

- Warrington & Co;
- The Highways Agency;
- Department for Transport

The principal challenges and barriers to implementation that Warrington Borough Council anticipates facing are funding and resources to complete the actions. The Covid pandemic and cost of living crisis create uncertainty over future funding but also how transport and travel patterns will change with potential reductions in use of public transport and increased home working that could change future travel patterns.

Progress on the following measures has been slower than expected:

- **Western Link Road**

This major new road is proposed to significantly reduce traffic in the town centre and within the Warrington AQMA. The proposal is now accepted on the Department of Transport's Programme of Entry schemes. Funding remains subject to approval from the Department of Transport. Public consultation on the detailed design was undertaken in 2020. The Project team are currently working on a major scheme business case which is expected to be submitted in late 2022.

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

Table 2.2 – Progress on Measures to Improve Air Quality

Measure No.	Measure	Category	Classification	Year Measure Introduced	Estimated / Actual Completion Year	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
1	Development Plan Context: Local Plan Review	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	2018	2021	WBC Planning Policy	Local Authority funding	NO	Funded	£50k - £100k	Implementation	N/A	N/A	Original consultation carried out and submitted to the S of S early 2020 and due to changes in housing allocation, delayed until end of 2022	Outcome of consultation and approval by Planning Inspectorate.
2	Sustainable Transport Strategies: Local Transport Plan (LTP4)	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	2018	2020	WBC Transport Planning	Local Authority funding	NO	Partially Funded	£50k - £100k	Completed	N/A	N/A	Adopted Dec 2019	Completed
3	Environmental Protection SPD	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	2018	2021	WBC Environmental Protection	Local Authority funding	NO	Funded	< £10k	Planning	N/A	N/A	Initial draft produced	Dependent upon Local Plan review
4	Council Procurement Policies	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	2018	2020	WBC Procurement	Local Authority funding	NO	Funded	< £10k	Completed	N/A	N/A	Completed	Policy in place
5	Smoke Control Area Review	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	2018	2021	WBC Environmental Protection / Legal services	Local Authority funding	NO	Not Funded	< £10k	Aborted	N/A	N/A	Currently deferred	Dependent upon national legislation changes in the Environment Bill
6	Highways England / TfN Working Group	Policy Guidance and Development Control	Regional Groups Co-ordinating programmes to develop Area wide Strategies to reduce emissions and improve air quality	2018	2020	WBC Transport Planning / Highways England	Local Authority funding	NO	Funded	< £10k	Completed	N/A	N/A	Completed	Air quality now included as agenda item
7	Warrington intelligent Transport System	Traffic Management	UTC, Congestion management, traffic reduction	2018	2020	WBC UTMC	DoT funded	NO	Funded	£100k - £500k	Completed	<1 µg/m³	<1 µg/m³	Action completed, assessing journey time improvements. Mobile app in development	System installed and showing improved journey times. Mobile phone app development
8	Chester Road Cycleway	Transport Planning and Infrastructure	Cycle network	2018	2021	WBC Transport planning	LEP funded	NO	Funded	£500k - £1 million	Implementation	<1 µg/m³	<1 µg/m³	Completed	Measuring usage
9	Burtonwood to Omega Cycling/walking link	Transport Planning and Infrastructure	Cycle network	2018	2021	WBC Transport Planning	DoT / developer funded	NO	Funded	£500k - £1 million	Planning	<1 µg/m³	<1 µg/m³	Completed	Measuring usage
10	Warrington West Rail Station	Transport Planning and Infrastructure	Public transport improvements- interchanges stations and services	2018	2019	WBC Transport Planning	DoT funded	NO	Funded	£1 million - £10 million	Completed	<1 µg/m³	<1 µg/m³	Opened December 2019	Completed
11	Centre Park Link Road	Transport Planning and Infrastructure	Other	2018	2021	WBC Transport Planning	DoT funded	NO	Funded	£1 million - £10 million	Implementation	6 µg/m³ on Chester Road and 11 µg/m³ on Wilson Patten Street monitoring points	6 µg/m³ on Chester Road and 11 µg/m³ on Wilson Patten Street monitoring points	Planning permission granted and ground works started June 2019	Opened March 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
12	Western Link Road	Transport Planning and Infrastructure	Other	2018	2024	WBC Transport Planning	DoT/WBC funded	NO	Partially Funded	> £10 million	Planning	Further transport modelling work with AQ assessment to be undertaken	Further transport modelling work with AQ assessment to be undertaken	Funding allocated in March 2019	Dependant on consultation and planning approval
13	Clean Air Zone Feasibility Study	Policy Guidance and Development Control	Low Emissions Strategy	2018	2019	WBC Transport Planning	Local Authority funding	NO	Not Funded	£50k - £100k	Completed	N/A	N/A	Initial study finished. Not to be progressed at this time	Completed
14	School, Nursery and Care Home Action Group	Policy Guidance and Development Control	Other policy	2018	2021	WBC Environmental Protection / Public Health	Local Authority funding	NO	Partially Funded	£10k - 50k	Planning	N/A	N/A	Initial work with several schools on monitoring	No funding allocated for any actions, grant bid unsuccessful. Staff time and resource
15	Temporary Play Streets	Promoting Travel Alternatives	Other	2018	2021	WBC Public Health	Local Authority funding	NO	Partially Funded	£10k - 50k	Implementation	N/A	N/A	Trail event held in Summer 2019	Staff resources required to be allocated
16	Air Quality webpage update	Public Information	Via the Internet	2018	2019	WBC Environmental Protection	Local Authority funding	NO	Funded	< £10k	Completed	N/A	N/A	Pages "live" July 2019	Completed and on-going
17	PM2.5 monitoring	Policy Guidance and Development Control	Other policy	2018	2021	WBC Environmental Protection	Some funding through transport projects	NO	Partially Funded	£100k - £500k	Implementation	N/A	N/A	Additional site installed Nov 2020.	Funding through transport schemes

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

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

PM_{2.5} impacts on mortality are included within the Public Health Outcomes Framework Indicator D01. The most recent figures available are for 2020, which show a slight increase to 5.0% compared to 4.8% in 2019; however this is derived with a new methodology compared to previous years which involves using total PM_{2.5} concentration rather than anthropogenic concentration only. The North West regional average is 5.0%. Figure A.5, in Appendix A, shows the comparison of Warrington to other North West authorities. The Council has used this indicator as part of the health evidence to produce a chapter on Air Quality in the Joint Needs Strategic Assessment (JSNA) Framework that was been adopted in April 2018.

Warrington Borough Council considers that the measures within the AQAP to reduce levels of NO₂ will be complementary in reducing PM_{2.5} emissions.

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

Action 1 within the AQAP for the Local Plan growth proposals, included a borough wide air quality assessment for PM_{2.5} levels. This concluded that whilst there will be some improvements, there will still remain areas that exceed the World Health Organization guideline value, and proposed national limit, in 2036. It is accepted that further actions, through the LTP4 and other measures, will be required.

Action 3 of the AQAP is to update the Environmental Protection Supplementary Planning Document in line with the new emerging Local Plan update. The current supplementary planning document (SPD) was produced in 2013 and requires updating to include new guidance. Planning applications for new developments are screened for air quality and, if considered necessary, include PM_{2.5} impacts and exposure.

Action 17 within the AQAP is to carry out PM_{2.5} monitoring to gain further and robust evidence of concentrations within poor air quality areas. Funding for this was sought via the Defra Air Quality Grant, but was unsuccessful. An additional real-time roadside monitoring site was set up on Sankey Way in November 2020 which included PM monitoring. This was funded by the Western Link road project. An Earthsense Zephyr sensor was also acquired and located adjacent to the Motorway AQMA to assess levels linked within HGV movements associated within the inland border facility in the south of the borough. This sensor has since been relocated in 2022 to assess idling outside a school within the borough, the results of which will be presented within the next ASR.

In addition, the majority of Warrington has been covered by Smoke Control Orders since the late 1960s, with the exception of the Hatton and Stretton Wards in the south of the borough. In recent years there has been an increase in the installation/use of wood burning stoves in domestic properties within urban areas. This is likely to cause an increase in PM_{2.5} emissions even with Defra approved appliances which may also cause a nuisance from the burning odour to neighbours, especially if used incorrectly. Due to the changes in national legislation requiring certain standards for wood burning stoves and wet wood, an action is included within the revised AQAP to provide additional information to the public via the Council's webpages (i.e. 'Ready to Burn scheme'). The information will include the legislative requirements and advice on how best to burn to reduce emissions as far as possible. It was proposed within the AQAP to assess whether the whole of Warrington should be included under one order, but this is now not being taken forward into the revised AQAP due to the national changes.

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

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

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

Warrington Borough Council undertook automatic (continuous) monitoring at 4 sites during 2021. Table A.1 in Appendix A shows the details of the automatic monitoring sites.

Monitoring data from the Selby Street AURN site is available at

<https://uk-air.defra.gov.uk/networks/network-info?view=aurn>

The data for Chester Road, Parker Street and Sankey Way roadside sites is available from the UK Air Quality website at

<http://www.ukairquality.net/>

The links can be accessed through the Council air quality webpage at

<https://www.warrington.gov.uk/airquality>

Alternatively the data can be provided by the Council on request.

The Council also acquired an Earthsense Zephyr ® sensor during 2021. The sensor was positioned in south Warrington at a junction on the A50 associated with the new inland border facility, near to the Motorway AQMA. The sensor data is presented in Appendix G but has not been used for any formal assessment due to concerns over the quality of the data, specifically for NO₂.

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

3.1.2 Non-Automatic Monitoring Sites

Warrington Borough Council undertook non- automatic (i.e. passive) monitoring of NO₂ at 32 sites during 2021. Table A.2 in Appendix A presents the details of the non-automatic sites.

Maps showing the location of the monitoring sites are provided in Appendix D. Further details on Quality Assurance/Quality Control (QA/QC) for the diffusion tubes, including bias adjustments and any other adjustments applied (e.g. annualisation and/or distance correction), are included in Appendix C.

Table 3.1 – Changes to Diffusion Tube Locations

Diffusion Tube:	Previous Location 2019/20:	Relocated to:	Reason:
DT7	Questy Birch adjacent to M56 within Motorway AQMA	Howshoots Farm adjacent to M6 Junction 20 within Motorway AQMA	Howshoots Farm is within close proximity to new inland border facility and motorway AQMA. The Questy Birch Farm location was located for a number of years and showed levels consistently below the objective level.

3.2 Individual Pollutants

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

3.2.1 Nitrogen Dioxide (NO₂)

Table A.3 and Table A.4 in Appendix A compare the ratified and adjusted monitored NO₂ annual mean concentrations for the past five years with the air quality objective of 40µg/m³. Note that the concentration data presented represents the concentration at the location of the monitoring site, following the application of bias adjustment and annualisation, as required (i.e. the values are exclusive of any consideration to fall-off with distance adjustment).

For diffusion tubes, the full 2021 dataset of monthly mean values is provided in Appendix B. Note that the concentration data presented in Table B.1 includes distance corrected values, only where relevant. The results for DT8 and DT11 have been distance corrected to the nearest receptor.

Table A.5 in Appendix A compares the ratified continuous monitored NO₂ hourly mean concentrations for the past five years with the air quality objective of 200µg/m³, not to be exceeded more than 18 times per year.

The monitoring data for 2021 is showing an improvement at the majority of locations, including within current AQMAs, compared to 2019 pre-pandemic levels. However, all concentrations measured during 2021 have increased in relation to 2020 with the exception of two locations, due to the easing of COVID-19 lockdown restrictions and increased traffic volume.

In 2021, no exceedences of the annual mean objective were recorded at any of the automatic monitoring sites; the highest result was 32 µg/m³ at CM2 on Parker Street which is located within the Town Centre AQMA. Concentrations were recorded in excess of the annual mean objective at only one of the non-automatic monitoring locations. An annual mean in excess of 40 µg/m³ was recorded at Parker Street (DT8) but following the correction for distance to the façade for the nearest relevant receptor (i.e. dwelling) this reduced to 35.4 µg/m³.

The trends in annual mean NO₂ concentrations for roadside, urban background, and rural background are shown in Figure A.1 within Appendix A. It should be noted that there may be significant variations and annual fluctuations in concentrations due to meteorological conditions that can affect dispersion as well as the secondary formation of pollutants. However, the general trend between 2017 and 2021 indicates that concentrations have been declining for the roadside monitoring sites, but the extent of this is largely dependent upon location.

The longer term trends will continue to be assessed in future ASRs. Monitoring will continue at locations that previously showed exceedances to assess longer term trends. As per the guidance, it is not proposed to amend the extent of any of the AQMAs at this time, unless there is at least 3 consecutive years of data showing no risk of exceedance, whilst excluding the years affected by the pandemic. This is also important to be able to assess a number of road schemes, principally the Centre Park and Western Link roads, that are expected to affect air quality. No exceedances were recorded outside of the existing AQMAs therefore there is no need to declare or extend the AQMAs at this time.

Table A.5 in Appendix A compares the ratified continuous monitored NO₂ hourly mean concentrations for the past five years with the 1-hour mean objective of 200µg/m³ not to be exceeded more than 18 times per year. No exceedances of the 1 hour mean objective have been recorded in 2021. Annual mean results from diffusion tubes that are above 60µg/m³ may indicate a likely exceedance of the hourly objective (as per LAQM.TG16 technical guidance). In 2021, NO₂ concentrations at all non-automatic sites were less than 60µg/m³, which would indicate that an exceedance of the 1-hour mean objective is unlikely.

A comparison of NO₂ monthly and hourly means in the local network against nearby AURN at various sites between 2016 and 2020 is presented in Figure A.2. The seasonality in monitoring data is clearly demonstrated; levels in summer months tend to be lower than winter months when cold, calm conditions tend to lessen the dispersion of pollutants emitted near ground level (i.e. vehicles exhausts).

Warrington AQMA

The monitoring data for 2021 indicate an increase in NO₂ concentration at all locations within the Town Centre AQMA compared to 2020, with the exception of DT9 and DT14, due to the easing of COVID-19 restrictions. An annual mean in excess of 40µg/m³ was recorded at Parker Street (DT8) but following the correction for distance to the façade for the nearest relevant receptor (i.e. dwelling) this reduced to 35.4µg/m³. All other locations/monitoring sites within the AQMA recorded an annual mean below the objective.

DT9 is located on Wilson Patten Street, where traffic volume have decreased since the opening of the new Centre Park Link road in March 2021 which was implemented to reduce traffic congestion. The new link road provides drivers travelling between the A57 Liverpool Road and the A5060 Chester Road with an alternative route to avoid the Bridgefoot gyratory and the congestion on Wilson Patten Street. The latest statistics show

that the Centre Park Link road has typical daily flows of 10,000 vehicles. The annual mean NO₂ concentration has reduced by over 20% at this location between 2019 and 2021.

DT14 is located adjacent to Walton Terrace, on the A5060 (Chester Road) and may also have seen reduced traffic volume and altered flow due to the opening of the Centre Park link road.

Motorway AQMA

The non-automatic monitoring sites located within the Motorway AQMA are DT5 (M6), DT6 (M62) and DT7 (M6 Howshoots Farm). DT6 was relocated in 2020 adjacent to residential properties on Elm Road and in close proximity to the M62 Junction 9. DT7 was relocated from a site close to the M56 to Howshoots Farm which is situated near to the M6 Junction 20, in proximity to the new inland border facility. The monitoring data for 2021 indicate an increase in the annual mean NO₂ concentrations at both DT5 and DT6 compared to 2020, but a significant reduction was noted for DT5 compared to 2019. The annual mean concentration at DT5 reduced by 35% from 41 µg/m³ to 26.9µg/m³ between 2019 and 2021. All concentrations are now below the objective, however the annual mean concentration for DT7 (M6 Howshoots Farm) is close to 10% of the objective at 35.2µg/m³. Elevated concentrations at this location are likely due to traffic on the A50 and the nearby roundabout as well as from the motorway.

Area Outside AQMAs

The annual mean concentrations for monitoring sites located outside of the AQMAs were all higher in 2021 compared to 2020, but significantly less than concentrations recorded in 2019. All concentrations remained below the objective. On average, 2021 concentrations at monitoring locations outside of the AQMAs have improved by 10-20% compared to 2019. This corresponds to traffic data provided in Appendix F which shows the traffic volume has reduced by 14% compared to 2019 i.e. pre-pandemic.

The real time analyser/continuous monitor at Selby Street (CM1) is part of the AURN and measures concentrations for urban background. In 2021, the mean annual concentration was 15.1µg/m³ which was similar to 2020, but a reduction from 2019 when the annual mean concentration was 20.5µg/m³.

There is no evidence of any locations outside of the current AQMAs that might have a risk of exceedance that would require further investigation at this time.

3.2.2 Particulate Matter (PM₁₀)

Table A.6 in Appendix A: Monitoring Results compares the ratified and adjusted monitored PM₁₀ annual mean concentrations for the past five years with the air quality objective of 40µg/m³.

Table A.7 in Appendix A compares the ratified continuous monitored PM₁₀ daily mean concentrations for the past five years with the air quality objective of 50µg/m³, not to be exceeded more than 35 times per year.

During 2021, PM₁₀ was measured at two sites within Warrington. A BAM type analyser is used to measure PM₁₀ concentrations at the Selby Street AURN site and a diode laser instrument is used at the Sankey Way site, which was set up in late 2020. In 2021, no exceedances of the annual mean objective were recorded, which is consistent with previous years. Figure A.3 shows the trend in PM₁₀ annual mean concentrations between 2017 and 2021.

The annual mean concentration at the Selby Street site, which is indicative of urban background, was 13µg/m³, which is a slight reduction compared to concentrations recorded in 2019 and 2020. The increased concentrations observed in 2020, were attributed to trans-boundary pollution and the increase in domestic burning during lockdown. The annual average concentration at the roadside Sankey Way site was 13 µg/m³, which is similar to the background concentration. The traffic on Sankey Way is generally free-flowing and the instrument is located on an open verge, where dispersion is likely. The results indicate no exceedances of the objective value of 40µg/m³.

The 24 hour mean objective of 50µg/m³ is not to be exceeded more than 35 times a year. During 2021, one exceedance was recorded at the Selby Street site on 03 March 2021 and two exceedances were recorded at the Sankey Way site on 28 February 2021 and 03 March 2021 both associated with transboundary pollution from northern Europe and the Sahara.

3.2.3 Particulate Matter (PM_{2.5})

Table A.8 in Appendix A presents the ratified and adjusted monitored PM_{2.5} annual mean concentrations for the past five years. Figure A.4 shows the trend in PM_{2.5} annual mean concentrations between 2017 and 2021.

During 2021, PM_{2.5} was measured at two sites within Warrington. A BAM type analyser is used to measure PM_{2.5} concentrations at the Selby Street AURN site and a diode laser instrument is used at the Sankey Way site, which was set up in late 2020. In 2021, no exceedances of the annual mean objective were recorded, which is consistent with previous years. The annual mean concentration at Selby Street was 8µg/m³ which is lower than previous years. The annual mean concentration at the Sankey Way site was 10µg/m³. The results indicate no exceedances of the objective value 25µg/m³, however the levels are in excess of the proposed national 10µg/m³ limit and the new recommended WHO guideline value of 5µg/m³.

The most recent figures available for the Public Health Outcomes Framework Indicator D01 are from 2020, which show a slight increase to 5.0% compared to 4.8% in 2019, however this is derived with a new methodology compared to previous years which involves using total PM_{2.5} concentration rather than anthropogenic concentration only. The North West regional average is 5.0%. Figure A.5, in Appendix A, shows the comparison of Warrington to other North West authorities.

Appendix A: Monitoring Results

Table A.1 – Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) ⁽¹⁾	Distance to kerb of nearest road (m) ⁽²⁾	Inlet Height (m)
CM1	Selby Street	Urban Background	359151	388218	NO ₂ , PM _{2.5} , PM ₁₀	NO	Chemiluminescent; FDMS/BAM	22m	50m	2.5
CM2	Parker Street	Roadside	360015	387907	NO ₂	YES	Chemiluminescent	1m	2 m	1.5
CM3	Chester Road	Roadside	360331	386454	NO ₂	YES	Chemiluminescent	1m	2 m	1.5
CM4	Sankey Way	Roadside	358390	388105	NO ₂ , PM _{2.5} , PM ₁₀	NO	Chemiluminescent; Diode Laser	0m	3.75m	1.5

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 A.2 – Details of Non-Automatic Monitoring Sites

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) ⁽¹⁾	Distance to kerb of nearest road (m) ⁽²⁾	Tube Co-located with a Continuous Analyser?	Tube Height (m)
DT1	WA08 Risley Moss	Rural	366949	392004	NO2	No	0.0	0.0	No	2.0
DT2	WA22 Selby Street	Urban Background	359152	388218	NO2	No	0.0	50.0	Yes	2.5
DT3	WA23 Selby Street	Urban Background	359152	388218	NO2	No	0.0	50.0	Yes	2.5
DT4	WA24 Selby Street	Urban Background	359152	388218	NO2	No	0.0	50.0	Yes	2.5
DT5	WA111 M6 Manchester Road	Roadside	366084	389210	NO2	Motorway AQMA	0.0	26.5	No	2.5
DT6	WA37 Elm Road	Roadside	360459	391869	NO2	Motorway AQMA	0.0	11.0	No	2.5
DT7	WA124 Howshoots Farm	Roadside	360233	381994	NO2	Motorway AQMA	17.0	17.0	No	2.5
DT8	WA20 Parker Street	Roadside	360044	388048	NO2	Warrington AQMA	2.0	1.5	No	2.5
DT9	WA102 Wilson Patten Street	Roadside	360309	387848	NO2	Warrington AQMA	4.5	1.0	No	2.5
DT10	WA67 Crosfield Island 2	Roadside	359509	388235	NO2	Warrington AQMA	2.0	1.0	No	2.5
DT11	WA65 Baxter Street 1	Roadside	359447	388112	NO2	Warrington AQMA	2.0	1.0	No	2.5
DT12	WA85 Old Liverpool Road 4	Roadside	359430	387947	NO2	No	4.0	2.0	No	2.5

Diffusio n Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) ⁽¹⁾	Distance to kerb of nearest road (m) ⁽²⁾	Tube Co- located with a Continuous Analyser?	Tube Height (m)
DT13	WA68 Chester Road	Roadside	360648	387388	NO2	Warrington AQMA	3.0	3.0	No	2.5
DT14	WA93 Walton Terrace	Roadside	360450	386052	NO2	Warrington AQMA	3.0	2.0	No	2.5
DT15	WA76 Wilderspool Causeway	Roadside	360880	387247	NO2	Warrington AQMA	2.5	2.5	No	2.5
DT16	WA118 Wilderspool Causeway 3	Roadside	361220	386874	NO2	Warrington AQMA	10.0	3.0	No	2.5
DT17	WA94 Wilderspool Causeway 2	Roadside	361319	386508	NO2	Warrington AQMA	0.0	2.0	No	2.5
DT18	WA90 Stockton Heath 3	Roadside	361470	385981	NO2	No	3.0	2.0	No	2.5
DT19	WA135 Grappenhall Road	Roadside	361537	386122	NO2	No	5.0	4.0	No	2.5
DT20	WA136 Walton Road	Roadside	361336	385956	NO2	No	1.0	1.5	No	2.5
DT21	WA77 Knutsford Road 1	Roadside	361898	387430	NO2	Warrington AQMA	0.0	3.0	No	2.5
DT22	WA92 Kingsway South (Latchford)	Roadside	362810	387187	NO2	Warrington AQMA	0.0	3.0	No	2.5
DT23	WA105 Latchford Village 2	Roadside	362779	387288	NO2	Warrington AQMA	1.0	1.5	No	2.5
DT24	WA115 Latchford Village 3	Roadside	362604	387222	NO2	Warrington AQMA	1.0	1.5	No	2.5
DT25	WA78 Mersey Street	Roadside	361005	388145	NO2	Warrington AQMA	2.5	6.0	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⁾	Distance to kerb of nearest road (m) ⁽²⁾	Tube Co-located with a Continuous Analyser?	Tube Height (m)
DT26	WA80 Bewsey Street	Roadside	360462	388501	NO2	Warrington AQMA	0.0	30.0	No	2.5
DT27	WA83 Crosfield Street	Roadside	360040	388406	NO2	Warrington AQMA	4.5	2.5	No	2.5
DT28	WA89 King Edward Street	Roadside	362392	389101	NO2	No	2.5	2.5	No	2.5
DT29	WA125 Steel Street	Roadside	362131	389473	NO2	No	7.0	1.5	No	2.5
DT30	WA95 Winwick Road 1	Roadside	360598	389820	NO2	Warrington AQMA	5.5	5.0	No	2.5
DT31	WA96 Winwick Road 2	Roadside	360484	390416	NO2	Warrington AQMA	5.5	3.0	No	2.5
DT32	WA112 Winwick Road 3	Roadside	360434	390968	NO2	Warrington AQMA	0.0	2.0	No	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 A.3 – Annual Mean NO₂ Monitoring Results: Automatic Monitoring (µg/m³)

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2021 (%) ⁽²⁾	2017	2018	2019	2020	2021
CM1	359152	388218	Urban Background	97.6	97.6	21	21.4	20.5	15	15
CM2	360015	387907	Roadside	98.9	98.9	37.9	38.1	41	28.2	32
CM3	360331	386454	Roadside	95.6	95.6	32	30	30	21.6	23
CM4	358390	388105	Roadside	99.8	99.8					21

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

☒ 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/m³.

Exceedances of the NO₂ annual mean objective of 40µg/m³ are shown in **bold**.

All means have been “annualised” as per LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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

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

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

Table A.4 – Annual Mean NO₂ Monitoring Results: Non-Automatic Monitoring (µg/m³)

Diffusion Tube ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2021 (%) ⁽²⁾	2017	2018	2019	2020	2021
DT1	366949	392004	Rural	100	99.7	17.3	16.1	16.3	10.4	11.7
DT2	359152	388218	Urban Background	100	99.7	21.2	21.4	19.7	12.9	14.6
DT3	359152	388218	Urban Background	100	99.7	21.6	21.3	20.4	13.5	15.0
DT4	359152	388218	Urban Background	91.7	92.0	21.5	21.7	20.2	13.5	15.6
DT5	366084	389210	Roadside	100	99.7	39.4	45.6	41.0	22.9	26.9
DT6	360459	391869	Roadside	100	99.7				23.9	28.4
DT7	365974	384982	Roadside	91.7	92.6					35.2
DT8	360044	388048	Roadside	83.3	80.2	45.2	45.9	43.8	31.1	40.0
DT9	360309	387848	Roadside	100	99.7	40.7	39.5	36.1	30.6	28.8
DT10	359509	388235	Roadside	100	99.7	32.8	32.2	30.7	25.3	26.2
DT11	359447	388112	Roadside	100	99.7	42.1	39.6	39.1	31.8	37.5
DT12	359430	387947	Roadside	100	99.7	37.7	35.5	31.7	26.2	28.2
DT13	360648	387388	Roadside	91.7	89.8	36.2	36.6	34.1	25.5	28.6

Diffusion Tube ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2021 (%) ⁽²⁾	2017	2018	2019	2020	2021
DT14	360450	386052	Roadside	83.3	82.7	37.1	34.5	31.4	26.1	25.2
DT15	360880	387247	Roadside	91.7	92.0	34.1	31.0	28.8	22.0	24.5
DT16	361220	386874	Roadside	100	99.7	31.8	30.1	29.7	20.6	24.3
DT17	361319	386508	Roadside	100	99.7	34.8	33.7	30.6	21.2	24.8
DT18	361470	385981	Roadside	100	99.7	28.5	27.5	25.1	17.7	21.0
DT19	361537	386122	Roadside	100	99.7				18.1	21.1
DT20	361336	385956	Roadside	100	99.7				21.7	24.1
DT21	361898	387430	Roadside	91.7	92.0	33.1	30.2	29.9	21.5	25.1
DT22	362810	387187	Roadside	91.7	89.8	36.2	35.2	32.5	22.9	29.0
DT23	362779	387288	Roadside	100	99.7	41.4	39.9	34.8	26.5	31.0
DT24	362604	387222	Roadside	100	99.7	34.5	33.7	31.0	22.2	26.8
DT25	361005	388145	Roadside	100	99.7	38.4	37.7	35.3	26.7	30.5
DT26	360462	388501	Roadside	100	99.7	32.9	32.3	30.6	23.2	27.2
DT27	360040	388406	Roadside	50	47.8	32.2	36.0	33.4	25.4	26.8

Diffusion Tube ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2021 (%) ⁽²⁾	2017	2018	2019	2020	2021
DT28	362392	389101	Roadside	91.7	89.8	42.2	37.9	35.1	26.8	31.6
DT29	362131	389473	Roadside	100	99.7		42.4	35.9	25.9	30.3
DT30	360598	389820	Roadside	100	99.7	34.7	32.6	30.2	22.0	25.7
DT31	360484	390416	Roadside	100	99.7	44.2	40.3	36.6	30.1	33.2
DT32	360434	390968	Roadside	100	99.7	49.3	43.9	39.8	27.0	30.3

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

☒ Diffusion tube data has been bias adjusted.

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

Notes:

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

Exceedances of the NO₂ annual mean objective of 40 $\mu\text{g}/\text{m}^3$ are shown in **bold**.

NO₂ annual means exceeding 60 $\mu\text{g}/\text{m}^3$, indicating a potential exceedance of the NO₂ 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.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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

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

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

Figure A.1a presents NO₂ annual mean concentrations for Motorway AQMA sites DT5 to DT7 between years 2017 to 2021.

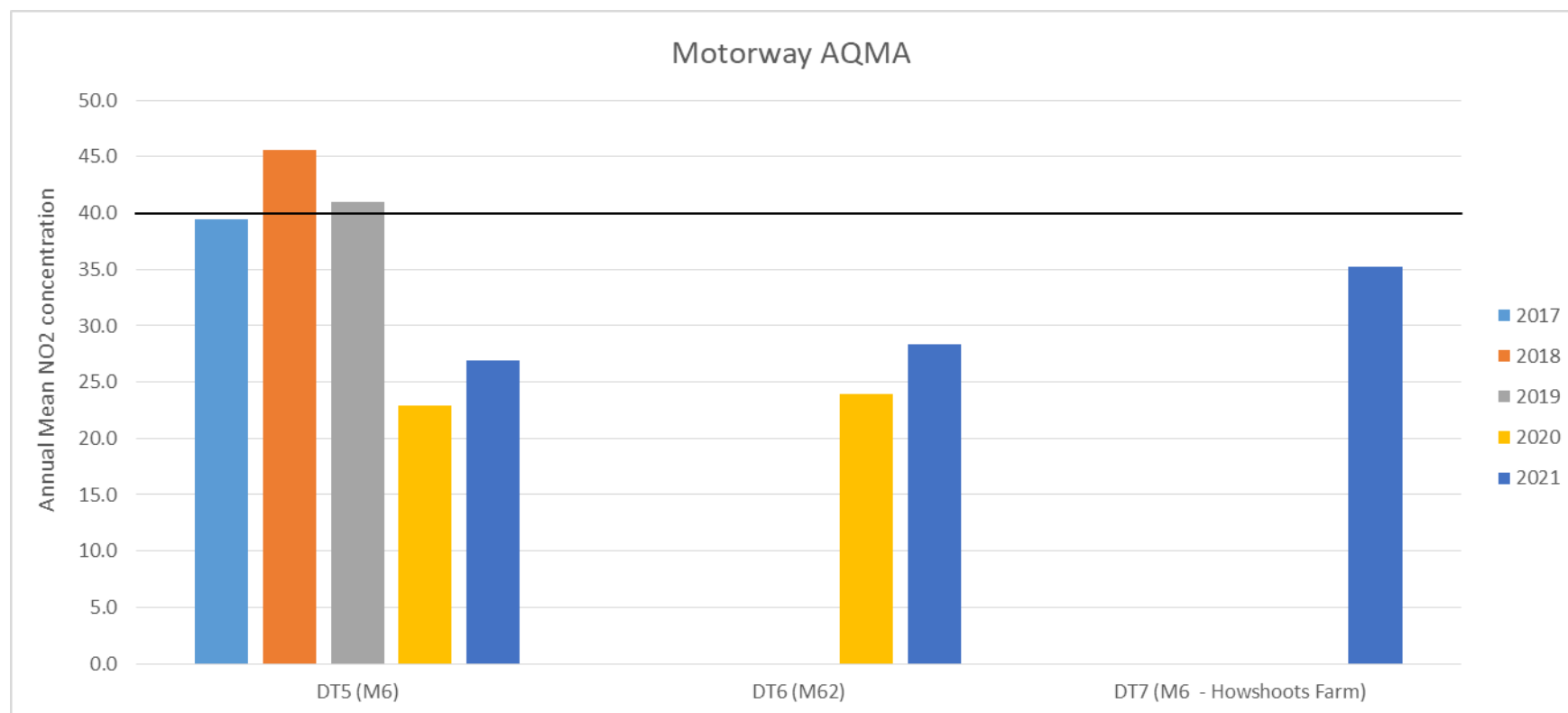


Figure A.1b presents NO₂ annual mean concentrations for Warrington AQMA between years 2017 to 2021.

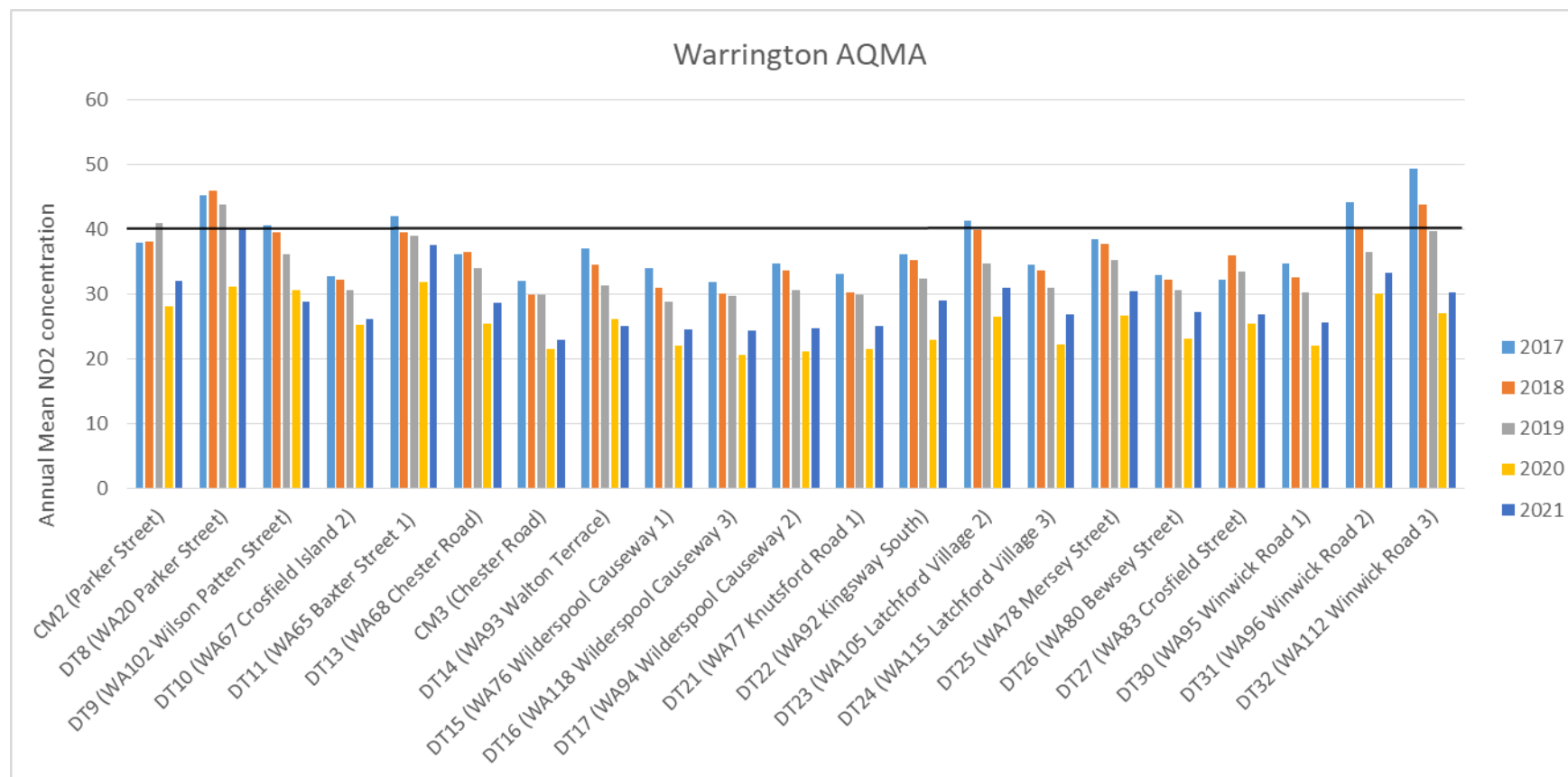


Figure A.1c presents NO₂ annual mean concentrations for outside of AQMAs between years 2017 to 2021.

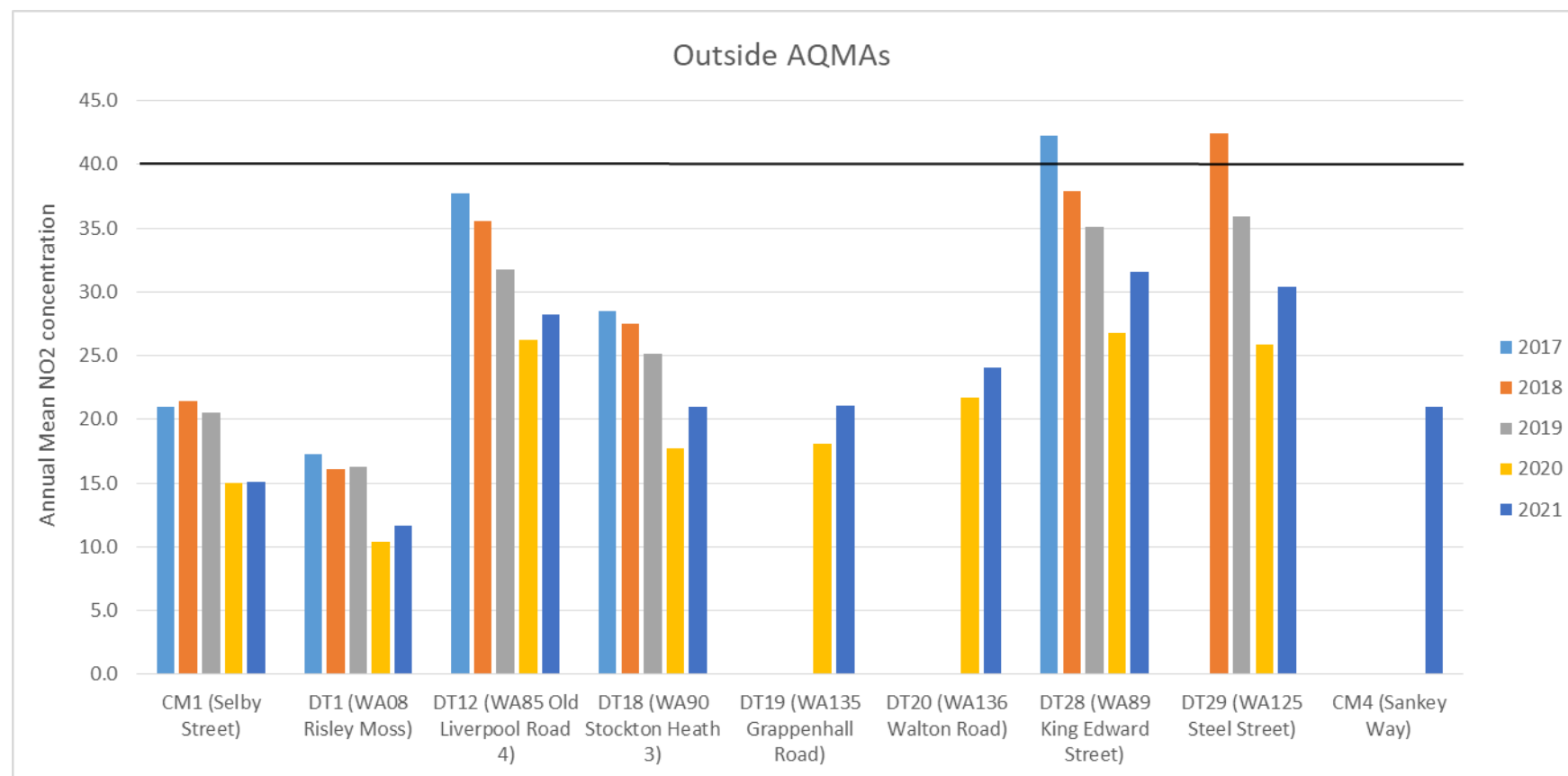
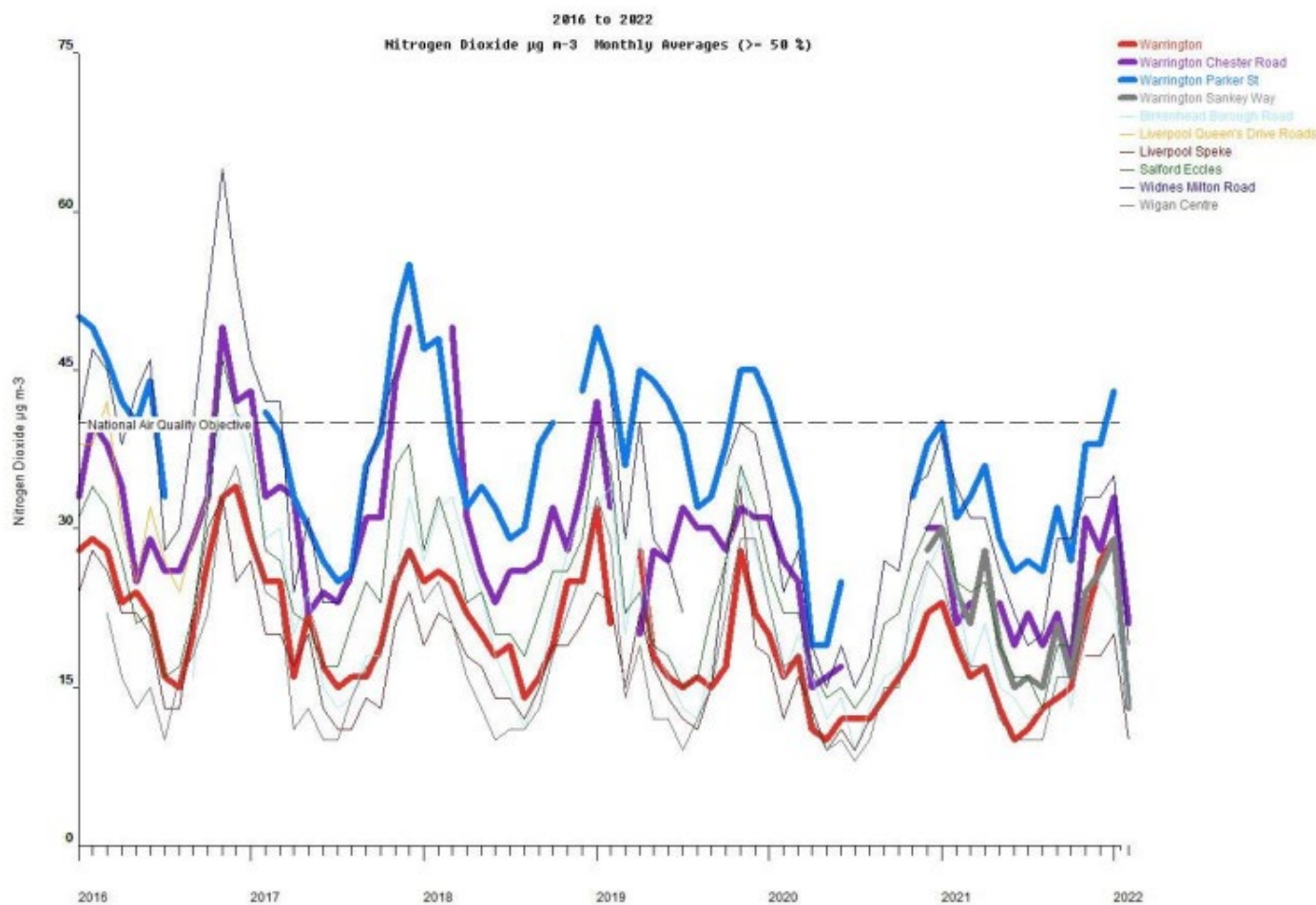


Figure A.2 Comparison of NO₂ Monthly Mean Concentrations measured at automatic monitoring sites across the North West



NO₂ Monthly Mean Concentrations from 2016

Source: AQDM

Table A.5 – 1-Hour Mean NO₂ Monitoring Results, Number of 1-Hour Means > 200µg/m³

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2021 (%) ⁽²⁾	2017	2018	2019	2020	2021
CM1	359152	388218	Urban Background	97.6	97.6	0	0	0	0	0
CM2	360015	387907	Roadside	98.9	98.9	0 (119µg/m³)	2	2	0 (107µg/m³)	0
CM3	360331	386454	Roadside	95.6	95.6	0	0 (113µg/m³)	1	0 (82µg/m³)	0
CM4	358390	388105	Roadside	99.8	99.8					0

Notes:

Results are presented as the number of 1-hour periods where concentrations greater than 200µg/m³ have been recorded.

Exceedances of the NO₂ 1-hour mean objective (200µg/m³ not to be exceeded more than 18 times/year) are shown in **bold**.

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

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

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

Table A.6 – Annual Mean PM₁₀ Monitoring Results (µg/m³)

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2021 (%) ⁽²⁾	2017	2018	2019	2020	2021
CM1	359152	388218	Urban Background	96.5	96.5	12	13	17	15	13
CM4	358390	388105	Roadside	99.8	99.8					13

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

Notes:

The annual mean concentrations are presented as µg/m³.

Exceedances of the PM₁₀ annual mean objective of 40µg/m³ are shown in **bold**.

All means have been “annualised” as per LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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

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

Figure A.1 Trends in Annual Mean PM₁₀ Concentrations

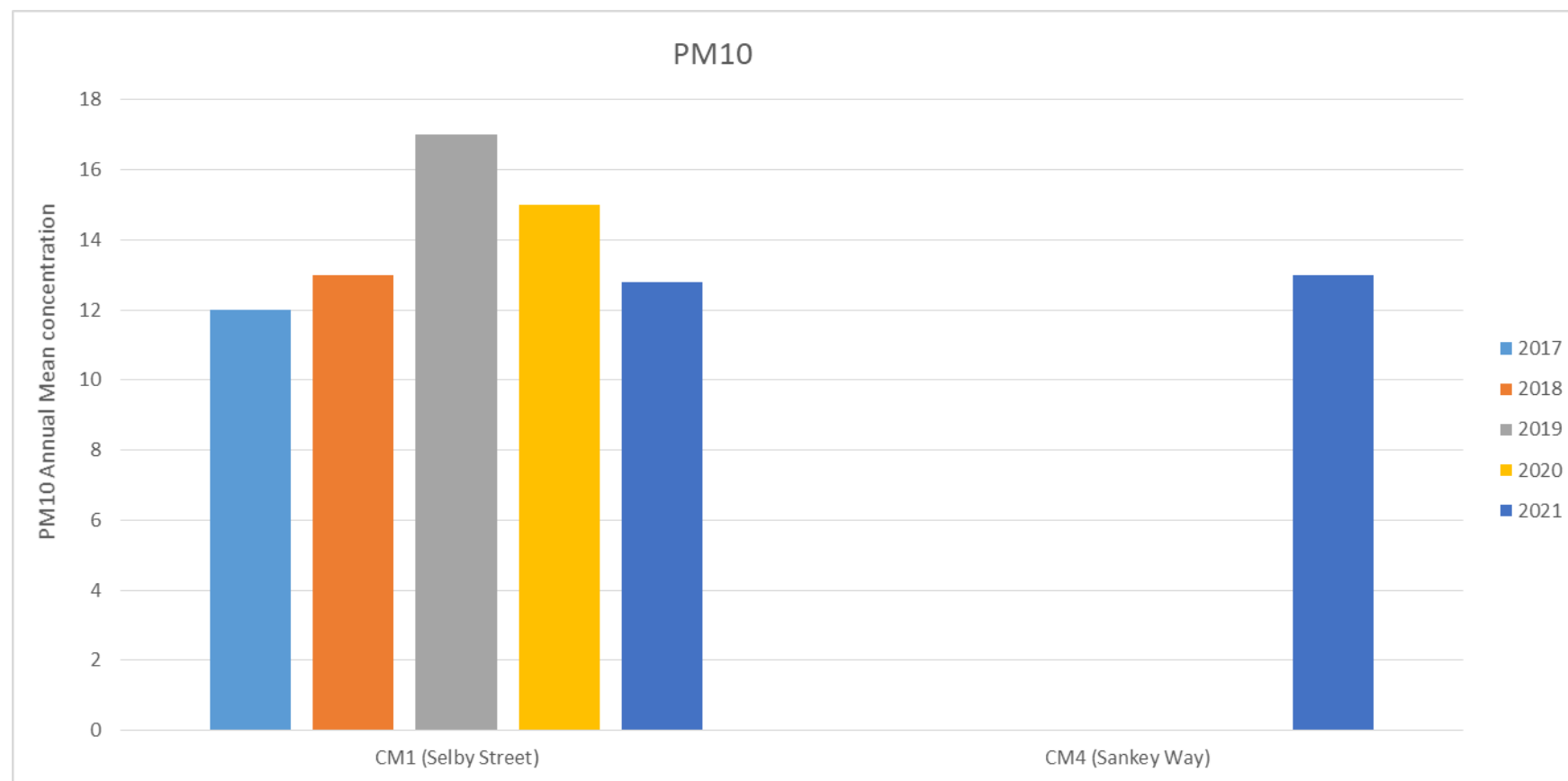


Table A.7 – 24-Hour Mean PM₁₀ Monitoring Results, Number of PM₁₀ 24-Hour Means > 50µg/m³

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2021 (%) ⁽²⁾	2017	2018	2019	2020	2021
CM1	359152	388218	Urban Background		96.5	3	1	5	1	1
CM4	358390	388105	Roadside		99.8					2

Notes:

Results are presented as the number of 24-hour periods where daily mean concentrations greater than 50µg/m³ have been recorded.

Exceedances of the PM₁₀ 24-hour mean objective (50µg/m³ 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 A.8 – Annual Mean PM_{2.5} Monitoring Results (µg/m³)

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2021 (%) ⁽²⁾	2017	2018	2019	2020	2021
CM1	359152	388218	Urban Background	93.9	93.9	10	9	11	9	8
CM4	358390	388105	Roadside	99.8	99.8					10

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

Notes:

The annual mean concentrations are presented as µg/m³.

All means have been “annualised” as per LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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

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

Figure A.4 Trends in Annual Mean PM_{2.5} Concentrations

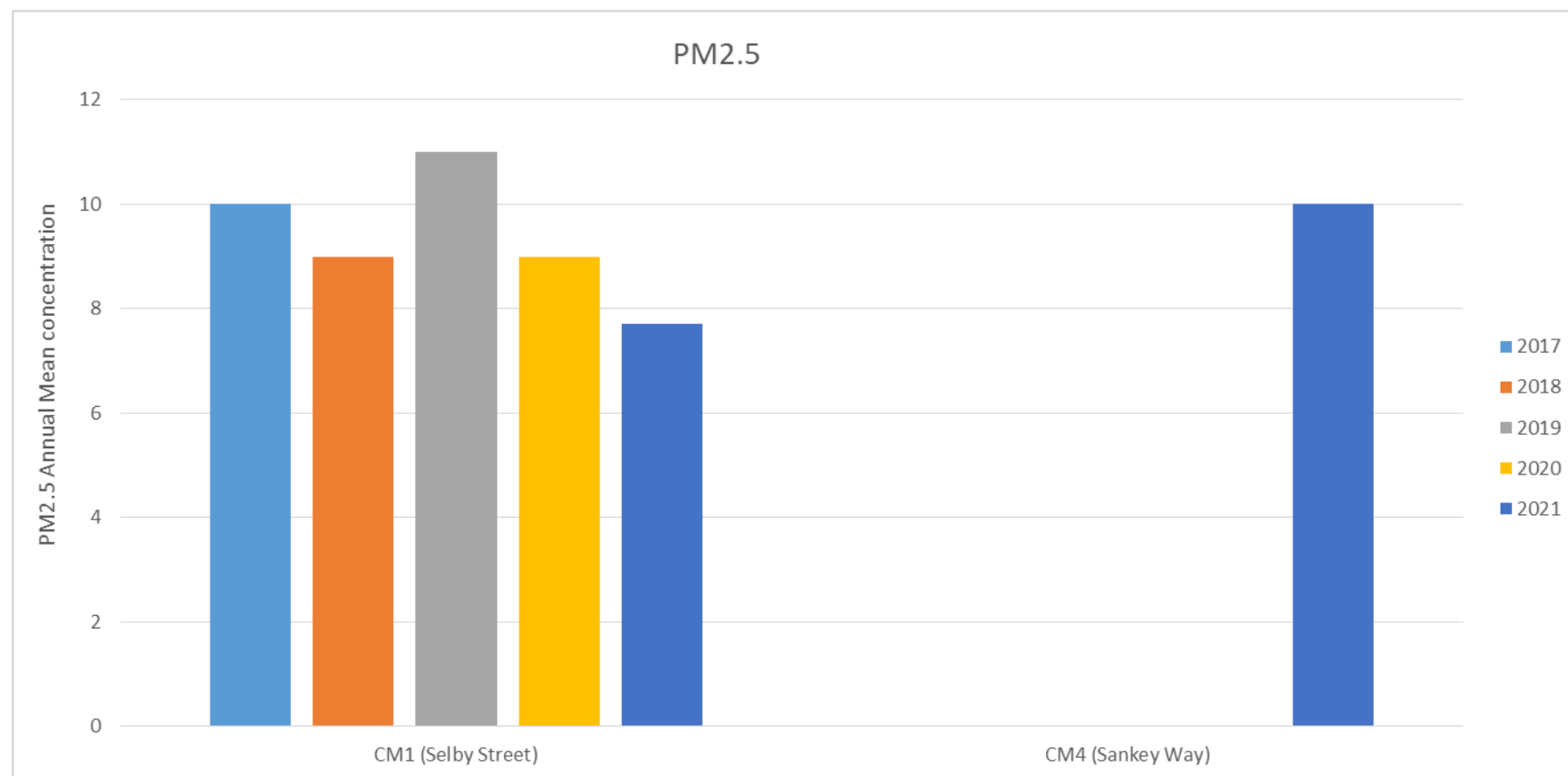













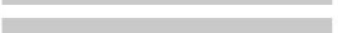
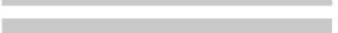












Figure A.5 – Comparison of 2020 PM_{2.5} PHOF indicator

Area	Recent Trend	Count	Value		95% Lower CI	95% Upper CI
England	–	-	5.6		-	-
North West region	–	-	5.0		-	-
Liverpool	–	-	5.9		-	-
Tameside	–	-	5.7		-	-
Knowsley	–	-	5.7		-	-
Manchester	–	-	5.6		-	-
Oldham	–	-	5.6		-	-
Salford	–	-	5.5		-	-
Bolton	–	-	5.4		-	-
Stockport	–	-	5.3		-	-
St. Helens	–	-	5.3		-	-
Bury	–	-	5.3		-	-
Rochdale	–	-	5.2		-	-
Halton	–	-	5.2		-	-
Trafford	–	-	5.2		-	-
Warrington	–	-	5.0		-	-
Wigan	–	-	5.0		-	-
Sefton	–	-	5.0		-	-
Blackburn with Darwen	–	-	4.9		-	-
Wirral	–	-	4.9		-	-
Cheshire East	–	-	4.6		-	-
Lancashire	–	-	4.6		-	-
Cheshire West and Chester	–	-	4.5		-	-
Blackpool	–	-	4.5		-	-
Cumbria	–	-	3.4		-	-

Appendix B: Full Monthly Diffusion Tube Results for 2021

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

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Easting)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted (0.89)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
DT1	366949	392004	23.9	15.8	11.6	13.0	9.5	9.3	10.2	8.4	11.3	10.9	17.8	16.0	13.1	11.7	-	
DT2	359152	388218	26.1	23.7	16.8	16.9	12.6	12.0	11.9	11.7	10.5	16.1	17.7	20.4	16.4	14.6	-	
DT3	359152	388218	28.0	23.4	16.0	16.3	13.0	12.3	11.8	11.8	17.2	15.7	16.1	20.6	16.8	15.0	-	
DT4	359152	388218	26.1	23.6	16.3	16.7	13.3	12.5	12.4		17.5	16.1	16.5	22.3	17.6	15.6	-	
DT5	366084	389210	41.7	33.6	28.6	29.6	26.5	26.6	27.0	26.4	33.7	25.0	33.2	30.6	30.2	26.9	-	
DT6	360459	391869	44.8	30.4	34.0	29.2	26.8	26.9	30.8	25.8	31.6	30.0	41.4	31.1	31.9	28.4	-	
DT7	365974	384982	46.1	39.2	37.4	36.1	40.0	35.2	42.2	35.5	50.7	34.7		38.4	39.6	35.2	-	
DT8	360044	388048	57.1	48.7	42.5	44.0	38.8	40.8		41.3	52.3	41.4	42.8		45.0	40.0	35.4	
DT9	360309	387848	47.4	32.9	30.9	28.6	26.7	26.0	30.2	27.0	32.3	28.4	38.7	39.5	32.4	28.8	-	
DT10	359509	388235	38.0	35.0	30.0	26.9	26.8	21.1	23.8	19.9	32.4	32.7	34.6	31.6	29.4	26.2	-	
DT11	359447	388112	54.0	34.5	44.5	42.3	38.6	38.4	39.3	38.5	45.9	39.4	49.4	41.2	42.2	37.5	32.6	
DT12	359430	387947	36.3	36.2	31.2	29.8	29.3	27.3	28.5	25.2	33.4	30.8	37.8	34.8	31.7	28.2	-	
DT13	360648	387388	45.4	36.0	31.9	31.4	29.7	28.0	29.4	27.4	32.4	28.8	33.0	N/A	32.1	28.6	-	
DT14	360450	386052	36.4	26.0	30.0	29.4	25.3	23.9	28.9	22.6	29.7	30.6			28.3	25.2	-	
DT15	360880	387247	39.6	27.0	29.0	22.3	23.3	20.8	24.9		26.1	24.8	34.7	30.8	27.6	24.5	-	
DT16	361220	386874	37.9	29.1	25.9	26.0	23.4	22.0	25.3	23.7	29.1	25.1	32.3	28.7	27.3	24.3	-	
DT17	361319	386508	38.6	29.7	28.8	26.4	23.6	21.7	27.0	20.7	25.1	26.6	34.9	30.8	27.8	24.8	-	
DT18	361470	385981	35.6	27.8	22.8	22.2	19.3	19.3	21.4	19.6	22.4	21.5	25.0	25.6	23.5	21.0	-	

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Easting)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted (0.89)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
DT19	361537	386122	33.4	27.5	23.3	21.7	19.8	19.2	22.4	18.1	23.6	20.7	27.5	27.2	23.7	21.1	-	
DT20	361336	385956	29.1	34.0	28.3	26.1	24.0	21.1	25.2	17.9	29.2	26.7	33.2	30.0	27.1	24.1	-	
DT21	361898	387430	37.9	29.0	26.0	24.5	25.9	21.2	24.8		28.5	27.1	34.2	31.1	28.2	25.1	-	
DT22	362810	387187	41.5	37.3	27.9	33.3	29.0	28.9	28.2	29.3	36.9		31.3	34.4	32.5	29.0	-	
DT23	362779	387288	48.0	39.8	32.4	34.4	31.4	27.7	30.4	30.4	35.5	33.9	38.2	36.5	34.9	31.0	-	
DT24	362604	387222	41.8	35.9	27.2	29.4	25.2	25.1	25.5	24.2	34.2	23.8	34.9	34.9	30.2	26.8	-	
DT25	361005	388145	39.1	40.9	34.8	31.7	30.2	28.5	32.0	28.9	38.8	26.9	39.9	40.0	34.3	30.5	-	
DT26	360462	388501	43.4	39.1	29.8	27.4	24.4	23.9	23.9	26.3	34.6	28.9	31.6	33.5	30.6	27.2	-	
DT27	360040	388406	45.0	33.3	31.1	29.5	26.4	25.1							31.7	26.8	-	
DT28	362392	389101	44.8	41.8	34.5	31.9	31.2	30.3	32.9	28.8	39.3	33.2	41.9		35.5	31.6	-	
DT29	362131	389473	49.0	39.9	35.2	30.2	32.1	28.8	29.7	25.3	33.1	27.1	40.5	38.3	34.1	30.3	-	
DT30	360598	389820	39.7	27.9	30.2	26.0	22.6	22.4	24.4	23.5	30.9	30.9	35.6	32.6	28.9	25.7	-	
DT31	360484	390416	50.3	40.9	36.6	30.1	31.4	30.9	33.9	29.8	36.5	40.7	48.0	39.3	37.3	33.2	-	
DT32	360434	390968	44.5	31.9	35.3	29.0	30.0	28.4	33.5	28.6	33.5	35.6	42.3	36.5	34.1	30.3	-	

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

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

☒ Local bias adjustment factor used.

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

☒ Warrington Borough Council confirm that all 2021 diffusion tube data has been uploaded to the Diffusion Tube Data Entry System.

Notes:

Exceedances of the NO₂ annual mean objective of 40µg/m³ are shown in **bold**.

NO₂ annual means exceeding 60µg/m³, indicating a potential exceedance of the NO₂ 1-hour mean objective are shown in **bold and underlined**.

See Appendix C for details on bias adjustment and annualisation.

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

New or Changed Sources Identified Within Warrington Borough Council During 2021

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

Additional Air Quality Works Undertaken by Warrington Borough Council During 2021

Warrington Borough Council has not completed any additional works within the reporting year of 2021. The revised Air Quality Action Plan was approved in January 2022.

QA/QC of Diffusion Tube Monitoring

The Council uses Gradko International Ltd Laboratories to supply and analyse the diffusion tubes. The tubes are prepared using 20% triethanolamine (TEA) in water. Manufacture and analysis of the tubes by Gradko are covered by the AIR PT scheme which assessed performance in February, March, May, August and October, as shown in the table/information below from Gradko.

All monitoring has been carried out in accordance to the 2021 Diffusion Tube Monitoring Calendar.

AIR PT Nitrogen Dioxide Proficiency Scheme Results 2021

Methods: GLM 7 – CARY 60 Spectrophotometer

AIR PT Proficiency Scheme - Nitrogen Dioxide 2021					
Date	Round	Assigned value	Procedure GLM 7		
			Measured concentration	z-Score	% Bias
Feb-21	AIR PT 42-1	1.71	1.13	-4.17	-33.9%
Feb-21	AIR PT 42-2	1.74	0.81	-6.29	-53.4%
Feb-21	AIR PT 42-3	1.40	0.83	-5.43	-40.7%
Feb-21	AIR PT 42-4	1.37	1.16	-1.91	-15.3%
Mar-21	AIR PT 42-1 Rpt	1.71	1.79	0.62	4.7%
Mar-21	AIR PT 42-2 Rpt	1.74	1.75	0.08	0.6%
Mar-21	AIR PT 42-3 Rpt	1.40	1.40	0	0.0%
Mar-21	AIR PT 42-4 Rpt	1.37	1.41	0.39	2.9%
May-21	AIR PT 43-1	1.19	1.23	0.35	3.4%
May-21	AIR PT 43-2	1.19	1.22	0.26	2.5%
May-21	AIR PT 43-3	2.00	1.97	-0.2	-1.5%
May-21	AIR PT 43-4	1.94	1.98	0.26	2.1%
Aug-21	AIR PT 45-1	1.58	1.58	0	0.0%
Aug-21	AIR PT 45-2	1.57	1.56	-0.08	-0.6%
Aug-21	AIR PT 45-3	2.43	2.41	-0.08	-0.8%
Aug-21	AIR PT 45-4	2.42	2.37	-0.28	-2.1%
Oct-21	AIR PT 46-1	2.7	2.77	0.33	2.6%
Oct-21	AIR PT 46-2	2.71	2.6	-0.49	-4.1%
Oct-21	AIR PT 46-3	2.17	2.06	-0.65	-5.1%
Oct-21	AIR PT 46-4	2.13	2.15	0.13	0.9%

Results from AIR-PT 42 showed a significant negative bias. An investigation was carried out and a repeat set of samples ordered (Mar-21) to confirm results.

Results from the investigation showed for AIR PT samples, extraction of nitrite was not complete and required further time on the shaker to extract all nitrite from the tubes. Successful extraction was demonstrated on the repeat Air PT samples in March 2021.

The investigation also showed that for laboratory standards and customer samples, extraction of nitrite from tubes was complete without further shaking, and there was no risk associated with results reported to customers.

For any queries please contact the Laboratory Manager at linda@gradkolab.com

Linda Gates

05/05/2022

Diffusion Tube Annualisation

Data collection for all sites was greater than 75% with the exception of DT27 due to replacement of the lamp post on which it was situated. The annualisation for this location has been carried out using three local north-west region sites: Warrington Selby Street, Blackpool Marton and Widnes Milton Road. The calculations have been carried out using

the Defra Diffusion Tube Data Processing Tool v1.1. Details of the calculation method undertaken provided in Table C.2.

Diffusion Tube Bias Adjustment Factors

The diffusion tube data presented within the 2022 ASR have been corrected for bias using an adjustment factor. Bias represents the overall tendency of the diffusion tubes to under or over-read relative to the reference chemiluminescence analyser. LAQM.TG16 provides guidance with regard to the application of a bias adjustment factor to correct diffusion tube monitoring. Triplicate co-location studies can be used to determine a local bias factor based on the comparison of diffusion tube results with data taken from NO_x/NO₂ continuous analysers. Alternatively, the national database of diffusion tube co-location surveys provides bias factors for the relevant laboratory and preparation method.

Warrington Borough Council have applied a local bias adjustment factor of 0.89 to the 2021 monitoring data. A summary of bias adjustment factors used by Warrington Borough Council over the past five years is presented in Table C.1.

A local factor has been used derived from a co-location study using triplicate diffusion tubes at Selby Street. The measurements obtained from automatic monitor and diffusion tubes at this site have good data capture and overall data precision.

Table C.1 – Bias Adjustment Factor

Monitoring Year	Local or National	If National, Version of National Spreadsheet	Adjustment Factor
2021	Local		0.89
2020	National	03/21	0.81
2019	Local		0.94
2018	Local		0.996
2017	Local		0.98

NO₂ Fall-off with Distance from the Road

Wherever possible, monitoring locations are representative of exposure. However, where this is not possible, the NO₂ concentration at the nearest location relevant for exposure has been estimated using the Diffusion Tube Data Processing Tool/NO₂ fall-off with distance calculator available on the LAQM Support website. Where appropriate, non-

automatic annual mean NO₂ concentrations corrected for distance are presented in Table B.1.

Fall-off-with-distance calculations were required at two monitoring sites; DT8 and DT11 as the annual mean concentration is greater than 36 µg/m³ at both of these locations.

QA/QC of Automatic Monitoring

QA/QC was contracted to ESU1 Ltd for the NO_x analyser at the Selby Street and ET Services for the NO_x analysers at Parker Street, Chester Road and Sankey Way during 2021. Routine calibrations are carried out by a trained officer from the Council. Six monthly routine services are carried out by the contractor at each site.

Selby Street NO_x and PM data is ratified as part of the AURN. Parker Street, Chester Road and Sankey Way data is ratified and provided by AQDM consultants. Ricardo-AEA provides six monthly independent QC audit checks for the Selby Street site as part of the AURN requirements. All QC checks have passed for each site.

The PM₁₀ and PM_{2.5} FDMS analysers are affiliated into the AURN. Servicing is carried out by Air Monitors Ltd with six monthly QC audits by Ricardo-AEA on behalf of Defra. Fortnightly calibration checks are completed by a trained Council Officer with data supplied for verification to Bureau Veritas and Ricardo-AEA acting on behalf of Defra. No performance issues have been reported from the audits or servicing during 2021.

PM₁₀ and PM_{2.5} Monitoring Adjustment

The type of PM₁₀/PM_{2.5} monitor(s) utilised within Warrington Borough Council do not required the application of a correction factor.

Automatic Monitoring Annualisation

All automatic monitoring locations within Warrington Borough Council recorded data capture of greater than 75% therefore it was not required to annualise any monitoring data. In addition, any sites with a data capture below 25% do not require annualisation.

NO₂ Fall-off with Distance from the Road

Wherever possible, monitoring locations are representative of exposure. However, where this is not possible, the NO₂ concentration at the nearest location relevant for exposure

has been estimated using the NO₂ fall-off with distance calculator available on the LAQM Support website. Where appropriate, non-automatic annual mean NO₂ concentrations corrected for distance are presented in Table B.1.

No automatic NO₂ monitoring locations within Warrington Borough Council required distance correction during 2021.

Table C.2 – Annualisation Summary (concentrations presented in $\mu\text{g}/\text{m}^3$)

Site ID	Annualisation Factor Selby Street	Annualisation Factor Blackpool Marton	Annualisation Factor Widnes Milton Road	Annualisation Factor	Average Annualisation Factor	Raw Data Annual Mean	Annualised Annual Mean	Comments
DT27	0.9145	0.9895	0.9477		0.9506	31.7	30.2	

Table C.3 – Local Bias Adjustment Calculation

	Local Bias Adjustment Input 1	Local Bias Adjustment Input 2	Local Bias Adjustment Input 3	Local Bias Adjustment Input 4	Local Bias Adjustment Input 5
Periods used to calculate bias	11				
Bias Factor A	0.89 (0.82 - 0.98)				
Bias Factor B	12% (3% - 22%)				
Diffusion Tube Mean ($\mu\text{g}/\text{m}^3$)	16.9				
Mean CV (Precision)	2.6%				
Automatic Mean ($\mu\text{g}/\text{m}^3$)	15.1				
Data Capture	99%				
Adjusted Tube Mean ($\mu\text{g}/\text{m}^3$)	15 (14 - 17)				

Notes:

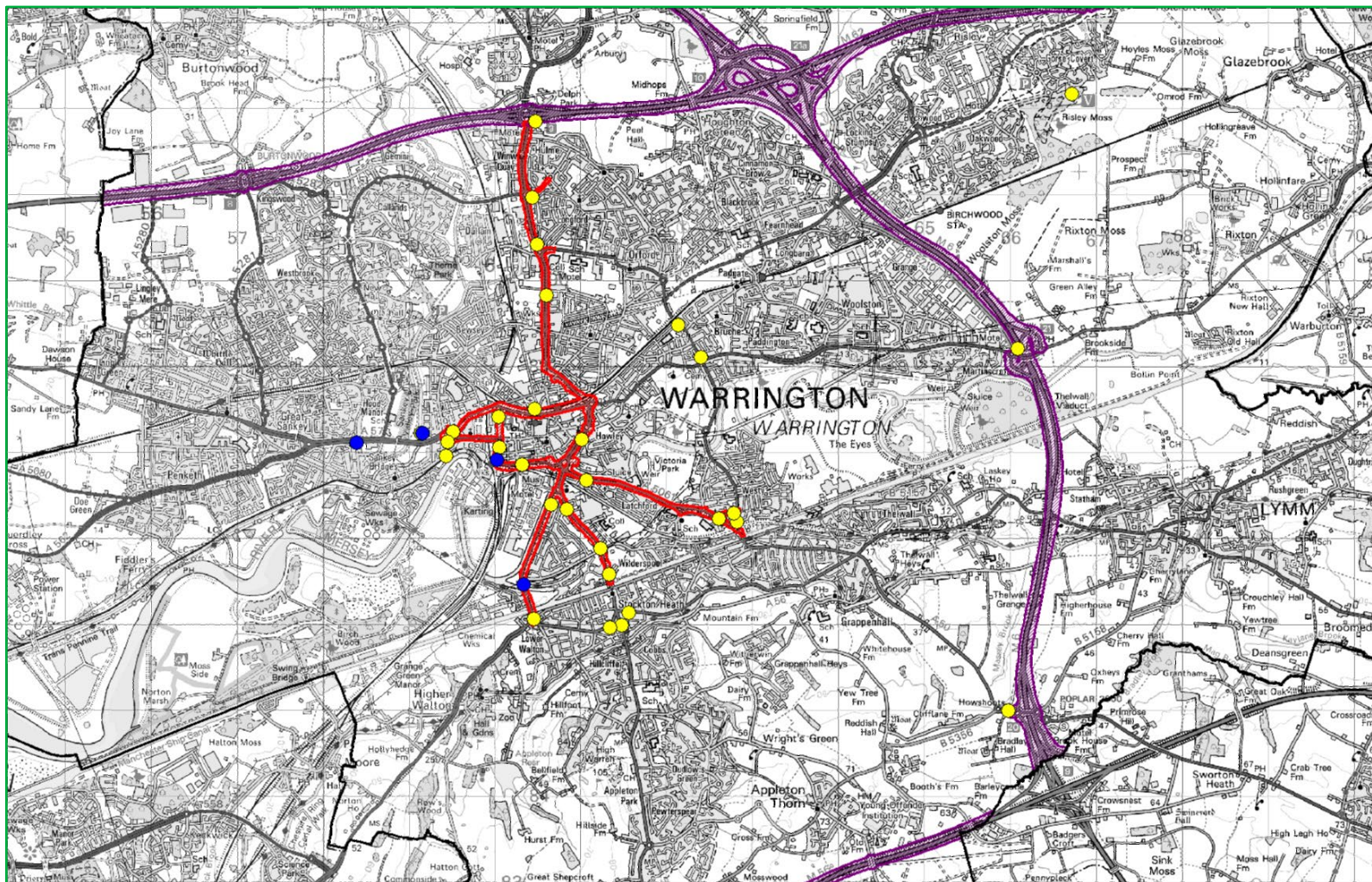
A single local bias adjustment factor has been used to bias adjust the 2021 diffusion tube results.

Table C.4 – NO₂ Fall off With Distance Calculations (concentrations presented in µg/m³)

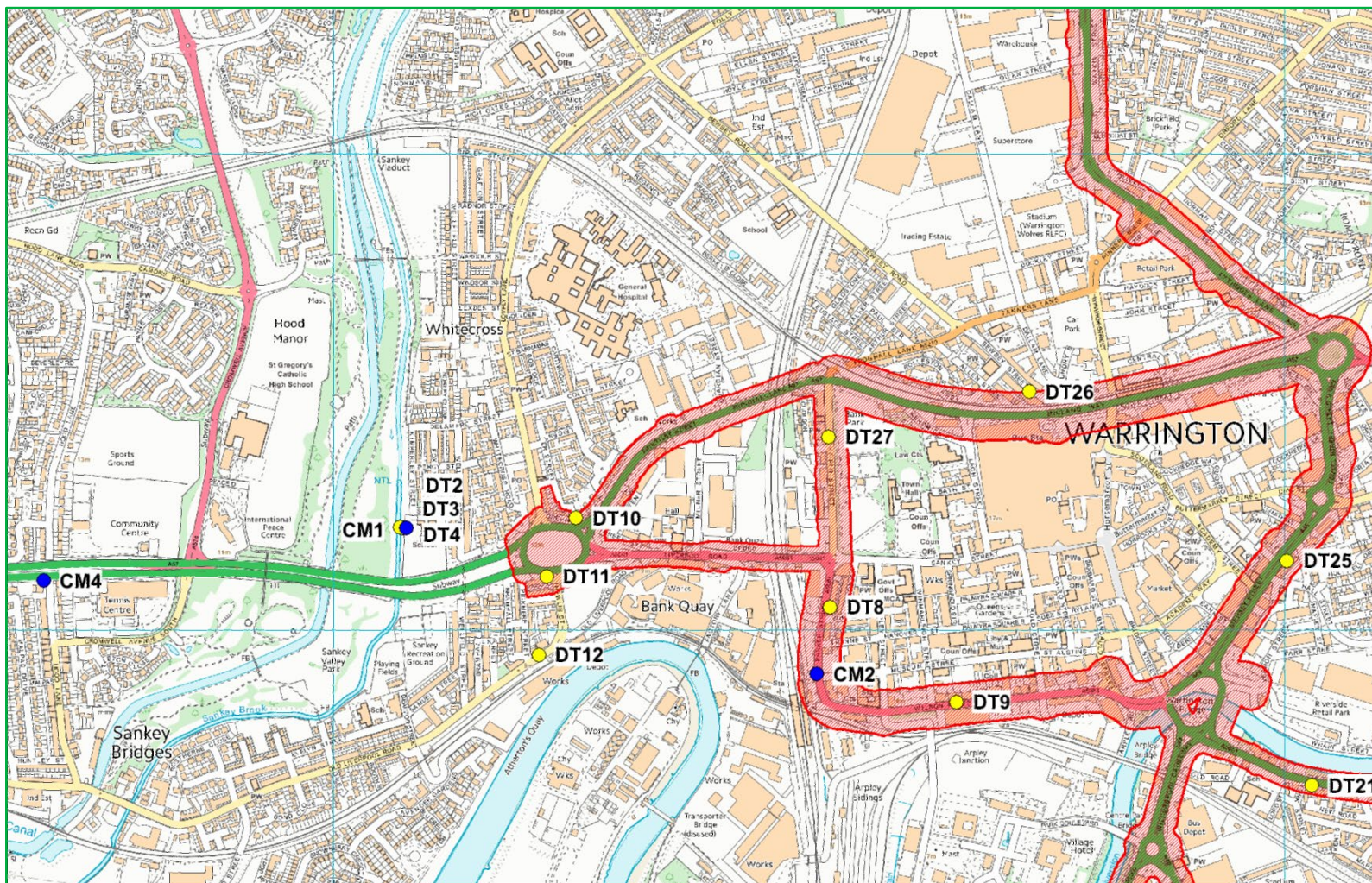
Site ID	Distance (m): Monitoring Site to Kerb	Distance (m): Receptor to Kerb	Monitored Concentration (Annualised and Bias Adjusted)	Background Concentration	Concentration Predicted at Receptor	Comments
DT8	1.5	3.5	40.0	15.1	35.4	
DT11	1.0	3.0	37.5	15.1	32.6	

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

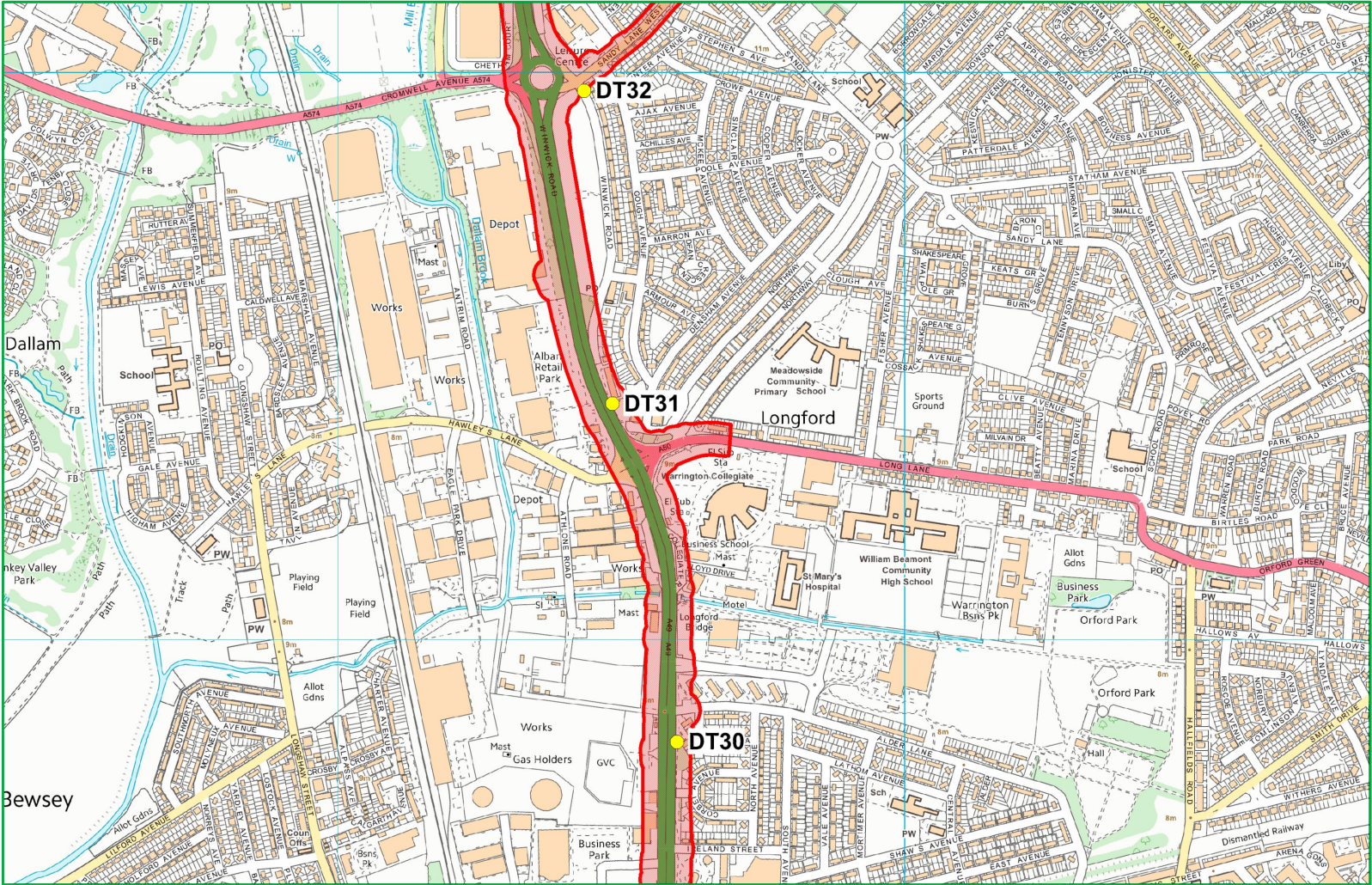
Figure D.1 – Map of all Automatic (Continuous Monitoring ●) and Non-Automatic Monitoring Site (Diffusion Tubes ●)



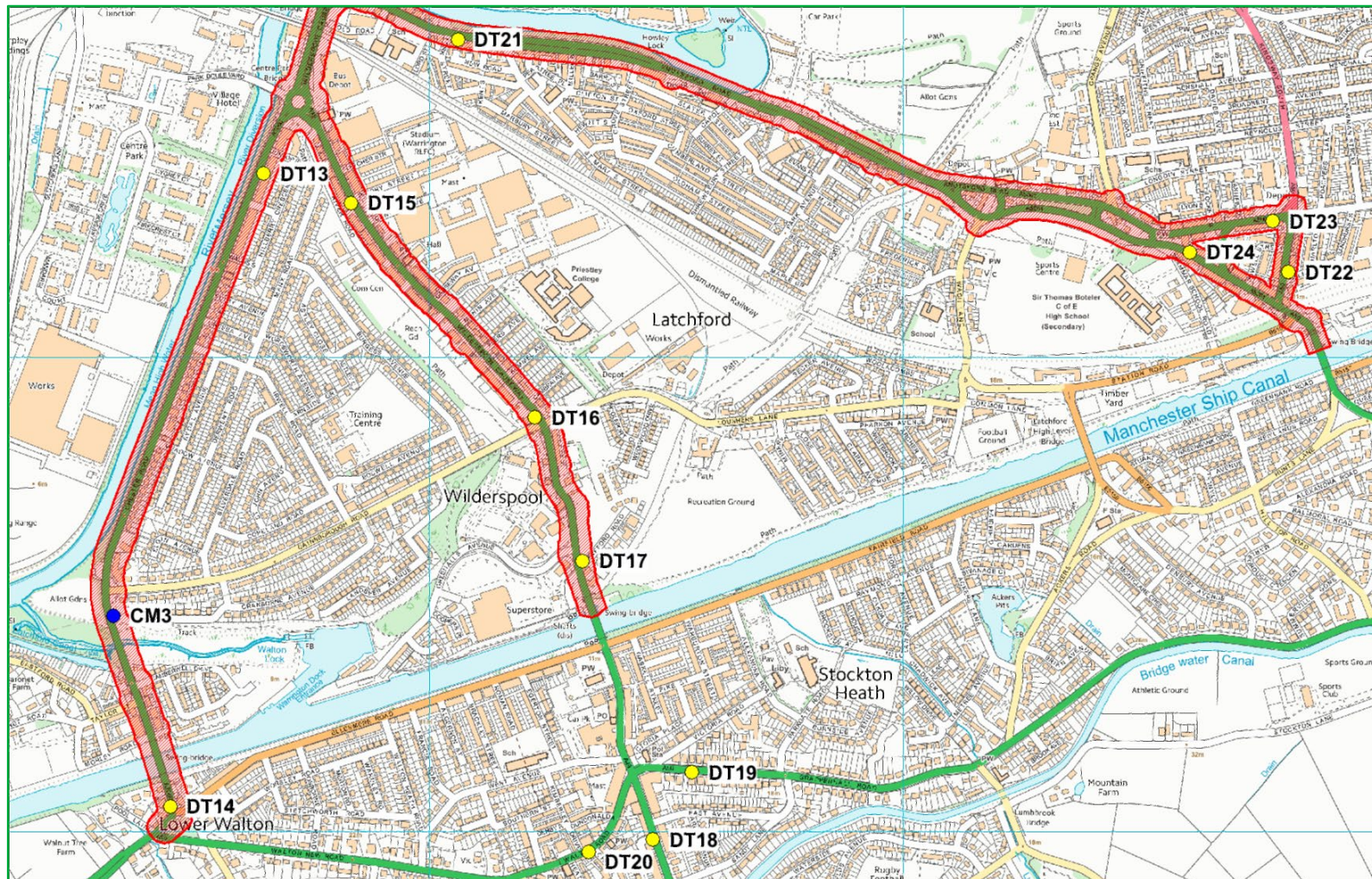
Town Centre



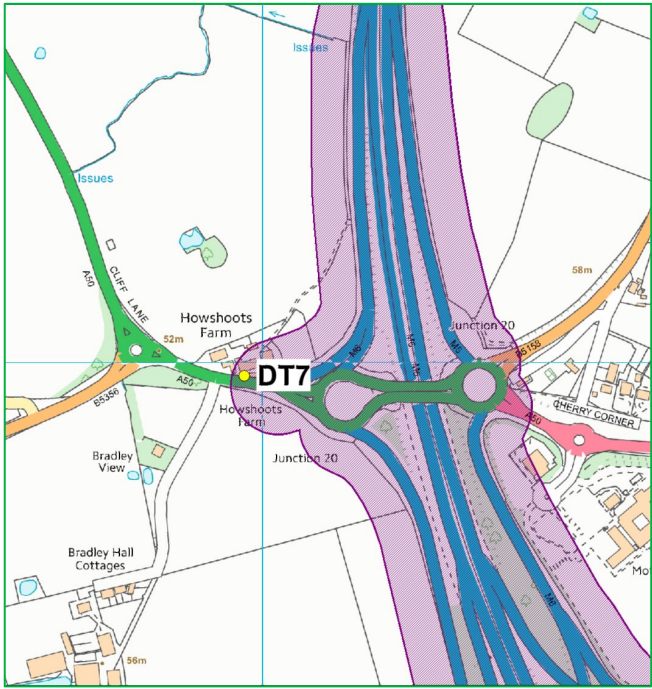
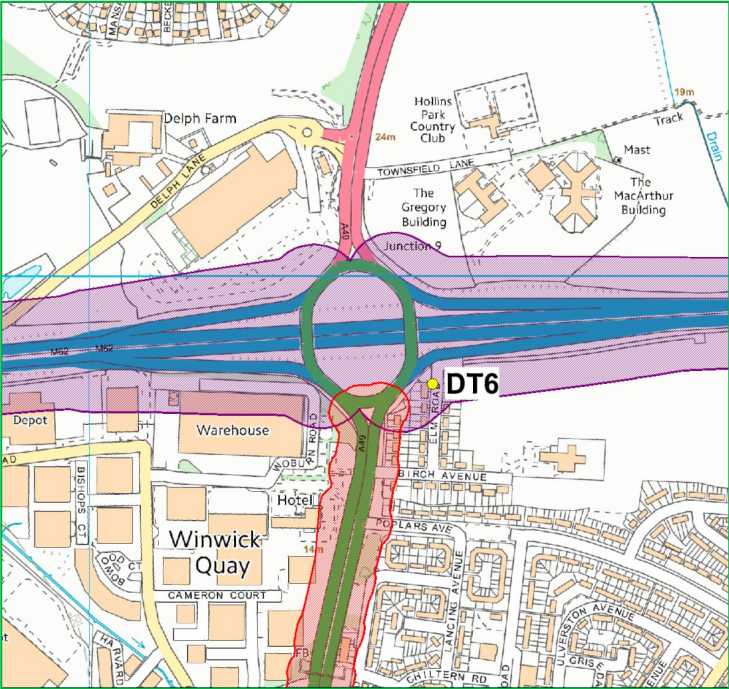
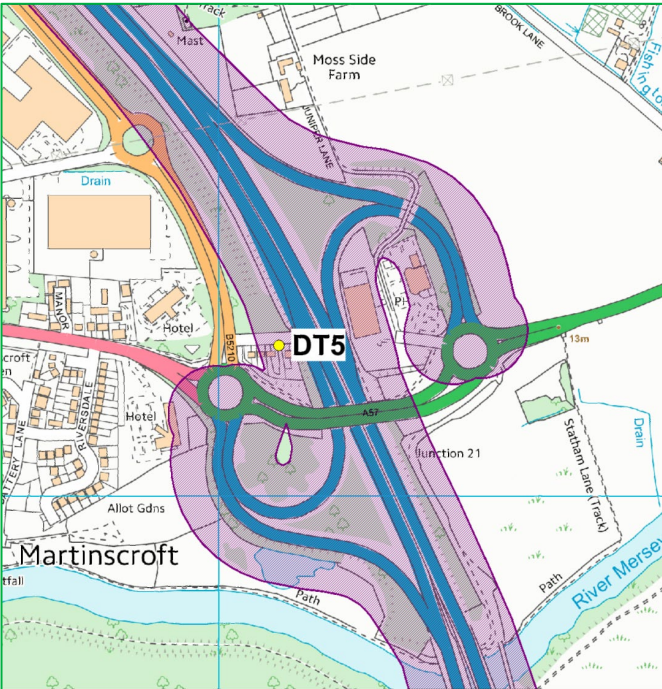
Winwick Road



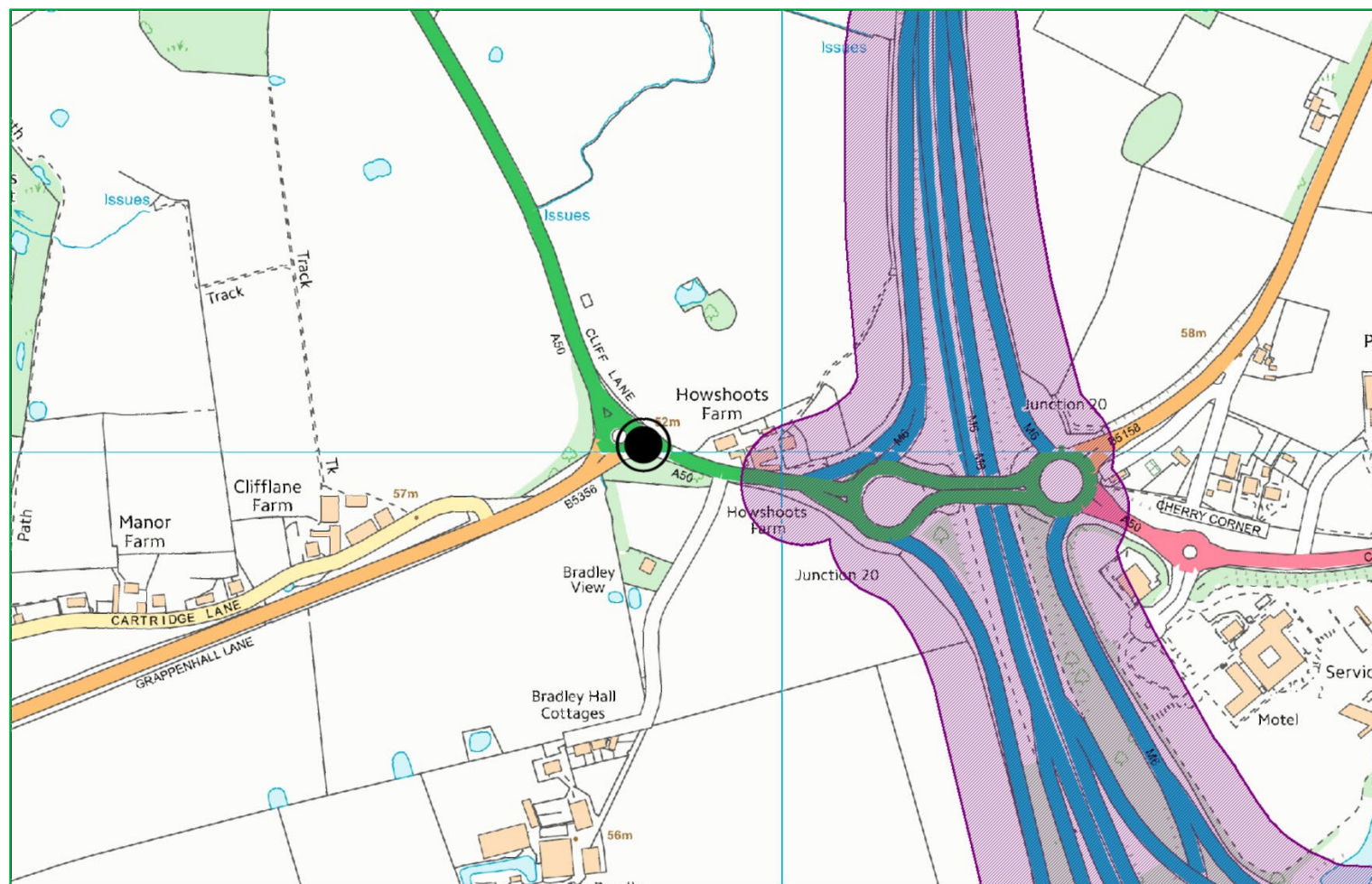
South Warrington



Motorway AQMA



Sensor Location



Appendix E: Summary of Air Quality Objectives in England

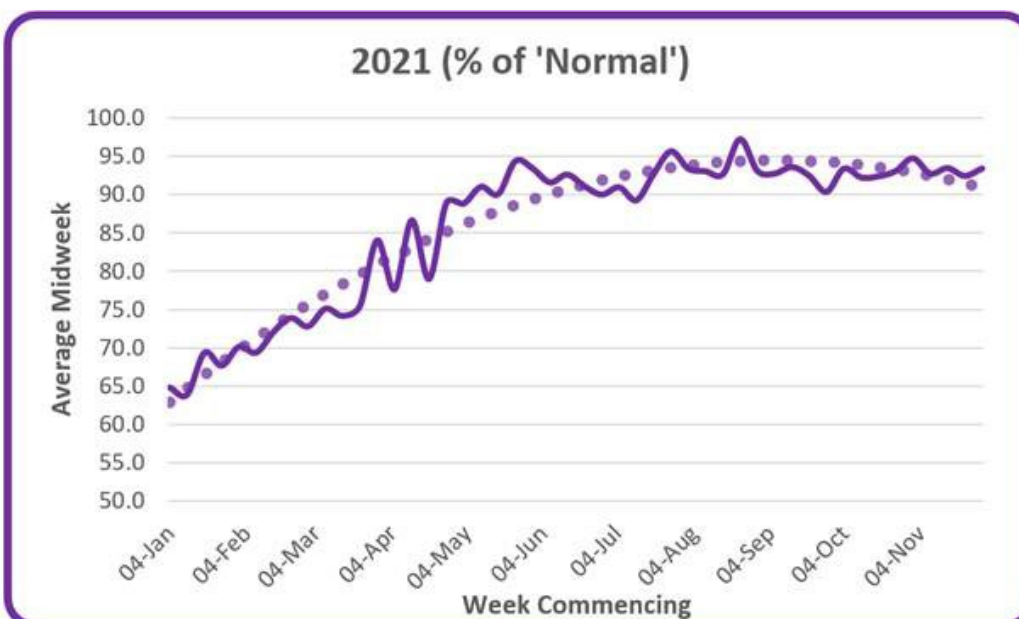
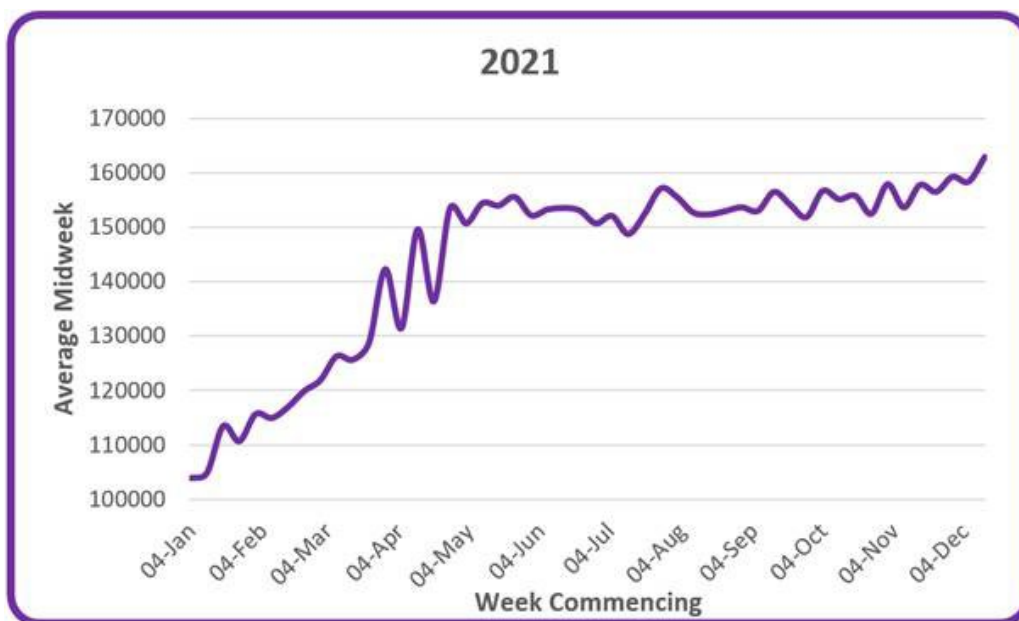
Table E.1 – Air Quality Objectives in England⁷

Pollutant	Air Quality Objective: Concentration	Air Quality Objective: Measured as
Nitrogen Dioxide (NO ₂)	200µg/m ³ not to be exceeded more than 18 times a year	1-hour mean
Nitrogen Dioxide (NO ₂)	40µg/m ³	Annual mean
Particulate Matter (PM ₁₀)	50µg/m ³ , not to be exceeded more than 35 times a year	24-hour mean
Particulate Matter (PM ₁₀)	40µg/m ³	Annual mean
Sulphur Dioxide (SO ₂)	350µg/m ³ , not to be exceeded more than 24 times a year	1-hour mean
Sulphur Dioxide (SO ₂)	125µg/m ³ , not to be exceeded more than 3 times a year	24-hour mean
Sulphur Dioxide (SO ₂)	266µg/m ³ , not to be exceeded more than 35 times a year	15-minute mean

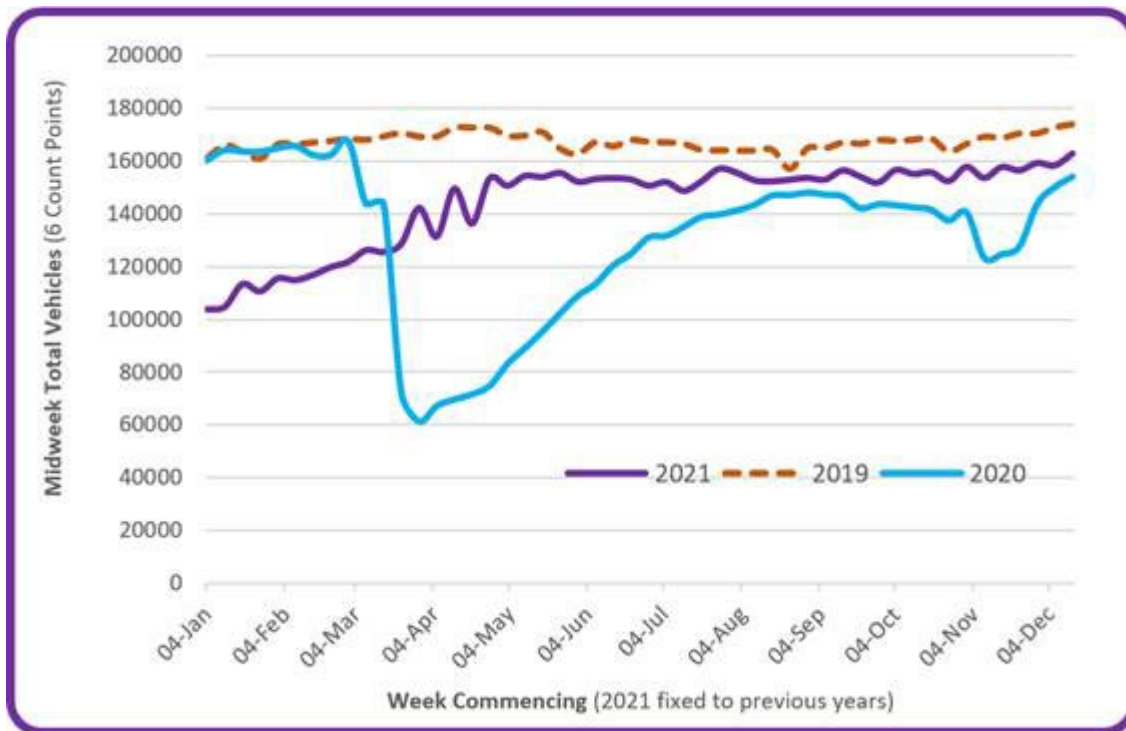
⁷ The units are in microgrammes of pollutant per cubic metre of air (µg/m³).

Appendix F: Traffic Information

This data has been taken from automatic traffic counts based on 6 major routes across Warrington, from Tuesday to Thursday only. As per the graphs below, the year started during the lockdown period with relatively low vehicle numbers (around 65%). This gradually picked up during the first half of the year reaching the early to mid-90s% by May/June. The remainder of the year was relatively consistent within this range.



The graph below summarises the past two years (2020/1) in comparison with the relative pre-pandemic 'normality' in 2019.



Whilst 2021 may not have seen the remarkable 'slump' in traffic that occurred in 2020, the number of vehicles traffic volume has not returned to pre-pandemic levels. Across the year, the Council recorded 14% less vehicles in 2021 than 'normal'. The pattern towards the end of 2021 has continued into 2022.

Appendix G: Sensor Data

Figure 1 – Average Daily Concentrations of NO₂ detected using Earthsense Zephyr® Sensor

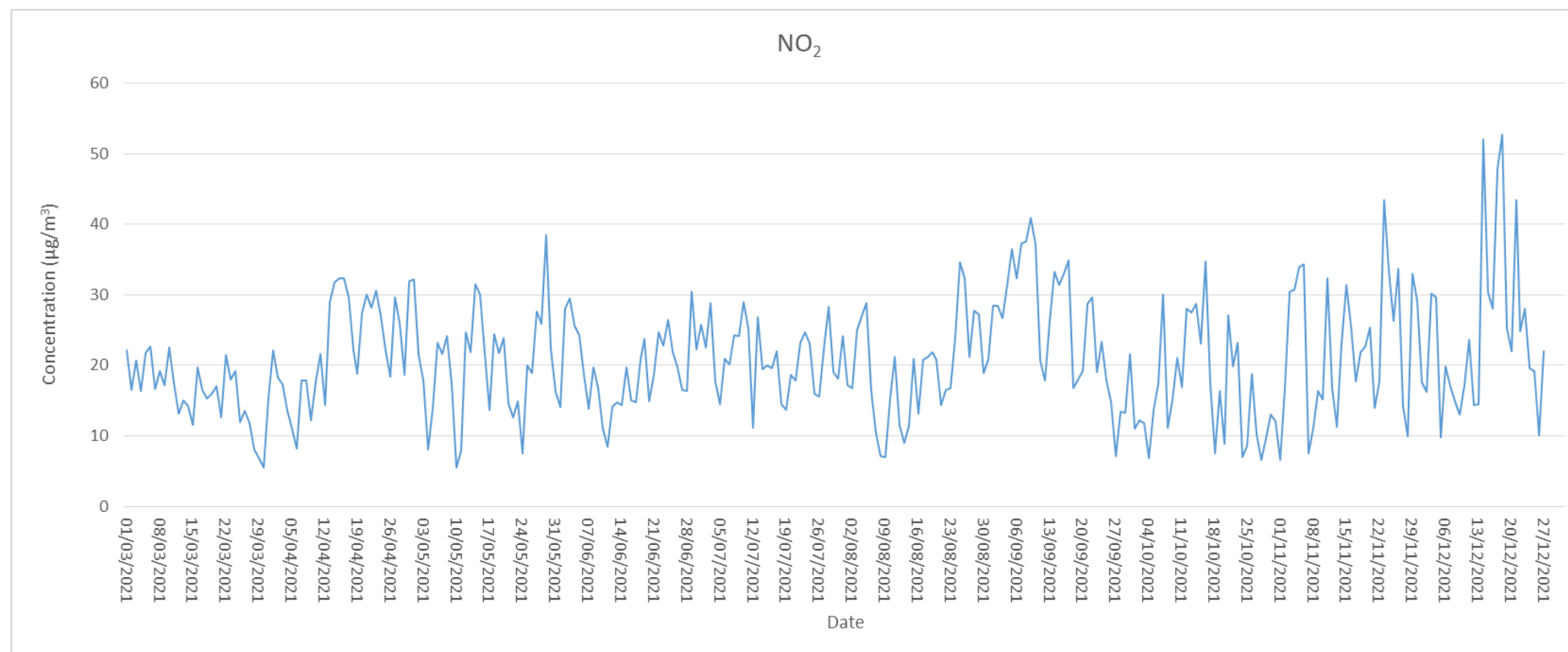


Table G1 – Annual Mean NO₂ Monitoring Results (µg/m³)

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2021 (%) ⁽²⁾	2017	2018	2019	2020	2021
Sensor 1	365925	385038	Urban Roadside	100	83					21

(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%).

The NO₂ data has not been used to assess the requirements for exceedances against the national objectives. Whilst the sensor seems to respond correctly to peaks, the actual qualitative data appears to be significantly under reporting. Diffusion tube DT at Howshoots farm is located close to the sensor and will measure traffic emission off the same road with same volume. This recorded levels of 35µg/m³. When comparing the sensor to the tube, there is a serious discrepancy. At this time it is conclude that for NO₂, the sensor is useful for indicative purposes only but should not be used for assessment work.

Figure 2 – Average Daily Concentrations of PM₁, PM_{2.5} and PM₁₀ detected using Earthsense Zephyr® Sensor

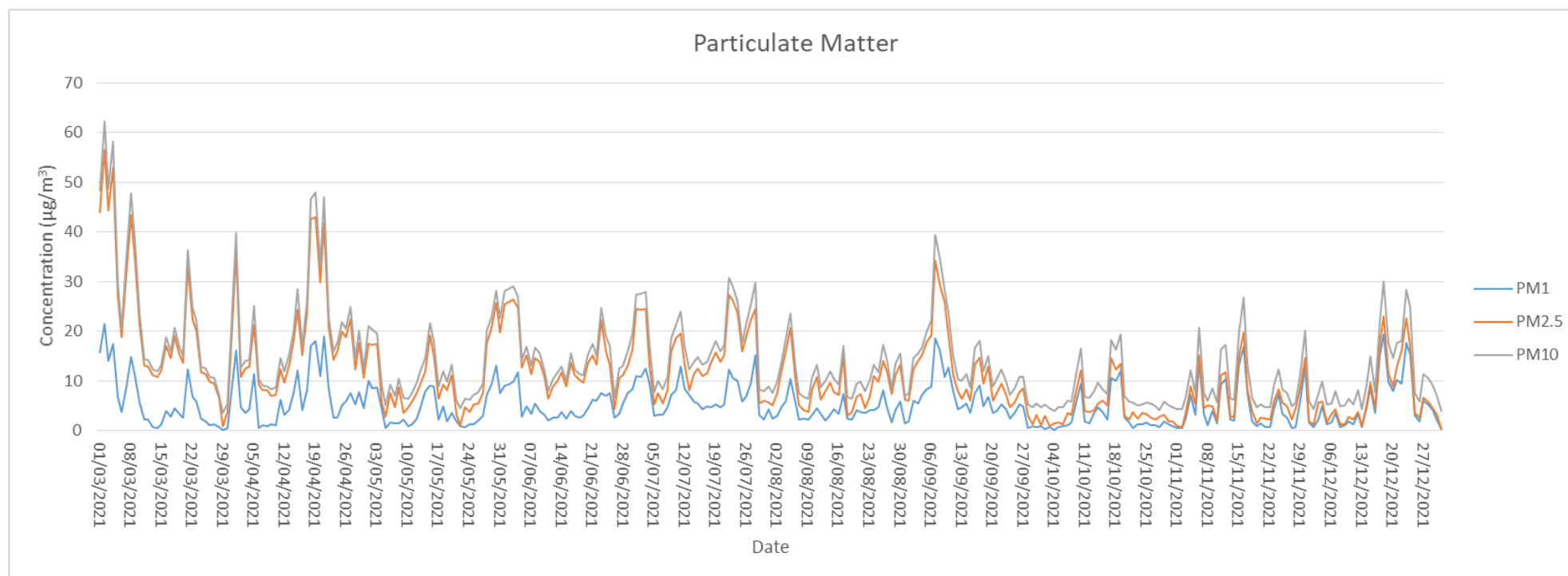


Table G2: Annual Mean PM Monitoring Results ($\mu\text{g}/\text{m}^3$)

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2021 (%) ⁽²⁾	2021 PM _{2.5}	2021 PM ₁₀
Sensor 1	365925	385038	Urban Roadside	100	83	12	15

Compared to the NO₂ data, the sensor data for particulates seems reasonable for the location. There are no exceedances in the relevant national objective limits which would then require more detailed investigation. The PM_{2.5} data though, does suggest that the new proposed national objective limit would not currently be met.

The sensor technology is new, and further research is required to assess the level of accuracy. Currently the Council considers them only useful for indicative purposes only and not suitable for LAQM assessment conclusions.

Glossary of Terms

Abbreviation	Description
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the local authority intends to achieve air quality limit values'
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
ASR	Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by National Highways
EU	European Union
FDMS	Filter Dynamics Measurement System
LAQM	Local Air Quality Management
NO ₂	Nitrogen Dioxide
NO _x	Nitrogen Oxides
PM ₁₀	Airborne particulate matter with an aerodynamic diameter of 10µm or less
PM _{2.5}	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
QA/QC	Quality Assurance and Quality Control
SO ₂	Sulphur Dioxide

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- Joint Needs Strategic Assessment Air Quality Chapter, Warrington Borough Council 2018
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- Local Plan (Draft), Warrington Borough Council
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