2022 Air Quality Annual Status Report (ASR)

In fulfilment of Part IV of the Environment Act 1995

Local Air Quality Management

July 2022

Cheshire West and Chester

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Executive summary: Air quality in our area

Air quality in Cheshire West and Chester

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

The mortality burden of air pollution within the UK is equivalent to 28,000 to 36,000 deaths at typical ages[3], with a total estimated healthcare cost to the NHS and social care of £157 million in 2017[4].

This annual status report (ASR) covers monitoring results for 2021 and action that the Council is taking in a bid to improve local air quality.

In Cheshire West and Chester (CWCC) the main pollutants of concern are nitrogen dioxide (NO_2), particulate matter (PM) and sulphur dioxide (SO_2).

National government has set health-based objectives for a range of pollutants and, where these are not met, the local authority must declare an air quality management area (AQMA) and commit to improving local air quality through action planning. There are four designated AQMAs in the borough. Three of these, located in Chester, Ellesmere Port and Frodsham, relate to exceedances of the annual mean NO_2 objective due to road traffic. The fourth, in Thornton-le-Moors, was declared because of exceedances of the 15-minute mean SO_2 objective caused by industrial emissions. Details of the AQMAs and associated action plans (AQAPs) can be found on the Council website at www.cheshirewestandchester.gov.uk/aqmanagement .

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

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

[3] Defra. Air quality appraisal: damage cost guidance, July 2020

[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

In 2021, for the first time (2020 national lockdown notwithstanding), the NO_2 annual average objective was not exceeded at any monitoring site in the Chester city centre AQMA. Similarly, the objective was not exceeded at residential properties in the AQMAs in Frodsham and Ellesmere Port. Current national air quality objectives for PM_{10} (particulate matter less than 10 micrometres in diameter) are complied with in Cheshire West and Chester. There is currently no regulatory standard applied to $PM_{2.5}$ (particulate matter less than 2.5 micrometres in diameter) for local authorities, but the national limit value is complied with at present. This is due to be revised later this year.

At our long-term monitoring sites there is a discernible downwards trend in NO_2 concentrations over time. PM_{10} levels, however, have remained fairly static over the last five years. It is not possible to derive significant trends in the data from SO_2 monitoring stations, but this is not unexpected due to the episodic nature of the exceedances.

As a unitary authority, Cheshire West and Chester Council benefits from inter-departmental working with all areas that may have an interest in and influence over local air quality matters. Externally, effective lines of communication have been established between CWCC and the Environment Agency, which is particularly important in respect of the air quality AQAP for Thornton-le-Moors.

Actions to improve air quality

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

The 2019 Clean Air Strategy[5] sets out the case for action, with goals even more ambitious than European Union (EU) requirements to reduce exposure to harmful pollutants. The Road to Zero[6] sets out the approach to reduce exhaust emissions from road transport through a number of mechanisms; this is extremely important given that the majority of Air Quality Management Areas (AQMAs) are designated due to elevated concentrations heavily influenced by transport emissions.

[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

In 2021-22, Cheshire West and Chester Council installed numerous electric car charging points (EVCPs), both in the public realm and at Council depots. The Council's current public network will allow up to 30 vehicles to charge simultaneously (complemented by many more in the private sector) but it is hoped that the number of EVCPs will increase significantly over the next few years to enable people to switch to zero emission vehicles. Transition to electric vehicles has also been encouraged through the use of planning conditions for new developments in advance of this becoming a national requirement through building control regulations.

Following declaration of a Climate Emergency in May 2019 the Council have been working and engaging with a range of partners, climate experts, community groups and businesses to understand the challenges and opportunities the Climate Emergency presents for our area. A Climate Emergency Fund (CEF) has been established to support a range of low carbon projects and, where there are co-benefits, projects that seek to improve local air quality. The rapid electric car chargers at the Boat Museum in Ellesmere Port were supported by both CEF and Local Enterprise Partnership (LEP) funding.

Conclusions and priorities

No exceedances of the NO_2 and PM_{10} objectives were identified outside any existing AQMAs in 2021. In 2021 the 15-minute SO_2 objective was not exceeded in the Thornton-le-Moors AQMA.

Long-term monitoring data shows a noticeable reduction in NO_2 levels over time, particularly at roadside sites. Monitoring results in the Ellesmere Port AQMA have been consistently below the air quality objective for NO_2 and we intend to revoke the AQMA. Also the status of the Frodsham AQMA needs to be reviewed as the NO_2 objective is not exceeded.

The finalised action plan for the Chester AQMA has been published and a measures appraisal is due to be commissioned. AQAP measures, as well as measures from the Low Emission Strategy, may be required to bring forward compliance in coming years.

In the coming year, the Council's priorities are to make progress with measures in the LES; complete and adopt the EV strategy; expand the availability of EVCPs in the borough; revoke the AQMA in Ellesmere Port; review the status of the AQMA in Frodsham, continue to lead by example and expand the number of ultra-low emission vehicles within the council fleet and take advantage of funding opportunities for the adoption of further air quality improvement measures.

Local engagement and how to get involved

There are many ways that we can all help to reduce outdoor air pollution:

- Leave your car at home and walk, cycle or use public transport instead. Car drivers can be exposed to significantly more air pollution than pedestrians or cyclists using the same streets
- When choosing your next car, consider alternatives to petrol and diesel such as electric cars or plug-in hybrids. Tailpipe emissions from these vehicles are much lower (or even zero) and running costs are significantly cheaper. Lease costs of electric cars are often similar to an equivalent petrol/diesel model, road tax is zero and the benefit in kind (BIK) tax cost is a fraction of that for traditional models.
- Switch your car's engine off whenever you're not moving and it's safe to do so. You'll improve air quality for yourself and others
- Keep your car regularly serviced and the tyres correctly inflated
- Adopt an efficient driving style – anticipate the road ahead, change up the gears earlier and brake smoothly. It could save you a lot of money over the course of a year
- Burning wood and other solid fuels produces a lot of air pollutants. If you do intend to buy a wood-burning stove, choose a Department for Environment, Food and Rural Affairs (Defra) approved Eco-Design Ready model. Make sure that the wood you use meets the 'Woodsure ready to burn' requirements (seasoned dry wood with moisture content below 20%).
- Compost your garden waste or use green wheelie bins rather than burning it

Adults and children with lung problems and adults with heart problems may be particularly affected by air pollution. Information on local air quality is available on the Council's website www.cheshirewestandchester.gov.uk/airquality and further information on forecasting and health advice is available on Defra's UK-air website https://uk-air.defra.gov.uk/.

Local Responsibilities and Commitment

This ASR was prepared by the Regulatory Services department of Cheshire West and Chester Council with the support and agreement of the following officers and departments:

[redacted] – Environmental Protection, Regulatory Services

[redacted] – Transport and Infrastructure

[redacted] – Planning Policy

This ASR has been approved by:

[redacted] – Director of Environment and Communities

[redacted] – Director of Public Health

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

If you have any comments on this ASR, please send them to Environmental Protection at:

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1 Local air quality management

This report provides an overview of air quality in Cheshire West and Chester 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 Cheshire West and Chester 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 16.

2 Actions to improve air quality

Air quality management areas

Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely exceedance of an air quality objective. After declaration, the authority should prepare an Air Quality Action Plan (AQAP) within 12 months setting out measures it intends to put in place in pursuit of compliance with the objectives.

A summary of AQMAs declared by Cheshire West and Chester Council can be found in Table 1. The table presents a description of the four AQMAs that are currently designated within Cheshire West and Chester. Appendix D: Map(s) of monitoring locations and AQMAs provides maps of AQMAs and also of the air quality monitoring locations in relation to the AQMAs. The air quality objectives pertinent to the current AQMA designations are as follows:

- NO_2 annual mean
- SO_2 15-minute mean

We propose to revoke Whitby Road / Station Road AQMA in Ellesmere Port and review the status of Fluin Lane AQMA in Frodsham (see 3.1.3).

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	Name and date of AQAP publication	Web link to AQAP
Chester city centre	May-17	NO_2 Annual Mean	Inner ring road and sections of Liverpool Rd, Parkgate Rd, Hoole Way, Boughton gyratory and Watergate St. Chester	No	50.3µg/m^3 (T6)	34.1µg/m^3 (T6)	Chester city centre air quality action plan 2022	www.cheshirewestandchester.gov.uk/aqmanagement
Thornton-le-Moors	Sep-16	SO_2 15-minute mean	An area around the oil refinery at Stanlow	No	56 exceedances (TLM)	4 exceedances (ELT)	Thornton-le-Moors air quality action plan 2018	
Fluin Lane	Nov-15	NO_2 annual mean	Junction of A56 and Fluin Lane, Frodsham	No	41.5µg/m^3 (FJ)	28.8µg/m^3 (FH)	Frodsham air quality action plan 2018	
Whitby Road / Station Road	May-05	NO_2 annual mean	Residential properties on parts of Whitby Rd, Station Rd and Princes Rd, Ellesmere Port	No	44.5µg/m^3 (SK)	31.4µg/m^3 (WH)	Ellesmere Port and Neston BC air quality action plan 2007	

☒ Cheshire West and Chester confirm the information on UK-Air regarding their AQMA(s) is up to date.

☒ Cheshire West and Chester confirm that all current AQAPs have been submitted to Defra.

Progress and impact of measures to address air quality in Cheshire West and Chester

Defra's appraisal of the 2020-21 ASR concluded that "on the basis of the evidence provided by the local authority the conclusions reached are acceptable for all sources". The appraiser's comments said:

- Trends are presented and discussed and a robust comparison with air quality objectives is provided. In addition, numerous graphs illustrating trends in pollutant concentrations in recent years have been provided, which are beneficial.
- The Council have continually reviewed their monitoring strategy and have reported on changes made in the past two years. This demonstrates the Councils commitment to close monitoring of air quality within their jurisdiction and will allow for the identification of potential new hotspots.
- Comments from the previous appraisal have been included and addressed, which is welcomed.
- The Council do not conduct monitoring of $PM_{2.5}$ but have provided an estimate from PM_{10}. The report also highlights the various measures implemented which target $PM_{2.5}$ specifically and demonstrate the close working relationship with Public Health teams.
- The Council have stated they intend to revoke the Whitby Road / Station Road (Ellesmere Port) AQMA, as there have been no exceedances recorded between 2017 and 2020. With the Fluin Lane (Frodsham) AQMA under review. This is supported.
- It is noted that the Chester City Centre AQAP is not published yet. This is unchanged since the 2019 ASR. The Council is encouraged to adopt the AQAP as soon as possible.
- QA/QC of 2020 monitoring data has been applied appropriately and accurately, with detailed evidence and justification outlined. Both local and national bias adjustment factors were calculated for the 2020 monitoring data. The national factor was chosen for consistency with previous years, despite the local factor being more conservative. This is acceptable for 2020 as concentrations are low and choice of the factor would not affect whether compliance with objectives is achieved. However, the local factor for 2019 is has not been reported. A more conservative

2019 local factor could affect the number of monitoring locations which are exceeding the objective.

- Maps of monitoring locations and AQMA boundaries have been provided. However, some minor improvements can be made to increase readability. Suggested improvements includes changes to base mapping, clearer labels, and/or additional mapping at a smaller scale.

Defra's report notes the Council's intention to revoke the AQMA in Ellesmere Port. This action has not progressed since publication of the 2019 ASR but as noted in this ASR, the matter needs to be revisited, along with review of the AQMA in Frodsham.

Following public consultation, the finalised AQAP for Chester was published in March 2022 and can be accessed at www.cheshirewestandchester.gov.uk/aqmanagement .

Cheshire West and Chester has taken forward a number of direct measures during the current reporting years of 2021-22 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2. Forty measures are included in Table 2, with the type of measure and the progress Cheshire West and Chester have made presented. Where there have been, or continue to be, barriers restricting the implementation of the measure, these are also presented within the table.

More detail on these measures can be found in their respective Action Plans, the Low Emission Strategy and the Local Plan part 2. Key completed measures are:

- Completion of the installation of 12 double-socket fast electric vehicle chargepoints (EVCPs) across 6 Council car parks, match funded through the Department for Transport (DfT) on-street residential chargepoint scheme, ORCS (May 2021) (measure 5 of the Chester AQAP)
- Completion of the installation of 14 double-socket fast EVCPs in Canalside depot along with 2 rapid chargers at the nearby Boat Museum. Local Enterprise Partnership was match funded with Climate Emergency Funds for this project. (May 2021) (measure 6 of the Chester AQAP)
- Installation of EV charging infrastructure at Phoenix House, Northern Lights, Browning Way and Leslie Road depots
- Revision of Licensing policy to stimulate the uptake of taxis and private hire ULEVs
- Implementation of planning conditions requiring EVCPs in new developments following adoption of the Local Plan, part 2 (measure 7, Chester AQAP).

Cheshire West and Chester expects the following prioritised measures to be completed over the course of the next reporting year:

- Revocation of the Whitby Road/Station Road AQMA in Ellesmere Port
- Review of the status of the Fluin Lane AQMA in Frodsham with consideration for potential revocation
- Completion and adoption of the EV strategy, which will help to inform and prioritise the rollout of additional EVCP infrastructure across a range of location types including on-street and Council workplaces
- Rollout of a comprehensive local network of privately funded rapid EVCPs across the borough
- Installation of the first phase of a mix of 40 fast and rapid EVCPs in the Northgate development multistorey car park in Chester
- Completion of a taxi driver engagement scheme to inform and demonstrate the feasibility and benefits of electric vehicles.

The principal challenges and barriers to implementation that Cheshire West and Chester anticipates facing are securing grant funding to support measures, ongoing staffing issues, effective engagement with partner organisations and balancing other council priorities.

Progress on the following measures has been slower than expected due to the impact of national covid-19 lockdowns and internal workload/staffing issues:

- Finalisation and publication of the Chester city centre AQAP
- Completion and submission of the ASR
- Commencement with the ultra-rapid EV charger hubs project
- Completion and adoption of the EV strategy
- Revocation of Ellesmere Port AQMA
- Review of the Frodsham AQMA

Cheshire West and Chester anticipates that the measures stated above and in Table 2 will achieve compliance in the Ellesmere Port and Frodsham AQMAs.

Whilst the measures stated above and in Table 2 will help to contribute towards compliance, Cheshire West and Chester anticipates that the trial of the de-SOx sulphur-reducing catalytic dosing system at the refinery will need to continue for several years in order to prove its efficacy.

Further additional measures not yet prescribed may be required in subsequent years to achieve compliance and enable the revocation of Chester city centre AQMA (due to the fact that 2020 and possibly 2021 were atypical years due to national lockdowns).

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 Chester AQAP measure number 1	Freight delivery and service plans, work with local distribution centres to change delivery emissions	Freight and Delivery Management	Delivery and Service plans	2021	2025	CWCC Transport	Levelling Up Fund	NO	Not Funded	£1 million - £10 million	Planning	Reducing emissions contribution from HGVs, reduced queuing traffic in peak hours	Successful bid to the Levelling Up Fund. Detailed design completion.	Bid submitted to Levelling Up Fund for multimodal hub including last mile delivery facility.	Unsuccessful. Integrated Sustainable Transport Taskforce will set up a freight subgroup as part of the work programme.
2 Chester AQAP measure number 2	HGV/LGV recognition schemes for Council contracts	Promoting Low Emission Transport	Public Vehicle Procurement - Prioritising uptake of low emission vehicles	2021	2025	CWCC Transport		NO	Not Funded	£10k - 50k	Planning	NO2 Emission Reduction	Amended procurement procedure	Not commenced	To ensure Council contracts require use of FORS or similar in Chester AQMA
3 Chester AQAP measure number 3	Collaborating with bus operators to introduce ultra-low emission vehicles into the bus fleet (new or retrofit). Target use of ULEV into the problem areas	Vehicle Fleet Efficiency	Promoting Low Emission Public Transport	2017	2023	CWCC Transport	N/A	NO	Not Funded	£500k - £1 million	Implementation	Reduced vehicle emissions	Number of ultra-low emission bus fleets introduced	On-going	Falling bus patronage and Covid disruption has impacted on operator priorities and profit. Bus Service Improvement Plan (BSIP) approved Oct 2021 - initial focus on passenger recovery. The CWCC BSIP received a nil settlement. Government.
4 Chester AQAP measure number 4	Update taxi / private hiring policy	Promoting Low Emission Transport	Taxi Licensing conditions	2021	2022	CWCC Licensing	CWCC	NO	Funded	£10k - 50k	Implementation	NO2/PM Emission Reduction	Amendment of Taxi Licensing Policy	Amended policy change adopted Nov '21 - require fleet transition to ULEV by 2031/2036, commencing 2025. Age policy also revised	This measure requires successful implementation of charging infrastructure, either by commercial third parties or the Council (Measure 5 below).
5 Chester AQAP measure number 5	Alternative fuel (EV) infrastructure development in city centre	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	2018	2030	CWCC	CWCC/LEP/DfT/3rd-party	NO	Funded	£500k - £1 million	Implementation	NO2 Emission Reduction	Number of alternative fuel (EV) infrastructure development in the city centre	Fast chargers delivered at Brook St & Bishop St car parks, EV hub comprising rapids and fast to come online 2022 at Northgate MSCP, Taxi rapids to come online early 2022.	Borough-wide EV strategy being developed. Continued rollout of EVCPs dependent on securing additional funding

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
6 Chester AQAP measure number 6	Procuring low emission vehicles for council-owned fleets	Promoting Low Emission Transport	Public Vehicle Procurement - Prioritising uptake of low emission vehicles	2019	2030	CWCC	CWCC	NO	Funded	< £10k	Implementation	NO2 Emission Reduction	Number of council-owned low emission fleet vehicles	Procurement policy amended to require ULEV first approach. EV chargers installed at depots	Dependent on fleet renewal dates, replacement has commenced and will run until 2030.
7 Chester AQAP measure number 7	Work together with developers to promote the inclusion of electric charging points for electric/hybrid vehicles at new development sites	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	2018	2030	CWCC	CWCC	NO	Funded	< £10k	Implementation	NO2 Emission Reduction	Number of properties and premises where charging points have been required through planning condition	Year 2020/21 102 residential schemes (345 chargers, 455 dwellings with cabling infrastructure and 234 requiring future submission/approval). 26 commercial schemes (52 parking spaces and 1 requiring future submission/approval).	Figures for 2021/22 will be published late 2022 in the Local Plan Annual Monitoring Report. Parking standards SPD were updated 2021. Borough-wide measure
8 Chester AQAP measure number 8	Public transport infrastructure improvements, e.g. - Enhanced bus shelters - Accurate electronic timetables - m-tickets / contactless payment options	Promoting Travel Alternatives	Intensive active travel campaign & infrastructure	2018	2022	CWCC / Public transport bodies	CWCC	NO	Not Funded	£100k - £500k	Completed	NO2 Emission Reduction	% modal shift to car share/public transport	Completed	Real-time passenger info provided at P&R sites, bus interchanges and some bus stops e.g. rail stations. Quarterly timetable updates agreed in the BSIP. Accurate information is available on operators' and Council websites and iTravel Smart app. Contactless payment available on bus and operator apps.

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
9 Chester AQAP measure number 9	Incentivise public transport usage, e.g. - Provision of information about existing services - Campaigns - Season ticket loan/discounts - Subsidised tickets	Promoting Travel Alternatives	Intensive active travel campaign & infrastructure	2021	2025	CWCC	tbc	NO	Not Funded	£50k - £100k	Implementation	NO2 Emission Reduction	% modal shift to car share/public transport	Work not commenced	Awaiting govt. initiative promised in Bus Back Better for enhanced ticketing offer. CWCC Enhanced Partnership will launch a joint marketing campaign later this financial year- focus on attracting passengers back to bus after negative health messages during covid. The Enhanced partnership has offered 2 months free travel on bus for Ukrainians, Afghans as well as promotions around armed forces and veterans day. Due to inflation, costs to operators are increasing and ability for wider ticketing offers are limited. Market changed with people still working from home.
10 Chester AQAP measure number 10	Behaviour change campaigns to reduce single occupancy car trips	Promoting Travel Alternatives	Intensive active travel campaign & infrastructure	2018	2023	CWCC	CWCC	NO	Funded	£10k - 50k	Planning	NO2 Emission Reduction	% modal shift to car share/public transport	Funding has been identified and ring fenced.	A Traffic Demand Study has been commissioned through Saighton Camp Section 106 funds, it is hoped the measures identified, once complete, can be rolled out elsewhere in the borough. This measure also tied to marketing campaign.
11 Chester AQAP measure number 11	Flexible working and home working encouraged	Promoting Travel Alternatives	Encourage / Facilitate home-working	2019	2022	CWCC	CWCC	NO	Funded	< £10k	Planning	NO2 Emission Reduction	Number of people working from home	Modern workforce programme fully implemented 2022	Staff are now classed as either fully agile, hybrid or fixed workers.

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 Chester AQAP measure number 12	Promoting Car Club / Car Sharing Schemes/ Car Pooling	Promoting Travel Alternatives	Workplace Travel Planning	2021	2025	CWCC	CWCC	NO	Not Funded	< £10k	Planning	NO2 Emission Reduction	% modal shift to car share/public transport	Not commenced	This work area needs substantial further development.
13 Chester AQAP measure number 13	Park and Ride Schemes with Euro VI Vehicles	Alternatives to private vehicle use	Bus based Park & Ride	2017	2023	CWCC / Bus operator	CWCC / Bus operator	NO	Funded	£1 million - £10 million	Implementation	NO_2 Emission Reduction	% modal shift to car share/public transport	Implemented	Euro VI vehicles on the P&R services. The focus is now on growing the passenger base and reducing single occupancy journey into Chester.
14 Chester AQAP measure number 14	On and off-street parking charges linked to vehicle emission standards - including any residents permits.	Traffic Management	Workplace Parking Levy, Parking Enforcement on highway	2021	2030	CWCC	bid application required	NO	Not Funded	£100k - £500k	Planning	NO_2 Emission Reduction	Improve traffic management	2021 funding application to appoint consultants unsuccessful.	This is a substantial work area and there is a need to identify funding to advance it both in terms of development, infrastructure / implementation.
15 Chester AQAP measure number 15	Restrict long stay parking in AQMA.	Traffic Management	Other	2021	2025	CWCC	CWCC	NO	Not Funded	£10k - 50k	Planning	NO_2 Emission Reduction	Improve traffic management	Not commenced	Substantial work area requiring funding and resourcing.
16 Chester AQAP measure number 16	Improve signage at main junctions within the AQMA and major spurs.	Transport Planning and Infrastructure	Other	2021	2025	CWCC	CWCC	NO	Not Funded	£50k - £100k	Planning	NO_2 Emission Reduction	Improve traffic management	Not commenced	Focus on smart digital signage to assist driver choice.

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
17 Chester AQAP measure number 17	Review active travel policy/strategy to identify opportunities to support delivery, for example improved signage and cycle route/parking	Transport Planning and Infrastructure	Cycle network	2020	2023	CWCC	CWCC	NO	Funded	< £10k	Implementation	NO_2 Emission Reduction	Improve traffic management	LCWIP published July 2020 Section 106 requirements successfully implemented through planning approval	LTN 1/20 published by Government. CWCC updating our Local Cycling and Walking Infrastructure Plan in line with new guidance. Active Travel England want to invest in walking and cycling schemes which will have most impact and lead to modal change to more active modes for short journeys.
18 Chester AQAP measure number 18	Work together with developers to improve sustainable transport links serving new developments	Transport Planning and Infrastructure	Other	2019	2023	CWCC	CWCC	NO	Funded	< £10k	Implementation	NO_2 Emission Reduction	To be determined	Local Plan Part 2 adopted 18 July 2019 strengthening planning obligations.	Borough-wide impact. Sustainable criteria are a fundamental requirement of the Local Plan. There is a need to devise an internal mechanism for gauging performance over time
19 Chester AQAP measure number 19	Provision of high quality, bespoke and accessible information on sustainable travel, e.g. on a dedicated travel website with route/mode options	Public Information	Via the Internet	2017	2024	CWCC	CWCC	NO	Funded	£10k - 50k	Implementation	NO_2 Emission Reduction	Number of hits on upgraded website per annum	Council have produced an app called iTravelsmart	Explore options to improve app and utilise it fully for the purpose of raising awareness and supporting other sustainable transport measures.

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
20 Chester AQAP measure number 20	Local air quality monitoring within the unitary authority to ensure a high standard of data is achieved	Public Information	Other	2021	2023	CWCC	CWCC	NO	Funded	£10k - 50k	Planning	NO_2 Emission Reduction	Number of monitoring locations	Funding has been ring fenced to introduced portable real-time monitors	Assessment and selection of appropriate monitoring devices needs to be undertaken.
21 Chester AQAP measure number 21	Low Emissions Strategy	Policy Guidance and Development Control	Low Emissions Strategy	2018	2021	CWCC	CWCC	YES	Funded	£10k - 50k	Completed	NO_2 Emission Reduction	The implementation of Low Emissions Strategy	Published September 2018	Targeting and prioritising implementation of measures on the AQMA. LES applies borough-wide
22 Chester AQAP measure number 22	Anti-idling enforcement at all on-street locations	Traffic Management	Other	2018	2020	CWCC	CWCC	NO	Funded	£10k - 50k	Completed	NO_2 Emission Reduction	Idling reduction	Legislation adopted, regular patrols in place.	Periodic review of intelligence to enable targeted patrols. Implemented borough-wide
23 Chester AQAP measure number 23	Review access permissions and use of the Northgate Street traffic barrier.	Traffic Management	Other	2021	2022	CWCC	CWCC	NO	Not Funded	< £10k	Planning	NO_2 Emission Reduction	Reduction in vehicles accessing the city centre during restricted day time hours.	Work not commenced	Presently access for taxis, hotel guests and disabled vehicles appears to be permitted although it is not clear whether this is supported by a traffic order.
24 Chester AQAP measure number 24	Explore the potential for extension of 20mph zones throughout the Chester AQMA.	Traffic Management	Reduction of speed limits, 20mph zones	2018	2022	CWCC	CWCC	NO	Not Funded	£10k - 50k	Planning	NO_2 Emission Reduction	Implementation of 20mph zones.	Work not commenced	A detailed scheme for reducing speed limits across the borough has been rolled out very successfully, the potential for extending this to the city centre needs to be assessed.
25 Frodsham AQAP measure number 1	Video survey of the Fluin Lane and Bears Paw junctions	Traffic Management	UTC, Congestion management, traffic reduction	2018	2019	CWCC	CWCC	NO	Funded	< £10k	Completed	NO_2 Emission Reduction	Measured annual mean NO2 concentrations in AQMA	Video camera survey carried out at Fluin / Red Lane junction	A video survey with turning counts on A56 replaced need for video surveys at Fluin and Bears Paw junctions

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
26 Frodsham AQAP measure number 8	Explore traffic regulation order (TRO) options for restricting HGVs travelling through the AQMA and Church Street	Traffic Management	UTC, Congestion management, traffic reduction	2018	2020	CWCC	CWCC	NO	Funded	< £10k	Implementation	NO_2 Emission Reduction	To be determined	Signage enhancement scheme commenced	TRO will not now be required, the preference being for a signage enhancement scheme warning drivers significantly in advance of height / weight restrictions to provide decision of selecting alternative routes
27 Frodsham AQAP measure number 10	Origin and destination survey to identify and liaise with commercial users of the route	Freight and Delivery Management	Route Management Plans/ Strategic routing strategy for HGV's	2018	2019	CWCC	CWCC	NO	Not Funded	< £10k	Completed	NO_2 Emission Reduction	Completion of survey	Video survey has been completed (see AQAP measure 1 above)	The video survey (AQAP measure 1) replaced the need for a full origin and destination survey
28 Frodsham AQAP measure number TI19	Box junction at the Main Street/Fluin Lane junction to remove queuing traffic at that point and reduce the impact of emissions	Traffic Management	UTC, Congestion management, traffic reduction	2017	2020	CWCC	CWCC	NO	Funded	< £10k	Completed	NO_2 Emission Reduction	Introduction of box junction	Box junction has been successfully implemented and is working well	Prevents vehicles from queuing across the Fluin Lane arm of the junction whilst the pedestrian crossing is in operation allowing some vehicles to exit Fluin Lane.

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
29 Thornton AQAP measure number 1	Remove sulphur compounds in process	Environmental Permits	Measures to reduce pollution through IPPC Permits going beyond BAT	2017	2025	Essar refinery	Operator	NO	Funded		Implementation	Reduction in 15-min exceedances to less than 35 per year. Potential air quality benefit = medium (in the range of 25-40%)	SO_2 measured at CCU stack / SO_2 measured at local AQ monitoring stations	Number of exceedances in 2020 and 2021 significantly lower than previous years. Dosing percentage reformulated 2020 to optimise at 20-30% SOx reduction. Trial ongoing to assess variables e.g. ambient conditions, operational parameters, feedstock concentrations. Ongoing monitoring.	Trial of 'de-SOx' additive on the catalytic cracking unit in progress. New dosing kit should allow improved performance data. Complexity of setup means that the trial needs extended timeframe to prove efficacy
30 Thornton AQAP measure number 2	Schedule maintenance / repair on sulphur-critical plant to suit the weather	Environmental Permits	Other	2017	2030	Essar refinery	Operator	NO	Funded		Implementation	SO_2 Emission Reduction (negligible)	SO2 measured at local AQ monitoring stations	Ongoing	Essar uses weather data to plan activities. Essar uses real time AQ monitoring data to respond rapidly to spikes.
31 Thornton AQAP measure number 3	Isolation of sulphur recovery units (SRU) to allow independent operation	Environmental Permits	Other	2017	2018	Essar refinery	Operator	NO	Funded		Completed	SO_2 Emission Reduction (negligible)	Reduced sour gas flaring	Complete. Installed during 2018 turnaround	This allows one SRU to be shut down for maintenance while keeping the other online. Reduces sour gas flaring
32 Thornton AQAP measure number 4	Fuel gas scrubbing and fuel substitution	Environmental Permits	Other	2017	2018	Essar refinery	Operator	NO	Funded		Completed	SO_2 Emission Reduction (negligible)	Sulphur content in refinery fuel gas	Complete. Installed during 2018 turnaround	Additional capability for removing sulphur from fuel gas (in addition to natural gas switch for some boilers)
33 Thornton AQAP measure number 5	Address fugitive emissions	Environmental Permits	Other	2017	2018	Essar refinery	Operator	NO	Funded		Completed	SO_2 Emission Reduction (negligible)	SO2 measured at local AQ monitoring stations	Completed. Medium pressure (MP) superheater replaced in 2018 turnaround	Fugitive emissions are addressed as they are identified, e.g. MP superheater replaced as it was approaching end of life

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
34 Thornton AQAP measure number 6	Air quality monitoring	Public Information	Via the Internet	2017	2017	CWCC	CWCC	NO	Funded	< £10k	Implementation	Nil	Real-time data published on website	Ongoing	Results published on Council website, updated hourly. Currently posted daily due to system fault. Replacement commissioned 2019. Launch delayed to late 2022
35 Thornton AQAP measure number 7	Real-time data provision to operator (with trigger capability)	Public Information	Via the Internet	2017	2021	CWCC / Essar	CWCC	NO	Funded	£10k - 50k	Implementation	Nil	Ongoing data sharing	Complete. Output data from both SO2 monitoring stations shared with Essar	Supports AQAP measure 2 above. Due to be superseded in tandem with measure 27 above
36 Borough-wide	Bikeability campaign (schools and adults only schemes)	Promoting Travel Alternatives	Promotion of cycling	2010	2025	CWCC Road safety	CWCC / Active Travel	NO	Funded	£50k - £100k	Implementation	Pollutant emission reduction	Increase in number cyclists	Ongoing. Subject to annual project review	DfT Active Travel / Council funded programmes. e.g. Sustrans secured Capability funding to work with Helsby High school and feeder schools in relation to the new cycling and walking infrastructure in Helsby (Applicable for 37, too)
37 Borough-wide	Let's Walk	Promoting Travel Alternatives	Promotion of walking	2015	2025	CWCC Road safety	CWCC	NO	Funded	< £10k	Implementation	Pollutant emission reduction	Improve pedestrian confidence to encourage more sustainable trips	Ongoing. Subject to annual project review	Child training promotes independence. DfT Active Travel / Council funded programmes. e.g. Sustrans secured Capability funding to work with Helsby High school and feeder schools in relation to the new cycling and walking infrastructure in Helsby

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
38 Borough-wide	Schools crossing patrols	Promoting Travel Alternatives	Promotion of walking	2010	2030	CWCC Road safety	CWCC	NO	Funded	£100k - £500k	Implementation	Pollutant emission reduction	Improve pedestrian confidence to encourage more sustainable trips	Ongoing. Subject to annual project review	Supporting vulnerable road users cross the highway – when arriving and leaving educational establishments
39 Borough-wide	20mph limits on residential streets (740km)	Traffic Management	Reduction of speed limits, 20mph zones	2015	2021	CWCC	CWCC	NO	Funded	£500k - £1 million	Implementation	Reduced vehicle emissions borough wide	Successful rollout of scheme over four-year programme	Implemented	Promotes smoother driving style. Emissions reduction from vehicles should lead to overall emissions reduction. Programme complete. Ongoing monitoring
40 Chester	Bus lane enforcement in Chester using automatic number plate recognition (ANPR)	Traffic Management	Strategic highway improvements, re-prioritising road space away from cars, including Access management, Selective vehicle priority, bus priority, high vehicle occupancy lane	2019	2030	CWCC	CWCC	NO	Funded	£100k - £500k	Implementation	Reduced vehicle emissions	Bus patronage	Ongoing	To date over 1800 fines issued.

$PM_{2.5}$ – 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. Based on national estimates, the public health outcomes framework indicates that the fraction of mortality attributable to particulate matter in Cheshire West and Chester is 5.2% which is equivalent to some 161 premature deaths. This figure rises to 285 per year when the effects of NO_2 are taken into account. Reductions in air pollution can therefore deliver significant improvements in local health outcomes.

The Council does not monitor $PM_{2.5}$ as it is not currently a requirement of LAQM (although some non-reference standard monitoring is currently being undertaken – see page 59). However, PM_{10} (particulate matter with an aerodynamic diameter of 10µm or less) is recorded at three monitoring stations in the borough. Because $PM_{2.5}$ is a constituent of PM_{10}, it is possible to estimate the probable local levels by considering the ratio of the two fractions of particulate matter – as detailed in the technical guidance LAQM.TG16. Applying the nationally derived correction ratio of 0.7 to local data suggests that local $PM_{2.5}$ levels at local sites lie in the range 15.4 to 9.1µg/m^3 in 2021, which is below the national annual mean objective for background sites of 25µg/m^3 (required to have been met by 2020). In recognition of the close association between particulates and health, these figures may be used as a benchmark against which to gauge local improvements over time. There is a national target value of 15% reduction at background urban locations between 2010 and 2020. Although this is not a requirement placed directly on local authorities, our long-term PM_{10} monitoring suggests that there was a reduction of 14% in $PM_{2.5}$ between 2010 and 2018 at former monitoring station LR, Ellesmere Port and was therefore on course to achieve the target. Table 8 indicates that there has however been little reduction in annual mean locally over the last five years and it can be assumed that a similar trend applies to $PM_{2.5}$.

National policy guidance assumes that local authorities will consider how to address $PM_{2.5}$ alongside other pollutants and that few standalone $PM_{2.5}$ measures will need to be chosen

unless they are needed to address a very specific local problem. So action to reduce PM_{10} and NO_2 would usually contribute to the reductions in $PM_{2.5}$. The Council is not, therefore, expected to be required to carry out additional local review and assessment (including monitoring).

The Council is taking the following measures to address $PM_{2.5}$: measures listed in Table 2 above will contribute in general to improvements in levels of $PM_{2.5}$. The Council's Low Emission Strategy (LES) aims to tackle NO_2, PM_{10} and $PM_{2.5}$, with a focus on reducing emissions from road vehicles and supporting more sustainable modes of transport. The ultimate ambition is to improve the health of residents and reduce the number of deaths attributable to poor air quality that arise every year. The action toolbox, Table A.1 in LAQM.TG16 lists a range of measures that can be implemented to tackle $PM_{2.5}$ and many of these are incorporated into the LES. Examples include:

- Smoke control areas are in place in a number of the Borough's urban areas and the LES includes a measure focused on exploring the feasibility of expanding SCAs and publicising health concerns related to domestic burning. A local study of SCAs and health impacts of domestic smoke has been commenced.
- The Council has introduced 20mph speed limits on numerous residential roads, particularly around schools, one of the benefits of which is to reduce emissions through the encouragement of smoother driving styles.
- A reduction in vehicle idling will deliver an immediate improvement in air quality particularly in urban centres. In January 2019, the Council approved the use of powers to require drivers of idling vehicles to switch off their engines while stationary. Enforcement officers are now authorised to issue fixed penalty notices to drivers who refuse to do so.
- A shift to electric vehicles is key in improving local air quality as there are no tailpipe emissions of $PM_{2.5}$ (as well as NO_2 and other gaseous pollutants). The first 30 public chargepoint equipped bays went live in May 2021. This will be enhanced in the next couple of years with commitments for significant charging infrastructure at the Northgate development in Chester and the town centre redevelopment in Winsford which, in common with other private-sector developments, have been secured through planning condition. Enabling the transition of the Council's fleet to EVs, there is now coverage across five depots, with plans for more to be installed in the near future. The

Council is also due to embark of a programme of installation of ultra-rapid charging hubs across the borough.

- In November 2021, the Licensing Committee approved changes to the current hackney carriage / private hire vehicle age policy to stimulate the uptake of ULEVs across the fleet. All new entrants from 2025 are now required to be ULEVs and the exit age policy has been removed for ULEVs such that, provided they pass inspection and testing, there is no set exit age. There is also a transitional exit age policy for the phase out of existing petrol/diesel vehicles, which is intended to ensure that they are gradually removed from the fleet by the end of 2030 (in the case of private hire vehicles) and 2035 (for hackney carriages). Therefore from 2031 (private hire) and 2036 (hackney carriages), the fleet will comprise 100% ULEVs.

The Environmental Protection team has a good working relationship with the Public Health team and will continue to work collaboratively to determine how air quality can be prioritised across a wide range of policy areas as well identifying specific measures to address $PM_{2.5}$.

3 Air quality monitoring data and comparison with air quality objectives and national compliance

This section sets out the monitoring undertaken in 2021 by Cheshire West and Chester 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.

Summary of monitoring undertaken

3.1.1 Automatic monitoring sites

Cheshire West and Chester undertook automatic (continuous) monitoring at six sites during 2021. Table 3 in Appendix A shows the details of the automatic monitoring sites. Information about the automatic monitoring sites is available on the Cheshire West and Chester website at: http://www.cheshirewestandchester.gov.uk/residents/pests-pollution-food-safety/pollution-and-air-quality/air-quality-monitoring/monitoring-station-map.aspx

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

Cheshire West and Chester undertook non-automatic (i.e. passive) monitoring of NO_2 at 84 sites during 2021. Table 4 in Appendix A presents the details of the non-automatic sites. Following 2020, diffusion tube monitoring was discontinued at 3 sites (CVR, FTG and SV2) and 1 site (HC) was re-established.

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

Individual pollutants

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

3.1.3 Nitrogen dioxide (NO_2)

Table 5 and Table 6 in Appendix A compare the ratified and adjusted monitored NO_2 annual mean concentrations for the past five years with the air quality objective of 40µg/m^3. Note that the concentration data presented represents the concentration at the location of the monitoring site, following the application of bias adjustment and annualisation, as required (i.e. the values are exclusive of any consideration of fall-off with distance adjustment – see NO2 Fall-off with distance from the road below).

For diffusion tubes, the full 2021 dataset of monthly mean values is provided in Appendix B. Note that the concentration data presented in Table 11 includes distance corrected values, only where relevant.

In 2021 no exceedances of the annual mean objective were recorded at any monitoring sites either within or outside of an AQMA and there is no need to declare or extend AQMAs. The highest results were 34.1µg/m^3 at T6 in Chester and 34.6µg/m^3 at NWH in Northwich. There were therefore no sites within 10% of the national objective in 2021.

The highest annual mean recorded by an automatic analyser in 2021 was 30µg/m^3 at CBI, which is adjacent to the bus interchange in Chester.

Following the easing of lockdown and the consequent increase in road traffic flows annual average concentrations of NO_2 in 2021 were higher than 2020 levels. In general, however, the levels were stilllower than they had been prior to lockdown (see comments on long-term trends below).

Monitored levels of NO_2 in the Whitby Road / Station Road AQMA in Ellesmere Port have steadily declined over time and no exceedances have been recorded in the five years 2017-2021. As noted in last year's report, we intend therefore to revoke the AQMA.

In the Frodsham AQMA all annual mean diffusion tube results were below the national objective, the highest being 28.8µg/m^3 at site FM. An exceedance of the objective was last recorded in the AQMA was 2017 and readings within 10% of the objective were last

recorded in 2019. So, notwithstanding the fact that 2020 and possibly 2021 were atypical years due to imposition of lockdowns, the status of the AQMA needs to be reviewed.

In the Christleton area, which in earlier rounds of LAQM review and assessment was considered to be close to being a candidate for AQMA declaration, the highest NO_2 annual mean in 2021 was 30.1μg/m^3 (at WCR) without distance correction.

On the stretch of the A51 passing through Littleton and Tarvin the highest annual mean NO_2, 30.9μg/m^3, was recorded at TBV. However, this monitoring site is not representative of relevant exposure and, if distance correction were applied, the calculated annual mean at the nearest residential receptor would be significantly lower and comfortably below the objective (as demonstrated in previous ASR reports).

Eight NO_2 monitoring sites were on or close to school premises in 2021 (BE, BSP, CRH, HSS, CPL, FMH, LVS and RPS). The highest recorded annual mean at these locations was 29.5μg/m^3 at RPS. However, the school itself is set much further back from the carriageway than the monitoring site.

Annual mean NO_2 at the residential receptor, AP in Allostock, close to the M6 motorway (at which monitoring was re-established in 2016 to address concerns over the smart motorway upgrade) was 19.7μg/m^3 in 2021. This is less than half of the annual mean objective.

On the A530 in Rudheath / Lostock the diffusion tubes KR and GR, which were established in response to local concerns about the anticipated increase in HGV movements along the A530 associated with industrial development, produced annual means of 25.9μg/m^3 and 17.2μg/m^3 respectively. Both were therefore well below the annual objective.

In Northwich, the highest annual mean recorded was at NWH on Winnington Hill. The residential receptor is set further back from the road so this is another location at which the annual mean would be lower than the monitoring result.

Of the two tubes along the A54 in Winsford, OSQ produced the higher result, but at 29μg/m^3 this is well below the objective.

Five-year trends in the annual mean NO_2 are presented in the bar charts in Figure 1 to Figure 4. Most sites, particularly those at roadside locations, show a noticable reduction in NO_2 levels over time. For the majority of sites the abnormally low NO_2 concentrations resulting from the reduction in road traffic due to national lockdown in 2020 can be clearly

discerned. In 2021 roadside concentrations of NO_2 increased following the easing of lockdown, although possibly not to a level that might have been expected on the basis of long term trends. It is probable that an increased tendency for staff to work from home post-lockdown has had a knock-on effect on road traffic flows and therefore emissions. Levels of NO_2 in the Ellesmere Port AQMA have been consistently below the national objective for five years and show a steady downward trend. As noted above, we intend to revoke this AQMA.

Table 7 in Appendix A compares the ratified continuous monitored NO_2 hourly mean concentrations for the past five years with the air quality objective of 200µg/m^3, not to be exceeded more than 18 times per year. Two exceedances of the hourly mean were recorded at BO in Chester, which is the only time that such episodes have been recorded at any monitoring station over that period. However, as the objective allows 18 readings in excess of 200µg/m^3, the objective was not exceeded. Annual mean results from diffusion tubes that are above 60µg/m^3 may indicate a likely exceedance of the hourly objective (as per LAQM.TG16 technical guidance). But in 2021 no diffusion tube results were close to 60µg/m^3 (the highest being 34.1µg/m^3) so on the basis of monitoring, it is highly unlikely that the hourly objective is exceeded anywhere in the borough. A 2019 modelling study conducted by consultants Bureau Veritas, in preparation for the Chester AQAP, predicted potential exceedances over a small discrete area adjacent to the inner ring road. This is being investigated through the deployment of additional diffusion tubes; CBR, ON and SAB, which are close to the bus interchange in Chester. To date, the highest annual mean recorded at any of these sites was 28.5µg/m^3 and as such the hourly objective is not at risk of exceedance.

Comparisons of hourly means in the local network against nearby national automatic urban and rural network (AURN) sites are shown in sites is shown in Figure 9.

A comparison of monthly average NO_2 at various sites between 2016 and 2022 is presented in Figure 10. This clearly shown the seasonality in monitoring data – levels in summer months tend to be lower than during winter months when cold, calm conditions tend to lessen the dispersion of pollutants emitted near ground level (i.e. vehicles exhausts).

3.1.4 Particulate matter (PM_{10})

Table 8 in Appendix A compares the independently ratified and adjusted monitored PM_{10} annual mean concentrations for the past five years with the air quality objective of

40µg/m^3. In 2021, PM_{10} levels were below the annual mean objective at all sites, and it has not been necessary to declare any AQMAs in respect of PM_{10}. In common with previous years, the highest monitored concentration of PM_{10} was recorded at the roadside site, CBI, which is located close to the bus interchange and the inner ring road in Chester. The annual mean here was 22µg/m^3, which despite being significantly higher than concentrations at background sites, remains below the current 40µg/m^3 objective.

Table 9 in Appendix A compares the ratified continuous monitored PM_{10} daily (24-hour) mean concentrations for the past five years with the air quality objective of 50µg/m^3, not to be exceeded more than 35 times per year. In 2021 just two 24-hour readings above 50µg/m^3 were recorded, both of which occurred at CBI. However, this was comfortably below the permitted threshold of 35.

Long term trends in annual PM_{10} monitoring are shown in Figure 5. There is no clear trend in the data, the annual means remaining fairly static year on year at CBI and TLP. Figure 6 shows the number of exceedances of the 24-hour mean objective over the last five years.

Daily PM_{10} readings from the local monitoring stations and other regional AURN sites are plotted in Figure 11. The data tend to follow similar patterns at certains times of the year, particularly during episodes of elevated concentrations.

3.1.5 Particulate matter ($PM_{2.5}$)

The Council does not monitor $PM_{2.5}$ using reference analysers (however, see Additional air quality works undertaken by Cheshire West and Chester during 2021 below) as it is not currently a requirement of LAQM. However, as $PM_{2.5}$ is a constituent fraction of PM_{10}, it is possible to estimate the probable local levels by considering the ratio of the two fractions of particulate matter, as detailed in the technical guidance LAQM.TG16. Applying the nationally derived correction ratio of 0.7 to local PM_{10} data suggests that local $PM_{2.5}$ levels at monitoring sites lay in the range 9.1 to 15.4µg/m^3 in 2021, which is below the current national annual mean objective of 25µg/m^3. Cheshire West and Chester Council is aware that the national targets for $PM_{2.5}$ are due to be tightened in the near future, as required by the Environment Act, 2021. Defra's consultation document on the new legislative requirements recommended setting an annual mean target of 10µg/m^3, to be achieved by 2040 along with 5-yearly interim targets. However, this is yet to be finalised and the drafted legislation is expected to be put before parliament by 31st October 2022.

3.1.6 Sulphur dioxide (SO_2)

Table 10 in Appendix A compares the ratified continuous monitored SO_2 concentrations for 2021 with the air quality objectives for SO_2.

In 2021 there was a single occasion when the 15-minute objective of 266μg/m^3 was exceeded in the village of Thornton-le-Moors (monitoring site TLP, within the AQMA). At monitoring station ELT (in Elton), which lies less than a kilometre outside the eastern edge of the AQMA, there were 4 15-min exceedances in 2021. The objective allows for 35 exceedances of the 15-min mean in a calendar year so in each case the objective was not exceeded at either monitoring station. However, the AQMA will remain in place and unaltered for the foreseeable future. A graphical representation of the numbers of 15-min exceedances over the last five years is presented in Figure 7.

The hourly mean standard was not exceeded at either Thornton-le-Moors or Elton in 2021. As there is an annual exceedance allowance of 24 hourly periods, the objective was not exceeded.

The 24-hour objective was complied with at both monitoring stations during 2021.

Figure 8 shows long term trends in 15-minute SO_2 99.9th percentiles (the concentration below which 99.9% of readings occur) for both the current monitoring stations and the former monitoring station in Ellesmere Port, LR-JG, the details for which can be found in earlier LAQM reports. There is no clear overall trend although percentile values in recent years do appear to be lower than earlier years, particularly at TLP.

SO_2 15-minute results from the local monitoring stations and the AURN site at Speke, Liverpool are plotted in Figure 12 (AQDM Ltd.). Unlike with the comparisons for NO_2 and PM_{10} (Figure 9 to Figure 11), the individual SO_2 plots in figure 12 do not show similarities in their trends. This is because the main sources of high concentration, short-term SO_2 episodes are tall industrial stacks and the locations and times that emission plumes reach ground level are highly dependent on wind direction and turbulence.

Appendix A: Monitoring results

Table 3 – 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)
BO	Boughton	Roadside	341864	366444	NO_2	Yes, Chester	Chemiluminescent	25	3	1
CBI	Chester Bus Interchange	Roadside	340645	366802	NO_2 PM_{10}	Yes, Chester	Chemiluminescent BAM	5.1	6.6	1.6
ELT	Elton	Industrial	345642	375522	SO_2	No	UV-fluorescent	0	N/A	2
FMH	Frodsham	Urban background	352445	378031	NO_2 PM_{10}	No	Chemiluminescent TEOM	24	7	2.5
TLP	Thornton-le-Moors, Park Road	Industrial	344103	374330	NO_2 SO_2 PM_{10}	Yes, Thornton-le-Moors	Chemiluminescent UV-fluorescent BAM	38	N/A	2.5
WH	Whitby Road	Roadside	340197	376363	NO_2	Yes, Ellesmere Port	Chemiluminescent	15	2.5	3.5

Notes:

(1) 0m if the monitoring site is at a location of exposure (e.g. installed on the façade of a residential property). Note, in all cases for Cheshire West and Chester sites, the distances given are direct measurements to relevant exposure and do not represent the distance of the nearest relevant receptor from pollutant source. For example, WH sample inlet is on a commercial property and the nearest residential receptor is a lateral distance of 15m away. However, both locations are an equal distance from the kerb.

(2) N/A if not applicable

Table 4 – Details of non-automatic monitoring sites (2021)

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)
AP	Middlewich Road AP	Roadside	373386	371500	NO_2	No	0.0	34.0	No	1.8
BBC	Bluebell Close	Suburban	342622	364613	NO_2	No	16.0	15.0	No	1.5
BE	Bedward Row BE	Roadside	340239	366418	NO_2	Yes, Chester	0.5	2.4	No	2.4
BJ	Boughton BJ	Roadside	341401	366512	NO_2	Yes, Chester	0.1	2.5	No	2.4
BSP	Brookside Primary	Roadside	338380	375840	NO_2	No	12.0	0.5	No	2.0
C11	Christleton Road C11	Roadside	341915	366427	NO_2	Yes, Chester	0.0	1.0	No	2.0
C36	Christleton Road C36	Roadside	342000	366374	NO_2	Yes, Chester	0.5	1.4	No	2.5
C75	Christleton Road C75	Roadside	342056	366354	NO_2	Yes, Chester	0.5	2.0	No	2.5
CAN	Canal Street CAN	Roadside	340375	366730	NO_2	Yes, Chester	1.0	1.5	No	3.0
CBI1, CBI2, CBI3.	Bus Interchange CBI	Other	340647	366803	NO_2	Yes, Chester	5.1	6.6	Yes	1.6
CBR	Bus ramp CBR	Other	340676	366782	NO_2	Yes, Chester	0.0	n/a	No	2.5
CFL	Church St CFL	Roadside	351762	377862	NO_2	No	4.8	1.0	No	2.2

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]	Distance to kerb of nearest road (m) [2]	Tube co-located with a continuous analyser?	Tube height (m)
CM	Whitchurch Road CM	Roadside	343761	365528	NO_2	No	0.0	5.0	No	2.2
CN	Chester Way CN	Roadside	366070	373905	NO_2	No	3.8	1.6	No	3.0
CP3	Canal Place CP3	Roadside	343970	365295	NO_2	No	4.0	2.3	No	2.4
CPL	Plough Lane CPL	Roadside	344377	365375	NO_2	No	1.1	0.7	No	2.1
CRH	Rookery Cottages CRH	Roadside	364171	372697	NO_2	No	0.0	3.5	No	1.5
DA	Davenham DA	Roadside	365953	371113	NO_2	No	0.1	1.6	No	2.0
EB	Boughton EB	Roadside	341658	366487	NO_2	Yes, Chester	0.0	2.0	No	2.5
FH	High Street FH	Roadside	352146	378139	NO_2	Yes, Frodsham	0.2	2.0	No	2.5
FJ	Fluin Lane FJ	Roadside	352171	378140	NO_2	Yes, Frodsham	0.5	2.0	No	2.5
FM	Fluin Lane FM	Roadside	352189	378094	NO_2	Yes, Frodsham	0.3	2.0	No	2.5
FRC	High Street FRC	Roadside	352023	378121	NO_2	No	1.3	1.6	No	2.5
FT	Fluin Lane FT	Roadside	352176	378105	NO_2	Yes, Frodsham	0.2	1.7	No	2.0
GE	George Street GE	Roadside	340657	366730	NO_2	Yes, Chester	1.0	5.0	No	2.4

Diffusion tube ID	Site name	Site type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants monitored	In AQMA? Which AQMA?	Distance to relevant exposure (m) [1]	Distance to kerb of nearest road (m) [2]	Tube co-located with a continuous analyser?	Tube height (m)
GR	Griffiths Road GR	Roadside	368634	374714	NO_2	No	0.2	8.0	No	1.8
GSW	Gorse Stacks GSW	Roadside	340700	366687	NO_2	Yes, Chester	1.0	1.6	No	2.1
GT	George Street GT	Roadside	340611	366747	NO_2	Yes, Chester	0.0	1.9	No	2.6
HB	Hoole Lane HB	Roadside	341605	366527	NO_2	Yes, Chester	3.0	1.2	No	2.4
HC	Holmes Chapel Road HC	Roadside	373375	366928	NO_2	No	3.0	1.0	No	1.8
HHB	Holme Street HHB	Roadside	347953	366723	NO_2	No	5.3	2.9	No	2.5
HO	Hoole Road HO	Roadside	341311	367207	NO_2	No	0.0	7.1	No	1.9
HSS	High Street Sch. HSS	Roadside	364711	366339	NO_2	No	8.0	4.0	No	2.4
HTC	Holme Street HTC	Roadside	348333	366763	NO_2	No	3.1	2.0	No	2.0
HW	Hoole Way HW	Roadside	340881	366826	NO_2	Yes, Chester	1.0	1.9	No	2.4
IC	Christleton Road IC	Roadside	342068	366332	NO_2	Yes, Chester	2.0	2.0	No	2.0
KR	King Street KR	Roadside	368432	372988	NO_2	No	4.5	2.2	No	2.0
LH	Lincoln House LH	Roadside	341126	366540	NO_2	Yes, Chester	3.0	2.0	No	3.0

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)
LI2	Liverpool Road LI2	Roadside	340354	367034	NO_2	Yes, Chester	7.0	2.5	No	2.2
LU	Lumley Place LU	Roadside	340838	366215	NO_2	Yes, Chester	0.0	9.4	No	2.1
LVR	Love Street LVR	Roadside	340980	366315	NO_2	Yes, Chester	0.0	1.8	No	2.2
LVS	Love Street LVS	Roadside	340990	366317	NO_2	Yes, Chester	8.0	1.8	No	2.2
MCC	Whitchurch Road MCC	Roadside	343785	365502	NO_2	No	0.5	2.4	No	2.0
MUL	Mulberry Close MUL	Roadside	346258	375321	NO_2	No	0.0	27.0	No	2.0
NCS	New Crane Street NCS	Roadside	339857	366460	NO_2	No	0.0	1.8	No	2.0
NIN	Nicholas Street NIN	Roadside	340284	366199	NO_2	Yes, Chester	0.0	3.0	No	2.3
NIS	Nicholas Street NIS	Roadside	340329	366114	NO_2	Yes, Chester	0.0	4.3	No	2.2
NSR	Station Road NSR	Roadside	366796	373984	NO_2	No	0.6	1.7	No	2.2
NWH	Winnington Hill NWH	Roadside	365590	373904	NO_2	No	2.4	0.7	No	2.4
OB	Boughton OB	Roadside	341633	366510	NO_2	Yes, Chester	0.6	2.5	No	2.5
OF	St Oswalds OF	Roadside	340453	366853	NO_2	Yes, Chester	0.0	4.8	No	3.0

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)
ON	St Oswalds ON	Roadside	340718	366815	NO_2	Yes, Chester	4.4	15.5	No	2.5
OP	Oulton Place OP	Roadside	340636	366770	NO_2	Yes, Chester	0.0	1.6	No	2.1
OSQ	Over Square OSQ	Roadside	364053	365977	NO_2	No	5.5	2.2	No	2.4
OVH	Overleigh Road OVH	Roadside	340770	365605	NO_2	No	0.0	1.3	No	2.5
OW	St Oswalds OW	Roadside	340623	366823	NO_2	Yes, Chester	2.3	2.3	No	2.3
PA	Parkgate Road PA	Roadside	340313	367014	NO_2	Yes, Chester	2.4	0.8	No	2.4
PG	Parkgate Road PG	Roadside	340322	366989	NO_2	Yes, Chester	0.2	1.8	No	2.0
QRN	Quarry Road QRN	Roadside	330565	378063	NO_2	No	0.0	3.0	No	2.0
RM	Parkgate Road RM	Roadside	340291	367108	NO_2	Yes, Chester	0.0	3.8	No	2.2
RPS	Rudheath Primary RPS	Roadside	367856	372667	NO_2	No	19.0	5.2	No	2.2
RR	Whitby Road RR	Roadside	340180	376338	NO_2	Yes, Ellesmere Port	3.0	2.1	No	2.5
SA	Upper Northgate SA	Roadside	340364	366929	NO_2	Yes, Chester	0.2	2.5	No	2.5
SAB	Stanley Arms SAB	Roadside	340838	366746	NO_2	Yes, Chester	4.9	2.3	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)
SF	Station Road SF	Roadside	341238	366976	NO_2	No	0.0	3.2	No	2.2
SLW	Stanney Wellington	Roadside	339889	375755	NO_2	No	3.0	3.2	No	2.0
SMH	St Martins SMH	Roadside	340243	366511	NO_2	Yes, Chester	0.7	2.2	No	2.0
SR	Station Road SR	Roadside	340435	376790	NO_2	Yes, Ellesmere Port	0.0	1.6	No	2.5
ST	St. Annes Place ST	Roadside	340794	366778	NO_2	Yes, Chester	18.4	0.1	No	2.2
SZ	Boughton SZ	Roadside	341819	366475	NO_2	Yes, Chester	0.5	2.0	No	2.5
T11	Tarvin Road T11	Roadside	341931	366458	NO_2	Yes, Chester	2.7	1.5	No	2.1
T44	Tarvin Road T44	Roadside	342085	366446	NO_2	Yes, Chester	3.5	1.0	No	2.5
T6	Tarvin Road T6	Roadside	341926	366446	NO_2	Yes, Chester	0.2	2.0	No	2.0
TA	Tarvin Road TA	Roadside	344519	366898	NO_2	No	6.0	2.0	No	2.0
TB	Bars TB	Roadside	341202	366470	NO_2	Yes, Chester	2.0	1.0	No	2.5
TBV	Tarvin Road TBV	Roadside	344013	366830	NO_2	No	14.4	1.4	No	2.5
UN	Upper Northgate Street UN	Roadside	340357	366960	NO_2	Yes, Chester	0.2	3.0	No	2.2

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)	Distance to kerb of nearest road (m) (2)	Tube co-located with a continuous analyser?	Tube height (m)
VXR	Vicars Cross Road VXR	Roadside	343365	366694	NO_2	No	1.7	11.2	No	1.8
WCR	Whitchurch Road WCR	Roadside	342951	366029	NO_2	No	7.2	1.5	No	2.0
WG	Watergate Street WG	Roadside	340217	366209	NO_2	Yes, Chester	0.2	1.5	No	2.0
WGW	Watergate Street WGW	Roadside	340165	366198	NO_2	Yes, Chester	0.0	2.2	No	2.2
WH1, WH2, WH3.	Whitby Road WH	Roadside	340196	376363	NO_2	Yes, Ellesmere Port	15.0	1.2	Yes	3.5
WVC	Weaver Court	Roadside	365788	373744	NO_2	No	0.0	4.0	No	2.0
XR	Boughton Heath XR	Roadside	343117	365949	NO_2	No	4.5	3.2	No	2.0

Notes:

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

(2) N/A if not applicable.

Table 5 – 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 2021 (%) (2)	2017	2018	2019	2020	2021
BO	341864	366444	Roadside	97.7	97.7	27	25	23	17	19
CBI	340645	366802	Roadside	99.6	99.6	**40**	**40**	38	29	30
FMH	352445	378031	Urban Background	98.9	98.9	14	14	15	13	15
TLP	344103	374330	Industrial	99.6	99.6	13	13	13	9	11
WH	340197	376363	Roadside	98.0	98.0	36	37	35	28	29

☒ Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG1.

☒ 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.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 6 – Annual mean NO_2 monitoring results: non-automatic monitoring (µg/m^3)

Diffusion Tube ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2021 (%) [2]	2017	2018	2019	2020	2021
AHH	373255	371475	Roadside			17.7	19.4	18.9		
AP	373386	371500	Roadside	92.3	92.3	28.3	25.3	23.9	16.3	19.7
BBC	342622	364613	Suburban	92.3	92.3				14.0	17.5
BE	340239	366418	Roadside	84.6	84.6	37.5	33.8	32.1	22.2	27.1
BJ	341401	366512	Roadside	90.4	90.4	38.7	39.5	33.9	24.6	26.1
BO	341864	366444	Roadside			29.2	28.7	23.1		
BSP	338380	375840	Roadside	100.0	100.0				16.2	19.5
BZ	341161	366460	Roadside			27.3				
C11	341915	366427	Roadside	100.0	100.0	43.0	41.1	41.0	27.8	31.8
C36	342000	366374	Roadside	100.0	100.0	50.8	47.6	43.9	31.8	33.6
C75	342056	366354	Roadside	100.0	100.0	26.9	27.2	26.4	18.9	21.2
CAN	340375	366730	Roadside	90.4	90.4	25.1	32.6	31.2	19.4	23.9
CBI1-3	340647	366803	Other	100.0	100.0	44.6	*39.8	36.4	26.4	28.2
CBR	340676	366782	Other	82.7	82.7				24.4	26.1
CFL	351762	377862	Roadside	100.0	100.0	30.4	30.5	29.9	21.6	23.3
CIN	341219	366768	Roadside			29.5				
CIS	341219	366692	Roadside			28.0				
CM	343761	365528	Roadside	100.0	100.0	30.8	33.9	32.6	23.1	24.3
CN	366070	373905	Roadside	90.4	90.4		33.0	31.0	24.1	25.3
CP3	343970	365295	Roadside	92.3	92.3	31.9	31.3	30.9	22.9	22.8
CPL	344377	365375	Roadside	100.0	100.0		19.0	18.2	11.8	12.2
CRH	364171	372697	Roadside	73.1	73.1				12.6	16.7
CVR	342930	365901	Roadside			30.3	30.2	27.8	19.9	
DA	365953	371113	Roadside	100.0	100.0			19.1	14.9	15.8

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
DEL	355255	368416	Roadside				20.2	19.0		
DSP	351627	364552	Roadside				25.3	21.8		
EB	341658	366487	Roadside	90.4	90.4	34.5	31.6	30.7	22.4	24.4
FGS	340859	366388	Roadside			27.2	28.9	27.6		
FH	352146	378139	Roadside	100.0	100.0	39.4	38.5	36.9	27.4	28.8
FJ	352171	378140	Roadside	100.0	100.0	40.5	38.2	36.9	28.6	28.3
FM	352189	378094	Roadside	71.2	71.2	33.2	35.0	29.4	24.3	28.5
FRC	352023	378121	Roadside	100.0	100.0		34.0	31.0	24.3	25.6
FT	352176	378105	Roadside	90.4	90.4	34.2	32.1	29.8	23.7	24.1
FTG	351993	378102	Roadside				33.2	30.6	22.4	
GB	364619	372594	Roadside				17.3	16.0		
GE	340657	366730	Roadside	92.3	92.3	26.9	32.0	30.7	20.1	26.4
GI	341951	366396	Roadside			33.4				
GR	368634	374714	Roadside	100.0	100.0		24.1	21.6	17.0	17.2
GSW	340700	366687	Roadside	90.4	90.4	33.3	34.3	33.9	23.2	28.1
GT	340611	366747	Roadside	82.7	82.7	26.1	34.1	30.5	23.0	29.0
HB	341605	366527	Roadside	92.3	92.3	32.9	32.0	30.9	21.6	22.7
HC	373375	366928	Roadside	90.4	90.4					23.3
HHB	347953	366723	Roadside	100.0	100.0			32.1	17.8	22.0
HHS	349518	375954	Roadside				22.7	21.4		
HO	341311	367207	Roadside	100.0	100.0		31.7	28.6	21.6	23.3
HSS	364711	366339	Roadside	100.0	100.0				19.2	22.9
HTC	348333	366763	Roadside	92.3	92.3			33.2	19.7	25.1
HW	340881	366826	Roadside	100.0	100.0	36.0	35.8	32.0	21.1	26.1
IC	342068	366332	Roadside	100.0	100.0	36.7	34.5	34.5	23.7	26.6

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
KR	368432	372988	Roadside	92.3	92.3	33.9	32.0	32.2	26.0	25.9
LH	341126	366540	Roadside	100.0	100.0	39.2	36.9	29.7	22.8	27.5
LI2	340354	367034	Roadside	92.3	92.3	39.7	38.6	38.8	27.6	29.9
LU	340838	366215	Roadside	100.0	100.0	27.9	27.0	24.1	16.4	16.9
LVR	340980	366315	Roadside	32.7	32.7	35.9	36.5	34.9	19.7	13.4
LVS	340990	366317	Roadside	90.4	90.4	36.0	31.4	28.3	19.2	17.5
MCC	343785	365502	Roadside	100.0	100.0	40.8	38.0	36.9	22.9	27.4
MOS	341245	369610	Roadside				28.1	24.2		
MUL	346258	375321	Roadside	100.0	100.0			16.8	13.4	14.2
NCS	339857	366460	Roadside	92.3	92.3		30.5	27.8	20.4	20.7
NIN	340284	366199	Roadside	100.0	100.0	39.8	34.7	33.9	24.0	29.8
NIS	340329	366114	Roadside	92.3	92.3	28.6	31.7	29.0	21.2	19.5
NS	340406	376724	Roadside			35.0	32.4			
NSR	366796	373984	Roadside	100.0	100.0		38.0	35.3	27.6	31.0
NWH	365590	373904	Roadside	100.0	100.0		41.5	41.7	27.8	34.6
OB	341633	366510	Roadside	100.0	100.0	39.8	44.8	36.1	29.0	30.2
OF	340453	366853	Roadside	100.0	100.0	35.3	34.3	30.6	21.5	24.3
ON	340718	366815	Roadside	100.0	100.0			23.3	16.5	18.9
OP	340636	366770	Roadside	100.0	100.0	28.3	32.1	30.8	22.3	26.2
OSJ	363781	366198	Roadside				20.8	20.1		
OSQ	364053	365977	Roadside	90.4	90.4				23.2	29.0
OVH	340770	365605	Roadside	100.0	100.0				19.3	20.4
OW	340623	366823	Roadside	84.6	84.6	51.8	43.6	43.3	27.2	32.2
PA	340313	367014	Roadside	92.3	92.3	42.7	41.2	40.3	27.9	30.3
PG	340322	366989	Roadside	84.6	84.6	46.0	45.2	40.8	29.9	33.1

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
QRN	330565	378063	Roadside	92.3	92.3				26.6	29.3
RM	340291	367108	Roadside	92.3	92.3	41.3	45.7	38.8	28.6	31.4
RPS	367856	372667	Roadside	100.0	100.0		42.4	40.5	29.0	29.5
RR	340180	376338	Roadside	100.0	100.0	36.8	36.5	35.2	30.0	31.4
SA	340364	366929	Roadside	100.0	100.0	36.9	37.7	34.4	24.8	27.5
SAB	340838	366746	Roadside	90.4	90.4			28.5	23.3	28.1
SF	341238	366976	Roadside	82.7	82.7	32.3	33.3	32.0	21.8	24.0
SLW	339889	375755	Roadside	51.9	51.9				16.8	18.3
SM	340224	366599	Roadside			27.7	25.2			
SMH	340243	366511	Roadside	67.3	67.3			26.0	15.7	21.1
SR	340435	376790	Roadside	90.4	90.4	34.3	33.8	31.0	26.3	29.3
ST	340794	366778	Roadside	82.7	82.7	44.6	42.4	40.2	30.1	33.8
SV2	339836	366620	Roadside				25.4	22.7	16.6	
SV3	339859	366620	Roadside			24.8	26.0			
SZ	341819	366475	Roadside	100.0	100.0	36.4	36.1	32.1	22.9	25.3
T11	341931	366458	Roadside	100.0	100.0	32.0	31.8	28.6	19.6	21.3
T44	342085	366446	Roadside	92.3	92.3	40.2	39.2	37.6	25.7	28.5
T6	341926	366446	Roadside	100.0	100.0	45.5	43.6	43.6	31.5	34.1
TA	344519	366898	Roadside	92.3	92.3	47.4	44.5	38.6	26.7	27.6
TB	341202	366470	Roadside	100.0	100.0	36.0	36.7	33.3	25.0	25.4
TBV	344013	366830	Roadside	82.7	82.7			44.4	28.2	30.9
TE	340739	366504	Roadside			21.7	25.3			
UCA	339687	375972	Roadside				28.6	24.9		
UHS	342010	369154	Roadside				26.4	26.1		
UN	340357	366960	Roadside	100.0	100.0	36.8	38.1	33.5	21.4	23.9

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
VRC	344129	365614	Roadside				18.2			
VXR	343365	366694	Roadside	100.0	100.0				19.0	22.2
W23	343729	365561	Roadside			29.2	33.1	30.6		
WCR	342951	366029	Roadside	82.7	82.7	41.1	39.0	41.1	25.8	30.1
WG	340217	366209	Roadside	100.0	100.0	42.8	39.8	35.2	27.3	25.4
WGW	340165	366198	Roadside	100.0	100.0	33.3	33.7	29.6	23.7	22.1
WH1-3	340196	376363	Roadside	100.0	100.0	32.3	*33.7	31.4	25.8	27.4
WIM	368933	363614	Roadside				31.7	27.8		
WVC	365788	373744	Roadside	100.0	100.0				17.3	18.2
WXP	339641	363499	Roadside			17.4				
XR	343117	365949	Roadside	100.0	100.0		31.1	29.7	18.2	23.0

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

☒ Diffusion tube data has been bias adjusted.

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

Notes: The annual mean concentrations are presented as µg/m^3. Exceedances of the NO_2 annual mean objective of 40µg/m^3 are shown in **bold**. NO_2 annual means exceeding 60µg/m^3, indicating a potential exceedance of the NO_2 1-hour mean objective are shown in **bold and underlined**.

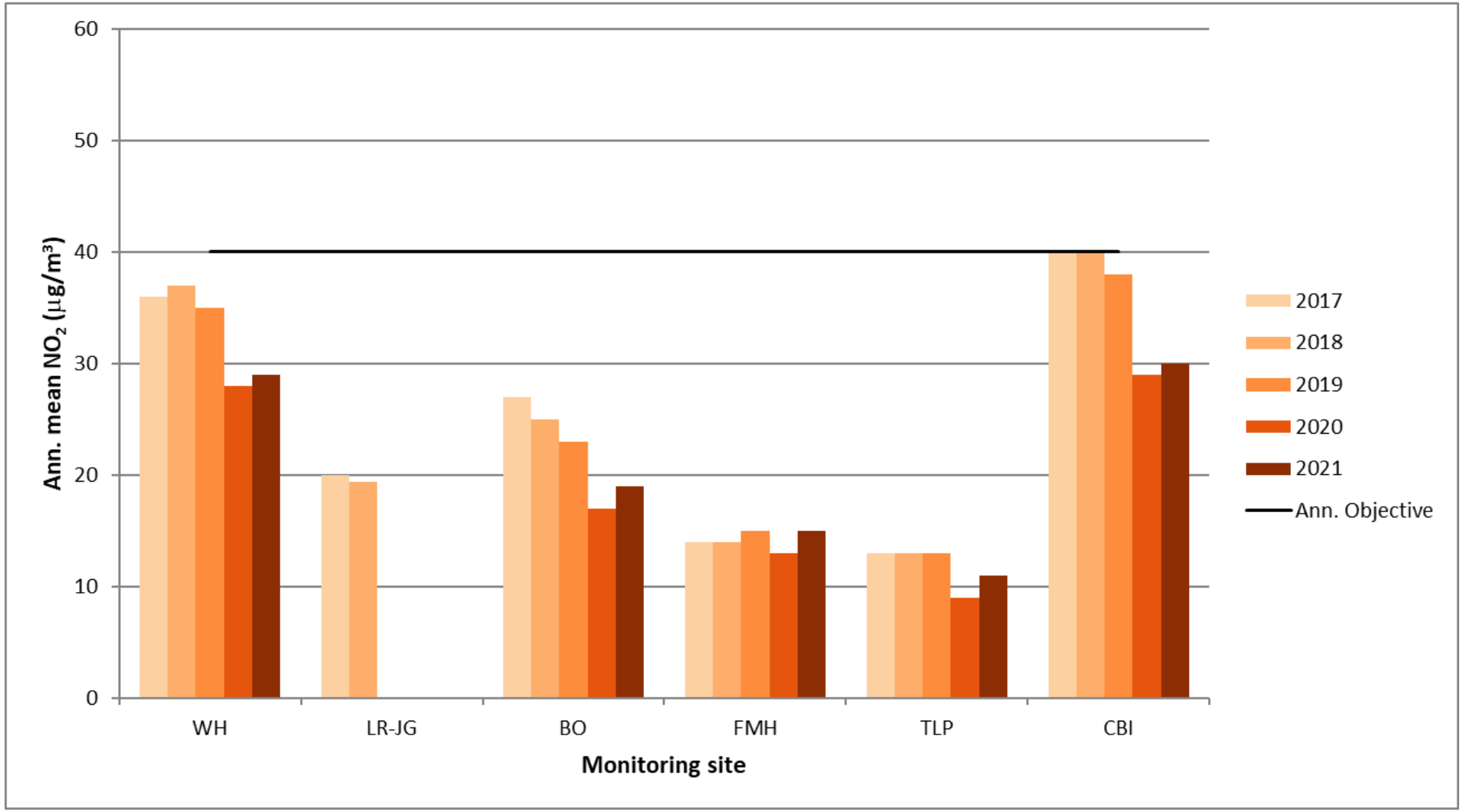
Concentrations are those at the location of monitoring and not those following any fall-off with distance adjustment.

(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%).

*2018 results for CBI and WH had previously been reported as 38.9 and 35.7µg/m^3 respectively due to a transcription error. Outcomes and conclusions unaffected.

Figure 1 – Trends in annual mean NO_2 concentrations – automatic sites



Note: Colour symbols used for bar charts sourced from: ColorBrewer.org

Figure 2 – Trends in annual mean NO_2 concentrations – Chester AQMA

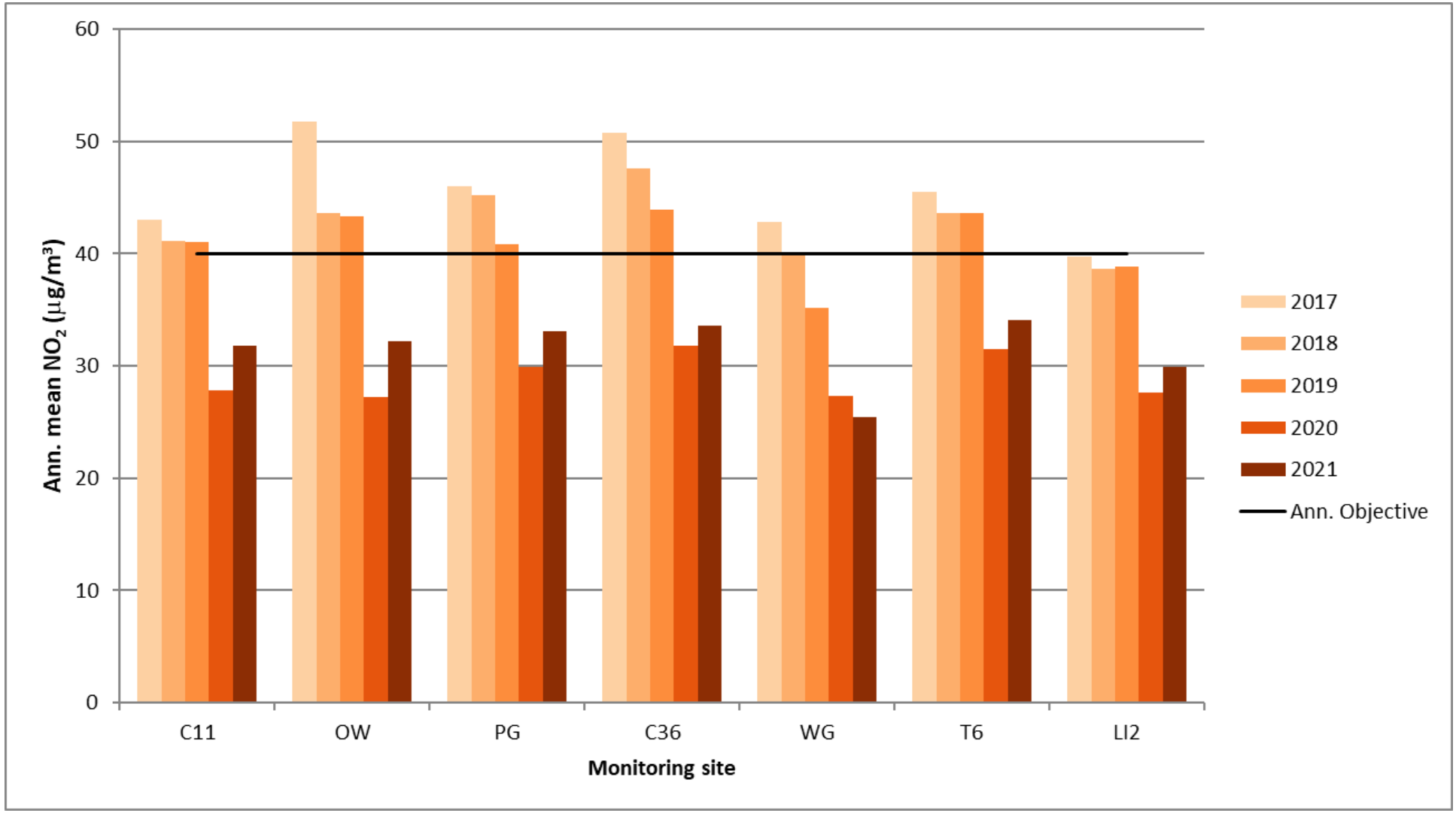


Figure 3 – Trends in annual mean NO_2 concentrations – Ellesmere Port AQMA

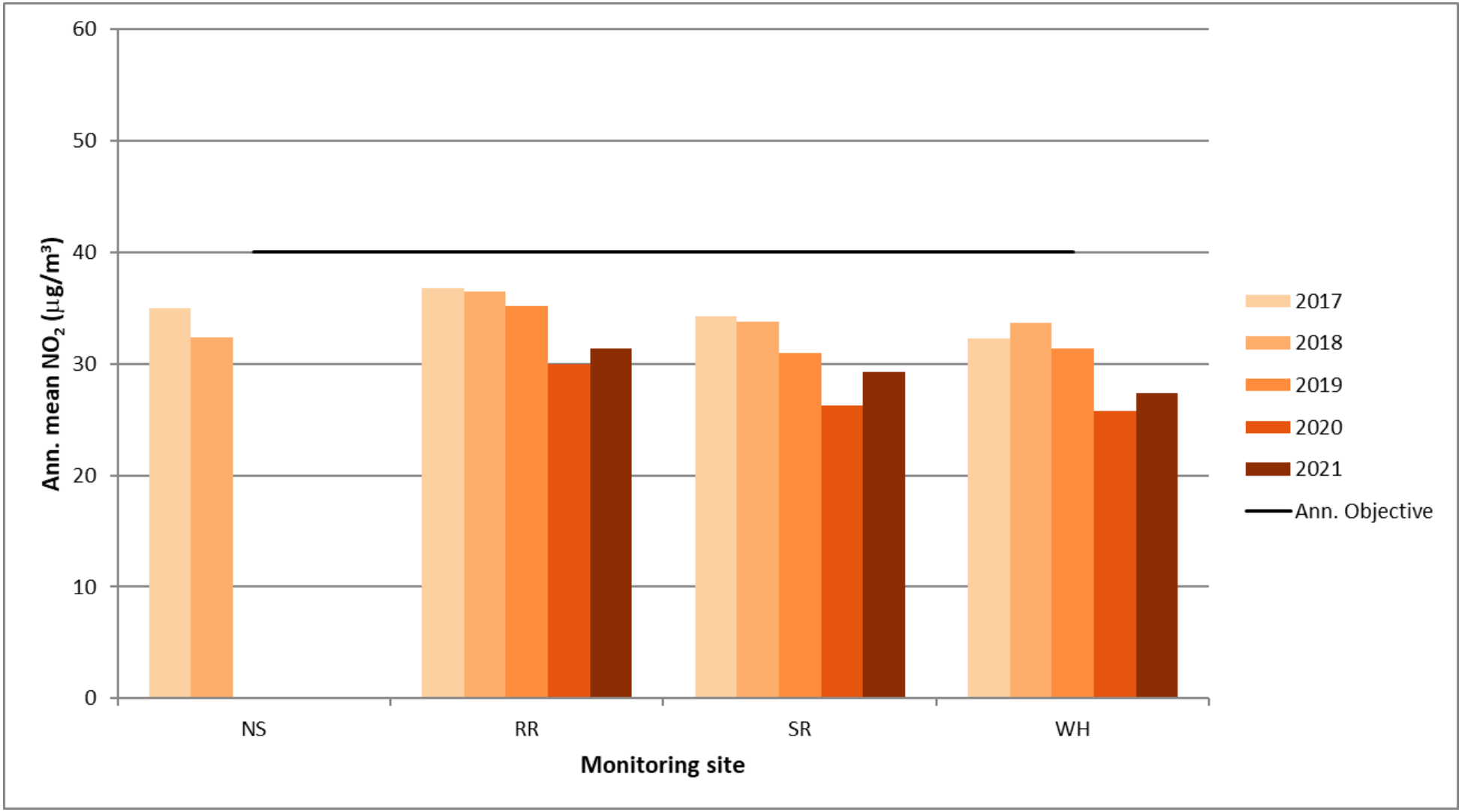


Figure 4 – Trends in annual mean NO_2 concentrations – Frodsham AQMA

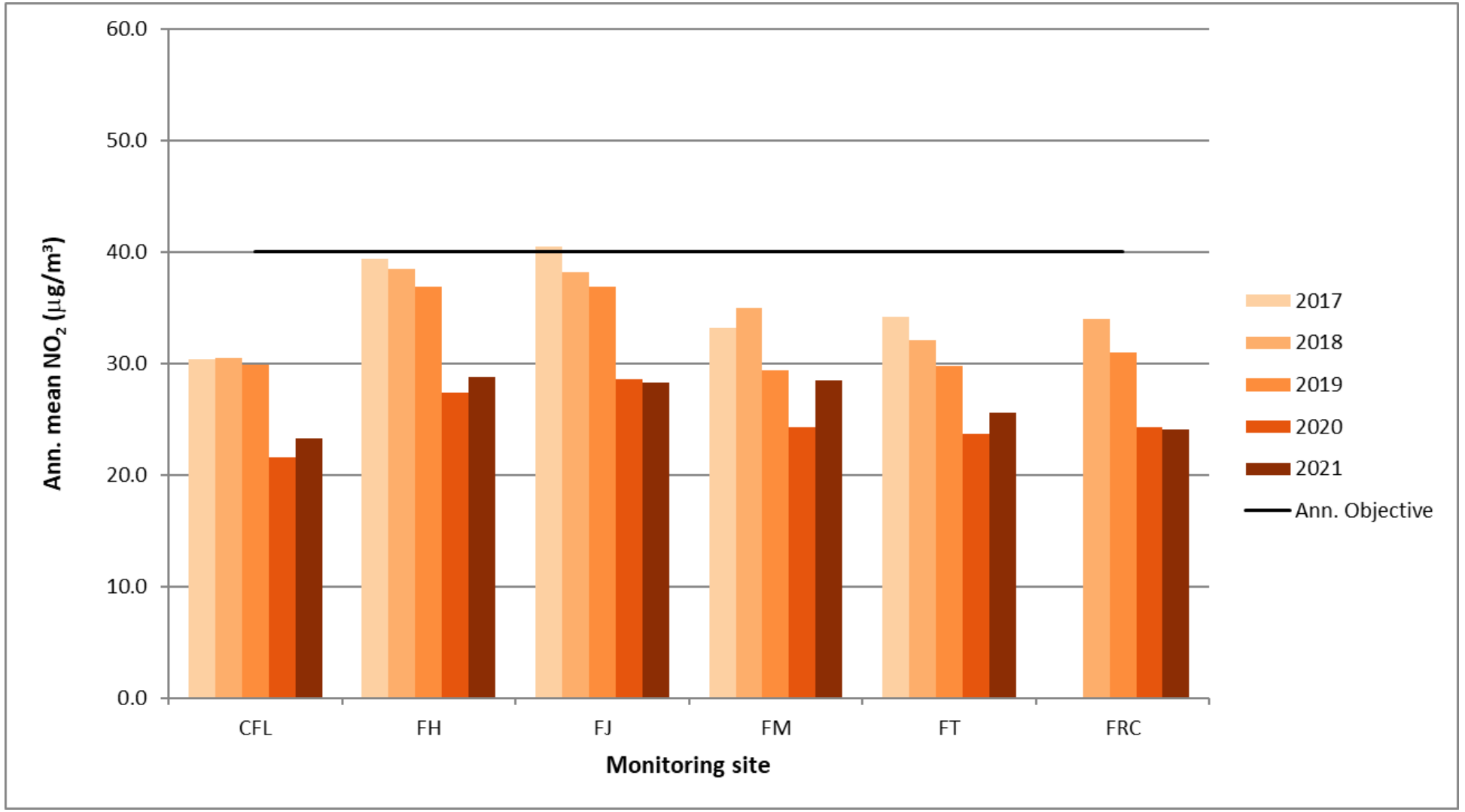


Table 7 – 1-Hour mean NO_2 monitoring results, number of 1-hour means > 200µg/m^3

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2021 (%) (2)	2017	2018	2019	2020	2021
BO	341864	366444	Roadside	97.7	97.7	0	0	0	0	2
CBI	340645	366802	Roadside	99.6	99.6	0	0	0	0	0
FMH	352445	378031	Urban Background	98.9	98.9	0	0	0	0	0
TLP	344103	374330	Industrial	99.6	99.6	0	0	0	0	0
WH	340197	376363	Roadside	98.0	98.0	0	0	0	0	0

Notes:

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

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

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

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

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

Table 8 – 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 2021 (%) (2)	2017	2018	2019	2020	2021
CBI	340645	366802	Roadside	97	97	21	21	21	23	22
FMH	352445	378031	Urban Background	99	99	13	16	15	12	13
LR	339947	375889	Urban Background	-	-	12	12	-	-	-
TLP	344103	374330	Industrial	90.3	90.3	13	13	14	13	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 $\mu g/m^3$.

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.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 5 – Trends in annual mean PM_{10} concentrations

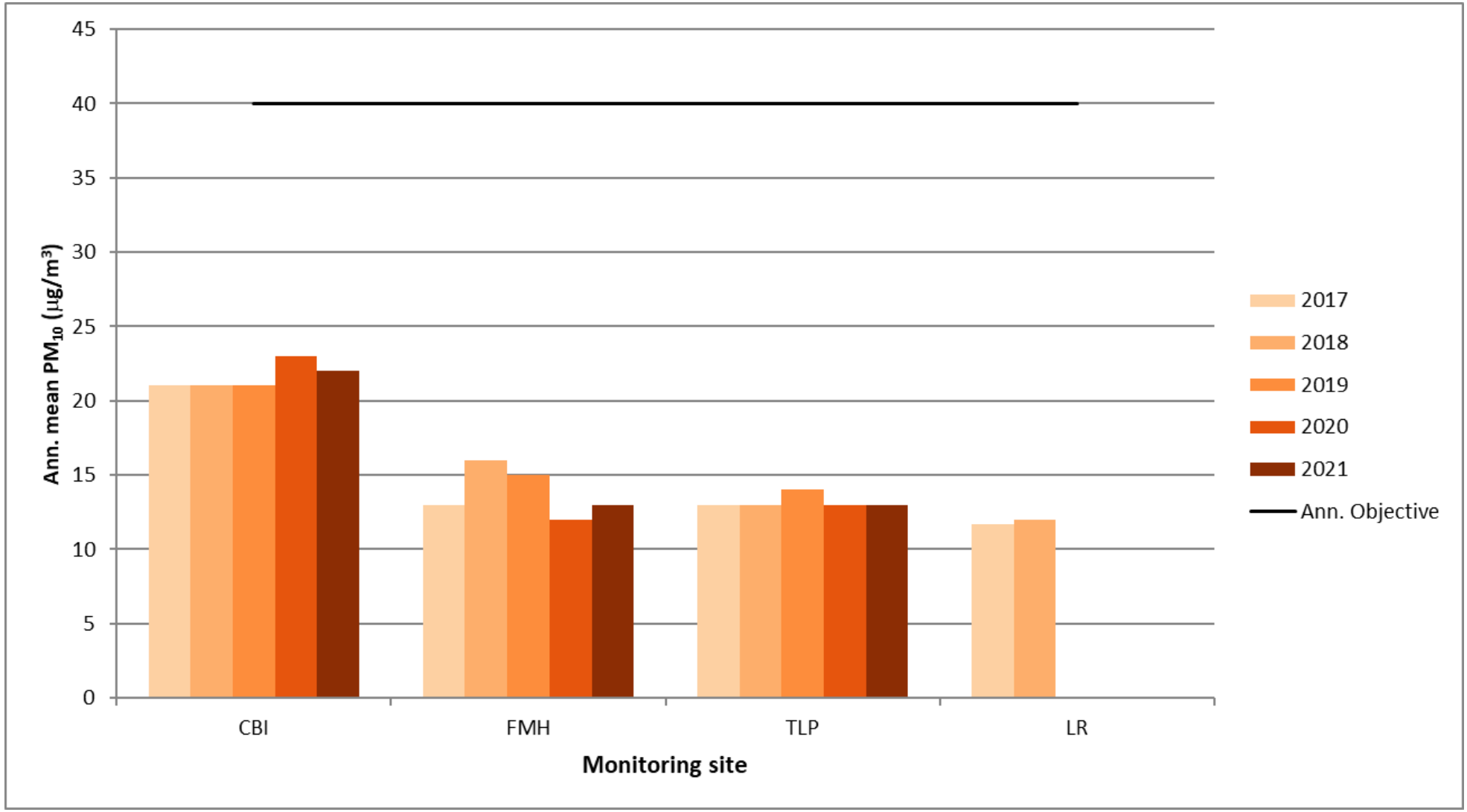


Table 9 – 24-Hour mean PM_{10} monitoring results, number of PM_{10} 24-hour means greater than 50µg/m^3

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2021 (%) (2)	2017	2018	2019	2020	2021
CBI	340645	366802	Roadside	97	97	8	4	9	4	2
FMH	352445	378031	Urban Background	99	99	0	0	1	0	0
LR	339947	375889	Urban Background	-	-	0	0	-	-	-
TLP	344103	374330	Industrial	90.3	90.3	2	0	3	0	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%).

Figure 6 – Trends in number of 24-hour mean PM_{10} results greater than 50µg/m³

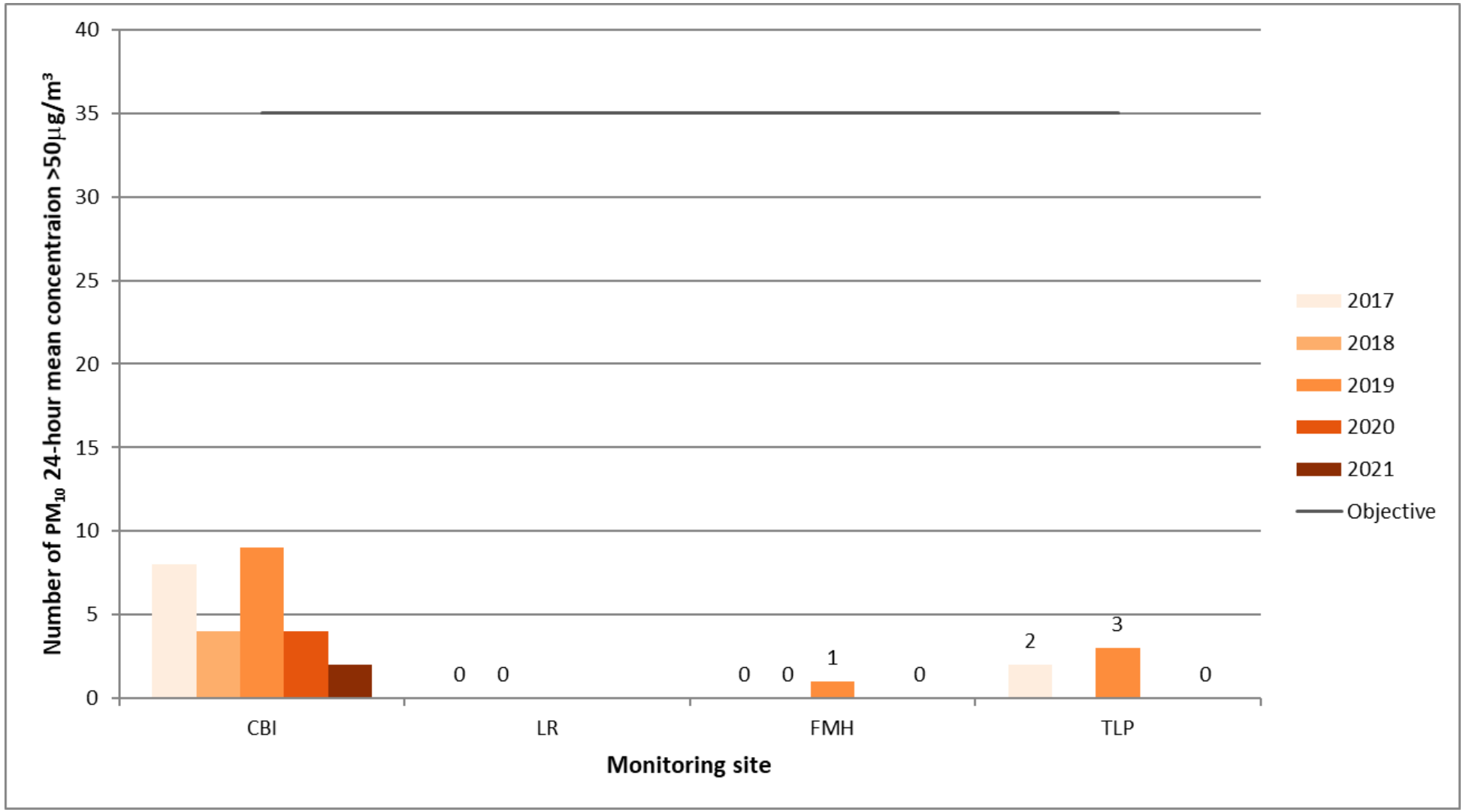


Table 10 – SO_2 monitoring results, number of relevant instances

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)	Number of 15-minute Means > 266µg/m^3	Number of 1-hour Means > 350µg/m^3	Number of 24-hour Means > 125µg/m^3
ELT	345642	375522	Industrial	98.2	98.2	4	0	0
TLP	344103	374330	Industrial	99.4	99.4	1	0	0

Notes:

Results are presented as the number of instances where monitored concentrations are greater than the objective concentration.

Exceedances of the SO_2 objectives are shown in **bold** (15-min mean = 35 allowed a year, 1-hour mean = 24 allowed a year, 24-hour mean = 3 allowed a year).

If the period of valid data is less than 85%, the relevant percentiles are provided in brackets.

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

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

Figure 7 – Trends in SO_2 concentrations – number of 15-min means greater than 266µg/m³

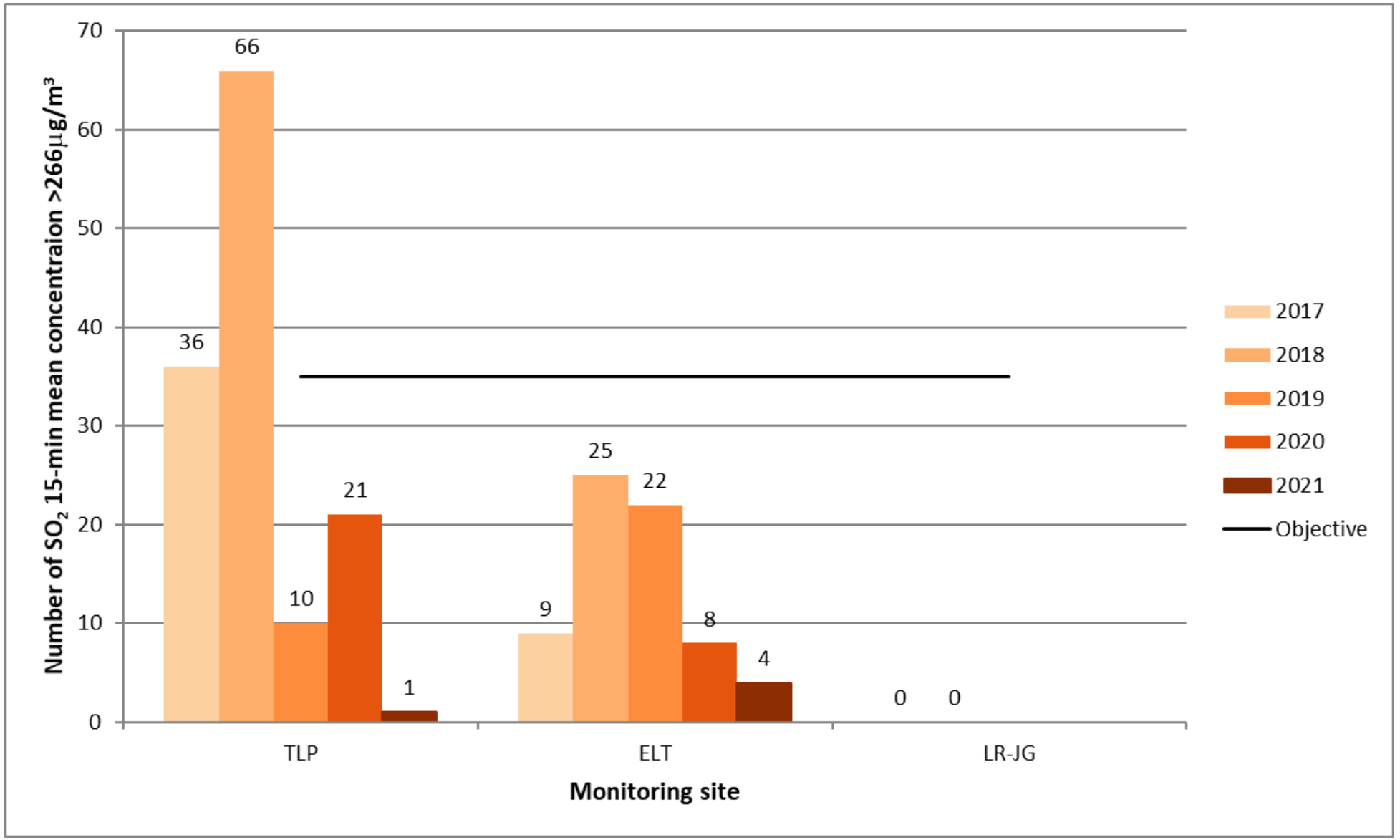
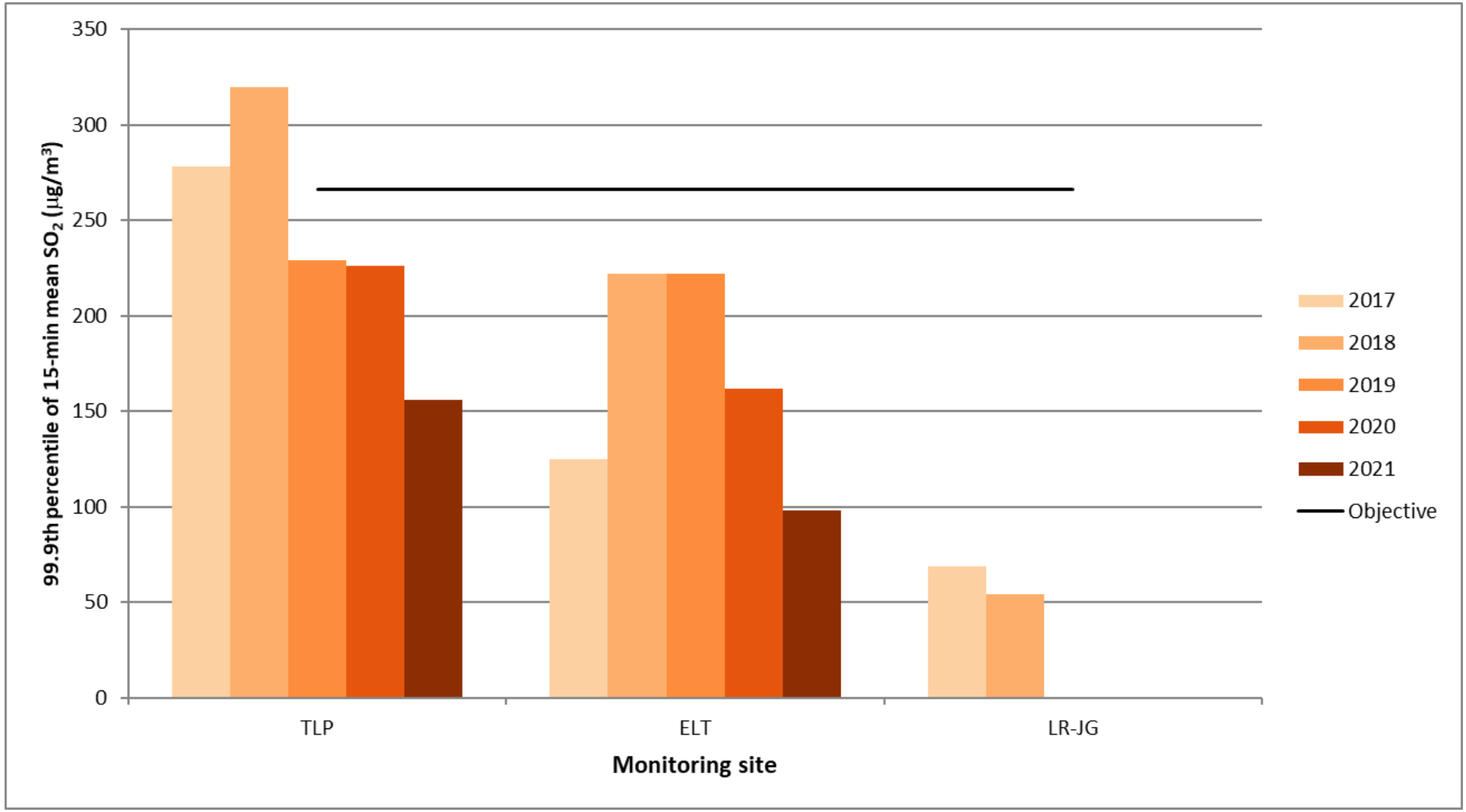


Figure 8 – Trends in SO_2 concentrations – 99.9th percentiles of 15-min means



Appendix B: Full monthly diffusion tube results for 2021

Table 11 – NO_2 diffusion tube results ($\mu g/m^3$)

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 (0.84)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
AP	373386	371500	27.4	18.6	23.0	20.4	21.4	22.0	22.8	21.1		25.6	31.6	23.6	23.4	19.7	-	
BBC	342622	364613	23.6	24.3	18.4	24.4		18.9	16.8	21.3	26.3	18.0	17.8	19.3	20.8	17.5	-	
BE	340239	366418	33.1	31.0	31.6	33.6			31.1	30.5	36.7	29.9	35.7	29.1	32.2	27.1	-	
BJ	341401	366512	32.2	25.8	28.1		28.9	32.4	32.0	32.2	35.7	26.0	39.5	28.6	31.0	26.1	-	
BSP	338380	375840	26.9	23.6	23.6	23.9	19.3	21.2	22.3	20.8	26.7	19.0	27.3	24.7	23.3	19.5	-	
C11	341915	366427	40.6	33.6	32.3	39.6	33.8	37.6	36.9	36.2	47.9	31.7	47.2	36.7	37.8	31.8	-	
C36	342000	366374	42.1	39.8	39.0	36.7	38.6	37.7	39.8	35.6	49.1	37.5	44.7	38.8	40.0	33.6	-	
C75	342056	366354	29.6	26.1	24.5	27.3	22.4	24.2	23.9	22.6	28.4	20.7	27.4	26.2	25.3	21.2	-	
CAN	340375	366730	29.4	28.1	24.4	32.1	22.1	30.0	27.3	29.4	35.5	23.7	30.9		28.4	23.9	-	
CBI1	340647	366803	41.3	35.8	31.4	33.9	29.2	29.7	33.1	32.1	35.8	31.6	39.8	30.5	-	-	-	Triplicate Site with CBI1, CBI2 and CBI3 - Annual data provided for CBI3 only
CBI2	340647	366803	40.5	33.9	33.0	34.3	30.6	30.9	34.4	32.0	35.0	30.2	35.0	34.1	-	-	-	Triplicate Site with CBI1, CBI2 and CBI3 - Annual data provided for CBI3 only
CBI3	340647	366803	42.4	34.2	34.5	34.3	30.9	30.3	30.3	30.4	36.1	30.8	36.6	30.9	33.6	28.2	-	Triplicate Site with CBI1, CBI2 and CBI3 - Annual data provided for CBI3 only
CBR	340676	366782	35.8	34.0	29.2	33.5	28.1	27.7	30.2	28.4	35.6	28.0			31.0	26.1	-	
CFL	351762	377862	34.6	27.0	25.3	26.6	27.3	27.1	27.8	24.5	26.8	24.4	33.7	28.2	27.8	23.3	-	
CM	343761	365528	32.2	29.1	24.1	28.0	30.3	27.6	28.2	26.8	33.4	26.3	33.2	28.4	29.0	24.3	-	
CN	366070	373905	39.5	31.2	29.0	28.7	26.7	22.8	25.3	25.9	30.5	34.6	36.7	void	30.1	25.3	-	
CP3	343970	365295	33.0		25.9	29.7	25.2	28.7	24.6	25.7	24.8	22.3	32.8	25.9	27.2	22.8	-	
CPL	344377	365375	16.4	13.7	13.5	13.3	14.0	12.7	13.0	12.7	18.3	14.3	19.9	13.1	14.6	12.2	-	

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 (0.84)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
CRH	364171	372697	29.1	24.6	18.4	17.6	16.2	15.5			18.6	15.4	23.2		19.8	16.7	-	
DA	365953	371113	25.3	21.5	19.9	20.5	17.0	15.5	8.3	15.1	20.1	15.9	24.1	22.5	18.8	15.8	-	
EB	341658	366487	37.7	26.8	29.0	28.6	24.9	23.3		24.6	28.0	27.2	36.9	31.8	29.0	24.4	-	
FH	352146	378139	41.6	36.8	33.8	32.9	32.0	30.3	30.0	31.3	37.8	32.8	36.5	35.1	34.2	28.8	-	
FJ	352171	378140	35.5	31.1	34.6	30.6	31.5	32.4	31.5	32.9	36.8	34.1	40.3	33.0	33.7	28.3	-	
FM	352189	378094	40.7	34.0	29.3		32.0	32.7		32.1	36.6		35.9	32.3	34.0	28.5	-	
FRC	352023	378121	39.5	27.2	28.1	29.6	27.2	29.1	31.8	29.0	33.0	26.5	36.4	28.8	30.5	25.6	-	
FT	352176	378105	34.6	24.0	30.3	27.5	25.4	27.6	28.7	27.9	29.2		34.6	25.4	28.6	24.1	-	
GE	340657	366730	44.3	35.2	29.1	29.0	26.2	26.3	25.2		34.7	32.3	32.6	30.4	31.4	26.4	-	
GR	368634	374714	24.9	23.8	19.5	19.1	19.2	17.1	17.5	17.3	21.3	20.7	22.9	22.6	20.5	17.2	-	
GSW	340700	366687	38.3	29.9	32.3	34.1	28.2	32.2		30.3	37.8	31.5	39.5	33.8	33.5	28.1	-	
GT	340611	366747	36.8	39.3	27.6	31.9	54.6	28.3		29.4	37.1	29.6		30.3	34.5	29.0	-	
HB	341605	366527	34.3		25.5	25.3	23.0	23.5	23.2	21.7	30.3	25.8	34.7	30.5	27.1	22.7	-	
HC	373375	366928	32.2	26.3	24.7	31.8	25.6	27.4	30.3	25.0	30.1		27.9	23.7	27.7	23.3	-	
HHB	347953	366723	25.9	21.0	20.3	24.3	19.3	25.5	29.4	28.5	32.8	27.9	34.2	25.6	26.2	22.0	-	
HO	341311	367207	32.4	30.2	25.5	24.1	25.0	27.6	23.8	26.3	32.8	25.2	34.3	25.8	27.8	23.3	-	
HSS	364711	366339	38.8	31.5	27.7	21.9	24.7	19.5	22.3	19.7	25.1	28.0	35.4	32.0	27.2	22.9	-	
HTC	348333	366763	32.8	32.9	25.4	29.3	30.6	28.6	26.0	25.7	34.3	28.9		33.6	29.8	25.1	-	
HW	340881	366826	36.4	34.6	28.8	27.8	29.1	27.0	25.5	28.3	37.6	27.9	39.4	30.3	31.0	26.1	-	
IC	342068	366332	34.6	28.7	33.8	31.5	27.6	27.6	30.7	28.2	33.9	30.7	41.2	31.4	31.6	26.6	-	
KR	368432	372988	35.7	34.1	29.3	27.2		25.9	28.9	28.7	29.5	34.7	33.2	31.7	30.8	25.9	-	

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 (0.84)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
LH	341126	366540	32.9	25.8	28.3	34.7	33.1	34.3	36.0	33.1	38.4	28.0	40.4	28.5	32.8	27.5	-	
LI2	340354	367034	42.0	36.4	31.9	36.0	29.1	void	32.2	30.9	41.9	33.2	42.2	35.9	35.6	29.9	-	
LU	340838	366215	22.3	17.8	18.3	19.6	19.4	17.6	19.5	19.4	23.7	19.9	25.5	18.6	20.1	16.9	-	
LVR	340980	366315	25.8	21.2									25.3	20.1	23.1	13.4	-	
LVS	340990	366317	25.7	20.3	19.8	20.9	16.9	18.7		21.2	21.7	17.6	28.1	18.2	20.8	17.5	-	
MCC	343785	365502	31.0	31.4	27.6	35.5	31.5	32.4	29.8	34.2	38.8	30.1	42.3	27.2	32.7	27.4	-	
MUL	346258	375321	25.3	18.9	15.9	15.5	12.5	12.9	13.6	14.4	18.0	14.7	21.5	18.8	16.8	14.2	-	
NCS	339857	366460	34.7	31.7	25.0	24.7	19.3	17.8	17.8	20.8	27.3	23.9		28.2	24.7	20.7	-	
NIN	340284	366199	33.0	27.2	32.1	42.9	40.9	39.3	36.6	30.8	36.3	31.6	44.7	30.6	35.5	29.8	-	
NIS	340329	366114	26.5	20.9	19.3	28.5	21.9	void	18.9	21.7	24.6	18.0	29.6	24.9	23.2	19.5	-	
NSR	366796	373984	44.0	39.2	36.5	42.8	34.4	35.3	37.2	31.8	41.5	28.8	38.3	33.1	36.9	31.0	-	
NWH	365590	373904	44.9	38.9	45.2	38.1	43.2	37.0	39.5	36.1	41.1	42.4	45.8	41.5	41.1	34.6	-	
OB	341633	366510	40.4	35.9	34.5	38.8	33.4	35.9	32.0	33.6	41.7	30.1	40.5	34.9	36.0	30.2	-	
OF	340453	366853	33.2	32.2	25.2	27.2	26.1	25.6	26.7	27.5	33.1	31.1	31.1	27.6	28.9	24.3	-	
ON	340718	366815	30.7	26.8	22.0	22.7	13.1	18.6	18.3	18.3	24.8	21.6	27.2	25.4	22.5	18.9	-	
OP	340636	366770	37.5	32.5	30.3	31.9	27.9	29.6	28.3	26.8	36.0	29.0	38.1	27.0	31.2	26.2	-	
OSQ	364053	365977	42.2	41.8	33.3	34.0	31.2	30.2	void	28.7	36.1	28.2	37.0	37.3	34.5	29.0	-	
OVH	340770	365605	26.8	24.0	25.0	21.0	22.8	21.4	22.2	20.1	24.7	24.8	33.5	25.5	24.3	20.4	-	
OW	340623	366823	45.1	41.2	37.5	35.8		31.5	36.2		40.3	37.6	41.4	36.3	38.3	32.2	-	
PA	340313	367014	42.5	39.9	35.4	36.4		31.7	29.9	30.3	40.0	35.7	40.9	33.6	36.0	30.3	-	
PG	340322	366989	46.0	42.0	37.0	41.9	34.2		34.4	38.0		37.2	42.7	40.8	39.4	33.1	-	

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 (0.84)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
QRN	330565	378063	39.8	38.1	32.7	38.6	34.3	34.5	30.3	void	36.4	32.7	34.8	31.0	34.8	29.3	-	
RM	340291	367108	40.5	41.6	31.3	45.9	33.8	38.4	35.0	36.6		33.2	37.7	37.4	37.4	31.4	-	
RPS	367856	372667	47.2	41.8	32.7	31.5	35.6	26.5	24.8	27.1	35.6	38.9	39.2	40.6	35.1	29.5	-	
RR	340180	376338	50.8	38.5	39.1	38.6	32.0	35.9	32.7	33.2	37.3	31.6	42.9	36.5	37.4	31.4	-	
SA	340364	366929	39.2	37.0	27.5	35.4	33.7	30.7	28.4	29.3	35.6	28.5	36.2	31.5	32.8	27.5	-	
SAB	340838	366746	38.2	32.0	29.8	30.0	34.5	30.0		32.6	40.1	29.4	39.5	32.1	33.5	28.1	-	
SF	341238	366976	34.3		25.4	26.5	25.7	24.8		26.2	32.3	27.5	32.3	30.4	28.6	24.0	-	
SLW	339889	375755	30.8	29.3			21.4		20.7			17.5		26.8	24.4	18.3	-	
SMH	340243	366511		29.8			17.8		19.6	25.1	31.9	24.1	26.8	28.6	25.5	21.1	-	
SR	340435	376790	40.8	33.9	37.2	36.2	31.6	32.8	void	30.6	36.0	31.8	39.1	33.6	34.9	29.3	-	
ST	340794	366778	45.8	39.5	37.4	41.9	43.3	37.8	34.8	36.3	47.0	38.9			40.3	33.8	-	
SZ	341819	366475	31.5	26.5	27.9	33.5	26.1	30.8	30.5	26.0	34.9	26.5	37.9	28.6	30.1	25.3	-	
T11	341931	366458	30.6	27.3	25.5	28.0	22.5	21.9	22.6	22.1	26.9	23.4	29.7	24.1	25.4	21.3	-	
T44	342085	366446		34.8	31.2	35.4	31.7	30.3	34.6	31.2	40.4	32.5	40.7	30.7	34.0	28.5	-	
T6	341926	366446	49.9	44.5	36.4	43.2	44.2	34.2	34.7	31.4	45.7	42.0	45.2	36.3	40.6	34.1	-	
TA	344519	366898		34.4	34.8	37.5	31.5	29.3	28.6	31.6	35.3	26.2	37.2	34.9	32.9	27.6	-	
TB	341202	366470	36.9	30.0	29.4	32.1	28.4	28.0	24.6	27.1	34.6	26.9	35.0	30.3	30.3	25.4	-	
TBV	344013	366830	42.5	35.2	34.5	33.9	35.7			32.7	42.6	36.1	41.1	33.7	36.8	30.9	-	
UN	340357	366960	31.9	32.1	25.7	33.0	24.4	26.0	25.8	26.4	34.6	24.6	30.7	25.9	28.4	23.9	-	
VXR	343365	366694	31.9	32.1	25.1	27.7	24.0	23.0	22.5	22.7	29.9	21.6	30.0	27.1	26.5	22.2	-	
WCR	342951	366029	36.6	37.0	33.0	41.2	33.8	34.3		33.8		37.0	36.4	35.3	35.8	30.1	-	

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 (0.84)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
WG	340217	366209	33.3	25.3	24.8	34.0	21.9	29.0	29.0	29.8	32.2	23.3	49.0	31.6	30.3	25.4	-	
WGW	340165	366198	28.1	24.9	25.5	29.9	21.6	26.2	24.6	27.2	24.5	20.5	36.7	25.7	26.3	22.1	-	
WH1	340196	376364	40.9	33.9	35.1	34.9	29.5	31.3	29.1	29.8				33.7	-	-	-	Triplicate Site with WH1, WH2 and WH3 - Annual data provided for WH3 only
WH2	340196	376364	37.9	33.4	31.9	34.6	27.3	30.3	33.8	26.9	33.1	31.8	36.8	32.4	-	-	-	Triplicate Site with WH1, WH2 and WH3 - Annual data provided for WH3 only
WH3	340196	376364	40.9	32.4	35.0	33.6	30.5	29.0	29.4	29.1	34.6	28.5	32.6	31.2	32.6	27.4	-	Triplicate Site with WH1, WH2 and WH3 - Annual data provided for WH3 only
WVC	365788	373744	33.6	24.6	19.9	20.0	17.8	16.6	18.1	16.2	22.3	20.8	24.0	26.5	21.7	18.2	-	
XR	343117	365949	30.8	29.5	25.4	29.4	23.9	24.6	23.1	27.8	31.7	25.1	32.5	24.2	27.3	23.0	-	

☒ All erroneous data has been removed from the NO_2 diffusion tube dataset presented in the table above

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

☒ National bias adjustment factor used

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

☒ Cheshire West and Chester confirm that all 2021 diffusion tube data has been uploaded to the Diffusion Tube Data Entry System

Notes:

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

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

See Appendix C for details on bias adjustment and annualisation.

Appendix C: Supporting technical information / air quality monitoring data QA/QC

New or changed sources identified within Cheshire West and Chester during 2021

Through the planning process, Cheshire West and Chester Council has identified a number of new sources with a potential to impact air quality, these are summarised in Table 12. The actual impacts of these sources have been deemed to be acceptable at the consultation stage either through assessment or the permitting regime.

Table 12 – New sources with a potential to impact air quality (2021)

Reference	Address	Proposal
21/00055/FUL	Land Off Hargreaves Road, Northwich	Residential development for 395 dwellings with associated access, car parking and landscaping.
21/01243/FUL	Land At Former Ellesmere Port Royal British Legion, Stanney Lane, Ellesmere Port CH65 9AF	Erection of 63no affordable dwellings comprising 26no 1- and 2-bedroom apartments in a 2-storey block; 12no 1 bedroom 'walk-up' cottage style apartments, 22no 2 bedroom houses and 3no 4 bedroom houses. New access road and associated external works.
21/01438/FUL	Land Adjacent to Labour Hall, Tabley Street, Northwich	Erection of a 3-storey residential development comprising of 34 apartments with associated car parking, landscaping and external works.
21/03468/FUL	Christleton Hall, Pepper Street, Christleton, Chester CH3 7AB	Redevelopment of the former University of Law Chester campus for residential use (Use Class C3) including demolition of late 20th century buildings; conversion of Christleton Hall to 18 apartments; erection of 24 new residential dwellings and an office building (Use Class E); and associated landscaping, parking and other works.
21/04604/REM	Land At Road One, Winsford	Construction of petrol filling station and associated works including creation of development plateau, installation of attenuation pond, car parking and landscaping
21/03479/OUT	Land Off Niddries Lane, Moulton, Northwich	Erection of up to 120 dwellings and associated infrastructure works, public open space and landscaping
21/03480/OUT	Land At Jack Lane, Davenham, Northwich	Erection of up to 60 dwellings and associated infrastructure works, public open space and landscaping
21/03663/FUL	Land At Hooton Road, Hooton, Ellesmere Port	Construction of a Crematorium with Ceremony Hall, memorial areas, garden of remembrance and associated parking and infrastructure.
21/03680/S73	Crown Farm Quarry, Stonyford Lane, Oakmere, Northwich CW8 2JL	Application to link and extend the extant planning permission consents at Delamere Quarry (Ref 4/31844) and Crown Farm Quarry (Ref. 4/APP/2002/1514) in order to work sand and gravel reserves in a phased manner. Variation of condition 17 of

		planning permission 20/01012/S73 to allow importation of limestone fines for blending with sand for construction market
21/03718/FUL	Land At Merseyton Road, Ellesmere Port	Construction and operation of a stand-by electricity generation plant gas-fired generators sited within individual sound-proof containers together with associated development
21/04076/FUL	Plots 9b, 10a, 11 and 12 Protos, Grinsome Road, Ellesmere Port CH2 4RB	Materials recycling facility, two plastics recycling facilities, a polymer laminate recycling facility and a hydrogen refuelling station
21/04398/OUT	Land At Utkinton Road, Tarporley	Outline planning application for 70 dwellings (with access considered)

Additional air quality works undertaken by Cheshire West and Chester during 2021

From the end of 2020 an indicative Turnkey Osiris monitor has been operated by independent consultants, at the roadside of the A51 in Littleton on behalf of the Council's Highways department in order to monitor potential impacts of the road widening scheme. The instrument has Environment Agency Monitoring Certification Scheme (MCERTS) approval for monitoring particulates but is not a reference quality analyser for the purposes of LAQM and the data cannot be subjected to the level of quality control that is applied to the reference analysers.

The 2021 annual mean PM_{10} for the Osiris monitor was 17$\mu g/m^3$ (data capture 88%). There were two days when the annual PM_{10} limit of 50$\mu g/m^3$ was exceeded but, as there is an allowance of 35 days, the objective was not exceeded. The annual mean $PM_{2.5}$ was 6$\mu g/m^3$ so the national objective of 25$\mu g/m^3$ was not exceeded.

QA/QC of diffusion tube monitoring

Environmental Protection staff follow internal QA/QC procedures relating to the use of diffusion tubes for the purpose of air quality monitoring. The procedures cover key stages in the monitoring process including storage, deployment, record keeping and management of NO_2 diffusion tube data.

NO_2 diffusion tubes are supplied and analysed by Gradko Ltd laboratory which holds UKAS accreditation. The method of preparation is 20% TEA in water. Gradko participate in the AIR NO_2 Proficiency Testing Scheme and their performance is publicly available on the Defra website. In rounds AR030, 31, 33, 34, 36 and 40 (2019 to 2020) Gradko achieved a

satisfactory result of 75% or above. This dropped to 25% in round AR042 (Jan-Mar 202) but an investigation was carried out and a repeat set of samples tested (Mar-21) to confirm results. It was concluded that there was no risk associated with results reported to customers. Gradko's precision score for 2021 was Good = 32 Bad = 0.

Cheshire West and Chester monitoring has been completed in adherence with the Defra diffusion tube monitoring calendars for exposure dates.

Diffusion tube annualisation

Annualisation is required for any site with data capture less than 75% but greater than 25%. 2021 data from three non-automatic monitoring sites were annualised, as shown in Table 14. The Diffusion Tube Data Processing Tool was used for these calculations.

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 oxides of nitrogen 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.

Cheshire West and Chester have applied a national bias adjustment factor of 0.84 to the 2022 monitoring data. A summary of bias adjustment factors used by Cheshire West and Chester over the past five years is presented in Table 13.

The overall accuracy and precision of the two local studies (sites CBI and WH) were good, as were data capture rates for the automatic analysers (see Table 15). A full 12 periods of diffusion tube data were used for calculation of the bias factor. The combined local factor was 0.88, which is slightly higher than the national factor of 0.84. As in previous years, and in line with the guidance notes in section 7.175 of LAQM.TG16, it has been decided to use the national bias adjustment factor (0.84) for the adjustment of all diffusion tube data as it is likely to be more statistically reliable.

Table 13 – Bias adjustment factors

Year	Local or National	If National, Version of National Spreadsheet	Adjustment Factor
2021	National	03/22	0.84
2020	National	06/21	0.81
2019	National	03/20	0.93
2018	National	03/19	0.93
2017	National	03/18	0.89

NO_2 Fall-off with distance from the road

Wherever possible, monitoring locations are representative of exposure. However, where this is not possible, the NO_2 concentration at the nearest location relevant for exposure is routinely estimated using the NO_2 fall-off with distance calculator, which is a feature of the diffusion tube date processing tool spreadsheet. Distance adjustment was not required for the 2021 dataset as none of the bias adjusted diffusion tube results were greater than 36$\mu g/m^3$.

No diffusion tube or automatic NO_2 monitoring locations within Cheshire West and Chester required distance correction during 2021.

QA/QC of automatic monitoring

Council staff perform fortnightly span and zero calibrations on the chemiluminescent analysers at the BO, CBI and WH roadside sites, and four-weekly span and zero calibrations on the remaining chemiluminescent and UV-fluorescent analysers, using BOC spectra-seal certified gas standards. The resultant span and offset values are used in the ratification of datasets. Automated internal zero checks are run overnight daily. Data from different sites is compared on a regular basis for the purposes of QA/QC. Data management and ratification is performed by an independent contractor, AQDM Ltd. This includes production of weekly, quarterly and annual summaries as well as ad hoc notifications of any exceedance episodes where necessary. The ratification process also involves comparison against national network sites to identify regional patterns and trends. Automatic analysers are serviced and calibrated at six-monthly intervals by Enviro Technology Services Ltd.

Currently, air quality monitoring data is publicly available at: www.cheshirewestandchester.gov.uk/airquality. This includes daily updates of automatic monitoring data, presented as both air quality index gauges and static time series graphs but it lacks the facility to download historical datasets. Diffusion tube data is also available on the site. The Council has commissioned a third-party contractor to create a replacement air quality website with a much-improved interface for the end user. This was due to be launched in 2021 but technical and developmental issues have pushed this back to 2022.

PM_{10} and $PM_{2.5}$ monitoring adjustment

PM_{10} monitoring data recorded by the BAM analysers at Thornton-le-Moors (TLP) and Chester bus interchange (CBI) have been adjusted by the factor 0.96618, to give the indicative gravimetric equivalent figure.

The volatile correction model (VCM) was used to correct TEOM monitoring data at Frodsham (FMH) to produce a gravimetric equivalent figure.

Automatic monitoring annualisation

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

NO_2 Fall-off with distance from the road

No automatic NO_2 monitoring locations within Cheshire West and Chester required distance correction during 2021. (Distance correction would have been considered were the annual mean concentrations at roadside sites greater than 36µg/m^3 and the monitoring site not located at a point of relevant exposure).

Table 14 – Annualisation summary (concentrations presented in μg/m^3)

Site ID	Annualisation Factor Crewe Coppenhall	Annualisation Factor Glazebury	Annualisation Factor Wigan Centre	Annualisation Factor Wirral Tranmere	Average Annualisation Factor	Raw Data Annual Mean	Annualised Annual Mean	Comments
LVR	0.6847	0.7056	0.7099	0.6692	0.6924	23.1	16.0	
SLW	0.9053	0.9373	0.9058	0.8295	0.8945	24.4	21.8	
SMH	1.0102	1.0522	1.0082	0.8830	0.9884	25.5	25.2	

Table 15 – Local bias adjustment calculation

	Local Bias Adjustment Input 1	Local Bias Adjustment Input 2
Periods used to calculate bias	12	12
Bias Adjustment Factor A	0.89 (0.84 - 0.94)	0.89 (0.83 - 0.95)
Diffusion Tube Bias B	13% (7% - 18%)	13% (6% - 20%)
Diffusion Tube Mean (µg/m^3)	32.6	33.6
Mean CV (Precision)	5.1%	3.5%
Automatic Mean (µg/m^3)	29.0	29.8
Data Capture	98%	99%
Adjusted Tube Mean (µg/m^3)	29 (27 - 31)	30 (28 - 32)
Overall Diffusion Tube Precision	Good Overall Precision	Good Overall Precision
Overall Continuous Monitor Data Capture	Good Overall Data Capture	Good Overall Data Capture
Combined Local Bias Adjustment Factor	0.88	

Notes:

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

Figure 9 – Inter-site hourly NO_2 comparisons 2021 (AQDM Ltd.)

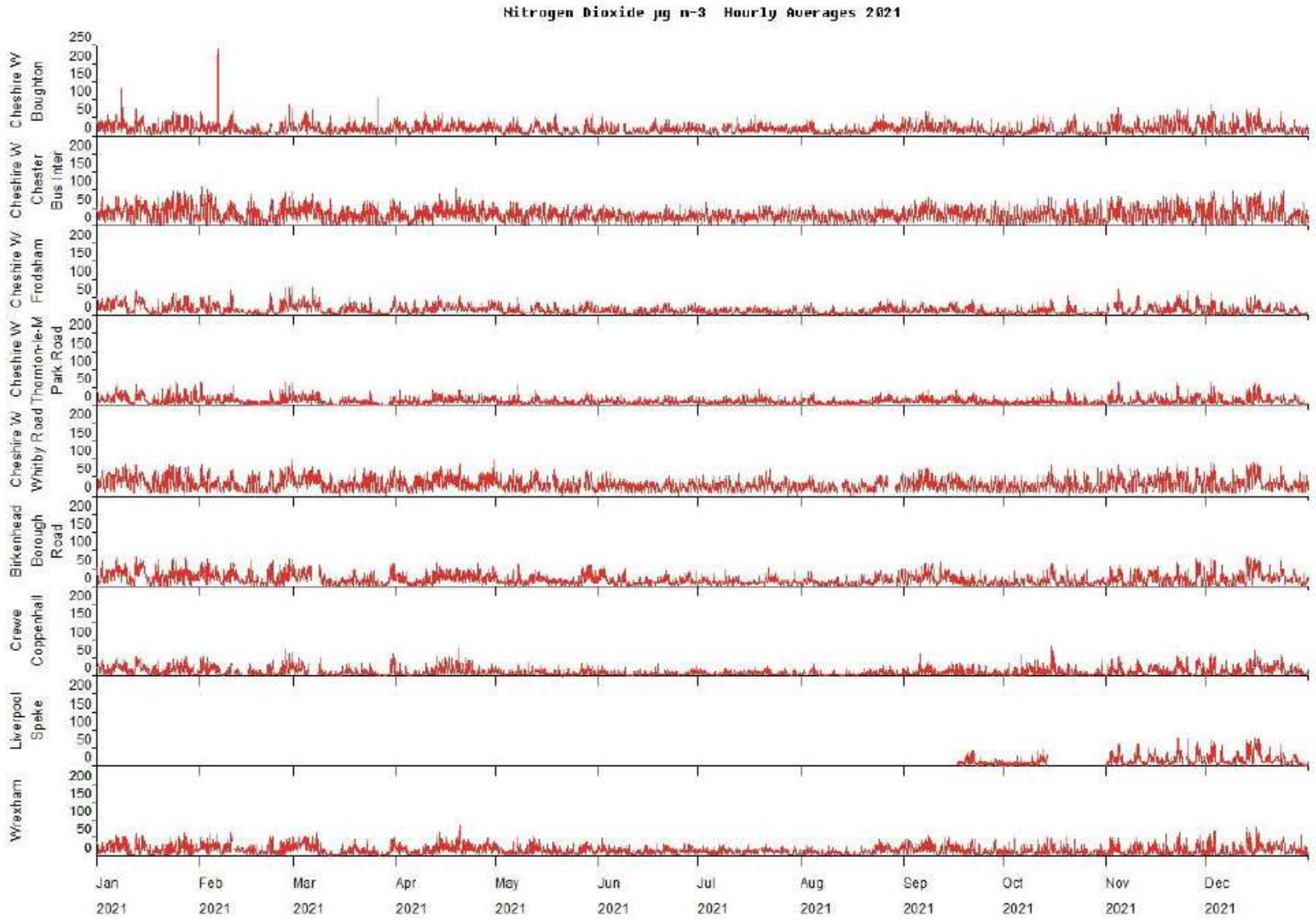


Figure 10 – Inter-site monthly NO_2 comparisons 2016-2021 (AQDM Ltd.)

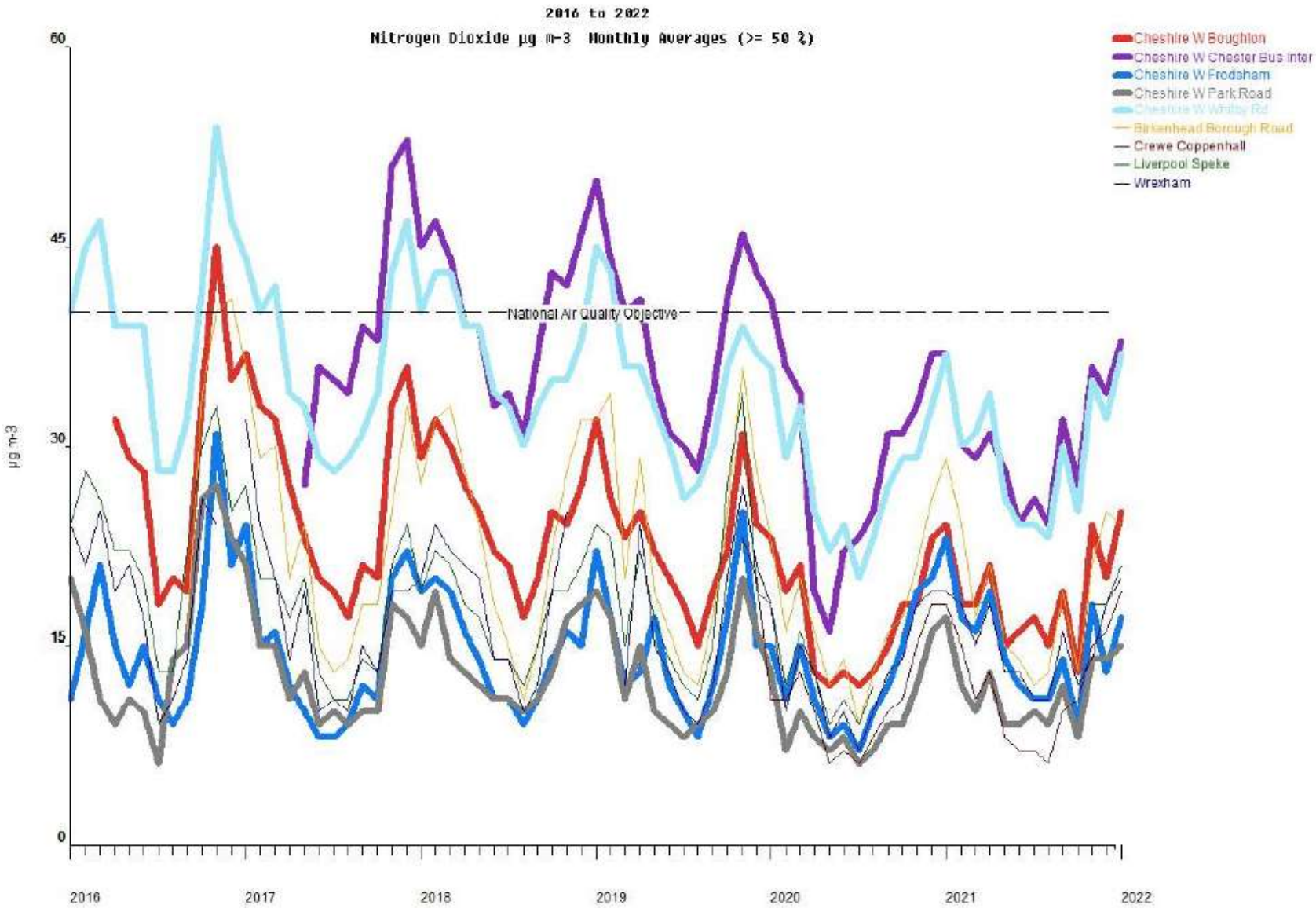


Figure 11 – Inter-site daily gravimetric PM_{10} comparisons 2021 (AQDM Ltd.)

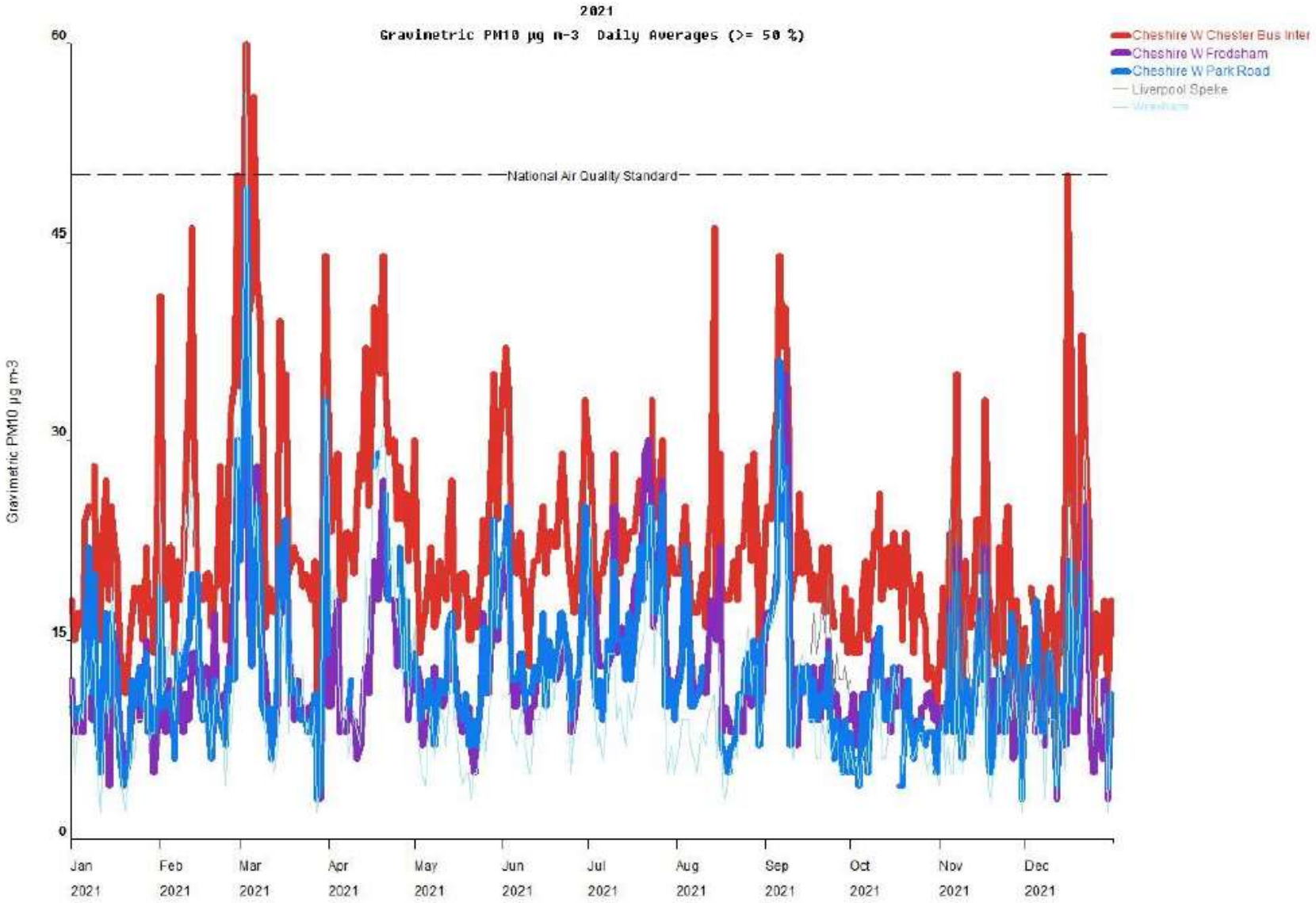


Figure 12 – Inter-site 15-minute SO_2 comparisons 2021 (AQDM Ltd.)

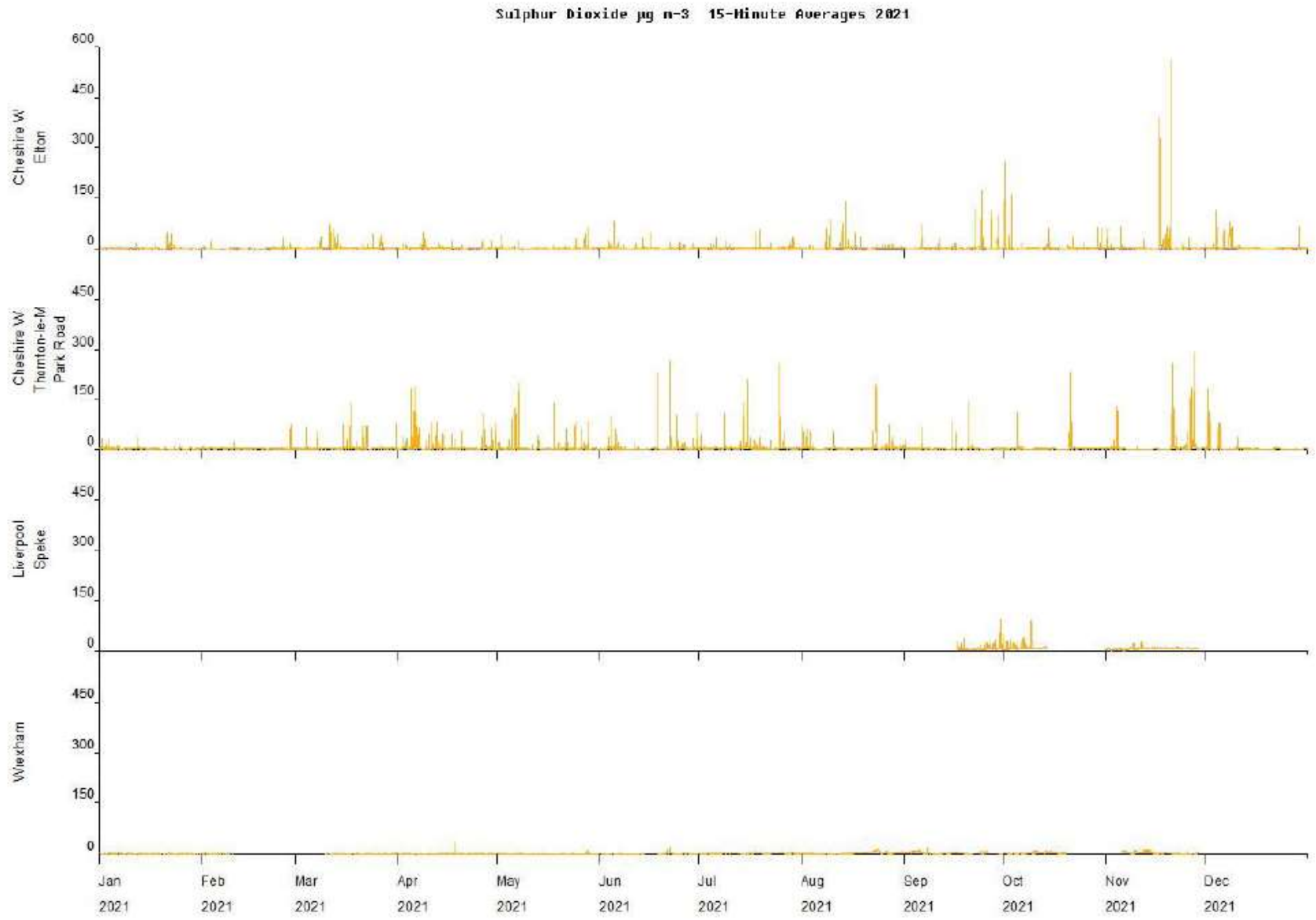
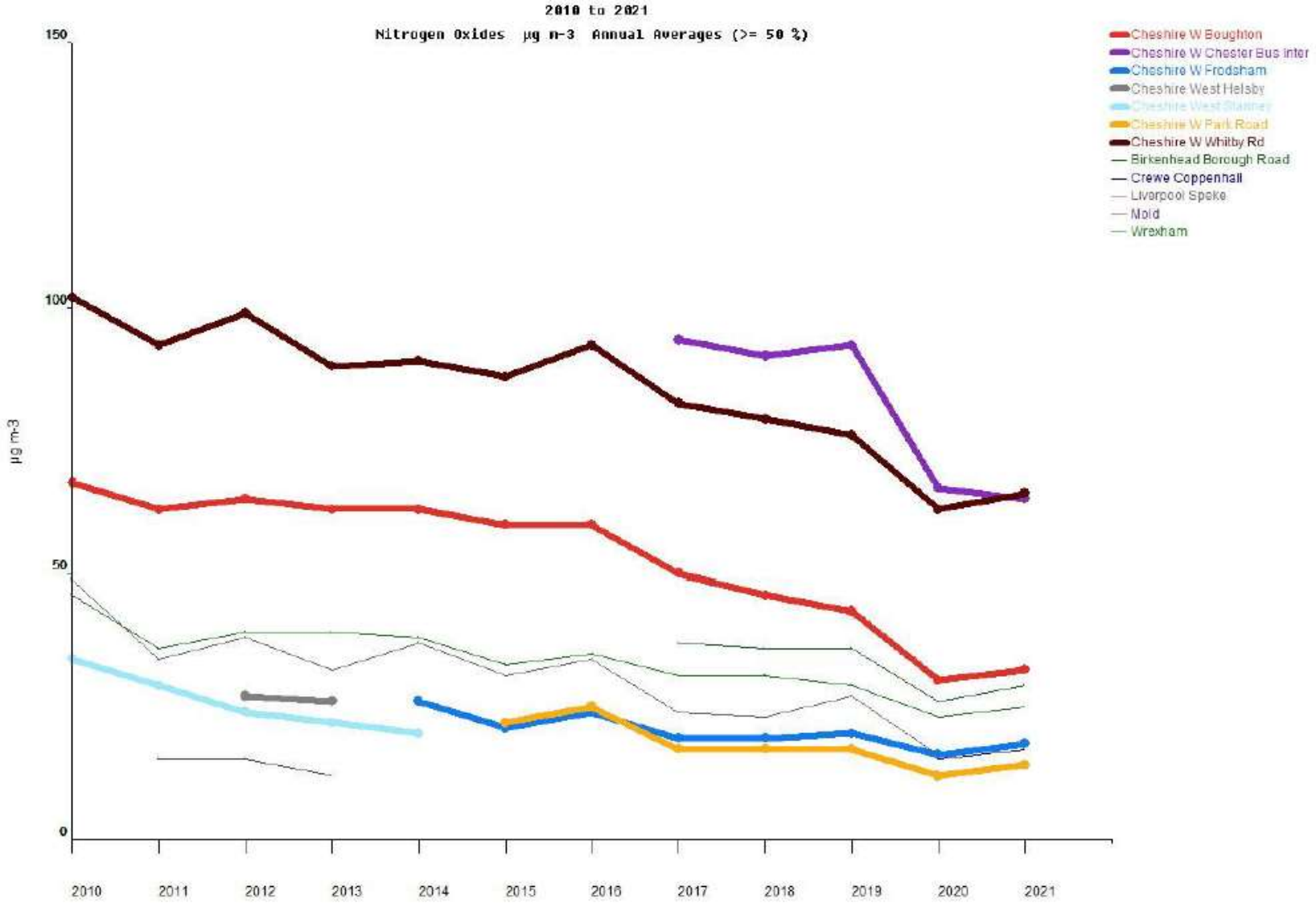


Figure 13 – Long-term trend in NOx concentrations 2010-2021 (AQDM Ltd.)



Appendix D: Map(s) of monitoring locations and AQMAs

Figure 14 – Map of monitoring sites and AQMA, Chester

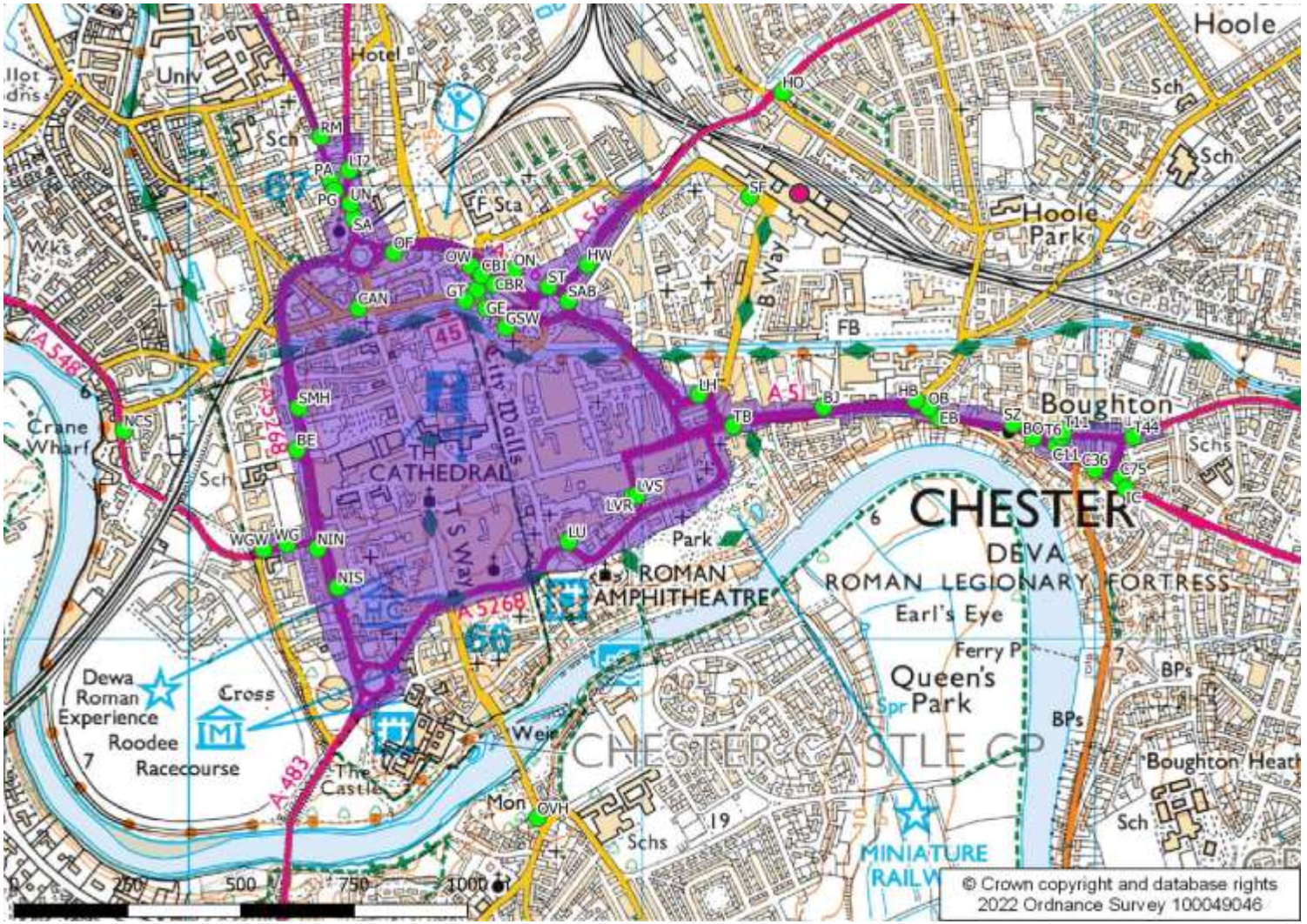


Figure 15 – Map of monitoring sites and AQMA, Ellesmere Port

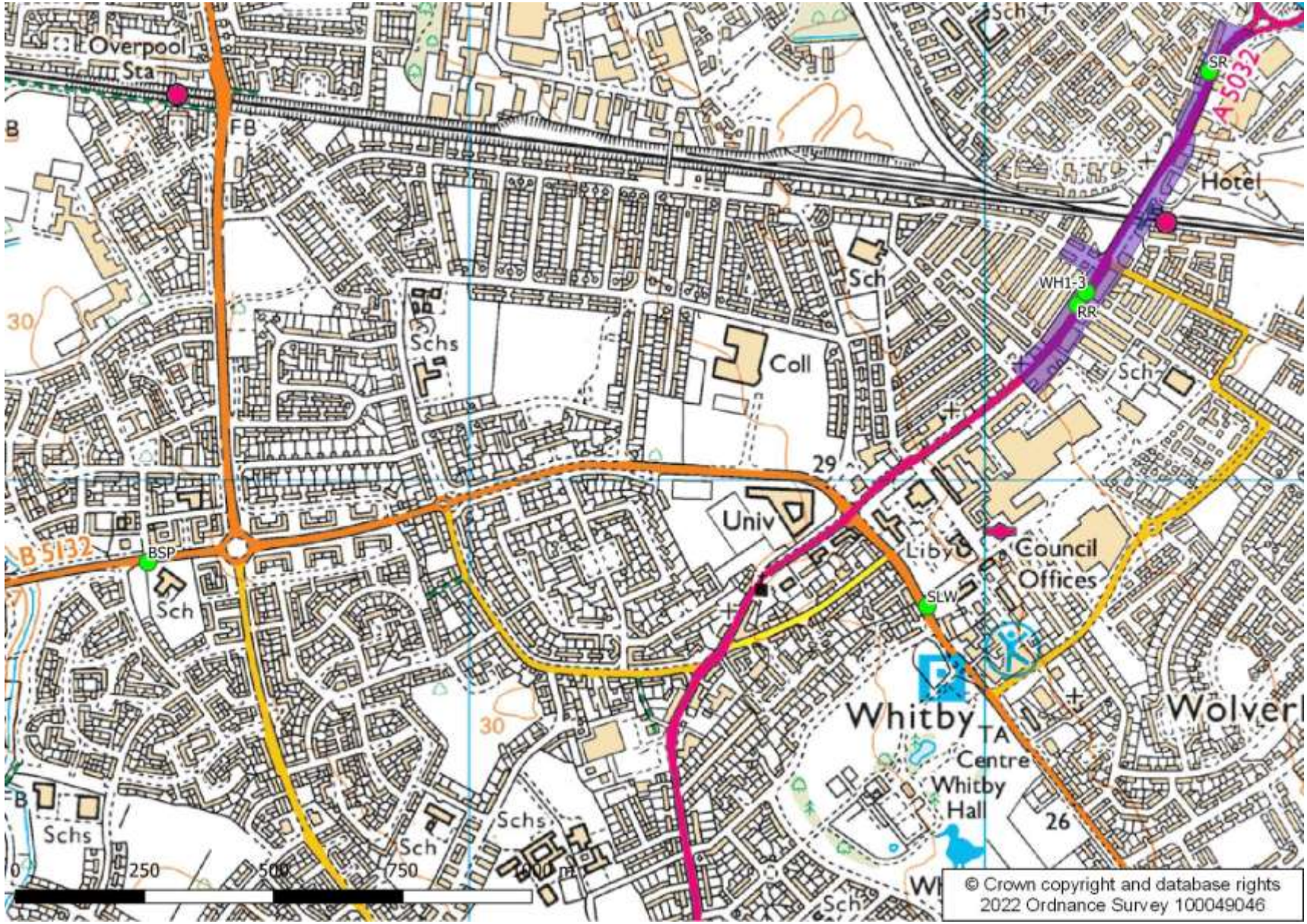


Figure 16 – Map of monitoring sites and AQMA, Frodsham

Figure 17 – Map of monitoring sites and AQMA, Thornton-le-Moors / Elton

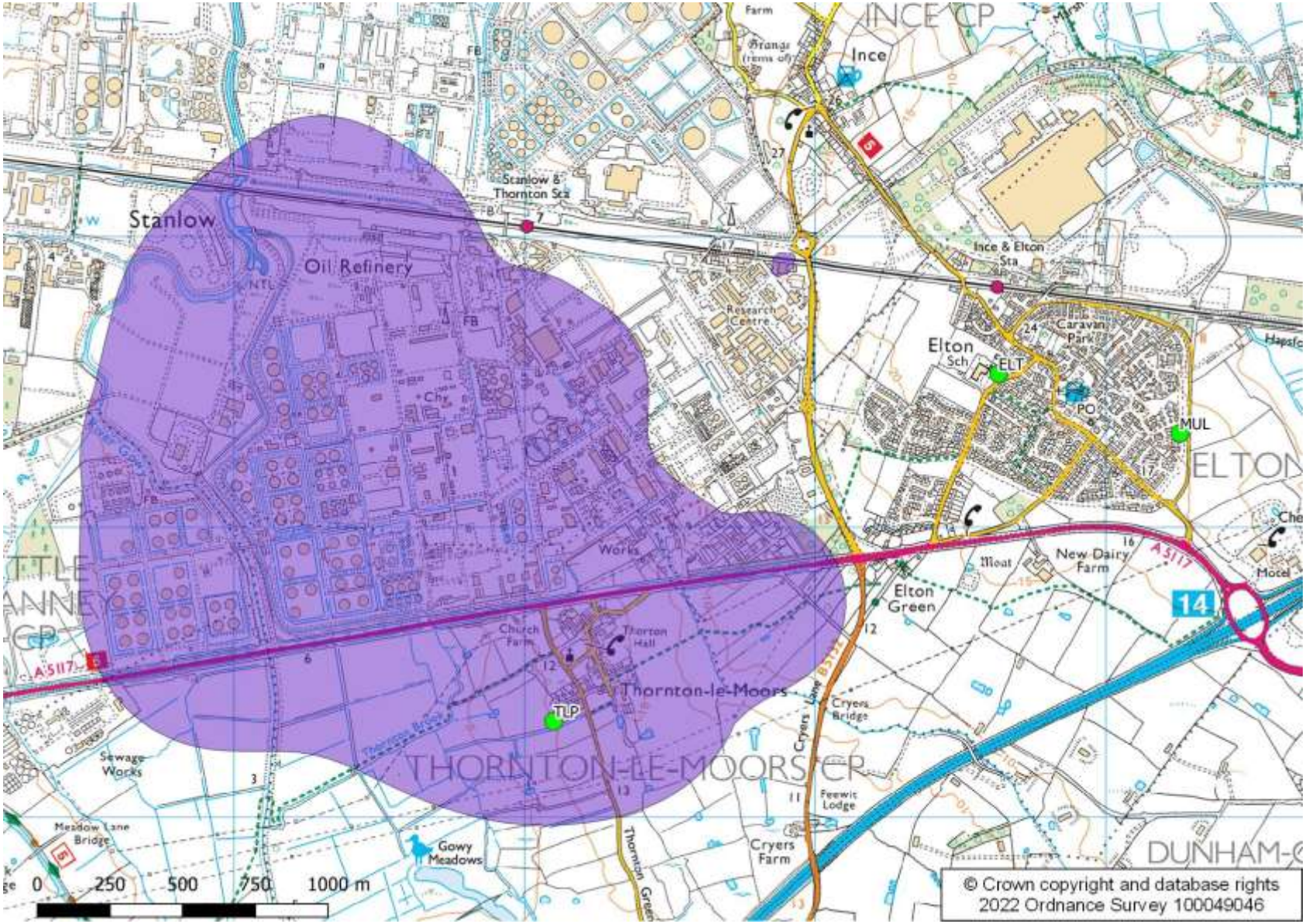


Figure 18 – Map of monitoring sites, Christleton / Littleton / Boughton Heath

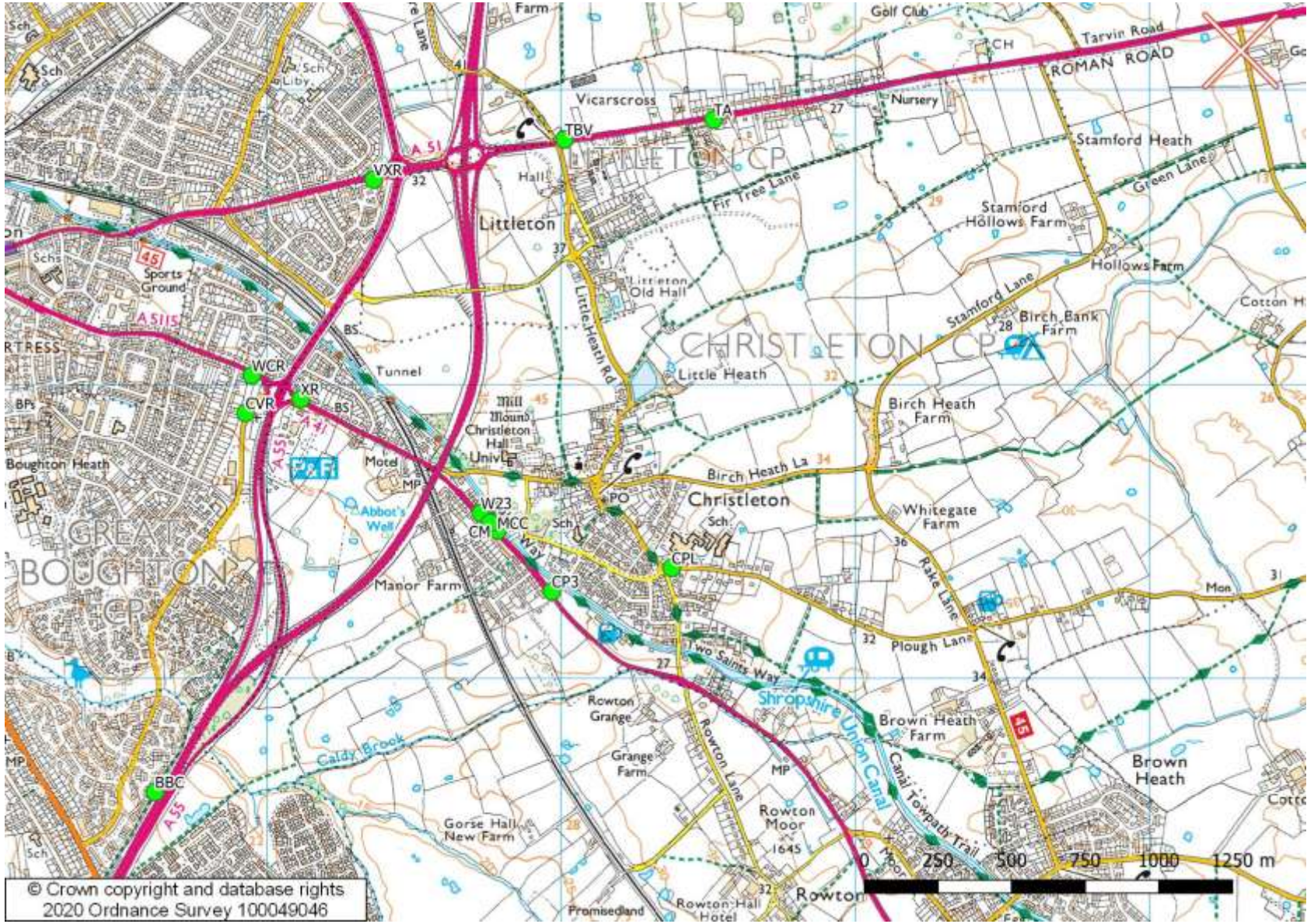


Figure 19 – Map of monitoring sites, Tarvin

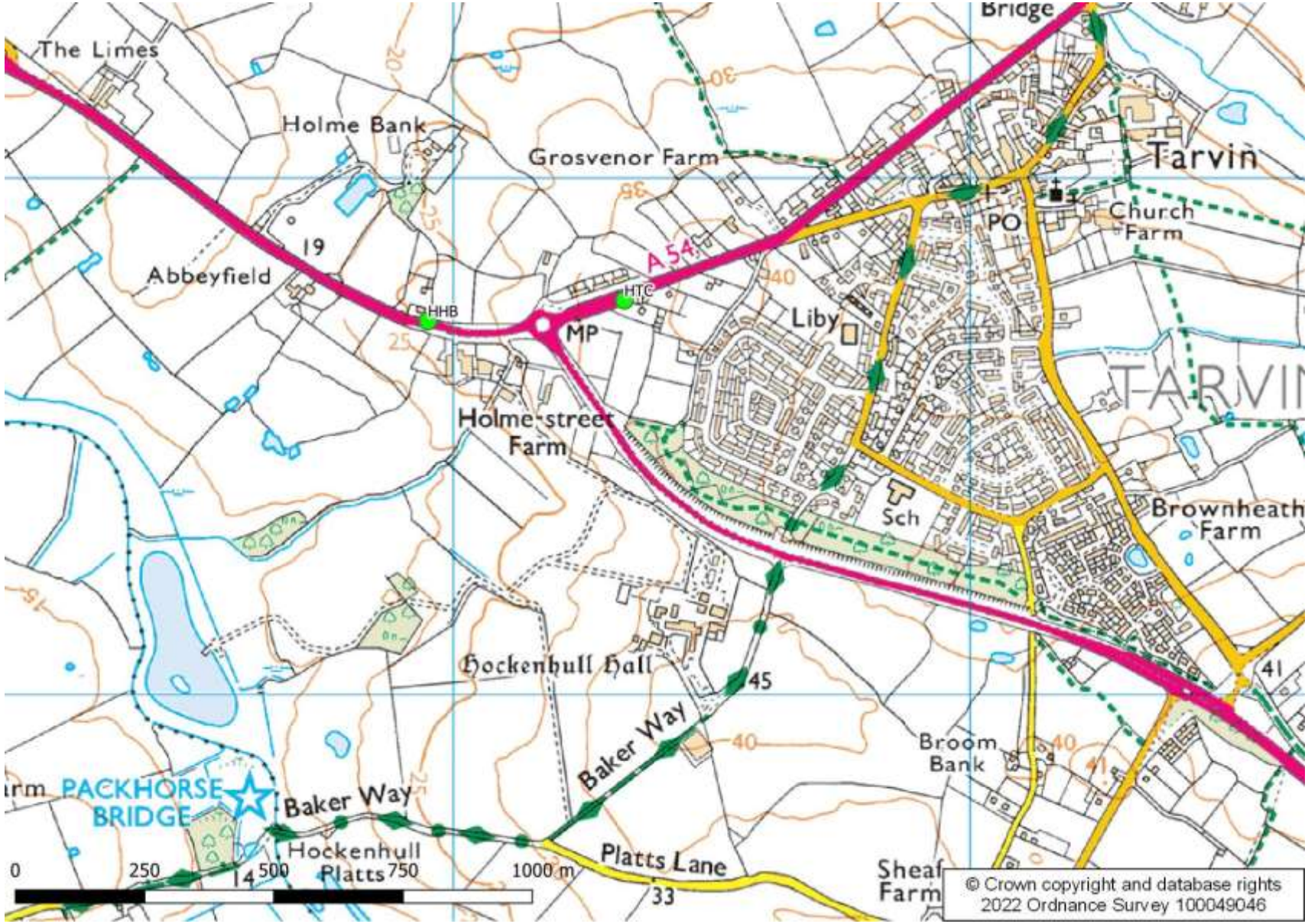


Figure 20 – Map of monitoring site, Neston

Figure 21 – Map of monitoring sites, Northwich

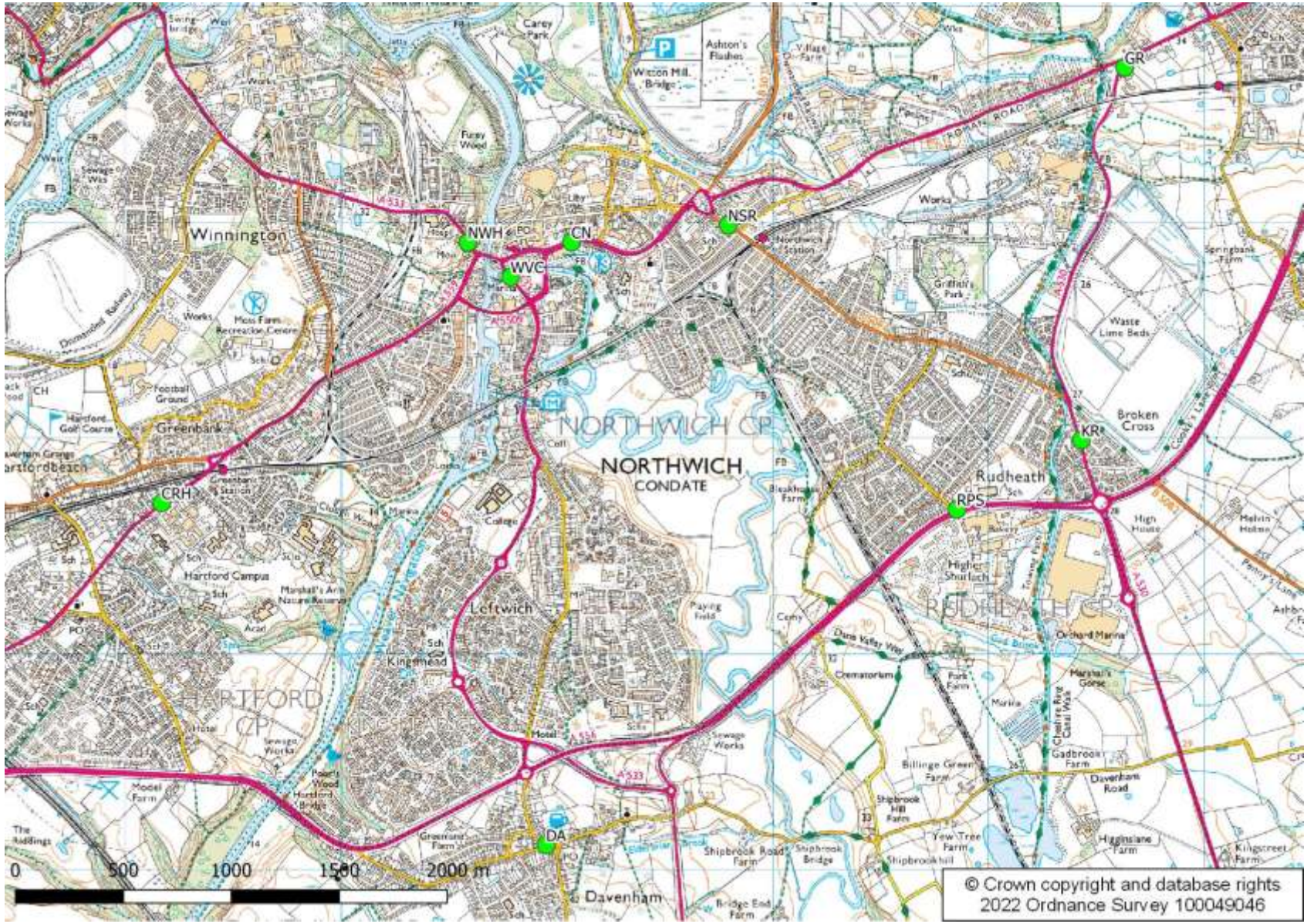


Figure 22 – Map of monitoring sites, Winsford

Figure 23 – Map of monitoring site, Allostock

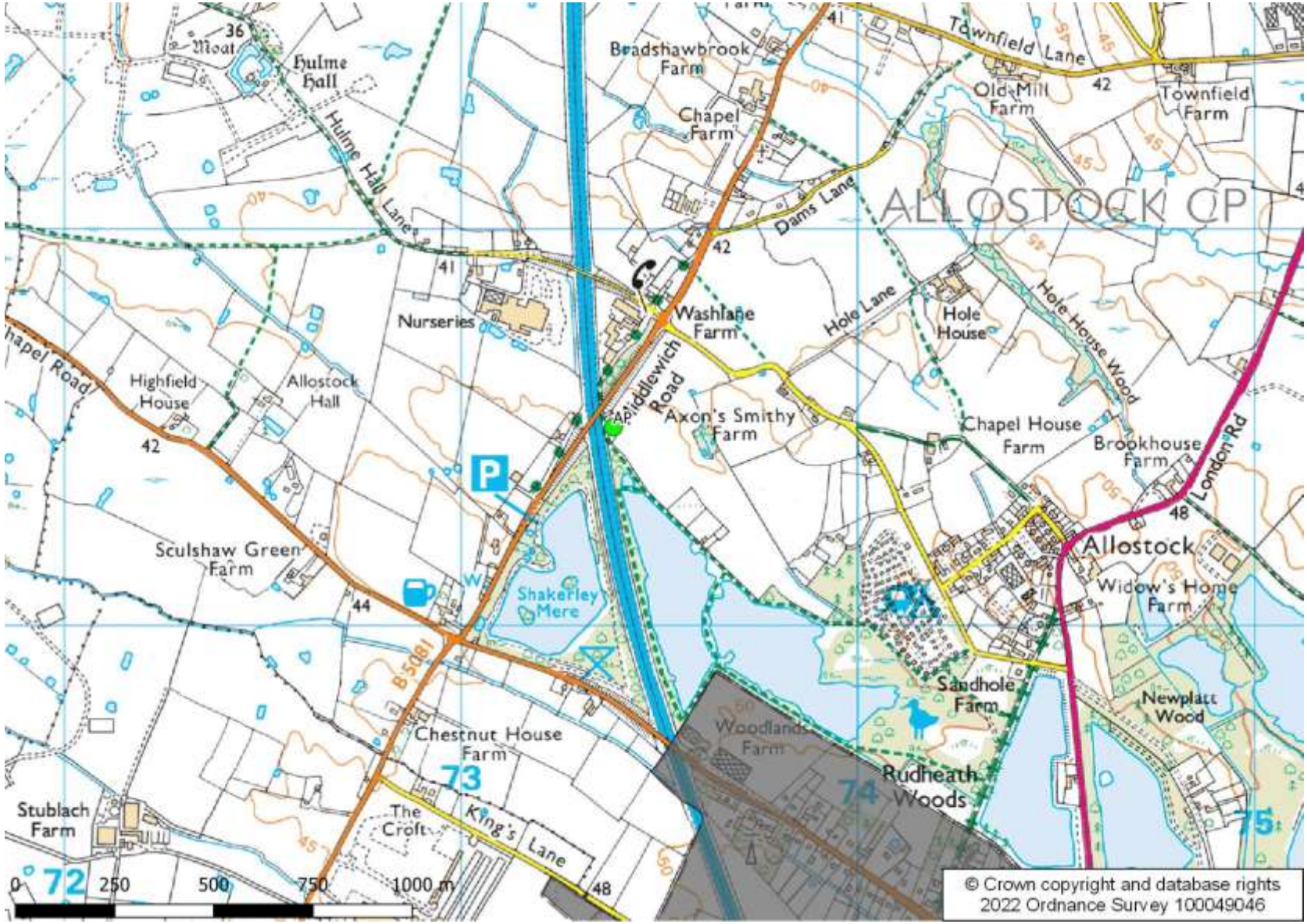


Figure 24 – Map of monitoring site, Sproston

Appendix E: Summary of air quality objectives in England

Table 16 – Air quality objectives in England[7]

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

[7] The units are in micrograms of pollutant per cubic metre of air (µg/m^3).

Glossary of terms

Abbreviation	Description
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the local authority intends to achieve air quality limit values'
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
ASR	Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by Highways England
EU	European Union
EVCP	Electric Vehicle Charge Point
ORCS	On-Street Residential Chargepoint Scheme
LAQM	Local Air Quality Management
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
OLEV	Office for Low Emission Vehicles (now OZEV – Office for Zero Emission Vehicles)
PM_{10}	Airborne particulate matter with an aerodynamic diameter of 10µm or less
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
QA/QC	Quality Assurance and Quality Control
SO_2	Sulphur dioxide

References

- Local Air Quality Management Technical Guidance LAQM.TG16. April 2021. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.
- Local Air Quality Management Policy Guidance LAQM.PG16. May 2016. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.