2023 Air Quality Annual Status Report (ASR)

In fulfilment of Part IV of the Environment Act 1995 Local Air Quality Management, as amended by the Environment Act 2021

Date: October 2023

Cheshire West and Chester

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This Annual Status Report has been prepared by Ricardo Energy and Environment

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 29,000 to 43,000 deaths at typical ages[3], with a total estimated healthcare cost to the NHS and social care of £157 million in 2017[4].

This annual status report (ASR) covers monitoring results for 2022 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.

In 2022, for the second year in a row, the NO_2 annual average objective was not exceeded at any monitoring site in the Chester city centre AQMA. Similarly, the objective was not

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

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

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

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

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.. 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 however the number of episodes continues to remain low. As a unitary authority, Cheshire West and Chester Council benefits from interdepartmental 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, there are some areas where local action is needed to protect people and the environment from the effects of air pollution.

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

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

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

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

public network will allow up to 71 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 the 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 the 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 2022. In 2022 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, as such, we intend to revoke the AQMA in 2023. 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 (LES), 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; implement the recently adopted EV strategy; expand the availability of EVCPs in the borough; revoke the AQMA in Ellesmere Port; review the status of the AQMA in Frodsham with a view to revoking in 2024, 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 Public Protection department of Cheshire West and Chester Council with the support and agreement of the following officers and departments:

[redacted] – Environmental Protection Team

[redacted] – Transport and Infrastructure

[redacted] – Planning Policy

This ASR has been approved by:

[redacted]

[redacted] – Director of Environment and Communities

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

[redacted]

[redacted] – 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 2022. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995), as amended by the Environment Act (2021), and the relevant Policy and Technical Guidance documents.

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

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

2 Actions to Improve Air Quality

2.1 Air Quality Management Areas

Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely exceedance of an air quality objective. After declaration, the authority should prepare an Air Quality Action Plan (AQAP) within 18 months. The AQAP should specify how air quality targets will be achieved and maintained, and provide dates by which measures will be carried out.

A summary of AQMAs declared by Cheshire West and Chester Council can be found in Table 2.1. 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 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 3.2.1) with the aim of revoking in 2024 subject to no exceedances in 2023.

Table 2.1 – Declared Air Quality Management Areas

AQMA Name	Date of Declaration	Pollutants and Air Quality Objectives	One Line Description	Is air quality in the AQMA influenced by roads controlled by Highways England?	Level of Exceedance: Declaration	Level of Exceedance: Current Year	Number of Years Compliant with Air Quality Objective	Name and Date of AQAP Publication	Web Link to AQAP
Chester City Centre AQMA (No.5)	23/05/2017	NO_2 Annual Mean	Inner ring road and sections of Liverpool Rd, Parkgate Rd, Hoole Way, Boughton gyratory and Watergate St. Chester	NO	50.3 µg/m^3 (T6)	36.4 µg/m^3 (C36)	3 years	Chester City Centre Air Quality Action Plan 2022	https://www.cheshirewestandchester.gov.uk/residents/pests-pollution-food-safety/pollution-and-air-quality/air-quality-review-and-assessment
Frodsham AQMA Cheshire West and Chester	27/11/2015	NO_2 Annual Mean	Junction of A56 and Fluin Lane, Frodsham	NO	41.5 µg/m^3 (FJ)	28.4 µg/m^3 (FJ)	5 years (FJ 2017)	Frodsham air quality action plan 2018	https://www.cheshirewestandchester.gov.uk/residents/pests-pollution-food-safety/pollution-and-air-quality/air-quality-review-and-assessment

Thornton le Moors AQMA No. 4	30/09/2016	SO_2 15 Minute Mean	An area around the oil refinery at Stanlow	NO	56 exceedances (TLM)	6 Exceedances (ELT)	4 years (66 exceedances at TLP in 2018)	Thornton-le-Moors air quality action plan 2017	https://www.cheshirewestandchester.gov.uk/residents/pests-pollution-food-safety/pollution-and-air-quality/air-quality-review-and-assessment
Whitby Rd/Station Rd AQMA	16/05/2005	NO_2 Annual Mean	Residential properties on parts of Whitby Rd, Station Rd and Princes Rd, Ellesmere Port	NO	44.5 µg/m^3 (SK)	29.2 µg/m^3 (RR)	5 years	Ellesmere Port and Neston BC air quality action plan 2007	https://www.cheshirewestandchester.gov.uk/residents/pests-pollution-food-safety/pollution-and-air-quality/air-quality-review-and-assessment

☒ **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.**

2.2 Progress and Impact of Measures to address Air Quality in Cheshire West and Chester

Defra's appraisal of last year's ASR concluded "on the basis of the evidence provided by the local authority the conclusions reached are acceptable for all sources".

The appraisers comments said:

- It is encouraging to see the council considered the comments made during the previous appraisal and actively made an effort to address all of these actions for this year's ASR.
- The council is recommended to continue to review their current monitoring regime, specifically the addition of several new non-automatic monitoring sites (diffusion tubes) across the region. This is important as additional sites will help to identify whether there are other key areas of relevant exposure where there may be exceedances and the appropriate measures can be adopted accordingly.
- There were no exceedances of AQO in CWCC during 2021, which is very encouraging.
- Maps have been provided to show the AQMA boundaries and the monitoring locations, which is commended. However, the monitoring site labels are not always clear against the base mapping. The council are highly encouraged to consider adding a white background to labels to improve readability of the figures.
- There is one minor formatting issue present in the report. The footer for each page of the ASR states "LAQM Annual Status Report 2021". This is incorrect and should read as "LAQM Annual Status Report 2022". The council are encouraged to correct this in future reports.
- The council are commended for their approach of inter-departmental working with all areas that may have an interest in and influence over local air quality matters. The council have established effective lines of communication with Environmental Agency, and they are encouraged to maintain this approach in future years.
- 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 2021. With the Fluin Lane (Frodsham) AQMA under review. This is supported.

- The council is commended for their extensive measures to reduce $PM_{2.5}$ emissions in the district.
- Extensive trend graphs have been presented and discussed for all monitoring data including diffusion tubes, which is commended.

Cheshire West and Chester Council has taken forward a number of direct measures during the current reporting year of 2023 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2. Forty measures are included within Table 2.2, with the type of measure and the progress Cheshire West and Chester Council have made during the reporting year of 2023 presented. Where there have been, or continue to be, barriers restricting the implementation of the measure, these are also presented within Table 2.2.

More detail on these measures can be found in 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 charge points (EVCPs) across 6 council car parks, match funded through the Department for Transport (DfT) on-street residential charge point 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 Northern Lights, Browning Way and Guilden Sutton depots.
- Revision of Licensing policy to stimulate the uptake of taxis and private hire ultra-low emission vehicles (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 Cheshire expects the following 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 in 2024.

- 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
- Finalisation of a procurement strategy, supported by LEVI funding, for a comprehensive local network of privately funded fast and rapid EVCPs across the borough
- Installation of the first phase of fast EVCPs in the Northgate development multistorey car park in Chester
- Installation of additional charging infrastructure at the Council's Guilden Sutton Depot
- 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 indirect impact of Covid-19 on recruitment leading to internal workload/staffing issues:

- Finalisation and publication of the Chester city centre AQAP
- 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 2.2 will ensure continued compliance in Ellesmere Port and Frodsham AQMAs. Similarly, Cheshire West and Chester Council anticipate that continued use of the de-SO_X sulphur-reducing catalytic dosing system at the refinery will ensure continued compliance in the Thornton le Moors AQMA.

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 2.2 – Progress on Measures to Improve Air Quality

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
1 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 not successful.	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	N/A	NO	Not Funded	£10k - 50k	Planning	NO_2 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.
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	NO_2/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	NO_2Emission 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 developed. LEVI funding secured. Comprehensive rollout of EVCPs to commence 2024.
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	NO_2Emission 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	NO_2Emission Reduction	Number of properties and premises where charging points have been required through planning condition	Year 2022/23 planning permission issued for 64 residential schemes including 113 chargepoints, 160 dwellings with infrastructure/cabling, and 30 commercial schemes including 138 parking spaces with charge points.	As of 15 June 2023 Building Regulations Approved Document S: infrastructure for charging electric vehicles, now imposes a legal duty on all new development to provide a minimum provision.

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
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	NO_2Emission 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.
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	NO_2Emission Reduction	% modal shift to car share/public transport	Work not commenced	£2 bus fare cap in place and extended until December 2024. Introduction of the Flexible Shuttle Service.
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	NO_2Emission 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	NO_2Emission 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 in AQAP	Estimated / Actual Completion Date	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
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	NO_2Emission 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_2Emission Reduction	% modal shift to car share/public transport	Implemented	Euro VI vehicles on the Park & Ride (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_2Emission 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_2Emission 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_2Emission Reduction	Improve traffic management	Not commenced	Focus on smart digital signage to assist driver choice.
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_2Emission 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_2Emission 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

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
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_2Emission 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.
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_2Emission 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 (LES)	Policy Guidance and Development Control	Low Emissions Strategy	2018	2021	CWCC	CWCC	YES	Funded	£10k - 50k	Completed	NO_2Emission 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_2Emission 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_2Emission 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_2Emission 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_2Emission 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 in AQAP	Estimated / Actual Completion Date	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
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_2Emission 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_2Emission 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_2Emission 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.
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)	SO_2 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	

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
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)	SO_2 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	
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
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

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
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.

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

As detailed in Policy Guidance LAQM.PG22 (Chapter 8), local authorities are expected to work towards reducing emissions and/or concentrations of $PM_{2.5}$ (particulate matter with an aerodynamic diameter of 2.5µm or less). There is clear evidence that $PM_{2.5}$ has a significant impact on human health, including premature mortality, allergic reactions, and cardiovascular diseases.

Cheshire West and Chester Council is taking the following measures to address $PM_{2.5}$: measures listed in Table 2.2 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.TG22 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 charge point equipped bays went live in May 2021. In 2022 a further 21 fast chargers with 41 sockets were commissioned as part of the Councils New Market Car Park and 10 fast chargers were commissioned in Winsford Town Centre as part

of the redevelopment scheme. 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 within 2022 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 2018 and 2022 to allow monitoring trends to be identified and discussed.

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

Cheshire West and Chester undertook automatic (continuous) monitoring at six sites during 2022. Table A.1 in Appendix A shows the details of the automatic monitoring sites. NB. Local authorities do not have to report annually on the following pollutants: 1,3 butadiene, benzene, carbon monoxide and lead, unless local circumstances indicate there is a problem. The Air Quality in Cheshire West and Chester (cheshirewest-air.info)page presents automatic monitoring results for Cheshire West and Chester with automatic monitoring results also available through the UK-Air website.

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 90 sites during 2022. Table A.2 in Appendix A presents the details of the non-automatic sites. After 2021, diffusion tube monitoring was discontinued at one site (LVR), and three new sites (CUD, LLH and OWR) were 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.

Additional information can be found on the Council air quality website Air Quality in Cheshire West and Chester (cheshirewest-air.info).

3.2 Individual Pollutants

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

3.2.1 Nitrogen Dioxide (NO_2)

Table A.3 and Table A.4 in Appendix A compare the ratified and adjusted monitored NO_2 annual mean concentrations for the past five years with the air quality objective of 40µg/m^3. Note that the concentration data presented represents the concentration at the location of the monitoring site, following the application of bias adjustment and annualisation, as required (i.e. the values are exclusive of any consideration to fall-off with distance adjustment).

For diffusion tubes, the full 2022 dataset of monthly mean values is provided in Appendix B. Note that the concentration data presented in Table B.1 includes distance corrected values, only where relevant.

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

In 2022 no exceedances of the annual mean objective were recorded at any monitoring sites either within or outside of an AQMA. As such, there is no need to declare additional AQMAs or extend existing AQMAs. The highest results were 36.4 µg/m^3 at site C36 in Chester and 35.9 µg/m^3 at site NWH in Northwich. There was therefore one site within 10% of the national objective in 2022, but there were no exceedances.

The highest annual mean recorded by an automatic analyser in 2022 was 32 µg/m^3 at site CBI, which is adjacent to the bus interchange in Chester.

Following the easing of Covid-19 lockdowns and the consequent increase in road traffic flows, annual average concentrations of NO_2 in 2022 were higher than 2021 levels. In general, however, the levels were still lower than they had been prior to Covid-19 lockdowns (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 2018-2022. 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 28.4 µg/m^3 at site FJ. An exceedance of the objective was last recorded in 2017, and readings within 10% of the objective were last recorded in 2019. So, notwithstanding the fact that 2020 and 2021 were atypical years due to Covid-19 lockdowns, the status of the AQMA shall be reviewed with the intention to revoke in 2024.

The Christleton area was considered to be close to being a candidate for AQMA declaration in earlier rounds of LAQM review and assessment. In this area in 2022, the highest NO_2 annual mean was 29.2 µg/m^3 at site WCR without distance correction. On the stretch of the A51 passing through Littleton and Tarvin, the highest annual mean NO_2 was 33.4 µg/m^3 at site TBV.

Eight NO_2 monitoring sites were on or close to school premises in 2022 (sites BE, BSP, CRH, HSS, CPL, FMH, LVS and RPS). The highest recorded annual mean at these locations was 30.8 µg/m^3 at site 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, site 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 19.2 µg/m^3 in 2022. This is less than half of the annual mean objective.

On the A530 in Rudheath / Lostock the diffusion tube sites 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 25.7 µg/m^3 and 18.1 µg/m^3 respectively. Both were therefore well below the annual objective.

In Northwich, the highest annual mean recorded was at site 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, site OSQ measured 29.3 µg/m^3, which is well below the objective.

Five-year trends in the annual mean NO_2 are presented in the bar charts in Figure A.1 and Figure A.2. Most sites, particularly those at roadside locations, show a noticeable

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 and 2022 roadside concentrations of NO_2 increased following the easing of lockdown, although the annual concentrations are significantly lower than 2018 and 2019. It is likely that the decreased NO_2 emissions in 2022 relative to 2018 and 2019 has been brought about in part by the measures implemented by Cheshire West and Chester Council to decrease congestion and improve traffic flows, which includes support for remote and hybrid working. 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 A.5 in Appendix A compares the ratified continuous monitored NO_2 hourly mean concentrations for the past five years with the air quality objective of 200 µg/m^3, not to be exceeded more than 18 times per year. For 2022, there were no exceedances of the NO_2 hourly mean concentration.

Annual mean results from diffusion tubes that are above 60 µg/m^3 may indicate a likely exceedance of the hourly objective (as per LAQM.TG22 technical guidance). But in 2022, no diffusion tube results were close to µg/m^3 (the highest being 36.4 µg/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 latest diffusion tubes sites 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 28.5 µg/m^3 and as such the hourly objective is not at risk of exceedance.

3.2.2 Particulate Matter (PM_{10})

Table A.6 in Appendix A: Monitoring Results compares the ratified and adjusted monitored PM_{10} annual mean concentrations for the past five years with the air quality objective of 40 µg/m^3. In 2022, 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 20 µg/m^3, which despite being significantly higher than concentrations at background sites, remains below the current 40 µg/m^3 objective.

Table A.7 in Appendix A compares the ratified continuous monitored PM_{10} daily mean concentrations for the past five years with the air quality objective of 50 µg/m^3, not to be exceeded more than 35 times per year. In 2022, seven 24-hour readings above 50 µg/m^3 were recorded, five of which occurred at site CBI and two occurred at site FMH. However, this was comfortably below the permitted threshold of 35 daily exceedances per year.

Long term trends in annual PM_{10} monitoring are shown in Figure A.3. There is no clear trend in the data, the annual means remaining fairly static year on year at sites CBI and TLP. Figure 6 shows the number of exceedances of the 24-hour mean objective over the last five years.

3.2.3 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.TG22. Applying the 2022 nationally derived background correction factor[7][8] of 5.5 µg/m^3 to local PM_{10} data suggests that local $PM_{2.5}$ levels at monitoring sites lay in the range 7.5 – 14.5 µg/m^3 in 2022, which is below the current national annual mean $PM_{2.5}$ objective of 25 µg/m^3.

In April 2023, Defra published a new Air Quality Strategy (AQS) for local authorities[9], which includes two legally binding $PM_{2.5}$ concentration targets which local authorities are responsible in working towards achieving:

- 10 µg/m^3 annual mean $PM_{2.5}$ concentration nationwide by 2040, with an interim target of 12 µg/m^3 by January 2028
- 35% reduction in average population exposure by 2040, with an interim target of a 22% reduction by January 2028 compared to a 2018 baseline.

[7] https://laqm.defra.gov.uk/air-quality/air-quality-assessment/estimating-pm2-5-from-pm10-measurements/

[8] Background factor (5.5 µg/m^3) is used here instead of roadside factor (6.4 µg/m^3) to give a conservative estimation of $PM_{2.5}$ concentrations/

[9] https://www.gov.uk/government/publications/the-air-quality-strategy-for-england/air-quality-strategy-framework-for-local-authority-delivery#

From latest available 1 km x 1 km background maps for $PM_{2.5}$ for 2022 (using 2018 baseline)[10], the Cheshire West & Cheshire area has an average background annual mean $PM_{2.5}$ concentration of 6.4 µg/m^3 which currently satisfies both $PM_{2.5}$ objectives. This is an improvement on the average background annual mean $PM_{2.5}$ concentration of 6.9 µg/m^3 in 2018.

Considering each data point at 1 km resolution from 2022 background concentration projections, 100% of the council area is still below the 12 µg/m^3 concentration objective for 2028 and the 10 µg/m^3 concentration objective for 2040.

Cheshire West & Chester Council will be proactive in further reducing $PM_{2.5}$ emissions within the area and their control in order to maintain the projected compliance with the new $PM_{2.5}$ objectives.

3.2.4 Sulphur Dioxide (SO_2)

Table A.8 in Appendix A compares the ratified continuous monitored SO_2 concentrations for 2022 with the air quality objectives for SO_2.

In 2022 there was a single occasion when the 15-minute objective of 266 µg/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 six 15-min exceedances in 2022. 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. Five-year trends in the number of 15-minute mean SO_2 results exceeding 266 µg/m^3 are presented in the bar charts in Figure A.5. Both sites show a noticeable reduction in SO_2 levels over time.

The hourly mean standard was not exceeded at either Thornton-le-Moors or Elton in 2022. As there is an annual exceedance allowance of 24-hourly periods, the objective was not exceeded.

The 24-hour SO_2 objective was complied with at both monitoring stations during 2022.

[10] https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018

Appendix A: Monitoring Results

Table A.1 – Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Inlet Height (m)
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, PM_{10}, SO_2	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).

(2) N/A if not applicable

Table A.2 – Details of Non-Automatic Monitoring Sites

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube Co-located with a Continuous Analyser?	Tube Height (m)
AP	Pine Cottage, Allostock	Roadside	373386	371500	NO_2	No	0.0	34.0	No	1.8
BBC	Bluebell Close, Huntington	Suburban	342622	364613	NO_2	No	16.0	15.0	No	1.5
BE	Bedward Row	Roadside	340239	366418	NO_2	Yes, Chester	0.5	2.4	No	2.4
BJ	Backpackers / Jade, Boughton	Roadside	341401	366512	NO_2	Yes, Chester	0.1	2.5	No	2.4
BSP	Brookside Primary, E.Port	Roadside	338380	375840	NO_2	No	12.0	0.5	No	2.0
C11	Christleton Road (11)	Roadside	341915	366427	NO_2	Yes, Chester	0.0	1.0	No	2.0
C36	Christleton Road (36)	Roadside	342000	366374	NO_2	Yes, Chester	0.5	1.4	No	2.5
C75	Christleton Road (75)	Roadside	342056	366354	NO_2	Yes, Chester	0.5	2.0	No	2.5
CAN	Canal Street	Roadside	340375	366730	NO_2	Yes, Chester	1.0	1.5	No	3.0
CBI1	Bus Interchange CBI	Other	340647	366803	NO_2	Yes, Chester	5.1	6.6	No	1.6
CBI2	Bus Interchange CBI	Other	340647	366803	NO_2	Yes, Chester	5.1	6.6	No	1.6
CBI3	Bus Interchange CBI	Other	340647	366803	NO_2	Yes, Chester	5.1	6.6	No	1.6

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube Co-located with a Continuous Analyser?	Tube Height (m)
CBR	Bus ramp CBR	Other	340676	366782	NO_2	Yes, Chester	0.0	N/A	No	2.5
CFL	Church St Frodsham	Roadside	351762	377862	NO_2	No	4.8	1.0	No	2.2
CM	Christleton Mill Apartments	Roadside	343761	365528	NO_2	No	0.0	5.0	No	2.2
CN	Chester Way, Northwich	Roadside	366070	373905	NO_2	No	3.8	1.6	No	3.0
CP3	Canal Place, Christleton (3)	Roadside	343970	365295	NO_2	No	4.0	2.3	No	2.4
CPL	Plough Lane, Christleton (adj Smithy)	Roadside	344377	365375	NO_2	No	1.1	0.7	No	2.1
CRH	Rookery Cottages Chester Rd Hartford	Roadside	364171	372697	NO_2	No	0.0	3.5	No	1.5
CUD	Cuddington A49	Roadside	359436	370534	NO_2	No	4.5	1.5	No	2.0
DA	453 London Rd, Davenham	Roadside	365953	371113	NO_2	No	0.1	1.6	No	2.0
EB	Edgeley, Boughton	Roadside	341658	366487	NO_2	Yes, Chester	0.0	2.0	No	2.5
FH	72 High St Frodsham	Roadside	352146	378139	NO_2	Yes, Frodsham	0.2	2.0	No	2.5
FJ	Fluin Lane (r/o 76 Chester Rd).	Roadside	352171	378140	NO_2	Yes, Frodsham	0.5	2.0	No	2.5

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube Co-located with a Continuous Analyser?	Tube Height (m)
FM	Fluin Lane (r/o 10 Manor Fm Ct)	Roadside	352189	378094	NO_2	Yes, Frodsham	0.3	2.0	No	2.5
FRC	Rock Cottage, Frodsham (67)	Roadside	352023	378121	NO_2	No	1.3	1.6	No	2.5
FT	Fluin Lane (terrace)	Roadside	352176	378105	NO_2	Yes, Frodsham	0.2	1.7	No	2.0
GE	George Street	Roadside	340657	366730	NO_2	Yes, Chester	1.0	5.0	No	2.4
GR	Griffths Road, Lostock	Roadside	368634	374714	NO_2	No	0.2	8.0	No	1.8
GSW	Gorse Stacks (Waterside)	Roadside	340700	366687	NO_2	Yes, Chester	1.0	1.6	No	2.1
GT	George Street (10)	Roadside	340611	366747	NO_2	Yes, Chester	0.0	1.9	No	2.6
HB	Hoole Lane Boughton	Roadside	341605	366527	NO_2	Yes, Chester	3.0	1.2	No	2.4
HC	5 Holmes Chapel Rd. Sproston	Roadside	373375	366928	NO_2	No	3.0	1.0	No	1.8
HHB	Holme Bank Cott. Holme St	Roadside	347953	366723	NO_2	No	5.3	2.9	No	2.5
HO	Hoole Road (no. 7)	Roadside	341311	367207	NO_2	No	0.0	7.1	No	1.9
HSS	High St Sch, Winsford	Roadside	364711	366339	NO_2	No	8.0	4.0	No	2.4
HTC	The Cottage, Holme St	Roadside	348333	366763	NO_2	No	3.1	2.0	No	2.0

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)
HW	Hoole Way	Roadside	340881	366826	NO_2	Yes, Chester	1.0	1.9	No	2.4
IC	Ingham Close 8	Roadside	342068	366332	NO_2	Yes, Chester	2.0	2.0	No	2.0
KR	King St. Rudheath	Roadside	368432	372988	NO_2	No	4.5	2.2	No	2.0
LH	Lincoln House (r/o The Bars)	Roadside	341126	366540	NO_2	Yes, Chester	3.0	2.0	No	3.0
LI2	Liverpool Road (2)	Roadside	340354	367034	NO_2	Yes, Chester	7.0	2.5	No	2.2
LLH	A41 Long Lane/Greenfield Lane	Roadside	342464	368461	NO_2	No	15	1.5	No	2.2
LU	Lumley Place	Roadside	340838	366215	NO_2	Yes, Chester	0.0	9.4	No	2.1
LVS	Love Street	Roadside	340990	366317	NO_2	Yes, Chester	8.0	1.8	No	2.2
MCC	Christleton (Mill Cottages)	Roadside	343785	365502	NO_2	No	0.5	2.4	No	2.0
MUL	1 Mulberry Close, Elton	Roadside	346258	375321	NO_2	No	0.0	27.0	No	2.0
NCS	New Crane Street	Roadside	339857	366460	NO_2	No	0.0	1.8	No	2.0
NIN	Nicholas Street (North)	Roadside	340284	366199	NO_2	Yes, Chester	0.0	3.0	No	2.3
NIS	Nicholas Street (South)	Roadside	340329	366114	NO_2	Yes, Chester	0.0	4.3	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)
NSR	Station Rd crossroads, Northwich	Roadside	366796	373984	NO_2	No	0.6	1.7	No	2.2
NWH	Winnington Hill, Northwich	Roadside	365590	373904	NO_2	No	2.4	0.7	No	2.4
OB	105 Boughton	Roadside	341633	366510	NO_2	Yes, Chester	0.6	2.5	No	2.5
OF	St Oswalds / Fountain	Roadside	340453	366853	NO_2	Yes, Chester	0.0	4.8	No	3.0
ON	St Oswalds Way north	Roadside	340718	366815	NO_2	Yes, Chester	4.4	15.5	No	2.5
OP	Oulton Place	Roadside	340636	366770	NO_2	Yes, Chester	0.0	1.6	No	2.1
OSQ	Over Square, Winsford	Roadside	364053	365977	NO_2	No	5.5	2.2	No	2.4
OVH	Overleigh Rd, Handbridge	Roadside	340770	365605	NO_2	No	0.0	1.3	No	2.5
OW	St Oswalds Way	Roadside	340623	366823	NO_2	Yes, Chester	2.3	2.3	No	2.3
OWR	Old Wrexham Rd. Handbridge (Catholic High Sch.)	Roadside	340482	365062	NO_2	No	29	2.3	No	3.0
PA	Parkgate Road (19)	Roadside	340313	367014	NO_2	Yes, Chester	2.4	0.8	No	2.4
PG	Parkgate Road (5)	Roadside	340322	366989	NO_2	Yes, Chester	0.2	1.8	No	2.0

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)
QRN	Quarry Road, Neston	Roadside	330565	378063	NO_2	No	0.0	3.0	No	2.0
RM	Rock Mount, Parkgate Road	Roadside	340291	367108	NO_2	Yes, Chester	0.0	3.8	No	2.2
RPS	Rudheath Primary School	Roadside	367856	372667	NO_2	No	19.0	5.2	No	2.2
RR	Richfield Recruitment	Roadside	340180	376338	NO_2	Yes, Ellesmere Port	3.0	2.1	No	2.5
SA	Samaritans, Liverpool Road	Roadside	340364	366929	NO_2	Yes, Chester	0.2	2.5	No	2.5
SAB	Stanley Arms, Brook St	Roadside	340838	366746	NO_2	Yes, Chester	4.9	2.3	No	2.5
SF	Station Road Flats	Roadside	341238	366976	NO_2	No	0.0	3.2	No	2.2
SLW	Stanney/Wellington E.Port	Roadside	339889	375755	NO_2	No	3.0	3.2	No	2.0
SMH	St Martins / Hunter St	Roadside	340243	366511	NO_2	Yes, Chester	0.7	2.2	No	2.0
SR	68 Station Rd	Roadside	340435	376790	NO_2	Yes, Ellesmere Port	0.0	1.6	No	2.5
ST	St Anne's Place	Roadside	340794	366778	NO_2	Yes, Chester	18.4	0.1	No	2.2
SZ	Specialized Bikes, Boughton	Roadside	341819	366475	NO_2	Yes, Chester	0.5	2.0	No	2.5

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube Co-located with a Continuous Analyser?	Tube Height (m)
T11	Tarvin Road (11)	Roadside	341931	366458	NO_2	Yes, Chester	2.7	1.5	No	2.1
T44	Tarvin Road (44)	Roadside	342085	366446	NO_2	Yes, Chester	3.5	1.0	No	2.5
T6	Tarvin Road (6)	Roadside	341926	366446	NO_2	Yes, Chester	0.2	2.0	No	2.0
TA	Tarvin Road (52)	Roadside	344519	366898	NO_2	No	6.0	2.0	No	2.0
TB	The Bars, Boughton (nr. Gyratory)	Roadside	341202	366470	NO_2	Yes, Chester	2.0	1.0	No	2.5
TBV	1 Tarvin Rd (Barnhouse Vets)	Roadside	344013	366830	NO_2	No	14.4	1.4	No	2.5
UN	44 Upper Northgate St	Roadside	340357	366960	NO_2	Yes, Chester	0.2	3.0	No	2.2
VXR	Vicars Cross Road (LP34)	Roadside	343365	366694	NO_2	No	1.7	11.2	No	1.8
WCR	Whitchurch Road (58)	Roadside	342951	366029	NO_2	No	7.2	1.5	No	2.0
WG	Watergate St.	Roadside	340217	366209	NO_2	Yes, Chester	0.2	1.5	No	2.0
WGW	Watergate St. / Walls	Roadside	340165	366198	NO_2	Yes, Chester	0.0	2.2	No	2.2
WH1	Whitby Rd collocated triplicate tubes	Roadside	340196	376363	NO_2	Yes, Ellesmere Port	15.0	1.2	No	3.5

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)
WH2	Whitby Rd collocated triplicate tubes	Roadside	340196	376363	NO_2	Yes, Ellesmere Port	15.0	1.2	No	3.5
WH3	Whitby Rd collocated triplicate tubes	Roadside	340196	376363	NO_2	Yes, Ellesmere Port	15.0	1.2	No	3.5
WVC	Weaver Court, Northwich	Roadside	365788	373744	NO_2	No	0.0	4.0	No	2.0
XR	Boughton Heath roundabout	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 façade of a residential property).

(2) N/A if not applicable.

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

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
BO	341864	366444	Roadside	99.3	99.3	25	23	17	19	18
CBI	340645	366802	Roadside	99.5	99.5	**40**	38	29	30	32
FMH	352445	378031	Urban Background	69.3	69.3	14	15	13	15	14
TLP	344103	374330	Industrial	99	99	13	13	9	11	11
WH	340197	376363	Roadside	99.1	99.1	37	35	28	29	29

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

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

Notes:

The annual mean concentrations are presented as µg/m^3.

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

All means have been "annualised" as per LAQM.TG22 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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

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

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

Table A.4 – Annual Mean NO_2 Monitoring Results: Non-Automatic Monitoring (µg/m^3)

Diffusion Tube ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
AP	373386	371500	Roadside	92.3	92.3	25.3	23.9	16.3	19.7	19.2
BBC	342622	364613	Suburban	92.3	92.3	-	-	14.0	17.5	17.7
BE	340239	366418	Roadside	84.1	84.1	33.8	32.1	22.2	27.1	25.2
BJ	341401	366512	Roadside	92.3	92.3	39.5	33.9	24.6	26.1	26.4
BSP	338380	375840	Roadside	92.3	92.3	-	-	16.2	19.5	19.0
C11	341915	366427	Roadside	82.4	82.4	**41.1**	**41.0**	27.8	31.8	30.6
C36	342000	366374	Roadside	92.3	92.3	**47.6**	**43.9**	31.8	33.6	36.4
C75	342056	366354	Roadside	92.3	92.3	27.2	26.4	18.9	21.2	21.1
CAN	340375	366730	Roadside	92.3	92.3	32.6	31.2	19.4	23.9	22.5
CBI1	340647	366803	Other	92.3	92.3	***39.8**	36.4	26.4	28.2	29.1
CBI2	340647	366803	Other	92.3	92.3	***39.8**	36.4	26.4	28.2	29.8
CBI3	340647	366803	Other	92.3	92.3	***39.8**	36.4	26.4	28.2	29.8
CBR	340676	366782	Other	92.3	92.3	-	-	24.4	26.1	27.0

Diffusion Tube ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2022 (%) [2]	2018	2019	2020	2021	2022
CFL	351762	377862	Roadside	92.3	92.3	30.5	29.9	21.6	23.3	22.8
CM	343761	365528	Roadside	92.3	92.3	33.9	32.6	23.1	24.3	23.6
CN	366070	373905	Roadside	92.3	92.3	33.0	31.0	24.1	25.3	26.0
CP3	343970	365295	Roadside	92.3	92.3	31.3	30.9	22.9	22.8	22.7
CPL	344377	365375	Roadside	84.3	84.3	19.0	18.2	11.8	12.2	13.3
CRH	364171	372697	Roadside	69.2	69.2	-	-	12.6	16.7	17.5
CUD	359436	370534		62.1	62.1	-	-	-	-	19.6
DA	365953	371113	Roadside	84.1	84.1	-	19.1	14.9	15.8	16.3
EB	341658	366487	Roadside	92.3	92.3	31.6	30.7	22.4	24.4	24.3
FH	352146	378139	Roadside	92.3	92.3	38.5	36.9	27.4	28.8	28.2
FJ	352171	378140	Roadside	92.3	92.3	38.2	36.9	28.6	28.3	28.4
FM	352189	378094	Roadside	92.3	92.3	35.0	29.4	24.3	28.5	27.5
FRC	352023	378121	Roadside	92.3	92.3	34.0	31.0	24.3	25.6	23.9
FT	352176	378105	Roadside	92.3	92.3	32.1	29.8	23.7	24.1	24.3

Diffusion Tube ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2022 (%) [2]	2018	2019	2020	2021	2022
GE	340657	366730	Roadside	59.1	59.1	32.0	30.7	20.1	26.4	25.5
GR	368634	374714	Roadside	92.3	92.3	24.1	21.6	17.0	17.2	18.1
GSW	340700	366687	Roadside	92.3	92.3	34.3	33.9	23.2	28.1	27.9
GT	340611	366747	Roadside	92.3	92.3	34.1	30.5	23.0	29.0	25.9
HB	341605	366527	Roadside	92.3	92.3	32.0	30.9	21.6	22.7	23.8
HC	373375	366928	Roadside	92.3	92.3	-	-	-	23.3	21.2
HHB	347953	366723	Roadside	92.3	92.3	-	32.1	17.8	22.0	24.6
HO	341311	367207	Roadside	92.3	92.3	31.7	28.6	21.6	23.3	24.8
HSS	364711	366339	Roadside	83	83.0	-	-	19.2	22.9	22.3
HTC	348333	366763	Roadside	85.2	85.2	-	33.2	19.7	25.1	24.3
HW	340881	366826	Roadside	82.4	82.4	35.8	32.0	21.1	26.1	27.1
IC	342068	366332	Roadside	84.6	84.6	34.5	34.5	23.7	26.6	26.9
KR	368432	372988	Roadside	92.3	92.3	32.0	32.2	26.0	25.9	25.7
LH	341126	366540	Roadside	92.3	92.3	36.9	29.7	22.8	27.5	27.0

Diffusion Tube ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2022 (%) [2]	2018	2019	2020	2021	2022
LI2	340354	367034	Roadside	92.3	92.3	38.6	38.8	27.6	29.9	30.9
LLH	342464	368461	Roadside	75	75.0	-	-	-	-	22.6
LU	340838	366215	Roadside	92.3	92.3	27.0	24.1	16.4	16.9	17.7
LVS	340990	366317	Roadside	92.3	92.3	31.4	28.3	19.2	17.5	21.7
MCC	343785	365502	Roadside	92.3	92.3	38.0	36.9	22.9	27.4	25.8
MUL	346258	375321	Roadside	92.3	92.3	-	16.8	13.4	14.2	14.0
NCS	339857	366460	Roadside	92.3	92.3	30.5	27.8	20.4	20.7	21.4
NIN	340284	366199	Roadside	92.3	92.3	34.7	33.9	24.0	29.8	26.2
NIS	340329	366114	Roadside	67	67.0	31.7	29.0	21.2	19.5	21.2
NSR	366796	373984	Roadside	92.3	92.3	38.0	35.3	27.6	31.0	30.1
NWH	365590	373904	Roadside	92.3	92.3	**41.5**	**41.7**	27.8	34.6	35.9
OB	341633	366510	Roadside	74.2	74.2	**44.8**	36.1	29.0	30.2	30.8
OF	340453	366853	Roadside	83	83.0	34.3	30.6	21.5	24.3	24.3
ON	340718	366815	Roadside	92.3	92.3	-	23.3	16.5	18.9	20.6

Diffusion Tube ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2022 (%) [2]	2018	2019	2020	2021	2022
OP	340636	366770	Roadside	92.3	92.3	32.1	30.8	22.3	26.2	26.3
OSQ	364053	365977	Roadside	63.2	63.2	-	-	23.2	29.0	29.4
OVH	340770	365605	Roadside	77.5	77.5	-	-	19.3	20.4	20.8
OW	340623	366823	Roadside	74.7	74.7	**43.6**	**43.3**	27.2	32.2	33.7
OWR	340482	365062	Roadside	92.3	92.3	-	-	-	-	9.5
PA	340313	367014	Roadside	92.3	92.3	**41.2**	**40.3**	27.9	30.3	30.7
PG	340322	366989	Roadside	84.6	84.6	**45.2**	**40.8**	29.9	33.1	32.6
QRN	330565	378063	Roadside	82.4	82.4	-	-	26.6	29.3	27.2
RM	340291	367108	Roadside	92.3	92.3	**45.7**	38.8	28.6	31.4	30.6
RPS	367856	372667	Roadside	92.3	92.3	**42.4**	**40.5**	29.0	29.5	30.8
RR	340180	376338	Roadside	92.3	92.3	36.5	35.2	30.0	31.4	29.2
SA	340364	366929	Roadside	92.3	92.3	37.7	34.4	24.8	27.5	28.2
SAB	340838	366746	Roadside	92.3	92.3	-	28.5	23.3	28.1	25.0
SF	341238	366976	Roadside	82.4	82.4	33.3	32.0	21.8	24.0	24.6

Diffusion Tube ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2022 (%) [2]	2018	2019	2020	2021	2022
SLW	339889	375755	Roadside	82.4	82.4	-	-	16.8	18.3	20.3
SMH	340243	366511	Roadside	84.3	84.3	-	26.0	15.7	21.1	22.0
SR	340435	376790	Roadside	92.3	92.3	33.8	31.0	26.3	29.3	27.3
ST	340794	366778	Roadside	92.3	92.3	**42.4**	**40.2**	30.1	33.8	30.8
SZ	341819	366475	Roadside	82.4	82.4	36.1	32.1	22.9	25.3	25.8
T11	341931	366458	Roadside	92.3	92.3	31.8	28.6	19.6	21.3	23.3
T44	342085	366446	Roadside	92.3	92.3	39.2	37.6	25.7	28.5	30.5
T6	341926	366446	Roadside	92.3	92.3	**43.6**	**43.6**	31.5	34.1	35.1
TA	344519	366898	Roadside	75	75.0	**44.5**	38.6	26.7	27.6	28.0
TB	341202	366470	Roadside	49.5	49.5	36.7	33.3	25.0	25.4	24.2
TBV	344013	366830	Roadside	92.3	92.3	-	**44.4**	28.2	30.9	33.4
UN	340357	366960	Roadside	84.3	84.3	38.1	33.5	21.4	23.9	23.9
VXR	343365	366694	Roadside	92.3	92.3	-	-	19.0	22.2	22.8
WCR	342951	366029	Roadside	92.3	92.3	39.0	**41.1**	25.8	30.1	29.2

Diffusion Tube ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
WG	340217	366209	Roadside	82.4	82.4	39.8	35.2	27.3	25.4	27.0
WGW	340165	366198	Roadside	92.3	92.3	33.7	29.6	23.7	22.1	24.5
WH1	340196	376363	Roadside	84.1	84.1	***33.7**	31.4	25.8	27.4	27.2
WH2	340196	376363	Roadside	84.1	84.1	***33.7**	31.4	25.8	27.4	26.6
WH3	340196	376363	Roadside	76.1	76.1	***33.7**	31.4	25.8	27.4	27.2
WVC	365788	373744	Roadside	84.1	84.1	-	-	17.3	18.2	18.2
XR	343117	365949	Roadside	92.3	92.3	31.1	29.7	18.2	23.0	22.4

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

☒ **Diffusion tube data has been bias adjusted.**

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

Notes:

The annual mean concentrations are presented as µg/m^3.

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

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

Means for diffusion tubes have been corrected for bias. All means have been “annualised” as per LAQM.TG22 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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

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

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

*2018 results for sites CBI and WH had previously been reported as 38.9 and 35.7$\mu g/m^3$ respectively due to a transcription error.

Outcomes and conclusions unaffected.

Figure A.1 – Trends in Annual Mean NO_2 Concentrations

Figure A.1.1 - Trends in annual mean NO_2 concentrations – Within and around Chester AQMA (North I)

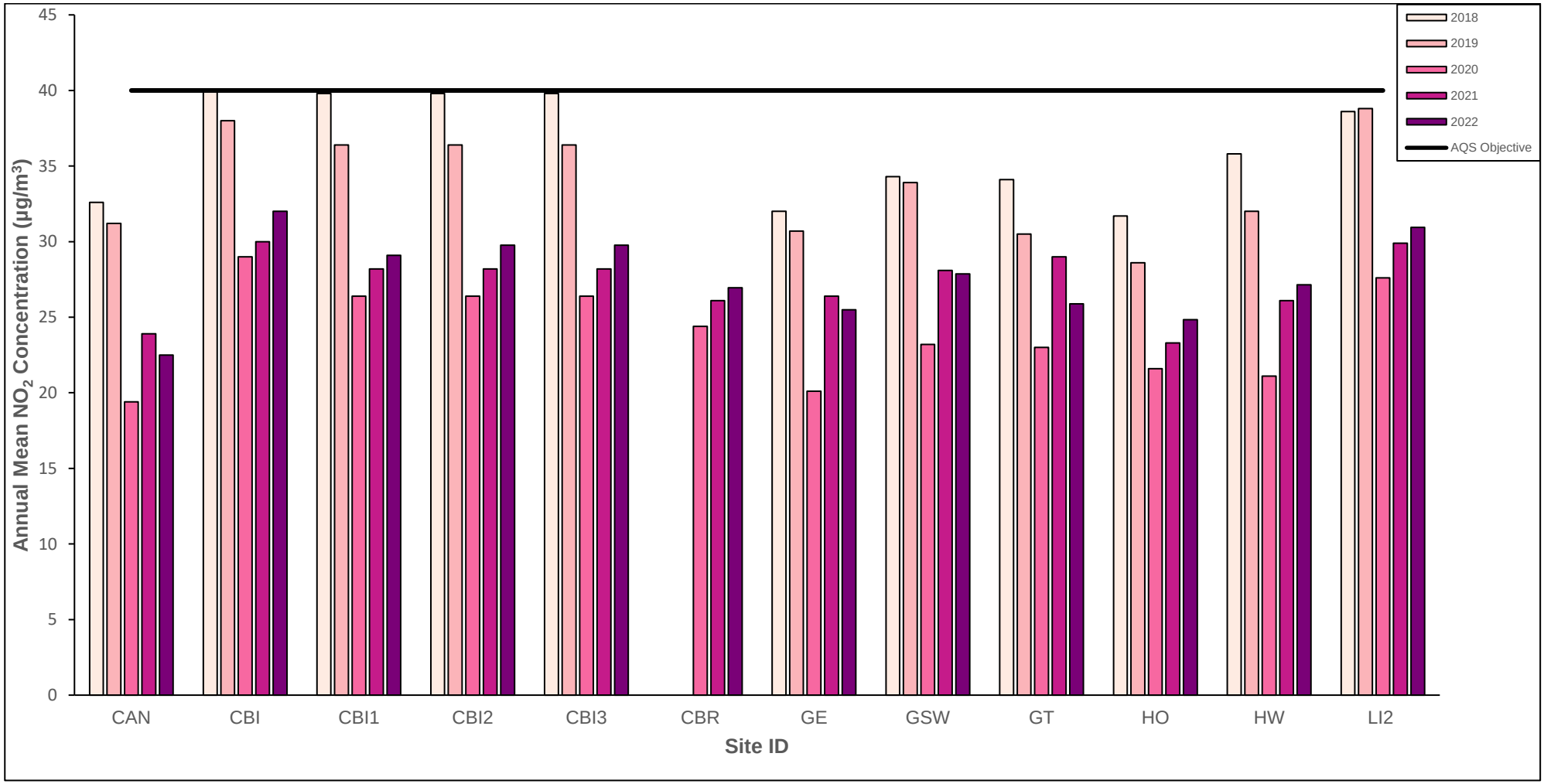


Figure A.1.2 - Trends in annual mean NO_2 concentrations – Within and around Chester AQMA (North II)

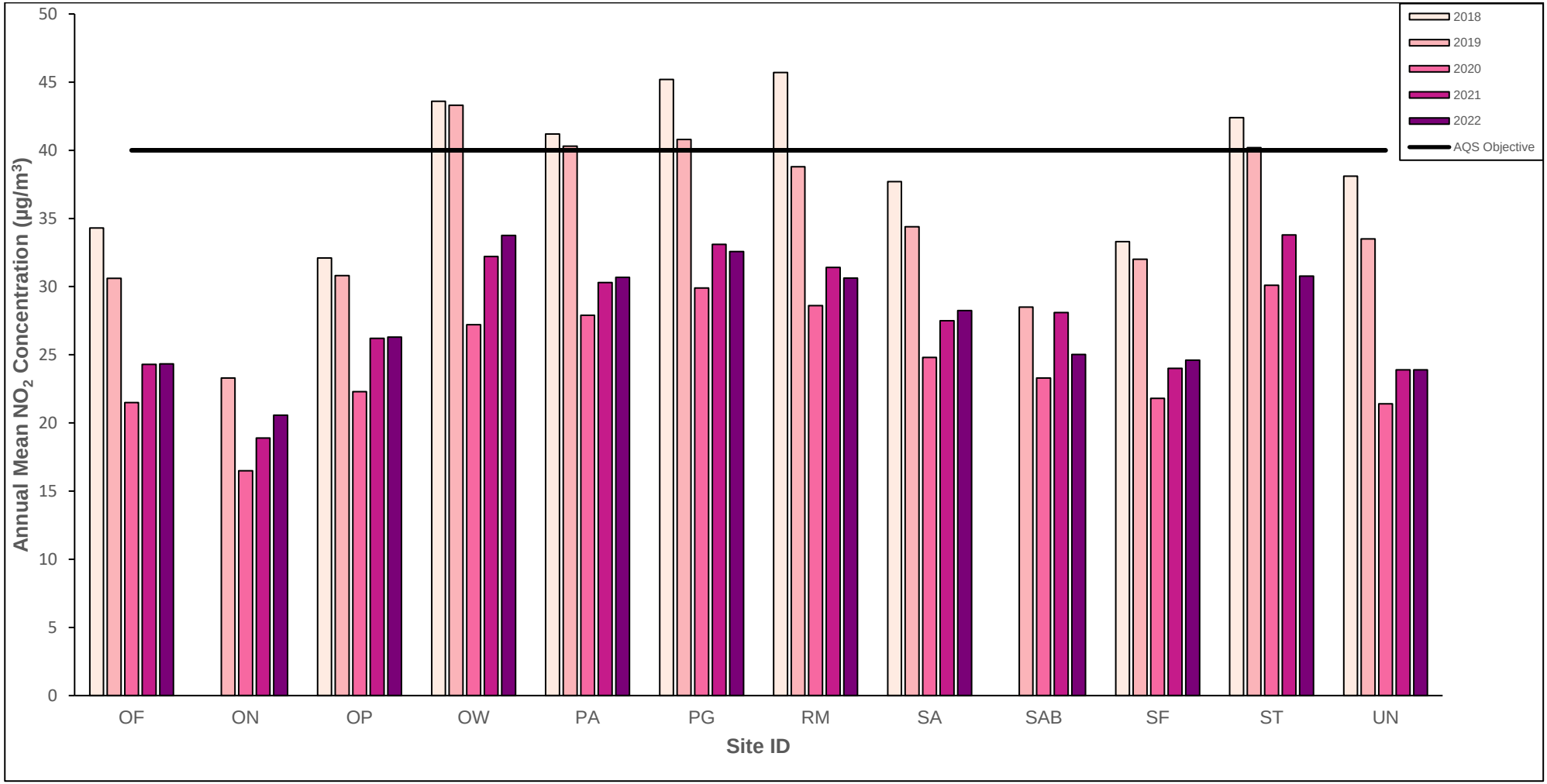


Figure A.1.3 - Trends in annual mean NO_2 concentrations – Within and around Chester AQMA (East/South)

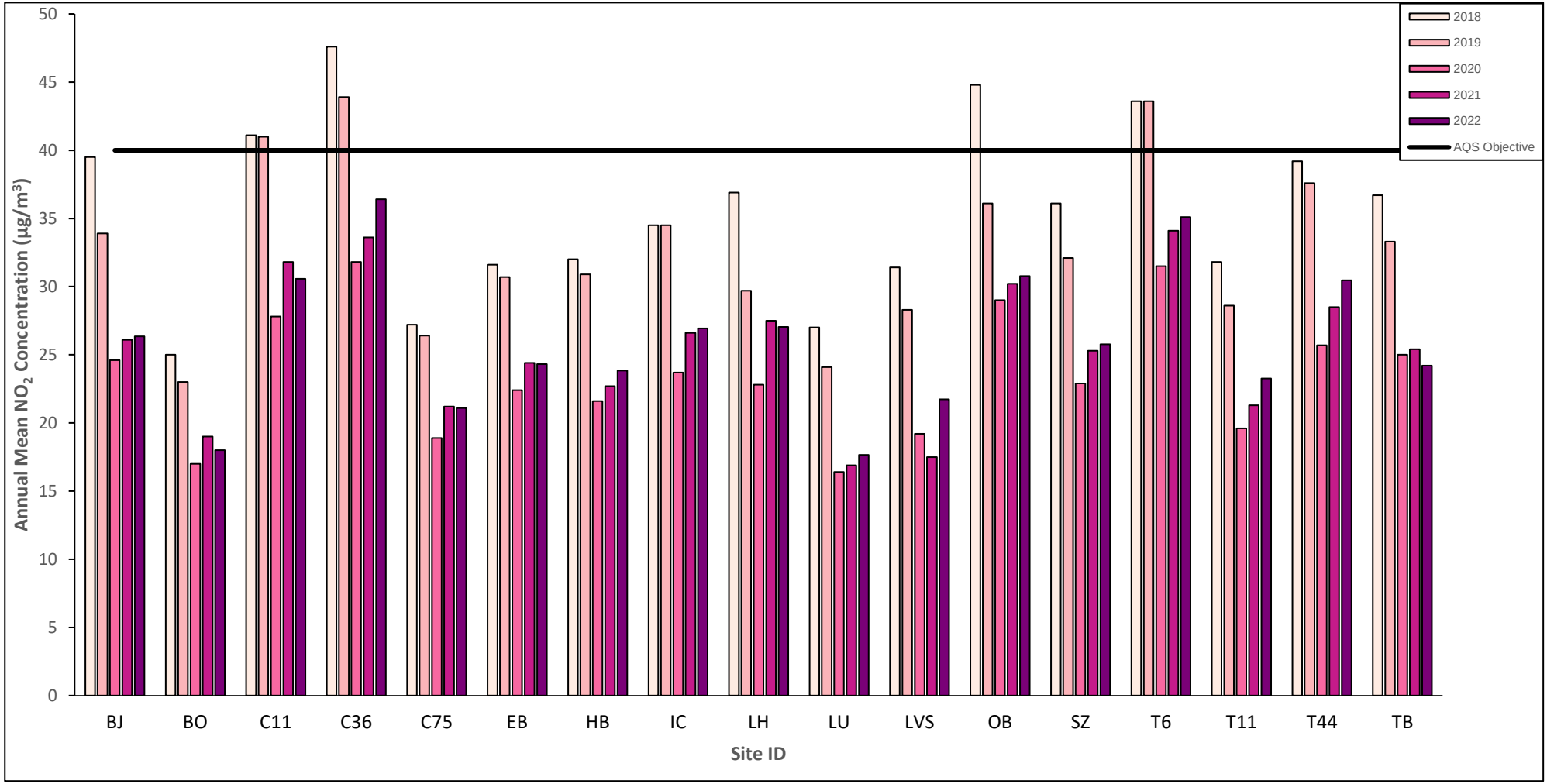


Figure A.1.4 - Trends in annual mean NO_2 concentrations – Within and around Chester AQMA (West)

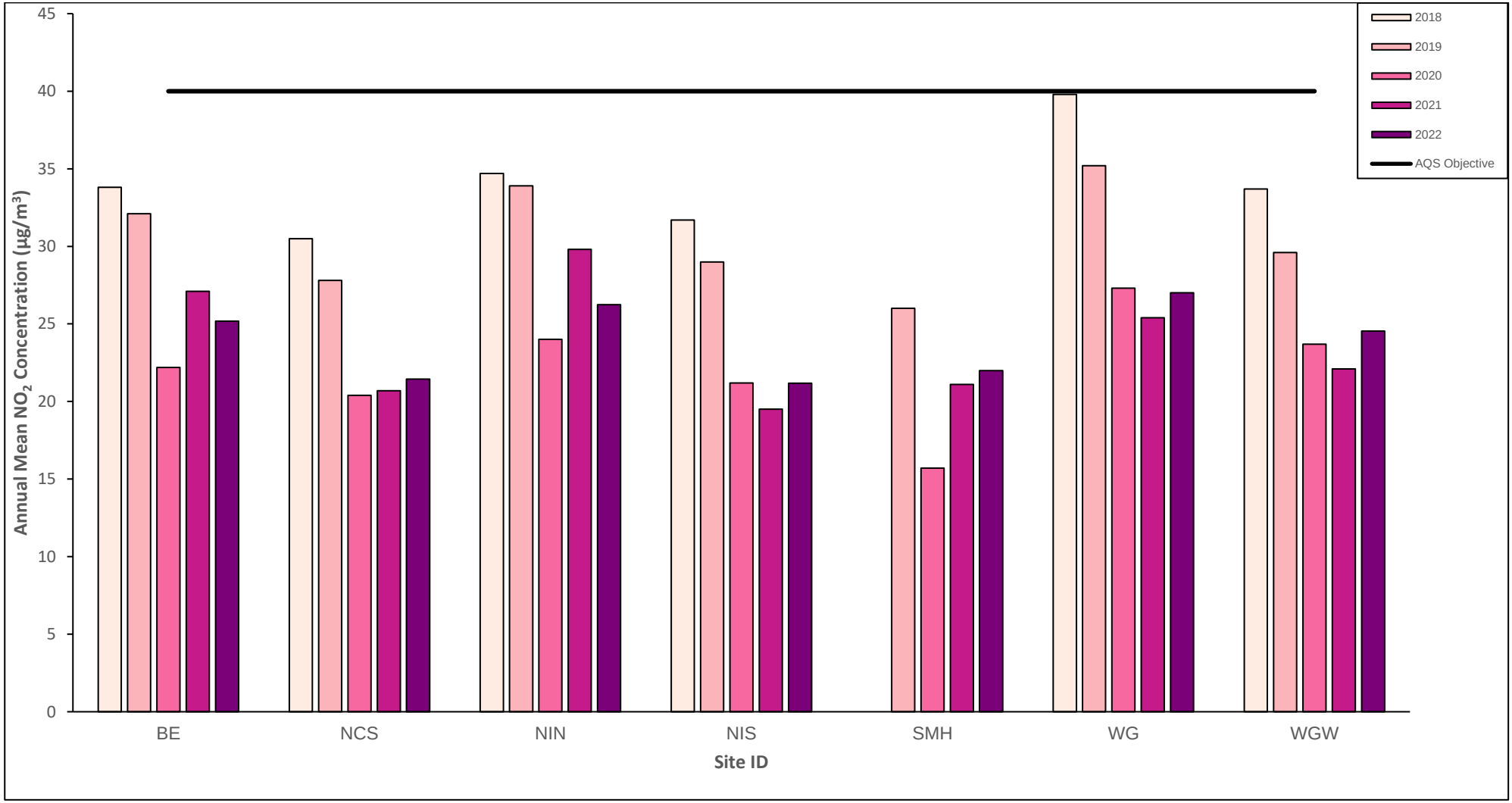


Figure A.1.5 - Trends in annual mean NO_2 concentrations – Within and around Ellesmere Port AQMA

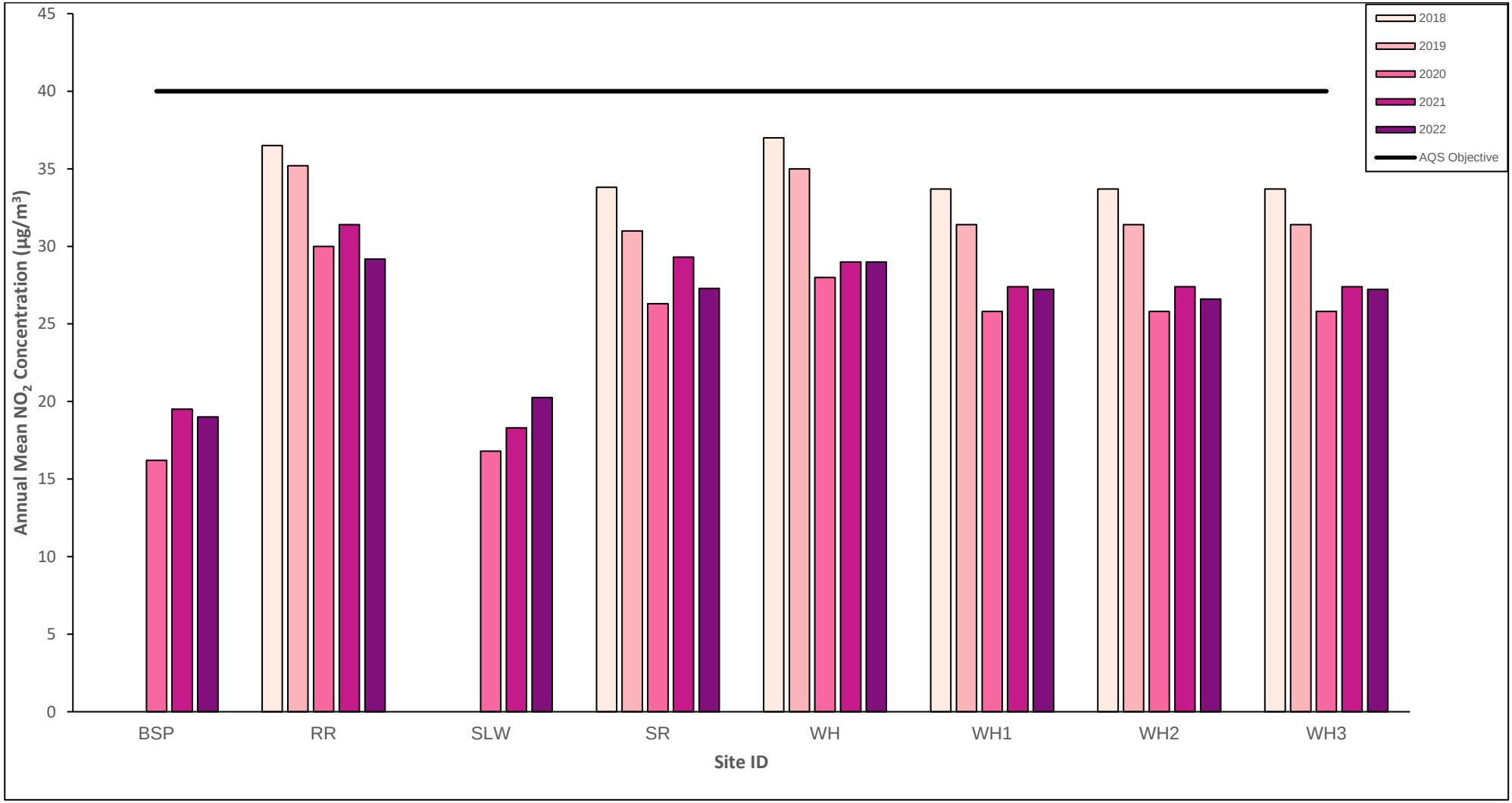


Figure A.1.6 - Trends in annual mean NO_2 concentration – Within and around Frodsham AQMA

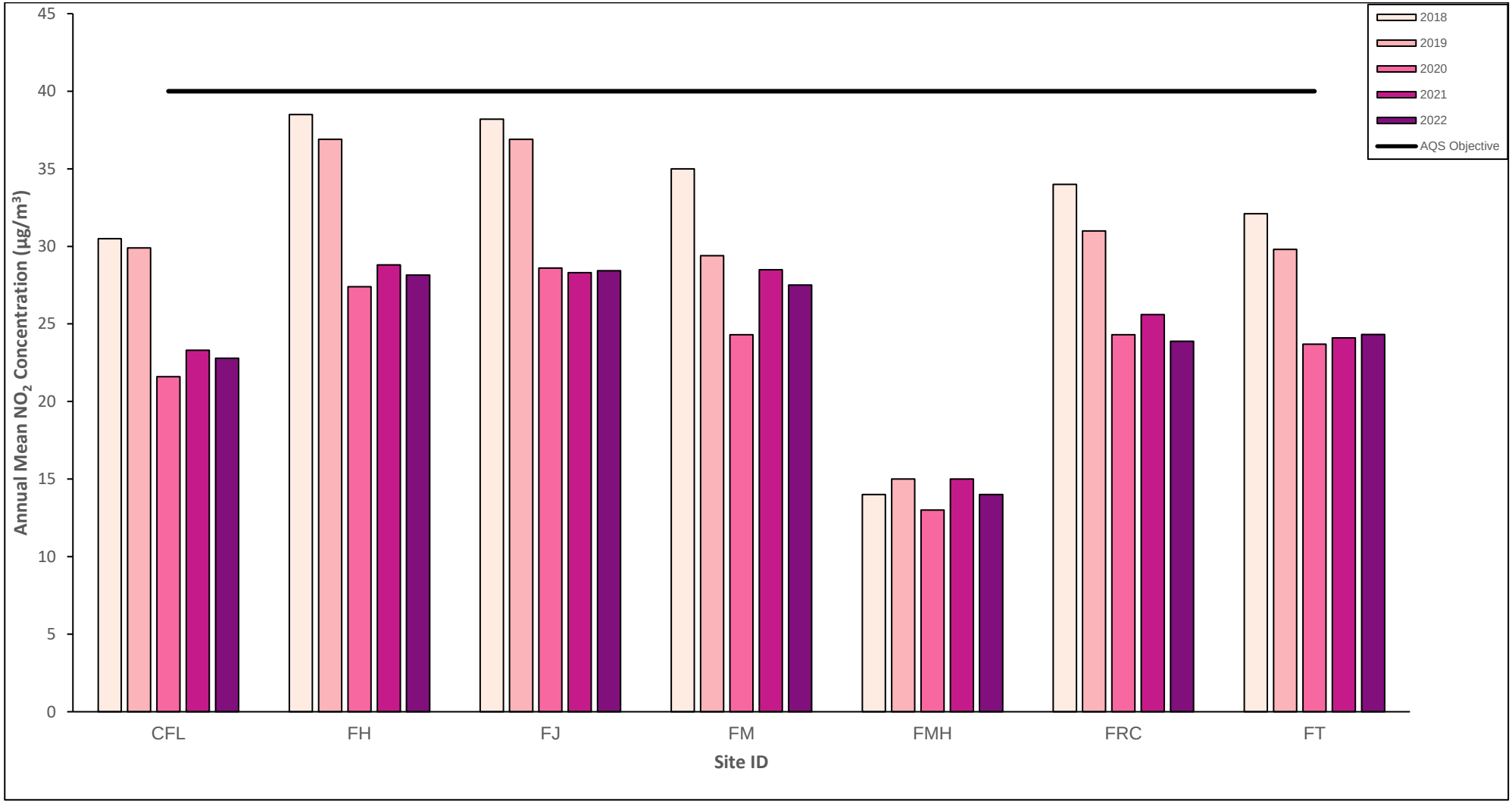


Figure A.1.7 - Trends in annual mean NO_2 concentration – Within Thornton-Le-Moors AQMA

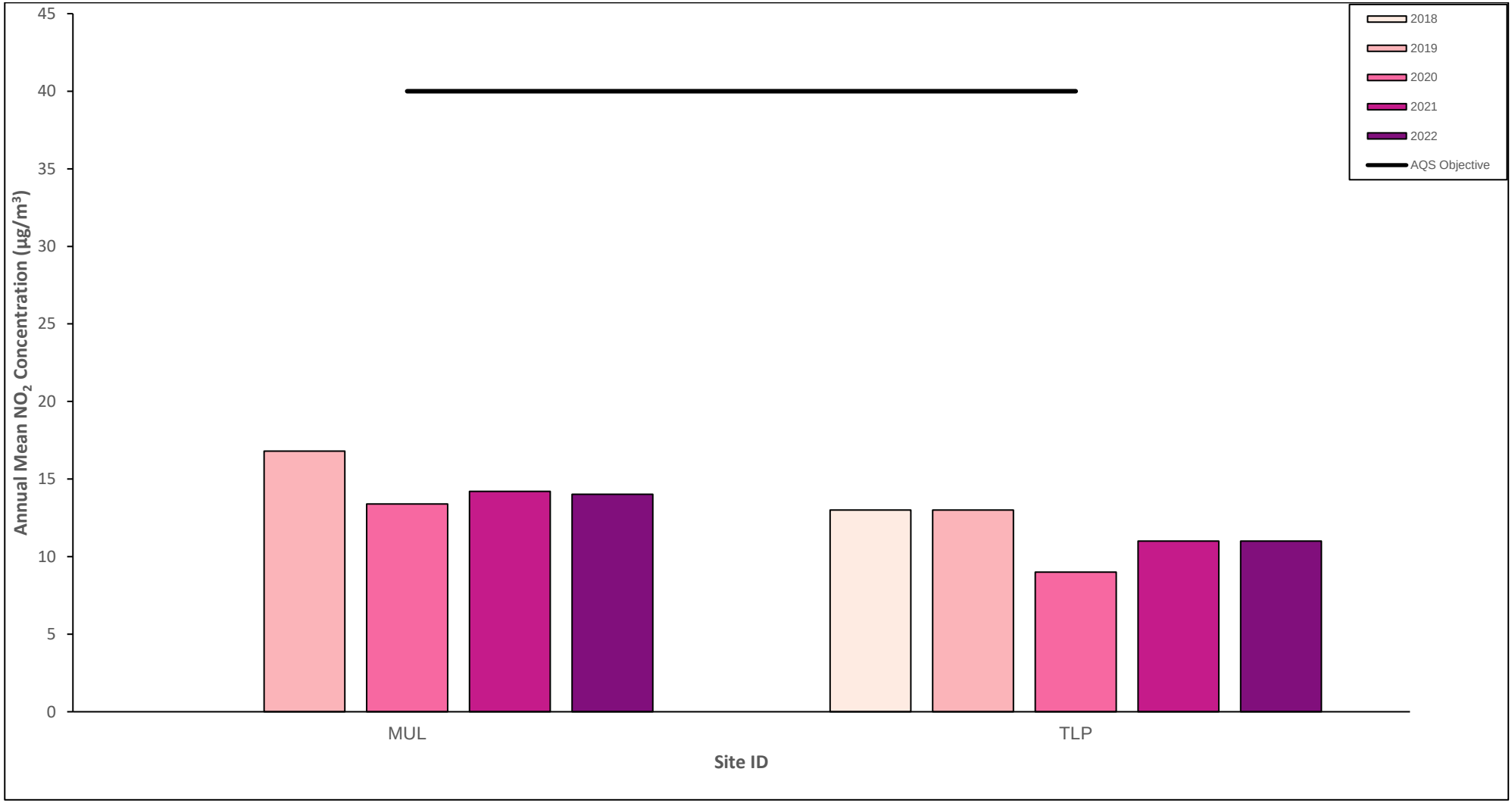


Figure A.1.8 - Trends in annual mean NO_2 concentration – Christleton / Littleton / Boughton Heath

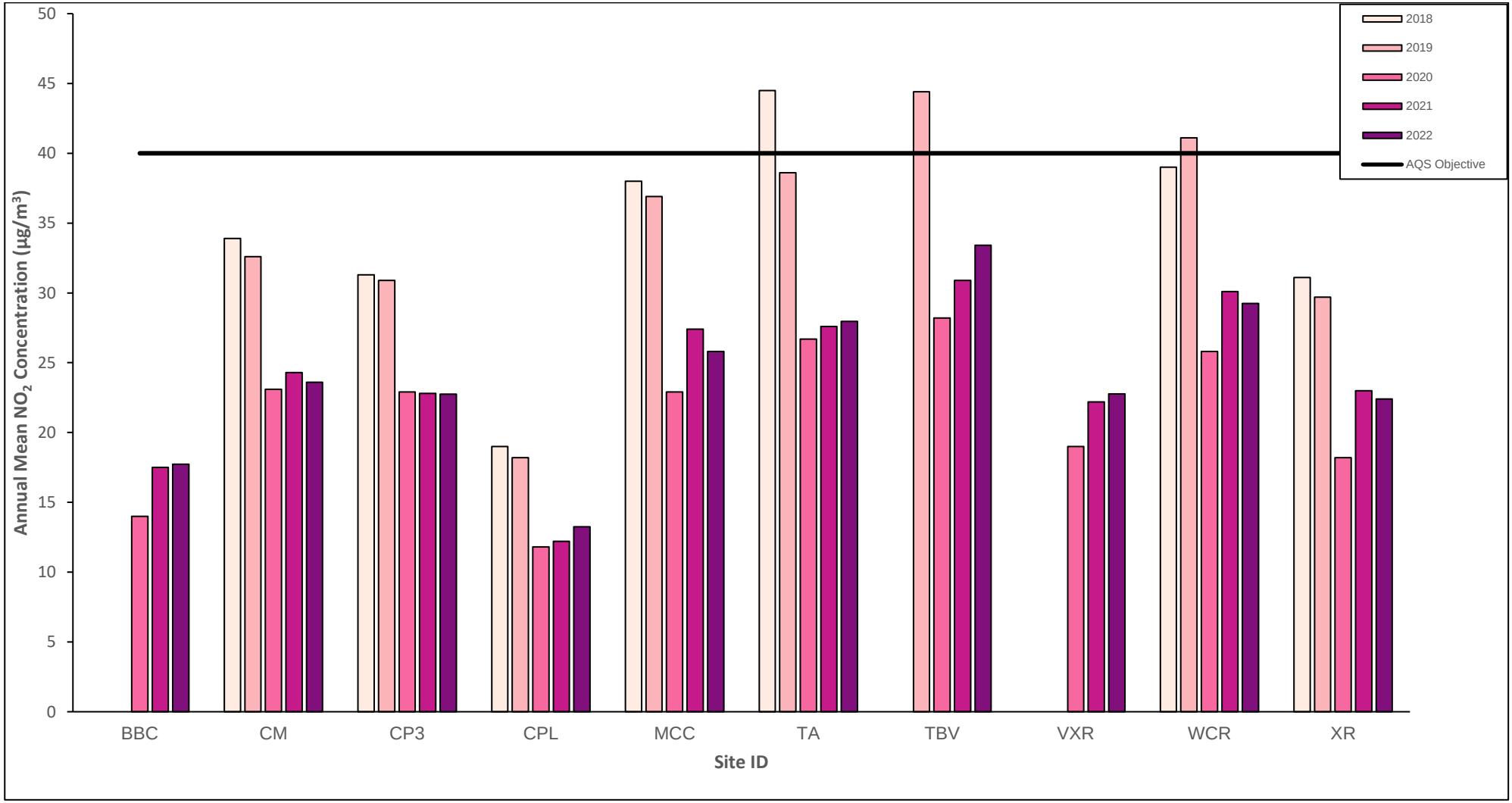


Figure A.1.9 - Trends in annual mean NO_2 concentration – Tarvin

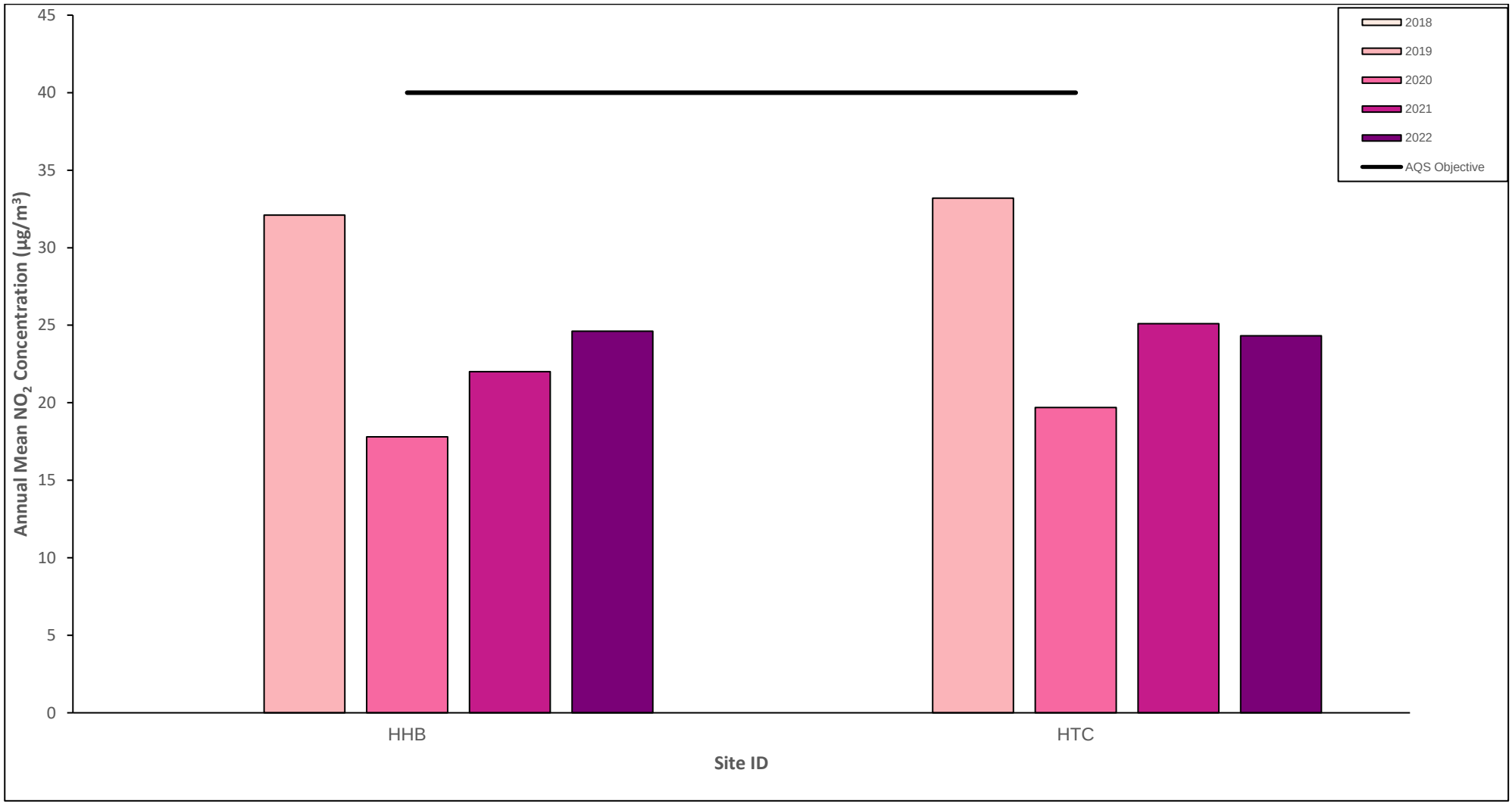


Figure A.1.10 - Trends in annual mean NO_2 concentration – Neston

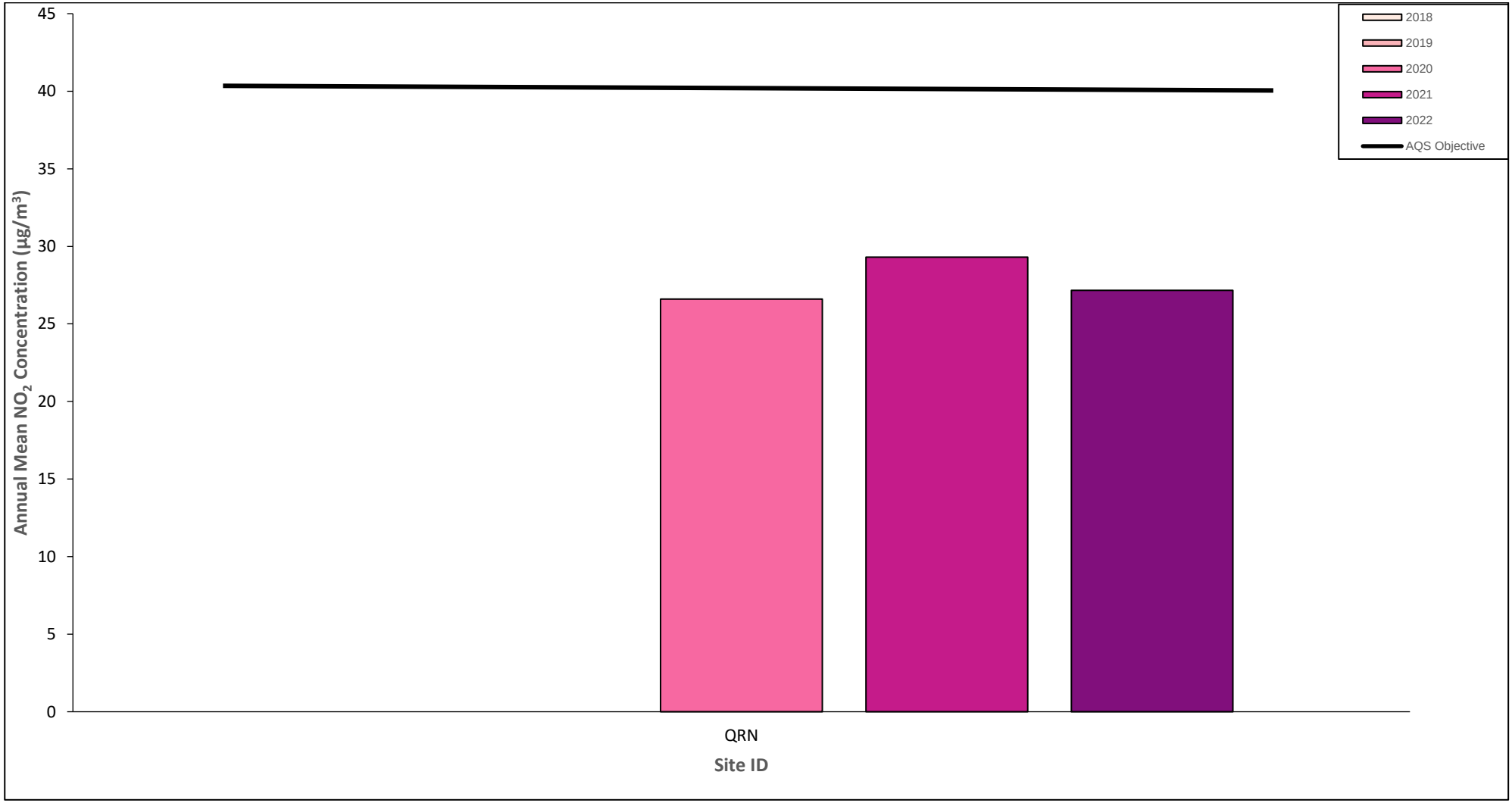


Figure A.1.11 - Trends in annual mean NO_2 concentration – Northwich

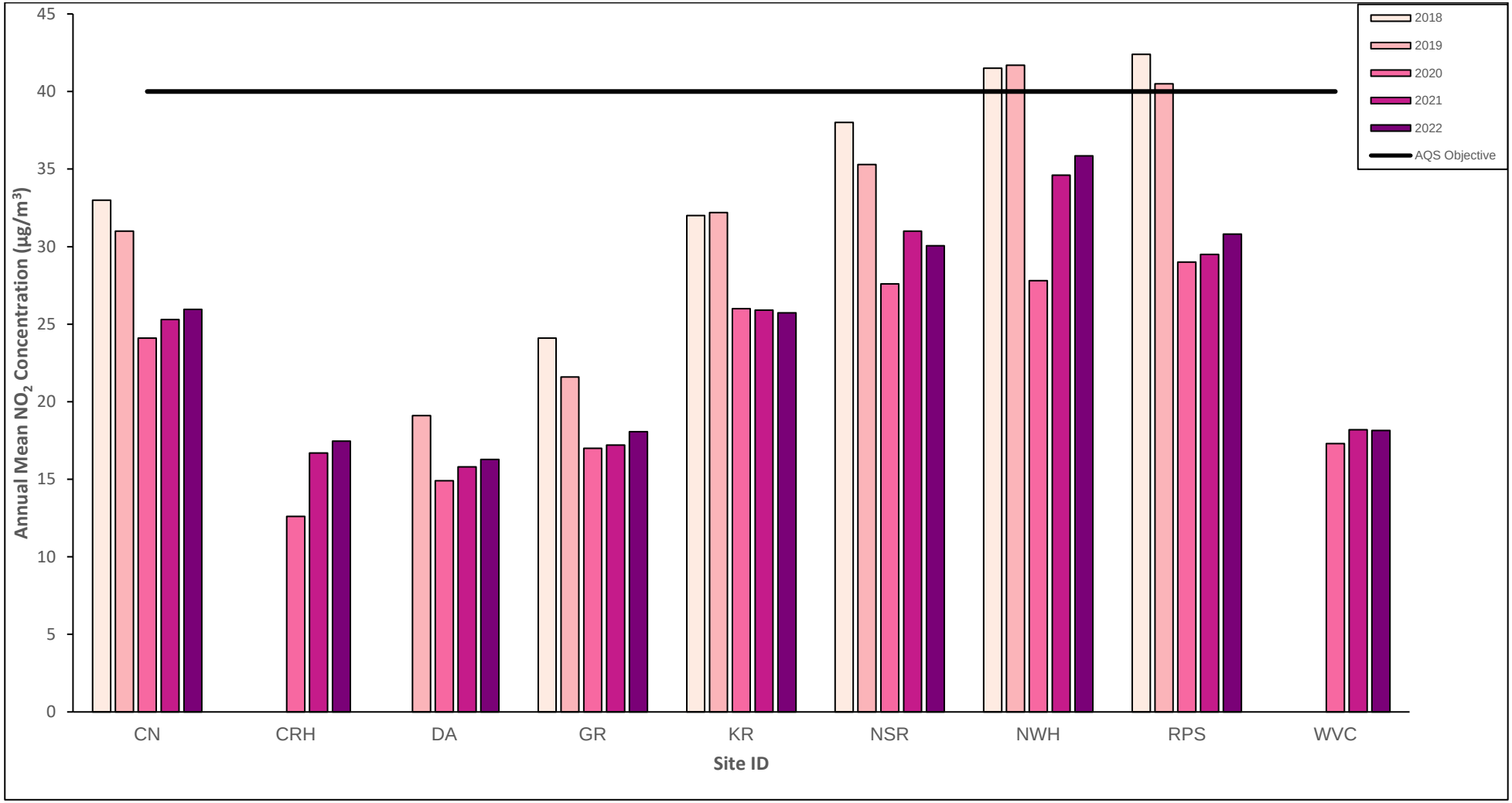


Figure A.1.12 - Trends in annual mean NO_2 concentration – Winsford

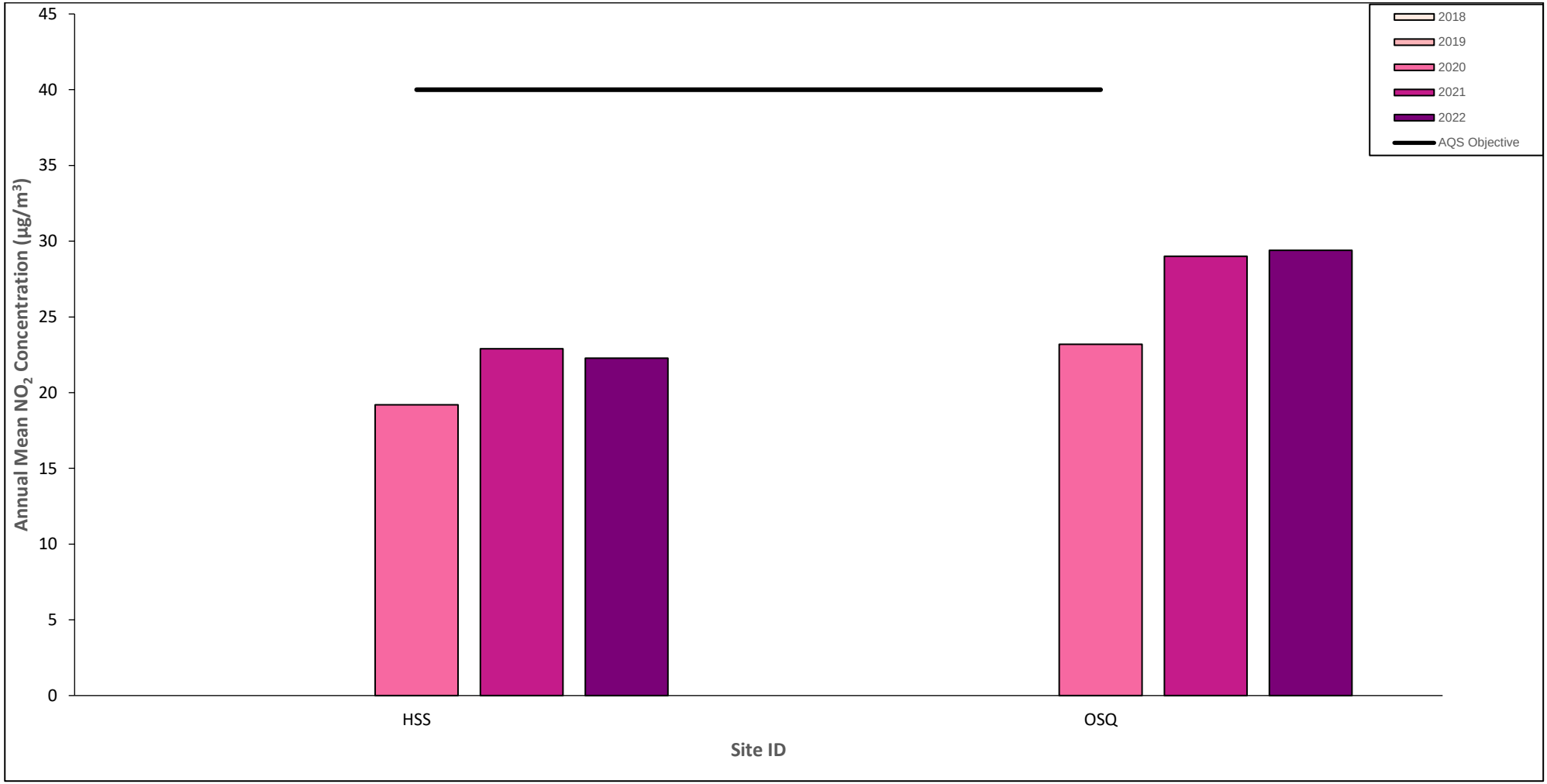


Figure A.1.13 - Trends in annual mean NO_2 concentration – Allostock

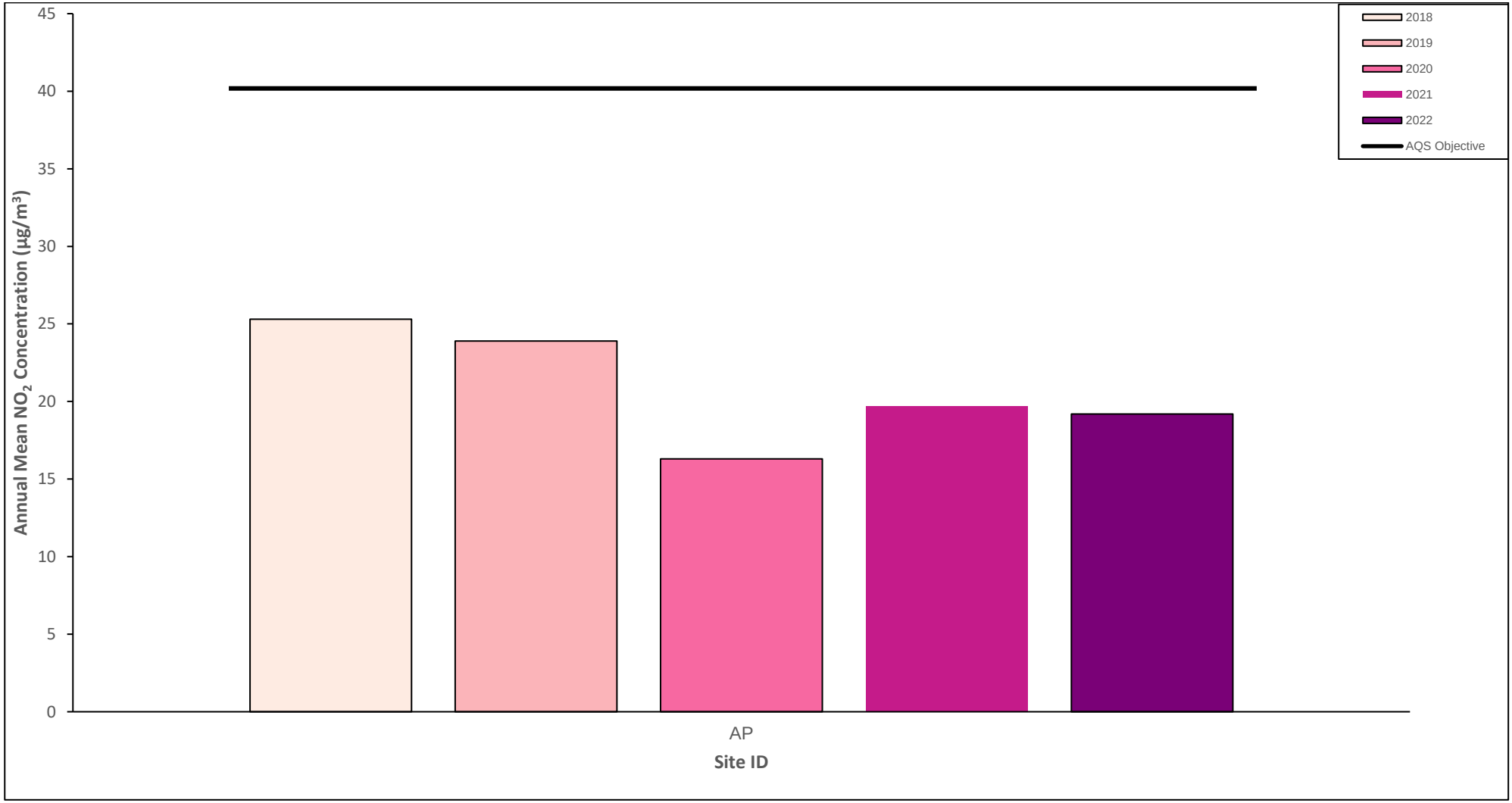


Figure A.1.14 - Trends in annual mean NO_2 concentration – Sproston

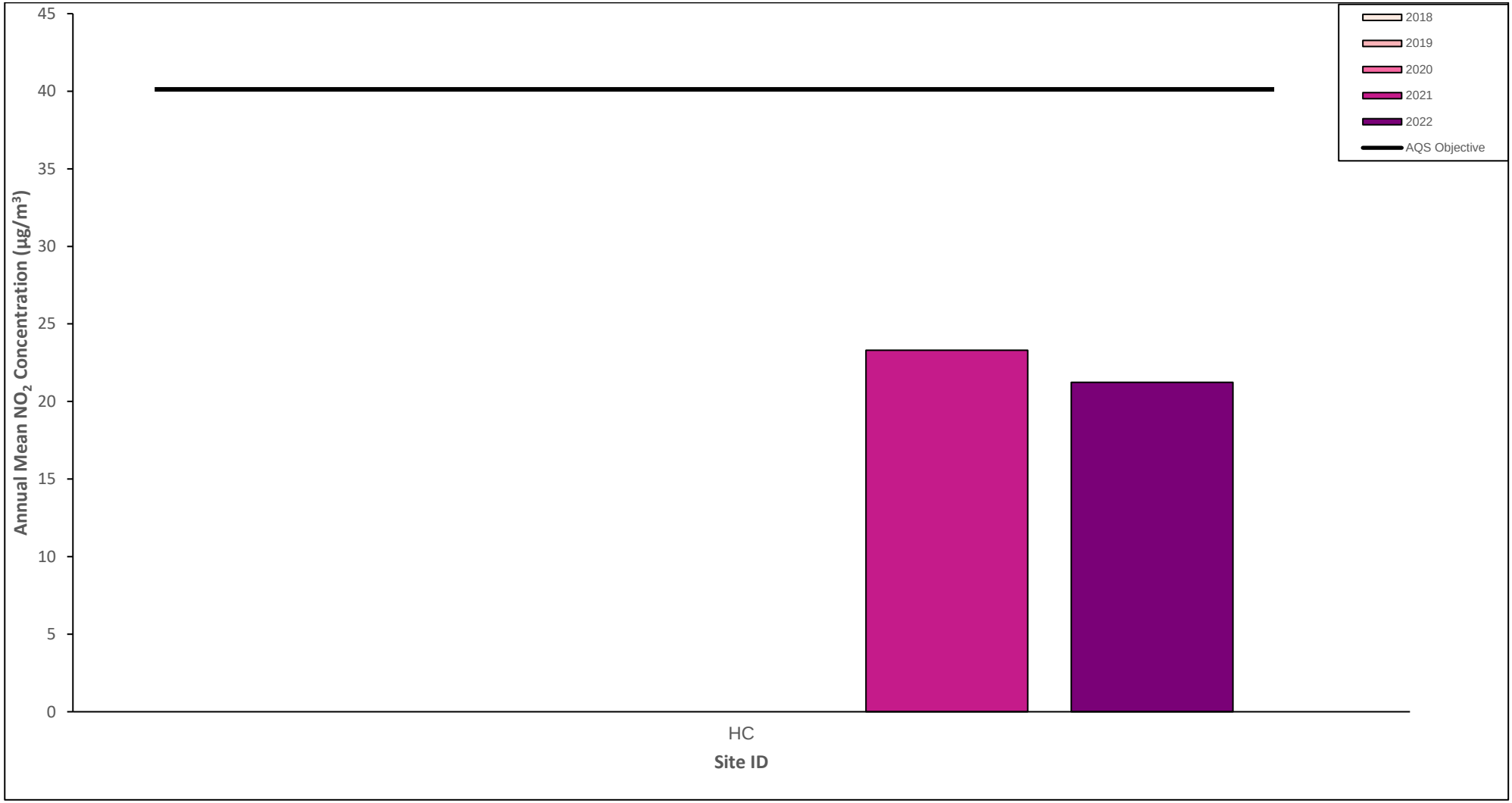


Figure A.1.15 - Trends in annual mean NO_2 concentration – A41 Long Lane / Greenfield Lane

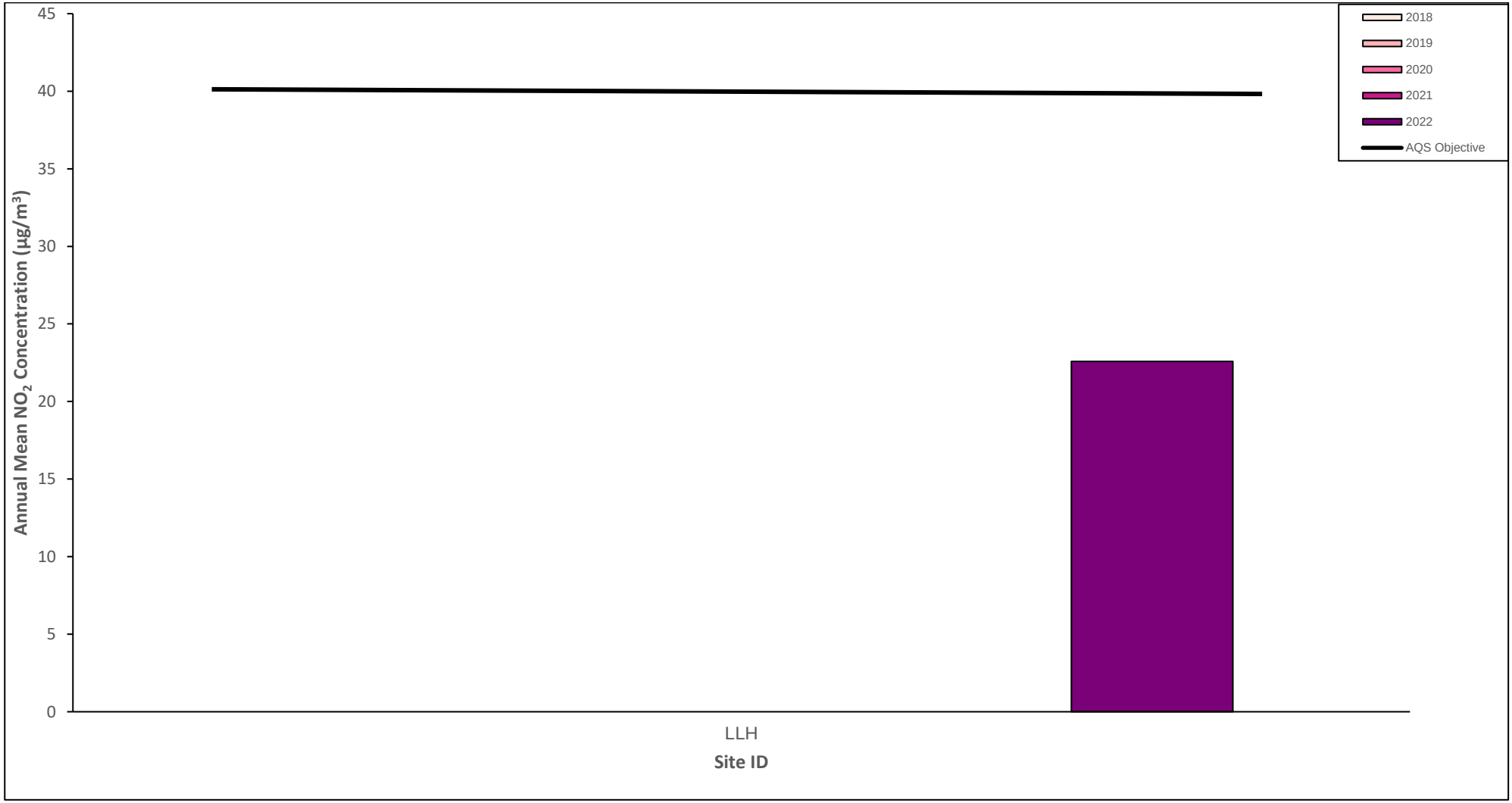


Figure A.1.16 - Trends in annual mean NO_2 concentration – Cuddington A49

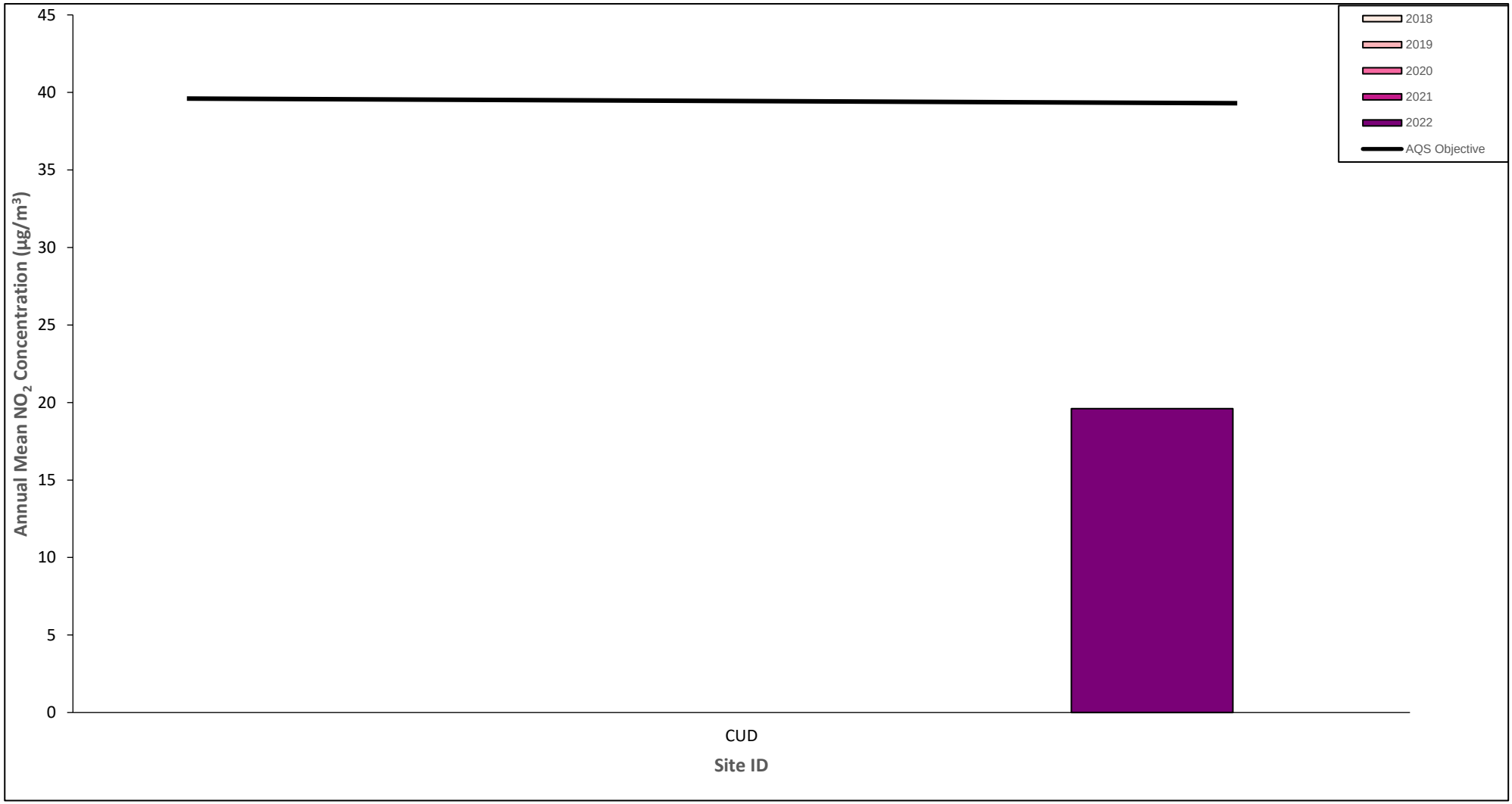


Figure A.1.17 - Trends in annual mean NO_2 concentration – Handbridge

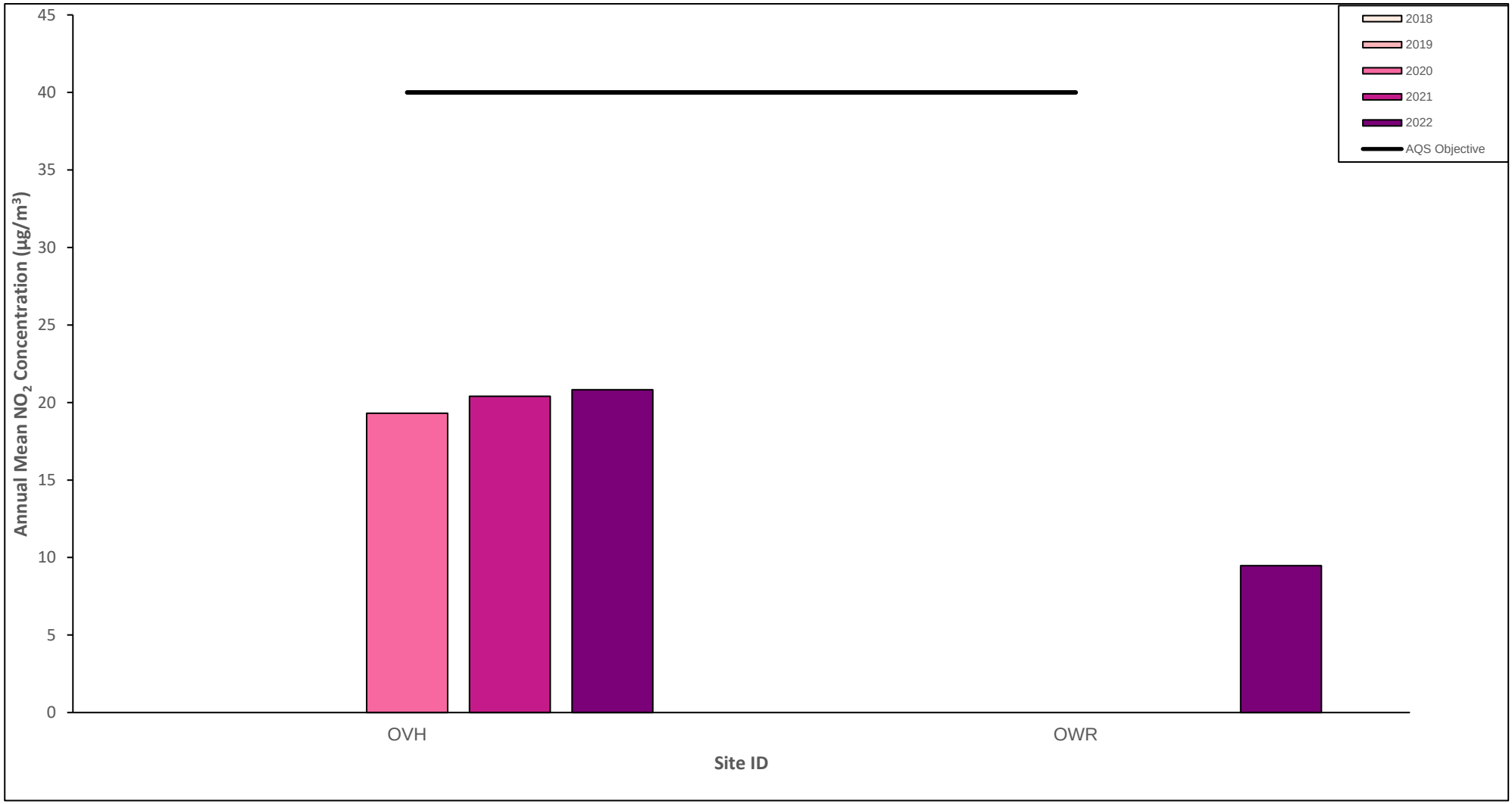


Table A.5 – 1-Hour Mean NO_2 Monitoring Results, Number of 1-Hour Means > 200µg/m^3

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
BO	341864	366444	Roadside	99.3	99.3	0	0	0	2	0
CBI	340645	366802	Roadside	99.5	99.5	0	0	0	0	0
FMH	352445	378031	Urban Background	69.3	69.3	0	0	0	0	0
TLP	344103	374330	Industrial	99	99	0	0	0	0	0
WH	340197	376363	Roadside	99.1	99.1	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%).

Figure A.2 – Trends in Number of NO_2 1-Hour Means > 200µg/m^3

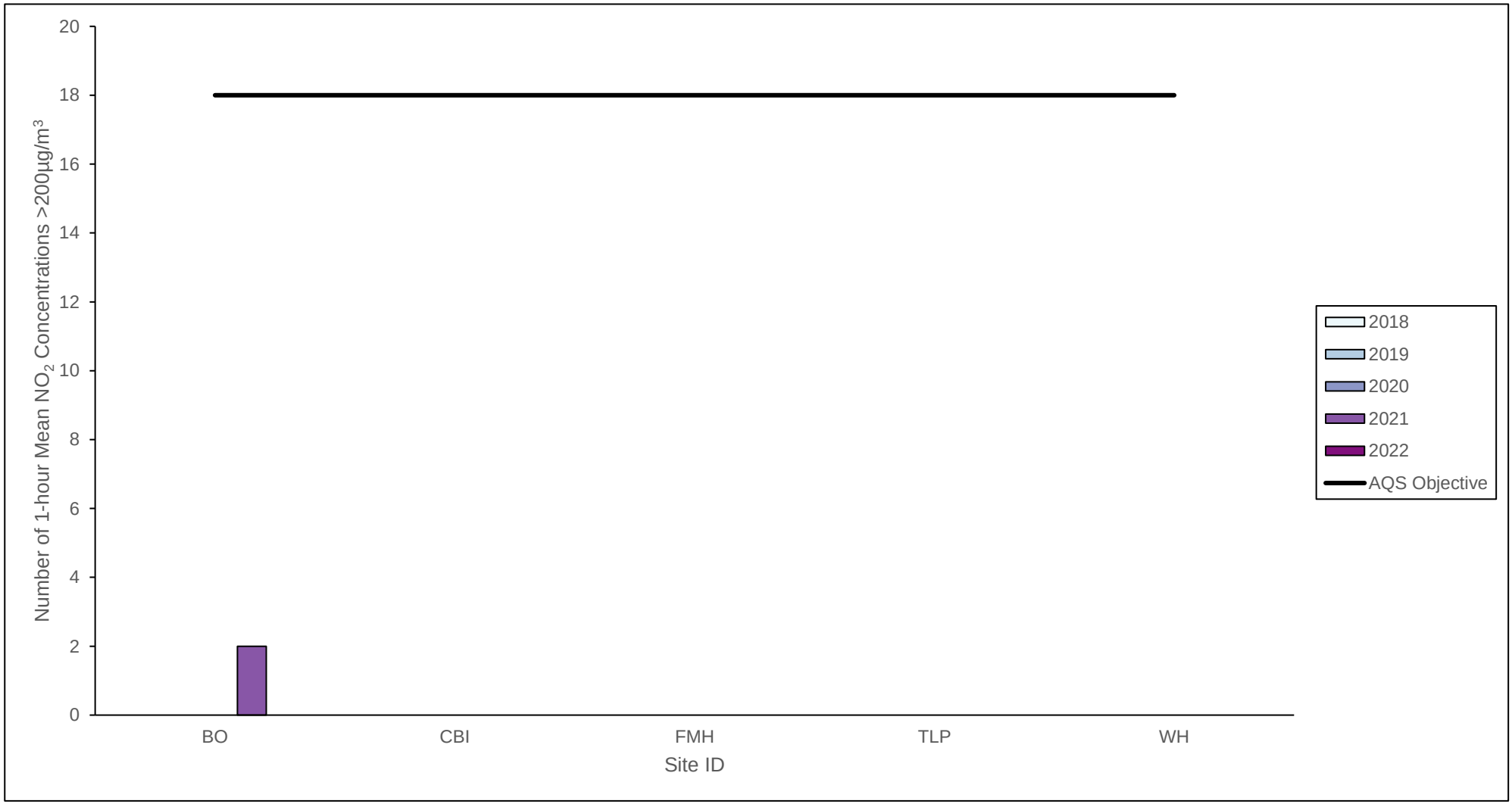


Table A.6 – Annual Mean PM_{10} Monitoring Results ($\mu g/m^3$)

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
CBI	340645	366802	Roadside	97.4	97.4	21	21	23	22	20
FMH	352445	378031	Urban Background	98.7	98.7	16	15	12	13	15
TLP	344103	374330	Industrial	97.6	97.6	13	14	13	13	13

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

Notes:

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

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

All means have been "annualised" as per LAQM.TG22 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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

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

Figure A.3 – Trends in Annual Mean PM_{10} Concentrations

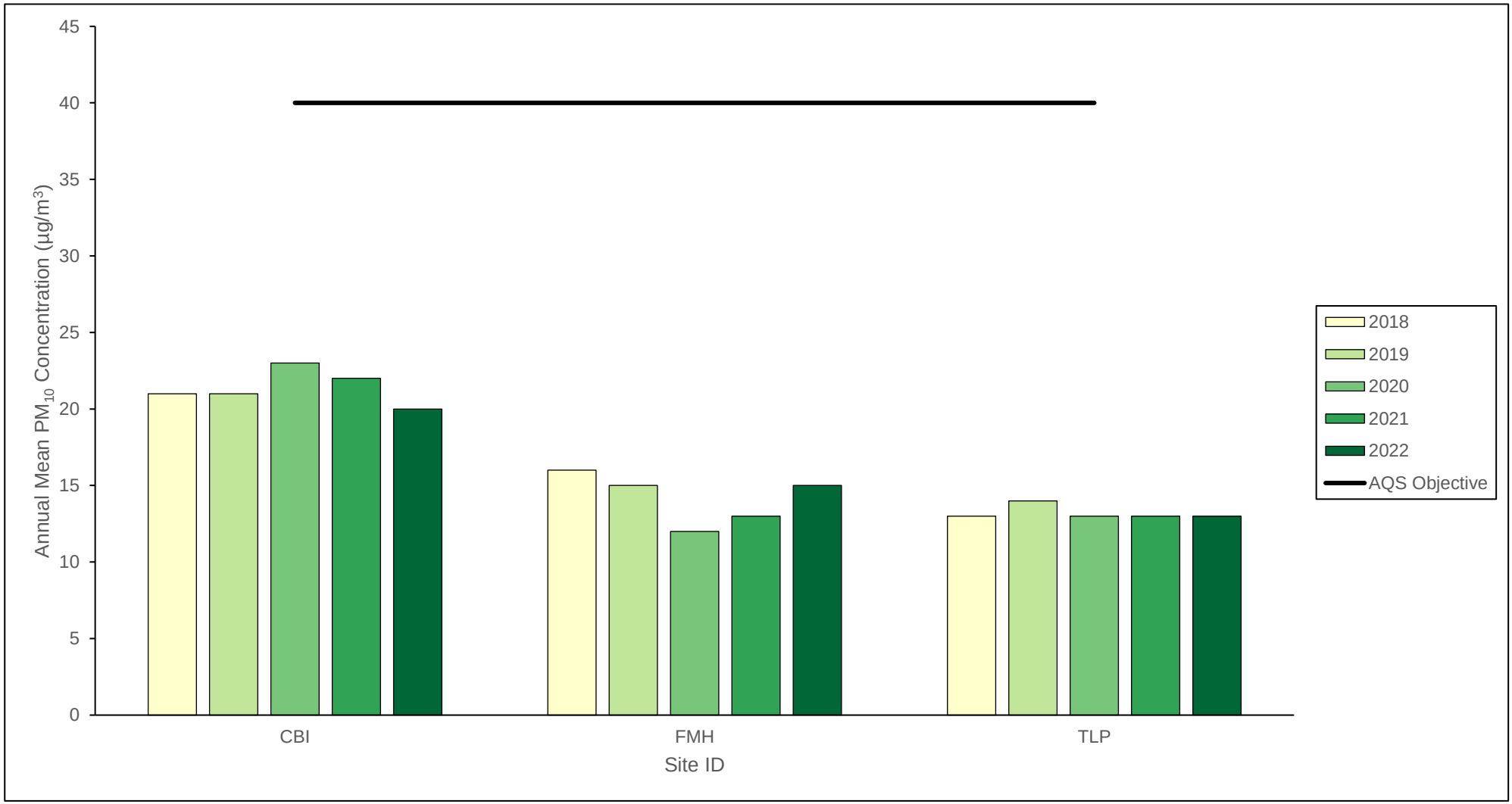


Table A.7 – 24-Hour Mean PM_{10} Monitoring Results, Number of PM_{10} 24-Hour Means > 50µg/m^3

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
CBI	340645	366802	Roadside	97.4	97.4	4	9	4	2	5
FMH	352445	378031	Urban Background	98.7	98.7	0	1	0	0	2
TLP	344103	374330	Industrial	97.6	97.6	0	3	0	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 A.4 – Trends in Number of 24-Hour Mean PM_{10} Results > 50µg/m³

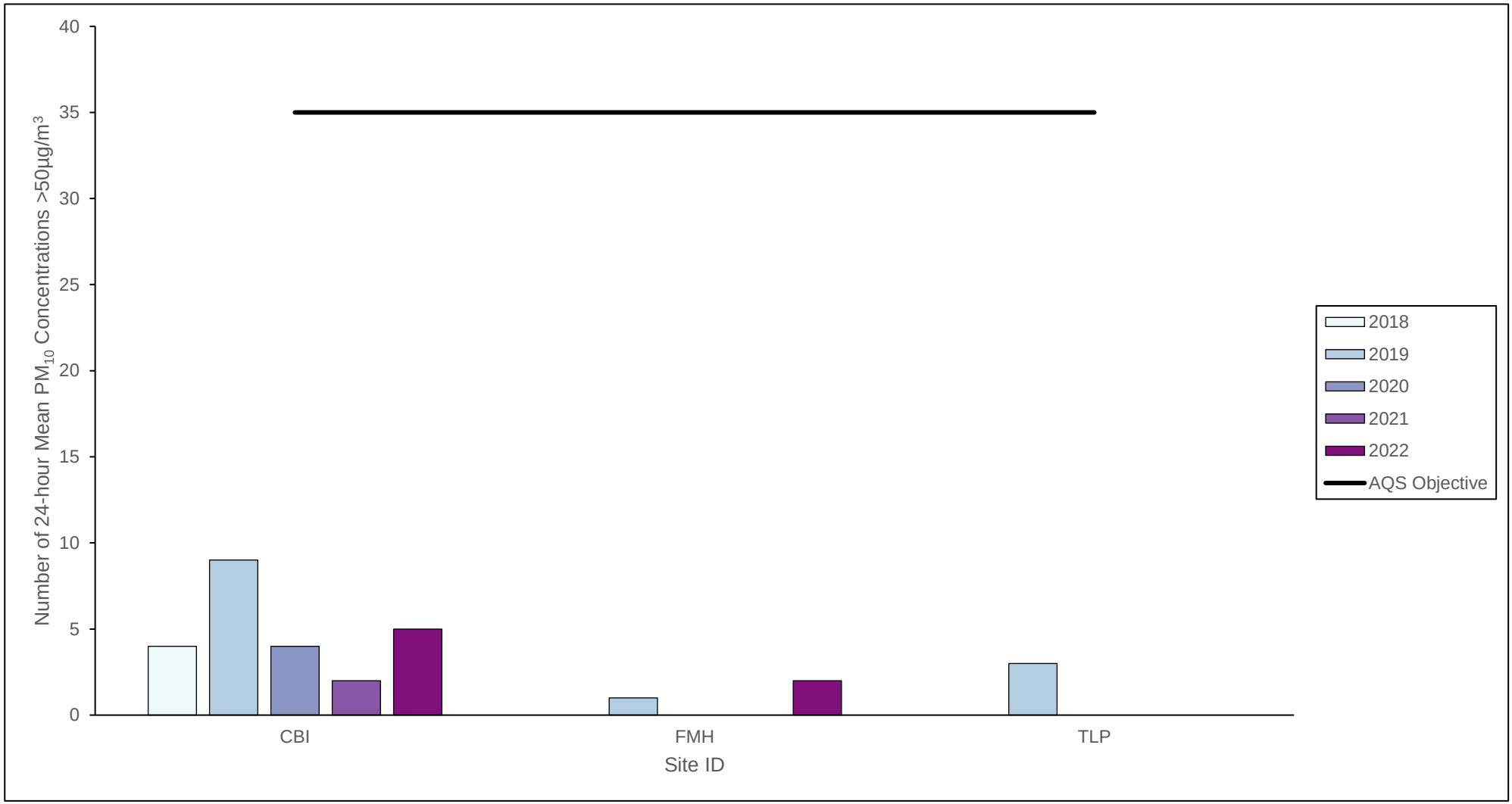


Table A.8 – SO_2 2022 Monitoring Results, Number of Relevant Instances

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	Number of 15-minute Means > 266µg/m³	Number of 1-hour Means > 350µg/m³	Number of 24-hour Means > 125µg/m³
ELT	345642	375522	Industrial	98	98	6	0	0
TLP	344103	374330	Industrial	98.5	98.5	1	0	0

Notes:

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

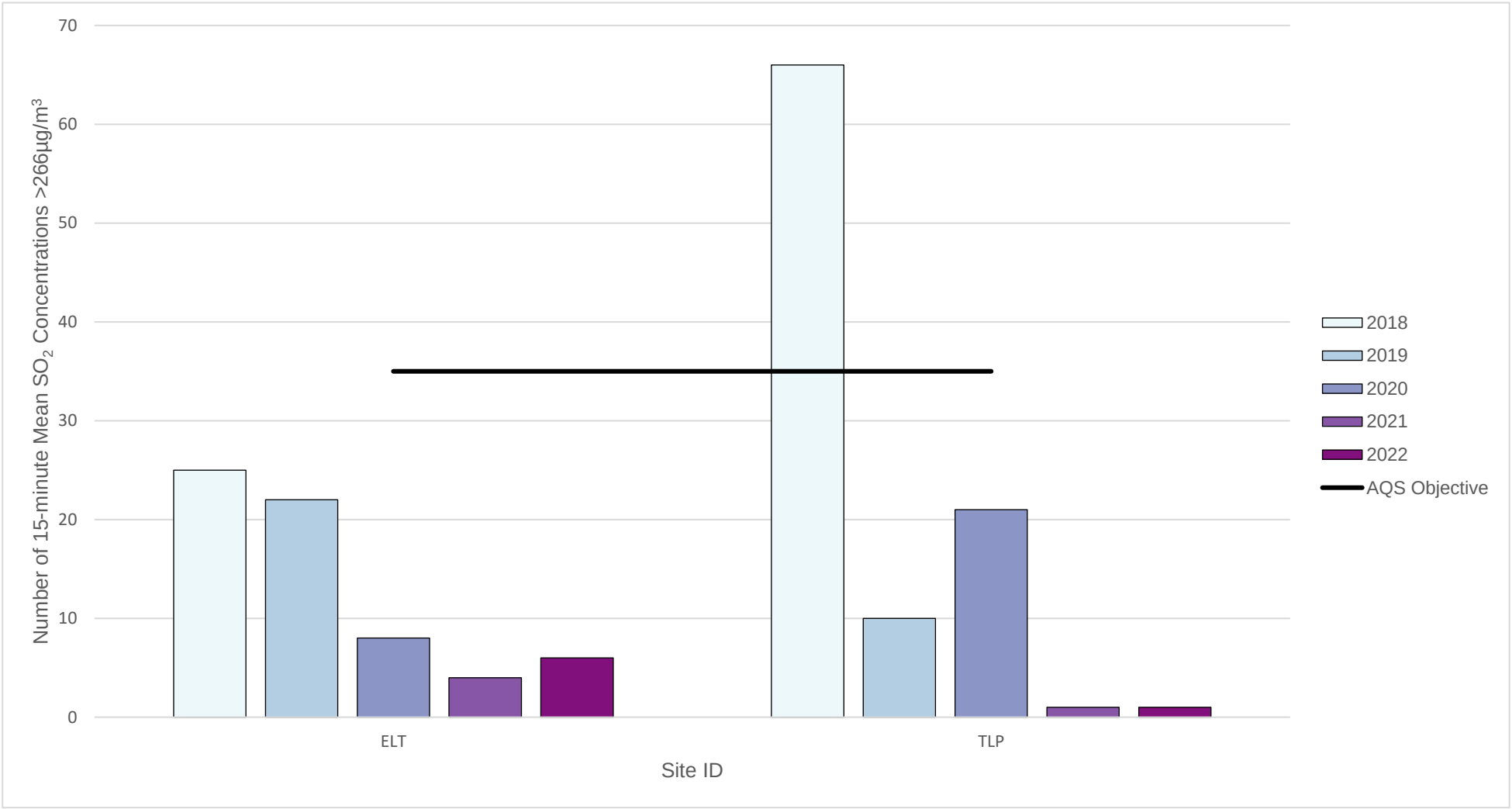
Exceedances of the SO_2 objectives are shown in **bold** (15-min mean = 35 allowed a year, 1-hour mean = 24 allowed a year, 24-hour mean = 3 allowed a year).

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 A.5 – Trends in Number of 15-Minute Mean SO_2 Results >266µg/m3



Appendix B: Full Monthly Diffusion Tube Results for 2022

Table B.1 – NO_2 2022 Diffusion Tube Results ($\mu g/m^3$)

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan	Feb	Mar	Apr	May	Jun	Jul[11]	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	29.4	24.1	20.4	18.0	22.5	23.9	N/A	23.8	22.1	19.6	22.7	24.9	22.8	19.2	-	
BBC	342622	364613	22.3	14.7	29.0	24.6	14.7	13.6	N/A	21.4	22.2	21.3	23.2	25.3	21.1	17.7	-	
BE	340239	366418	36.3	N/A	37.1	29.6	24.9	21.7	N/A	27.6	29.6	26.6	29.9	36.3	30.0	25.2	-	
BJ	341401	366512	37.1	26.8	31.9	32.4	27.6	25.4	N/A	34.5	37.8	28.9	28.4	34.1	31.4	26.4	-	
BSP	338380	375840	28.5	19.6	26.1	24.0	17.8	14.9	N/A	23.5	23.8	18.8	20.7	31.1	22.6	19.0	-	
C11	341915	366427	41.2	27.6	43.0	N/A	33.8	29.4	N/A	38.9	41.4	33.8	35.1	39.7	36.4	30.6	-	
C36	342000	366374	54.7	40.0	46.8	41.1	40.2	37.6	N/A	41.5	42.4	41.4	44.3	47.0	43.4	36.4	34.8	
C75	342056	366354	30.8	19.8	31.7	27.2	20.6	17.7	N/A	24.5	29.0	21.7	23.2	30.0	25.1	21.1	-	
CAN	340375	366730	30.8	20.0	29.7	30.0	22.0	18.6	N/A	25.9	31.4	23.5	27.2	35.5	26.8	22.5	-	
CBI1	340647	366803	34.8	30.1	39.9	32.6	30.6	30.0	N/A	32.3	38.6	36.0	38.3	37.6	34.6	29.1	-	
CBI2	340647	366803	36.7	29.3	38.5	35.2	32.6	29.4	N/A	34.1	37.5	36.9	38.8	40.7	35.4	29.8	-	
CBI3	340647	366803	35.2	34.0	40.4	32.6	30.6	28.3	N/A	35.1	39.0	34.9	38.1	41.5	35.4	29.8	-	
CBR	340676	366782	31.9	30.6	36.4	29.3	27.6	25.4	N/A	30.1	36.8	31.5	33.4	40.0	32.1	27.0	-	
CFL	351762	377862	34.2	23.6	33.3	27.4	22.4	20.6	N/A	28.3	26.9	23.2	26.7	31.7	27.1	22.8	-	
CM	343761	365528	36.0	20.9	33.6	26.0	24.8	21.3	N/A	27.6	31.1	26.8	27.9	33.1	28.1	23.6	-	

[11] July data unavailable for all non-automatic monitoring sites as tubes not refrigerated two weeks prior to planned deployment.

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan	Feb	Mar	Apr	May	Jun	Jul[11]	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
CN	366070	373905	42.2	32.2	35.0	30.1	21.8	23.9	N/A	26.7	27.1	28.9	34.9	37.0	30.9	26.0	-	
CP3	343970	365295	31.8	21.9	31.2	25.7	25.5	21.8	N/A	25.7	29.0	25.7	27.9	31.5	27.1	22.7	-	
CPL	344377	365375	19.6	13.7	19.0	14.6	11.1	N/A	N/A	12.9	16.6	13.7	15.7	20.9	15.8	13.3	-	
CRH	364171	372697	N/A	24.5	27.5	20.6	15.9	N/A	N/A	16.8	20.5	18.9	N/A	26.0	21.3	17.5	-	
CUD	359436	370534	N/A	N/A	N/A	24.3	21.4	20.3	N/A	25.6	N/A	21.5	22.7	27.3	23.3	19.6	-	
DA	365953	371113	25.8	N/A	26.5	17.5	12.6	12.6	N/A	16.4	19.1	16.3	20.3	26.6	19.4	16.3	-	
EB	341658	366487	36.4	29.5	31.6	28.8	23.2	20.3	N/A	26.9	27.7	29.1	29.4	35.4	28.9	24.3	-	
FH	352146	378139	43.2	30.1	41.8	35.2	28.5	25.6	N/A	32.7	33.5	24.4	37.8	35.8	33.5	28.2	-	
FJ	352171	378140	46.5	36.1	36.2	32.4	31.3	30.9	N/A	35.4	25.7	22.9	34.7	40.2	33.8	28.4	-	
FM	352189	378094	42.9	26.0	41.3	37.1	23.5	22.6	N/A	32.9	31.0	33.8	30.1	39.1	32.7	27.5	-	
FRC	352023	378121	37.9	24.7	33.1	30.7	23.6	20.9	N/A	29.1	28.0	23.7	25.8	35.2	28.4	23.9	-	
FT	352176	378105	41.2	26.1	28.4	26.2	26.6	23.9	N/A	28.6	28.9	29.0	27.2	32.3	28.9	24.3	-	
GE	340657	366730	33.0	29.0	39.0	N/A	25.2	25.2	N/A	N/A	N/A	35.8	N/A	41.3	32.6	25.5	-	
GR	368634	374714	26.9	17.9	26.5	20.3	17.9	15.8	N/A	18.7	20.2	20.2	24.7	27.6	21.5	18.1	-	
GSW	340700	366687	38.4	30.7	36.6	30.0	29.1	26.8	N/A	29.6	35.2	33.9	34.0	40.5	33.2	27.9	-	
GT	340611	366747	32.4	26.3	36.1	31.2	25.8	25.1	N/A	29.5	32.3	31.6	30.7	38.1	30.8	25.9	-	
HB	341605	366527	34.8	24.2	35.1	26.3	22.8	20.0	N/A	25.1	27.7	27.5	31.7	37.0	28.4	23.8	-	
HC	373375	366928	30.5	20.5	28.7	28.4	19.5	18.6	N/A	28.5	30.0	20.0	22.9	30.4	25.3	21.2	-	
HHB	347953	366723	30.6	25.7	31.8	31.6	27.0	25.3	N/A	33.6	32.0	25.3	29.2	30.1	29.3	24.6	-	
HO	341311	367207	34.4	24.6	38.0	26.9	25.4	24.4	N/A	28.1	29.0	26.7	32.8	35.0	29.6	24.8	-	
HSS	364711	366339	34.5	25.3	33.3	20.8	22.7	20.2	N/A	20.6	22.4	N/A	31.9	33.4	26.5	22.3	-	

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan	Feb	Mar	Apr	May	Jun	Jul[11]	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
HTC	348333	366763	32.1	25.2	N/A	28.7	26.0	22.3	N/A	28.2	31.0	30.9	31.5	33.4	29.0	24.3	-	
HW	340881	366826	38.3	30.4	37.7	N/A	25.1	22.9	N/A	30.2	31.7	33.9	35.0	38.0	32.3	27.1	-	
IC	342068	366332	40.4	33.5	35.5	28.3	27.8	25.4	N/A	29.5	N/A	30.2	31.9	38.0	32.1	26.9	-	
KR	368432	372988	40.4	26.6	36.6	26.0	23.6	23.8	N/A	29.5	29.7	27.7	35.0	38.2	30.6	25.7	-	
LH	341126	366540	38.0	30.1	33.1	34.2	30.5	26.7	N/A	33.6	37.8	27.5	28.1	34.6	32.2	27.0	-	
LI2	340354	367034	43.2	31.9	44.3	35.5	29.5	27.3	N/A	34.3	38.7	36.4	41.2	43.0	36.8	30.9	-	
LLH	342464	368461	36.2	21.8	32.0	21.4	N/A	N/A	N/A	19.3	22.9	26.0	30.7	31.7	26.9	22.6	-	
LU	340838	366215	25.0	18.0	22.4	19.0	19.0	15.2	N/A	19.4	20.7	21.0	22.4	29.0	21.0	17.7	-	
LVS	340990	366317	26.1	19.2	28.6	28.0	23.8	20.9	N/A	25.7	28.5	23.7	27.8	32.1	25.9	21.7	-	
MCC	343785	365502	32.8	25.9	33.7	33.1	22.8	25.4	N/A	32.1	34.5	30.1	30.1	37.3	30.7	25.8	-	
MUL	346258	375321	22.8	15.6	19.6	15.4	11.7	10.2	N/A	14.9	15.7	15.7	18.6	23.5	16.7	14.0	-	
NCS	339857	366460	30.5	21.4	30.8	23.1	19.7	16.6	N/A	21.4	26.4	27.4	29.8	33.8	25.5	21.4	-	
NIN	340284	366199	38.7	28.1	30.1	29.4	28.7	27.5	N/A	30.1	34.6	29.3	31.3	35.9	31.2	26.2	-	
NIS	340329	366114	28.0	17.2	34.7	27.9	N/A	N/A	N/A	29.4	30.5	24.7	N/A	36.8	28.7	21.2	-	
NSR	366796	373984	46.5	26.7	43.3	39.0	28.9	26.3	N/A	37.7	38.4	30.4	34.0	42.4	35.8	30.1	-	
NWH	365590	373904	47.8	44.7	48.4	37.9	42.1	37.6	N/A	40.3	42.0	40.5	42.1	46.1	42.7	35.9	-	
OB	341633	366510	44.5	N/A	41.9	40.3	29.5	26.3	N/A	36.1	39.0	35.5	36.6	N/A	36.6	30.8	-	
OF	340453	366853	30.2	24.2	32.8	25.4	24.1	22.2	N/A	28.4	31.5	N/A	34.6	36.1	29.0	24.3	-	
ON	340718	366815	26.7	20.9	30.3	20.1	17.4	13.2	N/A	36.7	21.3	23.2	27.3	32.2	24.5	20.6	-	
OP	340636	366770	35.6	28.2	35.1	29.9	27.1	23.7	N/A	29.3	35.3	30.2	33.1	36.9	31.3	26.3	-	
OSQ	364053	365977	43.7	25.9	45.4	N/A	N/A	24.7	N/A	31.5	32.0	30.6	37.4	N/A	33.9	29.4	-	

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan	Feb	Mar	Apr	May	Jun	Jul[11]	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
OVH	340770	365605	33.2	21.4	N/A	22.2	22.3	19.4	N/A	N/A	22.2	25.3	26.3	30.7	24.8	20.8	-	
OW	340623	366823	41.9	N/A	44.1	33.6	37.2	36.8	N/A	39.1	41.4	N/A	45.6	42.0	40.2	33.7	-	
OWR	340482	365062	14.6	10.1	14.0	10.6	7.6	6.6	N/A	8.9	12.4	9.3	11.1	18.8	11.3	9.5	-	
PA	340313	367014	44.8	30.3	45.8	29.6	28.0	27.3	N/A	30.1	40.0	41.3	42.0	42.3	36.5	30.7	-	
PG	340322	366989	48.1	31.2	43.3	35.1	32.8	33.2	N/A	35.7	N/A	37.9	43.5	47.2	38.8	32.6	-	
QRN	330565	378063	35.7	25.9	35.3	N/A	26.0	26.1	N/A	33.6	33.7	31.2	36.9	39.0	32.3	27.2	-	
RM	340291	367108	42.7	24.5	44.0	37.7	27.7	24.2	N/A	37.2	41.5	36.8	40.6	44.3	36.5	30.6	-	
RPS	367856	372667	45.9	32.8	49.1	33.3	28.2	23.4	N/A	30.9	36.3	38.6	43.6	41.2	36.7	30.8	-	
RR	340180	376338	36.4	31.3	36.9	34.8	30.6	30.5	N/A	36.2	35.1	34.2	35.1	41.0	34.7	29.2	-	
SA	340364	366929	37.5	27.7	43.7	31.5	24.1	23.5	N/A	30.8	36.9	34.8	35.2	44.2	33.6	28.2	-	
SAB	340838	366746	36.0	29.2	31.8	29.4	24.8	21.6	N/A	26.9	31.4	30.6	31.9	34.0	29.8	25.0	-	
SF	341238	366976	33.5	27.8	34.6	30.2	25.0	21.8	N/A	27.8	29.9	28.5	33.9	N/A	29.3	24.6	-	
SLW	339889	375755	26.8	18.0	34.3	N/A	18.5	15.9	N/A	22.6	27.0	20.9	25.4	31.8	24.1	20.3	-	
SMH	340243	366511	26.2	20.5	34.0	27.3	19.6	16.8	N/A	24.4	29.0	28.2	N/A	35.5	26.2	22.0	-	
SR	340435	376790	39.1	27.4	35.4	31.2	27.7	28.0	N/A	32.1	34.2	30.5	33.6	38.1	32.5	27.3	-	
ST	340794	366778	42.1	35.4	44.2	36.2	33.4	29.8	N/A	17.2	38.5	37.9	44.8	43.3	36.6	30.8	-	
SZ	341819	366475	37.8	24.5	27.7	N/A	26.3	22.1	N/A	32.8	36.4	28.8	31.2	39.2	30.7	25.8	-	
T11	341931	366458	34.5	25.3	34.0	27.6	22.2	17.6	N/A	25.6	27.5	26.8	28.7	34.6	27.7	23.3	-	
T44	342085	366446	42.5	32.0	46.1	34.8	27.9	27.5	N/A	34.1	37.6	37.5	39.3	39.6	36.3	30.5	-	
T6	341926	366446	47.2	37.0	50.7	41.0	32.7	30.9	N/A	39.4	42.5	44.1	46.2	47.7	41.8	35.1	-	
TA	344519	366898	34.2	29.6	41.8	37.1	29.3	26.0	N/A	32.0	32.1	N/A	N/A	37.5	33.3	28.0	-	

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan	Feb	Mar	Apr	May	Jun	Jul[11]	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
TB	341202	366470	35.9	25.8	40.2	N/A	29.4	N/A	N/A	29.8	N/A	N/A	N/A	36.2	32.9	24.2	-	
TBV	344013	366830	35.6	36.1	41.1	35.6	34.0	36.4	N/A	41.3	41.2	48.3	45.4	42.4	39.8	33.4	-	
UN	340357	366960	31.2	20.5	32.4	27.7	20.8	N/A	N/A	27.2	32.3	27.6	29.6	35.3	28.5	23.9	-	
VXR	343365	366694	30.2	23.7	37.5	25.5	22.2	17.4	N/A	24.6	26.8	27.4	28.3	34.5	27.1	22.8	-	
WCR	342951	366029	39.9	25.7	43.5	35.0	30.7	27.7	N/A	30.8	34.5	35.3	39.0	40.9	34.8	29.2	-	
WG	340217	366209	40.9	26.7	34.3	N/A	25.7	26.3	N/A	37.0	36.2	29.3	27.9	37.3	32.2	27.0	-	
WGW	340165	366198	35.7	21.3	32.1	31.5	24.9	23.1	N/A	34.4	36.7	24.8	24.8	32.2	29.2	24.5	-	
WH1	340196	376363	31.9	N/A	36.7	31.7	27.3	27.8	N/A	32.8	31.6	31.1	35.0	38.1	32.4	27.2	-	
WH2	340196	376363	29.4	N/A	35.0	29.8	27.0	27.7	N/A	32.7	31.0	31.5	33.8	38.8	31.7	26.6	-	
WH3	340196	376363	35.0	N/A	36.1	29.2	25.0	N/A	N/A	32.9	31.5	30.5	33.5	37.9	32.4	27.2	-	
WVC	365788	373744	29.7	N/A	28.0	18.5	14.9	12.2	N/A	17.6	20.1	21.1	24.9	29.0	21.6	18.2	-	
XR	343117	365949	31.9	24.8	33.3	26.5	23.2	20.6	N/A	24.2	26.2	25.5	27.5	29.6	26.7	22.4	-	

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

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

☒ **Local bias adjustment factor used.**

☒ **National bias adjustment factor used.**

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

☒ **Cheshire West and Chester confirm that all 2022 diffusion tube data has been uploaded to the Diffusion Tube Data Entry System.**

Notes:

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

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

See Appendix C for details on bias adjustment and annualisation.

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

New or Changed Sources Identified Within Cheshire West and Chester During 2022

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, 22 no. 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 LAQM Annual Status Report 2021 59 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 2022

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 2022 annual mean PM_{10} for the Osiris monitor was 14 µg/m^3 (data capture was 54%, which is below the recommended 75%). There was one day when the annual PM_{10} limit of 50 µg/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 µg/m^3 so the national objective of 25 µg/$m^3$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 AR037, 39, 40, 43, 45, 46, 49 and 50 (May 2020 to June 2022) Gradko achieved a satisfactory result of 75% or above. This dropped to 25% in round AR042 (Jan-Feb 2021) 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 2022 was Good = 33 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%. 2022 data from six non-automatic monitoring sites and one automatic monitoring site (FMH) were annualised, as shown in Table C.1. The Diffusion Tube Data Processing Tool was used for these calculations.

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

Site ID	Annualisation Factor, Crewe Copenhall	Annualisation Factor, Glazebury	Annualisation Factor, Wigan	Annualisation Factor, Wirral Tranmere	Average Annualisation Factor	Raw Data Annual Mean	Annualised Annual Mean
CRH	0.9798	0.9622	0.9886	0.9773	0.9770	21.3	20.8
CUD	1.0476	0.9790	1.0117	0.9749	1.0033	23.3	23.4
GE	0.9275	0.9428	0.9074	0.9455	0.9308	32.6	30.4
NIS	0.8634	0.8920	0.8903	0.8812	0.8817	28.7	25.3
OSQ	0.9840	1.0622	0.9982	1.0857	1.0325	33.9	35.0
TB	0.8578	0.8603	0.8794	0.9033	0.8752	32.9	28.8
FMH	0.9969	0.9753	1.0275	1.0406	1.0101	14.0	13.6

Diffusion Tube Bias Adjustment Factors

The diffusion tube data presented within the 2023 ASR have been corrected for bias using an adjustment factor. Bias represents the overall tendency of the diffusion tubes to under or over-read relative to the reference chemiluminescence analyser. LAQM.TG22 provides guidance with regard to the application of a bias adjustment factor to correct diffusion tube monitoring. Triplicate co-location studies can be used to determine a local bias factor based on the comparison of diffusion tube results with data taken from NO_x/NO_2 continuous analysers. Alternatively, the national database of diffusion tube co-location surveys provides bias factors for the relevant laboratory and preparation method.

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 C.2.

Table C.2 – Bias Adjustment Factor

Monitoring Year	Local or National	If National, Version of National Spreadsheet	Adjustment Factor
2022	National	06/23	0.84
2021	National	03/22	0.84
2020	National	06/21	0.81
2019	National	03/20	0.93
2018	National	03/19	0.93

NO_2 Fall-off with Distance from the Road

Wherever possible, monitoring locations are representative of exposure. However, where this is not possible, the NO_2 concentration at the nearest location relevant for exposure has been estimated using the Diffusion Tube Data Processing Tool/NO_2 fall-off with distance calculator available on the LAQM Support website. Where appropriate, non-automatic annual mean NO_2 concentrations corrected for distance are presented in Table B.1.

Table C.3 – NO_2 Fall off With Distance Calculations (concentrations presented in $\mu g/m^3$)

Site ID	Distance (m): Monitoring Site to Kerb	Distance (m): Receptor to Kerb	Monitored Concentration (Annualised and Bias Adjusted	Background Concentration	Concentration Predicted at Receptor	Comments
C36	1.4	1.9	36.4	11.3	34.8	

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.

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

As the automatic monitoring site FMH recorded a data capture of 69.3%, annualisation was required on this occasion. Details of the annualised data is shown in Table C.1.

NO_2 Fall-off with Distance from the Road

Wherever possible, monitoring locations are representative of exposure. However, where this is not possible, the NO_2 concentration at the nearest location relevant for exposure has been estimated using the NO_2 fall-off with distance calculator available on the LAQM Support website. Where appropriate, non-automatic annual mean NO_2 concentrations corrected for distance are presented in Table B.1.

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

Figure D.1 – Map of Monitoring sites and AQMA, Chester

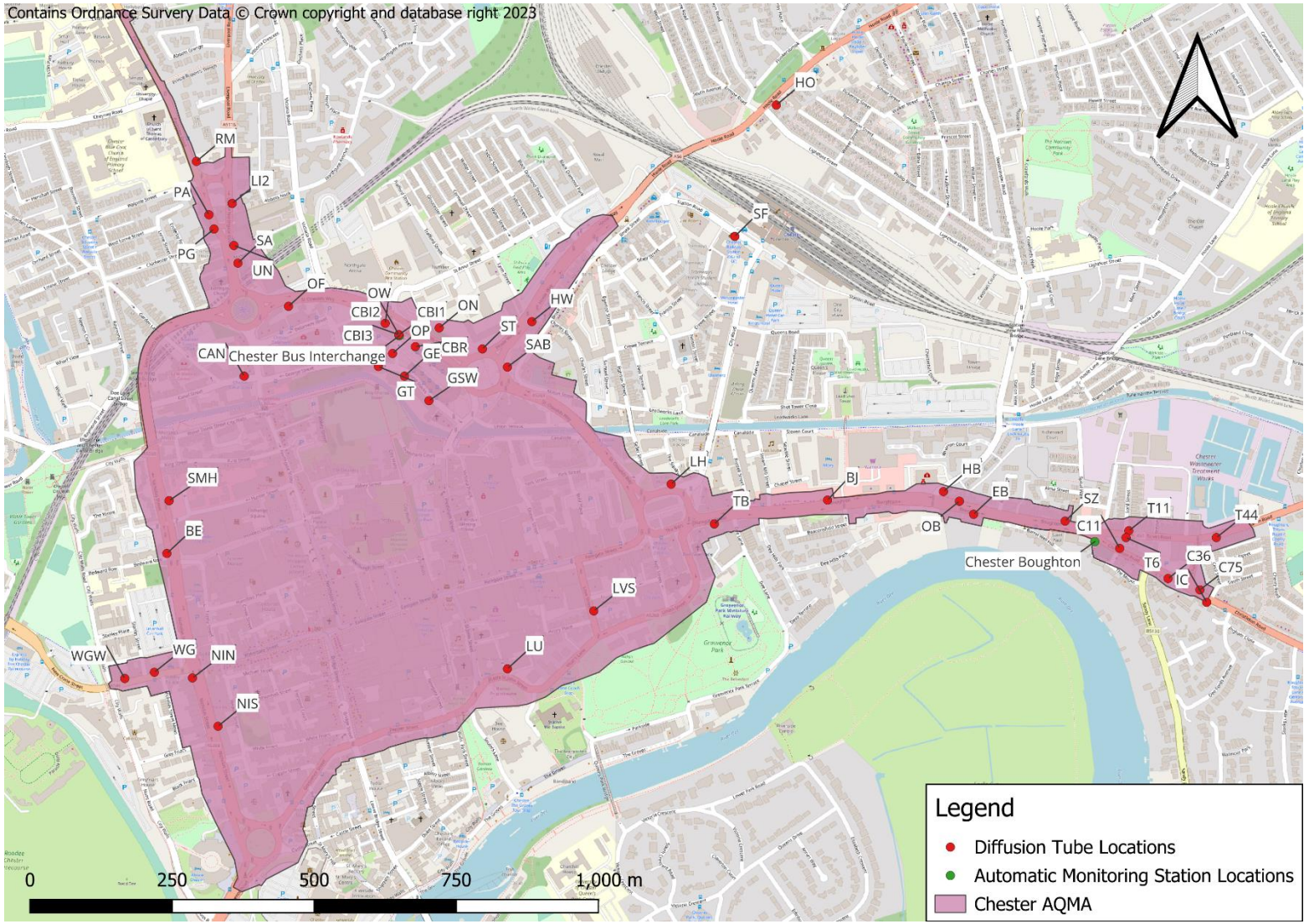


Figure D.2 – Map of Monitoring sites and AQMA, Ellesmere Port

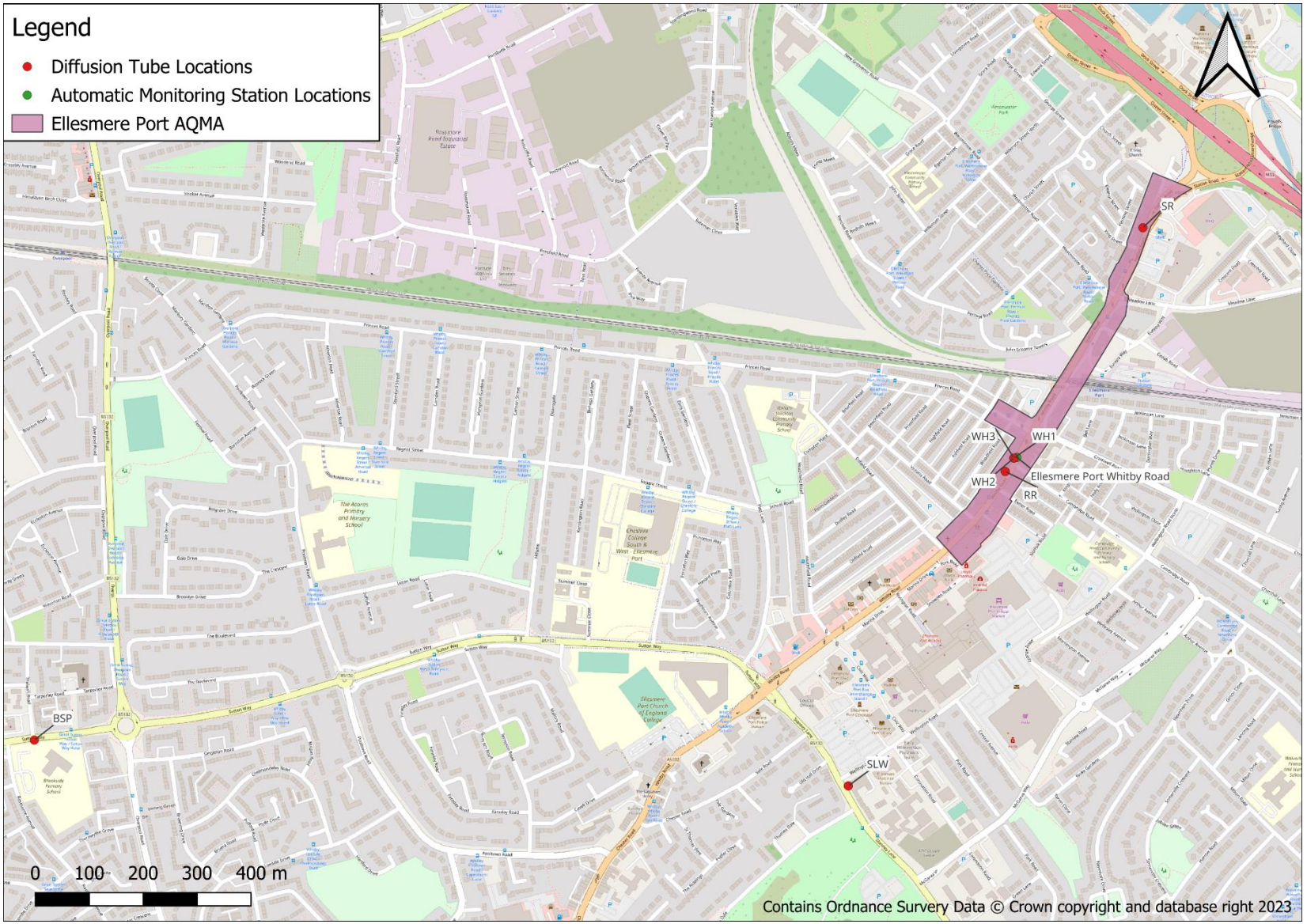


Figure D.3 – Map of Monitoring sites and AQMA, Frodsham

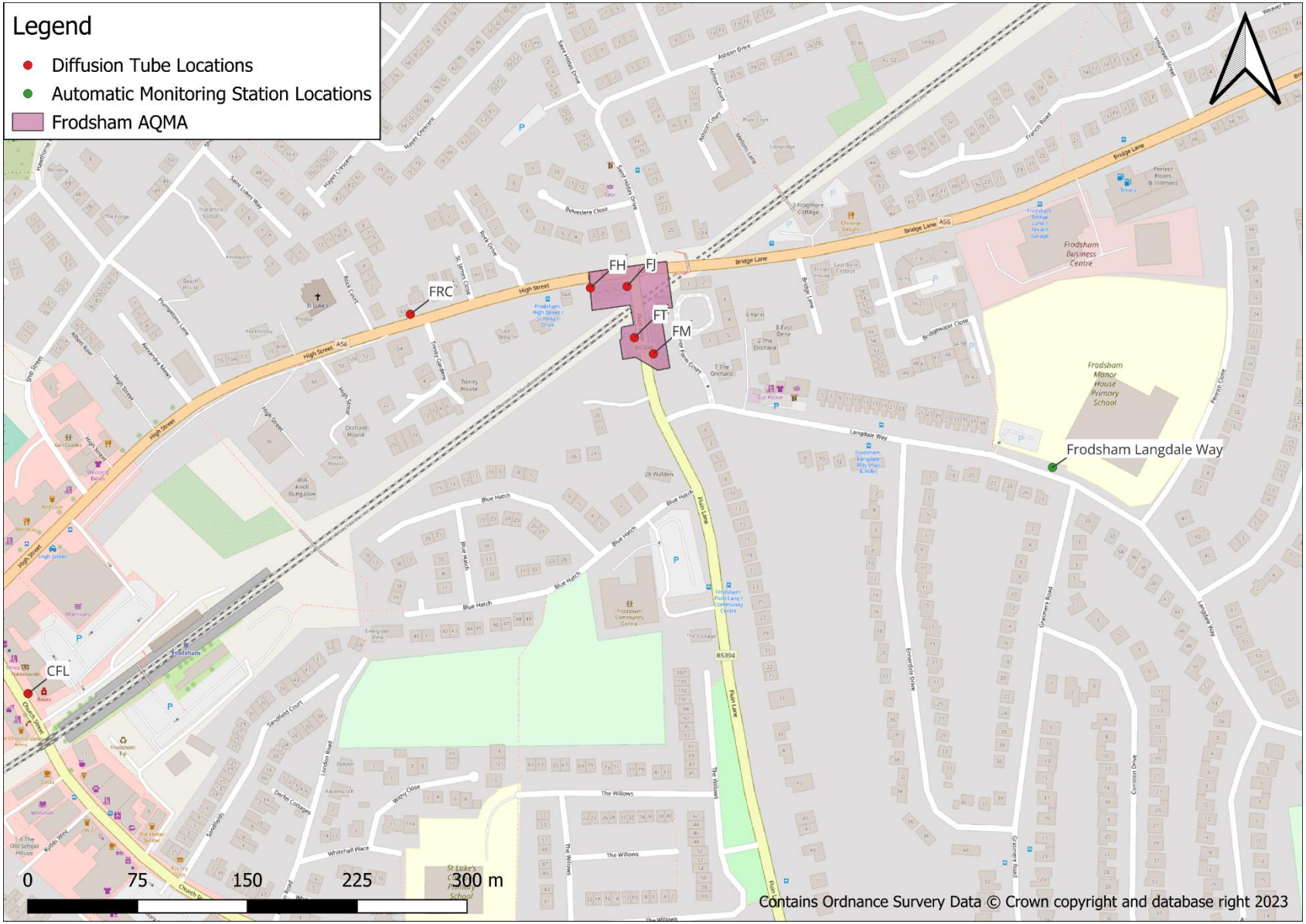


Figure D.4 – Map of Monitoring sites and AQMA, Thornton-le-Moors & Elton

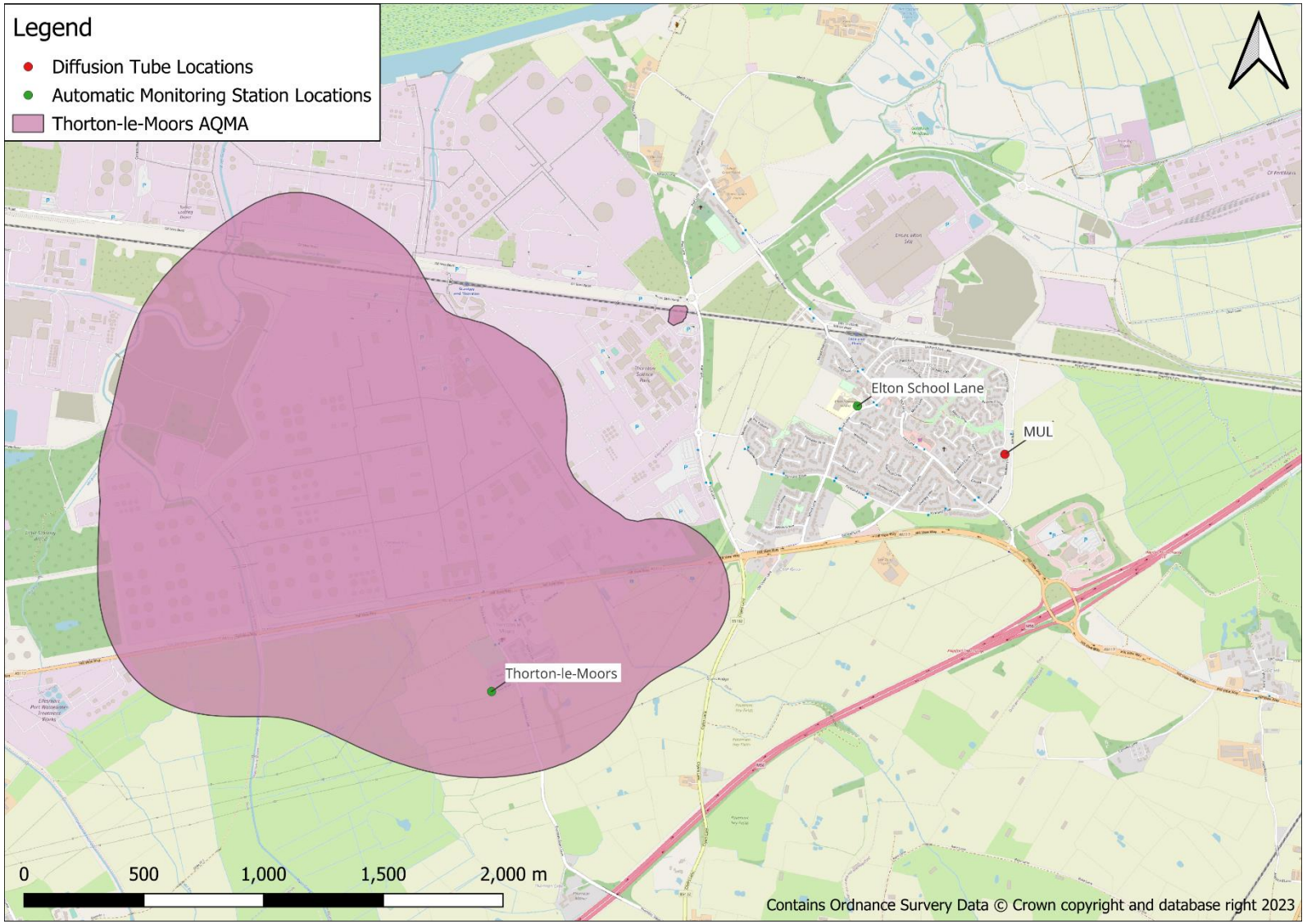


Figure D.5 – Map of Monitoring sites, Christleton / Littleton / Boughton Heath

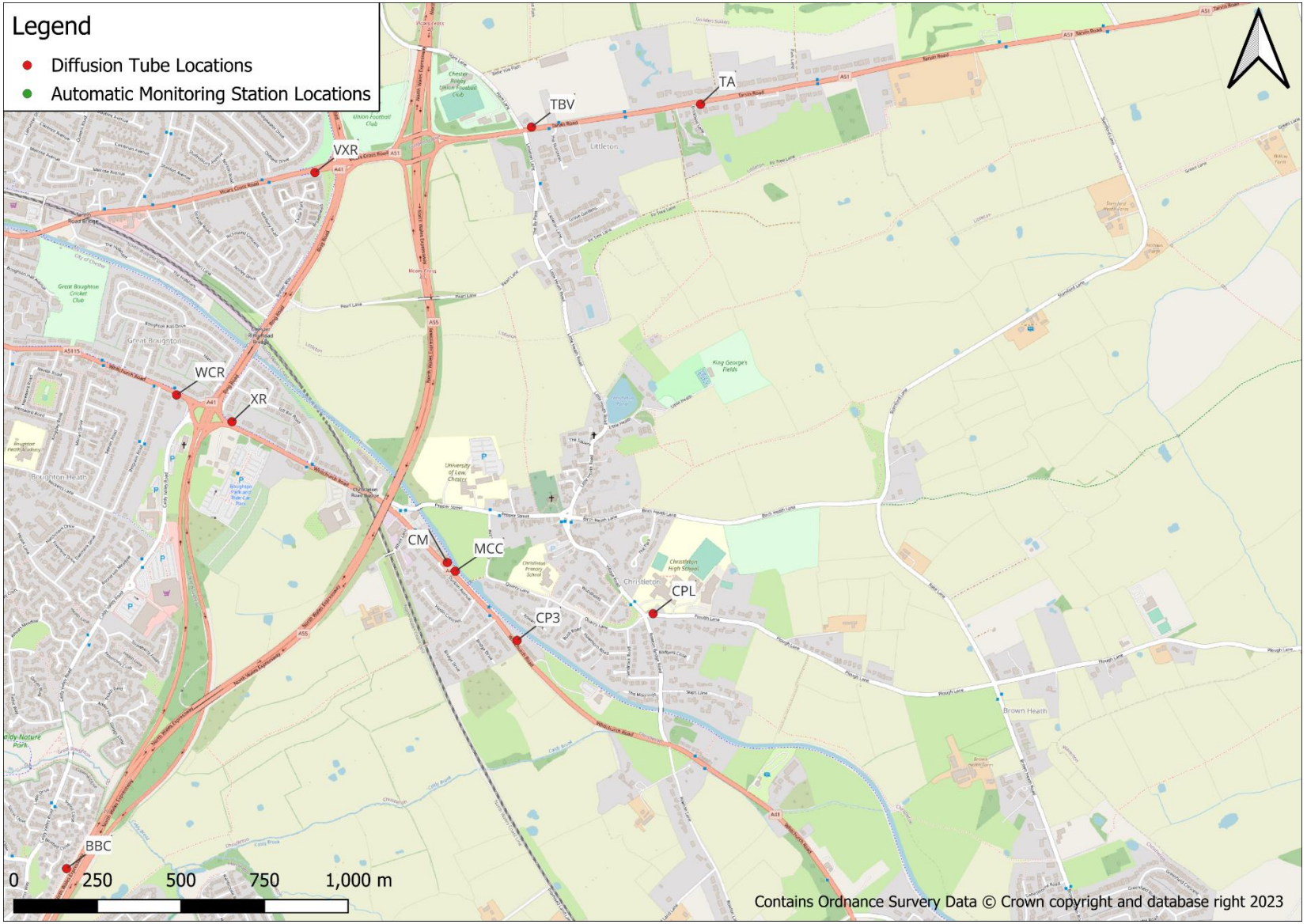


Figure D.6 – Map of Monitoring sites, Tarvin

Figure D.7 – Map of Monitoring sites, Neston

Figure D.8 – Map of Monitoring sites, Northwich

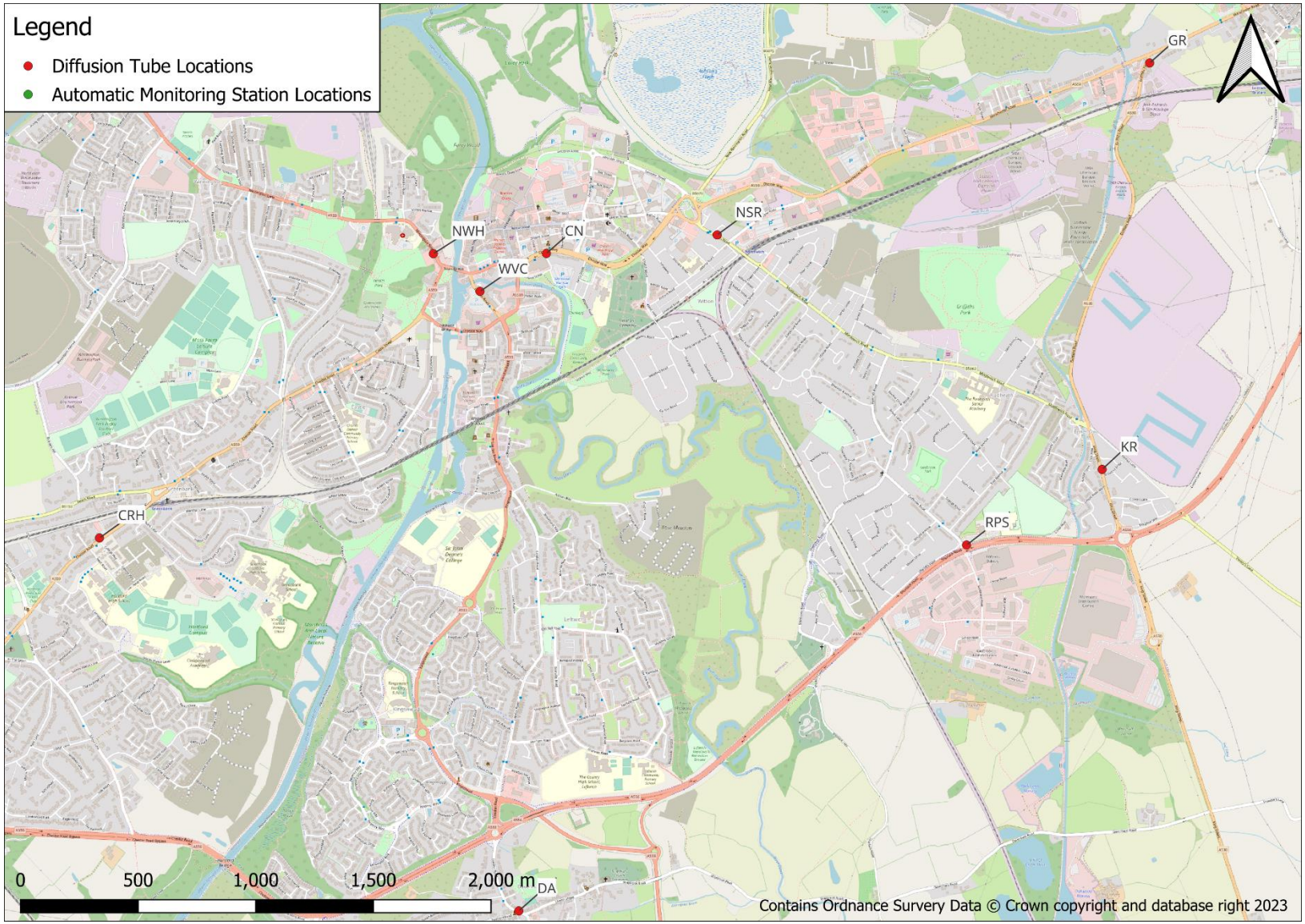


Figure D.9 – Map of Monitoring sites, Winsford

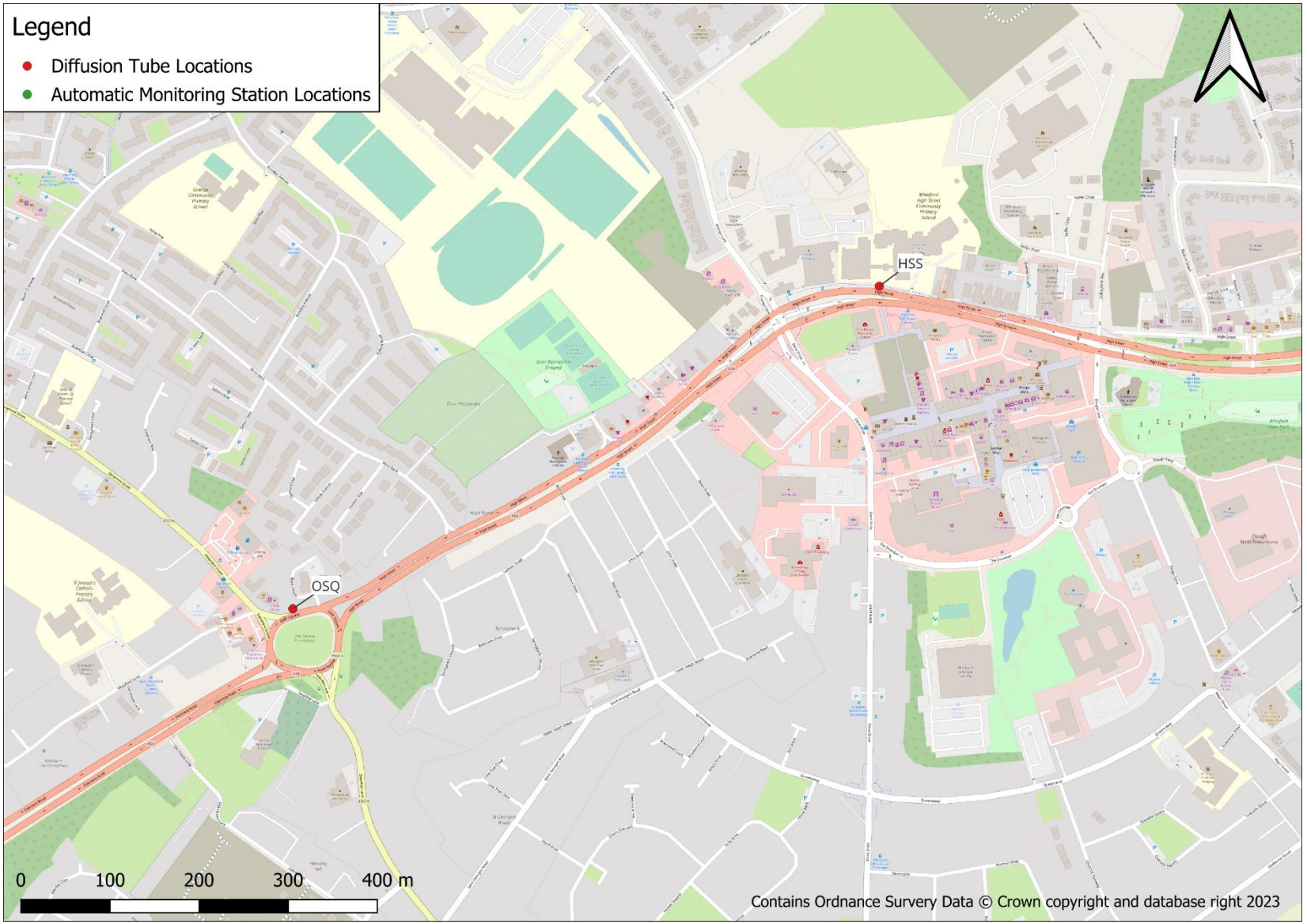


Figure D.10 – Map of Monitoring sites, Allostock

Figure D.11 – Map of Monitoring sites, Sproston

Figure D.12 – Map of Monitoring sites, A41 Long Lane / Greenfield Lane

Figure D.13 – Map of Monitoring sites, Cuddington A49

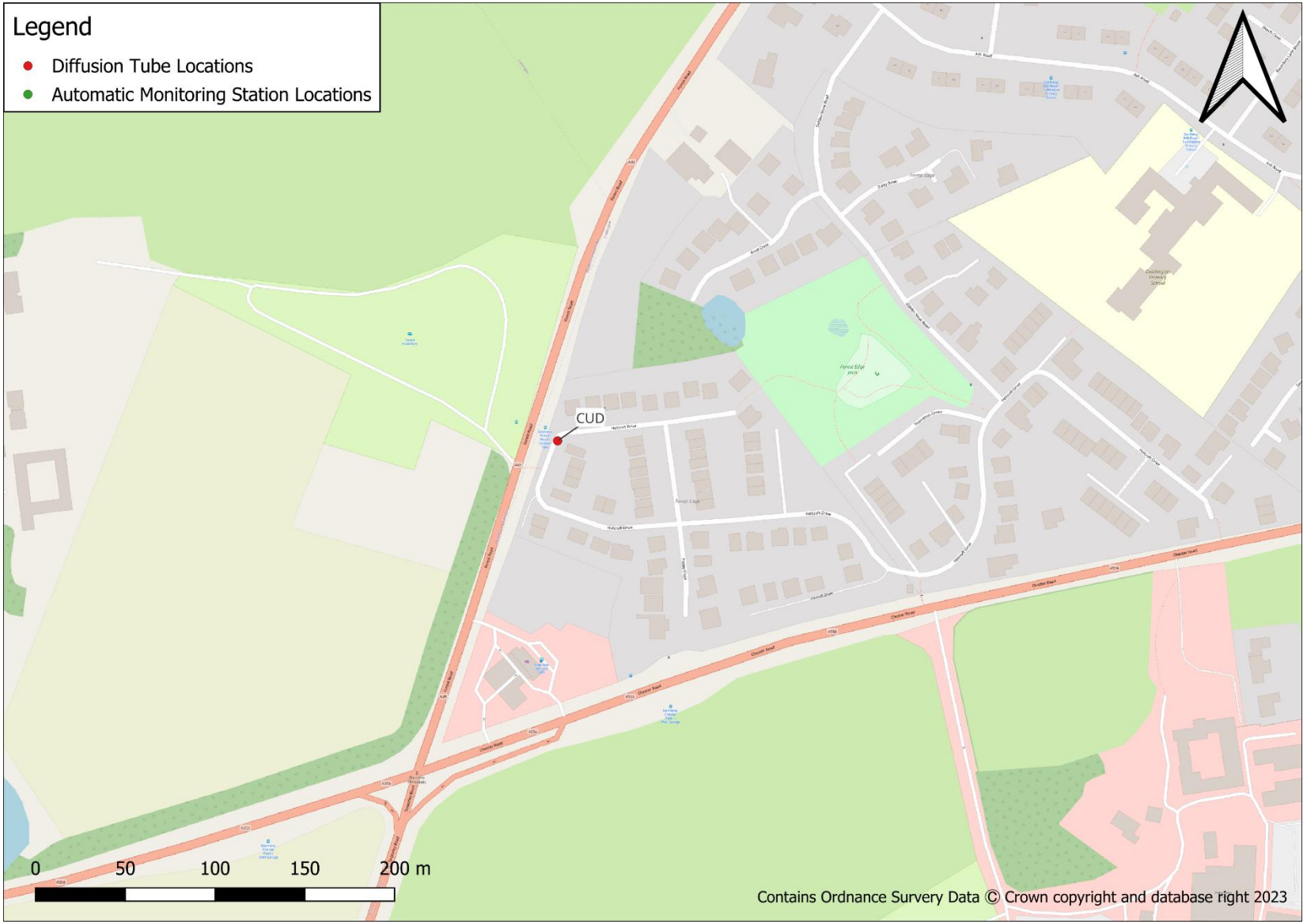


Figure D.14 – Map of Monitoring sites, Handbridge

Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England[12]

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

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

Glossary of Terms

Abbreviation	Description
ANPR	Automatic Number Plate Recognition
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
BIK	Benefit in Kind
BSIP	Bus Service Improvement Plan
CEF	Climate Emergency Fund
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by National Highways
EU	European Union
EVCPs	Electric Vehicle Charge Points
FDMS	Filter Dynamics Measurement System
LAQM	Local Air Quality Management
LCWIP	Local Cycling and Walking Infrastructure Plans
LEP	Local Enterprise Partnership
LES	Low Emissions Strategy
LTN	Local Transport Network
$\mu g/m^3$	Micrograms per cubic metre
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
ORCS	On-Street Residential Charge Point Scheme
P&R	Park and Ride
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

Abbreviation	Description
QA/QC	Quality Assurance and Quality Control
SCA	Smoke Control Area
SO_2	Sulphur Dioxide
TRO	Traffic Regulation Order
ULEVs	Ultra-Low Emission Vehicles

References

- Local Air Quality Management Technical Guidance LAQM.TG22. August 2022. 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.PG22. August 2022. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.