Staffordshire Moorlands District Council

Annual Status Report 2023

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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: July 2023

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Executive Summary: Air Quality in Our Area

Air Quality in Staffordshire Moorlands District Council

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

The mortality burden of air pollution within the UK is equivalent to 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].

Staffordshire Moorlands District Council (SMDC) is one of nine authorities that make up the County of Staffordshire. SMDC is located in the north of the region, with Stoke-on-Trent to the west and the Peak District National Park to the east.

The primary source of air pollution within SMDC is road traffic emissions from the major roads that cross the district as well as the local roads (A52, A520, A522 and A523) that connect the district's main population centres of Leek, Cheadle and Biddulph. Residential exposure to the increased pollutant concentrations caused by these emissions is the primary concern as there are a number of properties located within close proximity to the road network.

There are currently two Air Quality Management Areas (AQMAs) declared within the district in 2019. Both have been designated due to exceedances of the annual mean air quality objective (AQO) for nitrogen dioxide (NO_2). The AQMAs are:

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

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

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

- AQMA No.1, Leek, which encompasses sections of the A523, A53, A520 and A523; and
- AQMA No.2, Cellarhead, containing sections of the A52 and A520.

In 2022, Staffordshire Moorlands District Council undertook no automatic (continuous) monitoring and undertook non-automatic (passive) monitoring for NO_2 at 43 sites across the district. 20 of these sites were located within AQMAs – 12 in AQMA 1: Leek and eight in AQMA 2: Cellarhead. The current monitoring locations are constantly reviewed with respect to any hotspot area(s) of pollution being identified. In 2022, the SMDC incorporated 4 new sites (62 to 65) to the passive monitoring network in response to public queries regarding air quality.

There were no reported exceedances of the annual mean NO_2 objective of 40µg/m^3 at any of the 43 monitoring locations during 2022. The maximum concentration reported was 35.7µg/m^3 at site 38, which is within AQMA No.2, Cellarhead, at the A520 (Leek Rd). An increase in NO_2 concentrations was recorded at 31 sites. This is likely due to the recovery of traffic activities from impacts of the Covid-19 pandemic as national health management measures were still in place until March 2021. The recorded 2022 NO_2 concentrations remain below those recorded in 2019.

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

The revised AQAP is in preparation. A conservative revised detailed assessment and source apportionment exercise has been completed (Appendix F: Detailed Modelling Study) and established that the current AQMAs should remain in place, and monitoring expanded in some instance. A provisional set of additional measures have been identified to discussed within the steering group (Appendix F: Detailed Modelling Study).

Unfortunately, the setting up of the steering groups was in part delayed due to Council elections in early May, purdah and the change of administration.

The steering groups are now in the process of being set up with a view to meeting to discuss the proposed measures, with a view to publishing the full strategy by the 4th Quarter of 2023.

SMDC has taken forward a number of measures during the reporting year of 2022 in pursuit of improving local air quality:

Air Aware Project

The Air Aware Project was set up in 2019 and is joint project between SMDC, Staffs County Council, Cannock Chase District Council and East Staffordshire Borough Council supported by a Defra grant, and Council funding.

The goal of the Air Aware project is to raise awareness of air quality issues across the district with a focus on the schools and community (small businesses) engagement and the development of joint Electric Vehicle strategy for the whole of Staffordshire and Stoke on Trent.

The school engagement in has targeted areas where school traffic impacts on AQMA areas, in Leek and Cellarhead. Engagement includes:

- Providing School assembles on air quality, and access to promotional material,
- Active travel campaigns through an academic annual calendar,
- Accreditation of schools through STARS travel planning,
- Anti-idling campaigns to get parents to “switch off when they drop off”,
- Provision of walking bus co-ordinators, and
- Air Quality promotions

In 2022 there were 8 schools in Leek that are were engaged in the Air Aware Scheme, of these:

- 5 schools have initiated travel plans travel plans and another 3 without a travel plan (8 total).
- Of the 5 schools with travel plans, 2 schools achieved Silver standard and 2 bronze whilst one is working towards bronze.
- Engaged with around 2,000 pupils in total through assemblies and campaigns.

- At one school in Leek, 6th form pupils engaged with the whole school and the community to raise awareness of air pollution, including a study in Leek town measuring AQ and lessons in school.
- In March, an anti-idling campaign targeting schools and businesses took place. All schools engaged with the anti-idling promotion, displaying anti idling signs around the schools.
- All schools in AQMA's took part in the walk to school month, which took place in October 2022.
- We are coordinating with schools in developing a new parking Campaign which will be pupil led to promote active travel and reduce problem parking.

The business engagement has targeted areas where business traffic impacts on AQMAs and offers businesses a variety of options for engagement with the Air Aware team, based on their size, location and contribution to the local issue.

In 2022, 11 Businesses around Leek were engaged with the Air Aware project. Of these, two had completed travel plans and were on course to achieve bronze status.

Several of these businesses took part in the March anti idling campaign including of Ornua foods, one of Leeks largest employers, who handed out 250 anti-idling driver packs to their supplier's delivery drivers and displayed anti idling signs around the site.

Anti-Idling Campaign March 2022, Ornua Foods, Leek.

Staffordshire Live Labs – Cellarhead AQMA

Staffordshire Live Labs is a £1.95 million programme, funded by Department for Transport through ADEPT (Association of Directors for Economy, Environment, Planning and Transport). The programme has created a challenge fund for SMEs to bid into to trial and test innovative solutions to help solve the 2 challenges faced in Staffordshire – improving air quality and mobility.

At the Cellarhead junction an innovation to use fibre cables has been instigated that to detect vibrations from vehicles and pedestrians, using this data to monitor and detect traffic queues developing at the Cellarhead crossroad and relate this for real time (indicative) AQ monitors.

The project was initiated in 2020 and has continued through to 2022, early results indicate the system can be used to detect the movement of vehicles approaching a junction and priorities their movement to improve AQ. The projected finished in 2022, with the final AQ impact report expected towards the end of 2022. Unfortunately, the report has not been published yet.

In House – lead by example measures

The major actions included:

- A Climate Change Action plan was published; outlining the in house measures the council is taking to reduce CO_2 and other emissions from Council. Including:
    - Reduction of emissions from Council vehicles and Council related activity;
    - A new Asset Management plan will include energy and water efficiency technologies, revised operation schedules and potentially renewable energy in our own building;
    - All council reports now have climate listed as a consideration; and
    - The Council is engaged with a number of key agencies to assist with the development of plans including The Midlands Energy Hub, the Energy Saving Trust and Keele University.
- Agile Working Policy was implemented in 2022, that essentially allows staff to work from home more easily and cut down on travel. Remote meetings are now commonplace within the SMDC. Staff home working and increased use of virtual meetings have reduced staff business miles by over 60%.
- The Council partnered with and funded Staffordshire Wildlife Trust to assist in the development of the Green Infrastructure Delivery Plan. The project with the Wildlife

Trust has already identified some potential projects to improve rural green corridors working with some of our community groups.

- A Green Network of community groups and the community fund have both been established, amongst other things, to support communities enhance nature in their area. This includes the development of new or expanding orchards and native tree planting.
- The council's revised procurement policy has been designed to embed sustainability and low carbon and emissions considerations into decision making on goods and services. This will be rolled out to staff with procurement responsibilities.
- The council has achieved the Carbon Literacy Bronze in climate change awareness.
- Applications to the Public Sector Carbonisation Fund has been made for funding to improve energy efficiency and add some renewable generation to two leisure centres.
- The council applied to the Low Carbon Skills Fund for support in developing bespoke, holistic site-specific decarbonisation reports.
- Cycle to work scheme available.

Fleet Update

The Energy Saving Trust has assessed the councils fleet vehicles used to deliver council services and made recommendations. The majority of the fleet comply with highest EURO emission standard with the rest completed by 2023.

Whilst some of the recommendations are embedded into planned phasing out of fleet, some of the advice was not wholly and trials of electric vehicles in 2021 were unsuccessful. However, the waste vehicles used by our strategic partners are now operate on hydrogenated vegetable oil (HVO) which reduces the greenhouse gas emissions and has other benefits for air quality.

The Grey Fleet, which is the use of personal vehicles by staff and councillors for council business, is to be assessed.

The council are exploring a salary sacrifice scheme for interested staff to move to an electric vehicle, and the possibility of further procurement of LEV pool car that would be available for staff. In addition, workplace EV charge points are planned for sites.

EV Update

Staffordshire Moorlands published its EV strategy in 2022. This document analyses various aspects related to EV charging demand including policy, funding and technology that will impact the charging infrastructure network. The strategy identifies five types of charging solutions: EV charging hubs, EV forecourts, on street charging, residential off-street charging, and off street charging. The document also identified general areas in the Staffordshire Moorlands that should be taken into account for charging infrastructure, along with the best options for meeting both the present and future demand.

Implementation of the strategy is due to commence in 2023.

Conclusions and Priorities

During 2022, no exceedances of the NO_2 annual mean objective were recorded within Staffordshire Moorlands. NO_2 concentrations within the AQMAs, monitored via diffusion tubes, were higher at most of the sites (14 out of 19 sites) than concentrations measured at the same locations during 2021 but lower to 2019 and pre pandemic levels.

In relation to the two existing AQMAs, it is recommended that both Leek and Cellarhead remain in force, as monitoring sites within both AQMAs have recorded exceedances of the annual mean objective in 2018 and 2019 within the past five years. 2020 and 2021 where under the impact of the Covid-19 pandemic. It is hypothesized that the Covid-19 pandemic is having long term impacts on transport patterns and air pollution. The extent of it is still unclear. The SMDC will continue to monitor and evaluate the NO_2 annual average concentrations during the forthcoming years.

As highlighted above, SMDC are currently in the process of developing a new AQAP. Due to the impacts of Covid-19 and the resulting reallocation of Council resources during 2020 and 2021, the development and implementation of the AQAP has been slightly delayed. Current estimates are that the AQAP will be prepared and sent out for draft consultation during 2023.

Local Engagement and How to get Involved

The public can engage with SMDC via the local air quality website which contains further local information on the following:

- Air quality monitoring;

- Declared AQMAs;
- Smoke control areas; and
- Wood burning stoves.

Additional information can also be found on the Staffordshire County Council website, which discusses:

- What is air quality?
- What pollution is there?
- What can you do?
- Support for businesses via travel plans, sustainable travel tool-kits, support setting up a pool bike scheme, cycle and walking maps, and cycle training
- Support for schools:
    - Curriculum linked activities and lesson plans;
    - Modeshift Stars travel planning tool;
    - Calendar of campaigns;
    - Cycle training;
    - Parent engagement and attending school events such as assemblies, school fairs and parent's evenings to provide information;
    - Regular newsletters; and
    - Competitions, activities and rewards.

SMDC is also currently involved in the Air Aware project in collaboration with neighbouring Staffordshire authorities, contributing to the Air Aware website which provides downloadable materials and further information on:

- Funding;
- Volunteering;
- Small actions that can make a big difference, such as:
    - Turning your car off;
    - Car sharing;
    - Getting on your bike (or scooter);
    - Walking;
    - Getting your car serviced;
    - Working smarter;
    - Using public transport;
    - Zero and low carbon vehicles; and

- Renewable home energy sources.

Local Responsibilities and Commitment

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

- Communities and Climate Change
- Asset Management
- Service Commissioning

This ASR has been approved by:

- Alicia Patterson – Head of Environmental Health

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

Daniel McCrory, Principal Pollution Officer. Environmental Health department.

This ASR has been approved by:

This ASR has been signed off by Dr Richard Harling, Director of Health and Care

Staffordshire County Council.

If you have any comments on this ASR please send them to Daniel McCrory at:

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Endorsement from the Director of Health & Care, Staffordshire County Council

Staffordshire County Council (SCC) is committed to working with partners to ensure that Staffordshire will be a place where improved health and wellbeing is experienced by all. Poor air quality has a negative impact on public health, with potentially serious consequences for individuals, families, and communities. Identifying problem areas and ensuring that actions are taken to improve air quality forms an important element in protecting the health and wellbeing of Staffordshire residents. Improving air quality is often a complex issue, presenting a multi-agency challenge – so it is essential that all agencies work together effectively to deliver improvements where they are needed.

As Director of Health and Care across Staffordshire I endorse this Annual Status Report which sets out the position in all the Local Authorities across Staffordshire and Stoke-on-Trent focusing on human made pollution with particulate matter.

The Air Aware project "phase 2" ran until March 2023 with Defra Funding. The Air Aware project continues with joint funding from Staffordshire Public Health and Connectivity Teams to March 2025. The project delivers behaviour change to increase active travel, decrease car use, and raise awareness of air quality issues through five elements. These are business and school engagement, communications and campaigns, electric vehicles, and air quality monitoring in three targeted locations, Burton, Leek, and Cannock. Campaigns include Anti-Idling, walking and cycle activities and Clean Air Day. These have been countywide engaging a large number of businesses and schools. The programme focuses on reducing levels of NO and PM, which are monitored at key locations.

A number of the Staffordshire Authorities are currently involved in implementing measures to reduce levels of NO_2 within their areas, which are detailed elsewhere in their ASR. Since the update of the Environment Act 2021 there is now a statutory duty imposed on Local Authorities in England to reduce $PM_{2.5}$, a number of the measures are complementary with those being undertaken to reduce NO_x. A mapping exercise completed by the Staffordshire Air Quality Forum members details the measures currently in place which are considered to have an impact in reducing $PM_{2.5}$ within the County. These can be viewed in Table 2-5.

In addition, levelling up Fund 2 Schemes will improve a number of major roads around the county, reduce journey times, put greener, cleaner buses on main roads, improve walking and cycling routes and reduce the impact of housing and commercial developments. They will benefit East Staffordshire, Cannock Chase, and Stafford Borough. Total package cost circa £20m.

Finally, Officers from Newcastle Borough Council, Stoke City Council and Staffordshire County Council are jointly working under Ministerial Direction to improve transport related air pollution in North Staffordshire.

Dr Richard Harling

Director of Health and Care

Staffordshire County Council

[6th June 2023]

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1 Local Air Quality Management

This report provides an overview of air quality in Staffordshire Moorlands District Council 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 Staffordshire Moorlands District Council to improve air quality and any progress that has been made.

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

2 Actions to Improve Air Quality

2.1 Air Quality Management Areas

Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely exceedance of an air quality objective. After declaration, the authority should prepare an Air Quality Action Plan (AQAP) within 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 Staffordshire Moorlands District Council can be found in Table 2-1. The table presents a description of the two AQMAs that are currently designated within Staffordshire Moorlands District Council. Appendix D: Maps of Monitoring Locations and AQMAs provides maps of AQMAs and also the air quality monitoring locations in relation to the AQMAs. The air quality objectives pertinent to the current AQMA designations are as follows:

- NO_2 annual mean.

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
SMDC AQMA No.1: Leek	30/07/2019	NO_2 Annual Mean	The area encompasses the main travel routes through leek and incorporates the following sections of roads; • A523; from the A523 Macclesfield Rd/ Grace Rd Junction, through to A523 Ashbourne Road / Springfield Rd Junction. • A53; from the A53 Broad Street / Junction Rd, junction through to A53 Buxton Rd / Springfield Road Junction. • Springfield Road. • A520; from A520 St Edward Street /A523 Stockwell Street junction through to the A520 / Condlyffe Road Junction	NO	45.3 $\mu g/m^3$	34.4 $\mu g/m^3$	3 years	Ongoing, provisional measure and progress provided in Section 2.2	Ongoing

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
SMDC AQMA No. 2: Cellarhead	30/07/2019	NO_2 Annual Mean	The area encompasses the area known locally as the Cellarhead crossroads, which is a busy junction between the A52 and the A520. The AQMA extends 250m (A520) North, 230m South (A520), 480m East (A52) and 210m West (A52) of the junction	NO	51.1 µg/m^3	35.3 µg/m^3	3 years	Ongoing, provisional measure and progress provided in Section 2.2	Ongoing

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

☒ **Staffordshire Moorlands District Council confirm that all current AQAPs have been submitted to Defra.**

2.2 Progress and Impact of Measures to address Air Quality in Staffordshire Moorlands District Council

Defra's appraisal of last year's ASR concluded that "*the report is well structured, detailed, and provides the information specified in the Guidance*". Additional comments made are as follows:

1. *"Comments from the 2020 ASR appraisal have been included within the ASR and have been acted upon.*
2. *There is a detailed discussion of $PM_{2.5}$ in the district including the value from Defra background maps, the fraction of mortality attributable to particulate emission from Public Health England and a significant list of measures being undertaken to address $PM_{2.5}$ concentrations as well as clearly station which measures from Table 2.2 will also help to reduce $PM_{2.5}$. This is appreciated.*
3. *There is no clear identification or discussion of priorities or proposed future actions for the coming year aside from the overdue AQAP.*
4. *An AQAP has still not been produced for the AQMA's declared in 2019.*
5. *There is a good discussion of trends observed which is broken down into each AQMA and outside of the existing AQMA as well as presentation of this data.*
6. *The Air Aware Project is a good example of local engagement and very detailed information is provided; this is encouraged.*
7. *The Appendix includes clear maps showing the location of the diffusion tube monitoring locations and the AQMAs."*

SMDC has taken forward a number of direct measures during the current reporting year of 2022 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2-2. 29 measures are included within Table 2-2, with the type of measure and the progress SMDC have made during the reporting year of 2022 presented. Where there have been, or continue to be, barriers restricting the implementation of the measure, these are also presented within Table 2-2.

The revised AQAP is in preparation. A conservative revised detailed assessment and source apportionment exercise has been completed (Appendix F: Detailed Modelling Study) and established that the current AQMAs should remain in place, and monitoring expanded in some instance. A provisional set of additional measures have been identified to discussed within the steering group (Appendix F: Detailed Modelling Study).

Unfortunately, the setting up of the steering groups was in part delayed due to Council elections in early May, purdah and the change of administration.

The steering groups are now in the process of being set up with a view to meeting to discuss the proposed measures, with a view to publishing the full strategy by the 4th Quarter of 2023.

Both AQMAs withing SMDC have been compliant for the past 3 years reported (2020 to 2022). Due to the nature of 2020, 2021 and the impact of the COVID-19 pandemic restrictions on traffic volumes, and air quality, there is uncertainty with regard to whether 2020 and 2021 monitoring data will be considered an outlier when compared to the normal pollution trends until the long-term impacts are better understood. Further studies into the long-term impacts are required to fully determine the influence of the Covid-19 pandemic on air quality.

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	*New* Development of an Electric Vehicle strategy (County)	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	2019/2020	2023	SMDC/ Staffordshire County Council (SCC)	SCC/ SMDC/ Defra Grant	YES	Fully Funded		Implementation	Reduced emissions from vehicles	TBC - No of Charge Points	Renewed EV strategy Published in 2022	https://www.staffordshire.gov.uk/Transport/Sustainable-travel/Electric-vehicles/02-SCC-Public-EV-Charging-Strategy-V3-3.pdf
2	New Development of an Electric Vehicle strategy Staffordshire Moorlands	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	2022	2024	SMDC	SMDC	NO	Fully Funded		Implementation	Reduced emissions from vehicles	TBC - No of Charge Points	Strategy is being reviewed to ensure it compliments new SCC strategy and available funding sources (LEVI)	https://democracy.staffsmoorlands.gov.uk/documents/s32243/SM-Public-EV-Charging-Strategy-V1_Final_15.09.22.pdf
3	Installation of EV charge points at Council owned Car Parks	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	2022	2024	SMDC	SMDC/ Defra Grant	NO	Fully Funded		Implementation	Reduced emissions from vehicles	TBC	Installation delayed as Strategy is being reviewed to ensure it compliments new SCC strategy and available funding sources (LEVI)	
4	Incentivise parking for low emission vehicles	Promoting Low Emission Transport	Emission based parking or permit charges	2022	2024	SMDC	None	NO	Not Funded		Implementation	Reduced emissions from vehicles	TBC	Parking review being undertaken for the district	
5	Continue to promote and increase the installation of EV charging points through development control processes	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	2015	Operational	SMDC	None	NO	Not Funded			Reduced emissions from vehicles	increased installation of EV charging points	EV charging points are conditioned through the planning process, this is to be strengthened by the implementation of Air Quality supplementary planning document	

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
6	Deployment of Fotec Traffic Management Solutions at Cellarhead Crossroads	Traffic Management	Control systems, Congestion management, traffic reduction Urban Traffic	2020	2022	Amey/ SCC/ Keele University/ SMDC	Department for Transport through ADEPT.	NO	Funded		Implementation	Reduced emissions from vehicles	Reduction in traffic congestion	Project Completed in 2022, awaiting final results.	https://www.amey.co.uk/amey-consulting/news-and-case-studies/2021/march/staffordshire-county-council-and-amey-monitor-air-quality-ahead-of-innovative-trials/
7	Review of junctions in Leek and Cellarhead	Traffic Management	UTC, Congestion management, traffic reduction	Not yet commenced	Not yet commenced	SCC	SCC Capital Highways Programme	NO	Funded		Planning	Reduced emissions from vehicles	Reduction in traffic congestion	Not yet commenced	
8	Business Travel; Planning	Promoting Travel Alternatives	Workplace Travel Planning	2018/ 2019	Operational	SMDC/ SCC	SCC/ SMDC/Defra Grant	YES	Funded		Implementation	Reduced emissions from vehicles	No of Business Travel Plans approved & adopted	Quantitative appraisal is on-going	https://www.staffordshire.gov.uk/DoingOurBit/Get-Inspired/Clean-green-and- safe/Air-aware/Air-aware.aspx
9	Car share scheme	Promoting Travel Alternatives	Car and lift sharing schemes	2018/ 2019	Operational	SMDC/ SCC	SCC/ SMDC/Defra Grant	YES	Funded		Implementation	Reduced emissions from vehicles	No of users registered	Quantitative appraisal is on-going	https://share-a-lift.co.uk/
10	School Travel Planning	Promoting Travel Alternatives	School Travel Plans	2018/ 2019	Operational	SMDC/ SCC	SCC/ SMDC/Defra Grant	YES	Funded		Implementation	Reduced emissions from vehicles	No of Schools Travel Plans approved & adopted	Quantitative appraisal is on-going	https://www.staffordshire.gov.uk/DoingOurBit/Get-Inspired/Clean-green-and- safe/Air-aware/Air-aware.aspx
11	School based educational activities	Promoting Travel Alternatives / Public Information	Other	2018/ 2019	Operational	SMDC/ SCC	SCC/ SMDC/Defra Grant	YES	Funded		Implementation	Through public awareness	No of schools engaged	Quantitative appraisal is on-going	https://www.staffordshire.gov.uk/DoingOurBit/Get-Inspired/Clean-green-and- safe/Air-aware/Air-aware.aspx
12	Anti-idling initiatives in an educational & Business setting	Public Information	Other	2018/ 2019	Operational	SMDC/ SCC	SCC/ SMDC/Defra Grant	YES	Funded		Completed	Reduced emissions from vehicles	N/A	Quantitative appraisal is on-going	https://www.staffordshire.gov.uk/DoingOurBit/Get-Inspired/Clean-green-and-safe/Air-aware/Air-aware.aspx

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
13	Communication initiatives, e.g. website information updates	Public Information	Other	2017/18	Operational	SCC / SMDC	SCC / SMDC/Defra Grant	YES	Funded		Implementation	Through public awareness	New website	Implementation is on- going	https://www.staffordshire.gov.uk/DoingOurBit/Get-Inspired/Clean-green-and- safe/Air-aware/Air-aware.aspx
14	Encourage taxis licensed by the Council to comply with vehicle emission limits	Promoting Low Emission Transport	Taxi Licensing conditions	2022	2023	SMDC	SMDC	NO	Funded		Implementation	Reduced emissions from vehicles	Number of LEV Taxis in the fleet. All licensed taxis should meet minimum emission standard	Out to consultation with a view to adoption in 2023	https://democracy.highpeak.gov.uk/documents/b7626/Taxi%20Licensing%20Policy%20Review%20and%20consultation%2001st-Apr-2022%2010.00%20Licensing%20Regulatory%20Committee.pdf?T=9
15	Support the procurement of greener fleet	Vehicle Fleet Efficiency	Fleet efficiency and recognition schemes	2019	Not known	SMDC	SMDC	TBC	TBC		Implementation	Reduced emissions from vehicles and buildings	Number of LEV in the fleet	Green Fleet Review is on going	Energy Saving Trust have completed the assessment of our fleet and make recommendations to consider in fleet management www.staffsmoorlands.gov.uk/media/6671/Climate-change-action-plan/pdf/SM_Climate_change_plan.pdf?m=1625822514590
16	EcoStars Fleet Recognition Programme	Vehicle Fleet Efficiency	Fleet efficiency and recognition schemes	2015	2022	SMDC and Transport & Travel Research Ltd	SMDC/ Defra Grant	YES	Funded		Implementation	Reduced fuel consumption	Reduced fuel consumption	Quantitative appraisal is on-going	www.ecostars-uk.com
17	Review SMDC Local Plan Policy SD4	Policy Guidance and Development Control	Other policy	2020	2024	SMDC	SMDC	TBC	TBC		Implementation	Reduced emissions from vehicles and buildings	TBC	Implementation is on- going	
18	Review SMDC Local Plan Policy T1	Policy Guidance and Development Control	Other policy	2020	2024	SMDC	SMDC	TBC	TBC		Implementation	Reduced emissions from vehicles and buildings	TBC	Implementation is on- going	

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	Review SMDC Local Plan Policy DC1	Policy Guidance and Development Control	Other policy	2020	2024	SMDC	SMDC	TBC	TBC		Implementation	Reduced emissions from vehicles and buildings	TBC	Implementation is on- going	
20	Staffordshire Air Quality Forum	Policy Guidance and Development Control	Regional Groups Co-ordinating programmes to develop Area wide Strategies to reduce emissions and improve air quality	On-going	On-going	County-wide	-	TBC	TBC		Implementation	N/A	Full engagement across the group / regular meetings	On-going	-
21	Use of the planning regime to minimise impact of new developments on AQMAs	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	On-going	2023	SMDC/Staffordshire AQ Forum	SMDC	TBC	TBC		Implementation	Published Supplementary Planning Document (SPD)	SPD implemented	Draft SPD produced currently being reviewed by Staffs Air Quality Forum	
22	Integration of air quality into all relevant council policies and documents	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	2020	2024	SMDC	SMDC	TBC	TBC		Implementation	N/A	Reference to Air Quality in all relevant Council Policies	On-going	
23	Staffordshire Moorlands Climate Change Action Plan 2021 - 2030	Policy Guidance and Development Control	Low Emissions Strategy	2022	2030	SMDC	SMDC								www.staffsmoorlands.gov.uk/media/6671/Climate-change-action-plan/pdf/SM_Climate_change_plan.pdf?m=1625822514590
24	Staffordshire Moorlands Green Infrastructure Strategy	Policy Guidance and Development Control	Low Emissions Strategy	2018	2023	SMDC / Staffordshire Wildlife Trust	SMDC								-
25	Inspect under the Environmental Permit regime and enforce legislation to reduce combustion processes	Environmental Permits	Introduction/increase of environment charges through permit systems and economic instruments	Completed	Continual	SMDC	SMDC	NO	TBC		Completed	Restricting emissions from industrial processes	Installations adhering to permits and enforcement / penalties for breaches	On-going	This is standard work completed by the Environmental Protection team
26	Air quality monitoring	Public Information	Other	On-going	Reviewed annually	SMDC	SMDC	NO	TBC		Implementation	Through EHO / public awareness	Monitoring locations and LAQM reporting	On-going	Monitoring network is reviewed each year, consideration for funding through AQ grant

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
27	Electric vehicles trial and HVO (hydrotreated veg oil) trail	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	2021	2021	SMDC/ HPBC	SMDC/ HPBC	No	TBC		Completed	Reduced emissions from vehicles	N/A	Completed	During 2021 Environmental Services (Waste Collection) trialled a number of electric vehicles, unfortunately all were unsuccessful in having sufficient battery power to complete normal days duties. A 3 month trial of the use of HVO (hydrotreated veg. oil) has been completed with positive results.
28	Cycle to work	Promoting Travel Alternatives	Promotion of cycling	2021	Ongoing	SMDC	SMDC	TBC	TBC		Implementation	Reduced emissions from vehicles	No. of people attending the scheme	Ongoing	Cycle to work scheme relaunched
29	Staffordshire Live Labs – Cellarhead AQMA	Traffic Management	Other	2020	2022	SMDC/ Department for Transport	Department for Transport	NO	Funded		Implementation	N/A	N/A	Ongoing	Awaiting results. The project was initiated in 2020 and has continued through 2021, early results indicate the system can be used to detect the movement of vehicles approaching a junction and priorities their movement to improve air quality. The project finish in 2022 with the final AQ impact report expected towards the end of 2022 but not yet produced.

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

The Environment Act 2021 established a legally binding duty on Government to set an annual mean target on the level of fine particulate matter ($PM_{2.5}$), these have been set in The Environmental Targets (Fine Particulate Matter) (England) Regulations 2023. Also 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 are now two targets to work towards:

- The annual mean concentration target, which requires that by the end of 31st December 2040. The annual mean level of $PM_{2.5}$ in ambient air must be equal to or less than 10µg/m³ with an interim target of 12µg/m³ to be achieved by the end of January 2028 as set out in the Environmental Improvement Plan 2022.
- The other major target is, the population exposure reduction target, this requires that there is at least a 35% reduction in population exposure by the end of 31st December 2040 ("the target date"), as compared with the average population exposure in the three-year period from 1st January 2016 to 31st December 2018 ("the baseline period"), determined in accordance with regulation 8.

There is clear evidence that $PM_{2.5}$ has a significant impact on human health, including premature mortality, allergic reactions, and cardiovascular diseases.

Particulate matter, or PM, is the term used to describe particles found in the air, including dust, dirt and liquid droplets. PM comes from both natural and human-made sources, including traffic emissions and Saharan-Sahel dust. These particles can be suspended in the air for long periods of time and can travel across large distances.

PM less than 10 micrometres in diameter (PM_{10}) pose a health concern because they can be inhaled into and accumulate in the respiratory system. PM less than 2.5 micrometres in diameter ($PM_{2.5}$) are referred to as "fine" particles and are believed to pose the greatest health risks, as they can lodge deeply into the lungs and also pass into the bloodstream.

$PM_{2.5}$ is the pollutant which has the biggest impact on public health and on which the Public Health Outcomes Framework (PHOF) D01 Fraction of mortality attributable to particulate air pollution (2020), Public Health Outcomes Framework indicator 7 is based.

Air pollution affects us all. It is associated with impacts on lung development in children, heart disease, stroke, cancer, exacerbation of asthma and increased mortality, among other health effects[5].

The mortality burden of air pollution in England is estimated to be between 26,000 and 38,000 a year[5].

Within Staffordshire it is estimated that in 2021(latest figures) 5.0%of all deaths can be attributed to exposure to $PM_{2.5}$, compared to 5.5% across England (29,850 deaths annually)[6]. Overall, the estimated cost to individuals and society is more than £20 billion annually for the UK.

2.3.1 Fine Particulate Matter ($PM_{2.5}$) Levels in Staffordshire and Stoke-on-Trent

Within Staffordshire County Council, only Stoke on Trent monitor locally for PM_{10}. However, a number of authorities have been approached by Defra to host an Automatic Urban and Rural Network (AURN), which if suitable sites can be found would mean that these councils will have PM data specific to their area rather than having to rely on the $PM_{2.5}$ background maps provided by Defra.

As SMDC does not monitor either $PM_{2.5}$ nor PM_{10} the area of maximum background annual mean $PM_{2.5}$ concentrations and the area of minimum background annual mean $PM_{2.5}$ has been derived from the Defra Background maps. The Defra background maps[7] (2018 reference year) can be used to identify the predicted background $PM_{2.5}$ concentrations across the UK. For Staffordshire Moorlands District Council, the highest predicted concentration is 7.8µg/m^3, located within the 1 x 1km grid square with the centroid grid reference of 399500, 342500. This is an area to the southwest of Cheadle and includes a section of the A521 and the Draycott Cross Road, a Waste Recycling Centre, a transport depot and Industrial Parks. It is important to note that these estimations do not take into consideration any impacts as a result of the COVID-19

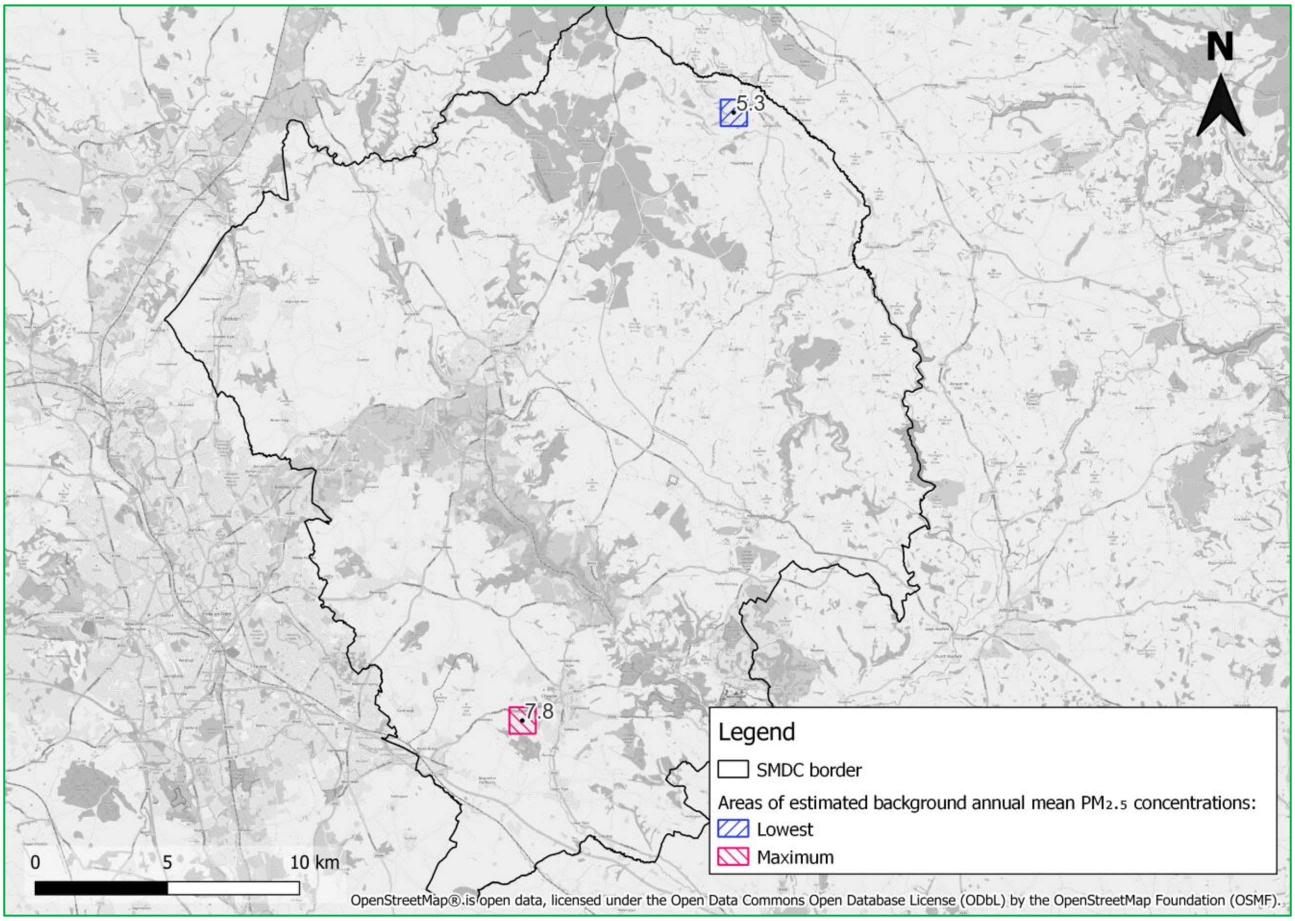
[5] Chief Medical Officer's annual report 2022.

[6] Public Health England. Public Health Outcomes Framework 5th May. Available at: https://fingertips.phe.org.uk/profile/public-health-outcomes-framework/data#page/3/gid/1000043/pat/6/par/E12000005/ati/102/are/E10000028/iid/30101/age/230/sex/4/cid/4/tbm/1/page-options/car-do-0_ine-yo-1:2019:-1:-1_ine-ct-2_ine-pt-0 © Crown copyright 2021

[7] Defra Background Mapping data for local authorities (2018-based), available online at https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018

pandemic. The background maps also provide a breakdown of sources. For this grid square, the majority of the $PM_{2.5}$ concentrations is estimated to arise from secondary $PM_{2.5}$ formation, which forms following chemical reactions of other gaseous atmospheric pollutants, such as NO_x, ammonia (NH_3), and volatile organic compounds (VOCs). The lowest $PM_{2.5}$ concentration within SMDC is estimated at 5.3µg/m^3 at an area located west to Longnor, with the centroid grid reference of 407500, 365500. Figure 2-1 shows a map indicating both areas.

Figure 2-1 Highest & lowest estimated annual mean $PM_{2.5}$ concentrations.



2.3.2 $PM_{2.5}$ and Mortality in Staffordshire & Stoke-on-Trent

Although the levels of $PM_{2.5}$ within the County and City of Stoke on Trent are below the 2020 EU Limit value, the impact on adult mortality directly attributable to $PM_{2.5}$ is nonetheless still an important public health issue within Staffordshire and Stoke-on-Trent. This is revealed in data obtained from UK Health Security Agency (UKHSA) used to inform Public Health Outcomes Framework indicator D015, as shown in Table 2-3.

The percentage estimated number of deaths attributable to $PM_{2.5}$ in adults over 30 has been translated into the estimated number of attributable deaths for each local authority area within Staffordshire, shown in Table 2-4. The data presented to 2021 is the latest data available at time of publication of this report. Approximately 5.8% of deaths between 2018 to 2021 within the County can be attributed to PM2.5. (Note the method for calculating this figure changed in 2022 and we have only the data for 2018,2019,2020 & 2021 using this new method, As the 2020 data for this indicator includes the period from March 2020 onwards, the mortality data used in its calculation will reflect effects of the COVID-19 pandemic.).

Table 2-3 - Estimated average number of deaths by local authority area attributable to $PM_{2.5}$ within Staffordshire for adults over 30

District/County	Percentage
Newcastle-under-Lyme	5.5%
Stafford	5.5%
East Staffordshire	6.0%
South Staffordshire	5.8%
Lichfield	6.0%
Staffordshire Moorlands	5.3%
Cannock Chase	6.0%
Tamworth	6.4%
Stoke on Trent	5.9%
Staffordshire County	5.8%
England	6.3%

Table 2-4 - Public Health Outcomes Framework Indicator 3.01- Fraction of annual all cause adult mortality attributable to anthropogenic (human made) particulate air pollution (measured as fine particulate matter, $PM_{2.5}$) for Staffordshire Authorities 2018 to 2021[6]

District/County	2018			2019			2020			2021		
	Deaths - all causes persons 30+	%*	Estimated attributable deaths	Deaths - all causes persons 30+	%*	Estimated attributable deaths	Deaths - all causes persons 30+	%*	Estimated attributable deaths	Deaths - all causes persons 30+	%*	Estimated attributable deaths
Newcastle- under-Lyme	1334	5.7	80	1282	6.8	90	1548	4.7	70	1409	5	70
Stafford	1336	5.8	80	1315	6.8	90	1565	4.5	70	1432	4.8	70
East Staffordshire	1093	6.3	70	1128	7.3	80	1355	5.1	70	1287	5.1	70
South Staffordshire	1211	6.3	80	1212	7.0	90	1418	4.9	70	1333	5.1	70
Lichfield	1087	6.4	70	1093	7.2	80	1272	5.2	70	1129	5.1	60
Staffordshire Moorlands	1108	5.2	60	1080	6.6	70	1276	4.5	60	1133	4.7	50
Cannock Chase	976	6.4	60	908	7.2	70	1046	5.1	50	1089	5.2	60
Tamworth	653	6.9	50	678	7.7	50	752	5.6	40	730	5.4	40
Stoke on Trent	2746	6.1	170	2490	7.2	180	3034	5.0	150	2790	5.2	150
Staffordshire	8798	6.1	530	8692	7.0	610	10227	4.9	500	9539	5	480

2.3.3 Actions being taken within Staffordshire County Council to reduce $PM_{2.5}$

A number of the Staffordshire Authorities are currently involved in implementing measures to reduce levels of NO_2 within their areas, which are detailed elsewhere in their ASR. Since the update of the Environment Act 2021 there is now a statutory duty imposed on Local Authorities in England to reduce $PM_{2.5}$, a number of the measures are complementary with those being undertaken to reduce NO_x. A mapping exercise completed by the Staffordshire Air Quality Forum members details the measures currently in place which are considered to have an impact in reducing $PM_{2.5}$ within the County. These are produced in Table 2-5 below.

Staffordshire Moorlands District Council is taking the following measures as outlined in Table 2-5 and with our partners at the county council and other partners identified in the table to address $PM_{2.5}$.

Smoke Control areas

Changes to the Environment act 2021 has enabled councils to now issue fines with respect to dark persistent smoke coming from household chimneys were as before this change this was difficult to address as household chimneys were exempt from being a statutory nuisance.

This change should enable SMDC to address the incorrect use of log burners even if they are Defra exempt.

Within the Staffordshire Moorlands District, the Leek, Biddulph, Cheadle and Brown edge have been designated as a smoke control area. Smoke control areas are a defined geographical region within which smoke cannot be legally emitted from a chimney, unless using authorised fuels or using exempt appliances. Staffordshire Moorlands Council does not recommend bonfires in any circumstance. You can be fined if smoke drifts onto roads, action can be taken against nuisance odours, and all fires have a risk of spreading and causing a danger to life. Under new smoke control area rules, Staffordshire Moorlands District Council is able to issue fixed penalty charge notices up to £300 to owners of chimneys where it is deemed too much smoke is being emitted, as well as issuing fines up to £1,000 where it is identified that unauthorised fuels are being burnt without an exempt appliance. The Defra has published a practical guide on these rules.

Whilst it is recognised that improvements in the regulation of these zones will improve air quality within these areas, it will not significantly affect the impacts of domestic burning outside of these established zones. Consequently, it has been proposed to consolidate and extend current smoke control zones across the district,

The extent of the proposed changes to smoke control areas has not yet been determined and varies from the entire district, to the restricting to the more populous towns currently not included, such as, Blythe Bridge, Endon and Werrington. The extent of the smoke control is currently being determined in consultation with relevant stakeholders.

Table 2-5 - Actions being taken within Staffordshire County Council to reduce $PM_{2.5}$

Measures category	Measure Classification	Effect on reducing NO_x and PM_{10} emissions (low, medium, high)	Reduces $PM_{2.5}$ emissions	Staffordshire Moorlands DC	Newcastle under - Lyme BC	Stafford BC	East Staffs BC	Lichfield DC	South Staffs DC	Tamworth BC
Traffic Management	Urban Traffic Control systems, Congestion management, traffic reduction	low	✓	UTC in Leek Town Centre	UTC in areas of Newcastle Town Centre AQMA and Kidsgrove AQMA. Live labs monitoring work linked to congestion in Newcastle.	UTC in Stafford Town Centre	Town Centre Regeneration Programme & a number of schemes are currently being progressed which will aid traffic management. Many of these will help improve traffic flow within the AQMA. Live labs monitoring work linked to congestion in Burton.	Still liaising with Midlands Connect to increase usage of M6 Toll to reduce congestion on A5 & lobbying for upgrade of A38 & A5. The A5 corridor identified as priority for congestion control, but the central section outside of the LDC has been prioritised for transport intervention measures. Junction improvements at Muckley Corner are being considered.		UTC in Tamworth Town Centre at Ventura Park
	Reduction of speed limits, 20mph zones	low	✓	Advisory 20mph zones near some schools in residential areas		20mph zones near some schools in residential areas	20 mph zones near some schools in residential areas	.	20mph zones in Trysull, Bradley, Kinver and Bilbrook	
	Road User Charging (RUC)/ Congestion charging	low	✓	No				M6 Toll	M6 Toll	Campaign only Air Aware project
	Anti-idling enforcement	low	✓	Campaign only Air Aware project	Campaign only Air Aware project		Campaign only Air Aware project	Campaign only Air Aware project	Campaign only Air Aware project	

Measures category	Measure Classification	Effect on reducing NO_x and PM_{10} emissions (low, medium, high)	Reduces $PM_{2.5}$ emissions	Staffordshire Moorlands DC	Newcastle under - Lyme BC	Stafford BC	East Staffs BC	Lichfield DC	South Staffs DC	Tamworth BC
	Workplace Travel Planning	low	✓	No workplace travel planning currently						
	Encourage / Facilitate home-working	low	✓	Agile working policy adopted	Homeworking Policy adopted	Homeworking Policy adopted	Homeworking Policy adopted	Homeworking policy adopted	Agile working policy adopted	Home working policy adopted
	School Travel Plans	low	✓	https://www.staffordshire.gov.uk/activeschooltravel						
Promoting Travel Alternatives	Promotion of cycling	low	✓	https://www.staffordshire.gov.uk/Transport/transportplanning/Walking-and-cycling.aspx Review of LCWIP will include additional areas such as Biddulph and Rugeley INTO Walking and Cycling Social Prescribing Specific to Newcastle-under-Lyme www.staffordshire.gov.uk/walkingandcycling					S Staffordshire Cycling Scheme	Same as other Staffs authorities
	Promotion of walking	low	✓	https://www.staffordshire.gov.uk/Transport/transportplanning/Walking-and-cycling.aspx Review of LCWIP will include additional areas such as Biddulph and Rugeley INTO Walking and Cycling Social Prescribing Specific to Newcastle-under-Lyme www.staffordshire.gov.uk/walkingandcycling					Good Life Health & Wellbeing in the community	Same as other Staffs authorities
	Staffordshire Share a Lift Scheme	low	✓	No Car Share Scheme currently						
	Promote use of rail and inland waterways	medium	✓	North Staffordshire Community Rail Partnership operating along the North Staffordshire Line includes Blythe Bridge station.	North Staffordshire Community Rail Partnership operating along the North Staffordshire Line includes Kidsgrove station. Kidsgrove station to be fully accessible and regenerated through Town Deal.	Redevelopment of Stafford Station into a gateway associated with HS2 works.	Burton Forecourt improvements completed	Lichfield Trent Valley access for all works recently completed including lifts.	Brinsford Park and Ride - Parkway Station business case ongoing	
Transport Planning & Infrastructure	Local Transport Plans and District Strategies	high	✓	District integrated transport strategies - Staffordshire County Council						
	Public transport improvements-interchanges stations and services	low	✓	Proposed reinstatement of Leek rail connection. Planning application approved during 2022. Funding being sought from central government	Kidsgrove Railway station will be multi-modal through Town Deal funding	New services with S106 funding provided in Stone to new estates in Walton and Yarnfield. Stafford Gateway will be multi- modal		Lichfield Bus Station resurfaced, repainted and new coach parking bays provided. Alternative location for bus station	Parkway station will be multi- modal	Planned improvements at Tamworth station

Measures category	Measure Classification	Effect on reducing NO_x and PM_{10} emissions (low, medium, high)	Reduces $PM_{2.5}$ emissions	Staffordshire Moorlands DC	Newcastle under - Lyme BC	Stafford BC	East Staffs BC	Lichfield DC	South Staffs DC	Tamworth BC
								currently under consideration		
	Public cycle hire scheme	low	√							
	Cycle network	low	√	[Local cycling and walking infrastructure plan 2021 - Staffordshire County Council]() Staffordshire cycle maps currently awaiting audit and review						
	Bus route improvements	high	√	Review of Integrated Transport Strategy will include consideration of improvements for public transport	RTPI on key routes in Newcastle Town Centre. Improved future bus services to Chatterley Valley	Improved bus priority and interchange on key routes in Stafford- post SWAR	Improvements in Burton town centre	RTPI introduced at key stops in Lichfield City.	Consider ation of future bus stop upgrades on key routes & improvem ents to rural services.	Corporation Street interchange improvements planned for future delivery discussions ongoing with TBC
	Active Travel Fund	low	√		ATF 2 measures to encourage walking and cycling	ATF 2 measures to encourage walking and cycling	ATF 2 and 4 measures to encourage walking and cycling			ATF 3 and 4 measures to encourage walking and cycling
	Levelling Up Fund 2	medium	√	Schemes will improve a number of major roads around the county, reduce journey times, put greener, cleaner buses on main roads, improve walking and cycling routes and reduce the impact of housing and commercial developments. They will benefit East Staffordshire, Cannock Chase and Stafford Borough. Total package cost circa £20m. Circa £6 million at the A38/A5121 Branston Interchange, near Burton, to complete the work at junction and open up for large scale housing and business development. Staffordshire County Council is adding additional money to walking and cycling schemes in the area for non-motorists to cross the A38 safely.						

Measures category	Measure Classification	Effect on reducing NO_x and PM_{10} emissions (low, medium, high)	Reduces $PM_{2.5}$ emissions	Staffordshire Moorlands DC	Newcastle under - Lyme BC	Stafford BC	East Staffs BC	Lichfield DC	South Staffs DC	Tamworth BC
				More than £9 million for work at either end of the A34 between Cannock and Stafford. In Cannock there will be walking and cycling routes to complement the planned town centre regeneration and link to the train station. In Stafford there will be the creation and maintenance of walking and cycling routes along from Radford Bank to the town centre. Approximately £4.2 million to introduce either the latest generation Euro VI diesels, or electric-powered buses on certain busy routes, as well as improving bus stops and changing priority at junctions. Bus routes benefiting from the new investment include the #8 and #9 services in Burton, run by Midland Classic; the #74 between Stafford and Cannock, run by Chaserider; and the #875 from Stafford to Cannock, via Penkridge, run by Select Buses.						
Alternatives to private vehicle use	Bus based Park & Ride	medium	✓					New bus central station as part of Friarsgate development scheme		
	Car Clubs	low	✓	✓						
Policy Guidance and Development Control	Planning applications to require assessment of exposure / emissions for development requiring air quality impact assessment	high	✓	https://www.staffsmoorlands.gov.uk/media/6155/Adopted-Local-Plan/pdf/Adopted_Local_Plan.pdf?m=1601645140880	Included as part of Local Validation List https://www.newcastle-staffs.gov.uk/planning-applications/information-requirements-validation-planning-applications	http://www.staffordbc..gov.uk/planning/planning-policy/local-plan-2012-2031	http://www.eastaffsbc.gov.uk/planning/planning-policy/local-plan-2012-2031	https://www.lichfielddc.gov.uk/Council/Planning/The-local-plan-and-planning-policy/Planning-policy.aspx	South Staffordshire Local Plan South Staffordshire Council (sstaffs.gov.uk)	Local & National Validation requirements 2017: http://www.tamworth.gov.uk/sites/default/files/planning_docs/National-and-Local-Validation-requirements-2017.pdf

Measures category	Measure Classification	Effect on reducing NO_x and PM_{10} emissions (low, medium, high)	Reduces $PM_{2.5}$ emissions	Staffordshire Moorlands DC	Newcastle under - Lyme BC	Stafford BC	East Staffs BC	Lichfield DC	South Staffs DC	Tamworth BC
	Air Quality Strategy			Revised Air Quality Action Plan due in 2023 will include requirements for $PM_{2.5}$	Revised Air Quality Action Plan due in 2024 will include requirements for $PM_{2.5}$	2019-2023 Air Quality Strategy			In development	
	Planning Guidance for developers		✓	"Air Quality and Emissions Mitigation" Guidance for Developers available, & currently being updated with view to be adopted as a official SPD	To be developed alongside New Local Plan HERE	http://www.stafforddc.gov.uk/planning/planning-policy/supplementary-planning-policy-documents	Informal guidance in place		Planning Guidance and SPDs (sstaffs.gov.uk)	https://www.tamworth.gov.uk/sites/default/files/planning_docs/Tamworth_Design_SPD_July_2019_v1-0.pdf
	Developer Contributions based on damage cost calculation		✓	Damage cost assessment has been used for applicable applications.	To be considered as above	Damage cost assessment now required for applicable applications.	Damage cost assessment now required for applicable applications.			
	Planning Policies		✓	https://www.staffsmoorlands.gov.uk/media/6155/Adopted-Local-Plan/pdf/Adopted_Local_Plan.pdf?m=16016451 40880	Various policies support alternatives to use of car and increased use of public transport HERE	http://www.staffordbc.gov.uk/planning/planning-policy/local-plan-2012-2031	Supplementary planning document in development	https://www.lichfielddc.gov.uk/Council/Planning/The-local-plan-and-planning-policy/Planning-policy.aspx	Planning Guidance and SPDs (sstaffs.gov.uk)	https://www.tamworth.gov.uk/local-plan
	STOR Sites (Short Term Operating Reserve) Energy Generation. Regulation via planning / permitting regime	high	✓	✓						

Measures category	Measure Classification	Effect on reducing NO_x and PM_{10} emissions (low, medium, high)	Reduces $PM_{2.5}$ emissions	Staffordshire Moorlands DC	Newcastle under - Lyme BC	Stafford BC	East Staffs BC	Lichfield DC	South Staffs DC	Tamworth BC
	Low Emissions Strategy	high	✓	Forms part of [Climate change action plan] & [Climate change action plan part 2]	In development	In development as part of Climate Change Policy				
Freight and Delivery Management	Freight ConsolidationCentre	medium	✓	X						
	Route Management Plans/ Strategic routing strategy for HGV's	high	✓	https://www.staffordshire.gov.uk/Transport/transportplanning/localtransportplan/home.aspx This should be considered as part of planning applications where new proposals come forward.						
	Quiet & out of hours delivery	low	✓			✓				
	Delivery and Service plans	medium	✓			x				
	Freight Partnerships for city centre deliveries	high	✓			x				
	Driver training and ECO driving aids	medium	✓	✓		✓				
	Promoting low emission public transport	high	✓	X		x				
Vehicle Fleet Efficiency	Vehicle retrofitting programmes	medium	✓	On going / in development Energy Saving Trust (EST) have reviewed current fleet and issued recommendations including training	Bus retrofit for vehicles using A53 service 4	x		Retrofitting of old Council owned HGVs and Buses with pollution abatement equipment will be considered		

Measures category	Measure Classification	Effect on reducing NO_x and PM_{10} emissions (low, medium, high)	Reduces $PM_{2.5}$ emissions	Staffordshire Moorlands DC	Newcastle under - Lyme BC	Stafford BC	East Staffs BC	Lichfield DC	South Staffs DC	Tamworth BC
								by the Council where technically and financially feasible		
	Fleet efficiency and recognition schemes	medium	✓	Staffordshire County Council's Climate Change Action Plan https://www.staffordshire.gov.uk/environment/Documents/Climate-Change-Action-Plan.pdf - Where possible consider and implement a transition plan to full EV vehicles within the SCC fleet						
	Low emission zone (LEZ) Clean Air Zone (CAZ)	high	✓	x						
	Public Vehicle Procurement Prioritising uptake of low emission vehicles	high	✓	Procurement Strategy in development; Climate change action plan		Waste fleet vehicles comply with Euro VI.			Council new vehicles all comply with Euro 6	
	Company Vehicle Procurement - Prioritising uptake of low emission vehicles	high	✓	Energy Saving Trust (EST) have reviewed current fleet and issued draft. The majority comply with are highest EURO emission standard with the rest completed between 2022/ 2023		Investigating replacing old vehicles within th fleet with more modern cleaner vehicles, which comply with the prevailing EURO standard. This will be extended to all Council owned Vehicles.		Vehicles replaced (in addition to normal fleet turnover	Most council vehicles were replaced last year with new cleaner vehicles	

Measures category	Measure Classification	Effect on reducing NO_x and PM_{10} emissions (low, medium, high)	Reduces $PM_{2.5}$ emissions	Staffordshire Moorlands DC	Newcastle under - Lyme BC	Stafford BC	East Staffs BC	Lichfield DC	South Staffs DC	Tamworth BC
	Procuring alternative refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	high	✓	EV strategy on council car parks. hydrated vegetable oil are currently being used by waste fleet		Procurement of EV on staff carparks			EV Parking on staff car parks	
	Priority parking for LEV's	high	✓	✓		✓				
	Taxi Licensing conditions	medium	✓	In development		✓				
	EV Strategy	High	✓	https://democracy.staffsmoorlands.gov.uk/documents/s32243/SM-Public-EV-Charging-Strategy-V1_Final_15.09.22.pdf	Staffordshire EV Charging Infrastructure Strategy https://www.staffordshire.gov.uk/Transport/Sustainable-travel/Electric-vehicles/02-SCC-Public-EV-Charging-Strategy-V3-3.pdf					
	Taxi emission incentives	medium	✓			✓				
Environmental permits	Introduction/Increase of environment charges through permit systems and economic instruments (Permit fees set centrally)	medium	✓	✓		✓		On going Environmental Permits inspection of installation adhering to permits and enforcement/penalties for breaches		
	Measures to reduce pollution through IPPC Permits going beyond BAT	medium	✓	https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/211863/env-permitting-general-guidance-a.pdf (Chapter 15)						

Measures category	Measure Classification	Effect on reducing NO_x and PM_{10} emissions (low, medium, high)	Reduces $PM_{2.5}$ emissions	Staffordshire Moorlands DC	Newcastle under - Lyme BC	Stafford BC	East Staffs BC	Lichfield DC	South Staffs DC	Tamworth BC
Other measures	Large Combustion Plant Permits and National Plans going beyond BAT	high	✓			Nil				
	Other		✓			Nil				
	Smoky Diesel Hotline		✓	https://www.gov.uk/report-smoky-vehicle						
	A5 & M6 Partnership					X		Strategy for the A5 2011-2026	Strategy for the A5 2011-2026	
	Domestic Smoke Control advice and Enforcement		✓	SMDC Smoke Control		https://www.staffordbc.gov.uk/environment/smoke-control.cfm	Provided via ESBC Website & other literature	https://www.lichfielddc.gov.uk/home-garden/bonfires-barbecues-smoke/1	Smoke Control Areas | South Staffordshire District Council (sstaffs.gov.uk)	
	Garden Bonfires - Advice and nuisance enforcement		✓	SMDC Smoke Nuisance and Bonfires & EPUK leaflet used		http://www.staffordbc.gov.uk/environmental-health/pollution/bonfires	Provided via ESBC Website & other literature	https://www.lichfielddc.gov.uk/home-garden/bonfires-barbecues-smoke/1	Smells, Dust and Fumes | South Staffordshire District Council (sstaffs.gov.uk)	http://www.tamworth.gov.uk/air-quality
	Commercial burning advice and enforcement		✓	SMDC Commercial smoke & waste management "its a burning issue" EA leaflet						

Measures category	Measure Classification	Effect on reducing NO_x and PM_{10} emissions (low, medium, high)	Reduces $PM_{2.5}$ emissions	Staffordshire Moorlands DC	Newcastle under - Lyme BC	Stafford BC	East Staffs BC	Lichfield DC	South Staffs DC	Tamworth BC
	Multi agency working with Fire Service and Environment Agency for trade burning		✓	✓		✓	Information shared as appropriate	Information shared as appropriate	✓	Information shared as appropriate
	Multi agency working with Staffordshire Fire Service and Local Authority Building Control regarding chimney fires and complaints about DIY domestic heating systems		✓	✓		✓	Information shared as appropriate	Information shared as appropriate	✓	
	Stoke-on-Trent Low Carbon District Heat Network		✓			Nil				

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

This section sets out the monitoring undertaken within 2022 by Staffordshire Moorlands District Council and how it compares with the relevant air quality objectives. In addition, monitoring results are presented for a five-year period between 2018 and 2022 to allow monitoring trends to be identified and discussed.

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

Staffordshire Moorlands District Council did not undertake any automatic (continuous) monitoring during 2022.

3.1.2 Non-Automatic Monitoring Sites

Staffordshire Moorlands District Council undertook non- automatic (i.e. passive) monitoring of NO_2 at 43 sites during 2022. Table A.1 in Appendix A presents the details of the non-automatic sites.

Maps showing the location of the monitoring sites are provided in Appendix D: Maps of Monitoring Locations and AQMAs. 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.

In 2022, four new non-automatic monitoring locations were implemented. Three (63 to 65) were installed in response to public queries regarding the air quality in Leek town centre, on Derby Street. Site 62 was installed in Cheadle near the intersection of A522 and B5032.

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.1 and

Table A.2 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.

During 2022, there were 12 monitoring locations within AQMA No.1, Leek. All monitoring locations reported concentrations below 10% of the NO_2 annual mean AQS objective of 40µg/m^3 (36µg/m^3), with the maximum reported being 34.4µg/m^3 at site 57, which shows an increase from 2021. Seven sites show a decreased NO_2 annual mean concentration compared with 2021 and five sites show increased concentrations in 2022. In general. At all sites, concentrations remain below 2019 levels after the substantial decrease reported in 2020, attributed to the impacts of the COVID-19 pandemic.

Within AQMA No.2, Cellarhead, there are 8 monitoring sites. The reported NO_2 annual mean concentrations during 2022 were below 10% of the NO_2 annual mean AQS objective. The maximum reported NO_2 annual mean concentration is 35.3µg/m^3 at site 38, which remains similar to 2021 levels. Most of the sites show an increase in annual mean concentrations reported in 2022 of up to 3.1µg/m^3 compared to 2021. Concentrations within Cellarhead AQMA remain below 2019 levels after the substantial decrease reported in 2020, attributed to the impacts of the COVID-19 pandemic.

At monitoring locations outside of any of the declared AQMAs, all NO_2 annual mean concentrations are below the AQS objective of 40µg/m^3, with the maximum being 32.8µg/m^3 reported at site 52. All sites show significantly lower NO_2 annual mean concentrations than those reported in 2019 but site 17 that shows an increase of 0.7µg/m^3 compared with 2019 levels.

As per LAQM.TG(22), an annual mean NO_2 concentration greater than 60µg/m^3 can be used as a proxy to indicate whether there is an exceedance of the NO_2 1-hour mean AQS objective (no more than 18 hourly mean concentrations in exceedance of 200µg/m^3). None of the monitoring locations reported an annual mean concentration greater than 60µg/m^3, therefore it is not believed that there has been an exceedance of the hourly objective within Staffordshire Moorlands.

Appendix A: Monitoring Results

Table A.1 – Details of Non-Automatic Monitoring Sites

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube Co-located with a Continuous Analyser?	Tube Height (m)
1	Wetley Rocks	Roadside	396535	349111	NO_2	No	1.7	2.5	No	3.0
5	Blythe Bridge (Chestnut Crescent)	Roadside	396353	340607	NO_2	No	0.0	0.0	No	2.6
6	Tean	Roadside	401095	339425	NO_2	No	0.5	2.0	No	2.7
7	Cheadle (Leek Road Rbt_ Central) (*2)	Roadside	400967	343564	NO_2	No	0.2	2.0	No	2.7
8	Alton (Chapel)	Roadside	407237	342257	NO_2	No	3.0	1.0	No	3.1
10	Leek (Moorlands House)	Roadside	398486	356630	NO_2	AQMA 1: Leek	3.5	0.2	No	3.4
11	Leek (Swan Hotel)	Roadside	398295	356587	NO_2	AQMA 1: Leek	7.0	0.7	No	2.9
12	Leek (Southlands Close)	Urban Background	397430	356516	NO_2	No	13.0	2.0	No	2.7
14	Cheadle (Tape Street)	Roadside	400990	343365	NO_2	No	1.0	1.0	No	2.8

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)
17	Biddulph (Knypersly, Cross Rds)	Roadside	388030	356757	NO_2	No	3.0	2.5	No	2.4
24A, 24B	Leek (Ball Haye St _ Central) (*2)	Roadside	398691	356579	NO_2	AQMA 1: Leek	0.2	3.0	No	2.7
25	Leek (Broad Street Jct North_1)	Roadside	398354	356329	NO_2	AQMA 1: Leek	NA	2.3	No	2.7
29	Cheadle (Leek Road Rbt_ North)	Roadside	400968	343579	NO_2	No	0.2	2.0	No	2.5
30	Cheadle (Leek Road Rbt _South)	Roadside	400967	343548	NO_2	No	0.2	2.0	No	2.8
31	Leek (Ball Haye St _ South)	Roadside	398688	356547	NO_2	AQMA 1: Leek	0.2	3.0	No	2.7
32	Leek (Ball Haye St_ North)	Roadside	398693	356616	NO_2	AQMA 1: Leek	0.2	3.0	No	2.8
34	Leek (Broad Street Vets_ South 2)	Roadside	398172	356215	NO_2	AQMA 1: Leek	1.5	2.4	No	2.9
37A, 37B	Leek (Broad Street North_3) (*2)	Roadside	398333	356313	NO_2	AQMA 1: Leek	0.2	3.5	No	2.5
38A, 38B	Cellarhead Junction_2 (*2)	Roadside	395702	347548	NO_2	AQMA 2: Cellarhead	0.2	1.8	No	2.6
39A, 39B	Cellarhead Junction_3 (*2)	Roadside	395702	347553	NO_2	AQMA 2: Cellarhead	0.2	1.8	No	2.5
41A, 41B	Leek (Broad Street Jct North_4) (*2)	Roadside	398323	356306	NO_2	AQMA 1: Leek	0.1	3.5	No	2.7
42A, 42B	Cellar Head Juction 4 (*2)	Roadside	395704	347562	NO_2	AQMA 2: Cellarhead	0.2	1.8	No	2.7

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)
47	Broad Street South	Roadside	398245	356232	NO_2	AQMA 1: Leek	1.4	2.8	No	2.6
48	Broad Street Junction	Roadside	398397	356322	NO_2	AQMA 1: Leek	2.0	2.0	No	3.3
49	Cellar Head Juction 4	Roadside	395811	347530	NO_2	AQMA 2: Cellarhead	3.0	2.0	No	2.5
50	Cheadle Tape St easb bound	Roadside	401043	342917	NO_2	No	3.6	2.0	No	2.5
51X	Cheadle Tape St west bound	Roadside	401066	343020	NO_2	No	1.2	1.8	No	2.6
52	Cheadle Tape St west bound 2	Roadside	401049	343151	NO_2	No	2.5	1.2	No	2.4
53	Cellarhead Junction_5	Roadside	395727	347570	NO_2	AQMA 2: Cellarhead	0.5	1.5	No	2.7
54	Cellarhead Junction_6	Roadside	395732	347575	NO_2	AQMA 2: Cellarhead	1.0	1.4	No	2.6
55	Cellarhead Junction_7	Roadside	395754	347560	NO_2	AQMA 2: Cellarhead	8.0	1.6	No	2.6
56	Cellarhead Junction_8	Roadside	395699	347577	NO_2	AQMA 2: Cellarhead	3.2	1.0	No	2.7
57	Broad Street South	Roadside	398107	356157	NO_2	AQMA 1: Leek	1.0	2.5	No	2.8
58	Blythe Bridge	Roadside	395980	341065	NO_2	No	7.0	1.8	No	2.6
59	Biddulph (Knypersly, Cross Rds)_2	Roadside	388054	356808	NO_2	No	4.9	2.7	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)
60	Biddulph (Knypersly, Cross Rds)_3	Roadside	387997	356756	NO_2	No	5.6	2.3	No	2.6
61	Leek Compton Rd	Roadside	398379	356756	NO_2	No	1.8	0.4	No	2.4
AS01	All Saints CE 1st School	Roadside	397386	356344	NO_2	No	N/A	2.1	No	2.6
WF01	Westwood 1st School Rd	Roadside	398537	355596	NO_2	No	N/A	1.6	No	2.6

Notes:

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

(2) N/A if not applicable.

Table A.2 – Annual Mean 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
1	396535	349111	Roadside	90.1	90.1	28.0	24.6	19.8	21.6	20.8
5	396393	340670	Roadside	84.3	84.3	24.7	24.4	17.9	17.9	20.0
6	401095	339425	Roadside	99.7	99.7	26.9	25.7	19.7	21.0	21.2
7	400967	343564	Roadside	99.7	99.7	38.0	36.2	27.7	30.7	31.4
8	407237	342257	Roadside	99.7	99.7	24.2	21.1	13.6	17.2	19.2
10	398486	356630	Roadside	99.7	99.7	30.6	29.8	21.1	25.5	23.4
11	398295	356587	Roadside	92.3	92.3	35.4	35.4	24.7	27.1	27.8
12	397430	356516	Urban Background	99.7	99.7	12.3	-	8.6	9.4	9.8
14	400990	343365	Roadside	99.7	99.7	32.0	26.6	19.3	21.8	22.4
17	388027	356755	Roadside	99.7	99.7	23.5	22.9	23.1	25.8	23.6
24A, 24B	398691	356579	Roadside	99.7	99.7	38.6	37.0	28.6	30.9	30.7
25	398354	356329	Roadside	92.0	92.0	**43.4**	**44.1**	32.0	35.6	34.3
29	400968	343579	Roadside	99.7	99.7	36.9	39.7	27.6	27.3	28.2

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
30	400967	343548	Roadside	99.7	99.7	33.5	35.5	27.3	30.7	29.8
31	398688	356547	Roadside	99.7	99.7	32.3	31.8	25.7	25.1	25.4
32	398693	356616	Roadside	92.0	92.0	37.0	34.1	26.1	31.0	30.8
34	398172	356215	Roadside	99.7	99.7	27.6	26.3	21.8	23.4	23.8
37A, 37B	398333	356313	Roadside	99.7	99.7	39.8	39.2	31.5	32.7	32.0
38A, 38B	395702	347548	Roadside	99.7	99.7	**42.3**	**42.5**	32.0	35.6	35.3
39A, 39B	395702	347553	Roadside	99.7	99.7	**42.1**	**42.7**	32.4	35.1	35.0
41A, 41B	398323	356306	Roadside	92.0	92.0	31.8	31.1	25.5	25.4	25.9
42A, 42B	395704	347562	Roadside	99.7	99.7	**40.7**	**42.0**	30.6	32.8	34.6
47	398245	356232	Roadside	92.0	92.0	27.5	28.8	22.5	24.6	21.7
48	398397	356322	Roadside	84.3	84.3	32.9	34.9	27.0	32.9	28.8
49	395811	347530	Roadside	99.7	99.7	30.0	25.1	18.7	20.0	20.0
50	401043	342917	Roadside	92.0	92.0	28.6	22.7	17.6	19.5	20.0
51X	401066	343020	Roadside	84.1	84.1	-	-	-	-	19.0

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
52	401049	343151	Roadside	92.3	92.3	37.1	**40.1**	28.7	29.9	32.8
53	395727	347570	Roadside	99.7	99.7	-	**41.9**	28.4	30.2	32.0
54	395732	347575	Roadside	73.1	73.1	-	30.5	17.4	19.3	20.0
55	395754	347560	Roadside	99.7	99.7	-	32.1	23.6	25.9	27.1
56	395699	347577	Roadside	99.7	99.7	-	38.1	27.6	27.3	30.4
57	398107	356157	Roadside	99.7	99.7	-	**41.7**	31.0	32.3	34.4
58	395980	341065	Roadside	99.7	99.7	-	25.1	17.2	18.9	19.4
59	388054	356808	Roadside	92.3	92.3	-	-	23.8	25.7	25.1
60	387997	356756	Roadside	90.1	90.1	-	-	16.0	17.9	17.0
61	398379	356313	Roadside	90.1	90.1	-	-	27.9	31.5	32.1
62	401078	343076	Roadside	100.0	92.0	-	-	-	-	24.5
63	398463	356510	Roadside	100.0	57.4	-	-	-	-	20.7
64	398447	356502	Roadside	100.0	57.4	-	-	-	-	19.5
65	398432	356513	Roadside	42.9	25.0	-	-	-	-	19.6

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
AS01	398537	355596	Roadside	90.1	90.1	-	-	-	11.2	19.9
WF01	397386	356344	Roadside	47.5	47.5	-	-	-	20.1	15.0

☒ **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%).

Figure A.1 – Trends in Annual Mean NO_2 Concentrations in AQMA No.1, Leek

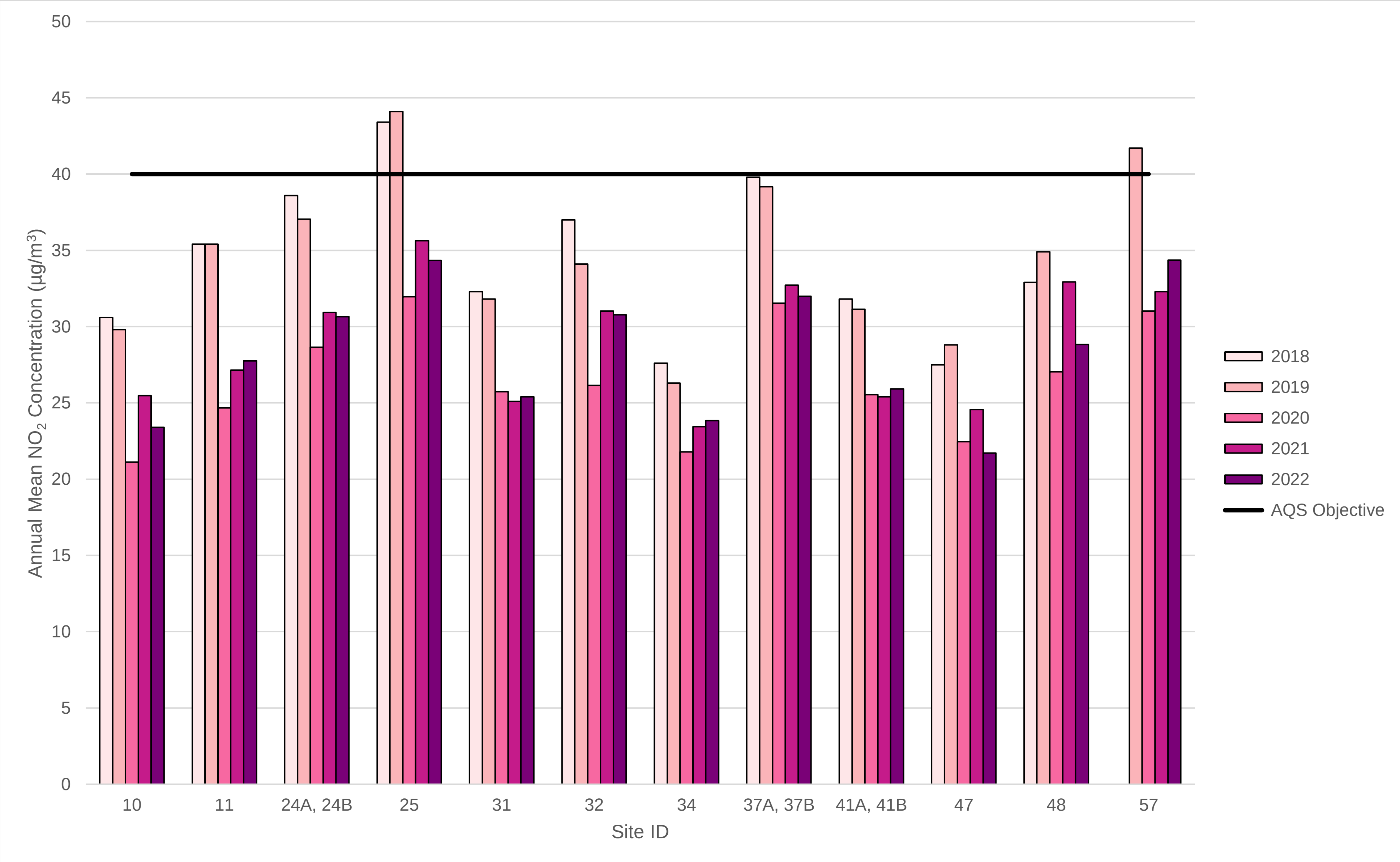


Figure A.2 – Trends in Annual Mean NO_2 Concentrations in AQMA No.2 Cellarhead

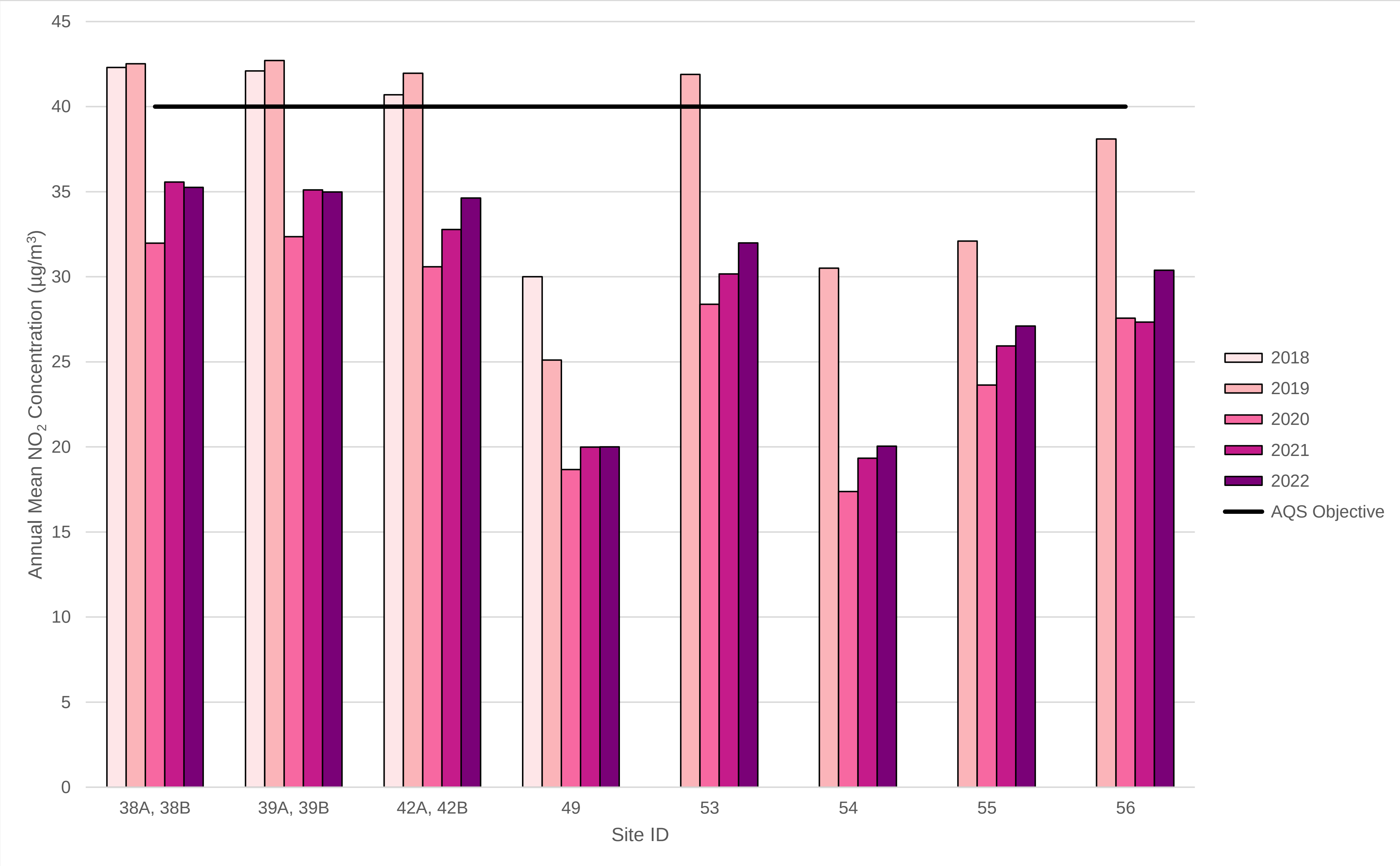
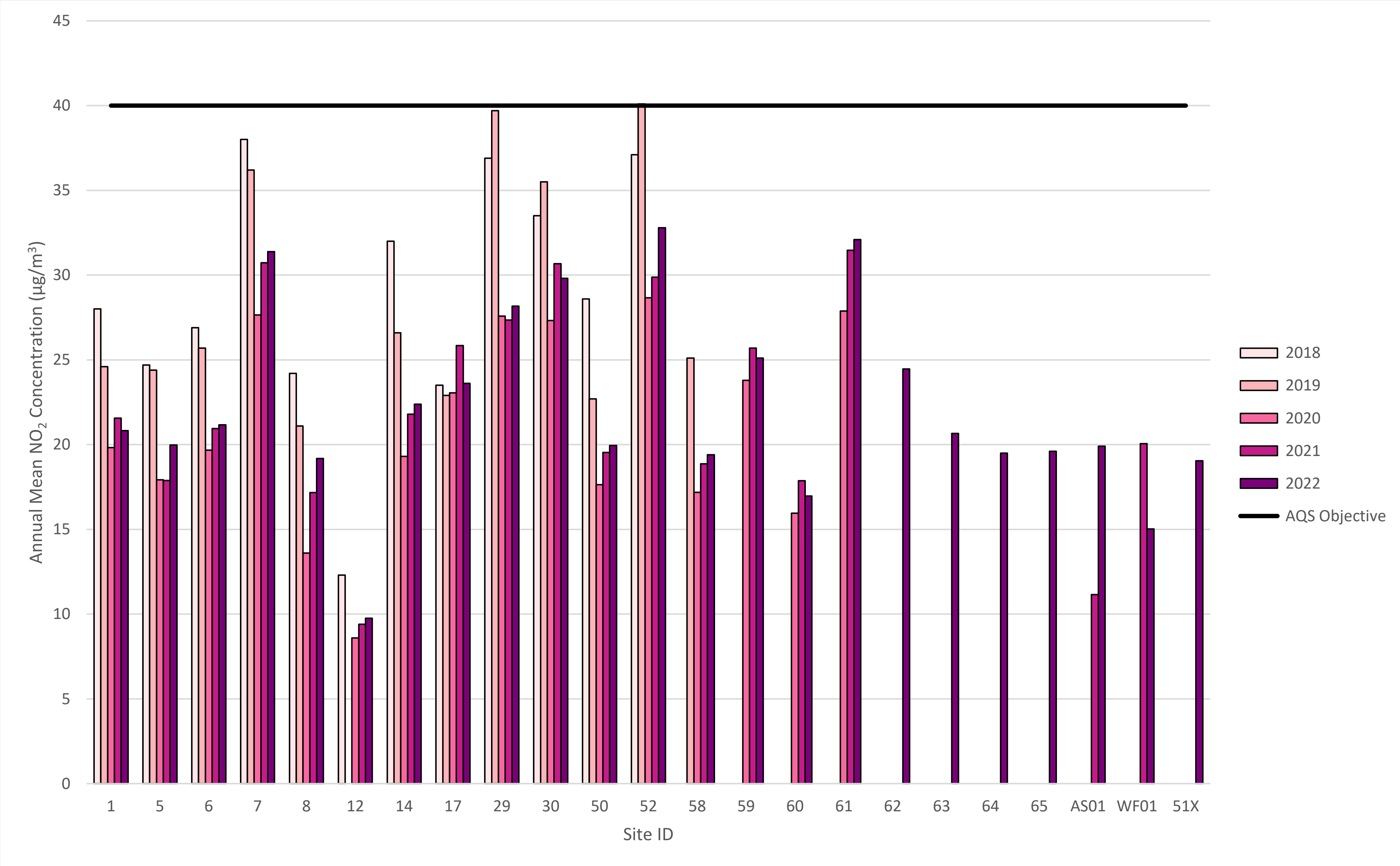


Figure A.3 – Trends in Annual Mean NO_2 Concentrations Outside any AQMA



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	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted (0.83)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
1	396535	349111	29.8	21.1	26.2	23.4	18.7	23.3	23.3	28.1	25.8	21.6	25.0		24.2	20.8	-	
5	396393	340670	24.6	21.4	25.7	16.4	20.1			19.4	23.4	24.6	29.5	27.1	23.2	20.0	-	
6	401095	339425	29.5	23.8	25.5	21.3	21.3	24.0	21.9	23.5	23.7	23.0	27.4	30.5	24.6	21.2	-	
7	400967	343564	37.7	29.5	42.9	34.8	35.3	33.6	35.7	38.8	35.8	36.5	39.8	37.5	36.5	31.4	-	
8	407237	342257	19.0	12.5	24.3	23.7	19.8	18.4	24.7	32.2	26.7	25.5	18.8	22.1	22.3	19.2	-	
10	398486	356630	32.7	20.5	23.7	24.2	22.9	25.9	24.6	28.1	27.2	29.2	36.5	31.0	27.2	23.4	-	
11	398295	356587	42.0	29.4		26.2	28.0	29.6	30.8	33.4	30.0	31.3	37.2	37.1	32.3	27.8	-	
12	397430	356516	19.1	18.1	8.0	8.5	6.1	7.9	8.5	6.8	9.1	14.5	16.8	12.8	11.4	9.8	-	
14	400990	343365	31.9	22.8	30.4	21.1	22.1	21.5	22.3	25.0	24.8	26.4	32.3	31.8	26.0	22.4	-	
17	388027	356755	35.6	24.3	29.5	26.3	23.9	25.7	25.6	30.6	30.1	21.8	27.8	28.3	27.5	23.6	-	
24A	398691	356579	40.7	35.0	31.5	27.0	38.9	36.8	35.2	37.3	33.7	34.1	36.0	38.8	-	-	-	Duplicate Site with 24A and 24B - Annual data provided for 24B only
24B	398691	356579	46.3		31.5	31.3	33.7	35.5	36.0	37.6	33.6	33.0	36.3	40.8	35.7	30.7	-	Duplicate Site with 24A and 24B - Annual data provided for 24B only
25	398354	356329	55.0		39.1	37.9	33.0	37.6	37.3	44.8	40.4	33.0	37.9	43.2	39.9	34.3	-	
29	400968	343579	36.7	30.1	37.3	25.3	28.3	30.3	30.7	30.7	31.9	35.9	37.6	38.3	32.8	28.2	-	
30	400967	343548	36.6	29.8	33.2	34.7	32.3	32.6	34.9	36.3	34.5	35.6	35.8	39.7	34.7	29.8	-	
31	398688	356547	38.1	28.4	27.5	23.1	27.1	26.9	27.1	29.3	27.5	29.9	33.6	35.9	29.5	25.4	-	
32	398693	356616		36.5	34.5	27.2	35.2	35.5	33.8	34.9	31.0	37.3	45.9	41.9	35.8	30.8	-	
34	398172	356215	39.2	27.6	27.0	22.0	20.9	23.4	24.3	25.8	26.0	29.5	32.9	34.1	27.7	23.8	-	

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted (0.83)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
37A	398333	356313	53.6	37.8	37.8	36.6	33.0	34.5	35.5	39.1	36.8	32.3	37.7	39.4	-	-	-	Duplicate Site with 37A and 37B - Annual data provided for 37B only
37B	398333	356313	47.7	34.0	36.6	34.5	33.2	36.4	33.6	39.1	37.1	31.2	35.7	39.6	37.2	32.0	-	Duplicate Site with 37A and 37B - Annual data provided for 37B only
38A	395702	347548	51.0	41.0	33.0	32.5	40.5	42.9	43.4	44.2	38.6	37.2	41.6	40.1	-	-	-	Duplicate Site with 38A and 38B - Annual data provided for 38B only
38B	395702	347548	50.6		37.1	33.3	42.5	44.5	42.5	43.2	37.8	39.6		44.1	41.0	35.3	-	Duplicate Site with 38A and 38B - Annual data provided for 38B only
39A	395702	347553		41.0	34.5	35.0	43.1	45.3	41.2	39.9	36.4	37.5	42.8	38.7	-	-	-	Duplicate Site with 39A and 39B - Annual data provided for 39B only
39B	395702	347553	50.3	44.3	32.2	34.3	44.2	43.0	41.3	40.2	39.0	37.7	42.1	41.9	40.7	35.0	-	Duplicate Site with 39A and 39B - Annual data provided for 39B only
41A	398323	356306	38.5		28.8	28.8	26.4	26.5	26.7	30.4	28.4	27.1	28.9	36.3	-	-	-	Duplicate Site with 41A and 41B - Annual data provided for 41B only
41B	398323	356306			32.5	30.3	25.1	27.5	28.3	31.1	30.4	28.6	31.6	32.3	30.1	25.9	-	Duplicate Site with 41A and 41B - Annual data provided for 41B only
42A	395704	347562		39.4	32.3	34.7	37.6	48.6	37.3	40.7	36.6	39.0	41.7	35.0	-	-	-	Duplicate Site with 42A and 42B - Annual data provided for 42B only
42B	395704	347562	51.1	41.9	34.5	33.6	38.6	46.4	40.1	42.9	35.8	41.3	43.5	42.6	40.3	34.6	-	Duplicate Site with 42A and 42B - Annual data provided for 42B only
47	398245	356232	38.2		27.4	21.5	19.9	20.5	19.7	23.9	23.6	26.2	27.1	29.7	25.2	21.7	-	
48	398397	356322	35.0	28.4	37.6	31.2	29.8	29.0	33.4			33.5	37.3	40.0	33.5	28.8	-	
49	395811	347530	31.7	20.2	21.3	21.2	23.1	23.7	22.5	24.9	23.8	22.5	25.1	19.2	23.3	20.0	-	
50	401043	342917		29.5	27.9	19.2	17.2	19.3	18.7	20.5	23.3	22.9	27.1	29.6	23.2	20.0	-	
51X	401066	343020		23.1	23.5	20.4	19.7		11.7	21.6	24.2	22.9	24.5	29.9	22.2	19.0	-	
52	401049	343151	41.1	42.7	37.1	28.1	33.1	34.8	35.8		34.1	39.5	48.5	44.6	38.1	32.8	-	
53	395727	347570	44.1	37.9	46.2	28.9	27.7	37.5	36.0	35.0	32.7	38.8	41.2	40.4	37.2	32.0	-	
54	395732	347575	33.3	20.8	25.4	20.6	21.1	22.7	22.8	19.0	24.1				23.3	20.0	-	
55	395754	347560	37.7	24.5	32.9	30.6	26.5	30.9	29.8	36.8	32.5	28.0	33.2	34.9	31.5	27.1	-	
56	395699	347577	28.6	30.1	42.5	29.5	32.5	36.4	38.3	40.7	33.4	38.1	37.8	36.1	35.3	30.4	-	
57	398107	356157	49.4	35.6	34.6	32.5	35.8	38.1	38.8	43.5	39.1	39.3	42.3	50.5	40.0	34.4	-	

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted (0.83)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
58	395980	341065	28.0	19.8	27.6	20.3	17.8	16.5	18.1	21.2	22.7	22.8	26.5	29.4	22.6	19.4	-	
59	388054	356808	36.0	26.1	29.1	26.0	27.6	28.7	28.9	33.7	32.9	27.7		24.4	29.2	25.1	-	
60	387997	356756	19.5	20.7	27.4	19.5	14.4	16.3	15.7	18.1	19.0	20.6	25.8		19.7	17.0	-	
61	398379	356313	47.0	36.5	36.5	32.6	32.3	36.3	35.0	36.0	36.0		39.8	42.6	37.3	32.1	-	
62	401078	343076		24.7	35.0	23.3	23.0	25.7	27.0	28.9	29.2	29.0	32.2	34.8	28.4	24.5	-	
63	398463	356510					17.1	19.0	17.7	20.5	17.9	20.0	22.4		19.2	20.7	-	
64	398447	356502					15.2	8.9	15.4	18.2	19.2	23.3	26.8		18.1	19.5	-	
65	398432	356513					13.6	13.7	16.0						14.4	19.6	-	
AS01	398537	355596	23.9	22.8	17.5	24.9	24.4	22.7	23.2	23.8	24.4	26.8	20.2		23.1	19.9	-	
WF01	397386	356344		16.2					7.5	12.4	11.8	16.6	26.8		15.2	15.0	-	

☒ **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.**

☒ **Staffordshire Moorlands District Council confirm that all 2022 diffusion tube data has been uploaded to the Diffusion Tube Data Entry System.**

Notes:

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

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

See Appendix C for details on bias adjustment and annualisation.

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

New or Changed Sources Identified Within Staffordshire Moorlands District Council During 2022

Staffordshire Moorlands District Council has not identified any major sources relating to air quality within the reporting year of 2022. Details of large developments are described in the table below:

Site location	Area	Validation Date	Planning Reference	Planning Proposal
Land At, Oakamoor Road, Cheadle, Staffordshire,	Cheadle	24/11/2022	SMD/2022/0592	Application for Outline Planning Permission with some matters reserved for the erection of up to 53no. dwellings
Land Off, Cheadle Road, Upper Tean, Staffordshire	Tean	22/06/2022	SMD/2022/0249	Full Planning Application for residential development of 67 houses with a mix of two and two and a half storey dwellings, consisting of new access to Cheadle Road, new public open space, sustainable urban drainage, landscaping, pumping Station and associated works
113, Mill Street, Leek, Staffordshire, ST13 8EU	Leek (AQMA)	04/03/2022	SMD/2022/0051	Construction of a drive through restaurant
FIE, Bones Lane, Cheddleton, Staffordshire, ST13 7BT	Cheddleton	15/02/2022	SMD/2022/0088	Food processing facility/edible bone factory
Land East Of, Sugar Street, Rushton Spencer, Staffordshire,	Rushton Spencer	30/11/2021	smd/2021/0784	*Erection of 4no. dwellings and associated works*

Site location	Area	Validation Date	Planning Reference	Planning Proposal
Land to the East of Froghall Road and North of Ayr Road, and Cheltenham Avenue, CHEADLE, STAFFORDSHIRE	Cheadle	08/12/2021	SMD/2021/0780	Reserved Matters application (access, layout, scale, appearance and landscaping) for residential development comprising 135 dwellings, with associated access, public open space and infrastructure
Reinstatement of railway track, new platform and and replacement footpath on former railway line between Cornhill, Leek and boundary of existing operational railway land at Leekbrook.	Leek (AQMA)	18/11/2021	SMD/2021/0700	Former Railway Line, Barnfield Road, Leek, Staffordshire,
Land at, Ash Bank Road, Werrington, Staffordshire	Werrington /Cellarhead	02/11/2021	smd/2021/0694	Development of 75 new dwellings, new access, provision of green infrastructure and all associated works
Land East Of, Froghall Road, Cheadle, Staffordshire	Cheadle	27/09/2021	SMD/2021/0610	Outline for up to 215 dwellings with access considered (all other matters reserved)
Site at Sandfields, Cellarhead	Cellarhead (AQMA)	16/07/2021	SMD/2021/0469	Resubmission of the previously refused application SMD/2021/0133 for the construction of 3No, two storey, detached houses in place of the 2No dormer bungalows previously approved under SMD/2019/045
Compton Mill, Compton, Leek, Staffordshire, ST13 5NJ	Leek (AQMA)	02/08/2021	SMD/2021/0441	Erection of 57 no. over-65 retirement living apartments, together with external amenity space, parking and associated facilities
Land South East Of A521, Uttoxeter Road, Draycott In The Moors, Staffordshire,	Blythe Bridge	02/07/2021	SMD/2021/0418	Full planning application for residential development of 200 dwellings + associated infrastructure

Site location	Area	Validation Date	Planning Reference	Planning Proposal
Land South East Of A521, A50 Blythe Bridge Bye Pass, Blythe Bridge, Staffordshire,	Blythe Bridge	25/06/2021	SMD/2021/0370	Development of 11 no. residential dwellings (Use Class C3) and associated works comprising internal access roads, parking and hard and soft landscaping, including alterations to and the replacement of 23 no. residential dwellings approved under full application Ref: SMD/2018/0790
Mill House, Oak Street, Cheadle, Staffordshire, ST10 1NX	Cheadle	06/04/2021	SMD/ 2021/ 0123	Conversion of existing store/workshop building to residential use
1 - 3, Market Place, Leek, Staffordshire, ST13 5HH	Leek	21/01/2021	SMD/2021/0035	Proposed change of use form use class A1, A3 and A4 (2020 use class E and sui generis) shops, offices, food/drink establishment to residential use class C3(upper floor accommodation) and part A1,A3 and A4 (2020 use class E and sui generis) shop (retail), pub and food/drink establishment. (ground floor accommodation only).
Land at Former Bolton's Copperworks, Froghall Road, Froghall, Staffordshire, ST10 2HH	Froghall	08/02/2021	SMD/2020/0684	Residential development (49 dwellings), including formation of new access, landscaping and associated works, and restoration of listed farmhouse and re-use as a dwelling house.

Additional Air Quality Works Undertaken by Staffordshire Moorlands District Council During 2022

Staffordshire Moorlands District Council has not completed any additional works within the reporting year of 2022.

QA/QC of Diffusion Tube Monitoring

Staffordshire Moorlands District Council's diffusion tubes in 2022 were supplied and analysed by Staffordshire Scientific Services, using the 20% TEA in water preparation method. All results have been bias adjusted and annualised where required before being presented in Table A.2.

Staffordshire Scientific Services laboratory is UKAS accredited and participates in the AIR-PT Scheme (a continuation of the Workplace Analysis Scheme for Proficiency (WASP)) for NO_2 tube analysis and the Annual Field Inter-Comparison Exercise. These provide strict performance criteria for participating laboratories to meet, thereby ensuring NO_2 concentrations reported are of a high calibre. In the latest available AIR-PT results, AIR PT AR042 (January – June 2022), Staffordshire Scientific Services scored 100%. No results have been published for the rest of 2022 at the time of writing. The percentage score reflects the results deemed to be satisfactory based upon the z-score of < ± 2, which indicates satisfactory laboratory performance.

The precision of all the 12 local authority co-location studies in 2022 were rated as 'good', as shown by the precision summary results. This precision reflects the laboratory's performance and consistency in preparing and analysing the tubes, as well as the subsequent handling of the tubes in the field. Tubes are considered to have a "good" precision where the coefficient of variation of duplicate or triplicate diffusion tubes for eight or more monitoring periods during a year is less than 20%.

Further information on the precision summary results can be found on the LAQM website.

Monitoring in 2022 had been completed in adherence with the 2022 Diffusion Tube Monitoring Calendar, whereby most changeovers were completed within ±2 days of the specified date.

Diffusion Tube Annualisation

As per LAQM.TG(22), annualisation is required for any site with data capture less than 75% but greater than 25%. Four sites (63, 64, 65 and WF01) required annualisation in 2022 due to low data capture. Background AURN sites used to complete this were Stoke-on-Trent Centre, Ladybower and Crewe Coppenhall. These were selected as they were the nearest AURN background monitoring locations with greater than 85% data capture in 2022. Annualisation was completed using the latest version of the LAQM Diffusion Tube Data Processing Tool, and the outputs are presented in Table C.1.

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

Site ID	Annualisation Factor Stoke-on-Trent Centre	Annualisation Factor Ladybower	Annualisation Factor Crewe Coppenhall	Average Annualisation Factor	Raw Data Annual Mean (µg/m^3)	Annualised Annual Mean (µg/m^3)
63	1.1564	1.2653	1.3259	1.2492	19.2	24.0
64	1.1564	1.2653	1.3259	1.2492	18.1	22.7
65	1.2957	1.4898	1.9544	1.5800	14.4	22.8
WF01	1.1153	1.1552	1.1736	1.1480	15.2	17.5

Diffusion Tube Bias Adjustment Factors

The diffusion tube data presented within the 2022 ASR have been corrected for bias using an adjustment factor. Bias represents the overall tendency of the diffusion tubes to under or over-read relative to the reference chemiluminescence analyser. LAQM.TG22 provides guidance with regard to the application of a bias adjustment factor to correct diffusion tube monitoring. Triplicate co-location studies can be used to determine a local bias factor based on the comparison of diffusion tube results with data taken from NO_x/NO_2 continuous analysers. Alternatively, the national database of diffusion tube co-location surveys provides bias factors for the relevant laboratory and preparation method.

No co-location studies are carried out by Staffordshire Moorlands District Council therefore data is not available to derive a local bias factor and the national factor has been used.

Diffusion tubes for Staffordshire Moorlands District Council are supplied and analysed by Staffordshire Scientific Services. The tubes were prepared using the 20% TEA in water preparation method. Figure C.1 shows the national bias adjustment factor for Staffordshire Scientific Services 20% TEA in water (0.86 for the year 2022 (based on 13 studies)) as per the National Bias Adjustment Factor Spreadsheet (version 07/23). Hence, Staffordshire

Moorlands District Council have applied a national bias adjustment factor of 0.86 to the 2022 monitoring data. A summary of bias adjustment factors used by Staffordshire Moorlands District Council over the past five years is presented in Table C.2.

Figure C.1 - National Diffusion Tube Bias Adjustment Factor for Staffordshire Scientific Services

National Diffusion Tube Bias Adjustment Factor Spreadsheet — Spreadsheet Version Number: 06/23

Follow the steps below **in the correct order** to show the results of **relevant** co-location studies
Data only apply to tubes exposed monthly and are not suitable for correcting individual short-term monitoring periods
Whenever presenting adjusted data, you should state the adjustment factor used and the version of the spreadsheet
This spreadhseet will be updated every few months: the factors may therefore be subject to change. This should not discourage their immediate use.

This spreadsheet will be updated at the end of September 2023

LAQM Helpdesk Website

The LAQM Helpdesk is operated on behalf of Defra and the Devolved Administrations by Bureau Veritas, in conjunction with contract partners AECOM and the National Physical Laboratory.

Spreadsheet maintained by the National Physical Laboratory. Original compiled by Air Quality Consultants Ltd.

Step 1: Select the Laboratory that Analyses Your Tubes from the Drop-Down List. If a laboratory is not shown, we have no data for this laboratory.

Step 2: Select a Preparation Method from the Drop-Down List. If a preparation method is not shown, we have no data for this method at this laboratory.

Step 3: Select a Year from the Drop-Down List. If a year is not shown, we have no data[2]

Step 4: Where there is only one study for a chosen combination, you should use the adjustment factor shown with caution. Where there is more than one study, use the overall factor[3] shown in blue at the foot of the final column.

If you have your own co-location study then see footnote[4]. If uncertain what to do then contact the Local Air Quality Management Helpdesk at LAQMHelpdesk@bureauveritas.com or 0800 0327953

Analysed By[1]	Method (To undo your selection, choose (All) from the pop-up list)	Year[5] (To undo your selection, choose (All))	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) (µg/m³)	Automatic Monitor Mean Conc. (Cm) (µg/m³)	Bias (B)	Tube Precision[6]	Bias Adjustment Factor (A) (Cm/Dm)
Staffordshire Scientific Services	20% TEA in water	2022	KS	Manchester City Council	12	49	43	13.8%	G	**0.88**
Staffordshire Scientific Services	20% TEA in water	2022	UC	Manchester City Council	12	29	29	0.4%	G	**1.00**
Staffordshire Scientific Services	20% TEA in water	2022	SI	Manchester City Council	12	17	16	12.1%	G	**0.89**
Staffordshire Scientific Services	20% TEA in water	2022	KS	Marylebone Road Intercomparison	12	51	42	20.5%	G	**0.83**
Staffordshire Scientific Services	20% TEA in water	2022	UB	Salford City Council	12	23	22	6.9%	G	**0.94**
Staffordshire Scientific Services	20% TEA in water	2022	B	Salford City Council	10	13	11	16.3%	G	**0.86**
Staffordshire Scientific Services	20% TEA in water	2022	R	Salford City Council	12	40	34	17.6%	G	**0.85**
Staffordshire Scientific Services	20% TEA in water	2022	R	Bury Council	11	24	21	16.0%	G	**0.86**
Staffordshire Scientific Services	20% TEA in water	2022	R	East Staffordshire Borough Council	10	39	31	23.9%	G	**0.81**
Staffordshire Scientific Services	20% TEA in water	2022	UB	Stoke-on-Trent City Council	11	23	20	17.1%	G	**0.85**
Staffordshire Scientific Services	20% TEA in water	2022	UB	Wigan Council	12	21	17	21.6%	G	**0.82**
Staffordshire Scientific Services	20% TEA in water	2022	R	Wigan Council	12	27	22	22.6%	G	**0.82**
Staffordshire Scientific Services	20% TEA in Water	2022	R	Bolton Council	9	29	23	25.6%	G	**0.80**
Staffordshire Scientific Services	20% TEA in water	2022		**Overall Factor[3] (13 studies)**				Use		**0.86**

Table C.2 – Bias Adjustment Factor

Monitoring Year	Local or National	If National, Version of National Spreadsheet	Adjustment Factor
2022	National	03/23	0.86
2021	National	03/22	0.85
2020	National	03/21	0.85
2019	National	03/20	0.93
2018	National	03/19	0.89

NO_2 Fall-off with Distance from the Road

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

Fall-off with distance calculations were not required as all sites reported an annual mean NO_2 concentration below 36μg/m^3.

Appendix D: Maps of Monitoring Locations and AQMAs

Figure D.1 – Map of Non-Automatic Monitoring Sites at Newpool and Knowle Style

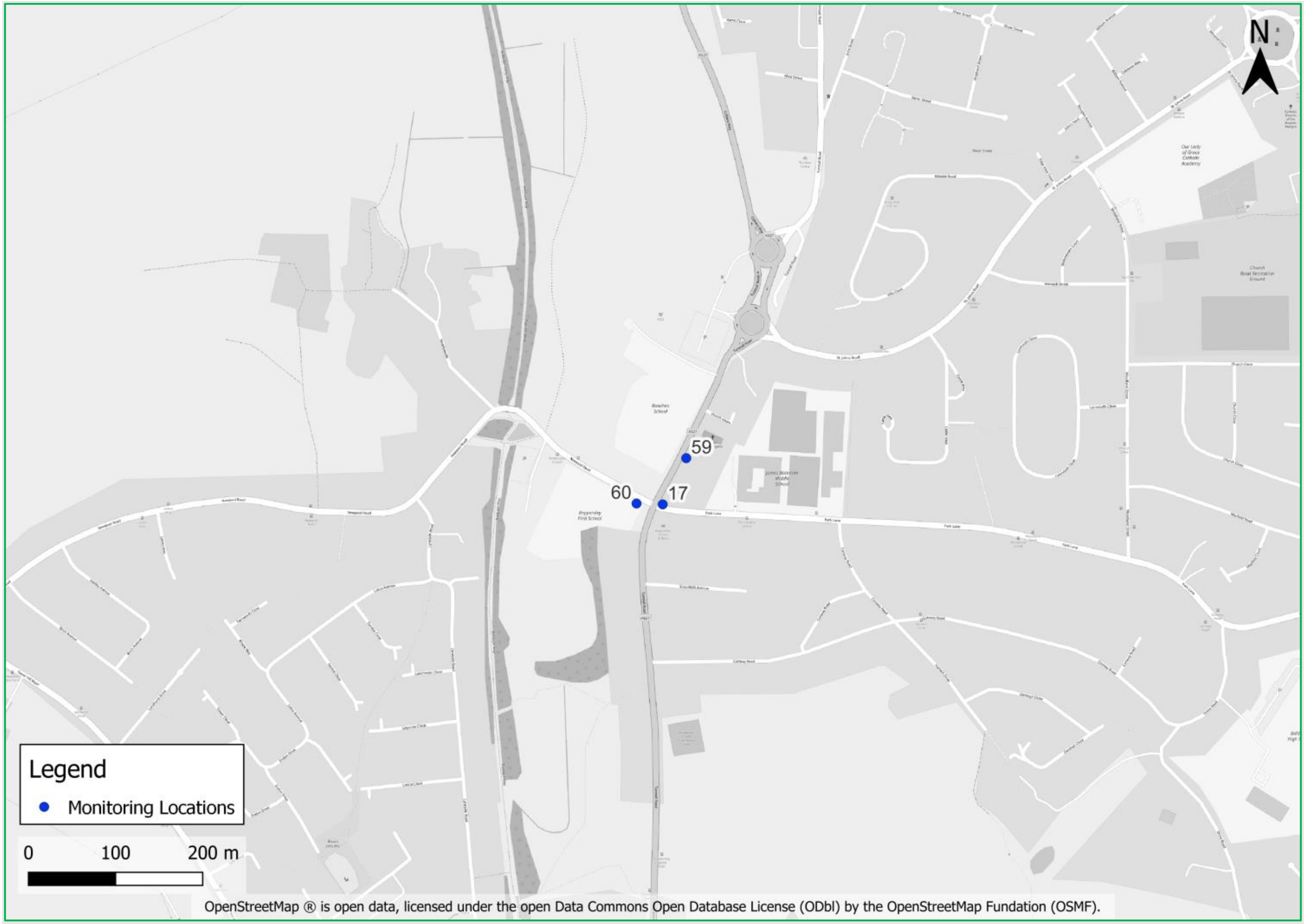


Figure D.2 – Map of Non-Automatic Monitoring Sites at AQMA No.1, Leek, and surrounding areas

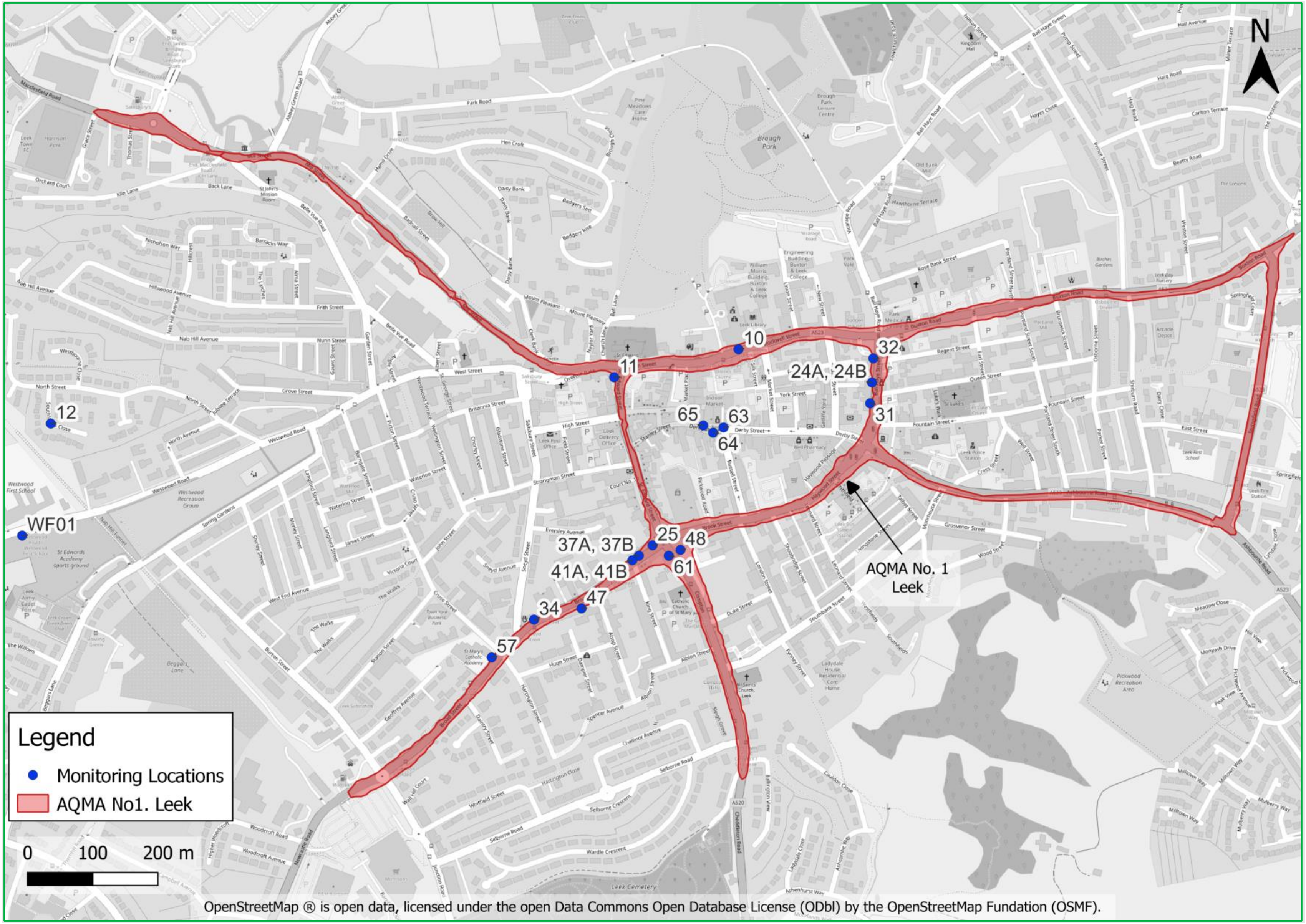


Figure D.3 – Map of Non-Automatic Monitoring Sites at Wetley Rocks

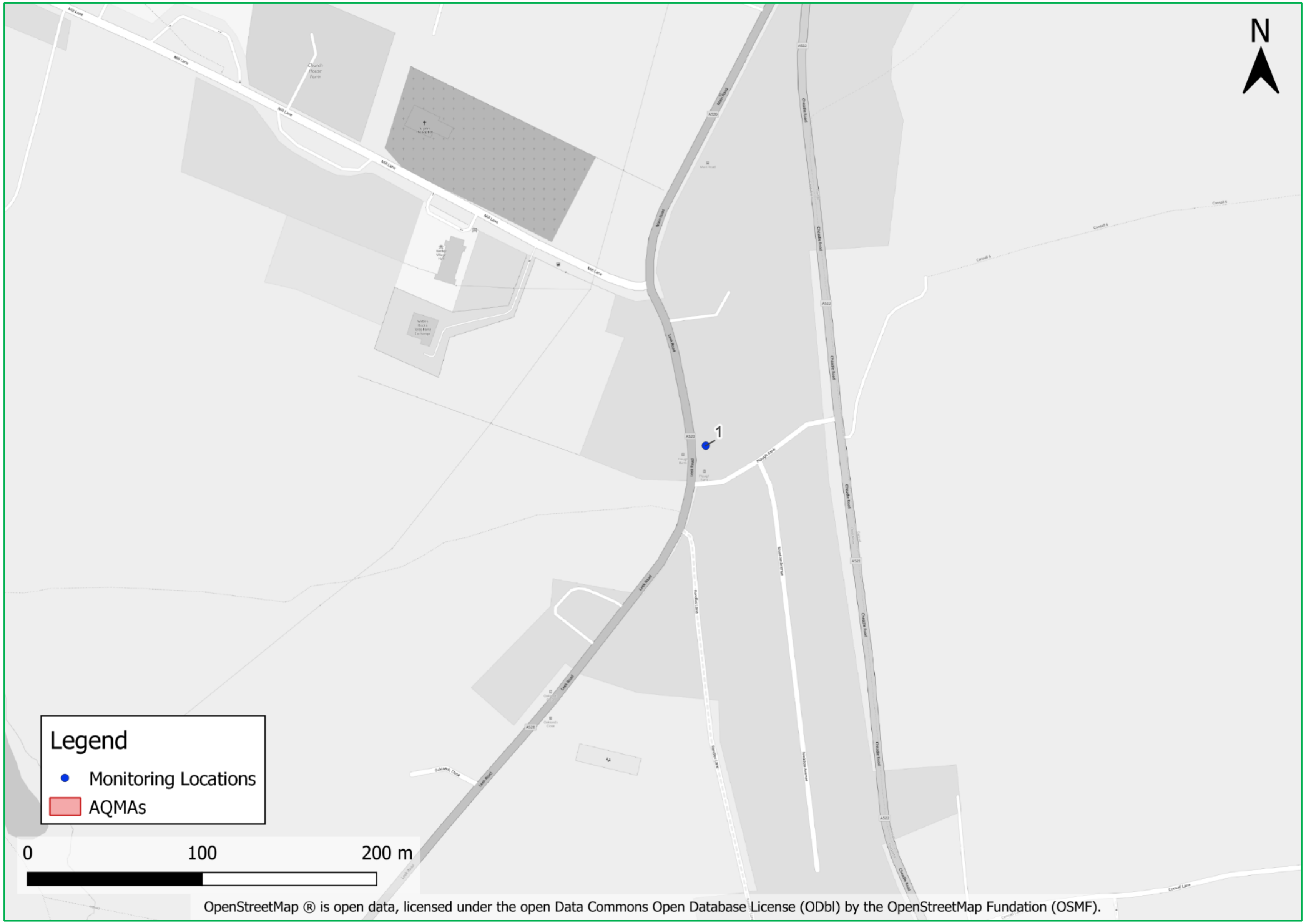


Figure D.4 – Map of Non-Automatic Monitoring Sites at AQMA No.2, Cellarhead

Figure D.5 – Map of Non-Automatic Monitoring Sites at Cheadle

Figure D.6 – Map of Non-Automatic Monitoring Sites at Blythe Bridge

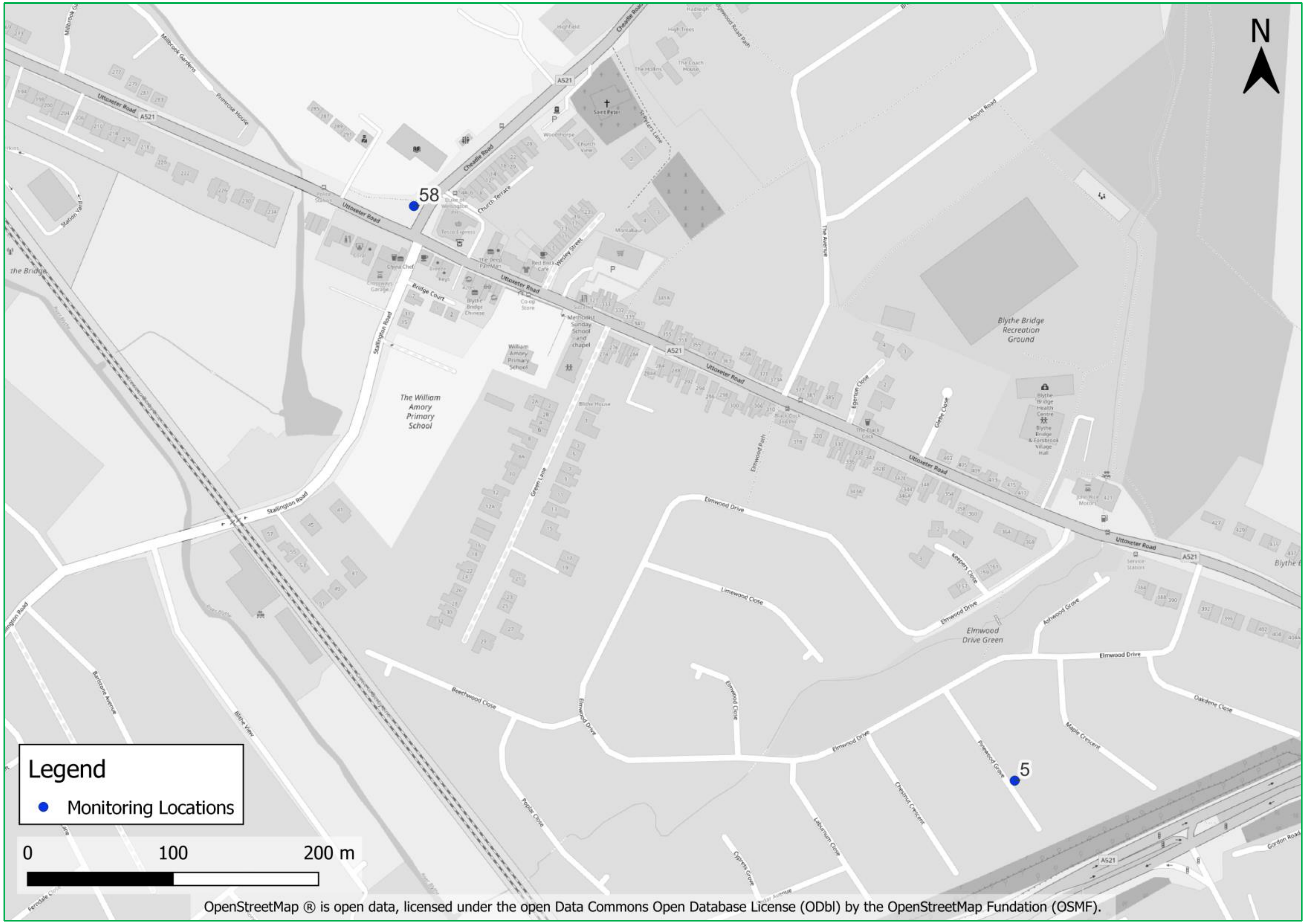


Figure D.7 – Map of Non-Automatic Monitoring Sites at Upper Tean

Figure D.8 – Map of Non-Automatic Monitoring Site at Alton

Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England[8]

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

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

Appendix F: Detailed Modelling Study

The detailed modelling study report is combined at the end of the ASR. Starting after page 65.

Glossary of Terms

Abbreviation	Description
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the local authority intends to achieve air quality limit values'
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
ASR	Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by National Highways
EU	European Union
FDMS	Filter Dynamics Measurement System
LAQM	Local Air Quality Management
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
PM_{10}	Airborne particulate matter with an aerodynamic diameter of 10µm or less
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
QA/QC	Quality Assurance and Quality Control
SO_2	Sulphur Dioxide

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.
- National Diffusion Tube Bias Adjustment Factor Spreadsheet, version 07/23. Published in July 2023.

Staffordshire Moorlands District Council

Detailed Modelling Study

December 2022

Move Forward with Confidence

BUREAU VERITAS

Document Control Sheet

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Client	Staffordshire Moorlands District Council
Document Title	Detailed Modelling Study
Bureau Veritas Ref No.	AIR15154581

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Executive Summary

Bureau Veritas have been commissioned by Staffordshire Moorlands District Council (SMDC) to complete a detailed modelling study of the two Air Quality Management Areas (AQMAs) in Staffordshire Moorlands declared in 2019 to inform their Air Quality Action Plan (AQAP). The Council has yet to publish an AQAP for these AQMAs due to a combination of factors, including their recent declaration coinciding with a shifting of priorities during 2020 as a result of the Covid-19 pandemic and nationally enforced lockdowns.

A dispersion modelling assessment has been completed whereby NO_2 concentrations have been predicted across all relevant areas at specific receptor locations. This has been used to supplement local monitoring data to provide a clear picture of the pollutant concentrations within Staffordshire Moorlands.

Currently there are two AQMAs within Staffordshire Moorlands, declared as a result of exceedances of the 40 µg/m^3 annual mean objective for Nitrogen Dioxide (NO_2). The two AQMAs are defined as follows;

- Leek AQMA – An area encompassing the main travel routes through Leek town centre, including sections of the A523, A53 and adjoining roads. (Declared July 2019)
- Cellarhead AQMA – An area encompassing the Cellarhead crossroads between the A52 and A520. (Declared July 2019)

The aim of this detailed modelling study is to increase the Council's understanding of pollutant concentrations within Staffordshire Moorlands in order to provide technical input into the AQAP and identify if changes to the current AQMAs are required.

In order to provide technical input into an updated AQAP that will cover the two AQMA boundaries, the air quality modelling accounted for a pre-COVID-19 baseline using 2019 traffic data, 2019 monitoring data and the latest Local Air Quality Management (LAQM) tools.

Leek AQMA

Within the Leek AQMA, the modelling has predicted that the 40µg/m^3 NO_2 annual mean Air Quality Strategy (AQS) objective is exceeded at a total of 13 (23%) of modelled receptor locations (i.e. residents within the AQMA), with 8 (14%) further locations modelling concentrations within 10 % of the objective.

Areas of exceedance or near exceedance of the annual mean NO_2 AQS objective were concentrated to roadside locations near junctions where key arterial roads meet. This confirms that vehicle traffic is the main cause of elevated levels of NO_2 concentrations within the Leek AQMA. Roads contributing to concentrations within the AQMA include A53 Broad Street, A53 Brook Street, A520 Compton, A53 Ball Haye Street and A523 Stockwell Street.

A NO_x 'source apportionment' exercise has been completed which demonstrates that Diesel Cars are found to the main contributors to total road NO_x concentrations within the Leek AQMA.

A reduction of approximately 41.9% in Road NO_x at the worst case receptor is required to meet the AQO for annual mean NO_2

The high traffic volume and congestion at the main junction of A53 Broad Street, A53 Brook Street, A52 St Edward Road and A52 Campton and the main junction of A53 Buxton Road, A523 Stockwell Street and A53 Ball Haye Street are considered to be the key contributors to elevated levels of NO_2 annual mean concentrations within the AQMA.

Following the completion of the detailed modelling study, the following recommendations are made:

- Continue to monitor NO_2 across the AQMA with the expansion of monitoring along Brook Street further east and A520 further south.

- Based on the source apportionment results, any future intervention measures should be targeted at reducing vehicle emissions from all vehicle types. Special targeted measures for reducing Diesel Car and LGV should be the primary focus as these are both observed to be the largest contributors to total vehicle emissions in the areas of exceedance.

- Measures to reduce congestion at the main junction of the A53 Broad Street A53 Broad Street, A520 Compton and A520 St Edward Street, and junction of A53 Buxton Road, A523 Stockwell Street and A53 Ball Haye Street would also help to reduce emissions of NO_2 in the Leek AQMA.

<u>Cellarhead AQMA</u>

Within the Cellarhead AQMA, the model has predicted that the 40µg/m^3 NO_2 annual mean AQS objective is exceeded at a total 8 (35% of all modelled receptors within the AQMA) receptor locations.

Areas of exceedance or near exceedance of the annual mean NO_2 AQS objective were concentrated to roadside locations particularly at Cellarhead junctions at A520 Leek Road, A52 Cellarhead Street and A52 Kingsley Road. These receptors in close proximity to the Cellarhead Junction are where the highest concentrations are observed. This is likely due to the high traffic volume and congestion around the junction.

A NO_x 'source apportionment' exercise has been completed which demonstrates that Diesel Cars and LGVs are found to the main contributors to total road NO_x concentrations within the Cellarhead AQMA.

A reduction of approximately 41.2% in Road NO_x at the worst-case receptor is required to meet the AQO for annual mean NO_2

Overall it suggests volume of traffic and congestion on the main junction of A52 Cellarhead Road, A52 Kingsley Road and A520 Leek Road are considered to be the key contributor to elevated levels of NO_2 annual mean concentrations within the AQMA.

<u>Summary and Conclusions</u>

Following the completion of the detailed modelling assessment, the following recommendations are made:

- Continue to monitor NO_2 across the AQMA, with the expansion of monitoring alongside the Leek Road at the north side of the Cellarhead Junction.

- Based on the source apportionment results, any future intervention measures should be targeted at reducing vehicle emissions from all vehicle types. Special targeted measures for reducing Diesel Car and LGV should be the primary focus as these are both observed to be the largest contributors to total vehicle emissions in the areas of exceedance.

- Measures to reduce congestion at the Cellarhead Junction atA520 Leek Road, A52 Cellarhead Street and A52 Kingsley Road will help to reduce NO_2 emissions.

1 Introduction

Bureau Veritas have been commissioned by Staffordshire Moorlands District Council (SMDC) to complete a detailed modelling study of the two Air Quality Management Areas (AQMAs) in Staffordshire Moorlands declared in 2019 to inform their Air Quality Action Plan (AQAP). The Council has yet to publish an AQAP for these AQMAs due to a combination of factors, including their recent declaration coinciding with a shifting of priorities during 2020 as a result of the Covid-19 pandemic and nationally enforced lockdowns. Currently there are two AQMAs within Staffordshire Moorlands, declared as a result of exceedances of the 40 µg/m^3 annual mean objective for Nitrogen Dioxide (NO_2). The two AQMAs are defined as follows;

- Leek AQMA – An area encompassing the main travel routes through Leek town centre, including sections of the A523, A53 and adjoining roads. (Declared July 2019)
- Cellarhead AQMA – An area encompassing the Cellarhead crossroads between the A52 and A520. (Declared July 2019)

Locations of both AQMAs are shown in Figure 1-1 and Figure 1-2 below. Both AQMAs were declared in 2019. The Council has yet to publish an AQAP for these AQMAs due to a combination of factors, including their recent declaration coinciding with a shifting of priorities during 2020 as a result of the Covid-19 pandemic and nationally enforced lockdowns.

This detailed modelling study has covered both AQMAs and has used pre-COVID-19 traffic data and local authority monitoring data to identify the extent of NO_2 exceedances in order to inform the AQAP.

Figure 1-1 – Location of Leek AQMA

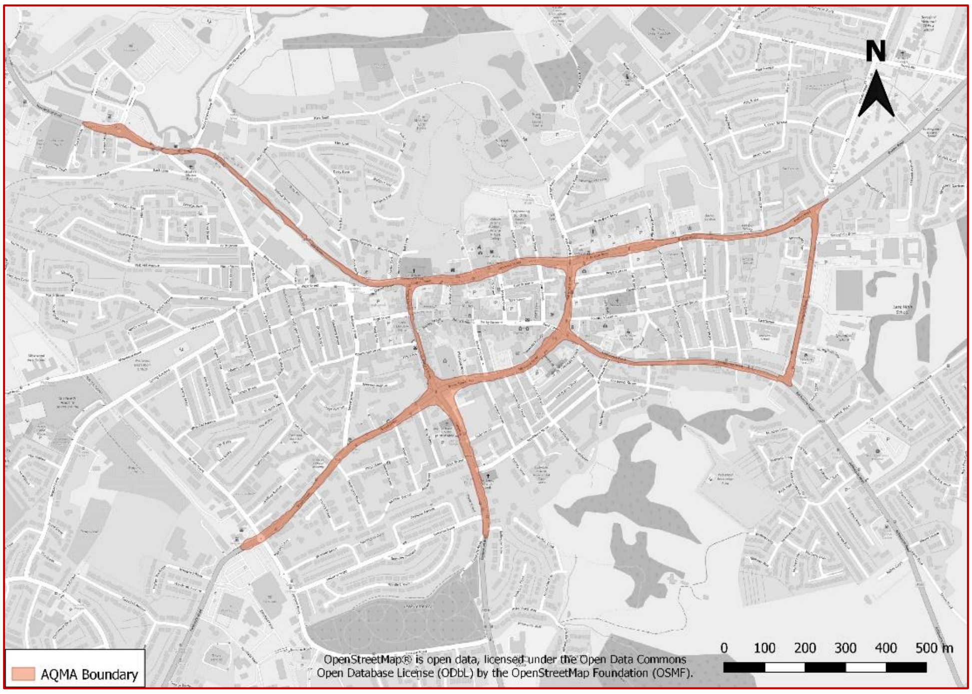


Figure 1-2 – Location of Cellarhead AQMA

1.1 Scope of Assessment

This assessment seeks to predict the magnitude and geographical extent of any exceedances of the AQS objectives, providing the Council with updated modelling data that can be used for the development and/or updates to specific measures that are to be included within the AQAP.

It is the general purpose and intent of this assessment to determine, with reasonable certainty, the magnitude and geographical extent of any exceedances of the AQS objectives for NO_2,$PM_{2.5}$ and PM_{10} enabling SMDC to provide a focused consideration on developing measures as part of the AQAP for each of the two AQMAs.

The following are the objectives of the assessment:

- To assess the air quality at selected locations ("receptors") representative of worst-case exposure relative to the averaging period of focus (i.e. annual objective - façades of the existing residential units), based on modelling of emissions from road traffic on the local road network;
- To establish the spatial extent of any likely exceedances of the UK annual mean NO_2 AQS objective limit, and to identify the spatial extent of any areas within 10%;
- To establish the required reduction in emissions to comply with the UK AQS objectives; and
- To determine the relative contributions of various source types to the overall pollutant concentrations within the AQMAs, through source apportionment, in order to inform an updated AQAP.

The approach adopted in this assessment to assess the impact of road traffic emissions on air quality utilised the atmospheric dispersion model ADMS-Roads version 5.0.0.1, focusing on emissions of oxides of nitrogen (NO_x), which comprise of nitric oxide (NO) and nitrogen dioxide (NO_2), and Particulate Matters (PM_{10} and $PM_{2.5}$).

In order to provide consistency with the Council's own work on air quality, the guiding principles for air quality assessments, as set out in the latest guidance provided by Defra for air quality assessment (LAQM.TG(22))[1], have been used.

[1] LAQM Technical Guidance LAQM.TG(22) – August 2022. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.

2 Air Quality – Legislative Context

2.1 Air Quality Strategy

The importance of existing and future pollutant concentrations can be assessed in relation to the national air quality standards and objectives established by Government. The Air Quality Strategy[2] (AQS) provides the over-arching strategic framework for air quality management in the UK and contains national air quality standards and objectives established by the UK Government and Devolved Administrations to protect human health. The air quality objectives incorporated in the AQS and the UK Legislation are derived from Limit Values prescribed in the EU Directives transposed into national legislation by Member States.

The CAFE (Clean Air for Europe) programme was initiated in the late 1990s to draw together previous directives into a single EU Directive on air quality. The CAFE Directive[3] has been adopted and replaces all previous air quality Directives, except the 4th Daughter Directive[4]. The Directive introduces new obligatory standards for $PM_{2.5}$ for Government but places no statutory duty on local government to work towards achievement of these standards.

The Air Quality Standards (England) Regulations[5] 2010 came into force on 11 June 2010 in order to align and bring together in one statutory instrument the Government's obligations to fulfil the requirements of the new CAFE Directive.

The objectives for ten pollutants – benzene (C_6H_6), 1,3-butadiene (C_4H_6), carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), particulate matter (PM_{10} and $PM_{2.5}$), ozone (O_3) and Polycyclic Aromatic Hydrocarbons (PAHs), have been prescribed within the AQS[2].

The EU Limit Values are considered to apply everywhere with the exception of the carriageway and central reservation of roads and any location where the public do not have access (e.g. industrial sites).

The AQS objectives apply at locations outside buildings or other natural or man-made structures above or below ground, where members of the public are regularly present and might reasonably be expected to be exposed to pollutant concentrations over the relevant averaging period. Typically, these include residential properties and schools/care homes for long-term (i.e. annual mean) pollutant objectives and high streets for short-term (i.e. 1-hour) pollutant objectives. Table 2-1 taken from LAQM TG(22)[1] provides an indication of those locations that may or may not be relevant for each averaging period.

This assessment focuses on NO_2 due to the significance this pollutant holds within the Council's administrative area - evidenced by the declared borough-wide AQMA. Moreover, as a result of traffic pollution the UK has failed to meet the EU Limit Values for this pollutant by the 2010 target date. As a result, the Government has had to submit time extension applications for compliance with the EU Limit Values, which has since passed and its continued failure to achieve these limits is currently giving rise to infraction procedures being implemented. The UK is not alone as the challenge of NO_2 compliance at EU level includes many other Member States.

In July 2017, the Government published its plan for tackling roadside NO_2 concentrations[6], to achieve compliance with EU Limit Values. This sets out Government policies for bringing NO_2

[2] Defra (2007), The Air Quality Strategy for England, Scotland, Wales and Northern Ireland.

[3] Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe.

[4] Directive 2004/107/EC of the European Parliament and of the Council of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic hydrocarbons in ambient air.

[5] The Air Quality Standards Regulations (England) 2010, Statutory Instrument No 1001, The Stationary Office Limited.

[6] Defra, DfT (2017), UK plan for tackling roadside nitrogen dioxide concentrations

concentrations within statutory limits in the shortest time period possible. Furthermore, the Clean Air Strategy was published in 2019, which outlines how the UK will meet international commitments to significantly reduce emissions of five damaging air pollutants by 2020 and 2030 under the adopted revised National Emissions Ceiling Directive (NECD)

The AQS objectives for these pollutants are presented in Table 2-2.

Table 2-1 – Examples of where the Air Quality Objectives should apply

Averaging Period	Objectives should apply at:	Objectives should generally not apply at:
Annual mean	All locations where members of the public might be regularly exposed. Building facades of residential properties, schools, hospitals, care homes etc.	Building facades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
24-hour mean and 8-hour mean	All locations where the annual mean objectives would apply, together with hotels. Gardens or residential properties[1].	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be shorter than either the 24- or 8-hour relevant mean.
1-hour mean	All locations where the annual mean and 24 and 8-hour mean objectives would apply. Kerbside sites (e.g. pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where the public might reasonably be expected to spend one hour or more. Any outdoor locations at which the public may be expected to spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.
15-minute mean	All locations where members of the public might reasonably be expected to spend a period of 15 minutes or longer.	

Note [1] For gardens and playgrounds, such locations should represent parts of the garden where relevant public exposure is likely, for example where there is seating or play areas. It is unlikely that relevant public exposure would occur at the extremities of the garden boundary, or in front gardens, although local judgement should always be applied.

Table 2-2 – Relevant AQS Objectives for the Assessed Pollutants in England

Pollutant	AQS Objective	Concentration Measured as:	Date for Achievement
Nitrogen dioxide (NO_2)	200 µg/m³ not to be exceeded more than 18 times per year	1-hour mean	31st December 2005
	40 µg/m³	Annual mean	31st December 2005
Particles PM_{10}	50 µg/m³ not to be exceeded more than 35 times a year	24-hour mean	31st December 2004
	40 µg/m³	Annual mean	31st December 2004
Particles $PM_{2.5}$	20 µg/m³	Annual mean	31st December 2010

Pollutant	AQS Objective	Concentration Measured as:	Date for Achievement
$PM_{2.5}$ Exposure Reduction	Target of 15% reduction in concentrations at urban background	Annual Mean	Between 2010 and 2020

2.2 Local Air Quality Management (LAQM)

Part IV of the Environment Act 1995[7] (as amended 2021)[8] places a statutory duty on local authorities to periodically review and assess air quality within their area, and determine whether they are likely to meet the AQS objectives set down by Government for a number of pollutants – a process known as Local Air Quality Management (LAQM). The AQS objectives that apply to LAQM are defined for seven pollutants: benzene, 1,3-butadiene, carbon monoxide, lead, nitrogen dioxide, sulphur dioxide and particulate matter.

Local Authorities were formerly required to report on all of these pollutants, but following an update to the regime in 2016, the core of LAQM reporting is now focussed around the objectives of three pollutants; NO_2, PM_{10} and SO_2. Where the results of the Review and Assessment process highlight that problems in the attainment of the health-based objectives pertaining to the above pollutants will arise, the authority is required to declare an AQMA – a geographic area defined by high concentrations of pollution and exceedances of health-based standards.

The areas in which the AQS objectives apply are defined in the AQS as locations outside (i.e. at the façade) of buildings or other natural or man-made structures above or below ground where members of the public are regularly present and might reasonably be expected to be exposed to pollutant concentrations over the relevant averaging period of the AQS objective.

Following any given declaration, the Local Authority is subsequently required to develop an Air Quality Action Plan (AQAP), which will contain measures to address the identified air quality issue, and bring the location into compliance with the relevant objective as soon as possible.

[7] http://www.legislation.gov.uk/ukpga/1995/25/part/IV

[8] Part IV of the Environment Act 2021. Published by the UK Government, 16th November 2021. Available at: https://www.legislation.gov.uk/ukpga/2021/30/part/4/enacted

3 Review and Assessment of Air Quality Undertaken by the Council

3.1 Local Air Quality Management

SMDC currently has two AQMAs, declared as a result of exceedances of the 40 µg/m^3 annual mean objective for Nitrogen Dioxide (NO_2). The two AQMA's are defined as follows;

- Leek AQMA – An area encompassing the main travel routes through Leek town centre, including sections of the A523, A53 and adjoining roads. (Declared July 2019)
- Cellarhead AQMA – An area encompassing the Cellarhead crossroads between the A52 and A520. (Declared July 2019)

The most recent LAQM report completed by the Council was the 2022 ASR[9], containing the 2021 monitoring data. The 2022 ASR acknowledged the need for an AQAP.

In order to provide technical input into an AQAP that will cover the two AQMA boundaries, the air quality modelling has accounted for a pre-COVID-19 based using 2019 traffic data, 2019 monitoring data and the latest Local Air Quality Management (LAQM) tools. Air quality monitoring data has decreased significantly since 2020 due to decrease of traffic under the lockdown during the COVID-19 pandemic. According to the traffic data from Department for Transport (DfT)[10], traffic in Staffordshire has a sharp decline of 23% from 2019 to 2020 which shows the impact of lockdown during the COVID-19 pandemic.

This report details the findings of this analysis, and provides recommendation on matters related to NO_2 exceedances, in order to inform a new targeted set of measures within the AQAP.

3.2 Review of Air Quality Monitoring

3.2.1 Local Automatic Air Quality Monitoring

During 2019, SMDC did not undertake any automatic (continuous) monitoring.

3.2.2 Local Non-Automatic Air Quality Monitoring

During 2019, SMDC's non-automatic monitoring programme consisted solely of recording NO_2 concentrations using a network of 34 sites (with 6 of these sites being duplicate colocation sites). All of these locations are roadside sites.

The details of the diffusion tube monitoring within each AQMA for 2019 are shown in Table 3-1 and Table 3-2.

Figure 3-1 and Figure 3-2 illustrate the locations of the non-automatic monitoring locations in each AQMA.

[9] https://www.staffsmoorlands.gov.uk/media/4582/Staffs-Moorlands-ASR-2019/pdf/Staffordshire_Moorlands_ASR__2019.pdf

[10] https://roadtraffic.dft.gov.uk/local-authorities/117

Table 3-1 – SMDC LAQM Diffusion Tube Monitoring – Leek AQMA

Site ID	Site Location	In AQMA	Annual Mean NO_2 Concentration (µg/m^3)						
			2015	2016	2017	2018	2019	2020	2021
10	Leek (Moorlands House)	Yes - Leek AQMA	30.1	31.1	31.3	30.6	29.8	21.1	25.5
11	Leek (Swan Hotel)	Yes - Leek AQMA	37.5	38.1	35.2	35.4	35.4	24.7	27.1
25	Leek (Broad Street Jct North_1)	Yes - Leek AQMA	**41.3**	**47.4**	**41.6**	**43.4**	**44.1**	32.0	35.6
31	Leek (Ball Haye St _ South)	Yes - Leek AQMA	33.8	34.6	33.9	32.3	31.8	25.7	25.1
32	Leek (Ball Haye St_ North)	Yes - Leek AQMA	**40.2**	39.5	36.0	37.0	34.1	26.1	31.0
34	Leek (Broad Street Vets_ South 2)	No - adjacent to AQMA	28.8	33.5	28.8	27.6	26.3	21.8	23.4
47	Broad Street South	Yes - Leek AQMA	-	-	22.6	27.5	28.8	22.5	24.6
48	Broad Street Junction	Yes - Leek AQMA	-	-	33.2	32.9	34.9	27.0	32.9
57	Broad Street South	Yes - Leek AQMA	-	-	-	-	**41.7**	31.0	32.3
24A,24B	Leek (Ball Haye St _ Central) (*2)	Yes - Leek AQMA	**41.9**	**43.2**	**42.1**	38.6	37.0	28.6	30.9
37A,37B	Leek (Broad Street North_3) (*2)	Yes - Leek AQMA	**40.8**	**45.3**	**41.8**	39.8	39.2	31.5	32.7
41A,41B	Leek (Broad Street Jct North_4) (*2)	Yes - Leek AQMA	34.6	37.7	32.3	31.8	31.1	25.5	25.4

Monitoring locations 10, 11, 24A, 24B, 25, 31, 37A, 37B, 47 and 57 are all located within the Leek AQMA. Monitoring locations 25 and 57 exceed the annual mean AQO for NO_2 in 2019. Monitoring locations 24A, 24B, 37A and 37B were within 10% of the exceedance value. With no locations close to exceeding 60µg/m^3, the empirical relationship given in LAQM.TG(22)[1] states that exceedances of the 1-hour mean objective for NO_2 is only likely to occur where annual mean concentrations are 60µg/m^3 or above at a location of relevant exposure (Table 2-1). This indicates that an exceedance of the 1-hour mean objective is unlikely to have occurred at these sites between 2015 and 2021.

Table 3-2 – SMDC LAQM Diffusion Tube Monitoring – Cellarhead AQMA

Site ID	Site Location	In AQMA	Annual Mean NO_2 Concentration (µg/m^3)						
			2015	2016	2017	2018	2019	2020	2021
49	Cellarhead Juction 4	Yes - Cellarhead AQMA	-	-	27.8	30.0	25.1	18.7	20.0

Site ID	Site Location	In AQMA	Annual Mean NO_2 Concentration (µg/m^3)						
			2015	2016	2017	2018	2019	2020	2021
53	Cellarhead Junction_5	Yes - Cellarhead AQMA	-	-	-	-	**41.9**	28.4	30.2
54	Cellarhead Junction_6	Yes - Cellarhead AQMA	-	-	-	-	30.5	17.4	19.3
55	Cellarhead Junction_7	Yes - Cellarhead AQMA	-	-	-	-	32.1	23.6	25.9
56	Cellarhead Junction_8	Yes - Cellarhead AQMA	-	-	-	-	38.1	27.6	27.3
38A, 38B	Cellarhead Junction_2 (*2)	Yes - Cellarhead AQMA	**47.6**	**50.8**	**47.9**	**42.3**	**42.5**	32.0	35.6
39A, 39B	Cellarhead Junction_3 (*2)	Yes - Cellarhead AQMA	**49.2**	**51.1**	**48.2**	**42.1**	**42.7**	32.4	35.1
42A, 42B	Cellar Head Junction 4 (*2)	Yes - Cellarhead AQMA	**47.6**	**48.9**	**41.2**	**40.7**	**42.0**	30.6	32.8

Monitoring locations 49, 53, 54, 55, 56, 39A, 39B, 42A and 42B are all located within the Cellarhead AQMA. Monitoring locations 53, 39A, 39B, 42A and 42B exceed the annual mean AQO for NO_2. Monitoring locations 56 was within 10% of the exceedance value. These exceedances are primarily located at junctions and at the centre of Cellarhead Junction.

Besides, the decline of concentrations in 2020 within both AQMAs indicates the impact of lockdown during COVID-19 pandemic. An average decline of 23.1% was observed in Leek AQMA from 2019 to 2020 and an average decline of 28.8% was observed in Cellarhead AQMA from 2019 to 2020. Therefore, the traffic data and monitoring data prior to 2020 are used to represent a normalised circumstance in both AQMAs .

Figure 3-1 – Staffordshire Moorlands District Council – Leek AQMA and Local Authority Monitoring Locations

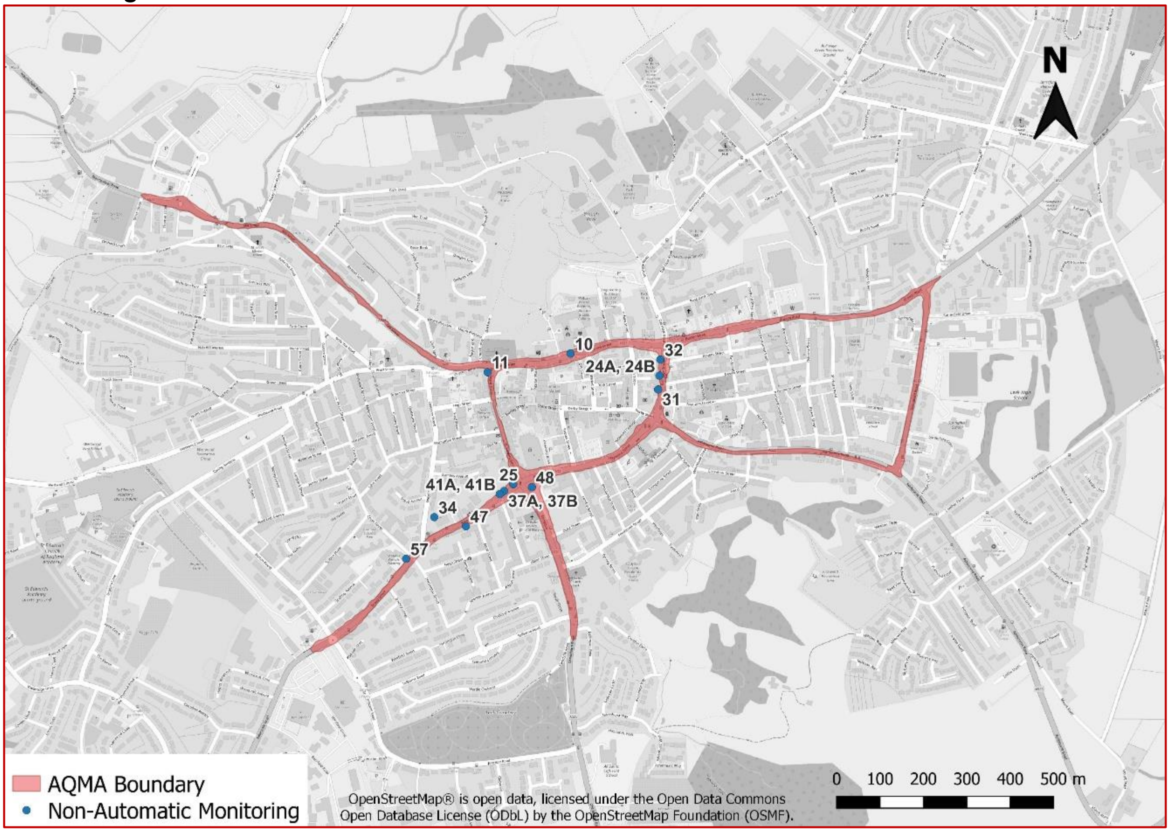
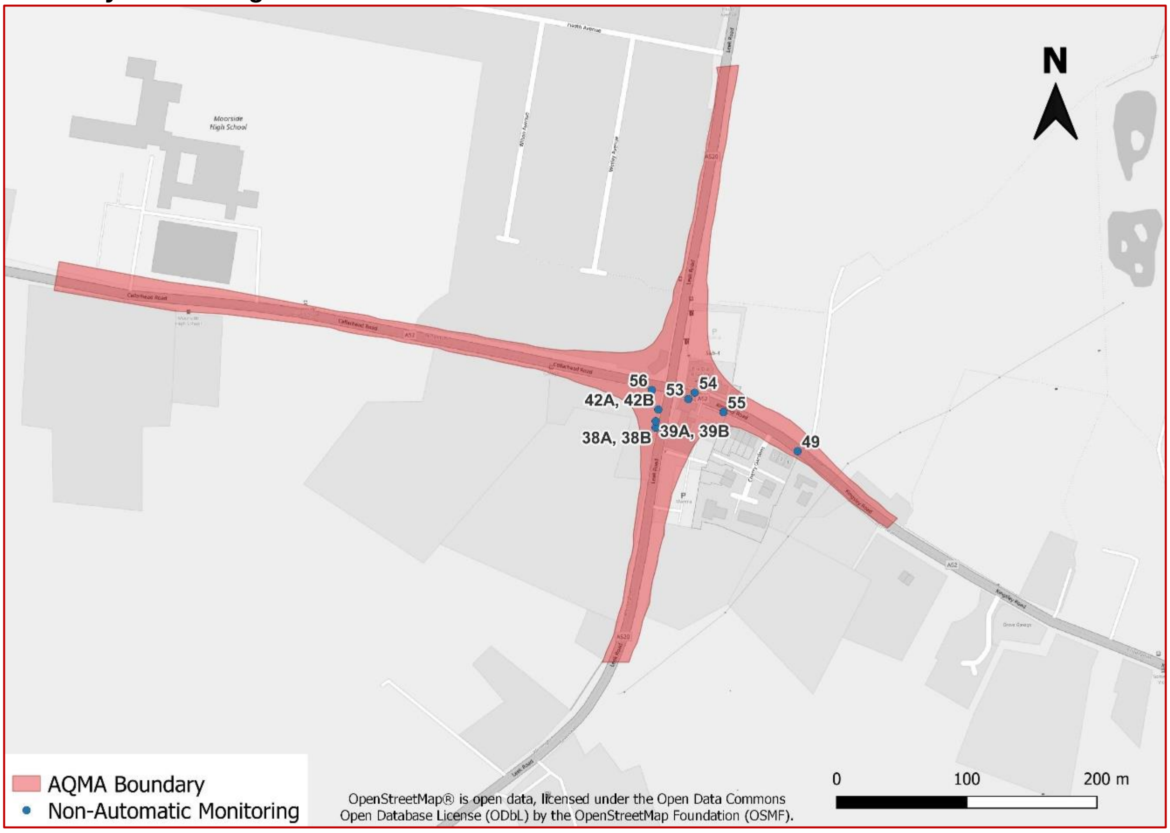


Figure 3-2 - Staffordshire Moorlands District Council – Cellarhead AQMA and Local Authority Monitoring Locations



3.3 Defra Background Concentration Estimates

Defra maintains a nationwide model of existing and future background air pollutant concentrations at a 1km x 1km grid square resolution. This data includes annual average concentration for NO_x, NO_2, PM_{10} and $PM_{2.5}$, using a base year of 2019 (the year in which comparisons between modelled and monitoring are made)[11]. The model used to determine the background pollutant levels is semi-empirical in nature: it uses the National Atmospheric Emissions Inventory (NAEI) emissions to model the concentrations of pollutants at the centroid of each 1km grid square, but then calibrates these concentrations in relation to actual monitoring data.

Due to the absence of local background monitoring within Staffordshire Moorlands and nearby to the AQMAs, pollutant background concentrations used for the purposes of this assessment have been obtained from the Defra supplied background maps for the relevant 1km x 1km grid squares covering the modelled domain for the year 2019. The relevant annual mean background concentration will be added to the predicted annual mean road contributions in order to predict the total pollutant concentration at each receptor location. The total pollutant concentration can then be compared against the relevant AQS objective to determine the event of an exceedance.

The Defra mapped background concentrations for base year of 2019, which cover the modelled domain, are presented in Table B.1 of Appendix B. All of the mapped background concentrations presented are well below the respective annual mean AQS objectives. No adjustment for background concentration variability with height has been made.

[11] Defra Background Maps (2019), available at https://uk-air.defra.gov.uk/data/laqm-background-home

4 Assessment Methodology

To predict pollutant concentrations of road traffic emissions the atmospheric model ADMS Roads version 5.0.0.1 was utilised to model a 2019 baseline predictions scenario. The guiding principles for air quality assessments as set out in the latest guidance and tools provided by Defra for air quality assessment LAQM.TG(22)[1] have been used.

The approach used in this assessment has been based on the following:

- Prediction of NO_2, PM_{10} and $PM_{2.5}$ concentrations to which existing receptors may be exposed and comparison with the relevant AQS objectives;
- Quantification of relative NO_2 contribution of sources to overall NO_2 pollutant concentration; and,
- Determination of the geographical extent of any potential exceedances in regards to the existing AQMA boundaries.

Concentrations of NO_2 have been predicted with a base year of 2019, with model inputs relevant to the assessment based upon the same year. A base year prior to 2020 was used due to the impact of the COVID-19 pandemic affecting pollutant concentrations in 2020. Reductions in travel gave rise to a change of air pollutant emissions associated with road traffic. To demonstrate, an average NO_2 monitoring concentration decline of 23.1% was observed in Leek AQMA from 2019 to 2020 and an average decline of 28.8% was observed in Cellarhead AQMA from 2019 to 2020.. Therefore, using pre-pandemic traffic levels would more likely represent normalised vehicle activity in Staffordshire Moorlands

4.1 Traffic Inputs

Traffic flows and vehicle class compositions for the 2019 baseline scenario were collected from the Department for Transport (DfT) traffic count point database. The data from DfT database was provided as annual average daily traffic(AADT).

It should be noted that although the DfT traffic was obtained for the baseline year of 2019, data of some count points was estimated using previous year's AADT on this link.

Traffic speeds were modelled at the relevant speed limit for each road. Where appropriate, vehicle speeds have been reduced in accordance with LAQM TG(22)[1] to simulate queues at junctions, traffic lights and other locations where queues or slower traffic are known to be an issue.

The Emissions Factors Toolkit (EFT) version 11.0 developed by Defra[12] has been used to determine vehicle emission factors for input into the ADMS-Roads model, based upon the traffic data inputs.

Details of the traffic flows used in this assessment are provided in Table C.1 of the Appendices. The entire modelled road network across each AQMA is presented in Figure 4-1 and Figure 4-2.

[12] Defra, Emissions Factors Toolkit (2021). https://laqm.defra.gov.uk/air-quality/air-quality-assessment/emissions-factors-toolkit/

Figure 4-1 – Leek AQMA Modelled Road Network

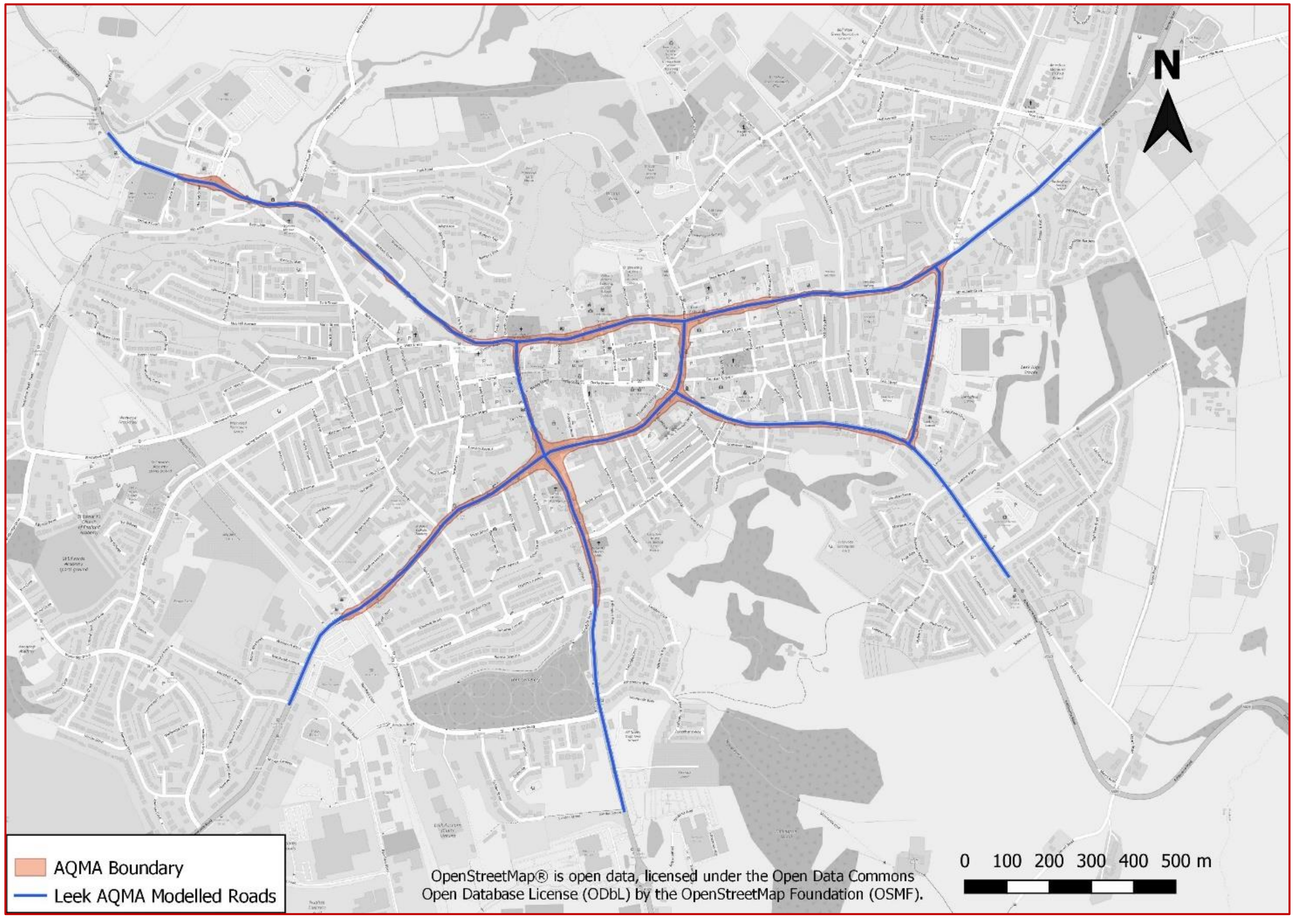


Figure 4-2 – Cellarhead AQMA Modelled Road Network

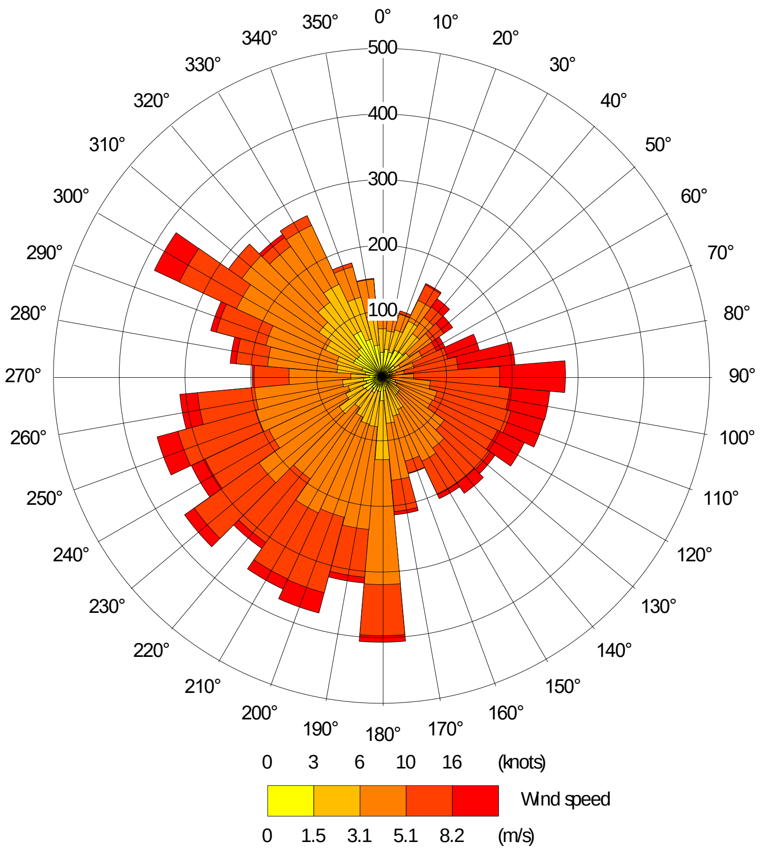
4.2 General Model Inputs

A site surface roughness value of 1 m was entered into the ADMS-roads model, consistent with the built-up nature of the modelled domain. In accordance with CERC's ADMS Roads User Guide[13], a minimum Monin-Obukhov length of 30 m was used for the ADMS Road model to reflect the suburban topography of the model domain.

One year of hourly sequential meteorological data from a representative synoptic station is required by the dispersion model. 2019 meteorological data from Leek Thorncliffe weather station has been used in this assessment. The station is located approximately 13 km northeast of the Cellarhead AQMA (furthest AQMA from the meteorological site) and is considered representative of the meteorological conditions experienced throughout the district. A surface roughness value of 0.5 m was used for the area surrounding the meteorological station, more representative of the Leek Thorncliffe location.

A wind rose for this site for the year 2019 is shown in Figure 4-3.

Figure 4-3 – Wind Rose for Leek Thorncliffe Data 2019



Most dispersion models do not use meteorological data if they relate to calm winds conditions, as dispersion of air pollutants is more difficult to calculate in these circumstances. ADMS-Roads treats calm wind conditions by setting the minimum wind speed to 0.75m/s. It is recommended in

[13] CERC (2020), ADMS-Roads User Guide Version 5

LAQM.TG(22)[1] that the meteorological data file be tested within a dispersion model and the relevant output log file checked, to confirm the number of missing hours and calm hours that cannot be used by the dispersion model. This is important when considering predictions of high percentiles and the number of exceedances. LAQM.TG(22)[1] recommends that meteorological data should have a percentage of usable hours greater than 85%. If the data capture is less than 85% short-term concentration predictions should be expressed as percentiles rather than as numbers of exceedances. The 2019 meteorological data from Leek Thorncliffe includes 8,666 lines of usable hourly data out of the total 8,760 for the year, i.e. 98.9% usable data. This is therefore suitable for the dispersion modelling exercise.

4.3 Modelled Sensitive Receptors

A total of;

- 57 discrete receptors for the Leek AQMA
- 23 discrete receptors for the Cellarhead AQMA, and

were included within the assessment to represent locations of relevant exposure. The locations were identified through completion of a desktop study, and primarily included places such as residential properties and schools. Details of the receptors are presented within Table 4-1 and their locations are illustrated in Figure 4-4 and Figure 4-5.

The majority of the receptors in each AQMA were included at a height of 1.5 m to represent ground level exposure. Where there was only sensitive receptors at 1st floor e.g. where there is commercial use at ground floor with flats above, receptors have been modelled at height of 4m.

Table 4-1 – Total NO_x Source Apportionment Across All Receptors

Receptor ID	X	Y	Height	Closest address/post code	Receptor Type
Cellarhead AQMA					
R1	395297	347628	1.5	75 Cellarhead Road, Werrington, Staffordshire Moorlands, England, ST9 0HP	Residential
R2	395367	347622	1.5	65 Cellarhead Road, Werrington, Staffordshire Moorlands, England, ST9 0HP	Residential
R3	395639	347618	1.5	26 Cellarhead Road, Werrington, Staffordshire Moorlands, England, ST9 0HW	Residential
R4	395657	347576	1.5	11 Cellarhead Road, Werrington, Staffordshire Moorlands, England, ST9 0HW	Residential
R5	395698	347575	1.5	1 Leek Rd, Werrington, Stoke-on-Trent ST9 0DH	Residential
R6	395683	347602	1.5	Cellarhead Road, Werrington, Staffordshire Moorlands, England, ST9 0HW	Residential
R7	395706	347590	1.5	7 Leek Rd, Werrington, Stoke-on-Trent ST9 0HX	Residential
R8	395706	347620	1.5	4, Leek Road, Werrington, Stoke-on-Trent ST9 0HX	Residential
R9	395720	347687	1.5	The Bowling Green PH, Leek Road, Werrington, Stoke-on-Trent ST9 0HX	Residential

Receptor ID	X	Y	Height	Closest address/post code	Receptor Type
R10	395736	347789	1.5	Heath Avenue, Leek Road, Werrington, Stoke-on-Trent ST9 0HX	Residential
R11	395737	347826	1.5	Heath Avenue, Leek Road, Werrington, Stoke-on-Trent ST9 0HX	Residential
R12	395722	347592	1.5	The Old Bowling Green, Leek Rd, Cheadle, Stoke-on-Trent ST9 OHX	Residential
R13	395731	347580	1.5	The Old Bowling Green, Leek Rd, Cheadle, Stoke-on-Trent ST9 OHX	Residential
R14	395729	347569	1.5	Mantra, Leek Road, Werrington, Stoke-on-Trent, Staffordshire, England, ST9 0DQ	Medical
R15	395768	347548	1.5	Crossroads, Kingsley Road, Werrington, Stoke-on-Trent, Staffordshire, England, ST9 0JQ	Residential
R16	395803	347528	1.5	2, Kingsley Road, Werrington, Stoke-on-Trent, Staffordshire, England, ST9 0JQ	Residential
R17	395885	347483	1.5	Kingsley Road, Werrington, Stoke-on-Trent, Staffordshire, England, ST9 0DJ	Residential
R18	395703	347561	1.5	Leek Road, Werrington, Stoke-on-Trent, Staffordshire, England, ST9 0DQ	Residential
R19	395702	347552	1.5	Leek Road, Werrington, Stoke-on-Trent, Staffordshire, England, ST9 0DQ	Residential
R20	395701	347543	1.5	Leek Road, Werrington, Stoke-on-Trent, Staffordshire, England, ST9 0DQ	Residential
R21	395690	347506	1.5	Leek Road, Caverswall, Staffordshire Moorlands, Staffordshire, England, ST9 0DQ	Residential
R22	395686	347385	1.5	Leek Road, Caverswall, Staffordshire Moorlands, Staffordshire, England, ST9 0DQ	Residential
R23	395665	347395	1.5	Leek Road, Caverswall, Staffordshire Moorlands, Staffordshire, England, ST9 0DQ	Residential
Leek AQMA					
R24	397967	355973	1.5	Wallhill Residential Home, Broad Street, Leek, Staffordshire Moorlands, Staffordshire, England, ST13 5QA	Residential
R25	397975	356020	1.5	4 Hampton Court, Leek, Staffordshire Moorlands, Staffordshire, England, ST13 8XZ	Residential
R26	397998	356000	1.5	Wallhill Residential Home, Broad Street, Leek, Staffordshire Moorlands, Staffordshire, England, ST13 5QA	Residential

Receptor ID	X	Y	Height	Closest address/post code	Receptor Type
R27	398005	356053	4.0	Residential Property, Broad Street, Leek, Staffordshire Moorlands, Staffordshire, England, ST13 5QA	Residential
R28	398059	356114	4.0	Residential Property, Broad Street, Leek, Staffordshire Moorlands, Staffordshire, England, ST13 5NS	Residential
R29	398104	356159	1.5	St Mary's Catholic Academy, Cruso Street, Leek, Staffordshire Moorlands, Staffordshire, England, ST13 8BW	Educational
R30	398132	356187	1.5	94 Broad St, Leek ST13 5NU	Residential
R31	398197	356210	1.5	Hillside Court, Broad St, Leek ST13 5NX	Residential
R32	398245	356230	1.5	31 Broad St, Leek ST13 5NS	Residential
R33	398303	356270	1.5	Leek Masonic Hall, Broad Street, Leek, Staffordshire Moorlands, Staffordshire, England, ST13 5NS	Residential
R34	398325	356307	1.5	10 Broad St, Leek ST13 5NS	Residential
R35	398334	356313	1.5	4 Broad St, Leek ST13 5NS	Residential
R36	398358	356315	1.5	1 Broad St, Leek ST13 5NR	Residential
R37	398380	356308	1.5	6 Compton, Leek ST13 5NH	Residential
R38	398428	356218	1.5	40 Compton, Leek ST13 5NH	Residential
R39	398441	356185	1.5	52 Compton, Leek ST13 5NH	Residential
R40	398464	356155	1.5	7 Compton, Leek ST13 5DE	Residential
R41	398506	356039	1.5	2 Ballington View, Leek ST13 5SF	Residential
R42	398360	356372	4.0	69 St Edward St, Leek ST13 5DN	Residential
R43	398348	356365	1.5	68 St Edward St, Leek ST13 5DL	Residential
R44	398318	356465	1.5	50 St Edward St, Leek ST13 5DL	Residential
R45	398317	356515	1.5	29 St Edward St, Leek ST13 5DN	Residential
R46	398296	356571	1.5	10 St Edward St, Leek ST13 5DS	Residential
R47	398172	356609	1.5	5 Mill Street, Leek, , England, ST13 8GB	Residential
R48	397927	356841	1.5	142 Mill St, Leek ST13 8HA	Residential
R49	397661	356950	1.5	Mill Street, Macclesfield Road, Leek, England, ST13 8JZ	Residential
R50	397532	356974	1.5	49 Macclesfield Rd, Leek ST13 8LD	Residential
R51	398440	356618	4.0	5 Stockwell St, Leek ST13 6DH	Residential
R52	398485	356632	1.5	15 Stockwell St, Leek ST13 6DH	Residential
R53	398587	356659	1.5	41 Stockwell St, Leek ST13 6DH	Residential

Receptor ID	X	Y	Height	Closest address/post code	Receptor Type
R54	398725	356666	1.5	Park Medical Centre, Ball Haye Rd, Leek ST13 6QR	Medical
R55	398645	356645	1.5	57 Stockwell St, Leek ST13 6DH	Residential
R56	398792	356662	1.5	30 Buxton Rd, Leek ST13 6EE	Residential
R57	398959	356713	1.5	Nursery, Roche Villa, Buxton Road, Leek ST13 6EG	Educational
R58	399007	356723	1.5	Hen Cloud House, Buxton Rd, Leek ST13 6EQ	Residential
R59	398995	356702	1.5	96 Buxton Rd, Leek ST13 6EE	Residential
R60	399100	356706	1.5	Warrington House, 108 Buxton Rd, Leek ST13 6EJ	Residential
R61	399262	356740	1.5	128 Buxton Rd, Leek ST13 6EJ	Residential
R62	399301	356800	1.5	151 Buxton Rd, Leek ST13 6EH	Residential
R63	399311	356683	1.5	Leek High School, 11 Springfield Rd, Leek ST13 6LG	Educational
R64	399289	356517	1.5	Springfield Rd, Leek ST13 6LQ	Residential
R65	399241	356481	1.5	Leek First School, East Street, Leek ST13 6LF	Educational
R66	399187	356369	1.5	98 Ashbourne Rd, Leek ST13 5AT	Residential
R67	399149	356402	1.5	92 Ashbourne Rd, Leek ST13 5AT	Residential
R68	399043	356400	1.5	72 Ashbourne Rd, Leek ST13 5AT	Residential
R69	399017	356414	1.5	49 Ashbourne Rd, Leek ST13 5AU	Residential
R70	398978	356401	1.5	56 Ashbourne Rd, Leek ST13 5AU	Residential
R71	398853	356403	1.5	24 Ashbourne Rd, Leek ST13 5AS	Residential
R72	398770	356430	1.5	Rethink Mental Illness, 4 Ashbourne Rd, Leek ST13 5AS	Medical
R73	398618	356425	4.0	71 Haywood St, Leek ST13 5JH	Residential
R74	398581	356385	1.5	6 Leonard St, Leek ST13 5JP	Residential
R75	398475	356359	1.5	Residential Property, Brook Street, Leek, England, ST13 5JX	Residential
R76	398397	356337	4.0	2-6, Brook St, Leek ST13 5JE	Residential
R77	398697	356530	4.0	1 Fountain St, Leek ST13 6JS	Residential
R78	398690	356546	4.0	3 Ball Haye St, Leek ST13 6JN	Residential
R79	398694	356615	1.5	31 Ball Haye St, Leek ST13 6JN	Residential
R80	398693	356579	1.5	17 Ball Haye St, Leek ST13 6JN	Residential

Figure 4-4 – Leek AQMA Modelled Receptors

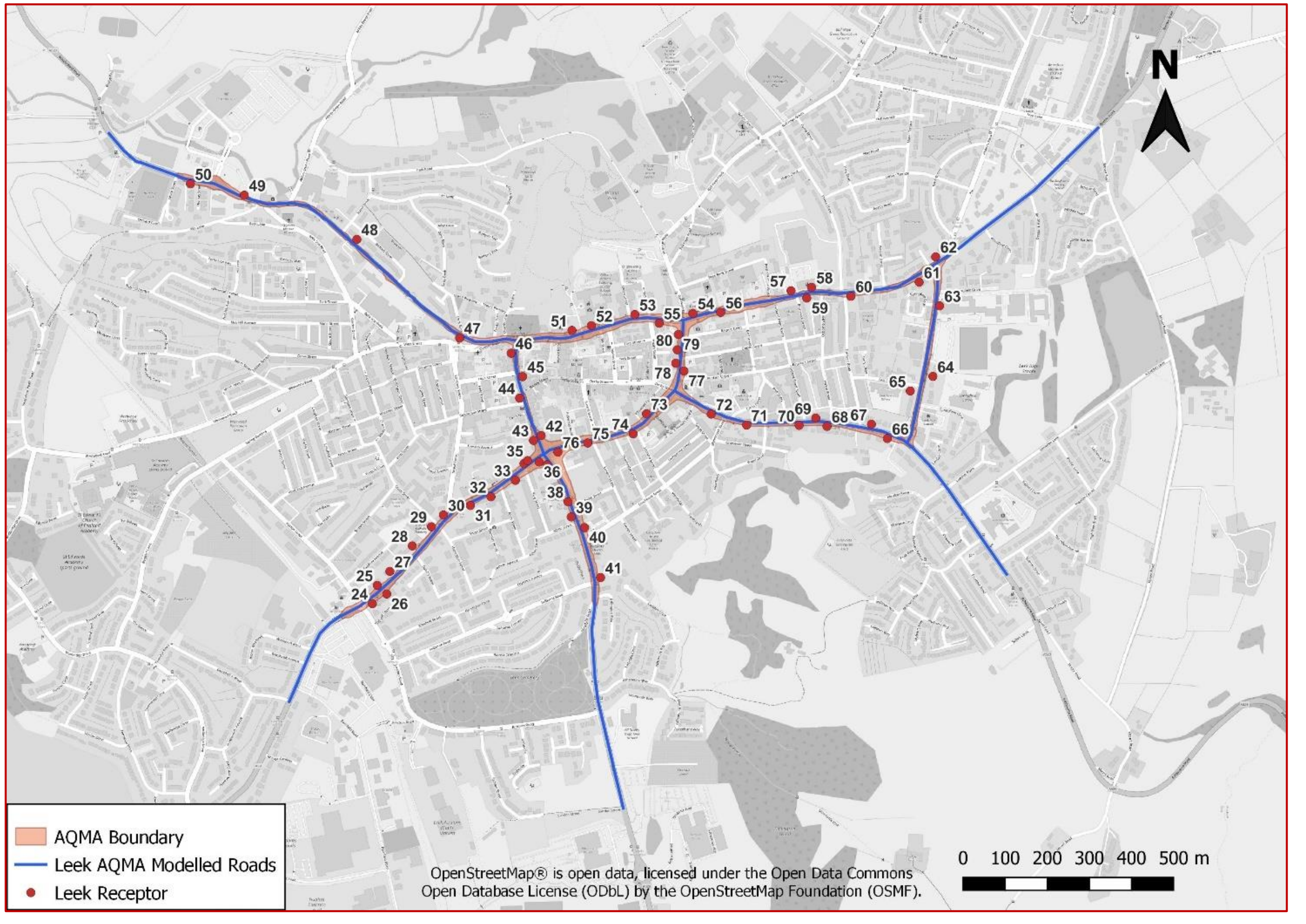


Figure 4-5 – Cellarhead AQMA Modelled Receptors

4.4 Model Outputs

The background pollutant values discussed in Section 3.3 have been used in conjunction with the concentrations predicted by the ADMS-Roads model to calculate predicted total annual mean concentrations of NO_x.

For the prediction of annual mean NO_2 concentrations for the modelled scenarios, the output of the ADMS-Roads model for road NO_x contributions has been converted to total NO_2 following the methodology in LAQM.TG(22)[1], using the NO_x to NO_2 conversion tool developed on behalf of Defra. This tool also utilises the total background NO_x and NO_2 concentrations. This assessment has utilised version 8.1 (August 2020) of the NO_x to NO_2 conversion tool[14]. The road contribution is then added to the appropriate NO_2 background concentration value to obtain an overall total NO_2 concentration.

For the prediction of short term NO_2 impacts, LAQM.TG(22)[1] advises that it is valid to assume that exceedances of the 1-hour mean AQS objective for NO_2 are only likely to occur where the annual mean NO_2 concentration is 60µg/m^3 or greater.

In addition to total annual mean concentrations, NO_x source apportionment was carried out for the following vehicle classes:

- Petrol Cars
- Diesel Cars
- Petrol LGV
- Diesel LGV
- Rigid HGV
- Artic HGV
- Buses
- Motorcycle
- Full Hybrid Petrol Cars
- Plug-in Hybrid Petrol Cars
- Full Hybrid Diesel Cars
- Hybrid/ CNG Buses

Verification of the ADMS-Roads assessment has been undertaken using a number of local authority diffusion tube monitoring locations, and separate verifications have been undertaken for each AQMA. All NO_2 results presented in the assessment are those calculated following the process of model verification. Full details of the verification process are provided in Appendix A.

This provides vehicle contributions of NO_x as a proportion of the total NO_x concentration, which will allow the Council to develop specific AQAP measures targeting a reduction in emissions from specific vehicle types. Local fleet information has been derived from the DfT road traffic statistics.

It should be noted that emission sources of NO_2 are dominated by a combination of direct NO_2 (f-NO_2) and oxides of nitrogen (NO_x), the latter of which is chemically unstable and rapidly oxidised upon release to form NO_2. Reducing levels of NO_x emissions therefore reduces concentrations of NO_2. Consequently, the source apportionment study has firstly considered the emissions of NO_x, which are assumed to be representative of the main sources of NO_2, and secondly emissions of NO_2.

The source apportionment study has evaluated the following receptor combinations:

- The average NO_x and NO_2 contributions across all modelled locations. This provides useful information when considering possible action measures to test and adopt. It will however understate road NO_x concentrations in problem areas;

- The NO_x and NO_2 contributions at the receptor with the maximum road NO_x and NO_2 contribution. This provides a comparison to the previous two groups, with the identification

[14] Defra NO_x to NO_2 Calculator (2020), available at https://laqm.defra.gov.uk/air-quality/air-quality-assessment/nox-to-no2-calculator/

of the most prominent vehicle source at receptor with the highest predicted NO_2 concentration.

4.5 Uncertainty

Due to the number of inputs that are associated with the modelling of the study area there is a level of uncertainty that has to be taken into account when drawing conclusions from the predicted concentrations of NO_2. The predicted concentrations are based upon the inputs of traffic data, background concentrations, emission factors, street canyon calculations, meteorological data, modelling terrain limitations and the availability of monitoring data from the assessment area(s).

4.5.1 Uncertainty in NO_x and NO_2 Trends

Recent studies have identified historical monitoring data within the UK that shows a disparity between measured concentration data and the projected decline in concentrations associated with emission forecasts for future years[15]. Ambient concentrations of NO_x and NO_2 have shown two distinct trends over the past twenty-five years: (1) a decrease in concentrations from around 1996 to 2002/04, followed by (2) a period of more stable concentrations from 2002/04 rather than the further decline in concentrations that was expected due to the improvements in vehicle emissions standards.

The reason for this disparity is related to the actual on-road performance of vehicles, in particular diesel cars and vans, when compared with calculations based on the Euro emission standards. Preliminary studies suggest the following:

- NO_x emissions from petrol vehicles appear to be in line with current projections and have decreased by 96% since the introduction of 3-way catalysts in 1993;

- NO_x emissions from diesel cars, under urban driving conditions, do not appear to have declined substantially, up to and including Euro 5. There is limited evidence that the same pattern may occur for motorway driving conditions; and

- NO_x emissions from HDVs equipped with Selective Catalytic Reduction (SCR) are much higher than expected when driving at low speeds.

This disparity in the historical national data highlights the uncertainty of future year projections of both NO_x and NO_2.

Defra and the Devolved Administrations have investigated these issues and have since published updated versions of the EFT that utilise COPERT 5 emission factors, which may go some way to addressing this disparity, but it is considered likely that a gap still remains. This assessment has utilised the latest EFT version 11.0 and associated tools published by Defra to help minimise any associated uncertainty when forming conclusions from the results.

[15] Carslaw, D, Beevers, S, Westmoreland, E, Williams, M, Tate, J, Murrells, T, Steadman, J, Li, Y, Grice, S, Kent, Aand Tsagatakis, I. 2011, Trends in NO_x and NO_2 emissions and ambient measurements in the UK, prepared for Defra, July 2011.

5 Results

5.1 Modelled Concentrations

The results following the detailed modelling assessment have been split into each AQMA:

- Leek AQMA – An area encompassing the main travel routes through Leek town centre, including sections of the A523, A53 and adjoining roads. (Declared July 2019)
- Cellarhead AQMA – An area encompassing the Cellarhead crossroads between the A52 and A520. (Declared July 2019)

5.1.1 Leek AQMA - Baseline 2019 NO_2 Concentrations

The assessment has considered emissions of NO_2 from road traffic at 57 existing receptor locations representing locations of relevant exposure.

Table 5-1 provides a summary of the modelled receptors split into groups based on the predicted annual mean NO_2 concentration. It can be seen that of the 57 discrete receptors, 13 (23%) are predicted to be above the NO_2 annual mean AQS objective limit, with a further 8 (14%) within 10%. The remaining 36 (63%) receptors were below the AQO for annual mean NO_2.

Table 5-1 – Summary of 2019 Modelled Receptor Results NO_2

Modelled NO_2 Concentration (µg/m^3)	Number of Receptors	Reference to the AQS Objective	Number of Receptors	% of Receptors
>60	0	**Above 60µg/m^3**	**0**	**0.0%**
>44	6	**Above 40µg/m^3 AQS Objective**	**13**	**22.8%**
40 - 44	7			
36 - 40	8	Within 10% of AQS Objective	8	14.0%
32 - 36	8	Below 36µg/m^3 AQS Objective	36	63.2%
<32	28			

The highest annual mean NO_2 concentration was recorded at Receptor 36 with a concentration of 55.7µg/m^3, this is much greater than the highest monitoring location in 2019, location 25, which monitored an annual mean NO_2 concentration of 44.1µg/m^3. Receptor 36 is located along a façade of a residential property which immediately fronts onto a stretch of the A53 – Broad Street, which is considered to be susceptible to congestion due to the convergence of high capacity and town centre roads (A53 Brook Street, A53 Broad Street, A520 St Edward Street and A520 Compton). Receptor 36 is opposite a local authority monitoring location 25 which measured the highest concentration of 44.1µg/m^3 in Leek AQMA in 2019.

The empirical relationship given in LAQM.TG(22)[1] states that exceedance of the 1-hour mean objective for NO_2 is only likely to occur where annual mean concentrations are 60µg/m^3 or above. Given the NO_2 annual mean concentration recorded at Receptor 36 is below the hourly exceedance indicator (60µg/m^3), an exceedance of the hourly NO_2 AQS objective is unlikely at this location. This is also the case for monitoring location 25 which also does not exceed 60µg/m^3. There are no relevant locations with a modelled annual mean NO_2 concentration above 60µg/m^3, which suggests that an exceedance of the hourly NO_2 AQS objective is unlikely across the modelled area.

Figure 5-1 shows the locations of those receptors which are exceeding the 40µg/m^3 annual mean AQS objective and those receptors which are within 10% of the annual mean AQS objective (36 to 40µg/m^3). Based on these results, the following observations were made:

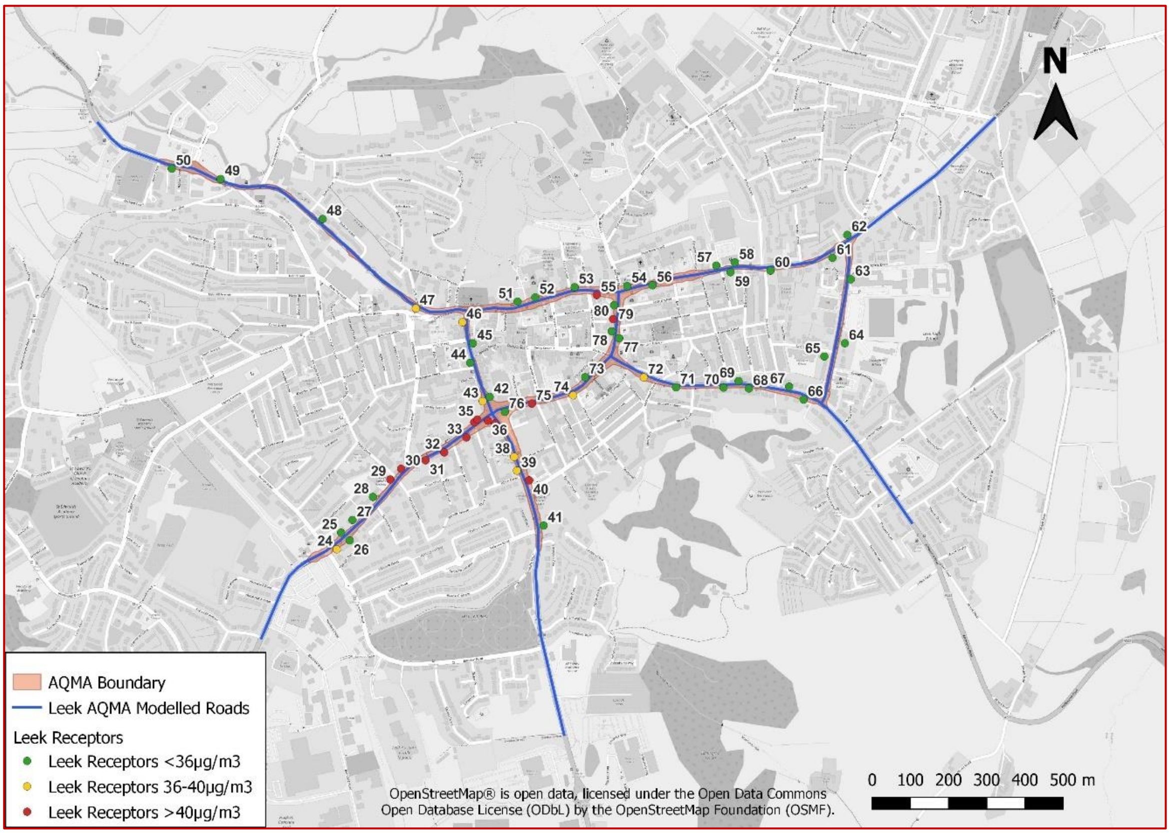
- Areas of exceedance or near exceedance of the annual mean NO_2 AQS objective were concentrated to roadside locations near junctions where key arterial roads meet, confirming vehicular traffic to be the main contributor to elevated levels of NO_2 concentrations within the Leek AQMA. Notable roads include: A53 Broad Street A53 Brook Street, A520 Compton, A53 Ball Haye Street and A523 Stockwell Street.

- These five roads are all busy roads with major junctions which are where the highest concentrations are observed. The high concentrations are likely due to the high traffic volume and congestion around the junctions.

Monitoring sites within and/or adjacent to the remainder of the locations identified to have a modelled exceedance and/or near exceedance outside of the declared AQMA area should be reviewed in order to support the predicted model findings.

A full set of concentration results for the discrete receptors used within the assessment is provided in Table D.1 of the Appendices.

Figure 5-1 – Leek AQMA Modelled Receptors NO_2 Annual Mean Concentration Range



5.1.2 Cellarhead AQMA - Baseline 2019 NO_2 Concentrations

The assessment has considered emissions of NO_2 from road traffic at 23 existing receptor locations representing locations of relevant exposure.

Table 5-2 provides a summary of the modelled receptors split into groups based on the predicted annual mean NO_2 concentration. It can be seen that of the 23 discrete receptors, 9 (34.8%) are predicted to be above the NO_2 annual mean AQS objective limit. The remaining 15 (65.2%) receptors were below the AQO for annual mean NO_2.

Table 5-2 – Summary of 2019 Modelled Receptor Results NO_2

Modelled NO_2 Concentration (µg/m^3)	Number of Receptors	Reference to the AQS Objective	Number of Receptors	% of Receptors
>60	0	**Above 60µg/m^3**	**0**	**0.0%**
>44	7	**Above 40µg/m^3 AQS Objective**	**8**	**34.8%**
40 - 44	1			
36 - 40	0	Within 10% of AQS Objective	0	10.2%
32 - 36	0	Below 36µg/m^3 AQS Objective	15	65.2%
<32	15			

The highest annual mean NO_2 concentration was recorded at Receptor 14 with a concentration of 49.7µg/m^3, the highest monitoring location in Cellarhead AQMA in 2019 monitored an annual mean NO_2 concentration of 42.7µg/m^3 at location 39A/B. Receptor 14 is located at a residential building which immediately fronts onto the Junction of A520 Leek Road and A52 Kingsley Road, susceptible to congestion due to the convergence of high capacity and town centre roads, A520 Leek Road.

The empirical relationship given in LAQM.TG(22)[1] states that exceedance of the 1-hour mean objective for NO_2 is only likely to occur where annual mean concentrations are 60µg/m^3 or above. Given the NO_2 annual mean concentration recorded at Receptor 14 is below the hourly exceedance indicator (60µg/m^3), an exceedance of the hourly NO_2 AQS objective is unlikely at this location.

Figure 5-2 shows the locations of those receptors which are exceeding the 40µg/m^3 annual mean AQS objective. Based on these results, the following observations were made:

- Areas of exceedance or near exceedance of the annual mean NO_2 AQS objective were concentrated to roadside locations particularly at junctions along the main road running through A520 Leek Road, A52 Cellarhead Road and A52 Kingsley Road. These roads are busy roads in Cellarhead town centre with a high traffic volume.

- Additionally, areas of exceedance of the annual mean NO_2 AQS objective were concentrated on Leek Street by the junction. This is likely due to the traffic congestion at the junction area.

Monitoring sites within and/or adjacent to the remainder of the locations identified to have a modelled exceedance and/or near exceedance outside of the declared AQMA area should be reviewed in order to validate predicted model findings.

A full set of concentration results for the discrete receptors used within the assessment is provided in Table D.1 of the Appendices.

Figure 5-2 – Cellarhead AQMA Modelled Receptors NO_2 Annual Mean Concentration Range

5.1.3 Leek AQMA - Baseline 2019 PM_{10} and $PM_{2.5}$ Concentrations

The assessment has considered emissions of PM_{10} and $PM_{2.5}$ from road traffic at 57 existing receptor locations representing locations of relevant exposure.

All of the 57 discrete receptors are predicted to be well below the PM_{10} and $PM_{2.5}$ annual mean AQS objective limit of 40µg/m^3 and 25µg/m^3. The highest annual mean PM_{10} and $PM_{2.5}$ concentration was recorded at Receptor 36 with a PM_{10} concentration of 15.8µg/m^3 and a $PM_{2.5}$ concentration of 10.7µg/m^3, this is much lower than the annual mean AQS objective limit.

A full set of concentration results for the discrete receptors used within the assessment is provided in Table D.1 of the Appendices

5.1.4 Cellarhead AQMA - Baseline 2019 PM_{10} and $PM_{2.5}$ Concentrations

The assessment has considered emissions of PM_{10} and $PM_{2.5}$ from road traffic at 23 existing receptor locations representing locations of relevant exposure.

All of the 23 discrete receptors are predicted to be well below the PM_{10} and $PM_{2.5}$ annual mean AQS objective limit of 40µg/m^3 and 25µg/m^3. The highest annual mean PM_{10} and $PM_{2.5}$ concentration was recorded at Receptor 13 with a PM_{10} concentration of 14.0µg/m^3 and a $PM_{2.5}$ concentration of 9.3µg/m^3, this is much lower than the annual mean AQS objective limit.

A full set of concentration results for the discrete receptors used within the assessment is provided in Table D.1 of the Appendices

5.2 Estimated Year of Compliance

Following the identification of exceedances of the AQS objectives, it is useful to provide an estimate of the year by which concentrations at the identified locations of exceedances will become compliant with the relevant AQS objective. This is initially provided below assuming only the trends for future air quality, as currently predicted by Defra, are realised. The implementation of specific intervention measures to mitigate the local air quality issues, as are currently being developed by the Council within an AQAP, would then be considered most likely to bring forwards the estimated date of compliance.

Following the methodology outlined in LAQM.TG(22)[1] paragraph 7.75 onward, the year by which concentrations at the identified locations of exceedances will become compliant with the NO_2 annual mean AQS objective has been estimated. This has been completed using the predicted modelled NO_2 concentrations from the 2019 Base scenario.

5.2.1 Leek AQMA - Baseline 2019 NO_2 Concentrations

As a worst-case approach, the projection is based upon the receptor predicted as having the maximum annual mean NO_2 concentration, which in this case is Receptor 36. The appropriate roadside NO_2 projection factors, as provided on the LAQM Support website[16], are then applied to this concentration value to ascertain the estimated NO_2 annual mean reduction per annum, and hence the anticipated year of compliance. In this case, roadside projection factors for 'Rest of UK (HDV <10%)' have been applied, consistent with the worst-case receptor location.

The projected NO_2 annual mean concentrations following the above approach are presented in Table 5-3.

Table 5-3 – Projected Annual Mean NO_2 Concentrations – Leek AQMA

Receptor 36											
2019 Annual Mean Concentration (µg/m³)	**Predicted Annual Mean Concentration (µg/m³)**										
	2020	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
55.7	**53.0**	**50.0**	**47.2**	**44.7**	**42.3**	**40.1**	38.2	36.4	34.8	33.4	32.2
In **bold**, exceedance of the NO_2 annual mean AQS objective of 40µg/m³ Vehicle Adjustment Factor = Rest of UK (HDV <10%)											

Table 5-3 indicates that the first year by which Receptor 36 will be exposed to a concentration below the annual mean NO_2 AQS objective will be 2026. Additionally, it is expected that concentrations are expected to drop below 10% of the annual mean NO_2 AQS objective by 2028. 2026 is therefore considered the predicted year of compliance for those receptors used within the model, which are believed to represent worst case exposure within the Leek AQMA, in the absence of the implementation of any specific intervention measures to further bring forward local air quality improvements in the area.

Table 5-4 below also illustrates the required reduction in NO_x emissions for annual mean NO_2 concentrations to fall below the AQO of 40µg/m³. As shown a 41.9% reduction in road NO_x is required to meet the AQO for annual mean NO_2 at the worst-case receptor in Leek AQMA.

[16] https://laqm.defra.gov.uk/air-quality/air-quality-assessment/roadside-no2-projection-factors/

Table 5-4 – Required Reduction in NO_x emissions to meet AQO for Annual Mean NO_2

Metric	Value (Concentrations as µg/m³)
Worst-Case Relevant Exposure NO_2 Concentration	55.8
Equivalent NO_x Concentration	114.4
Background NO_x	15.5
Background NO_2	11.7
Road NO_x - Current	98.9
Road NO_x - Required (to achieve NO_2 concentration of 39.9µg/m³)	57.5
Required Road NO_x Reduction	41.4
Required % Reduction	41.9%

5.2.2 Cellarhead AQMA - Baseline 2019 NO_2 Concentrations

As a worst-case approach, the projection is based upon the receptor predicted as having the maximum annual mean NO_2 concentration, which in this case is Receptor 14. The appropriate roadside NO_2 projection factors, as provided on the LAQM Support website[17], are then applied to this concentration value to ascertain the estimated NO_2 annual mean reduction per annum, and hence the anticipated year of compliance. In this case, roadside projection factors for 'Rest of UK (HDV <10%)' have been applied, consistent with the worst-case receptor location.

The projected NO_2 annual mean concentrations following the above approach are presented in Table 5-5

Table 5-5 – Projected Annual Mean NO_2 Concentrations – Cellarhead AQMA

Receptor 14											
2019 Annual Mean Concentration (µg/m³)	Predicted Annual Mean Concentration (µg/m³)										
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
49.7	**47.3**	**44.6**	**42.1**	39.9	37.8	35.8	34.1	32.5	31.0	29.8	28.7
In **bold**, exceedance of the NO_2 annual mean AQS objective of 40µg/m³ Vehicle Adjustment Factor = Rest of UK (HDV <10%)											

Table 5-5 indicates that the first year by which Receptor 14 will be exposed to a concentration below the annual mean NO_2 AQS objective will be 2023. Additionally, it is expected that concentrations are expected to drop below 10% of the annual mean NO_2 AQS objective by 2025. 2023 is therefore considered the predicted year of compliance for those receptors used within the model, which are believed to represent worst case exposure within the Cellarhead AQMA, in the absence of the implementation of any specific intervention measures to further bring forward local air quality improvements in the area.

Table 5-6 below also illustrates the required reduction in NO_x emissions for annual mean NO_2 concentrations to fall below the AQO of 40µg/m³. As shown a 41.2% reduction in road NO_x is required to meet the AQO for annual mean NO_2 at the worst-case receptor in the Cellarhead AQMA.

[17] https://laqm.defra.gov.uk/air-quality/air-quality-assessment/roadside-no2-projection-factors/

Table 5-6 – Required Reduction in NO_x emissions to meet AQO for Annual Mean NO_2

Metric	Value (Concentrations as µg/m^3)
Worst-Case Relevant Exposure NO_2 Concentration	49.7
Equivalent NO_x Concentration	117.9
Background NO_x	12.2
Background NO_2	9.4
Road NO_x - Current	105.7
Road NO_x - Required (to achieve NO_2 concentration of 39.9µg/m^3)	62.2
Required Road NO_x Reduction	43.6
Required % Reduction	41.2%

5.3 Source Apportionment

To help inform the development of measures as part of the action plan stage of the project, a NO_x source apportionment exercise was undertaken for the following vehicle classes:

- Petrol Cars
- Diesel Cars
- Petrol LGV
- Diesel LGV
- Rigid HGV
- Artic HGV
- Buses
- Motorcycle
- Full Hybrid Petrol Cars
- Plug-in Hybrid Petrol Cars
- Full Hybrid Diesel Cars
- Hybrid/ CNG Buses

This will provide vehicle emission proportions of NO_x that will allow the Council to design specific AQAP measures targeting a reduction in emissions from specific vehicle types for each of the AQMAs.

It should be noted that emission sources of NO_2 are dominated by a combination of direct NO_2 (f-NO_2) and oxides of nitrogen (NO_x), the latter of which is chemically unstable and rapidly oxidised upon release to form NO_2. Reducing levels of NO_x emissions therefore reduces levels of NO_2. As a consequence, the source apportionment study has considered the emissions of NO_x which are assumed to be representative of the main sources of NO_2.

The sections below detail the source apportionment results for NO_x concentrations at modelled receptors for three scenarios:

- The average Total NO_x split across all modelled receptors. This provides useful information to understand the split between local and regional background sources as well as local road sources. In accordance with TG(22)[1]. Regional background is considered to be the emissions from background sources that the authority is unable to influence and the local background the background emissions they have some influence over. Local Sources give rise to the hotspot areas of exceedances, and the principal sources for the local authority.

- The average NO_x contributions within the AQMA. This will inform potential prominent NO_x contributors present within the identified area of exceedance and therefore be useful when testing and adopting action measures; and,

- The location where the maximum road NO_x concentration has been predicted within the AQMA. This is likely to be in the area of most concern within the proposed AQMA and so a good place to test and adopt action measures. Any gains predicted by action measures are however likely to be greatest at this location and so would not represent gains across the whole modelled area.

5.3.1 Leek AQMA - Baseline 2019 NOx Concentrations

When considering the average NO_x background split across all modelled receptor locations, the following observations were found:

- Regional Background NO_x accounted for 8.0% (4.9µg/m^3)
- Local Background NO_x accounted for 16.0% (9.8µg/m^3)
- Local Road Traffic accounted for the largest majority, 76.0% (46.4µg/m^3)

When considering the average NO_x concentration across all modelled receptor locations, the following observations were found:

- Road traffic accounts for 46.4/m^3 (76.0%) of total NO_x (61.0µg/m^3), with background accounting for 14.6µg/m^3 (24.0%);
- Of the total road NO_x, Diesel Cars are the highest contributing vehicle class accounting for 47.1% (21.9µg/m^3);
- Diesel LGVs are found to be the second highest contributing vehicle class accounting for 23.3% (10.8µg/m^3);
- Rigid HGVs are the third highest contributing vehicle class accounting for 12.0%(5.5µg/m^3);
- Petrol Cars, Buses and Artic HGVs account for similar total road NO_x (Petrol Cars – 5.9% (2.7µg/m^3), Buses – 5.7% (2.6µg/m^3) and Artic HGVs – 2.5% (3.7µg/m^3)));
- All other vehicle types accounting for <1%.

When considering the modelled receptor location at which the maximum road NO_x concentration has been predicted:

- Road traffic accounts for 86.4% (98.9µg/m^3) of the total NO_x (114.4µg/m^3) – highlighting contributions from road traffic to be the core component in areas of exceedance;
- Of the total road NO_x, Diesel Cars are found to be the highest contributing vehicle class accounting for 44.7% (44.2µg/m^3). This is slightly lower than the trend across all modelled receptors, but still indicating that Diesel Vehicles are the predominant source of NO_x emissions across the AQMA;
- Diesel LGVs are found to be the second highest contributing vehicle class accounting for 23.1% (22.9µg/m^3). This observed percentage contribution is very similar to the observations found across the AQMA;
- Rigid HGVs account for 13.3% (13.2µg/m^3) of the total road NO_x, Buses account for 7.3% (7.2µg/m^3) and Artic HGVs accounting for 5.8% (5.7µg/m^3). This is a slight increase to the contribution observed across the whole AQMA and suggests an influence on exceedance within key areas of the AQMA;
- Petrol Cars account for 5.3% (5.2µg/m^3) of the total road NO_x – similar to the observations found across the AQMA; and
- All other vehicle types are similarly found to contribute <1%.

The NO_x source apportionment exercise demonstrates a largely consistent ranking of contributing vehicle classes exhibited (Diesel Cars, Diesel LGVs, Rigid HGVs and Petrol Cars), where Diesel Cars primarily are found to be the main contributors to total road NO_x concentrations across the Leek AQMA.

Whilst comparing modelled contributions at identified receptor locations within the AQMA against the max receptor within the AQMA, Diesel Cars were observed to have a slightly lower but still predominant influence to total road NO_x concentrations within the AQMA. For all the other vehicle types at the max receptors, they have very similar influence to total road NO_x concentrations within the AQMA when compared the average across the AQMA

Overall this suggests the volume of traffic and congestion in the AQMA is considered to be the key contributor to elevated levels of NO_2 annual mean concentrations within the AQMA. The key location in the AQMA where elevated levels of NO_2 are observed are the main junction of A53 Broad Street, A53 Brook Street, A52 St Edward Road and A52 Campton and the main junction of A53 Buxton Road, A523 Stockwell Street and A53 Ball Haye Street.

Table 5-7 and Table 5-8 illustrate the NO_x source apportionment results for the Leek AQMA, with Figure 5-3 providing a graphical representation of the split in background concentrations, and local road source.

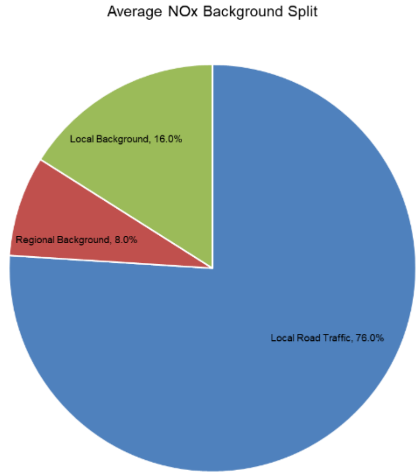
Table 5-7 – Total NO_x Source Apportionment Across All Receptors

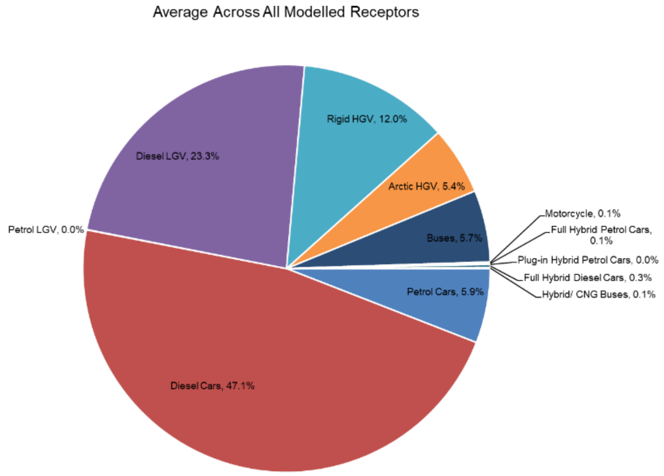
Results	Local Background NO_x	Regional Background NO_x	Local Road NO_x
NO_x Concentration (µg/m^3)	9.8	4.9	46.4
Percentage of total NO_x	16.0%	8.0%	76.0%

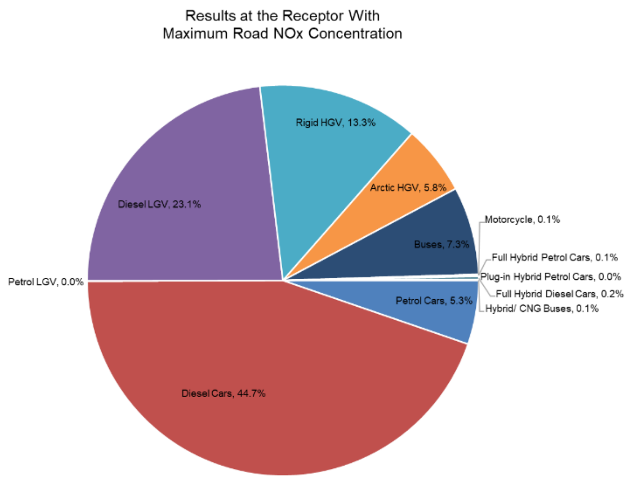
Table 5-8 – Detailed Source Apportionment of Road NO_x Concentrations

Results	All Vehicles	Petrol Cars	Diesel Cars	Petrol LGV	Diesel LGV	Rigid HGV	Artic HGV	Buses	Motorcycle	Full Hybrid Petrol Cars	Plug-in Hybrid Petrol Cars	Full Hybrid Diesel Cars	Hybrid/ CNG Buses	Background
Average Across all Receptors within AQMA														
NO_x Concentration (µg/m^3)	46.4	2.7	21.9	0.0	10.8	5.5	2.5	2.6	0.0	0.0	0.0	0.1	0.0	14.6
Percentage of total NO_x	76.0%	4.5%	35.8%	0.0%	17.7%	9.1%	4.1%	4.3%	0.1%	0.1%	0.0%	0.2%	0.1%	24.0%
Percentage Road Contribution to total NO_x	100.0%	5.9%	47.1%	0.0%	23.3%	12.0%	5.4%	5.7%	0.1%	0.1%	0.0%	0.3%	0.1%	-
At Receptor with Maximum Road NO_x Concentration														
NO_x Concentration (µg/m^3)	98.9	5.2	44.2	0.0	22.9	13.2	5.7	7.2	0.1	0.1	0.0	0.2	0.1	15.5
Percentage of total NO_x	86.4%	4.6%	38.6%	0.0%	20.0%	11.5%	5.0%	6.3%	0.1%	0.1%	0.0%	0.2%	0.1%	13.6%
Percentage Road Contribution to total NO_x	100.0%	5.3%	44.7%	0.0%	23.1%	13.3%	5.8%	7.3%	0.1%	0.1%	0.0%	0.2%	0.1%	-

Figure 5-3 Detailed Source Apportionment of NO_x Concentrations – Leek AQMA







5.3.2 Cellarhead AQMA - Baseline 2019 NOx Concentrations

When considering the average NO_x background split across all modelled receptor locations, the following observations were found:

- Regional Background NO_x accounted for 7.4% (4.8µg/m^3)
- Local Background NO_x accounted for 11.6% (7.5µg/m^3)
- Local Road Traffic accounted for the largest majority, 81.0% (52.1µg/m^3)

When considering the average NO_x concentration across all modelled receptor locations, the following observations were found:

- Of the total road NO_x, Diesel Cars are highest contributing vehicle class accounting for 36.5% (19.0µg/m^3);
- Diesel LGVs are found to be the second highest contributing vehicle class accounting for 21.1% (11.0µg/m^3);
- Rigid HGVs and Artic HGVs are the third and fourth highest contributing vehicle class (Rigid HGVs – 18.5% (9.7µg/m^3), Artic HGVs – 12.3% (6.4µg/m^3));
- Petrol Cars accounted for 4.6% (2.4µg/m^3) and Buses' accounted for Buses 6.6% (3.5µg/m^3), with all other vehicle types accounting for <1%.

When considering the modelled receptor location at which the maximum road NO_x concentration has been predicted:

- Road traffic accounts for 89.6% (105.7µg/m^3) of the total averaged NO_x (117.9µg/m^3) – highlighting contributions from road traffic to be the core component in areas of exceedance;
- Of the total road NO_x, Diesel Cars are found to be the highest contributing vehicle class accounting for 31.4% (33.2µg/m^3). This is 4.1% lower than the trend across all modelled receptors, but still indicating that Diesel Vehicles are the predominant source of NO_x emissions across the AQMA;
- Rigid HGVs are found to be the second highest contributing vehicle class accounting for 22.1% (23.3µg/m^3). This observed percentage contribution is 3.6% higher than the observations found across the AQMA;
- Diesel LGVs account for 19.5% (20.6µg/m^3) of the total road NO_x, Artic HGVs accounting for 15.1% (16.0µg/m^3) and Buses 7.6% (8.1µg/m^3). This is a slight increase to the contribution observed for Artic HGVs and Buses but a slightly decrease of 1.6% for diesel LGV's across the whole AQMA and suggests an influence on exceedance within key areas of the AQMA;
- Petrol Cars account for 3.8% (4.0µg/m^3) of the total road NO_x – a slightly decrease in percentage contribution in comparison to the whole- suggesting that buses are not a large influence on exceedance of the AQO within this specific area of the AQMA; and
- All other vehicle types are similarly found to contribute <1%.

The NO_x source apportionment exercise demonstrates a largely consistent ranking of contributing vehicle classes exhibited (Diesel Cars, Diesel LGVs, Rigid HGVs and Artic HGVs), where Diesel Cars primarily are found to be the main contributors to total road NO_x concentrations across the Cellarhead AQMA.

Whilst comparing modelled contributions at identified receptor locations within the AQMA against the max receptor within the AQMA, Diesel Cars were observed to have a very slightly lower but still predominant influence to total road NO_x concentrations within the AQMA. This is the case for Diesel LGVs and Petrol Cars, showing a decrease in percentage contribution at the max receptors when compared the average across the AQMA. For all the other vehicle types, they show an increase in percentage contribution at the max receptors when compared the average across the AQMA.

Overall this suggests volume of traffic and congestion on the main junction of A52 Cellarhead Road, A52 Kingsley Road and A520 Leek Road are considered to be the key contributor to elevated levels of NO_2 annual mean concentrations within the AQMA.

Table 5-9 and Table 5-10 illustrate the NO_x source apportionment results for the Cellarhead AQMA, with Figure 5-4 providing a graphical representation of the split in background concentrations, and local road source.

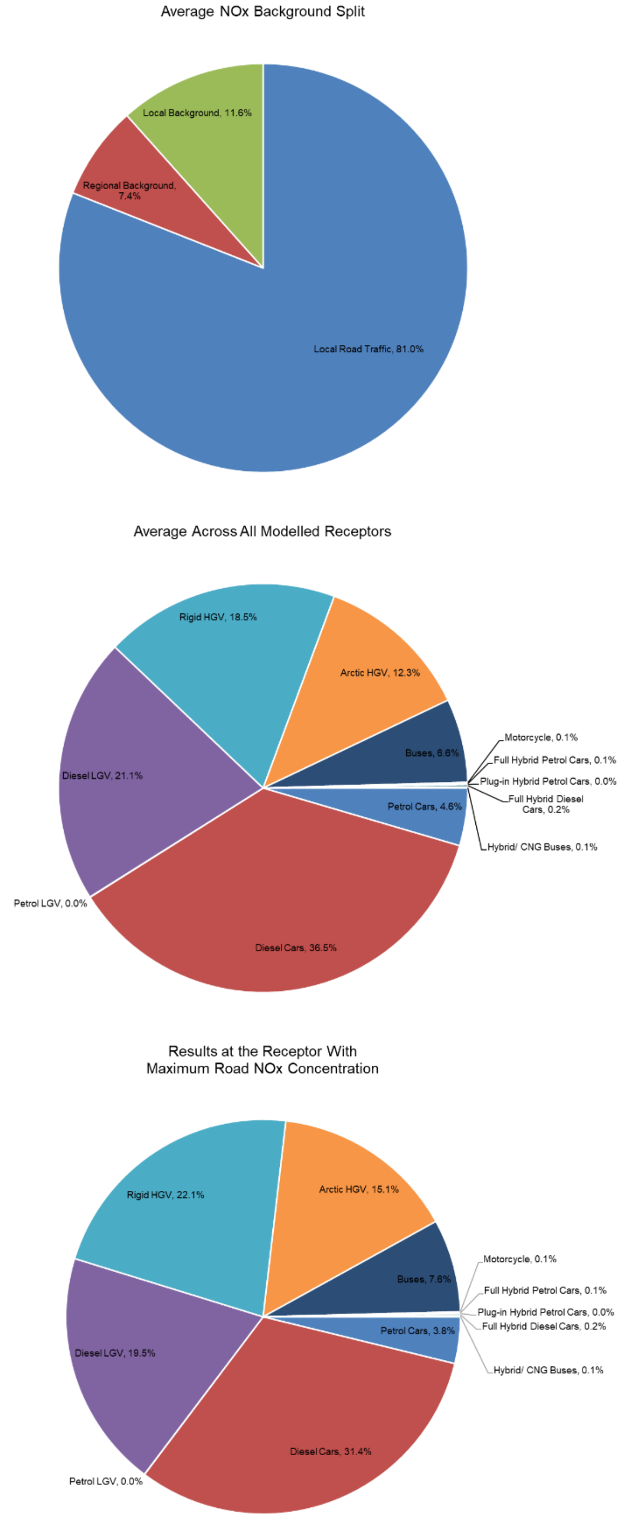
Table 5-9 – Total NO_x Source Apportionment Across All Receptors – Cellarhead AQMA

Results	Local Background NO_x	Regional Background NO_x	Local Road NO_x
NO_x Concentration (µg/m³)	7.5	4.8	52.1
Percentage of total NO_x	11.6%	7.4%	81.0%

Table 5-10 – Detailed Source Apportionment of Road NO_x Concentrations – Cellarhead AQMA

Results	All Vehicles	Petrol Cars	Diesel Cars	Petrol LGV	Diesel LGV	Rigid HGV	Artic HGV	Buses	Motorcycle	Full Hybrid Petrol Cars	Plug-in Hybrid Petrol Cars	Full Hybrid Diesel Cars	EV Cars	Background
Average Across all Receptors within AQMA														
NO_x Concentration (µg/m³)	52.1	2.4	19.0	0.0	11.0	9.7	6.4	3.5	0.0	0.0	0.0	0.1	0.0	12.2
Percentage of total NO_x	81.0%	3.7%	29.6%	0.0%	17.0%	15.0%	9.9%	5.4%	0.1%	0.1%	0.0%	0.2%	0.1%	19.0%
Percentage Road Contribution to total NO_x	100.0%	4.6%	36.5%	0.0%	21.1%	18.5%	12.3%	6.6%	0.1%	0.1%	0.0%	0.2%	0.1%	-
At Receptor with Maximum Road NOx Concentration														
NO_x Concentration (µg/m³)	105.7	4.0	33.2	0.0	20.6	23.3	16.0	8.1	0.1	0.1	0.0	0.2	0.1	12.2
Percentage of total NO_x (µg/m³)	89.6%	3.4%	28.2%	0.0%	17.5%	19.8%	13.6%	6.8%	0.1%	0.1%	0.0%	0.2%	0.1%	10.4%
Percentage Road Contribution to total NO_x (µg/m³)	100.0%	3.8%	31.4%	0.0%	19.5%	22.1%	15.1%	7.6%	0.1%	0.1%	0.0%	0.2%	0.1%	-

Figure 5-4 – Detailed Source Apportionment of NO_x Concentrations – Cellarhead AQMA



6 Conclusions and Recommendations

The dispersion modelling exercise undertaken has provided the following updated perspective on NO_2 challenges within the three declared AQMAs in Sttaffordshire Moorlands District Council.

6.1 Leek AQMA

6.1.1 Leek Predicted Concentrations

The model suggests that the 40µg/m³ NO_2 annual mean AQS objective is exceeded at a total 13 (23%) receptor locations, with 8 (14%) further locations within 10 % of the objective.

The highest modelled annual mean NO_2 concentration was recorded at Receptor 36 with a concentration of 55.8µg/m³. Receptor 36 is located along a façade of a residential property which immediately fronts onto a stretch of the A53 – Broad Road and in close proximity to the main junction. The stretch of road is susceptible to congestion due to the convergence of high capacity and town centre roads (A53 Broad Road, A53 Brook Street, A520 St Edward Street and A520 Compton). Receptor 36 is opposite a local authority monitoring location 25 which measured the highest concentration of 44.1µg/m³ in 2019.

The empirical relationship given in LAQM.TG(22)[1] states that exceedance of the 1-hour mean objective for NO_2 is only likely to occur where annual mean concentrations are 60µg/m³ or above. Given the NO_2 annual mean concentration recorded at Receptor 36 is below the hourly exceedance indicator (60µg/m³), an exceedance of the hourly NO_2 AQS objective is unlikely at this location. This is also the case for duplicate monitoring location 25 which also does not exceed 60µg/m³,which suggests that an exceedance of the hourly NO_2 AQS objective is unlikely across the modelled area.

Based on the modelled results, the following observations were made:

- Areas of exceedance or near exceedance of the annual mean NO_2 AQS objective were concentrated to roadside locations near junctions where key arterial roads meet, confirming vehicular traffic to be the main contributor to elevated levels of NO_2 concentrations within Leek AQMA. Notable roads include: A53 Broad Street, A53 Brook Street, A520 Compton, A53 Ball Haye Street and A523 Stockwell Street.

- These five roads all busy roads with major junctions which are where the highest concentrations are observed. This is likely due to the high traffic volume and congestion around the junctions.

6.1.2 Leek Estimated Year of Compliance

Using the recommended method in TG(22)[1], the estimated year of compliance within the AQMA should no additional measures be put in place is 2026 and will be below 10% of the AQO by 2028.

A reduction of approximately 41.9% in Road NO_x at the worst-case receptor is required to meet the AQO for annual mean NO_2.

6.1.3 Leek Source Apportionment

To help inform the development of measures as part of the AQAP, a NO_x source apportionment exercise was undertaken to provide an understanding of the main vehicle emission contributors within the AQMA.

The NO_x source apportionment exercise demonstrates a largely consistent ranking of contributing vehicle classes exhibited (Diesel Cars, Diesel LGVs, Rigid HGVs and Petrol Cars), where Diesel Cars are found to be the main contributors to total road NO_x concentrations across the Leek AQMA.

Whilst comparing modelled contributions at identified receptor locations within the AQMA against the max receptor within the AQMA, Diesel Cars were observed to have a slightly lower but still predominant influence to total road NO_x concentrations within the AQMA. For all the other vehicle types at the max receptors, they have very similar influence to total road NO_x concentrations within the AQMA when compared the average across the AQMA

Overall, this suggests the volume of traffic and congestion in the AQMA is the key contributor to elevated levels of NO_2 annual mean concentrations within the AQMA. The key location in the AQMA where elevated levels of NO_2 are observed are the main junction of A53 Broad Street, A53 Brook Street, A52 St Edward Road and A52 Campton and the main junction of A53 Buxton Road, A523 Stockwell Street and A53 Ball Haye Street.

6.1.4 Leek Future Recommendations

Following the completion of the detailed modelling assessment, the following recommendations are made:

- Continue to monitor NO_2 across the AQMA, with the expansion of monitoring along Brook Street further east and A520 further south.
- Based on source apportionment results, any future intervention measures should be targeted at reducing vehicle emissions from all vehicle types, Diesel Cars and LGVs, which are both observed to be the two largest contributors to total vehicle emissions in areas of exceedance.
- Measures to reduce congestion at the main junction of the A53 Broad Street A53 Broad Street, A520 Compton and A520 St Edward Street, and junction of A53 Buxton Road, A523 Stockwell Street and A53 Ball Haye Street would also help to reduce emissions of NO_2 in the Leek AQMA.

6.2 Cellarhead AQMA

6.2.1 Cellarhead Predicted Concentrations

The model suggests that the 40µg/m^3 NO_2 annual mean AQS objective is exceeded at a total 8 (34.8%) receptor locations.

The highest annual mean NO_2 concentration was recorded at Receptor 14 with a concentration of 49.7µg/m^3. Receptor 14 is located at the residential property immediately fronts onto the Cellarhead Junction, susceptible to congestion due to the convergence of high capacity and town centre roads, particularly A520 Leek Road. Receptor 36 is besides a local authority monitoring location, 53. This monitoring location monitored an annual mean NO_2 concentration of 42.7µg/m^3 in 2019.

The empirical relationship given in LAQM.TG(22)[1] states that exceedance of the 1-hour mean objective for NO_2 is only likely to occur where annual mean concentrations are 60µg/m^3 or above. Given the NO_2 annual mean concentration recorded at Receptor 26 is below the hourly exceedance indicator (60µg/m^3), an exceedance of the hourly NO_2 AQS objective is unlikely at this location.

There are no relevant locations with a modelled annual mean NO_2 concentration above 60µg/m^3, which suggests that an exceedance of the hourly NO_2 AQS objective is unlikely across the modelled area.

Based on these results, the following observations were made:

- Areas of exceedance or near exceedance of the annual mean NO_2 AQS objective were concentrated to roadside locations particularly at Cellarhead junctions at A520 Leek Road, A52 Cellarhead Street and A52 Kingsley Road.

- These receptors in close proximity to the Cellarhead Junction are where the highest concentrations are observed. This is likely due to the high traffic volume and congestion around the junction.

6.2.2 Cellarhead Estimated Year of Compliance

Using the recommended method in TG(22)[1], the estimated year of compliance within the AQMA should no additional measures be put in place is 2023 and will be below 10% of the AQO by 2025.

A reduction of approximately 41.2% in Road NO_x at the worst-case receptor is required to meet the AQO for annual mean NO_2

6.2.3 Cellarhead Source Apportionment

To help inform the development of measures as part of the AQAP, a NO_x source apportionment exercise was undertaken to provide an understanding of any potential similarities in vehicle emission contributors within the AQMA.

The NO_x source apportionment exercise demonstrates a largely consistent ranking of contributing vehicle classes exhibited (Diesel Cars, Diesel LGVs, Rigid HGVs and Artic HGVs), where Diesel Cars primarily are found to be the main contributors to total road NO_x concentrations across the Cellarhead AQMA.

Whilst comparing modelled contributions at identified receptor locations within the AQMA against the max receptor within the AQMA, Diesel Cars were observed to have a very slightly lower but still predominant influence to total road NO_x concentrations within the AQMA. This is the case for Diesel LGVs and Petrol Cars, showing a decrease in percentage contribution at the max receptors when compared the average across the AQMA. For all the other vehicle types, they show an increase in percentage contribution at the max receptors when compared the average across the AQMA.

Overall this suggests volume of traffic and congestion on the main junction of A52 Cellarhead Road, A52 Kingsley Road and A520 Leek Road are considered to be the key contributor to elevated levels of NO_2 annual mean concentrations within the AQMA.

6.2.4 Cellarhead Future Recommendations

Following the completion of the detailed modelling assessment, the following recommendations are made:

- Continue to monitor NO_2 across the AQMA, with the expansion of monitoring alongside the Leek Road at the north site of the Cellarhead Junction.

- Based on source apportionment results, any future intervention measures should be targeted at reducing vehicle emissions from all vehicle types, Diesel Cars and LGVs, which are both observed to be the two largest contributors to total vehicle emissions in areas of exceedance.

- Measures to reduce congestion at the Cellarhead Junction at A520 Leek Road, A52 Cellarhead Street and A52 Kingsley Road will help to reduce NO_2 emissions.

Appendices

Appendix A - ADMS Model Verification

The ADMS-Roads dispersion model has been widely validated for this type of assessment and is specifically listed in the Defra's LAQM.TG(22)[1] guidance as an accepted dispersion model.

Model validation undertaken by the software developer (CERC) will not have included validation in the vicinity of the proposed development site. It is therefore necessary to perform a comparison of modelled results with local monitoring data at relevant locations. This process of verification attempts to minimise modelling uncertainty and systematic error by correcting modelled results by an adjustment factor to gain greater confidence in the final results.

The predicted results from a dispersion model may differ from measured concentrations for a large number of reasons, including uncertainties associated with:

- Background concentration estimates;
- Source activity data such as traffic flows and emissions factors;
- Monitoring data, including locations; and
- Overall model limitations.

Model verification is the process by which these and other uncertainties are investigated and where possible minimised. In reality, the differences between modelled and monitored results are likely to be a combination of all of these aspects.

Model setup parameters and input data were checked prior to running the models in order to reduce these uncertainties. The following were checked to the extent possible to ensure accuracy:

- Traffic data;
- Distance between sources and monitoring as represented in the model;
- Speed estimates on roads;
- Background monitoring and background estimates; and
- Monitoring data.

The traffic data for this assessment has been collated using DfT traffic count data, as outlined in Section 0.

NO_2 Verification Calculations

During 2019, concentrations of NO_2 were monitored at 34 sites across Staffordshire Moorlands District Council, all of which are diffusion tube sites. 6 of the 34 diffusion tube sites are duplicate locations, all undertaken at roadside locations. All Diffusion tubes within each respective AQMA was used within the separate model verifications. The following monitoring locations were used in each respective verification

Leek AQMA –. 10,11,24A/B, 25, 31, 32, 37A/B, 41A/B, 47, 48 and 57.

Cellarhead AQMA – 38, 39A/B, 42A/B, 49, 53, 55 and 56.

Please note that tube 54 was excluded in the verification of Cellarhead AQMA result, as it has a much lower concentration recorded compared with diffusion tube in close proximity (53 opposite to

54 recorded concentration 11.4 µg/m^3 higher). According to the comment of its location provided by the Council that "*Part of the building is at this distance to road (no openings)*", this location might be obstructed by building, therefore cannot be used in verification.

Full details of the diffusion tubes and automatic monitoring station locations and results are shown in Figure 3-1 and Figure 3-2.

Two separate verifications were undertaken for each of the two AQMAs.

Leek AQMA - NO_2 Verification calculations

The verification of the modelling output was performed in accordance with the methodology provided in Chapter 7 of LAQM.TG(22)[1].

Verification for each AQMA was completed using the 2019 (2018 reference year) Defra background mapped concentrations for the relevant 1km x 1km grid squares within SMDC (i.e. those within which the model verification locations are located), as displayed in Table B.1 of the Appendices.

Table A.1 below shows an initial comparison of the monitored and unverified modelled NO_2 results for the year 2019, in order to determine if verification and adjustment was required.

Table A.1 – Comparison of Unverified Modelled and Monitored NO_2 Concentrations

Site ID	Background NO_2	Monitored total NO_2 (µg/m^3)	Unverified Modelled total NO_2 (µg/m^3)	Difference (modelled vs. monitored) (%)
10	11.7	29.8	15.43	-48.22
11	11.7	35.4	18.77	-46.98
24A/B	11.7	37.0	16.90	-54.32
25	11.7	44.1	21.01	-52.36
31	11.7	31.8	16.41	-48.40
37 A/B	11.7	39.2	18.89	-51.81
47	11.7	28.8	18.04	-37.36
57	11.7	41.7	20.77	-50.19
32	11.7	34.1	18.99	-44.31
41 A/B	11.7	31.1	18.50	-40.58
48	11.7	34.9	20.27	-41.92

The data in the table above shows that the model was solely under predicting at all verification points, with the highest under prediction between the modelled and monitored concentrations observed at 24A/B (-54.32 %). At this stage all model inputs were checked to ensure their accuracy, this includes road and monitoring sire geometry, traffic data, link emission rates, 2019 monitoring results, background concentrations and modelling features such as "street canyons". Following a level of QA/QC completed upon the model, no further improvement of the modelled results could be obtained on this occasion. The difference between modelled and monitored concentrations was greater than -25% at all locations, therefore adjustment of the results was necessary. The relevant data was then gathered to allow the adjustment factor to be calculated.

Model adjustment needs to be undertaken based for NO_x and not NO_2. For the Council operated monitoring results used in the calculation of the model adjustment, NO_x was derived from NO_2; these calculations were undertaken using a spreadsheet tool available from the LAQM website[18].

[18] https://laqm.defra.gov.uk/air-quality/air-quality-assessment/nox-to-no2-calculator/

Table A.2 provides the relevant data required to calculate the model adjustment based on regression of the modelled and monitored road source contribution to NO_x.

Figure A.1 provides a comparison of the Modelled Road Contribution NO_x versus Monitored Road Contribution NO_x, and the equation of the trend line based on linear regression through zero. The Total Monitored NO_x concentration has been derived by back-calculating NO_x from the NO_x/NO_2 empirical relationship using the spreadsheet tool available from Defra's website. The equation of the trend lines presented in

Figure A.1 gives an adjustment factor for the modelled results of 3.616.

Table A.2 – Data Required for Adjustment Factor Calculation – Leek AQMA

Site ID	Monitored total NO_2 (µg/m^3)	Monitored total NO_x (µg/m^3)	Background NO_2 (µg/m^3)	Background NO_x (µg/m^3)	Monitored road contribution NO_2 (total - background) (µg/m^3)	Monitored road contribution NO_x (total - background) (µg/m^3)	Modelled road contribution NO_x (excludes background) (µg/m^3)
10	29.8	50.8	11.7	15.5	18.1	35.3	6.9
11	35.4	62.9	11.7	15.5	23.7	47.4	13.2
24A/B	37.0	66.5	11.7	15.5	25.3	51.0	9.7
25	44.1	83.0	11.7	15.5	32.4	67.5	17.5
31	31.8	55.1	11.7	15.5	20.1	39.6	8.7
37 A/B	39.2	71.5	11.7	15.5	27.5	56.0	13.4
47	28.8	48.7	11.7	15.5	17.1	33.2	11.8
57	41.7	77.3	11.7	15.5	30.0	61.8	17.1
32	34.1	60.1	11.7	15.5	22.4	44.5	13.6
41 A/B	31.1	53.6	11.7	15.5	19.5	38.1	12.7
48	34.9	61.8	11.7	15.5	23.2	46.3	16.1

Figure A.1 – Leek AQMA Comparison of the Modelled Road Contribution NO_x versus Monitored Road Contribution NO_x

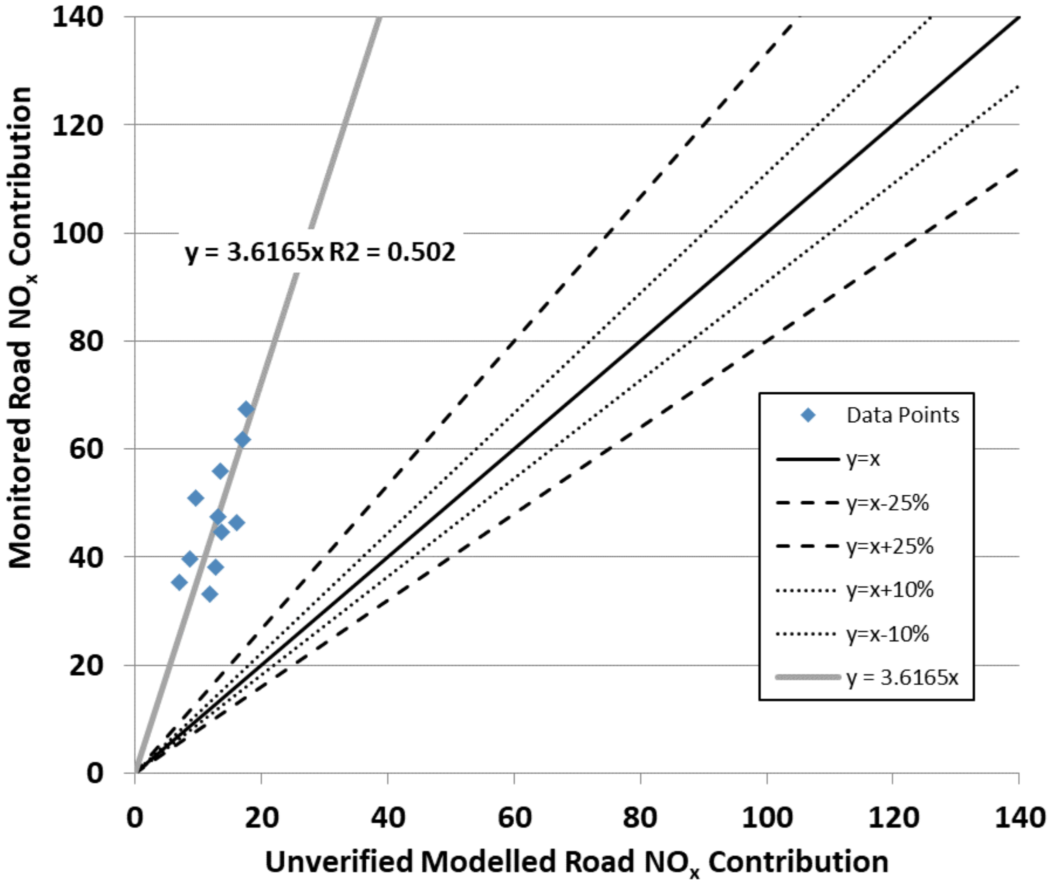


Table A.3 – Leek AQMA Adjustment Factor and Comparison of Verified Results against Monitoring Results

Site ID	Ratio of monitored road contribution NO_x / modelled road contribution NOx	Adjustment factor for modelled road contribution NO_x	Adjusted modelled road contribution NO_x (µg/m³)	Adjusted modelled total NO_x (including background NO_x) (µg/m³)	Modelled total NO_2 (based upon empirical NO_x / NO_2 relationship) (µg/m³)	Monitored total NO_2 (µg/m³)	Difference (adjusted modelled NO_2 vs. monitored NO_2) (%)
10	5.11	3.616	24.98	40.49	24.78	29.80	-16.85
11	3.59		47.71	63.22	35.54	35.40	0.40
24A/B	5.28		34.91	50.42	29.61	37.00	-19.97
25	3.85		63.39	78.90	42.38	44.10	-3.90
31	4.53		31.57	47.09	28.01	31.80	-11.92
37 A/B	4.17		48.56	64.07	35.92	39.20	-8.37
47	2.81		42.67	58.18	33.24	28.80	15.42
57	3.62		61.69	77.20	41.66	41.70	-0.10
32	3.27		49.28	64.79	36.24	34.10	6.28
41 A/B	3.01		45.87	61.38	34.71	31.14	11.48
48	2.88		58.15	73.66	40.14	34.90	15.01

Figure A.2 – Leek AQMA Comparison of the Verified Modelled Total NO_2 versus Monitored NO_2

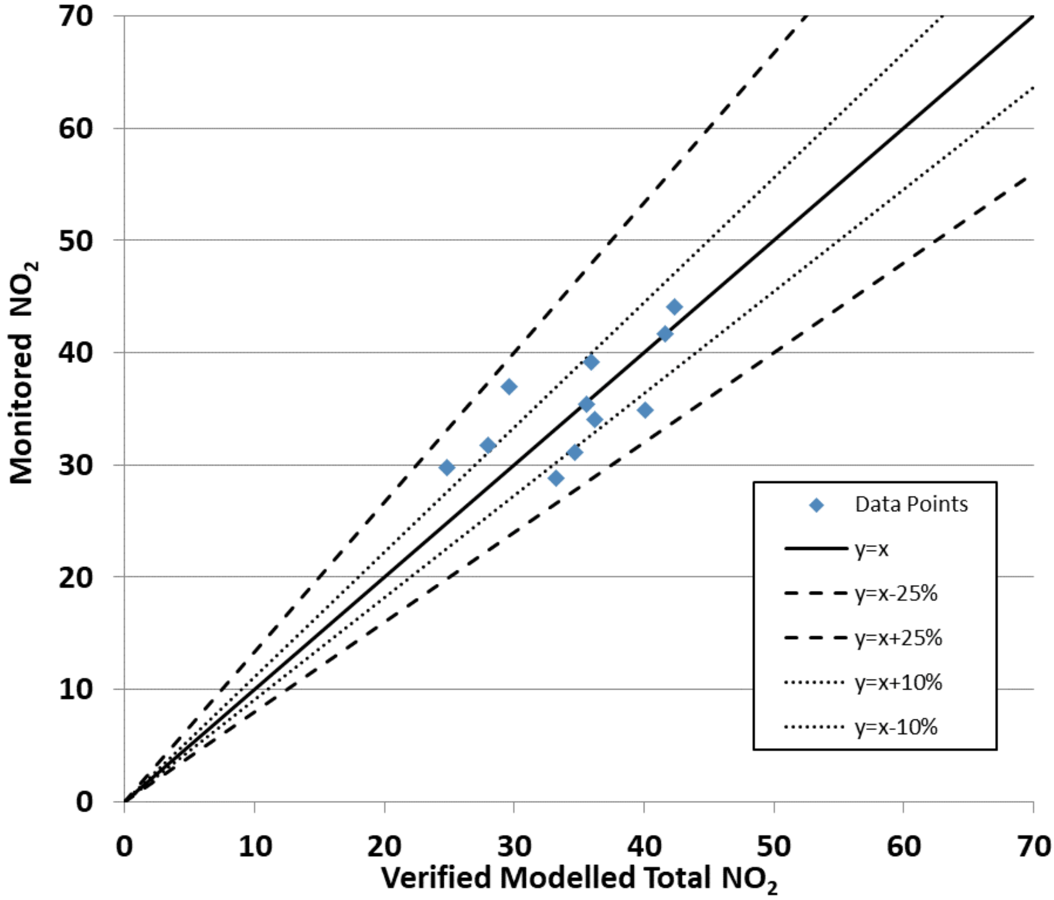


Table A.3 and

Figure A.**2** show the ratios between monitored and modelled NO_2 for each monitoring location after using the calculated adjustment factor. LAQM.TG(22)[1] states that:

"In order to provide more confidence in the model predictions and the decisions based on these, the majority of results should be within 25% of the monitored concentrations, ideally within 10%."

The sites show good agreement between the ratios of monitored and modelled NO_2,

A factor of 3.616 reduces the Root Mean Square Error (RMSE) from a value of 17.1 to 4.0, which is in line with the guidance value of 4 µg/m^3 as stated within LAQM.TG(22).

The 3.616 Leek adjustment factor was applied to the road contribution NOx concentrations predicted by the model to arrive at the final NO_2 concentrations in and around the Leek AQMA.

Cellarhead AQMA - NO_2 Verification calculations

The verification of the modelling output was performed in accordance with the methodology provided in Chapter 7 of LAQM.TG(22)[1].

Verification for each AQMA was completed using the 2019 (2018 reference year) Defra background mapped concentrations for the relevant 1km x 1km grid squares within SMDC (i.e. those within which the model verification locations are located), as displayed in Table B.1 of the Appendices.

Table A.4 below shows an initial comparison of the monitored and unverified modelled NO_2 results for the year 2019, in order to determine if verification and adjustment was required.

Table A.4 – Comparison of Unverified Modelled and Monitored NO_2 Concentrations

Site ID	Background NO_2	Monitored total NO_2 (µg/m^3)	Unverified Modelled total NO_2 (µg/m^3)	Difference (modelled vs. monitored) (%)
56	9.4	38.1	19.59	-48.58
39A/B	9.4	42.7	19.82	-53.58
42A/B	9.4	42.0	20.17	-51.98
55	9.4	32.1	16.11	-49.81
53	9.4	41.9	19.70	-52.98
49	9.4	25.1	13.56	-45.98
38	9.4	42.5	19.47	-54.21

The data in the table above shows that the model was solely under predicting at all verification points, with the highest under prediction between the modelled and monitored concentrations observed at 38 (-54.21 %). At this stage all model inputs were checked to ensure their accuracy, this includes road and monitoring sire geometry, traffic data, link emission rates, 2019 monitoring results, background concentrations and modelling features such as street canyons. Following a level of QA/QC completed upon the model, no further improvement of the modelled results could be obtained on this occasion. The difference between modelled and monitored concentrations was greater than -25% at all locations, therefore adjustment of the results was necessary. The relevant data was then gathered to allow the adjustment factor to be calculated.

Model adjustment needs to be undertaken based for NO_x and not NO_2. For the Council operated monitoring results used in the calculation of the model adjustment, NO_x was derived from NO_2; these calculations were undertaken using a spreadsheet tool available from the LAQM website[19].

[19] https://laqm.defra.gov.uk/air-quality/air-quality-assessment/nox-to-no2-calculator/

Table A.5 provides the relevant data required to calculate the model adjustment based on regression of the modelled and monitored road source contribution to NO_x.

Figure A.3 provides a comparison of the Modelled Road Contribution NOx versus Monitored Road Contribution NO_x, and the equation of the trend line based on linear regression through zero. The Total Monitored NO_x concentration has been derived by back-calculating NO_x from the NO_x/NO_2 empirical relationship using the spreadsheet tool available from Defra's website. The equation of the trend lines presented in Figure A.3 gives an adjustment factor for the modelled results of 3.443.

Table A.5 – Data Required for Adjustment Factor Calculation – Cellarhead AQMA

Site ID	Monitored total NO_2 (µg/m^3)	Monitored total NO_x (µg/m^3)	Background NO_2 (µg/m^3)	Background NO_x (µg/m^3)	Monitored road contribution NO_2 (total - background) (µg/m^3)	Monitored road contribution NO_x (total - background) (µg/m^3)	Modelled road contribution NO_x (excludes background) (µg/m^3)
56	38.1	70.3	9.4	12.2	28.7	58.1	19.0
39A/B	42.7	81.1	9.4	12.2	33.3	68.9	19.4
42A/B	42.0	79.5	9.4	12.2	32.6	67.2	20.1
55	32.1	56.9	9.4	12.2	22.7	44.7	12.3
53	41.9	79.2	9.4	12.2	32.5	67.0	19.2
49	25.1	42.2	9.4	12.2	15.7	30.0	7.6
38	42.5	80.7	9.4	12.2	33.1	68.5	18.8

Figure A.3 – Cellarhead AQMA Comparison of the Modelled Road Contribution NO_x versus Monitored Road Contribution NO_x

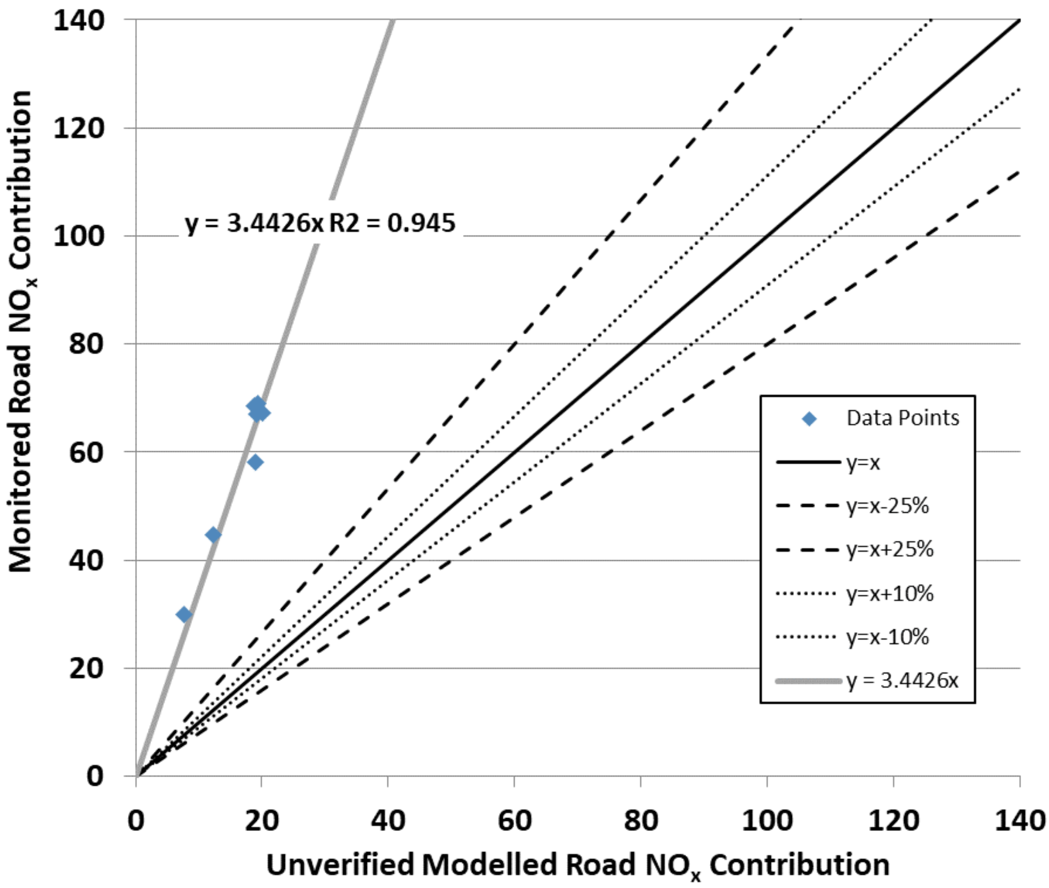


Table A.6 – Cellarhead AQMA Adjustment Factor and Comparison of Verified Results against Monitoring Results

Site ID	Ratio of monitored road contribution NO_x / modelled road contribution NOx	Adjustment factor for modelled road contribution NO_x	Adjusted modelled road contribution NO_x (µg/m^3)	Adjusted modelled total NO_x (including background NO_x) (µg/m^3)	Modelled total NO_2 (based upon empirical NO_x / NO_2 relationship) (µg/m^3)	Monitored total NO_2 (µg/m^3)	Difference (adjusted modelled NO_2 vs. monitored NO_2) (%)
56	3.06	3.443	65.41	77.65	41.24	38.10	8.24
39A/B	3.54		66.95	79.19	41.89	42.70	-1.90
42A/B	3.34		69.33	81.57	42.89	42.00	2.12
55	3.62		42.49	54.72	31.08	32.10	-3.18
53	3.48		66.18	78.41	41.56	41.90	-0.81
49	3.95		26.13	38.36	23.20	25.10	-7.57
38	3.65		64.61	76.85	40.90	42.52	-3.81

Figure A.4 – Cellarhead Comparison of the Verified Modelled Total NO_2 versus Monitored NO_2

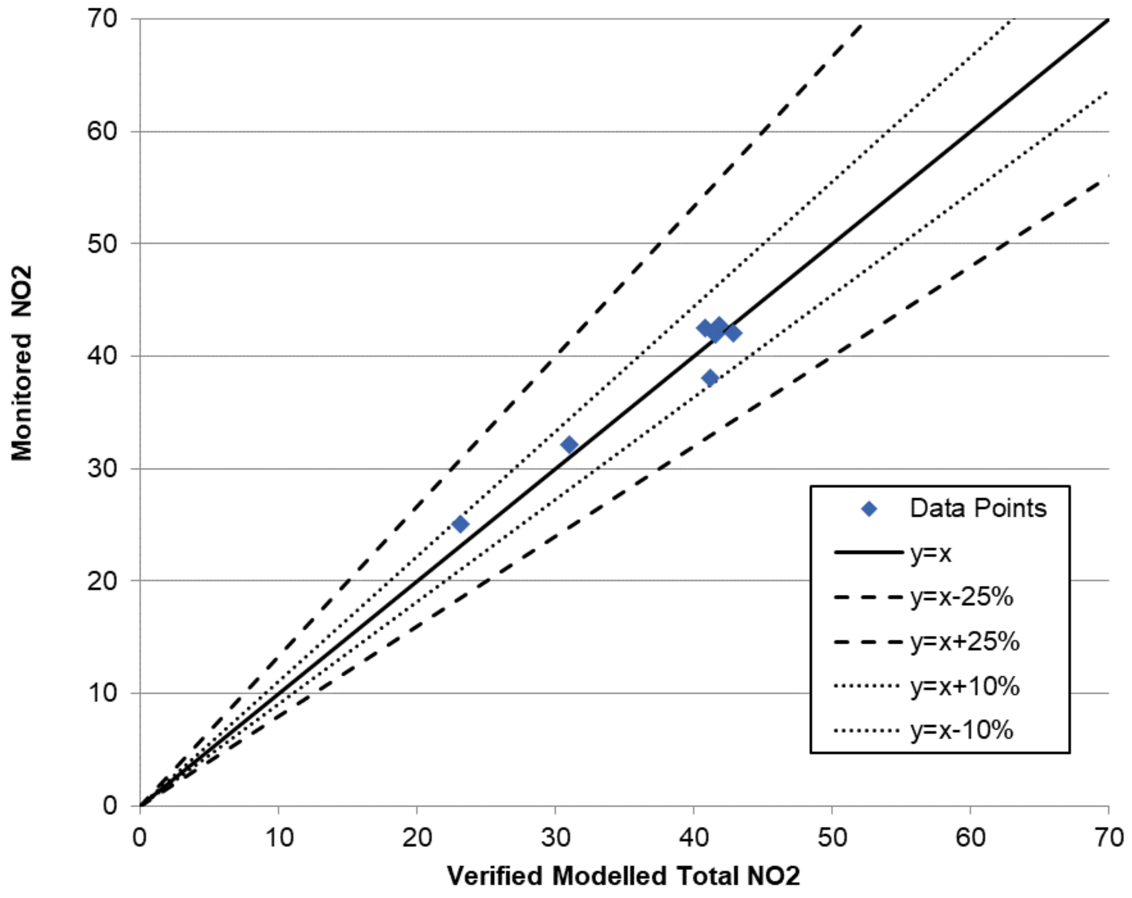


Table A.6 and Figure A.4 show the ratios between monitored and modelled NO_2 for each monitoring location after using the calculated adjustment factor. LAQM.TG(22)[1] states that:

"In order to provide more confidence in the model predictions and the decisions based on these, the majority of results should be within 25% of the monitored concentrations, ideally within 10%."

The sites show good agreement between the ratios of monitored and modelled NO_2,

A factor of 3.443 reduces the Root Mean Square Error (RMSE) from a value of 19.8 to 1.6, which is in line with the guidance value of 4 µg/m^3 as stated within LAQM.TG(22)[1].

The 3.443 Cellarhead adjustment factor was applied to the road contribution NOx concentrations predicted by the model to arrive at the final NO_2 concentrations in and around the Cellarhead AQMA.

Appendix B – Background Concentrations Used

Table B.1 – Defra Background Pollutant Concentrations Covering the Modelled Domain

2019 Annual Mean Background Concentration (µg/m^3) [1]					
Grid Reference (x)	**Grid Reference (Y)**	**Total Background NOx**	**Total Background NO_2**	**Total Background PM_{10}**	**Total Background $PM_{2.5}$**
Leek AQMA					
397500	355500	13.0	9.9	9.8	6.6
397500	356500	13.1	9.9	10.1	7.0
398500	356500	15.5	11.7	10.9	7.4
Cellarhead AQMA					
395500	347500	12.2	9.4	10.3	6.9

Note:
[1] Values obtained from the 2019 Defra Mapped Background estimates for the relevant 1km x 1km grid squares covering the modelled domain

Appendix C – Traffic Inputs

Table C.1 – Traffic Data used in the Detailed Assessment

Source	Traffic Point	Modelled Road Link Name		AADT	HGV (%)	Average Speed (kph)
Cellarhead AQMA						
DFT Traffic Data 2019	56537	1	Cellarhead Road	10915	2.0	5
DFT Traffic Data 2019	56537	2	Cellarhead Road	10915	2.0	20
DFT Traffic Data 2019	56537	3	Cellarhead Road	10915	2.0	48
DFT Traffic Data 2019	56537	4	Cellarhead Road	10915	2.0	64
DFT Traffic Data 2019	36561	5	Kingsley Road	8738	3.9	5
DFT Traffic Data 2019	36561	6	Kingsley Road	8738	3.9	15
DFT Traffic Data 2019	36561	7	Kingsley Road	8738	3.9	48
DFT Traffic Data 2019	36561	8	Kingsley Road	8738	3.9	64
DFT Traffic Data 2019	36561	9	Kingsley Road	8738	3.9	76
DFT Traffic Data 2019	17197	10	A520 (north)	8845	6.2	10
DFT Traffic Data 2019	17197	11	A520 (north)	8845	6.2	20
DFT Traffic Data 2019	17197	12	A520 (north)	8845	6.2	48
DFT Traffic Data 2019	17197	13	A520 (north)	8845	6.2	80
DFT Traffic Data 2019	56819	14	A520/ Leek Road (south)	11148	7.2	5
DFT Traffic Data 2019	56819	15	A520/ Leek Road (south)	11148	7.2	20
DFT Traffic Data 2019	56819	16	A520/ Leek Road (south)	11148	7.2	48
DFT Traffic Data 2019	56819	17	A520/ Leek Road (south)	11148	7.2	80
Leek AQMA						
DFT Traffic Data 2019	77359	18	A520	10701	2.5	10
DFT Traffic Data 2019	77359	19	A520	10701	2.5	20
DFT Traffic Data 2019	77359	20	A520	10701	2.5	32
DFT Traffic Data 2019	77359	21	A520	10701	2.5	48
DFT Traffic Data 2019	77359	22	A520	10701	3.3	32
DFT Traffic Data 2019	77363	23	A53	16344	3.3	10
DFT Traffic Data 2019	77363	24	A53	16344	3.3	24
DFT Traffic Data 2019	77363	25	A53	16344	3.2	5
DFT Traffic Data 2019	77363	26	A53	16344	3.2	32
DFT Traffic Data 2019	77363	27	A53	16344	3.2	20
DFT Traffic Data 2019	77363	28	A53	16344	3.2	10
DFT Traffic Data 2019	77363	29	A53	16344	2.6	10
DFT Traffic Data 2019	77363	30	A53	16344	2.6	24
DFT Traffic Data 2019	77363	31	A53	16344	1.8	32
DFT Traffic Data 2019	17881	32	A520	7467	1.8	10
DFT Traffic Data 2019	17881	33	A520	7467	1.9	24
DFT Traffic Data 2019	17881	34	A520	7467	1.9	10
DFT Traffic Data 2019	77362	35	A523	12451	1.9	10
DFT Traffic Data 2019	77362	36	A523	12451	1.9	24
DFT Traffic Data 2019	77362	37	A523	12451	3.3	48
DFT Traffic Data 2019	77362	38	A523	12451	3.3	24
DFT Traffic Data 2019	8751	39	A523	11217	3.3	16
DFT Traffic Data 2019	8751	40	A523	11217	3.3	10
DFT Traffic Data 2019	8751	41	A523	11217	3.3	24
DFT Traffic Data 2019	8751	42	A523	11217	3.5	48
DFT Traffic Data 2019	38025	43	A523	15865	3.5	10
DFT Traffic Data 2019	38025	44	A523	15865	3.5	24
DFT Traffic Data 2019	38025	45	A523	15865	3.5	24

Source	Traffic Point	Modelled Road Link Name		AADT	HGV (%)	Average Speed (kph)
DFT Traffic Data 2019	38025	46	A523	15865	3.5	24
DFT Traffic Data 2019	38025	47	A523	15865	3.5	10
DFT Traffic Data 2019	57966	48	A523	11812	3.5	10
DFT Traffic Data 2019	57966	49	A523	11812	3.5	24
DFT Traffic Data 2019	57966	50	A523	11812	3.5	48
DFT Traffic Data 2019	57966	51	A523	11812	3.2	24
DFT Traffic Data 2019	57966	52	A523	11812	3.2	10
DFT Traffic Data 2019	57966	53	A523	11812	3.2	24
DFT Traffic Data 2019	57966	54	A523	11812	3.5	40
DFT Traffic Data 2019	57966	55	A523	11812	3.5	24
DFT Traffic Data 2019	57966	56	A523	11812	3.5	10
DFT Traffic Data 2019	77361	57	A53	6842	3.5	10
DFT Traffic Data 2019	77361	58	A53	6842	3.5	24
DFT Traffic Data 2019	77361	59	A53	6842	3.5	48
DFT Traffic Data 2019	77361	60	A53	6842	3.5	64
DFT Traffic Data 2019	38026	61	A53	14277	3.5	10
DFT Traffic Data 2019	38026	62	A53	14277	2.3	24
DFT Traffic Data 2019	38026	63	A53	14277	2.3	32
DFT Traffic Data 2019	38026	64	A53	14277	2.3	24
DFT Traffic Data 2019	38026	65	A53	14277	2.3	10
DFT Traffic Data 2019	17880	66	A53	8962	2.3	10
DFT Traffic Data 2019	17880	67	A53	8962	5.1	10
DFT Traffic Data 2019	17880	68	A53	8962	5.1	10
DFT Traffic Data 2019	56312	69	A523	11804	5.1	10
DFT Traffic Data 2019	56312	70	A523	11804	5.1	24
DFT Traffic Data 2019	56312	71	A523	11804	5.1	32
DFT Traffic Data 2019	56312	72	A523	11804	5.1	48
DFT Traffic Data 2019	56312	73	A523	11804	5.1	24
DFT Traffic Data 2019	56312	74	A523	11804	5.1	10
DFT Traffic Data 2019	77360	75	A523	9049	5.1	10
DFT Traffic Data 2019	77360	76	A523	9049	6.5	24
DFT Traffic Data 2019	77360	77	A523	9049	6.5	48
DFT Traffic Data 2019	7908	78	A523	8949	6.5	10
DFT Traffic Data 2019	7908	79	A523	8949	6.5	24
DFT Traffic Data 2019	7908	80	A523	8949	4.2	32
DFT Traffic Data 2019	7908	81	A523	8949	4.2	48
DFT Traffic Data 2019	7908	82	A523	8949	4.2	32
DFT Traffic Data 2019	7908	83	A523	8949	4.2	24
DFT Traffic Data 2019	7908	84	A523	8949	4.2	10
DFT Traffic Data 2019	77363	85	A53	16344	4.5	20
DFT Traffic Data 2019	77363	86	A53	16344	4.5	48
DFT Traffic Data 2019	17880	87	A53	8962	4.5	10

Notes

Traffic flows and vehicle class compositions were taken from the DfT traffic count point database.
Traffic speeds were modelled at either the relevant speed limit for each road or based on the Google Traffic Database.
Where appropriate, vehicle speeds have been reduced to simulate queues at junctions, traffic lights and other locations where queues or slower traffic are known to be an issue – in accordance with LAQM TG(22)[1]

Appendix D – Receptor Locations and Corresponding Modelled Predictions

Table D.1 – Predicted 2019 Annual Mean Concentrations of NO_2, PM_{10} and $PM_{2.5}$ at Discrete Receptor Locations

Receptor ID	X	Y	Height	Closest address/post code	2019 Annual Mean Concentration (µg/m^3)		
					NO_2	PM_{10}	$PM_{2.5}$
Cellarhead AQMA							
R1	395297	347628	1.5	75 Cellarhead Road, Werrington, Staffordshire Moorlands, England, ST9 0HP	16.74	11.36	7.54
R2	395367	347622	1.5	65 Cellarhead Road, Werrington, Staffordshire Moorlands, England, ST9 0HP	17.21	11.41	7.57
R3	395639	347618	1.5	26 Cellarhead Road, Werrington, Staffordshire Moorlands, England, ST9 0HW	20.81	11.54	7.68
R4	395657	347576	1.5	11 Cellarhead Road, Werrington, Staffordshire Moorlands, England, ST9 0HW	26.39	12.09	8.03
R5	395698	347575	1.5	1 Leek Rd, Werrington, Stoke-on-Trent ST9 0DH	46.82	13.72	9.13
R6	395683	347602	1.5	Cellarhead Road, Werrington, Staffordshire Moorlands, England, ST9 0HW	28.79	12.25	8.14
R7	395706	347590	1.5	7 Leek Rd, Werrington, Stoke-on-Trent ST9 0HX	47.26	13.86	9.23
R8	395706	347620	1.5	4, Leek Road, Werrington, Stoke-on-Trent ST9 0HX	28.62	12.21	8.12
R9	395720	347687	1.5	The Bowling Green PH, Leek Road, Werrington, Stoke-on-Trent ST9 0HX	21.59	11.85	7.86
R10	395736	347789	1.5	Heath Avenue, Leek Road, Werrington, Stoke-on-Trent ST9 0HX	18.6	11.58	7.68
R11	395737	347826	1.5	Heath Avenue, Leek Road, Werrington, Stoke-on-Trent ST9 0HX	16.74	11.32	7.52
R12	395722	347592	1.5	The Old Bowling Green, Leek Rd, Cheadle, Stoke-on-Trent ST9 OHX	46.19	13.74	9.15
R13	395731	347580	1.5	The Old Bowling Green, Leek Rd, Cheadle, Stoke-on-Trent ST9 OHX	48.8	13.96	9.31
R14	395729	347569	1.5	Mantra, Leek Road, Werrington, Stoke-on-Trent, Staffordshire, England, ST9 0DQ	49.73	13.90	9.27
R15	395768	347548	1.5	Crossroads, Kingsley Road, Werrington, Stoke-on-Trent, Staffordshire, England, ST9 0JQ	30.11	12.43	8.29
R16	395803	347528	1.5	2, Kingsley Road, Werrington, Stoke-on-Trent, Staffordshire, England, ST9 0JQ	25.44	12.15	8.08
R17	395885	347483	1.5	Kingsley Road, Werrington, Stoke-on-Trent, Staffordshire, England, ST9 0DJ	22.89	12.20	8.06
R18	395703	347561	1.5	Mantra, Leek Road, Werrington, Stoke-on-	49.29	13.55	9.02

Receptor ID	X	Y	Height	Closest address/post code	2019 Annual Mean Concentration (µg/m³)		
					NO_2	PM_{10}	$PM_{2.5}$
				Trent, Staffordshire, England, ST9 0DQ			
R19	395702	347552	1.5	Mantra, Leek Road, Werrington, Stoke-on-Trent, Staffordshire, England, ST9 0DQ	46.82	13.34	8.88
R20	395701	347543	1.5	Mantra, Leek Road, Werrington, Stoke-on-Trent, Staffordshire, England, ST9 0DQ	43.52	13.21	8.79
R21	395690	347506	1.5	Mantra, Leek Road, Caverswall, Staffordshire Moorlands, Staffordshire, England, ST9 0DQ	30.63	12.48	8.29
R22	395686	347385	1.5	Mantra, Leek Road, Caverswall, Staffordshire Moorlands, Staffordshire, England, ST9 0DQ	31.28	12.92	8.55
R23	395665	347395	1.5	Mantra, Leek Road, Caverswall, Staffordshire Moorlands, Staffordshire, England, ST9 0DQ	24.28	12.07	8.00
Leek AQMA							
R24	397967	355973	1.5	Wallhill Residential Home, Broad Street, Leek, Staffordshire Moorlands, Staffordshire, England, ST13 5QA	36.58	12.47	8.37
R25	397975	356020	1.5	4 Hampton Court, Leek, Staffordshire Moorlands, Staffordshire, England, ST13 8XZ	30.66	12.29	8.37
R26	397998	356000	1.5	Wallhill Residential Home, Broad Street, Leek, Staffordshire Moorlands, Staffordshire, England, ST13 5QA	34.32	12.45	8.34
R27	398005	356053	4.0	Residential Property, Broad Street, Leek, Staffordshire Moorlands, Staffordshire, England, ST13 5QA	23.42	12.14	8.25
R28	398059	356114	4.0	Residential Property, Broad Street, Leek, Staffordshire Moorlands, Staffordshire, England, ST13 5NS	23.42	12.10	8.22
R29	398104	356159	1.5	St Mary's Catholic Academy, Cruso Street, Leek, Staffordshire Moorlands, Staffordshire, England, ST13 8BW	42.64	13.39	9.08
R30	398132	356187	1.5	94 Broad St, Leek ST13 5NU	46.47	13.57	9.20
R31	398197	356210	1.5	Hillside Court, Broad St, Leek ST13 5NX	46.19	14.73	9.71
R32	398245	356230	1.5	31 Broad St, Leek ST13 5NS	41.69	14.28	9.43
R33	398303	356270	1.5	Leek Masonic Hall, Broad Street, Leek, Staffordshire Moorlands, Staffordshire, England, ST13 5NS	43.12	14.56	9.64
R34	398325	356307	1.5	10 Broad St, Leek ST13 5NS	42.2	14.71	9.91
R35	398334	356313	1.5	4 Broad St, Leek ST13 5NS	44.02	14.93	10.06
R36	398358	356315	1.5	1 Broad St, Leek ST13 5NR	55.74	15.78	10.65

Receptor ID	X	Y	Height	Closest address/post code	2019 Annual Mean Concentration (µg/m^3)		
					NO_2	PM_{10}	$PM_{2.5}$
R37	398380	356308	1.5	6 Compton, Leek ST13 5NH	48.17	14.70	9.94
R38	398428	356218	1.5	40 Compton, Leek ST13 5NH	39.43	14.09	9.50
R39	398441	356185	1.5	52 Compton, Leek ST13 5NH	38.11	13.96	9.41
R40	398464	356155	1.5	7 Compton, Leek ST13 5DE	40.21	14.38	9.67
R41	398506	356039	1.5	2 Ballington View, Leek ST13 5SF	26.88	12.86	8.69
R42	398360	356372	4.0	69 St Edward St, Leek ST13 5DN	28.09	12.59	8.55
R43	398348	356365	1.5	68 St Edward St, Leek ST13 5DL	37.25	13.55	9.19
R44	398318	356465	1.5	50 St Edward St, Leek ST13 5DL	27.89	13.06	8.88
R45	398317	356515	1.5	29 St Edward St, Leek ST13 5DN	30.91	13.49	9.16
R46	398296	356571	1.5	10 St Edward St, Leek ST13 5DS	36.05	13.35	9.05
R47	398172	356609	1.5	5 Mill Street, Leek, , England, ST13 8GB	37.52	13.90	9.33
R48	397927	356841	1.5	142 Mill St, Leek ST13 8HA	23.23	12.00	8.13
R49	397661	356950	1.5	Mill Street, Macclesfield Road, Leek, England, ST13 8JZ	23.63	11.95	8.23
R50	397532	356974	1.5	49 Macclesfield Rd, Leek ST13 8LD	25.87	12.32	8.43
R51	398440	356618	4.0	5 Stockwell St, Leek ST13 6DH	22.76	12.30	8.36
R52	398485	356632	1.5	15 Stockwell St, Leek ST13 6DH	33.58	14.19	9.64
R53	398587	356659	1.5	41 Stockwell St, Leek ST13 6DH	34.04	14.28	9.70
R54	398725	356666	1.5	Park Medical Centre, Ball Haye Rd, Leek ST13 6QR	42.19	13.96	9.49
R55	398645	356645	1.5	57 Stockwell St, Leek ST13 6DH	35.32	14.32	9.73
R56	398792	356662	1.5	30 Buxton Rd, Leek ST13 6EE	31.92	13.83	9.41
R57	398959	356713	1.5	Nursery, Roche Villa, Buxton Road, Leek ST13 6EG	27.22	13.21	8.89
R58	399007	356723	1.5	Hen Cloud House, Buxton Rd, Leek ST13 6EQ	23.53	11.99	8.07
R59	398995	356702	1.5	96 Buxton Rd, Leek ST13 6EE	29.03	13.48	9.07
R60	399100	356706	1.5	Warrington House, 108 Buxton Rd, Leek ST13 6EJ	33.86	12.42	8.36
R61	399262	356740	1.5	128 Buxton Rd, Leek ST13 6EJ	28.83	12.13	8.13
R62	399301	356800	1.5	151 Buxton Rd, Leek ST13 6EH	30.83	11.79	7.94
R63	399311	356683	1.5	Leek High School, 11 Springfield Rd, Leek ST13 6LG	26.72	12.20	8.19
R64	399289	356517	1.5	Springfield Rd, Leek ST13 6LQ	22.2	11.69	7.86
R65	399241	356481	1.5	Leek First School, East Street, Leek ST13 6LF	18.6	11.03	7.44
R66	399187	356369	1.5	98 Ashbourne Rd, Leek ST13 5AT	32.93	12.68	8.47
R67	399149	356402	1.5	92 Ashbourne Rd, Leek ST13 5AT	23.22	11.80	7.90
R68	399043	356400	1.5	72 Ashbourne Rd, Leek ST13 5AT	27.38	12.61	8.40

Receptor ID	X	Y	Height	Closest address/post code	2019 Annual Mean Concentration (µg/m^3)		
					NO_2	PM_{10}	$PM_{2.5}$
R69	399017	356414	1.5	49 Ashbourne Rd, Leek ST13 5AU	27.53	12.63	8.41
R70	398978	356401	1.5	56 Ashbourne Rd, Leek ST13 5AU	30.66	13.72	9.20
R71	398853	356403	1.5	24 Ashbourne Rd, Leek ST13 5AS	30.84	13.57	9.12
R72	398770	356430	1.5	Rethink Mental Illness, 4 Ashbourne Rd, Leek ST13 5AS	37.27	14.27	9.59
R73	398618	356425	4.0	71 Haywood St, Leek ST13 5JH	23.52	12.43	8.44
R74	398581	356385	1.5	6 Leonard St, Leek ST13 5JP	37.76	14.81	9.98
R75	398475	356359	1.5	Residential Property, Brook Street, Leek, England, ST13 5JX	41.19	15.30	10.29
R76	398397	356337	4.0	2-6, Brook St, Leek ST13 5JE	32.74	13.07	8.86
R77	398697	356530	4.0	1 Fountain St, Leek ST13 6JS	25.22	12.51	8.56
R78	398690	356546	4.0	3 Ball Haye St, Leek ST13 6JN	23.97	12.35	8.45
R79	398694	356615	1.5	31 Ball Haye St, Leek ST13 6JN	46.84	14.59	9.92
R80	398693	356579	1.5	17 Ball Haye St, Leek ST13 6JN	35.15	13.89	9.57