Annual Progress Report (APR)

2023 Air Quality Annual Progress Report (APR) for Stirling Council

In fulfilment of Part IV of the Environment Act 1995, as amended by the Environment Act 2021

Local Air Quality Management 1 September 2023

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Executive Summary: Air Quality in Our Area

Air Quality in Stirling Council

This Annual Progress Report provides an overview of air quality in the Stirling Council area. Air quality monitoring was performed at the automatic monitoring station on Craig's Roundabout in the City of Stirling measuring nitrogen dioxide (NO_2) and particulate matter ($PM_{2.5}$ and PM_{10}), and passive monitoring was undertaken for NO_2, using diffusion tubes at 12 sites in the wider urban area.

Based on the available monitoring data for NO_2, $PM_{2.5}$ and PM_{10}, there were no exceedances of the relevant Air Quality Objectives and it is unlikely that they will be exceeded in the near future. Therefore, it is not considered necessary to declare an Air Quality Management Area (AQMA) in the Stirling area.

Actions to Improve Air Quality

When we breathe polluted air, pollutants get into our lungs; they can enter the bloodstream and be carried to our internal organs such as the brain. This can cause severe health problems such as asthma, cardiovascular diseases and even cancer, and reduces the quality and number of years of life. Vulnerable groups – such as children, people with chronic diseases, and the elderly – are particularly sensitive to the dangerous effects of toxic air pollution and so it is critical that human health and the environment are protected. Stirling Council has a number of initiatives and actions to improve air quality, such as a sustainable transport strategy, a comprehensive monitoring programme, and developmental control requirements.

Stirling Council has partnered with East Central Scotland Vehicles Emissions Partnership, which is a coalition of East Lothian, Falkirk, Midlothian and West Lothian councils. The remit of the Vehicles Emissions Partnership is to reduce vehicle emissions by encouraging drivers to switch off their engines, and to handle idling complaints. Further information can be found at http://switchoffandbreathe.org/about/

As part of the Sustainable Growth Agreement Actions, Stirling Council procured ten mobile air quality monitoring units (Zephyrs) to monitor NO_2, NO, O_3, PM_{10}, $PM_{2.5}$ and PM_{10}. The units are deployed in the villages of Aberfoyle, Doune and Deanston, Fintry, Kippen and Thornhill. Data from this programme can be viewed at the Stirlingshire Villages Project - Air Quality website.

New development in the Stirling area is a key issue affecting air quality. Where relevant, development applications are requested to submit an Air Quality Impact Assessment to allow for the potential impact to be assessed and any necessary mitigation measures to be applied. Applications include biomass installations and increased traffic emissions from major housing developments.

Stirling Council's Local Transport Strategy (LTS) establishes a long-term strategic vision for transport management, provision and services, and sets out how Stirling Council will work to promote and deliver sustainable travel and transportation. Routine reviews of the LTS, and the associated consultations, have identified that progress towards achieving many of the objectives is largely positive.

The Local Transport Strategy is delivered via a number of supporting plans including the City Transport Plan 2013; the Towns, Villages and Rural Transport Plan 2014; and the Walking and Cycling to a Healthier Stirling: Active Travel Action Plan. The Active Travel Action Plan focuses on encouraging walking and cycling through improving infrastructure and changing behaviours via training and promotional activities.

Stirling Council's Sustainable Development Strategy establishes a collective vision to balance the needs of its communities and businesses with the needs of the environment. The strategy establishes objectives that focus on five main areas: energy, transport, sustainable ecosystems, sustainable resource/waste management, and climate change adaption. This includes reducing fuel poverty levels to zero by 2040; Stirling City Centre Emissions Free Zones by 2030; 40% natural vegetation cover by 2040; Zero Waste City by 2040; and 80% reduction in carbon emissions by 2050.

Stirling Council actively participates in and promotes the Cycle to Work Scheme and the NextBikes cycle hire scheme, encouraging staff to use sustainable methods of transport for both commuting and work purposes.

A number of Schools within the Stirling Council area deliver the Level 1 Bikeability Scotland Cycle Training, providing children with the skills, confidence and encouragement to cycle safely on the roads. Further information can be found at: http://www.bikeabilityscotland.org/

Stirling Council is part of the Tactran (Tayside and Central Scotland Transport Partnership) Electric Vehicle Steering Group and has contributed to the Regional Electric Vehicle Strategy, which was published at the end of 2019. Tactran has the primary purpose of developing a regional transport strategy setting out a vision for the medium- to long-term future of transport in the area, and to oversee its implementation.

Stirling Council has significantly increased its fleet of electric vehicles and installed additional charging bays, with projects ongoing.

Local Priorities and Challenges

The anticipated growth in traffic volume is seen as a priority air quality issue and the above plans were developed to manage this issue into the future. The reports and other related documents can be viewed at: http://my.stirling.gov.uk/services/transport-and-streets/transport-policy

How to Get Involved

A number of local and national organisations exist to promote more active and sustainable travel, and members of the public can access further information or become directly involved by following the links below:

https://www.livingstreets.org.uk/who-we-are/scotland

http://www.sustrans.org.uk/scotland

http://www.stirlingcyclehub.org

http://nextbike.co.uk

http://Stirlingshire Villages Project - Air Quality (sepa.org.uk)

Members of the public who wish to access information and advice on air quality across Scotland can do so at: http://www.scottishairquality.co.uk/

Air quality data specific to the Stirling Council area can be found at: http://www.scottishairquality.co.uk/latest/site-info?site_id=STRL

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1 Local Air Quality Management

This report provides an overview of air quality in Stirling 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 the air quality objectives are likely to be achieved. Where an exceedance is considered likely, the local authority must declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives. This Annual Progress Report (APR) summarises the work being undertaken by Stirling Council to improve air quality and any progress that has been made.

Table 1.1 – Summary of Air Quality Objectives in Scotland

Pollutant	Air Quality Objective Concentration	Air Quality Objective Measured as	Date to be Achieved by
Nitrogen dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
Nitrogen dioxide (NO_2)	40 µg/m^3	Annual mean	31.12.2005
Particulate Matter (PM_{10})	50 µg/m^3, not to be exceeded more than 7 times a year	24-hour mean	31.12.2010
Particulate Matter (PM_{10})	18 µg/m^3	Annual mean	31.12.2010
Particulate Matter ($PM_{2.5}$)	10 µg/m^3	Annual mean	31.12.2021
Sulphur dioxide (SO_2)	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
Sulphur dioxide (SO_2)	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
Sulphur dioxide (SO_2)	266 µg/m^3, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005
Benzene	3.25 µg/m^3	Running annual mean	31.12.2010
1,3 Butadiene	2.25 µg/m^3	Running annual mean	31.12.2003
Carbon Monoxide	10.0 mg/m^3	Running 8-Hour mean	31.12.2003

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 must prepare publish and implement an Air Quality Action Plan (AQAP) within the shortest possible time and no later than 12 months of the date of AQMA Designation Order. The AQAP must set out measures the local authority intends to put in place in pursuit of the objectives within the shortest possible time Measures should be provided with milestones and a final date for completion. The action plan itself should have a timescale for completion and for revocation of the AQMA. Where measures to reduce air pollution may require a longer timescale an action plan shall be reviewed and republished within five years of initial publication and then five-yearly thereafter.

Stirling Council currently does not have any AQMAs, and the results of past and present monitoring indicate that it will not be necessary to declare any AQMAs in the future.

2.2 Cleaner Air for Scotland 2

Cleaner Air for Scotland 2 – Towards a Better Place for Everyone (CAFS2) is Scotland's second air quality strategy. CAFS2 sets out how the Scottish Government and its partner organisations propose to further reduce air pollution to protect human health and fulfil Scotland's legal responsibilities over the period 2021 – 2026. CAFS2 was published in July 2021 and replaces Cleaner Air for Scotland – The Road to a Healthier Future (CAFS), which was published in 2015. CAFS2 aims to achieve the ambitious vision for Scotland "to have the best air quality in Europe". A series of actions across a range of policy areas are outlined, a summary of which is available on the Scottish Government's website.

Progress by Stirling Council against relevant actions for which local authorities are the lead delivery bodies within this strategy is demonstrated below.

2.2.1 Placemaking – Plans and Policies

Local authorities with support from the Scottish Government will assess how effectively air quality is embedded in plans, policies, City Deals and other initiatives, and more generally in cross-departmental working, identifying and addressing evidence, skills, awareness and operational gaps.

Local authorities working with Transport Scotland and SEPA will look at opportunities to promote zero-carbon city centres within the existing LEZs structure.

Stirling Council has no Low Emission Zones established within the Local Authority area.

Walk, Cycle, Live Stirling is a transformational active travel project that will deliver 6.5km of new active travel infrastructure from the Forth Valley College to the city centre, and Stirling University to the train station; making it easier for people to walk and cycle in Stirling. Having this transport choice will reduce car dependence and congestion, and hopefully contribute towards improving air quality.

2.3 Implementation of Air Quality Action Plan(s) and/or measures to address air quality

In order to ensure that local authorities implement the measures within an action plan by the timescales stated within that plan, the Scottish Government expects authorities to submit updates on progress through the APR process. Stirling Council has taken forward a number of measures within the action plan during the current reporting year of 2022 in pursuit of improving local air quality and meeting the air quality objectives within the shortest possible time. Details of all measures completed, in progress or planned are set out in Table 2.1.

Key completed measures:

- The Electric Vehicle Policy was approved by Council in October 2022.
- An additional 14 public charging bays were introduced in 2022.
- An additional 32 fleet charging bays were introduced in 2022.

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

- Four electric minibuses will be added to the fleet in 2023.
- A further 51 public charging bays, 24 fleet charging bays and one dedicated bus charging bay will be delivered in 2023. With suitable infrastructure in place, it is hoped that people will be encouraged to consider changing to EVs, and also that bus and taxi companies will consider switching their vehicles to electric.

Table 2.1 – Progress on Measures to Improve Air Quality

Measure No.	Measure	Category	Expected/Actual Completion year	Measure Status	Funding Status	Key Milestones	Progress	Barriers to implementation
1	Fleet	Alternatives to private vehicle user.	2023	Delivery	No funding for 23/24 allocated.	Phase-out of Internal Combustion Engine (ICE) cars in public sector fleet by 2025 and all ICE vehicles by 2030.	5.8%	Funding and availability of suitable vehicles.
2	EV Policy - Transition to a fossil fuel-free climate-ready area by 2045.	Promoting low emission transport.	ongoing	Adopted - October 22	No funding for 23/24 allocated.	Residents have access to charging within 10-minute walk.	Total increase of 46 charging bays (public & fleet) in 2022 (21%).	Funding, suitable council land, electrical grid constraints.
3	Transport Scotland's Switched on Towns and Cities - To encourage the uptake of EVs in towns and cities.	Promoting low emission transport.	2023	Delivery	Funding now closed	Project completion of remaining EVCP installations.	The number of plug-in vehicles registered in Stirling at third quarter 2022 are 5917 (increase of 39%).	N/A as project is nearing completion.
4	Climate and Nature Emergency Plan (CaNE Plan).	This will cover a number of the categories.	Stirling Council area will be net zero by 2045.	Delivery	Various	75% carbon reduction by 2030.	47.8% reduction in emissions by 2020 (Data from UK Govt Department of Business, Energy and Industrial Strategy (DBEIS). Data for 2021 will be available in July. (Note: data is published two years behind due to long verification process.)	Availability of project funding. Staff resource. Lack of experience in the workforce. Increasing demand for limited resources.
5	Investigating the purchase and implementation of Variable Messaging Signs to use in conjunction with air quality monitors.	Promoting low emission transport.	2023	Planning	Funding confirmed for pilot.	Unconfirmed	Assessing feasibility	Seeking approval
6	Walk, Cycle, Live Stirling	Promoting travel alternatives.	50% completed - expected completion date summer 2024.	In progress	Fully funded. Sustrans with match form City Region Deal and developer contributions.	1. Award issued. 2. Consultation and design. 3. Concept design. 4. Detailed design. 5. Developed design. 6. Construction. 7. Routes promoted. 8. Monitoring and evaluation.	Causewayhead Rd – completed. Raploch Rd. North, Albert Place to Corn Exchange Rd – completed. Goosecroft Rd – in progress. Cowane St., Upper Bridge St., connection to Old Stirling Bridge, Airthrey Rd, Raploch Rd street – design stage.	Project is currently progressing smoothly with some congestion and delays creating negative public feedback. Inflation and increasing costs.

3 Air Quality Monitoring Data and Comparison with Air Quality Objectives

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

This section sets out what monitoring has taken place and how local concentrations of the main air pollutants compare with the objectives.

Stirling Council undertook automatic (continuous) monitoring at one site during 2022. Table A.1 in Appendix A shows the details of the site. National monitoring results are available at Site Data | Scottish Air Quality.

A map showing the location of the automatic monitoring site is provided in Figure A.1 in Appendix A. Further details on how the monitors are calibrated and how the data has been adjusted are included in Appendix C.

3.1.2 Non-Automatic Monitoring Sites

Stirling Council undertook non-automatic (passive) monitoring of NO_2 at 12 sites during 2022. Table A.2 in Appendix A shows the details of the sites. A map showing the location of the monitoring sites is provided in Figure A.2 in Appendix A. Further details on Quality Assurance/Quality Control (QA/QC), annualisation, and bias adjustment for the diffusion tubes are included in Appendix C.

3.1.3 Other Monitoring Activities

The University of Stirling is working alongside the Scottish Environment Protection Agency (SEPA), with support from Stirling Council, to organise a series of community-based workshops across Stirlingshire. These workshops are designed to empower local communities to take ownership of the air quality monitoring, information delivery and action within their local neighbourhoods.

Low-cost air quality sensors (Zephyr units) are being set up for the duration of this project in the villages of Aberfoyle, Doune and Deanston, Fintry, Kippen and Thornhill. These sensors record air quality pollutants associated with traffic movement and domestic

heat combustion emissions. Village residents can also borrow small sensors to distribute across the village, measuring Particulate Matter. A measuring period of four weeks will be conducted across each village, along with the community-based workshops. The data will be fed back to the communities in the workshops, during which participants will be asked to delve into the data and use their local knowledge to explore and explain the possible trends and potential sources.

As part of this project, SEPA has developed a visualisation tool that will allow residents to look at data recorded in their village, exploring some of the potential causes and drivers of local pollution events. This tool can be accessed at Stirlingshire Villages Project - Air Quality.

Stirling Council will resume the full use of these monitors in the second half of 2023. External funding to pay for the ongoing fees associated with the Zephyrs will be applied for in January each year to pay for the subsequent year.

3.2 Individual Pollutants

The air quality monitoring results presented in this section are, where relevant, adjusted for annualisation and bias. Further details on adjustments are provided in Appendix C.

3.2.1 Nitrogen Dioxide (NO_2)

Table A.4 in Appendix A compares the ratified continuous monitored NO_2 hourly mean concentrations for the past five years, with the air quality objective of 200µg/m^3 not to be exceeded more than 18 times per year.

For diffusion tubes, the full 2022 dataset of monthly mean values is provided in Table B.1 in Appendix B. Figure B.1 shows the trends in annual mean NO_2 concentrations between 2016 and 2022. There were no exceedances of the objectives.

3.2.2 Particulate Matter (PM_{10})

Table A.5 in Appendix A compares the ratified and adjusted monitored PM_{10} annual mean concentrations for the past five years, with the air quality objective of 18µg/m^3.

Table A.6 in Appendix A compares the ratified continuous monitored PM_{10} daily mean concentrations for the past five years, with the air quality objective of 50µg/m^3 not to be exceeded more than seven times per year. There were no exceedances of the objectives.

3.2.3 Particulate Matter ($PM_{2.5}$)

Table A.7 in Appendix A compares the ratified and adjusted monitored $PM_{2.5}$ annual mean concentrations for the past five years, with the air quality objective of 10µg/m^3. Stirling Council has only been monitoring $PM_{2.5}$ since 2019 and there is limited data for this pollutant. There have been no exceedances of the objectives thus far.

3.2.4 Sulphur Dioxide (SO_2)

Stirling Council does not monitor for SO_2.

3.2.5 Carbon Monoxide, Lead and 1,3-Butadiene

Stirling Council does not monitor for Carbon Monoxide, Lead or 1,3-Butadiene.

4 New Local Developments

4.1 Road Traffic Sources

There are no new road traffic sources, as listed below, that would have a significant impact on air quality.

- Narrow congested streets with residential properties close to the kerb.
- Busy streets where people may spend one hour or more close to traffic.
- Roads with a high flow of buses and/or HGVs.
- Junctions.
- Bus or coach stations.

4.2 Other Transport Sources

There are no new sources, as listed below, that would have a significant impact on air quality.

- Airports.
- Locations where diesel or steam trains are regularly stationary for periods of 15 minutes or more, with potential for relevant exposure within 15m.
- Locations with a large number of movements of diesel locomotives, and potential long-term relevant exposure within 30m.
- Ports for shipping.

The Stirling Council Public Transport Co-ordinator confirmed that the total number of movements at Stirling Bus Station for 2022 is 118,893. This approximates to a four-week average of 9145, or daily average of 327. The criterion for assessment where there is relevant exposure within 10m is 2,500 movements a day. It is therefore concluded that a Design Manual for Roads and Bridges (DMRB) assessment is not required.

4.3 Industrial Sources

It is confirmed that during 2022 none of the following would warrant further assessment:

- Industrial installations: new or proposed installations for which an air quality assessment has been carried out.
- Industrial installations: existing installations where emissions have increased substantially or new relevant exposure has been introduced.
- Industrial installations: new or significantly changed installations with no previous air quality assessment.

- Major fuel storage depots storing petrol.
- Poultry farms.

SEPA confirmed that one new PPC permit was issued in the Stirling Council area in 2022. The details are provided in Table 4.1, below.

Table 4.1 – PPC Permits 2022

Auth. No	Auth. Level	Site Address	Authorisation Holder	Authorisation Activity	Type
PPC/A/1198070	PPC Part A	Airthrey Kerse Dairy, Henderson Street, Bridge of Allan	Graham's Dairies Limited	PPC(A) - Animal By-product Processing	New Licence

4.4 Commercial and Domestic Sources

The locations of previously assessed and proposed biomass installations are summarised in Table 5.1. There are no clusters of installations in 500 x 500 metre squares that could result in cumulative impacts of emissions of PM_{10}.

With the exception of the Acharn Power Station (Killin) Development, which is operational, all are small-scale plants with minimal potential for significant release of PM_{10} or NOx. Where required, the applications were screened using the Defra review and assessment tools, and further assessment was not considered necessary.

4.5 New Developments with Fugitive or Uncontrolled Sources

There are no new developments with fugitive or uncontrolled sources, as listed below, that would have a significant impact on air quality:

- Landfill sites.
- Unmade haulage roads on industrial sites.
- Waste transfer stations.
- Other potential sources of fugitive particulate matter emissions.

5 Planning Applications

Stirling Council's Local Development Plan (LDP) identifies a number of sites for large-scale development between 2014 and 2034. Each development site shall be assessed for its impact on air quality through the planning consultation process. Where appropriate, detailed air quality impact assessments shall be required to be submitted.

A full application for a major housing and mixed development (Durieshill) is under consideration. This is an application for a 3,000-house residential development, village centre, employment land, community campus and primary school located on land between Plean and the Bannockburn Interchange.

The air quality assessment has been reviewed. Modelling used in the assessment indicated that there are mainly negligible impacts on NO_2, PM_{10} and $PM_{2.5}$ from the development at the 29 receptors selected, with the exception of NO_2, which has a minor impact at four of the 29 receptors. The planning development approval process is ongoing.

Planning permission for a redevelopment of the Craigforth Campus (21/00552/FUL) to comprise offices, retail, leisure, public houses, restaurants, residential premises, hotel, care home, nursery, distillery, landscaping, car park and associated infrastructure is subject to a planning appeal (2022).

The Environment Impact Assessment air quality study for the extension of aggregate extraction operations at land south of Cambusmore House, Doune, concluded that with the implementation of the recommended mitigation measures, the proposal was unlikely to lead to significant dust impacts at the receptors considered in the assessment.

Table 5.1 – Locations of Installed, Permitted and Proposed Biomass Combustion Plant within Stirling Council

Name	Reference	Status	Easting	Northing
Wester Auchentroig, Buchlyvie	20/00628/FUL	Granted	10695	343755
Ogilvie House Pirnhall biomass boiler, Stirling	20/00399/FUL	Granted	84931	929328
Broich Arngomery Kippen FK8 3EN	21/00417/LAW	Permitted 30/06/2021 Status unknown	128510	188565
Lendrick Cottage, Callander FK17 8HR	2021/0283/LAW	Withdrawn	226904	340725
West Rossburn Lane Farm, Stirling, FK9 4AH	20/00142/FUL (retrospective)	Permitted 18 May 2020 Status: Operational	146354	042009
Stockbridge Nursery, Kilbryde and Brack Road, Doune, FK15 9ND	18/00712/FUL	Permitted 27 November 2018 Status: Unknown	191627	991943
Land adjacent to North and West of 27 Whitehouse Rd, Forthside Way, Stirling	16/00775/FUL	Permitted 27/02/2017 Status: Unknown	280695	693347
Carsten Mews, Drumbeg Rd, Killearn	16/00749/FUL	Permitted 15/02/2017 Status: Unknown	250499	684139
48 Glasgow Road, Blanefield	15/00644/FUL	Permitted 30/11/2015 Status: Unknown	255744	679621

6 Conclusions and Proposed Actions

6.1 Conclusions from New Monitoring Data

The annual mean for NO_2 at the active monitoring station shows no change from the 2021 data.

Based on the data in Tables A.3 to A.7 and the graph in Figure B.1 of Appendix B, it can be seen that there was a minor increase in NO_2 at the passive monitoring sites DT2, DT3, DT4(A-C), DT5, DY8, DT11 and DT12. A minor reduction is seen at sites DT1, DT6, DT7, DT9 and DT10, however, with the exception of DT9, these are the sites subject to annualisation of the data due to reduced recovery rates (<75%). As reported in previous years, the above increases in NO_2 appear to be the result of the artificially low levels in 2020 resulting from Covid restrictions.

A similar trend is seen for PM_{10} at the automatic monitoring station, with the annual mean showing an increase from 2020. As above, this appears to be the result of the artificially low levels in 2020.

$PM_{2.5}$ has only been measured since 2019. The results for the annual mean (Table A.7) show no change since 2021, however, there is minor increase since 2020.

The following conclusions can be made:

- Based on the air quality data collected in 2022, there are no exceedances of the relevant Air Quality Objectives and it is considered unlikely that they will be exceeded in the near future.
- On this basis it is not considered necessary to declare an AQMA within the Stirling area.

The results and conclusions of air quality monitoring in the Stirling area should be considered in relation to traffic data and, specifically, the impact of Covid in 2020.

Vehicle miles travelled in Great Britain have had year-on-year growth in each year between 2011 and 2019. Following a sharp decline in 2020, traffic levels for 2022 have increased on the previous year but still remain lower than the 2011 levels. Source: Road traffic statistics - Local authority: Stirling (dft.gov.uk)

6.2 Conclusions Relating to New Local Developments

In relation to new local developments, it is determined that the key issue regarding air quality is the potential for increased road traffic. It is recognised that future and pending applications may increase traffic numbers and, as a result, negatively impact on the air quality within the Stirling Council area.

Biomass installations are also still considered a potential source of increased emissions affecting air quality. As such, biomass applications are screened using the Defra review-and-assessment tools, and are not expected to have a significant impact on local air quality.

It has been highlighted that there is an increased demand for domestic households to install alternative heat and power sources into their homes. The installation of wood-burning stoves may require planning permission if a chimney/flue has to be installed and would protrude more than one metre. As such, reference is made to the Residential Alterations and Extensions Supplementary Guidance SG12.

6.3 Proposed Actions

Stirling Council will continue with the following actions:

- Monitor for NO_2, $PM_{2.5}$ and PM_{10} at the locations detailed in this report. Results of the monitoring and other air quality assessment work will be presented in the next Annual Progress Report in 2024.
- Require air quality assessments where a development may result in significant increases in traffic as outlined in Defra Local Air Quality Guidance Management, Technical Guidance (TG16).
- Screening of biomass applications to assess the potential impact on local air quality.
- Provide information and support to Stirling Council Sustainable Development Team on future developments in the Stirling area.

As detailed in Table 2.2., the Sustainable Development Team has taken forward a number of measures to improve local air quality. Key projects include:

- The Electric Vehicle Policy, approved by Council in October 2022.
- An additional 14 public charging bays, introduced in 2022.
- An additional 32 fleet charging bays, introduced in 2022.

In addition, it is anticipated that the following measures will be completed over the course of the next reporting year:

- Four electric minibuses will be added to the fleet in 2023.
- A further 51 public charging bays, 24 fleet charging bays and one dedicated bus charging bay will be delivered in 2023. With suitable infrastructure in place, it is hoped that people will be encouraged to consider changing to EVs, and that bus and taxi companies will consider switching their vehicles to electric.

Stirling Council has published a Climate and Nature Emergency Plan, which has the vision of leading the transition to a fossil fuel-free climate-ready area by 2045 through five objectives, with themes of energy, transport, resource efficiency, nature and biodiversity, and preparing for the impacts of climate change.

Appendix A: Monitoring Results

Table A.1 – Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA? Which AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Inlet Height (m)
CM1	Craig's Roundabout	Roadside	279944	693005	PM_{10}; $PM_{2.5}$	N	FDMS (Palas Fidas)	10m	3	2.2
CM2	Craig's Roundabout	Roadside	279944	693005	NO_x	N	Chemiluminescent (Serinus)	10m	3	2.2

Notes:

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

(2) N/A if not applicable.

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

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	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?
	Dumbarton Road	Kerbside	279655	693240	NO_2	N	2	0.5	N
DT2	Port Street	Kerbside	279634	693160	NO_2	N	2	0.5	N
DT3	Craigs Roundabout No. 1	Roadside	279987	693043	NO_2	N	10	2	N
DT4A,B,C	Craigs Roundabout No.2	Roadside	279944	693005	NO_2	N	10	3	Y
DT5	Lennox Avenue, Stirling	Urban Background	279354	691933	NO_2	N	4	1.5	N
DT6	Barnsdale Road, Stirling	Roadside	279520	691252	NO_2	N	18	1.5	N
DT7	Main Street, Plean	Roadside	283222	687582	NO_2	N	6	1.5	N
DT8	Alloa Road	Roadside	282075	695057	NO_2	N	9	2	N
DT9	Henderson Street, Bridge of Allan	Roadside	279177	697497	NO_2	N	7	1.5	N
DT10	Stirling Road, Dunblane	Roadside	278081	700580	NO_2	N	8	1.5	N
DT11	Stirling University	Roadside	280346	696339	NO_2	N	>50	2	N
DT12	Airthrey Road, Stirling	Roadside	280505	695719	NO_2	N	3	2	N

Notes:

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

(2) N/A if not applicable.

Figure A.1 - Automatic monitor location

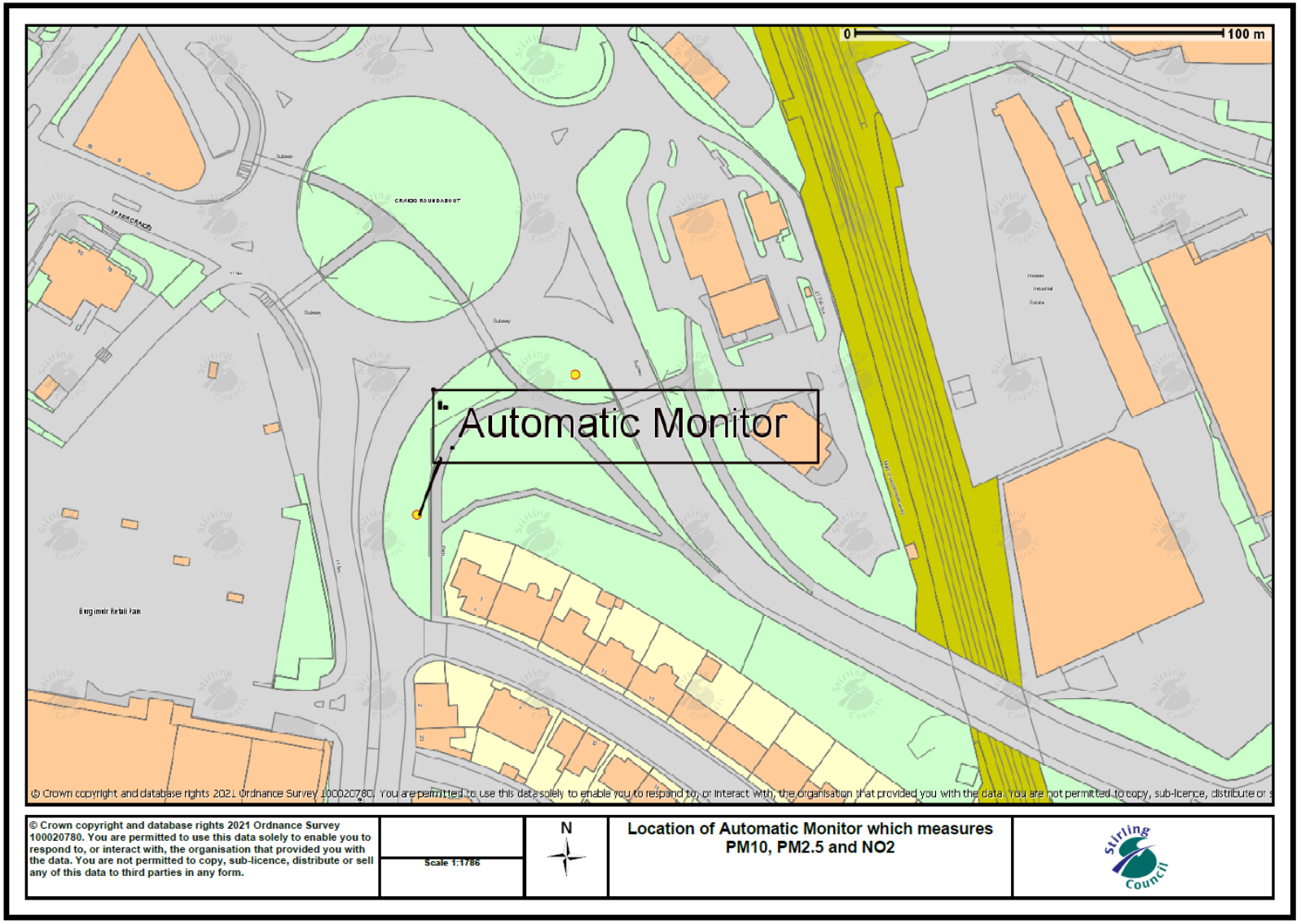


Figure A.2 – Diffusion tube locations

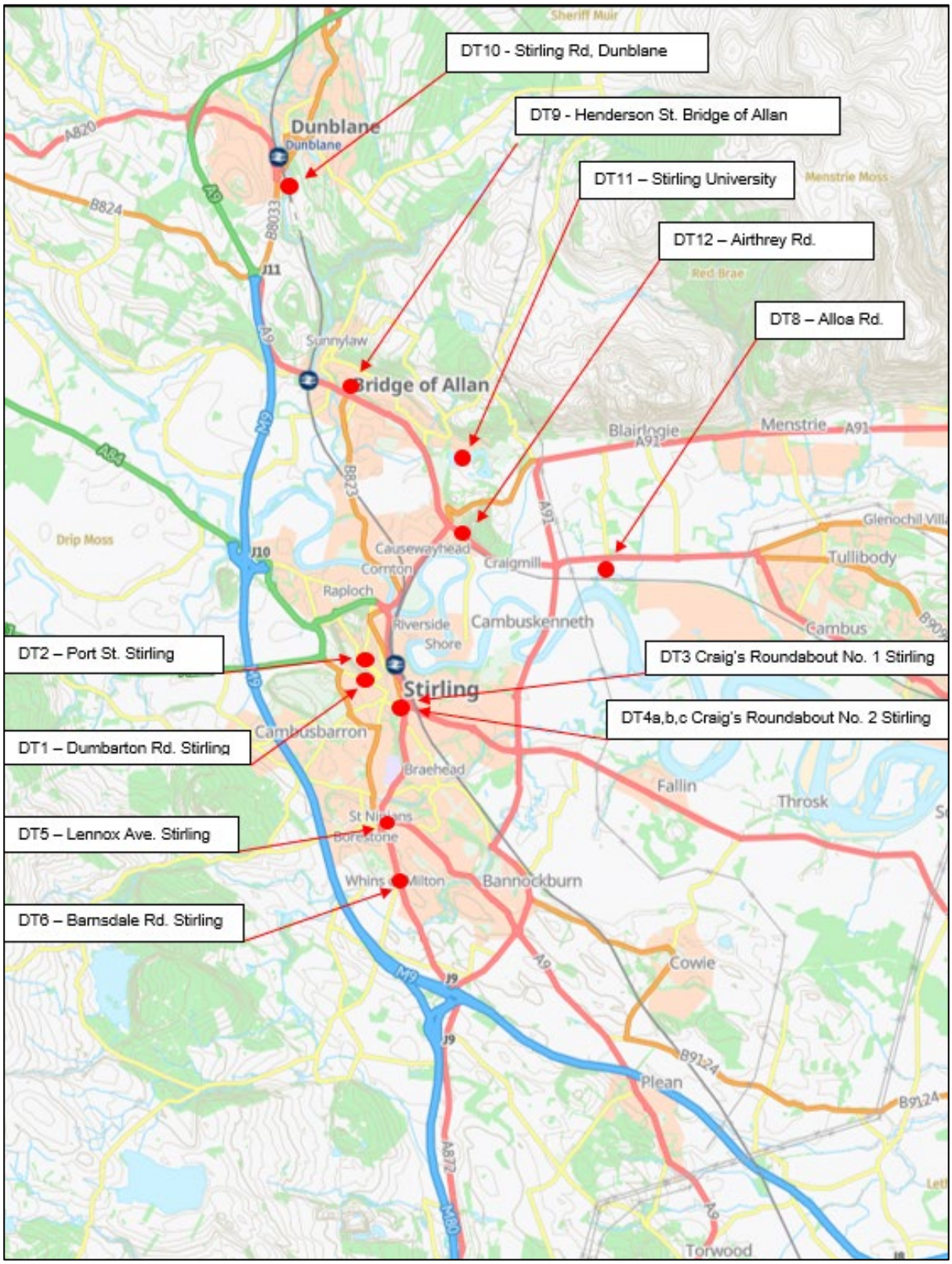


Table A.3 – Annual Mean NO_2 Monitoring Results (µg/m3)

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
CM1	Roadside	Automatic	90	90	23	20	14	15	15
DT1	Kerbside	Diffusion Tube	58.3	58.3	24.1	20.4	16.2	16.6	13.8(a)
DT2	Kerbside	Diffusion Tube	75	75	21.7	19.7	14.6	15.7	16.2
DT3	Roadside	Diffusion Tube	75	75	20.5	22.0	17.6	16.8	17.7
DT4A,4B,4C	Roadside	Diffusion Tube	75	75	20.5	19.6	14.3	15.3	16.7
DT5	Urban Background	Diffusion Tube	75	75	11.5	10.3	8.3	8.5	8.9
DT6	Roadside	Diffusion Tube	66.7	66.7	16.5	14.0	10.5	12.6	10.6(a)
DT7	Roadside	Diffusion Tube	50	50	16.4	13.8	10.5	12	11.4(a)
DT8	Roadside	Diffusion Tube	75	75	26.8	22.3	16.2	15.3	16
DT9	Roadside	Diffusion Tube	75	75	22.7	17.6	12.2	14.3	13.9
DT10	Roadside	Diffusion Tube	66.7	66.7	15.4	11.6	9.1	10.5	8.6(a)
DT11	Roadside	Diffusion Tube	75	75	19.0	16.3	11.5	11.4	11.8
DT12	Roadside	Diffusion Tube	75	75	22.4	16.7	14.0	13.2	13.4

Notes:

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

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.TG(22) if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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

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

(3) Annualised results include the postscript (a)

Table A.4 – 1-Hour Mean NO_2 Monitoring Results, Number of 1-Hour Means > 200µg/m^3

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2021 (%) (2)	2018	2019	2020	2021	2022
CM2	Roadside	Automatic	90	90	0	0	0	0	0

Notes:

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

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

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

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

Table A.5 – Annual Mean PM_{10} Monitoring Results (µg/m3)

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2021 (%) (2)	2018	2019	2020	2021	2022
CM1	Roadside	86	86	13	14	11	8.7	10

Notes:

Exceedances of the PM_{10} annual mean objective of 18 µg/m^3 are shown in bold.

All means have been 'annualised' as per LAQM.TG(22), valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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

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

Table A.6 – 24-Hour Mean PM_{10} Monitoring Results, Number of PM_{10} 24-Hour Means > 50µg/m^3.

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2020 (%) (2)	2018	2019	2020	2021	2022
CM1	Roadside	86	86	0	0	0	0	0

Notes:

Exceedances of the PM_{10} 24-hour mean objective (50 µg/m^3 not to be exceeded more than seven times/year) are shown in bold.

If the period of valid data is less than 85%, the 98.1st percentile of 24-hour means is provided in brackets.

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

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

Table A.7 – Annual Mean $PM_{2.5}$ Monitoring Results (µg/m3)

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2020 (%) (2)	2018	2019	2020	2021	2022
CM1	Roadside	86	86	N/A	5.6	4.25	5	5

Notes:

Exceedances of the $PM_{2.5}$ annual mean objective of 10 µg/m^3 are shown in bold.

All means have been 'annualised' as per LAQM.TG(22), valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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

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

Appendix B: Full Monthly Diffusion Tube Results for 2022

Table B.1 – NO_2 2022 Monthly Diffusion Tube Results (µg/m3)

Site ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annualised Mean: Bias Adjusted (1)
DT1	18.9	Missing	26.8	14.0	13.9	Missing	Missing	Missing	Missing	18.1	18.5	Missing	18.4	**13.8(2)**
DT2	20.7	19.4	19.1	20.3	15.8	Missing	Missing	Missing	14.5	15.5	29.4	25.7	20.0	**16.2**
DT3	16.1	19.3	31.9	22.0	15.1	Missing	Missing	Missing	16.2	21.1	30.9	24.9	21.9	**17.7**
DT4A	20.4	20.5	23.5	16.0	14.2	Missing	Missing	Missing	22.7	19.6	23.1	24.5	20.5	**16.6**
DT4B	24.3	17.4	25.2	17.3	15.7	Missing	Missing	Missing	15.9	18.4	24.1	29.1	20.8	**16.8**
DT4C	20.4	23.0	21.2	16.7	13.2	Missing	Missing	Missing	14.9	20.0	24.5	31.1	20.6	**16.7**
DT5	7.0	7.9	13.0	8.6	6.4	Missing	Missing	Missing	7.0	13.2	18.5	17.1	11.0	**8.9**
DT6	15.8	9.5	19.3	13.7	Missing	Missing	Missing	Missing	13.6	5.2	13.4	21.6	14.0	**10.6(2)**
DT7	Missing	13.5	19.9	16.3	Missing	Missing	Missing	Missing	12.6	10.3	18.2	Missing	15.1	**11.4(2)**
DT8	20.0	21.6	28.5	4.8	16.0	Missing	Missing	Missing	17.9	19.0	35.2	15.6	19.8	**16.0**
DT9	19.9	18.7	21.6	17.4	12.9	Missing	Missing	Missing	12.5	13.2	19	19.5	17.2	**13.9**
DT10	14.1	13.0	17.2	9.8	9.6	Missing	Missing	Missing	9.2	6.9	12	Missing	11.5	**8.6(2)**
DT11	12.4	13.8	15.8	13.4	10.1	Missing	Missing	Missing	16.2	11.0	20.1	18.5	14.6	**11.8**
DT12	21.0	17.5	20.3	13.7	14.2	Missing	Missing	Missing	13.4	16.1	17.4	15.0	16.5	**13.4**

Notes:

(1) See Appendix C for details on bias adjustment and annualisation.

(2) Annualised data

Figure B.1 Trends in Annual Mean Concentration of NO_2 at Diffusion Tube Sites 2016-2022

(1)

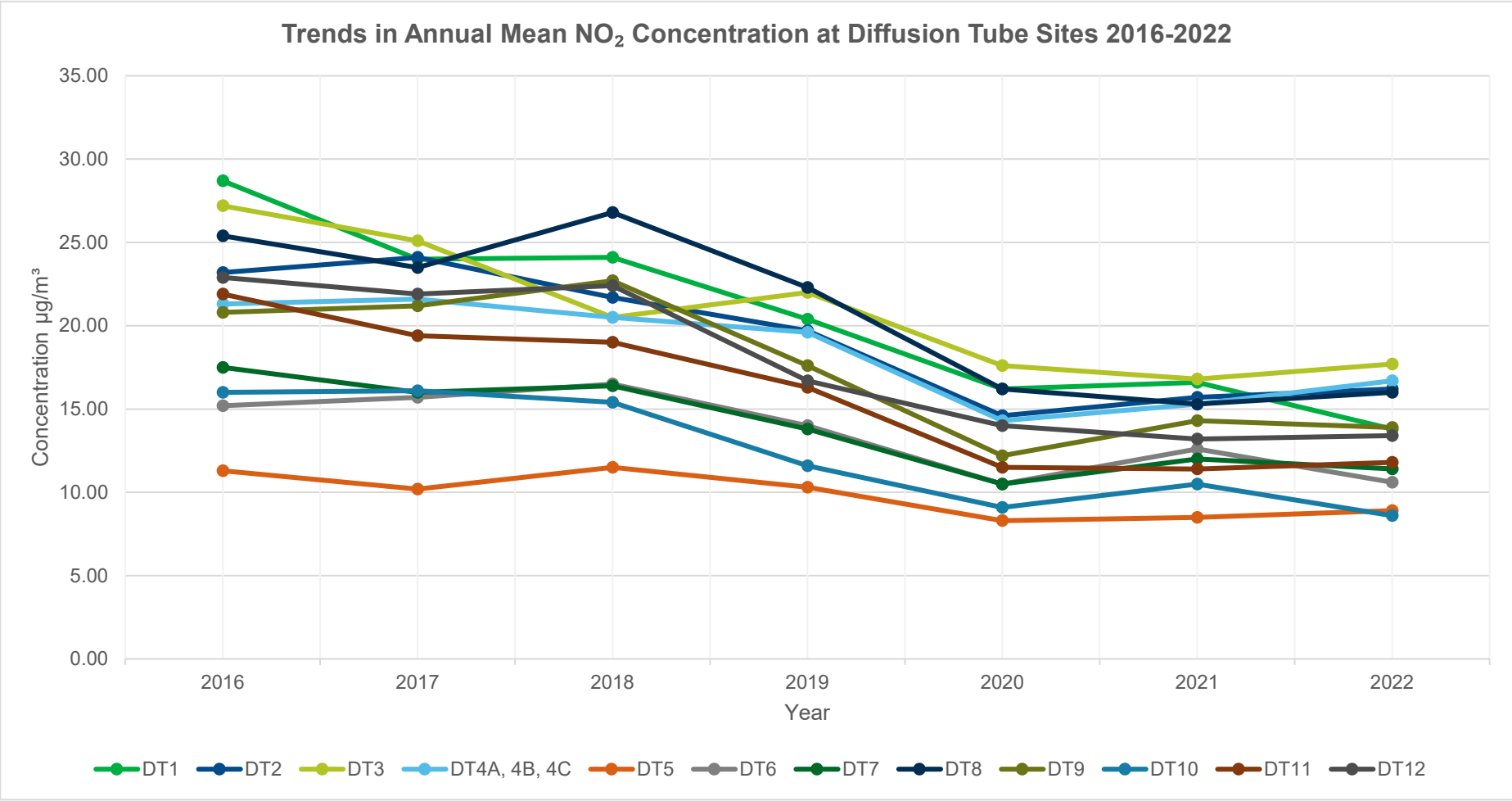
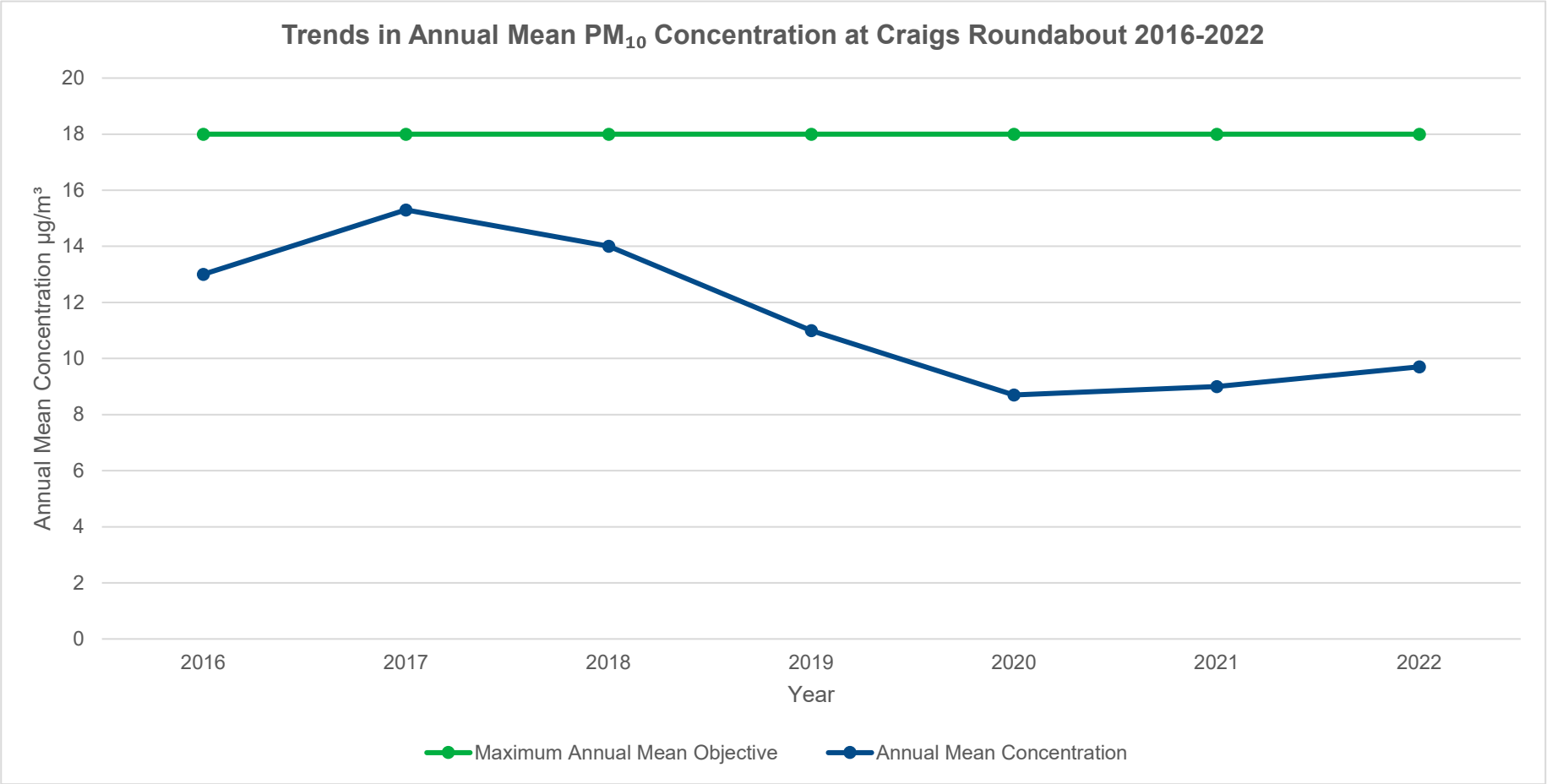


Figure B.2 Trends in Annual Mean PM_{10} Concentration at Craigs Roundabout 2016-2020



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

New or Changed Sources Identified Within Stirling Council

Stirling Council has not identified any new sources relating to air quality within the reporting year of 2022.

Additional Air Quality Works Undertaken by Stirling Council

Stirling Council has 10 Zephyr units located in the Stirling Region, which have been recording data throughout 2021 and 2022. This monitoring equipment is being shared with specialists at SEPA who are carrying out a project with the University of Stirling to analyse air quality in rural areas. Data and results from this are being shared with the Council and published into the public domain. Stirling Council will resume the full use of these monitors in the second half of 2023.

QA/QC of Diffusion Tube Monitoring

Stirling Council receives the diffusion tubes from Edinburgh Scientific Services. The tubes are prepared using 50% TEA in acetone.

Edinburgh Scientific Services are United Kingdom Accreditation Service (UKAS) accredited for the analysis method that they use. The analysis is a colorimetric method with the absorbance being measured at 540nm using a spectrophotometer.

In addition to internal quality control samples, they take part in two external quality analysis schemes; the first one run by the National Physics Laboratory (NPL) and the second scheme is the AIR_PT scheme, run by LGC.

Diffusion Tube Annualisation

As a result of procedural errors in the deployment and collection of the NO_2 tubes, no data was captured across any of the diffusion tube monitoring sites in June, July and August 2022. In addition, no data was captured for DT1 (February, December); DT6 (May); DT7 (January, May, December); and DT10 (December).

As a result of data capture rates less than 75% (but greater than 25%), the results were annualised for locations DT1, DT6, DT7 and DT10 (see C.1). As there is only one automatic monitor available for annualisation purposes, the method detailed in Box 7-10 of the Technical Guidance (TG22) was used.

Table C.1 – Annualisation Summary (concentrations presented in µg/m3)

Site ID	R (Craigs roundabout)	Raw Data Annual Mean	Annualised Annual Mean
DT1	0.92	18.4	18.4*0.93 = 17.08
DT6	0.85	14	14*0.93 = 13.03
DT7	0.96	15.1	15.1*0.93 = 14.07
DT10	0.99	11.5	11.5*0.93 = 10.67
Average	0.93		

Diffusion Tube Bias Adjustment Factors

Stirling Council has applied a national bias adjustment factor of 0.81 to the 2022 monitoring data (Table C.2). This factor was taken from the 06/23 version of the national spreadsheet, which can be viewed at the following link: https://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html. The local bias adjustment factor is also 0.81 (Table C.3).

A summary of bias adjustment factors used by Stirling Council over the past five years is presented below in Table C.2. A national bias adjustment factor was chosen, as this is the factor that has been used in Stirling Council for the last five years, ensuring consistency.

Table C.2 – Bias Adjustment Factor

Year	Local or National	If National, Version of National Spreadsheet	Adjustment Factor
2022	National	06/23	0.81
2021	National	09/22	0.85
2020	National	03/21	0.9
2019	National	09/20	1.01
2018	National	06/19	1.05

Table C.3 – Local Bias Adjustment Factor

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements

Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 µgm^{-3}	Tube 2 µgm^{-3}	Tube 3 µgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Automatic Method: Period Mean	Automatic Method: Data Capture (% DC)	Data Quality Check: Tubes Precision Check	Data Quality Check: Automatic Monitor Data
1	06/01/2022	03/02/2022	20.4	24.3	20.4	22	2.3	10	5.6	19.0	100	Good	Good
2	03/02/2022	03/03/2022	20.5	17.4	23.0	20	2.8	14	7.0	12.1	100	Good	Good
3	03/03/2022	30/03/2022	23.5	25.2	21.2	23	2.0	9	5.0	19.5	100	Good	Good
4	30/03/2022	05/05/2022	16.0	17.3	16.7	17	0.7	4	1.6	12.3	100	Good	Good
5	05/05/2022	06/06/2022	14.2	15.7	13.2	14	1.3	9	3.1	8.3	99	Good	Good
6	06/06/2022	29/06/2022								10.4	30		or Data Capture
7	29/06/2022	02/08/2022								9.1	100		Good
8	02/08/2022	31/08/2022								10.6	100		Good
9	31/08/2022	29/09/2022	22.7	15.9	14.9	18	4.2	24	10.5	11.6	72	Poor Precision	or Data Capture
10	29/09/2022	02/11/2022	19.6	18.4	20.0	19	0.8	4	2.1	15.9	79	Good	Good
11	02/11/2022	30/11/2022	23.1	24.1	24.5	24	0.7	3	1.8	20.8	100	Good	Good
12	30/11/2022	05/01/2023	24.5	29.1	31.1	28	3.4	12	8.4	27.3	99	Good	Good
13													
										Overall survey -->		Good precision	Poor Overall DC

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

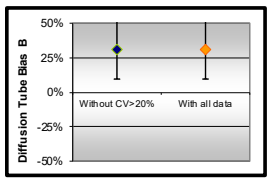
(Check average CV & DC from Accuracy calculations)

Site Name/ ID:

Precision: 8 out of 9 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval) without periods with CV larger than 20%	
Bias calculated using 8 periods of data	
Bias factor A	0.81 (0.69 - 0.97)
Bias B	24% (3% - 45%)
Diffusion Tubes Mean:	21 µgm^{-3}
Mean CV (Precision):	8
Automatic Mean:	17 µgm^{-3}
Data Capture for periods used:	97%
Adjusted Tubes Mean:	17 (14 - 20) µgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 8 periods of data	
Bias factor A	0.81 (0.69 - 0.97)
Bias B	24% (3% - 45%)
Diffusion Tubes Mean:	21 µgm^{-3}
Mean CV (Precision):	8
Automatic Mean:	17 µgm^{-3}
Data Capture for periods used:	97%
Adjusted Tubes Mean:	17 (14 - 20) µgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

QA/QC of Automatic Monitoring

The automatic monitoring equipment is audited every six months by Ricardo Energy and Environment, and a routine service and breakdown call-out service is contracted to Air Monitors. Local Site Operator (LSO) calibrations are also performed. Ricardo advises that they be done fortnightly but due to resourcing issues, Stirling Council is limited to monthly calibrations. Data recorded by the station is analysed by Ricardo Energy and Environment. The data used within this APR is ratified and live, and historic data can be viewed through the Scottish Air Quality website. The website can be accessed here: http://www.scottishairquality.scot/latest/site-info?site_id=STRL

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

The type of PM_{10}/$PM_{2.5}$ monitors used within Stirling Council do not require the application of a correction factor.

Automatic Monitoring Annualisation

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

NO_2 Fall-off with Distance from the Road

No automatic NO_2 monitoring locations required distance correction during 2022.

Glossary of Terms

Abbreviation	Description
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the LA 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
APR	Air quality Annual Progress Report
AURN	Automatic Urban and Rural Network (UK air quality monitoring network)
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by Highways England
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 (micrometres or microns) 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

(1) http://www.scottishairquality.scot/latest/site-info?site_id=STRL
(2) http://www.scottishairquality.scot/latest/site-info?site_id=STRL&view=statistics
(3) https://laqm.defra.gov.uk/technical-guidance/index.html?d=Chapter7
(4) https://laqm.defra.gov.uk/bias-adjustment-factors/bias-adjustment.html
(5) 2022 Air Quality Annual Progress Report for Stirling Council