



2016 Air Quality Progress Report for Glasgow City Council

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

June 2016

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Executive Summary

Local Authorities are required to regularly review and assess the air quality within their area of responsibility. This Review and Assessment process is the basis of local air quality management and is intended to compare current and future concentrations of key air pollutants against the objectives detailed in the regulations as part of the National Air Quality Strategy. This Progress Report is required as part of Glasgow City Council's Review and Assessment programme. This Progress Report has looked in detail at the new monitoring data available since the last round of review and assessment as well as considering the impact from various potential sources of pollution.

Air Quality in Glasgow

During 2015, Glasgow City Council has measured concentrations of nitrogen dioxide above the Annual Mean Objective at two automatic monitoring stations within existing Air Quality Management Areas (AQMA's) and at multiple locations, by diffusion tube, within the existing City Centre AQMA. The Hourly Mean Objective was not exceeded at any of the automatic monitoring stations.

Neither the Annual Mean Objective for PM₁₀ nor the Daily Mean Objective was exceeded at any monitoring location during 2015.

Actions to Improve Air Quality

In response to the implementation of the AQMA's in the city, Glasgow Council produced Air Quality Action Plans in 2004 and 2009 introducing a range of measures aimed at reducing pollution in the city. The Action Plan is an evolving project, several measures such as vehicle idling enforcement, vehicle emission testing and initiatives towards cleaner taxis and passenger vehicles remain on going. Other measures such as a council workplace travel plan and easier public access to air quality information have been introduced. The Air Quality Action Plan programme is shown in Appendix A. Measures recently introduced by the council include the Glasgow ECO Stars Fleet Recognition Scheme, which aims to promote best practise for fleet operators and city car club. The Council continues to promote and facilitate improvements in sustainable transport through investment in cycling infrastructure.

Local Priorities and Challenges

During November 2015 the Scottish Government launched the Cleaner Air for Scotland (CAFS) strategy which is intended to shape the direction taken in Scotland to achieve compliance with the air quality objectives. This strategy incorporates actions on a range of related subjects such as transport, health, legislation, place making, communication and climate change.

As part of the strategy there will be a National Low Emission Framework (NLEF) which will seek to set out the methodology for actions and interventions intended to reduce the emission of pollutants. This will be informed by a National Modelling Framework (NMF) which will help local authorities to identify and quantify the pollution sources in their areas.

Glasgow City Council is involved in the development and oversight of both CAFS and the NLEF.

How to Get Involved

Information relating to Local Air Quality Management (LAQM) and AQMA's in Glasgow is available via the Glasgow Council website. This information includes Air Quality Action Plans, Progress Reports and Detailed Assessments.

<https://www.glasgow.gov.uk/index.aspx?articleid=18863>

The website also contains links to the national Air Quality in Scotland webpage where the public can access both real time and historical monitoring data in addition to registering to receive text/email alerts where poor air quality is forecast.

<http://www.scottishairquality.co.uk/>

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1.0 Introduction

1.1 Description of Local Authority Area

Glasgow City Council (GCC), serving a population of almost 600,000, is Scotland's largest local authority. As the largest city in Scotland, Glasgow is a centre for business, manufacturing and retail. As such, the city attracts a large daily influx of people and traffic from the surrounding areas.

The city of Glasgow lies at the western end of the Clyde Valley which takes its name from the river which runs through the city. The Glasgow area is bounded both north and south by low hill ranges which can adversely affect air quality.

Glasgow in many ways typifies the modern developed city where road traffic tends to be the major air quality concern, superseding a long industrial heritage. The Glasgow area contains an extensive motorway network with traffic travelling to and through the area on the M8, M74, M77 and M80 motorways.

1.2 Purpose of Progress Report

From 2016 onwards Local Authorities (LA) are required to produce an annual Progress Report detailing the review and assessment work in the previous calendar year. This replaces the previous three year reporting cycle whereby Progress Reports were required in the intervening years between the three-yearly Updating and Screening Assessment reports.

The requirement for the LA to proceed to a formal Detailed Assessment, where the risk of the exceedence of an Air Quality Objective has been identified, has also been removed. However, the requirement on the LA to proceed immediately with a detailed investigation remains.

1.3 Air Quality Objectives

The air quality objectives applicable to LAQM in Scotland are set out in the Air Quality (Scotland) Regulations 2000 (Scottish SI 2000 No 97), the Air Quality (Scotland) (Amendment) Regulations 2002 (Scottish SI 2002 No 297), the Air Quality (Scotland) Amendment Regulations 2016 and are shown in Table 1.1. This table shows the objectives in units of microgrammes per cubic metre, $\mu\text{g}/\text{m}^3$ (milligrammes per cubic metre, mg/m^3 for carbon monoxide) with the number of exceedences in each year that are permitted (where applicable).

Table 1.1 Air Quality Objectives included in Regulations for the purpose of Local Air Quality Management in Scotland.

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene (C ₃ H ₆)	16.25 µg/m ³	Running annual mean	31.12.2003
	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 (CO)	10.0 mg/m ³	Running 8-hour mean	31.12.2003
Lead (Pb)	0.5 µg/m ³	Annual mean	31.12.2004
	0.25 µg/m ³	Annual mean	31.12.2008
Nitrogen dioxide (NO ₂)	200 µg/m ³ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 µg/m ³	Annual mean	31.12.2005
Particles (PM ₁₀) (gravimetric)	50 µg/m ³ , not to be exceeded more than 7 times a year	24-hour mean	31.12.2010
	18 µg/m ³	Annual mean	31.12.2010
Particles (PM _{2.5}) (gravimetric)	10 µg/m ³	Annual mean	31.12.2020
Sulphur dioxide (SO ₂)	350 µg/m ³ , not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 µg/m ³ , not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 µg/m ³ , not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

1.4 Summary of Previous Reviews and Assessments

Glasgow's first AQMA was declared in 2002 for NO₂ within the City Centre area. Since that time further assessments have concluded that the boundary of the original AQMA required to be increased and that new AQMAs were required for Parkhead Cross and the Byres Road / Dumbarton Road areas, both declared 2007. At this time the City Centre AQMA was also amended to include the annual mean PM₁₀ Objective. In March 2012 further extensions were made to the City Centre and Byres Road / Dumbarton Road AQMAs, additionally the City Centre area was declared in respect of the hourly mean NO₂ Objective. At this time the whole of the Glasgow area was also declared an AQMA in respect of the daily and annual mean PM₁₀ Objectives.

Table 1.2 shows a summary of the previous rounds of review and assessment and a brief description of the outcomes from each.

Table 1.2 Summaries of Previous Rounds of Review and Assessment

Report	Date Produced	Outcome
Stage I	1998	Proceeded to Stage II for CO. Proceed to Stage III for NO ₂ and PM ₁₀
Stage II	2000	Concluded that levels of CO and SO ₂ will meet Objectives
Stage III	2001	Recommended an AQMA be declared for the city centre for NO ₂
Updating and Screening Assessment	2003	Proceeded to Detailed Assessment for NO ₂ , SO ₂ and PM ₁₀
Stage IV	2004	Confirmed city centre AQMA declared for NO ₂
Detailed Assessment	2005	Recommended AQMA's be declared for NO ₂ at Parkhead Cross and Dumbarton Rd / Byres Rd. Extension of city centre AQMA to Royston Rd and recommended declaration of the city centre as an AQMA for PM ₁₀

Table 1.2 Summaries of Previous Rounds of Review and Assessment (Cont.)

Report	Date Produced	Outcome
Progress Report	2005	Reported on continuing monitoring and recommended new monitoring at various locations
Updating and Screening Assessment	2006	Proceeded to Detailed Assessment for NO ₂ in a variety of areas. Recommended new monitoring of PM ₁₀ at various locations
Detailed Assessment	2007	Recommended additional NO ₂ monitoring at locations of concern
Further Assessment	2008	Confirmed ongoing exceedences of the objectives in the declared AQMA's
Progress Report	2008	Confirmed ongoing exceedences of the objectives in the declared AQMA's and predicted likely exceedences of PM ₁₀ objectives for 2010
Updating and Screening Assessment	2009	Proceeded to Detailed Assessment for NO ₂ at a variety of locations and for PM ₁₀ citywide
Progress Report	2010	Highlighted exceedences of NO ₂ hourly objective at Glasgow Kerbside
Detailed Assessment	2010	Recommended extension of city centre AQMA to Bridge Street for NO ₂ . Recommended further monitoring city wide for PM ₁₀ and Queen Margaret Drive for NO ₂
Progress Report	2011	Confirmed exceedences at Bridge St and QMD for NO ₂ and citywide for PM ₁₀ . Recommended new AQMA's be declared.
Updating and Screening Assessment	2012	Proceeded to Detailed Assessment for NO ₂ in the Crow Road and Great Western Road areas.
Further Assessment	2013	Recommended not to proceed to an action plan in regard to the AQMA's declared in 2011 until monitoring data for 2013 becomes available.

Table 1.2 Summaries of Previous Rounds of Review and Assessment (Cont.)

Report	Date Produced	Outcome
Progress Report	2013	Reported on continuing monitoring, no recommendation of changes to existing AQMA's or need for progression to Detailed Assessment.
Detailed Assessment	2013	Dispersion modelling of locations highlighted by monitoring and USA 2012 as potentially exceeding NO ₂ annual mean Objective showed that exceedences were unlikely. Confirmed that monitoring should continue at these locations.
Progress Report	2014	Reported on continuing monitoring, no recommendation of changes to existing AQMA's or need for progression to Detailed Assessment.
Detailed Assessment	2014	Monitoring and modelling showed widespread compliance with the objective levels and modelling predicted total compliance by 2015. Proposal to revoke the current Citywide AQMA in respect of PM ₁₀ in tandem with the amendment of the existing Byres Rd /Dumbarton Rd AQMA to include the PM ₁₀ objectives.
Updating and Screening Assessment	2015	Reported on continued monitoring and new developments. Concluded that no new areas were likely to exceed the objectives.
Detailed Assessment	2015	Monitoring and modelling on Maryhill Road concluded that there was no requirement to proceed towards an AQMA at this time.

1.4.1 Response to Updating and Screening Assessment 2015

The Scottish Government accepted the conclusions presented in the USA for all pollutants. The statutory consultees made reference to several points contained within the document.

It was noted and agreed that the council intend to revoke the citywide AQMA in respect of PM₁₀ and amend the existing Byres Rd / Dumbarton Rd AQMA to include the PM₁₀ objectives.

It was noted that a detailed assessment for NO₂ at Maryhill Road was to be carried out. This assessment has subsequently been completed the conclusion being that there was no requirement to proceed towards an AQMA at this time.

1.4.1 Response to Updating and Screening Assessment 2015 (Cont.)

It was noted from monitoring results that NO₂ levels at Burgher Street has been consistently below the objectives for this pollutant and suggested that consideration be given to revocation of this AQMA. Additional monitoring within the AQMA was introduced for 2015 and the results included in this report.

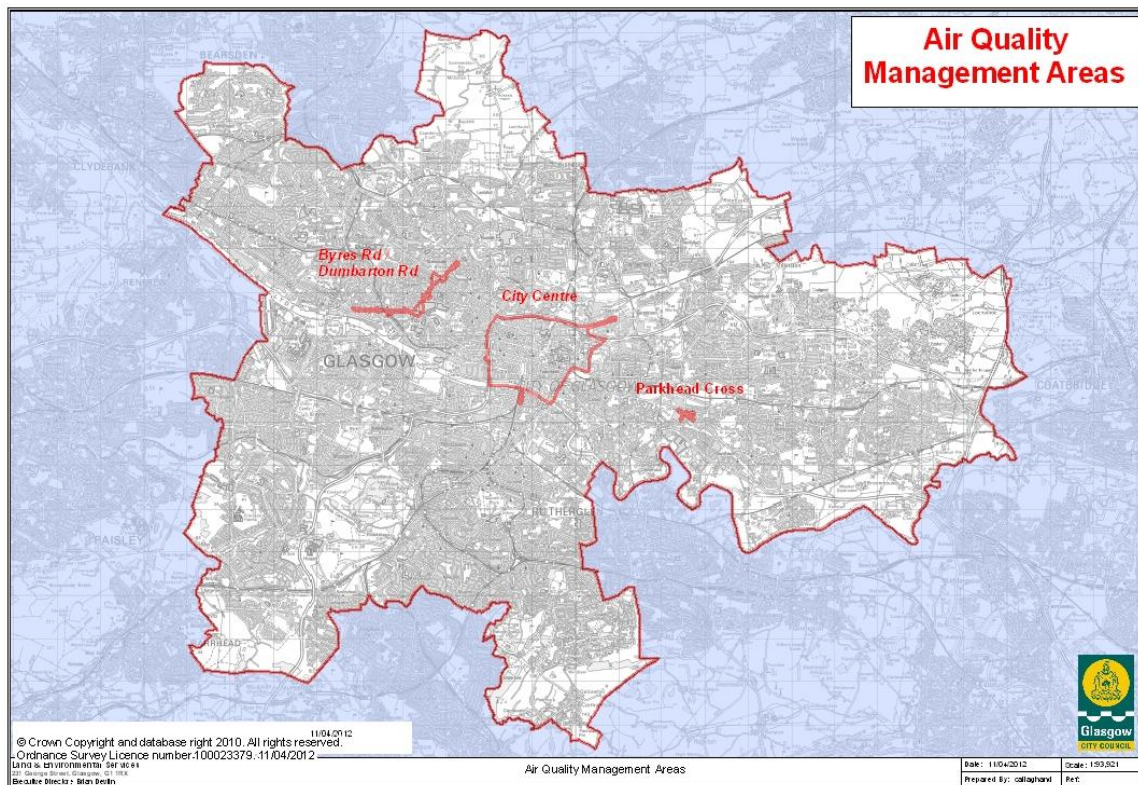
It was noted that several NO₂ diffusion tubes within the city centre AQMA are described as being not relevant exposure and may require to be corrected for distance. It is not considered that this is necessary as these locations are either already within the objective or public areas (non residential).

It was noted that measured PM₁₀ levels at Byres Road are consistently lower than expected. This continues to be under review. The instrument is regularly serviced and audited and has continually passed all relevant QA/QC inspections implying that an external factor may be responsible. However after relocating the station away from tree cover (approx. 10m) and a period of instrument colocation no external source has been identified.

1.5 Air Quality Management Areas

Glasgow City Council has declared three Air Quality Management Areas for Nitrogen Dioxide across the city and also for the entire Glasgow area for the daily and annual mean Particulate PM₁₀ Objectives. The areas are shown in Figure 1.1

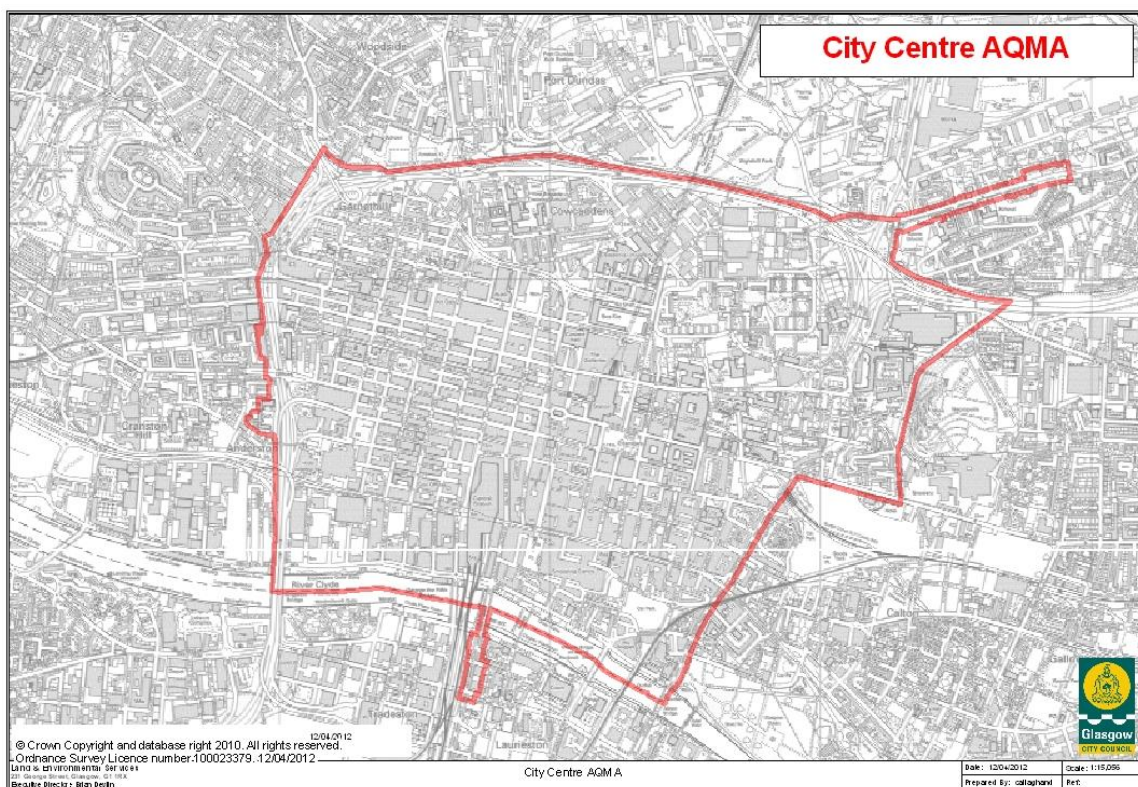
Figure 1.1 Map of AQMA Boundaries



1.5.1 City Centre Air Quality Management Area

The city centre area has been extensively developed with a large number of multi-storey properties for both commercial and residential use. The city centre AQMA is loosely bound by the M8 motorway to the west and north (with slight protrusions at North Street and Royston Road), by High Street and Saltmarket to the east and by the river Clyde to the south. This area was declared an AQMA in 2004 in respect of the annual mean NO₂ objective. In 2007 the area covered by this AQMA was extended and declared in respect of the annual mean PM₁₀ objective. In 2012 a further extension of the AQMA was declared and the order amended in respect of the NO₂ hourly mean objective. The area is shown in Figure 1.2

Figure 1.2 City Centre Air Quality Management Area

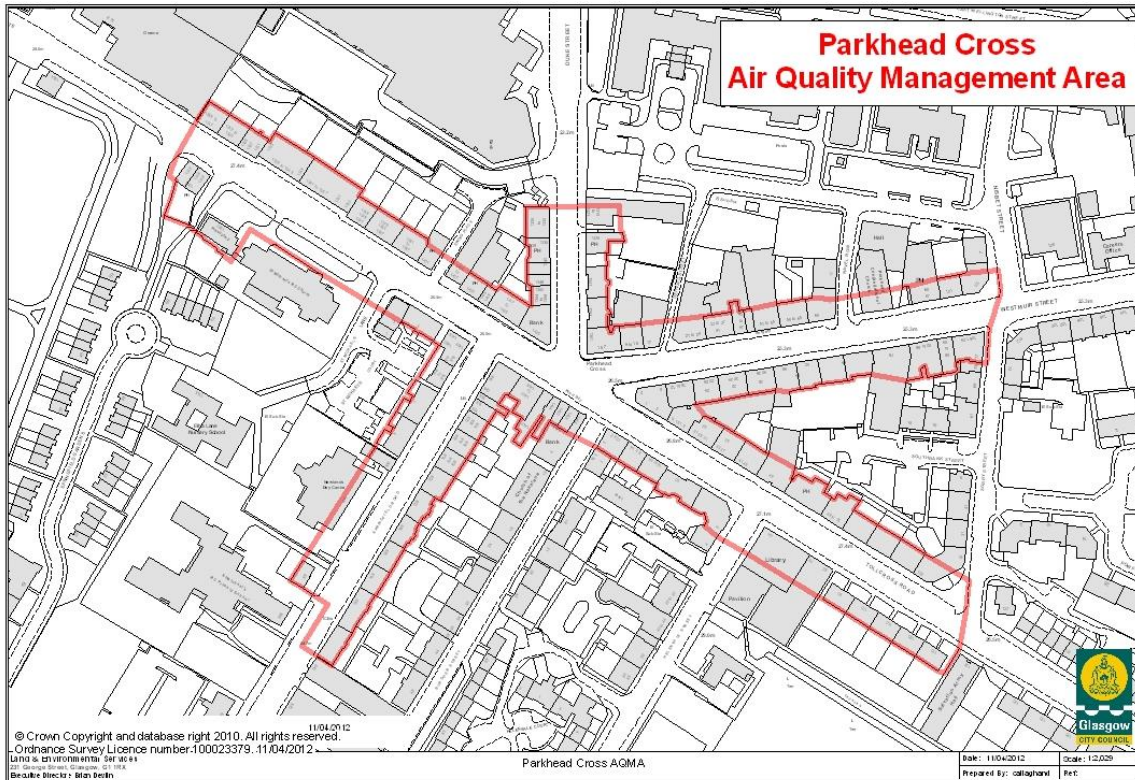


The detailed street listing for this AQMA can be found in the 1st March 2012 order.

1.5.2 Parkhead Cross Air Quality Management Area

Parkhead Cross is formed by the convergence of five roads in Glasgow's east end. The roads are Westmuir Street, Tollcross road, Springfield Road, Duke Street and Gallowgate. The area is a mixture of commercial and residential properties within mostly tenement properties. This area was declared in respect of the annual mean NO₂ objective. The area is shown in Figure 1.3.

Figure 1.3 Parkhead Cross Air Quality Management Area

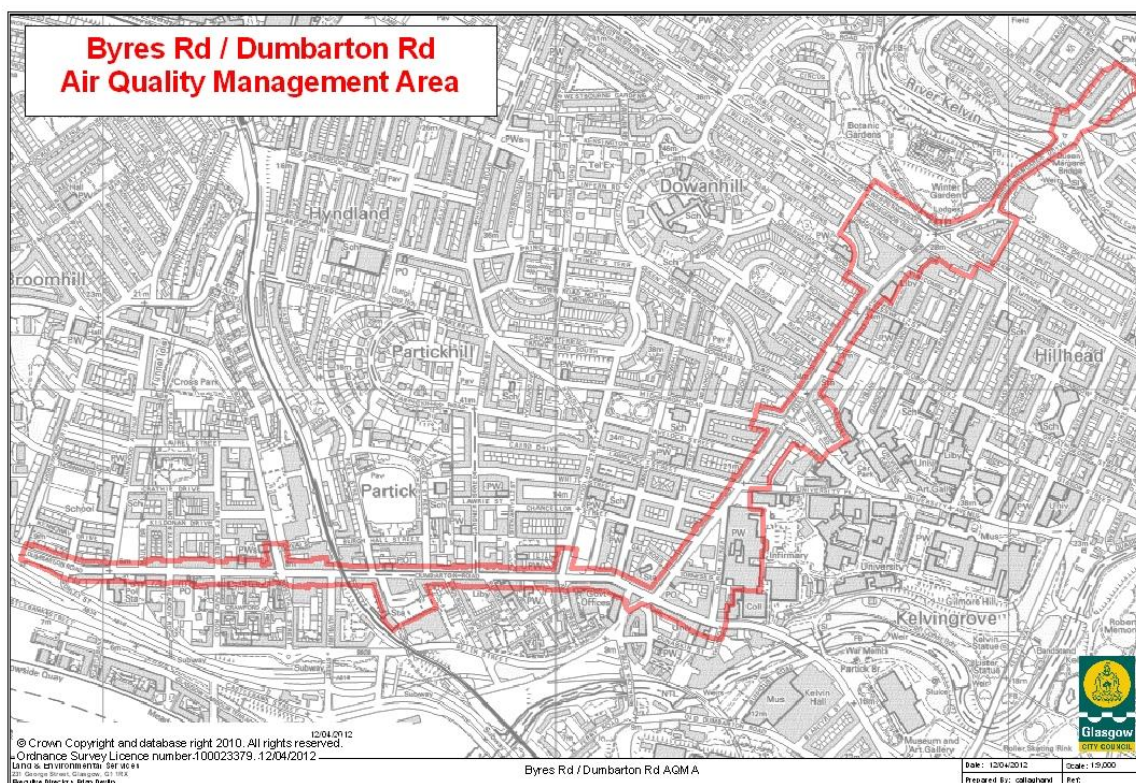


The detailed street listing for this AQMA can be found in the 1st July 2007 order.

1.5.3 Byres Road and Dumbarton Road Air Quality Management Area

Byres Road and Dumbarton Road are at the heart of Glasgow’s west end and comprise a mixture of residential and commercial properties within mostly tenement type buildings. The area covers from the junction of Byres Road and Great Western Road south to Dumbarton Road and west along Dumbarton Road as far as Thornwood Drive roundabout. This area was declared an AQMA in 2007 in respect of the annual mean NO₂ objective. In 2012 the area covered by this AQMA was extended northwards along Queen Margaret Drive to the junction with Oban Drive. The area is shown in Figure 1.4

Figure 1.4 Byres Road and Dumbarton Road Air Quality Management Area

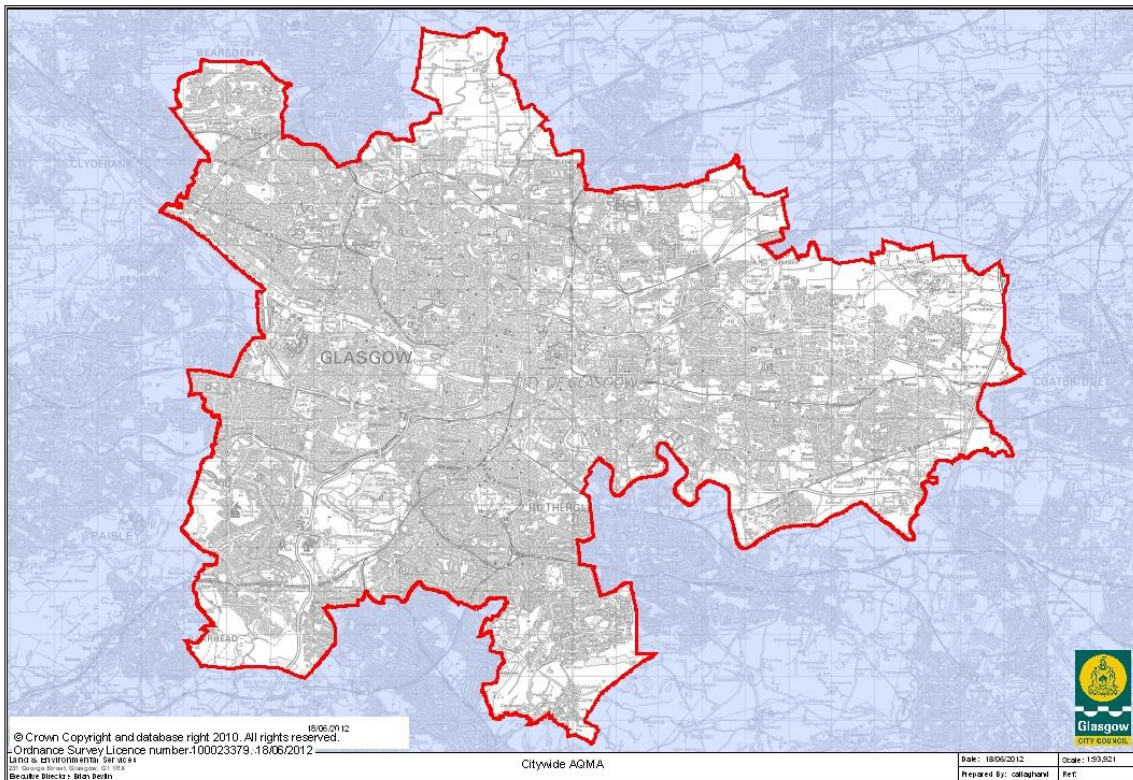


The detailed street listing for this AQMA can be found in the 1st March 2012 order.

1.5.4 Citywide Air Quality Management Area

The Citywide AQMA was declared in 2012 as a result of monitoring results showing exceedences of both the annual mean PM₁₀ objective and the daily mean PM₁₀ objective. Since these exceedences occurred at multiple locations across the city it was decided that the most effective strategy would be to declare the entirety of the city as an AQMA in respect of these Objectives.

Figure 1.5 Citywide Air Quality Management Area



The detailed street listing for this AQMA can be found in the 1st March 2012 order.

The Detailed Assessment 2014 proposed the revocation of this AQMA on the basis that these Objectives were being met at most locations across the citywide area. The Detailed Assessment also proposed that the existing Byres Road / Dumbarton Road AQMA be amended to include these PM₁₀ objectives. These proposals have been accepted by the relevant statutory authorities and have been approved by Council Committee. The revocation and amendment orders will come in place during 2016.

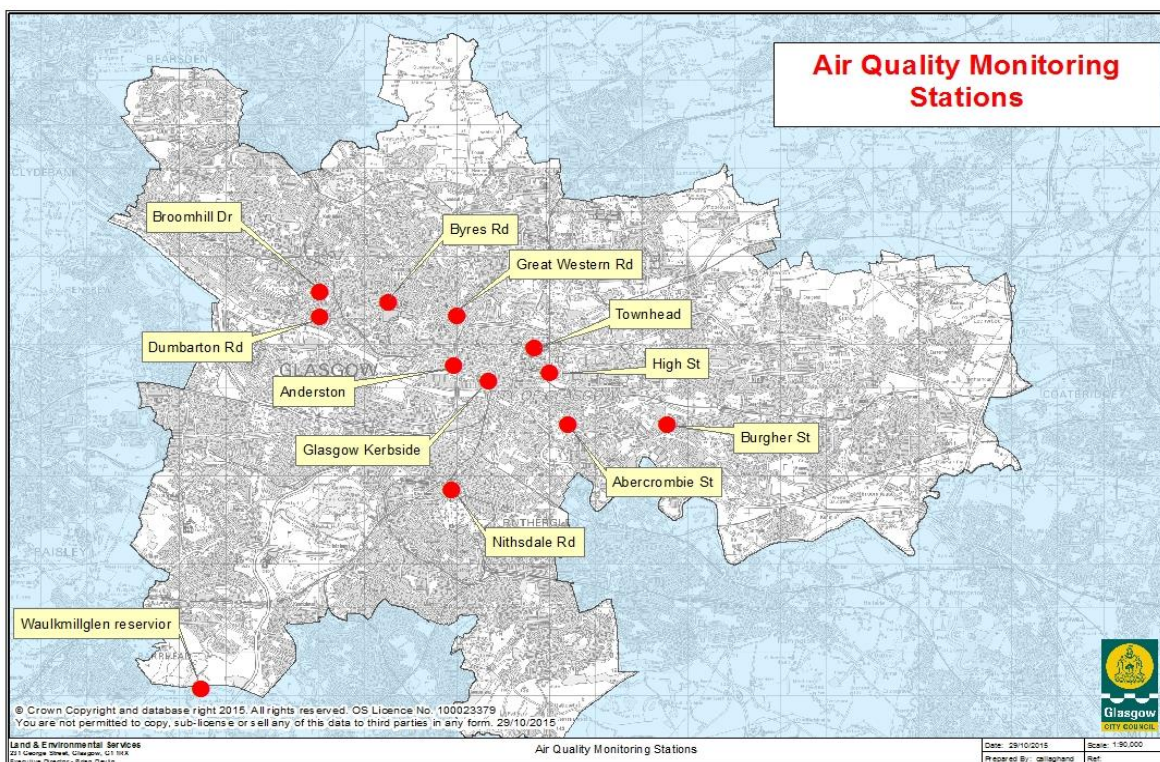
2.0 Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

Glasgow City Council operates an extensive monitoring network across the city to measure ambient levels of air pollutants. During 2015, automated monitoring equipment was located at twelve sites. Four of which, Glasgow Kerbside, Townhead, Great Western Road and High Street form part of the Department for Environment, Food and Rural Affairs (DEFRA) Automated Urban and Rural Network (AURN).

Figure 2.1 Locations of Automatic Monitoring Sites



2.1.1 Automatic Monitoring Sites (Cont.)**Table 2.1 Details of Automatic Monitoring Sites**

Site Name	Site Type	OS Grid Ref	Pollutants Monitored	In AQMA?	Relevant Exposure?	Distance to kerb of nearest road	Worst-case Location?
Glasgow Kerbside	Kerbside	258708 665200	NO ₂	City Centre	Yes	1m	Yes
Glasgow Townhead	Urban Background	259675 665900	NO ₂ PM ₁₀ PM _{2.5} O ₃	City Centre	Yes	120m	No
Glasgow Great Western Road	Roadside	258007 666649	NO ₂	No	Yes	5m	Yes
Glasgow High Street	Roadside	260013 665346	NO ₂ PM ₁₀ PM _{2.5}	City Centre	Yes	3m	Yes
Glasgow Anderston	Urban Background	257925 665487	NO ₂ PM ₁₀ SO ₂	City Centre	Yes	N/A	No
Glasgow Byres Road	Roadside	256526 666933	NO ₂ PM ₁₀	Byres Dumbarton	Yes	3m	Yes
Glasgow Dumbarton Road	Roadside	255030 666608	NO ₂ PM ₁₀	Byres Dumbarton	Yes	3m	Yes
Glasgow Burgher Street	Roadside	262550 664164	NO ₂ PM ₁₀	Parkhead	Yes	3m	Yes
Glasgow Abercromby Street	Roadside	260420 664175	PM ₁₀	Citywide	Yes	3m	Yes
Glasgow Broomhill	Roadside	255030 667195	PM ₁₀	Citywide	Yes	3m	Yes

2.1.1 Automatic Monitoring Sites (Cont.)**Table 2.1 Details of Automatic Monitoring Sites (Cont.)**

Site Name	Site Type	OS Grid Ref	Pollutants Monitored	In AQMA?	Relevant Exposure?	Distance to kerb of nearest road	Worst-case Location?
Glasgow Nithsdale Road	Roadside	257883 662673	PM ₁₀	Citywide	Yes	3m	Yes
Glasgow Waulkmillglen Reservoir	Rural	252520 658095	NO ₂ PM ₁₀ O ₃	No	No	N/A	No

Equipment located at these sites measure a variety of air pollutants including NO₂, SO₂ and Particulates. Instruments are calibrated by the Local Site Operators according to the specific site guidelines, audits are carried out every six months by Ricardo AEA Technology. All of the automatic air quality data gathered is independently ratified by Ricardo AEA Technology and made available for viewing by the public at the Scottish Government funded air quality website at: <http://www.scottishairquality.co.uk>

The automatic monitoring sites at Waulkmillglen and Dumbarton Road measure PM₁₀ by standard TEOM, and the results expressed using the Volatile Correction Model adjustment, the other sites measure PM₁₀ using FDMS TEOM.

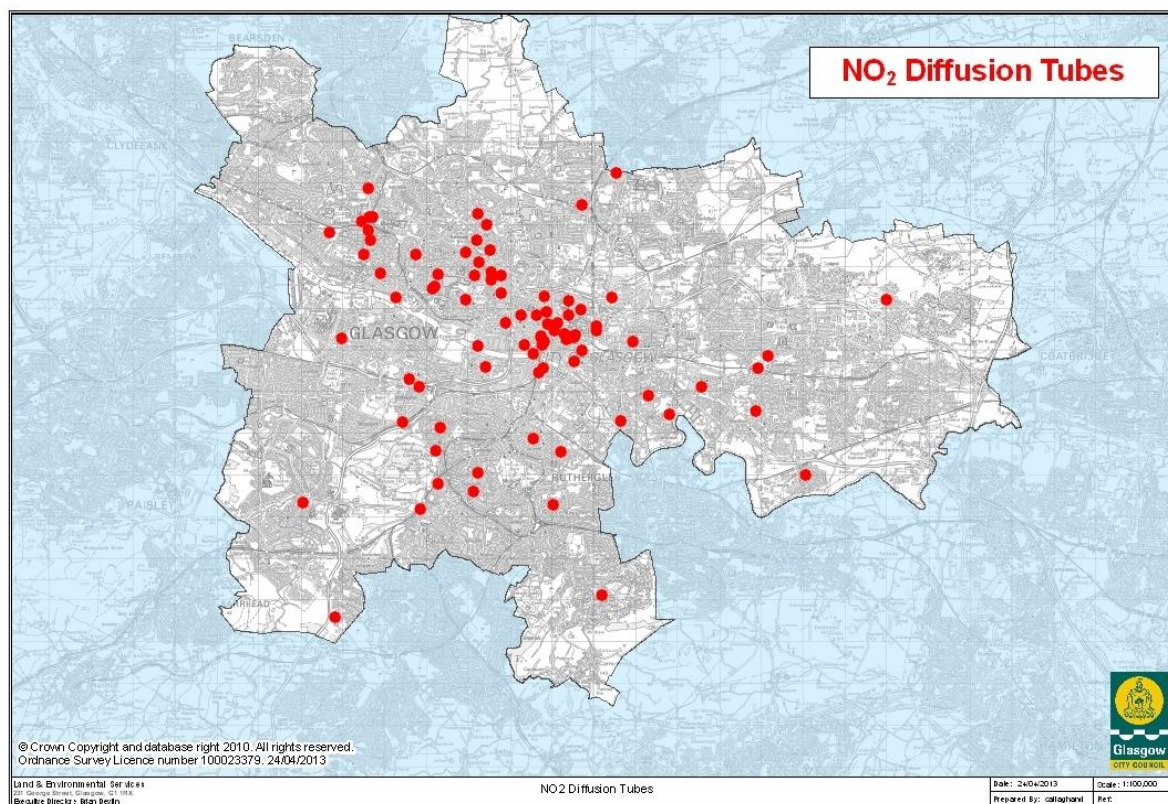
The Council also operates a mobile monitoring station, equipped with instrumentation to measure NO₂ and Particulates (PM₁₀, PM_{2.5}). During 2015 the station was located on Clutha Street adjacent to Paisley Road West (June - October) and Corunna Street adjacent to Argyle Street (November - December).

Table 2.2 Details of Mobile Monitoring Station Sites

Site Name	Site Type	OS Grid Ref	Pollutants Monitored	In AQMA?	Relevant Exposure?	Distance to kerb of nearest road	Worst-case Location?
Clutha Street	Kerbside	256689 664495	PM ₁₀ , PM _{2.5}	Yes	No	<1m	Yes
Corunna Street	Kerbside	257111 665873	NO ₂ PM ₁₀ , PM _{2.5}	Yes	No	<1m	Yes

2.1.2 Non-Automatic Monitoring Sites

Figure 2.2 Locations of Nitrogen Dioxide Diffusion Tubes



Glasgow City Council operates an extensive network of diffusion tubes measuring NO₂ levels at almost 100 sites around the city. NO₂ diffusion tubes represent a simple, effective and low cost method of monitoring ambient concentrations of NO₂ in a large number of locations.

However, NO₂ concentration data provided by diffusion tubes is limited to fairly long-term exposure. Tubes are generally exposed for periods of a month, annual mean concentrations determined and compared with the annual mean objective. Furthermore, the accuracy of diffusion tubes can vary depending on the preparation methodology, handling procedures and the identity of the analysing laboratory. To correct for this possible bias in tube data, results are corrected using information gained from co-location studies. Diffusion tubes utilised by Glasgow City Council are prepared and analysed by Glasgow City Council's Scientific Services (GSS). Triplicate tubes were co-located with automatic NO₂ analysers in Glasgow and both East and West Dunbartonshire. Concentrations obtained by both methods were compared over the same sampling period and a national factor for GSS determined. For 2015 a bias correction factor of 0.98 was calculated. This laboratory participates in both the WASP scheme and the field intercomparison exercise managed by Ricardo AEA. The laboratory also follows the procedures set out in the Harmonisation Practical Guidance.

2.1.2 Non-Automatic Monitoring Sites (cont.)**Table 2.3 Details of Non - Automatic Nitrogen Dioxide Monitoring Sites**

Site Name	Site Type	OS Grid Ref	In AQMA?	Relevant Exposure	Distance to kerb of nearest road	Worst-case Location?
George Square	Urban Background	259296 665389	Yes	No (30m)	30m	No
Union Street	Roadside	258828 665204	Yes	Yes	3m	Yes
Bath Street	Roadside	258262 665851	Yes	No (3m)	3m	Yes
Glassford Street	Roadside	259361 665252	Yes	Yes	3m	Yes
Buchanan Street	Roadside	259055 665468	Yes	Yes	3m	No
Castle Street	Roadside	260068 665589	Yes	Yes	3m	No
Hope Street 3	Kerbside	258856 665940	Yes	No (5m)	1m	No
Montrose Street	Roadside	259536 665313	Yes	Yes	3m	Yes
Cochrane Street	Roadside	259430 665316	Yes	Yes	3m	Yes
Renfield Street	Roadside	258896 665637	Yes	Yes	3m	Yes
George Street	Kerbside	259551 665380	Yes	No (3m)	1m	Yes
North Street	Roadside	257906 665672	Yes	No (15m)	3m	No
Hope Street 1	Roadside	258730 665322	Yes	Yes	3m	Yes
Gordon Street	Roadside	258756 665346	Yes	No (5m)	3m	No
Heilanmans Umbrella North	Roadside	258770 665120	Yes	Yes	3m	Yes
Saltmarket	Roadside	259545 664739	Yes	Yes	3m	Yes
High Street	Roadside	259732 664991	Yes	Yes	3m	Yes

2.1.2 Non-Automatic Monitoring Sites (cont.)**Table 2.3 Details of Non - Automatic Nitrogen Dioxide Monitoring Sites (Cont.)**

Site Name	Site Type	OS Grid Ref	In AQMA?	Relevant Exposure	Distance to kerb of nearest road	Worst-case Location?
Dobbies Loan	Urban Background	259415 666194	Yes	Yes	3m	No
Cathedral Bridge	Roadside	259136 665661	Yes	No (10m)	3m	No
Dundasvale Street	Urban Background	258820 666306	Yes	Yes	15m	No
Royston Road	Roadside	260429 666264	Yes	No (5m)	3m	No
St Mungo Avenue	Urban Background	259392 665866	Yes	Yes	5m	Yes
Brown Street	Roadside	258336 665122	Yes	Yes	3m	No
Broomielaw	Roadside	258562 664933	Yes	No (5m)	3m	No
McLeod Street	Urban Background	260077 665481	Yes	Yes	8m	No
Sauchiehall Street	Urban Background	258639 665852	Yes	No (10m)	N/A	No
Kennedy Path	Urban Background	259701 665983	Yes	Yes	10m	No
Dumbarton Road	Roadside	256209 666525	Yes	No (3m)	3m	Yes
Lawrence Street	Roadside	256295 666816	Yes	No (5m)	2m	No
Cooperswell Street	Roadside	256154 666478	Yes	Yes	4m	Yes
Westmuir Street	Roadside	262589 664139	Yes	Yes	3m	Yes
Mossie Road	Roadside	257235 662064	No	No (3m)	3m	Yes
Bridge Street	Roadside	258702 664480	Yes	No (3m)	3m	Yes
Finnieston Street	Roadside	257235 665108	No	No (5m)	3m	Yes

2.1.2 Non-Automatic Monitoring Sites (cont.)**Table 2.3 Details of Non - Automatic Nitrogen Dioxide Monitoring Sites (Cont.)**

Site Name	Site Type	OS Grid Ref	In AQMA?	Relevant Exposure	Distance to kerb of nearest road	Worst-case Location?
Hillcrest Road	Roadside	265075 662001	No	No (5m)	3m	No
St Andrews Drive	Urban Background	256229 662587	No	Yes	N/A	No
Haggs Road	Roadside	256295 661792	No	Yes	3m	Yes
Pollokshaws Road	Roadside	255864 661180	No	Yes	5m	No
Queen Margaret Drive	Roadside	257435 668015	No	No (20m)	3m	Yes
Napiershall Street	Roadside	257790 666791	No	Yes	4m	Yes
Queen Margaret Drive 2	Roadside	257216 667639	Yes	Yes	3m	Yes
Queen Margaret Drive 3	Roadside	257012 667433	Yes	Yes	3m	No
Oxford Street	Roadside	258798 664570	No	Yes	3m	No
Anniesland Cross	Roadside	254613 668886	No	Yes	15m	No
Balshagray Avenue	Roadside	254498 667291	No	Yes	10m	No
Dougie Road	Roadside	260203 659128	No	No (20m)	3m	Yes
Main Street (Bridgeton)	Roadside	260650 663319	No	Yes	5m	Yes
Aikenhead Road	Roadside	259225 662579	No	Yes	6m	Yes
Langside Primary School	Roadside	257138 661617	No	No (5m)	3m	No
Thornwood Drive	Roadside	254903 666855	No	Yes	3m	No
Springburn Road	Roadside	260541 669268	No	Yes	6m	Yes

2.1.2 Non-Automatic Monitoring Sites (cont.)**Table 2.3 Details of Non - Automatic Nitrogen Dioxide Monitoring Sites (Cont.)**

Site Name	Site Type	OS Grid Ref	In AQMA?	Relevant Exposure	Distance to kerb of nearest road	Worst-case Location?
Paisley Road West	Roadside	255599 664313	No	Yes	3m	Yes
Sutherland Avenue	Urban Background	256343 663153	No	No (10m)	5m	No
Belmont Street	Roadside	257533 667418	No	No (5m)	3m	Yes
Mallaig Place	Urban background	253989 665298	No	No (20m)	6m	No
Govanhill Street	Roadside	258678 662901	No	No (3m)	3m	No
Westercraigs	Urban Background	260942 665226	No	Yes	15m	No
Inveresk Lane	Urban Background	264163 664856	No	Yes	20m	No
Kippen Street	Urban Background	259731 668488	No	No (5m)	3m	No
Sacone SW	Urban background	263920 664569	No	Yes	20m	No
Invergarrie Road	Urban Background	253821 658590	No	No (5m)	3m	No
Easterhouse	Roadside	267005 666217	No	Yes	5m	No
Dunn Street	Urban Background	261305 663928	No	Yes	5m	No
Glasgow Harbour	Urban Background	255287 666276	No	Yes	30m	No
Mosspark Boulevard	Urban Background	255436 663274	No	Yes	15m	No
Crow Road	Roadside	254640 254730	No	Yes	3m	Yes
Silverburn	Roadside	253047 661349	No	Yes	5m	No
Hyndland Road	Roadside	255764 667297	No	Yes	4m	No

2.1.2 Non-Automatic Monitoring Sites (cont.)**Table 2.3 Details of Non - Automatic Nitrogen Dioxide Monitoring Sites (Cont.)**

Site Name	Site Type	OS Grid Ref	In AQMA?	Relevant Exposure	Distance to kerb of nearest road	Worst-case Location?
Urrdale Road	Urban Background	255826 664118	No	Yes	N/A	No
Park Road	Roadside	257555 666896	No	Yes	3m	Yes
Springfield Road	Roadside	261823 663468	No	Yes	3m	No
Paisley Rd West 2	Roadside	257415 664616	No	Yes	3m	Yes
Crow Road 2	Roadside	254606 667894	No	Yes	3m	Yes
Maryhill Road	Roadside	257243 668285	No	Yes	3m	Yes
Scotstoun	Urban Background	253592 667771	No	Yes	>10m	No
Hampden	Urban Background	259038 661285	No	Yes	3m	No
Kelvingrove Park	Roadside	256950 666229	No	No	3m	No
Tollcross Park	Roadside	263864 663544	No	Yes	3m	No
Milner Road	Roadside	254456 668108	No	No	3m	No
Gibson Street	Roadside	257166 666787	No	Yes	3m	Yes
Woodlands Road	Roadside	257550 666697	No	Yes	3m	Yes
Arlington Street	Roadside	257796 666378	No	Yes	3m	No
Poplar Avenue	Roadside	254662 667636	No	Yes	3m	Yes
Great Western Road	Roadside	257255 667112	No	No	3m	Yes
1031 Maryhill Road	Roadside	257352 668122	No	Yes	5m	Yes

2.1.2 Non-Automatic Monitoring Sites (cont.)**Table 2.3 Details of Non - Automatic Nitrogen Dioxide Monitoring Sites (Cont.)**

Site Name	Site Type	OS Grid Ref	In AQMA?	Relevant Exposure	Distance to kerb of nearest road	Worst-case Location?
MHR Shawpark Street	Roadside	257075 668502	No	Yes	5m	Yes
1428 Maryhill Road	Roadside	257243 668285	No	No	3m	Yes
45 Clifford Street	Roadside	256262 664308	No	Yes	3m	Yes
608 Scotland Street West	Roadside	256948 664270	No	Yes	<1m	Yes
17 Kilbride Street	Roadside	259732 663032	No	Yes	3m	Yes
2 Myrtle Drive	Roadside	259246 661979	No	Yes	3m	Yes
183 Crossloan Road	Roadside	254724 665407	No	Yes	3m	Yes
234 Berryknowes Road	Urban Background	253542 664443	No	Yes	15m	Yes
64 Minard Road	Roadside	257256 662295	No	Yes	3m	Yes
Battlefield Road	Roadside	258084 661642	No	Yes	3m	Yes
128 Mennock Road	Roadside	259871 660618	No	Yes	3m	Yes
187 Castlemilk Drive	Roadside	260268 658856	No	Yes	3m	Yes
79 Tollcross Road	Roadside	262668 664115	Yes	Yes	3m	Yes
101 Westmuir Street	Roadside	262732 664229	Yes	Yes	3m	Yes
1341 Duke Street	Roadside	262545 664241	Yes	Yes	3m	Yes
St Michaels Lane	Roadside	262472 664214	Yes	Yes	3m	Yes
902 Springfield Road	Roadside	262467 664141	Yes	Yes	3m	Yes

2.1.2 Non-Automatic Monitoring Sites (cont.)

In addition to monitoring NO₂ levels, Glasgow City Council also monitors Benzene by diffusion tube at four sites across the city. This analysis is also conducted by the GSS laboratory.

Table 2.4 Details of Non - Automatic Benzene Monitoring Sites

Site Name	Site Type	OS Grid Ref	In AQMA?	Relevant Exposure	Distance to kerb of nearest road	Worst-case Location?
Heilanmans Umbrella North	Roadside	258770 665121	Yes	Yes	3m	Yes
Hope Street	Kerbside	258738 665167	Yes	No (3m)	<1m	Yes
Ochiltree Avenue	Roadside	254839 669295	No	No (3m)	5m	Yes
Pollokshaws Road	Roadside	255869 661185	No	No (3m)	3m	Yes

2.2 Comparison of Monitoring Results with Air Quality Objectives

2.2.1 Nitrogen Dioxide

2.2.1.1 Automatic Monitoring Data

Nitrogen dioxide is monitored using automatic analysers at nine locations; the Kerbside, Townhead, Great Western Road and High Street AURN sites and the GCC stations at Byres Road, Dumbarton Road, Burgher Street, Anderston and Waulkmillglen reservoir. Objectives have been set for both the Annual Mean and an Hourly Mean. Table 2.5 shows the measured annual mean at these locations over the last five years. No data was obtained during 2015 at Anderson due to long term renovation works adjacent to the monitoring location.

Table 2.5 Results of Automatic Monitoring for Nitrogen Dioxide Comparison with Annual Mean Objective (40µg/m³)

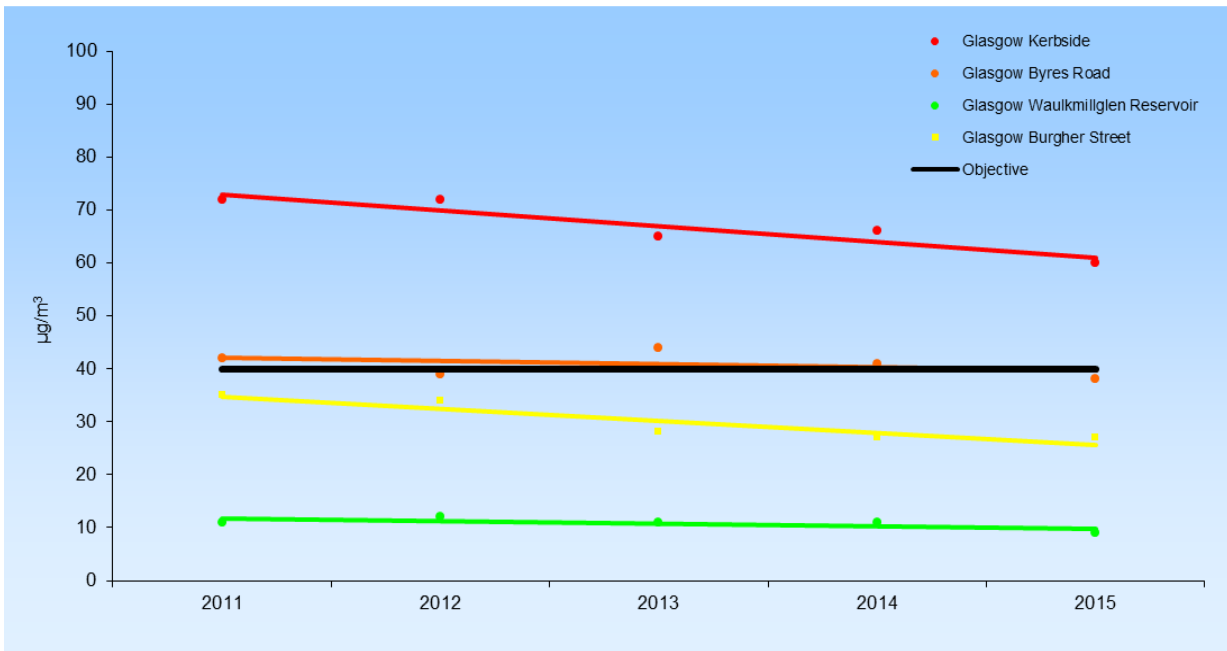
Site Name	Within AQMA?	Relevant Public Exposure	Valid Data Capture 2015 %	Annual Mean Concentration µg/m ³				
				2011	2012	2013	2014	2015
Glasgow Kerbside	City Centre	Yes	99	72	72	65	66	60
Glasgow Townhead	City Centre	Yes	95	-	-	-	27	26
Glasgow Great Western Road	No	Yes	100	-	-	-	31	31
Glasgow High Street	City Centre	Yes	75	-	-	-	-	32
Glasgow Anderston	City Centre	Yes	-	36	33	28	18	-
Glasgow Byres Road	Byres / Dumbarton	Yes	98	42	39	44	41	38
Glasgow Dumbarton Road	Byres / Dumbarton	Yes	97	-	-	46	38	41
Glasgow Burgher Street	Parkhead	Yes	99	35	34	28	27	27
Glasgow Waulkmillglen Reservoir	No	No	81	11	12	11	11	9

During 2015 the Annual Mean Objective was exceeded at Glasgow Kerbside and Dumbarton Road.

2.2.1.1 Automatic Monitoring Data (Cont.)

Figure 2.3, displays the five year trend at those locations with sufficient data. The 5 year trend for Byres Road now shows this location as being marginally within the Objective. Glasgow Kerbside whilst showing a gradual improvement has continually exceeded the Annual Mean Objective.

Figure 2.3 Trends in Annual Mean Nitrogen Dioxide Concentration Measured at Automatic Monitoring Sites.



2.2.1.1 Automatic Monitoring Data (Cont.)

Table 2.6 shows the number of exceedences of the $200\mu\text{g}/\text{m}^3$ hourly objective over the last five years. During 2015, the permitted number of exceedences (18) of the Objective was not breached at any of the automatic monitoring locations.

Table 2.6 Results of Automatic Monitoring for Nitrogen Dioxide Comparison with Hourly Mean Objective

Site Name	Within AQMA?	Relevant Public Exposure	% Valid Data Capture 2015	Number of Exceedences of Hourly Mean Objective ($200\mu\text{g}/\text{m}^3$) (99.8 th Percentile of Hourly Means) if % Valid Data Capture < 90%				
				2011	2012	2013	2014	2015
Glasgow Kerbside	City Centre	Yes	99	31	17	12	11	4
Glasgow Townhead	City Centre	Yes	95	-	-	-	0	0
Glasgow Great Western Road	No	Yes	100	-	-	-	0(119)	0
Glasgow High Street	City Centre	Yes	75	-	-	-	-	0(110)
Glasgow Anderston	City Centre	Yes	-	4	4	42	0(55)	-
Glasgow Byres Road	Byres / Dumbarton	Yes	98	0(145)	7 (168)	4 (164)	7 (162)	0
Glasgow Dumbarton Road	Byres / Dumbarton	Yes	97	-	-	0 (141)	0 (117)	0
Glasgow Burgher Street	Parkhead	Yes	99	52(338)	0 (153)	1	0	0
Glasgow Waulkmillglen Reservoir	No	No	81	0	0 (109)	0	0	0(92)

2.2.1.1 Automatic Monitoring Data (Cont.)**Table 2.7 Results of Mobile Station Monitoring for Nitrogen Dioxide**

Table 2.7 following shows the Nitrogen Dioxide data gathered from the mobile unit (Nov – Dec) mean value and the 99.8th percentile of hourly means.

Site Name	Within AQMA?	Relevant Public Exposure	Valid Data Capture 2014 %	Annual Mean Concentration $\mu\text{g}/\text{m}^3$	Number of Exceedences of Hourly Mean Objective ($200 \mu\text{g}/\text{m}^3$) (99.8 th Percentile of Hourly Means) if % Valid Data Capture < 90%
Mobile Station Corunna Street	No	No	100 (Nov – Dec)	33	1(181)

2.2.1.2 Non Automatic Monitoring Data

Monitoring for NO₂ by diffusion tube is currently carried out at 28 locations within the City Centre Air Quality Management Area the results of which are shown in Table 2.8 below. Figure 2.4 following shows five year trends based on the average value from those tubes classified as urban background and roadside.

Table 2.8 Results of Diffusion Tube Monitoring for Nitrogen Dioxide Within City Centre AQMA Comparison with Annual Mean Objective (40µg/m³)

Site Name	Data Collection 2015 (%)	Annual Mean Concentration (µg/m ³) (Bias Adjustment)				
		2011 (0.94)	2012 (0.95)	2013 (0.96)	2014 (0.83)	2015 (0.98)
George Square	92	44	41	48	41	38
Union Street	42	64	63	65	61	65 *
Bath Street	100	51	44	53	44	39
Glassford Street	100	48	44	54	46	42
Buchanan Street	83	46	45	48	41	39
Castle Street	100	35	34	35	29	27
Hope Street 3	92	55	50	59	52	48
Montrose Street	100	42	39	47	38	35
Cochrane Street	100	42	38	38	39	34
Renfield Street	100	59	60	59	56	57
George Street	92	47	45	47	41	39
North Street	92	30	26	33	30	22
Hope Street 1	92	76	73	87	67	63

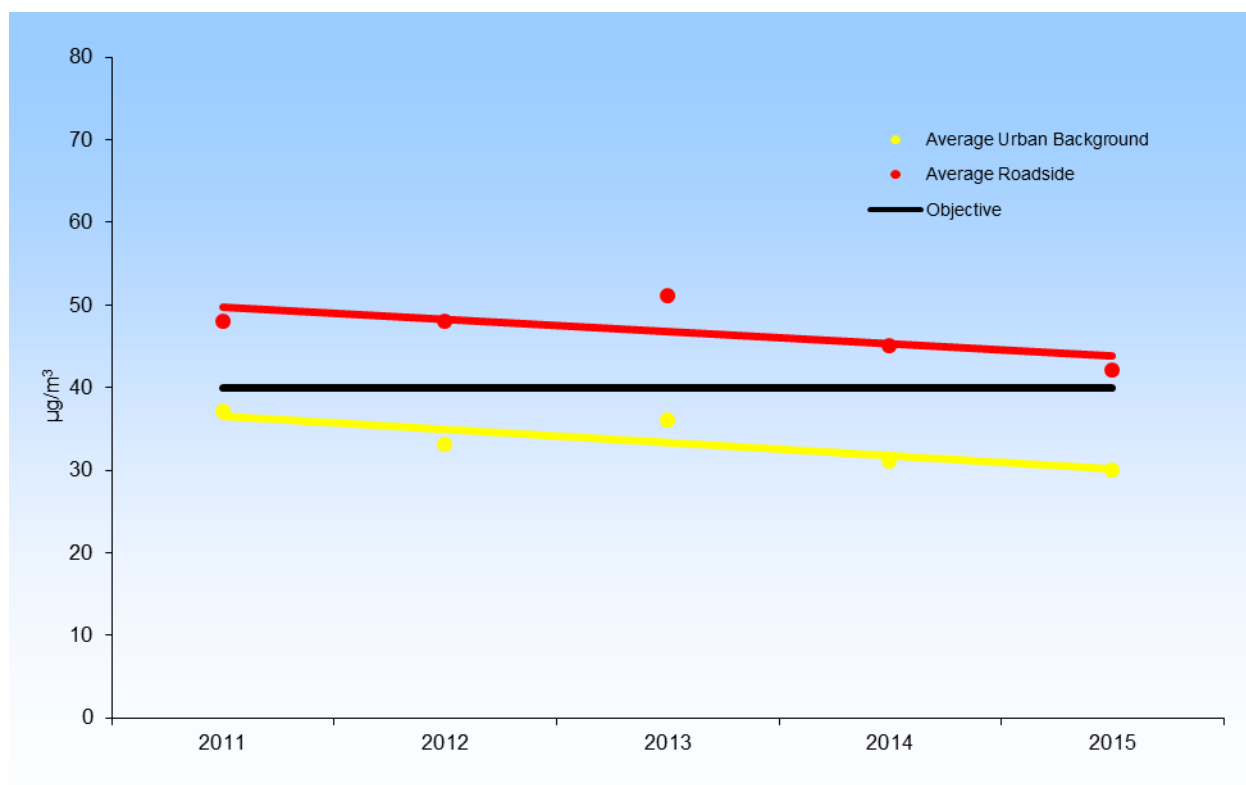
2.2.1.2 Non Automatic Monitoring Data (Cont.)

Table 2.8 Results of Diffusion Tube Monitoring for Nitrogen Dioxide Within City Centre AQMA (cont.) Comparison with Annual Mean Objective (40µg/m³)

Site Name	Data Collection 2015 (%)	Annual Mean Concentration (µg/m ³) (Bias Adjusted)				
		2011 (0.94)	2012 (0.95)	2013 (0.96)	2014 (0.83)	2015 (0.98)
Gordon Street	83	-	-	75	68	67
Heilanmans Umbrella North	100	68	68	78	64	69
Saltmarket	100	42	42	37	37	32
High Street	100	49	49	46	43	40
Dobbies Loan	100	31	31	28	26	24
Cathedral Bridge	100	53	53	57	47	46
Dundasvale Street	100	-	-	31	32	30
Royston Road	92	45	45	43	34	34
St Mungo Avenue	100	34	34	35	28	28
Brown Street	92	31	31	33	27	23
Broomielaw	75	40	40	47	41	41
McLeod Street	92	35	35	35	30	31
Sauchiehall Street	100	51	51	43	36	35
Kennedy Path	100	27	27	30	24	25
Bridge Street	100	39	39	35	31	30

2.2.1.2 Non Automatic Monitoring Data (Cont.)

Figure 2.4 Trends in Annual Mean Nitrogen Dioxide Concentration Within City Centre AQMA Comparison with Annual Mean Objective ($40\mu\text{g}/\text{m}^3$)



Monitoring for NO_2 by diffusion tube is currently carried out at 5 locations within the Byres Road / Dumbarton Road City Centre Air Quality Management Area. There were no exceedences of the Annual Mean Objective during 2015 the results of which are shown in Table 2.9.

Table 2.9 Results of Diffusion Tube Monitoring for Nitrogen Dioxide Within the Byres Road / Dumbarton Road AQMA Comparison with Annual Mean Objective ($40\mu\text{g}/\text{m}^3$)

Site Name	Data Collection 2015 (%)	Annual Mean Concentration ($\mu\text{g}/\text{m}^3$) (Bias Adjusted)				
		2011 (0.94)	2012 (0.95)	2013 (0.96)	2014 (0.83)	2015 (0.98)
Dumbarton Road	75	32	33	32	28	26
Lawrence Street	100	26	25	26	21	19
Cooperswell Street	83	27	23	28	23	21
Queen Margaret Drive 3	100	42	36	40	35	25
Queen Margaret Drive 2	92	36	31	34	33	34

2.2.1.2 Non Automatic Monitoring Data (Cont.)

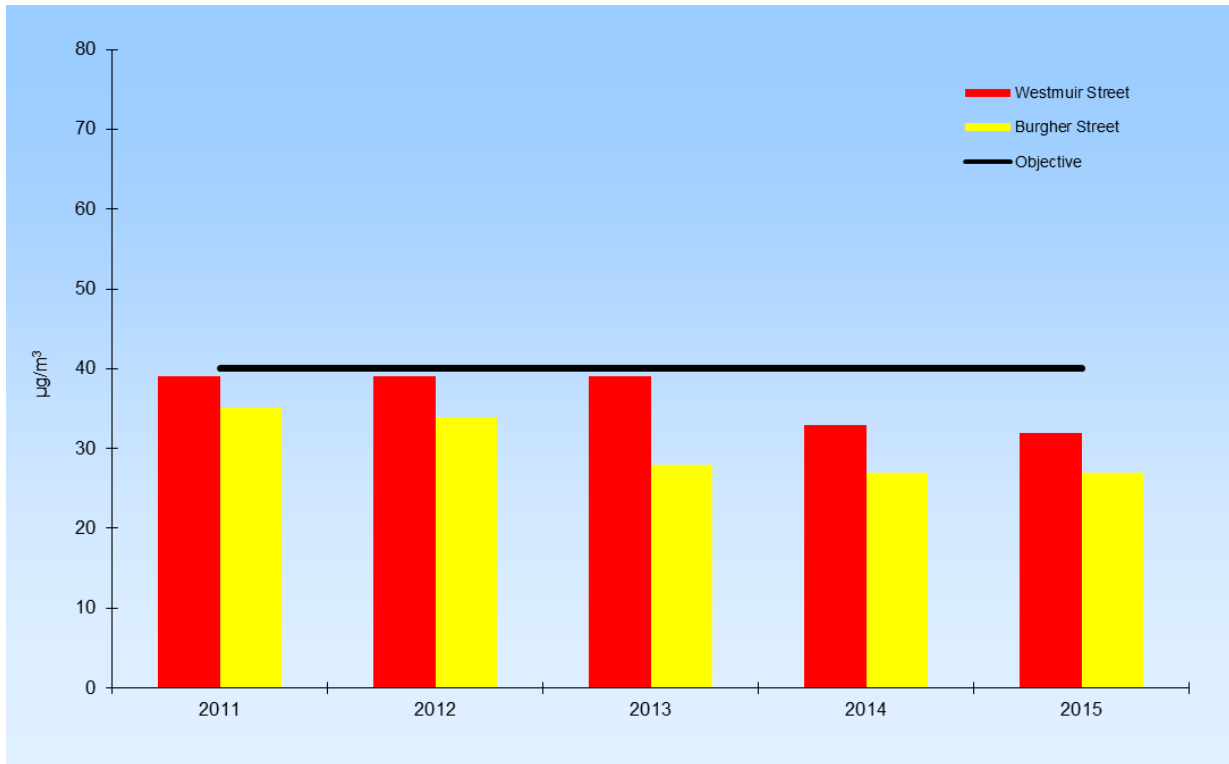
Monitoring for NO₂ by diffusion tube was previously carried out at a single location within the Parkhead Cross Air Quality Management Area. During 2015 additional tubes were installed in this area as a precursor to proceeding towards revoking the AQMA. The Annual Mean Objective was not exceeded during 2015; results from this location are shown in Table 2.10. For comparison Figure 2.5 also shows the annual mean concentration from the automatic monitoring station at Burgher Street which is also located within this AQMA.

Table 2.10 Results of Diffusion Tube Monitoring for Nitrogen Dioxide Within Parkhead Cross AQMA Comparison with Annual Mean Objective (40µg/m³)

Site Name	Data Collection 2015 (%)	Annual Mean Concentration (µg/m ³) Bias Adjusted				
		2011 (0.94)	2012 (0.95)	2013 (0.96)	2014 (0.83)	2015 (0.98)
Westmuir Street	100	39	39	39	33	32
79 Tollcross Road	100	-	-	-	-	25
101 Westmuir Street	100	-	-	-	-	27
1341 Duke Street	92	-	-	-	-	24
St Michaels Lane	100	-	-	-	-	37
902 Springfield Road	92	-	-	-	-	24

2.2.1.2 Non Automatic Monitoring Data (Cont.)

Figure 2.5 Annual Mean Nitrogen Dioxide Concentrations Within Parkhead Cross AQMA Comparison with Annual Mean Objective (40µg/m³)



2.2.1.2 Non Automatic Monitoring Data (Cont.)

Monitoring for NO₂ by diffusion tube is extensively carried out across the Glasgow Area at locations out with Air Quality Management Areas. The Annual Mean Objective was not exceeded at any location during 2015; monitoring results are shown in Table 2.11.

Table 2.11 Results of Diffusion Tube Monitoring for Nitrogen Dioxide Outwith the Existing AQMA's Comparison with Annual Mean Objective (40µg/m³)

Site Name	Data Collection 2015 (%)	Annual Mean Concentration (µg/m ³) Bias Adjusted				
		2011 (0.94)	2012 (0.95)	2013 (0.96)	2014 (0.83)	2015 (0.98)
Mossie Road	100	29	26	37	26	23
Finnieston Street	83	35	32	36	29	26
Hillcrest Road	92	19	21	24	19	16
St Andrews Drive	100	22	18	19	17	17
Haggs Road	100	36	32	30	24	22
Pollokshaws Road	100	32	20	25	24	27
Queen Margaret Drive	100	30	27	27	25	24
Napiershall Street	100	31	30	33	27	27
Oxford Street	100	34	29	31	28	25
Annie'sland Cross	100	34	26	30	23	23
Balshagray Avenue	100	26	25	29	31 *	24
Dougrie Road	100	20	20	19	16	22
Main Street (Bridgeton)	100	23	23	25	21	20
Aikenhead Road	83	23	27	29	22	18
Langside Primary School	100	18	22	22	16	15
Thornwood Drive	100	21	18	21	18	17
Springburn Road	100	30	22	31	24	21

2.2.1.2 Non Automatic Monitoring Data (Cont.)**Table 2.11 Results of Diffusion Tube Monitoring for Nitrogen Dioxide
Outwith the Existing AQMA's (cont.)
Comparison with Annual Mean Objective (40µg/m³)**

Site Name	Data Collection 2015 (%)	Annual Mean Concentration (µg/m ³) Bias Adjusted				
		2011 (0.94)	2012 (0.95)	2013 (0.96)	2014 (0.83)	2015 (0.98)
Paisley Road West	100	31	33	28	29	25
Sutherland Avenue	100	16	18	18	15	13
Belmont Street	100	23	21	21	18	18
Mallaig Place	92	23	19	23	19	19
Govanhill Street	100	28	26	28	24	23
Westercraigs	92	22	24	24	20	18
Inveresk Lane	100	18	18	17	16	15
Kippen Street	92	29	22	23	19	18
Sacone SW	100	21	21	21	16	16
Invergarrie Road	100	18	17	17	14	13
Easterhouse	100	20	19	24	16	17
Dunn Street	100	20	20	23	19	18
Glasgow Harbour	100	28	25	26	21	20
Mosspark Boulevard	92	27	25	25	22	22
Crow Road	100	44	37	33	34	28
Silverburn	100	21	23	23	17	14
Hyndland Road	100	31	27	33	26	21
Urrdale Road	100	31	31	32	26	22
Park Road	100	40	31	36	28	24

2.2.1.2 Non Automatic Monitoring Data (Cont.)**Table 2.11 Results of Diffusion Tube Monitoring for Nitrogen Dioxide Outwith the Existing AQMA's (cont.) Comparison with Annual Mean Objective (40µg/m³)**

Site Name	Data Collection 2015 (%)	Annual Mean Concentration (µg/m ³) Bias Adjusted				
		2011 (0.94)	2012 (0.95)	2013 (0.96)	2014 (0.83)	2015 (0.98)
Springfield Road	92	30	25	21	20	20
Paisley Road West 2	100	-	37	40	33	30
Crow Road 2	100	-	28	34	30	26
Maryhill Road	75	-	40	41	34	30
Scotstoun	100	-	19	22	20	16
Hampden	100	-	18	21	16	16
Kelvingrove Park	100	-	29	25	23	23
Tollcross Park	100	-	30	25	19	16
Milner Road	100	-	-	20	16	16
Gibson Street	100	-	-	32	27	30
Woodlands Road	100	-	-	31	28	23
Arlington Street	100	-	-	31	23	22
Poplar Avenue	100	-	-	29	25	21
Great Western Road	33	-	-	37	30	25 *
1031 Maryhill Road	100	-	-	37	32	30
MHR Shawpark Street	100	-	-	34	30	28
1428 Maryhill Road	100	-	-	29	26	19
45 Clifford Street	100	-	-	-	24	24
608 Scotland Street West	92	-	-	-	27	27

2.2.1.2 Non Automatic Monitoring Data (Cont.)**Table 2.11 Results of Diffusion Tube Monitoring for Nitrogen Dioxide Outwith the Existing AQMA's (cont.) Comparison with Annual Mean Objective (40µg/m³)**

Site Name	Data Collection 2015 (%)	Annual Mean Concentration (µg/m ³) Bias Adjusted				
		2011 (0.94)	2012 (0.95)	2013 (0.96)	2014 (0.83)	2015 (0.98)
17 Kilbride Street	100	-	-	-	20	20
2 Myrtle Drive	100	-	-	-	18	16
183 Crossloan Road	100	-	-	-	-	22
234 Berryknowes Road	100	-	-	-	-	22
64 Minard Road	100	-	-	-	-	20
Battlefield Road	100	-	-	-	-	26
128 Mennock Road	100	-	-	-	-	21
187 Castlemilk Drive	100	-	-	-	-	12

* Annualised data

2.2.2 Particulate Material at PM₁₀

Particulate Material (PM₁₀) is monitored using automatic analysers at ten locations across Glasgow, the High Street and Townhead AURN sites, the air quality stations at Glasgow Anderson, Byres Road, Burgher Street, Dumbarton Road and Waulkmillglen reservoir and three Particulate (PM₁₀) only locations at Abercromby Street, Broomhill and Nithsdale Road. Objectives have been set for both the Annual Mean and a 24 Hour Mean. Table 2.12 shows the measured annual mean at these locations over the last five years. There were no exceedences of the Annual Mean Objective during 2015.

Table 2.12 Results of PM₁₀ Automatic Monitoring Comparison with Annual Mean Objective (18 µg/m³)

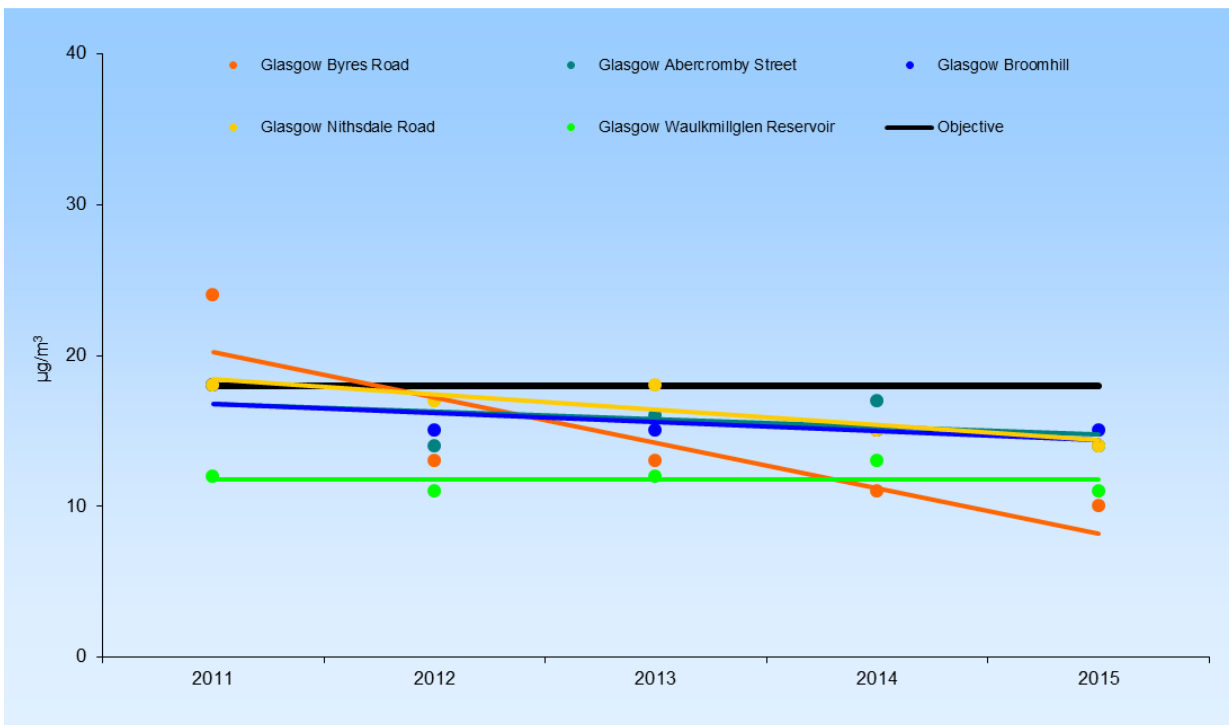
Site Name	Within AQMA?	Gravimetric Equivalent	% Valid Data Capture 2015	Annual Mean Concentration (µg/m ³)				
				2011	2012	2013	2014	2015
Glasgow Townhead	Yes	Yes	44	-	-	-	13	12
Glasgow High Street	Yes	Yes	91	-	-	-	-	16
Glasgow Anderston	Yes	Yes	-	16	14	16	18	-
Glasgow Byres Road	Yes	Yes	90	24	13	13	11	10
Glasgow Dumbarton Road	Yes	Yes	99	-	18	19	17	17
Glasgow Burgher Street	Yes	Yes	96	-	15	17	16	16
Glasgow Abercromby Street	Yes	Yes	97	18	14	16	17	14
Glasgow Broomhill	Yes	Yes	99	18	15	15	15	15
Glasgow Nithsdale Road	Yes	Yes	93	18	17	18	15	14
Glasgow Waulkmillglen Reservoir	No	Yes	83	12	11	12	13	11

Note, DEFRA discontinued monitoring of Particulates at Glasgow Kerbside during January 2015.

2.2.2 Particulate Material at PM₁₀ (Cont.)

Figure 2.6 following, shows the generally decreasing trend at these locations over the previous five year period. Results obtained from Byres Road during this period are currently under review. Whilst the monitoring instrument used (FDMS TEOM) was regularly serviced and met all QA/QC audits, the results appear lower than anticipated.

Figure 2.6 Trends in Annual Mean PM₁₀ Concentration from Automatic Monitoring Comparison with Annual Mean Objective (18µg/m³)



2.2.2 Particulate Material at PM₁₀ (Cont.)

During 2015, there were no exceedences of the Daily Mean Objective. Table 2.13 shows the exceedences of the Daily Mean Objective over the last five years.

Table 2.13 Results of PM₁₀ Automatic Monitoring Comparison with 24 hour Mean Objective (50 µg/m³)

Site Name	Within AQMA?	Gravimetric Equivalent	% Valid Data Capture 2015	Number of Exceedences of Daily Mean Objective (98 th Percentile of Daily Means) if % Valid Data Capture < 90%				
				2011	2012	2013	2014	2015
Glasgow Townhead	Yes	Yes	44	-	-	-	0(31)	0(33)
Glasgow High Street	Yes	Yes	91	-	-	-	-	0
Glasgow Anderston	Yes	Yes	-	2(25)	3(39)	2	0(42)	-
Glasgow Byres Road	Yes	Yes	90	2(40)	3(37)	0(31)	0(24)	0
Glasgow Dumbarton Road	Yes	Yes	99	-	2(39)	1	0	3
Glasgow Burgher Street	Yes	Yes	96	-	4	3	3	3
Glasgow Abercromby Street	Yes	Yes	97	9	4	2	0(34)	1
Glasgow Broomhill	Yes	Yes	99	6	6	0	0	2
Glasgow Nithsdale Road	Yes	Yes	93	6	9	3(43)	2(36)	1
Glasgow Waulkmillglen Reservoir	No	Yes	83	0(20)	0(29)	0	0(22)	0(34)

Table 2.14 Results of Mobile Station Monitoring for PM₁₀

Site Name	Within AQMA?	Gravimetric Equivalent	Valid Data Capture 2015 %	Annual Mean Concentration µg/m ³	Number of Exceedences of Daily Mean Objective (50 µg/m ³) (98 th Percentile of Daily Means) if % Valid Data Capture < 90%
Mobile Station Clutha Street	Yes	Yes	100 (Jun – Oct)	9	0(23)
Mobile Station Corunna Street	Yes	Yes	100 (Dec)	9	0(15)

2.2.3 Sulphur Dioxide

Sulphur Dioxide is measured at only one location, Glasgow Anderston. No monitoring was carried out at this location during 2015 due to long term renovation works adjacent to the site.

2.2.4 Benzene

Benzene is measured using diffusion tubes at four sites in Glasgow. The tubes are exposed for one month at a time and then analysed. The results are shown in Table 2.15 below.

Table 2.15 Results of Diffusion Tube Monitoring for Benzene Comparison with Annual Mean Objective (3.25µg/m³)

Site Name	% Valid Data Capture 2015	Annual Mean Concentration (µg/m ³)
Heilanmans Umbrella North	75	0.7
Hope Street	92	0.6
Ochiltree Avenue	92	0.8
Pollokshaws Road	92	0.8

2.2.5 Ozone

Ozone is measured at two locations, Glasgow Waulkmillglen Reservoir and the Townhead AURN site. Ozone is a secondary pollutant and the highest concentrations are generally measured remotely from sources of pollution. There were 10 exceedences over 2 days of the Running 8-hour Mean Objective at the rural site at Glasgow Waulkmillglen Reservoir and 11 exceedences over 2 days at Townhead AURN during 2015.

Table 2.16 Results of Monitoring for Ozone Comparison with 8 hour Running Mean Objective (100µg/m³)

Site Name	% Valid Data Capture 2015	Number of Exceedences of 8 hour Running Mean Objective (Number of Days) (Maximum Number Days Allowed = 10)
Glasgow Townhead	99	11(2)
Glasgow Waulkmillglen Reservoir	97	10(2)

2.2.6 Particulate Material at PM_{2.5}

The Scottish Government has set an Annual Mean Objective for PM_{2.5}. Monitoring of PM_{2.5} is currently carried out at two locations, Glasgow Townhead and High Street AURN. Annual mean concentrations for PM_{2.5} are shown in Table 2.17 below. Annual mean concentrations for PM_{2.5} measured at the mobile station monitoring locations are shown in Table 2.18 following.

Table 2.17 Results of PM_{2.5} Automatic Monitoring Comparison with Annual Mean Objective (10 µg/m³)

Site Name	Gravimetric Equivalent	% Valid Data Capture 2015	Annual Mean Concentration (µg/m ³)				
			2011	2012	2013	2014	2015
Glasgow Townhead	Yes	93	-	-	-	7	7
Glasgow High Street	Yes	92	-	-	-	-	8

Table 2.18 Results of Mobile Station Monitoring for PM_{2.5} Comparison with Annual Mean Objective (10 µg/m³)

Site Name	Gravimetric Equivalent	Valid Data Capture 2015 %	Mean Concentration µg/m ³
Mobile Station Clutha Street	Yes	100 (Jun – Oct)	6
Mobile Station Corunna Street	Yes	100 (Dec)	6

2.2.7 Summary of Compliance with AQS Objectives

During 2015, Glasgow City Council has measured concentrations of nitrogen dioxide above the Annual Mean Objective at several locations within existing AQMA's. The Hourly Mean Objective was not exceeded at any of the automatic monitoring stations across the city.

The Annual Mean Objective for PM₁₀ was not exceeded at any monitoring locations; note however that monitoring has been discontinued at Glasgow Kerbside. There were no exceedences of the Daily Mean Objective.

NO₂ Annual Mean Objective

The Annual Mean Objective was exceeded at Glasgow Kerbside AURN and Dumbarton Road automatic monitoring stations and at various diffusion tube locations within the city centre AQMA.

NO₂ Hourly Mean Objective

There were no exceedences of the NO₂ Hourly Mean Objective. The 99.8th percentile value of the objective measured at those locations where the percentage data capture was <90%, Waulkmillgen and High Street did not indicate that this objective would have been exceeded.

PM₁₀ Annual Mean Objective

The PM₁₀ annual mean objective was not exceeded at any monitoring location.

It should be noted that the objective referred to above is the Annual Mean Objective for Scotland. This objective is set at 18 µg/m³; this is significantly lower than the UK objective of 40 µg/m³.

PM₁₀ Daily Mean Objective

There were no exceedences of the Daily Mean Objective, neither did the 90th percentile value from those sites with <90% data capture indicate that this objective would have been exceeded.

As with the Annual Mean Objective, Scotland has adopted a significantly lower objective for the daily objective. The number of permitted exceedences of the Objective has been set at 7, the UK Objective being set at 35 exceedences.

Other Objectives

Monitoring results for benzene continue to show that concentrations of this pollutant are within the objectives set by the Air Quality (Scotland) Regulations. During 2015, concentrations of ozone were within the objective set by the Regulations. The Scottish Government has set an Annual Mean Objective for PM_{2.5}; there were no exceedences of this Objective.

3.0 New Local Policies and Developments

3.1 Policies (Air Quality Action Plan)

In response to the implementation of the AQMA's in the city, Glasgow Council produced Air Quality Action Plans in 2004 and 2009 introducing a range of measures aimed at reducing pollution in the city. The Action Plan is an evolving project, several measures such as vehicle idling enforcement, vehicle emission testing and initiatives towards cleaner taxis and passenger vehicles remain on going. Other measures such as a council workplace travel plan and easier public access to air quality information have been introduced. The Air Quality Action Plan in its current form is shown in Appendix A. Measures recently introduced by the council include.

3.1.1 City Development Plan

Glasgow is currently undertaking consultation on a proposed City Development Plan. The Plan will set out the planning framework for the city for the next ten years and will include spatial strategy, policies and proposals for the future use of land and infrastructure.

Supplementary Guidance relating to air quality in the planning process is currently being produced. This will update and replace the current Air Quality and Planning Guidance and Biomass Air Quality Guidance documents described below.

Policy on the Introduction of Biomass Installations

Recent years have seen an increase in the uptake of biomass as a fuel source for domestic, commercial and industrial sources. While there may be some environmental benefits in the use of renewable sources of fuel, the replacement of cleaner burning sources such as gas with biomass could have negative impacts on local air quality.

In November 2010 Glasgow City Council introduced a policy on biomass installations which made the following recommendations:

- All new biomass plant should be of high quality, corresponding to the best performing units currently on the market.
- Biomass heat uptake should only be used to replace or displace existing coal and oil fired heating in urban areas.
- Uptake levels of new biomass installations should be substantially lower in AQMAs and areas of known poor air quality than in other locations.

Additionally, the policy document sets out a requirement for biomass installations in, or in close proximity to AQMAs to be assessed for a range of environmental impacts, and only approved where a detailed environmental cost benefit analysis can demonstrate an overall net positive environmental benefit and no unacceptable deterioration in air quality.

3.1.1 City Development Plan (Cont.)

Air Quality and Planning Guidance

Glasgow City Council is in the process of replacing its current Planning Guidance with more formal Supplementary Planning Guidance in respect of air quality (SPG). This is being prepared under section 22 of the Planning (Scotland) Act 2006 and sets out further information and detail in respect of the policies / proposals set out in the Local Development Plan.

The aim of this Supplementary Guidance is to help improve air quality by providing information on the way in which air quality and air pollution issues will be dealt with through the development management system in Glasgow. This guidance helps to fulfil three of the five Council objectives:

- making Glasgow a cleaner, safer city;
- building a prosperous city; and
- improving health and wellbeing

This Supplementary Guidance also serves the two Key Aims of the City Development Plan:

- A healthy, high quality place
- A compact city form that supports sustainable development

3.1.2 Construction / Demolition Site Code of Practice for Dust and Emissions

Construction activities can give rise to a number of sources of dust and emissions. In October 2011 Glasgow City Council introduced a code of practice for developments within the city. The aim of this code of practice is to improve air quality within Glasgow through the adoption of the best possible techniques for the control of dust emissions from construction and demolition sites.

Developers within Glasgow are encouraged to reference the appropriate mitigation strategies for their particular circumstances and to commit to these strategies both within their air quality assessment and in practice.

3.1.3 City Centre Strategy / City Deal

Glasgow has recently adopted a new City Centre Strategy (2014) which has potential effects on traffic routes throughout the city centre including changes to bus routes, the adoption of avenues and increased cycling infrastructure. The Strategy will be in place from 2014 to 2019 and the potential air quality impacts of individual aspects will be assessed as and when they are approved for implementation. Glasgow has received substantial funding through the City Deal to provide the identified infrastructure investment programme.

3.2 Clean Air for Scotland Strategy / National Low Emission Framework

Clean Air for Scotland Strategy (CAFS) is Scotland's first distinct air quality strategy and sets an ambitious vision of Scotland to have the cleanest air in Europe. CAFS draws together the various policies being implemented and developed across a range of central, regional and local government portfolios which have the potential to improve air quality, and presents these within a coherent overall strategy. CAFS sets out the contribution that better air quality can make to sustainable economic growth and quality of life for the citizens of Scotland.

Whilst CAFS is a national strategy its implementation will shape Glasgow's future policies in LAQM. The development of CAFS was overseen by the Scottish Urban Air Quality Steering Group (SUAQ), which comprised members from Scottish Government's Environmental Quality Division, Transport Scotland, SEPA, RTPI, Health Protection Scotland and Glasgow City Council.

Chapter 11 of CAFS provides an outline of the National Low Emission Framework (NLEF), where the purpose is '...to enable local authorities to appraise, justify the business case for, and implement a range of air quality improvement options related to transport (and associated land use). The NLEF will support and build on the work already being done through the Local Air Quality Management system.' Work on the development of the NLEF continues with representation from a number of local authorities including Glasgow City Council

Glasgow is currently undertaking a modelling exercise in accordance with the National Modelling Framework (NMF). It is expected that this modelling will inform future actions under the NLEF and these will be reported and enacted in future reporting cycles and updated action plans.

3.3 Developments

3.3.1 Road Traffic Sources

The M74 Completion opened in June 2011, extending the M74 through to the M8 motorway immediately west of the Kingston Bridge in Glasgow city centre, completing the motorway network around Glasgow. The M74C has several intersections within Glasgow where traffic can join/exit the surface street network. Whilst the route generally avoids residential areas, the Environment Statement concluded that a marginal noncompliance with annual air quality objectives at locations close to the route and at junctions with the surface street network was possible. Monitoring and modelling was carried out on behalf of Transport Scotland as part of the Project Evaluation which is scheduled to be published in 2016. Initial analysis of the data has resulted in several additional NO₂ diffusion tubes being placed at locations adjacent to the route. Results from these tubes were within the Annual Mean Objective value during 2015.

The East End Regeneration Route (EERR) was intended to be a motorway to motorway link through Glasgow's east end, the latest completed section Phase 2 opened in April 2012. This section links the Commonwealth Games venues at Parkhead, the National Indoor Sports Arena and the athletes' village with the previously completed Phase 1 link to the M74C motorway. Construction of the final phase of the route, linking with the M8 motorway, was delayed until after the Commonwealth Games in 2014. There is no current start date for this work to recommence.

3.3.2 Industrial Sources

Polmadie Recycling Centre

Planning consent has been granted for the construction and operation of a major recycling centre to be housed on the site of an existing council facility on Polmadie Road. The development included plans for a CHP plant running on anaerobic digestion derived biogas and gasifiers fuelled by non-recyclable waste. This facility will be licensed by the Scottish Environment Protection Agency and has been subject to an Environmental Impact Assessment. The EIA included modelling of impacts on a variety of pollutants including those covered by the Local Air Quality Management process. The modelling predicted negligible or imperceptible impacts at all modelled receptors. This facility is scheduled to commence operations in 2016.

3.3.3 Commercial and Domestic Sources

Gorbals District Heating

Planning consent has been granted for the construction and operation of a district heating project serving five multi-storey residential blocks in the Gorbals area. This system will utilise biomass as the major energy source.

Given the recent introduction of the Council's policy on the implementation of biomass installations, this development undertook a detailed assessment of air quality impacts. The developers also undertook a detailed environmental cost benefit analysis as part of the planning process.

The air quality assessment predicted negligible impacts on air quality at all receptors.

4.0 Conclusions and Proposed Actions

4.1 New Monitoring Data

NO₂ Annual Mean Objective

Automatic analyser and diffusion tube monitoring of NO₂ indicates that concentrations are likely to continue to exceed the Annual Mean Objective at locations within the existing City Centre and Byres Road / Dumbarton Road Air Quality Management Areas. Concentrations within the Parkhead AQMA whilst below this Objective during 2015 require further monitoring prior to any progression towards revoking this AQMA. It is not considered that any further amendment to the existing AQMA's is necessary or that any new areas require more detailed investigation.

NO₂ Hourly Mean Objective

Whilst there were no exceedences of the Hourly Mean Objective at any of the automatic monitoring stations, several diffusion tubes within the City Centre AQMA continue to produce an annual mean concentration in excess of 60µg/m³. It is not considered that any further amendment to the existing AQMA's is necessary or that any new areas require more detailed analysis.

PM₁₀ Annual Mean Objective

There were no exceedences of the PM₁₀ Annual Mean Objective. Glasgow City Council is currently preparing to revoke the city wide AQMA and amend the Byres Road / Dumbarton Road Air Quality Management Area to include this pollutant.

PM₁₀ 24-hour Mean Objective

There were no exceedences of the Daily Mean Objective, neither did the 90th percentile value from those sites with <90% data capture indicate that this objective would have been exceeded.

4.2 New Local Developments

4.2.1 Road Traffic Sources

The Environment Statement for the M74 Completion concluded that a marginal non-compliance with annual air quality objectives was possible at locations close to the route and at junctions with the surface street network. Monitoring and modelling is being carried out on behalf of Transport Scotland as part of the Project Evaluation which is scheduled to be published in 2016. Initial analysis of the data has resulted in several additional NO₂ diffusion tubes being placed at locations adjacent to the route.

Appendix A Air Quality Action Plan

Measure	Lead Authority / Focus	Planning / Implementation	Progress	Progress During 2015	Completion Date
Vehicle Idling	GCC / Council will expand programme of vehicle idling enforcement	NA / 2003 onwards	Regular scheduled patrols to enforce and/or educate regarding vehicle idling	Council continues to promote awareness and benefits in regard to reduction of vehicle idling via billboards and advertising campaign on PSV vehicles and bus stops. No FPN's issued during 2015.	Ongoing
Emission Testing	GCC / Council will continue a programme of roadside emission testing	NA / 2003 onwards	30000+ vehicles tested	3002 vehicles tested 31 FPN's issued	Ongoing
Low Emission Zones	GCC / The Council will undertake a detailed feasibility study with a view to introducing LEZs in Glasgow	2009 / 2009 -10 2014 2015	Feasibility study into LEZs in Glasgow was completed in 2010. Trial of LEZ camera technology completed. ----- Scottish Government are working towards a national low emission strategy with Glasgow involved as a partner authority.	----- Glasgow Council were part of the steering group which worked with the Scottish Government to introduce CAFS and NLEF.	Complete Ongoing

Measure	Lead Authority / Focus	Planning / Implementation	Progress	Progress During 2015	Completion Date
Cleaner Taxis	GCC / Council will prepare an emissions strategy to reduce emissions from taxi and private hire vehicles	2009 onwards / ongoing	Proposals to limit the maximum age and increase the emission testing frequency for taxis researched and discussed with interested parties	Taxis have been preferentially selected for roadside emissions testing. Further discussions with Licensing and Test centre re-taxi maximum age and increased testing.	Ongoing
Council Workplace Travel Plan	GCC / Council will prepare a workplace travel plan for all employees	2009 - 10 / 2011 onwards	The travel plan has been completed, however it is a living document – tasks have no finite life span ----- Travel Plan was relaunched in an updated form in 2014.	Cycling Infrastructure improvements Lift share, car share facility for GCC Pool bike scheme Site Bike Scheme Cycle to work scheme Improvements at council premises including secure parking facilities.	Ongoing
Car Clubs	GCC / The Council will make on street spaces available for car club vehicles.	2009 - 10 / 2010 onwards	Car club has 32 vehicles including 9 hybrids in operation within Glasgow located on street in council provided bays.	Phase 4 brought 3 additional spaces in Yorkhill bringing Current total to 40. Additional funding was also provided to promote and increase uptake of car club membership.	Ongoing. Further expansion in the West End with approx. 7 new spaces being rolled out in 2016-17.

Measure	Lead Authority / Focus	Planning / Implementation	Progress	Progress During 2015	Completion Date
Public Service Vehicles	GCC / The Council will pursue the use of traffic regulation conditions to control bus emissions within AQMAs	2009 onwards / 2009 ongoing	<p>The Quality Partnership Scheme in the city requires that buses have to meet set emission standards by pre-agreed dates on certain routes.</p> <p>From January 2014 100% of each operator's streamline journeys within Glasgow City boundary will be operated with vehicles meeting EURO 3 emission engine standard for particulates (PM10).</p>	<p>The implementation of the Fastlink route linking the City Centre and the new Southern General Hospital scheduled to commence in 2015 will introduce emission standards of initially Euro Cat 4 or 5</p> <p>-----</p> <p>A Scottish Government funded study of bus emissions in the city centre was incorporated into the upcoming NMF study for Glasgow. The results for this will include detailed analysis of public service vehicle contributions to air pollution in Glasgow and will be reported in 2017.</p>	<p>Ongoing</p> <p>-----</p> <p>2017</p>
Boiler Emissions	GCC / The Council will raise awareness and provide information to assist in energy efficiency in the home and workplace	2010 / 2011 onwards	<p>Biomass Guidance produced 2011 addressing boiler emissions</p> <p>Glasgow Home Energy Advice Team (G-HEAT) has been established to provide independent advice on energy related issues to householders in the city</p>	<p>Attention of developers continues to be drawn to biomass guidance at the planning stage</p> <p>Awareness raising continues through G-HEAT</p>	Ongoing

Measure	Lead Authority / Focus	Planning / Implementation	Progress	Progress During 2015	Completion Date
Planning Guidance	<p>GCC / The Council will produce revised planning guidance</p> <p>-----</p> <p>Glasgow City Council is in the process of replacing its current Planning Guidance with more formal Supplementary Planning Guidance in respect of air quality (SPG).</p>	<p>2010 – 11/ 2012</p> <p>-----</p> <p>2015/ 2016</p>	<p>Guidance produced.</p> <p>-----</p>	<p>Guidance complete and available on council website</p> <p>-----</p> <p>Preparation of Supplementary Planning Guidance ongoing</p>	Ongoing
Air Quality Information	<p>GCC / The Council will provide data and information regarding current and longer term air quality monitoring on our web site and at variable message signs throughout the city</p>	2010 onwards / 2010 ongoing	<p>All air quality review and assessment reports are available on the GCC website. Further reports, guidance documents and links to be added when complete.</p>	<p>Daily Update of Air Quality Data now also published on the GCC website.</p> <p>Discussions ongoing with Transport Scotland re-motorway network VMS</p>	Ongoing
Construction Sites	<p>GCC / The Council will produce a code of practice for construction / demolition contractors</p>	2011 / 2012	<p>Guidance produced and available on Council web site</p>		2012
Fire Reduction	<p>GCC / The Council will investigate multi agency strategic level actions aimed at reducing the number of fires and harmful emissions</p>	2011 / 2011	<p>The Council have promoted and facilitated educational visits to schools to highlight the dangers of fires and fire starting to children.</p>		2011

Measure	Lead Authority / Focus	Planning / Implementation	Progress	Progress During 2015	Completion Date
Cycling Strategy	GCC / Air Quality grants will be sourced for funding cycling improvements in the city	2011 onwards / 2011 ongoing	Grants worth approx. £500,000 have been obtained from Scottish Govt. and used for provision of cycling infrastructure such as bike shelters and stances across the city.	Continued investment in cycling infrastructure including community centred projects and secure bike storage at schools.	Ongoing A further grant application was submitted for 2016/17
Bus Retro-fit Scheme	GCC – SPT / Grant funding to retro-fit Buses with new exhaust tech to reduce harmful emissions	2011 onwards / 2011 ongoing	Grant of ~ £250k agreed from Scot Gov. Discussions with bus operators / SPT / Retrofit companies and procurement ----- Follow up proposals rejected by bus companies. Funding redirected towards joint purchase with SPT of 2 fully electric buses for use on Route 100 to Transport museum.		Completed
Tree Planting	GCC / The Council will investigate the potential for a programme of tree planting as a means of city centre PM10 reduction	2011 - 12 / 2012 Ongoing		Programme of tree planting within the city continues	Ongoing

Measure	Lead Authority / Focus	Planning / Implementation	Progress	Progress During 2015	Completion Date
CARBOTRAF	EU – Air Monitors Ltd / EU project to bring about real-time reduction in traffic pollution through active traffic management.	2011 ongoing	Participation in EU project (2 cities Glasgow and Graz, Austria) ----- Project completed		2014
Promote Greener Vehicles	The Council will investigate the potential for reduced rate street parking for electric and hybrid vehicles	2012 / Ongoing	Glasgow City Council has introduced a network of public charging points; each point is capable of simultaneously charging 2 vehicles. Charging points have also been provided within council car parking facilities.	GCC now have 84 publically available electric vehicle charge points. Due to the popularity of these, particularly the on-street units, parking charges and time limits will be imposed in Autumn 2016. The electricity consumed will remain free. Further sites continue to be investigated in order to continue to expand the network with particular attention being paid to charging 'hubs'	Ongoing

Measure	Lead Authority / Focus	Planning / Implementation	Progress	Progress During 2015	Completion Date
<p>Leading by Example</p>	<p>The Council will demonstrate best practice in the operation of its vehicle fleet</p>	<p>Ongoing / Ongoing</p>	<p>The Council have introduced a fleet of electric vehicles through a government backed scheme and trained staff in the efficient use of these vehicles.</p> <p>-----</p> <p>The Glasgow ECO Stars Fleet Recognition Scheme is being promoted by Glasgow City Council. The scheme is designed to raise awareness with both public and private organisations of the important role they can play in helping to improve air quality.</p>	<p>Expanded the use of electric vehicles within the fleet including new Nissan Leaf vehicles.</p> <p>'Fuel Efficient Driver' training recently undertaken by 120 members of staff, who regularly drive on business.</p> <p>Council now has a total of 20 electric vehicles and have sought additional funding from transport Scotland to add to this total.</p> <p>The vehicle procurement framework is being reviewed allowing renewed emphasis to be placed on zero and low emissions vehicles.</p> <p>-----</p> <p>The scheme has been operating since September 2014 and has currently recruited 87 members encompassing approximately 5500 fleet vehicles including two of the largest bus companies operating within Glasgow.</p>	<p>Ongoing</p>

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

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