2015 Air Quality Updating and Screening Assessment for **Carlisle City Council**

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

April 2015

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Executive Summary

The Government published the revised Air Quality Strategy for England, Scotland, Wales and Northern Ireland in July 2007. At the centre of this Air Quality Strategy are the use of air quality standards, which enable air quality to be measured and assessed. These standards also provide the means to set air quality objectives and timescales. The air quality objectives had to be achieved between 2003 and 2010.

Local Authorities are required to review and assess the air quality in their areas to determine whether the air quality objectives are likely to be met. Where the likelihood of exceedances of the air quality objectives are identified, in areas of significant public exposure, a detailed assessment of that area will be required. Depending upon the findings, an Air Quality Management Area (AQMA) may need to be declared, followed by a further assessment and the formulation of an Action Plan to help reduce these exceedances.

The three principal pollutants that are currently monitored by Carlisle City Council include; nitrogen dioxide (NO_2), particulate matter (PM_{10} and $PM_{2.5}$) and benzene. For comparison purposes this report presents the most recent results for 2014 and the data collected from previous years. The latest results for PM_{10}, $PM_{2.5}$ and Benzene show that levels remain consistently below the objective levels for these pollutants.

This report represents the first stage of the sixth round of review and assessment of local air quality in Carlisle and the surrounding district. Carlisle City Council has previously undertaken 5 rounds of review and assessment. This has concluded that overall air quality within the district is good. There are, however, small pockets within the city where the annual mean objective level for nitrogen dioxide (NO_2) is being exceeded, mainly due to road traffic sources. As a consequence 6 Air Quality Management Areas have been declared between 2005 and 2008. In 2010 AQMA number 3 was subsequently extended to incorporate more properties along Wigton Road.

Detailed analysis of the new monitoring data for NO_2 indicates that the annual mean concentrations have decreased at many of the monitoring locations across the district, compared to previous years. There are still locations within some of our AQMA's which remain above, or borderline of, the annual mean objective level. The new monitoring data for 2014 has not identified any new locations outside of the AQMA's that have exceeded the objective levels therefore there is no need to proceed to a Detailed Assessment for any pollutant.

This Updating and Screening Assessment identifies any significant changes within the city that may have occurred since the previous rounds of review and assessment. This includes a breakdown of any new or changed emissions sources across the district, as well as any other local changes that may have air quality implications.

New emission sources and exposure risks are dealt with in the planning process. In most cases the prospective developers are asked to demonstrate the likely impacts and appropriate mitigation measures by submitting an Air Quality Impact Assessment (AQIA). If significant new sources or public exposure risks are identified then the City

Council may need to proceed to a Detailed Assessment. This report concludes that there are no new or proposed developments that have predicted impacts which are sufficient to warrant further detailed investigation.

The most significant recent development within the district was the completion of the city bypass known as the Carlisle Northern Development Route (CNDR) in February 2012. The Further Assessment (2007) indicated that the opening of the CNDR would have a major impact on nitrogen dioxide levels along A7 (AQMA 1) bringing levels to below the objective level. A Further Assessment undertaken in 2009 also indicated that the CNDR will have a significant positive impact on air quality along the A595 (AQMA's 3 and 4).

During the first month in which the CNDR was open, indications from traffic counts and local observation suggested that congestion and traffic volume on some of the key arterial routes through the city had reduced substantially. This was immediately followed by significant traffic disruption for around 8 months, due to two new major city centre developments. Despite the added congestion our 2012 monitoring still revealed reductions in NO_2 annual mean concentrations within AQMAS 1 (A7), 3 (Wigton Road) and 4 (Bridge Street). This report provides a second full year of data without such disruption since the opening of the CNDR. The 2014 data shows a significant improvement in all six AQMAS when compared to 2012. In particular there has also been consecutive annual improvement observed during 2013 and 1014 in AQMA's 1 (A7), 2 (Currock Street), 3 (Wigton Road) and 6 (London Road).

Some minor changes were made to the diffusion tube monitoring network in 2012 due to the new major developments on Castle Way and to allow monitoring of NO_2 to begin at residential properties along the route of the CNDR. This report reveals the second full calendar year of monitoring at these locations. It shows that there are no exceedances of the objective at any of the newly identified receptors along the CNDR route. This is due to the distance of these properties from the road, the open rural environment and the free flowing nature of the road traffic. The Air Quality Impact Assessment carried out during the planning stages of the CNDR also supports this conclusion.

In order to enable further comparisons to be drawn as to the long term impact of the CNDR at key locations it is anticipated that the monitoring network will remain unchanged during 2015.

The revised Air Quality Action Plan 2012 is available to view on the City Council website at:
http://www.carlisle.gov.uk/environment_and_waste/environmental_health/air_quality/air_quality_documents.aspx

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1 Introduction

1.1 Description of Local Authority Area

Carlisle City Council is the most northerly of the 6 Cumbrian authorities and covers more than 400 square miles.

The City of Carlisle supports the highest population concentration in Cumbria with over 70,000 people living within the urban area. The rural towns of Brampton and Longtown support the next two highest population concentrations, around 4000 and 2000 respectively. The total recorded population in Carlisle as a whole from the 2011 census is 107’500.

Carlisle is remote from other centres of population being 300 miles from London, more than 120 miles from Manchester, more than 90 miles from Glasgow and Edinburgh, and 60 miles from Newcastle Upon Tyne. Consequently Carlisle is the regional, commercial, administrative and retail centre serving a catchment population of around 450,000 who live within one hour travelling time of the city.

Today’s economy is characterised by food processing, agricultural support, automotive component manufactures and engineering. The dominant sectors are branch operation in warehousing, retailing, manufacturing, public administration and health services.

Carlisle is also a significant transport hub for rail services and the national road transport network.

1.2 Purpose of Report

This report fulfils the requirements of the Local Air Quality Management process as set out in Part IV of the Environment Act (1995), the Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2007 and the relevant Policy and Technical Guidance documents. The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where exceedances are considered likely, the local authority must then 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.

The objective of this Updating and Screening Assessment is to identify any matters that have changed which may lead to risk of an air quality objective being exceeded. A checklist approach and screening tools are used to identify significant new sources or changes and whether there is a need for a Detailed Assessment. The USA report should provide an update of any outstanding information requested previously in Review and Assessment reports.

1.3 Air Quality Objectives

The air quality objectives applicable to LAQM in England are set out in the Air Quality (England) Regulations 2000 (SI 928), The Air Quality (England) (Amendment) Regulations 2002 (SI 3043), and are shown in Table 1.1. This table shows the objectives in units of micrograms per cubic metre μg/m^3 (milligrammes per cubic metre, mg/m^3 for carbon monoxide) with the number of exceedances in each year that are permitted (where applicable).

Table 1.1 Air Quality Objectives included in Regulations for the purpose of LAQM in England

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	16.25 μg/m^3	Running annual mean	31.12.2003
	5.00 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
Lead	0.5 μg/m^3	Annual mean	31.12.2004
	0.25 μg/m^3	Annual mean	31.12.2008
Nitrogen dioxide	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 35 times a year	24-hour mean	31.12.2004
	40 μg/m^3	Annual mean	31.12.2004
Sulphur dioxide	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 Review and Assessments

Since 1996 Carlisle City Council has been monitoring air pollution levels in Carlisle. The council has continuously compared the monitoring results with the national air quality objectives as part of a process known as review and assessment. This work has concluded that air quality within our local authority area is generally very good. For the majority of air pollutants the concentrations found in Carlisle are well below the governments health based objectives and are not of any concern. Unfortunately there are small pockets within the city where the annual mean objective for nitrogen dioxide is not being met due to road traffic emissions. The local authority has subsequently declared six Air Quality Management Areas within the city.

Stage 1 Report 1996 - Concluded that a stage 2 assessment would be required for nitrogen dioxide and particulates

Stage 2 Report 1998 - Concluded that a detailed stage 3 assessment would be required in respect to nitrogen dioxide and particulates.

Stage 3 Report 2000 - Concluded that it was unlikely that an air quality objective would be exceeded.

Updating and Screening Assessment 2003 – Concluded that a detailed assessment would be required for nitrogen dioxide and particulates.

Detailed Assessment 2004 – Concluded that it was likely that the annual mean objective for nitrogen dioxide would be exceeded at locations alongside the A7. As a consequence Air Quality Management Area No.1 was declared in 2005

Progress Report 2005 – Concluded that it was likely that the annual mean objective for nitrogen dioxide would be exceeded at locations alongside Currock Street. As a consequence Air Quality Management Area No.2 was declared in Dec 2006

Updating and Screening Assessment 2006 - Concluded that a detailed assessment would be required in respect to the annual mean nitrogen dioxide at 4 locations within the City i.e. Wigton Rd, Bridge St, London Rd and Dalston Rd.

Progress Report 2007 – Update on air quality issues.

Detailed Assessment 2007 – Concluded that it was likely that the annual mean objective for nitrogen dioxide would be exceeded at locations alongside Wigton Rd, Bridge St, London Rd and Dalston Rd. As a consequence Air Quality Management Areas No's. 3, 4, 5 and 6 were declared in 2008.

Further Assessment Report 2007 – Confirmed that AQMA boundaries for AQMA No's 1 and 2 were correct.

Progress Report 2008 – Update on air quality issues

Further Assessment Report 2009 – Confirmed that the boundaries AQMA's No's. 4- 6 are correct. It recommends that the boundary of AQMA No.3 be extended to the bottom of Caldewgate roundabout.

Updating and Screening Assessment 2009 - Concludes that the existing boundary of AQMA No.3 on Wigton Rd will need to be extended to the Caldewgate roundabout and include properties on Caldcotes.

Progress Report 2010 – Update on Air Quality issues. Confirmed that the recent extension of AQMA No.3 had taken place and gave an update on progress with action plan measures.

Progress Report 2011 – Update on Air Quality issues. Confirmed no further changes required to AQMA's and gave an update on progress with action plan measures.

Updating and Screening Assessment 2012 - Concludes that no further amendments to AQMA's are required. Overall improvement seen in every AQMA compared to previous year. Some minor changes to monitoring network were introduced, to include new receptors on newly built Carlisle Northern Development Route (CNDR).

Action Plan 2012 – Introduced a revised concise set of measures to be implemented over the following 5 years, the main improvement being the opening of the new Carlisle bypass (CNDR).

Progress Report 2013 – This presents the first data set since the opening of the CNDR including reductions in NO_2 annual mean concentrations in AQMA 1 (A7), 3 (Wigton Road) and 4 (Bridge Street). It also revealed new data for new monitoring locations along the CNDR route.

Progress Report 2014 – This presents the second data set since the opening of the CNDR. It outlines further reductions in NO_2 annual mean concentrations within all of the AQMA's.

The following maps show all six of the AQMA's that have been declared in the district. All of the AQMA's have been declared due to exceedances of the nitrogen dioxide annual mean objective. Figure 1.1 shows all of the AQMA's on one large map and the subsequent figures show the individual AQMA's in more detail.

Figure 1.1 Map of all AQMA Boundaries

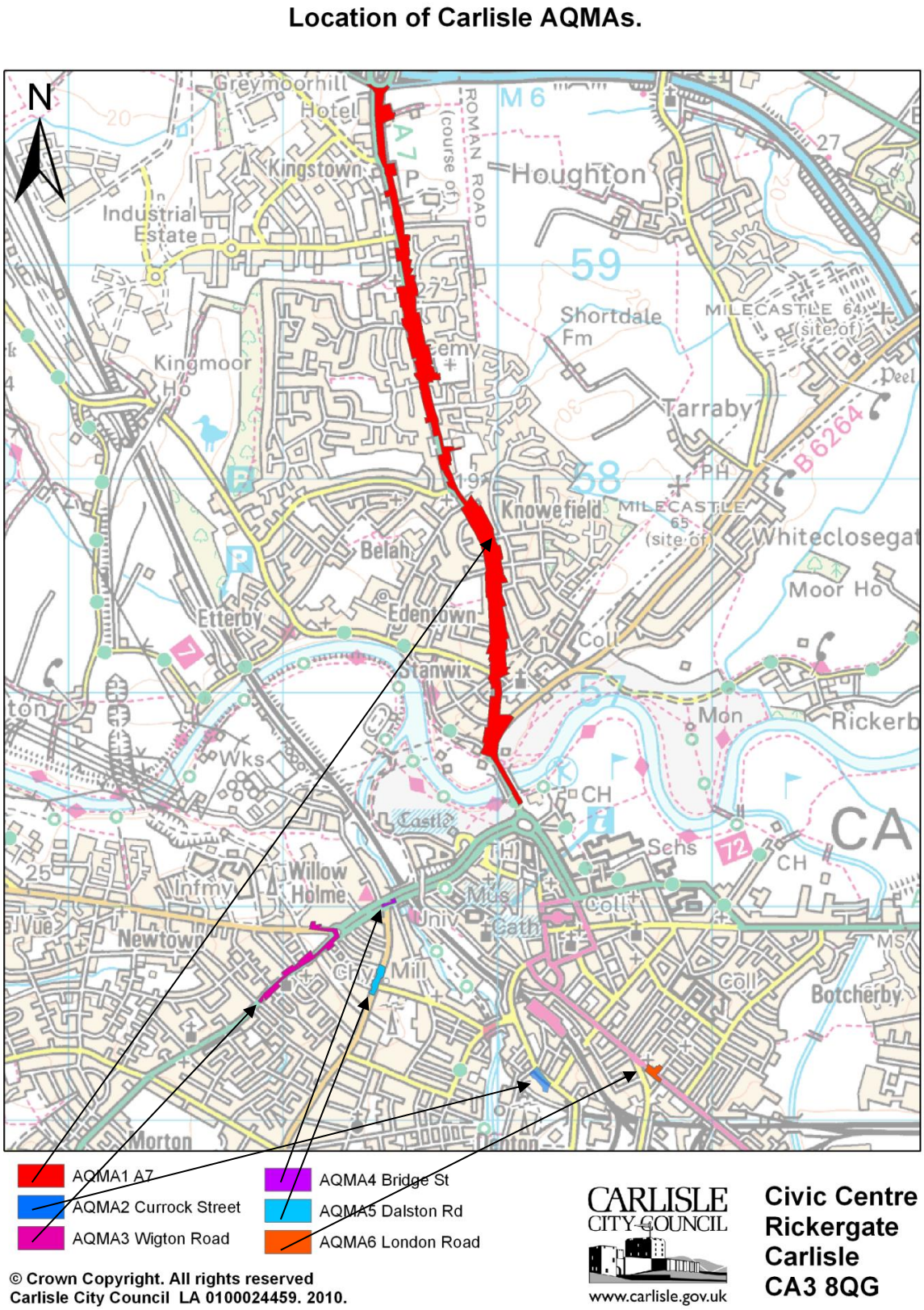
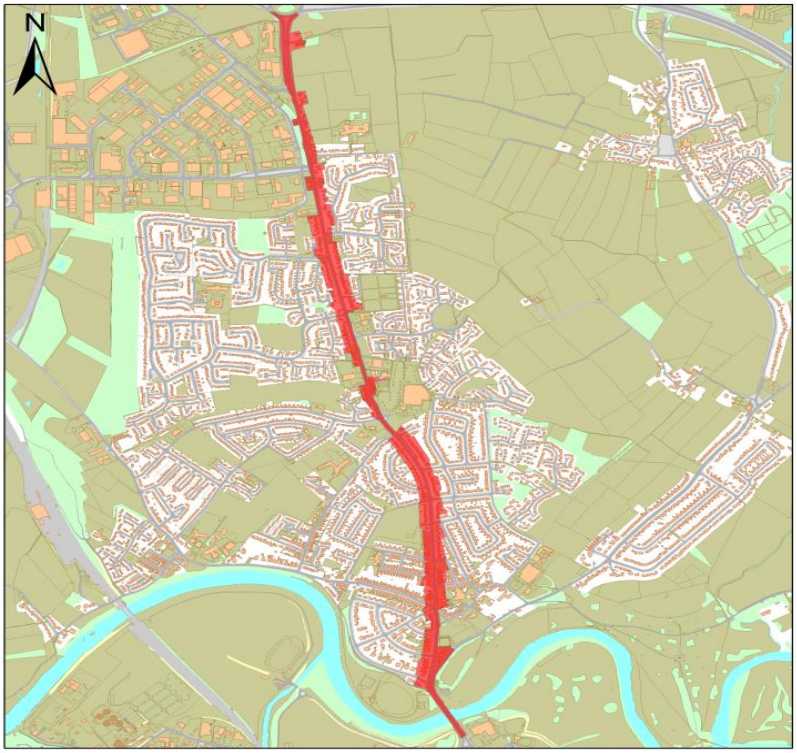


Figure 1.2 Maps of individual AQMA Boundaries

Air Quality Management Area 1 - A7



AQMA1 A7

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Air Quality Management Area 2 - Currock Street.

AQMA2 Currock Street

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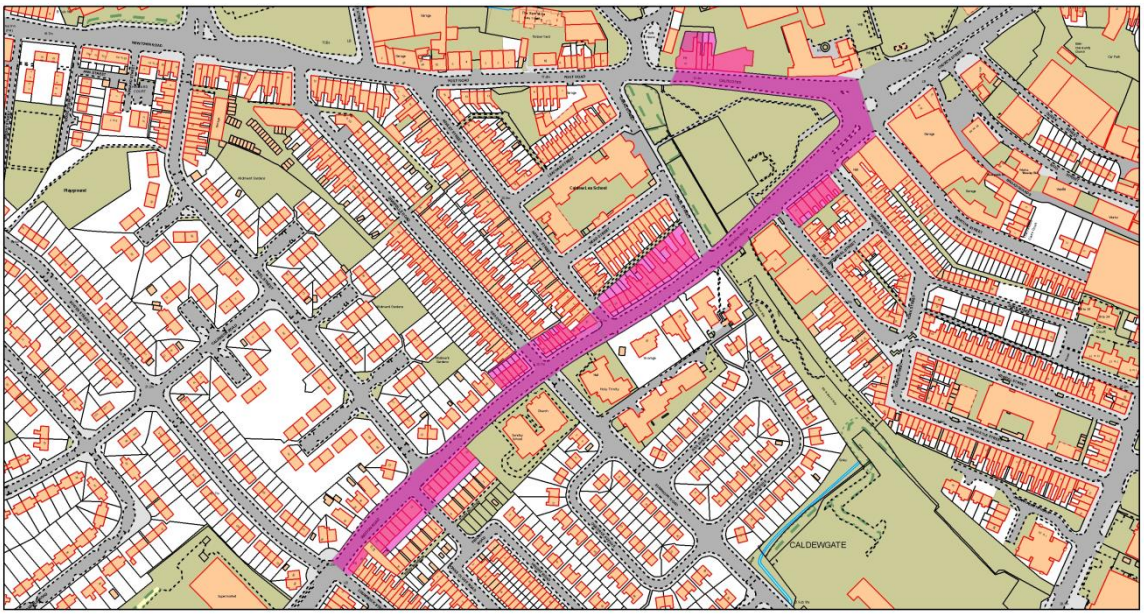
AQMA3 Wigton Road (Extended)



AQMA3 Wigton Road (Extended)

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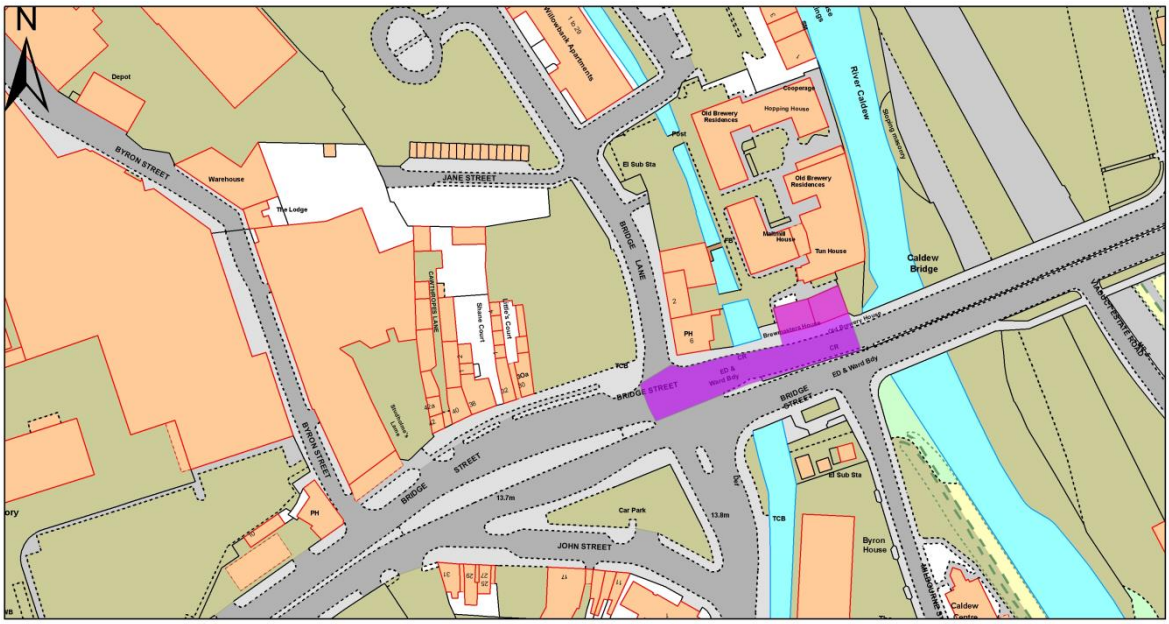
Air Quality Management Area 4 - Bridge Street.



AQMA4 Bridge St

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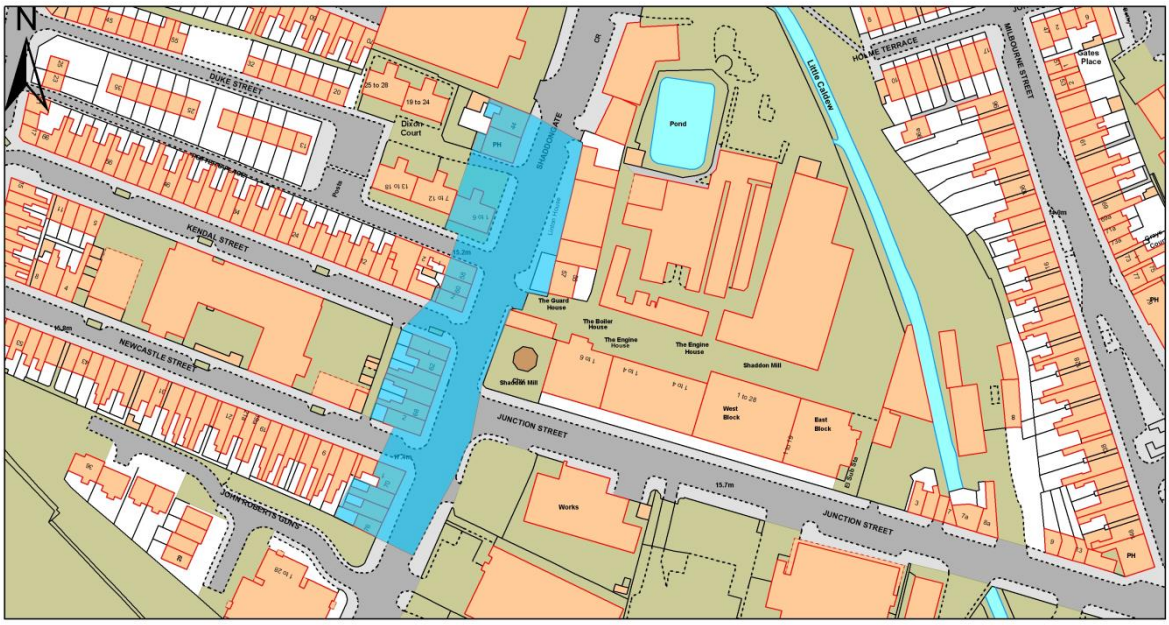
Air Quality Management Area 5 - Dalston Road.



AQMA5 Dalston Rd

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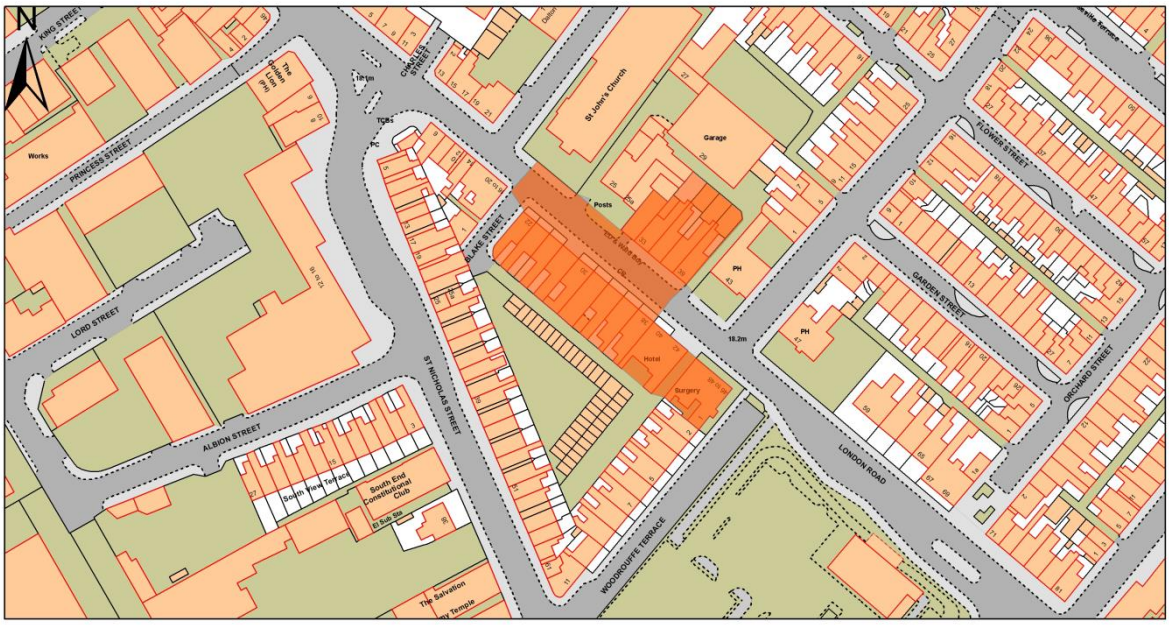
Air Quality Management Area 6 - London Road.



AQMA6 London Road

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2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

Air quality monitoring in Carlisle City Council is driven by the local air quality management process and in particular the review and assessment of air quality. Carlisle City Council currently monitors for 3 pollutants; **nitrogen dioxide, particulates** and **benzene** and employs two principle methods of monitoring; diffusion tubes and continuous monitoring.

Nitrogen dioxide (NO_2) and nitric oxide (NO) are both oxides of nitrogen and are collectively referred to as nitrogen oxides (NO_x). All combustion processes produce NO_x emissions, largely in the form of NO, which is then converted to NO_2, mainly as a result of reaction with ozone in the atmosphere.

The principle source of nitrogen dioxide within the district is road transport.

Particulates are the fraction of suspended airborne particles, these small particles can be breathed into the lungs carrying with them a range of both natural and manmade substances.

Particulate Matter 10 or PM_{10} is the fraction of particulate matter less than 10µm (Ten micrometres) in aerodynamic diameter. This comes from a wide range of sources known as *primary* i.e. combustion processes such as vehicle exhaust emissions, *secondary* i.e. formed in the atmosphere and *course* i.e. from suspended soils, dust and construction etc. In Carlisle the dominating sources are likely to be:

- Local traffic
- Resuspension of road dust
- Agriculture
- Background PM_{10} carried from other parts of the UK and continental Europe.

The $PM_{2.5}$ fraction of particulate matter differs from PM_{10} only in respect of the size of the particles, these particles are much smaller, less than 2.5µm (2.5 micrometres) in aerodynamic diameter. Carlisle City Council began measuring $PM_{2.5}$ at the Paddy's Market monitoring station in March 2009.

Benzene is a recognised genotoxic human carcinogen. The main sources of benzene in the UK are petrol engine vehicles, petrol refining and the distribution and uncontrolled emissions from petrol station forecourts without vapour recovery systems.

Whilst Carlisle City Council does not have any sources within the area which are likely to exceed the objective levels it has been monitoring benzene at the Paddy's Market monitoring station since April 2008, as part of the national Non Automatic Hydrocarbon Network (NAHN).

2.1.1 Automatic Monitoring Sites

There are two continuous monitoring stations in Carlisle. These are located at Paddy's Market and Stanwix Bank.

Paddy's Market site in Caldewgate has been used as a roadside monitoring site since 2005. The pollutants which are automatically measured at the site include:

- Oxides of nitrogen, including nitrogen dioxide (NO_2), using a Chemiluminescent Analyser. The service and maintenance contract for the analyser was undertaken by Supporting U during 2014. This was later moved to Air Monitors Ltd in January 2015.
- Particulate matter (PM10) using a Tapered Element Oscillating Microbalance (TEOM).
- Particulate matter (PM2.5). In March 2009 this additional TEOM used to measure smaller sized particles was installed by Defra.
  (Both TEOM's have since been upgraded to include a Filter Dynamics Measurement System (FDMS) to allow better equivalence to the objective level.)

This site is now partly funded by Defra and since February 2008 the site has been affiliated to the Automatic Urban and Rural Network (AURN). The network quality assurance and control procedures are implemented at the site.

Stanwix Bank site has been in operation since the beginning of 2007 and measures nitrogen dioxide with a chemiluminescent analyser. The data management and the service and maintenance contracts for the site were undertaken by Supporting U Ltd during 2014 on behalf of Carlisle City Council. Supporting U had defined quality assurance and quality control systems in place. The data management contract was moved to RICARDO-AEA and the service and maintenance contract moved to Air Monitors Ltd, both in January 2015.

Daily data from both monitoring stations is available to the public on the Carlisle City Council website.

Appendix A contains further details on our automatic monitoring including information on the co-location study carried out at Paddys Market, as well as all other quality control and quality assurance measures.

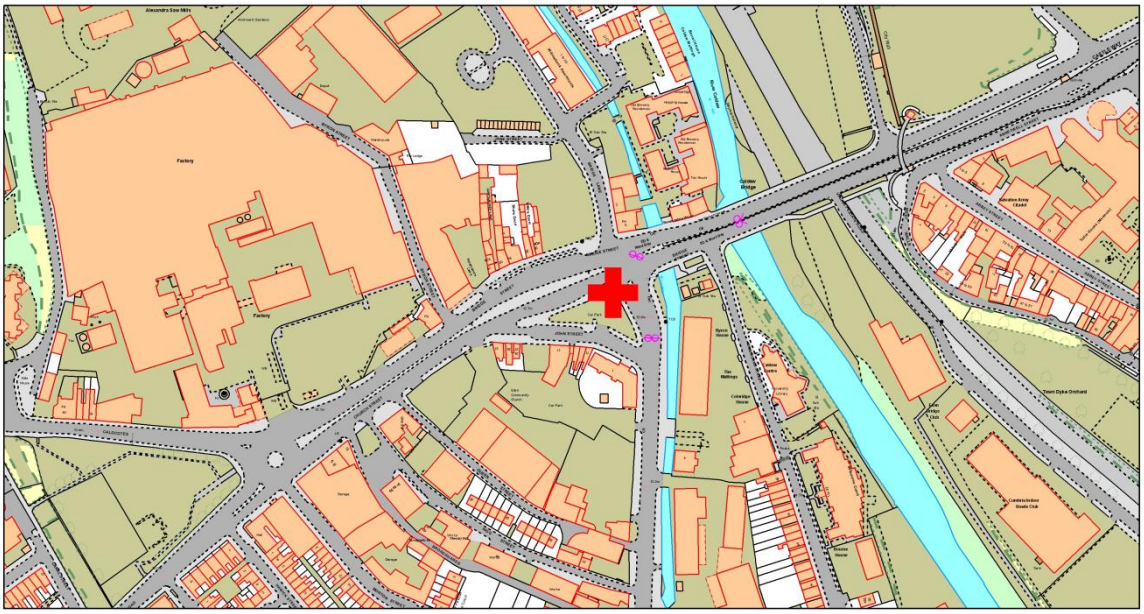
Table 2.1 gives further details of the above sites and the following maps show the locations of the automatic monitoring stations.

Table 2.1 Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	OS Grid Ref		Inlet Height (m)	Pollutants Monitored	Monitoring Technique	In AQMA ?	Relevant Exposure ?	Distance to kerb of nearest road	Does this location represent worst-case exposure?
			X	Y							
PM 1	Paddy's Market	Road side	339467	555974	3	NOx,	Chemiluminescent analyser,	N	N 42m to relevant exposure	4m	Y
					2.9	PM_{10},	TEOM FDMS				
					3	$PM_{2.5}$	TEOM FDMS				
SB 1	Stanwix Bank	Road side	340018	557044	2.2	NOx	Chemiluminescent analyser.	Y	N 15m to relevant exposure	3m	Y

Figure 2.1 Maps of Automatic Monitoring Sites

Paddys Market Automatic Monitoring Station



Scale: 1:2,500

Automatic Monitoring Station

Date: 02/03/2010

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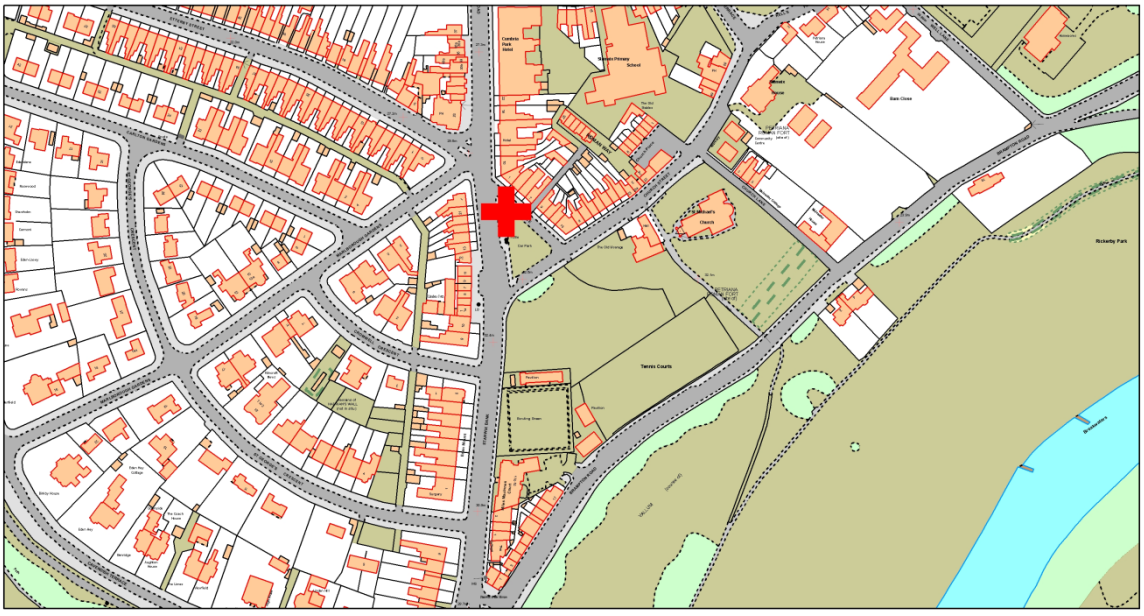
Stanwix Bank Automatic Monitoring Station



Scale: 1:2,500

Automatic Monitoring Station

Date: 02/03/2010

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2.1.2 Non-Automatic Monitoring Sites

Benzene

The council operates a pumped tube benzene sampler which uses sorbent tubes containing Carbopack X. The benzene monitor is located within the Paddy's Market monitoring station and has been in operation since April 2008. It is entirely funded by Defra as part of the UK Non-Automatic Hydrocarbon Network (NAHN).

Nitrogen Dioxide

Carlisle City Council operates an extensive network of Nitrogen Dioxide diffusion tubes across the district. Since February 2009 the council has utilised tubes prepared with 20% Triethanolamine (TEA) in water, prepared and analysed by Gradko Environmental Ltd.

During 2014 the council has obtained a full twelve months of monitoring data from most of the diffusion tube monitoring locations. Some locations have slightly fewer monthly results due to problems with individual tubes such as laboratory issues and dislodging or unauthorised removal of a tube from its mounting.

Monitoring at four new locations on the newly opened Carlisle Northern Development Route began in May 2012. This report presents the data collected for these locations so far.

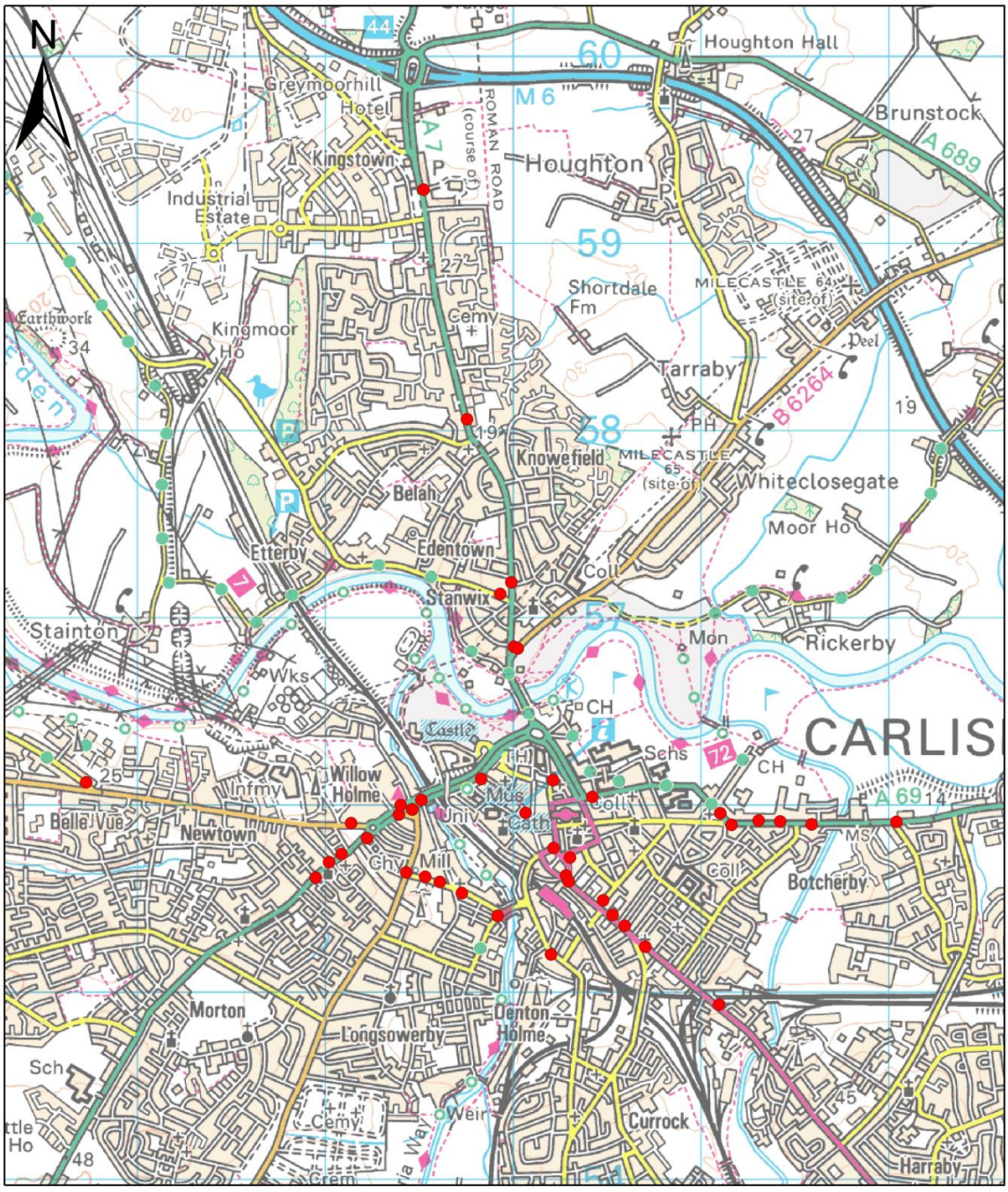
Appendix A contains further details on the NO_2 diffusion tube analysis including bias adjustment and Quality control measures.

All of the monthly diffusion tube results for 2014 can be found in appendix B. The bias adjusted annual mean data and information relating to other calculated results can be found in appendix C.

Further detail relating to each specific monitoring location is provided in Table 2.2.

The majority of the diffusion tube monitoring locations are shown on the following map (Figure 2.2). More close up maps accurately showing each location within each separate monitoring area are provided later in this chapter.

Figure 2.2 Map of Non-Automatic Monitoring Sites



NO2 Diffusion Tube Location Map

NO2 Tube

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Table 2.2 Details of Non-Automatic Monitoring Sites

Site ID	Site Name	Site Type	OS Grid Ref		Site Height (m)	Pollutants Monitored	In AQMA? (AQMA n°)	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road	Does this location represent worst-case exposure?
			X	Y							
A1	45 SCOTLAND RD	Roadside	339995	557188	3.05	NO_2	Y (1)	N	N (4.5)	1.5	Y
A10	STANWIX BANK	Roadside	340008	556842	2.95	NO_2	Y (1)	N	N (1.5)	1.5	Y
A12	14 ETTERBY ST	Roadside	339935	557125	2.8	NO_2	N	N	Y (0)	3	Y
A5	37 KINGSTOWN RD	Roadside	339758	558059	2.8	NO_2	Y (1)	N	Y (0)	4	Y
A7	282 KINGSTOWN RD	Roadside	339526	559285	2.7	NO_2	Y (1)	N	N (7.5)	4	Y
A9	BRAMPTON RD	Roadside	340028	556833	2.75	NO_2	Y (1)	N	Y (0)	1.5	Y
B12	DENTON ST	Kerbside	339921	555406	2.65	NO_2	N	N	N (10)	0.5	Y
B4	DALSTON RD	Roadside	339434	555638	2.8	NO_2	Y (5)	N	Y (0)	3.5	Y
B5	8 JUNCTION ST	Roadside	339613	555587	2.7	NO_2	N	N	Y (0)	2.5	Y
B6	41 CHARLOTTE ST	Roadside	339731	555526	2.75	NO_2	N	N	Y (0)	2.5	Y
B7	12 CURROCK ST	Roadside	340205	555198	3.05	NO_2	Y (2)	N	Y (0)	3	Y
C1	LOWTHER ST	Roadside	340216	556131	2.85	NO_2	N	N	Y (0)	3	Y
C2	TOURIST INFO	Urban Centre	340069	555955	2.7	NO_2	N	N	N	N/A	N
C3	DEVONSHIRE ST	Roadside	340218	555768	2.85	NO_2	N	N	Y (0)	3	Y
C4	BAR SOLO	Roadside	340286	555622	2.7	NO_2	N	N	Y (0)	9	Y
C5	GRIFFIN	Roadside	340298	555589	3	NO_2	N	N	Y (0)	3	Y
D10	368 WARWICK RD	Roadside	342044	555907	2.75	NO_2	N	N	Y (0)	5	Y
D11	CARTREF	Roadside	340426	556040	2.7	NO_2	N	N	Y (0)	4.5	Y
D12	POST OFFICE	Kerbside	340307	555718	2.95	NO_2	N	N	N	5	Y
D5	215 WARWICK RD	Roadside	341310	555914	2.4	NO_2	N	N	Y (0)	9	Y
D7	282 WARWICK RD	Roadside	341593	555893	2.8	NO_2	N	N	Y (0)	7	Y
D9	251 WARWICK RD	Roadside	341426	555910	2.7	NO_2	N	N	Y (0)	8.5	Y

Site ID	Site Name	Site Type	OS Grid Ref		Site Height (m)	Pollutants Monitored	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road	Does this location represent worst-case exposure?
			X	Y							
E22	FINKLE ST	Roadside	339834	556137	2.8	NO_2	N	N	Y (0)	12	Y
E12	3 WIGTON RD	Roadside	339225	555821	2.95	NO_2	Y (3)	N	N (2)	2.5	Y
E15	22 WIGTON RD	Roadside	339091	555736	3.9	NO_2	Y (3)	N	Y (0)	4.5	Y
E16	JOVIAL SAILOR	Roadside	339141	555900	2.7	NO_2	Y (3)	N	Y (0)	2.5	Y
E19	49 WIGTON RD	Roadside	338953	555610	3.1	NO_2	Y (3)	N	Y (0)	2.5	Y
E20	44 WIGTON RD	Roadside	339023	555692	2.5	NO_2	Y (3)	N	Y (0)	5.5	Y
E4	JOHN ST	Roadside	339396	555947	2.75	NO_2	N	N	N (3)	3	Y
E6	PADDYS MARKET 1	Roadside	339467	555974	3	NO_2	N	Y	N (42)	9	Y
E6	PADDYS MARKET 2	Roadside	339467	555974	3	NO_2	N	Y	N (42)	9	Y
E6	PADDYS MARKET 3	Roadside	339467	555974	3	NO_2	N	Y	N (42)	9	Y
E8	BRIDGE ST	Roadside	339516	556024	3.05	NO_2	Y (4)	N	Y (0)	4	Y
E21	BURGH RD	Roadside	337730	556118	2.9	NO_2	N	N	N (8)	3	Y
F1	3 TAIT ST	Roadside	340482	555489	2.7	NO_2	N	N	Y (0)	3.5	Y
F10	155 BOTCHERGATE	Roadside	349597	555351	2.7	NO_2	N	N	Y (0)	3	Y
F5	STANLEY HALL	Roadside	340534	555409	2.7	NO_2	N	N	Y (0)	3	Y
F7	24 LONDON RD	Roadside	340708	555240	2.7	NO_2	Y (6)	N	Y (0)	4.5	Y
F9	129 LONDON RD	Kerbside	341099	554931	2.95	NO_2	N	N	Y (0)	0.5	Y
G1	SPA HOUSE	Rural	338109	557841	2.8	NO_2	N	N	Y (0)	85	Y
G2	KNOCKUPWORTH COTTAGE	Rural	337093	556785	2.9	NO_2	N	N	Y (0)	22	Y
G3	CORNHILL FARM	Roadside	336338	556311	2.9	NO_2	N	N	Y (0)	3	Y
G4	THE HOBBIT	Rural	336905	554036	2.85	NO_2	N	N	Y (0)	19	Y
H1	BRAMPTON	Roadside	352824	561039	2.75	NO_2	N	N	N (0.5)	2.5	Y
H3	LONGTOWN	Roadside	338052	568478	2.8	NO_2	N	N	N (0.5)	2.5	Y
H4	WARWICK BRIDGE	Roadside	347411	556881	2.6	NO_2	N	N	N (0.5)	2.5	Y
H5	WIGTON RD	Roadside	337643	554100	2.4	NO_2	N	N	Y (0)	1.5	Y
H6	PETER LANE	Roadside	337962	553220	2.4	NO_2	N	N	Y (0)	4	Y
H7	DALSTON RD	Roadside	338282	553396	2.4	NO_2	N	N	Y (0)	6.5	Y
H8	AIRPORT	Other	347874	561254	2.4	NO_2	N	N	Y (0)	2	Y

2.2 Comparison of Monitoring Results with AQ Objectives

2.2.1 Nitrogen Dioxide

Automatic Monitoring Data

All 2014 nitrogen dioxide (NO_2) monitoring data from Paddys Market was collected and ratified by RICARDO-AEA. Data from the Stanwix Bank site was collected and ratified by SupportingU Ltd. Monitoring for both sites was undertaken throughout 2014 therefore the data capture is given as the valid data capture for 2014.

There was a significant issue in obtaining the NO_2 data from the Stanwix Bank monitoring unit for 2014. The data from the analyser was collected and managed by Supporting U Ltd. This company entered liquidation on 26 November 2014, as a result the data collected from September – December was not provided to Carlisle City Council. The remaining 8 months of data covers less than 75% of 2014, therefore it required further adjustment in order to estimate the NO_2 annual mean concentration. The methodology and calculations carried out for this data adjustment are given in Box 3.2 of LAQM.TG(09), further information is also contained in appendix A of this report.

The NO_2 data from the Stanwix Bank Unit is now collected and managed by Air Monitors Ltd. The future of the site will be reviewed in April 2016 with a view to potentially removing it from the monitoring programme.

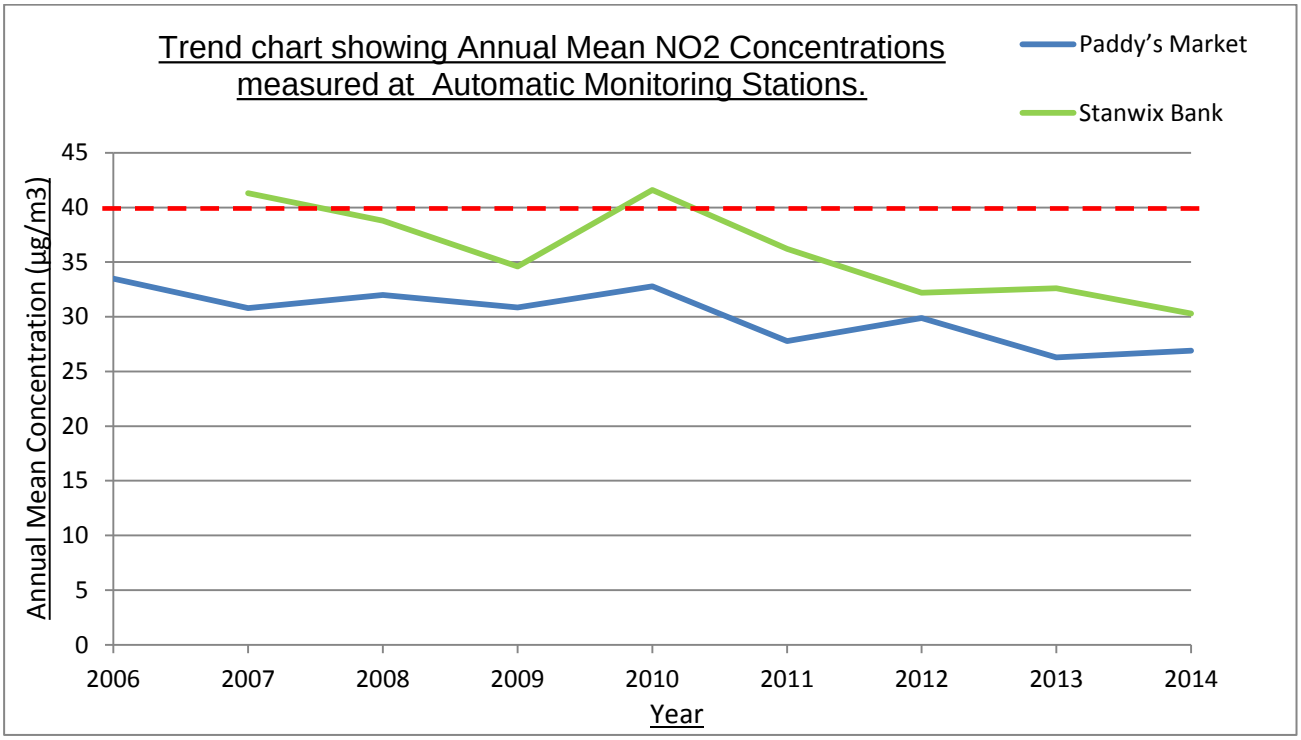
Table 2.3 Results of Automatic Monitoring of Nitrogen Dioxide: Comparison with Annual Mean Objective

Data in red indicates results that exceed the annual mean objective of 40 μg/m^3

Site ID	Site Name	Site Type	Within AQMA?	Valid Data Capture 2014 (%)	Annual Mean Concentration μg/m^3								
					2006	2007	2008	2009	2010	2011	2012	2013	2014
PM1	Paddy's Market	Road side	N	79.1	33.5	30.8	32.0	30.9	32.8	27.8	29.9	26.3	26.9
SB1	Stanwix Bank	Road side	Y	66.3	-	41.3	38.8	34.6	41.6	36.2	32.2	32.6	30.3 (Est)

Figure 2.3 Trends in Annual Mean Nitrogen Dioxide Concentrations measured at Automatic Monitoring Sites

The dashed red line on the following trend chart is used to indicate the annual mean objective of 40 μg/m^3.



The above trend chart indicates that nitrogen dioxide levels at the Paddys Market roadside unit have shown a slow gradual improvement over 9 years of monitoring. The result for 2014 is consistent with the previous year which showed the lowest recorded annual mean since monitoring began in 2006.

The Stanwix Bank unit has shown a gradual reduction in nitrogen dioxide levels between 2007 and 2009. In 2010 there was a sharp increase which is believed to be due to meteorological conditions. Since 2010 the annual means have continued to gradually reduce and the estimated annual mean for 2014 is the lowest since monitoring began in 2007.

Table 2.4 Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with 1-hour mean Objective

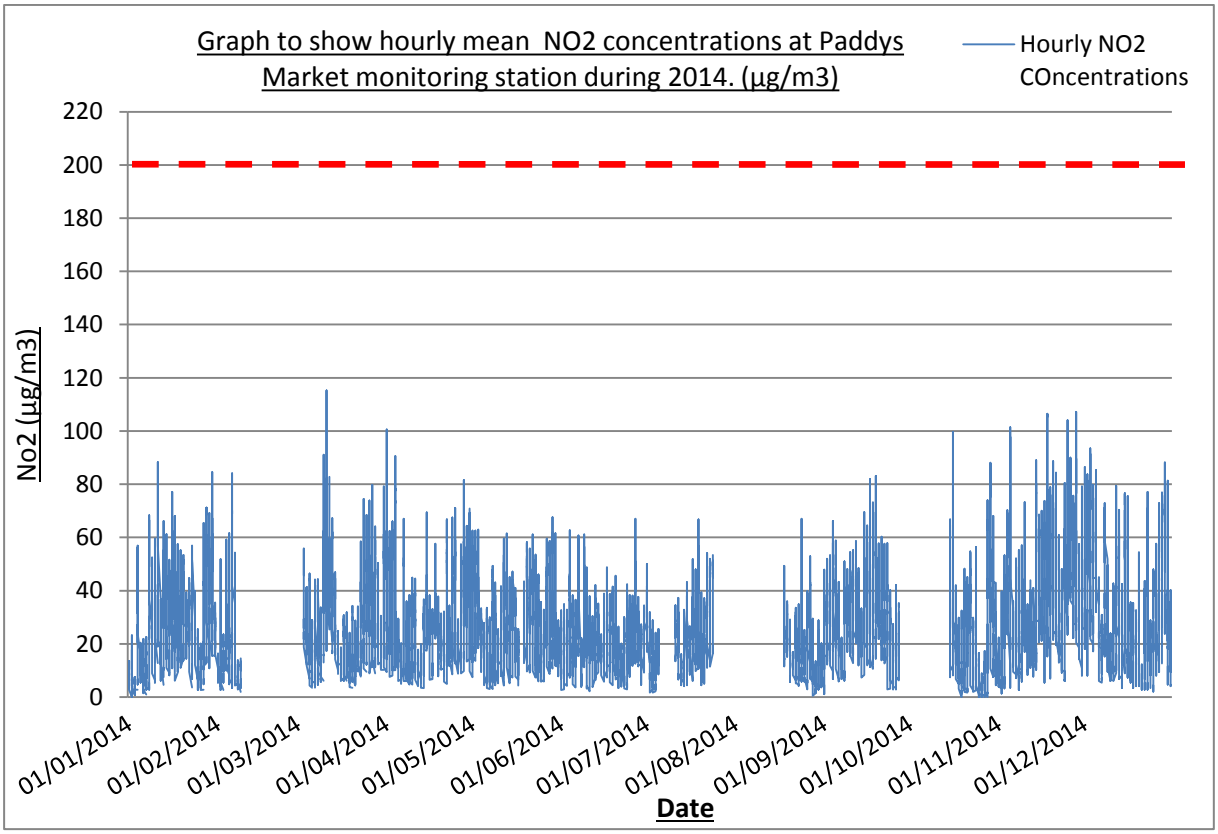
(Results in brackets indicate the 99.8th percentile of the hourly means)

Site ID	Site Name	Site Type	Within AQMA?	Valid Data Capture 2014 (%)	Number of Exceedances of Hourly Mean (200 µg/m³)								
					2006	2007	2008	2009	2010	2011	2012	2013	2014
PM1	Paddy's Market	Road side	N	79.1	0	0	0	0	0	0	0	0	0 (91)
SB1	Stanwix Bank	Road side	Y	66.3	0	0	0	0	0	0	0	0	0 (112)

The 200 µg/m^3 1 hour mean objective for Nitrogen Dioxide should not be exceeded more than 18 times per year, neither of the monitoring sites showed any exceedance of this objective during the periods of monitoring. Figures 2.4 and 2.5 below, display the hourly data collected from both monitoring stations.

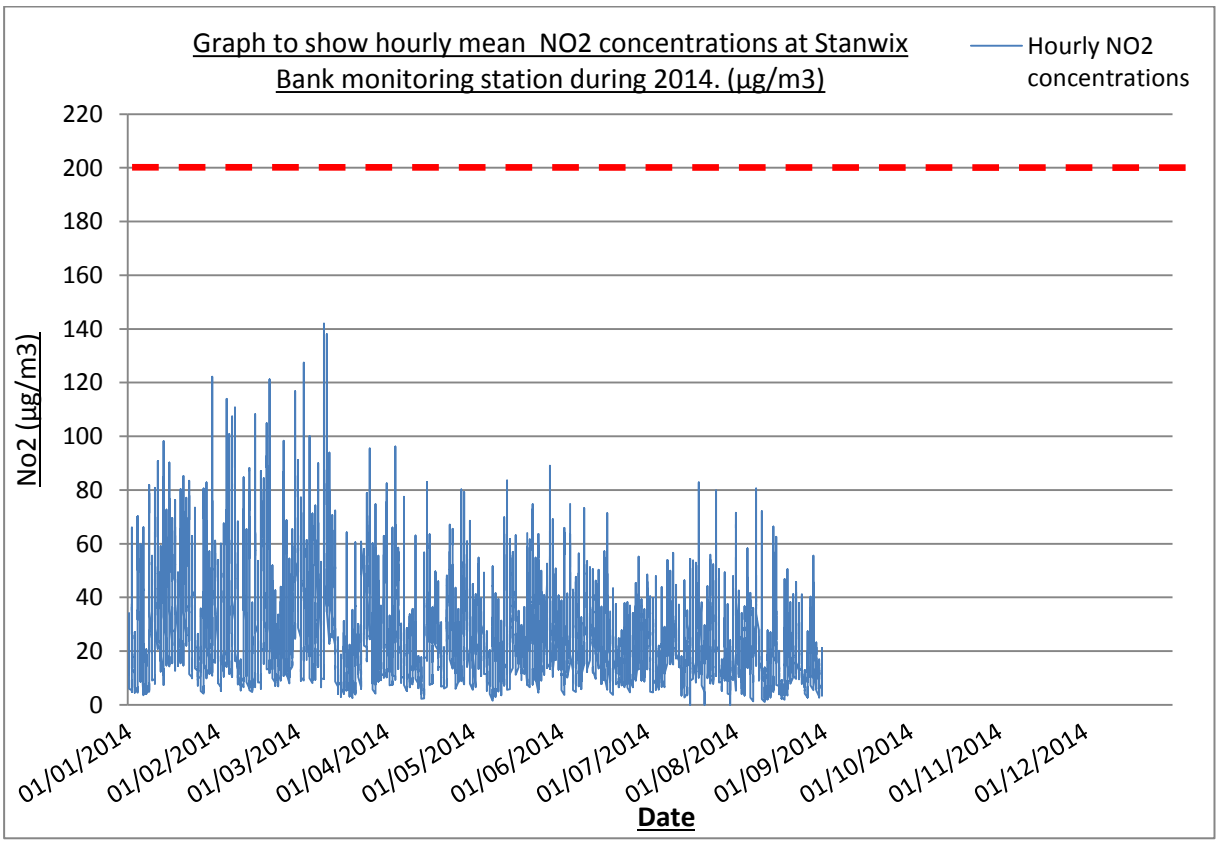
The NO_2 data capture for both sites was less than 90% for 2014. For this reason it is necessary to calculate the 99.8th percentile of the hourly means. The results of this calculation can be seen in brackets in table 2.4 (above). If the 99.8th percentile was in excess of 200µg/m^3 it would indicate an exceedance of the overall 1 hour mean objective level. The results show that both sites are significantly below this level. There is therefore no indication that the 1 hour mean objective level was likely to be exceeded.

Figure 2.4 Results of Hourly Automatic Monitoring for Nitrogen Dioxide: Comparison with 1- hour Mean Objective at Paddys Market:



The graph above shows that there were no recorded exceedances of the 1 hour mean objective for Nitrogen Dioxide during 2014. The highest reading at the Paddys Market site was 115µg/m^3.

Figure 2.5 Results of Hourly Automatic Monitoring for Nitrogen Dioxide: Comparison with 1- hour Mean Objective at Stanwix Bank:



The graph above shows that there were no recorded exceedances of the 1 hour mean objective for Nitrogen Dioxide during 2014. The highest reading at the Stanwix Bank site was 142µg/m3.

The results of the Automatic Monitoring for Nitrogen Dioxide during 2014 shows that there is no risk of exceeding the annual mean or 1 hour objective levels, at either monitoring location.

Diffusion Tube Monitoring Data

All of the 50 diffusion tube locations had a monitoring period of 12 months and all obtained at least 10 months of valid data during 2014. The annual mean for each of these monitoring locations has been adjusted using the national bias adjustment factor of 0.91. (See appendix A for details).

In some cases it is not possible to carry out monitoring directly at a point of relevant public exposure such as the facade of a residential property, in these cases monitoring was undertaken at the nearest feasible location such as a nearby lamp post. In these cases it has been necessary to distance correct the data in order to predict the NO_2 concentration at the nearest receptor using the methodology given in Box 2.3 of LAQM.TG(09). The locations where this calculation has been applied are identified below in table 2.5.

Table 2.5 Results of Nitrogen Dioxide Diffusion Tubes.

Data shown in red indicates a result which has exceeded the annual mean objective of 40μg/m^3. Data shown is distance corrected where necessary.

Site ID	Location	Site Type	Within AQMA (Y/N)	Triplicate / Co-located Tube	Data Capture for 2014 (%)	Has data been distance corrected (Y/N)	Annual mean concentration 2014 (μg/m^3) (Bias Adjustment factor = 0.91)
A1	45 SCOTLAND RD	Roadside	✓	N	100	Y	28.9
A10	STANWIX BANK	Roadside	✓	N	100	Y	36.8
A12	14 ETTERBY ST	Roadside	x	N	100	N	19.87
A5	37 KINGSTOWN RD	Roadside	✓	N	83	N	32.35
A7	282 KINGSTOWN RD	Roadside	✓	N	100	Y	20.8
A9	BRAMPTON RD	Roadside	✓	N	100	N	36.50
B12	DENTON ST	Kerbside	x	N	92	Y	24.9
B4	DALSTON RD	Roadside	✓	N	100	N	44.76
B5	8 JUNCTION ST	Roadside	x	N	100	N	28.96
B6	41 CHARLOTTE ST	Roadside	x	N	92	N	30.84
B7	12 CURROCK ST	Roadside	✓	N	100	N	36.84
C1	LOWTHER ST	Roadside	x	N	100	N	31.76
C2	TOURIST INFO	Urban Centre	x	N	100	N	24.00
C3	DEVONSHIRE ST	Roadside	x	N	100	N	31.77
C4	BAR SOLO	Roadside	x	N	92	N	32.82
C5	GRIFFIN	Roadside	x	N	100	N	34.95
D10	368 WARWICK RD	Roadside	x	N	100	N	28.15
D11	CARTREF	Roadside	x	N	100	N	31.89
D12	POST OFFICE	Kerbside	x	N	100	N	38.59
D5	215 WARWICK RD	Roadside	x	N	100	N	23.24
D7	282 WARWICK RD	Roadside	x	N	100	N	32.24
D9	251 WARWICK RD	Roadside	x	N	100	N	28.19

Site ID	Location	Site Type	Within AQMA (Y/N)	Triplicate / Co-located Tube	Data Capture for 2014 (%)	Has data been distance corrected (Y/N)	Annual mean concentration 2014 (μg/m^3) (Bias Adjustment factor = 0.91)
E22	FINKLE ST	Roadside	x	N	100	N	33.43
E12	3 WIGTON RD	Roadside	✓	N	92	Y	33.4
E15	22 WIGTON RD	Roadside	✓	N	100	N	31.02
E16	JOVIAL SAILOR	Roadside	✓	N	92	N	34.85
E19	49 WIGTON RD	Roadside	✓	N	92	N	38.19
E20	44 WIGTON RD	Roadside	✓	N	100	N	31.97
E4	JOHN ST	Roadside	x	N	100	Y	34.1
E6	PADDYS MARKET 1	Roadside	x	Triplicate & Co-located	100	N	31.29
E6	PADDYS MARKET 2	Roadside	x	Triplicate & Co-located	100	N	30.91
E6	PADDYS MARKET 3	Roadside	x	Triplicate & Co-located	100	N	29.75
E8	BRIDGE ST	Roadside	✓	N	100	N	44.46
E21	BURGH RD	Roadside	x	N	100	Y	14.8
F1	3 TAIT ST	Roadside	x	N	100	N	29.06
F10	155 BOTCHERGATE	Roadside	x	N	100	N	37.34
F5	STANLEY HALL	Roadside	x	N	83	N	33.36
F7	24 LONDON RD	Roadside	✓	N	100	N	35.29
F9	129 LONDON RD	Kerbside	x	N	100	N	32.08
G1	SPA HOUSE	Rural	x	N	100	N	12.58
G2	KNOCKUPWORTH COTTAGE	Rural	x	N	100	N	13.50
G3	CORNHILL FARM	Roadside	x	N	100	N	11.25
G4	THE HOBBIT	Rural	x	N	100	N	14.58
H1	BRAMPTON	Roadside	x	N	100	Y	16.7
H3	LONGTOWN	Roadside	x	N	100	Y	21.4
H4	WARWICK BRIDGE	Roadside	x	N	100	Y	28.5
H5	WIGTON RD	Roadside	x	N	92	N	17.50
H6	PETER LANE	Roadside	x	N	100	N	11.38
H7	DALSTON RD	Roadside	x	N	100	N	16.76
H8	AIRPORT	Other	x	N	100	N	8.41

The table above shows that during 2014 a small number of the annual mean concentrations for NO_2 have exceeded or are borderline of the 40μg/m^3 objective level. These results will be discussed later in this section.

An annual mean of 60μg/m^3 or above is the equivalent indicator level for the likelihood of exceedance of the hourly mean objective of 200 μg/m^3. The data shows that none of the annual means exceeded 60μg/m^3. It can therefore be concluded that there has been no indication of any exceedance of the hourly mean objective at any location.

Trends in Annual Mean Nitrogen Dioxide Concentration Measured at Diffusion Tube Monitoring Sites.

The diffusion tube locations are divided into geographical areas of the city, including areas A, B, C, D, E, F, G and H. The following section looks at each of these areas individually. For each area there is a map showing each monitoring location, a table showing all previous annual mean NO_2 concentrations and a trend chart displaying this data. Results in (brackets) indicate the distance corrected annual mean for the 10 locations that are not relevant to public exposure. In these cases the associated trend charts show the bias adjusted annual mean results from the actual location, not the nearest receptor, as this is always the highest figure.

Area A – A7 Stanwix Bank, Scotland Rd and Kingstown Rd (AQMA No1)

Figure 2.6 Map of diffusion tube locations in area A.

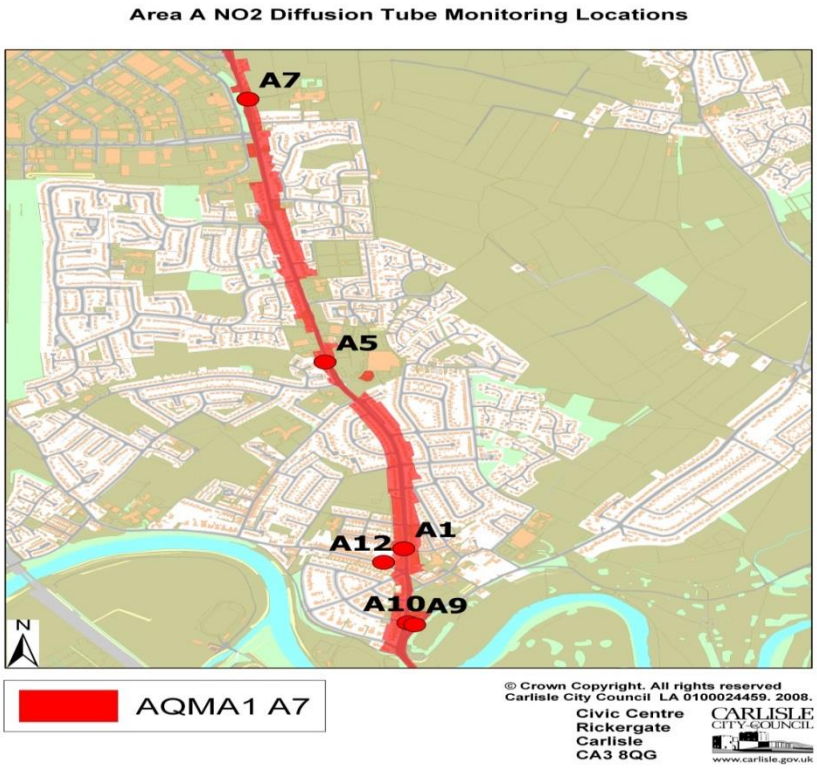
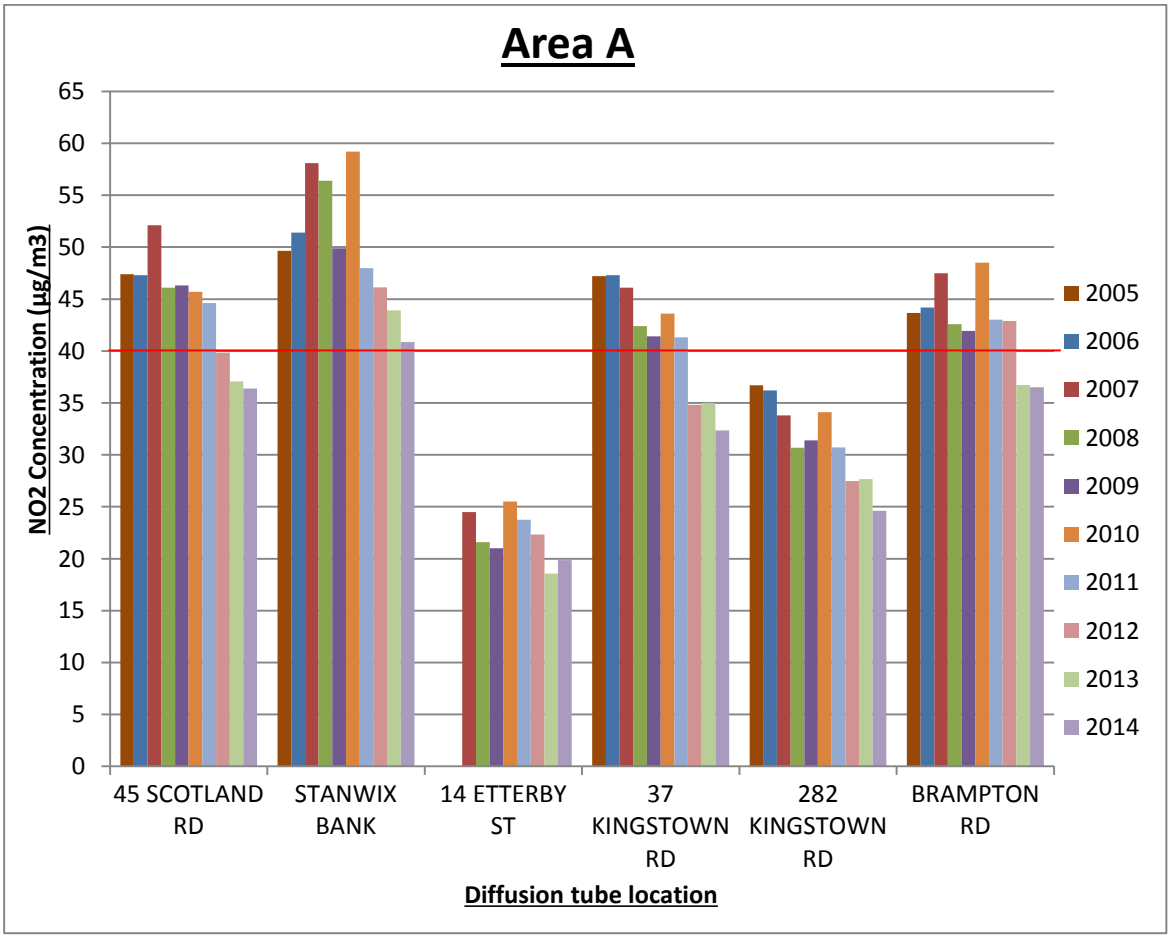


Table 2.5a NO_2 diffusion tube results at monitoring locations in area A.

SITE ID	LOCATION	Site Type	Within AQMA?	ANNUAL MEAN CONCENTRATIONS ADJUSTED FOR BIAS (µg/m3)									
				2005 (0.81)	2006 (0.87)	2007 (0.89)	2008 (0.82)	2009 (0.86)	2010 (0.92)	2011 (0.89)	2012 (0.97)	2013 (0.95)	2014 (0.91)
A1	45 SCOTLAND RD	Road side	✓	47.4	47.3	52.1	46.1 (43.4)	46.3 (35.8)	45.7 (35.6)	44.6 (34.6)	39.8 (31.8)	37.1 (29.7)	36.4 (28.9)
A10	STANWIX BANK	Road side	✓	49.7	51.4	58.1	56.4	49.9 (44.8)	59.2 (52.5)	48 (42.9)	46.1 (41.5)	43.9 (39.6)	40.9 (36.8)
A12	14 ETTERBY ST	Road side	x	-	-	24.5	21.6	21.0	25.5	23.8	22.3	18.6	19.9
A5	37 KINGSTOWN RD	Road side	✓	47.2	47.3	46.1	42.4	41.4	43.6	41.3	34.8	35	32.4
A7	282 KINGSTOWN RD	Road side	✓	36.7	36.2	33.8	30.7 (28.3)	31.4 (26.4)	34.1 (27.1)	30.7 (25.4)	27.5 (23.4)	27.7 (23.3)	24.6 (20.8)
A9	BRAMPTON RD	Road side	✓	43.7	44.2	47.5	42.6	41.9	48.5	43.0	42.9	36.7	36.5

Figure 2.7 Chart showing NO_2 diffusion tube trends at monitoring locations in area A



Results indicate that, for the second year running, there is only one location (A10) within AQMA 1 that remains above the NO_2 annual mean objective level. When distance correction is applied for the nearest residential receptor the annual mean is also below the objective level at the receptor location.

During 2012 the measured levels at locations A1 and A5 dropped below the objective level for the first time since monitoring began. These locations have both shown further reductions in 2014. Location A9 also fell below the objective for the first time during 2013, this has remained the case in 2014.

The above results show that the annual mean concentrations decreased at every location over consecutive years between 2010 and 2012. Results for 2014 now show a further improvement when compared to the 2012 levels at every location.

The opening of the CNDR in February 2012 was expected to bring a sustained reduction in traffic flows along this particular main route. It would appear that since this time the traffic volume has reduced and there is evidence of a reduction in the NO_2 annual means at all locations in this area. The traffic and air quality data will continue to be monitored and reported upon in Progress Report 2016. There is no proposal to amend AQMA 1 at this stage.

Results indicate that there are no locations within this area that are likely to have exceeded the 1 hour mean objective level for nitrogen dioxide. This is supported by results from the Stanwix Bank automatic monitoring station, in this area.

Area B – Currock St, Victoria Viaduct, Charlotte St, Junction St and Dalston Rd (Includes AQMA No.2 and No.5)

Figure 2.8 Map of diffusion tube locations in area B

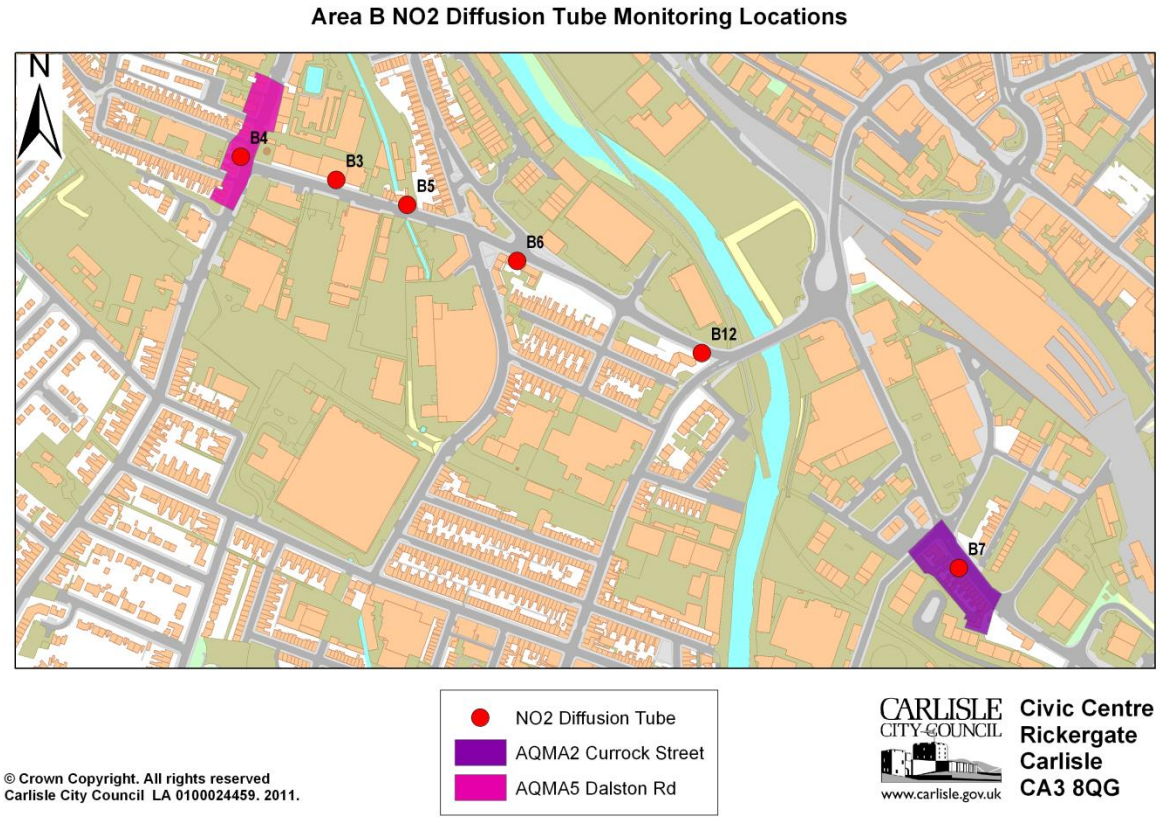
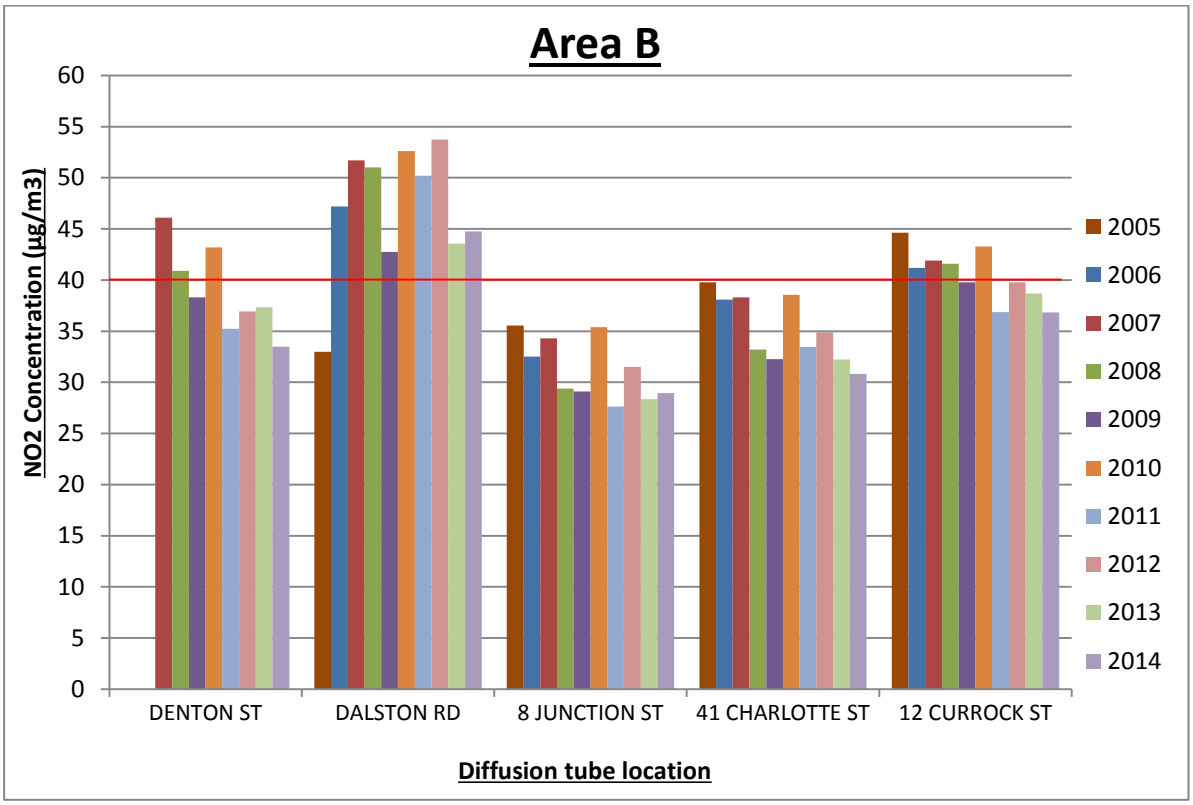


Table 2.5b NO_2 diffusion tube results at monitoring locations in area B.

SITE ID	LOCATION	Site Type	Within AQMA?	ANNUAL MEAN CONCENTRATIONS ADJUSTED FOR BIAS (µg/m3)									
				2005 (0.81)	2006 (0.87)	2007 (0.89)	2008 (0.82)	2009 (0.86)	2010 (0.92)	2011 (0.89)	2012 (0.97)	2013 (0.95)	2014 (0.91)
B12	DENTON ST	Kerb Side	x	-	-	46.1	40.9 (25.9)	38.3 (35.0)	43.2 (33.6)	35.2 (29.5)	36.9 (31.3)	37.3 (31.0)	33.5 (24.9)
B4	DALSTON RD	Road side	✓	33.0	47.2	51.7	51	42.8	52.6	50.2	53.7	43.6	44.8
B5	8 JUNCTION ST	Road side	x	35.6	32.5	34.3	29.4	29.1	35.4	27.6	31.5	28.4	29.0
B6	41 CHARLOTTE ST	Road side	x	39.8	38.1	38.3	33.2	32.3	38.6	33.5	34.9	32.2	30.8
B7	12 CURROCK ST	Road side	✓	44.6	41.2	41.9	41.6	39.8	43.3	36.9	39.8	38.7	36.8

Figure 2.9 Chart showing NO_2 diffusion tube trends at monitoring locations in area B



Results in this area show that during 2014 NO_2 concentrations at most locations along this main traffic route have decreased from the previous year and the majority of locations remain below the objective level. Location B4 (Dalston Road) is the only location in this area that remains above the objective, it has shown a slight increase on the previous year and is located within AQMA 5.

As with all other locations in this area the annual mean NO2 concentration at location B7 (Currock St) (AQMA No.2) increased slightly in 2012. It is likely that this was due to nearby construction work which led to major traffic disruption and increased HGV movements between March and October 2012. The subsequent two years have shown improvement and 2014 has shown the lowest annual mean since 2005.

Carlisle City Council has worked with Cumbria County Council to develop a revised Action Plan. This aims to reduce nitrogen dioxide levels along Dalston Rd (AQMA No5) and Currock Street (AQMA No.2). The final Action Plan was approved by Carlisle City Council's Executive Committee in July 2012.

Results indicate that there are no locations within this area that are likely to have exceeded the 1 hour mean objective level for nitrogen dioxide.

Area C – City Centre Locations

Figure 2.10 Map of diffusion tube locations in area C

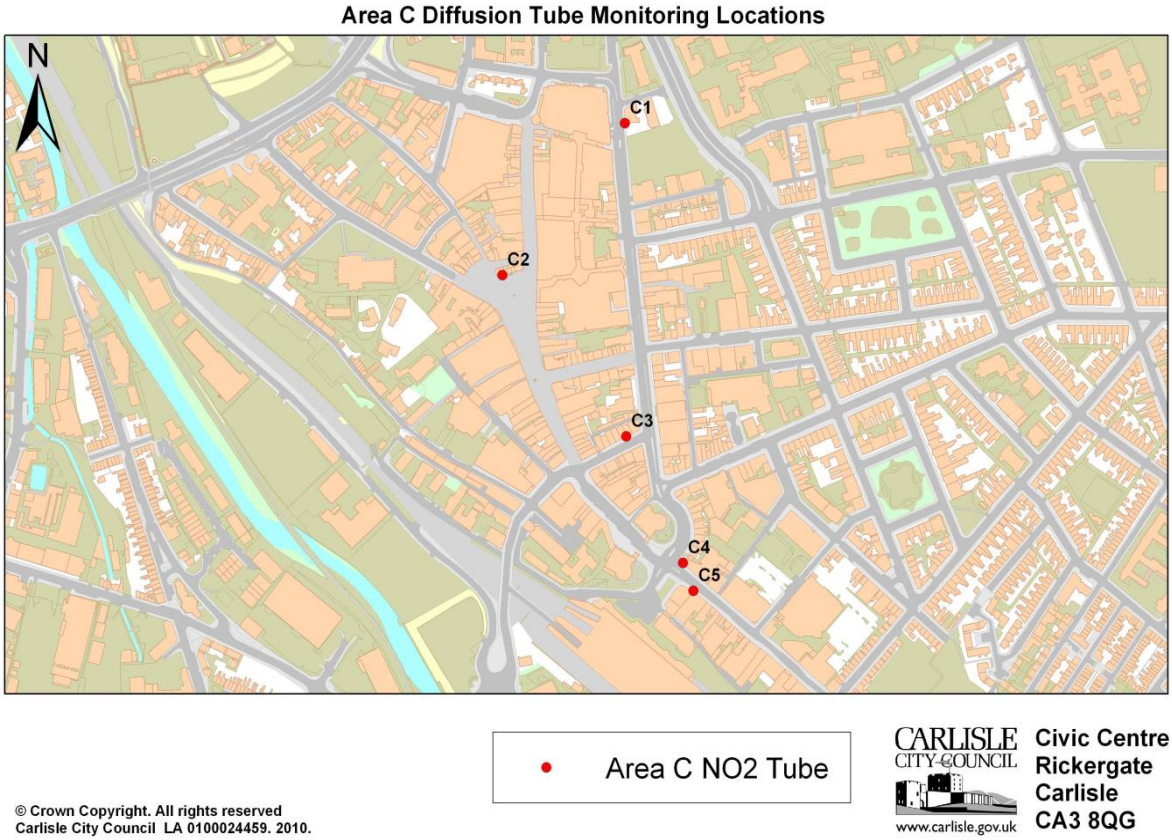
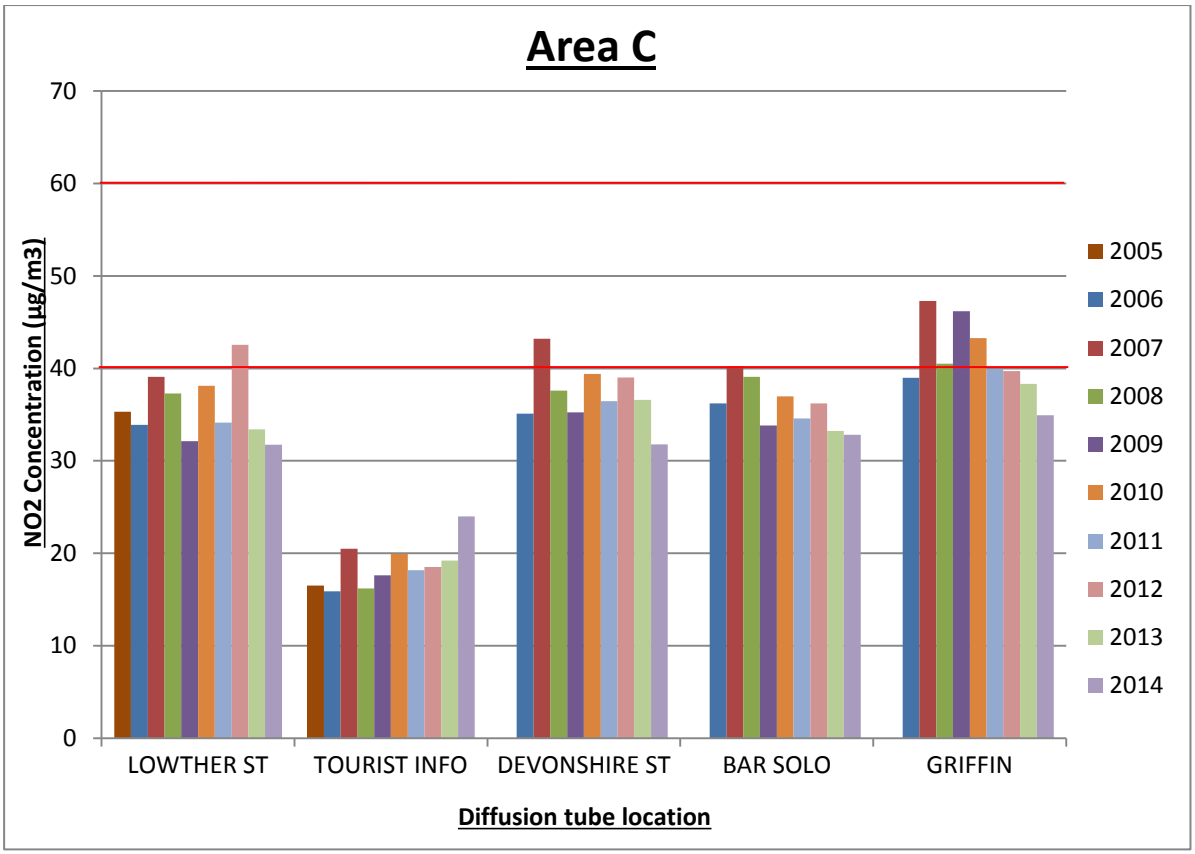


Table 2.5c NO_2 diffusion tube results at monitoring locations in area C.

SITE ID	LOCATION	Site Type	Within AQMA?	ANNUAL MEAN CONCENTRATIONS ADJUSTED FOR BIAS (µg/m3)									
				2005 (0.81)	2006 (0.87)	2007 (0.89)	2008 (0.82)	2009 (0.86)	2010 (0.92)	2011 (0.89)	2012 (0.97)	2013 (0.95)	2014 (0.91)
C1	LOWTHER ST	Road side	x	35.3	33.9	39.1	37.3	32.1	38.1	34.1	42.6	33.4	31.8
C2	TOURIST INFO	Urban Centre	x	16.5	15.9	20.5	16.2	17.6	19.9	18.2	18.5	19.2	24.0
C3	DEVONSHIRE ST	Road side	x	-	35.1	43.2	37.6	35.2	39.4	36.5	39.0	36.6	31.8
C4	BAR SOLO	Road side	x	-	36.2	40.2	39.1	33.8	37.0	34.6	36.2	33.2	32.8
C5	GRIFFEN	Road side	x	-	39	47.3	40.5	46.2	43.3	40.0	39.7	38.3	34.9

Figure 2.11 Chart showing NO_2 diffusion tube trends at monitoring locations in area C



The majority of these city centre locations show a reduction in NO_2 concentrations when compared to 2013. All locations continue to show annual mean results below the relevant objective levels. There are no AQMA's in this area.

Location C1 is a hostel on Lowther Street with residential bedsits on the first and second floors, it is the only residential location monitored in this area. For this reason it is the only result that should be compared to the annual mean objective of 40μg/m^3. The data shows that this location exceeded the objective for the first time in 2012. It is likely that this was due to an increased volume of traffic being diverted onto Lowther Street from March to October 2012. This was due to the major road works associated with the nearby Sainsbury's development. Since then there has been a significant reduction in the annual mean concentrations, as predicted in Progress report 2013. It was not necessary to proceed to a 'detailed assessment' at this location due to the temporary nature of the exceedance.

Locations C2 – C5 cover the main shopping and outdoor cafe areas within the centre of Carlisle, which are located near busy roads. These results should therefore only be compared to the 1 hour mean objective level of 200 µg/m^3 for nitrogen dioxide, which is equivalent to an annual mean of 60μg/m^3. This is due to the likelihood of people spending extended periods of time in these areas, for example, shopping, drinking and dining outdoors. All are significantly below the hourly objective level.

Tube C2 is located in the main shopping area in the heart of the city centre. The area is a pedestrianised shopping precinct and represents an urban centre location. The 2014 annual mean shows an increase, this is likely to have been influenced by recent development work on adjacent buildings. Under normal circumstances there are very few vehicle and HGV movements in this part of the city centre. This location has consistently shown no indication of exceeding the hourly objective.

Area D A69 – Warwick Rd

Figure 2.12 Map of diffusion tube locations in area D.

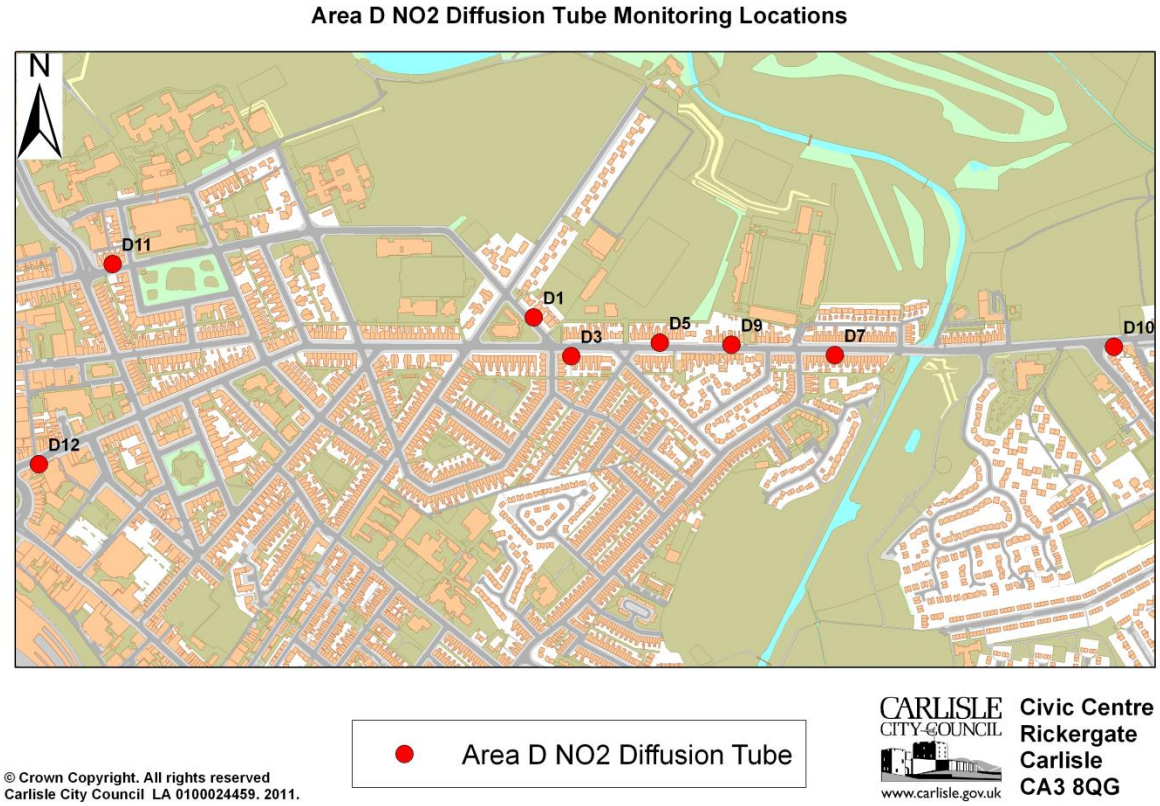
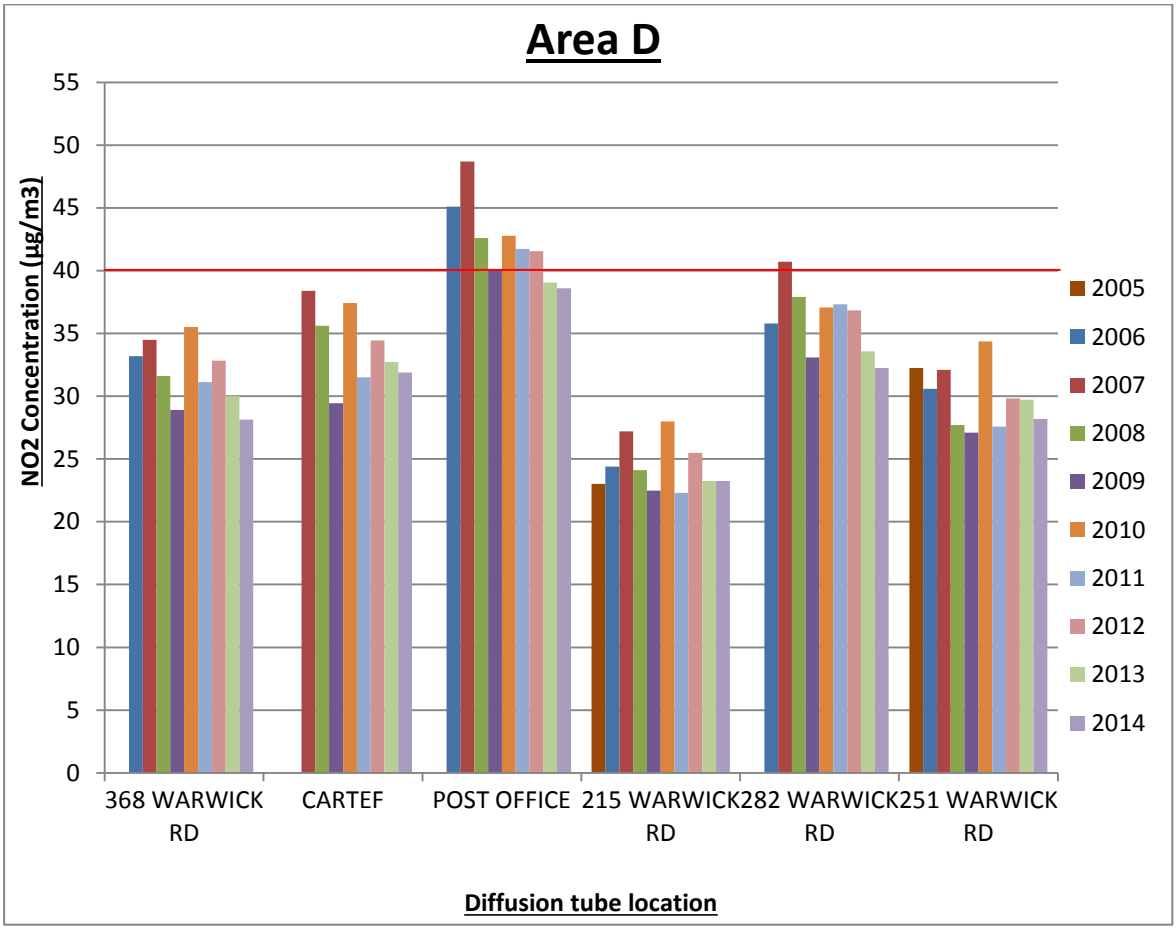


Table 2.5d NO_2 diffusion tube results at monitoring locations in area D.

SITE ID	LOCATION	Site Type	Within AQMA?	ANNUAL MEAN CONCENTRATIONS ADJUSTED FOR BIAS (µg/m3)									
				2005 (0.81)	2006 (0.87)	2007 (0.89)	2008 (0.82)	2009 (0.86)	2010 (0.92)	2011 (0.89)	2012 (0.97)	2013 (0.95)	2014 (0.91)
D10	368 WARWICK RD	Road side	x	-	33.2	34.5	31.6	28.9	35.5	31.1	32.8	30	28.1
D11	CARTEF	Road side	x	-	-	38.4	35.6	29.4	37.4	31.5	34.4	32.7	31.9
D12	POST OFFICE	Kerb Side	x	-	45.1	48.7	42.6	40.1	42.8	41.7	41.6	39.1	38.6
D5	215 WARWICK RD	Road side	x	23.0	24.4	27.2	24.1	22.5	28.0	22.3	25.5	23.3	23.2
D7	282 WARWICK RD	Road side	x	-	35.8	40.7	37.9	33.1	37.1	37.3	36.8	33.6	32.2
D9	251 WARWICK RD	Road side	x	32.2	30.6	32.1	27.7	27.1	34.4	27.6	29.8	29.7	28.2

Figure 2.13 Chart showing NO_2 diffusion tube trends at monitoring locations in area D



The NO_2 annual mean concentrations in this area have decreased at all locations compared to 2013. All locations in this area continue to show annual mean concentrations that are below the relevant objective level.

The location with the highest annual mean is D12 (Post Office). This location is not a residential property, although it is a place where people may spend an hour or more outdoors. Works have taken place to turn this old Post Office building into a boutique hotel with outdoor seating. Given the new use for the building the annual mean results should continue to be compared to the 1 hour mean objective level for nitrogen dioxide which is equivalent to an annual mean of 60$\mu g/m^3$. This location has consistently shown no indication of exceeding the hourly mean objective. Monitoring will continue to ensure that any potential future exceedances are detected.

Tube D7 is located on a residential property and has shown a borderline result in the past. Improvements have been revealed year on year since 2011, it is therefore no longer considered borderline. Monitoring at this location will continue in the same way during 2015.

Results indicate that there are no locations within this area that are at risk of exceeding the objective levels for nitrogen dioxide and there is therefore no need to proceed to a 'Detailed Assessment'.

Area E - A595 Caldewgate, Wigton Rd and Newtown Rd (includes AQMA No3 and AQMA No4)

Figure 2.14 Map of diffusion tube locations in area E.

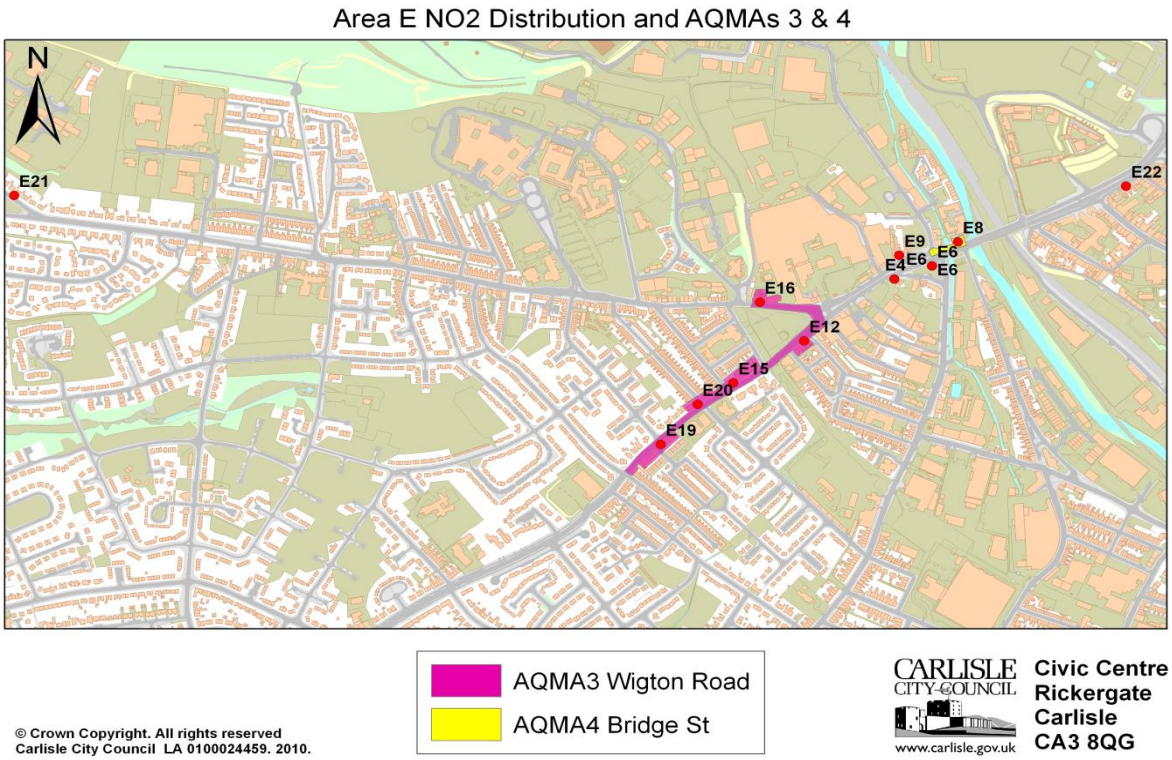
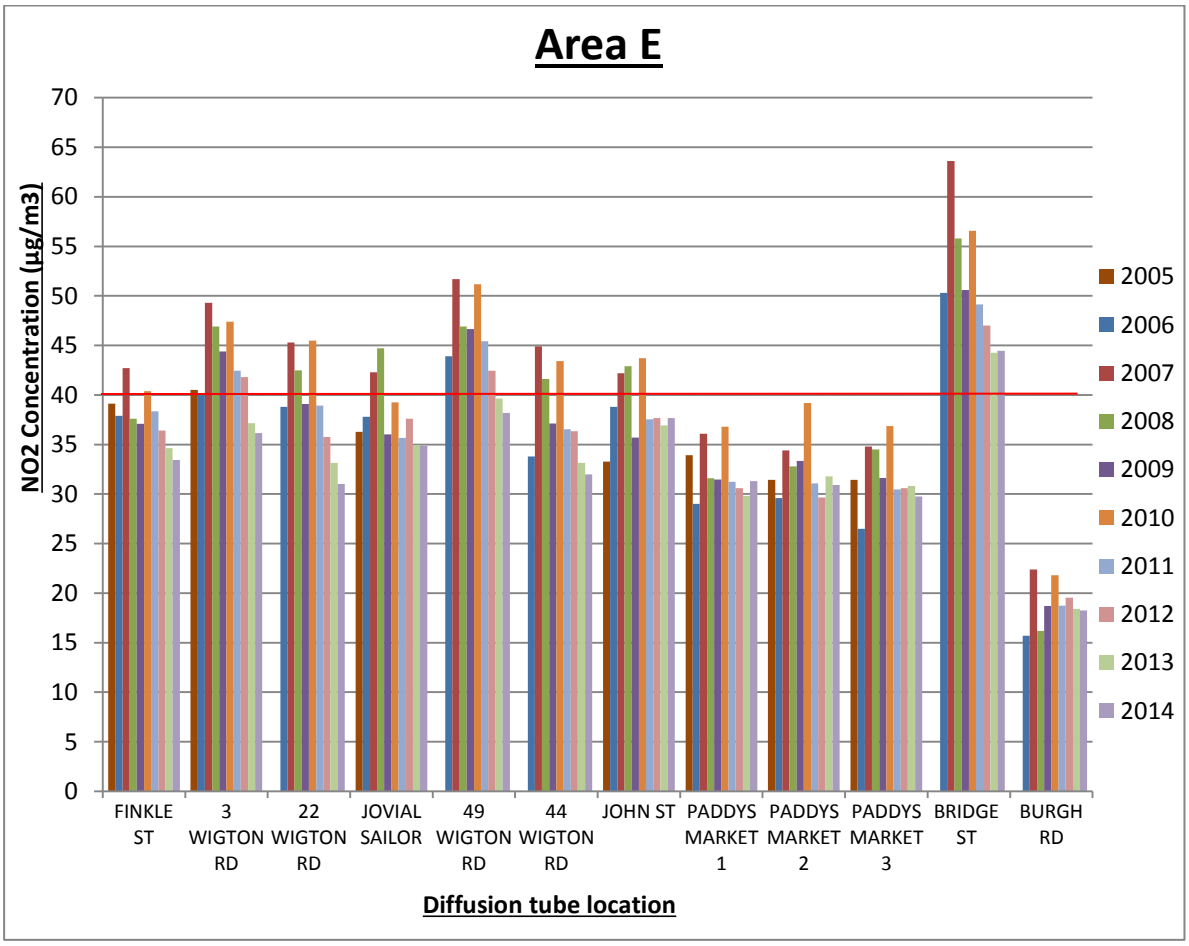


Table 2.5e NO_2 diffusion tube results at monitoring locations in area E.

SITE ID	LOCATION	Site Type	Within AQMA?	ANNUAL MEAN CONCENTRATIONS ADJUSTED FOR BIAS (µg/m3)									
				2005 (0.81)	2006 (0.87)	2007 (0.89)	2008 (0.82)	2009 (0.86)	2010 (0.92)	2011 (0.89)	2012 (0.97)	2013 (0.95)	2014 (0.91)
E22	FINKLE ST	Road side	x	39.1	37.9	42.7	37.6	37.1	40.4	38.4	36.4	34.6	33.4
E12	3 WIGTON RD	Road side	✓	40.5	40.1	49.3	46.9 (41.5)	44.4 (41.8)	47.4 (44.2)	42.4 (39.9)	41.8 (39.6)	37.1 (35.5)	36.1 (33.4)
E15	22 WIGTON RD	Road side	✓	-	38.8	45.3	42.5	39.1	45.5	38.9	35.8	33.1	31.0
E16	JOVIAL SAILOR	Road side	✓	36.3	37.8	42.3	44.7	36.0	39.3	35.7	37.6	35.0	34.9
E19	49 WIGTON RD	Road side	✓	-	43.9	51.7	46.9	46.7	51.2	45.4	42.5	39.7	38.2
E20	44 WIGTON RD	Road side	✓	-	33.8	44.9	41.6	37.1	43.4	36.5	36.3	33.2	32.0
E4	JOHN ST	Road side	x	33.3	38.8	42.2	42.9 (37.8)	35.7 (34.1)	43.7 (40.4)	37.5 (35.2)	37.7 (35.7)	36.9 (34.9)	37.7 (34.1)
E6	PADDYS MARKET 1	Road side	x	33.9	29	36.1	31.6	31.5	36.8	31.2	30.6	29.8	31.3
E6	PADDYS MARKET 2	Road side	x	31.4	29.6	34.4	32.8	33.3	39.2	31.1	29.7	31.8	30.9
E6	PADDYS MARKET 3	Road side	x	31.4	26.5	34.8	34.5	31.6	36.9	30.5	30.6	30.8	29.7
E8	BRIDGE ST	Road side	✓	-	50.3	63.6	55.8	50.6	56.6	49.2	47.0	44.3	44.5
E21	BURGH RD	Road side	x	-	15.7	22.4	16.2 (15.5)	18.7 (16.1)	21.8 (17.9)	18.7 (15.7)	19.5 (16.7)	18.4 (15.8)	18.3 (14.8)

Figure 2.15 Chart showing NO_2 diffusion tube trends at monitoring locations in area E.



These results show that during 2014 NO_2 concentrations at most locations along this main traffic route have decreased slightly compared to 2013. Several have also continued a trend of reduction over a number of years.

Only one location within this area (E8) has shown an annual mean above the objective level during 2014 and it is within AQMA 4 (Bridge Street). This location has shown year on year improvement from 2010 – 2013, the result for 2014 is similar to that of the previous year.

All locations within AQMA 3 (Wigton Road) have continued to show annual mean results below the objective level. Location E19 has shown the highest annual mean within the AQMA but has continued to show improvement over the last four consecutive years of monitoring.

It was anticipated that both of these AQMA's would benefit from a substantial reduction in traffic flows due to the opening of the CNDR in February 2012. Following the opening of the route and the alterations to a major junction in the area it appears that traffic congestion has reduced. This appears to have had a beneficial impact on NO_2 concentrations in the area. During 2014 locations E22, E12, E15, E16, E19 and E20 showed their lowest levels since monitoring began.

Results indicate that there are no locations within area E that are at risk of exceeding the 1 hour mean (60µg/m^3) objective level for nitrogen dioxide, this is also supported by results from the automatic monitoring site within this area.

Area F – A6 London Road / Botchergate (AQMA No6)

Figure 2.16 Map of diffusion tube locations in area F.

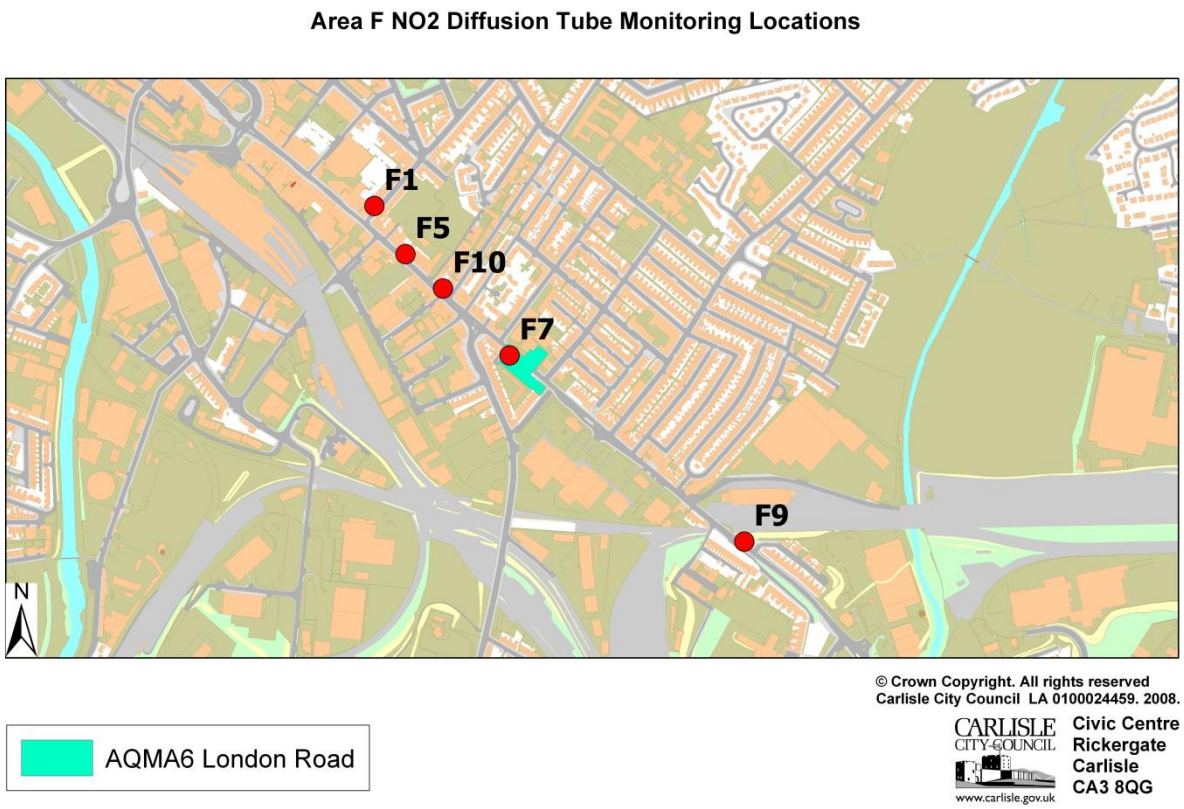
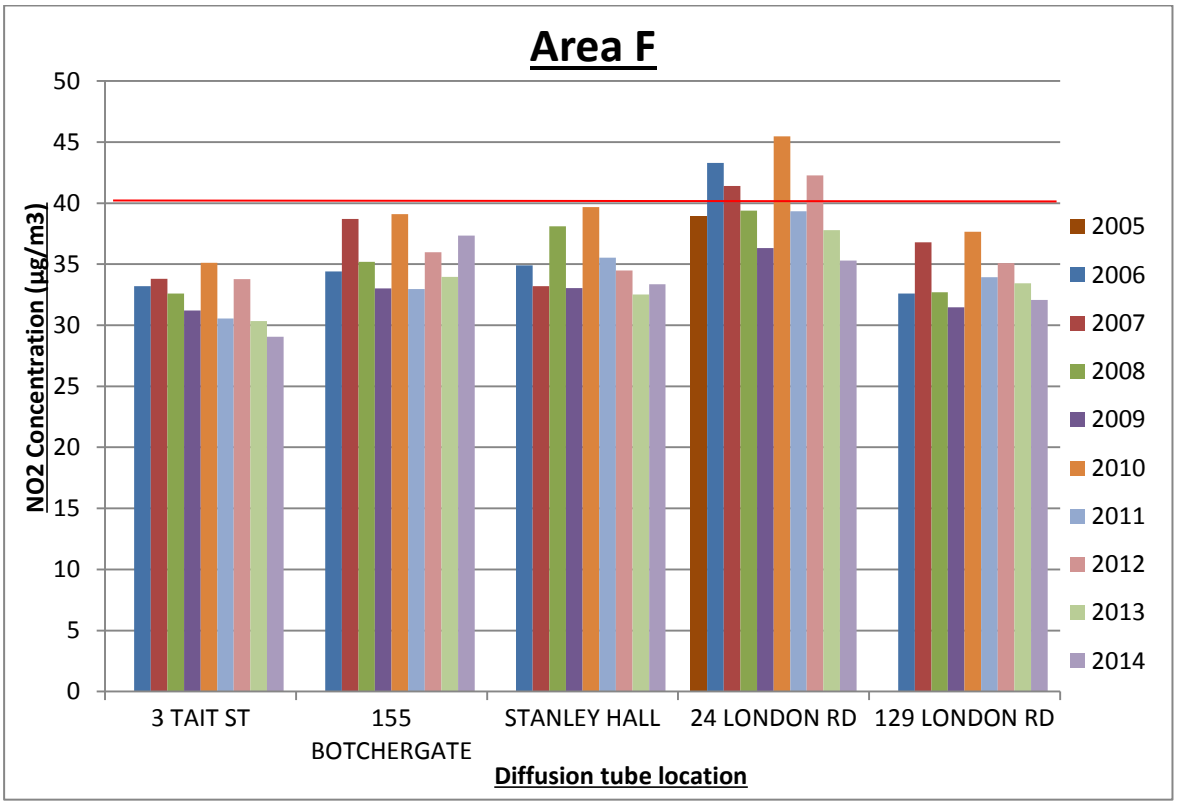


Table 2.5f NO_2 diffusion tube results at monitoring locations in area F.

SITE ID	LOCATION	Site Type	Within AQMA?	ANNUAL MEAN CONCENTRATIONS ADJUSTED FOR BIAS (µg/m3)									
				2005 (0.81)	2006 (0.87)	2007 (0.89)	2008 (0.82)	2009 (0.86)	2010 (0.92)	2011 (0.89)	2012 (0.97)	2013 (0.95)	2014 (0.91)
F1	3 TAIT ST	Road side	x	-	33.2	33.8	32.6	31.2	35.1	30.5	33.8	30.3	29.1
F10	155 BOTCHERGATE	Road side	x	-	34.4	38.7	35.2	33.0	39.1	33.0	36.0	34.0	37.3
F5	STANLEY HALL	Road side	x	-	34.9	33.2	38.1	33.0	39.7	35.5	34.5	32.5	33.4
F7	24 LONDON RD	Road side	✓	39.0	43.3	41.4	39.4	36.3	45.5	39.3	42.3	37.8	35.3
F9	129 LONDON RD	Kerb Side	x	-	32.6	36.8	32.7	31.5	37.7	33.9	35.1	33.4	32.1

Figure 2.17 Chart showing NO_2 diffusion tube trends at monitoring locations in area F.



These results show that the nitrogen dioxide annual mean concentrations at all locations along this main traffic route remain below the objective levels for 2014.

Location F7 (24 London Road) is located within AQMA 6. It has shown significant improvement over the last two years of monitoring and a trend of improvement since 2010. There is no proposal to revoke AQMA 6 at this stage, however this may be considered if future results indicate long term compliance with the objective level.

Work on a new ASDA supermarket development and associated road and junction improvement work was carried out in this area from January - July 2013. This temporarily disrupted traffic flows in this area. The completion of the junction improvements, combined with the potential knock on effects of the Carlisle Northern Development Route, should provide some improvement in the long term. The combined impacts of these factors will continue to be monitored and reported upon in Progress report 2016.

Results indicate that there are no locations within this area that are at risk of exceeding the 1 hour mean (60µg/m3) objective level for nitrogen dioxide.

Area G – Bypass

Figure 2.18 Map of diffusion tube locations in area G.

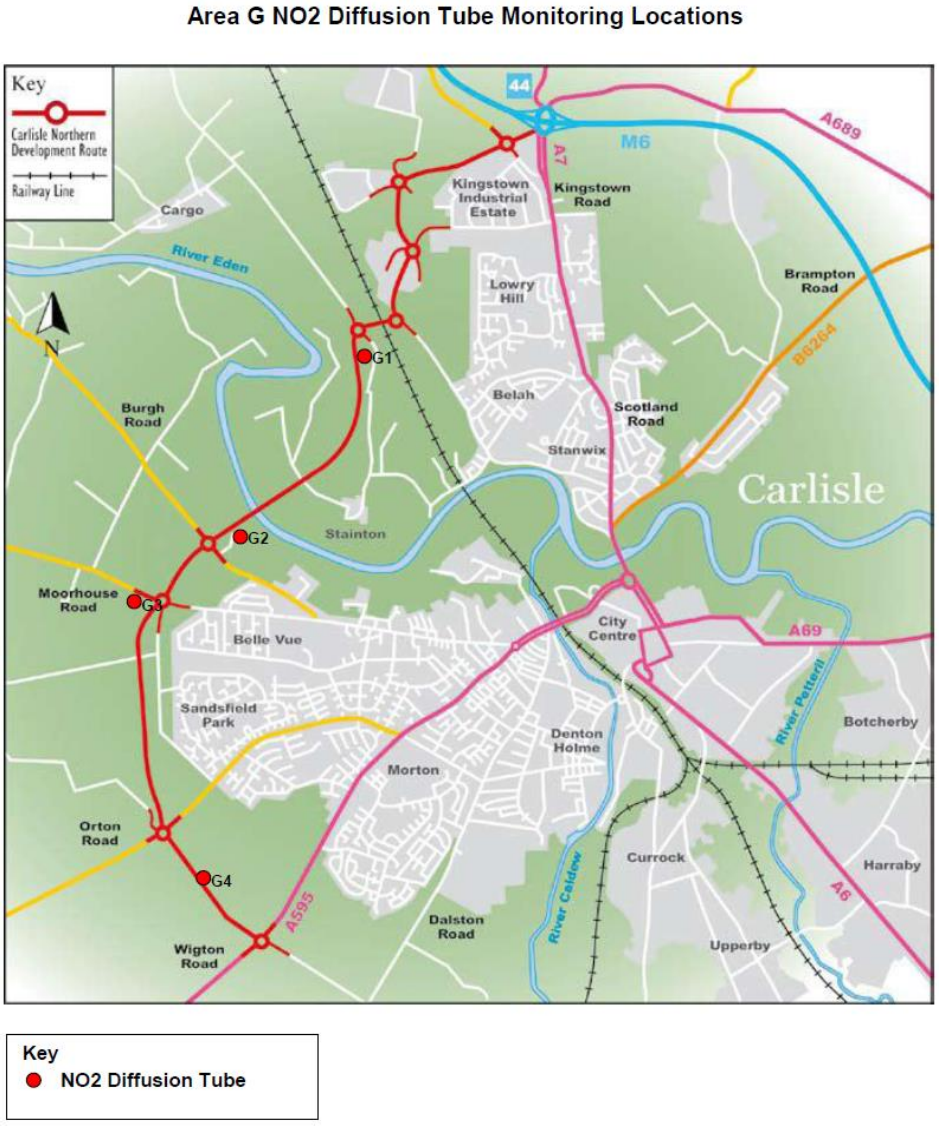
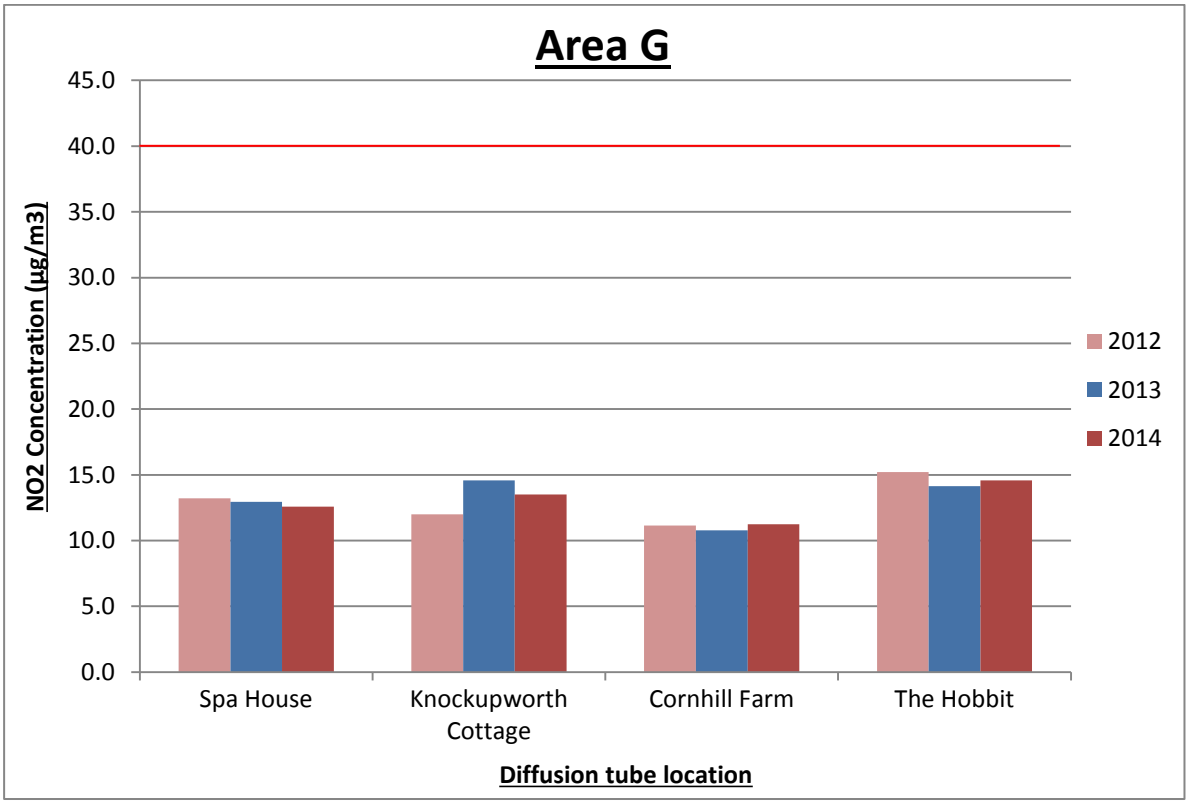


Table 2.5g NO_2 diffusion tube results at monitoring locations in area G.

SITE ID	LOCATION	Site Type	Within AQMA?	ANNUAL MEAN CONCENTRATIONS ADJUSTED FOR BIAS (µg/m3)									
				2005	2006	2007	2008	2009	2010	2011	2012 (0.97)	2013 (0.95)	2014 (0.91)
G1	Spa House	Rural	x	-	-	-	-	-	-	-	13.2 (Est)	12.9	12.6
G2	Knockupworth Cottage	Rural	x	-	-	-	-	-	-	-	12.0 (Est)	14.6	13.5
G3	Cornhill Farm	Road Side	x	-	-	-	-	-	-	-	11.2 (Est)	10.8	11.2
G4	The Hobbit	Rural	x	-	-	-	-	-	-	-	15.2 (Est)	14.1	14.6

Figure 2.19 Chart showing NO_2 diffusion tube trends at monitoring locations in area G



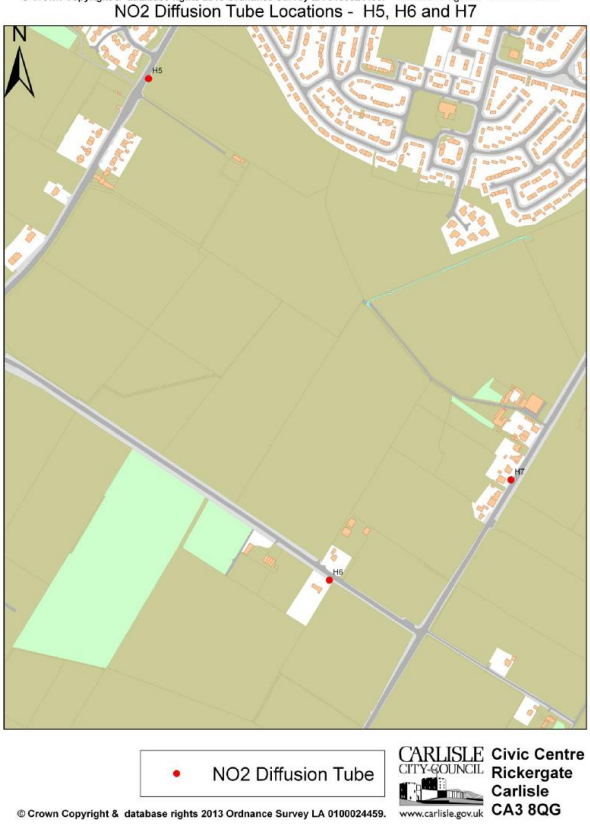
The four diffusion tube locations shown above are detached residential dwellings located closest to the new Carlisle Northern Development Route, which opened in February 2012. They had an initial monitoring period of 8 months from May to December 2012 and the estimated annual mean values were calculated. The 2014 data represents the second full year of monitoring and it is consistent with the results from 2013 and the estimated means from 2012.

This data shows that there is unlikely to be any exceedance of the annual mean or hourly mean objective levels at any relevant location along the new bypass. It is possible that future commercial investment and development attracted by the CNDR, particularly in the north and south west of the city, may increase traffic flow along this route. Given the very low recorded annual mean concentrations, it seems unlikely that such traffic increase will result in any exceedance of the air quality objectives in the near future.

Monitoring will continue at these locations throughout 2015, in the same way.

Area H – Outskirts of City, Townships and Airport

Figure 2.20 Maps of diffusion tube locations in area H.



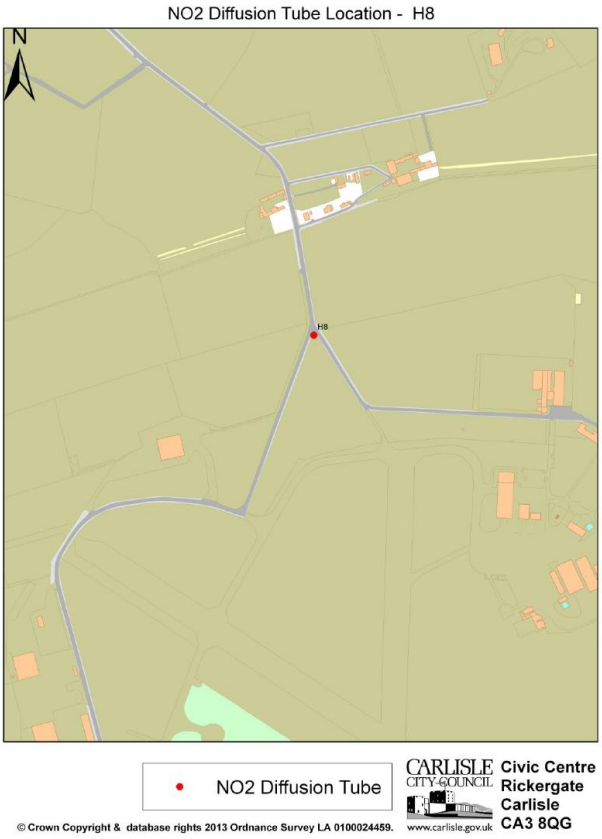
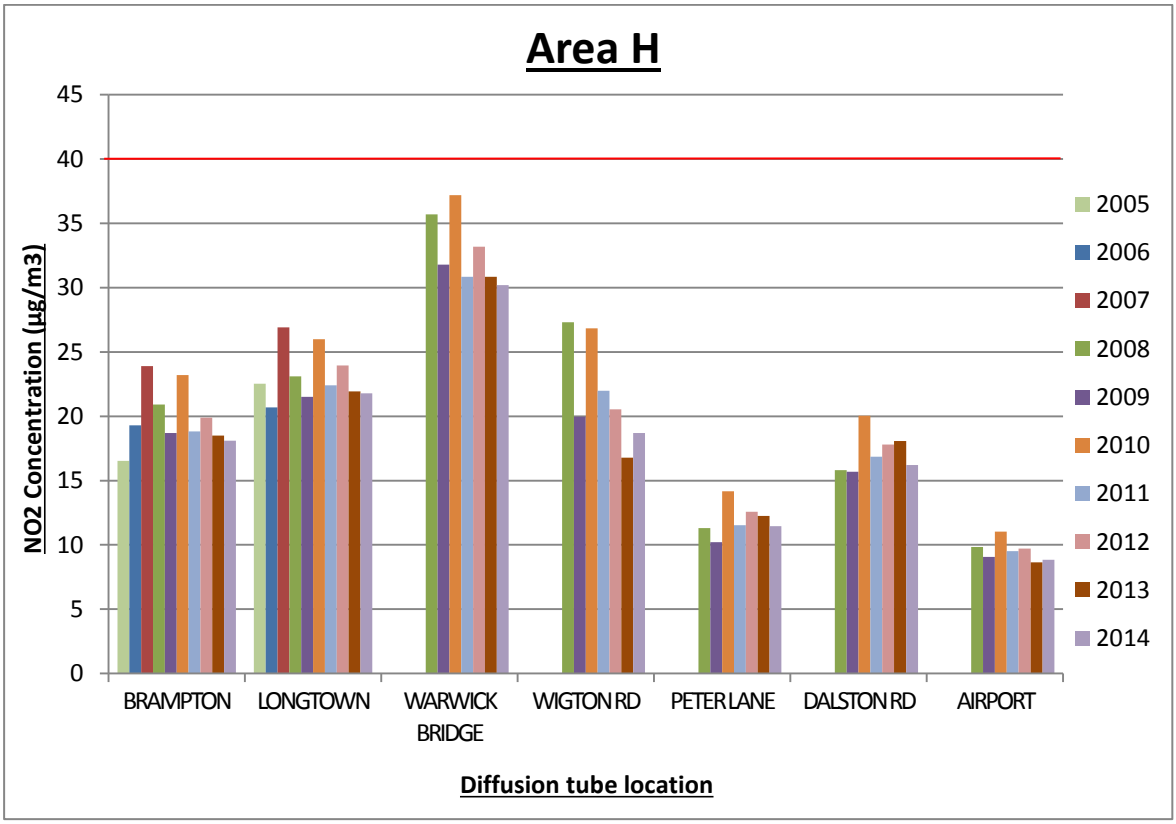


Table 2.5h NO_2 diffusion tube results at monitoring locations in area H.

SITE ID	LOCATION	Site Type	Within AQMA?	ANNUAL MEAN CONCENTRATIONS ADJUSTED FOR BIAS (µg/m3)									
				2005 (0.81)	2006 (0.87)	2007 (0.89)	2008 (0.82)	2009 (0.86)	2010 (0.92)	2011 (0.89)	2012 (0.97)	2013 (0.95)	2014 (0.91)
H1	BRAMPTON	Road side	x	16.5	19.3	23.9	20.9 (20.3)	18.7 (18.2)	23.2 (22.4)	18.8 (18.3)	19.9 (19.3)	18.5 (17.9)	17.2 (16.7)
H3	LONGTOWN	Road side	x	22.5	20.7	26.9	23.1 (22.4)	21.5 (20.8)	26.0 (24.9)	22.4 (21.7)	24.0 (23.2)	21.9 (21.2)	22.1 (21.4)
H4	WARWICK BRIDGE	Road side	x	-	-	-	35.7 (34.5)	31.8 (30.8)	37.2 (35.9)	30.9 (29.8)	33.2 (32)	30.8 (29.8)	29.6 (28.5)
H5	WIGTON RD	Road side	x	-	-	-	27.3	20.0	26.8	22.0	20.5	16.8	17.5
H6	PETER LANE	Road side	x	-	-	-	11.3	10.2	14.2	11.5	12.6	12.3	11.4
H7	DALSTON RD	Road side	x	-	-	-	15.8	15.7	20.0	16.9	17.8	18.1	16.8
H8	AIRPORT	Other	x	-	-	-	9.8	9.1	11.0	9.5	9.7	8.6	8.4

Figure 2.21 Chart showing NO_2 diffusion tube trends at monitoring locations in area H



Locations H1 & H3 are located in the two largest centres of population outside the city of Carlisle and locations H5 – H8 are located on the outskirts of the city. All have consistently shown NO_2 concentrations well below the objective level.

Location H4 is in the nearby village of Warwick Bridge, it showed the highest annual mean in the group. The 2014 annual mean result at this location was, however, the lowest since monitoring began in 2008. Carlisle City Council will continue to monitor all of these areas during 2015.

Results from all of these locations indicate that the nitrogen dioxide levels are significantly below the objective levels and there is no risk of exceeding the objective level for nitrogen dioxide.

2.2.2 Particulate Matter (PM_{10})

The TEOM analysers at Paddys Market were upgraded using a Filter Dynamics Measurement System (FDMS) on 18th March 2009. The FDMS records gravimetric equivalent particulate data and therefore allows equivalence to the objective level. (More information on this change can be found in Appendix A.) The location of the monitoring unit is not representative of relevant public exposure.

All PM_{10} data has been collected by Bureau Veritas as part of the Automatic Urban and Rural Network (AURN) and ratified by Ricardo-AEA. The PM_{10} monitoring at the Paddys Market site suffered, during 2014, due to various faults with the analyser and issues with the air conditioning system serving the unit. The data capture for 2014 was 71%, which is less than the required 75%. The data therefore required further adjustment in order to estimate the mean PM_{10} concentration for the whole calendar year. The annual mean data for both 2013 and 2014 have both been annualised in the same way. The methodology and calculations carried out for this adjustment are given in Box 3.2 of LAQM.TG(09), a detailed explanation can be found in appendix A.

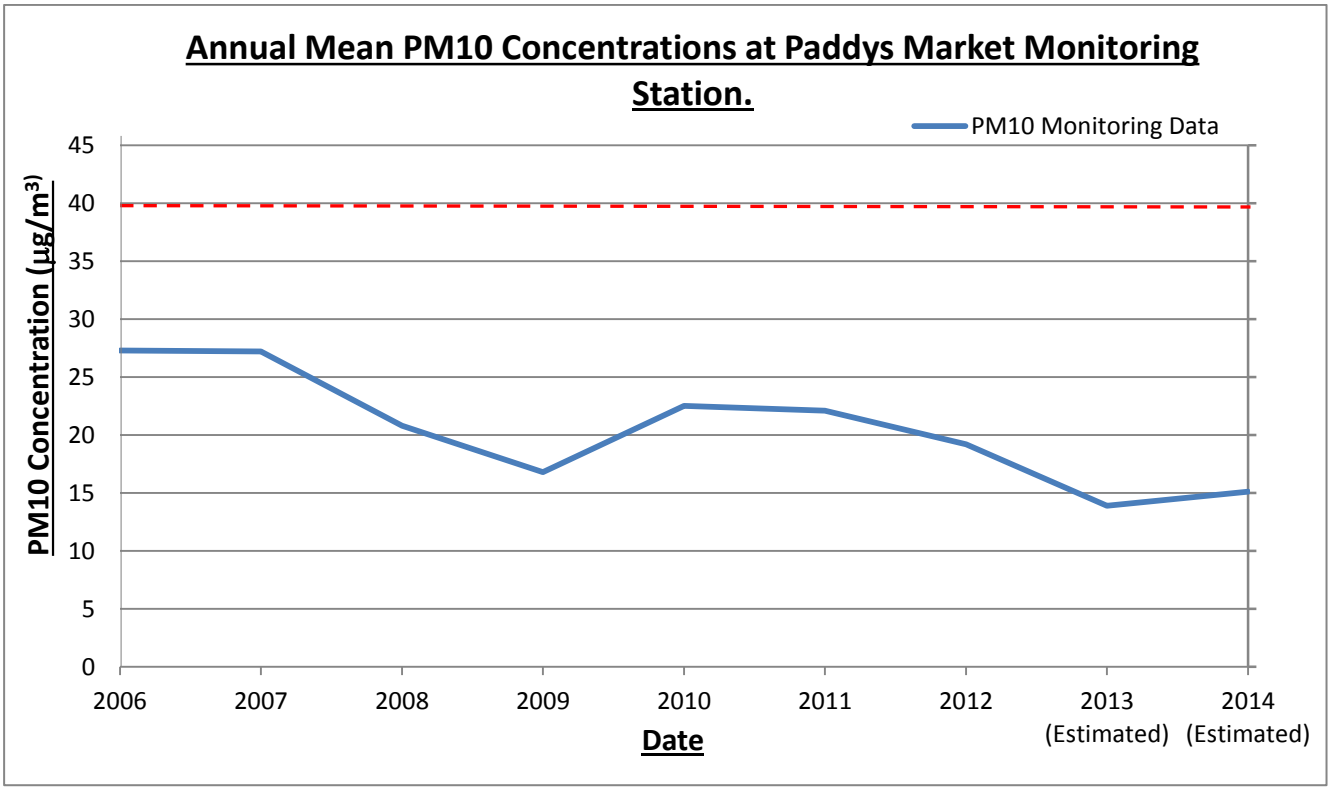
The PM_{10} objective for England is an annual mean of 40μg/m^3. There is also a 50μg/m^3 24 hour mean not to be exceeded more than 35 times per year.

Monitoring was undertaken throughout 2014, therefore the data capture shown in table 2.6 is the data capture for 2014. The data capture is derived from the 24 hour mean monitoring data, as advised by the LAQM helpdesk.

Table 2.6 Results of Automatic Monitoring of PM_{10} Comparison with Annual Mean Objective

Site ID	Location	Site Type	Within AQMA ?	Data Capture for 2014 (%)	Gravim-etric Equival-ent	Annual mean concentrations (μg/m^3)								
						2006	2007	2008	2009	2010	2011	2012	2013 (Est)	2014 (Est)
PM1	Paddy's Market	Road Side	N	71	Y	27.3	27.2	20.8	16.8	22.5	22.1	19.2	13.9	15.0

Figure 2.22 Trends in Annual Mean PM_{10} Concentrations.

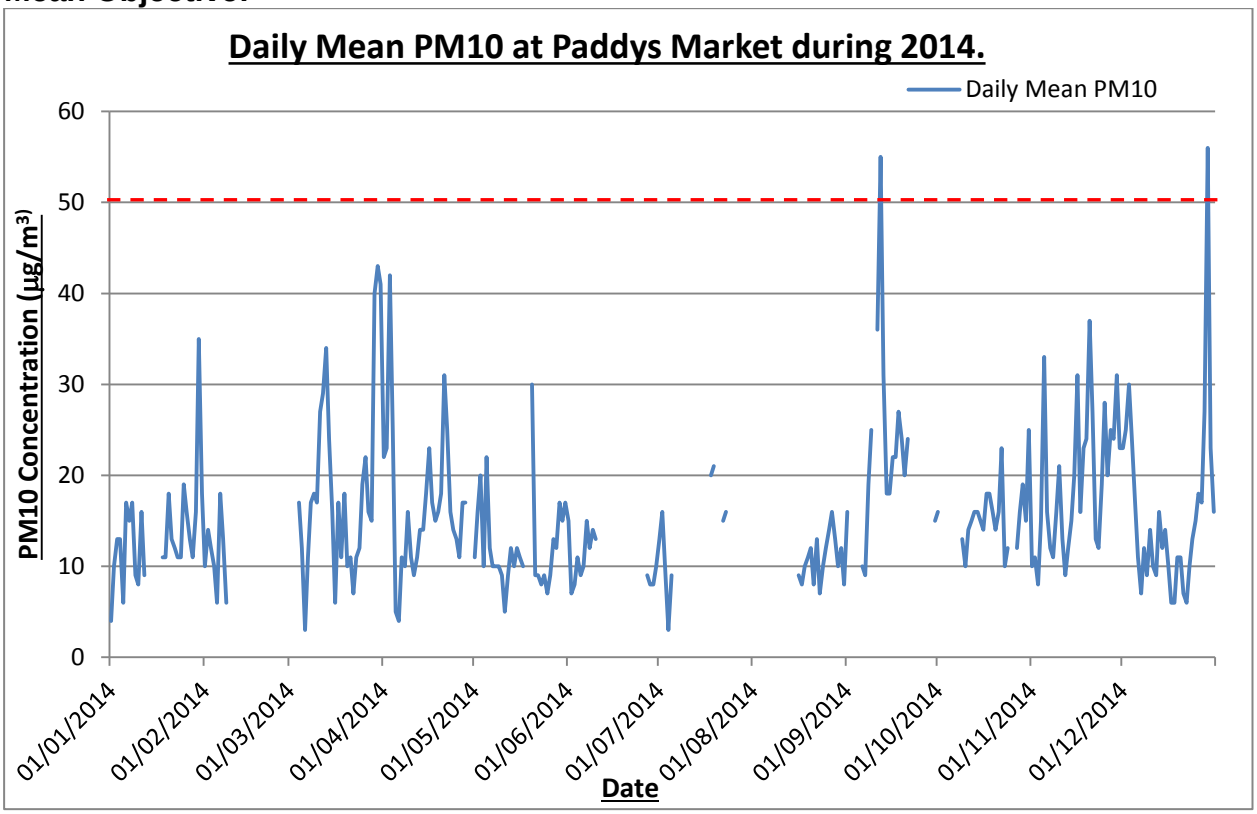


The table and trend chart above show that the estimated PM_{10} annual mean for 2014 remains significantly below the objective level of 40μg/m^3. This is consistent with recorded data from the eight previous years of monitoring.

Table 2.7 Results of Automatic Monitoring for PM_{10}: Comparison with 24-hour mean Objective.

Site ID	Location	Site Type	Within AQMA?	Data Capture for 2014 (%)	Gravim-etric Equival-ent	Number of Exceedences of daily mean objective (50 μg/m^3)								
						2006	2007	2008	2009	2010	2011	2012	2013	2014
PM1	Paddy's Market	Road Side	N	71	Y	16	11	0	7	18	11	3	1	2

Figure 2.23 Results of PM_{10} Automatic Monitoring: Comparison with 24-hour Mean Objective:



The actual recorded data shows that during 2014 there were only 2 exceedances of the 50μg/m^3 24 hour mean objective during the period of valid data. This is significantly less than the objective level of 35 exceedences per year.

Unfortunately the PM_{10} data capture for 2014 was less than 90%. For this reason it was necessary to calculate the **90th percentile of the daily means**. This revealed a result of **25.0μg/m^3**. If this was in excess of 50μg/m^3 it would indicate that there may be an overall exceedance of the 24 hour mean objective level. This result shows that concentrations are significantly below this level. There is therefore no indication that the annual mean or 24 hour mean objective levels for PM_{10} are likely to be exceeded.

2.2.3 Benzene

Carlisle has been monitoring benzene since April 2008 as part of the Non Automatic Hydrocarbon Network (NAHN). The site is located on the roadside, 42 metres away from the nearest relevant public exposure.

The objective level for benzene is an annual mean of 5μg/m3 to be achieved by December 2010. There is also a running annual mean objective of 16.25μg/m3 to be achieved by December 2003.

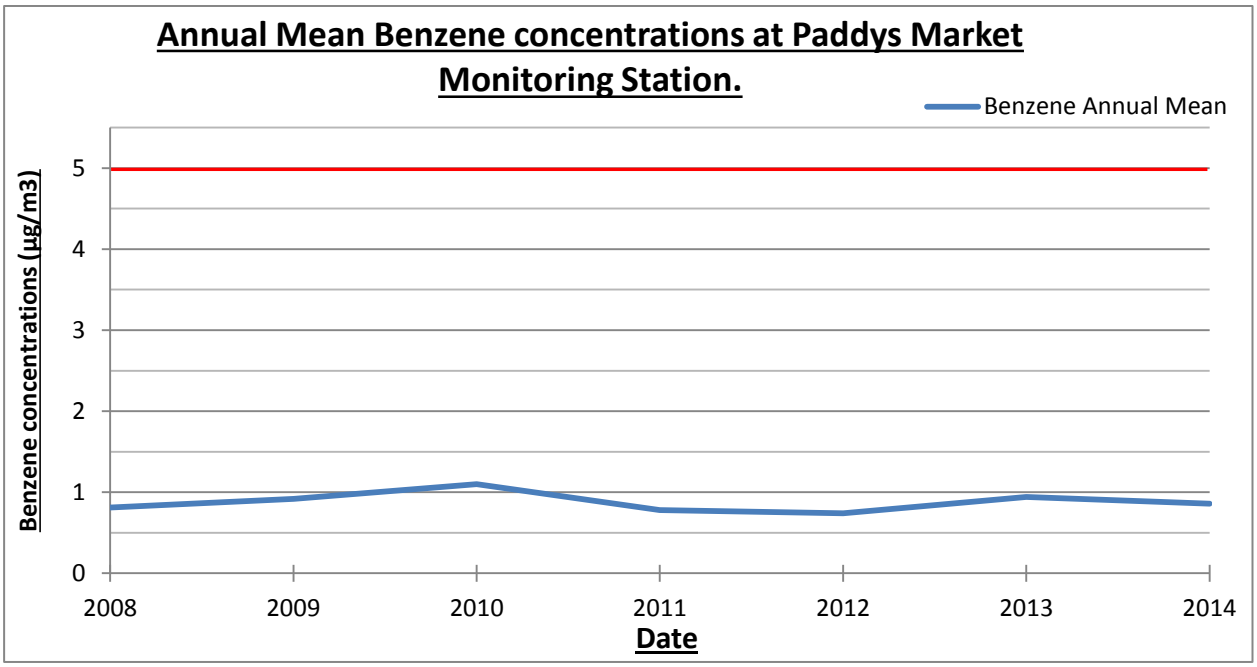
The benzene data shown has been ratified by Ricardo-AEA, they manage the Non Automatic Hydrocarbons Network.

Monitoring data was collected throughout 2014 therefore the data capture for the monitoring period is the data capture for 2014.

Table 2.8 Results of Benzene Monitoring: Comparison with Annual Mean Objective

Site ID	Location	Within AQMA?	Data Capture for 2014 (%)	Annual mean concentrations (μg/m^3)						
				2008	2009	2010	2011	2012	2013	2014
PM1	Paddy's Market	N	92.3	0.81	0.92	1.1	0.78	0.74	0.94	0.86

Figure 2.24 Trends in Annual Mean Benzene Concentrations.



The data above shows that the 2014 annual mean concentration for benzene remains consistently below the objective level. There is no indication that the national objectives for benzene will be exceeded at this location.

2.2.4 PM $_{2.5}$

Carlisle City Council began monitoring PM 2.5 at the Paddy's Market site in March 2009. This is the sixth year that the measurements have been reported in the review and assessment process.

The $PM_{2.5}$ objective for England is an annual mean of 25μg/m^3, to be achieved by 2020. There is also an exposure reduction target of 15% (measured as a 3-year mean) between 2010 and 2020, applicable at urban background locations. The objectives for this pollutant are not included in the air quality regulations for the purpose of local air quality management.

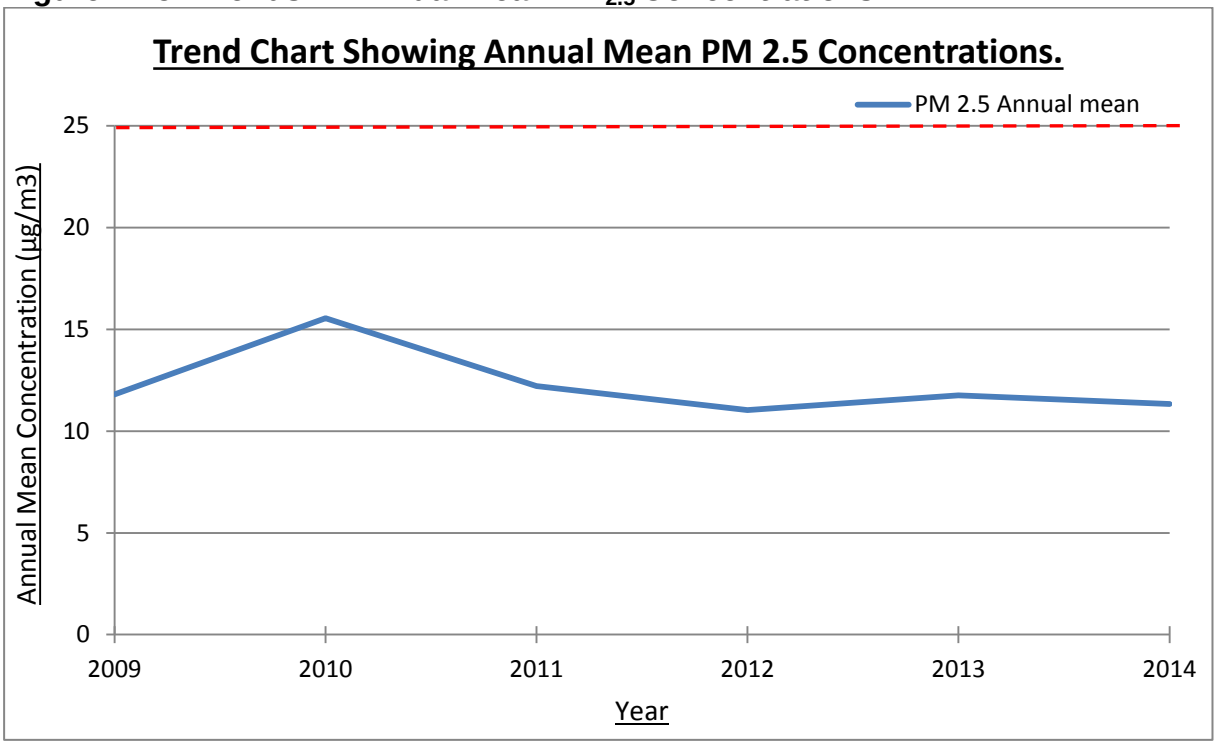
Monitoring data was collected throughout 2014 therefore the data capture for the monitoring period is the data capture for 2014.

All $PM_{2.5}$ data has been collected by Bureau Veritas as part of the AURN and ratified by Ricardo-AEA.

Table 2.9 Results of PM2.5 Automatic Monitoring: Comparison with Annual Mean Objective

Site ID	Location	Within AQMA?	Data Capture for 2014 (%)	Annual mean concentrations (μg/m^3)					
				2009	2010	2011	2012	2013	2014
PM1	Paddy's Market	N	75.6	11.8	15.54	12.21	11.04	11.75	11.32

Figure 2.25 Trends in Annual Mean $PM_{2.5}$ Concentrations.



The 2014 annual mean for $PM_{2.5}$ remains significantly below the 25μg/m^3 objective level. The annual mean concentration has remained consistent with previous years. Monitoring will continue in the same way at this location for $PM_{2.5}$.

2.2.5 Summary of Compliance with AQS Objectives

Carlisle City Council has examined the results from monitoring in the district. Concentrations outside of the AQMA's are all below the objectives at relevant locations, therefore there is no need to proceed to a Detailed Assessment.

3 Road Traffic Sources

Carlisle City Council operates an extensive network of nitrogen dioxide diffusion tube monitoring designed to cover the busy routes, congested roads, narrow streets, city centre locations and roads with high flows of buses and HGV's. A map of our diffusion tube locations in respect to the road network is shown in Figure 2.2.

3.1 Narrow Congested Streets with Residential Properties Close to the Kerb

Concentrations are often higher where traffic is slow moving with stop/start driving and where buildings on either side of the road impede dispersion. Previous review and assessments undertaken by Carlisle City Council have considered streets with more than 5000 vehicles per day, where residential properties are located within 2m of the kerb and buildings are on both sides of the road. Where these are identified outside an AQMA, the local authority is requested to proceed to a detailed assessment.

There are very few streets within the Carlisle district where residential property is located within 2m of a kerb. Those identified in previous rounds of review and assessment include: Stanwix Bank, Brampton Rd, Warwick Bridge, Front St (Brampton), Denton St, Albert St (Longtown), Caldcotes, John St, Bridge St and London Rd. Monitoring is being, or has been, undertaken at all of these locations since they were identified. In most cases the results have shown no exceedance of the nitrogen dioxide objectives. In those areas where exceedance has been found AQMA's have already been declared

There are no new or newly identified congested streets, which match the above criteria that have not been considered in previous rounds of review & assessment.

Carlisle City Council confirms that there are no new/newly identified congested streets with a flow above 5,000 vehicles per day and residential properties close to the kerb, that have not been adequately considered in previous rounds of Review and Assessment.

3.2 Busy Streets Where People May Spend 1-hour or More Close to Traffic

There are some locations within the district where individuals may regularly spend 1 hour or more close to traffic, including streets with many shops or outdoor cafes and bars. Previous assessments undertaken by Carlisle City Council have identified several such locations including Botchergate, City Centre, Lowther St, Devonshire St, The Crescent and Warwick Rd. Nitrogen dioxide monitoring has subsequently been undertaken at these locations, and still continues. Monitoring to date has not found any locations which are likely to exceed the 1 hour objective level for nitrogen dioxide. The monitoring data collected to date is presented in section 2. There are no new or newly identified busy streets where people may spend 1 hour or more, that have not been considered in previous rounds of review & assessment.

Carlisle City Council confirms that there are no new/newly identified busy streets where people may spend 1 hour or more close to traffic.

3.3 Roads with a High Flow of Buses and/or HGVs.

There are no new/newly identified roads with high flows of buses/HGV (greater than 25%) that have not been considered in previous rounds of review and assessment.

Investigation of traffic count data and discussion with Cumbria County Council has revealed that the northern section of the CNDR between Parkhouse Rd and Kingmoor Hub has the highest percentage of HGV movements in the district. In 2014 the traffic counts in both directions show that 15.2% of the average daily traffic was comprised of HGV's. This was increase from 14.3% which was recorded in 2013 and 13.8% recorded in 2012. (See Appendix D for this traffic count data).

Investigation has shown that there is no relevant exposure within 10m of the CNDR along its entire length and there are no roads with flows of buses/HGV (greater than 25% within the district. There is therefore no need to proceed to a detailed assessment.

Carlisle City Council confirms that there are no new/newly identified roads with high flows of buses/HDVs.

3.4 Junctions

During previous rounds of review and assessment all major junctions have been considered within the local authority area. Those assessed include the following:

Dalston Rd/Junction St, Eden Bridge Junction,
Botchergate/LondonRd Junction
Newtown Rd/Wigton Rd/Church St Junction
Charlotte St/Nelson Bridge Junction
James St/Currock Rd Junction
Warwick Rd/Victoria Place Junction
Victoria Place/Georgian Way Junction
Tait St/Botchergate Junction
Denton St/Victoria Viaduct
St Nicholas St/Botchergate

Monitoring is being, or has been, undertaken at all of these locations since they were identified. In most cases the results have shown no exceedance of the nitrogen dioxide objectives. In those areas where exceedance has been found AQMA's have already been declared.

As part of the CNDR there are 9 new roundabouts that link the CNDR to existing arterial routes leading in and out of the city. Since the bypass has opened traffic counts have been ongoing at three key sections of this new road between these roundabout junctions. The 2014 annual average daily traffic (AADT) count data, combined for both directions of traffic flow, is briefly summarised as follows:

- Parkhouse Rd - Kingmoor Hub: AADT was 9988 with 15.2% HGV.
- Burgh Road – Cargo Roundabout: AADT was 13687 with 9.9% HGV.
- Wigton Road (A595) - Orton Rd: AADT was 9139 with 10.7% HGV.

The full CNDR traffic count data which has been collected during 2014 can be found in appendix E.

The above traffic count data has revealed that the stretch of the CNDR between Burgh Road – Cargo Roundabout has average daily traffic which exceeds the 10'000 vehicles threshold level. The other AADT data shows daily traffic which is just below this threshold. There is, however, no relevant exposure within 10m of these two roundabout junctions or indeed any of the new junctions associated with the CNDR. Monitoring data obtained from the nearest residential receptors to the CNDR can be found in section 2 of this report.

A junction change to allow access to the new Sainsbury's supermarket and petrol filling station on Bridge Street was completed in October 2012. The road is now wider with additional lanes and new traffic signals. This development was detailed in the previous round of review and assessment. The impact of the change, particularly on nearby AQMA's 1, 3 and 4, will continue to be monitored by nearby diffusion tube locations and the Paddys Market automatic analyser situated opposite the junction.

The ASDA development and associated junction on London Road was completed in July 2013. This included the removal of the existing traffic signals on the junction with Grey Street and the introduction of new signals at the entrance to the retail park. The new signalling system incorporates a pedestrian crossing and the road layout provides additional lanes. Removal of the old traffic signals adjacent to AQMA 6 has reduced the number of standing vehicles in this location and there has been significant improvement in recorded NO_2 levels over the last two years of monitoring. This development was detailed in the previous round of review and assessment. The impact of the change, particularly on nearby AQMA 6 will continue to be monitored by the diffusion tube located there.

Carlisle City Council confirms that there are no new/newly identified busy junctions/busy roads.

3.5 New Roads Constructed or Proposed Since the Last Round of Review and Assessment

The only recent major new road development was the CNDR which was completed in February 2012. The road development was considered in detail in the previous round of review and assessment and continues to be monitored as part of the diffusion tube network. There are no other new roads constructed since the previous round of review and assessment, other than minor roads associated with new residential developments.

Carlisle City Council has assessed new/proposed roads meeting the criteria in Section A.5 of Box 5.3 in TG(09), and concluded that it will not be necessary to proceed to a Detailed Assessment.

3.6 Roads with Significantly Changed Traffic Flows

Technical guidance advises that roads with significantly changed traffic flow are those with more than 10,000 vehicles per day which have experienced more than a 25% increase in traffic flow.

Investigation of traffic count data and discussion with Cumbria County Council has revealed an overall slight increase in traffic flows across Carlisle and Cumbria during 2014.There is, however, no indication that there are any roads within the authority area that have experienced a 25% increase in traffic flow since the last round of review and assessment. The opening of the CNDR has resulted in significant reduction in traffic flows on many major routes through the city.

Carlisle City Council confirms that there are no new/newly identified roads with significantly changed traffic flows.

3.7 Bus and Coach Stations

Carlisle has only one bus station within the district. Updated information provided by the bus station indicates that there are currently approximately 300 bus movements per day. This is significantly less than the 2,500 threshold, which, according to Defra guidance, may indicate a risk of an air quality objective being exceeded at adjacent relevant locations. There are no current plans for extension or relocation of the bus station.

Carlisle City Council confirms that there are no relevant bus stations in the Local Authority area.

4 Other Transport Sources

4.1 Airports

Aircraft are potentially significant sources of nitrogen oxides emissions, especially during take-off. Guidance suggests that only nitrogen dioxide should be considered in respect to aircraft. There may be a risk of exceeding the objective levels for nitrogen dioxide where the annual throughput of passengers and tonnes of freight is more than 10 million passengers per annum (mppa). For the purpose of this section 100'000 tonnes of freight is equivalent to 1 mppa.

There is one airport within the district. Carlisle Airport has operated as a small, privately operated site. The majority of aviation activity at the airport has been light flying training, aviation club activities, private aviation, air ambulance and occasional MOD training, including both fixed wing and helicopter.

There have been various applications made to develop the airport and negotiations have been ongoing over recent years. The most recent plans were examined in previous rounds of review and assessment and have now been approved by Carlisle City Council in 18 August 2014 following a judicial review. The plans include the development of a distribution centre inclusive of air freight and road haulage. It includes the development of buildings to include warehousing, hangers, improvements to the passenger terminal, integrated chillers, workshops, offices, a gatehouse, new access, auxiliary fire station and a raised re-profiled runway. Works are now underway with this development and it is anticipated that it will be completed by September 2015.

The potential impact of the Airport development was considered in detail in the Updating and Screening Assessment 2012. As part of the application the developer provided an Environmental Statement in 2010 which estimated a maximum of 200'000 passengers passing through the airport per year and an average of 1560 air freight movements per year, by 2025.

In May 2011 specialist aviation consultancy, Alan Stratford and Associates Ltd carried out an independent review of the aviation-related impacts described in the Environmental Statement. It indicates that the above estimates are too high for the development. It gives an optimistic case of 100,000 passengers per annum and a cargo throughput of 2,000 tonnes per annum which might perhaps be attained in 10-12 years. It states that even with a passenger throughput of 50,000-100,000 passengers per annum, it is unlikely that the terminal could cope with peak period throughput particularly in the event of delays etc. If the terminal of the size proposed were to be used solely for air cargo, it expects this to handle up to around 100,000 tonnes per annum and perhaps as much as 200,000 tonnes per annum if it specialised in small package / express delivery. It also states that there are no examples of other UK regional airports with a similar runway length to Carlisle with cargo volumes in excess of 1000 tonnes per year.

A further independent assessment was carried out by Airport Planning and development (APD) Ltd on behalf of Carlisle City Council, in July 2014. This estimates significantly less aircraft movements, of around 1000 in total per year, and likely passenger movements of 74'000 in year 20. The report concludes that the introduction of passenger movements would not have any adverse impact on air quality.

The highest estimate from the above information suggests a possible 200'000 tonnes of air freight per year, this would be equivalent to 2 mppa. When this is combined with a maximum of 200'000 passenger movements per year the overall indicative estimate of the effective operational size of the airport is 2.2 mppa. This would be a worst case scenario as it is expected that the actual figure will be much lower. This estimate is still significantly below the 10mppa threshold which if exceeded would require further detailed assessment.

There are residential properties within 1000 metres of the airport boundary and the NO_2 annual mean concentration has been measured since 2008 in this area. There is a diffusion tube located on the airport boundary, adjacent to the nearest residential properties. This location recorded an NO_2 annual mean of 8.4 $\mu g/m^3$ in 2014, which is the lowest since monitoring began. There is therefore no concern with the existing NO_2 levels in this area. Any changes to the airport will be re-examined in future stages of review and assessment.

Carlisle City council confirms that there are no airports in the Local Authority area which have an annual throughput of passengers and tonnes of freight of 10mppa or more. There is therefore no need to proceed to a detailed assessment.

4.2 Railways (Diesel and Steam Trains)

Carlisle has a significant railway network. Government guidance suggests that stationary locomotives, both diesel and coal fired, can give rise to high levels of sulphur dioxide close to the point of emission. Recent evidence suggests that moving diesel locomotives, in sufficient numbers, can also give rise to high NO_2 concentrations close to the track. These two potentially significant sources are considered below.

4.2.1 Stationary Trains

Whilst there are relevant locations throughout the authority which are located within 15m of a railway track there were no locations identified during the last round of review and assessment where trains remain stationary for more than 15 minutes with engines idling at those locations. This has been rechecked for the purposes of this assessment and it is still the case.

Carlisle City Council confirms that there are no locations where diesel or steam trains are regularly stationary for periods of 15 minutes or more, with potential for relevant exposure within 15m.

4.2.2 Moving Trains

Updated guidance suggests that moving diesel locomotives, in sufficient numbers (in excess of 100 trains per day), can also give rise to high nitrogen dioxide concentrations within 30m of the track where the background annual mean is $25\mu g/m^3$.

As part of a previous round of review and assessment a survey of the Newcastle/Leeds line, West Coast Mainline and West Cumbria Mainline together with the convergence of these lines adjacent to Carlisle Station indicates that there is no

risk of exceeding the above criteria at any location within the district. There have been no major changes to the lines or rail traffic since this time.

Carlisle City Council confirms that there are no locations with a large number of movements of diesel locomotives, and potential long-term relevant exposure within 30m.

4.3 Ports (Shipping)

There are no ports within the local authority area.

Carlisle City Council confirms that there are no ports or shipping that meet the specified criteria within the Local Authority area.

5 Industrial Sources

5.1 Industrial Installations

5.1.1 New or Proposed Installations for which an Air Quality Assessment has been Carried Out

There have been no new or proposed industrial installations with an air quality assessment, since the last round of review and assessment.

Carlisle City Council confirms that there are no new or proposed industrial installations for which planning approval has been granted within its area or nearby in a neighbouring authority.

5.1.2 Existing Installations where Emissions have Increased Substantially or New Relevant Exposure has been Introduced

There have been no substantial changes to any of the permitted industrial installations in the Carlisle area in the last 3 years.

There have been no significant changes which would create new relevant exposure in the Carlisle area.

The only permitted industrial process in neighbouring authorities which could potentially be significant is 'Innovia' at Wigton, within the district of Allerdale Borough Council. The plant is permitted by the Environment Agency to produce 17'000 tonnes of cellophane film per year and 5'000 tonnes of saleable viscose. The installation is located 7.45 Km away from the Carlisle City Council border and 7.47 Km from the nearest relevant receptor within our area. For these reasons it was not considered to have any significant impact by any previous round of assessment. The Environment Agency has also reported that abatement measures are in place to significantly reduce emissions, including Carbon Disulphide. The Operator upgraded their power plant in 2014 and as a result applied for a Permit Variation. Expansion at the Innovia site is restricted to the polypropylene plant which is not a Part A1 activity and therefore not regulated by the Environment Agency.

Carlisle City Council confirms that there are no industrial installations with substantially increased emissions or new relevant exposure in their vicinity within its area or nearby in a neighbouring authority.

5.1.3 New or Significantly Changed Installations with No Previous Air Quality Assessment

There have been no new or significantly changed industrial installations without previous air quality assessment since the last round of review and assessment.

Carlisle City Council confirms that there are no new or proposed industrial installations for which planning approval has been granted within its area or nearby in a neighbouring authority.

5.2 Major Fuel (Petrol) Storage Depots

There is some evidence that major petrol fuel depots could emit sufficient benzene to put the 2010 objective at risk of being exceeded, especially if combined with higher levels from nearby busy roads. There is one medium sized fuel storage depot within the district. The nearest properties are approximately 200m away from the petrol storage tanks.

The storage site, formerly BP (Oil) Dalston ltd is now known as 'Ineos LTD, Dalston Terminal.' This site was considered in the last round of review and assessment. It was revealed that this point source is well below the threshold at which exceedances of the benzene objective could occur. The site utilises a vapour recovery system to minimise any emissions. It is permitted by Carlisle City Council and visited every six months.

There is one major fuel (petrol) storage depot within the Local Authority area, but this has been considered in previous reports.

5.3 Petrol Stations

Guidance suggests that petrol stations could emit sufficient benzene to put the 2010 objective at risk of being exceeded, especially if combined with higher levels from nearby busy roads. Defra requests that local authorities identify all petrol stations with an annual throughput of more than 2000m^3 of petrol (2million litres per annum), with a busy road nearby and determine whether there is relevant exposure. This includes residential property within 10m of the pumps that have not been covered by previous review & assessment reports.

All petrol stations found within the district have been considered against the above criteria in previous rounds of review & assessment and none were found to meet the trigger levels. This has been reviewed and the situation remains the same.

Carlisle City Council confirms that there are no petrol stations meeting the specified criteria**.**

5.4 Poultry Farms

A small number of local authorities have identified potential exceedances of PM_{10} objectives associated with emissions from poultry farms defined as chickens (laying hens and broilers), turkeys, ducks and guinea fowl. DEFRA advise that there may be a risk of a poultry farm exceeding an objective where it houses in excess of:
400,000 birds if mechanically vented
200,000 birds if naturally vented
100,000 birds for any turkey farm
There are 8 poultry farms on the integrated pollution, prevention and control register within our area, these are as follows:

Wreay Poultry Farm, Chapel Hill Road, Wreay, CA4 0PR
Lyne Moor Poultry, Lyne Moor Farm, Brampton Road, Longtown, CA6 5TR
The Bow, Great Orton, Carlisle, CA5 6EW
Close Gap Poultry Farm Ltd. Longtown, CA6 5NA

Edenford Poultry, Randlaw Lane, Great Corby, Carlilse, CA8 9BZ
Fairholme Farm Poultry Unit, Walby, Carlilse, CA6 4QL
Cairnholm Poultry Unit, Cumwhitton, Carlisle, CA8 9BZ

The largest mechanically vented unit we have permitted, by the Environment Agency, is 330,000 broilers which is 70,000 below the 400,000 threshold.

We have no naturally vented farms above 200,000 and no turkey farms above 100,000 currently permitted.

Carlisle City Council confirms that there are no poultry farms meeting the specified criteria.

6 Commercial and Domestic Sources

6.1 Biomass Combustion – Individual Installations

Biomass burning can lead to an increase in PM_{10} emissions, due to the process of combustion. Aerosol formation from volatile materials distilled from the wood is also an issue. Compared to conventional gas-burning, biomass burning can also result in an increase in the overall NO_x emissions due to the fuel-derived portion that is not present in gas combustion. Guidance suggests that consideration needs to be given to biomass combustion installations in the range of 50kW to 20MW units.

There are several new biomass boiler developments since the last round of review and assessment which meet these criteria. These include the following:

- Four Gables, Brampton, Carlisle. 80KW biomass boiler.
- Henry Lonsdale Home, Warwick on Eden, Carlisle. 500KW biomass boiler.
- Lynmoor, Longtown, Carlisle 990KW biomass boiler.
- Tempest Tower, Little Orton, Carlisle. 199KW biomass boiler.

The air quality implications of each application were considered by the planning department in consultation with the Environmental Health department. In some cases an Air Quality Impact Assessment has been provided as part of the application. In other cases the emissions data was evaluated using the Biomass Calculator Tool (tool 6) from the Defra Website. The procedures detailed in paragraphs 5.74 - 5.86 and the nomograms in figure 5.19 - 5.21 of (TG(09)) give further guidance on this process.

The local area is considered when all such applications are made. Air quality data and background levels are used, where possible, to determine if there is likely to be any exceedance of the air quality objectives. It is necessary to identify the proposed stack height, as well as the emission and flow rates of the proposed unit. Any nearby receptors and buildings within 5 stack heights of the stack, which may impede dispersion, are also taken into account. There have been cases where amendments were required at the planning stage, such as an increased stack height in order to aid dispersion. In other cases the proposed units have been relocated or alternative heating systems selected where necessary.

The results of investigation into each new source and proposed developments have not identified any potential exceedance of the air quality objectives for either PM_{10} or NO_2. It is therefore not necessary to proceed to a detailed assessment.

Carlisle City Council has assessed the biomass combustion plant, and concluded that it will not be necessary to proceed to a Detailed Assessment.

6.2 Biomass Combustion – Combined Impacts

There is the potential that many small biomass combustion installations, whilst individually acceptable, could in combination lead to unacceptably high PM_{10} concentrations. This is of particular concern in areas where PM_{10} concentrations are close to or above the objectives.

Carlisle City Council currently does not have any housing estates which use biomass installations as a primary source of heat. For this part the burning of solid fuel burning in domestic properties is also considered.

Guidance provides details of the minimum number of households per 500m by 500m area required to trigger the need for a Detailed Assessment based on the worst assumption that wood is burnt in an open fireplace as a primary source of heat and based on background PM_{10} concentrations.

Previous rounds of review and assessment identified 6 villages and a small town in the district that do not have a mains gas supply and therefore use alternatives as a primary fuel source. The maximum number of dwellings in a 500x500m grid was established and the background PM_{10} concentrations in these areas were taken into account. The outcome was that none of the locations met the criteria for a detailed assessment. Since the previous round of review and assessment there has been little change to the housing density or background PM_{10} concentrations in these areas.

Previous rounds of review and assessment also gave detailed consideration to more densely populated areas within the city which, although on mains gas, may have properties which burn solid fuel. This mainly includes Victorian terraced properties within the city centre and other residential areas. Background concentrations were considered in these areas and it was concluded that the housing density would not be sufficient to meet the criteria. Officers regularly visit these locations and have not experienced/witnessed significant or problematic burning of solid fuel at any location. Carlisle City Council has also not substantiated any relevant complaints of smoke nuisance from domestic heating in these locations.

Carlisle City Council has assessed the biomass combustion plant, and concluded that it will not be necessary to proceed to a Detailed Assessment.

6.3 Domestic Solid-Fuel Burning

Guidance states that where the density of coal burning premises exceeds 100 per 500x500m area there may be a risk of the SO_2 air quality objective being exceeded. As discussed in the previous section there are a number of villages and a small town that do not have a mains gas supply and therefore use alternatives as a primary fuel. These areas were all examined in detail in previous rounds of review and assessment.

It was revealed by the previous investigation that only Longtown was considered a possible location where there may be a risk of exceeding the air quality objective for SO_2, because it is the only area with a housing density over 100 dwellings in any 500x500m grid. A questionnaire was sent to 350 households and as a result it was estimated that the number of houses which use coal as the predominant source of heating was significantly below the threshold for exceeding the objective. It is not considered likely that there has been a significant increase since this study was carried out.

Further frequent visits to each of these areas have not identified any significant smoke problems. Carlisle City Council has also not taken any enforcement action as a result of any relevant complaints with regard to smoke nuisance from residential properties in these areas.

Carlisle City Council confirms that there are no areas of significant domestic fuel use in the Local Authority area.

7 Fugitive or Uncontrolled Sources

Dust emissions from a range of fugitive and uncontrolled sources can give rise to elevated PM_{10} concentrations.

Dust arises from the passage of vehicles over unpaved ground and from the passage of vehicles along public roads that have been affected by dust and dirt tracked out from dusty sites. It also arises from the handling of dusty materials and processes such as the cutting of concrete. There is also a possibility of wind-blown dust emanating from stockpiles and dusty surfaces.

Potential sources of fugitive or uncontrolled dust within the local authority area were considered during previous rounds of review and assessment. Whilst there are a number of potential sources including quarries and concrete batching within the district it was found that there were no adjacent relevant locations. In addition these premises are permitted by Carlisle City Council and are regularly inspected. No particular dust emissions have been noted during site visits.

Since the last round of review and assessment there are the same number of operational cement batching sites all have reported significant reduction in throughput.

Any complaints received by the Environmental Health department, since the last round of review and assessment, have also been considered. Records indicate that a small number of complaints have been received regarding dust. No enforcement action was necessary as a result of these investigations.

There have been no new sources likely to emit fugitive or uncontrolled dust emissions since the last round of review and assessment.

Carlisle City Council confirms that there are no potential sources of fugitive particulate matter emissions in the Local Authority area.

8 Conclusions and Proposed Actions

8.1 Conclusions from New Monitoring Data

Nitrogen Dioxide
The monitoring undertaken for the purpose of this report has not identified any potential exceedance of the nitrogen dioxide objective level at any relevant locations outside the current AQMA's. The 2014 annual mean NO_2 concentrations decreased at many of the monitoring locations across the district. Some locations have also shown continued improvement over recent consecutive years.

The monitoring data indicates that there are still locations within some of the 6 AQMA's which remain above, or borderline of, the annual mean objective level. Other locations within AQMA's have dropped below the objective however there are no immediate plans to revoke or amend any AQMA's until further monitoring data has been collected.

The monitoring network will continue to operate unchanged during 2015. A consistent monitoring programme will allow accurate comparisons to be drawn since the opening of the Carlisle Northern Development Route (CNDR) in February 2012. This Action Plan measure appears to have reduced NO_2 concentrations in several areas and is expected to have a long term improvement on inner city traffic congestion.

There continues to be diffusion tubes located on four residential properties which are closest to the CNDR. The data collected so far has shown that there are no concerns with air quality at these receptors. The monitoring locations showed annual means which are among the lowest of all of the collected data.

Monitoring from the continuous analyser at Paddys Market showed no exceedance of the 1 hour mean or the annual mean objective, for nitrogen dioxide during 2014.

Monitoring from the continuous analyser unit at Stanwix Bank showed no exceedance of the 1 hour mean or the annual mean objective, for nitrogen dioxide during 2014. The location of the unit is not representative of public exposure and is within AQMA 1.

Particulate Matter (PM_{10})
Monitoring from our unit at Paddys Market showed 2 recorded exceedances of the 50$\mu g/m^3$ 24 hour mean, this is below the permitted 35 exceedances given in the objective. The 90th percentile of the daily means was 25$\mu g/m^3$. A result in excess of 50$\mu g/m^3$ would indicate that there may be an exceedance of the 24 hour mean objective level. This result shows that there is no indication that the 24 hour mean objective levels for PM_{10} are likely to be exceeded. The estimated PM_{10} annual mean of 15.1$\mu g/m^3$ was also significantly below the objective level of 40$\mu g/m^3$, during 2014.

Particulate Matter ($PM_{2.5}$)
Monitoring from the Paddys Market unit showed no exceedance of the 25$\mu g/m^3$ annual mean objective, for $PM_{2.5}$. The recorded annual mean of 11.32µg/m3 was significantly below the national objective level, during 2014. $PM_{2.5}$ is not a prescribed pollutant for the purpose of LAQM.

Benzene.
Monitoring from our pumped diffusion tubes unit at Paddys Market revealed an annual mean of 0.86μg/m^3 for benzene. There was therefore no exceedance of the 5μg/m^3 annual mean or the running annual mean objective of 16.25μg/m^3.

No other pollutants are of concern, or monitored by, Carlisle City Council.

8.2 Conclusions from Assessment of Sources

The new local developments within the district are detailed in sections 3 -7 of this report. The air quality impacts of prospective developments have all been assessed either as part of the planning process or under the Environmental Permitting Regulations 2010. It can be concluded that there are no new major developments of any particular concern or significant changes to existing installations that have taken place since the last round of review and assessment.

This report has considered the commencement of the new airport development within the district. Given the predicted passenger and freight throughput and the low measured NO_2 levels in the vicinity of the airport, it has been concluded that the air quality impacts of the development are not of concern at this time.

The most significant recent development in the district has been the opening of the Carlisle Northern Development Route (CNDR) in February 2012. This appears to be improving traffic congestion within the city centre and on key arterial routes. The effects of this new road will continue to be monitored during 1015.

Minor changes were made in 2012 to the monitoring network (as discussed in chapter 2) to allow monitoring of NO_2 at residential properties along the route of the CNDR. There is unlikely to be an exceedance of the objectives at any of these new receptors, due to the distance from the road, the open rural environment and the free flowing traffic. These results support previous air quality impact assessment work carried out in the planning stages of the development.

This assessment has not identified any new developments, or significantly changed sources, that may cause any potential exceedance outside the AQMA's. There is no need to proceed to a detailed assessment.

8.3 Proposed Actions

This Updating and Screening Assessment has not identified the need to proceed to a Detailed Assessment for any pollutant. It has also not revealed any reason for the boundaries of any of any existing AQMA's to be amended.

During 2015 the monitoring programme will remain the same to enable comparisons to be drawn as to the long term effects of the CNDR. If this demonstrates long term compliance with the objectives within any AQMAs then consideration may be given to possible revocation where necessary.

The next report to be submitted to DEFRA will be Progress Report 2016. This will be submitted in spring 2016 and will present all of the 2015 monitoring data, as well as detail any progress with proposed or existing developments within the district. It will also provide an update on progress with regards the measures detailed within the revised Action Plan.

9 References

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The Air Quality (England) Regulations 2000 (as amended 2002)

Appendices

Appendix A: QA/QC Data.

Appendix B: Monthly No_2 Diffusion Tube Results 2014 – Raw Data.

Appendix C: No_2 Diffusion Tube Results 2014 – Calculated Data.

Appendix D: CNDR Traffic Count Data 2014

Appendix A: Quality Assurance / Quality Control (QA/QC) Data.

Diffusion Tube Bias Adjustment Factors

Diffusion tube precision can be described as the ability of a measurement to be consistently reproduced, i.e. how similar the results of duplicate or triplicate tubes are to each other. Accuracy represents the ability of the measurement to represent the 'true' value, which, in this case, is defined as the result from the automatic analyser. When averaged over a number of sets of results bias can be evident. This represents the overall tendency of the diffusion tubes to depart from the 'true' value, i.e. to systematically over or under-read when compared against the reference method. Once identified, bias can be adjusted for in order to improve the accuracy of diffusion tube results. This is done using bias adjustment factors, which have been found to be specific to a laboratory and tube preparation method.

As a result of the considerable difference in the performance of tubes prepared by different labs, government guidance recommends that a bias adjustment factor is determined and applied to the data. Technical guidance gives a method for this, which involves the co-location of these tubes with a chemiluminescent NOx analyser.

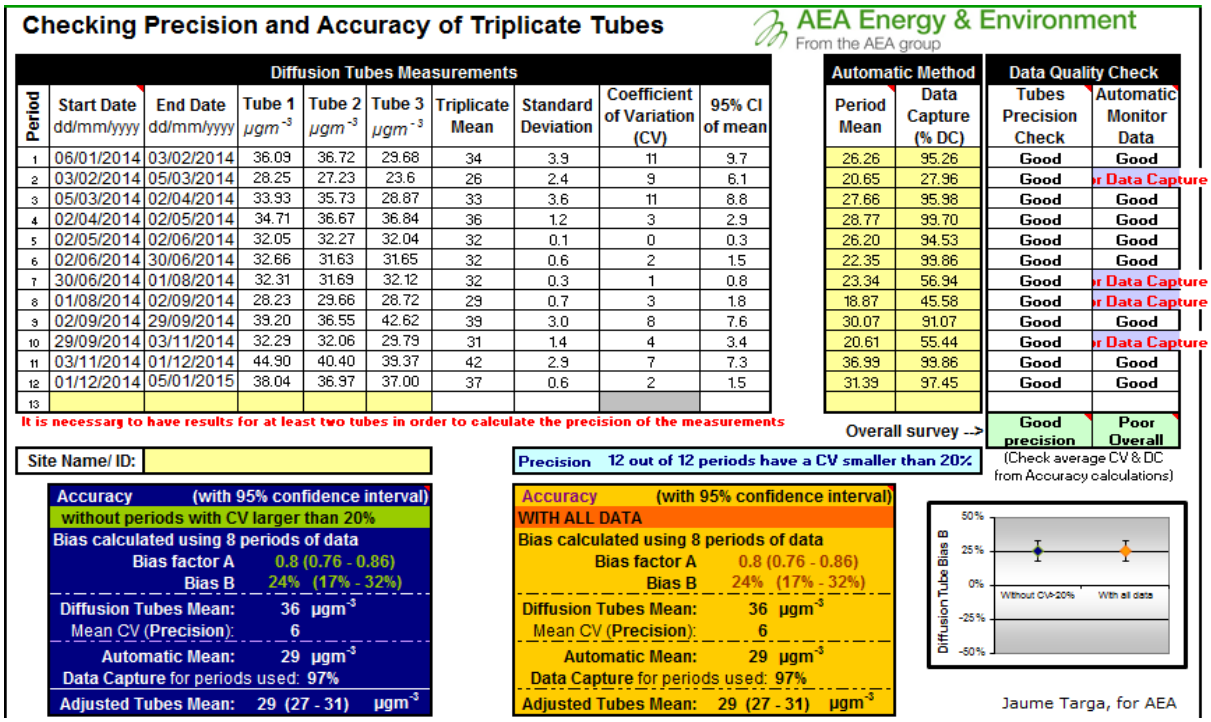
Authorities are asked to report the adjustment factor from their own co-location study, where available. The national bias adjustment factor is then determined by collating and assessing data from NO_2 co-location studies across the UK. Full details of both the national and local bias adjustment factors used to adjust data and details of data precision are provided below.

Factor from Local Co-location Study

Carlisle City Council utilises NO_2 diffusion tubes prepared with 20% TEA in water, these are prepared and analysed by Gradko Environmental Ltd.

A local bias adjustment factor of **0.8** was derived from the diffusion tubes co-located at the Paddy's Market monitoring station for 2014. This is a roadside location, not representative of public exposure, located close to two air quality management areas.

The local bias adjustment factor was calculated using the RICARDO-AEA Spreadsheet for checking the precision and accuracy of triplicate tubes, found on the Defra Local Air Quality Management (LAQM) website. The following screen print shows the results of the data that was input into the spreadsheet:



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
1	06/01/2014	03/02/2014	36.09	36.72	29.68	34	3.9	11	9.7
2	03/02/2014	05/03/2014	28.25	27.23	23.6	26	2.4	9	6.1
3	05/03/2014	02/04/2014	33.93	35.73	28.87	33	3.6	11	8.8
4	02/04/2014	02/05/2014	34.71	36.67	36.84	36	1.2	3	2.9
5	02/05/2014	02/06/2014	32.05	32.27	32.04	32	0.1	0	0.3
6	02/06/2014	30/06/2014	32.66	31.63	31.65	32	0.6	2	1.5
7	30/06/2014	01/08/2014	32.31	31.69	32.12	32	0.3	1	0.8
8	01/08/2014	02/09/2014	28.23	29.66	28.72	29	0.7	3	1.8
9	02/09/2014	29/09/2014	39.20	36.55	42.62	39	3.0	8	7.6
10	29/09/2014	03/11/2014	32.29	32.06	29.79	31	1.4	4	3.4
11	03/11/2014	01/12/2014	44.90	40.40	39.37	42	2.9	7	7.3
12	01/12/2014	05/01/2015	38.04	36.97	37.00	37	0.6	2	1.5
13									

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

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
26.26	95.26	Good	Good
20.65	27.96	Good	r Data Capture
27.66	95.98	Good	Good
28.77	99.70	Good	Good
26.20	94.53	Good	Good
22.35	99.86	Good	Good
23.34	56.94	Good	r Data Capture
18.87	45.58	Good	r Data Capture
30.07	91.07	Good	Good
20.61	55.44	Good	r Data Capture
36.99	99.86	Good	Good
31.39	97.45	Good	Good
Overall survey -->		Good precision	Poor Overall

(Check average CV & DC from Accuracy calculations)

Site Name/ ID:

Precision 12 out of 12 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 0.8 (0.76 - 0.86)
Bias B 24% (17% - 32%)
Diffusion Tubes Mean: 36 µgm^{-3}
Mean CV (Precision): 6
Automatic Mean: 29 µgm^{-3}
Data Capture for periods used: 97%
Adjusted Tubes Mean: 29 (27 - 31) µgm^{-3}

Accuracy (with 95% confidence interval)
WITH ALL DATA
Bias calculated using 8 periods of data
Bias factor A 0.8 (0.76 - 0.86)
Bias B 24% (17% - 32%)
Diffusion Tubes Mean: 36 µgm^{-3}
Mean CV (Precision): 6
Automatic Mean: 29 µgm^{-3}
Data Capture for periods used: 97%
Adjusted Tubes Mean: 29 (27 - 31) µgm^{-3}

Jaume Targa, for AEA

Tube precision is separated into two categories good or poor. Tubes are considered to have good precision where the coefficient of variation (CV) of duplicate or triplicate diffusion tubes for eight or more periods during the year is less than 20%, and the average CV of all monitoring periods is less than 10%. Tubes are considered to have poor precision where the CV of four or more periods is greater than 20% and/or the average CV is greater than 10%. All of the 12 diffusion tube study periods shown above had a CV of below 20% (good precision).

The data capture from the automatic analyser for 2014 was poor overall. As a result the local bias adjustment factor was calculated using 8 months of valid data and the outcome is summarised as follows:

Diffusion tubes annual mean: **36µg/m^3**
Automatic monitoring station mean: **29 µg/m^3**
Local bias adjustment factor: **0.8**

Factor from National Co-location Studies

A national bias adjustment factor of **0.91** was calculated using the bias adjustment factor spreadsheet version 03/15 from the Defra LAQM website. This adjustment factor is based on 16 other co-location studies nationwide. All of the studies were analysed by Gradko for the method 20% TEA in water during 2014.

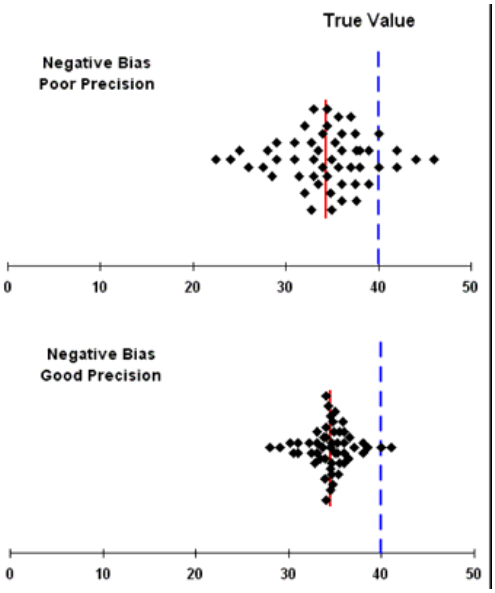
Discussion of Choice of Factor to Use

It was decided that the national bias adjustment factor would be the most appropriate to use. This factor is the higher of the two so it would give the worst case results when multiplied with the raw monitoring data. It was also considered that a correction factor derived from 16 co-location studies would incorporate variation from many different types of monitoring site. This would reflect the wide range of locations in which we expose our 50 diffusion tubes across the district, some of which differ considerably from our own co-location site. In addition to this the data capture from our Paddys Market automatic analyser was less than 90% for 2014, this is shown as poor overall in the data quality check on the above screen print. **The annual mean for each diffusion tube location has therefore been adjusted using the national bias adjustment factor of 0.91**.

Precision

Unlike bias, poor precision cannot be adjusted for. It can only be improved by careful handling of the tubes in both the laboratory and the field. The two figures below illustrate the difference between bias and precision. Both sets of results have the same calculated negative bias, shown by the vertical red line, compared with the true value. However, those in the top part of the Figure have poor precision, whereas those in the lower part have good precision. (The vertical spread is just a way of displaying the large number of individual results).

Good vs Poor Precision



The distinction between good and poor precision is an indicator of how well the same measurement can be reproduced. This precision will reflect the laboratories performance/consistency in preparing and analysing the tubes, as well as the subsequent handling of the tubes in the field. Any laboratory can show poor precision for a particular period/collocation study, if this is due to poor handling of the tubes in the field. Therefore, when assessing the performance of a laboratory, account should be taken of the proportion of poor precision collocation results, not just the presence or absence of poor precision co-location results.

Particulate Matter Monitoring Adjustment

DEFRA published the results of a study investigating the equivalence of various samplers and instruments for measuring PM_{10} in comparison with the European reference method (a gravimetric technique). The study found that the TEOM did not meet the equivalence criteria of the European reference method within the UK, even with the 1.3 correction factor (as advised in previous guidance). The outcome of the equivalence study means that TEOM analysers cannot strictly be used to measure PM_{10} concentrations for comparison with the air quality objectives.

TEOM's are still widely used in LAQM work. DEFRA & the Devolved Administrations advice to local authorities using TEOM's is that it is generally not necessary to replace the instrument immediately, but when the time does come to replace it, the selected sampler should be a reference sampler, or one that meets the equivalence criteria.

During some early rounds of review and assessment the data was corrected wherever possible using the King's College London Volatile Correction Model (VCM) for PM_{10} (rather than by the application of a 1.3 correction factor). This adjustment is not necessary for the purpose of more recent monitoring because the TEOM's were upgraded to FDMS on 18th March 2009. For this reason the PM_{10} data presented here can be compared to the air quality objectives.

Short-term to Long-term Data Adjustment

In circumstances where the valid monitoring data is less than 9 months of the calendar year it is necessary to estimate the annual mean concentration. In order to do this there is a defined procedure that must be followed in LAQM TG(09) chapter 3. The intention is to calculate an adjustment factor that can be applied to the data in order to estimate the mean pollutant concentration for the whole calendar year. It was necessary to apply this procedure to two sets of 2014 monitoring data. The PM_{10} monitoring at the Paddys Market site suffered due to various faults with the analyser throughout the year. This led to a loss of 29% of the data. There was also a problem with the NO_2 monitoring data from Stanwix Bank as discussed in section 2.2.1 of this report. The liquidation of the data management company, Supporting U, resulted in the loss of 4 months of monitoring data.

The data adjustment process is based on the principle that patterns in pollution concentrations, such as seasonal variation, usually affect a wide region. Thus if a six month period is above average at one location it is also likely to be above average at other locations in the region. The first step is to identify two to four nearby continuous monitoring sites that measure the pollutant in question. The selected monitoring sites must be at a background location, be affiliated to the Automatic Urban and Rural Network (AURN) and have a data capture of above 90% for 2014.

In order to select locations which match the above criteria it was only possible to use locations which lie outside of the desired 50 mile radius. The required data was obtained from the following monitoring sites:

PM_{10} Paddys Market

- Salford Eccles. Located approximately 101 miles directly south south east of Carlisle.
- York Bootham. Located approximately 99 miles directly south east of Carlisle.

NO_2 Stanwix Bank

- Blackpool Marton. Located approximately 75 miles directly south of Carlisle.
- Leeds Centre. Located approximately 95 miles directly south east of Carlisle.

The monitoring data was obtained for each of these locations and the annual means (Am) were calculated. The period means (Pm) were then calculated for each location, to match the period in which our analyser collected valid data, for the pollutant in question.

The ratios of the annual mean to the period mean (Am/Pm) were then calculated for each location. An average was then taken of the two ratios to give the final adjustment factor (Ra). The tables below show the monitoring data that was collected and a summary of the results:

Short-term to long-term Monitoring Data Adjustment (PM_{10}, Paddys Market)

Background Automatic Monitoring Site	Annual Mean (Am) 2014 (µg/m^3)	Period Mean (Pm) 2014 (µg/m^3)	Ratio (Am/Pm)
Salford Eccles	17.58	18.47	0.95
York Bootham	14.96	15.59	0.96
Average Ratio (Ra)			0.96

The adjustment factor calculated above was then applied to the measured period mean for the PM_{10} monitoring data. This was done by multiplying the measured period mean (M) with this adjustment factor (Ra). (M x Ra = Predicted Annual Mean) this produced the following result: (15.78 x 0.96 = **14.98µg/m^3**). Further discussion can be found in section 2 of this report.

Short-term to long-term Monitoring Data Adjustment (NO_2, Stanwix Bank)

Background Automatic Monitoring Site	Annual Mean (Am) 2014 (µg/m^3)	Period Mean (Pm) 2014 (µg/m^3)	Ratio (Am/Pm)
Blackpool Marton	16.19	14.00	1.16
Leeds Centre	38.28	37.05	1.03
Average Ratio (Ra)			1.10

The adjustment factor calculated above was then applied to the measured period mean for the NO_2 monitoring data. This was done by multiplying the measured period mean (M) with this adjustment factor (Ra). (M x Ra = Predicted Annual Mean) this produced the following result: (27.52 x 1.1 = **30.27µg/m^3**). Further discussion can be found in section 2 of this report.

QA/QC of automatic monitoring

Both of our automatic stations are subject to stringent QA/QC procedures.

Paddy's Market, which monitors PM_{10}, NO_2 and $PM_{2.5}$, is part of the AURN and the network quality assurance and control procedures are implemented.

To ensure optimum data quality and capture, a three-tier system of calibration and analyser test procedures is employed in the AURN. The major components of this system are briefly described below.

a) Daily automatic IZS checks - these allow instrumental drifts to be examined, and act as a daily check on instrument performance.

b) Fortnightly manual calibrations - these are performed by the local site operators and are used by management unit to scale raw pollution data.

c) 6 – monthly network inter calibrations – These exercises are performed by the QA/Qc Unit every 6 months to ensure that all measurements from all network stations are completely representative and intercomparable. The inter calibrations will also act as an independent audit of the system at the site.

Data ratification is undertaken at 3 monthly intervals. This involves a critical review of all information relating to the data set to verify, amend or reject the data. The ratified data represents the final data set in the review & assessment process.

The NO_2 monitoring data from the Stanwix Bank monitoring unit was collected and managed by Supporting U during 2014. The NO_2 data from the Stanwix Bank Unit is now collected and managed by Air Monitors Ltd, this has been the arrangement since January 2015.

Re-scaling of the data relies on the Local Site Operator (Carlisle City Council) providing fortnightly calibration reports using calibration sources such as gas cylinders and zero air scrubbers. This data is used to calculate the true analyser zero and response factor and is used to scale data for the following two weeks leading up to the next scheduled calibration.

QA/QC of diffusion tube monitoring

Carlisle City Council QA/QC of diffusion tube monitoring

Carlisle City Council follows the guidance set out in the 'Diffusion Tubes for Ambient NO_2 Monitoring: Practical Guidance for Laboratories and User' which includes advice on selection of site, the location of the samplers, instructions for exposure, and co-location with automatic analysers.

Laboratory QA/QC of diffusion tube monitoring

Gradko International has a defined quality system which forms part of the UKAS accreditation that the laboratory holds. All accredited methods are fully documented. The analytical laboratory is assessed by UKAS to establish conformance of Laboratory Quality Procedures to the requirements of ISO/IEC 17025 Standard.

UKAS assessors visit on an annual basis and review all aspects of the analysis from the sample handling to analysis and reporting. As a condition of the accreditation the laboratory is required to participate in external proficiency schemes. Gradko participates in the Workplace Analysis Scheme for Proficiency (WASP) organised by the Health and Safety Laboratory. This scheme provides a regular assessment of the labs performance in that, every quarter, the laboratory receives four diffusion tubes doped with an amount of nitrite known to HSL, but not the laboratory. At least two of the tubes are usually duplicates, which enables precision, as well as accuracy, to be assessed. Any result from such a scheme that falls outside the relevant limits is immediately investigated and steps taken to rectify the situation.

Calibration

The instrument is calibrated twice daily, using a series of calibration standards to ensure a satisfactory linear response is obtained. A standard check is analysed after every fifty samples to ensure that the calibration is still valid.

Quality Control

A quality control check is run after ten samples and is assessed against warning and action limits defined in the method. Quality control solutions are prepared from standards supplied by a different vendor to that of the calibration standards. Any AQC exceeding the action limit or two consecutive warning limits is internally assessed and is reported to the client as an AQC failure.

Travel Blank

A travelling blank is analysed at the same time as the samples, any blank exceeding the currently prescribed maximum is investigated and reported to the client.

Appendix B MONTHLY NO2 DIFUSION TUBE RESULTS 2014 - Raw Data

AREA A - A7 STANWIX BANK, SCOTLAND ROAD AND KINGSTOWN ROAD

Site ID	OS Grid Reference		Site Name	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	No of months
A1	339995	557188	45 SCOTLAND RD	39.5	53.04	34.57	35.94	38.9	33.12	35.06	34.12	40.95	42.95	44.35	47.18	12
A10	340008	556842	STANWIX BANK	46.89	44.92	37.26	44.72	45.06	43.65	37.74	41.94	54.12	49.85	53.40	39.17	12
A12	339935	557125	14 ETTERBY ST	26.37	24.81	20.25	20.8	17.95	19.12	15.40	15.57	25.23	22.67	34.03	19.81	12
A5	339758	558059	37 KINGSTOWN RD	40.26	a	28.65	34.38	34.85	32.37	31.12	39.12	35.27	38.64	40.86	a	10
A7	339526	559285	282 KINGSTOWN RD	29.03	34.78	22.06	20.04	25.57	17.38	25.23	25.27	28.98	31.28	32.51	32.32	12
A9	340028	556833	BRAMPTON RD	38.31	39.95	40.14	38.68	42.03	39.37	32.79	34.41	46.39	41.06	42.78	45.38	12
	AREA B - CURROCK ST-DENTON ST															
B12	339928	555428	DENTON ST	42.69	36.44	37.94	36.11	38.38	37.47	33.20	28.97	36.76	41.54	a	35.09	11
B4	339434	555638	DALSTON RD	46.2	50.22	36.64	42.13	43.83	36.84	39.17	39.3	52.57	62.22	55.25	85.81	12
B5	339613	555587	8 JUNCTION ST	34.41	30.9	29.69	31.08	31.72	31.48	26.19	28.72	36.25	29.66	36.86	34.89	12
B6	339731	555526	41 CHARLOTTE ST	40.98	34.45	28.93	31.19	28.56	a	28.02	28.82	42.27	34.58	39.99	34.98	11
B7	340205	555198	12 CURROCK ST	46.64	50.04	32.69	34.64	38.56	37.03	30.33	33.62	38.83	41.29	61.97	40.15	12
	AREA C - CITY CENTRE															
C1	340216	556131	LOWTHER ST	42.89	40.31	30.38	32.77	33.15	28.92	25.15	27.83	35.64	33.27	50.00	38.51	12
C2	340069	555955	TOURIST INFO	33.35	30.4	21.18	22.75	15.65	14.95	16.89	19.59	40.48	38.52	35.31	27.40	12
C3	340218	555768	DEVONSHIRE ST	37.53	40.98	37.55	32.55	40.53	41.60	33.91	34.99	21.89	25.08	42.08	30.22	12
C4	340286	555622	BAR SOLO	39.48	38.84	34.51	29.71	34.39	34.68	28.19	29.92	39.60	a	44.99	42.37	11
C5	340298	555589	GRIFFIN	41.97	49.56	31.57	34.24	37.15	34.99	38.73	36.16	36.38	38.33	50.17	31.58	12
	AREA D - A69 WARWICK ROAD															
D10	342044	555907	368 WARWICK RD	38.46	32.91	28.53	26.57	28.05	26.33	24.83	26.18	33.41	32.21	41.47	32.23	12
D11	340426	556040	CARTEF	32.39	31.43	30.64	35.09	38.46	33.48	28.90	35.23	38.97	36.26	43.60	36.10	12
D12	340307	555718	POST OFFICE	51.34	47.15	31.91	40.94	42.11	34.38	34.53	38.88	43.27	42.91	56.00	45.44	12
D5	341310	555914	215 WARWICK RD	28.19	21.19	23.55	25.15	24.7	19.80	22.44	23.56	30.23	23.36	35.60	28.73	12
D7	341593	555893	282 WARWICK RD	39.08	42.47	30.56	31.04	36.59	33.28	25.69	34.03	34.70	41.56	35.02	41.17	12
D9	341426	555910	251 WARWICK RD	35.41	27.58	26.88	29.36	28.04	30.73	25.28	27.88	36.51	29.68	37.69	36.66	12

	AREA E - CALDEWGATE-WIGTON ROAD-NEWTOWN ROAD															
E22	339834	556137	FINKLE ST	41.56	44.95	33.94	32.61	34.18	29.57	26.75	35.57	37.06	42.32	41.38	40.89	12
E12	339225	555821	3 WIGTON RD	43.16	40.71	37.43	37.37	44.34	39.62	29.57	32.94	45.51	43.96	42.26	a	11
E15	339091	555736	22 WIGTON RD	36.35	3.36	34.16	40.33	41.14	37.84	31.32	33.36	37.88	35.90	41.33	36.03	12
E16	339141	555900	JOVIAL SAILOR	38.64	a	36.28	40.78	38.14	34.95	31.47	30.75	42.91	35.15	56.21	36.00	11
E19	338953	555610	49 WIGTON RD	50.33	41.95	43.55	45.22	38.98	a	32.32	28.94	41.05	45.64	56.68	36.93	11
E20	339023	555692	44 WIGTON RD	34.27	30.24	34.13	37.95	37.39	37.19	34.01	32.78	39.07	29.35	41.91	33.34	12
E4	339396	555947	JOHN ST	41.42	39.44	37.26	43.66	40.51	39.90	35.89	35.08	45.31	42.58	52.77	42.91	12
E6	339467	555974	PADDYS MARKET 1	36.09	28.25	33.93	34.71	32.05	32.66	32.31	28.23	39.20	32.29	44.90	38.04	12
E6	339467	555974	PADDYS MARKET 2	36.72	27.23	35.73	36.67	32.27	31.63	31.69	29.66	36.55	32.06	40.40	36.97	12
E6	339467	555974	PADDYS MARKET 3	29.68	23.6	28.87	36.84	32.04	31.65	32.12	28.72	42.62	29.79	39.37	37.00	12
E8	339516	556024	BRIDGE ST	43.44	38.81	46.86	57.2	51.61	49.50	46.02	44.87	54.77	50.92	52.86	49.45	12
E21	337730	556118	BURGH RD	26.28	21.01	18.92	18.44	14.59	15.35	12.53	15.09	21.75	20.19	35.28	21.29	12
	AREA F - BOTCHERGATE / LONDON ROAD															
F1	340482	555489	3 TAIT ST	36.31	32.76	27.29	31.28	31.74	28.47	25.41	32.33	33.81	32.08	37.89	33.90	12
F10	349597	555351	155 BOTCHERGATE	49.36	39.24	38.11	43.99	43.11	38.53	36.91	35.85	44.61	32.29	48.25	42.12	12
F5	340534	555409	STANLEY HALL	36.56	27.74	34.86	40.02	a	a	30.59	31.41	46.27	30.86	54.96	33.30	10
F7	340708	555240	24 LONDON RD	43.61	40.68	35.46	36.02	42.66	33.55	33.23	41.4	39.92	34.52	43.18	41.08	12
F9	341099	554931	129 LONDON RD	40.02	30.51	31.49	33.52	34	33.88	31.75	32.11	42.60	36.85	44.19	32.16	12
	AREA G - BYPASS															
G1	338109	557841	SPA HOUSE	18.28	15.43	13.84	12.62	9.93	10.23	11.94	11.74	14.75	11.71	21.85	13.62	12
G2	337093	556785	KNOCKUPWORTH COTTAGE	16.21	12.42	13.68	13.78	12.16	13.58	12.80	12.17	17.37	13.53	22.29	18.00	12
G3	336338	556311	CORNHILL FARM	18.84	13.34	10.87	9.94	8.31	8.97	8.83	8.58	11.73	13.58	22.47	12.85	12
G4	336905	554036	THE HOBBIT	17.29	13.12	13.66	17.75	12.34	14.27	14.72	12.52	21.93	14.02	27.71	12.86	12
	AREA H - OUTSKIRTS OF CITY, TOWNSHIPS AND AIRPORT															
H1	352824	561039	BRAMPTON	22.15	18.66	19.5	17.97	18.38	16.39	14.59	17.07	22.20	16.64	26.10	17.46	12
H3	338052	568478	LONGTOWN	32.08	27.84	23.33	22.04	22.07	21.42	19.88	20.87	22.74	24.56	31.57	22.73	12
H4	347411	556881	WARWICK BRIDGE	30.96	26.88	31.05	33.89	34.61	33.67	30.29	32.62	43.25	31.49	38.73	22.52	12
H5	337643	554100	WIGTON RD	22.39	19.52	22.18	19.45	16.02	13.91	11.84	a	18.04	17.83	27.54	22.77	11
H6	337962	553220	PETER LANE	15.67	9.28	12.42	11.3	7.62	10.82	11.02	8.57	14.88	11.43	27.46	9.56	12
H7	338282	553396	DALSTON RD	23.67	20.05	12.41	11.07	9.16	13.16	14.76	12.64	24.06	27.65	34.95	17.39	12
H8	347874	561254	AIRPORT	13.13	11.04	9.85	8.01	5.55	6.46	6.53	6.48	8.87	8.80	17.84	8.33	12

a - Absent data.

Appendix C NO2 DIFUSION TUBE RESULTS 2014 - Calculated Data

Site ID	Site Name	Annual Mean (µg/m3)	Local Bias Adjustment (0.8)	National Bias Adjustment (0.91)	In relevant location? (Distance of residence from tube) (m)	Distance of tube from kerb of nearest Road. (m)	NO2 Background Concentration (µg/m3)	Predicted NO2 Concentration at receptor (µg/m3)
	AREA A - A7 STANWIX BANK, SCOTLAND ROAD AND KINGSTOWN ROAD							
A1	45 SCOTLAND RD	39.97	31.98	36.38	N (4.5)	1.5	11.745168	28.9
A10	STANWIX BANK	44.89	35.92	40.85	N (1.5)	1.5	14.093652	36.8
A12	14 ETTERBY ST	21.83	17.47	19.87	Y	3	-	-
A5	37 KINGSTOWN RD	35.55	28.44	32.35	Y	4	-	-
A7	282 KINGSTOWN RD	27.04	21.63	24.60	N (7.5)	4	11.59345	20.8
A9	BRAMPTON RD	40.11	32.09	36.50	Y	1.5	-	-
	AREA B - CURROCK ST-DENTON ST							
B12	DENTON ST	36.78	29.43	33.47	N (10)	0.5	17.613678	24.9
B4	DALSTON RD	49.18	39.35	44.76	Y	3.5	-	-
B5	8 JUNCTION ST	31.82	25.46	28.96	Y	2.5	-	-
B6	41 CHARLOTTE ST	33.89	27.11	30.84	Y	2.5	-	-
B7	12 CURROCK ST	40.48	32.39	36.84	Y	3	-	-
	AREA C - CITY CENTRE							
C1	LOWTHER ST	34.90	27.92	31.76	Y	3	-	-
C2	TOURIST INFO	26.37	21.10	24.00	N	-	-	Not residential
C3	DEVONSHIRE ST	34.91	27.93	31.77	N	3	-	Not residential
C4	BAR SOLO	36.06	28.85	32.82	N	9	-	Not residential
C5	GRIFFIN	38.40	30.72	34.95	N	3	-	Not residential
	AREA D - A69 WARWICK ROAD							
D10	368 WARWICK RD	30.93	24.74	28.15	Y	5	-	-
D11	CARTEF	35.05	28.04	31.89	Y	4.5	-	-
D12	POST OFFICE	42.41	33.92	38.59	N	5	-	Not residential
D5	215 WARWICK RD	25.54	20.43	23.24	Y	9	-	-
D7	282 WARWICK RD	35.43	28.35	32.24	Y	7	-	-
D9	251 WARWICK RD	30.98	24.78	28.19	Y	8.5	-	-

	AREA E - CALDEWGATE-WIGTON ROAD-NEWTOWN ROAD							
E22	FINKLE ST	36.73	29.39	33.43	Y	12	-	-
E12	3 WIGTON RD	39.72	31.77	36.14	N (2)	2.5	17.613678	33.4
E15	22 WIGTON RD	34.08	27.27	31.02	Y	4.5	-	-
E16	JOVIAL SAILOR	38.30	30.64	34.85	Y	2.5	-	-
E19	49 WIGTON RD	41.96	33.57	38.19	Y	2.5	-	-
E20	44 WIGTON RD	35.14	28.11	31.97	Y	5.5	-	-
E4	JOHN ST	41.39	33.11	37.67	N (3)	3	17.613678	34.1
E6	PADDYS MARKET 1	34.39	27.51	31.29	N (42)	9	-	Not residential
E6	PADDYS MARKET 2	33.96	27.17	30.91	N (42)	9	-	Not residential
E6	PADDYS MARKET 3	32.69	26.15	29.75	N (42)	9	-	Not residential
E8	BRIDGE ST	48.86	39.09	44.46	Y	4	-	-
E21	BURGH RD	20.06	16.05	18.25	N (8)	3	8.119659	14.8
AREA F - BOTCHERGATE / LONDON ROAD								
F1	3 TAIT ST	31.94	25.55	29.06	Y	3.5	-	-
F10	155 BOTCHERGATE	41.03	32.82	37.34	Y	3	-	-
F5	STANLEY HALL	36.66	29.33	33.36	Y	3	-	-
F7	24 LONDON RD	38.78	31.02	35.29	Y	4.5	-	-
F9	129 LONDON RD	35.26	28.21	32.08	Y	0.5	-	-
	AREA G - BYPASS							
G1	SPA HOUSE	13.83	11.06	12.58	Y	85	-	-
G2	KNOCKUPWORTH COTTAGE	14.83	11.87	13.50	Y	22	-	-
G3	CORNHILL FARM	12.36	9.89	11.25	Y	3	-	-
G4	THE HOBBIT	16.02	12.81	14.58	Y	19	-	-
	AREA H - OUTSKIRTS OF CITY, TOWNSHIPS AND AIRPORT							
H1	BRAMPTON	18.93	15.14	17.22	N (0.5)	2.5	5.887088	16.7
H3	LONGTOWN	24.26	19.41	22.08	N (0.5)	2.5	6.095361	21.4
H4	WARWICK BRIDGE	32.50	26.00	29.57	N (0.5)	2.5	6.683193	28.5
H5	WIGTON RD	19.23	15.38	17.50	Y	1.5	-	-
H6	PETER LANE	12.50	10.00	11.38	Y	4	-	-
H7	DALSTON RD	18.41	14.73	16.76	Y	6.5	-	-
H8	AIRPORT	9.24	7.39	8.41	Y	2	-	-

Results in red indicate an exceedence of the annual mean objective of 40 µg/m3.

Appendix D: CNDR TRAFFIC COUNT DATA 2014

Yearly classified during 2014 for site 101/1005101

WB, A689, CNDR - Asda(E338762, N559552) view site location on map

Month		24hr				18hr				16hr				12hr				ATC
		ADT	%>6.6m	AWT	%>6.6m	ADT	%>6.6m	AWT	%6.6m	ADT	%>6.6m	AWT	%>6.6m	ADT	%>6.6m	AWT	%>6.6m	DAY
bo	Jan	4440	15.1	5013	17	4265	14.1	4816	16	4192	14.2	4739	16.1	3766	13.9	4243	15.8	30
o	Feb	4713	15.3	5362	17.1	4529	14.4	5151	16.2	4446	14.4	5065	16.2	3968	14.2	4505	16.1	28
	Mar	5011	15.3	5626	17.3	4820	14.4	5409	16.4	4735	14.5	5318	16.5	4204	14.4	4706	16.4	31
bo	Apr	4962	14.6	5553	16.6	4780	13.8	5345	15.8	4692	13.9	5253	15.9	4148	13.9	4630	15.9	30
bo	May	5015	14.6	5612	16.4	4825	13.8	5399	15.5	4732	13.9	5298	15.6	4162	13.8	4649	15.6	31
	Jun	5186	14.8	5777	16.7	4990	14	5567	15.8	4888	14.1	5457	15.9	4270	14.1	4757	16.1	29
o	Jul	5200	14.8	5818	16.6	5001	14	5599	15.8	4894	14.1	5483	15.9	4249	14.2	4738	16.1	30
bo	Aug	5035	14.5	5599	16.3	4840	13.8	5387	15.5	4747	13.9	5288	15.6	4155	13.9	4617	15.7	31
o	Sep	5256	15.2	5889	17.1	5064	14.5	5668	16.3	4975	14.5	5574	16.4	4379	14.5	4891	16.5	30
o	Oct	5318	15.3	5954	17.2	5120	14.5	5731	16.4	5035	14.6	5641	16.4	4488	14.5	5012	16.5	30
	Nov	5352	15.6	6021	17.5	5144	14.8	5783	16.6	5054	14.8	5687	16.7	4507	14.7	5056	16.6	30
bo	Dec	4816	14.6	5364	16.2	4630	13.7	5154	15.3	4540	13.7	5059	15.4	4056	13.5	4503	15.2	31
Avg		5025	15	5632	16.8	4834	14.2	5417	16	4744	14.2	5322	16	4196	14.1	4692	16.1	361

b Bank Holiday w Weather a Accident t Time change r Road Works s Sporting Event o Other

Yearly classified during 2014 for site 101/1005102

EB, A689, CNDR - Asda(E338762, N559552) view site location on map

Month		24hr				18hr				16hr				12hr				ATC
		ADT	%>6.6m	AWT	%>6.6m	ADT	%>6.6m	AWT	%6.6m	ADT	%>6.6m	AWT	%>6.6m	ADT	%>6.6m	AWT	%>6.6m	DAY
bo	Jan	4315	14.9	4852	16.9	4178	14	4699	16	4118	14	4634	16	3772	13.6	4232	15.6	30
o	Feb	4624	15.5	5233	17.5	4484	14.7	5075	16.7	4422	14.7	5006	16.7	4041	14.5	4566	16.4	28
	Mar	4954	15.7	5543	18	4801	14.9	5369	17.1	4736	14.9	5296	17.2	4304	14.7	4800	17	31
bo	Apr	4940	15.1	5489	17.3	4788	14.3	5316	16.5	4722	14.4	5247	16.6	4269	14.2	4734	16.4	30
bo	May	4996	15.4	5532	17.6	4834	14.6	5352	16.8	4762	14.6	5275	16.8	4301	14.5	4752	16.7	31
	Jun	5162	15.5	5735	17.7	4989	14.8	5542	16.9	4909	14.8	5456	17	4402	14.6	4884	16.8	28
o	Jul	5139	15.5	5713	17.5	4964	14.7	5518	16.7	4883	14.8	5431	16.8	4358	14.8	4828	16.9	30
bo	Aug	5032	15.1	5556	17.2	4862	14.5	5368	16.5	4788	14.5	5289	16.6	4303	14.5	4739	16.6	31
o	Sep	5202	15.9	5810	18.1	5033	15.1	5618	17.2	4962	15.1	5542	17.2	4466	15	4972	17.2	30
o	Oct	5209	16	5824	18.1	5045	15.1	5640	17.2	4977	15.1	5566	17.2	4540	15	5060	17.2	30
	Nov	5240	15.6	5871	17.6	5063	14.8	5674	16.8	4992	14.7	5594	16.8	4545	14.6	5079	16.6	30
bo	Dec	4745	14.6	5277	16.4	4589	13.7	5102	15.5	4519	13.6	5025	15.5	4129	13.4	4572	15.2	31
Avg		4963	15.4	5536	17.5	4803	14.6	5356	16.7	4733	14.6	5280	16.7	4286	14.5	4768	16.6	360

b Bank Holiday *w* Weather *a* Accident *t* Time change *r* Road Works *s* Sporting Event *o* Other

Yearly classified during 2014 for site 101/1005301

WB, A689, CNDR - Eden Bridge(E337135, N556852) view site location on map

Month		24hr				18hr				16hr				12hr				ATC
		ADT	%>6.6m	AWT	%>6.6m	ADT	%>6.6m	AWT	%6.6m	ADT	%>6.6m	AWT	%>6.6m	ADT	%>6.6m	AWT	%>6.6m	DAY
bo	Jan	6260	9.7	7028	11.1	6131	9.5	6894	10.9	6025	9.5	6779	11	5501	9.7	6177	11.2	31
o	Feb	6576	10.4	7402	11.8	6437	10.2	7251	11.6	6319	10.3	7124	11.7	5725	10.5	6443	12.1	28
	Mar	6972	10.3	7765	11.8	6828	10.1	7613	11.6	6706	10.2	7481	11.7	6042	10.4	6728	12	31
bo	Apr	6887	10	7651	11.4	6746	9.8	7502	11.3	6617	9.9	7367	11.4	5908	10.2	6569	11.8	30
bo	May	6940	9.8	7699	11.1	6790	9.6	7544	11	6657	9.7	7399	11.1	5925	10	6579	11.4	31
	Jun	7269	9.8	8062	11.2	7102	9.6	7893	11	6954	9.7	7734	11.1	6162	10	6847	11.5	28
o	Jul	7316	9.9	8169	11.1	7152	9.7	7999	10.9	6996	9.8	7828	11.1	6163	10.2	6877	11.5	29
bo	Aug	7003	9.9	7763	11.2	6841	9.7	7597	11	6701	9.8	7444	11.1	5918	10.1	6564	11.5	31
o	Sep	7205	10	8006	11.4	7054	9.8	7846	11.2	6931	9.9	7714	11.3	6174	10.2	6863	11.7	30
o	Oct	7223	10.3	8042	11.7	7071	10.1	7885	11.5	6950	10.1	7753	11.6	6273	10.4	6988	11.9	30
	Nov	7300	10.1	8141	11.5	7150	9.9	7982	11.3	7022	10	7843	11.4	6344	10.2	7078	11.7	30
bo	Dec	6596	9.3	7288	10.5	6453	9	7138	10.3	6327	9.1	7002	10.4	5715	9.3	6309	10.6	30
Avg		6962	9.9	7751	11.3	6813	9.8	7595	11.1	6684	9.8	7456	11.2	5988	10.1	6669	11.6	359

b Bank Holiday w Weather a Accident t Time change r Road Works s Sporting Event o Other

Yearly classified during 2014 for site 101/1005302

EB, A689, CNDR - Eden Bridge(E337135, N556852) view site location on map

Month		24hr				18hr				16hr				12hr				ATC
		ADT	%>6.6m	AWT	%>6.6m	ADT	%>6.6m	AWT	%6.6m	ADT	%>6.6m	AWT	%>6.6m	ADT	%>6.6m	AWT	%>6.6m	DAY
bo	Jan	5832	9.9	6527	11.4	5653	9.8	6326	11.2	5574	9.8	6244	11.2	5109	10	5712	11.5	31
o	Feb	6339	10.4	7130	11.9	6155	10.3	6921	11.7	6071	10.3	6833	11.8	5564	10.5	6254	12	28
	Mar	6799	10.5	7552	12	6602	10.3	7329	11.8	6517	10.3	7239	11.9	5931	10.5	6574	12.1	31
bo	Apr	6734	10	7447	11.4	6541	9.8	7229	11.2	6451	9.8	7139	11.3	5828	10.1	6441	11.6	30
bo	May	6780	9.7	7465	11.1	6581	9.6	7242	11	6485	9.6	7144	11	5857	9.9	6441	11.3	31
	Jun	7056	9.8	7802	11.2	6838	9.7	7561	11	6732	9.7	7451	11.1	6060	10	6704	11.4	28
o	Jul	7022	9.5	7780	10.8	6807	9.3	7543	10.6	6691	9.4	7420	10.6	5965	9.8	6594	11.1	31
bo	Aug	6802	9.7	7490	11	6593	9.6	7259	10.9	6489	9.6	7149	11	5816	9.9	6392	11.3	31
o	Sep	6965	10	7716	11.4	6758	9.8	7483	11.2	6667	9.8	7391	11.2	6026	10.1	6664	11.5	30
o	Oct	6957	10.3	7724	11.7	6750	10.2	7491	11.6	6664	10.2	7402	11.6	6079	10.4	6735	11.9	30
	Nov	7053	10.2	7848	11.6	6838	10	7605	11.4	6751	10	7513	11.4	6158	10.2	6841	11.7	30
bo	Dec	6361	9.2	7026	10.5	6170	9	6813	10.3	6078	9	6716	10.3	5557	9.1	6122	10.5	30
Avg		6725	9.9	7459	11.3	6524	9.8	7234	11.2	6431	9.8	7137	11.2	5829	10	6456	11.5	361

b Bank Holiday w Weather a Accident t Time change r Road Works s Sporting Event o Other

Yearly classified during 2014 for site 101/1005501

WB, A689, CNDR - Newby West(E336905, N553997) view site location on map

Month		24hr				18hr				16hr				12hr				ATC
		ADT	%>6.6m	AWT	%>6.6m	ADT	%>6.6m	AWT	%6.6m	ADT	%>6.6m	AWT	%>6.6m	ADT	%>6.6m	AWT	%>6.6m	DAY
bo	Jan	3176	9	3369	10.4	3076	8.9	3269	10.3	3020	8.9	3213	10.3	2732	9	2899	10.5	6
o	Feb	4395	11.7	4958	13.2	4264	11.4	4814	13	4192	11.5	4740	13	3772	11.6	4260	13.3	28
	Mar	4407	11.1	4895	12.8	4293	10.8	4773	12.4	4223	10.8	4702	12.5	3784	10.9	4217	12.6	26
bo	Apr	4434	10.4	4919	12	4321	10.2	4801	11.7	4244	10.2	4722	11.8	3788	10.4	4212	12	30
bo	May	4591	10.3	5073	11.7	4466	10.1	4944	11.5	4386	10.1	4858	11.6	3895	10.3	4310	11.9	31
	Jun	5067	10.2	5600	11.8	4913	10	5444	11.5	4822	10	5350	11.5	4265	10.2	4732	11.8	30
o	Jul	4887	10.3	5435	11.7	4739	10.1	5279	11.5	4648	10.2	5184	11.6	4104	10.5	4570	12	31
bo	Aug	4643	10.4	5112	12	4495	10.2	4957	11.7	4413	10.3	4871	11.8	3900	10.6	4300	12.2	31
o	Sep	4912	10.7	5452	12.3	4765	10.6	5293	12.1	4692	10.6	5217	12.1	4177	10.9	4641	12.5	30
o	Oct	4889	10.9	5467	12.4	4749	10.7	5322	12.1	4677	10.7	5245	12.1	4215	10.8	4721	12.4	30
	Nov	4906	10.9	5456	12.5	4767	10.7	5307	12.2	4692	10.8	5229	12.3	4223	11	4705	12.6	30
bo	Dec	4410	10.2	4867	11.6	4279	9.9	4729	11.3	4202	10	4648	11.4	3781	10.1	4175	11.5	31
Avg		4560	10.5	5050	12	4427	10.3	4911	11.8	4351	10.3	4832	11.8	3886	10.5	4312	12.1	334

b Bank Holiday w Weather a Accident t Time change r Road Works s Sporting Event o Other

Yearly classified during 2014 for site 101/1005502

EB, A689, CNDR - Newby West(E336905, N553997) view site location on map

Month		24hr				18hr				16hr				12hr				ATC
		ADT	%>6.6m	AWT	%>6.6m	ADT	%>6.6m	AWT	%6.6m	ADT	%>6.6m	AWT	%>6.6m	ADT	%>6.6m	AWT	%>6.6m	DAY
bo	Jan	3131	9.5	3318	10.9	3038	9.3	3220	10.8	2987	9.4	3168	10.8	2729	9.5	2894	11	6
o	Feb	4368	12	4923	13.6	4262	11.8	4807	13.5	4198	11.9	4738	13.5	3835	12.2	4332	13.9	28
	Mar	4413	11.5	4897	13.2	4306	11.2	4779	13	4248	11.3	4720	13	3865	11.6	4297	13.4	26
bo	Apr	4475	10.8	4935	12.5	4370	10.6	4819	12.3	4310	10.7	4761	12.3	3894	11	4298	12.7	30
bo	May	4662	10.5	5124	12	4548	10.3	5000	11.8	4480	10.3	4932	11.9	4043	10.7	4448	12.3	31
	Jun	5104	10.4	5624	12	4976	10.2	5486	11.8	4889	10.3	5395	11.8	4400	10.6	4862	12.2	30
o	Jul	4906	10.6	5427	12	4781	10.3	5293	11.8	4696	10.4	5205	11.8	4209	10.9	4667	12.4	31
bo	Aug	4712	10.5	5159	12.1	4586	10.4	5024	11.9	4508	10.4	4942	12	4042	10.8	4429	12.5	31
o	Sep	4939	10.9	5458	12.5	4813	10.7	5318	12.3	4735	10.7	5238	12.3	4268	11.1	4718	12.8	30
o	Oct	4883	11.2	5452	12.6	4759	10.9	5317	12.4	4692	11	5246	12.4	4285	11.3	4786	12.8	30
	Nov	4952	11.2	5519	12.6	4825	11	5380	12.5	4754	11	5304	12.5	4346	11.3	4837	12.9	30
bo	Dec	4398	10.4	4853	11.8	4278	10.2	4724	11.6	4207	10.2	4650	11.7	3841	10.4	4238	11.9	31
Avg		4579	10.8	5057	12.3	4462	10.6	4931	12.1	4392	10.6	4858	12.2	3980	10.9	4401	12.6	334

b Bank Holiday w Weather a Accident t Time change r Road Works s Sporting Event o Other