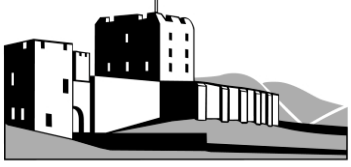
CARLISLE
CITY COUNCIL



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# AIR QUALITY

# PROGRESS

# REPORT

## Local Air Quality Management

## Environment Act 1995

## Contents

## Executive Summary

The production of an annual air quality report is now a statutory duty for all local authorities. The report will help to keep air quality issues high on the agenda, further raising the publics awareness and local member's awareness of its importance.

As part of the National Air Quality Strategy (NAQS) local authorities are required to undertake assessments of air quality within their borough. All potential sources of pollution (primarily industry and traffic related sources) must be taken into consideration and seven major pollutants are considered; carbon monoxide, benzene, 1, 3 butadiene, lead, nitrogen dioxide, sulphur dioxide and $PM_{10}$. The concentration of these pollutants in the air are compared to air quality objectives, which are based on current medical evidence for the health effects of the particular pollutant and provide a framework for determining the extent to which authorities should aim to improve air quality.

Two rounds of review and assessment have taken place since the National Air Quality Strategy was first published in 1996.

The first round took place between 1997 – 2000 and the second round between 2003 – 2004.

During the last round of review and assessment it was identified that an exceedence of the annual mean $NO_2$ objective was likely to occur along sections of the A7 between Stanwix Bank and Kingstown and that an Air Quality Management Area (AQMA) would have to be declared for this area. This was subsequently approved by Executive, Council and DEFRA.

Further monitoring and detailed air dispersion modelling undertaken by Westlakes Scientific Consulting Ltd has since been carried out to assist Carlisle City Council in defining the boundaries of the AQMA. The results of this work are included in this Progress Report.

The Progress Report recommends that an AQMA be designated along the A7 between junction 44 of the M6 and Hardwick Circus extending only to properties located directly adjacent to the roadside and also properties adjacent to the junction of Brampton Road and Stanwix Bank.

Following the declaration of the AQMA Carlisle City Council will have a duty to draw up an Action Plan within 18 months specifying the measures it intends to take in pursuit of reducing nitrogen dioxide concentrations within the AQMA.

This Progress Report also provides an update of new monitoring data for $NO_2$ at long term sites, locations considered during the last detailed assessment and new monitoring locations.

The Progress Report identifies that further detailed assessment work is required for several roadside locations within the City where exceedences of the annual mean $NO_2$ objective may occur. It is proposed that the detailed assessment will be based on both monitoring data and detailed air dispersion modelling.

Results for the $PM_{10}$ real time analyser located in Caldewgate has not identified an exceedence of the $PM_{10}$ objective in 2004.

Results of the $PM_{10}$ monitoring has however identified that there may be a risk of the provisional $PM_{10}$ objectives being exceeded in 2010 alongside several busy roads and junctions due to road traffic emissions and also in an area where significant domestic solid fuel burning takes place. The provisional $PM_{10}$ objectives have not yet been included in the Air Quality Regulations and there is no requirement for Local Authorities to undertake a detailed review and assessment for the objectives at the present time. The situation will however be kept under review.

This report also outlines new developments, which have taken place or are planned, which may have an impact on air quality and will be considered during future review and assessment work.

Since both the need to declare an AQMA along the A7 and the need for further detailed assessment work to be carried out elsewhere in the City has arisen out of vehicle emissions, traffic based management measures and techniques will need to be employed. This will require a collaborative effort amongst land use planners and transport planners alike.

Policy areas of economic development, environmental protection and sustainability all need to be considered in the context of developing the air quality action plan as will the wider involvement of the community and other stakeholders.

Preliminary discussions have already taken place with colleagues in the Planning Department and Cumbria County Council Highways Department.

As a separate issue it is also hoped that, in the near future, real time $NO_2$ and $PM_{10}$ data will be made available on the Councils Website from the Councils automatic air quality monitoring station.

Should you wish to discuss any matters relating to this Progress Report please contact:

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## 1.0 INTRODUCTION

### 1.1 Background to Air Quality Review and Assessment

This is a Progress Report undertaken by the Environmental Protection Department as part of its local air quality management duties.

The Environment Act 1995 requires every local authority to periodically review and assess air quality within their geographical areas against the standards and objectives set out in the Air Quality Regulations 2000 and (Amendment) Regulations 2002.

Carlisle City Council in line with other local authorities completed the second round of review and assessment in 2004. This was undertaken in two stages. Initially an updating and screening assessment was carried out and completed in May 2003 for all pollutants identified in the Air Quality Regulations.

The purpose of the updating and screening assessment was to identify any matters that had changed since the first round of review and assessment completed by this authority in March 2000, which might lead to a risk of an air quality objective being exceeded.

The Updating and Screening Assessment Report identified that there might be a risk of both the $NO_2$ annual mean objective and $PM_{10}$ objectives being exceeded at relevant locations along the A595 running through Caldewgate, and the $NO_2$ annual mean objective being exceeded at relevant locations alongside the A7.

Where a significant risk of exceeding one or more of the air quality objectives is identified local authorities are required to proceed to the second stage and carry out a detailed assessment. Carlisle City Council consequently undertook a detailed assessment in 2004 at these two localities. The purpose of the detailed assessment was to determine with reasonable certainty whether these objectives were likely to be exceeded at relevant locations.

The detailed assessment concluded that :-

- The current and forward predicted exceedences of the relevant air quality objectives for $NO_2$ and $PM_{10}$ had not been identified for Caldewgate but that monitoring would continue in the locality.

- Current and forward predicted exceedences of the annual mean $NO_2$ objective had been identified for the A7.

As a result of the detailed assessment it was recommended that an air quality management area (AQMA) be declared for the A7. Progress in the declaration of the AQMA is discussed in Chapter 3.

## 1.2 Purpose of the Progress Report

Following consultation on the LAQM process the Government concluded that it was too 'stop-start', and that gaps of several years might occur between air quality reviews.

A new timetable for the submission of reviews and assessments was subsequently set in 2003 and is shown in Appendix 1.

Updating and screening assessments are required every three years, 2003, 2006 and 2009.

Progress reports are only required in the intervening years when the local authority is not carrying out either an updating and screening assessment or a detailed assessment and therefore ensures continuity in the Local Air Quality Management (LAQM) process as they fill in the gaps between the 3 yearly requirement to carry out a full review and assessment of air quality.

It is intended that this Progress Report will assist the local authority in several ways:-

- Helping retain a profile for LAQM within the authority.
- Providing a means of communicating air quality information to members and the public.
- Maximising the usefulness and interpretation of the monitoring effort being carried out by the local authority.
- Helping the local authority to respond to requests for up to date information on air quality.

- Providing information to assist in other policy areas such as transport and land use planning.
- By providing a timely indication of the need for further measures to improve air quality rather than delaying until the next round of review and assessment.

Progress Reports are not designed to represent a further updating and screening assessment although authorities are required, if at any time they identify a risk of an air quality exceedence, to proceed to a detailed assessment and not delay until the next round of review and assessment

A Progress Report Guidance document, LAQM PRG (03), has been issued by the Government to assist local authorities in the preparation of air quality progress reports. This document supplements the two documents LAQM PG (03) and LAQM TG(03) issued in February 2003 by Defra, which provide policy guidance and technical guidance for local authorities carrying out their LAQM duties.

The progress report guidance states that the overall aim of the Progress Report should be to :-

- report progress on implementing local air quality management, and
- report progress in achieving concentrations below the national air quality standards and objectives.

It suggests that these aims can be best achieved by addressing two matters:-

- new monitoring results and
- identifying and listing new local developments that might affect local air quality. The progress report should log these changes so that they can be considered more thoroughly during the next full round of review and assessment.

Carlisle City Council has taken account of this guidance when carrying out this Progress Report.

## 1.3 National Air Quality Standards and Objective

The air quality objectives set by the Air Quality Regulations are shown in table 1 below. These objectives are to be achieved between 2003 and 2010.

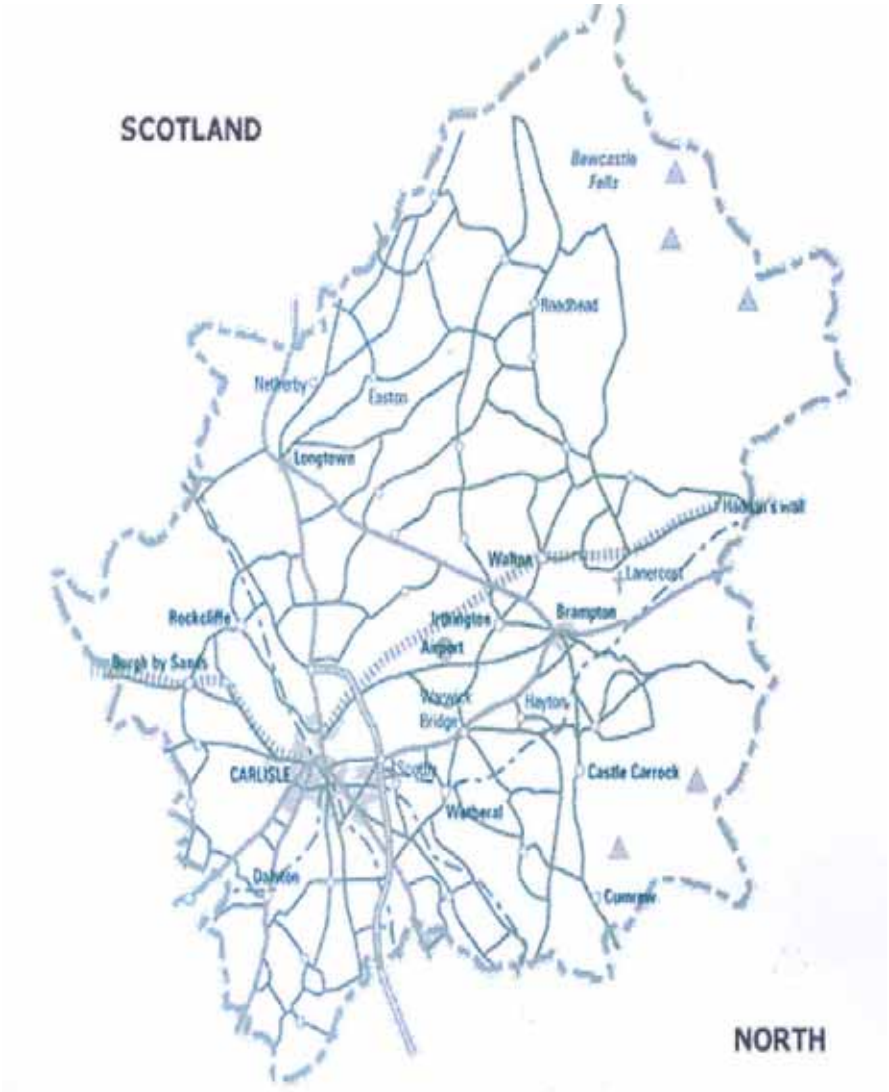
| Table 1: Objectives included in the Air Quality Regulations 2000 and (Amendment) Regulations 2002[a] for the purpose of Local Air Quality Management | | | |
|---|---|---|---|
| Pollutant | Air Quality Objective | | Deadline |
| | Concentration | Measured as | |
| **Benzene**<br><br>All authorities | 16.25 μg/m$^3$ | Running annual mean | 31.12.2003 |
| Authorities in England and Wales only | 5.00 μg/m$^3$ | 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$^3$ | Maximum daily 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)*** <br><br>All authorities | 50 μg/m$^3$ not to be exceeded more than 35 times a year<br><br>40 μg/m$^3$ | 24 hour mean<br><br>annual mean | 31.12.2004<br><br>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 |

* The EU has also set indicative limit values for $PM_{10}$ which are to be achieved by 1st January 2010. These limit values are considerably more stringent and are 20μgm$^{-3}$ as the annual mean and 50 μgm$^{-3}$ as the 24 hour mean to be exceeded on no more than 7 days per year.

These provisional objectives for $PM_{10}$ are not currently included in the Regulations for the purposes of LAQM. Local authorities are under no obligation to review and assess against these objectives. However the government recommends it might be helpful to do so for long term planning and the assessment of development proposals within the local authority area. Assessment against these provisional objectives is provided in this progress report.

## 2.0 A BRIEF DESCRIPTION OF THE CARLISLE CITY COUNCIL AREA

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




The City of Carlisle supports the highest population concentration in Cumbria with 70,000 people living within the urban area. The rural towns of Brampton and Longtown support the next two highest population concentrations, 4000 and 2000 respectively.

Carlisle is remote from other main centres of population being 300 miles from London, more than 120 miles from Manchester, more than 90 miles from Glasgow and

Edinburgh and more than 50 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 an hours travelling time of the city.

Today's economy is characterised by food processing, agricultural support, automotive component manufacturers and engineering. The dominant sectors being branch operation in wholesaling and retailing, manufacturing, public administration and health services.

It is a significant transport hub for rail services and the national road transport network. It's regional role has been greatly enhanced in recent years by The Lanes Shopping Centre, The Sands Leisure Centre, Tullie House and the Art Gallery and the City is well placed to advance as a regional centre.

The Government Regional Planning Guidance for the North West identifies Carlisle as one of the North Wests key town and cities where development should be concentrated.

As part of its role as community leader the City Council has, in partnership with local key public, private and volunteering sector organisations, developed a Corporate Plan for promoting the long term economic, social and environmental well being of the local area.

The Corporate Plan sets out the Council's priorities for 2004-2007. Although the Council priorities are categorised into five different promises they are all integrated and positive progress within one promise is likely to have a positive knock on effect. Together the promises aim to meet the Council's overall mission:

'To ensure a high quality of life for all in both our urban and rural communities'

Clean air is an essential ingredient of a good quality of life. The main reasons for managing air quality are the links between air quality and the quality of life, and the need to minimise the risk of poor air quality to human health. In the wider context managing air quality is central to the strategy for sustainable development.

As well as fulfilling a statutory duty, managing local air quality therefore significantly contributes towards the achievement of Councils priorities set out in the Corporate Plan, namely;

To develop a sustainable economy
To manage our environment responsibly
To improve local housing, health and well being
To ensure Carlisle is a safe and attractive place

## 3. 0 NEW MONITORING DATA - NITROGEN DIOXIDE

### 3.1 Introduction

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 coverted to $NO_2$ , mainly as a result of reaction with ozone in the atmosphere.

The principal source of nitrogen dioxide ($NO_2$) within the district of Carlisle City Council is road transport. A map of Carlisle City's main roads is shown in Appendix 4 along with the most up to date information on current annual average daily traffic flows (AADT). This information is supplied by Cumbria County Council

The Council has been monitoring nitrogen dioxide at sites around the District using diffusion tubes for many years. Four of the sites in Carlisle contribute information to the United Kingdom Nitrogen Dioxide Survey.

This section identifies the diffusion tube sites used for collecting data in the Carlisle area. For the purposes of this report new monitoring results are reported for the following:

i Long term monitoring sites

Reason: to provide evidence of any trends over recent years

ii Locations considered during the last detailed assessment
Reason: To provide updates on monitoring sites alongside the A7 and Caldewgate/Castleway A595.

iii New monitoring sites

Reason: to establish whether they reveal any new information about air quality.

The sites are subject to regular review and where sufficient data has been gathered, some of the diffusion tubes are relocated to new locations of interest. Occasionally problems occur such as tubes are stolen or interfered with on a regular basis leading to the sites becoming unsuitable. As a result some diffusion tubes have been relocated to other similar sites close by.

Analysis for all $NO_2$ diffusion tubes used by Carlisle Council is undertaken by Casella Cre Air. Their method of tube preparation is 10% TEA (triethanolamine) in water. Quality assurance/quality control methods for the tubes are explained in the Detailed Assessment Report published in 2004.

**Bias adjustment of Diffusion Tube Data**

As a result of the considerable difference in the performance of tubes prepared by different labs, technical guidance LAQM TG (03) recommends that a bias adjustment factor is determined and applied to the data.

LAQM TG 03 gives a method for this which involves the collocation of these tubes with a chemiluminescent Nox analyser. The minimum period for which this must be carried out is 9 months.

Guidance issued recommends that authorities report the adjustment factor from both their own collocation study (where available), and the 'national' bias adjustment factor determined by Air Quality Consultants (AQC) who, on behalf of Defra, collate and assess data from $NO_2$ collocation studies across the UK. As a result of the AQC work new annual mean national correction factors are now available for the specific Casella Cre Air 10% TEA in water diffusion tubes used by Carlisle City Council.

The national bias adjustment factor for Casella Cre Air in 2004 is 0.85

Carlisle City Council did operate a NOx chemiluminescent analyser but unfortunately results from August 2004 onwards could not be quality assured due to repeated significant span gas drift between calibrations. The analyser and data logger was completely destroyed in January 2005 during major flooding in the City. New data from the chemiluminescent analyser is therefore not included in this Progress Report.

A bias adjustment factor of 0.9 was however calculated from a 6 month collocation study undertaken between January – June 2004. When added to the adjustment factors provided by Defra the bias adjustment factor remains at 0.85.

The national bias adjustment factor of 0.85 has subsequently been applied to data sets of 9 months or more for 2004. It is important to note that data reported for monitoring surveys less than 9 months can not be bias adjusted and subsequently it has not been possible to adjust the data to predict annual mean concentrations and allow easy comparison with the annual mean objective. Raw data must be treat with caution.

## 3.2. Long Term Monitoring Sites

### Table 2

# Long Term $NO_2$ Monitoring Sites – Carlisle City

| Location | Type of Site | Grid Reference | Annual NO2 Concentrations μgm$^3$ | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1997 R | 1998 R | 1999 R | 2000 R | 2001 R | 2002 R | 2003 V | 2004 V |
| Wigton Road | Roadside | 337926 554558 | 27.50 | 38.50 | 25.30 | 21.00 | 20.50 | 20.50 | 17.30 | 14.1 |
| Scotland Road | Roadside | 339992 557187 | 54.20 | 93.70 | 56.40 | 46.20 | 49.10 | 42.60 | 45.30 | |
| Hardwick Circus | Roadside | 340143 556347 | 50.60 | 79.20 | 51.80 | 39.70 | 39.50 | 45.50 | 35.00 | 34.8 |
| Shaddon gate | Roadside | 339483 555892 | 44.80 | 74.50 | 48.50 | 32.00 | 34.00 | 31.00 | 28.00 | 25.9 |
| London Road | Roadside | 341912 553972 | 31.50 | 43.70 | 35.30 | 23.60 | 26.60 | 23.00 | 29.50 | 25.9 |
| Warwick Road | Roadside | 341310 555918 | 36.00 | 59.30 | 37.40 | 28.80 | 29.30 | 27.80 | 30.00 | 25.7 |
| Sanderson Close | Suburban | 339461 558489 | 17.00 | 29.00 | 15.00 | 15.00 | 17.40 | 17.20 | 14.00 | 11.8 |
| Tourist Info Centre | Urban Centre | 340070 555955 | 25.00 | 40.00 | 25.00 | 16.20 | 15.80 | 20.00 | 18.00 | 15.1 |
| Dale Street | Urban Background | 339615 554863 | | | 25.00 | 19.00 | 21.00 | 20.00 | 18.00 | 15.5 |
| Strand Road | Urban Background | 340550 556174 | | | 32.00 | 25.80 | 26.70 | 23.00 | 23.00 | 20.1 |
| Fueshill Street | Urban Background | 340780 555600 | | | 36.00 | 29.80 | 25.60 | 25.00 | | |
| Quebec Avenue | Suburban | 340408 554143 | | | 21.30 | 20.00 | 22.10 | 18.10 | | |
| Palmer Road | Suburban | 337171 556340 | | | 12.40 | 10.20 | 14.10 | 12.90 | | |

**Figure 1**

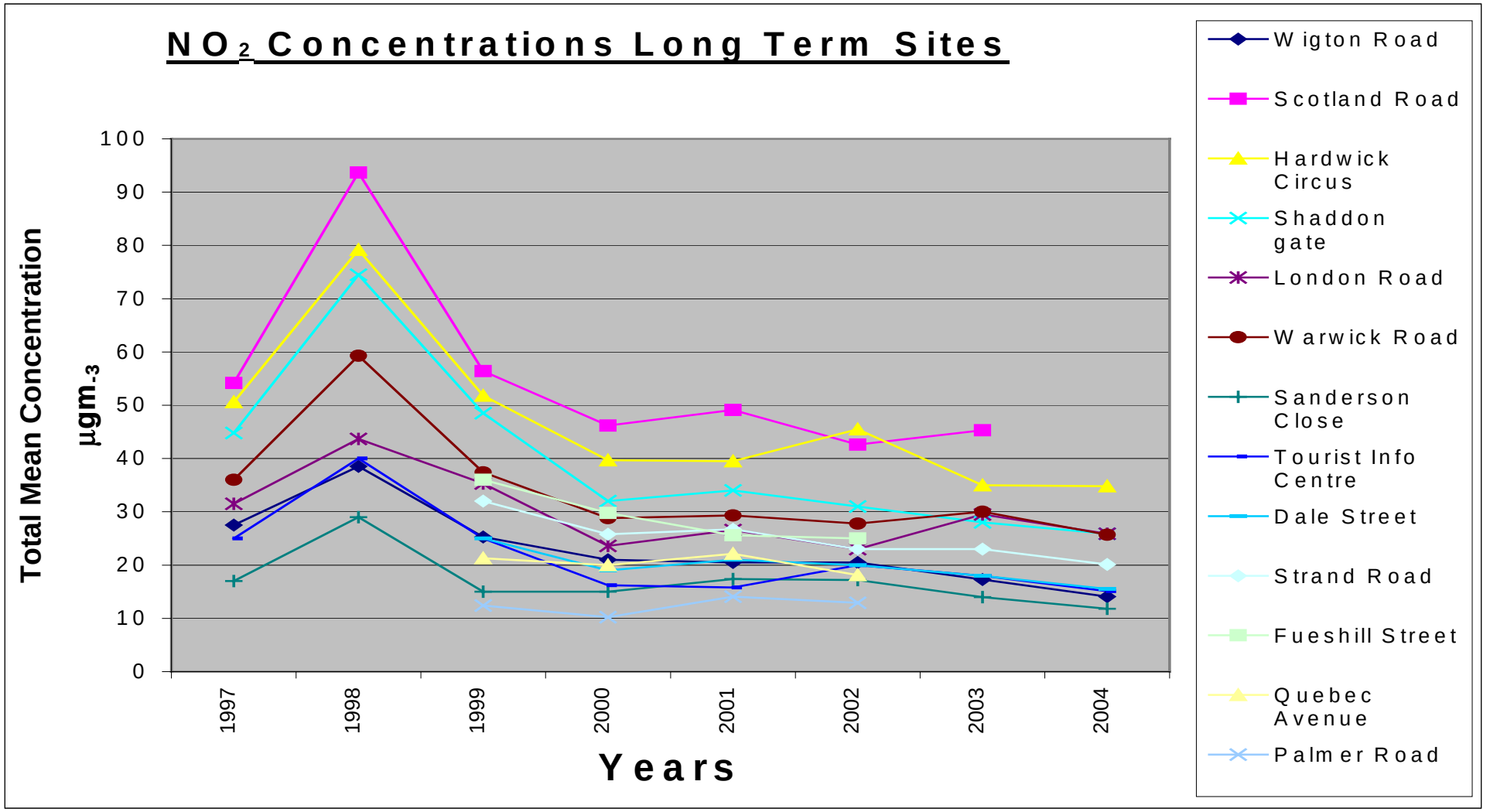

NO2 Concentrations Long Term Sites
Total Mean Concentration µgm-3
100
90
80
70
60
50
40
30
20
10
0
1997
1998
1999
2000
2001
2002
2003
2004
Years
Wigton Road
Scotland Road
Hardwick Circus
Shaddon gate
London Road
Warwick Road
Sanderson Close
Tourist Info Centre
Dale Street
Strand Road
Fueshill Street
Quebec Avenue
Palmer Road

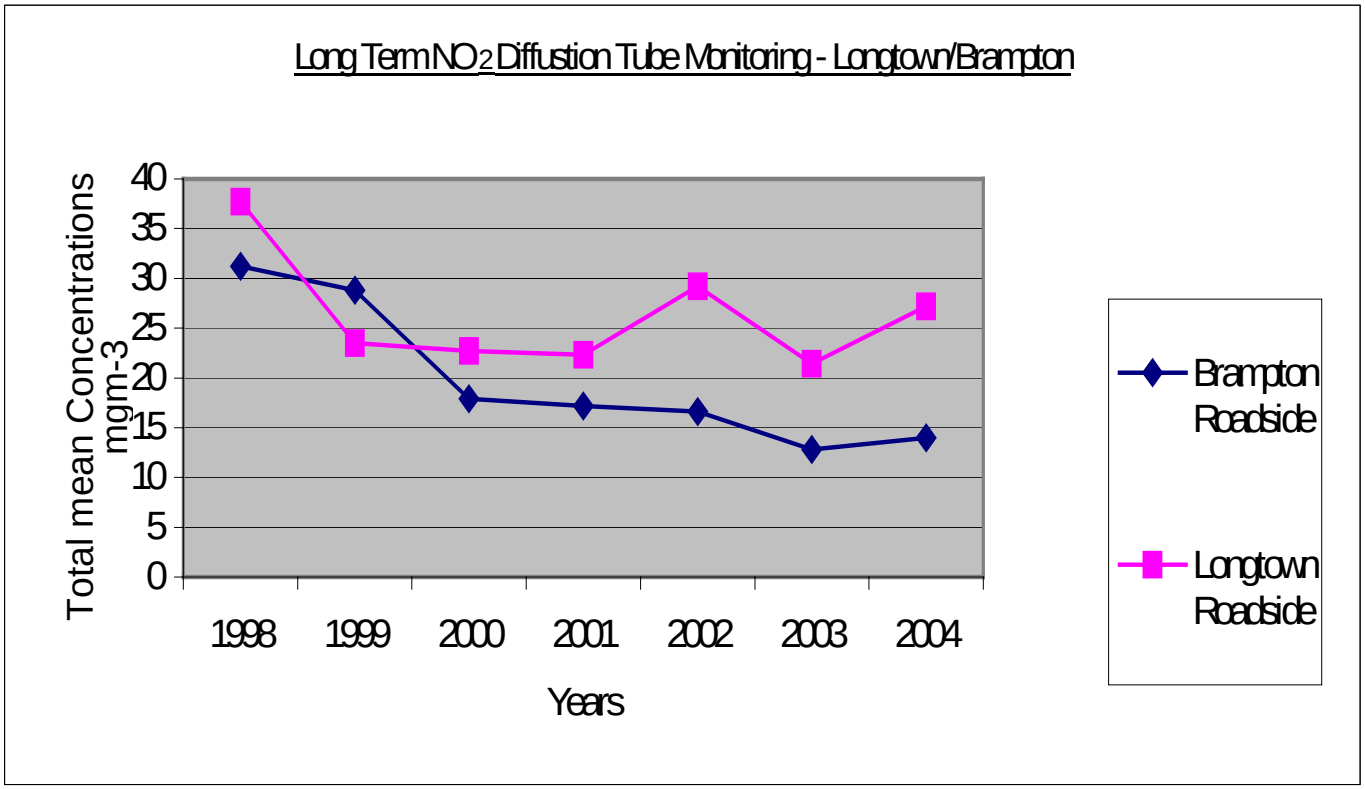
**Table 3**

**Long Term $NO_2$ Diffusion Tube Monitoring – Longtown/Brampton**

| Location | Type of Site | Annual NO2 Concentrations μgm$^3$ | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
| Brampton | Roadside | 31.2 | 28.8 | 17.9 | 17.2 | 16.6 | 12.8 | 14 |
| Longtown | Roadside | 37.7 | 23.5 | 22.7 | 22.3 | 29.2 | 21.4 * | 27.2 |

- **2003 – Tube relocated**

**Figure 2**



The long-term sites cover a range of different types of monitoring locations including roadside, urban centre, urban background and suburban sites.

Results indicate that nitrogen dioxide concentrations are reducing at these long term sites and indicate that the contribution from road traffic to nitrogen dioxide concentrations have significantly declined in recent years as a direct result of national and international policies to improve emissions from vehicles.

As stated previously technical guidance indicates that exceedances of the $NO_2$ objective are still likely to occur but only along side busy and congested roads. This is discussed in more detail in the following section.

## 3.3 New Data For Locations Considered During The Last Detailed Assessment (Undertaken In 2004)

Relevant locations alongside two of the most heavily used road traffic routes in Carlisle were considered during the last detailed assessment; the A7 and the A595.

### 3.3.1 A7 Stanwix Bank / Scotland Road / Kingstown Road

The Detailed Assessment undertaken in 2004 concluded that current and forward predicted exceedences of the annual mean $NO_2$ objections had been identified for relevant locations alongside the A7 and that an Air Quality Management Area (AQMA) would be required.

The report however also concluded that further monitoring would be necessary to assess the likely area of exceedence and establish the boundaries of the AQMA. Results at the time indicated that exceedences of the objective levels would not occur along the entire length of the A7 but in pockets where relevant locations are closet to the roadside.

The Detailed Assessment Report and its recommendation to declare an AQMA was endorsed by Council in January 2005.

Further monitoring has since taken place and air quality consultants have been commissioned to carry out complex air dispersion modelling for the City of Carlisle and specifically alongside the A7 to assist in defining the AQMA. Results of both monitoring and modelling are discussed below.

## Table 4 – $NO_2$ Diffusion Tube Results 2004

## A7 Stanwix Bank / Scotland Road / Kingstown Road

| | | Monthly $NO_2$ Concentration ($\mu gm^{-3}$) 2004 | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Area Location | Grid Reference | J | F | M | A | M | J | J | A | S | O | N | D | Length of survey (Months) | Raw | Bias Adjusted (0.85) | Projected 2005 |
| 1 | 339991 557187 | 46 | 48 | A | 50 | A | 32 | 49 | 50 | 49 | | | | 7 | 46.3 | | |
| 2 | 340013 557218 | 40 | 45 | 42 | 45 | 30 | 20 | 31 | 36 | Stopped | | | | 8 | 36.1 | | |
| 3 | 340082 557178 | 24 | 34 | 18 | 26 | 19 | 19 | Stopped | | | | | | 6 | 23.3 | | |
| 4 | 339972 557218 | 24 | 26 | 29 | 23 | 21 | 14 | Stopped | | | | | | 6 | 22.8 | | |
| 5 | 339985 557346 | | | | 48 | 41 | 42 | 45 | 37 | 37 | 42 | 41 | 47 | 9 | 42.2 | 34.18 | |
| 6 | 340004 557382 | | | | 29 | 20 | 13 | A | 21 | Stopped | | | | 5 | 20.7 | | |
| 7 | 339999 557506 | | | | 33 | 21 | 17 | 22 | 21 | Stopped | | | | 5 | 22.8 | | |
| 8 | 339973 557580 | | | | 25 | 27 | 13 | 19 | 30 | 18 | 35 | 49 | 30 | 9 | 27.3 | 22.11 | |
| 9 | 339758 558065 | | | | 55 | 44 | 49 | 52 | 51 | 48 | 50 | 48 | 51 | 9 | 49.8 | 42.3 | 41.2 |
| 10 | 339678 558386 | | | | 43 | 33 | 24 | 29 | 38 | 25 | 36 | 46 | 39 | 9 | 34.7 | 29.5 | |
| 11 | 339528 559284 | | | | 32 | 38 | 39 | 36 | 35 | 31 | 45 | 40 | 54 | 9 | 38.9 | 33.1 | |
| 12 | 339558 559107 | | | | 38 | 33 | 34 | 35 | 34 | A | 44 | 61 | 37 | 9 | 39.5 | 33.6 | |
| 13 | 340009 556852 | | | | A | 52 | 49 | 57 | 35 | 45 | 73 | 67 | 50 | 8 | 53.5 | | |
| 14 | 339707 558266 | | | | | | | | | 32 | 57 | 49 | 42 | 4 | 45 | | |
| 15 | 340028 556835 | | | | | | | | | 46 | 51 | 63 | 51 | 4 | 52.7 | | |

# $NO_2$ Diffusion Tube Monitoring Locations – A7

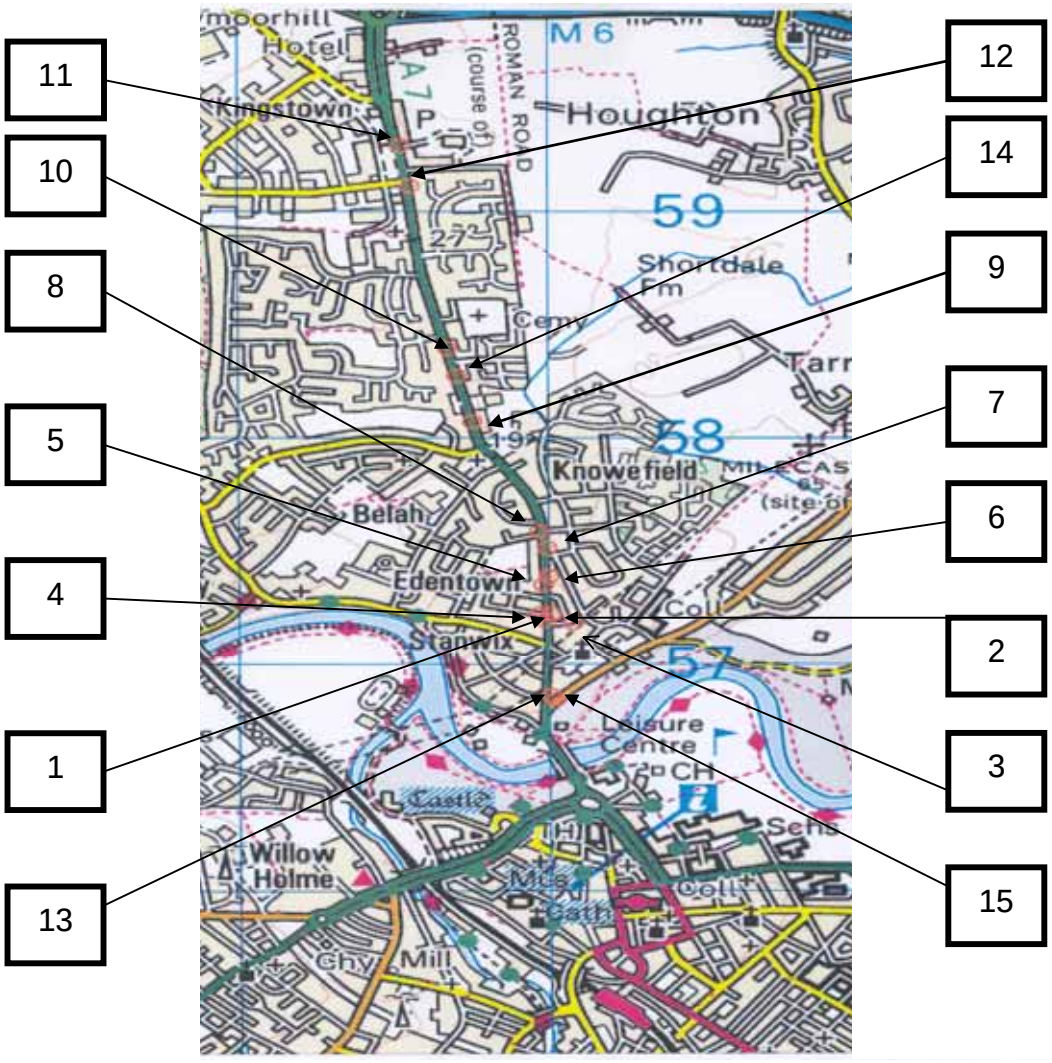


**Table 5**

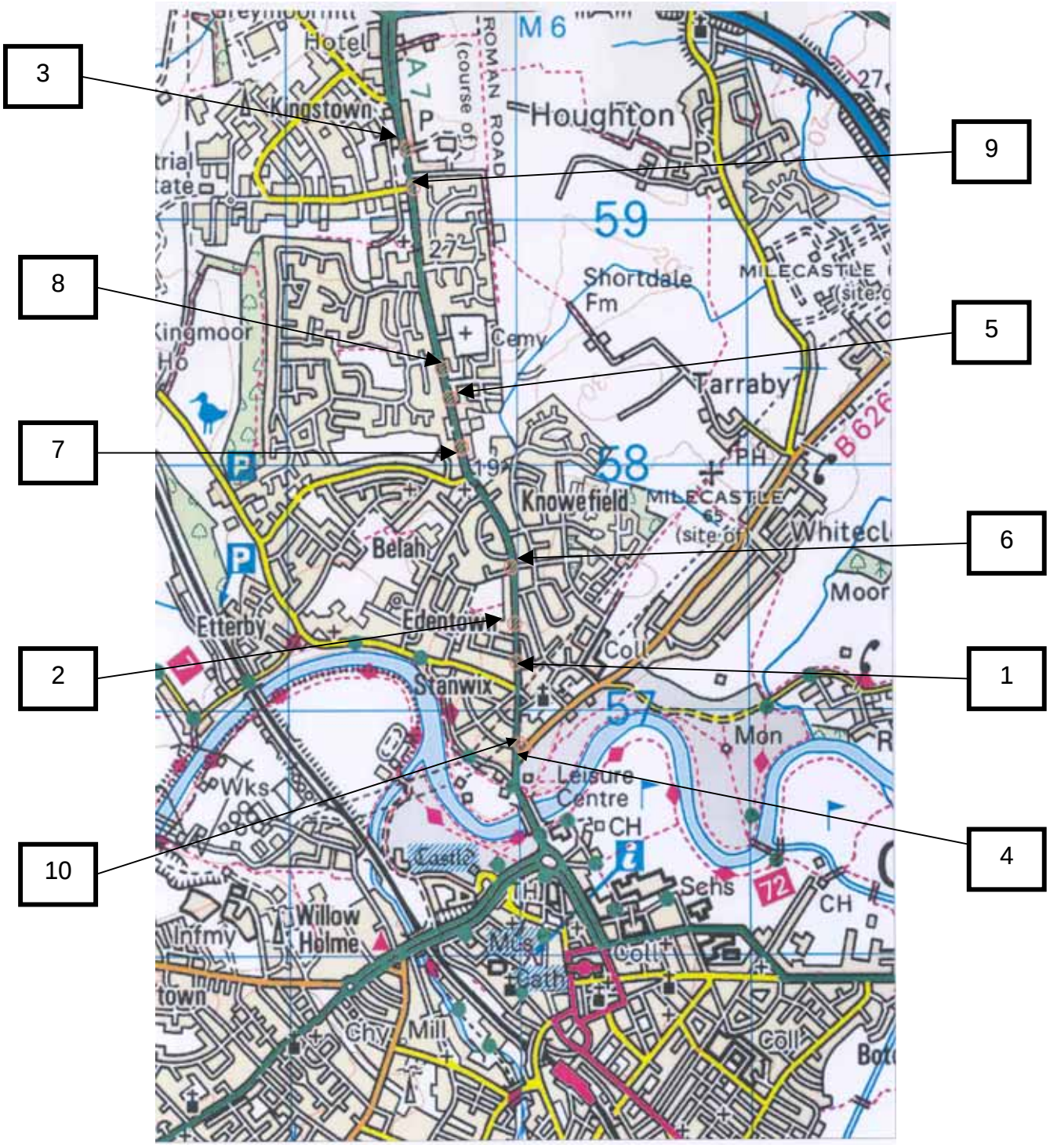
**$NO_2$ Diffusion Tube Results 2005**
**A7 Stanwix Bank / Scotland Road / Kingstown Road - 2005**

| Location | Grid Reference | Raw Monthly Mean $NO_2$ Concentration $\mu gm^{-3}$ | | | Length of Survey (months) | Av |
|---|---|---|---|---|---|---|
| | | J | F | M | | |
| 1 * | 339995 557191 | 71 | 50 | 50 | 3 | 57 |
| 2 * | 339988 557348 | 42 | 58 | 51 | 3 | 50.3 |
| 3 * | 339527 559285 | 70 | 59 | - | 2 | 64.5 |
| 4 | 340028 556835 | 57 | 62 | 49 | 3 | 56 |
| 5 | 309709 558266 | 46 | 42 | 42 | 3 | 43.3 |
| 6 | 339973 557580 | 28 | 37 | 34 | 3 | 33 |
| 7 * | 339759 558065 | 61 | 70 | 59 | 3 | 63.3 |
| 8 * | 339678 558386 | 35 | 36 | 40 | 3 | 37 |
| 9 | 339555 559123 | A | 56 | 44 | 3 | 50 |
| 10 | 340009 556852 | 52 | 69 | 66 | 3 | 62.3 |

* = Diffusion tubes relocated to lamposts closer to roadside where $NO_2$ concentrations are higher. These new monitoring points are <u>not</u> at relevant locations but will assist in the validation of future air dispersion modelling.

**Figure 4**

**$NO_2$ Diffusion Tube Monitoring Locations – A7**



Bias adjusted diffusion tube results measured during 2004 when projected to 2005 (using a correction factor of 0.975) confirms that an exceedence of the 2005 $NO_2$ annual mean objective has been identified for relevant locations alongside Kingstown Road.

Bias adjusted diffusion tube results measured during April 2004 – March 2005 at relevant locations alongside Stanwix Bank are shown in the table below. When projected to 2005 (using a correction factor of 0.975) the results confirm that an exceedence of the 2005 annual mean $NO_2$ objective is likely to occur.

Only 7 months of raw data has been collected over the monitoring period September 2004 – March 2005 for locations near to the Brampton Road/Stanwix Bank Junction, shown in the table below. These results (as there is less than 9 months data) cannot be bias adjusted, however it is considered that an exceedence of the 2005 $NO_2$ annual mean objective is likely to occur at these localities.

| | Monthly Mean $NO_2$ Concentration $\mu gm^{-3}$ | | | | | | | | | | | Raw Average | Bias Adjusted (0.85) | Projected 2005 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Location** | M | J | J | A | S | O | N | D | J | F | M | | | |
| Stanwix Bank | 52 | 49 | 57 | 35 | 45 | 73 | 67 | 50 | 52 | 69 | 66 | 55.9 | 47.5 | 46.3 |
| Brampton Road | | | | | 46 | 51 | 63 | 51 | 57 | 62 | 49 | 54.1 | | |

### 3.3.2 Dispersion Modelling For $NO_2$ Along The A7

Air quality consultants, Westlakes Scientific Consulting Ltd were commissioned to assist Carlisle City Council with the designation of an air quality management Area (AQMA) to the north of Carlisle City along the A7 road link between Stanwix and Kingstown.

Westlakes Scientific Consulting have developed an emissions database (EDB) of $NO_x$ in and around the City. The creation of an EDB along with statistical meteorological data for the years 2000 to 2004, topographical data and physiological data for the area allowed $NO_2$ concentrations to be modelled over the City and specifically along the A7 using the airviro air quality management system.

Two air dispersion models have been used:-

- Gauss model
- Canyon Model

The Gaussion model is used to predict air concentrations of $NO_2$ over the entire City including the A7 during 2004. The model was configured so that all sources within the Council EDB were included (road, point and grid sources).

The canyon model is designed for use on individual streets where tall buildings are present either side of the road link and takes account of the effects of buildings.

The following input data was used in the modelling system:

- Emission of pollutants from grid, road and point sources.

- Topography data on surface roughness and percentage of urban area / open area and forest in each grid cell

- Meteorological data (wind speed, wind direction, temperature and temperature difference with respect to height) for the years 2000 to 2004 obtained from the Met Office. Temperature difference values were calculated from data supplied from Eskdalemuir (the nearest site with boundary layer data) whilst the remainder were determined from Carlisle Airport.

The modelling studies were conducted in three stages:

1. Annual average concentrations of $NO_x$ and $NO_2$ arising from background emissions were calculated using the Gauss model on a coarse grid resolution (1 x 1 km) across the map area using meterological data for 2004, a year for which Carlisle City Council has comprehensive $NO_2$ monitoring data. Similar studies were also undertaken to determine $NO_x$ and $NO_2$ concentrations from road link sources surrounding the A7 between Stanwix and Kingstown on a medium (250 x 250m) and fine (25 x 25m) scale resolution. The Gauss model is particularly suited to local-dispersion studies and was, therefore, considered appropriate for use in the Carlisle EDB map area.

2. Specific modelling studies were conducted using the Canyon model to predict annual $NO_x$ and $NO_2$ concentrations at the Scotland Road, Kingstown Road and Stanwix Bank sections of the A7, where the designation of an AQMA is proposed. The Canyon model is designed for use on individual streets where tall buildings are present either side of the road link.

3. Validation studies for $NO_2$ were carried out by comparing modelled concentrations of the pollutant with those monitored by Carlisle City Council in 2004.

An outline of how the modelling studies were conducted are given in Appendix 2 along with the validation of the dispersion model.

### 3.3.3 Results of Gauss Model Studies for the A7

The annual mean concentration of $NO_2$ along the A7, using the Gauss model for the meterological period 2000 to 2004 is shown below:

**Figure 5**
**Contour Plot Showing Predicted Annual Mean Concentration of $NO_2$ ($\mu gm^{-3}$) Along The A7 For The Years 2000 – 2004**


Figure 7: Contour plot showing predicted annual mean concentration of $NO_2$ ($\mu g\ m^{-3}$) along the A7 for the years 2000 – 2004. Location of diffusion tubes indicated by black circles.

Using the Gauss model it is shown that $NO_2$ concentrations between Stanwix and Kingstown do not exceed the annual mean $NO_2$ objective of $40\mu gm^{-3}$.

### 3.3.4 Results of Canyon Model Studies for the A7

The mean annual concentrations of $NO_2$ at Scotland Road, Kingstown Road and Stanwix Bank, predicted for the meterogical periods 2004 and 2000-2004 in the canyon model studies are presented below:

**Figure 6**
**Predicted Annual Concentration of $NO_2$ ($\mu gm^{-3}$)**
**Along the A7 in 2004 using Canyon Model**

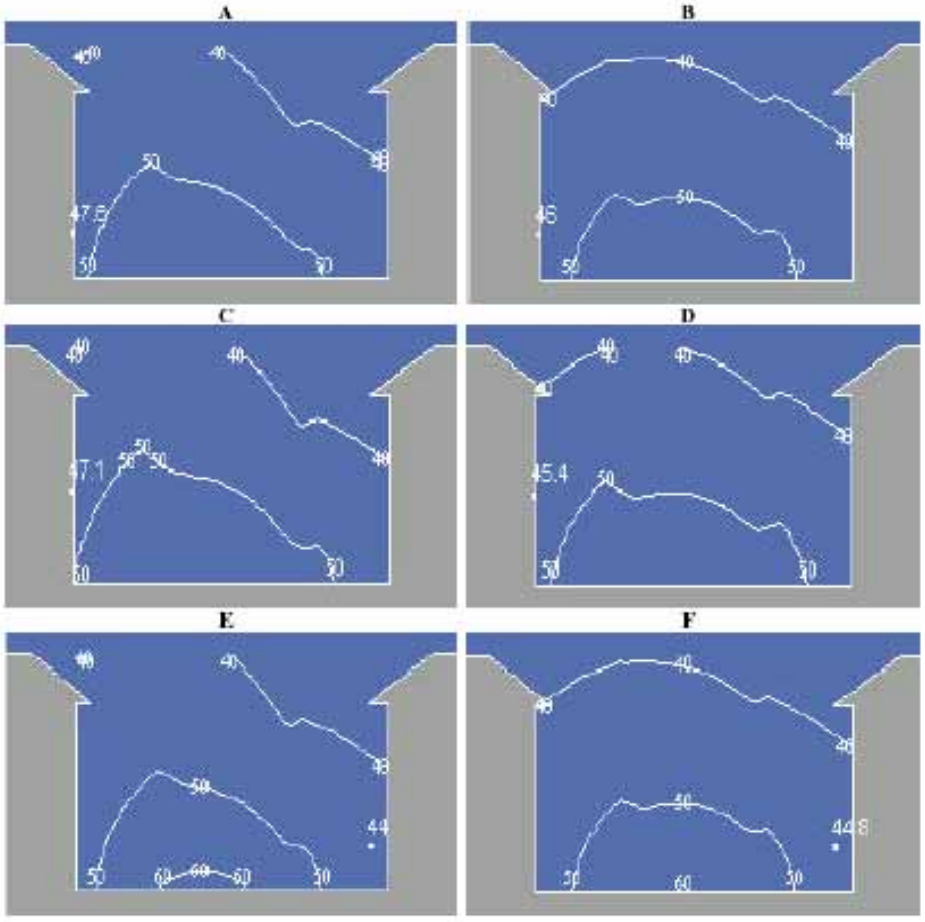



Figure 9: Predicted annual concentration of $NO_2$ ($\mu g\ m^{-3}$) along Scotland Road in 2004 (A) and 2000-2004 (B), Kingstown Road in 2004 (C) and 2000-2004 (D) and Stanwix Bank in 2004 (E) and 2000-2004 (F).

It can be seen that for all canyon studies undertaken , $NO_2$ concentration at a height of between 2 and 3 m exceed the annual LAQM standard, ranging between 44 and 47 $\mu gm^{-3.}$ Such concentrations are considerably higher than those predicted for these locations using the Gauss model, and

demonstrate the effect of pollutant circulation created as a result of buildings effects on air movements. Although above the objective of 40$\mu gm^{-3}$ the $NO_2$ concentrations predicted using the Canyon Model suggest that the AQMA need not extend beyond on the width of the street canyon.

Results from both monitoring and modelling undertaken shows that there is a close relationship between the annual mean $NO_2$ concentrations predicted by the Canyon Model studies and actual monitored concentrations:-

| | Annual Mean $NO_2$ Concentrations $\mu gm^{-3}$ | |
|---|---|---|
| Location | Modelled | Monitored |
| Scotland Road | 47.6 | 45.3 * |
| Kingstown Road | 47.1 | 42.3 |
| Stanwix Bank | 44 | 45.5 [A] |

* = 2003 $NO_2$ Concentration

[A] = Based on 2004 average

### 3.3.5 Recommended Boundary of the Air Quality Management Area

Given the results of the canyon model studies and diffusion tube monitoring it is recommended that an AQMA be designated along the A7 between Junction 44 of the M6 and Hardwicke Circus, extending only to properties located directly adjacent to the roadside and also properties adjacent to the junction of Brampton Road and Stanwix Bank.

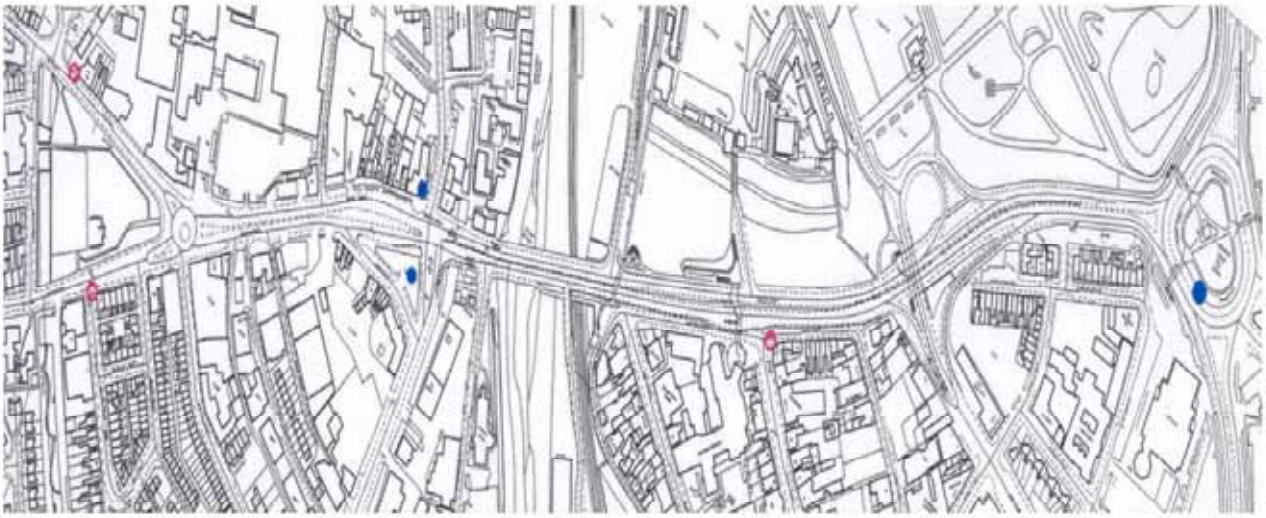
A map with the proposed AQMA boundary is shown in Appendix 3 A and 3 B.

### 3.3.6 A595 Caldewgate

A detailed assessment was undertaken at this locality because results from a DMRB model used in the Updating and Screening assessment indicated that there was a risk that both the $NO_2$ and $PM_{10}$ objectives keeping exceeded at relevant locations along this route.

The detailed assessment concluded in 2004 that exceedences of the air quality objectives for nitrogen dioxide and particulates (PM10) at relevant locations had not been identified but that monitoring would continue. Monitoring has been extended to include residential properties alongside Castleway and the base of Wigton Road and Newtown Road and covers the A595 from the Hardwicke Circus to the Caldewgate roundabout. A location map with the previous and new $NO_2$ monitoring locations is shown below and the most up to date results are given in table 6.

**Figure 7**
**Monitoring Locations – Hardwick Circus – Wigton Road / Newtown Road Area**



## Table 6

## A595 Caldewgate/Castleway – 2004

| Area | Grid Reference | Monthly Mean $NO_2$ Concentrations ($\mu gm^{-3}$) 2004 | | | | | | | | | | | | Length of survey (Months) | Raw | Bias Adjusted (0.85) | Projected 2005 Annual Mean Concentration |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | J | F | M | A | M | J | J | A | S | O | N | D | | | | 2005 (0.975) |
| Bridge Street | 339452 556014 | 42 | 43 | 35 | 35 | 41 | 37 | 37 | 41 | 41 | 46 | 46 | 47 | 12 | 40.9 | 34.8 | 33.8 |
| Paddys Market 1. | 339465 555973 | 39 | 50 | | 45 | 45 | 42 | 41 | 45 | 36 | 49 | 49 | 38 | 11 | 43.5 | 36.9 | 36 |
| Paddys Market 2. | 339465 555973 | 39 | 43 | | 43 | 51 | 43 | 45 | 42 | 39 | 50 | 54 | 40 | 11 | 44.4 | 37.7 | 36.8 |
| Paddys Market 3. | 339465 555973 | 33 | 42 | | 34 | 43 | 38 | 41 | 52 | 40 | 48 | 50 | 36 | 11 | 41.5 | 35.3 | 34.4 |
| Wigton Road | 339202 555801 | | | | | | | | | 57 | 50 | 43 | 40 | 4 | 47.5 | | |
| Finkle Street | 339784 556110 | | | | | 41 | 40 | 36 | 44 | 43 | 52 | 49 | 43 | 8 | 43.5 | | |
| Newtown Road | | | | | | | | | | | | | | | | | |

## Table 7

## A595 Caldewgate / Castleway – 2005

| Area | Grid Reference | Monthly Mean $NO_2$ Concentration ($\mu gm^{-3}$) 2005 | | | | | | | | | | | | Length of survey (Months) | Raw | Bias Adjusted |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | J | F | M | A | M | J | J | A | S | O | N | D | | | |
| Bridge Street | 339452 556014 | 44 | 35 | 29 | | | | | | | | | | 3 | 36 | |
| Paddys Market 1. | 339465 555973 | 48 | 58 | 46 | | | | | | | | | | 3 | 50.7 | |
| Paddys Market 2. | 339465 555973 | 42 | 55 | 42 | | | | | | | | | | 3 | 46.3 | |
| Paddys Market 3. | 339465 555973 | 46 | 41 | 42 | | | | | | | | | | 3 | 43 | |
| Wigton Road | 339202 555801 | 55 | 44 | A | | | | | | | | | | 2 | 49.5 | |
| Finkle Street | 339784 556110 | 63 | 54 | A | | | | | | | | | | 2 | 58.5 | |
| Newtown Road | | | | | | | | | | | | | | | | |

### 3.3.7 Gauss Modelling Data – A595 Caldewgate / Castleway

As discussed previously annual average concentration of $NO_x$ and $NO_2$ were calculated using a Gauss model on a course grid resolution (1km/1km) across the City of Carlisle.

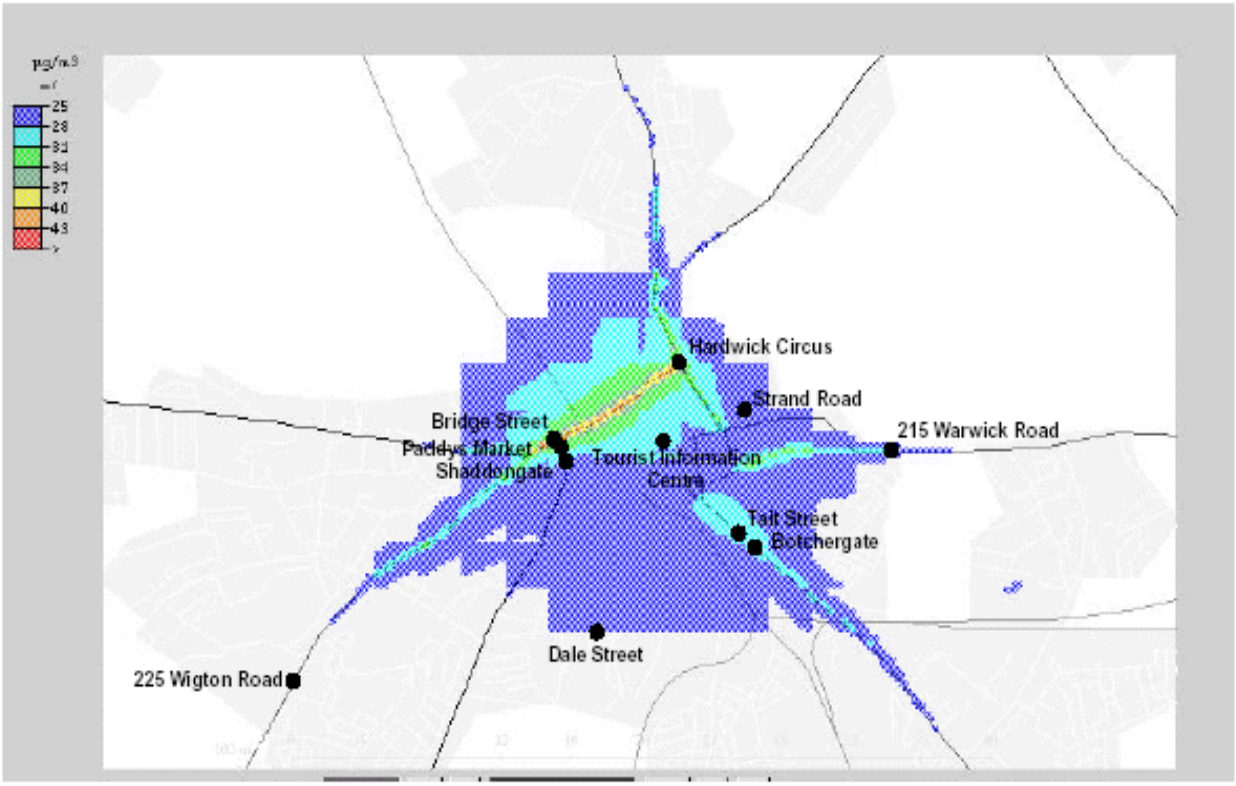
The model was configured so that all sources within the Carlisle emissions database were included (road, point and grid sources)

The model does not take account of very localised air dispersion (e.g. effects of buildings, localised traffic movement) but provides a general picture of $NO_2$ dispersion.

**Figure 8**

**Contour Plot Showing Predicted Annual Mean Concentration of $NO_2$ Over The Centre Of Carlisle City For The Years 2000 – 2004**






Gaussian plume modelling of $NO_2$ over Carlisle City Centre revealed that annual air concentrations of the pollutants were predicted to be above the $NO_2$ 2005 annual mean objectives along many sections of Caldewgate and Castle Way, ranging between 30.5 and 47.9 $\mu gm^{-3}$ when accounting for model

uncertainty. However diffusion tube monitoring undertaken in 2004 at Bridge Street, and Paddys Market thought to be two hot spot locations has not to date shown any exceedence.

Comparisons between $NO_2$ concentrations in 2004 predicted by airviro and those actually measured using NOx diffusion tubes at Paddys Market and Bridge Street (See Appendix 2) are in close agreement. Both studies indicate that the $NO_2$ concentrations at these two localities will be below the annual mean $NO_2$ objective in 2005.

More recent diffusion tube results in 2005 at these sites have however indicated higher concentrations for the first 3 months of this year. It is likely that this has occurred due to road works at Junction Street, Victoria Viaduct, Spencer Street and possibly from the conversion of Hardwicke Circus from being controlled by traffic lights to normal roundabout conditions. The situation is to be kept under review.

Eight months of raw data collected over the monitoring period September 2004 – March 2005 collected from a new site located at the bottom of Wigton Road indicates that there may be an exceedence at this locality.

It is therefore considered necessary that a further detailed assessment is carried out for the A595.

Both $NO_2$ diffusion tubes and the newly purchased NOx chemiluniniscent analyser (once delivered and installed) will continue to monitor $NO_2$ concentrations at this locality and it is proposed that more detailed dispersion modelling will also be undertaken along this traffic route.

Given the results of the Gauss Model a Nitrogen Dioxide tube is to be relocated to the lower end of John Street and positioned closer to the junction with Church Street and it has also proposed to undertake diffusion tube monitoring near to the Graham and Bowness garage where residential development has been approved.

Impact of proposed development particularly to the west of the city which may lead to a deterioration in $NO_2$ levels will need to be considered in future air quality assessments. New development is discussed further in Chapter 5.

The Gauss model also predicts elevated $NO_2$ concentrations along sections of Warwick Road, London Road, Botchergate, Wigton Road and Stanwix Bank, between 31 – 34 $\mu gm^{-3}$.

Although below the $NO_2$ 2005 objective it is important to stress that modelling with the exception of the A7 is on a course grid resolution (1km x 1km) and does not take account of very localised air dispersion nor uses the canyon model.

Diffusion tube monitoring sites are located at each of the sections identified in the dispersion model where higher $NO_2$ concentrations are likely to occur. The results from existing sites have already been discussed in previous sections however new monitoring sites have also been established.

### 3.4 Monitoring Data - New Monitoring Sites

Guidance issued to local authorities to assist them in carrying out their updating and screening assessment in 2003 suggested that exceedences may occur at busy junctions or where residential property is within 10 metres of a kerbside, where relatively low traffic flows of 10,000 – 20,000 vehicles per day occur, if they are in congested towns, and in particular where towns have narrow streets with residential property within 5 metres or so of the kerb.

In the absence of monitoring data during the Updating and Screening Assessment particularly in respect to busy junctions, a simple DMRB model recommended by Defra was utilised.

Results of the DMRB model indicated that there may be a risk of the 2005 annual mean objective being exceeded in Caldewgate at relevant locations adjacent to the Bridge Street Junction and consequently a detailed assessment was undertaken at this locality. (refer to section 3.3.6)

However a number of new monitoring sites have been recently established within the City located adjacent to congested roads and in particular busy junctions. These are in the following areas:

1. Warwick Road / Spencer Street / Victoria Place
2. Currock Street / Dalston Road / Junction Street / Charlotte Street / Denton Street
3. London Road / Botchergate / Tait Street

Location of monitoring sites are shown below.

**Figure 9**
**$NO_2$ Diffusion Tube Monitoring Locations – Warwick Road Area**

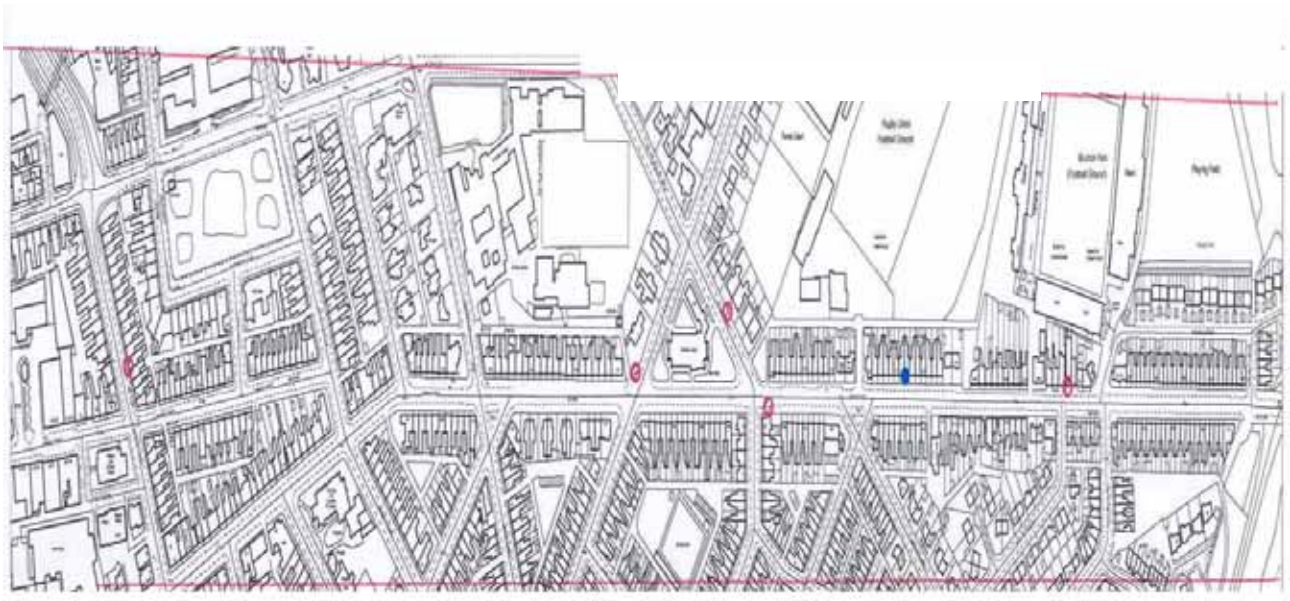


**Figure 10**
**$NO_2$ Diffusion Tube Monitoring Locations -Botchergate / London Road Area**

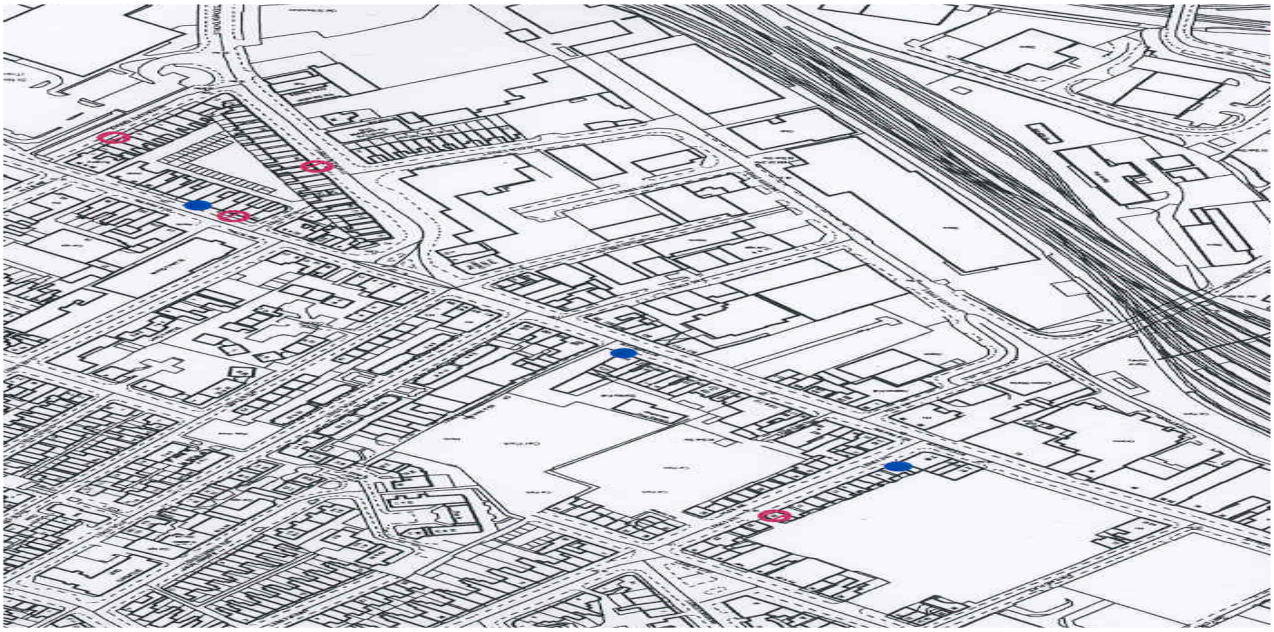
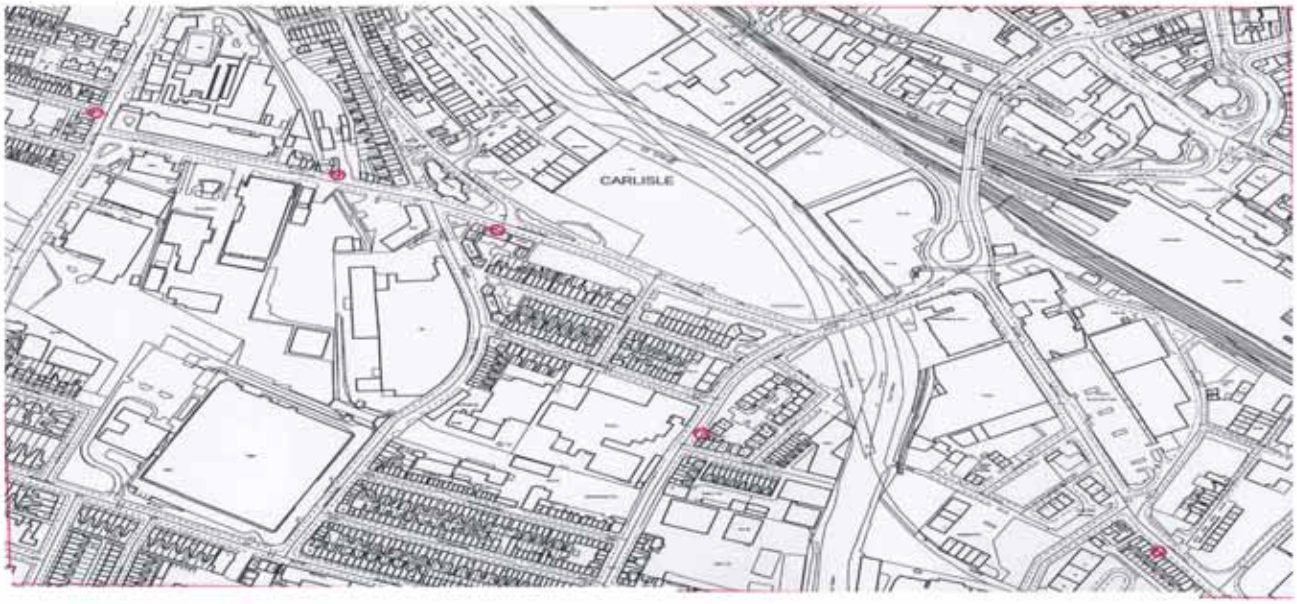


**Figure 11**
**$NO_2$ Diffusion Tubes Monitoring Locations –**
**Currock St / Victoria Viaduct / Junction St / Shaddongate Area**




Only short term data for the majority of these sites has been collected so far and therefore it is not possible to draw any conclusions from the results to date.

As previously stated only data sets covering monitoring periods of 9 months or more can be adjusted for laboratory bias (using the correction factor 0.85) and therefore a combination of raw and bias adjusted results (where applicable) is reported in the table below.

Again because short term data cannot be bias adjusted it has not been possible to adjust the data to provide an estimate of the annual mean and therefore comparison with the annual mean objectives. Raw data must be treat with caution.

## Table 8

## New NO2 Monitoring Sites 2004/05

| ocation | Grid Reference | Site Type | Monthly Mean NO2 Concentrations (µg/m $^{-3}$) | | | | | | | | | | | | | | | Length of Study | Raw | Bias adjusted (0.85) | Projected 2005 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | | | | |
| ondon Road ) | 340722 555228 | R | | | 59 | 54 | 54 | 50 | 68 | 63 | | | | | | | | 6 | 58 | | |
| ondon Road ) | 340704 555237 | R | | | | | | | | | 40 | 61 | 57 | 49 | 52 | 53 | 53 | 7 | 52.1 | | |
| t. Nicholas t | 340671 555200 | R | | | | | | | 31 | 36 | 21 | 40 | 29 | 25 | 48 | 41 | 37 | 9 | 34.2 | 29 | |
| ondon Road ) r Halfords | 340986 555022 | R | | | | | | | 37 | 34 | 35 | 41 | 50 | 37 | 60 | 47 | 36 | 9 | 41.8 | 35.5 | |
| ait Street | 340483 555488 | R | | | 43 | 45 | 45 | 48 | 41 | 43 | 41 | 45 | 55 | 43 | | | | 10 | 44.9 | 38 | 37.2 |
| otchergate | 340566 555376 | R | | | 37 | 46 | 47 | 39 | 55 | 52 | 34 | 52 | 57 | 42 | 71 | 70 | 54 | 13 | 50.5 | 42.9 | 41.8 |
| urrock treet | 340202 555199 | R | | | | | | | | | 45 | 60 | 61 | 50 | 74 | 57 | 56 | 7 | 57.6 | | |
| unction St ) | 339438 555649 | R | | | | | | | | | 35 | 46 | 51 | 45 | 36 | 47 | 43 | 7 | 43.3 | | |
| unction St ) | 339616 555585 | R | | | | | | | | | | | | | | 72 | 45 | | 58.5 | | |
| harlotte St | 339739 555523 | R | | | | | | | | | | | | | | | | | | | |
| enton St | 339878 555313 | R | | | | | | | | | | | | | | | 28 | | 28 | | |
| pencer St | 340428 555920 | R | | | | | | | | | | | | | | | 30 | | 30 | | |
| Varwick Rd | 341150 555897 | R | | | | | | | | | | | | | | 40 | 38 | | 39 | | |
| ctoria Place | 341104 555956 | R | | | | | | | | | | | | | | 29 | 28 | | 28.5 | | |
| Varwick Rd | 341424 555911 | R | | | | | | | | | | | | | | 68 | 37 | | 52.5 | | |

**Results from the new monitoring locations indicate the following:**

### 3.4.1 A6 London Road / Botchergate Area

Elevated $NO_2$ concentrations have been measured alongside Botchergate and London Road. 13 Months (2004/05) of monitoring data for Botchergate gives a bias adjusted concentration of 42.9 $\mu gm^{-3}$ . When projected forward to 2005 it is predicted that the $NO_2$ concentration will be 41.8 $\mu gm^{-3}$ in 2005 which exceeds the $NO_2$ annual mean objective level of 40$\mu gm^{-3}$.

Where Botchergate runs into London Road 6 and 7 months of raw data results at two respective localities indicate concentrations above 50$\mu gm^{-3}$, this may indicate levels being over the $NO_2$ annual mean objective level.

It is therefore proposed that a detailed assessment is required for the A6 particularly at relevant locations running alongside Botchergate and London Road.

Monitoring will continue along the traffic route and it is proposed that more detailed dispersion modelling will also be undertaken. e.g. to take account of the effects of buildings.

### 3.4.2 Currock Street / Junction Street / Charlotte Street

7 months raw data for Currock Street indicates that there may be an exceedence of the $NO_2$ annual mean objective as the uncorrected measured level exceeds 50 $\mu gm^{-3}$.

New monitoring sites have been located alongside Junction Street, Charlotte Street and Denton Street. Insufficient data has been obtained so far to draw any conclusions.

It is however proposed that a detailed assessment for Currock Street will be required and that this will be extended to include Victoria Viaduct and Junction Street, connecting to Dalston Road and Caldewgate.

It is proposed that more detailed dispersion modelling along this route will be undertaken.

A long term site has been located along Warwick Road for several years, which has indicated $NO_2$ levels are below the objective level for 2005.

However additional diffusion tubes have been located alongside Warwick Road and adjacent to the Victoria Place junction. Only 2 months data has been obtained so far and therefore it is not possible to draw any conclusions at the present time.

Monitoring will however continue at these locations. Rather than waiting for additional data before deciding to carry out a detailed assessment it is proposed that a detailed assessment will be carried out for relevant locations along this route. This will also include more detailed dispersion modelling along the A69.

## 4.0 NEW MONITORING DATA – PARTICULATE MATTERS ($PM_{10}$)

### 4.1 Introduction

Particulate matter ($PM_{10}$'s) consists of solid matter and is categorised according to its size. $PM_{10}$ are particulate's, which are 10 microns or less in diameter. This very fine dust can be inhaled into the lungs.

The Government has adopted two air quality objectives for $PM_{10}$. The objectives are 40 $\mu gm^{-3}$ as the annual mean and 50 $\mu gm^{-3}$ as the fixed 24 hour mean to be exceeded no more than 35 days per year to be achieved by the end of 2004.

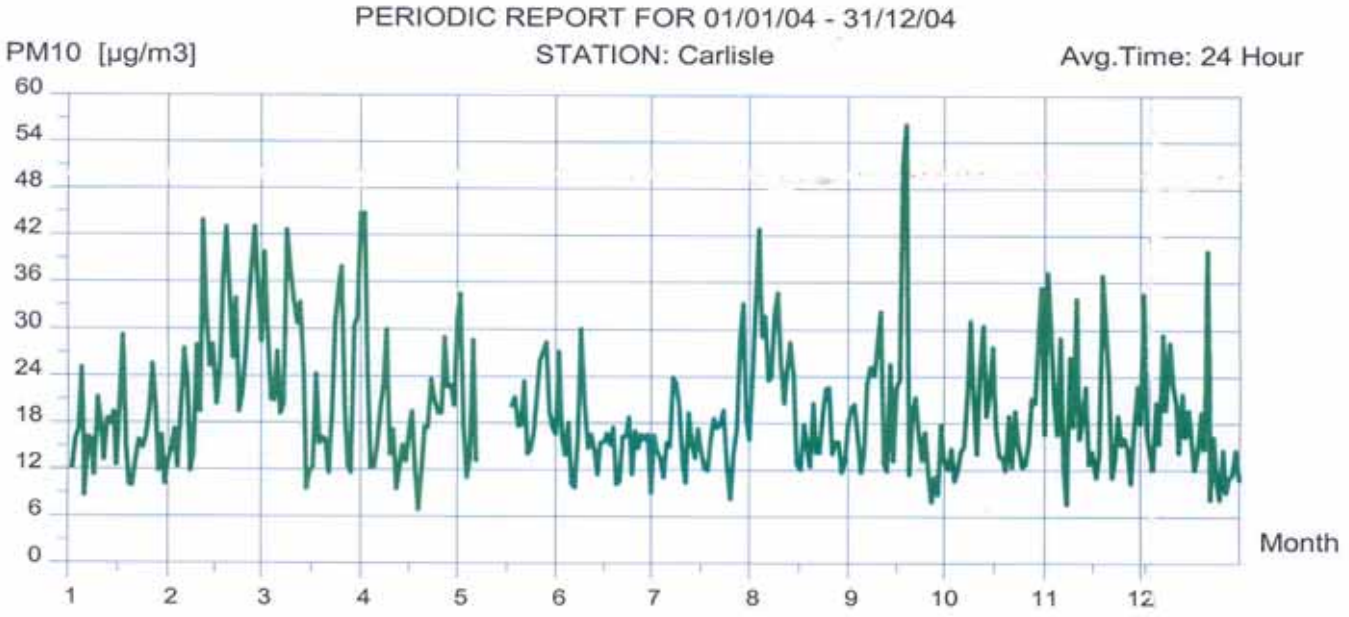
The objectives are based upon measurements carried out using the European gravimetric transfer sampler or equivalent.

### 4.2 Results of $PM_{10}$ Monitoring

Results of a DMRB screening model used during the updating and screening assessment indicated that there was a risk of 2004 $PM_{10}$ objectives being exceeded alongside Caldewgate. A TEOM monitor was subsequently located at Paddys Market.

A summary of the $PM_{10}$ concentrations monitored between January and December 2004 at Paddys Market are presented in diagram (below). Data capture during this period was 97%.

**Figure 12**




Technical guidance LAQM TG 03 advises that for data collected using a TEOM a default factor of 1.3 should be applied to estimate the gravimetric concentration, which is then compared against air quality objectives.

The annual mean for 2004 measured using the TEOM was 19.8 $^{\mu g/m3}$ or 25.74 $^{\mu g/m3}$ when converted to gravimetric. During this period there were 12 days when the TEOM monitor measured 24 hour concentrations greater than 50 $^{\mu g/m3}$ once the data was adjusted to give gravimetric readings. Both the annual mean and number of 24 hour exceedences were below the objective levels for 2004.

The Government has also introduced <u>provisional</u> $PM_{10}$ objectives to be achieved by the end of 2010. The provisional objectives are a 24 hour mean of 50$\mu gm^{-3}$ not to be exceeded more than 7 times a year and an annual mean of 20$\mu gm^{-3}$ to be achieved by the end of 2010. There is no requirement at present for local authorities in England to undertake a review and assessment for 2010 objectives as they have not been included in the air quality regulations. However consideration is given to these objectives below.

concentrations can be projected to estimate the annual mean and 24 hour exceedence in 2010. All concentrations are stated as gravimetric readings.

It is estimated that the annual mean $PM_{10}$ concentration in 2010 at Paddys Market will measure 23.77 $\mu g/m^{-3}$ and the number of 24 hour exceedences will measure 9.64. There is therefore a risk that the provisional 2010 $PM_{10}$ objective will be exceeded alongside Caldewgate.

This compares with the results of the DMRB model run for this location during the Updating and Screening Assessment, which predicted an annual mean of $24\mu g/m^{-3}$ and 10 exceedences above the 24 hour objective.

The DMRB screening model was applied to other busy junctions in Carlisle during the Updating and Screening Assessment to predict the $PM_{10}$ concentrations in 2010. Results indicated that there may be a risk of exceeding the provisional annual mean 2010 objective at the Scotland Road/Brampton Road/Eden Bridge Junction, Junction Street/Dalston road junction and Victoria Place/Warwick Road Junction.

$PM_{10}$ monitoring has not taken place at these locations to date but will be considered in more detail in the next Updating and Screening Assessment Report.

Results of a screening assessment for domestic solid fuel burning also indicated that an area of Longtown where solid fuel is predominantly used may exceed the provisional 2010 objectives. Again no monitoring or modelling has taken place but will be considered in more detail during the next Updating and Screening Assessment.

## 4.3 Monitoring of other Pollutants

- Carbon Monoxide
- Benzene
- 1,3 – Butadiene
- Lead
- Sulphur Dioxide

No monitoring or modelling is carried out for these pollutants as Government Guidance indicates that it is unlikely that there is a risk of a breech of their objective levels within this local authority area.

Our position remains as summarised in the Updating and Screening Assessment undertaken in 2003.

## 5.0 NEW DEVELOPMENTS

### 5.1 New Industrial Process

#### New Part A1 Processes

There are no new Part A1 Industrial Processes in Carlisle's area, however a number of existing processes received a permit since 2003 which has now classified them as A1 industrial processes. These are Stead McAlpin a material printing process at Cummersdale, Hespin Woodland Fill Site, McVities UK food processor Caldewgate, Cavaghan and Gray, Eastern Way and Nestle UK Ltd, Dalston also food processors.

#### New Part A2 Processes

One A2 Industrial Process has been permitted in Carlisle since the last Updating and Screening Assessment in 2003. The process was previously authorised by the Council under part B of the Environmental Protection Act 1990. Changes to process classifications contained in the Pollution Prevention & Control (England & Wales) Regulations 2000 means the process is now classed as an A2 process, although emissions to air from the process have not altered. The process is Carnauld Metal Box which is a metal coating process based at Botcherby, Carlisle.

#### New Part B Processes

There have been a few new Part B industrial processes permitted in Carlisle since the last Updating and Screening Assessment in 2003. These have been small operations and do not have a significant impact on Local Air Quality. The processes included sand and cement batching and waste oil burners.

### 5.2 New Landfill/Quarrying/Mineral Development Processes

There have been no new landfill sites established in Carlisle since 2003.

There are no new quarrying or mineral processes taking place in Carlisle since 2003.

There is a recycling site being operated at the Hespin Wood land fill site, by Cumbria Waste Management and also a stone reclamation activity run by Ken Hope Ltd is also based at the same site.

## 5.3 New Road Developments

Consultation with Cumbria County Council has confirmed the following:

- No new roads have been constructed since the previous Updating and Screening Assessment in 2003. Work on the Carlisle Northern Development Route discussed in detail in the Updating and Screening Assessment Report 2003 has still not started.

No roads in the Carlisle area have experienced large increases (Greater than 25% or more) in traffic flow since the previous Updating and Screening Assessment. There is however an extra lane currently being added to Victoria Bridge on the outskirts of Denton Holme, which may have an impact on air quality. This will be considered during future monitoring.

## 5.4 New Commercial Development

There are a number of new commercial developments proposed that could have an impact on air quality and will therefore be considered during future monitoring:-

- The new Tesco store at the Viaduct, Carlisle,
- The new B & Q Store on London Road, Carlisle and
- Further development at Parkhouse Business Park and Kingmoor Park for offices, retail, warehousing and small industrial use.

## 5.5 New Residential Development

### Residential Development that is currently in progress

The following developments are currently taking place:

1. Carlton Grange (495 units)
2. Garlands (302 units)
3. Wigton Road Suttlehouse (157 units)
4. Cargo – 14 MU (96 units)
5. Windsor Way (156 units)
6. Dobinson Road and Parham Drive (96 units)

These developments may have an impact on traffic flow in the future.

### Future Developments With Permission

permission. These are

1. Rome Street (199)
2. Remainder of Raffles (343)

There are also two smaller developments namely:

Shaddonmills (58) and land on Botchergate (40)

**Land Allocated But Without Permission**

The following land has been set aside for residential use this land is on

1. West of Morton Road (8.1 hectres – 197 units)
2. East of Wigton Road (25 hectres 566 units)
3. Peter Lane, Dalston (47 hectres 101 units)

There are also a number of applications in for developments that have not currently been determined, but are below 50 dwellings/units. Quite a few of these are around the Denton Holme area, Dalston Road (Well Flat farm) and Bousteads Grassing.

Small developments by themselves are not significant but the cumulative effect may have an impact on air quality.

Any expected or predicted future developments will be taken into account in the monitoring regime.

It is also recommended that future planning policy requires air quality assessments to be submitted for the following types of development.:-

- Extension of, or new proposals for industrial activities with potentially significant emissions
- Proposals that will results in an increase in vehicle trip generation in the local area, and which will result in increases in traffic volumes (AADT) of 5% or more on individual road links with more than 10,000 vehicles per day.
- Proposals that may result in increased congestion and lower vehicle speeds than is present on the existing local road network, particularly in areas of public exposure.
- Proposals that may significantly alter the composition of traffic such that adverse air quality impacts arise, particularly in areas of public exposure.

existing parking provision of 300 spaces or more.

- Proposals for coach and lorry parks, and in areas of public exposure in particular
- Any developments likely to have an adverse impact on air quality, particularly in sensitive areas (e.g. Where predicted air pollution levels already exceed air quality objectives levels by 10% or more)

## 6.0 CONCLUSIONS AND RECOMMENDATIONS

1. A detailed assessment undertaken along the A7 in 2004 concluded that there was a risk of the nitrogen dioxide ($NO_2$) annual mean objectives being exceeded at relevant locations between Stanwix Bank and Kingstown due to road traffic emissions and that an air quality management area was required.

   It was subsequently recommended to Council that an Air Quality Management Area (AQMA) be declared for this area. This was endorsed by Council in January 2005.

2. Additional monitoring and detailed air dispersion modelling work undertaken by Westlakes Scientific Consulting Ltd has since taken place to assist in defining the boundaries of the AQMA.

3. As a result of this work it is recommended that an AQMA be formally declared along the A7 between Junction 44 of the M6 and Hardwicke Circus, extending only to properties located directly adjacent to the roadside and also properties adjacent to the junction of Brampton Road and Stanwix Bank as shown in Appendix 3.

4. Following declaration of the AQMA Carlisle City Council will have a duty to draw up an action plan within 18 months of the declaration specifying the measures it intends to take in pursuit of reducing nitrogen dioxide concentrations within the AQMA.

5. As the AQMA has been required as a result of traffic based emissions, traffic based management measures and techniques will be required to reduce $NO_2$ levels below the objective level.

   This will require a collaborative effort amongst land use planners and transport planners alike.

   Policy areas of economic development, wider environmental protection and sustainability all need to be considered in the context of developing the air quality action plan as will the wider involvement of the community and other stakeholders.

   Preliminary discussion have already taken place with colleagues in the Planning Department and Cumbria County Council's Highways Department .

existing and new locations, recent gaussion air dispersion modelling undertaken by Westlakes Scientific Consulting Ltd for the City of Carlisle and an outline of recent or proposed new development which will need to be considered during the next review and assessment.

7. Air Dispersion Modelling over the Carlisle Centre has revealed that the annual air concentration were predicted to be over the annual mean objectives along many sections of Caldewgate and Castleway. However both modelled and monitoring results have not indicated that an exceeding will occur at relevant locations to date.

   It is recommended that further detailed assessment work is undertaken along the A595 to include new monitoring locations and additional air dispersion modelling.

8. This Report also highlights several other road sections within the City where there may be an exceedence of the annual mean $NO_2$ objective in 2005:-

- Botchergate/ London Road
- Currock Street/Victoria Viaduct/Junction Street
- Warwick Road/Victoria Place

It is therefore considered necessary for a further detailed assessment to be undertaken at these localities which will include both monitoring and more detailed air quality dispersion modelling.

9. It is recommended that air quality assessments be required for development which may have an impact on air quality and that this be reflected in the Councils planning policies.

1. DETR (2000). The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. Department of the Environment, Transport and the Regions.

2. Carlisle City Council (2003). Updating and Screening Assessment of Air Quality in Carlisle.

3. Carlisle City Council Review and Assessment of Air Quality in Carlisle – Second and Third Stages.

4. DEFRA (2003) Local Air Quality Management LAQM.TG(03). Department for Environment, Food and Rural Affairs.

5. DEFRA (2003) Local Air Quality Management LAQM.PRG(03). Department for Environment, Food and Rural Affairs

## Appendix 1
## Recommended timescales for submission of reviews and assessments and progress reports

| Appendix 1: Recommended timescales for submission of reviews and assessments and progress reports | | |
|---|---|---|
| **LAQM activity** | **Completion Date** | **Which Authorities?** |
| Updating & Screening Assessment | End of May 2003 | All authorities[a] |
| Detailed Assessment | End of April 2004 | Those authorities[a] which have identified the need for a detailed assessment in their May 2003 updating and screening assessment |
| Progress Report | End of April 2004 | Those authorities[a] which have identified no need for a detailed assessment in their May 2003 updating and screening assessment |
| Progress Report | End of April 2005 | All authorities |
| Updating and screening assessment | End of April 2006 | All authorities |
| Detailed assessment | End of April 2007 | Those authorities which have identified the need for a detailed assessment in their April 2006 updating and screening assessment |
| Progress report | End of April 2007 | Those authorities which have identified **no need** for a detailed assessment in their April 2006 updating and screening assessment |
| Progress report | End of April 2008 | All authorities |
| Updating and screening assessment | End of April 2009 | All authorities |
| Detailed assessment | End of April 2010 | Those authorities which have identified the need for a detailed assessment in their April 2009 updating and screening assessment |
| Progress report | End of April 2010 | Those authorities which have identified **no need** for a detailed assessment in their April 2009 updating and screening assessment |

| | |
|---|---|
| a) | All local authorities except those in Northern Ireland and London local authorities that have designated AQMAs. London local authorities that have designated AQMAs will be expected to submit a Updating and Screening Assessment by the end of 2003 or earlier if possible, and to complete Detailed Assessments (where required by the end of 2004. |

**Appendix 2**
**Air Dispersion Modelling Of $NO_2$**

The airviro air quality management system was used to model the atmospheric dispersion of NOx emissions.

The modelling studies were conducted in three stages:

4. Annual average concentrations of $NO_x$ and $NO_2$ arising from background emissions were calculated using the Gauss model on a coarse grid resolution (1 x 1 km) across the map area using meteorological data for 2004, a year for which Carlisle City Council has comprehensive $NO_2$ monitoring data. Similar studies were also undertaken to determine $NO_x$ and $NO_2$ concentrations from road link sources surrounding the A7 between Stanwix and Kingstown on a medium (250 x 250m) and fine (25 x 25m) scale resolution. The Gauss model is particularly suited to local-dispersion studies and was, therefore, considered appropriate for use in the Carlisle EDB map area.

5. Specific modelling studies were conducted using the Canyon model to predict annual $NO_x$ and $NO_2$ concentrations at the Scotland Road, Kingstown Road and Stanwix Bank sections of the A7, where the designation of an AQMA is proposed. The Canyon model is designed for use on individual streets where tall buildings are present either side of the road link.

6. Validation studies for $NO_2$ were carried out by comparing modelled concentrations of the pollutant with those monitored by Carlisle City Council in 2004.

Plotting measured $No_2$ concentrations against those predicted by the model and fitting the data to a linear model, revealed a significant relationship between the two ($r^2$

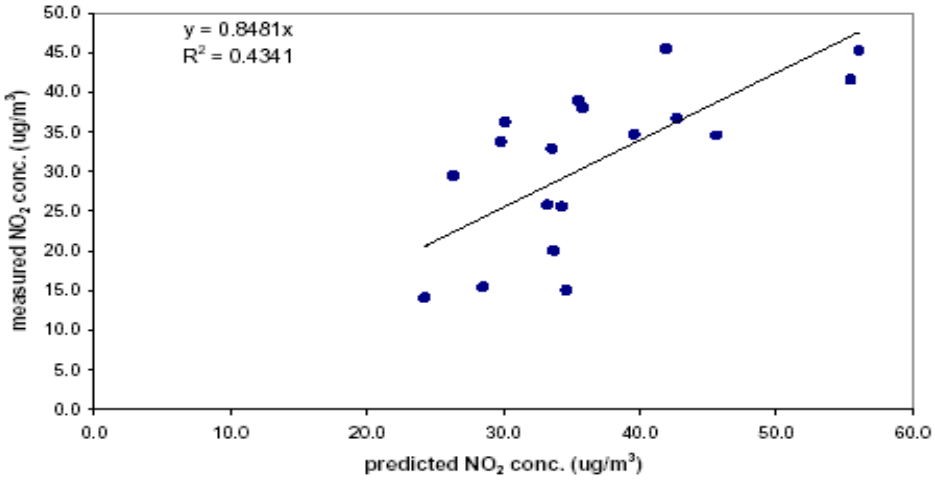



Figure 6: Relationship between predicted and measured $NO_2$ concentrations during 2004

=0.43) with a slope coefficient of 0.85 when setting the y-intercept to zero.

All $No_2$ predicted concentrations derived using the Derwent & Middleton formula were, therefore, corrected by a factor of 0.85. Corrected concentrations predicted by the dispersion model were compared with diffusion tube estimates of air concentrations of $NO_2$ from 18 sites across the city measured in 2004. The majority of the dispersion model predictions (89%) were at or within 50% of the measured values, demonstrating that the model had performed acceptably (in-line with the TG3 (00) guidance). In cases such as the Tourist Information Centre and Dale Street, the large difference between predicted and monitored $NO_2$ concentration may be explained by the fact that a number of road links in this vicinity were not included in the EDB due to insufficient data. As such $NO_2$ predicted in this area is dependent on the use of NAEI data based on a 1km resolution.

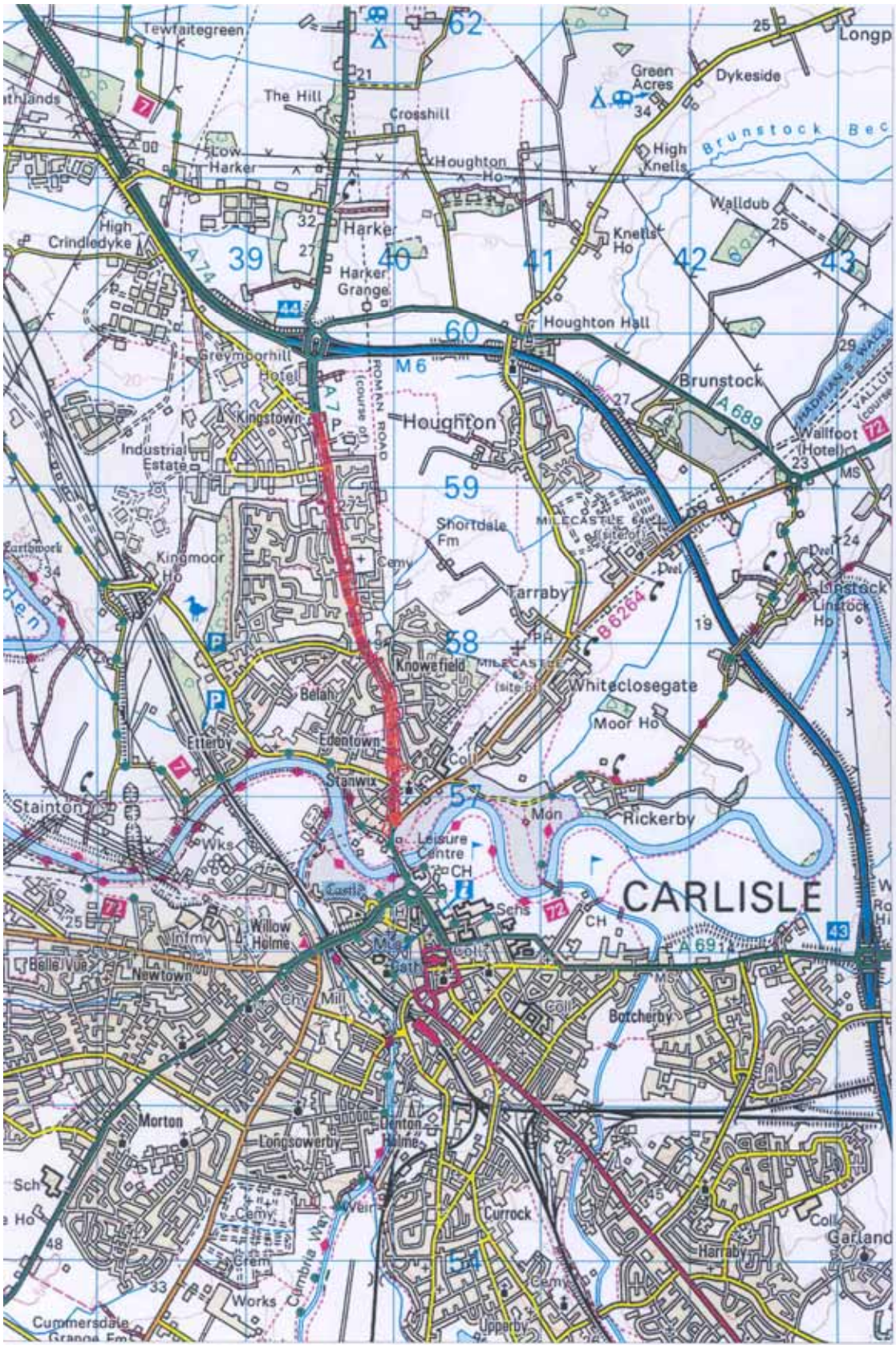
Comparing measured and predicted concentrations of $NO_2$ at each of the 18 monitoring sites allowed and determination of the Root Mean Square (RMS) of the difference between predicted and monitored $NO_2$ concentrations, providing an indication of model accuracy. RMS analysis demonstrated that prior to correction of $NO_2$ concentrations by a factor of 0.85, the uncertainty limits for the dispersion model were $\pm$ 9.4 $\mu gm^{-3}$, however after correcting predicted $NO_2$ concentration, uncertainty limits were $\pm$ 6.9$\mu gm^{-3}$.

## Comparison between $NO_2$ concentrations predicted by Airviro and those monitored using $NO_2$ tubes at 18 locations throughout the City of Carlisle

| Monitoring point | Monitor Location | | $NO_x$ concentration ($\mu g\ m^{-3}$) | | | | | $NO_2$ concentration ($\mu g\ m^{-3}$) | Monitored concentration ($\mu g\ m^{-3}$) | % difference |
|---|---|---|---|---|---|---|---|---|---|---|
| | E | N | Local concentration[a] (25 m grid resolution) | "Regional" background[b] (250 m grid resolution) | "National" background[c] (1km grid resolution) | Total background[d] (b + c) | Total predicted concentration (a+ d) | | | |
| Wigton Road | 337926 | 554558 | 6.5 | 16.6 | 8.0 | 24.6 | 31.1 | 20.6 | 14.1 | + 45.8 |
| Scotland Road | 339992 | 557187 | 69.7* | 25.8 | 8.0 | 33.8 | 103.5 | 47.6 | | + 5.2 |
| Hardwick Circus | 340143 | 556347 | 21.7 | 43.0 | 8.0 | 51.0 | 72.7 | 38.8 | 34.6 | + 12.0 |
| Shaddongate | 339483 | 555892 | 9.5 | 28.6 | 8.0 | 36.6 | 46.1 | 28.2 | 25.8 | + 9.3 |
| Warwick Road | 341310 | 555918 | 11.5 | 28.5 | 8.0 | 36.5 | 48.0 | 29.1 | 25.6 | + 13.7 |
| Tourist Information Centre | 340070 | 555955 | 5.1 | 35.6 | 8.0 | 43.6 | 48.7 | 29.4 | 15.1 | + 95.4 |
| Dale Street | 339615 | 554863 | 1.5 | 28.3 | 8.0 | 36.3 | 37.8 | 24.2 | 15.5 | + 56.5 |
| Strand Road | 340550 | 556174 | 5.4 | 33.5 | 8.0 | 41.5 | 46.9 | 28.6 | 20.1 | + 42.6 |
| Bridge Street | 339452 | 556014 | 20.3 | 30.4 | 8.0 | 38.4 | 58.7 | 33.6 | 34.7 | - 3.1 |
| Paddys Market | 339465 | 555973 | 28.5 | 29.2 | 8.0 | 37.2 | 65.7 | 36.3 | 36.7 | - 1.1 |
| Scotland Road | 339985 | 557346 | 9.7 | 22.8 | 8.0 | 30.8 | 40.6 | 25.6 | 36.3 | - 29.5 |
| Kingstown Road | 339527 | 559284 | 12.8 | 19.3 | 8.0 | 27.3 | 40.1 | 25.3 | 33.8 | - 25.0 |
| Kingstown Road | 339758 | 558062 | 73.8* | 19.7 | 8.0 | 27.7 | 101.5 | 47.1 | 42.3 | + 13.2 |
| Kingstown Road | 339679 | 558386 | 8.7 | 17.8 | 8.0 | 25.8 | 34.4 | 22.4 | 29.5 | - 24.1 |
| Coach & Horses | 339558 | 559107 | 15.6 | 23.1 | 8.0 | 31.1 | 46.7 | 28.5 | 32.9 | - 13.4 |
| Stanwix Bank | 340009 | 556852 | 50.0* | 31.7 | 8.0 | 39.7 | 89.7 | 44.0 | 45.5 | - 3.3 |
| Tait Street | 340483 | 555488 | 8.2 | 34.8 | 8.0 | 42.8 | 51. | 30.4 | 38.1 | - 20.0 |
| Botchergate | 340566 | 555376 | 7.8 | 34.6 | 8.0 | 42.6 | 50.4 | 30.2 | 39.0 | - 22.6 |

a = $NO_x$ concentration arising from local road link and point sources at a grid resolution of 25 m.
b = "Regional background" derived by subtracting $NO_x$ concentration arising from local road link and point sources at a grid resolution of 250 m from $NO_x$ concentrations arising from all sources in the EDB (road, point and grid).
c = "National background" derived by subtracting $NO_x$ concentrations arising from sources in the EDB (road, point and grid) at a grid resolution of 1km from $NO_x$ concentration obtained from the air quality website.
d = Total background is the sum of the "Regional" and "National" background concentrations.
e = Annual averaged $NO_2$ concentrations derived from annual averaged $NO_x$ concentrations using the empirical formula developed by Derwent & Middleton (1996) and adjusted using a conversion factor of 0.85.
f = percentage difference between predicted and monitored $NO_2$ concentrations.
* = figures derived from street Canyon model runs.

**APPENDIX 3 – Recommended Air Quality Management Area (A7) (A)**



**(B)**

## Appendix 4 – Traffic Flows in Carlisle