

NORWICH
City Council

ENVIRONMENT ACT 1995 PART IV

LOCAL AIR QUALITY MANAGEMENT

Air Quality Review and Assessment
Annual Progress Report 2004

City of Norwich

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Executive Summary

The statutory review and assessment of air quality in Norwich was carried out in four stages to determine whether the national air quality objectives would be met by 2005. The results of these assessments indicated that there are areas of Norwich almost certain to exceed the annual mean objective for Nitrogen Dioxide (NO₂). Consequently, Norwich City Council declared three Air Quality Management Areas (AQMA's) on 1st June 2003 for NO₂ exceedance at St Augustines Street, Grapes Hill and the Castle area of Norwich. The location and extent of these three areas is shown in Appendix 1.

In conjunction with AEA Technology, the Updating and Screening Assessment (USA) of local air quality for Norwich was produced in January 2004. This reviews the previous assessments undertaken for all pollutants identified in the Air Quality Regulations.

Where a significant risk of exceedance is identified for a pollutant, the local authority has to proceed to a Detailed Assessment. However, the updating and screening assessment concluded that Norwich did not require a detailed assessment for NO₂, PM₁₀, Benzene, Carbon Monoxide, Lead, 1-3 Butadiene or Sulphur Dioxide.

In March 2004 Norwich City Council produced an Air Quality Action Plan, which considers a range of strategy options to address poor air quality, together with the feasibility of these options. This document is currently being considered by Defra.

Air quality will continue to be monitored in areas of Norwich in order to identify trends in pollution levels, and to assess progress towards achieving the annual average NO₂ objective in the three AQMA's.

Introduction

The UK Government published its policy framework for air quality management in 1995, establishing national strategies and policies on air quality, which culminated in the Environment Act 1995. Air quality standards and objectives were identified and enacted through the Air Quality Regulations in 1997, 2000 and 2002.

The air quality objectives set out in the Air Quality Regulations provide the statutory basis for the system of Local Air Quality Management (LAQM). The standards and objectives are shown in the following tables.

The Environment Act 1995 requires Local Authorities to undertake air quality reviews in their respective areas. In areas where an air quality objective is not anticipated to be met, Local Authorities are required to declare Air Quality Management Areas (AQMA's) and implement action plans to improve air quality.

Pollutant	Objective	Measured as	To be achieved by
Benzene	16.25 µg/m ³	Running Annual Mean	31/12/2003
	5 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 running 8 Hour Mean	31/12/2003
Lead	0.5 µg/m ³	Annual Mean	31/12/2004
	0.25 µg/m ³		31/12/2008
Nitrogen dioxide	200 µg/m ³ Not to be exceeded more than 18 times per year	1 Hour Mean	31/12/2005
	40 µg/m ³	Annual Mean	31/12/2005
Particles (PM₁₀) (gravimetric)	50 µg/m ³ Not to be exceeded more than 35 times per year	24 Hour Mean	31/12/2004
	40 µg/m ³	Annual Mean	31/12/2004
Sulphur dioxide	266 µg/m ³ Not to be exceeded more than 35 times per year	15 Minute Mean	31/12/2005
	350 µg/m ³ Not to be exceeded more than 24 times per year	1 Hour Mean	31/12/2004
	125 µg/m ³ Not to be exceeded more than 3 times per year	24 Hour Mean	31/12/2004

Air Pollution Bandings and Index and the Impact on the Health of People who are Sensitive to Air Pollution

Banding	Index	Health Descriptor
Low	1	Effects are unlikely to be noticed even by individuals who know they are sensitive to air pollutants
	2	
	3	
Moderate	4	Mild effects, unlikely to require action, may be noticed amongst sensitive individuals.
	5	
	6	
High	7	Significant effects may be noticed by sensitive individuals and action to avoid or reduce these effects may be needed (e.g. reducing exposure by spending less time in polluted areas outdoors). Asthmatics will find that their 'reliever' inhaler is likely to reverse the effects on the lung.
	8	
	9	
Very High	10	The effects on sensitive individuals described for 'High' levels of pollution may worsen.

Boundaries Between Index Points for Each Pollutant

Band	Index	Ozone *		Nitrogen Dioxide		Sulphur Dioxide		Carbon Monoxide		PM10 Particles
		8 hourly running mean or hourly mean		hourly mean		15 minute mean		8 hour running mean		24 hour running mean
		µg/m ³	ppb	µg/m ³	ppb	µg/m ³	ppb	mg/m ³	ppm	µg/m ³
Low										
	1	0-32	0-16	0-95	0-49	0-88	0-32	0-3.8	0.0-3.2	0-16
	2	33-66	17-32	96-190	50-99	89-176	33-66	3.9-7.6	3.3-6.6	17-32
	3	67-99	33-49	191-286	100-149	177-265	67-99	7.7-11.5	6.7-9.9	33-49
Moderate										
	4	100-126	50-62	287-381	150-199	266-354	100-132	11.6-13.4	10.0-11.5	50-57
	5	127-152	63-76	382-476	200-249	355-442	133-166	13.5-15.4	11.6-13.2	58-66
	6	153-179	77-89	478-572	250-299	443-531	167-199	15.5-17.3	13.3-14.9	67-74
High										
	7	180-239	90-119	573-635	300-332	532-708	200-266	17.4-19.2	15.0-16.5	75-82
	8	240-299	120-149	363-700	333-366	709-886	267-332	19.3-21.2	16.6-18.2	83-91
	9	300-359	150-179	701-763	367-399	887-1063	333-399	21.3-23.1	18.3-19.9	92-99
Very High										
	10	360 or more	180 or more	764 or more	400 or more	1064 or more	400 or more	23.2 or more	20 or more	100 or more
<p>* Note that in view of the transboundary nature of this pollutant, and thus the limited effectiveness of action on a local scale, Ozone is not included in the regulations for air quality management</p>										

Purpose of the Progress Report

Progress Reports were introduced into the LAQM system following a detailed evaluation of the first round of local authority review and assessments. A need was identified to develop a longer-term vision for both LAQM and the review and assessment process. The process was seen to be too stop-start, possibly resulting in gaps of several years between air quality reviews.

Updating and screening assessments are now required at three yearly intervals, while annual progress reports maintain continuity in the intervening years. This encourages the integration of LAQM into the routine work of local authorities, and is intended to assist local authorities by:-

- helping retain a profile for LAQM within the authority, including the retention of staff with a knowledge of air quality issues
- providing a means for 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
- maximising the value of the investment in monitoring equipment
- making the next round of review and assessment that much easier, as there will be a readily available up-to date source of information
- helping local authorities 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
- providing a ready source of information on air quality for developers carrying out environmental assessments for new schemes
- demonstrating progress with implementation of air quality Action Plans and/or air quality strategies
- providing a timely indication of the need for further measures to improve air quality, rather than delaying until the next full round of review and assessment

New Monitoring Results

Automatic Air Quality Monitoring

Norwich has two sites within its boundaries funded by the Dept of the Environment, Food and Rural Affairs (Defra). The Norwich Centre site is part of their Automated Urban and Rural Network (AURN), and the council owned Norwich Roadside site is affiliated to the AURN. Norwich Centre is an 'urban background' site whilst Norwich Roadside is a 'roadside' site. Additionally the council operates a mobile air quality monitoring station as part of the AEA 'calibration club'. The QA/QC for this partnership is in line with that for the AURN. The Norwich Centre and mobile sites use Ambirak analysers. These continuously monitor NO₂, CO, SO₂ and PM₁₀. The Norwich Roadside site monitors NO₂ only.

Estimated background air pollution data for the Norwich City area can be viewed at: www.airquality.co.uk/archive/laqm/tools (file reference 187_2001.csv)

Diffusion Tubes

The council presently monitors NO₂ at 34 locations (compared to 24 in 2003) throughout the City, using diffusion tubes on a monthly exposure basis. These tubes are supplied and analysed by Gradko International Ltd. The method of preparation is 50% TEA/Acetone, and the values are blank corrected using travelling blanks. Gradko's quality control includes measuring tubes spiked with a known concentration of nitrite solution, measurement of stock solution received from AEA (these results are used as part of the UK NO₂ Survey), and the laboratory measurements are monitored by participation in an external Laboratory Proficiency Scheme ie W.A.S.P (implemented by the Health and Safety Laboratory at Sheffield).

The council is currently running a co-location study with the Norwich Roadside continuous analyser. Results of this study will be available for comparison in the next annual report. The results shown in this progress report have therefore been adjusted for bias using the Review and assessment helpdesk website www.uwe.ac.uk/aqm/review.

Occasional vandalism or theft of tubes from some sites has led to some loss of data for the year. Where this has become a significant issue, we have opted to relocate the tubes to try and overcome the problem, whilst trying to maintain continuity of the results.

Benzene

In 2003 the average background benzene concentration, estimated from the UK background maps, was $0.6 \mu\text{g}/\text{m}^3$, and the maximum was $0.8 \mu\text{g}/\text{m}^3$.

Measurements using diffusion tubes at three locations in Norwich (Unthank Road, Guildhall and St Augustines St), showed a maximum annual mean of $4.69 \mu\text{g}/\text{m}^3$ at St Augustines St. This concentration does not exceed the air quality objective. Monthly average concentrations for 2003 are plotted in Appendix 2.

There were no exceedences of the air quality strategy objective of $16.25 \mu\text{g}/\text{m}^3$ for benzene in 2003.

1,3-Butadiene

In 2003 the average background 1,3-butadiene concentration, estimated from the UK background maps, was $0.2 \mu\text{g}/\text{m}^3$, and the maximum was $0.3 \mu\text{g}/\text{m}^3$.

There are no authorised industrial processes within Norwich that have the potential to emit significant quantities of 1,3-butadiene.

No monitoring of 1,3-butadiene has been undertaken by Norwich City Council.

Carbon Monoxide (CO)

There were no exceedences of the air quality strategy objective of $10 \text{mg}/\text{m}^3$ for carbon monoxide in 2003.

Monitoring data is available for carbon monoxide in the Norwich City area from the Norwich Centre site. In 2003, summary statistics for this site showed a maximum 8 hour running mean of $2.2 \text{mg}/\text{m}^3$. This concentration does not exceed the air quality objective.

Further monitoring data for carbon monoxide is available for the Norwich City area on the UK National Air Quality Information Archive website at www.airquality.co.uk

Lead (Pb)

Only one potential source of exceedence was revealed during the stage 1 review and assessment. This was screened out during stage 2. There are no authorised industrial processes within Norwich that have the potential to emit significant quantities of lead. It is expected that the objectives for lead will be achieved for 2004 and 2008.

Fine Particles (PM₁₀)

The UK Government and the devolved administrations have adopted two air quality objectives for fine particles (PM₁₀) which are equivalent to the EU Stage 1 limit values in the first Air Quality Daughter Directive. The objectives relevant to Norwich City Council are 40 µg/m³ as the annual mean, and 50 µg/m³ as the fixed 24 hour mean to be exceeded on no more than 35 days per year, to be achieved by the end of 2004.

Results from the Norwich Mobile site based at Golding Place during the period 1st March – 22 September 2003 showed that PM₁₀ concentrations were recorded in the Defra 'moderate' band on 17 occasions during April 03. The Defra objective value of 50 µg/m³ based on daily gravimetric equivalent data was exceeded on 7 occasions during this period. The objective allows up to 35 exceedences per year. The mean concentration of 22 µg/m³ gravimetric equivalent was below the Defra annual mean objective value of 40 µg/m³.

The Design Manual for Roads and Bridges (DMRB) screening model indicates that the annual mean objective for PM₁₀ will be met in 2004, but that exceedences of the 2010 objective are likely. It is not yet possible to declare an AQMA for the 2010 PM₁₀ objective. Therefore Norwich City Council have decided not to proceed to a detailed assessment at this time, but will take into consideration having to comply with the objective when deciding on future monitoring strategies.

Sulphur Dioxide (SO₂)

There were no exceedences of the air quality strategy objective of 125 µg/m³ as a daily average for sulphur dioxide in 2003.

Monitoring data is available for SO₂ in the Norwich City area from the Norwich Centre site. In 2003, summary statistics for this site showed a maximum 24 hour mean of 29 µg/m³ with a daily maximum of 80 µg/m³. These concentrations do not exceed the air quality objectives.

Further monitoring data for sulphur monoxide is available for the Norwich City area on the UK National Air Quality Information Archive website at www.airquality.co.uk

Nitrogen Dioxide

Nitrogen Dioxide and Nitric Oxide are both oxides of nitrogen, which together are referred to as NO_x. All combustion processes produce some NO_x, but only NO₂ is associated with adverse effects on human health. NO₂ is mainly a secondary pollutant formed by the oxidation of nitric oxide in the atmosphere. On a national level, the main sources of NO_x are road transport (48%), power generation (20%), other industry (15%) and domestic sources (4%). The remainder arises from other forms of transport and commercial heating systems. In urban environments the contribution from road traffic will be much higher, and in the absence of localised point sources will account for the majority of the NO₂ present. Measures to reduce traffic pollution will therefore play a major role in meeting the air quality objective for NO₂. Such schemes have therefore been included in Norwich's Air Quality Action Plan, which has been submitted to Defra for their consideration.

Monitoring data is available for NO₂ in the Norwich City area from the Norwich Centre site. In 2003, statistics for this site showed a maximum of 111 µg/m³ with an annual mean of 25 µg/m³. These concentrations do not exceed the air quality objectives. Daily average concentrations for 2003 are plotted in Appendix 2.

Monitoring data is also available for NO₂ from the Norwich Roadside site. In 2003, statistics for this site showed a maximum of 120 µg/m³ with an annual mean of 33 µg/m³. These

concentrations do not exceed the air quality objectives. Daily average concentrations for 2003 are plotted in Appendix 2.

Monitoring data from diffusion tubes mounted within two of the three AQMA's is also included in Appendix 2. The monitoring positions for the Grapes Hill AQMA are new this year. Results from these sites will be included in next years report.

Appendix 2 also includes all other NO₂ data for 2003. This has been corrected for diffusion tube bias. There are also projected concentration levels for 2005, based on the 2003 data.

Further monitoring data for Nitrogen dioxide is available for the Norwich City area on the UK National Air Quality Information Archive website at www.airquality.co.uk

New Local Developments

Industry

- No new industrial processes (A1, A2 or B) commenced operation or changed significantly during 2003.
- There are no significant industrial developments planned for the City.

Housing and Redevelopment

- One large retail redevelopment is currently under construction within the City, at Chapelfield Road. This is a replacement for an existing factory and public car park. It is not anticipated that in the longer term this redevelopment will impact significantly on air quality over the previous land use.
- Several other small to medium scale developments are currently under construction within the City, the largest of which is new housing on the site of the former Norfolk and Norwich Hospital. These developments caused some localised dust nuisance during the long dry spell of 2003. It is not anticipated that these developments will impact significantly on air quality once completed.

Road Network Changes

- Several temporary road closures, lane restrictions or diversions were experienced within Norwich during 2003. These were largely in connection with the aforementioned redevelopments, and the demolition of existing buildings and road surfaces etc. Some minor road layout changes are being incorporated into the designs for these areas, although a significant impact on air quality is not anticipated.

Appendix 1

Air Quality Management Areas in Norwich

CONTENTS

Overview map

Castle AQMA

Grapes Hill AQMA

St Augustines AQMA

Diffusion Tube Locations Castle AQMA

- Castle Meadow
- Upper King Street
- Cattlemarket Street

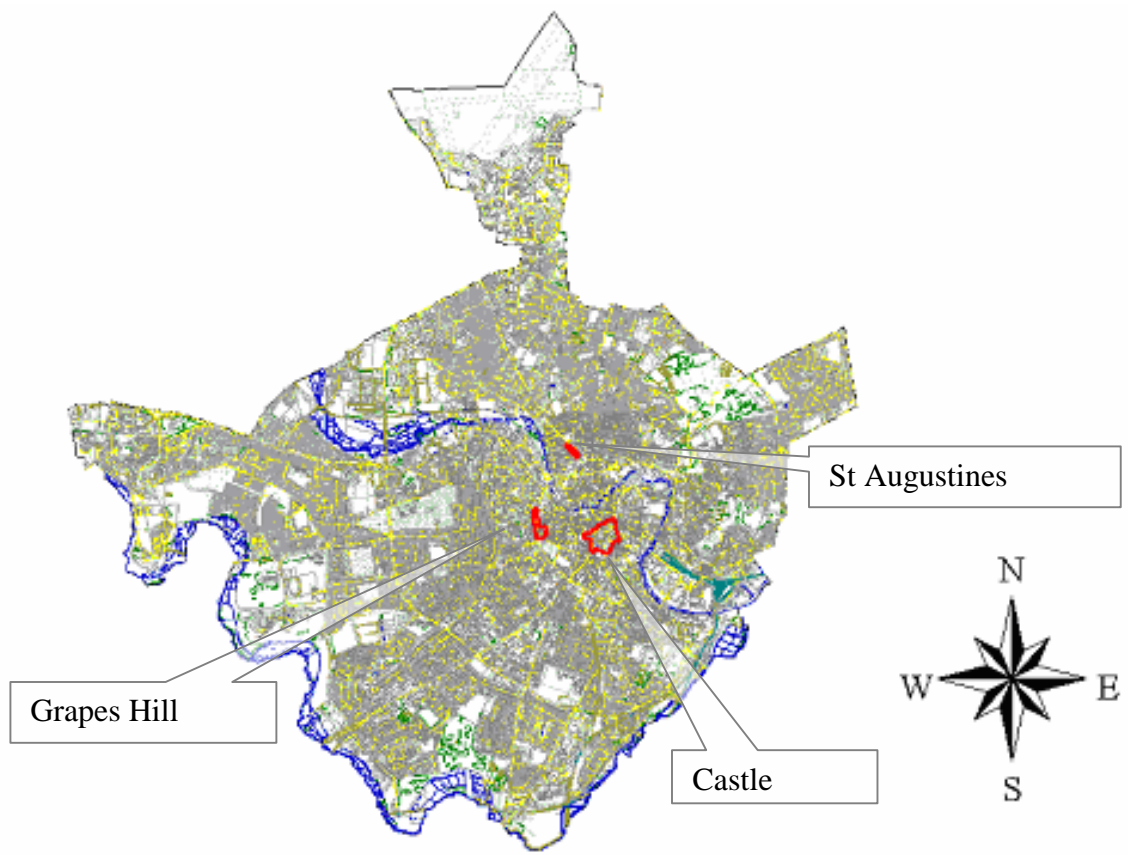
Diffusion Tube Locations Grapes Hill AQMA

- Grapes Hill / Wellington Lane

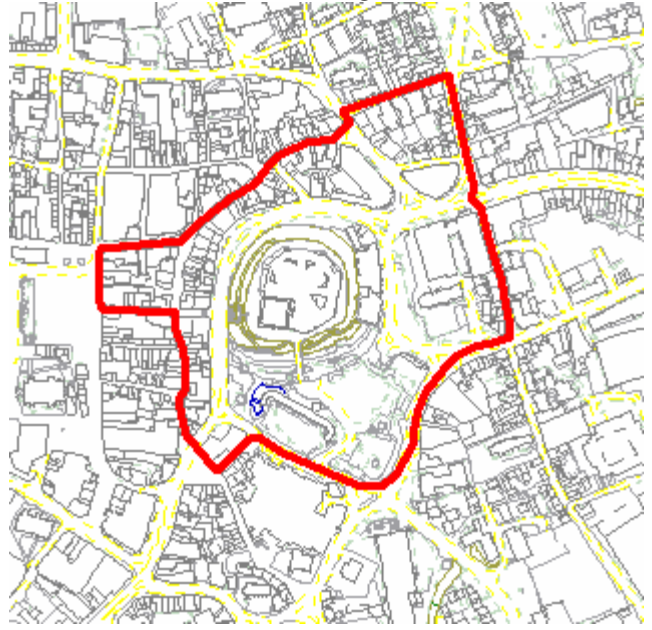
Diffusion Tube Locations St Augustines AQMA

- St Augustines Street

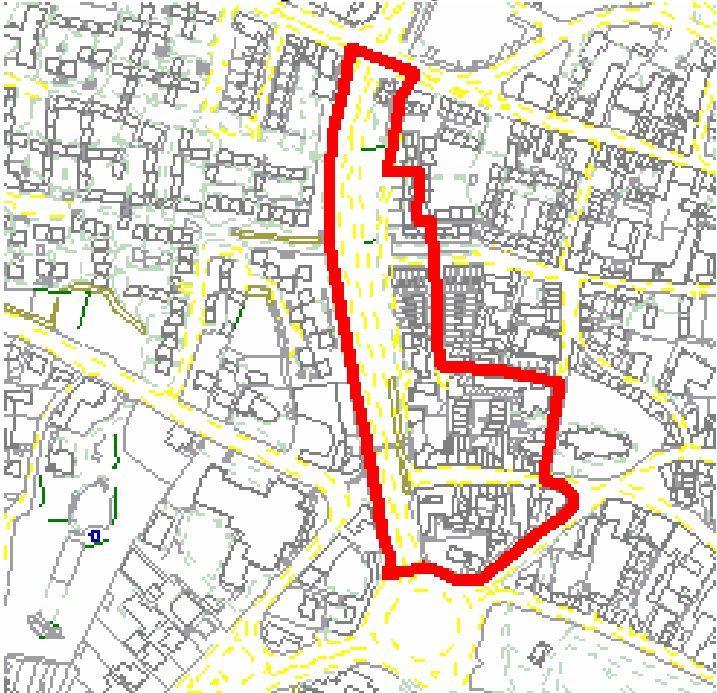
Air Quality Management Areas in Norwich



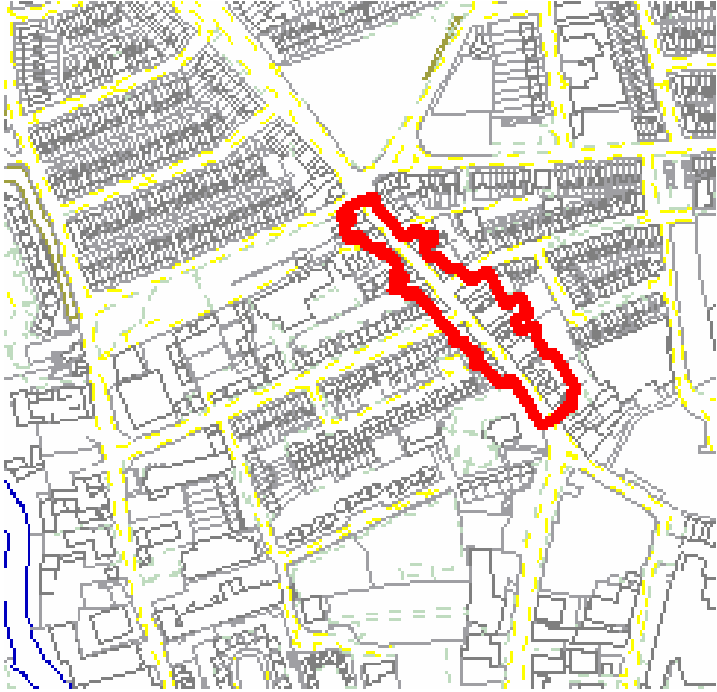
Castle AQMA



Grapes Hill AQMA

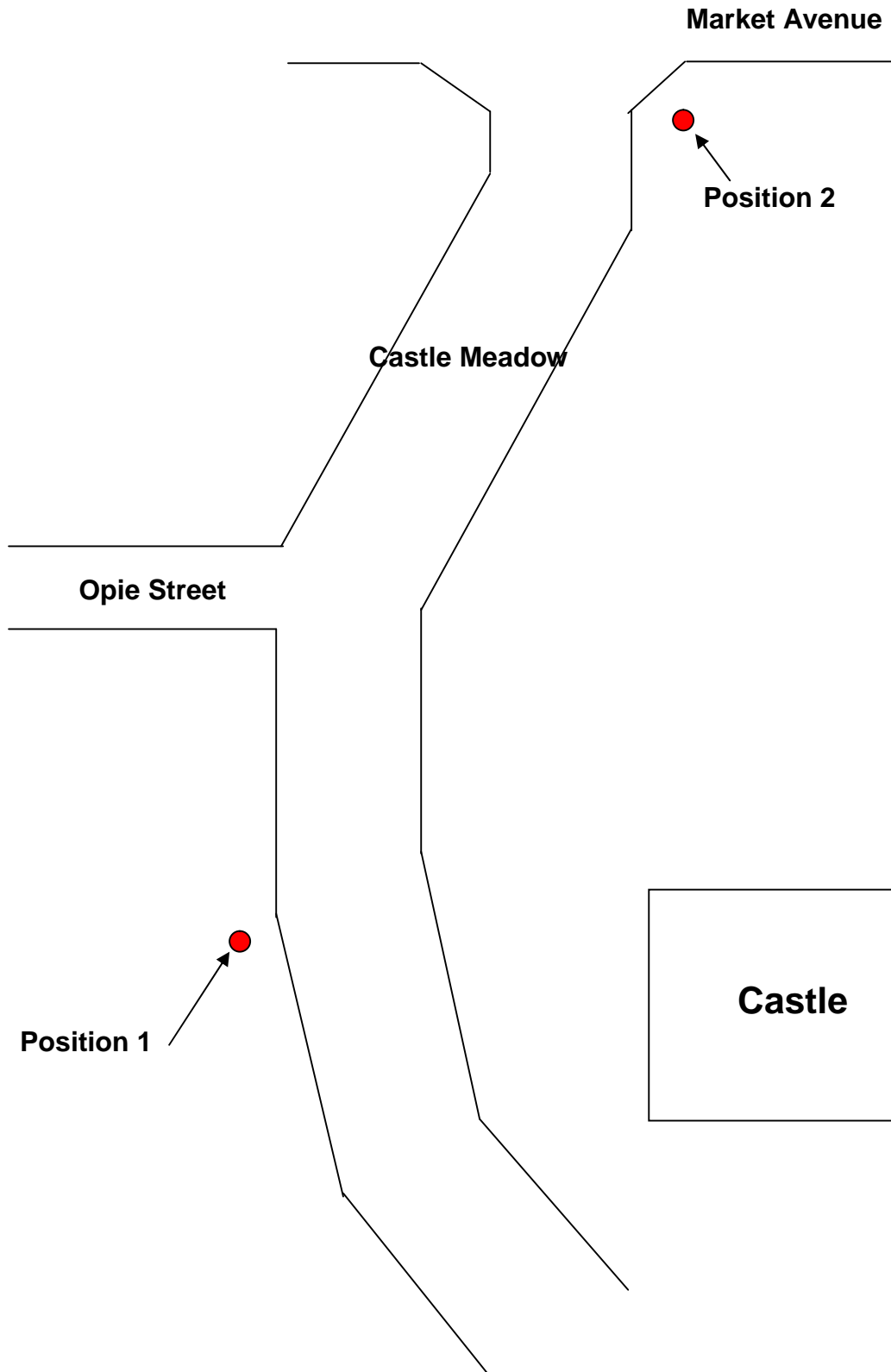


St Augustines AQMA



**Castle AQMA (Castle Meadow)
Location of NO₂ Tubes**

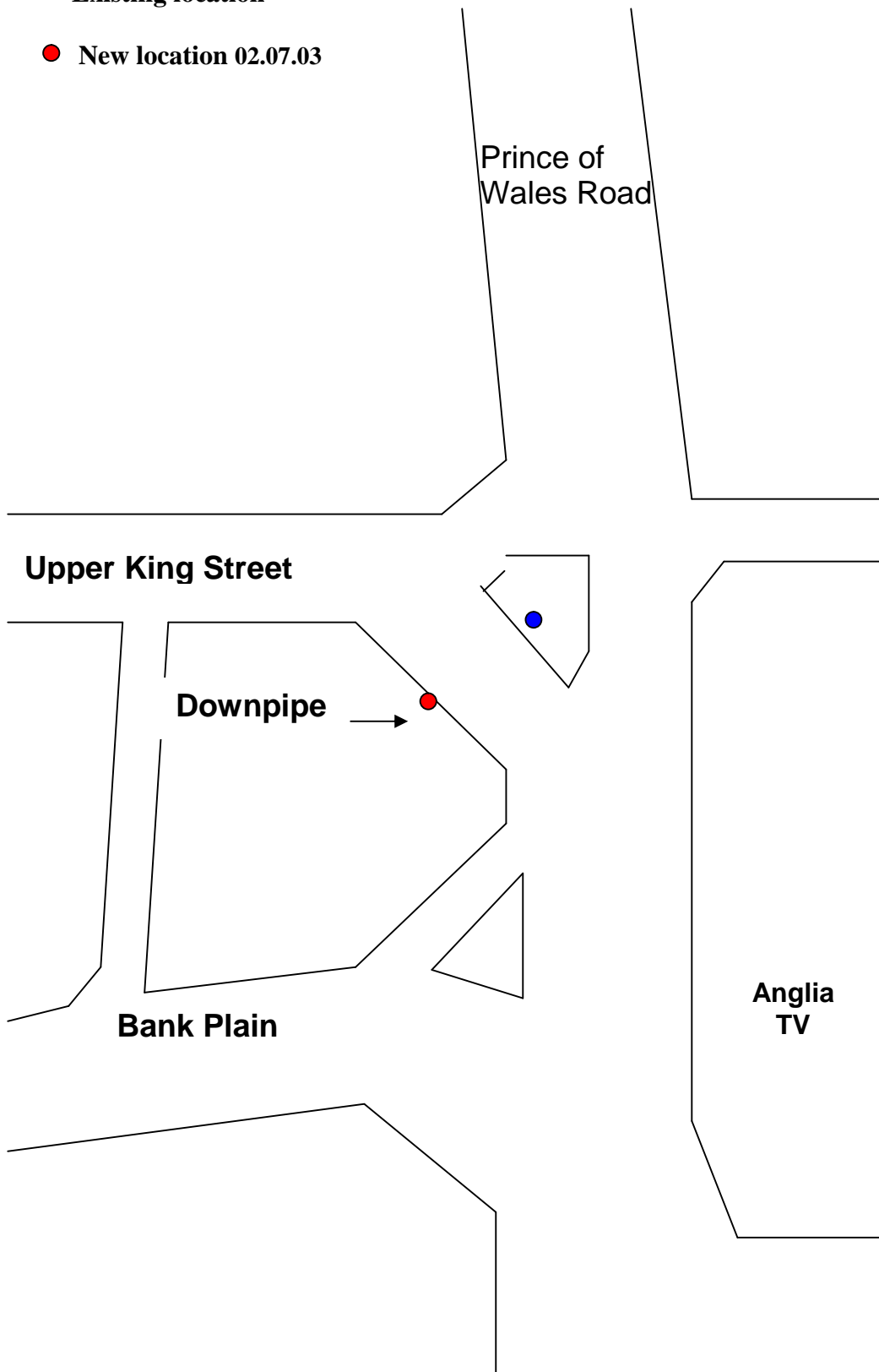
● Position of tubes



Castle AQMA (Upper King Street) Repositioning of NO₂ Tube

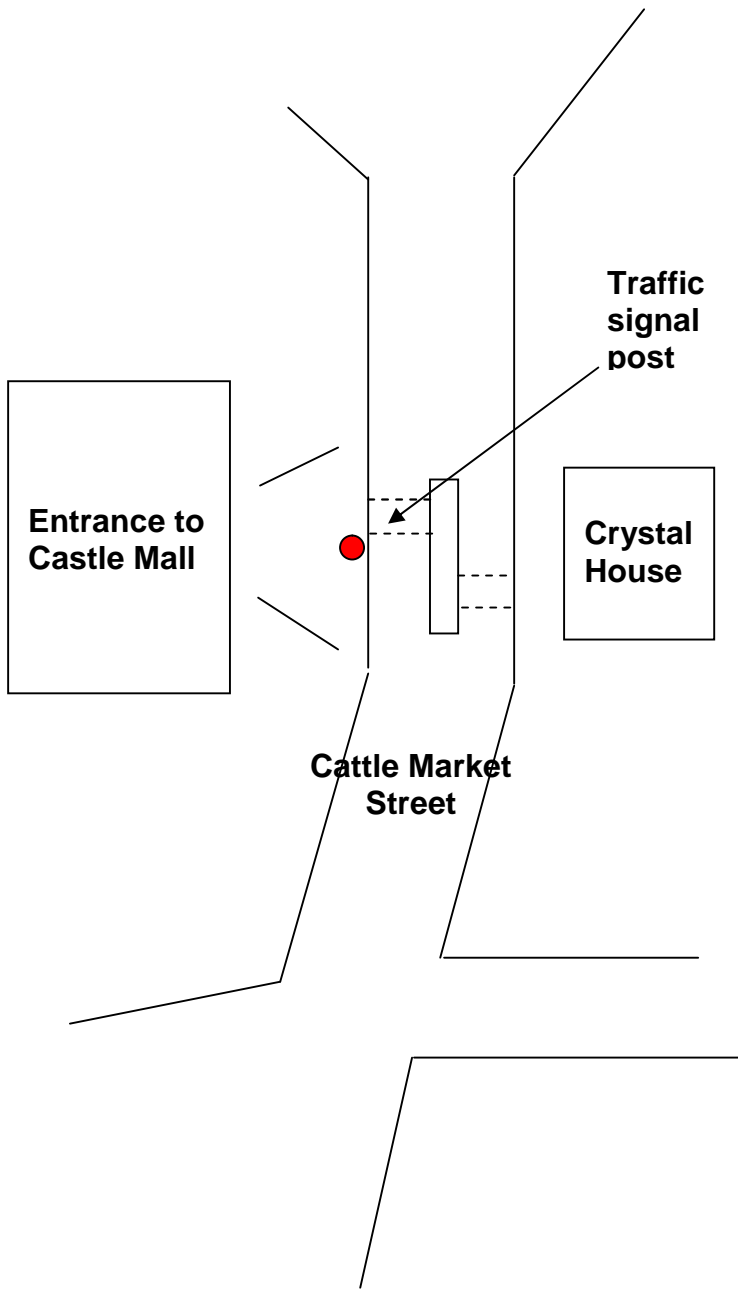


- Existing location
- New location 02.07.03

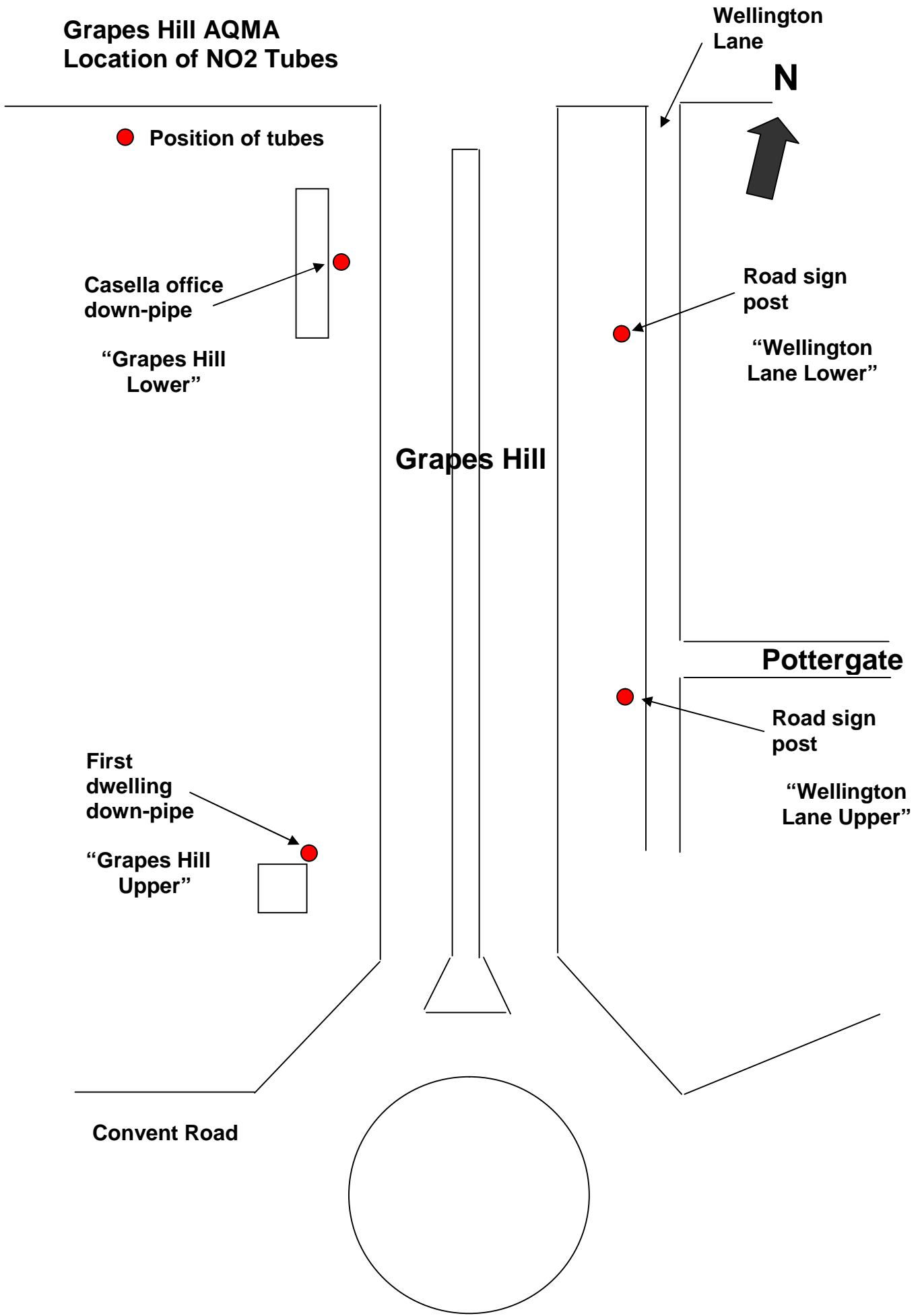


Castle AQMA (Cattlemarket Street) Location of NO2 Tube

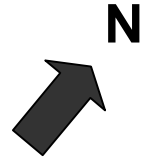
● Position of tube



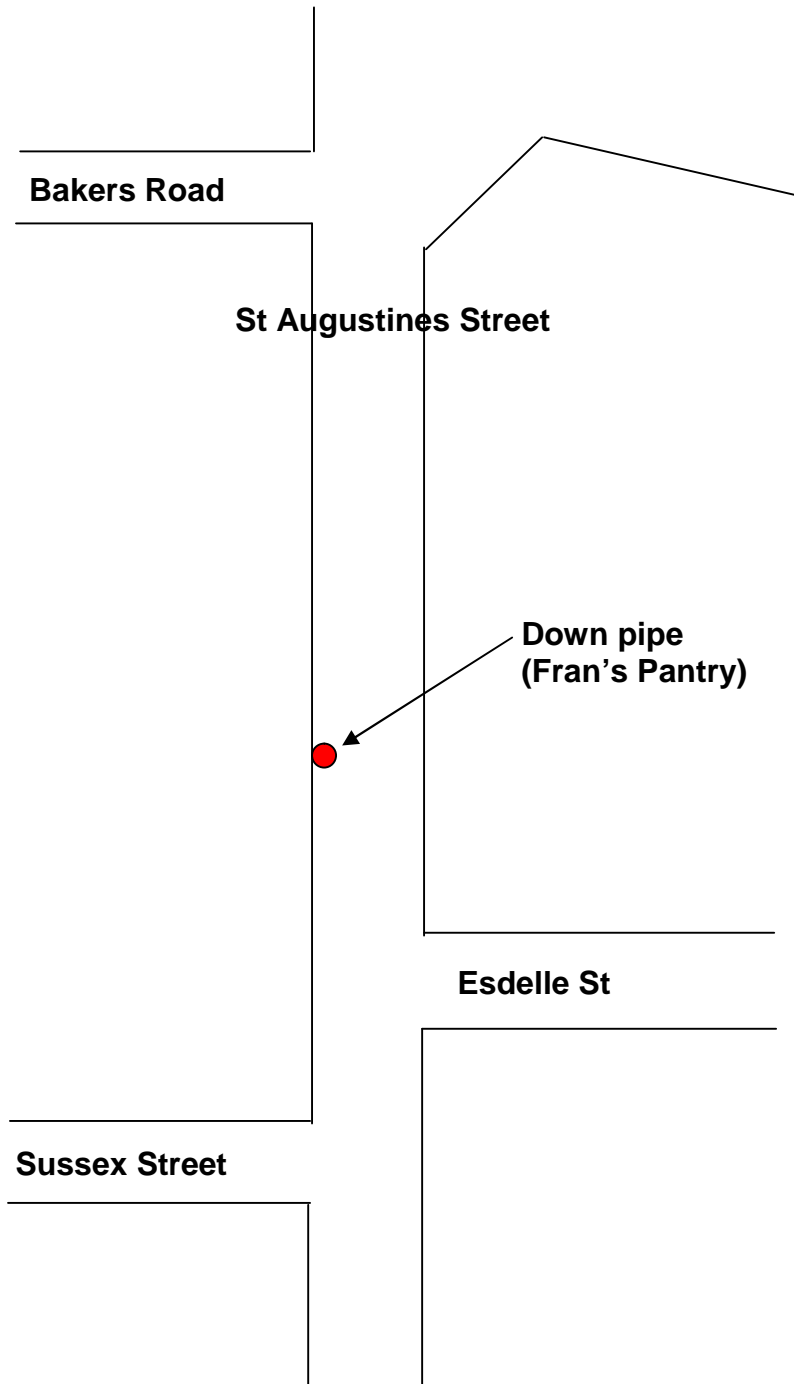
Grapes Hill AQMA Location of NO2 Tubes



**St Augustines AQMA
Location of NO2 Tube**



● Position of tube



Appendix 2

Monitoring Data

CONTENTS

Norwich Centre daily mean NO₂ concentrations 2003

Norwich Roadside daily mean NO₂ concentrations 2003

Castle AQMA NO₂ diffusion tube results 2003

- Castle Meadow
- Upper King Street
- Cattlemarket Street

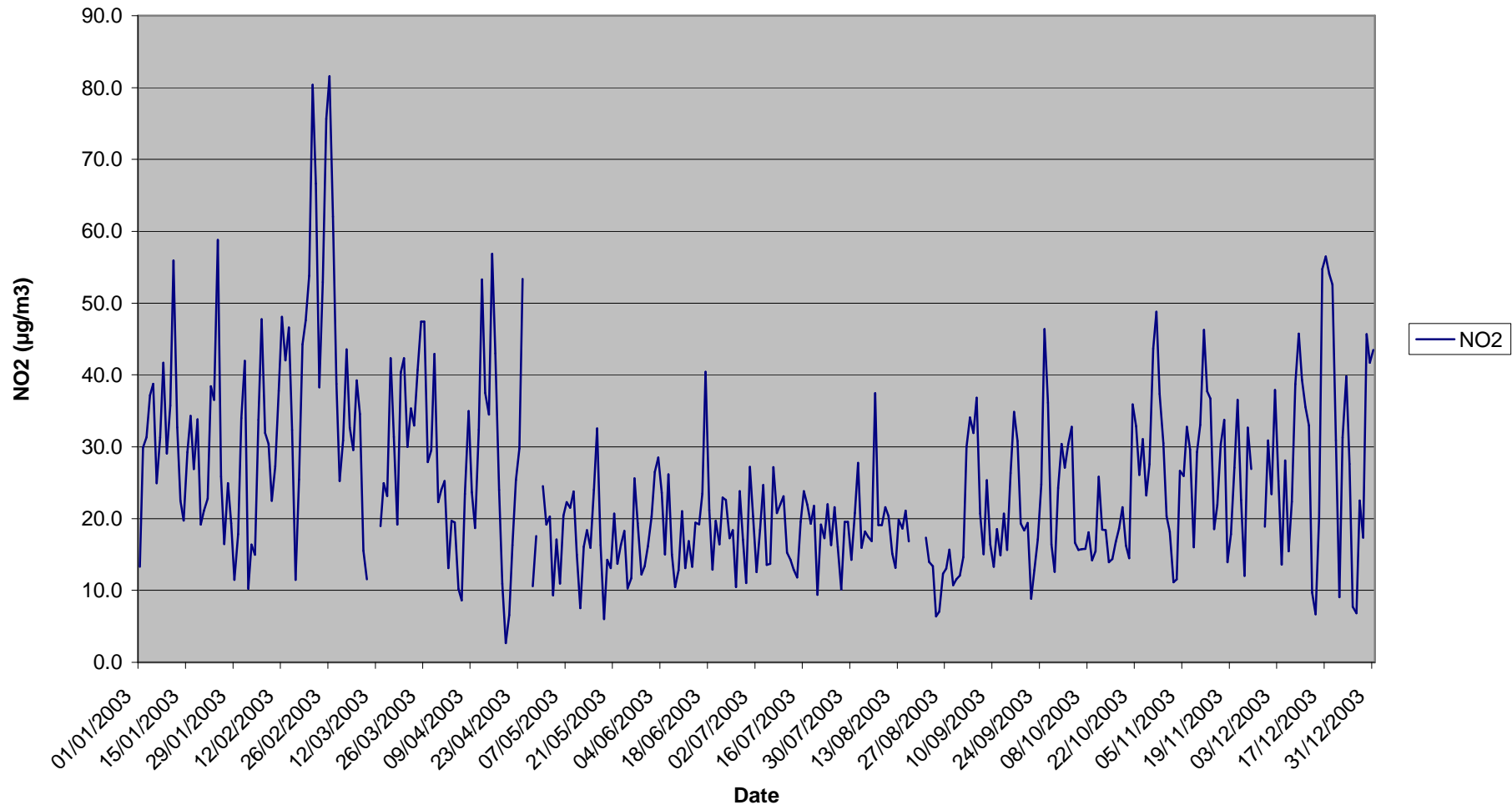
St Augustines AQMA NO₂ diffusion tube results 2003

Benzene diffusion tube results 2003

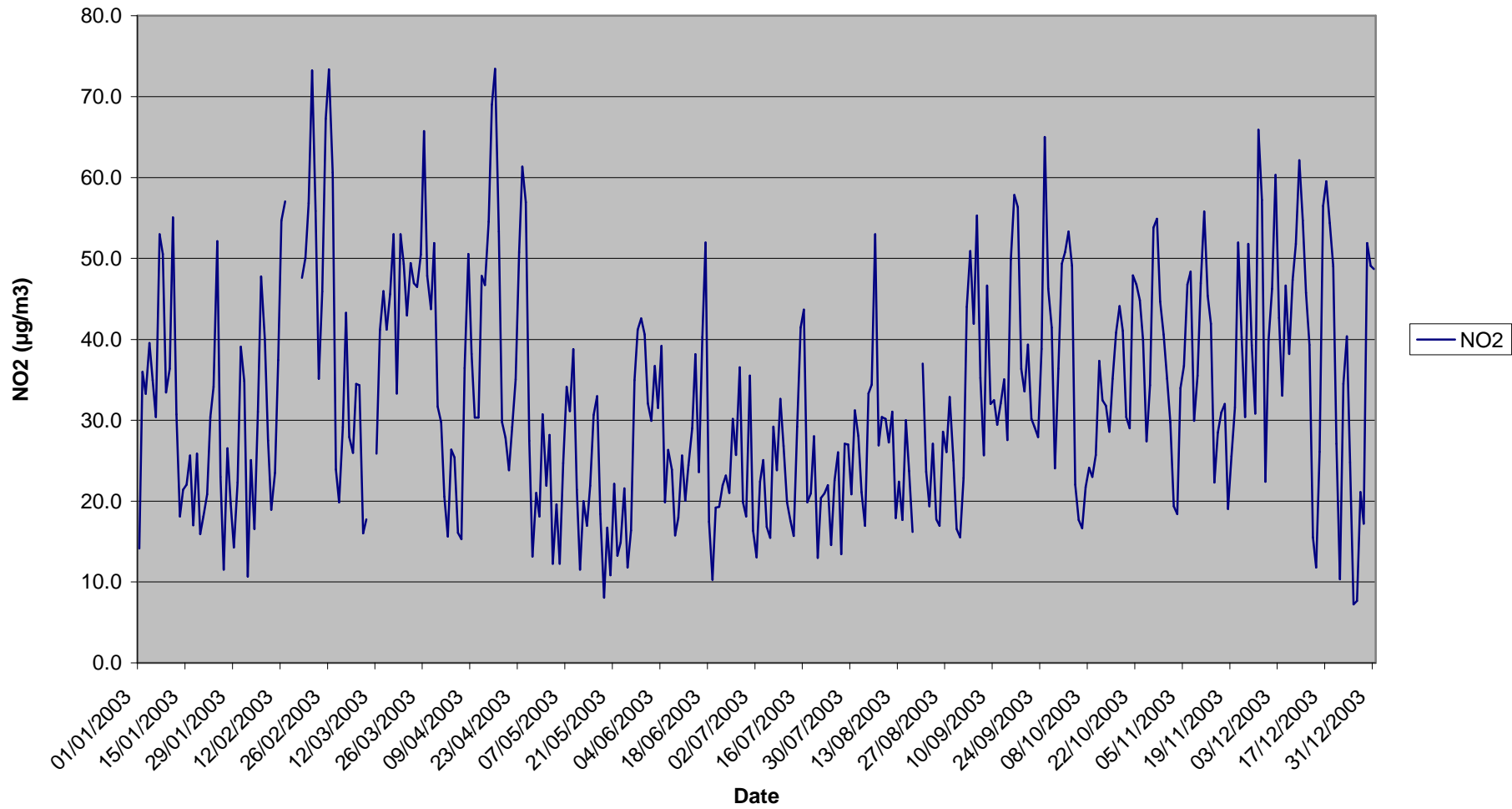
Monthly NO₂ concentrations (all locations)

Summary NO₂ Diffusion Tube data 2003

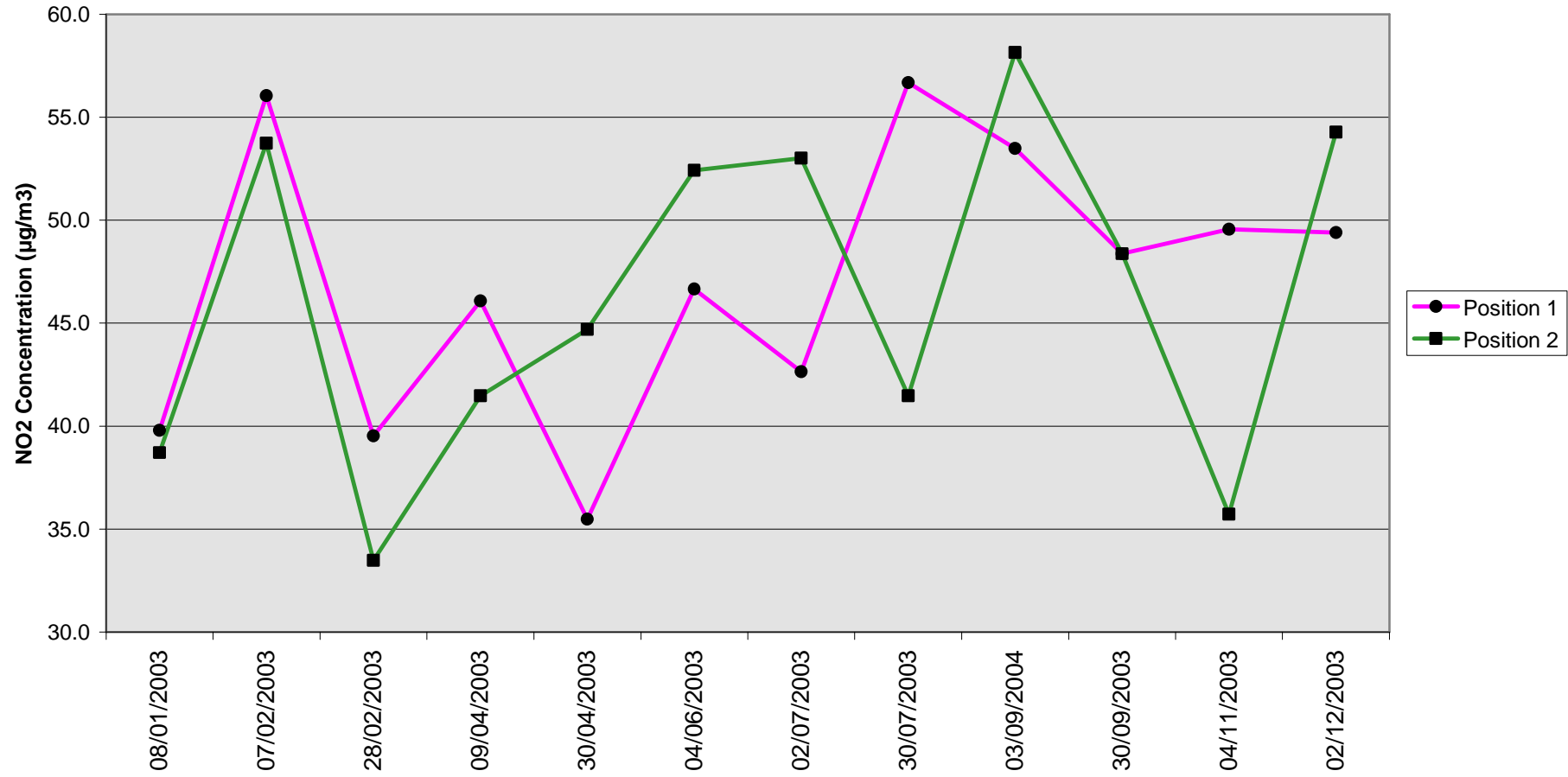
Norwich Centre Daily Mean Values 2003



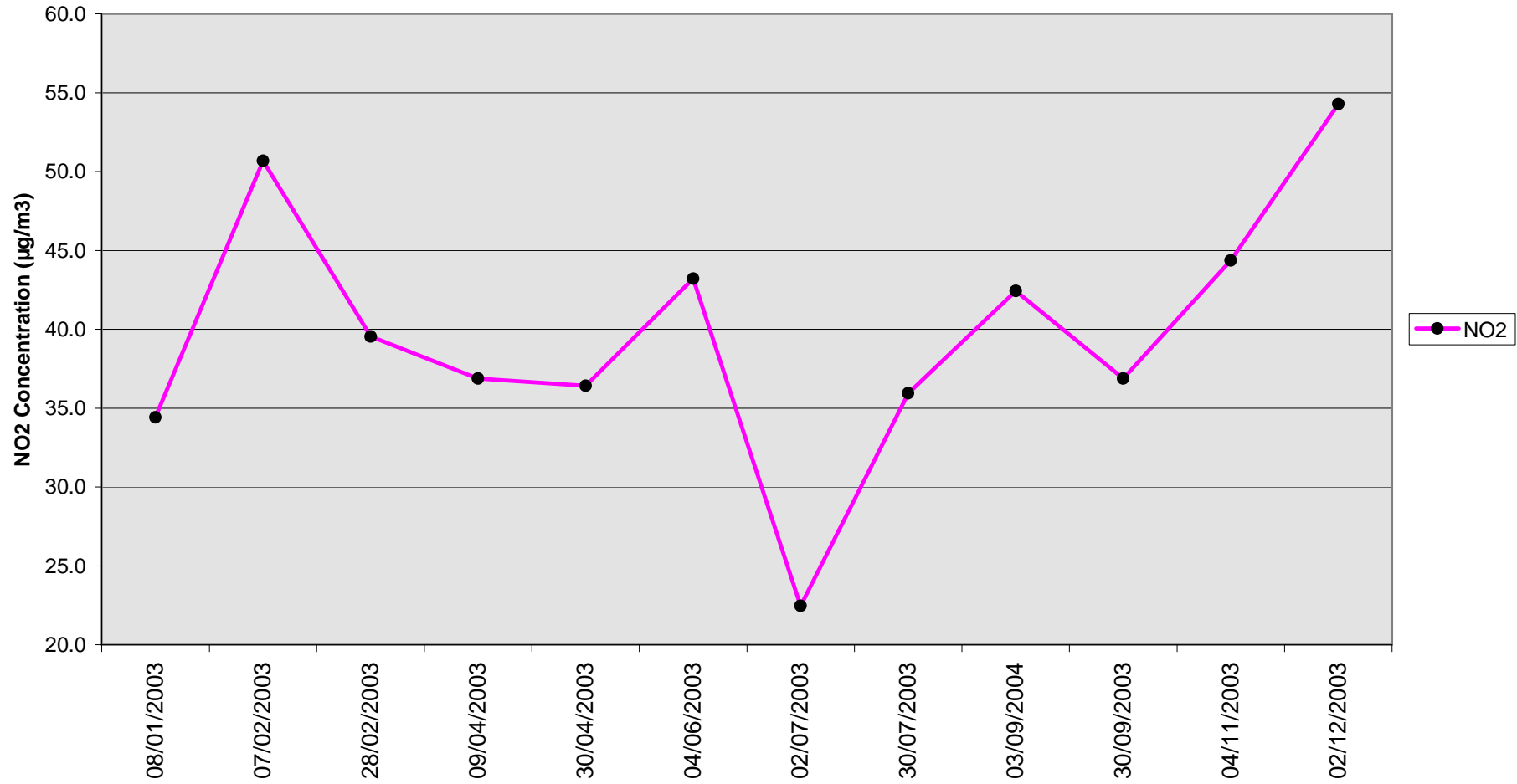
Norwich Roadside Daily Mean Values 2003



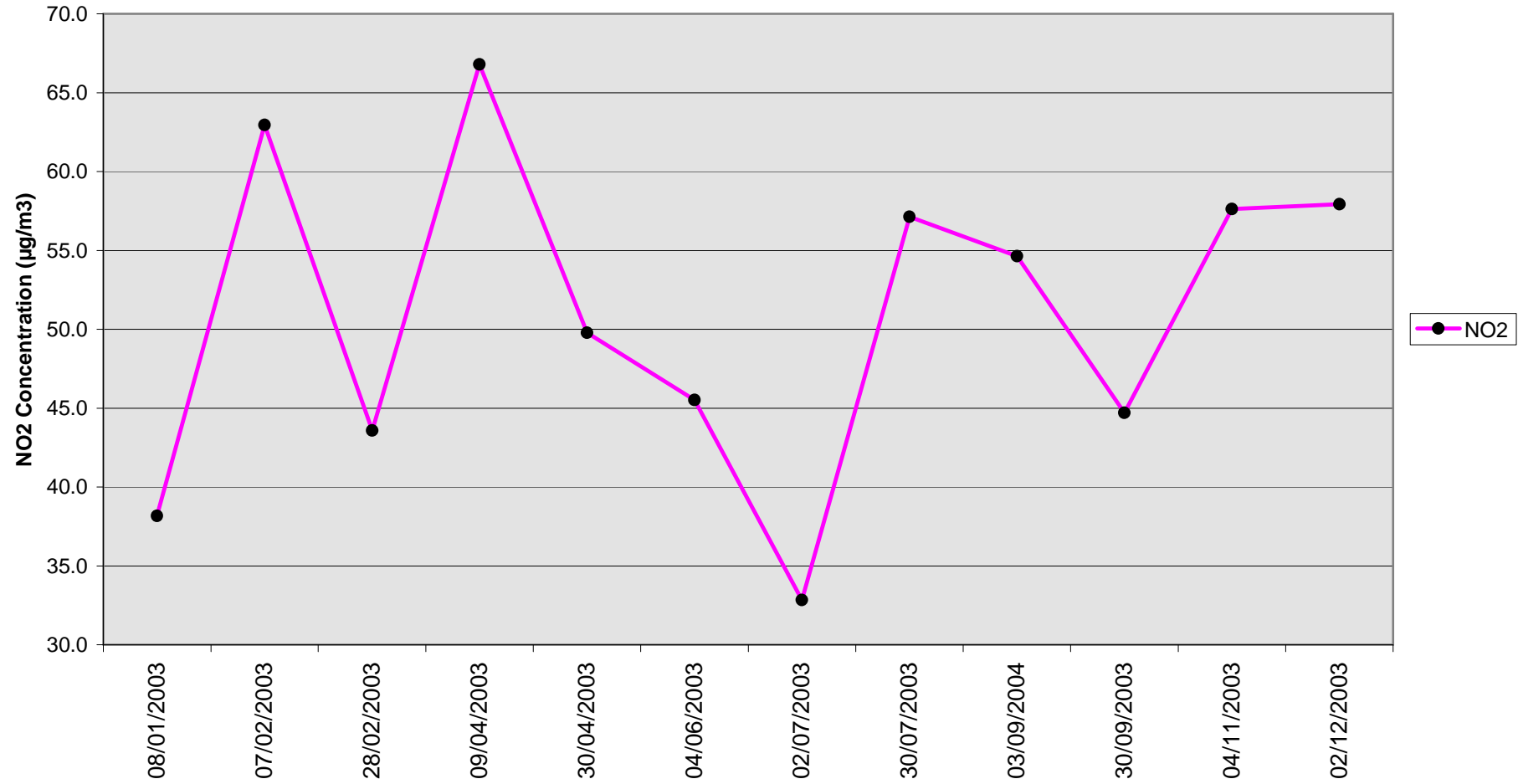
Castle AQMA
Castle Meadow Diffusion Tubes 2003



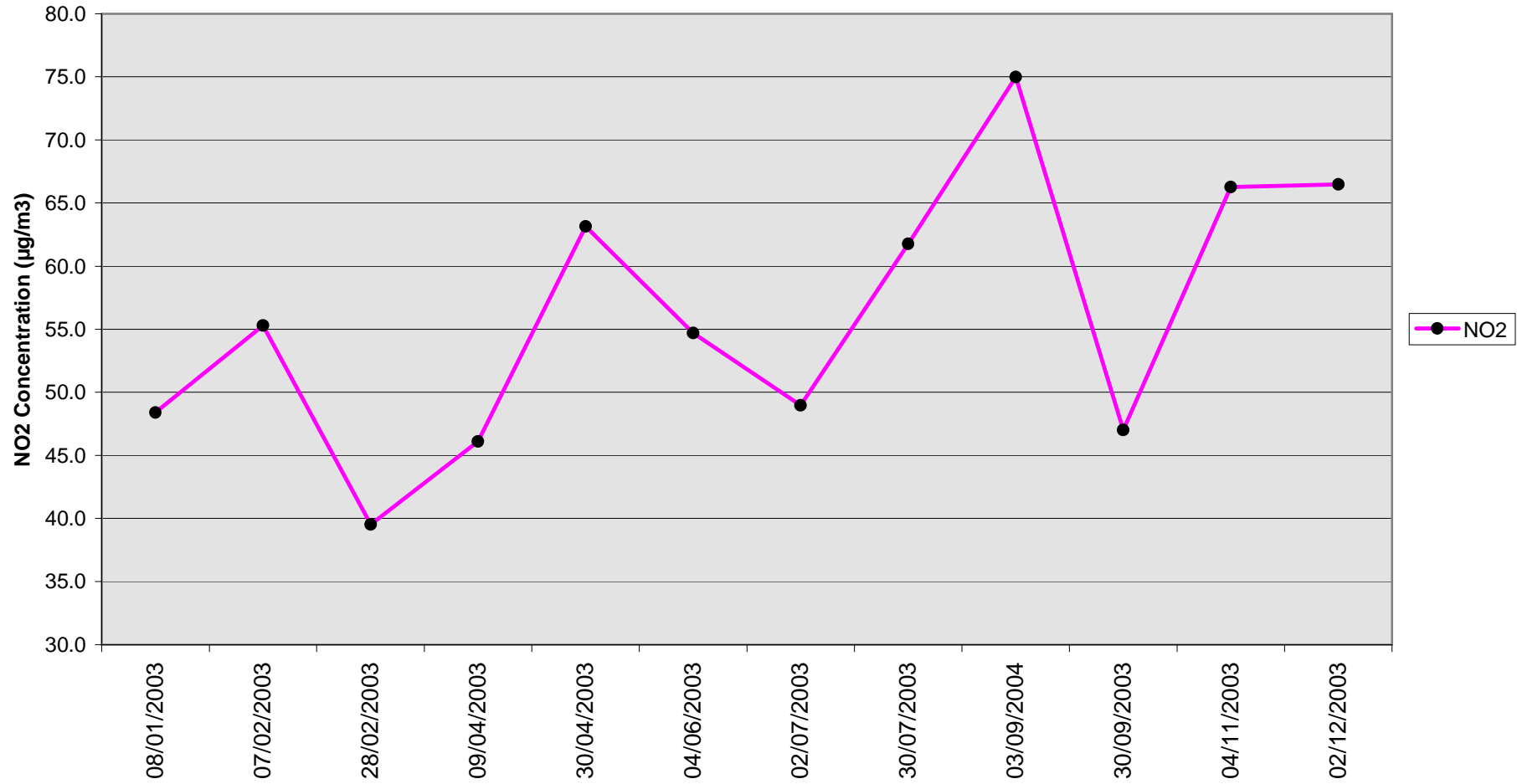
Castle AQMA
Upper King Street Diffusion Tube 2003



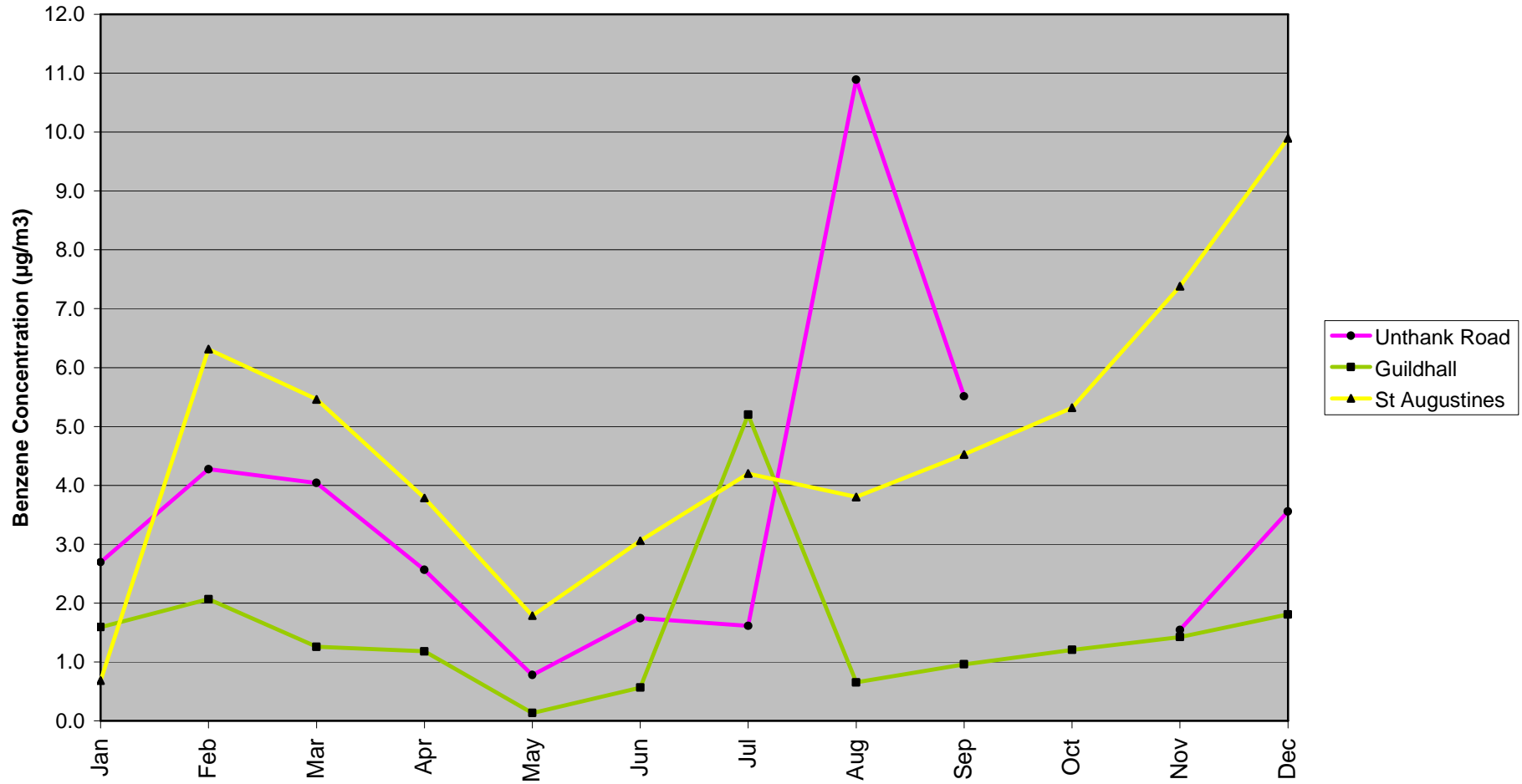
Castle AQMA
Cattlemarket Street Diffusion Tube 2003



St Augustines Street Diffusion Tube 2003



Benzene Diffusion Tube Survey Monthly Averages



2003 Monthly Uncorrected NO₂ Concentrations (µg/m³)

Location													Annual	Corrected *
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean	Annual Mean
Vulcan Road	67.2	61.4	35.9	41.5	43.8	43.2	42.6	36.9	46.5	41.0	51.3	36.6	45.7	47.0
Heartsease	29.0	41.5	19.0	24.6	22.6	23.6	18.4	32.3	32.6	25.8	40.3	39.0	29.1	29.9
Tombland	38.2	43.0	41.6	44.6		49.5	45.5	46.1	50.6	45.6	48.4	32.9	44.2	45.5
Cattlemarket St	38.2	63.0	43.6	66.8	49.8	45.5	32.8	57.1	54.6	44.7	57.6	57.9	51.0	52.5
St Stephens	40.3	43.0	42.0	43.0	32.3	40.3	30.0	40.6	50.0	38.7	42.6	31.7	39.5	40.7
Ipswich Rd	37.1	49.2	31.9	25.4				23.1	24.4	24.4	35.2	29.3	31.1	32.0
Earlham Rd	33.3	51.4	33.5	42.2	37.4	46.1	45.5	33.6	23.3	25.8	40.9	35.4	37.4	38.5
Colman Rd	35.5	36.9	26.2	17.7	36.9	32.3	37.5	30.9	39.5	36.9	22.5	35.4	32.3	33.3
Unthank Rd	34.4	51.4	46.4	43.0	31.4	37.4	45.5	42.4	46.5	39.2	0.6	41.5	38.3	39.5
Johnston Place	39.8	64.5	46.8	49.2	43.8	46.1	50.1	45.6	55.2	41.0	57.0	49.4	49.0	50.5
Castle Meadow	39.8	56.0	39.5	46.1	35.5	46.7	22.2	56.7	53.5	48.4	49.6	49.4	45.3	46.6
Guildhall	29.6	34.1	25.2	23.0	22.6	26.5	23.0	24.4	34.9	32.3	34.6	35.4	28.8	29.7
Exchange St	37.1	47.6	38.3	35.3	31.8	39.2	27.7	40.1	46.5	39.6	30.5	42.7	38.0	39.2
St Georges St	30.1	47.6	25.4	24.6	21.7	21.3		19.4	22.1	30.9	36.9	40.3	29.1	30.0
St Augustines	48.4	55.3	39.5	46.1	63.2	54.7	49.0	61.8	75.0	47.0	66.3	66.5	56.1	57.7
Ber St	18.8	41.1	28.0	25.3	24.6	31.0	28.8	22.6	30.2	28.0	32.3	32.9	28.6	29.5
Riverside	48.6	53.7	44.8		50.2	60.5	56.5	59.9	58.1	55.3	58.2	51.8	54.3	56.0
Eastbourne PI	32.8	57.6			46.5		41.5	41.9	57.5	48.4	39.2	50.6	46.2	47.6
St Vedast St	31.7	50.7			43.3	46.1	36.3	35.5	46.5	42.4	53.0	46.3	43.2	44.5
Upper King St	34.4	50.7	39.5	36.9	36.4	43.2	22.5	35.9	42.4	36.9	44.4	40.9	38.7	39.8
Castle Meadow 2	38.7	53.7	33.5	41.5	44.7	52.4	53.0	41.5	58.1	48.4	35.7	54.3	46.3	47.7

* Bias Adjustment Factor (A) = 1.03

Summary NO₂ Diffusion Tube Data 2003

Location	2003 Annual Mean (µg/m ³)	Corrected Annual Mean ² (µg/m ³)	2005 Projected Annual Mean ¹ (µg/m ³)	Exceedence of 2005 Objective of 40 µg/m ³	AQMA
Vulcan Road	45.7	47.0	44.6	Y	N
Heartsease	29.1	29.9	28.4	N	N
Tombland	44.2	45.5	43.1	Y	N
Cattlemarket St	51.0	52.5	49.8	Y	Y
St Stephens	39.5	40.7	38.6	N	N
Ipswich Rd	31.1	32.0	30.4	N	N
Earlham Rd	37.4	38.5	36.5	N	N
Colman Rd	32.3	33.3	31.6	N	N
Unthank Rd	38.3	39.5	37.4	N	N
Johnston Place	49.0	50.5	47.9	Y	Y
Castle Meadow	45.3	46.6	44.2	Y	Y
Guildhall	28.8	29.7	28.1	N	N
Exchange St	38.0	39.2	37.1	N	N
St Georges St	29.1	30.0	28.4	N	N
St Augustines	56.1	57.7	54.7	Y	Y
Ber St	28.6	29.5	28.0	N	N
Riverside	54.3	56.0	53.0	Y	N
Eastbourne PI	46.2	47.6	45.1	Y	N
St Vedast St	43.2	44.5	42.2	Y	N
Upper King St	38.7	39.8	37.8	N	Y
Castle Meadow 2	46.3	47.7	45.2	Y	Y

¹ Correction factor derived from Guidance LAQM.TG(03) Box 6.6

² Bias adjustment factor determined from review and assessment helpdesk website

Gradko Laboratories, using 50% TEA in Acetone method for 2003 gives overall factor of 1.03