



2012 Air Quality Updating and
Screening Assessment incorporating
the 2013 and 2014 Progress Reports
for
Eden District Council

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

Dec 2014

Local Authority Officer	Sara Watson
Department	Environmental Services
Address	Mansion House, Friargate, Penrith, CA11 7YG
Telephone	01768 817817
e-mail	pollution @eden.gov.uk
Report Reference number	SJW/SJH/AQ2014
Date	Dec 2014

Executive Summary

This report fulfils Eden District Council's legal responsibilities under the Local Air Quality Management process as set out in Part IV of the Environment Act 1995 and the Air Quality Strategy for England, Scotland, Wales and Northern Ireland.

The report provides a full screening assessment undertaken in accordance with the Technical Guidance TG(09) and an update of recent air quality issues in the district, including results of recent monitoring undertaken and also any potentially significant sources of air pollution that have been identified since the previous assessment which could lead to the risk of an air quality objective being exceeded.

Eden District Council undertook a review of its air pollution monitoring in the District in June 2011. As a consequence some long term monitoring sites have been discontinued with monitoring being transferred to more urban roadside locations. The basis of the review was to ensure that all tubes were located in the most appropriate locations having regard to earlier results and also to monitor the impact of a new Town Centre development in Penrith which opened in November 2011 and has seen an increase in town centre road traffic and two altered road junctions.

The 2012 Updating and Screening Assessment Report has been delayed for two reasons:

- To obtain sufficient results of the extended monitoring to enable meaningful conclusions to be made and,
- To divert resources into undertaking a Detailed Assessment of nitrogen dioxide (NO₂) concentrations in Penrith Town Centre and Eamont Bridge, a conclusion of the 2011 Progress Report.

As a result of this delay, it was considered expedient to incorporate the 2013 and 2014 Progress Reports into this document so that the most up to date monitoring data is included. As Progress Reports generally include information of local policies and strategies relating to air quality, additional chapters have been included in the report for completeness.

Results from the new and existing monitoring sites are reported for the periods January – December 2011, January – December 2012 and January to December 2013, which indicate that the annual mean air quality objective for NO₂ is at risk of being exceeded in two areas (Penrith Town Centre and Eamont Bridge) due to road traffic emissions and therefore a Detailed Assessment has been undertaken. Air Quality modelling has been commissioned from specialist air quality consultants with a view to determining:

- Whether Air Quality Management Areas should be declared in Penrith and/or Eamont Bridge, and
- In the event that an Air Quality Management Area is needed to be declared, to define the boundaries of the affected area.

The results of the Detailed Assessment conclude that the Council needs to declare Air Quality Management Areas in part of Penrith Town Centre and along a stretch of the A6 in Eamont Bridge. The process of declaring the AQMAs is nearing completion at the date of publishing this report.

There are currently no Air Quality Management Areas within the District.

An application for a large mixed residential/commercial development (shopping complex) was approved in 2010 and opened in December 2011. It was considered that the predicted increase in traffic around the new development site would have an impact on local air quality and this appears to have happened. Eden District Council will continue to monitor at relevant locations surrounding the site.

There have been no new relevant industrial installations and no new or substantially altered roads within the District since the last report other than those in connection with the shopping development. This involved the creation of two new traffic light controlled junctions in the town centre and an altered roundabout at the junction of the A66 and A6 at Eamont Bridge. There are also no new significant commercial, domestic or fugitive sources of emissions.

Subsequent proposed actions as a result of this report are:

- Complete the process of declaring the AQMAs
- Proceed to a Further Assessment and the development of an Air Quality Action Plan. As the pollutant of concern is nitrogen dioxide arising from road traffic it will be necessary to work with partner organisations in the development of the Action Plan, particularly the Cumbria County Council Highways Department.
- The next reports that will be published by the Council relating to air quality management will be the Further Assessment and Air Quality Action Plans for Penrith Town Centre and Eamont Bridge and the 2015 Updating and Screening Assessment.

Table of contents

1. Introduction	8
1.1 Description of Local Authority Area.....	8
1.2 Purpose of Report.....	9
1.3 Air Quality Objectives	10
1.4 Summary of Previous Review and Assessments	12
2. New Monitoring Data.....	15
2.1 Summary of Monitoring Undertaken	15
2.2 Comparison of Monitoring Results with AQ Objectives.....	21
3. Road Traffic Sources.....	41
3.1 Narrow Congested Streets with Residential Properties Close to the Kerb.	41
3.2 Busy Streets Where People May Spend 1-hour or More Close to Traffic..	42
3.3 Roads with a High Flow of Buses and/or HGVs.....	42
3.4 Junctions.....	42
3.5 New Roads Constructed or Proposed Since the Last Round of Review and Assessment	43
3.6 Roads with Significantly Changed Traffic Flows	43
3.7 Bus and Coach Stations	43
4. Other Transport Sources.....	43
4.1 Airports	44
4.2 Railways (Diesel and Steam Trains).....	44
4.3 Ports (Shipping).....	45
5. Industrial Sources	46
5.1 Industrial Installations	46
5.2 Major Fuel (Petrol) Storage Depots	47
5.3 Petrol Stations	47

5.4 Poultry Farms	47
6. Commercial and Domestic Sources	48
6.1 Biomass Combustion – Individual Installations	48
6.2 Biomass Combustion – Combined Impacts	49
6.3 Domestic Solid-Fuel Burning	49
7. Fugitive or Uncontrolled Sources	50
8. Local/Regional Air Quality Strategy	51
9. Planning Applications	52
10. Air Quality Planning Policies	53
11. Local Transport Plans and Strategies	59
12. Climate Change Strategies	61
13. Conclusions and Proposed Actions	62
13.1 Conclusions from New Monitoring Data	62
13.2 Conclusions from Assessment of Sources	62
13.3 Proposed Actions	63
14. References	64
Appendices	65
Appendix A: QA:QC Data	66
Appendix B: Nitrogen Dioxide Diffusion Tube Location in Penrith and Eamont Bridge	75
Appendix C: Nitrogen Dioxide Diffusion Tube Monitoring – Full Monthly Data	77
Appendix D: Pollution Prevention & Control Act 1999	82
Appendix E	90

List of Tables

Table 1.1	Air Quality Objectives included in Regulations for the purpose of LAQM in England
Table 1.2	Summary of Previous Review and Assessments
Table 2.1	Details of Non-Automatic Monitoring Sites For Nitrogen Dioxide
Table 2.2	Results of Nitrogen Dioxide Diffusion Tubes in 2011
Table 2.3	Results of Nitrogen Dioxide Diffusion Tubes in 2012
Table 2.4	Results of Nitrogen Dioxide Diffusion Tubes in 2013
Table 2.5	Monthly mean nitrogen dioxide concentrations from two diffusion tube monitoring sites for Castlegate 2011 and 2012
Table 2.6	Trends in Annual Mean Nitrogen Dioxide Concentrations measured at Diffusion Tube Monitoring Sites
Table A.1	2011 Bias Adjustment Factor for ESG Glasgow nitrogen dioxide diffusion tubes
Table A.2	2012 Bias Adjustment Factor for ESG Glasgow nitrogen dioxide diffusion tubes
Table A.3	2013 Bias Adjustment Factor for ESG Glasgow nitrogen dioxide diffusion tubes

List of Figures

Figure 1.1	Map Of Eden District Council
------------	------------------------------

Appendices

Appendix A:	QA:QC Data
Appendix B:	Nitrogen Dioxide Diffusion Tube Location in Penrith and Eamont Bridge
Appendix C:	Nitrogen Dioxide Diffusion Tube Monitoring – Full Monthly Data
Appendix D:	Pollution Prevention & Control Act 1999; Operating Installations as at 31 Mar 2014
Appendix E:	Eden District Council Penrith and Eamont Bridge LAQM NO ₂ Detailed Assessment

1. Introduction

1.1 Description of Local Authority Area

Eden District Council has the largest geographical area of all Cumbrian Authorities. At 2,146 Km² and with a population of 52,600 it is the second largest and most sparsely populated district within England. Approximately one-fifth of the District lies within the Lake District National Park and one quarter within the North Pennines Area of Outstanding Natural Beauty (AONB). It stretches from North Lakeland in the west, to the Pennines in the east, with the Eden Valley running through the centre.

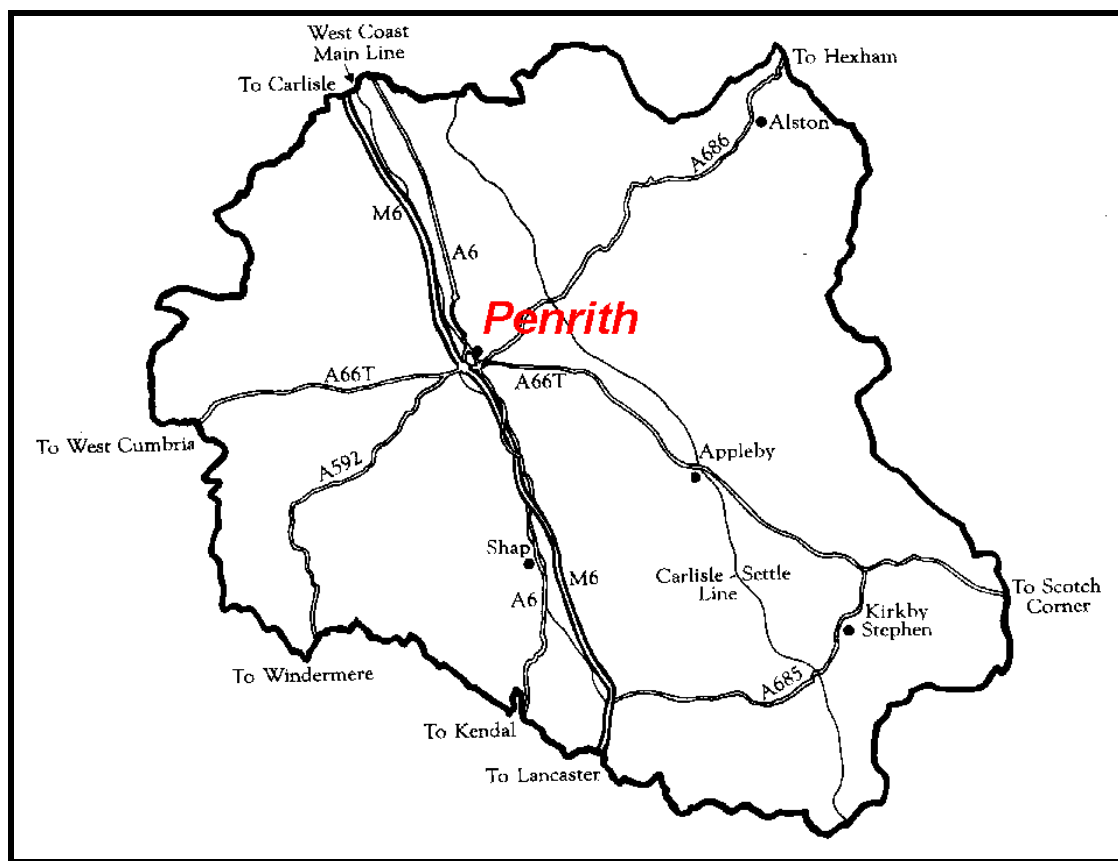
The District benefits from good road transport links running east to west along the A66 trunk road and north/south via the M6 and A6. Most of the county is within a travel time of one hour.

The West Coast Mainline provides rail links to the north and south and the regional railway link from Carlisle to Leeds (via Settle/Carlisle) is of particular importance to settlements in the Eden Valley.

The population is scattered in small villages through a wide rural area. Penrith, Kirkby Stephen, Alston and Appleby are the four main towns with Penrith the largest having a population of around 15,000.

A map of the district including the location of all A-roads/trunk roads and the M6 motorway is shown below in Figure 1.1

Figure 1.1 Map of Eden District Council



Map of area showing major highways and settlements

1.2 Purpose of Report

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

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

should provide an update of any outstanding information requested previously in Review and Assessment reports.

The 2012 Updating and Screening Assessment reports 2011 monitoring data but in order to bring the Local Air Quality Management process up to date this report also incorporates the 2013 and 2014 progress report by including 2012 and 2013 monitoring data.

1.3 Air Quality Objectives

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

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

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	16.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2003
	5.00 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2010
1,3-Butadiene	2.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2003
Carbon monoxide	10.0 mg/m^3	Running 8-hour mean	31.12.2003
Lead	0.5 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2004
	0.25 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2008
Nitrogen dioxide	200 $\mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2005
Particles (PM ₁₀) (gravimetric)	50 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2004
Sulphur dioxide	350 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

1.4 Summary of Previous Review and Assessments

The Council has been monitoring air quality within the District since 1996 as part of its local air quality management duties. Previous rounds of review and assessments undertaken by Eden District Council are listed in Table 1.2 below. The first stage review and assessment for Eden District Council was published in 2000. It concluded that the risk of the air quality objectives in respect of carbon monoxide, benzene, 1,3 butadiene, lead, nitrogen dioxide, sulphur dioxide and fine particulates not being met within the prescribed time scales was negligible.

To date, the Council has published three Updating and Screening Assessments of local air quality, in 2003, 2006 and 2009. These reports concluded that air quality currently was meeting the national objectives and that it was not necessary to undertake a Detailed Assessment or to declare an Air Quality Management Area (AQMA).

The Council has published six previous Progress Reports on Air Quality, in 2004, 2005, 2007, 2008, 2010 and 2011. The results of the first five of these reports confirmed that a Detailed Assessment for air quality within Eden District Council was not required for any pollutant.

The Progress Report published in 2011 (based on 2010 data) highlighted potential concerns with five monitoring locations for annual mean nitrogen dioxide objective and concluded that a Detailed Assessment should be undertaken. That conclusion was based on limited diffusion tube monitoring data and in order to assist the Detailed Assessment, it was decided to obtain a more complete data set.

In addition a large supermarket, retail and housing development was due to open at the end of 2011 in Penrith town centre which had the potential to impact on air quality. It was felt to be important to assess the impact of this development as part of the Detailed Assessment.

At the time of writing this report the Detailed Assessment has been completed and has concluded that Air Quality Management Areas should be declared in Penrith town centre and along a short stretch of the A6 in Eamont Bridge. The detailed assessment is shown in full at Appendix E.

Table 1.2 Summary of Previous Review and Assessments

Year	Monitored Or Calculated Exceedence	Detailed Assessment/ Aqma Required?	Concerns	Actions	Comments
2000 Stage 1	N	N	N	N	N
2003 USA	N	N	N	N	N
2004 Progress Report	Y NO ₂ Monitoring Brunswick Rd & The Narrows – Annual mean>40	N	NO ₂ results: Brunswick Rd for relevant exposure	Relocate NO ₂ diffusion tube @ Brunswick Rd for relevant exposure	No relevant exposure at Narrows; diffusion tube @ Brunswick Rd too close to kerb for relevant exposure
2005 Progress Report	Y NO ₂ monitoring Brunswick Rd	DA required for NO ₂	Brunswick Rd	Planning condition requires submission of AQ impact for proposed town centre mixed development	The proposed town centre mixed development would have potential impacts on traffic flows and air quality
2006 USA	N	Possible DA required for NO ₂	Brunswick Rd	Decision about Detailed Assessment delayed until modelling data received	
2007 Progress Report	N	N	N	N	p.8 mistaken reference to 50% TEA in water instead of 50% TEA in acetone lab preparation for diffusion tubes
2008 Progress Report	N	N	Air quality impacts of proposed mixed development assessed as not likely to cause AQ objectives to be exceeded	Increased NO ₂ concentrations likely at some locations due to mixed dev. Examine in 2009 USA	Since this AQ report was published the development is being redesigned due to collapse of funding
2009 USA	N	N	Future of new mixed development still uncertain. Further update to be provided in the next Progress Report (due in 2010)		

Eden District Council

Year	Monitored Or Calculated Exceedence	Detailed Assessment/ Aqma Required?	Concerns	Actions	Comments
2010 Progress Report	N	N	Future of new mixed development still uncertain. Further update to be provided in the next Progress Report (due in 2011)	Relocate diffusion tubes from outlying areas to Penrith urban areas	Since this AQ report was published a revised air quality impact assessment has recently been submitted which indicates that there will be exceedences of the annual mean objective adjacent to a junction which will be newly formed as part of the development. The assessment along with the proposed mitigation measures are currently being reviewed
2011 Progress Report	Y	Y	Not based on full year's data and doesn't include New Squares development which due to open at end of 2011.	Rationalise diffusion tube locations to better cover areas where exceedences may be present	Detailed Assessment likely if further monitoring confirms exceedences of the annual mean nitrogen dioxide objective in Penrith ten centre and Eamont Bridge

2. New Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

Eden District Council has no automatic monitoring sites within its boundaries

2.1.2 Non-Automatic Monitoring Sites

Nitrogen dioxide is currently monitored within Eden District Council through the use of passive diffusion tubes. Details of each site are shown in Table 2.1 below. The Council utilises tubes provided and analysed by ESG Glasgow using 50% TEA (Triethanolamine) in acetone, which are typically exposed for four week periods in accordance with the National NO₂ Network exposure calendar. The laboratory is accredited to NAMAS and UKAS BS EN ISO 9001 and has implemented the methodology set out in the Harmonisation Practical Guidance. Results from the WASP¹ scheme show 100% for Rounds 116, 117 and 119 (Jan – Dec 2012) and also 100% for rounds 120 – 123 (Jan - Dec 2013).

The 2011 results have been corrected for a bias using a factor of 0.87 for ESG Glasgow (R&A website, spread sheet version 07/13).

The 2012 results have been corrected for a bias using a factor of 0.84 for ESG Glasgow (R&A website, spread sheet version 07/13).

The 2013 results have been corrected for a bias using a factor of 0.73 for ESG Glasgow (R&A website, spread sheet version 03/14). Further information on quality assurance/quality control for the diffusion tubes is provided in Appendix A.

Eden District Council undertook a review of the Council's nitrogen dioxide monitoring programme at the beginning of 2010. As a result of this review new monitoring locations were identified and some were discontinued. The review has led to an increase in monitoring within the town centre of Penrith. Diffusion tubes have also been located at relevant locations adjacent to the A6 (Eamont Bridge) and the A66 (Kirkby Thore). A summary of the current and previous monitoring sites is shown in Table 2.1 below.

The locations of the diffusion tube monitoring sites are shown at Appendix B.

Note: ¹ The Workplace Analysis Scheme for Proficiency Scheme is an independent analytical performance testing scheme operated by the Health and Safety laboratory

Table 2.1 Details of Non-Automatic Monitoring Sites For Nitrogen Dioxide

Tube Ref	Site Name	2011	2012	2013	Site Type	X OS Grid Ref	Y OS Grid Ref	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
Penrith												
V2	25 Victoria Rd	Y			Roadside	351760	529908	N	N	Y	1.5m	Y
V3	25b King Street	Y	Y	Y	Roadside	351720	529966	N	N	Y	2m	Y
V5	Front Victoria Rd/ Langton Cott	Y	Y	Y	Roadside	351713	529941	N	N	Y	1m	Y
V6	4 Crown Square	Y			Roadside	351683	529964	N	N	Y	0.5m	Y
V7	Café 15	Y	Y	Y	Roadside	351733	528918	N	N	Y	2.5m	Y
V8	Front 45 King St	Y			Roadside	x351633	y530075	N	N	Y	1.5m	Y
V9	Front 9b King St		Y	Y	Roadside	351651	530085	N	N	Y	2m	Y
V11	RAFA		Y	Y	Roadside	351785	529852	N	N	Y	1m	Y

Eden District Council

Tube Ref	Site Name	2011	2012	2013	Site Type	X OS Grid Ref	Y OS Grid Ref	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
B12	18 Brunswick Rd	Y			Roadside	351340	530302	N	N	Y	4m	Y
B13	Post adj 12 Brunswick Rd	Y			Roadside	351347	530334	N	N	Y	1m	Y
B14	4 Brunswick Rr	Y	Y	Y	Roadside	351394	530344	N	N	Y	2m	Y
C1	Railway Tavern		Y	Y	Roadside	351298	530006	N	N	Y	1m	Y
C4	18 Castlegate			Y	Roadside	351396	530051	N	N	Y	1m	Y
C30	40 Castlegate			Y	Roadside	351333	530016	N	N	Y	1.5m	Y
SG23	22 Stricklandgate	Y	Y	Y	Roadside	351321	530516	N	N	Y	2m	Y
SG24	22 Stricklandgate	Y	Y	Y	Roadside	351321	530516	N	N	Y	2m	Y
SG25	22 Stricklandgate	Y	Y	Y	Roadside	351321	530516	N	N	Y	2m	Y
SG26	99a Scotland Rd	Y			Roadside	x351136	y530673	N	N	Y	1m	Y

Eden District Council

Tube Ref	Site Name	2011	2012	2013	Site Type	X OS Grid Ref	Y OS Grid Ref	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
SG27	8 Scotland Rd	Y	Y	Y	Roadside	351171	530649	N	N	Y	1m	Y
SG28	53 Scotland Rd	Y			Roadside	351208	530609	N	N	Y	1m	Y
SG29	The Royal Wilson Row			Y	Roadside	351404	530428	N	N	Y	2m	Y
31	3 Benson Row			Y	Roadside	351741	530313	N	N	Y	1m	Y
32	Penrith Nursey	Y		Y	Roadside	351687	530387	N	N	Y	1m	Y
33	Middlegate	Y	Y	Y	Roadside	351485	530248	N	N	Y	7m	Y
34b	Bridge La	Y			Roadside	351836	529709	N	N	Y	1.5m	Y
36	Roper St		Y	Y	Roadside	351810	529861	N	N	Y	1m	Y

Eden District Council

Tube Ref	Site Name	2011	2012	2013	Site Type	X OS Grid Ref	Y OS Grid Ref	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
Eamont Bridge												
EB15	Glendale	Y	Y	Y	Roadside	352329	528475	N	N	Y	1m	Y
EB16	Smithy Cott	Y			Roadside	352321	528524	N	N	Y	0m	Y
EB17	Old Mansion House	Y			Roadside	352303	528584	N	N	Y	5m	Y
EB18	Cherry Cottage	Y	Y	Y	Roadside	352246	528667	N	N	Y	2.5m	Y
EB19	8 Kemplay Rd	Y			Roadside	352207	528827	N	N	Y	4m	Y
EB20	2 Kemplay Rd	Y	Y	Y	Roadside	352207	528827	N	N	Y	4m	Y
EB21	Swallow Barn	Y			Roadside	352194	528799	N	N	Y	5m	Y
EB22	Post Office Row	Y			Roadside	352266	528649	N	N	Y	1m	Y

Tube Ref	Site Name	2011	2012	2013	Site Type	X OS Grid Ref	Y OS Grid Ref	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
Kirkby Thore												
35	Kirkby Thore	Y	Y	Y	Roadside	363523	525329	N	N	Y	5m	Y

2.2 Comparison of Monitoring Results with AQ Objectives

2.2.1 Nitrogen Dioxide

Diffusion Tube Monitoring Data

The nitrogen dioxide concentrations from the diffusion tube monitoring is shown for 2011 in Table 2.2, for 2012 in Table 2.3. and for 2013 in Table 2.4 As the tube locations were extensively changed during these years only data where there is 9 months or more data capture are shown.

Full monthly data is shown in Appendix C.

Table 2.2 Results of Nitrogen Dioxide Diffusion Tubes in 2011

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2011 (Number of Months)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration (Bias Adjustment factor = 0.87)
								2011 ($\mu\text{g}/\text{m}^3$)
Penrith								
V2	25 Victoria Rd	Roadside	N	N	10	n/a	N	30
V3	25b King Street	Roadside	N	N	11	n/a	N	33
V5	Front Victoria Rd/ Langton Cott	Roadside	N	N	11	n/a	N	37
V6	4 Crown Square	Roadside	N	N	9	n/a	N	37
V7	Café 15	Roadside	N	N	11	n/a	N	36
V8	Front 45 King St	Roadside	N	N	9	n/a	N	27

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2011 (Number of Months)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration (Bias Adjustment factor = 0.87)
								2011 ($\mu\text{g}/\text{m}^3$)
B12	18 Brunswick Rd	Roadside	N	N	11	n/a	N	25
B13	Post adj 12 Brunswick Rd	Roadside	N	N	11	n/a	N	20
B14	4 Brunswick Rd	Roadside	N	N	12	n/a	N	37
SG23	22 Stricklandgate	Roadside	N	triplicate	9	n/a	N	34
SG24	22 Stricklandgate	Roadside	N	triplicate	10	n/a	N	36
SG25	22 Stricklandgate	Roadside	N	triplicate	10	n/a	N	31
SG26	99a Scotland Rd	Roadside	N	N	11	n/a	N	37

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2011 (Number of Months)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration (Bias Adjustment factor = 0.87)
								2011 ($\mu\text{g}/\text{m}^3$)
SG27	8 Scotland Rd	Roadside	N	N	11	n/a	N	33
SG28	53 Scotland Rd	Roadside	N	N	10	n/a	N	28
32	Penrith Nursery	Roadside	N	N	11	n/a	N	32
33	Middlegate	Roadside	N	N	11	n/a	N	32
34b	Bridge La	Roadside	N	N	10	n/a	N	26

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2011 (Number of Months)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration (Bias Adjustment factor = 0.87)
								2011 ($\mu\text{g}/\text{m}^3$)
Eamont Bridge								
EB15	Glendale	Roadside	N	N	11	n/a	N	36
EB16	Smithy Cott	Roadside	N	N	11	n/a	N	29
EB17	Old Mansion House	Roadside	N	N	11	n/a	N	18
EB18	Cherry Cottage	Roadside	N	N	12	n/a	N	40
EB19	8 Kemplay Rd	Roadside	N	N	11	n/a	N	29
EB20	2 Kemplay Rd	Roadside	N	N		n/a	N	

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2011 (Number of Months)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration (Bias Adjustment factor = 0.87)
								2011 ($\mu\text{g}/\text{m}^3$)
EB21	Swallow Barn	Roadside	N	N	11	n/a	N	20
EB22	Post Office Row	Roadside	N	N	11	n/a	N	34
Kirkby Thore								
35	Kirkby Thore	Roadside	N	N	12	n/a	N	33

Table 2.3 Results of Nitrogen Dioxide Diffusion Tubes in 2012

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2012 (Number of Months)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration (Bias Adjustment factor = 0.84)
								2012 ($\mu\text{g}/\text{m}^3$)
Penrith								
C1	Railway Tavern	Roadside	N	N	12	n/a	N	34
V3	25 King Street	Roadside	N	N	11	n/a	N	39
V5	Front Victoria Rd/ Langton Cott	Roadside	N	N	12	n/a	N	38
V7	Café 15	Roadside	N	N	11	n/a	N	48
V9	Front 9b King Street	Roadside	N	N	12	n/a	N	27
V11	RAFA	Roadside	N	N	12	n/a	N	31

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2012 (Number of Months)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration (Bias Adjustment factor = 0.84)
								2012 ($\mu\text{g}/\text{m}^3$)
SG23	22 Stricklandgate	Roadside	N	triplicate	10	n/a	N	34
SG24	22 Stricklandgate	Roadside	N	triplicate	10	n/a	N	34
SG25	22 Stricklandgate	Roadside	N	triplicate	10	n/a	N	36
SG27	8 Scotland Rd	Roadside	N	N	12	n/a	N	37
33	Middlegate	Roadside	N	N	9	n/a	N	36
36	Roper St	Roadside	N	N	12	n/a	N	34
B14	4 Brunswick Rd	Roadside	N	N	12	n/a	N	38

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2012 (Number of Months)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration (Bias Adjustment factor = 0.84)
								2012 ($\mu\text{g}/\text{m}^3$)
EB15	Glendale	Roadside	N	N	12	n/a	N	37
EB18	Cherry Cottage	Roadside	N	N	12	n/a	N	42
EB20	2 Kemplay Rd	Roadside	N	N	12	n/a	N	38
Kirkby Thore								
35	Kirkby Thore	Roadside	N	N	12	n/a	N	33

Table 2.4 Results of Nitrogen Dioxide Diffusion Tubes in 2013

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2013 (Number of Months)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration (Bias Adjustment factor = 0.73)
								2013 ($\mu\text{g}/\text{m}^3$)
Penrith								
C1	Railway Tavern	Roadside	No	No	11	N	N	28
V3	25b King St	Roadside	No	No	12	N	N	33
V5	Front Victoria Rd/Langton Cott	Roadside	No	No	12	N	N	32
V7	Cafe15	Roadside	No	No	12	N	N	34
V9	Front 9b King St	Roadside	No	No	12	N	N	22
V11	RAFA	Roadside	No	No	12	N	N	25

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2013 (Number of Months)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration (Bias Adjustment factor = 0.73)
								2013 ($\mu\text{g}/\text{m}^3$)
SG23	22 Stricklandgate(N)	Roadside	No	triplicate	9	N	N	26
SG24	22 Stricklandgate(S)	Roadside	No	triplicate	9	N	N	25
SG25	22 Stricklandgate(W)	Roadside	No	triplicate	8	N	N	26
SG27	8 Scotland Rd	Roadside	No	No	12	N	N	31
33	Middlegate	Roadside	No	No	7	N	N	24
36	Roper St	Roadside	No	No	12	N	N	27
B14	4 Brunswick Rd	Roadside	No	No	12	N	N	32
31	3 Benson Row	Roadside	No	No	12	N	N	28

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2013 (Number of Months)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration (Bias Adjustment factor = 0.73)
								2013 ($\mu\text{g}/\text{m}^3$)
32	Opp Penrith Nursery	Roadside	No	No	10	N	N	33
SG29	The Royal	Roadside	No	No	12	N	N	28
C4	18 Castlegate	Roadside	No	No	9	N	N	37
C30	40 Castlegate	Roadside	No	No	10	N	N	35

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2013 (Number of Months)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration (Bias Adjustment factor = 0.73)
								2013 ($\mu\text{g}/\text{m}^3$)
Eamont Bridge								
EB15	Glendale	Roadside	No	No	11	N	N	32
EB18	Cherry Cottage	Roadside	No	No	12	N	N	35
EB20	2 Kemplay Rd	Roadside	No	No	12	N	N	31
Kirkby Thore								
35	Kirkby Thore	Roadside	N	N	12	N	N	29

One of the areas identified previously as having a potential exceedance of nitrogen dioxide is Castlegate in Penrith town Centre. Castlegate is a narrow street forming part of the one-way system. There are residential properties just 1m from the carriageway and also has a fairly steep gradient such that traffic is moving up the hill with standing traffic at peak times.

There have been diffusion tubes sited at two locations on Castlegate for a number of years. It is unfortunate that there is no single monitoring location for 2011 and 2012.

Site C4 at 18 Castlegate has consistently shown high concentrations however, it is unfortunate that there were not full year's data for 2011 and 2012. The diffusion tube at this site was removed in error part-way through 2012 and reinstated later in the year. The results for 2011 and 2012 have been annualised using the method set out on Box 3.2 in LAQM TG(09) as part of the Detailed Assessment undertaken by Bureau Veritas. The annualised annual mean nitrogen dioxide concentrations for 2011 and 2012 are $62.7\mu\text{g}/\text{m}^3$ and $41.9\mu\text{g}/\text{m}^3$ respectively. The monthly mean nitrogen dioxide concentrations for the castlegate sites is shown in Table 2.5.

A full year of data was collected in 2013 but the annual mean concentration was $37\mu\text{g}/\text{m}^3$. This is significantly lower than the two previous years for which there is no obvious explanation. It is noted that all the annual mean concentrations across the district were significantly lower in 2013. (See "Comments on Diffusion Tube Data 2011 to 2013" at page 32).

Table 2.5 Monthly mean nitrogen dioxide concentrations from two diffusion tube monitoring sites for Castlegate 2011 and 2012

	2011							2012											
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
C4 18 Castlegate	58.3	40.0	60.9	65.5	62.9	60.2	51.0	52.8	Missing	50.2							57.1	61.1	51.6
C30 40 Castlegate	29.8	37.8	37.3	37.1	39.7	39.9	43.7	45.5	Missing	Missing							Missing	74.2	38.8

The nitrogen dioxide concentrations for Castlegate (Table 2.5) relate to relevant receptors. These data are presented in the knowledge that they are not a true annual mean nitrogen dioxide concentration, however, they clearly demonstrate that the nitrogen dioxide concentration is high and is most likely above the annual mean Objective. As stated previously the data is presented as “annualised data” in the Details Assessment at Appendix E. Further monitoring and assessment is on-going. This area has been included in the Detailed Assessment which concluded that it should be declared an AQMA.

Tables 2.2 and 2.3 demonstrate that there is good evidence that the concerns expressed in previous reports had reached the point where the annual mean nitrogen dioxide concentration had possibly exceeded the Air Quality Objective in Penrith Town Centre and Eamont Bridge. As a result the Council commissioned a Detailed Assessment using modelling which was the subject of a further report. This concluded that AQMAs should be declared in Penrith town centre and Eamont Bridge. The process of declaring the AQMAs is being undertaken at the time of writing this report and should be completed during 2014.

Due to the many changes in diffusion tube site locations over the past few years it is not possible to show the trends in annual mean nitrogen dioxide concentrations over a number of years for all sites. For those sites that have sufficient data these are shown in Table 2.6

Table 2.6 Trends in Annual Mean Nitrogen Dioxide Concentrations measured at Diffusion Tube Monitoring Sites

Site	Location	Annual Mean Nitrogen Dioxide Concentration $\mu\text{g}/\text{m}^3$		
		2011	2012	2013
Penrith				
C1	Railway Tavern		34	28
V3	25b King St	33	39	33
V5	Front Victoria Rd/Langton Cott	37	38	32
V7	Cafe15	36	48	34
V9	Front 9b King St		27	22
V11	RAFA	27	31	25
SG23	22 Stricklandgate(N)	34	34	26
SG24	22 Stricklandgate(S)	36	34	25
SG25	22 Stricklandgate(W)	31	36	26
SG27	8 Scotland Rd	33	37	31
33	Middlegate	32	36	24
36	Roper St		34	27
B14	4 Brunswick Rd	37	38	32
31	3 Benson Row			28
32	Opp Penrith Nursery	28	37	33
SG29	The Royal	32	42	28

		Annual Mean Nitrogen Dioxide Concentration $\mu\text{g}/\text{m}^3$		
Site	Location	2011	2012	2013
C4	Castlegate		38	37
C30	40 Castlegate	26		35
Eamont Bridge				
EB15	Glendale	36	37	32
EB18	Cherry Cottage	40	42	35
EB20	2 Kemplay Rd		38	31
Kirkby Thore				
35	Kirkby Thore	33	33	29

Comments on Diffusion Tube Data 2011 to 2013

There has been a noticeable reduction in nitrogen dioxide concentration in 2013 compared with the previous year's data, typically by around 20%. No monitoring locations have exceeded the Annual Mean Nitrogen Dioxide Objective in 2013. There is no obvious explanation for this in terms of emissions or mitigation measures such as road improvements.

There is one significant factor which may explain this to some extent and this is a large change in the laboratory bias adjustment factor (see Appendix A).

In 2011 and 2012 the bias adjustment factor was based on four collocation studies, three at automatic stations operated by Slough Borough council and one at the Marylebone Road Intercomparison site. The bias adjustment factors for 2011 were 0.82, 0.89 and 0.90 $\mu\text{g}/\text{m}^3$ for the slough sites and 0.86 $\mu\text{g}/\text{m}^3$ for the Marylebone Road site. In 2012 these were 0.84, 0.88 and 0.87 $\mu\text{g}/\text{m}^3$ for slough and a very much lower 0.73 $\mu\text{g}/\text{m}^3$ for Marylebone Road.

In 2013 there was just one site, Marylebone Road used for the computation of the bias adjustment factor and this again was 0.73 $\mu\text{g}/\text{m}^3$, the same as the previous year but without the three higher data points from the Slough sites the bias adjustment factor is given as a much reduced 0.73 $\mu\text{g}/\text{m}^3$. This appears to have contributed significantly to the apparent reduced concentrations in the Council's area.

The Council is considering the implications of this as the National Diffusion Tube Bias Adjustment Factor spreadsheet states that "Where there is only one study for a chosen combination, you should use the adjustment factor shown with caution". Further advice is being sought in this matter.

2.2.2 PM₁₀

No monitoring for particulates has been undertaken by the Council. Previous review and assessments have not identified any significant sources.

2.2.3 Sulphur Dioxide

There is currently no automatic or non-automatic monitoring of SO₂ concentrations carried out by Eden District Council. Previous monitoring for many years using a bubbler has indicated that it is unlikely that the Air Quality objectives will be exceeded.

In 2002, the Council set up a continuous analyser to measure SO₂ in the most densely populated part of Penrith (Castletown). At no time were any of the objective levels reached.

2.2.4 Benzene

No monitoring for benzene has been undertaken by the Council. Previous Review and Assessment Reports have not identified any significant sources affecting the district.

2.2.5 Summary of Compliance with AQS Objectives

Eden District Council has measured concentrations of nitrogen dioxide above the annual mean objective at relevant locations outside of an AQMA, and **will need to proceed to a Detailed Assessment**, for Penrith Town Centre and Eamont Bridge.

3. Road Traffic Sources

3.1 Narrow Congested Streets with Residential Properties Close to the Kerb

There are two areas where narrow, busy streets have been identified which may be a cause for concern in terms of air quality. Both have probably experienced increased traffic flows and are subject to greater congestion at peak times. The first is Castlegate in particular, but the town centre generally in Penrith, which has seen a large new retail development with car parking built (The New Squares Development). Not only is this likely to be attracting more traffic into the town centre, the development involved creating two new traffic light controlled junctions which has altered the traffic flow. The new shopping centre opened in December 2011.

At the village of Eamont Bridge, approximately 1 mile south of Penrith Town Centre there is a narrow road with a traffic light controlled bridge which is often subject to traffic congestion. Also in 2011 an existing roundabout at the junction of the A66 and A6 (Kemplay) was altered (increased lanes and traffic light controlled). This roundabout is at the boundary of Eamont Bridge and it is possible that it may have impacted on traffic in the village with congestion at peak times.

It is possible that in 2011 the traffic derived nitrogen dioxide may have been artificially elevated due to the construction work which caused a certain amount of disruption to traffic flows in the town centre and around the Kemplay roundabout.

Eden District Council has identified congested streets with a flow above 5,000 vehicles per day and residential properties close to the kerb, new or not adequately considered in previous rounds of Review and Assessment, and **will need to proceed to a Detailed Assessment.**

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

Busy street locations where individuals may regularly spend one hour or more have been considered and identified in previous review and assessment reports.

Notwithstanding the previously identified potential exceedence of the annual mean nitrogen dioxide objective requiring a Detailed Assessment, there are no streets where people will regularly spend 1-hour or longer as detailed in Section A.2 of Box 5.3 to the Technical Guidance TG (09).

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

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

Eden District Council confirms that there are no new/newly identified roads with high flows of buses/HGVs.

3.4 Junctions

As discussed previously there are two altered junctions in connection with the New Squares shopping centre development in Penrith town centre. These are traffic light controlled junctions at Victoria Road with Roper Street and the newly created one-way Kilgour Street out of the New Squares development and the other being Victoria Road, Bridge Lane and Southend Road (the latter being the new access road into the New Squares development). Both have sensitive receptors within 2m of the kerb.

These junctions were considered as part of the Detailed Assessment already identified as being required for Penrith town centre and have been included in the proposed Air Quality Management Area.

Eden District Council has assessed new/newly identified junctions meeting the criteria in Section A.4 of Box 5.3 in TG(09), and concluded that **it will be necessary to proceed to a Detailed Assessment for nitrogen dioxide.**

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

There has been one newly constructed road with sensitive receptors within 10m since the previous assessment. This is Kilgour Street which is the main route out of the New Squares shopping development. Although the daily traffic flow is not known the road is part of the altered junction identified at section 3.4 and will be considered further as part of the Detailed Assessment already identified as being required for Penrith town centre.

Eden District Council has assessed new/proposed roads meeting the criteria in Section A.5 of Box 5.3 in TG(09), and concluded that **it will be necessary to proceed to a Detailed Assessment for nitrogen dioxide.**

3.6 Roads with Significantly Changed Traffic Flows

There are no roads with significantly increased traffic flows that are not already considered in the previous sections.

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

3.7 Bus and Coach Stations

There are no bus and coach stations in the Council's area that have not been previously considered.

Eden District Council confirms that there are no relevant bus stations in the Local Authority area.

4. Other Transport Sources

4.1 Airports

Eden District Council confirms that there are no airports in the Local Authority area.

4.2 Railways (Diesel and Steam Trains)

4.2.1 Stationary Trains

There are two railway lines passing through the District. The west coast mainline, which has a station close to Penrith town centre and the Leeds to Carlisle railway which has a number of small rural stations within the Council's area. None of these are in locations where trains are regularly stationary for 15 minutes or longer.

There are also rail loading facilities at a mineral works in Shap Blue Quarry and British Gypsum.

Previous assessments have concluded there is no potential for outdoor exposure from loading of quarry products at Shap Blue Quarry or unloading of material at British Gypsum.

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

4.2.2 Moving Trains

None of the sections of rail lines identified as having a large number of diesel passenger trains shown in Table 5.1 of the Technical Guidance TG(09) are within the Council's boundary.

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

4.3 Ports (Shipping)

There are no ports or shipping within the Council area.

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

5. Industrial Sources

5.1 Industrial Installations

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

There are no significant industrial pollutant sources within the Council's area or in any neighbouring Councils' areas which would have a significant impact on air quality in terms of the annual mean and short-term Air Quality Objectives

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

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

There are no installations with substantially increased industrial emissions nor are there any new relevant exposures near to existing emissions within the Council's area

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

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

There are no new or significantly changed installations or proposed installations within the Council's area or neighbouring Councils' areas.

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

5.2 Major Fuel (Petrol) Storage Depots

There are no major fuel storage depots within the Council's area

Eden District Council confirms that there are no major fuel (petrol) storage depots within the Local Authority area.

5.3 Petrol Stations

There are no petrol filling stations near to busy roads with a throughput in excess of 2000m³ with a relevant exposure within 10m of the pump or that does not have a Stage 2 petrol vapour recovery system installed.

Eden District Council confirms that there are no petrol stations meeting the specified criteria.

5.4 Poultry Farms

Eden District council confirms that there are no poultry farms meeting the specified criteria.

6. Commercial and Domestic Sources

6.1 Biomass Combustion – Individual Installations

There are a number of biomass combustion plants located within the local authority area, notably at Jeldwen, Mardale Road, Penrith, AMP Low Plains, Calthwaite, Sainsbury's at the New Squares shopping development in Penrith, Newton Rigg College and the Veterinary Laboratories Agency (VLA).

The latter two were considered in previous review and assessments. Both are rated at 150KW and are situated in very rural locations. Neither plant exceeds the threshold emission rates provided in the nomograms in Figs 5.19 and 5.20 of the technical guidance TG(09).

There is a 2.3MW biomass boiler at Jeldwen, Mardale Road, Penrith. This factory manufactures timber doors and the boiler is fuelled exclusively from "clean" timber offcuts and timber shavings collected by a cyclone. The criteria in Box 5.8 of TG(09) have been applied which concluded, from the nomogram, that a Detailed Assessment is unnecessary.

A biomass boiler is installed and operational at the Sainsbury's supermarket at the Penrith New Squares development. The biomass boiler provides a thermal capacity of circa 750kW and is fuelled by a renewable source of wood pellets. An air quality impact assessment was required as part of the planning application which concluded that the impact on air quality will be negligible.

There is also a small biomass boiler at a hotel in Patterdale. The air quality impact was assessed at the planning stage and it was considered to be negligible.

The biomass plant located at Low Plains, Calthwaite. Is a This 0.3 MW gasification plant produces electricity that is fed into the national grid. This is in a remote location and is not considered to have a significant impact on local air quality. It is currently subject to a planning application for various alterations and air Quality is being considered as a result of this application. The significance on air quality will be detailed in a future assessment.

Eden District council has assessed the biomass combustion plant, and concluded that it will not be necessary to proceed to a Detailed Assessment.

6.2 Biomass Combustion – Combined Impacts

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

6.3 Domestic Solid-Fuel Burning

Eden District covers an area of 2,142 km² with a population of around 52,000.

Penrith, the largest population centre, has around 15,000 residents. The population of Eden DC is therefore distributed throughout the area in relatively small population centres. There is only one possible area within the District where more than 100 properties may have solid fuel appliances: the Castletown area of Penrith. This was considered in the 2003 USA, previous monitoring indicated that objectives for both SO₂ and PM₁₀ were not exceeded.

Eden District Council has assessed areas of significant domestic solid fuel use, and concluded that it will not be necessary to proceed to a Detailed Assessment.

7. Fugitive or Uncontrolled Sources

There are no known sources of fugitive particulate matter that have not been assessed in previous rounds of review and assessment nor are there any new relevant locations near to such sources.

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

8. Local/Regional Air Quality Strategy

Eden District Council does not have Local Air Quality Strategy but contributes to the regional Local Transport Plan (LPT)

9. Planning Applications

There have been several parcels of land identified around the Council's area as being suitable for housing developments as part of the Council's strategic development process. The environmental protection team have had some input into this process and the need to consider air quality has been identified, especially in the light of the proposed AQMAs.

A planning application is expected in the near future for Phase II of the New Squares development in Penrith. This is likely to involve the development of a petrol filling station and a hotel. Discussions are already taking place with the developer on air quality issues as the development has the potential to impact on the proposed AQMA for Penrith town centre.

A new retail development has just been completed on Ullswater Road, Penrith. This is in effect a small extension of an existing retail area and is considered unlikely to have any significant impact on air quality in the town.

There have been a number of small housing developments such as at Clifton (south of Penrith) and Kirkby Stephen.

In addition, work has started on a new small housing development of around 30 dwellings at Castle Park, Brough.

None of these are considered likely to have a significant impact on air quality.

10. Air Quality Planning Policies

The land-use planning system is recognised to play an integral part in maintaining and improving air quality. The Council has procedures in place that allows input from the environmental health team into planning decisions which includes an assessment of any adverse impact on air quality any particular proposed development may have. Liaison is undertaken with developers at an early stage whenever the opportunity presents itself.

Eden District Council's local development framework 'Core Strategy Development Plan' was adopted at full council on the 31 March 2010. The Strategy sets out a strategic vision and strategic policies to guide the growth of the District up to the year 2025. It also contains a range of development control policies against which planning applications will be assessed. It is accompanied by a Final Sustainability Appraisal undertaken by Entec (setting out the likely social, economic and environmental effects of the policies and proposals).

This Progress Report lists the Council's policies which may have an affect on air quality. It should be noted that Eden District Council's Environmental Protection Unit also follows the guidance set out in the Environmental Protection UK Guidance 'Air Quality: Planning for Development' when considering planning applications where air quality may be a material consideration. This updated guidance deals with air quality concerns within the development control process and is closely followed to ensure there is a clear understanding between environmental health, planning. and the applicant. In the event that an AQIA is required we endeavour to work closely with any private consultants involved from an early stage to help specify the extent of the investigation that will be required. Once the AQIA is submitted we evaluate its findings and suitability and then make comments to the planning department.

Development Control policies include:

CS 5 Transport and Accessibility

The council will work with partner organisations to ensure that development accords with the following principles:

1. Focus the majority of new development in the Key services Centres of Penrith, Appleby, Alston and Kirkby Stephen and the Local Service Centres which are accessible by a variety of modes of transport, in particular public/community transport.
2. Promote development that will reduce reliance on the private car to access shops, services and employment opportunities.
3. Promote improvements in accessibility for all people regardless of disability, age, gender or ethnicity.
4. Support the maintenance and enhancement of the public transport network including access to and use of rail services (including freight transport).
5. Support justified proposals for improvements on the national and regional road networks where this would resolve safety problems or facilitate environmental enhancement and planned development, including the provision of a new road linking the Gilwilly Industrial Estate/Eden Business Park to Junction 41 of the M6.
6. Provide adequate levels of car parking to service the key centres of Penrith, Appleby, Alston and Kirkby Stephen
7. Promote the use of walking and cycling by making those modes more integrated, accessible, safer and attractive
8. Promote a healthy lifestyle through travel choice
9. Reduce the environmental impact of travel, to conserve energy and reduce air pollution by limiting the growth in traffic
10. Promote transport proposals that will protect or enhance the built and natural environment

11. Promote community based alternatives to traditional public such as car pools, car sharing and community mini bus services such as Fellrunner and Plusbus

12. Promote the use of travel plans for larger developments

CS6 Developer Contributions

Planning obligations will be sought where implementation of a development would create a need to provide additional or improved infrastructure, amenities or facilities.

Contributions may be sought for the following:

1. Affordable Housing
2. Education
3. Health facilities
4. Transport infrastructure
5. Open space and leisure
6. Community and cultural facilities
7. Environmental Improvements
8. Drainage/flood prevention
9. Water and sewerage infrastructure

CS8 Making Efficient Use of Land

Housing Schemes should;

1. Have a minimum density of 30 dwellings per hectare. Higher densities will be expected in locations close to town centres which are accessible by a range of means of transport. Lower densities may be considered where there is a need to preserve the character of the area.
2. Provided at least 30% of new dwellings district wide on brownfield land and buildings including the conversion of traditional agricultural/farm buildings

CS19 Energy Conservation, Efficiency and Production in New Developments

Applications for new developments should seek to maximise the potential for energy conservation and efficiency and the use of low carbon energy sources. Consideration should be given to design, construction, layout, orientation, massing, internal design, materials used, insulation and heat recovery of the scheme.

CS20 Renewable Energy

Renewable energy proposals will be supported particularly where they contribute towards meeting and exceeding the minimum renewable energy targets set out in the RSS and where there are no significant unacceptable effects which cannot be mitigated or are not outweighed by the national and regional need for renewable energy development or the wider environmental, social and economic benefits that the scheme may bring.

This document is in the process of being replaced by an updated version which reflects the National Planning Policy Framework (NPPF). Under the Government's National Planning Policy Framework (NPPF) Local Planning authorities are now charged with producing a single Local Plan for their area.

The Local Plan will include a vision for the district, including site allocations and policies which will guide development to the most sustainable areas in Eden.

To this end the Council have consulted on a draft housing and employment sites (February and July 2013). The next document to be published will add policies and sites to the existing Core Strategy to form an eventual full Local Plan.

The Council have just completed consultation on the Sustainability Appraisal (SA) Scoping Report. This is undertaken in the pre-production stages of a Local Plan, designed to draw together information about Eden to establish a sustainability baseline and determine the key challenges for the area.

Links to these key documents are given below:

Core Strategy Development Plan Document

<http://www.eden.gov.uk/planning-and-development/planning-policy-for-eden/current-policy-and-the-emerging-local-plan/core-strategy-dpd/> - superseded by adopted Local Plan 2014 to 2032

<https://www.eden.gov.uk/planning-and-building/planning-policy/eden-local-plan/eden-local-plan-adoption/>

Draft Local Plan

<http://www.eden.gov.uk/planning-and-development/planning-policy-for-eden/current-policy-and-the-emerging-local-plan/draft-local-plan/> - superseded by adopted Local Plan 2014 to 2032

<https://www.eden.gov.uk/planning-and-building/planning-policy/eden-local-plan/eden-local-plan-adoption/>

Preferred Housing Site and Policies Document

<http://www.eden.gov.uk/planning-and-development/planning-policy-for-eden/current-policy-and-the-emerging-local-plan/preferred-housing-sites-and-policies-document/> - superseded by adopted Local Plan 2014 to 2032

<https://www.eden.gov.uk/planning-and-building/planning-policy/eden-local-plan/eden-local-plan-adoption/>

Employment Preferred Sites and Policies Document

<http://www.eden.gov.uk/planning-and-development/planning-policy-for-eden/current-policy-and-the-emerging-local-plan/employment-preferred-sites-and-policies-document/> - superseded by adopted Local Plan 2014 to 2032

<https://www.eden.gov.uk/planning-and-building/planning-policy/eden-local-plan/eden-local-plan-adoption/>

Sustainability Appraisal Scoping Report

<http://www.eden.gov.uk/EasySiteWeb/GatewayLink.aspx?allId=41552> - superseded by adopted Local Plan 2014 to 2032

<https://www.eden.gov.uk/planning-and-building/planning-policy/eden-local-plan/eden-local-plan-adoption/>

Eden District Council

Eden District Council is actively involved in developing Neighbourhood Plans which are relevant to the rural communities.

11. Local Transport Plans and Strategies

The Local Transport Plan ('LTP') is the statutory planning document that sets out the Council's vision, strategy and policies for transport. It also describes the approaches and measures that will be taken to implement these policies in each of the Council's Local Committee areas over the course of the Plan. It provides the framework to co-ordinate the local delivery of integrated transport and seeks improvements to our transport systems and the quality of people lives.

The majority of air quality issues in the UK relate to emissions from the road transport sector. Measures to improve air quality on a local scale are thus closely related to the Local Transport Plan.

The current Local Transport Plan (third Plan) for Cumbria is a statutory document that sets out how roads, footways, cycleways, rights of way and bus and train services in Cumbria will be improved and managed. The Plan contains a strategy for the 15 years from 2011 to 2026.

The LTP is underpinned by a shorter-term Implementation Plan covering the period 2012 to 2015.

The key documents can be accessed form the following web links:

15 Year strategy of the third Local Transport Plan, Moving Cumbria Forward

<http://www.cumbria.gov.uk/eLibrary/view.asp?ID=48214>

Implementation Plan (2012-2015) of the third Local Transport Plan, Delivering Cumbria's Transport Needs

<http://www.cumbria.gov.uk/eLibrary/view.asp?ID=54158>

The Council also has planning policies relating to travel initiatives covering public transport, provision for cyclists and road user facilities as follows:

Public Transport

Policy PT9

Development proposals that help maintain or improve public transport facilities will be permitted. Proposals that would result in a loss of existing public transport facilities will not be permitted.

Provision for Cyclists

Policy PT10

The design and layout of development proposals should, where appropriate, take into account the needs of cyclists, especially through the provision of cycle paths and secure parking facilities.

Road User Facilities

Policy PT11

Proposals for road user facilities on the Primary Road Network will only be approved as an exception to Policy NE1 if all of the following criteria are satisfied:

- a need is established for the service in the specific location concerned which is sufficient to outweigh any environmental cost;
- the siting of the development and any landscaping proposed will minimise impact;
- the design and materials proposed are appropriate to the location;
- an unacceptable level of harm will not be caused to any interests of acknowledged importance; and
- the full requirements of highway safety can be met. In the case of all-purpose trunk roads these requirements will be defined by the Department of Transport.

12. Climate Change Strategies

The Council is committed to tackling the causes and effects of climate change which is reflected in its Environmental Policy (2009).

The Strategic Actions of the policy are:

- Manage waste effectively.
- Ensure a well balanced spatial planning framework.
- Support the clean and green agenda.

The Council has a stated commitment:

“Eden District Council recognises that it has a wide-ranging impact on the environment through its use of energy, water, transport and waste generation. In addition to this, the Council is responsible for the provision of a number of environmental services, and is involved in raising awareness, and setting an example to partners and the wider community. It is therefore important that the Council takes responsibility for its environmental impact”.

Specific references are made in the Policy with respect to climate change:

Climate Change

- We will reduce, where possible, greenhouse gas emissions.
- We will ensure, where possible, buildings and services are able to adapt to climate change.
- We will monitor, manage and minimise the Council’s use of energy.

13. Conclusions and Proposed Actions

13.1 Conclusions from New Monitoring Data

The Council's nitrogen dioxide diffusion tube monitoring programme has been extensively reviewed during the three years which this report covers (2011, 2012 and 2013). This is to better target the monitoring to areas where previous assessments had identified concerns and to monitor the impact of a new shopping development and associated changes to the road network in Penrith town centre.

The monitoring confirmed that it was necessary to proceed to a Detailed Assessment for the nitrogen dioxide annual mean objective in Penrith town centre and Eamont Bridge.

The Detailed Assessment has been completed and concluded that Air Quality Management Areas should be declared for two areas of Penrith town centre and along a short stretch of the A6 at Eamont Bridge.

The declaration of the AQMAs has been approved by the Council's Executive and at the time of producing the report the Order was being prepared by the Council's legal officers.

It is interesting to note that the nitrogen dioxide concentrations across the whole district were significantly lower in 2013, although the reason for this is not clear.

The concentration of nitrogen dioxide will be kept under review as this could have major implications on the steps that may need to be considered as part of the Air Quality Action Plan if the pollution is found to be significantly less than the levels encountered in 2011 and 2012.

13.2 Conclusions from Assessment of Sources

An assessment of sources has revealed that altered road junctions and new roads created in connection with the New Squares development together with the identification of narrow and congested streets, particularly Castlegate in Penrith town centre, has also shown that a Detailed Assessment should be undertaken for the nitrogen dioxide annual mean objective.

The Detailed Assessment covered both aspects ie the areas where monitoring has indicated exceedences supported by the change to the road network.

The screening assessment has not identified any other concerns relating to any other sources or pollutants.

13.3 Proposed Actions

A Detailed Assessment has been completed as a result of the monitoring detailed within this report specifically to examine the annual mean nitrogen dioxide objective in Penrith town centre and Eamont Bridge. In addition, arising from the recommendations of the Detailed Assessment, further targeted diffusion tube monitoring has been implemented to give a better understanding of pollutant concentrations in these and the areas immediately surrounding the areas of interest.

The Council is in the final stages of declaring the AQMAs and will then proceed to a further assessment and the development of an Air Quality Action Plan. As the pollutant of concern is nitrogen dioxide arising from road traffic it will be necessary to work with partner organisations in the development of the Action Plan, particularly the Cumbria County Council Highways Department.

The next reports that will be published by the Council relating to air quality management will be the Further Assessment and Air Quality Action Plans for Penrith Town Centre and Eamont Bridge and the 2015 Updating and Screening Assessment.

14. References

Technical Guidance LAQM.TG(09)

Eden District Council Air Quality Review and Assessment Reports:

- Air Quality Review and Assessment Stage 1 Report
- Air Quality Review and Assessment 2003 Updating and Screening Assessment
- Air Quality Review and Assessment 2004 Progress Report
- Air Quality Review and Assessment 2005 Progress Report
- Air Quality Review and Assessment 2006 Updating and Screening Assessment
- Air Quality Review and Assessment 2007 Progress Report
- Air Quality Review and Assessment 2008 Progress Report
- Air Quality Review and Assessment Updating and Screening Report 2009
- Air Quality Review and Assessment Progress Report 2010
- Air Quality Review and Assessment Progress Report 2011
- Eden District Council Penrith and Eamont Bridge Detailed Assessment; Bureau Veritas June 3013.

DEFRA Local Authority Support Website

<https://laqm.defra.gov.uk/>

Appendices

Appendix A: QA:QC Data

Diffusion Tube Bias Adjustment Factors

Nitrogen dioxide is currently monitored within Eden District Council through the use of passive diffusion tubes. Details of each site are shown in Table 2.1 below. The Council utilises tubes provided and analysed by ESG Glasgow using 50% TEA (Triethanolamine) in acetone, which are typically exposed for four week periods in accordance with the National NO₂ Network exposure calendar. The laboratory is accredited to NAMAS and UKAS BS EN ISO 9001 and has implemented the methodology set out in the Harmonisation Practical Guidance. Results from the WASP¹ scheme show 100% for Rounds 116, 117 and 119 (Jan – Dec 2012) and also 100% for rounds 120 – 123 (Jan - Dec 2013).

The 2011 results have been corrected for a bias using a factor of 0.87 for ESG Glasgow (R&A website, spread sheet version 07/13).

The 2012 results have been corrected for a bias using a factor of 0.84 for ESG Glasgow (R&A website, spread sheet version 07/13).

The 2013 results have been corrected for a bias using a factor of 0.73 for ESG Glasgow (R&A website, spread sheet version 03/14).

The spread sheets used in obtaining the relevant bias adjustment factor are shown below in Tables A1 to A3.

Table A.1 2011 Bias Adjustment Factor for ESG Glasgow nitrogen dioxide diffusion tubes

National Diffusion Tube Bias Adjustment Factor Spreadsheet							Spreadsheet Version Number: 07/13				
Follow the steps below in the correct order to show the results of relevant co-location studies							This spreadsheet will be updated at the end of September 2013				
Data only apply to tubes exposed monthly and are not suitable for correcting individual short-term monitoring periods							Whenever presenting adjusted data, you should state the adjustment factor used and the version of the spreadsheet				
This spreadsheet will be updated every few months; the factors may therefore be subject to change. This should not discourage their immediate use.							LAQM Helpdesk Website				
The LAQM Helpdesk is operated on behalf of Defra and the Devolved Administrations by Bureau Veritas, in conjunction with contract partners AECOM and the National Physical Laboratory.							Spreadsheet maintained by the National Physical Laboratory. Original compiled by Air Quality Consultants Ltd.				
Step 1:		Step 2:		Step 3:		Step 4:					
Select the Laboratory that Analyses Your Tubes from the Drop-Down List		Select a Preparation Method from the Drop-Down List		Select a Year from the Drop-Down List		Where there is only one study for a chosen combination, you should use the adjustment factor shown with caution. Where there is more than one study, use the overall factor ⁴ shown in blue at the foot of the final column.					
If a laboratory is not shown, we have no data for this laboratory.		If a preparation method is not shown, we have no data for this method at this laboratory.		If a year is not shown, we have no data ⁵ .		If you have your own co-location study then see footnote ⁶ . If uncertain what to do then contact the Local Air Quality Management Helpdesk at LAQMHelpdesk@uk.bureauveritas.com or 0800 0327953					
Analysed By ¹	Method ²	Year ³	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) ($\mu\text{g}/\text{m}^3$)	Automatic Monitor Mean Conc. (Cm) ($\mu\text{g}/\text{m}^3$)	Bias (B)	Tube Precision ⁷	Bias Adjustment Factor (A) (Cm/Dm)	
ESG Glasgow	50% TEA in acetone	2011	K	Marylebone Road Intercomparison	11	121	33	21.5%	G	0.82	
ESG Glasgow	50% TEA in acetone	2011	UB	Slough BC	3	48	43	12.5%	G	0.89	
ESG Glasgow	50% TEA in acetone	2011	UB	Slough BC	13	35	31	11.0%	G	0.90	
ESG Glasgow	50% TEA in acetone	2011	R	Slough BC	13	41	36	15.7%	P	0.86	
ESG Glasgow	50% TEA in acetone	2011	Overall Factor⁴ (4 studies)						Use	0.87	

¹ For Casella Stanger/Bureau Veritas (NOT Bureau Veritas Labs) use Gradko 50% TEA in Acetone. For Casella Sesi/GMSS/Casella CRE/Bureau Veritas Labs/Eurofinol use Environmental Scientific Groups. From 2011 for Environmental Scientific Groups use ESG Glasgow. From 2011 for Harwell Scientific Services use ESG Didcot. For Staffordshire CC SS/Staffordshire County Analyst use Staffordshire Scientific Services. For Bodycote Health Sciences and Clyde Analytical Laboratories use Exova. For Rotherham MBC use South Yorkshire Labs. For Dundee CC use Tayside SS. For Leicester Scientific Services use Staffordshire Scientific Services. For South Yorkshire Air Quality Samplers use South Yorkshire Labs. As of January 2010 sampler body changed. As of April 2010 sampler cap changed. Lancashire County Analysts withdrew from the Field intercomparison at the end of 2010. No submissions were supplied in 2011. Walsall MBC closed in March 2011. Bristol Scientific Services closed at the end of 2011. Somerset County Council did not start the Marylebone road intercomparison until June 2012.

² In this situation it would be reasonable to use data from the nearest year.

³ Overall factors have been calculated using orthogonal regression to allow for uncertainty in both the automatic monitor and diffusion tube. The uncertainty of the diffusion tube has been assumed to be double that of the automatic monitor.

⁴ If you have your own co-location study, please send your data to us, so that it can be included here. If this is not possible, but you wish to combine these factors with your own, select and copy the relevant data from this spreadsheet and paste them into a new one (otherwise your calculations will include hidden data). Then add your own data and calculate the bias. To obtain a new correction factor that includes your data, average the bias (B) values, expressed as a factor, i.e. -16% is -0.16. Next add 1 to this value, e.g. $-0.16 + 1.00 = 0.84$ in this example, then take the inverse to give the bias adjustment factor $1/0.84 = 1.19$. (This will not be exactly the same as the correction factor calculated using orthogonal regression as used in this spreadsheet, but will be reasonably close).

[To add data download a questionnaire](#)

⁵ Where an annual data set falls into two years it has been ascribed to the year in which most of the data has fallen.

⁷ Tube precision is determined as follows: G = G precision - coefficient of variation (CV) of diffusion tube replicates is considered G when the CV of eight or more periods is less than 20%; and the average CV of all monitoring periods is less than 10%; P = P precision - CV of four or more periods >20% and/or average CV >10%; S = Single tube, therefore not applicable; ns = not available.

The 2011 results have been corrected for a bias using a factor of 0.87 for ESG Glasgow (R&A website, spread sheet version 07/13).

Table A.2 2012 Bias Adjustment Factor for ESG Glasgow nitrogen dioxide diffusion tubes

National Diffusion Tube Bias Adjustment Factor Spreadsheet							Spreadsheet Version Number: 07/13				
<p>Follow the steps below in the correct order to show the results of relevant co-location studies</p> <p>Data only apply to tubes exposed monthly and are not suitable for correcting individual short-term monitoring periods</p> <p>Whenever presenting adjusted data, you should state the adjustment factor used and the version of the spreadsheet</p> <p>This spreadsheet will be updated every few months; the factors may therefore be subject to change. This should not discourage their immediate use.</p> <p>The LAQM Helpdesk is operated on behalf of Defra and the Devolved Administrations by Bureau Veritas, in conjunction with contract partners AECCOM and the National Physical Laboratory.</p>										<p>This spreadsheet will be updated at the end of September 2013</p> <p>LAQM Helpdesk Website</p>	
<p>Spreadsheet maintained by the National Physical Laboratory. Original compiled by Air Quality Consultants Ltd.</p>											
Step 1:		Step 2:		Step 3:		Step 4:					
<p>Select the Laboratory that Analyses Your Tubes from the Drop-Down List</p> <p>If a laboratory is not shown, we have no data for this laboratory.</p>		<p>Select a Preparation Method from the Drop-Down List</p> <p>If a preparation method is not shown, we have no data for this method at this laboratory.</p>		<p>Select a Year from the Drop-Down List</p> <p>If a year is not shown, we have no data.</p>		<p>Where there is only one study for a chosen combination, you should use the adjustment factor shown with caution. Where there is more than one study, use the overall factor² shown in blue at the foot of the final column.</p> <p>If you have your own co-location study then see footnote⁴. If uncertain what to do then contact the Local Air Quality Management Helpdesk at LAQMHelpdesk@uk.bureauveritas.com or 0800 0327953</p>					
Analysed By ¹	Method ³	Year ²	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) (µg/m ³)	Automatic Monitor Mean Conc. (Cm) (µg/m ³)	Bias (B)	Tube Precision ⁵	Bias Adjustment Factor (A) (Cm/Dm)	
ESG Glasgow	50% TEA in acetone	2012	UB	Slough Borough Council	12	47	40	18.6%	G	0.84	
ESG Glasgow	50% TEA in Acetone	2012	UB	Slough Borough Council	12	34	30	13.8%	G	0.88	
ESG Glasgow	50% TEA in acetone	2012	R	Slough Borough Council	12	43	37	15.1%	G	0.87	
ESG Glasgow	50% TEA in acetone	2012	KS	Marylebone Road Intercomparison	11	130	35	37.2%	G	0.73	
Overall Factor² (4 studies)								Use		0.82	

¹ For Casella Stanger/Bureau Veritas (NOT Bureau Veritas Labs) use Gradko 50% TEA in Acetone. For Casella Seal/GMSS/Casella CRE/Bureau Veritas Labs/Eurofin/ use Environmental Scientific Groups.
 From 2011 for Environmental Scientific Groups use ESG Glasgow.
 From 2011 for Harwell Scientific Services use ESG Didcot.
 For Staffordshire CC SS/Staffordshire County Analyst use Staffordshire Scientific Services.
 For Bodycote Health Sciences and Clyde Analytical Laboratories use Exova.
 For Rotherham MBC use South Yorkshire Labs.
 For Dundee CC use Tayside SS.
 For Leicester Scientific Services use Staffordshire Scientific Services.
 For South Yorkshire Air Quality Samplers use South Yorkshire Labs. As of January 2010 sampler body changed. As of April 2010 sampler cap changed.
 Lancashire County Analysts withdrew from the Field intercomparison at the end of 2010. No submissions were supplied in 2011.
 Walsall MBC closed in March 2011.
 Bristol Scientific Services closed at the end of 2011.
 Somerset County Council did not start the Marylebone road intercomparison until June 2012.

² In this situation it would be reasonable to use data from the nearest year.

³ Overall factors have been calculated using orthogonal regression to allow for uncertainty in both the automatic monitor and diffusion tube. The uncertainty of the diffusion tube has been assumed to be double that of the automatic monitor.

⁴ If you have your own co-location study, please send your data to us, so that it can be included here. If this is not possible, but you wish to combine these factors with your own, select and copy the relevant data from this spreadsheet and paste them into a new one (otherwise your calculations will include hidden data). Then add your own data and calculate the bias. To obtain a new correction factor that includes your data, average the bias (B) values, expressed as a factor, i.e. -16% is -0.16. Next add 1 to this value, e.g. -0.16 + 1.00 = 0.84 in this example, then take the inverse to give the bias adjustment factor 1/0.84 = 1.19. (This will not be exactly the same as the correction factor calculated using orthogonal regression as used in this spreadsheet, but will be reasonably close). [To add data download a questionnaire](#)

⁵ Where an annual data set falls into two years it has been ascribed to the year in which most of the data has fallen.

⁶ Tube precision is determined as follows: G = G precision - coefficient of variation (CV) of diffusion tube replicates is considered G when the CV of eight or more periods is less than 20%, and the average CV of all monitoring periods is less than 10%; P = P precision - CV of four or more periods >20% and/or average CV >10%; S = Single tube, therefore not applicable; na = not available.

The 2012 results have been corrected for a bias using a factor of 0.82 for ESG Glasgow (R&A website, spread sheet version 03/1131).

Table A.3 2013 Bias Adjustment Factor for ESG Glasgow nitrogen dioxide diffusion tubes

National Diffusion Tube Bias Adjustment Factor Spreadsheet						Spreadsheet Version Number: 03/14				
<p>Follow the steps below in the correct order to show the results of relevant co-location studies</p> <p>Data only apply to tubes exposed monthly and are not suitable for correcting individual short-term monitoring periods</p> <p>Whenever presenting adjusted data, you should state the adjustment factor used and the version of the spreadsheet</p> <p>This spreadsheet will be updated every few months; the factors may therefore be subject to change. This should not discourage their immediate use.</p>						<p>This spreadsheet will be updated at the end of June 2014</p> <p>LAQM Helpdesk Website</p>				
<p>The LAQM Helpdesk is operated on behalf of Defra and the Devolved Administrations by Bureau Veritas, in conjunction with contract partners AECOM and the National Physical Laboratory.</p>						<p>Spreadsheet maintained by the National Physical Laboratory. Original compiled by Air Quality Consultants Ltd.</p>				
Step 1:		Step 2:		Step 3:		Step 4:				
<p>Select the Laboratory that Analyses Your Tubes from the Drop-Down List</p>		<p>Select a Preparation Method from the Drop-Down List</p>		<p>Select a Year from the Drop-Down List</p>		<p>Where there is only one study for a chosen combination, you should use the adjustment factor shown with caution. Where there is more than one study, use the overall factor² shown in blue at the foot of the final column.</p>				
<p>If a laboratory is not chosen, we have no data for this laboratory.</p>		<p>If a preparation method is not chosen, we have no data for this method at this laboratory.</p>		<p>If a year is not chosen, we have no data.</p>		<p>If you have your own co-location study then see footnote³. If uncertain what to do then contact the Local Air Quality Management Helpdesk at LAQMHelpdesk@uk.bureauveritas.com or 0800 0327953</p>				
Analysed By	Method	Year	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) ($\mu\text{g}/\text{m}^3$)	Automatic Monitor Mean Conc. (Cm) ($\mu\text{g}/\text{m}^3$)	Bias (B)	Tube Precision ⁴	Bias Adjustment Factor (A) (Cm/Dm)
ESG Glasgow	50% TEA in acetone	2013	KS	Marglebone Road Intercomparison	12	111	81	37.3%	G	0.73
ESG Glasgow	50% TEA in acetone	2013		Overall Factor² (1 study)				Use		0.73
<p>¹ For Casella Stanger/Bureau Veritas (NOT Bureau Veritas Labs) use Gradko 50% TEA in Acetone. For Casella Seal/GMSS/Casella CRE/Bureau Veritas Labs/Eurofins² use Environmental Scientific Groups. From 2011 for Environmental Scientific Groups use ESG Glasgow. From 2011 for Harwell Scientific Services use ESG Didcot. For Staffordshire CC SSI/Staffordshire County Analyst use Staffordshire Scientific Services. For Bodycote Health Sciences and Clyde Analytical Laboratories use Exova. For Rotherham MBC use South Yorkshire Labs. For Dundee CC use Tayside SS. For Leicester Scientific Services use Staffordshire Scientific Services. For South Yorkshire Air Quality Samplers use South Yorkshire Labs. As of January 2010 sampler body changed. As of April 2010 sampler cap changed. Lancashire County Analysts withdrew from the Field intercomparison at the end of 2010. No submissions were supplied in 2011. Walsall MBC closed in March 2011. Bristol Scientific Services closed at the end of 2011. Somerset County Council did not start the Marglebone road intercomparison until June 2012.</p>										
<p>² In this situation it would be reasonable to use data from the nearest year.</p>										
<p>³ Overall factors have been calculated using orthogonal regression to allow for uncertainty in both the automatic monitor and diffusion tube. The uncertainty of the diffusion tube has been assumed to be double that of the automatic monitor.</p>										
<p>⁴ If you have your own co-location study, please send your data to us, so that it can be included here. If this is not possible, but you wish to combine these factors with your own, select and copy the relevant data from this spreadsheet and paste them into a new one (otherwise your calculations will include hidden data). Then add your own data and calculate the bias. To obtain a new correction factor that includes your data, average the bias (B) values, expressed as a factor, i.e. -16% is -0.16. Next add 1 to this value, e.g. $-0.16 + 1.00 = 0.84$ in this example, then take the inverse to give the bias adjustment factor $1/0.84 = 1.19$. (This will not be exactly the same as the correction factor calculated using orthogonal regression as used in this spreadsheet, but will be reasonably close). To add data download a questionnaire</p>										
<p>⁵ Where an annual data set falls into two years it has been ascribed to the year in which most of the data has fallen.</p>										
<p>⁶ Tube precision is determined as follows: G = G precision - coefficient of variation (CV) of diffusion tube replicates is considered G when the CV of eight or more periods is less than 20%, and the average CV of all monitoring periods is less than 10%; P = P precision - CV of four or more periods > 20% and/or average CV > 10%; S = Single tube, therefore not applicable; na = not available.</p>										

The 2013 results have been corrected for a bias using a factor of 0.73 for ESG Glasgow (R&A website, spread sheet version 03/14).

QA/QC of diffusion tube monitoring

The Workplace Analysis Scheme for Proficiency (WASP)

The Workplace Analysis Scheme for Proficiency (WASP) is an independent analytical proficiency-testing (PT) scheme, operated by the Health and Safety Laboratory (HSL). WASP offers a number of test samples designed to test the proficiency of laboratories undertaking analysis of chemical pollutants in workplace and ambient air. One such sample is the WASP NO₂ test sample type that is distributed to participants in a quarterly basis.

WASP NO₂ PT forms an integral part of the UK NO₂ Network's QA/QC, and is a useful tool in assessing the analytical performance of laboratories supplying diffusion tubes to Local Authorities for use in the context of Local Air Quality Management (LAQM). With consent from the participating laboratories, HSL provides summary proficiency testing data to the LAQM Helpdesk for hosting on the web-pages at <http://laqm.defra.gov.uk/diffusion-tubes/qa-qc-framework.html>

The WASP scheme is operated independently by HSL.

Defra and the Devolved Administrations advise that diffusion tubes used for Local Air Quality Management should be obtained from laboratories that have demonstrated satisfactory performance in the WASP scheme.

For this reason, although WASP remains an independent proficiency-testing scheme, laboratory performance in WASP is also assessed by NPL in conjunction with separate data from the Field Intercomparison Exercise carried out at Marylebone Road, central London. The information is used to help the laboratories to identify if they have problems and may assist devising measures to improve their performance.

Eden District Council

The monitoring data for 2011 to 2013 (the period covered by this report) is subject to round 112 to round 123 is shown in Table 1 below. The ESG laboratory used by Eden District Council scored 100% for each of the periods as shown below.

Table 1: Laboratory summary performance for WASP NO₂ PT rounds 112 - 119

The following table lists those UK laboratories undertaking LAQM activities that have participated in recent HSL WASP NO₂ PT rounds and the percentage (%) of results submitted which were subsequently determined to be **satisfactory** based upon a z-score of $\leq \pm 2$ as defined above.

WASP Round	WASP R112	WASP R113	WASP R114	WASP R115	WASP R116	WASP R117	WASP R118	WASP R119
Round conducted in the period	January - March 2011	April - June 2011	July - September 2011	October - December 2011	January - March 2012	April - June 2012	July - September 2012	October - December 2012
Aberdeen Scientific Services	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Bristol City Council [5]	100 %	100 %	100 %	100 %	-	-	-	-
Cardiff Scientific Services	100 %	100 %	100 %	75 %	100 %	100 %	100 %	100 %
Edinburgh Scientific Services	100 %	100 %	100 %	0 %	100 %	100 %	100 %	100 %
Environmental Services Group, Didcot (formerly Bureau Veritas Laboratories, Glasgow and Harwell Scientifics) [1] [2]	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Exova (formerly Clyde Analytical)	100 %	100 %	0 %	75 %	0 %	0 %	100 %	25 %
Glasgow Scientific Services	100 %	100 %	100 %	100 %	100 %	50 %	100 %	100 %
Gradko International [2]	100 %	100 %	100 %	37.5 %	100 %	100 %	100 %	100 %
Kent Scientific Services	50 %	100 %	100 %	75 %	75 %	100 %	75 %	100 %
Kirklees MBC	100 %	0 %	0 %	50 %	100 %	100 %	75 %	100 %
Lambeth Scientific Services	50 %	25 %	100 %	25 %	75 %	100 %	0 %	100 %
Lancashire County Analysts [3]	75 %	-	-	-	-	-	-	-
Milton Keynes Council	100 %	75 %	100 %	100 %	100 %	100 %	75 %	100 %
Northampton Borough Council	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Somerset Scientific Services [4]	-	-	-	100 %	100 %	100 %	100 %	100 %
South Yorkshire Air Quality Samplers	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Staffordshire County Council	100 %	100 %	100 %	100 %	100 %	100 %	75 %	100 %
Tayside Scientific Services (formerly Dundee CC)	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
West Yorkshire Analytical Services	75 %	75 %	100 %	100 %	75 %	75 %	50 %	100 %

[1] Bureau Veritas laboratory and Harwell Scientific now part of ESG Group.

[2] Participant subscribes to two sets of test samples (2 x 4 test samples) in each WASP PT round.

[3] No longer involved in NO₂ diffusion tube measurements from R113.

[4] New participant from R115.

[5] No longer involved in NO₂ diffusion tube measurements from R116.

Table 1: Laboratory summary performance for WASP NO₂ PT rounds 115 - 122

The following table lists those UK laboratories undertaking LAQM activities that have participated in recent HSL WASP NO₂ PT rounds and the percentage (%) of results submitted which were subsequently determined to be **satisfactory** based upon a z-score of $\leq \pm 2$ as defined above.

WASP Round	WASP R115	WASP R116	WASP R117	WASP R118	WASP R119	WASP R120	WASP R121	WASP R122
Round conducted in the period	October - December 2011	January – March 2012	April – June 2012	July – September 2012	October – December 2012	January – March 2013	April – June 2013	July – September 2013
Aberdeen Scientific Services	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Bristol City Council [4]	100 %	-	-	-	-	-	-	-
Cardiff Scientific Services	75 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Edinburgh Scientific Services	0 %	100 %	100 %	100 %	100 %	100 %	100 %	75 %
Environmental Services Group, Didcot (formerly Bureau Veritas Laboratories, Glasgow and Harwell Scientifics) [1] [2]	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Exova (formerly Clyde Analytical)	75 %	0 %	0 %	100 %	25 %	75 %	NR [5]	NR [5]
Glasgow Scientific Services	100 %	100 %	50 %	100 %	100 %	50 %	25 %	100 %
Gradko International [2]	37.5 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Kent Scientific Services	75 %	75 %	100 %	75 %	100 %	50 %	75 %	100 %
Kirklees MBC	50 %	100 %	100 %	75 %	100 %	100 %	100 %	100 %
Lambeth Scientific Services	25 %	75 %	100 %	0 %	100 %	100 %	0 %	50 %
Milton Keynes Council	100 %	100 %	100 %	75 %	100 %	50 %	100 %	75 %
Northampton Borough Council	100 %	100 %	100 %	100 %	100 %	0 %	100 %	100 %
Somerset Scientific Services [3]	100 %	100 %	100 %	100 %	100 %	100 %	100 %	75 %
South Yorkshire Air Quality Samplers	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Staffordshire County Council	100 %	100 %	100 %	75 %	100 %	50 %	100 %	100 %
Tayside Scientific Services (formerly Dundee CC)	100 %	100 %	100 %	100 %	100 %	75 %	100 %	100 %
West Yorkshire Analytical Services	100 %	75 %	75 %	50 %	100 %	100 %	100 %	50 %

[1] Bureau Veritas laboratory and Harwell Scientific now part of ESG Group.

[2] Participant subscribes to two sets of test samples (2 x 4 test samples) in each WASP PT round.

[3] New participant from R115.

[4] No longer involved in NO₂ diffusion tube measurements from R116.

[5] Not reported before round deadline

Table 1: Laboratory summary performance for WASP NO₂ PT rounds 117 - 124

The following table lists those UK laboratories undertaking LAQM activities that have participated in recent HSL WASP NO₂ PT rounds and the percentage (%) of results submitted which were subsequently determined to be **satisfactory** based upon a z-score of $\leq \pm 2$ as defined above.

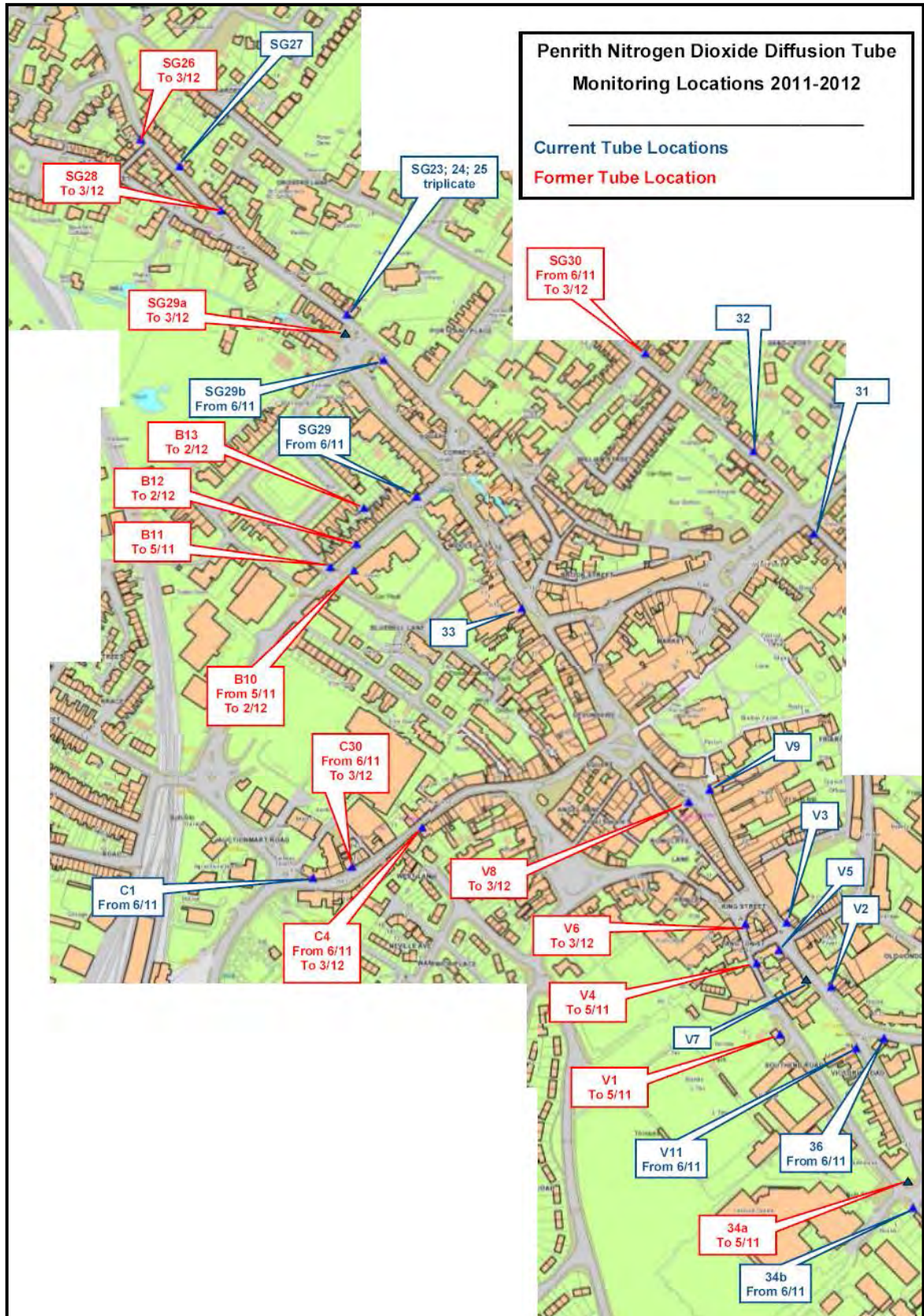
WASP Round	WASP R117	WASP R118	WASP R119	WASP R120	WASP R121	WASP R122	WASP R123	WASP R124
Round conducted in the period	April – June 2012	July – September 2012	October – December 2012	January – March 2013	April – June 2013	July – September 2013	October – December 2013	January – March 2014
Aberdeen Scientific Services	100 %	100 %	100 %	100 %	100 %	100 %	NR [2]	75 %
Cardiff Scientific Services	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Edinburgh Scientific Services	100 %	100 %	100 %	100 %	100 %	75 %	100 %	100 %
Environmental Services Group, Didcot [1]	100 %	100 %	100 %	100 %	100 %	100 %	100 %	
Exova (formerly Clyde Analytical)	0 %	100 %	25 %	75 %	NR [2]	NR [2]	NR [2]	50 %
Glasgow Scientific Services	50 %	100 %	100 %	50 %	25 %	100 %	100 %	100 %
Gradko International [1]	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Kent Scientific Services	100 %	75 %	100 %	50 %	75 %	100 %	100 %	100 %
Kirklees MBC	100 %	75 %	100 %	100 %	100 %	100 %	100 %	100 %
Lambeth Scientific Services	100 %	0 %	100 %	100 %	0 %	50 %	75 %	25 %
Milton Keynes Council	100 %	75 %	100 %	50 %	100 %	75 %	75 %	75 %
Northampton Borough Council	100 %	100 %	100 %	0 %	100 %	100 %	100 %	100 %
Somerset Scientific Services	100 %	100 %	100 %	100 %	100 %	75 %	100 %	100 %
South Yorkshire Air Quality Samplers	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Staffordshire County Council	100 %	75 %	100 %	50 %	100 %	100 %	100 %	100 %
Tayside Scientific Services (formerly Dundee CC)	100 %	100 %	100 %	75 %	100 %	100 %	100 %	100 %
West Yorkshire Analytical Services	75 %	50 %	100 %	100 %	100 %	50 %	100 %	75 %

[1] Participant subscribes to two sets of test samples (2 x 4 test samples) in each WASP PT round.

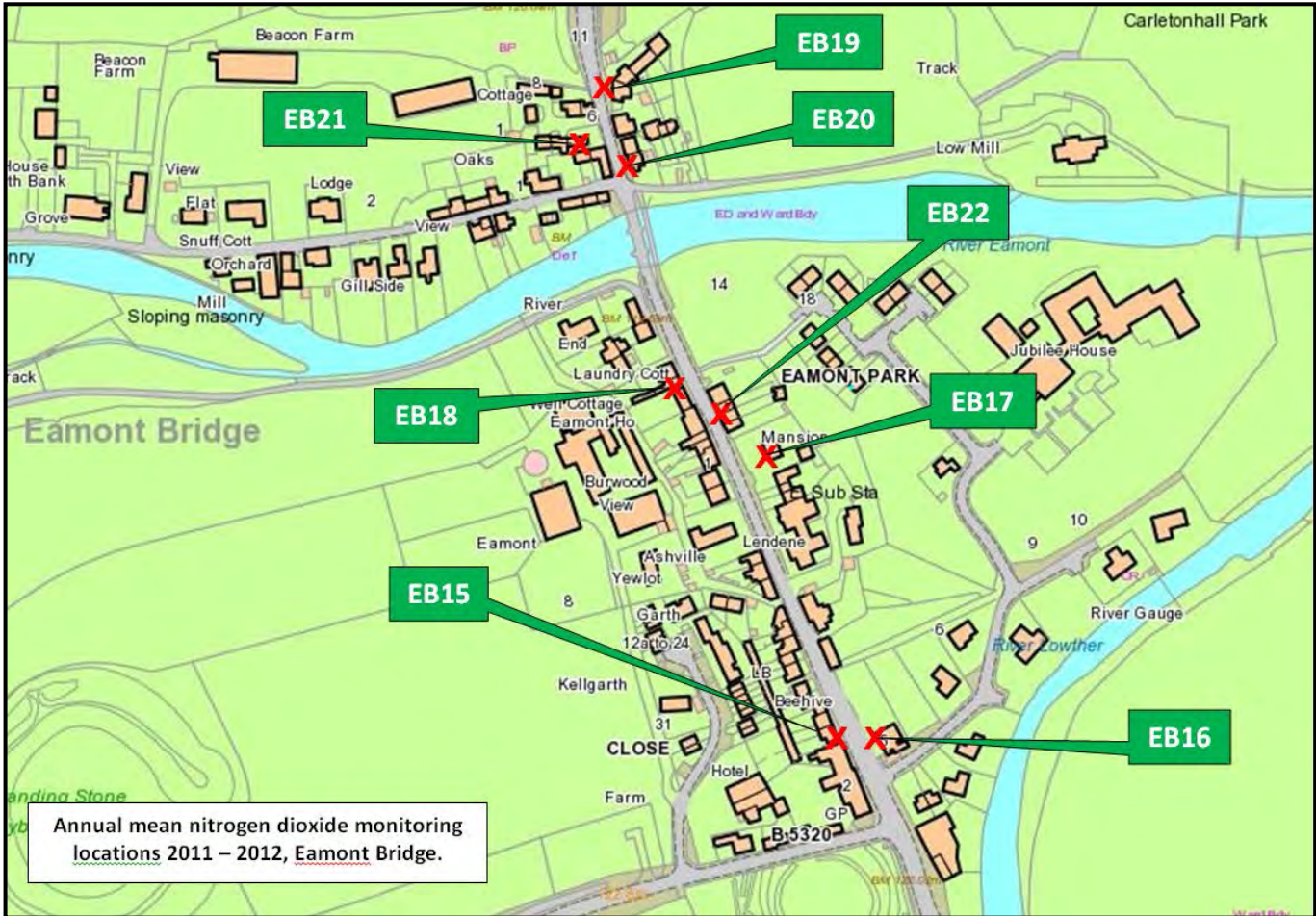
[2] NR Not reported

**Appendix B:
Nitrogen Dioxide Diffusion Tube Location in Penrith and Eamont
Bridge**

Penrith



Eamont Bridge



**Appendix C: Nitrogen Dioxide Diffusion Tube Monitoring – Full
Monthly Data**

2011

		Monthly NO2 concentrations 2011 µg/m ³												No of Data	Data Capture %	Annual Mean µg/m ³	Bias Factor Adjusted µg/m ³
TUBE	LOCATION	JAN	FEB	MAR	APRIL	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC				
NO																	
Penrith																	
V2	25 Victoria Rd		50.3	29.1	29.7	23.6		24.6	31.9	36.6	41.2	37.1	37.7	10	83	34.2	30
V3	25b King St	32.2	66.7	33.5	37.8	25.5	26.8	31.6	38.7	44.7		41.1	39.6	11	92	38.0	33
V5	Front Victoria Rd/Lanaton Cott		58.9	43.9	33.1	31.2	30.5	29.4	40.9	49.9	53.2	50.5	40.8	11	92	42.0	37
V6	4 Crown Sq		104	57.5	58.4	31		14.9	21.8	26.3	36.3	32.6		9	75	42.6	37
V7	Cafe15	58.6	51.3	31.6	33		26.8	26.3	35.7	39.6	50.8	51.4	47.7	11	92	41.2	36
V8	Front 45 King St				31	20	22.7	18.7	28.8	32.5	38.4	36.6	49	9	75	30.9	27
B12	18 Brunswick Rd		40.2	26.5	30.9	25.6	14.5	20.8	30.3	30.1	33.2	32.2	33.1	11	92	28.9	25
B13	Post adj 12 Brunswick Rd		37.1	27.9	16.1	13.9	13.3	15.6	18.1	24.3	33	27.9	26.1	11	92	23.0	20
B14	4 Brunswick Rd	63.4	55.8	43.3	37.3	39.3	22.2	25.4	38.8	45.6	45.1	49.2	48.7	12	100	42.8	37
SG23 (N)	22 Stricklandaate(N)	47.4	58.6	38.2	37.6		22.2		29.4		47.3	37	38.7	9	75	39.6	34
SG23 (S)	22 Stricklandaate(S)	56.8	65.7	41.1	29	36.4	20		31.3		42.3	45.6	40.6	10	83	40.9	36
SG23 (W)	22 Stricklandaate(W)	22.5	50.6	40.6	25.4	28.7	21.1		32.6		44.7	45.6	47.8	10	83	36.0	31
SG26	99a Scotland Rd		68.3	49.3	35.1	32.3	28.3	23	33.7	46.5	56.9	47.1	44.7	11	92	42.3	37
SG27	8 Scotland Rd		69.1	40.1	33.2	25.6	24.2	30	32.8	36.5	48.3	43.1	40.1	11	92	38.5	33
SG28	53 Scotland rd		57.1	37.5	22.9	21.9	25.7	25.1	27.7	33.2	37.6		36.2	10	83	32.5	28
32	Penrith Nursery		45.4	29.7	28.5	19.2	32	19.9	43.8	44.5	50	47	40.5	11	92	36.4	32
33	Middlegate		52	36.7	26.3	35.9	22.5	23.5	36.1	41.7	46.2	45.6	39	11	92	36.9	32
34b	Bridge Lane	48.4	48.3	34.2	29.1			13.7	17.7	28.2	33.3	29.5	21.9	10	83	30.4	26
Eamont Bridge																	
EB15	Glendale		53.3	35.4	47.1	34.8	36.9	26.1	45.4	45	43.8	43.1	40.8	11	92	41.1	36
EB16	Smithy Cottage		46.3	30.3	40.2	18.9	23.3	26	34.6	29.5	41	39.4	31.1	11	92	32.8	29
EB17	Old Mansion House		25.3	17.8	19.9	12	16.5	11.5	19.6	23.6	30	26.7	19.6	11	92	20.2	18
EB18	Cherry Cottage	64.6	51.1	44.6	40.6	41.5	37.3	28.5	48.4	53.1	51.6	48	42.4	12	100	46.0	40
EB19	8 Kempplay Rd		50.7	27.9	42.6	28.5	26.1	23.6	25	36.3	42.6	34.1	30.3	11	92	33.4	29
EB20	2 Kempplay Rd		56.1	35	54.1	30.3	33.5	27.7	32.6	40.4	51.4	42.5	32.2	11	92	39.6	34
EB21	Swallow Barn		36.1	24.2	23.3	14.7	14.7	12.9	21.1	23.4	30.8	27.4	23.4	11	92	22.9	20
EB22	Post Office Row		54.8	39.1	43.5	29	28.4	23.2	38.6	44.8	50	41.9	33.9	11	92	38.8	34
Kirby Thore																	
35	Kirby Thore	49.7	49.6	27.9	40.1	33	35.3	28.6	33	38.1	49.7	40.7	36	12	100	38.5	33

2012

TUBE	LOCATION	Monthly NO2 concentrations 2012 µg/m ³												No of Data	Data Capture %	Annual Mean µg/m ³	Bias Factor Adjusted µg/m ³	
		JAN	FEB	MAR	APRIL	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC					
NO																		
Penrith																		
C1	Railwat Tavern	47.3	42.2	47.6	38	37.2	34.2	33.7	36	45	41.9	50.3	42.5	12	100	41.3	34	
V3	25b King St	57.3	39.6	54.4		42.2	43.1	39.2	43.3	35.3	58.5	60.1	55.3	11	92	48.0	39	
V5	Front Victoria Rd/Langton Cott	50.6	42.3	53.7	35.2	37	41.2	37.2	40.5	46.7	55.9	62.1	47.7	12	100	45.8	38	
V7	Cafe15	51.6	49.7	45.8	38.5		43.4	36.5	47.3	64.2	86.7	112	68.5	11	92	58.5	48	
V9	Front 9b King St	34.7	29.1	38.3	27.5	29.8	29.5	26	26.4	32.4	42.9	49.5	34.3	12	100	33.4	27	
V11	RAFA	43.9	38.6	41.7	25.8	30.2	32.3	29.5	34.3	34.6	43.6	52.8	43	12	100	37.5	31	
SG23	22 Stricklandgate(N)	40.2		41.5	36.7	38	33.8	31.6		43.7	50.9	62.9	34.4	10	83	41.4	34	
SG24	22 Stricklandgate(S)	48.5		42.9	31.2	36.5	34.6	30.5		38.6	53.4	56.6	42.2	10	83	41.5	34	
SG25	22 Stricklandgate(W)	48.7		45.7	37.2	37	34.3	33.2		41	52.5	56.6	48.2	10	83	43.4	36	
SG27	8 Scotland Rd	53.4	36.7	50.7	40.5	40.7	41.4	36.4	39.8	40	54	55.4	50.5	12	100	45.0	37	
33	Middlegate	47.9	34.3	44.3			37.2	33.9	37.3		50.9	59.7	47.1	9	75	43.6	36	
36	Roper ST	53.3	38.8	45.5	26.5	38.9	35.2	36.6	28.5	39.2	53.2	59.8	43.8	12	100	41.6	34	
Eamont Bridge																		
B14	4 Brunswick Rd	45.9	51.1	57.7	41	32.2	41.5	37.5	36.9	51.3	53.6	58.6	50	12	100	46.4	38	
EB15	Glendale	51.2	41.8	51.7	38	36	37.1	44.4	45.3	44.6	44.2	62.5	46.5	12	100	45.3	37	
EB18	Cherry Cottage	55.4	49.3	54	45.4	39.1	42.4	48.4	51.6	49.7	55.5	64.4	53.8	12	100	50.8	42	
EB20	2 Kemplay Rd	48	37.7	41.6	47.2	47.4	40.8	39.7	42.2	42.3	57.2	59.3	52.4	12	100	46.3	38	
Kirby Thore																		
35	Kirby Thore	45.3	38.7	43.5	39.2	31.7	39.9	32.6	40.3	36.5	44.8	56.2	40.8	12	100	40.8	33	

2013

		Monthly NO2 concentrations 2013 $\mu\text{g}/\text{m}^3$															
TUBE	LOCATION	JAN	FEB	MAR	APRIL	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC	No of Data	Data Capture %	Annual Mean $\mu\text{g}/\text{m}^3$	Bias Factor Adjusted $\mu\text{g}/\text{m}^3$
NO																	
Penrith																	
C1	Railway Tavern	37.1	39.8	39.4	32.6	35.6	31.6	29.8		39.0	48.6	52.8	36.8	11	92	38.5	28
V3	25b King St	45.2	58.9	48.5	35.8	41.6	33.4	38.7	36.6	47.8	50.6	59.8	39.9	12	100	44.7	33
V5	Front Victoria Rd/Langton Cott	45.8	54.1	37.1	34.9	38.3	36.6	43.4	41.7	45.7	49.6	51.4	46.1	12	100	43.7	32
V7	Cafe15	45.1	49.1	48.4	37.6	41	33.9	47.2	49.4	44.5	58.0	56.2	45.6	12	100	46.3	34
V9	Front 9b King St	30.3	37	34.5	23.4	25.4	22.8	23.7	25.5	32.0	35.7	43.0	31.0	12	100	30.4	22
V11	RAFA	40.3	39.3	29.2	33.0	28.9	24.9	32.8	32.9	32.6	40.6	41.2	40.4	12	100	34.7	25
SG23	22 Stricklandgate(N)	41	48.9	31.2	27.5	31.4	27.7	36.0	34.5				36.5	9	75	35.0	26
SG24	22 Stricklandgate(S)	43.2	45.6	35.5	28.3	32.3	28.9	30.3	31.3				35.9	9	75	34.6	25
SG25	22 Stricklandgate(W)	33.1	38.5	40.4	33.0	40.1	30	32.4					39.4	8	67	35.9	26
SG27	8 Scotland Rd	52.1	57.8	42.5	36.2	37.7	29.5	35.3	33.6	42.9	49.7	57.6	36.7	12	100	42.6	31
33	Middlegate	47.5	44.2	27.6	34.2	33.9			36.4	7.8				7	58	33.1	24
36	Roper ST	41	43.4	32.5	32.5	32.5	27.9	30.5	31.2	42.9	41.1	50.8	38.5	12	100	37.1	27
B14	4 Brunswick Rd	51	48.2	31.6	41.7	43.4	39.7	39.9	42.1	41.1	49.1	54.4	40.4	12	100	43.6	32
31	3 Benson Row	51	49.1	29.3	26.9	34.5	31.6	32.5	32.8	37.7	39.2	50.1	38.2	12	100	37.7	28
32	Opp Penrith Nursery		51.2	40.8	41.1	39.7	40		42.0	43.7	50.5	55.4	47.5	10	83	45.2	33
SG29	The Royal	43.2	45.1	28.5	38.3	33.2	33.3	35.6	37.5	40.5	45.4	53.6	30.3	12	100	38.7	28
C4	Castlegate	56.8	34	55.1			44.7	53.4	51.2	61.4	56.4		48.3	9	75	51.3	37
C30	40 Castlegate		59.3	42.0		44.5	38.1	36.5	45.5	55.5	54.2	65.6	37.2	10	83	47.8	35
Eamont Bridge																	
EB15	Glendale	47.8	47.3	33.9		38.3	41.5	45.7	46.5	43.6	45.0	56.7	38.0	11	92	44.0	32
EB18	Cherry Cottage	53.3	50.1	36.8	44.5	48.7	43	46.2	51.5	43.0	51.6	61.9	43.4	12	100	47.8	35
EB20	2 Kempplay Rd	43	57.5	48.4	33.6	34.5	36.9	39.3	37.7	43.7	44.7	57.2	29.8	12	100	42.2	31
Kirby Thore																	
35	Kirby Thore	44.9	44.6	28.4	31.6	42	36.2	33.9	43.7	43.1	46.4	51.2	33.1	12	100	39.9	29

Appendix D: Pollution Prevention & Control Act 1999

Operating Installations as at 31 Dec 2013

Part A2 Installations: Responsibility of Local Authority

Operator	Reference Number	Date of Application	Date of Permit
Omega Proteins Ltd Wildriggs Penrith	EPA39		20/04/06 HIGH

Part B Installations: Responsibility of Local Authority

Operator	Reference Number	Date of Application	Date of Permit	Risk Rating
Timber Installations				
1	Jeldwen (Penrith UK) Ltd Mardale Road Penrith Industrial Estate Penrith Cumbria	EPA12	30/09/91	24/09/92 MEDIUM
2	A W Jenkinson Forest Products Clifton Moor Clifton Cumbria	EPA84	18/04/00	15/06/00 LOW
Animal Feed Manufacturers				
3	J Stobart & Sons Limited Newlands Mill Hesket Newmarket Wigton Cumbria	EPA40	29/09/92	22/07/93 LOW

Operator	Reference Number	Date of Application	Date of Permit Risk Rating	
Cement and Lime Manufacture				
4	Hanson Limited (Premix Plant) The Brickworks Station Yard Blencowe Penrith Cumbria	EPA19	16/03/92	26/11/92 LOW
5	PD Bricks Ltd The Brickworks Blencowe Penrith Cumbria	EPA22	24/03/92	26/11/92 LOW
6	Hope Construction [Bulk Cement] Gilwilly Industrial Estate Penrith Cumbria	EPA29	25/03/92	25/02/93 LOW
7	Lakeland Concrete Products Flusco House Penrith Cumbria	EPA43	29/07/93	07/10/93 MEDIUM
8	L Hoist UK Ltd Hartley Quarry Hartley Kirkby Stephen CA17 4JJ	EPA55	30/04/97	01/07/97 LOW
9	Russell Hogg and Sons Old Depot Crackenthorpe Appleby Cumbria	EPA56	08/12/97	13/03/97 LOW

Operator	Reference Number	Date of Application	Date of Permit Risk Rating
Mineral Process			
10	Cemex- Hartley Quarry Kirkby Stephen Cumbria	EPA18	19/02/92 Mothballed 2009/10 25/02/93 LOW
11	Hanson Aggregates Shap Beck Quarry Shap Penrith Cumbria	EPA24	11/03/92 25/02/93 LOW
12	Cemex Shap Blue Quarry Shap Penrith Cumbria	EPA32	11/03/92 25/02/93 LOW
13	Sherburn Stone Company Ltd Helbeck Quarry Brough Cumbria	EPA33	30/03/92 25/02/93 MEDIUM
Iron and Steel Process			
14	Bonds Precision Casting Ltd Potters Loaning Alston Cumbria	EPA23	25/03/92 25/02/93 MEDIUM
Carbon Manufacture Process			
15	Lakeland Carbons Limited Flusco Penrith Cumbria	EPA44	10/01/94 24/02/94 LOW

Operator		Reference Number	Date of Application	Date of Permit Risk Rating
Mobile Crushers/Screeners				
16	Metcalfe Plant Hire Ltd Gilwilly Road Gilwilly Industrial Estate Penrith CA11 9BL	EPA79 Extec Robotrac Screener 5872	13/10/99	17/10/99 LOW
17	Metcalfe Plant Hire Ltd Gilwilly Road Gilwilly Industrial Estate Penrith Cumbria	EPA94 Extec C-12 Crusher 9401	21/04/05	09/08/05 LOW
18	Metcalfe Plant Hire Ltd Gilwilly Road Gilwilly Industrial Estate Penrith CA11 9BL	EPA98 Maxtrac 1000 Cone Crusher 100679FC	21/06/10	17/11/10 LOW
19	Metcalfe Plant Hire Ltd Gilwilly Road Gilwilly Industrial Estate Penrith CA11 9BL	EPA99 Warrior Screener 140000122JD GA20353	21/06/10	25/11/10 LOW
Waste Oil Burners				
20	Armstrong & Fleming Limited Roper Street Penrith CA11 8HT	EPA1	30/05/91	26/11/92 LOW
21	Firwood Garage Winskill Penrith CA10 1PA	EPA3	20/09/91	27/05/93 LOW
22	Potter Brothers Garage Rowgate Garage Kirkby Stephen CA17 4SR	EPA5	27/09/91	27/05/93 LOW

Operator		Reference Number	Date of Application	Date of Permit Risk Rating
23	New Rent Workshop Hutton in the Forest Penrith Cumbria	EPA9	09/10/91	27/05/93 LOW
24	Bridge Street Garage Appleby Cumbria	EPA13	24/10/91	27/05/93 LOW
25	J S & M G Bowness Bridge Garage Bampton Penrith Cumbria	EPA35	09/10/92	07/10/93 LOW
26	Braithwaite Garage Newbiggin Stainton Penrith Cumbria	EPA45	03/02/94	26/05/94 LOW
27	Neil Bousfield Motors Cromwell Road Penrith Cumbria	EPA81	20/01/00	07/02/00 LOW
28	Chambers Garage Tirril Penrith Cumbria	EPA88	02/04/02	30/06/02 LOW
29	Thompsons of Penrith Ltd The Garage Mardale Road Penrith Industrial Estate Penrith Cumbria	EPA89	24/02/04	17/03/04 LOW

Operator		Reference Number	Date of Application	Date of Permit Risk Rating
30	Mr C Griffiths Manor House Garage Ltd Manor House Garage Plumpton Penrith Cumbria	EPA91	07/07/04	14/07/04 LOW
31	Laces The Garage Kirkoswald Penrith CA10 1DG	EPA95	14/08/06	05/09/06 LOW
32	Metcalfe Plant Hire Ltd Gilwilly Road Gilwilly Industrial Estate Penrith CA11 9BL	EPR01	23/03/11	23/03/11 LOW
33	Johnstone Garage Kirkby Stephen Cumbria	EPA61	06/05/98	17/07/98 LOW
34	KTEE Ltd Kirkby Thore Penrith Cumbria	EPA62	08/06/98	20/08/98 LOW
35	Hills Corby Hill Scotland Road Penrith Cumbria	EPA63	08/06/98	25/08/98 LOW
36	M6 Diesel Services Junction 38 Tebay Penrith Cumbria	EPA64	12/06/98	30/07/98 LOW

Operator		Reference Number	Date of Application	Date of Permit Risk Rating
37	Westmorland Motorway Services North-Bound Tebay Service Area Orton Penrith	EPA65	01/07/98	11/08/98 LOW PVR I & II
38	Davidsons Garage Penrith Ltd Scotland Road Penrith Cumbria	EPA67	29/10/98	16/12/98 LOW
39	Wm Morrison Supermarkets Plc Brunswick Road Penrith Cumbria	EPA68	02/11/98	16/11/98 LOW PVR I & II
40	Shell UK Bridge Lane Penrith Cumbria	EPA69	05/11/98	23/11/98 MEDIUM PVR I & II
41	Moto Services (North) Southwaite Filling Station M6 Penrith Cumbria	EPA70	07/12/98	14/12/98 LOW
42	Euro Garages Ltd (Esso) Bridge Lane Service Station Penrith Cumbria	EPA71	27/11/98	06/10/98 LOW
43	Mark Johns Motors Edensyde Garage Kirkby Stephen Cumbria	EPA72	18/12/99	18/01/00 LOW

Operator		Reference Number	Date of Application	Date of Permit Risk Rating
44	Ullswater Body Repairs Ltd Ullswater Road Penrith Cumbria	EPA73	18/12/98	19/02/99 MEDIUM
45	Moto Services (South) Southwaite Filling Station M6 Penrith Cumbria	EPA74	07/12/98	14/12/98 LOW
46	Westmorland Services Southbound Tebay Service Area Orton Penrith	EPA75	26/01/99	04/02/99 LOW
47	Hopes Garage Meadow Court Langwathby Penrith Cumbria	EPA80	22/12/99	18/01/00 LOW
48	Westmorland Motorway Services Ltd Rheged Filling Station Redhills Penrith Cumbria	EPA83	28/02/98	01/06/00 LOW PVR I & II
49	GEM Alston Town Foot Alston	EPR003	17/01/12	19/03/12 LOW PVR I & II

Appendix E

**Eden District Council Penrith
and
Eamont Bridge**

LAQM NO2 Detailed Assessment

Bureau Veritas June 2013



***Eden District Council
Penrith and Eamont Bridge
LAQM NO2 Detailed Assessment***

June 2013



Move Forward with Confidence





DOCUMENT CONTROL SHEET

Issue/Revision	Issue 1	Issue 2	Issue 3
Remarks	Draft for Comment	Draft for Comment	Final
Date	April 2013	April 2013	June 2013
Submitted to	Steven Holmes	Steven Holmes	Steven Holmes
Prepared by	James Bellinger	James Bellinger	James Bellinger
Signature			
Approved by	Lakhu Luhana	Lakhu Luhana	Ben Warren
Signature			
Project number	AGGX7242885	AGGX7242885	AGGX7242885
File reference	2858	2858	2858

Disclaimer

This Report was completed by Bureau Veritas on the basis of a defined programme of work and terms and conditions agreed with the Client. Bureau Veritas' confirms that in preparing this Report it has exercised all reasonable skill and care taking into account the project objectives, the agreed scope of works, prevailing site conditions and the degree of manpower and resources allocated to the project.

Bureau Veritas accepts no responsibility to any parties whatsoever, following the issue of the Report, for any matters arising outside the agreed scope of the works.

This Report is issued in confidence to the Client and Bureau Veritas has no responsibility to any third parties to whom this Report may be circulated, in part or in full, and any such parties rely on the contents of the report solely at their own risk.

Unless specifically assigned or transferred within the terms of the agreement, the consultant asserts and retains all Copyright, and other Intellectual Property Rights, in and over the Report and its contents.

Any questions or matters arising from this Report should be addressed in the first instance to the Project Manager.



Move Forward with Confidence

Bureau Veritas UK Limited
 Brandon House
 180 Borough High Street
 SE1 1LB

Telephone: +44 (0) 207 6610 0700
 Fax: +44 (0) 207 6610 0741
 Registered in England 1758622
 www.bureauveritas.co.uk

Registered Office
 Brandon House
 180 Borough High Street
 SE1 1LB

This page is left blank intentionally



TABLE OF CONTENTS

Executive Summary	ii
1 Introduction	1
1.1 Project Background	1
1.2 Legislative Background	1
1.3 Local Air Quality Management (LAQM) Review and Assessment.....	2
1.4 Summary of Review and Assessment Undertaken by Eden District Council.....	3
1.5 Scope and Methodology of the Detailed Assessment	4
2 Baseline Information	5
2.1 Traffic data	5
2.2 Air Quality Monitoring Data	6
2.2.1 Automatic Monitoring Data.....	6
2.2.2 Nitrogen Dioxide Diffusion Tube Data	6
2.2.3 Background Concentrations	11
3 Dispersion Modelling Methodology	12
4 Results	13
4.1 Model Verification and Adjustment	13
4.2 New Development in Penrith and Eamont Bridge.....	16
4.3 Modelled NO ₂ Concentrations	18
4.4 Population Exposure	23
5 Conclusions and Recommendations	24



LIST OF FIGURES

Figure 1 - NO₂ Monitoring Sites and Modelled Roads in Penrith 8
Figure 2 - NO₂ Monitoring Sites and Modelled Roads in Eamont Bridge 9
Figure 3 - Shap 2012 Hourly Sequential Meteorological data 12
Figure 4 Junction with Victoria Road and Roper Street 17
Figure 5 Junction with Victoria Road and Southend Road 17

LIST OF TABLES

Table 1 - Air Quality Objectives included in the Regulations for LAQM In England 2
Table 2 - Traffic Data for Penrith and Eamont Bridge 5
Table 3 - NO₂ Passive Monitoring in Penrith and Eamont Bridge 6
Table 4 - Results of Nitrogen Dioxide Diffusion Tubes in Study Area 10
Table 5 - Background Concentrations 2012 11
Table 6 - Model Verification Results at Penrith High Street 14
Table 7 - Model Verification Results at Penrith Main Routes 14
Table 8 - Model Verification Results at Penrith Back Streets 15
Table 9 - Model Verification Results at Penrith street canyons with a gradient 15
Table 10 - Model Verification Results at Eamont Bridge 16
Table 11 - Modelled results at Specific Receptors 18

Executive Summary

Part IV of the Environment Act 1995 places a statutory duty on local authorities to review and assess the air quality within their area and take account of Government guidance when undertaking such work.

This report is a Detailed Assessment of nitrogen dioxide (NO₂) which covers Penrith town centre and the A6 through Eamont Bridge. Eden District Council commissioned the report following measured exceedences of the annual mean objective for NO₂ identified in the 2011 Annual Progress Report.

The Detailed Assessment has been undertaken in accordance with Defra's Technical Guidance LAQM.TG (09) methodologies, based on advanced atmospheric dispersion modelling of NO₂ traffic emissions, relying on updated emission factors and background pollutant concentrations released by Defra in 2013, and the latest monitoring, traffic and meteorological data for the year 2012.

Due to measured and modelled exceedences of the air quality objectives for NO₂ at the façade of properties both in Penrith and Eamont Bridge it is recommended the council declare AQMAs and carry out the following recommendations:

- Declare an AQMA from Corn Market all the way along Castlegate up to the roundabout on Cromwell Road.
- Install extra monitoring in that area at the façade of properties in the worst case locations along Castlegate.
- Declare an AQMA along Victoria Road (A6) from the junction with Southend Road to 60m north of the junction with Langton Street.
- Install new monitoring at the façade of properties along Victoria Road between Southend Road and Roper Street. Install monitoring at the façade of properties along Roper Street.
- Install further monitoring along Scotland Road and continue to monitor as SG27.
- Install further monitoring at relevant locations along Meeting House Lane, Benson Row and Friargate.
- Declare an AQMA along the A6 though Eamont Bridge from the start of the village to the north to The Beehive Inn.
- Install further monitoring in Eamont Bridge at site of relevant exposure.

1 Introduction

1.1 Project Background

Part IV of the Environment Act 1995 places a statutory duty on local authorities to review and assess the air quality within their area and take account of Government guidance when undertaking such work.

This report is a Detailed Assessment (DA) of nitrogen dioxide (NO₂) which covers Penrith town centre and the A6 through Eamont Bridge. Eden District Council commissioned the DA following measured exceedences of the annual mean objective for NO₂ identified in the 2011 Annual Progress Report.

This report takes account of detailed dispersion modelling undertaken by WYG Environment in 2011 for the planning application for a new Sainsbury's supermarket in Penrith.

This report will inform the Council for any need to declare an Air Quality Management Area (AQMA) in either Penrith town centre or in Eamont Bridge area. This report will focus on NO₂, as PM₁₀ has previously been identified being below the objective levels in both study areas.

1.2 Legislative Background

The significance of existing and future pollutant levels are assessed in relation to the national air quality standards and objectives, established by Government. The revised Air Quality Strategy (AQS)¹ for the UK (released in July 2007) provides the over-arching strategic framework for air quality in the UK and contains national air quality standards and objectives established by the UK Government and devolved administrations to protect human health. The air quality objectives incorporated in the AQS and the UK Legislation are derived from the Limit Values prescribed in the EU Directives transposed into national legislation by member states.

The CAFE (Clean Air for Europe) programme was initiated in the late 1990s to draw together previous directives into a single EU Directive on air quality. The Directive 2008/50/EC² introduces new obligatory standards for PM_{2.5} for Government but places no statutory duty on local Government to work towards achievement.

The Air Quality Standards (England) Regulations 2010³ came into force on 11th June 2010 in order to align and bring together in one statutory instrument the Government's obligations to fulfil the requirements of the CAFE Directive.

The objectives for ten pollutants (benzene, 1,3-butadiene, carbon monoxide, lead, nitrogen dioxide (NO₂), sulphur dioxide (SO₂), particulates - PM₁₀ and PM_{2.5}, ozone and Polycyclic Aromatic Hydrocarbons (PAHs)) have been prescribed within the Air Quality Strategy based on the Air Quality Standards (England) Regulations 2010.

This assessment focuses on those pollutants included in Air Quality Regulations for the purpose of Local Air Quality Management⁴, in respect of pollutant sources affecting air quality within the Council's administrative area. The objectives set out in the AQS for these pollutants are presented in the table below.

The locations where the AQS objectives apply are defined in the AQS as locations outside buildings or other natural or man-made structures above or below ground where members of the public are regularly present and might reasonably be expected to be exposed [to pollutant concentrations] over

¹ The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (2007), Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland

² Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe

³ The Air Quality Standards Regulations 2010, Statutory Instrument No 1001, The Stationary Office Limited

⁴ The Air Quality (England) (Amendments) Regulations 2002 (Statutory Instrument 3043)

the relevant averaging period of the AQS objective. Typically these include residential properties and schools/care homes for longer period (i.e. annual mean) pollutant objectives and high streets for short-term (i.e. 1-hour) pollutant objectives.

Table 1 - Air Quality Objectives included in the Regulations for LAQM In England

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	16.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2003
	5.00 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2010
1,3-Butadiene	2.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2003
Carbon monoxide	10.0 mg/m^3	Running 8-hour mean	31.12.2003
Lead	0.5 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2004
	0.25 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2008
Nitrogen dioxide	200 $\mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2005
Particles (PM ₁₀) (gravimetric)	50 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2004
Sulphurdioxide	350 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

1.3 Local Air Quality Management (LAQM) Review and Assessment

As established by the Environment Act 1995 Part IV, all local authorities in the UK are under a statutory duty to undertake an air quality assessment within their area and determine whether they are likely to meet the air quality objectives set down by Government for a number of pollutants. The process of review and assessment of air quality undertaken by local authorities is set out under the Local Air Quality Management (LAQM) regime and involves a phased three yearly assessment of local air quality. Where the results of the review and assessment process highlight that problems in the attainment of health-based objectives for air quality will arise, the authority is required to declare an Air Quality Management Area (AQMA) – a geographic area defined by high levels of pollution and exceedences of AQS objectives.

The LAQM regime was first set down in the 1997 National Air Quality Strategy (AQS)⁵ and introduced the idea of local authority 'Review and Assessment'. The Government subsequently published policy and technical guidance related to the review and assessment processes in 1998. This guidance has since been reviewed and the latest documents include Policy Guidance (LAQM.PG (09))⁶ and Technical Guidance (LAQM.TG (09))⁷ released in February 2009 (updated in 2012) in anticipation of the Fourth Round of Review and Assessment. The guidance lays down a progressive, but continuous, framework for the local authorities to carry out their statutory duties to monitor, assess and review air quality in their area and produce action plans to meet the air quality objectives.

1.4 Summary of Review and Assessment Undertaken by Eden District Council

Eden District Council have been carrying out monitoring of air quality in the local authority area since 1996. A summary of the past rounds of review and assessment can be found in the table below.

Round	Date(s)	Summary
1	1998-2001	Concluded that all AQOs would be met for all pollutants. No AQMAs were declared.
2	2003	USA concluded that it was not necessary to declare any AQMAs within the District.
	2004-2005	The 2004 APR identified a potential exceedence of the NO ₂ annual mean along Brunswick Road, Penrith. Recommended to relocate monitoring to the façade of the closest property. The 2005 APR indicated a need to carry out a Detailed Assessment on Brunswick Road. No AQMAs were declared.
3	2006	USA concluded that AQOs would be met for all pollutants except for NO ₂ along Brunswick Road, however, the decision to carry out the Detailed Assessment was put on hold until further monitoring data could be gathered.
	2007-2008	Progress Report concluded that AQOs would be met for all pollutants at relevant receptor locations. No Detailed Assessment for NO ₂ along Brunswick Road was carried out due to a fall in measured concentrations below the objective levels.
4	2009	USA concluded that all AQOs would be met for all pollutants.
5	2010-2011	The 2010 APR concluded that all AQOs would be met for all pollutants. The 2011 APR concluded that exceedences of the NO ₂ annual mean objective were recorded at five locations in the borough. A detailed assessment was recommended.

⁵ DoE, 1997, 'The United Kingdom National Air Quality Strategy', The Stationary Office

⁶ Policy Guidance LAQM.PG(09) (2009), Part IV of the Environment Act 1995, Local Air Quality Management, Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland, The Stationery Office

⁷ Technical Guidance LAQM.TG (09) (2009), Part IV of the Environment Act 1995, Local Air Quality Management, Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland, The Stationery Office



Round	Date(s)	Summary
6	2012	The 2012 USA is currently being completed by the local authority.

1.5 Scope and Methodology of the Detailed Assessment

The purpose of the Detailed Assessment is to provide the Local Authority with an opportunity to supplement the information they have gathered in their earlier Review and Assessment work and more accurately assess the impact of pollution sources on local receptors at identified hotspots through dispersion modelling. Dispersion modelling can be used to predict concentrations over a wider area than can be monitored. It is important to ensure, as far as possible, that the results of modelling reflect the results from local monitoring sites across the assessment area and allow comparison of pollutant concentrations against the AQS objectives. This Assessment will identify with reasonable certainty whether or not pollutant concentrations are likely to exceed the AQS objectives and, if so, define the extent and magnitude of the exceedences.

This assessment will take account findings of detailed dispersion modelling undertaken by WYG Environment as part of a planning application for a new Sainsbury's supermarket in Penrith located where the football stadium close to Victoria Road stood.

The dispersion modelling for the Assessment was carried out using the Cambridge Environmental Research Consultants (CERC) ADMS-Roads (v3.1) atmospheric dispersion model. Results from nitrogen dioxide monitoring sites located in the assessment area were used to verify and adjust the modelled results. Concentrations of oxides of nitrogen (NO_x) and NO₂ were predicted for the base year 2012.

The dispersion modelling was undertaken in accordance with the methodologies provided in the Technical Guidance (LAQM.TG (09)) for Detailed Assessments and amended tools released in 2013 by Defra, including the new Emission Factor Toolkit (EFT v5.2c), background pollutant maps and NO_x/NO₂ converter.

2 Baseline Information

2.1 Traffic data

Traffic data for the Detailed Assessment was provided by Cumbria County Council's, Highways and Transportation team.

As the traffic counts taken did not include a detailed breakdown of the traffic fleet, only percentage of heavy goods vehicles (HDV) was available for this assessment.

The average speed of vehicles was assumed to be the speed limit, although speed was reduced near to junctions and along narrow streets to account for stop / start emissions conditions.

In order to calculate NO_x exhaust emissions, traffic data were combined with the latest road-traffic emission factors. The most recent version of the Emission Factors Toolkit (EFT v5.2c)⁸ released in 2013 was used. The new EFT includes updated vehicle fleet information and emission factors for NO_x based on COPERT4 (v8.1).

The traffic data used in this assessment is summarised in Table 2.

Maps and available geographic tools, have been used to identify if any street canyons existing in the modelled area so they could be incorporated into the modelling to account for reduced dispersion. Many of the roads in Penrith have been modelled as street canyons due to the narrow roads with buildings along either side. The A6 through Eamont Bridge also contains sections of street canyon. LAQM TG(09) provides guidance on modelling roads which have a steep gradient as the impact of HDV vehicles traveling up and down a slope will be different to their impact on a flat road. Roads with an increased gradient have been identified as Castlegate, Brunswick Road and Scotland Road. The gradient of these roads has been taken into account in the modelling.

Table 2 - Traffic Data for Penrith and Eamont Bridge

Road	Traffic flow (AADT)	HDV%
A6 King Street	6235	6.1%
Roper Street	3637	6.4%
A6 Victoria Road	11314	4.4%
A6 Bridge Lane	11140	5.1%
A592 Corn Market	7141	4.9%
A592 Castlegate	7803	4.8%
A592 Brunswick Road	13292	1.6%
A6 Duke Street	9546	1.4%
A6 Stricklandgate	11203	1.9%
Portland Place	4855	0.0%
Meeting House Lane	4845	0.2%
A6 Scotland Road	7794	2.9%
Benson Row	5060	0.5%
Friargate	6625	3.9%
Old London Road	2282	7.6%
Langton Street	4259	2.4%
A6 Middlegate	6796	2.2%
A6 Kemplay Bank	8433	7.2%

⁸ Emission Factors Toolkit v5.2c – Available at <http://laqm.defra.gov.uk/review-and-assessment/tools/emissions.html>

2.2 Air Quality Monitoring Data

2.2.1 Automatic Monitoring Data

Currently no automatic monitoring is undertaken by the council.

2.2.2 Nitrogen Dioxide Diffusion Tube Data

Monitoring of NO₂ is undertaken using passive diffusion tubes at a number of sites throughout the county. Prior to 2011 monitoring in Penrith and Eamont Bridge was carried out using eleven diffusion tubes. Poor data capture at a number of these sites reduced reliability of annual mean concentrations. However results from these eleven sites indicated potential exceedences of the annual mean objective for NO₂ in Penrith (Victoria Road, Brunswick Road and Stricklandgate), Eamont Bridge and in Kirby Thore.

In 2011 as a response to the potential exceedences recorded in 2010 a number of additional monitoring locations were added in Penrith and Eamont Bridge. The total number of monitoring points in 2011 was forty. The number of monitoring locations was reduced in 2012 in order to focus on high pollution areas identified in 2011. This assessment uses the diffusion tube data from 2012 to verify the modelled concentrations. The diffusion tube data in the study area is presented in Table 3.

Table 3 – NO₂ Passive Monitoring in Penrith and Eamont Bridge

Site Name	Location	OS Grid Ref		Pollutants Monitored	Distance to kerb of nearest road (m)
Penrith Town Centre Tubes					
C1	Tavern Flats	351298	530006	NO ₂	1
V3	25b King Street	351720	529966	NO ₂	2
V5	Front Victoria road/ Langton Cottage	351713	529941	NO ₂	1
V7	Café 15	351733	528918	NO ₂	2.5
V9	Front 9b King Street	351651	530085	NO ₂	2
V11	Victoria Road RAFA	351785	529852	NO ₂	1
B14	4 Brunswick Road	351394	530344	NO ₂	2
SG23	22 Stricklandgate (N)	351321	530516	NO ₂	2
SG24	22 Stricklandgate (S)	351321	530516	NO ₂	2
SG25	22 Stricklandgate (W)	351321	530516	NO ₂	2
SG27	8 Scotland Road	351171	530649	NO ₂	1
SG29	Front-The Royal (Town Hall)	351404	530426	NO ₂	2



Site Name	Location	OS Grid Ref		Pollutants Monitored	Distance to kerb of nearest road (m)
31	3 Benson Row	351741	530313	NO ₂	1
32	Opposite Penrith Nursery	351687	530387	NO ₂	1
33	Middlegate	351485	530248	NO ₂	7
36	Roper Street	351810	529861	NO ₂	1
C4	Castlegate	351396	530051	NO ₂	1
Eamont Bridge Tubes					
EB15	Glendale	352329	528475	NO ₂	1
EB18	Cherry Cottage	352246	528667	NO ₂	2.5
EB20	2 Kemplay Road	352213	528797	NO ₂	2

The location of all monitoring sites within the modelled area is illustrated in Figure 1 Figure 2 below, together with roads included in the dispersion model.



Figure 1 – NO₂ Monitoring Sites and Modelled Roads in Penrith

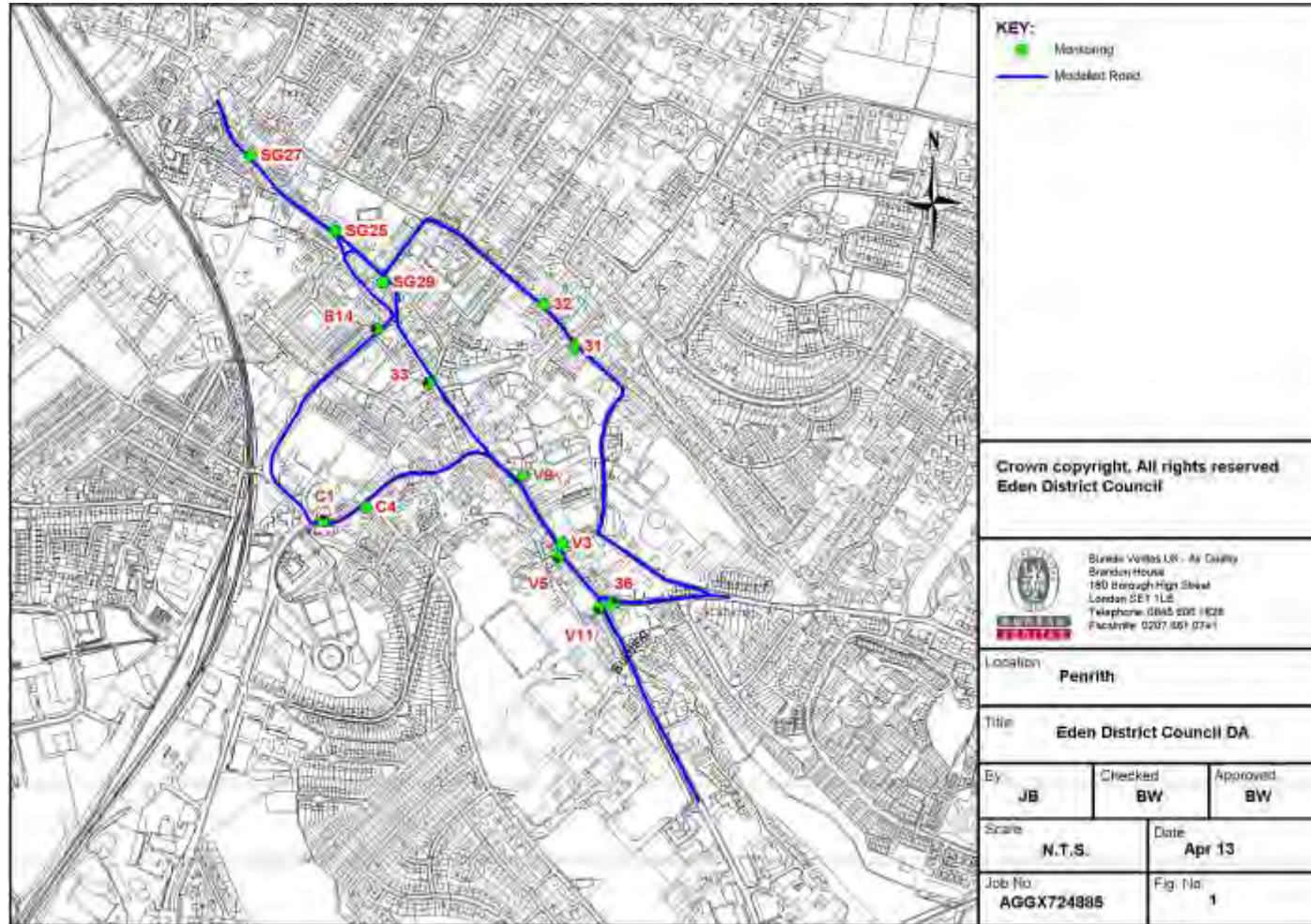
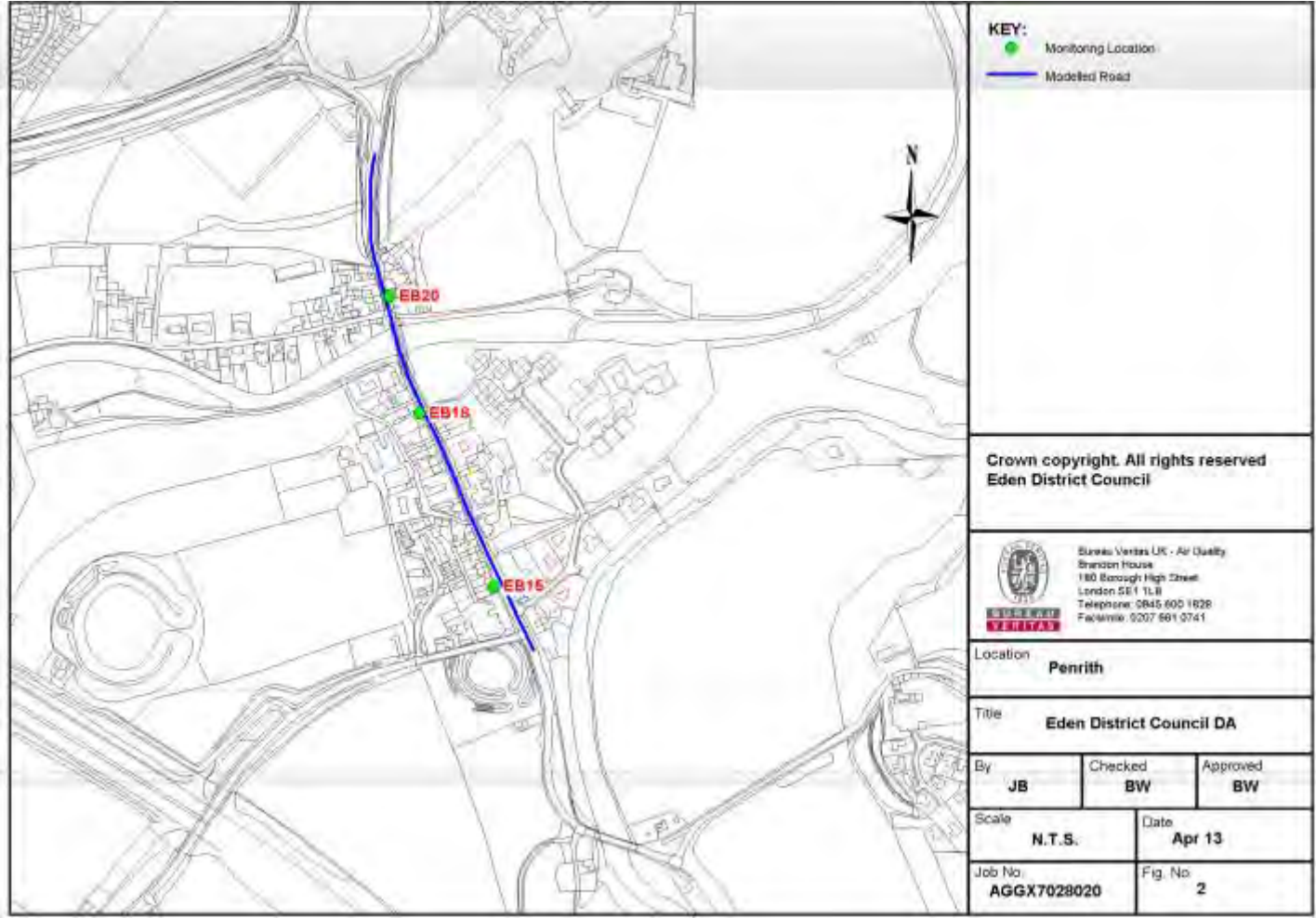




Figure 2 – NO₂ Monitoring Sites and Modelled Roads in Eamont Bridge



Where possible verification has been carried out using tubes which recorded over nine months of data in 2012 and therefore did not require annualisation. One diffusion tube location (site C4) on Castlegate is in a key location for this assessment due to the high recorded NO₂ concentrations in 2011 and 2012. Site C4 however was removed in error part way through 2012 and reinstalled later in the year, so only five months of data are available for 2012. The results for 2011 and 2012 have been annualised using the method set out in Box 3.2 LAQM TG(09). Due to the importance of this location for the assessment the annualised results have been included in the verification process despite the uncertainty associated with annualisation. Full details of the annualisation process are included in the appendix.

Results for all sites considered for model verification within in the study area have been presented in Table 4.

Table 4 - Results of Nitrogen Dioxide Diffusion Tubes in Study Area

Site ID	Location	Within AQMA?	Data Capture for Full Calendar Year 2012	Annual Mean NO ₂ Concentrations (µg/m ³)	
			Months	2011 (bias adjusted 0.87)	2012 (bias adjusted 0.84)
C1	Tavern Flats	No	12	32.8	34.7
V3	25b King Street	No	11	33.1	40.3
V5	Front Victoria road/Langton Cottage	No	12	36.6	38.5
V9	Front 9b King Street	No	12	34.2	28.0
V11	Victoria Road RAFA	No	12	32.9	31.5
B14	4 Brunswick Road	No	12	37.3	39.0
EB15	Glendale	No	12	35.7	38.0
EB18	Cherry Cottage	No	12	40.0	42.6
EB20	2 Kemplay Road	No	12	34.5	38.9
SG23, 24, 25	22 Sticklandgate Triplicate	No	10	33.8	35.4
SG27	8 Scotland Road	No	12	33.5	37.8
SG29	Front-The Royal (Town Hall)	No	12	34.9	34.8
31	3 Benson Row	No	9	32.5	36.7
33	Middlegate	No	9	32.1	36.6
36	Roper Street	No	12	27.9	35.0
C4	Castlegate	No	5	62.7*	41.9*

* Data has been annualised.
Bold indicated exceedence of the annual mean objective for NO₂.

With regard to the application of a bias adjustment factor for the diffusion tubes, the LAQM TG(09) and the LAQM Support website recommend using the most applicable bias adjustment factor depending on the local circumstances. No colocation with an automatic monitor has taken place in Eden District Council therefore the national bias adjustment spreadsheet (v03_13)⁹ has been used to provide a bias adjustment factor for 2012 based on the laboratory and method used (Laboratory used; ESG Glasgow, Method used; 50% TEA in Acetone, bias adjustment factor 0.84).

2.2.3 Background Concentrations

No background monitoring is undertaken within the administrative area of Eden District Council surrounding the study area. Therefore the LAQM background maps¹⁰ released in 2012 were considered to determine the appropriate background pollutant concentrations for this assessment.

For the study area in Penrith one of the 1x1km square areas covered most of the modelled area (351500, 530500). The squares adjacent show little variation and the pollutant concentrations in the grid square mentioned were judged to be appropriate.

The background concentrations in Eamont Bridge were also selected using the background maps. The study area lay on the border of two separate 1x1km square areas. The two squares had a variation of 5µg/m³ of NO₂ as one square is predominantly rural and the other includes the M6 motorway. The study area is only 400m from the M6 and therefore an average of the two squares was chosen.

Both areas included modelling of the main roads therefore the NO_x apportionment of primary A roads in each grid square was removed and the NO₂ concentration adjusted using the NO₂ adjustment for NO_x sector removal tool¹¹. A summary of background concentrations used in the assessment is provided in Table 5.

Table 5 - Background Concentrations 2012

Penrith			
X	Y	NO _x	NO ₂
351500	530500	18.4	13.0
Eamont Bridge			
352500	528500	16.0	11.6
351500	528500	24.0	16.7
average		20.4	14.1

⁹ <http://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html>

¹⁰ <http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html>

¹¹ <http://laqm.defra.gov.uk/maps/maps2010.html#NO2adj>

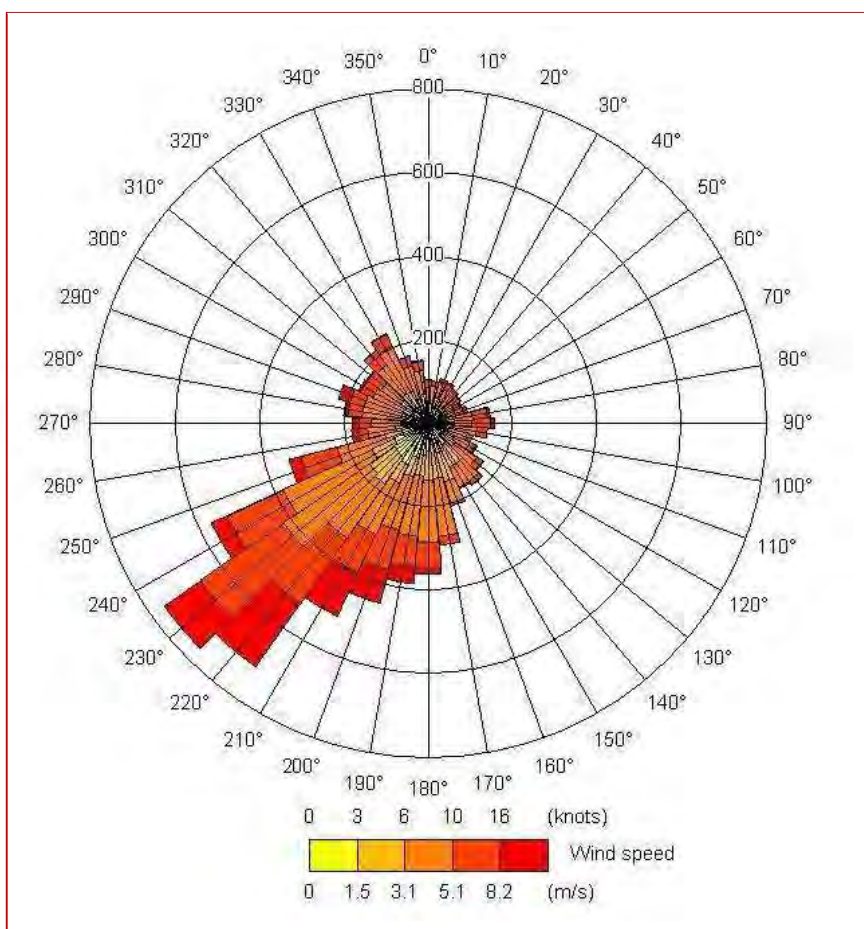
3 Dispersion Modelling Methodology

Detailed dispersion modelling of road-NO_x emissions was undertaken using ADMS-Roads (version 3.1) atmospheric dispersion model from Cambridge Environmental Research Consultants (CERC). Conversion to NO₂ was based on the latest NO_x /NO₂ conversion model released by Defra in August 2012 as part of the updated LAQM.TG (09) tools¹².

ADMS-Roads is an advanced Gaussian dispersion model, which has been extensively used in Local Air Quality Management and has formed the basis for many AQMA declarations. A number of validation studies have been completed, showing overall good agreement between model outputs and observations at continuous monitoring sites but that local verification is important to improve performance.

Dispersal of pollutant emissions is dependent (amongst other factors like topography and street canyon effects) upon the prevailing meteorological conditions at the time of emissions release. Hourly sequential meteorological data for 2012 from the closest Met Office station (Shap) has been used in this assessment. The wind rose derived from meteorological data is shown in Figure 3. There are 8,320 lines of usable meteorological data (95%). LAQM.TG(09) recommends that meteorological data should only be used if the percentage of usable hours is greater than 75%, and preferably 90%. Data is therefore adequate for the dispersion modelling.

Figure 3 - Shap 2012 Hourly Sequential Meteorological data



¹² <http://laqm.defra.gov.uk/tools-monitoring-data/no-calculator.html>

4 Results

4.1 Model Verification and Adjustment

Model verification was carried out at monitoring sites prior to predicting concentrations within the assessment area at sensitive receptor locations. The objectives of the model verification are:

- to evaluate model performance;
- to show that the baseline is well established; and
- to provide confidence in the assessment.

Comparison of the modelled and monitored results was carried out based on local NO₂ monitoring data. NO₂ was calculated from predicted NO_x concentrations, using the latest NO_x/NO₂ converter.

During the verification process, Bureau Veritas aim to ascertain whether all final modelled NO₂ concentrations are within 25% of the monitored NO₂ concentrations. Modelled results may not compare as well at some locations for a number of reasons including:

- Errors in traffic flow and speed data estimates;
- Model setup (including street canyons, road widths, receptor locations);
- Model limitations (treatment of roughness and meteorological data);
- Uncertainty in monitoring data (notably diffusion tubes, e.g. bias adjustment factors and annualisation of short-term data); and
- Uncertainty in emission factors.

The above factors were investigated as part of the model verification process to minimise the uncertainties as far as practicable. Some tube locations have been identified as not being applicable for verification purposes. In Eamont Bridge, tube EB15 was removed as it is close to a bus stop which has not been included in the model. In Penrith, tube V9 has not been used as it is located away from the main road in the vicinity of a car park which has not been included in the model. Tube SG29 was also removed as it is close to a bus stop which has not been included in the model.

In order to verify the model area five separate areas have been identified as requiring a separate verification factor. This approach allows local influence on NO_x to NO₂ to be taken into account in the model by providing greater accuracy of model adjustment in each area, rather than just having one factor for the whole model. The five areas identified are:

- Eamont Bridge;
- Penrith High Street;
- Penrith main traffic routes (A6 south of High Street, A592, A6 north of High Street);
- Penrith back streets (Portland Place, Meeting House Lane, Benson Row, Friargate); and
- Penrith street canyons with a gradient (Castlegate and Scotland Road).

The model verification results are provided in Table 6 to Table 10. Final verified NO₂ concentrations in the modelled area are in good agreement with monitoring data, as modelled results at all sites are within ±25% of monitored concentrations. The resulting adjustment factors for road-NO_x contribution for each area are:

- Eamont Bridge – 3.1;
- Penrith High Street – 4.0;
- Penrith main traffic routes – 2.1;
- Penrith back streets – 4.9; and
- Penrith street canyons with gradients – 2.9.

The full verification methodology for each site is shown in Appendix 1.

Table 6 - Model Verification Results at Penrith High Street

Site	Within AQMA (Yes/No)	Modelled NO ₂ 2012 (µg/m ³)	Monitored NO ₂ 2012 (µg/m ³)	Percentage Difference	Difference (Modelled - Monitored) (µg/m ³)
T33	N	36.6	36.6	0%	0.0
Summary					
Number of sites	Within ±10%			1	
	Between ± 10-25%			0	
	Exceeds ±25%			0	
	Total			1	
In bold: exceedence of the NO ₂ annual mean AQS objective of 40µg/m ³					

Table 7 – Model Verification Results at Penrith Main Routes

Site	Within AQMA (Yes/No)	Modelled NO ₂ 2012 (µg/m ³)	Monitored NO ₂ 2012 (µg/m ³)	Percentage Difference	Difference (Modelled - Monitored) (µg/m ³)
C1	N	36.4	34.7	5%	1.7
V3	N	37.2	40.3	-8%	-3.1
V5	N	35.8	38.5	-7%	-2.7
V11	N	32.7	31.5	4%	1.2
B14	N	41.0	39.0	5%	2.0
SG2345	N	36.3	35.4	3%	0.9
Summary					
Number of sites	Within ±10%			6	
	Between ± 10-25%			0	
	Exceeds ±25%			0	
	Total			6	
In bold: exceedence of the NO ₂ annual mean AQS objective of 40µg/m ³					

Table 8 – Model Verification Results at Penrith Back Streets

Site	Within AQMA (Yes/No)	Modelled NO ₂ 2012 (µg/m ³)	Monitored NO ₂ 2012 (µg/m ³)	Percentage Difference	Difference (Modelled - Monitored) (µg/m ³)
T31	N	37.4	36.7	2%	0.7
T36	N	34.1	35.0	-3%	-0.9
Summary					
Number of sites	Within ±10%			2	
	Between ± 10-25%			0	
	Exceeds ±25%			0	
	Total			2	
In bold: exceedence of the NO ₂ annual mean AQS objective of 40µg/m ³					

Table 9 – Model Verification Results at Penrith Street Canyons with a Gradient

Site	Within AQMA (Yes/No)	Modelled NO ₂ 2012 (µg/m ³)	Monitored NO ₂ 2012 (µg/m ³)	Percentage Difference	Difference (Modelled - Monitored) (µg/m ³)
SG27	N	36.2	37.8	-4%	-1.6
C4	N	43.0	41.9	3%	1.1
Summary					
Number of sites	Within ±10%			2	
	Between ± 10-25%			0	
	Exceeds ±25%			0	
	Total			2	
In bold: exceedence of the NO ₂ annual mean AQS objective of 40µg/m ³					

Table 10 – Model Verification Results at Eamont Bridge

Site	Within AQMA (Yes/No)	Modelled NO ₂ 2012 (µg/m ³)	Monitored NO ₂ 2012 (µg/m ³)	Percentage Difference	Difference (Modelled - Monitored) (µg/m ³)
EB18	N	40.8	42.6	-4%	-1.8
EB20	N	40.8	38.9	5%	1.8
Summary					
Number of sites	Within ±10%			2	
	Between ± 10-25%			0	
	Exceeds ±25%			0	
	Total			2	
In bold: exceedence of the NO ₂ annual mean AQS objective of 40µg/m ³					

4.2 New Development in Penrith and Eamont Bridge

Penrith

An area in Penrith to the south of the town centre where the football ground was previously located has been redeveloped to include a shopping and residential area. As a result of the redevelopment, a new road layout along Victoria Road has been created in 2012. Two new traffic lights have been put on Victoria Road at the junction with Southend Road (Figure 5) and at the junction with Roper Street (Figure 4). A new road linking the development with Victoria Road has also been added.

A detailed dispersion model for air quality was undertaken by WYG Environment as part of the planning application for this development. The air quality report concluded that an increase in traffic in the area of the development was expected and that this would lead to exceedences of the annual mean objective for NO₂ at locations of relevant exposure. The report stated the data was based on 'worst case assumptions' and that due to highways improvements along Victoria Road congestion was expected to decrease along Victoria Road.

The reported figures in the planning application do appear to have been conservative based upon data provided by Cumbria County Council for the purpose of this Detailed Assessment. Data from the WYG assessment indicated the worst impact area is likely to be at the junction of Victoria Road and Roper Street.

The completion of this development was still ongoing at the time of writing and the council expects final traffic flows along Victoria Road to increase during 2013 as a result.

Eamont Bridge

In 2011/12 significant changes were made to the Kemplay roundabout at the junction of the A6 with the A66 at Eamont Bridge. The changes include additional lanes and traffic light controls at all entries and exits to the roundabout. This is may have affected the traffic flows through Eamont Bridge, particularly at peak times.

Figure 4 Junction with Victoria Road and Roper Street



Figure 5 Junction with Victoria Road and Southend Road



4.3 Modelled NO₂ Concentrations

Annual average NO₂ concentrations were predicted for 2012 at a number of specific receptors across the modelled area representing relevant public exposure, located at the facade of properties. Receptor locations are shown in Appendix 2. Additionally, predictions were made to a 5m grid spacing across the assessment area to produce NO₂ concentration contour maps for year 2012. NO₂ concentrations were modelled at a height of 1.5m above ground, which represents the average respirable height of an adult.

Results at specific receptors are provided in Table 11. Contours are shown in Appendix 3 for the modelled areas.

Table 11 - Modelled results at Specific Receptors

Specific Receptor	X(m)	Y(m)	Z(m)	Total Modelled NO ₂ 2012 µg/m ³
1	351333.0	530016.0	1.5	44.1
2	351396.0	530051.0	1.5	43.9
3	351942.1	529603.3	1.5	17.5
4	351860.9	529682.3	1.5	17.8
5	351853.0	529762.6	1.5	20.1
6	351811.4	529796.1	1.5	19.3
7	351724.8	529930.3	1.5	33.7
8	351708.6	529963.5	1.5	44.0
9	351657.2	530037.9	1.5	33.2
10	351639.0	530068.5	1.5	20.5
11	351601.4	530104.0	1.5	42.2
12	351540.1	530122.3	1.5	22.3
13	351408.0	530061.8	1.5	25.2
14	351384.9	530052.1	1.5	44.0
15	351349.2	530025.9	1.5	42.8
16	351421.3	530070.9	1.5	24.6
17	351788.3	530077.1	1.5	27.6
18	351839.7	529950.3	1.5	23.9
19	351938.1	529875.3	1.5	25.1
20	351816.5	529872.8	1.5	31.9
21	351766.6	529904.9	1.5	22.5

Specific Receptor	X(m)	Y(m)	Z(m)	Total Modelled NO ₂ 2012 µg/m ³
22	351787.9	529841.8	1.5	21.1
23e	352207.1	528815	1.5	44.2
24e	352207.1	528781.8	1.5	42.8
25e	352239.9	528678.8	1.5	37.2
26e	352255.4	528648.8	1.5	35.0
27e	352271.2	528639.9	1.5	35.2
28e	352289	528601.8	1.5	25.0
29e	352304.8	528536.1	1.5	35.6
30e	352323.8	528491.1	1.5	20.0
31	351687.6	530387.4	1.5	33.6
32	351280.9	530201.6	1.5	18.6
33	351291.0	530241.1	1.5	26.5
34	351310.3	530272.6	1.5	25.3
35	351325.0	530288.8	1.5	29.0
36	351363.3	530300.4	1.5	30.1
37	351425.1	530346.5	1.5	24.0
38	351392.9	530383.9	1.5	21.2
39	351376.4	530422.9	1.5	30.3
40	351317.3	530508.3	1.5	37.8
41	351300.6	530536.4	1.5	24.3
42	351246.3	530573.3	1.5	24.4
43	351194.8	530623.8	1.5	50.6
44	351159.2	530648	1.5	25.3
45	351119.1	530704.5	1.5	21.0
46	351402.4	530449.9	1.5	34.3
47	351422.8	530444.9	1.5	26.8
48	351442.6	530502.2	1.5	27.6



Specific Receptor	X(m)	Y(m)	Z(m)	Total Modelled NO ₂ 2012 µg/m ³
49	351505.2	530535.4	1.5	28.0
50	351534.1	530502.3	1.5	22.2
51	351592.2	530473.9	1.5	27.2
52	351612.1	530441.9	1.5	37.4
53	351650.0	530425.1	1.5	26.9
54	351738.2	530317.6	1.5	38.9
55	351782.0	530288.7	1.5	35.6
56	351822.3	530261.5	1.5	24.8
In bold: exceedence of the NO ₂ annual mean AQS objective of 40µg/m ³ e = receptor is in Eamont Bridge				

Penrith Modelled Results:

Specific receptor results in Penrith indicated four potential areas of exceedence at the façade of properties (receptors 1, 2, 14, 15, 8, 11, and 43). Discussion regarding each of these locations will help to inform conclusions in each area.

Castlegate (A6)

Receptors 1, 2, 14 and 15 are all located on Castlegate which is known to have high pollutant concentrations from monitoring carried out in 2011 and 2012. Whilst the monitoring results in 2012 are limited in reliability due to only five months of data being available the concentrations were still all consistently high. As a result it would be expected that high concentrations would be predicted in this area. The combination of a very narrow street canyon coupled with a steep gradient and slow moving traffic is causing an exceedence of the annual mean objective for NO₂. Modelled contours indicate a potential exceedence area extending from Corn Market all the way along Castlegate up to the roundabout on Cromwell Road. As a result of the monitored and modelled exceedences it is recommended that an AQMA is declared from Corn Market all the way along Castlegate up to the roundabout on Cromwell Road. Additionally it would be recommended to install extra monitoring in that area at the façade of properties in the worst-case locations. Recommended AQMA areas and new monitoring locations are shown in Appendix 4.

Victoria Road (A6)

Receptor 8 is located at the façade of a property on Victoria Road (A6) opposite monitoring location V3, which recorded an exceedence of the NO₂ annual mean objective in 2012 of 40.3 µg/m³. This part of the A6 narrows into a street canyon and houses are located within the canyon. Modelled contours indicate the exceedence area where pollutant concentrations are likely to be above 40µg/m³ are not widespread along the A6 but rather are concentrated at worst-case locations in narrow street canyons. The concentrations of NO₂ along Victoria Road at site V3 have increased by 7µg/m³ from 2011 to 2012. Concentrations at V5 have increased by 2µg/m³ and concentrations at site 36 have increased by 7µg/m³. Whilst V5 and 36 are still below the objective limit of 40µg/m³ both are close to or within 10% of the limit (36µg/m³) indicating a potential breach of air quality objectives in the area. Site V11 is outside of the street canyon and has not shown the increase in concentrations recorded elsewhere.

The impact of the new development may have had an impact upon air quality in this area due to the increase in traffic. As traffic is expected to be higher in 2013 compared to 2012, air quality would be expected to deteriorate.

As a result of the new development traffic along with modelled and monitored exceedences, it is recommended that an AQMA is declared along Victoria Road (A6) from the junction with Southend Road to 60m north of the junction with Langton Street. Additionally, new monitoring should be installed at the façade of properties along Victoria Road between Southend Road and Roper Street also along Roper Street close to the junction.

Recommended AQMA areas and new monitoring locations are shown in Appendix 4.

King Street (A6)

Receptor 11 is also located on the A6 within a street canyon. The street canyon is again very narrow and will be a busy section of road with the traffic from the High Street one way system merging back into the A6 going south. The properties are all commercial, therefore there is no need to declare an AQMA in this area.

Scotland Road (A6)

Receptor 43 is located on Scotland Road (A6). The receptor is close to the monitoring location SG27 which recorded an annual mean NO₂ concentration of 37.8µg/m³ in 2012 (this is a 4µg/m³ rise in concentrations since 2011). The section along Scotland Road is a street canyon and is on a slight gradient, which has been taken into account when modelling. Contours at this location indicate the pollutant concentrations at the façade of properties are close to the objective levels for annual mean NO₂. Due to uncertainties related to traffic breakdown along the A6 (only AADT and %HDV were available) and as monitoring at a worst case location in the area has recorded concentrations below

40µg/m³ it would not be recommended to declare an AQMA at this location. It would be recommended the council continue to monitor at the façade of properties in this location and add in extra monitoring in this area.

Recommended new monitoring locations are shown in Appendix 4.

Brunswick Road (A6)

The location around monitoring location B14 on Brunswick Road is an area which historically has been identified as being close to exceeding the objective levels for NO₂. In 2012, the monitoring point recorded a concentration of 39.0µg/m³. The modelled contours indicate a potential exceedence of the annual mean objective at facades near to the junction with Duke Street. Analysis of the model verification for this location indicates the modelled results are over predicting concentrations at this location as a result of uncertainties identified in the verification section. The recommendation for this area would be to continue monitoring at property facades and re-evaluate the situation should any potential future exceedences be recorded. If exceedences at B14 and SG27 occur it would be recommended to create an AQMA linking to the two areas. It would be recommended to link the areas if this occurs as it will aid decision making regarding the air quality action plan.

Meeting House Lane, Benson Row and Friargate

The roads running parallel to the High Street and back to the A6 such as Meeting House Lane, Benson Row and Friargate are another area where potential exceedences of the annual mean objective have been identified, with monitoring at tube 33 recording a concentration of 36.6µg/m³ in 2012 which is within 10% of the objective. Modelled contours indicate potential areas of exceedence at junctions within street canyons in this area with the hotspots being located where Meeting House Lane meets with Benson Row and Burrowgate. Also, an area of potential high pollution is identified along Friargate. Due to uncertainties related to traffic flow and speeds in the modelled domain it is not recommended an AQMA be declared in this area. It is recommended further monitoring be included along these roads at locations of relevant exposure.

High Street (A6)

The High Street contains areas of pollutant contours over 40µg/m³ however as there is no relevant exposure along this road there is no need to consider an AQMA in this area. The single monitoring location is sufficient to inform the council if there is any chance of exceeding the hourly objective which is unlikely as the concentration in 2012 was 36µg/m³.

Analysis of UK continuous NO₂ monitoring data has shown that it is unlikely that the hourly mean NO₂ objective, of 18 hourly means over 200µg/m³, would be exceeded where the annual mean objective is below 60µg/m³¹³. All sites are below the 60µg/m³ level in 2012, therefore, the NO₂ hourly mean AQS objective is expected to be met at all relevant locations. Concentrations along Castlegate did exceed this 60µg/m³ limit in 2011 and improved data capture in 2013 should indicate if the short-term objective is likely to be an issue in that area.

Eamont Bridge Modelled Results:

Specific receptor results in Eamont Bridge indicated exceedences of the annual mean objective for NO₂ occurring at two locations (23e and 24e). Both of these locations are located to the north of the actual bridge. To the south of the bridge monitoring has indicated an exceedence of the annual mean objective (site EB18 - 42.6µg/m³ in 2012). Modelled contours indicate a potential exceedence area along the A6 though Eamont Bridge from the start of the village to the north to The Beehive Inn. Based on monitored and modelled exceedences of the annual mean objective for NO₂ it is recommended that the Council declare this area as an AQMA. Recommended AQMA areas and recommended new monitoring locations are shown in Appendix 4.

¹³ Analysis of the relationship between annual mean nitrogen dioxide concentration and exceedences of the 1-hour mean AQS Objective – AEA - 2008



4.4 Population Exposure

Technical Guidance LAQM.TG(09) requires local authorities to estimate the number of people exposed to pollutant concentrations above the relevant air quality objectives.

In the recommended AQMA in Penrith, fewer than 34 homes are included therefore approximately 60-80 people are likely to be exposed. In Eamont Bridge, around 30 homes are included in the area so approximately 50-100 people are likely to be exposed.

5 Conclusions and Recommendations

As part of the Local Air Quality Management (LAQM) regime, a Detailed Assessment based on detailed dispersion modelling of NO₂ emissions from road-traffic was carried out for Penrith and Eamont Bridge, due to measured exceedences of the NO₂ annual mean Air Quality Strategy (AQS) Objective.

The Detailed Assessment has been undertaken in accordance with Defra's Technical Guidance LAQM.TG (09) methodologies, based on advanced atmospheric dispersion modelling of NO₂ traffic emissions, relying on updated emission factors and background pollutant concentrations released by Defra in 2013, and the latest monitoring, traffic and meteorological data for the year 2012.

Due to measured and modelled exceedences of the air quality objectives for NO₂ at the façade of properties both in Penrith and Eamont Bridge it is recommended the council declare AQMAs and carry out the following recommendations:

- Declare an AQMA from Corn Market all the way along Castlegate up to the roundabout on Cromwell Road;
- Install extra monitoring in that area at the façade of properties in the worst case locations along Castlegate;
- Declare an AQMA along Victoria Road (A6) from the junction with Southend Road to 60m north of the junction with Langton Street;
- Install new monitoring at the façade of properties along Victoria Road between Southend Road and Roper Street. Install monitoring at the façade of properties along Roper Street;
- Install further monitoring along Scotland Road and continue to monitor at SG27;
- Install further monitoring at relevant locations along Meeting House Lane, Benson Row and Friargate;
- Declare an AQMA along the A6 though Eamont Bridge from the start of the village to the north to The Beehive Inn;
- Install further monitoring in Eamont Bridge at site of relevant exposure.

As part of the further assessment and continuing air quality management in Penrith and Eamont Bridge, the Council should consider gathering detailed traffic data with a breakdown in traffic type. Additionally, depending on future monitoring result and results of the further assessment, if exceedences are recorded on Scotland Road, the Council may wish to consider a consolidated AQMA covering the A6 from Bridge Street around Castlegate and Brunswick Road and along Scotland Road. This would simplify action planning in the town and provide a town-wide approach to tackling air quality pollution.



Appendix 1 – Model Verification

Model Verification Results at Penrith High Street

Site	Background NO ₂ (µg/m ³)	Background NO _x (µg/m ³)	Monitored Road Contribution NO _x (µg/m ³)	Modelled Road Contribution NO _x (µg/m ³)	Ratio of Monitored Road NO _x /Modelled Road NO _x	Adjustment Factor (Regression) for Modelled Road Contribution	Adjusted Modelled Road Contribution NO _x (µg/m ³)	Adjusted Modelled Total NO _x (µg/m ³)	Modelled Total NO ₂ (µg/m ³)	Monitored Total NO ₂ (µg/m ³)	% Difference NO ₂ [(Modelled - Monitored)/ Monitored]
T33	13	18.4	51.7	12.8	4.1	4.05	51.7	71.9	36.6	36.6	0%

In bold, exceedence of the NO₂ annual mean AQS objective of 40µg/m³

Model Verification Results at Penrith Back Streets

Site	Background NO ₂ (µg/m ³)	Background NO _x (µg/m ³)	Monitored Road Contribution NO _x (µg/m ³)	Modelled Road Contribution NO _x (µg/m ³)	Ratio of Monitored Road NO _x /Modelled Road NO _x	Adjustment Factor (Regression) for Modelled Road Contribution	Adjusted Modelled Road Contribution NO _x (µg/m ³)	Adjusted Modelled Total NO _x (µg/m ³)	Modelled Total NO ₂ (µg/m ³)	Monitored Total NO ₂ (µg/m ³)	% Difference NO ₂ [(Modelled - Monitored)/ Monitored]
T31	13	18.4	51.7	10.3	5.0	5.32	54.9	73.3	37.9	36.7	3%
T36			47.4	8.2	5.8		43.4	61.8	33.3	35.0	-5%

In bold, exceedence of the NO₂ annual mean AQS objective of 40µg/m³



Model Verification Results at Penrith Main Routes

Site	Background NO ₂ (µg/m ³)	Background NO _x (µg/m ³)	Monitored Road Contribution NO _x (µg/m ³)	Modelled Road Contribution NO _x (µg/m ³)	Ratio of Monitored Road NO _x /Modelled Road NO _x	Adjustment Factor (Regression) for Modelled Road Contribution	Adjusted Modelled Road Contribution NO _x (µg/m ³)	Adjusted Modelled Total NO _x (µg/m ³)	Modelled Total NO ₂ (µg/m ³)	Monitored Total NO ₂ (µg/m ³)	% Difference NO ₂ [(Modelled - Monitored)/ Monitored]
C1	13	18.4	46.9	24.8	1.9	2.06	51.1	69.5	36.4	34.7	5%
V3			61.3	25.8	2.4		53.1	71.5	37.2	40.3	-8%
V5			56.5	24.1	2.3		49.6	68.0	35.8	38.5	-7%
V11			39.2	20.3	1.9		41.9	60.3	32.7	31.5	4%
B14			57.8	30.6	1.9		63.0	81.4	41.0	39.0	5%
SG2345			48.5	24.6	2.0		50.7	69.1	36.3	35.4	3%

In bold, exceedence of the NO₂ annual mean AQS objective of 40µg/m³

Model Verification Results at Penrith street canyons with a gradient

Site	Background NO ₂ (µg/m ³)	Background NO _x (µg/m ³)	Monitored Road Contribution NO _x (µg/m ³)	Modelled Road Contribution NO _x (µg/m ³)	Ratio of Monitored Road NO _x /Modelled Road NO _x	Adjustment Factor (Regression) for Modelled Road Contribution	Adjusted Modelled Road Contribution NO _x (µg/m ³)	Adjusted Modelled Total NO _x (µg/m ³)	Modelled Total NO ₂ (µg/m ³)	Monitored Total NO ₂ (µg/m ³)	% Difference NO ₂ [(Modelled - Monitored)/ Monitored]
SG27	13	18.4	54.5	17.3	3.2	2.92	50.5	68.9	36.2	37.8	-4%
C4			65.4	23.5	2.8		68.4	86.8	43.0	41.9	3%

In bold, exceedence of the NO₂ annual mean AQS objective of 40µg/m³

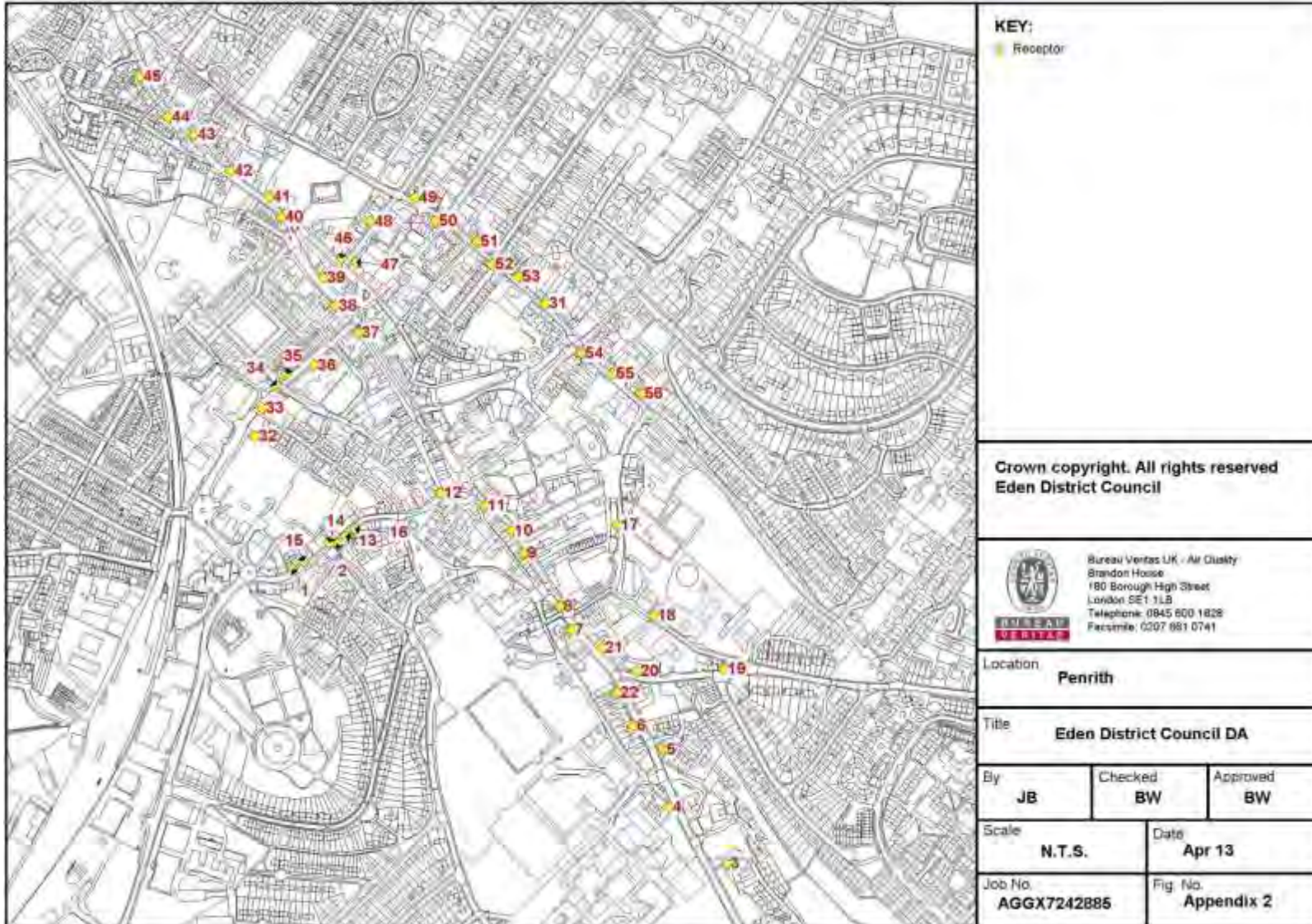


Model Verification Results at Eamont Bridge

Site	Background NO ₂ (µg/m ³)	Background NO _x (µg/m ³)	Monitored Road Contribution NO _x (µg/m ³)	Modelled Road Contribution NO _x (µg/m ³)	Ratio of Monitored Road NO _x /Modelled Road NO _x	Adjustment Factor (Regression) for Modelled Road Contribution	Adjusted Modelled Road Contribution NO _x (µg/m ³)	Adjusted Modelled Total NO _x (µg/m ³)	Modelled Total NO ₂ (µg/m ³)	Monitored Total NO ₂ (µg/m ³)	% Difference NO ₂ [(Modelled - Monitored)/ Monitored]
EB18	14.1	20	64.9	19.4	3.3	3.09	60.1	80.1	40.8	42.6	-4%
EB20			55.0	19.4	2.8		59.9	79.9	40.8	38.9	5%



Appendix 2 – Specific Receptor Locations



KEY:
 ● Receptor

Crown copyright. All rights reserved
 Eden District Council

 Bureau Veritas UK - Air Quality
 Brandon House
 180 Borough High Street
 London SE1 1LB
 Telephone: 0845 600 1828
 Facsimile: 0207 981 0741

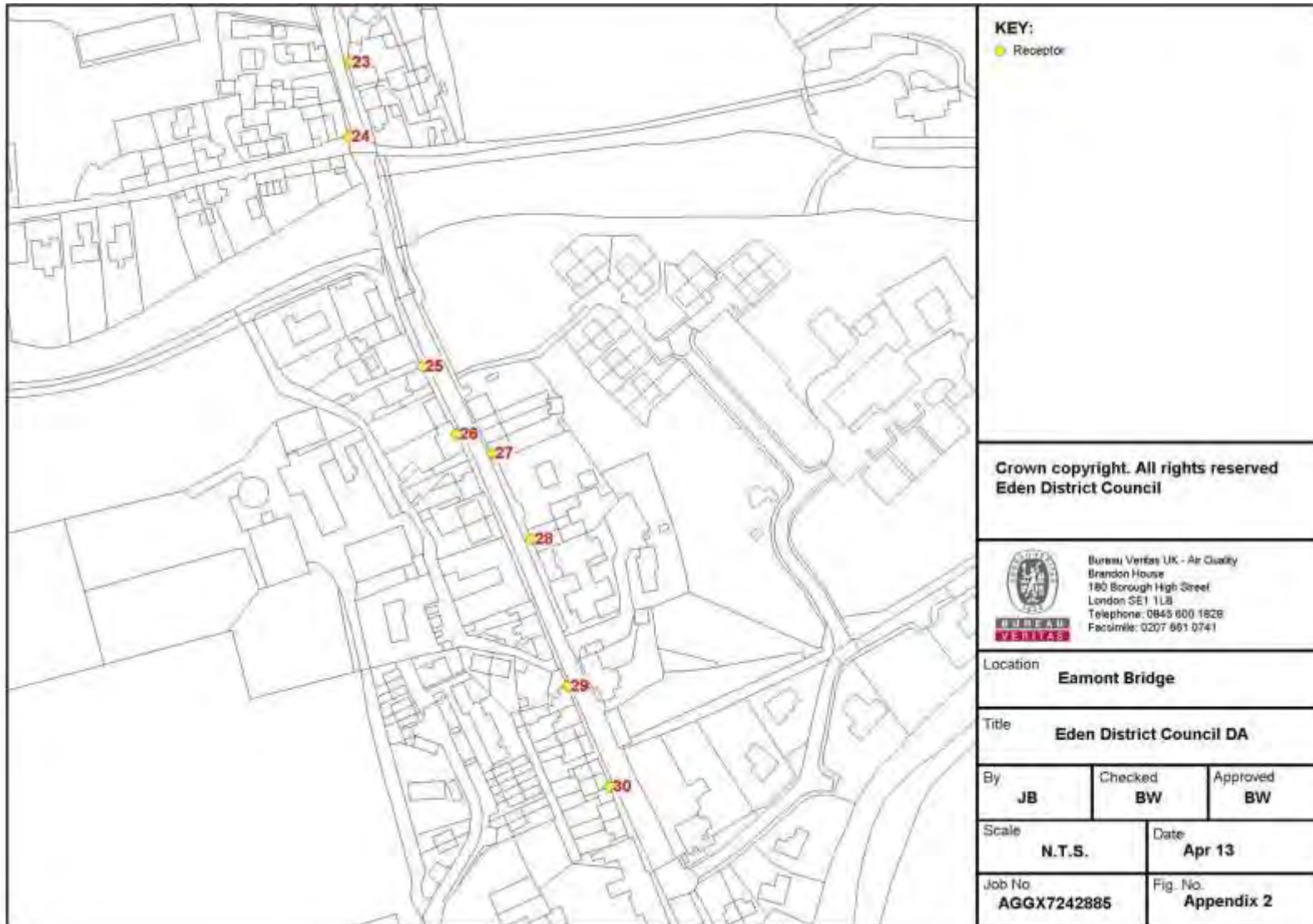
Location **Penrith**

Title **Eden District Council DA**

By JB	Checked BW	Approved BW
-----------------	----------------------	-----------------------

Scale N.T.S.	Date Apr 13
------------------------	-----------------------

Job No. AGGX7242885	Fig. No. Appendix 2
-------------------------------	-------------------------------



KEY:
 ● Receptor

Crown copyright. All rights reserved
 Eden District Council

 Bureau Veritas UK - Air Quality
 Brandon House
 180 Borough High Street
 London SE1 1LB
 Telephone: 0843 800 1628
 Facsimile: 0207 861 0741

Location **Eamont Bridge**

Title **Eden District Council DA**

By JB	Checked BW	Approved BW
-----------------	----------------------	-----------------------

Scale N.T.S.	Date Apr 13
------------------------	-----------------------

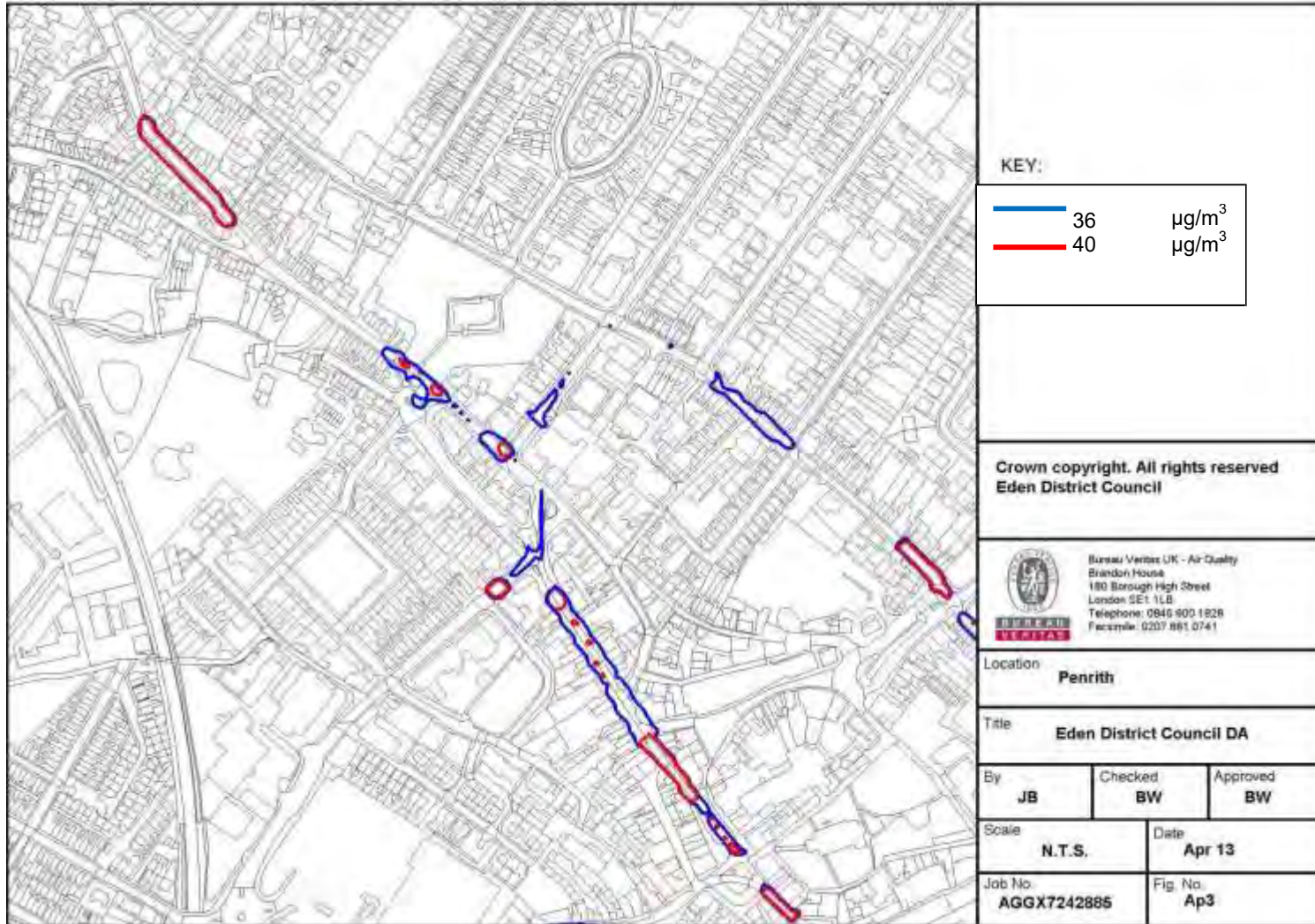
Job No. AGGX7242885	Fig. No. Appendix 2
-------------------------------	-------------------------------



Appendix 3 – Modelled Contours

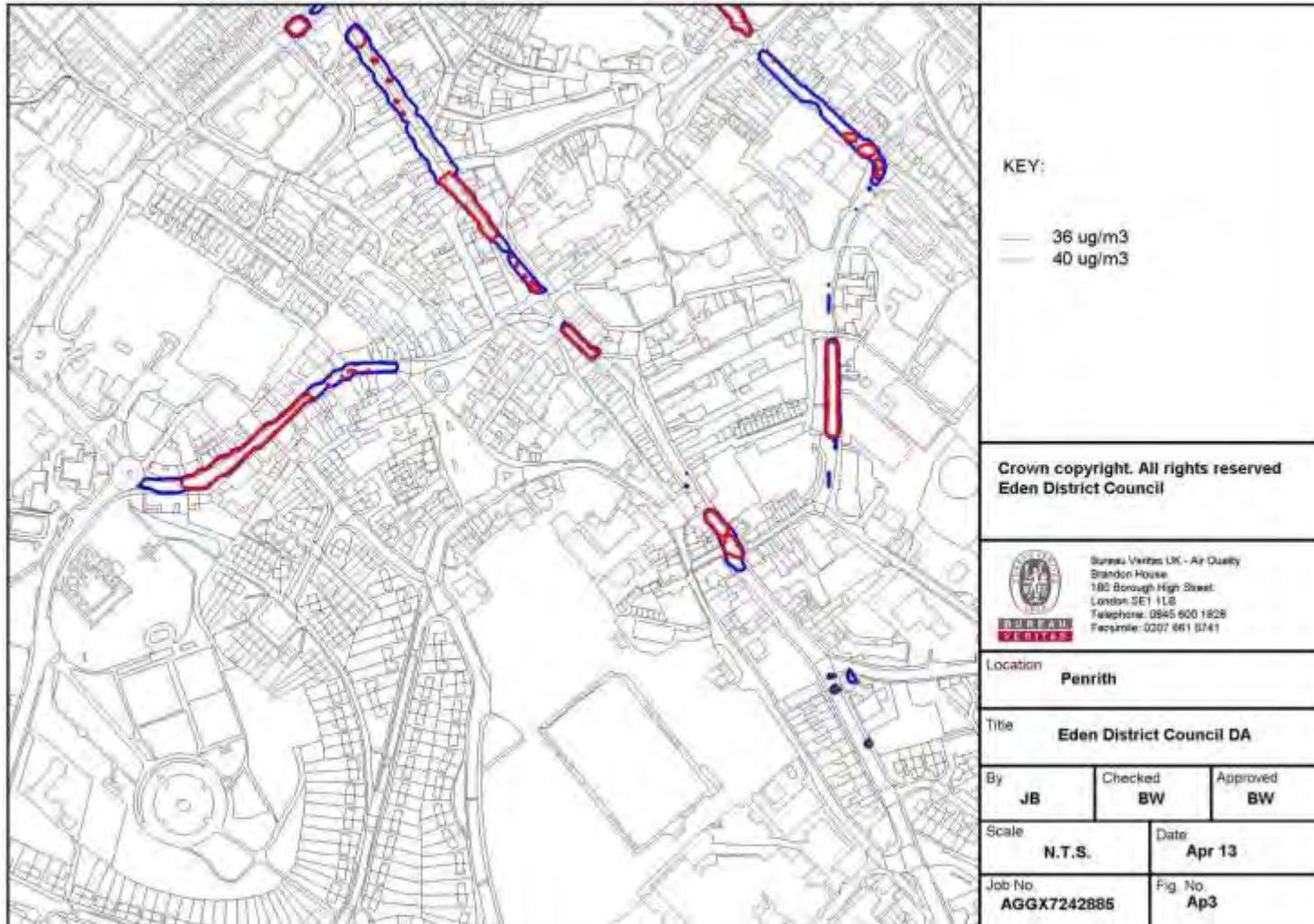


Modelled NO₂ Contour Concentrations – Northern Penrith 2012



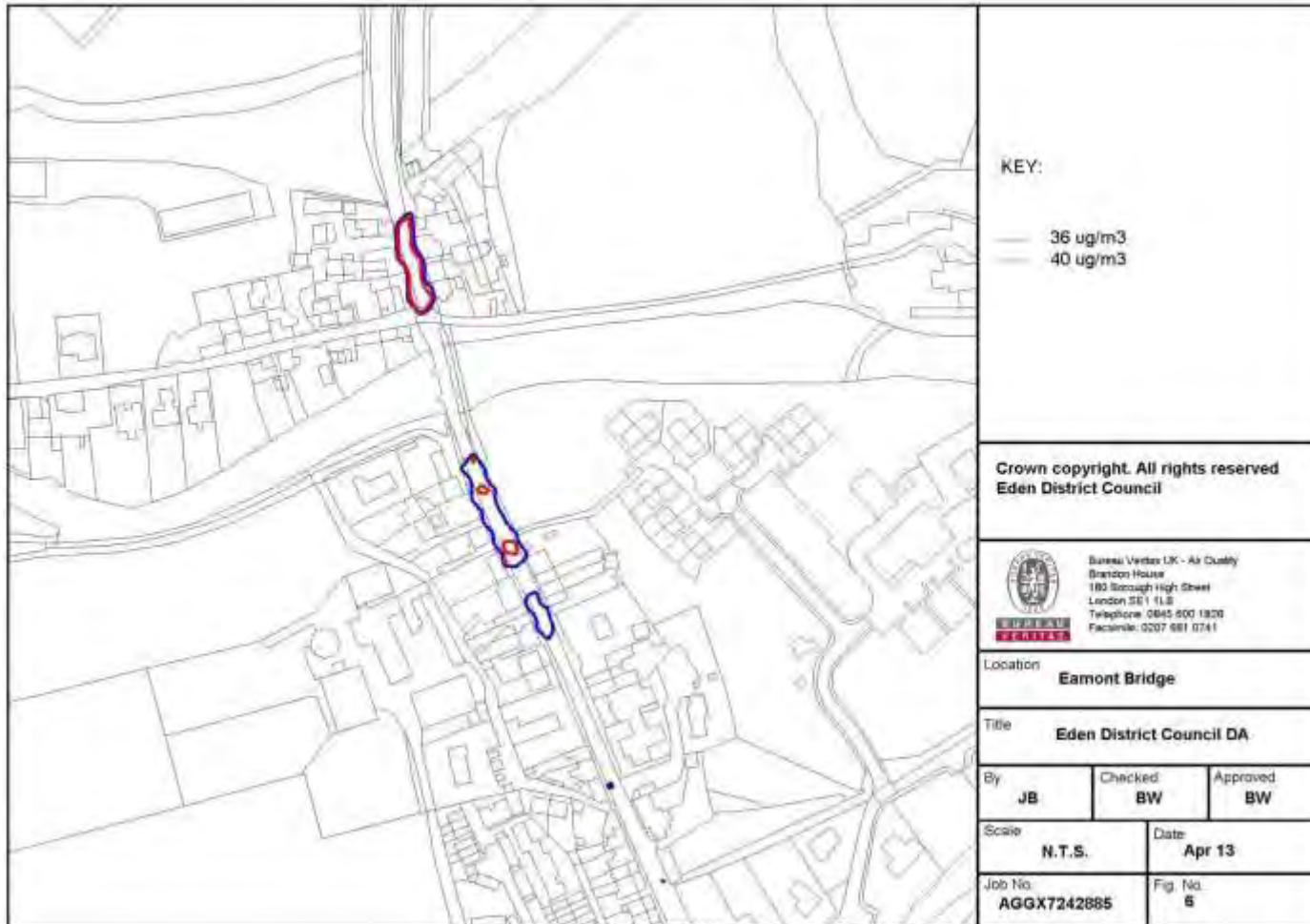


Modelled NO₂ Contour Concentrations – Southern Penrith 2012





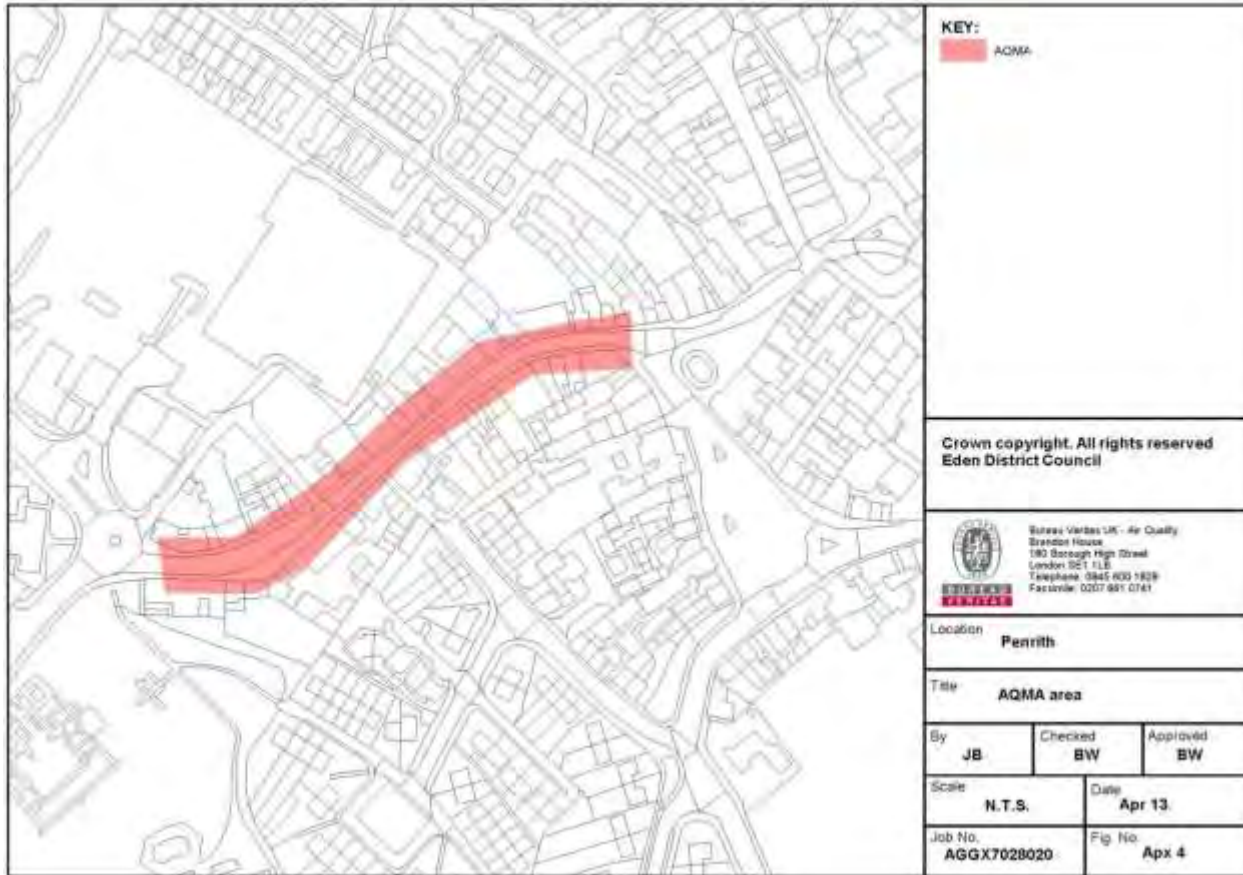
Modelled NO₂ Contour Concentrations – Eamont Bridge 2012





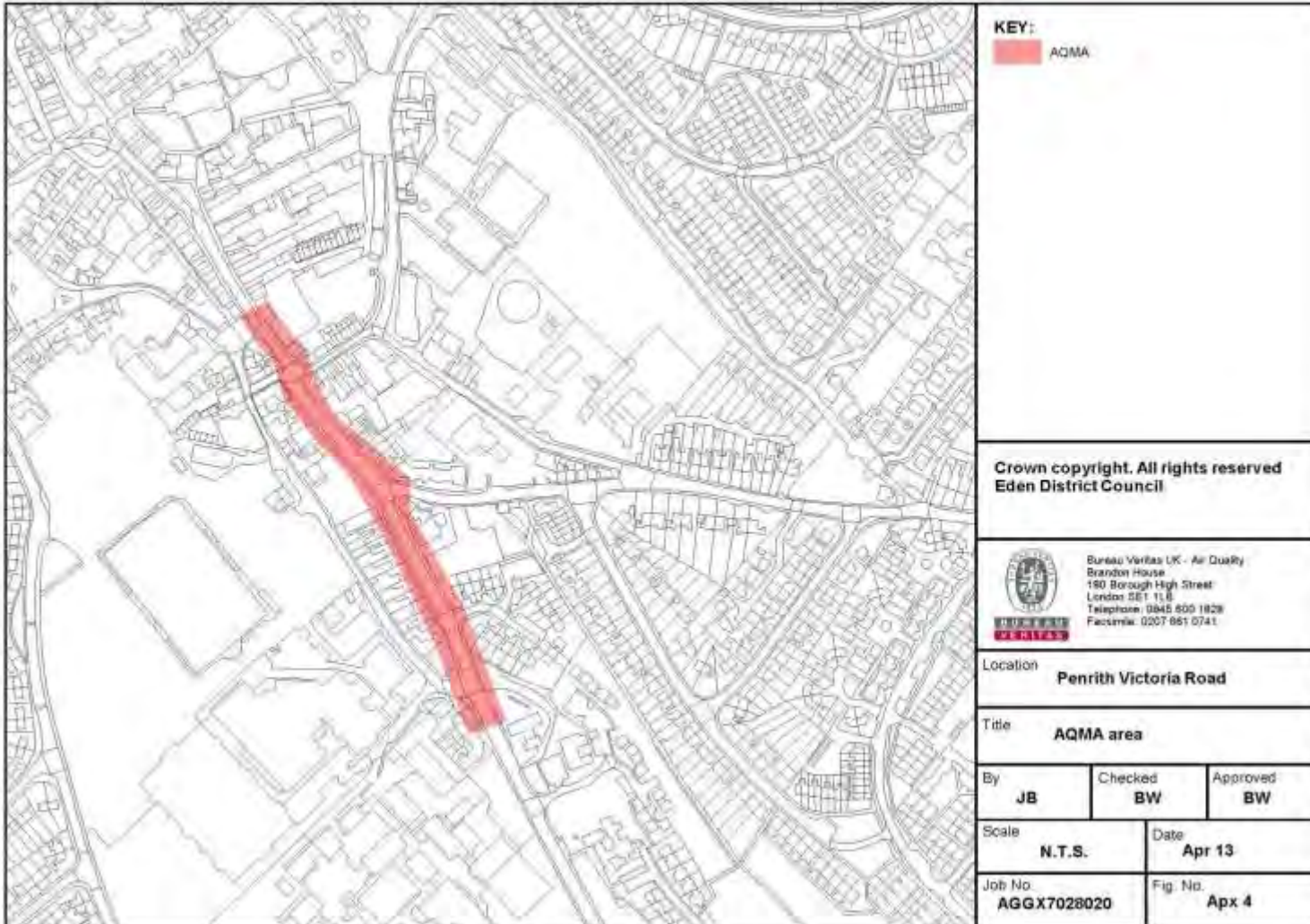
Appendix 4 – Recommended AQMA areas and recommended new monitoring locations

Castlegate AQMA



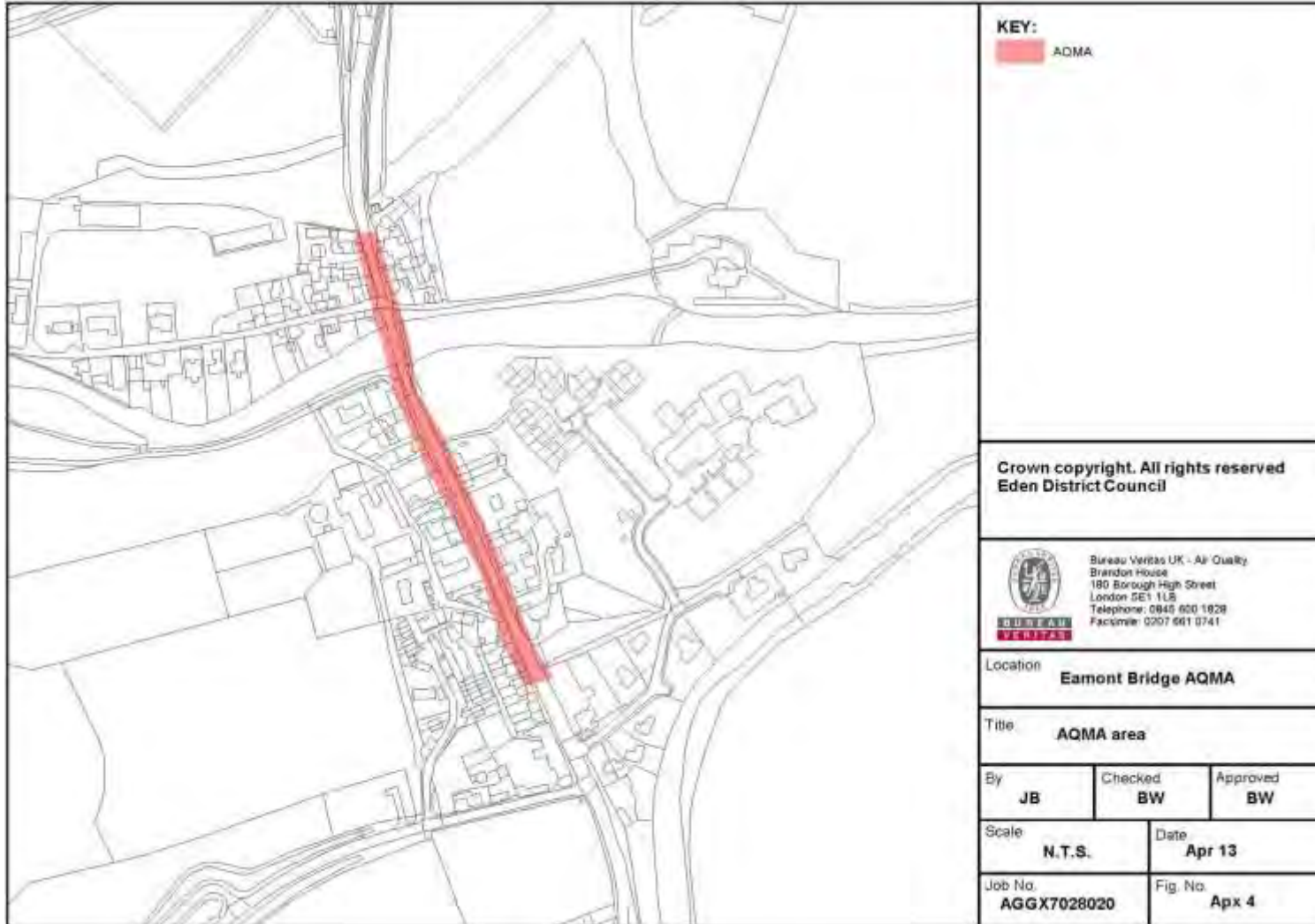


Victoria Road AQMA





Eamont Bridge AQMA



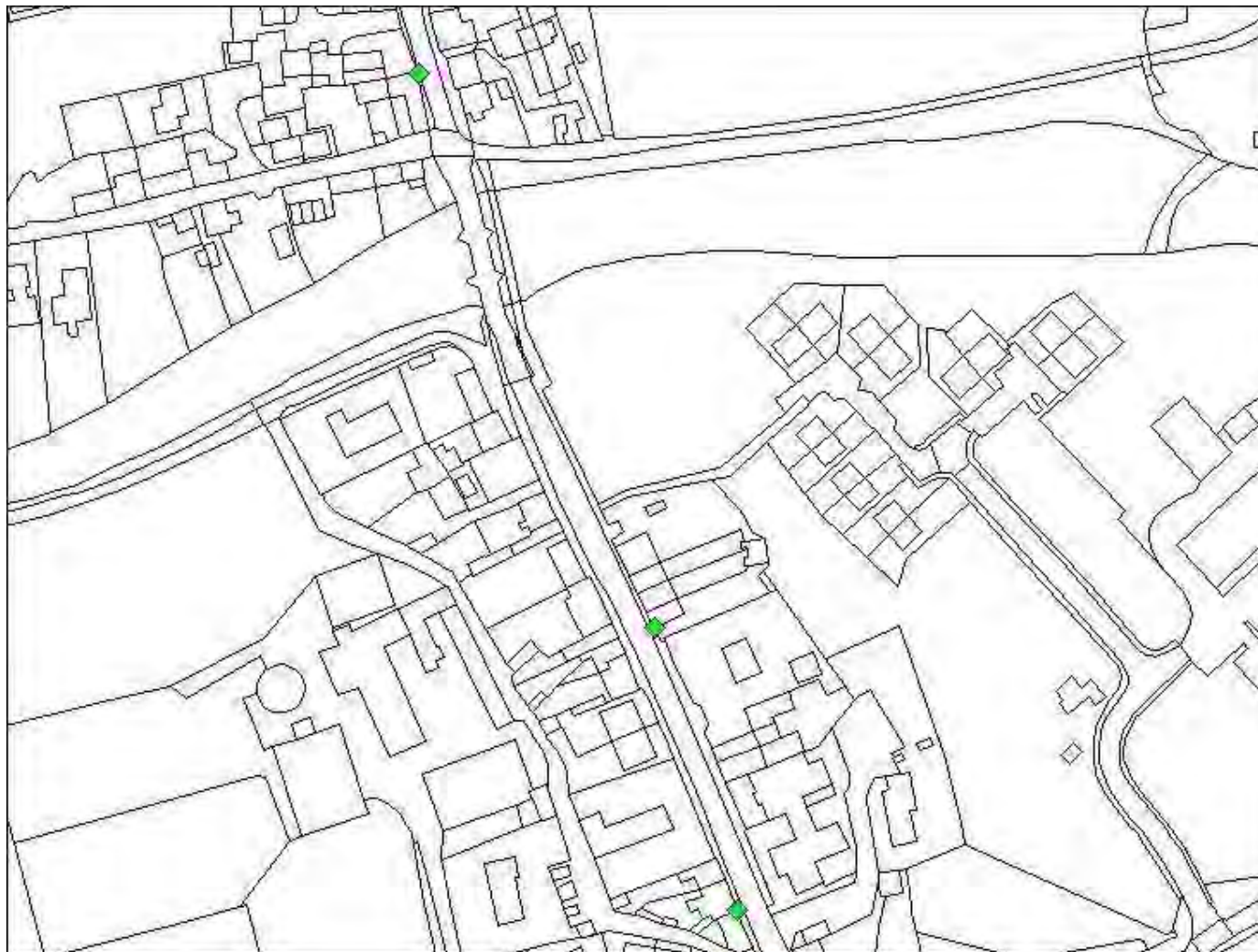


New monitoring locations Penrith





New monitoring locations Eamont Bridge





Appendix 5 - Short-Term to Long-Term Monitoring Data Adjustment

Site	Uncorrected Diffusion Tube Mean ($\mu\text{g}/\text{m}^3$)	Annualisation factor Eskdalemuir	Annualisation factor Peebles	Annualisation factor Blackpool	Average Annualisation factor	Annualised Bias Adjusted Concentration ($\mu\text{g}/\text{m}^3$)
C4	65.0	0.9	0.7	0.8	0.8	41.9