



Detailed Assessment

AIR QUALITY

APRIL 2007

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Executive Summary

Part IV of the Environment Act 1995 requires local authorities to review and assess the current, and likely future, air quality in their areas against the objectives in the National Air Quality Strategy. Where objectives are likely to be exceeded, the local authority is required to designate an Air Quality Management Area (AQMA) for the relevant locations and draw up an action plan setting out the measures it intends to take to ensure the air quality objectives within the area covered by the AQMA are not exceeded.

Wychavon District Council's first round of review and assessment was published in December 2000 and concluded that it was unlikely there would be any exceedences of the objectives.

The second round of review and assessment in February 2003 was an Updating and Screening Assessment (USA) for identifying those aspects that have changed since the first round of reviews and assessment. The USA was carried out in accordance with technical guidance (LAQM.TG(03)) which encompasses details of new emission factors for the UK, revised assessment criteria and tighter formal (or provisional) air quality objectives.

The conclusion was that the objectives were unlikely to be exceeded, therefore there was no need to proceed to a detailed assessment.

The third round of review and assessment, a Updating and Screening Assessment (USA) was completed in April 2006, it was carried out in accordance with the revised technical guidance (LAQM.TG(03)).

The conclusion was that it was necessary to proceed to a Detailed Assessment of nitrogen dioxide (NO₂) in the following locations:

- Swan Lane, Evesham
- Port Street, Evesham

and for particulate matter (PM₁₀) at:

- Walton Lane, Hartlebury

The report summarises the Detailed Assessment of the above locations in Evesham and Hartlebury that commenced in June 2006.

The technical approach taken for the Detailed Assessment is consistent with policy and technical in LAQM.TG(03) and LAQM.PG(03) and on the LAQM review and assessment helpdesk.

The conclusions of the Detailed Assessment are:

- the annual mean objective for the nitrogen dioxide concentration not to exceed $40 \mu\text{g}/\text{m}^3$ by the 31 December 2005 is exceeded in part of Port Street Evesham.
- Port Street includes relevant public exposure i.e. the mixed shopping and residential areas.
- an Air Quality Management Area (AQMA) is required for part of Port Street. This recommendation is made in accordance with section 83(1) of the Environment Act 1995.
- the annual mean objective for the nitrogen dioxide concentration not to exceed $40 \mu\text{g}/\text{m}^3$ by the 31 December 2005 is not currently exceeded in Swan Lane, but any future changes in road layout and traffic flows in the area will need to be assessed against the effect on air quality. Nitrogen dioxide monitoring will continue.
- the 24 hourly mean objective for PM_{10} not exceed $50 \mu\text{g}/\text{m}^3$ more than 35 times per year to be achieved by 31st December 2004 is not being exceeded in the area of Hartlebury, that was the subject of the detailed assessment and neither is the objective for the annual mean not to exceed $40 \mu\text{g}/\text{m}^3$ by 31 December 2004.

The full conclusions and recommendations are set out in Section 4 of the Detailed Assessment.

A draft AQMA boundary has been drawn-up for further consultation and is detailed in Section 5 of the report.

1. INTRODUCTION

1.1 Purpose of Report

The Updating and Screening Assessment in 2006 identified possible exceedences of the following objectives

- the annual mean concentration of nitrogen dioxide shall not exceed 40 $\mu\text{g}/\text{m}^3$ to be achieved by the 31 December 2005.
- the 24 hourly mean of PM_{10} must not exceed 50 ug/m^3 more than 35 times per year to be achieved by 31st December 2004.
- the annual mean of PM_{10} must not exceed 40 ug/m^3 to be achieved by 31st December 2004.

This report is a summary of the detailed assessment. It has been carried out to discharge the Council's Local Air Quality Management obligations under the Environment Act 1995 for the third round of review and assessment.

1.2 Introduction to Local Air Quality Management

Part IV of the Environment Act 1995 requires local authorities to review and assess air quality in their areas against the national Air Quality objectives. Where it is probable that these objectives will be exceeded the local authority is required to designate an Air Quality Management Areas (AQMA) for the relevant locations. An action plan must then be drawn up setting out the measures intended to improve the air quality within the area covered by the AQMA.

Wychavon District Council's previous review and assessments have concluded that it was not necessary to designate any AQMA's within Wychavon, but the Updating and Screening assessment (USA), completed in April 2006 concluded that it was necessary to carry out detailed assessments at some locations.

1.3 Recommendations of Updating and Screening Assessment (USA) Report

The results of the diffusion tube monitoring in Swan Lane and Port Street during 2005 are shown below. The results have been corrected for bias and distance.

Site Reference	Location	National Bias 1.03	Local Bias 0.96	Revised National Bias 0.97
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EPS 13	Swan Lane	39.85	37.15	38.66
EPS 14	Port Street	42.75	39.56	41.77
EPS 15	High Street	41.72	38.89	40.47

Since the USA was submitted in April 2006 the national bias for 2005 has been revised from 1.03 to 0.97 and is now based on 14 studies. The local bias of 0.96 was derived from a co-location study with Herefordshire.

The USA concluded that it was necessary to carry out the following detailed assessments.

- For nitrogen dioxide in Swan Lane and Port Street Evesham

These locations were identified as potentially having nitrogen dioxide concentrations greater than the air quality objective of an annual mean concentration of 40 $\mu\text{g}/\text{m}^3$ to be achieved by the 31 December 2005.

- For particulate matter PM₁₀ at Hartlebury

The USA concluded that there was a risk of exceedences of the current objectives for particulate matter (PM₁₀)

the 24 hourly mean of PM₁₀ must not exceed 50 $\mu\text{g}/\text{m}^3$ more than 35 times per year to be achieved by 31st December 2004.

the annual mean of PM₁₀ must not exceed 40 $\mu\text{g}/\text{m}^3$ to be achieved by 31st December 2004.

and that the lack of any monitoring data for this pollutant meant that accurate comparison with air quality objectives was not possible.

2. Description of the Detailed Assessment Nitrogen Dioxide

2.1 Location

Evesham is an historic market town with the River Avon flowing through its centre. Through traffic is taken around the town on the A44 via the Evesham Bypass.

Traffic needing access to the Town Centre from the north of the river Avon travels down the High Street to the junction with Oat Street where it can turn left to a town car park or carry on through the town centre to the New Bridge over the Avon.

Swan Lane is a one way street, and the only exit route for traffic from the residential developments along the north bank of Avon. Also traffic that has crossed over the Workman Bridge and into the Mill Street the start of the one

way system and the vehicles leaving the Oat Street car park have to leave using Swan Lane.

Close to the High Street junction it is a canyon and traffic queues waiting for the lights to change. There is a mix of residential and commercial premises.

Heavy goods vehicles use the route to service the shops that are accessed from the one way system.

The main bus station is located on the High Street adjacent to the junction, but very few the buses use Swan Lane.

From the south of the river vehicles have two routes into the Town Centre either

- via Cheltenham Road to the New Bridge and on into High Street. A 7.5 tonne weight restriction has been introduced on the New Bridge. The excluded vehicles must use either the A44 and come in from the north or use Waterside and over the Workman Bridge into the one-way system that comprises Mill Street and Swan Lane.

or

- via Port Street that is two way and carries traffic into the Town Centre over the Workman Bridge or left into the Waterside. Vehicles that have not entered the one way system from the south can exit the Town using Port Street.

It is narrow canyon like street and traffic queues at the traffic lights to cross the Bridge or turn into Waterside. There are commercial and residential premises along the route.

Figure 1 shows the Detailed Assessment area and the road links in Evesham.

Figures 2 and 3 are more detailed plans of the assessment areas showing the sites of the diffusion tubes. Figures 4, 5, 6 and 7 are photographs showing Swan Lane and Port Street.

All relevant sources of nitrogen dioxide that may have an effect on the Detailed Assessment area were assessed and it was concluded that there were no significant point or fugitive emission sources present. The overwhelming local contribution to pollutant levels is road transport emissions.

2.2 Monitoring of Nitrogen Dioxide

For the purposes of Detailed Assessment, the diffusion tube network was increased from the two at the Swan Lane/ High Street Junction EPS 13 and EPS 15 and the single tube in Port Street EPS 14 to include the following:

- triplicate nitrogen tubes at the existing sites in Swan Lane and Port Street.
- additional single tubes along Swan Lane, High Street, Mill Street and Port Street.

The additional sites were chosen to provide information as to the possible spatial extent of air quality objective exceedences along the traffic route formed by the above roads.

The locations of the monitoring sites are shown in Figures 2 and 3.

The locations chosen were in accordance with the following criteria,

- Roadside locations (between 1m and 5m of the kerbside) for worst-case assessment
- Close proximity to appropriate receptor locations (monitoring at building facades or within 3m of receptor locations) for worst-case assessment
- Within street canyons or other areas with potentially detrimental street topography for worst case assessment
- Away from local point sources of combustion (e.g. heating flues) and away from overhanging/dense vegetation
- Avoidance of unrepresentative monitoring locations at (or adjacent to) local site where engines may be at idle in stationary vehicles off the highway (e.g. bus-stops and taxi ranks)
- Sampling height of between 1.5m (breathing zone) and 4m
- Good site security to minimise data loss and enable long-term monitoring

A full description of the monitoring positions and monitoring techniques is given in Appendix 1.

2.3 Monitoring results and air quality objective comparisons

The nitrogen dioxide monitoring reported in this assessment is for 2006 and in particular June to December 2006 when the new sites were installed. Figures 8, 8a, 9 and 9a show a summary of the monitoring results.

As the monitoring was for only a short period it has been necessary to apply the procedure set out in table 6.5 of LAQM TG(03) for the estimation of the annual mean for nitrogen dioxide from short monitoring data.

The approach is based on the fact that patterns in pollutant concentrations usually affect a wide region and uses a comparison of annual results and period results from sites that form part of the National Monitoring Network that are reported on the Air Quality Archive. There are no sites on the automatic monitoring network close to Wychavon, therefore four sites that had data capture percentages above 97% were chosen.

The results of that estimation are set on below.

Long Term Site	Annual Mean 2005(Am)	Period Mean 2006 (Pm)	Ratio Am/Pm)
Birmingham Tyburn	34.12	36.28	0.937
Canterbury	17.13	16.84	1.018
Harwell	11.62	11.42	1.017
Coventry Memorial Park	22.47	16.04	1.400
		Average (Ra)	1.093

Figures 8b and 9b show the outcome of applying the Ra factor to the annual means of each tube to produce a best estimate of the annual mean for 2006. The figures also show the outcome of applying of the national bias correction of 0.98 and the factor for the distance from the monitoring location to the receptor.

The results demonstrate that the nitrogen dioxide concentrations in Port Street exceed the 2005 annual mean objective of 40 µg/m³ at following monitoring sites the triplicate EPS14, EPS14a, EPS14b, EPS44 and EPS43.

The concentrations in Swan Lane area do not exceed the objective. At site EPS15 in High Street there is no relevant exposure.

2.4 Areas of Air Quality Objective exceedences

Additional assessment work has been carried out using the approved DMRB modelling methodology to establish the likely spatial extent of air quality exceedences for nitrogen dioxide using the background concentrations for 2005 and 2010 shown on the national air quality archive. The traffic flow data was provided by Worcestershire County Council, but a pessimistic estimate of 5km/h has been used for the annual average traffic speed.

The properties along Port Street form a road canyon that screens properties at the rear of the immediate road frontage using the methodology set out in paragraph 6.29 LAQM. TG(03). The premises in the length of Port Street where exceedences have been identified are immediately adjacent to the footpath with no garden areas.

The results of the modelling are shown on figure 10, the nitrogen dioxide concentrations fall to below the objective within 10 metres of the centre of Port Street.

The results of the diffusion tube monitoring at sites EPS 45, EPS 46 and EPS49 (see figure 3 and 9) support this and show the nitrogen dioxide levels falling to below the objective a short distance away from Port Street. EPS 42 that is located beyond the zone where traffic normally queues shows concentrations below the objective.

EPS 45 is approximately 15 metres from the centre of Port Street and the concentration level is $27.95\mu\text{g}/\text{m}^3$. EPS 46 is approximately 10m and the level is $30.21\mu\text{g}/\text{m}^3$, Castle Street is one way with vehicles turning off Port Street into it.

EPS 49 is approximately 25m from the centre of Port Street and the level is $31.94\mu\text{g}/\text{m}^3$, Burford Road is a two-way street and traffic queues waiting to turn into Port Street.

EPS 42 is approximately 2 metres from the kerb and close to a pedestrian crossing and the level is $31.91\mu\text{g}/\text{m}^3$

No vertical dispersion of pollutants has been assumed, in accordance with technical guidance. As a result the 1st or 2nd floor residential properties in Port Street are considered to be within the exceedence areas where appropriate.

Figure 11 shows the properties on Port Street where there is an element of residential use, it is mostly at first and second floor level. The breaks in the development line are Castle Street, Burford Road, Shor Street, Northwick Road and Church Street.

3 Detailed Assessment of Particulate Matter (PM₁₀)

3.1 Location

The detailed assessment location in Hartlebury shown on figure 12 has a number of significant potential sources of particulate matter PM₁₀ that may affect residential premises

- the Baggeridge Brick Plc, Waresley Works, quarry and stockpiles of raw materials.
- the current Biffa landfill site adjacent to The Waresley Works that uses the worked out clay quarry.
- the Baggeridge Brick Plc, Hartlebury Works, quarry and stockpiles of raw materials.
- the closed landfill site and quarry that will become a new landfill site in the near future.

3.2 Monitoring of Particulate Matter

The approach to the assessment was to use a portable light scattering Osiris monitor installed in the area for a period of continuous monitoring.

A study by Camden Council in 2002 compared the results from their TEOM's, Partisol-Plus Sequential Air sampler and Osiris instruments. It concluded that the Osiris results were comparable by applying the 1.3 factor when comparing a TEOM data with health based standards. The Osiris results should provide a good correlation with the results obtained using approved instruments.

3.3 Monitoring results and air quality objective comparisons

Figure 13 shows a summary of the particulate matter monitoring results from the Osiris for the period July to December 2006.

The results are from the instrument corrected by bias of 1.3 as recommended in the Camden Council study.

During the period of the monitoring there were 3 exceedences of the objective before correction and 14 after correction.

It has been necessary to apply the procedure set on in table 8.5 of LAQM TG(03) for the estimation of the annual mean PM₁₀ from short monitoring data because the monitoring period was only July to December.

The approach uses a comparison of annual results and period results from sites that form part of the National Monitoring Network and are reported on the Air Quality Archive. There are no sites on the automatic monitoring network close to Wychavon, therefore four sites that had data capture percentages above 97% were chosen.

The results of that estimation are set on below.

Long Term Site	Annual Mean 2005(Am)	Period Mean 2006 (Pm)	Ratio Am/Pm)
Birmingham Tyburn	22	24.13	0.912
Canterbury	23	23.61	0.974
Harwell	19	18.48	1.028
Coventry Memorial Park	19	20.46	0.928
		Average (Ra)	0.961

The measured corrected period mean was 27.787, therefore the best estimate of the annual mean for the site in 2006 is $27.787 \times Ra (0.961) = 26.703 \mu\text{g}/\text{m}^3$ gravimetric

The results to date demonstrate that the current concentrations are unlikely to exceed the 24 hourly mean objective for PM₁₀ not to exceed 50 ug/m³ more than 35 times per year and that the annual mean of 40 ug/m³ is unlikely to be exceeded.

4. CONCLUSIONS AND RECOMMENDATIONS OF THE DETAILED ASSESSMENT

4.1 Conclusions and Recommendations

The conclusions of the Detailed Assessment of nitrogen dioxide are:

- The annual mean objective for the nitrogen dioxide concentration not to exceed 40 µg/m³ by the 31 December 2005 is not currently exceeded in Swan Lane, but any future changes in road layout and traffic flows in the area will need to be assessed against the effect on air quality. Nitrogen dioxide monitoring will continue.
- the annual mean objective for the nitrogen dioxide concentration not to exceed 40 µg/m³ by the 31 December 2005 is exceeded in part of Port Street Evesham.
- The 24 hourly mean of PM₁₀ must not exceed 50 ug/m³ more than 35 times per year to be achieved by 31st December 2004 is not currently being exceeded in Hartlebury.
- The annual mean of PM₁₀ must not exceed 40 ug/m³ to be achieved by 31st December 2004 is not currently being exceeded in Hartlebury.

As a result of the above conclusions, and in accordance with the Council's statutory obligations under Local Air Quality Management (LAQM), the following recommendations are made:

- 1. An Air Quality Management Area (AQMA) must be declared in Port Street Evesham in respect of nitrogen dioxide because the air quality objectives are unlikely to be met.**
- 2. An AQMA shall be designated within the relevant area under section 83(1) of the Environment Act 1995, by means of an official order.**
- 3. The AQMA shall as a minimum, include all those areas identified as the having exceedences of air quality objective as shown in Figures 13 of this report.**

4. A draft boundary for the AQMA figure 14 shall be identified at this stage of the review and assessment process for wider consultation purposes (see Section 6).

5. Consultation on the formal boundary of the AQMA shall be carried out following the publication of this report.

6. The formal boundary of any AQMA shall be finalised and the formal AQMA order completed in August 2007

7. An Evesham Air Quality Steering Group shall be established to take forward the development and implementation of an air quality action plan in pursuit of the relevant air quality objectives.

Note: The production of an action plan is a statutory obligation following designation of an AQMA. The formation of a Steering Group is viewed as best practice and should include relevant officers from District and County departments as well as local members and representatives from outside bodies and local community groups.

8. The Steering Group shall be chaired by a senior officer of Wychavon District Council.

Note: This recommendation ensures a corporate approach is taken and will help other Council services discuss how the action plan can be taken into account in other Council plans such as Local Development Plans, Local Transport Plans and Local Community and Agenda 21 Strategies. A senior officer will be important to the development of strong working links with other agencies and public bodies that will have an important input in the action planning process.

9. A provisional air quality action plan shall be completed within 18 months of designation of the AQMA.

Note: This recommendation is not statutory but represents best practice as prescribed in current LAQM policy guidance, LAQM.PG(03)Ref2.

10. Further assessment work is carried out prior to designation of the AQMA to 'source apportion' the likely key pollutant sources e.g. different vehicle classes using enhanced traffic flow and composition data

Note: This recommendation is not statutory but represents best practice as prescribed in current LAQM policy guidance, LAQM.PG(03)2 and will provide important information for action planning purposes.

5. DRAFT AIR QUALITY MANAGEMENT AREA (AQMA) BOUNDARY AND TIMETABLE FOR FURTHER ACTION

5.1 Draft AQMA boundary

Any boundary for an AQMA must include, as a minimum, all areas of exceedence of the air quality objective, however, in accordance with policy guidance, the Council has also considered the following points before drafting an AQMA boundary:

- Designation of a wider area, based on existing features, transport infrastructure or natural boundaries. This avoids artificially precise boundaries and accommodates the fact that the air quality action plan is likely to cover a wider area
- Ultimately, there are no hard or fast rules in determining the boundary of an AQMA beyond the exceedence areas, an element of judgement is required.

Policy guidance states that this should be based on the local situation, whilst drawing upon relevant independent guidance and the experience of other local authorities, which have already have an AQMA.

In drawing up a draft AQMA boundary, the Council has consulted a recommended toolkit provided by the environmental protection charity NSCA published in 2003 and applied local knowledge and professional officer judgement.

Consultation has been carried out during June and July 2007 with representatives of key services (environmental, transport and forward planning) and elected members, at County and District level, in order to refine a workable boundary.

The draft AQMA boundary figure 14 has the following key features:

- It is a provisional boundary subject to possible amendment following wider consultation and review.
- Follows at its narrowest extent a band of uncertainty around the air quality objective exceedence area. This ensures that the full spatial extent of affected areas is included directly within the action planning process.
- Follows natural boundaries where possible to ease administration, however some boundary areas follow an artificial line where no natural route exists or its use is unjustified.

- Overall, recognises that any air quality action plan is likely to cover a wider area than that strictly defined by the measured/modelled areas of air quality objective exceedences.

5.2 Timetable for further action

In order to ensure the full recommendations of the Detailed Assessment are met the following timetable for further action is outlined in Figure 15.

The timetable forms the basis of an outline project plan and includes all initial regulatory (and some non-regulatory) requirements of the Local Air Quality Management process.

6. CONSULTATION

The external consultation requirements of Detailed Assessment reports are set out in Schedule 11 of the Environment Act 1995 for Wychavon District Council they are detailed below.

External Consultees

- (i) DEFRA
- (ii) Worcestershire County Council (Highways Authority)
- (iii) Evesham Town Council
- (iii) All neighbouring local authorities (Worcester City Council, Redditch BC, Malvern DC, Wyre Forest DC, Bromsgrove DC)
- (v) Environment Agency Area Office

Additional, non-statutory consultation is as follows.

Internal Consultees

- (i) Environmental Services Committee
- (ii) Chief Executive
- (iii) Forward Planning
- (iii) Development Control

(v) Community Regeneration

A wider consultation will be conducted on the AQMA boundary and for action planning purposes.

7. REFERENCES

1. Part IV of the Environment Act 1995 Local Air Quality Management. Technical Guidance LAQM.TG(03), February 2003 (The Stationary Office Limited)
2. Part IV of the Environment Act 1995 Local Air Quality Management. Policy Guidance LAQM.PG(03), February 2003 (The Stationary Office Limited)
3. Updating and Screening Assessment Report 2003, May 2003 (Wychavon District Council)
4. Worcestershire Local Transport Plan 2001-2006
5. Air Quality Management Areas: A Review of Procedures and Practice for Local Authorities, 2003 (NSCA)
6. UK NO₂ Diffusion Tube Network Instruction Manual. Version 1.5, February 2003 (AEA Technology plc)

8. ABBREVIATIONS AND GLOSSARY

AADT	Annual Average Daily Traffic (vehicles per day)
AQMA	Air Quality Management Area
ATC	Automatic Traffic Counter
AURN	Automatic Urban and Rural (air quality monitoring) Network
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges Screening Model (v1.02)
GIS	Geographical Information System
HDV	Heavy Duty Vehicles (includes rigid and articulated Heavy Goods Vehicles and Buses and Coaches) greater than 3.5 tonnes in weight
HGV	Heavy Goods Vehicles greater than 7.5 tonnes in weight
ISO	International Standards Organisation
LAQM	Local Air Quality Management
LAQM.PG(03)	LAQM Policy Guidance 2003 (see ref.2 in section 8 above)
LAQM.TG(03)	LAQM Technical Guidance 2003 (see ref. 1 in section 8 above)
LDV	Light Duty Vehicles (includes passenger cars and other vehicles <3.5t gross vehicle weight)
m	metre
Wychavon	Wychavon District Council (WDC)
NETCEN	National Environmental Technology Centre, part of AEA Technology plc
NO₂	Nitrogen dioxide
NO_x	Nitrogen oxides
OS	Ordnance Survey
PM₁₀	Particulate matter with a (equivalent aerodynamic) diameter of ten microns (10 µm) or less
QA/QC	Quality Assurance and Quality Control
TEOM	Tapered Element Oscillating Microbalance (PM ₁₀ monitoring technique)
µg/m³	microgrammes per cubic metre in air (a concentration of 1 µg/m ³ means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant)
UKAS	United Kingdom Accreditation Service
USA	Updating and Screening Assessment
UWE	University of the West of England
WASP	Workplace Analysis Scheme for Proficiency

APPENDIX 1 – DETAILED ASSESSMENT MONITORING DATA

(A) Description of monitoring technique

Monitoring for nitrogen dioxide has been completed using the following specification of passive diffusion tubes:

- Standard environmental monitoring nitrogen dioxide tubes
- Tube preparation method: 20% Triethanolamine (TEA) in deionised water
- Supplier and analysing laboratory: Gradko International Ltd

These tubes were exposed for one-month periods in accordance with LAQM.TG (03) guidance.

(B) Laboratory QA/QC

Gradko International Ltd are an experienced and long-standing supplier and analysing laboratory for passive air quality monitoring tubes in the UK.

Laboratory procedures include for system blanks and calibration runs at prescribed intervals. The laboratory has specific UKAS accreditation (testing no. 2187) for the analysis of nitrogen dioxide diffusion tubes using documented in-house reference methods GLM3 and 6. A copy of the UKAS accreditation schedule is available from the Council or from the laboratory on request. Gradko also participate in independent proficiency testing (inter-laboratory round-robin exercises) via the WASP scheme.

The WASP scheme is carried out quarterly using an accurately doped tube (of known concentration to WASP). The doped tube is analysed 'blind' by the laboratory and the reported results then compared by WASP against the true concentration and comparisons are also made with other laboratories participating in the survey. The WASP results indicate the laboratory results are good in terms of accuracy and precision (performance category 1 using the Running Performance Index criteria). A copy of the WASP performance results from the two most recent rounds is available from the Council or from the laboratory on request.

(C) Tube handling procedures

The Wychavon NO₂ diffusion tube monitoring is completed in full accordance with the UK NO₂ Diffusion Tube Network Instruction Manual, 4 results are reported as part of the UK network none of these are within the area of the detailed assessment area.

Prior to sampling, the NO₂ tubes are stored in cool location within the supplied packaging until use. All handling is carried out in a clean, well ventilated environment.

The tube end caps are not removed until the tube has been placed at the monitoring location at the start of the monitoring period.

Once sampling is completed, tubes are recapped with the storage caps and returned as quickly as possible to the clean storage environment. All tubes are then re-enclosed in the supplied packaging and returned to Gradko for analysis within 24 hours.

A 'field' blank tube is analysed with each monthly batch of tubes. The field blank is an unexposed tube from the same batch as the exposed tubes and undergoes the same handling and transport (including travel to and from the monitoring sites).

The purpose of this tube is to determine any inadvertent NO₂ contamination of the tubes, before and after exposure. Any resultant contamination found on the analysed field blank is then used to 'blank correct' the reported results for the exposed tubes.

(D) Data ratification

All reported results are well within the documented limit of detection and uncertainty of the measurement technique and all results are laboratory blank corrected.

NO₂ diffusion tubes provide a cost-effective means of monitoring a wide range of monitoring locations. However, the accuracy of tubes is variable depending on the tube handling procedures, the specific tube preparation/adsorbent mixture and the analysing laboratory.

National annual mean correction factors are now available for the specific Gradko 20% TEA in water combination of tubes as used by Wychavon. The latest correction factors have been retrospectively applied to the diffusion tube data obtained from the diffusion tubes in Swan Lane and Port Street.

A local bias factor has also been derived from a collocation study with Herefordshire County Council:

Correction factor = CM/DM

Where, CM is the ratified continuous chemiluminescence monitor mean and DM is the raw monthly mean for the average of the collocated triplicate diffusion

tubes. In all cases it was possible to match the continuous monitoring data period and the diffusion tube monthly exposure period to within 1-hour.

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- Figure 15 Timetable

Figure 1 Map of Evesham showing area of Detailed Assessment

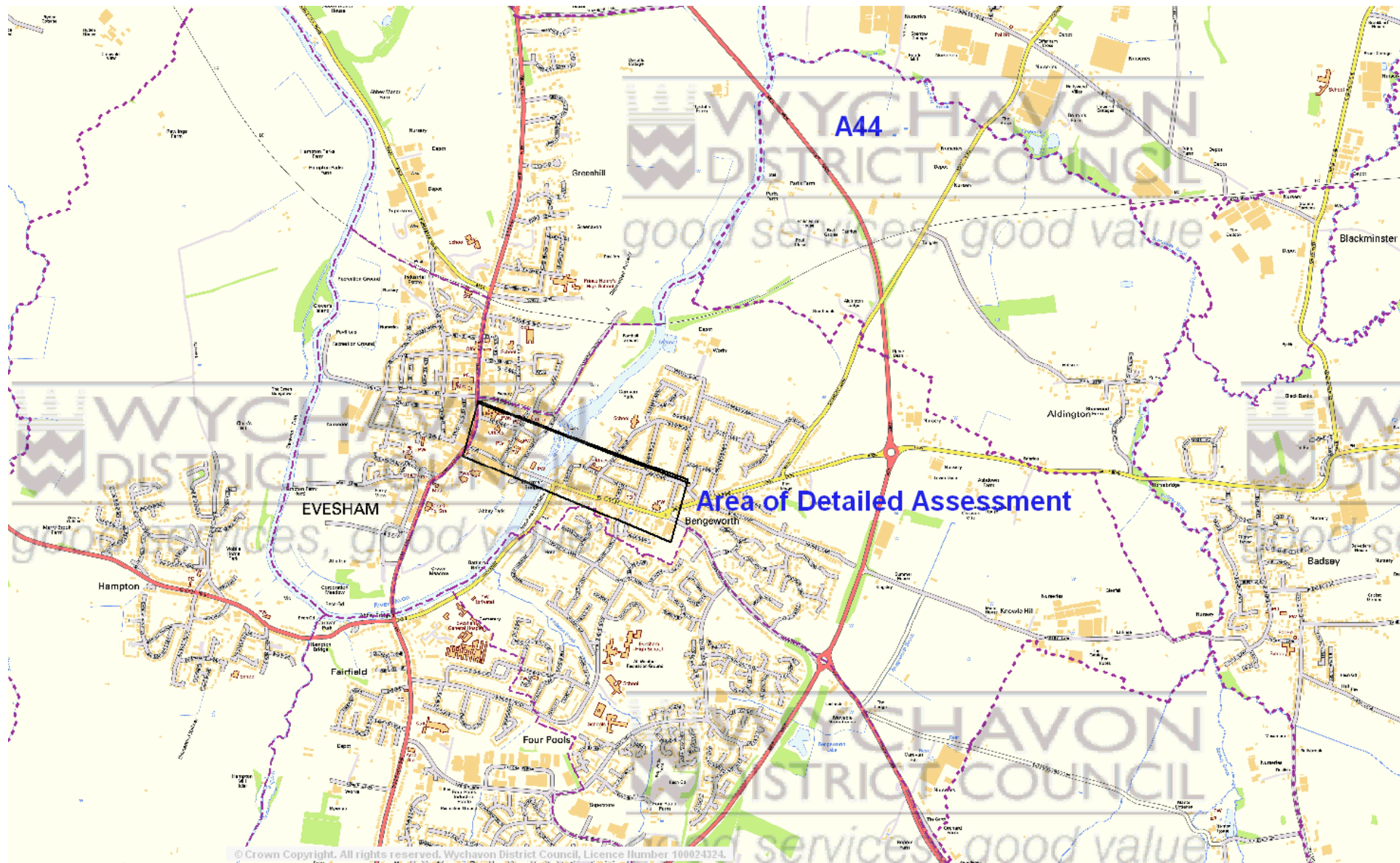


Figure 2 NO2 tubes High Street, Swan Lane, Chapel Street Evesham

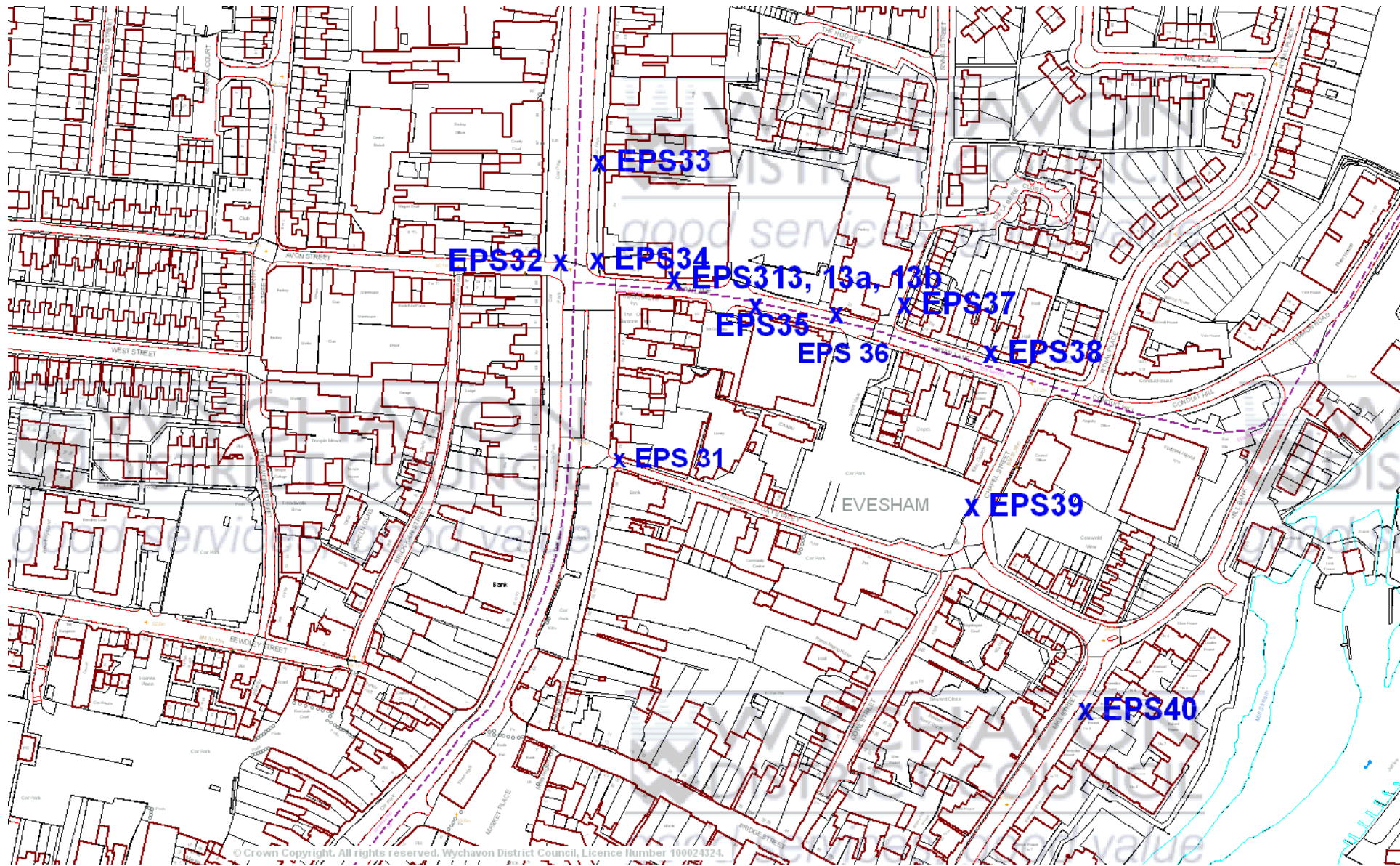


Figure 3 NO2 tubes Port Street Evesham

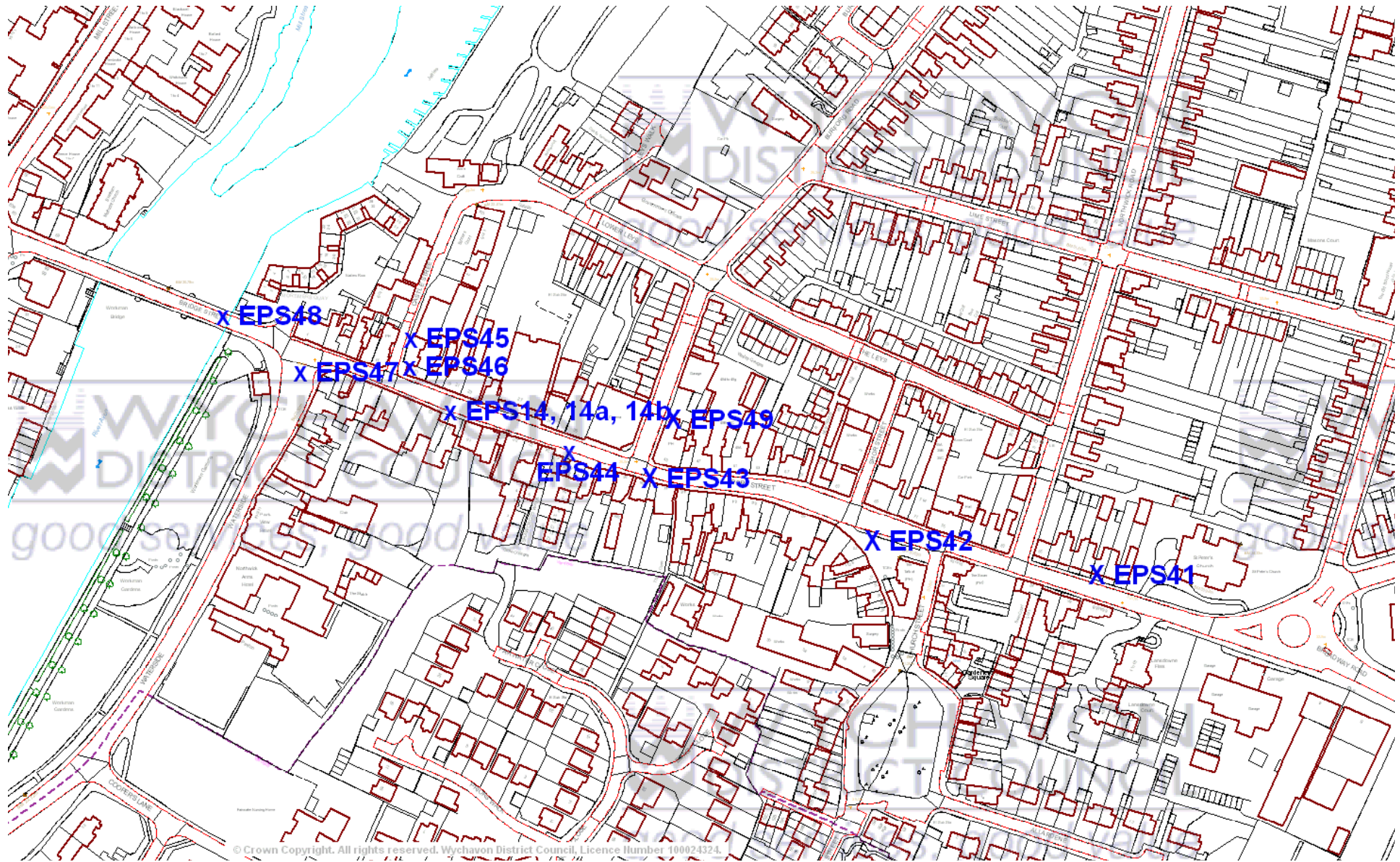




Figure 4 Traffic at the Swan Lane/HighStreet junction



EPS35

EPS13, 13a, 13b

Figure 5 Traffic in Swan Lane queuing to get into High Street

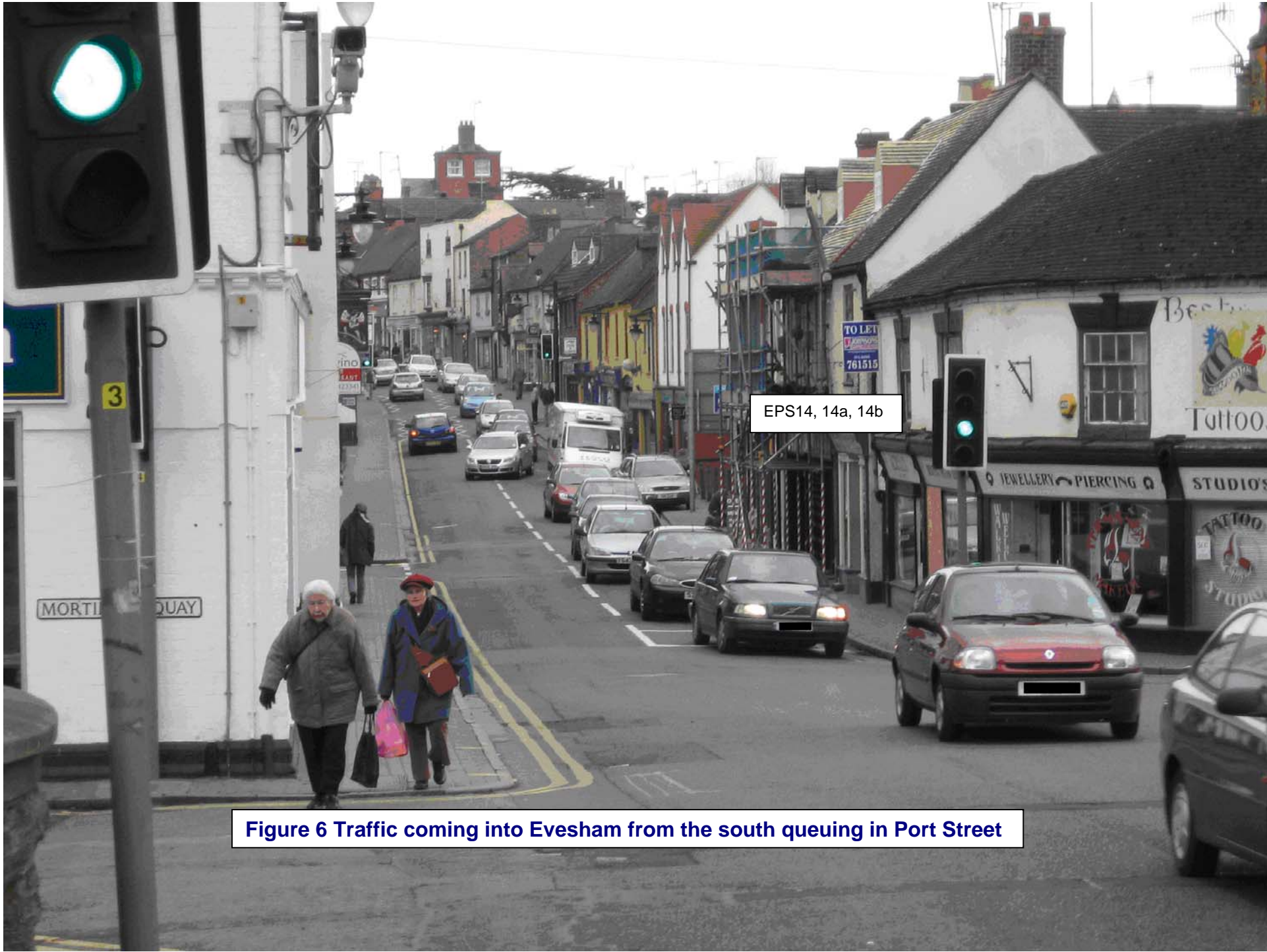
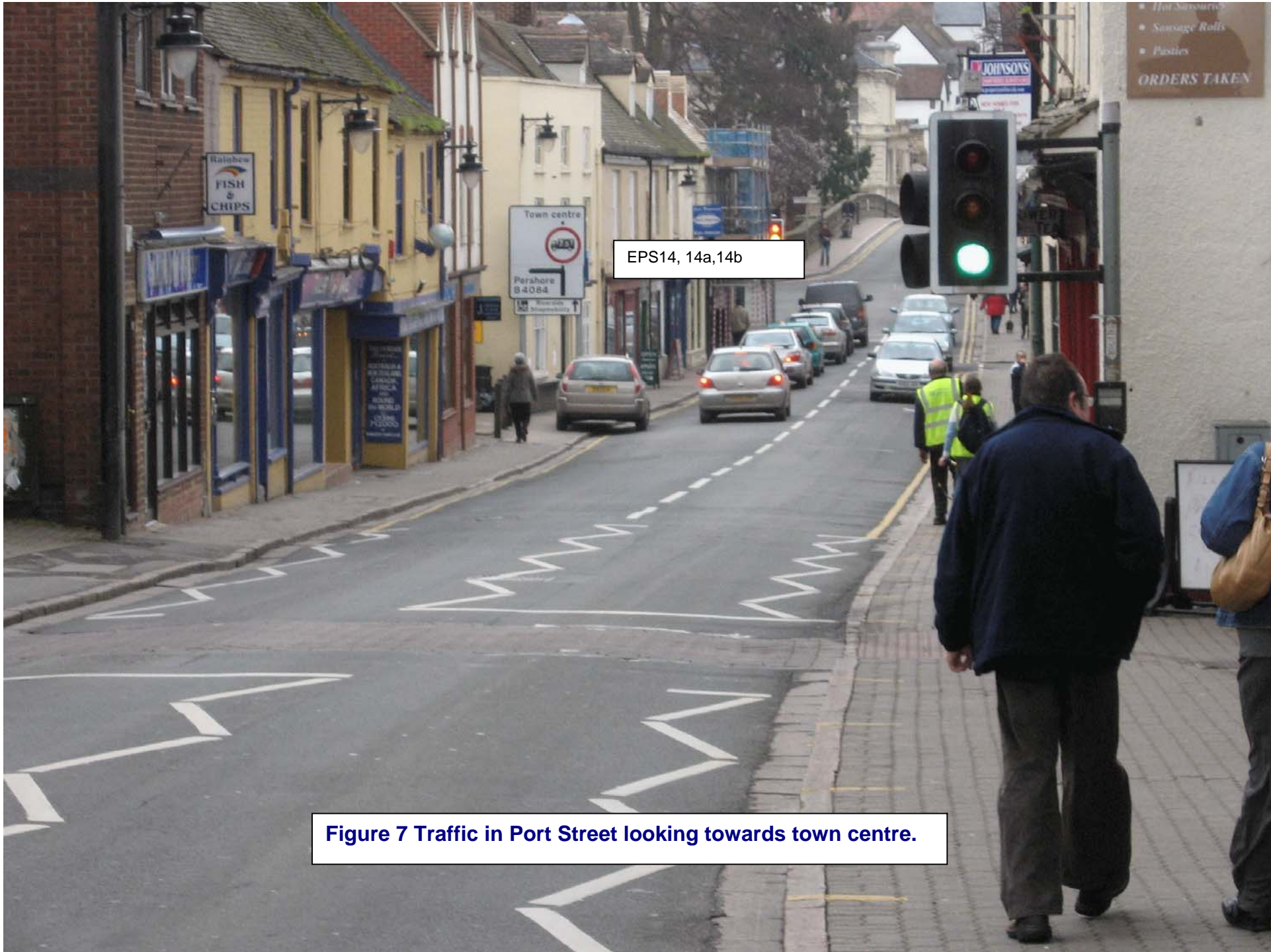


Figure 6 Traffic coming into Evesham from the south queuing in Port Street



EPS14, 14a, 14b

Figure 7 Traffic in Port Street looking towards town centre.

Roadside NO₂ concentration 2006

Figure 8

	Evesham	Jan	Feb	March	April	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Annual Mean	Annual Mean
EPS13	Swan Lane	43.57	49.00	35.64	37.79	27.47	32.17	34.06	42.78	33.43	37.10	41.13		37.65	
EPS13a	Swan Lane						31.43	36.08	36.01	40.47	41.43			37.08	
EPS13b	Swan Lane						35.44	27.59	41.76	32.84	43.12	39.38	39.80	37.13	*37.29
EPS15	High Street							35.66		35.77	49.47	42.80	38.46	40.43	
EPS31	High Street LP28								35.61	41.55	31.97	29.46	36.54	35.03	
EPS32	Avon Street LP 11						28.14	23.45	25.6	25.16	31.97	31.44	34.46	28.60	
EPS33	High Street LP32							37.44	28.44	29.63	38.89	33.86	35.23	33.92	
EPS34	High Str/ Swan La Camera						22.36	31.87	30.25	31.26	33.10	38.68	40.49	32.57	
EPS35	Swan Lane LP 2						28.90	19.46	25.64	26.26	34.67		38.52	28.91	
EPS36	Swan Lane LP 3						23.06	17.03	21.42	25.98		24.06	27.06	23.10	
EPS37	Cowl Street								17.55	19.71	28.99			22.08	
EPS38	Swan Lane LP 5						24.01	23.78	23.24	20.71	22.85	30.14	25.35	24.30	
EPS39	Chapel Street LP 1						21.07	25.92	18	21.07	25.72	26.31	24.41	23.21	
EPS40	Mill Street LP 4						22.22		22.9	27.42	30.50	33.41	28.09	27.42	

*Average annual mean EPS13, EPS13a and EPS13b

NO₂ concentration ug/m³

Roadside NO2 diffusion tube results June to December 2006

Figure 8a

	Evesham	Jun	July	Aug	Sept	Oct	Nov	Dec	Annual Mean	Annual Mean
EPS13	Swan Lane	32.17	34.06	42.78	33.43	37.10	41.13		36.78	
EPS13a	Swan Lane	31.43	36.08	36.01	40.47	41.43			37.08	
EPS13b	Swan Lane	35.44	27.59	41.76	32.84	43.12	39.38	39.80	37.13	37.00
EPS15	High Street		35.66		35.77	49.47	42.80	38.46	40.43	
EPS31	High Street LP28			35.61	41.55	31.97	29.46	36.54	35.03	
EPS32	Avon Street LP 11	28.14	23.45	25.6	25.16	31.97	31.44	34.46	28.60	
EPS33	High Street LP32		37.44	28.44	29.63	38.89	33.86	35.23	33.92	
EPS34	High Str/ Swan La Camera	22.36	31.87	30.25	31.26	33.10	38.68	40.49	32.57	
EPS35	Swan Lane LP 2	28.90	19.46	25.64	26.26	34.67		38.52	28.91	
EPS36	Swan Lane LP 3	23.06	17.03	21.42	25.98		24.06	27.06	23.10	
EPS37	Cowl Street			17.55	19.71	28.99			22.08	
EPS38	Swan Lane LP 5	24.01	23.78	23.24	20.71	22.85	30.14	25.35	24.30	
EPS39	Chapel Street LP 1	21.07	25.92	18	21.07	25.72	26.31	24.41	23.21	
EPS40	Mill Street LP 4	22.22		22.9	27.42	30.50	33.41	28.09	27.42	

Annual Mean adjusted for Ra, Bias and Distance

Figure 8b

	Evesham	Annual Mean	Annual Mean	Ra	Annual Mean		Bias	Result		Distance	Result	
EPS13	Swan Lane	36.78		1.093	40.20		0.98	39.39		0.95	37.43	
EPS13a	Swan Lane	37.08		1.093	40.53		0.98	39.72		0.95	37.74	
EPS13b	Swan Lane	37.13	37.00	1.093	40.58	40.44	0.98	39.77	39.63	0.95	37.78	37.65
EPS15	High Street	40.43		1.093	44.19		0.98	43.31		0.95	41.14	
EPS31	High Street LP28	35.03		1.093	38.28		0.98	37.52		0.95	35.64	
EPS32	Avon Street LP 11	28.60		1.093	31.26		0.98	30.64		1	30.64	
EPS33	High Street LP32	33.92		1.093	37.07		0.98	36.33		0.95	34.51	
EPS34	High Str/ Swan Lane Camera	32.57		1.093	35.60		0.98	34.89		0.95	33.15	
EPS35	Swan Lane LP 2	28.91		1.093	31.60		0.98	30.96		1	30.96	
EPS36	Swan Lane LP 3	23.10		1.093	25.25		0.98	24.75		1	24.75	
EPS37	Cowl Street	22.08		1.093	24.14		0.98	23.65		1	23.65	
EPS38	Swan Lane LP 5	24.30		1.093	26.56		0.98	26.03		0.95	24.72	
EPS39	Chapel Street LP 1	23.21		1.093	25.37		0.98	24.87		0.95	23.62	
EPS40	Mill Street LP 4	27.42		1.093	29.97		0.98	26.87		0.95	25.53	

Roadside NO₂ Concentrations 2006

Figure 9

	Evesham	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean	Annual Mean
EPS14	Port Street	50.54	47.45	44.43	49.78	48.71	47.01	49.52	42.50	42.32	43.97	37.32	44.04	45.63	
EPS14a	Port Street						35.20	58.34	38.57	46.61	45.04	46.29	42.29	44.62	
EPS14b	Port Street						48.22		44.04	43.81	47.23	55.31	44.90	47.25	*45.84
EPS41	Port Street LP21						28.83	37.39	30.3	29.91	34.73	34.22	31.56	32.42	
EPS42	Port Street LP40											37.27	29.38	33.33	
EPS43	Long Stay opp cinema						44.38	47.14	35	41.33	36.25	43.02	36.26	40.49	
EPS44	Camera Post opp 33						39.05	42.96			41.27	46.29	34.34	40.78	
EPS45	Castle Street LP1						24.44	19.81	25.6	26.69	31.75	36.26	27.75	27.47	
EPS46	Castle Str 20 mph sign						29.64	26.62	30.1		31.13	31.08	29.50	29.69	
EPS47	Waterside centre RES						37.82	36.58	37.1	32.84	37.38	41.94	32.62	36.62	
EPS48	LP12 on bridge							23.26	22.2	28.05	28.99	25.73	25.83	25.68	
EPS49	Burford Road LP12							30.37	25	30.13			33.77	29.82	

* Average annual mean EPS14, EPS14a and EPS14b

NO₂ concentration ug/m³

Roadside NO₂ diffusion tube results for June to December 2006

Table 9a

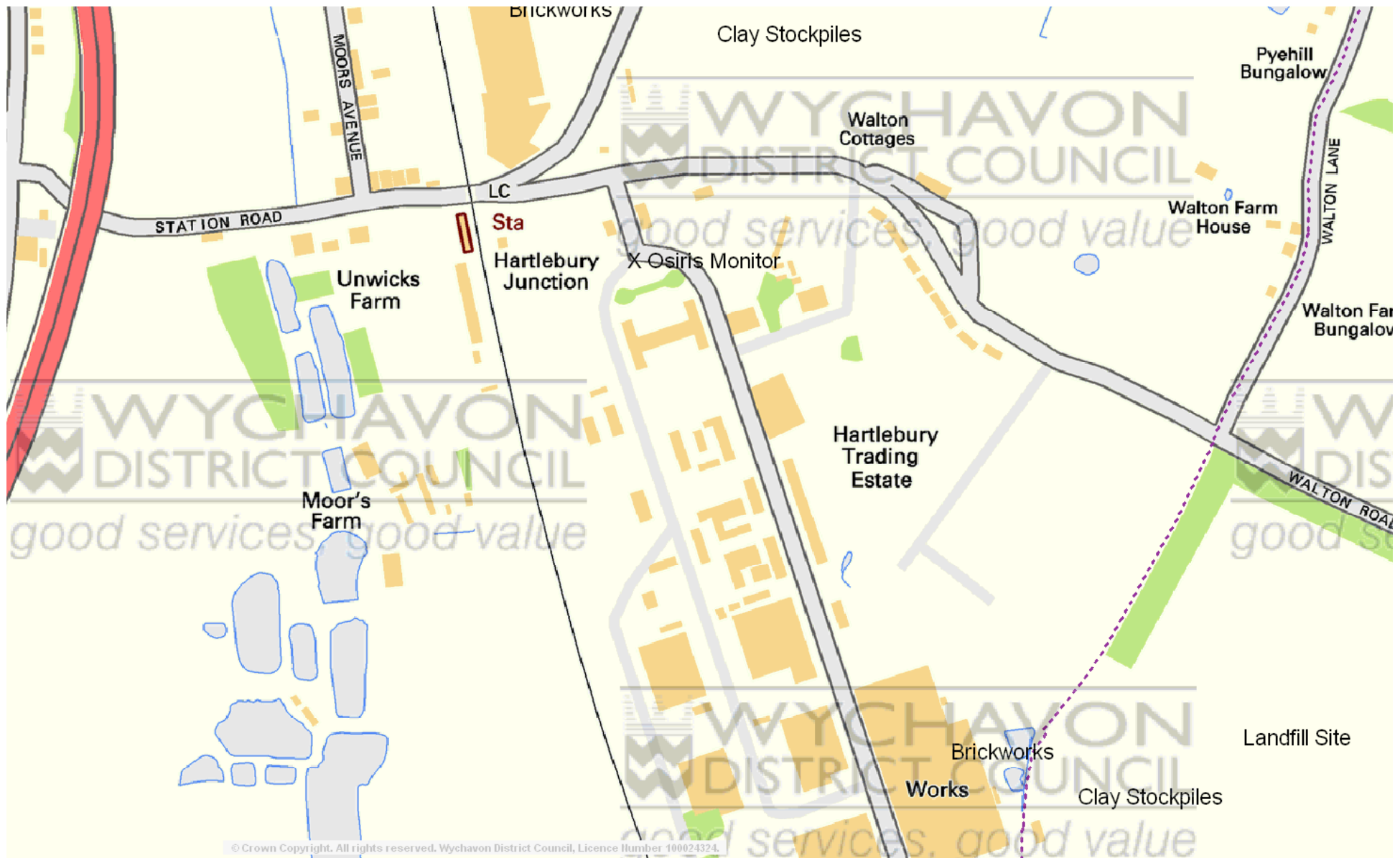
	Evesham	Jun	July	Aug	Sept	Oct	Nov	Dec	Annual Mean	Annual Mean
EPS14	Port Street	47.01	49.52	42.50	42.32	43.97	37.32	44.04	43.81	
EPS14a	Port Street	35.20	58.34	38.57	46.61	45.04	46.29	42.29	44.62	
EPS14b	Port Street	48.22		44.04	43.81	47.23	55.31	44.90	47.25	*45.23
EPS46	Castle Street 20 mph sign	29.64	26.62	30.14		31.13	31.08	29.50	29.69	
EPS45	Castle Street LP1	24.44	19.81	25.58	26.69	31.75	36.26	27.75	27.47	
EPS44	Camera Post opp 33	39.05	42.96			41.27	46.29	34.34	40.78	
EPS43	Long Stay opp cinema	44.38	47.14	35.04	41.33	36.25	43.02	36.26	40.49	
EPS49	Burford Road LP12		30.37	25.01	30.13			33.77	29.82	
EPS42	Port Street LP40						37.27	29.38	33.33	
EPS41	Port Street LP21	28.83	37.39	30.3	29.91	34.73	34.22	31.56	32.42	
EPS47	Waterside centre	37.82	36.58	37.14	32.84	37.38	41.94	32.62	36.62	
EPS48	LP63 on bridge		23.26	22.22	28.05	28.99	25.73	25.83	25.68	

Results of DRMB modelling

Figure 10

Distance	AADT	Annual average speed	Type of road	Total % LDV	Total % HDV	NO₂ concentration ug/m³
2005						
5m	12750	5km/h	B	93	7	39.5
10m	12750	5km/h	B	93	7	37.5
15m	12750	5km/h	B	93	7	35.1
2010						
5m	13000	5km/h	B	93	7	30.3
10m	13000	5km/h	B	93	7	28.9
15m	13000	5km/h	B	93	7	27.1

Figure 12 Area of detailed assessment Hartlebury



24 HOUR AVERAGE PM10 MONITORING RESULTS

Figure 13

Date	24h Average	Bias adjusted									
07/06/2006	28	36.4	10/07/2006	18	23.4	14/08/2006	18	23.4	18/09/2006	14	18.2
08/06/2006	36	46.8	11/07/2006	17	22.1	15/08/2006	11	14.3	19/09/2006	26	33.8
09/06/2006	29	37.7	12/07/2006	16	20.8	16/08/2006	16	20.8	20/09/2006	28	36.4
10/06/2006	32	41.6	13/07/2006	75	97.5	17/08/2006	16	20.8	21/09/2006	35	45.5
11/06/2006	17	22.1	14/07/2006	29	37.7	18/08/2006	18	23.4	22/09/2006	26	33.8
12/06/2006	21	27.3	15/07/2006	28	36.4	19/08/2006	13	16.9	23/09/2006	19	24.7
13/06/2006	23	29.9	16/07/2006	29	37.7	20/08/2006	8	10.4	24/09/2006	25	32.5
14/06/2006	42	54.6	17/07/2006	39	50.7	21/08/2006	13	16.9	25/09/2006	20	26
15/06/2006	24	31.2	18/07/2006	28	36.4	22/08/2006	12	15.6	26/09/2006	13	16.9
16/06/2006	30	39	19/07/2006	35	45.5	23/08/2006	11	14.3	27/09/2006	14	18.2
17/06/2006	26	33.8	20/07/2006	46	59.8	24/08/2006	25	32.5	28/09/2006	7	9.1
18/06/2006	19	24.7	21/07/2006	39	50.7	25/08/2006	19	24.7	29/09/2006	10	13
19/06/2006	9	11.7	22/07/2006	35	45.5	26/08/2006	11	14.3	30/09/2006	20	26
20/06/2006	11	14.3	23/07/2006	20	26	27/08/2006	15	19.5	01/10/2006	18	23.4
21/06/2006	19	24.7	24/07/2006	18	23.4	28/08/2006	13	16.9	02/10/2006	13	16.9
22/06/2006	18	23.4	25/07/2006	27	35.1	29/08/2006	15	19.5	03/10/2006	10	13
23/06/2006	30	39	26/07/2006	24	31.2	30/08/2006	11	14.3	04/10/2006	13	16.9
24/06/2006	31	40.3	27/07/2006	22	28.6	31/08/2006	11	14.3	05/10/2006	12	15.6
25/06/2006	45	58.5	28/07/2006	8	10.4	01/09/2006	17	22.1	06/10/2006	10	13
26/06/2006	25	32.5	29/07/2006	11	14.3	02/09/2006	13	16.9	07/10/2006	16	20.8
27/06/2006	24	31.2	30/07/2006	23	29.9	03/09/2006	13	16.9	08/10/2006	23	29.9
28/06/2006	19	24.7	31/07/2006	17	22.1	04/09/2006	13	16.9	09/10/2006	22	28.6
29/06/2006	26	33.8	01/08/2006	17	22.1	05/09/2006	22	28.6	10/10/2006	45	58.5
30/06/2006	22	28.6	02/08/2006	20	26	06/09/2006	16	20.8	11/10/2006	25	32.5
01/07/2006	18	23.4	03/08/2006	26	33.8	07/09/2006	23	29.9	12/10/2006	31	40.3
02/07/2006	24	31.2	04/08/2006	22	28.6	08/09/2006	24	31.2	13/10/2006	22	28.6
03/07/2006	31	40.3	05/08/2006	14	18.2	09/09/2006	40	52	14/10/2006	33	42.9
04/07/2006	35	45.5	06/08/2006	17	22.1	10/09/2006	39	50.7	15/10/2006	55	71.5
05/07/2006	41	53.3	07/08/2006	26	33.8	11/09/2006	47	61.1	16/10/2006	63	81.9
06/07/2006	28	36.4	08/08/2006	20	26	12/09/2006	30	39	17/10/2006	41	53.3
07/07/2006	13	16.9	09/08/2006	24	31.2	13/09/2006	12	15.6	18/10/2006	22	28.6
08/07/2006	17	22.1	10/08/2006	24	31.2	14/09/2006	11	14.3	19/10/2006	24	31.2
09/07/2006	7	9.1	11/08/2006	27	35.1	15/09/2006	36	46.8	20/10/2006	15	19.5
			12/08/2006	24	31.2	16/09/2006	62	80.6	21/10/2006	19	24.7
			13/08/2006	8	10.4	17/09/2006	36	46.8	22/10/2006	24	31.2

23/10/2006	11	14.3	10/11/2006	27	35.1	28/11/2006	21	27.3	16/12/2006	8	10.4
24/10/2006	19	24.7	11/11/2006	12	15.6	29/11/2006	29	37.7	17/12/2006	10	13
25/10/2006	20	26	12/11/2006	25	32.5	30/11/2006	29	37.7	18/12/2006	13	16.9
26/10/2006	18	23.4	13/11/2006	11	14.3	01/12/2006	22	28.6	19/12/2006	31	40.3
27/10/2006	32	41.6	14/11/2006	12	15.6	02/12/2006	26	33.8	20/12/2006	24	31.2
28/10/2006	15	19.5	15/11/2006	19	24.7	03/12/2006	21	27.3	21/12/2006	21	27.3
29/10/2006	25	32.5	16/11/2006	17	22.1	04/12/2006	19	24.7	22/12/2006	18	23.4
30/10/2006	20	26	17/11/2006	8	10.4	05/12/2006	19	24.7	23/12/2006	27	35.1
31/10/2006	14	18.2	18/11/2006	9	11.7	06/12/2006	15	19.5	24/12/2006	17	22.1
01/11/2006	22	28.6	19/11/2006	10	13	07/12/2006	20	26	25/12/2006	8	10.4
02/11/2006	26	33.8	20/11/2006	15	19.5	08/12/2006	21	27.3	26/12/2006	12	15.6
03/11/2006	30	39	21/11/2006	12	15.6	09/12/2006	11	14.3	27/12/2006	38	49.4
04/11/2006	33	42.9	22/11/2006	18	23.4	10/12/2006	12	15.6	28/12/2006	23	29.9
05/11/2006	24	31.2	23/11/2006	17	22.1	11/12/2006	15	19.5	29/12/2006	12	15.6
06/11/2006	26	33.8	24/11/2006	20	26	12/12/2006	20	26	30/12/2006	13	16.9
07/11/2006	23	29.9	25/11/2006	6	7.8	13/12/2006	19	24.7	31/12/2006	24	31.2
08/11/2006	21	27.3	26/11/2006	16	20.8	14/12/2006	7	9.1			
09/11/2006	30	39	27/11/2006	25	32.5	15/12/2006	10	13			

Figure 14 Area of proposed Air Quality Management Area (AQMA)

