2019 Air Quality Annual Status Report (ASR)

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

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Executive Summary: Air Quality in Our Area

Air Quality in Herefordshire Council

Air pollution is associated with a number of adverse health impacts. It is recognised as a contributing factor in the onset of heart disease and cancer. Additionally, air pollution particularly affects the most vulnerable in society: children and older people, and those with heart and lung conditions. Further, there is often a strong correlation with equalities issues, because areas with poor air quality are also often the less affluent areas[1,2].

The annual health cost to society of the impacts of particulate matter alone in the UK is estimated to be around £16 billion[3].

Herefordshire is located in the West Midlands of England. It is bordered by five counties; Shropshire, Worcestershire, Gloucestershire, Powys and Monmouthshire. As of mid-2018, Herefordshire's resident population was estimated to be 192,100, which has increased by 1,600 since 2016. Herefordshire is one of the least densely populated areas of the United Kingdom, with residents scattered across 842 square miles.

The main pollutant of concern within Herefordshire is nitrogen dioxide (NO_2). The major source of air pollutants in Herefordshire is vehicle emissions, specifically the emissions from the A49 Road through Hereford and Bargates Road junction in Leominster have been identified as significant.

In Herefordshire, there are two Air Quality Management Areas (AQMA's) due to high levels of nitrogen dioxide, exceeding national standards (40µg/m^3). The AQMA's include A49 Road through Hereford and Bargates Road junction in Leominster.

In 2018, the ratified continuous monitored nitrogen dioxide annual mean was 40µg/m^3 for Hereford AQMA. The Bargates AQMA is monitored using three diffusion tubes at three various locations within the AQMA. The highest nitrogen dioxide annual mean concentration, of the three sites, for 2018 was 43.5µg/m^3 at site 61b (35 Bargates, Leominster), identifying an exceedance of the Air Quality Objective by

[1] Environmental equity, air quality, socioeconomic status and respiratory health, 2010
[2] Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006
[3] Defra. Abatement cost guidance for valuing changes in air quality, May 2013

3.5µg/m^3. From 2017 to 2018, the nitrogen dioxide levels at Hereford AQMA have generally decreased by roughly 2µg/m^3.

In 2018, five monitoring sites also exceeded the NO_2 air quality objective. This includes sites 10, 61a, 91, 95 and 103.

There is currently no requirements to extend or amend Herefordshire's AQMAs, however these will be reviewed in the near future. Further information related to Herefordshire's declared AQMAs can be found on the following website; https://uk-air.defra.gov.uk/aqma/list.

Eighteen of the twenty-seven monitored sites during 2017 and 2018 have shown an increased level in NO_2. The remaining nine monitoring sites showed a reduction in levels of NO_2 during 2017 and 2018.

Herefordshire Council is a Unitary Authority, which enables close working between the sections and teams, which are involved with air quality, its causes and effects and mitigation measures. These include the Energy and Environmental Management team, Transportation team and Public Health. There is also close working with the Environment Agency through various mechanisms including permit consultations and a formal liaison group.

Actions to Improve Air Quality

Bargates Air Quality Action Plan

The Bargates Air Quality Action plan was published in 2014. Action 1 was to improve the traffic light sequencing at the Bargates junction. A report was commissioned in 2015, which identified the need to upgrade the pedestrian crossing and road surfacing and to install a Microprocessor Optimised Vehicle Actuation (MOVA) traffic management system. This system sought to increase the capacity at the junction, help to disperse queues more effectively and therefore could reduce emissions from idling vehicles at the traffic lights. The work commenced in September 2016 and has been completed. The monitoring data in Bargates AQMA indicates that nitrogen dioxide levels have fallen between 2017 (45.1µg/m^3) and 2018 (43.5µg/m^3). Although we are unable to identify if this reduction is a direct result of this improvement or not.

The Major Infrastructure Projects

Figure 1 shows the geographical scope of the major infrastructure projects (Hereford City Centre Transport Package, South Wye Transport Package and Hereford Transport Package), ongoing and emerging within Hereford.

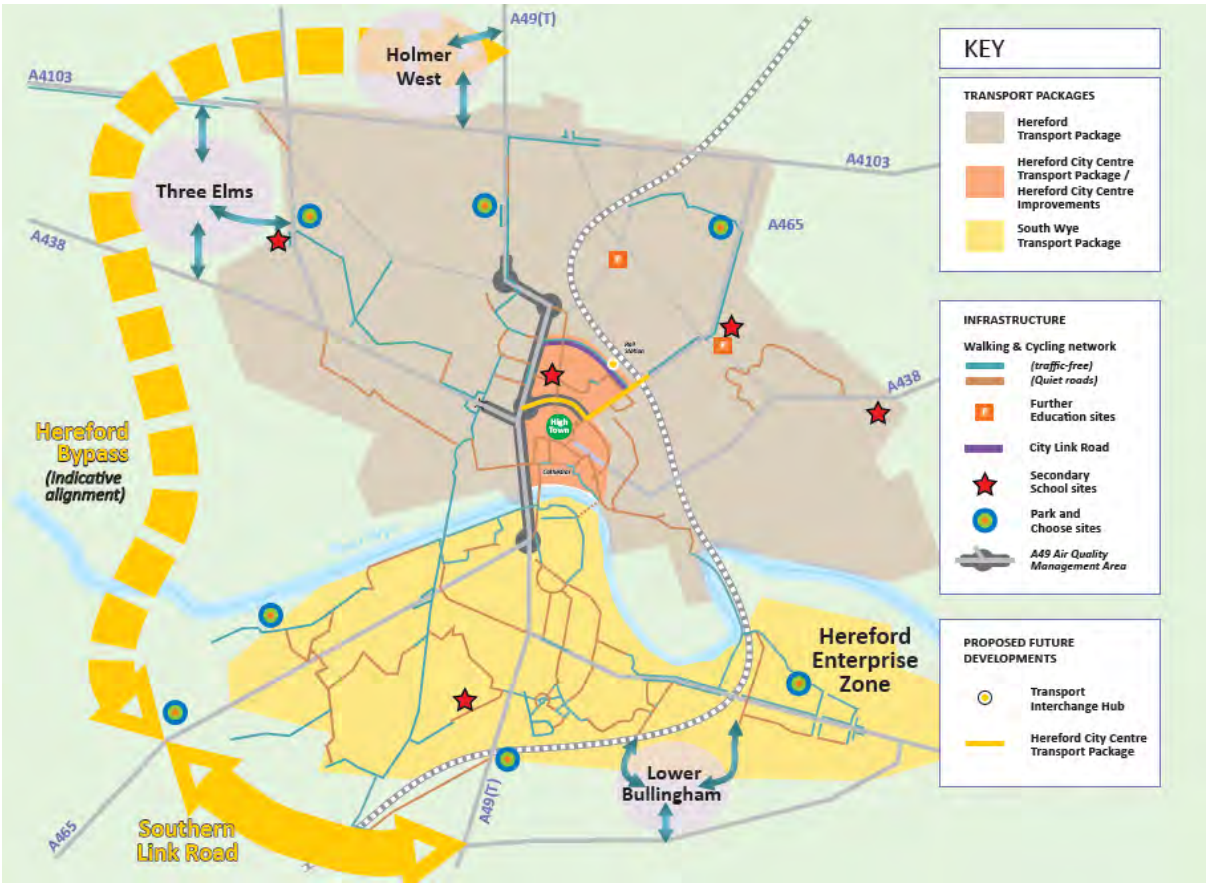


Figure 1: *Major transport projects geographical scope in Hereford*

Hereford City Centre Transport Package

In December 2017, the City Centre Link Road opened. This formed the first part of Hereford City Centre Transport Package and linked the A49 (Edgar Street to Aylestone Hill). The second part of the scheme is a transport hub adjacent to the railway station and active travel improvements to Newmarket Street, Blueschool Street and Commercial Road. Herefordshire Council and Marches Local Enterprise Partnership funded these schemes.

South Wye Transport Package

This package contains a new link road (linking A465 and A49) and active travel measures in South Hereford (South of the river Wye). In 2016, planning consent was granted for the Southern Link and the link road is due to open in 2020.

Hereford Transport Package

This package contains a new road linking the A465 in the south to the A49 in the north. This will provide an additional crossing over the river Wye and provide an alternative route for traffic travelling along the A49, therefore traffic will avoid the city centre.

Market Town Studies

Studies are currently being conducted for the market towns in Herefordshire. The aim of the studies is to establish an appraised programme of interventions to improve the transport within the towns.

These studies are at various development stages and include the following towns;

- Bromyard;
- Ross on Wye;
- Leominster; and
- Ledbury.

Local Cycling and Walking Infrastructure Plan (LCWIP)

The LCWIP is a long-term plan to outline required interventions to improve the cycling and walking infrastructure for an area. The Transport Department in Herefordshire Council are in the process of developing a plan for Hereford. The final output will identify a list of prioritised walking and cycling schemes. When these interventions have been prioritised for delivery, the LCWIP will be integrated with key council plans and policies.

Destination Hereford

The Department for Transport has funded a behavioural change project called 'Destination Hereford', which includes targeted interventions. The aim of the project is to encourage people to increase their use of active modes and reduce their car usage.

Sustainable Modes of Travel to School Strategy (SMOTS)

SMOTS aims to promote and facilitate sustainable travel to and from school and thus reduce private car use. This project includes road safety education to pupils, school engagement and infrastructure delivery.

Other Relevant Policies:

- The Health and Well-being strategy- supporting a shift away from private vehicles to active travel;
- Hereford Bus Strategy; and

- Walking and Cycling Strategies - reducing short distance car journeys and modal shift to active travel.

Conclusions and Priorities

Monitoring of pollutants within the Herefordshire district in 2018 has shown an exceedance of the NO_2 Air Quality Objectives at both AQMA's (Hereford 42 µg/m^3 and Bargates 45.1 µg/m^3). There is currently no intension to extend, revoke or amend Herefordshire's AQMAs, however these will be reviewed in the near future. Further information related to Herefordshire's declared AQMAs can be found on the following website; https://uk-air.defra.gov.uk/aqma/list.

The 2015 Core strategy provides the strategic planning framework for Herefordshire's future development needs up to 2031. A number of major housing developments were identified to meet Herefordshire's housing need along with the need to ensure appropriate infrastructure such as the Hereford Relief Road and the Leominster Relief Road. The potential impact of these developments on air quality will need to be considered during the planning application stages.

Other Priorities for Herefordshire include:

- Continue to monitor and review both the Hereford and Leominster AQMA's
- Identify and review other locations in Herefordshire that may benefit from additional monitoring considering identified sites in the core strategy
- Review the Air Quality Action Plan for Herefordshire
- Comment on planning applications for major housing road schemes in relation to air quality
- Continue to inspect Local Authority Permitted installations.

Local Engagement and How to get Involved

The major source of air pollution in Herefordshire is from vehicle emissions. Therefore, the best way for members of the public to help improve air quality in Herefordshire is to adjust their normal travel pattern to be more sustainable.

Herefordshire is sparsely populated with over half the population living in the rural areas which presents challenges for sustainable transport. However, over half of all car journeys in Hereford at peak time are less than two miles.[4]

[4] Local Transport Plan 2016 – 2031 Strategy

Therefore, there is scope to change the way we travel to help improve air quality, our health and reduce congestion in the City. By making short trips and journeys on foot or by bike instead of by car, or using public transport. Car sharing with colleagues, or with other parents on the school run, are some other examples of ways to reduce traffic congestion.

Other examples include:

- Purchasing low-emission electric and/or hybrid vehicles.
- Upgrading boilers to newest and most efficient gas condensing boilers with lowest NOx (and carbon) emissions.

The Choose how you move webpage https://www.herefordshire.gov.uk/info/200136/travel_and_transport/544/choose_how_you_move is a good place to find information on ways to travel sustainably and help to reduce vehicle emissions.

Table of Contents

List of Tables

List of Figures

1 Local Air Quality Management

This report provides an overview of air quality in Herefordshire Council during 2018. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995) 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 the air quality objectives are likely to be achieved. Where there is an exceedance or it is considered likely an exceedance will occur, the local authority must 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. This Annual Status Report (ASR) is an annual requirement showing the strategies employed by Herefordshire Council to improve air quality and any progress that has been made.

The statutory air quality objectives applicable to LAQM in England can be found in Appendix E.

2 Actions to Improve Air Quality

2.1 Air Quality Management Areas

Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely exceedance of an air quality objective. After a declaration, the authority must prepare an Air Quality Action Plan (AQAP) within 12-18 months setting out measures it intends to put in place in pursuit of compliance with the objectives.

A summary of AQMAs declared by Herefordshire Council can be found in Table 2.1. Further information related to declared or revoked AQMAs, including maps of AQMA boundaries are available online at https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=126. Alternatively, see Appendix D: Map(s) of Monitoring Locations and AQMAs, which provides for a map of air quality monitoring locations in relation to the AQMA(s).

Table 2.1 – Declared Air Quality Management Areas

AQMA Name	Date of Declaration	Pollutants and Air Quality Objectives	City / Town	One Line Description	Is air quality in the AQMA influenced by roads controlled by Highways England?	Level of Exceedance (maximum monitored/modelled concentration at a location of relevant exposure)				Action Plan		
						At Declaration		Now		Name	Date of Publication	Link
AQMA Hereford	Declared 23/11/2001	NO_2 Annual Mean	Hereford	The A49(T) corridor in Hereford, extending from Holmer Road in the north to Belmont Road in the south and extending east along New Market/Blue School Street and west along Eign Street as far as Barton Yard.	YES	47	µg/m^3	40	µg/m^3	Hereford Action Plan	2008	http://aqma.defra.gov.uk/action-plans/HC%20AQAP%202008.pdf
AQMA Bargates	Declared 01/03/2006	NO_2 Annual Mean	Leominster	An area encompassing the junction between the A44 Bargates and B4361 Dishley Street/Cursneh Road in Leominster.	NO	61	µg/m^3	43.5	µg/m^3	Bargates Action Plan	2014	https://www.herefordshire.gov.uk/download/downloads/id/4823/bargates_air_quality_draft_action_plan.pdf

☒ **Herefordshire Council confirm the information on UK-Air regarding their AQMA(s) is up to date**

2.2 Progress and Impact of Measures to address Air Quality in Herefordshire Council

Defra's appraisal of the 2017 ASR concluded the vast majority of monitoring sites in Herefordshire demonstrated continued reductions of NO_2 levels over the past 5 years.

In 2017, Defra identified corrective measures required for the Hereford and Bargates AQAP including setting emission reduction targets and providing further discussion on the progress of each measure within the AQAP. Although it was suggested that both AQAPs were generally good and monitoring results demonstrated the measures in the AQAPs were effective in reducing NO_2 emissions.

Further, in 2017 Defra suggested that this service should identify new hotspots in Herefordshire. From 2017 to 2018, Herefordshire Council has added 25 new NO_2 diffusion tubes.

Herefordshire Council has taken forward a number of direct measures during the current reporting year of 2019 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2. More detail on these measures can be found in their respective plans.

Key completed measures are:

- Review of air monitoring locations, considering the proposed development locations in the Core Strategy and to assist in assessing potential air quality impact of any development
- Review of Poultry sites reference Defra Policy Guidance LAQM.TG16

Herefordshire Council expects the following measures to be completed over the course of the next reporting year:

- Continue to monitor and review both the Hereford and Leominster AQMA's
- Identify and review other locations in Herefordshire 1that may benefit from additional monitoring considering identified sites in the core strategy.
- Review the Air Quality Action Plans for Herefordshire including setting emission reduction targets and providing more discussion on the progress of each measure.

- Short Term Operating Reserve (STOR) Planning Applications
- Comment on planning applications for major housing road schemes in relation to air quality
- Continue to inspect Local Authority Permitted installations

The principal challenges and barriers to implementation that Herefordshire Council anticipates facing are the potential impact of major housing and infrastructure developments arising from the 2015 Core Strategy; these impacts will need to be considered during the planning application stages. The strategy identified a number of major housing developments required to meet Herefordshire's housing need along with the need to ensure appropriate infrastructure such as the Hereford Relief Road and the Leominster Relief Road.

Herefordshire Council anticipates that the measures stated above and in Table 2.2 will achieve compliance in Hereford and Leominster AQMAs.

Table 2.2 – Progress on Measures to Improve Air Quality

Hereford Action Plan

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
1	Edgar Street Grid Re-development	Traffic Management	Reduction of speed limits, 20mph zones	Herefordshire Council & Advantage West Midlands formed ESG Herefordshire Ltd	Not Applicable	2010 - 2025	Trends in diffusion tube results	Not Specified	"Old Market" retail area development completed 2015.	2025	NO_2 levels at the city centre sites have been gradually reducing since 2007, although this cannot be attributed to the actual re-development, as works have not yet been completed. NO_2 data to be reviewed once action is complete.
2	Improvement of A4103 road west of Herefordshire	Transport Planning and Infrastructure	Other	Herefordshire Council - Highways and Transportation Service	Not Applicable	Jun-08	Not Applicable	Not Specified	Road completed 2005 however signage still to be installed to indicate northern east-west bypass.	2008	Since 2007 NO_2 levels along the Roman Road have been below the objective. Annual Average Daily Flow trends (AADT) along the Roman Road indicate a continuing increase of traffic since the completion of the improved road and an increase in HGVs until 2008 with a slight reduction in 2009. Traffic data to be reviewed in future report.
3	Rotherwas Access Road Link	Transport Planning and Infrastructure	Other	Herefordshire Council - Highways and Transportation Service	Not Applicable	Jun-08	Annual Average Daily Flow trends (AADT) and diffusion tubes	Not Specified	Completed June 2008	2008	Annual Average Daily Flow trends (AADT) show a reduction in HGVs from 1045 in 2008 to 964 in 2009 however total motor vehicles has increased. Updated traffic data to

											be reviewed in future reports.
4	City Link Road Hereford	Transport Planning and Infrastructure	Other	Herefordshire Council - Highways and Transportation Service	2012-2014	2014-2017	Annual Average Daily Flow trends (AADT) and diffusion tubes	Not Specified	Consultation and preparatory work is progressing on the link road 2015.	Construction complete Decemeber 2017.	NO_2 levels will be reviewed in 2018.
5	New Outer Distributer road (3rd Link) Hereford Relief Road	Transport Planning and Infrastructure	Other	Herefordshire Council – Highways and Transportation Service	Ongoing	2016-2031	Annual Average Daily Flow trends (AADT) and diffusion tubes	Not Applicable	The potential corridor for the road has been proposed in the Councils Draft Core Strategy.	Constructed by 2031	Not applicable until road is constructed.
6	Alteration of traffic management at the Belmont Roundabout	Traffic Management	Other	Highway Agency	Not Applicable	2005-2006	Diffusion tube at the roundabout	Not Specified	Completed in 2006. New signals are now fully integrated into the Council's SCOOT system and the infrastructure improvements have greatly improved traffic movements	Complete	The diffusion tube measurements at this roundabout were showing exceedances of the NO_2 objective in 2006 and 2007 although levels were falling. However, a noticeable reduction occurred in 2008 and 2009, to a level well below the objective level.
7	"North & South" Park and ride Scheme in Hereford	Alternatives to private vehicle use	Bus based Park & Ride	Herefordshire Council – Highways and Transportation Service	Not Applicable	Timescales are currently undecided	Annual Average Daily Flow trends (AADT) and diffusion tubes	Not Applicable	No longer being taken forward.	Not Applicable	Not Applicable
8	Parking Strategy in Hereford to reduce commuter parking	Traffic Management	Other	Herefordshire Council – Highways and Transportation Service and Planning Services	Not Applicable	Not Applicable	Annual Average Daily Flow trends (AADT) and diffusion tubes	Not Applicable	No longer being taken forward. Alternative parking strategy in place.	Not Applicable	Not Applicable

9	Improve and increase number of cycle routes and facilities in Hereford	Transport Planning and Infrastructure	Cycle network	Herefordshire Council – Highways and Transportation Service	Not Appilicable	Ongoing	Diffusion tubes	Not Specified	1.5km of the Great Western Way was completed in 2008 along with a cycle lane along Aylestone Hill. Connect 2 Rotherwas Cycle Link completed.	Rotherwas Cycle Link currently in progress – Completed Dec 2013	NO_2 levels at the city centre sites have been gradually reducing since 2007
10	City Centre Pedestrian Enhancement in Hereford	Traffic Management	Strategic highway improvements, Re-prioritising road space away from cars, including Access management, Selective vehicle priority, bus priority, high vehicle occupancy lane	Herefordshire Council – Highways and Transportation Service	Not Applicable	2005	Diffusion tubes at Wide-marsh Street, Broad Street and Edgar Street sites	Not Specified	Completed in 2006.	Complete	NO_2 levels at Site 6 (Broad Street) and Site 59 (Widemarsh St) have remained at or below 75% of the objective for the last 5 year trend, following the introduction of the scheme. Sites 12, 13 and 14 (Edgar Street) are no longer monitored.
11	Behavioural Change Programme	Promoting Travel Alternatives	Workplace Travel Planning	Herefordshire Council - Highways and Transportation Service	Ongoing	Ongoing	Diffusion tubes	Not Specified	Ongoing programme of promotions and initiatives. Examples include Bike ability Training and the promotion of TwoShare, Destination Herefordshire.	Ongoing	NO_2 levels throughout the county have fallen in 2009 and the majority of AADT flows are less in 2009 than in 2008. Recent air quality & traffic data to be reviewed in future reports.
12	Designation of a Traffic manager for network management Duties along the A49 in Hereford	Traffic Management	Other	Highway Agency and Herefordshire Council	Not Applicable	Not Applicable	Diffusion tubes akibg A49 corridor	Not Specified	Completed in 2008.	Complete	NO_2 levels at the sites along the A49 have been gradually reducing since 2007. Recent air quality data to be reviewed.

13	Continue to implement Vehicle Emission Testing in Hereford	Traffic Management	Testing Vehicle Emissions	Herefordshire Council - Environmental Health and Trading Standards	Not Applicable	Annually since 2000	Review of project dependant upon number of vehicles failing.	Not Specified	Commenced in 2000 and was carried out every year until 2007. A dramatic continual improvement in exhaust emissions with the Hereford AQMA noted each year. No failures in 2006 and 2007.	This project has been completed. No plans for further testing.	100% compliance in 2006 and 2007.
14	Information and awareness training	Public Information	Via the Internet	Herefordshire Council - Environmental Health and Trading Standards	Not Applicable	On-going improvement of web-site material on air quality	Number of hits on the website.	Not Specified	Ongoing	Ongoing	Currently investigating whether the hits on the website can be calculated.
15	Southern Link Road A49 Ross Road / Rotherwas Access Road roundabout to the A465 and the B4349 Clehonger Road	Transport Planning and Infrastructure	Other	Herefordshire Council - Highways and Transportation Service	2012-2016	2016-2026	Annual Average Daily Flow trends (AADT) and diffusion tubes	Not Specified	Scope route was undertaken in 2010. Planning permission has been granted	Constructed by 2026.	Not applicable until road is constructed.

Bargates Action Plan

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
1	Improvements to the traffic light sequencing at the A44/B4361 junction at Bargates	Transport Planning and Infrastructure	Other	Herefordshire Council	2014-2015	2016	Reduction of NO_2 levels at diffusion tubes	Not Specified	Report commissioned reviewing the best options for the junction arrangement.	2016	Not Applicable
2	Improvements to cycle facilities/ routes between Morrisons Store and the Town centre	Transport Planning and Infrastructure	Cycle network	Herefordshire Council	2014-2016	Sep-16	Reduction of NO_2 levels at diffusion tubes	Not Specified	Awaiting S106 monies.	2014-2016	Not Applicable
3	Improvements to the public transport facilities between Morrisons Store and the Town centre	Transport Planning and Infrastructure	Other	Herefordshire Council	2014-2016	2016	Reduction of NO_2 levels at diffusion tubes	Not Specified	Awaiting S106 monies.	2016	Not Applicable
4	Improve and increase number of pedestrian routes and facilities in Leominster	Transport Planning and Infrastructure	Other	Herefordshire Council	2014-2016	Not Applicable	Reduction of NO_2 levels at diffusion tubes	Not Specified	Awaiting S106 monies.	Not Applicable	Not Applicable

5	Behavioural Change Programme	Promoting Travel Alternatives	Promotion of walking	Herefordshire Council	2014-2016	Not Applicable	Reduction of NO_2 levels at diffusion tubes	Not Specified	Work ongoing. Bid submitted for funding in 2016.	Ongoing	Not Applicable
6	Behavioural Change Programme	Promoting Travel Alternatives	Promotion of cycling	Herefordshire Council	2014-2016	Not Applicable	Reduction of NO_2 levels at diffusion tubes	Not Specified	Work ongoing. Bid submitted for funding in 2016.	Ongoing	Not Applicable
7	Development of the southern Relief Road	Transport Planning and Infrastructure	Other	Herefordshire Council	For the period up to 2031	Not Applicable	Reduction of NO_2 levels at diffusion tubes	Not Specified	Ongoing	Not set	Not Applicable

2.3 $PM_{2.5}$ – Local Authority Approach to Reducing Emissions and/or Concentrations

As detailed in Policy Guidance LAQM.PG16 (Chapter 7), local authorities are expected to work towards reducing emissions and/or concentrations of $PM_{2.5}$ (particulate matter with an aerodynamic diameter of 2.5µm or less). There is clear evidence that $PM_{2.5}$ has a significant impact on human health, including premature mortality, allergic reactions, and cardiovascular diseases.

There are many different sources of $PM_{2.5}$, these can be from natural or anthropogenic (manmade) sources. Anthropogenic sources include industrial sources, road transport, off road transport, residential sources (such as non-smokeless fuels and bonfires) and polluted air traveling from the continent.[5]

Health based objective levels for $PM_{2.5}$'s have not yet been set for local authorities. The EU annual average limit value for $PM_{2.5}$ is 25µg/m^3, further there is an additional requirement to reduce the average urban background concentrations by 15% by 2020 (against a 2010 baseline).

$PM_{2.5}$'s in Herefordshire.

Public health framework indicator 3.01 states that the fraction of mortality in Herefordshire attributable to anthropogenic (man-made) $PM_{2.5}$ particulate air pollution is 4.5% of all deaths. The average for this indicator in the West Midlands is 5.2% and in England is 5.1%.

Policy Guidance LAQM.TG(16) acknowledges that many local authorities will consider how to address $PM_{2.5}$ alongside other pollutants such as Nitrogen Dioxide and PM_{10}'s when determining appropriate actions and that a few standalone $PM_{2.5}$ measures will be chosen (unless in order to address a very specific local problem).

The AURN is the UK's largest automatic monitoring network and is the main network used for compliance reporting against the Ambient Air Quality Directives. $PM_{2.5}$'s are measured at some of the network of ARUN sites. The closest ARUN monitoring site to Herefordshire that measures $PM_{2.5}$ is Chepstow on the A48, this is an urban traffic site. Therefore, it is perhaps difficult to draw direct comparisons to Herefordshire.

[5] Fine Particulate Matter (PM2.5) in the United Kingdom, AQEG, 2012

It has been recognised that the cost of monitoring for $PM_{2.5}$'s can be prohibitive. Therefore, other methods of estimating the likely $PM_{2.5}$ levels in Herefordshire have been considered to establish an overview of the possible levels.

Background mapping of $PM_{2.5}$ published by Defra has been reviewed http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html and the background levels in 2018 were found to be between 4.52 and 6.61µg/m^3.

Calculations can be undertaken to estimate the $PM_{2.5}$ fraction from PM_{10} monitoring data. The monitoring data for PM_{10}'s at the Victoria Street location in 2018 was 24µg/m^3 (as measured by a BAM using a gravimetric factor of 0.833 for Indicative Gravimetric Equivalent). Also, the data capture for PM_{10} in 2018 was 79.4%. Further, $PM_{2.5}$ was estimated based on the recorded PM_{10} measurements, using the calculation method detailed in TG16. As such, the estimated annual mean of $PM_{2.5}$ in 2018 was 16.8µg/m^3. It should be noted that this estimation would only give an indication of $PM_{2.5}$'s at the roadside location in the Hereford AQMA (a worst-case scenario). For further information on the calculation used to estimate $PM_{2.5}$ from PM_{10} measurements please refer to Appendix C.

Herefordshire Council is taking the following measures to address $PM_{2.5}$:

Ensure $PM_{2.5}$'s are considered at the planning application stage for relevant development

- Inspection of Local Authority Permitted installations
- Review AQAP's to include additional actions for $PM_{2.5}$
- Consider the need for background monitoring of $PM_{2.5}$

NB It should be noted that actions 1-6 9-11, 13-15 of the Hereford AQAP, and Action points 1-7 of the Leominster AQAP also deal with $PM_{2.5}$ as well as NO_2.

The approach being taken taking in terms of $PM_{2.5}$ assessment and possible monitoring has been considered together with Public Health. Further work is to be undertaken in this area.

3 Air Quality Monitoring Data and Comparison with Air Quality Objectives and National Compliance

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

This section sets out what monitoring has taken place and how it compares with objectives.

Herefordshire Council undertook automatic (continuous) monitoring at Victoria Street in Hereford city centre during 2018. Table A.1 in Appendix A shows the details of the sites. NB. Local authorities do not have to report annually on the following pollutants: 1,3 butadiene, benzene, carbon monoxide and lead, unless local circumstances indicate there is a problem. National monitoring results are available at https://uk-air.defra.gov.uk/data/.

Maps showing the location of the monitoring sites are provided in Appendix D. Further details on how the monitors are calibrated and how the data has been adjusted are included in Appendix C.

In addition, Defra has an Automatic Urban and Rural Network (AURN) site that is located opposite to the Minster school in Leominster. This suburban background site continuous monitors Nitrogen Dioxide and Ozone. During 2018, the annual mean Nitrogen Dioxide levels were 8µg/m^3. Maps showing the location of the monitoring site can be found in Appendix D.

3.1.2 Non-Automatic Monitoring Sites

Herefordshire Council undertook non-automatic (passive) monitoring of NO_2 at 46 sites during 2018. Table A.2 in Appendix A shows the details of the sites.

Maps showing the location of the monitoring sites are provided in Appendix D. Further details on Quality Assurance/Quality Control (QA/QC) for the diffusion tubes, including bias adjustments and any other adjustments applied (e.g. “annualisation” and/or distance correction), are included in Appendix C.

3.2 Individual Pollutants

The air quality monitoring results presented in this section are, where relevant, adjusted for bias, “annualisation” and distance correction. Further details on adjustments are provided in Appendix C.

3.2.1 Nitrogen Dioxide (NO_2)

Table A.3 in Appendix A compares the ratified and adjusted monitored NO_2 annual mean concentrations for the past 5 years with the air quality objective of 40µg/m^3.

For diffusion tubes, the full 2018 dataset of monthly mean values are provided in Appendix B.

Table A.4 in Appendix A compares the ratified continuous monitored NO_2 hourly mean concentrations for the past 5 years with the air quality objective of 200µg/m^3, not to be exceeded more than 18 times per year. The maximum hourly mean was 157µg/m^3 so there were no exceedences in 2018 of the NO_2 hourly limit.

Hereford AQMA

The NO_2 data in Hereford AQMA (table A.3) shows the automatic monitoring site, HRD1, in 2018 showed levels of 40µg/m^3. Although this monitoring location is not at a receptor location, it met the air quality objective (40µg/m^3).

Generally, non-automatic monitoring sites within Hereford AQMA have increased in NO^2 levels, which include sites 9, 22, 53, 57, 59, 88, 90 and 91. Although sites 87 and 89 have decreased in NO_2 levels (Figure A.1). All of these sites have not exceeded the air quality objectives. The sites 57, 89, 90 and 91 have also been calculated back to the nearest receptor as shown in Table C1.

Previously, Herefordshire Council has not able to conduct monitoring at site 10. However, in 2018 we were able to gather monitoring data from this site. The data capture for site 10 was below 75%, as such annulisation was conducted which identified the NO_2 levels in 2018 were 41.33 µg/m^3. As such this site exceeded the NO_2 air quality objective by 1.33 µg/m^3.

In 2018, Herefordshire Council added 5 new monitoring sites in Hereford AQMA, these include sites 94, 95, 96, 103 and 104. Two of these sites exceeded the air quality objective inlcuding site 95 (43 µg/m^3) and site 103 (40.1 µg/m^3). However, as site 95 was not near a receptor, the results have been calculated to the nearest

receptor as shown in Table C1. This calculation identified that the NO_2 levels at site 95 in 2018 was 38.6µg/m^3. Similarly, sites 94 and 104 were also calculated to the nearest receptor, these calculations can be found in Table C1. Sites 94, 95, 96 and 104 were all below the air quality objectives at the receptor location.

Data collected in 2017 has shown a breach in the national NO_2 objective of 2µg/m^3 at site HRD1. Despite 2018 identifying a reduction of levels to 40µg/m^3, it is concluded that Herefordshire Council will not be revoking Hereford AQMA. Particularly as trends have not demonstated that NO_2 levels are unlikely to breach the national objective. However, Herefordshire Council will continue to review Hereford AQMA.

The boundaries of the AQMA are monitored through two sites which indicate whether these boundaries need to be extended. These sites include site 54 (Holmer Road) and site 65 (95 Whitecross Road), please refer to figure A.2.1.

Site 54 has demonstrated an increase in NO_2 concentrations from 2017 (20.7µg/m^3) to 2018 (23.7µg/m^3). Although the site is below the air quality objective, the site will continue to be monitored.

Site 65 is a kerbside monitoring location and the results have been calculated back to position of nearest receptor to compare with air quality objective, see Table C1. The estimation of concentration at the nearest receptor, 26.9µg/m^3 which is below the air quality objective. Site 65 will continue to remain as an indicator of any changes in NO_2 levels along Whitecross Road which is a key traffic route into the City.

In 2018, Herefordshire Council added 5 new monitoring sites to the boundaries of the AQMA, including site 97, 88, 89, 101 and 102. All of these locations were below the air quality objectives. Site 97 and 102 were calculated to the nearest receptor, as shown in Table C1.

In 2018, sites 54, 65, 97, 88, 89, 101 and 102 have not exceeded the air quality objective and confirm no extension of the AQMA boundary is required at this time.

The sites located outside Hereford's AQMA include sites 6, 74, 75, 79, 84, 85, 86, 92 and 93. 2018 data identifies all of the sites are below the air quality objective. The Council will continue to monitor these locations.

In 2018, Herefordshire Council added 4 new monitoring sites which are located in outside Hereford's AQMA. These sites include 100, 105, 106, 107 and 108. Sites

105, 106 and 107 have been calculated back to the nearest receptor, as shown in Table C1. All of these locations were below the air quality objectives.

Leominster AQMA

From 2015 to 2018 trend data for sites in the Leominster AQMA can be found in the graph of figure A3. Site 46 – Bengry's Light, was below the air quality objective in 2018 recording concentrations 31.6µg/m^3. The site 61a recorded NO_2 levels of 40.2 µg/m^3 and the site 61b recorded NO_2 levels of 43.5 µg/m^3. Both of these sites recorded NO_2 levels which exceeded the objective level of 40 µg/m^3.

Outside of the AQMA there have been 3 new monitoring sites which include sites 109, 110 and 111. The data capture for these sites were below 75%, as such annualisation was conducted. The NO_2 levels of these sites in 2018 are shown in Appendix B.

A40 corridor

With reference to figure A4, the two roadside locations along this corridor (site 32 – Weir End House and site 33 – Apple Tree Cottage) continue to follow the linear downward trend. In 2018 the NO_2 recorded levels at site 32 were 28.3µg/m^3 and at site 33 were 28.1µg/m^3. Both of these sites will continue to be monitored in 2019.

Other Market Towns and Villages

Monitoring is no longer undertaken in Bromyard, Kington, Ledbury, Pembridge and Wedobley. However, monitoring re-commenced in Cantilupe Street, Ross-on-Wye in May 2015 at sites 82 and 83 due to concerns regarding vehicle and bus emissions. Since 2017 the site 83 has no longer be monitored.

In 2018, site 83 recorded NO_2 levels of 21.3µg/m^3, which is below the air quality objective. Although this reading has increased by 0.8µg/m^3 since 2017. This site will continue to be monitored in 2019.

The monitoring undertaken to date is under the air quality objective in this location.

3.2.2 Particulate Matter (PM_{10})

PM_{10} was previously measured by the Council at the automatic monitoring station at Edgar Street. The site was decommissioned in 2011 due to redevelopment of the site where it was located. The monitor was repositioned in Victoria Street and PM_{10} figures have been subsequently available since 2017.

Table A.5 in Appendix A compares the ratified and adjusted monitored PM_{10} annual mean concentrations for the past 5 years with the air quality objective of 40µg/m^3. As shown in table A.5 the monitored PM_{10} annual mean concentrations at Victoria Street in 2018 was 24µg/m^3. This was measured by a BAM using a gravimatric factor of 0.833 for Indicative Gravimetric Equivalent. Futher, the annual data capture for this reading was 79.4% compared to the 85% target. The monitored PM_{10} annual mean concentrations in 2017 were 25µg/m^3, as such there has been a reduction of 1µg/m^3 in PM_{10} from 2017 to 2018.

Table A.6 in Appendix A compares the ratified continuous monitored PM_{10} daily mean concentrations for the past 5 years with the air quality objective of 50µg/m^3, not to be exceeded more than 35 times per year. The maximum daily mean for PM_{10} monitored at Victoria Street was 66µg/m^3. Therefore, the daily mean limit value of 50µg/m^3 was exceeded on 2 days. Although, the annual allowance for this limit value is 35 days so this objective was not exceeded.

3.2.3 Particulate Matter ($PM_{2.5}$)

$PM_{2.5}$ monitoring is not currently undertaken by Herefordshire Council.

3.2.4 Sulphur Dioxide (SO_2)

Sulphur Dioxide has not been monitored by Herefordshire County Council since January 2011. Results of monitoring previously undertaken by the Council are presented in previous annual reports submitted to Defra.

Appendix A: Monitoring Results

Table A.1 – Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Inlet Height (m)
HRD1	Victoria Street	Roadside	350721	239791	NO_2; PM_{10}	YES	Chemiluminescent and PM_{10}	10	5	1.9

Notes:

(1) 0m if the monitoring site is at a location of exposure (e.g. installed on the façade of a residential property).

(2) N/A if not applicable.

Table A.2 – Details of Non-Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
6	Broad Street, Hereford	Urban Background	350890	240000	NO_2	NO	1	0.3	NO	2.8
9	Bus Stop,Victoria Street, Hereford (A49)	Roadside	350688	239864	NO_2	YES	N/A	2.9	NO	2.9
10	7 Victoria Street, Hereford (A49)	Roadside	350677	240015	NO_2	YES	0	2.9	NO	2.5
22	Façade Edgar/ Mor St, Hfd (A49)	Roadside	350860	240615	NO_2	YES	0	2.3	NO	2.3
32	Weir End, Ross (A40)	Roadside	357717	223736	NO_2	NO	0	4.5	NO	2
33	House façade, Wilton (A40)	Roadside	358506	224214	NO_2	NO	0	2.9	NO	1.9
46	Bengry's Lights, Leominster (A44)	Roadside	349409	259010	NO_2	YES	0	3.4	NO	2.1
53	Façade, Belmont Rd/Asda Junc Hfd	Roadside	350723	239163	NO_2	YES	0	5.3	NO	2.1
54	House façade,	Urban Background	350602	241097	NO_2	NO	0	9.5	NO	1.7

	Holmer Rd Hfd (A49)									
57	Eign Street, Hereford (A438)	Urban Background	350499	240108	NO_2	YES	1	0.5	NO	2.2
59	Façade, Widemarsh St, Town Hfd	Urban Centre	350987	240108	NO_2	YES	0	3	NO	2.4
61a	29 Bargates, Leominster (A44)	Roadside	349363	259013	NO_2	YES	0	2.85	NO	2.2
61b	35 Bargates, Leominster (A44)	Roadside	349352	259015	NO_2	YES	0	2	NO	2.2
65	96 Whitecross Road, Hfd (A438)	Urban Background	350086	240296	NO_2	NO	4	1.3	NO	2.2
74	140 Whitecross Rd, Hfd (A438)	Roadside	349985	240334	NO_2	NO	0	8.2	NO	2.1
75	22 Barton Road, Hfd	Roadside	350511	239740	NO_2	NO	15	1.4	NO	2.4
79	76 Belmont Road, Hfd (A465)	Roadside	350472	238999	NO_2	NO	7	1	NO	2.3
82	Cantilupe Road 1 (Flats), Ross-on-Wye	Urban Background	360204	224177	NO_2	NO	1.5	1.7	NO	2.3
84	Kings Acre Rd, Hfd (A438)	Suburban	347864	241236	NO_2	NO	N/A	6.2	NO	2.55
85	Huntington Lane, Hfd	Rural	348752	241941	NO_2	NO	N/A	1.2	NO	2.1

86	Three Elms Rd, Hfd (A4110)	Roadside	349067	241933	NO_2	NO	N/A	1.5	NO	1.7
87	Nr Cemetery, Victoria St, Hfd (A49)	Roadside	350694	239819	NO_2	YES	N/A	2.7	NO	2.5
88	Adj 34 Victoria St, Hfd (A49)	Roadside	350684	239900	NO_2	YES	0	2.8	NO	2.32
89	Edgar St/Prior St, Hfd (A49)	Roadside	350800	240441	NO_2	YES	6.5	2.2	NO	2.1
90	Cross Street, Asda Traffic Island, Hfd	Roadside	350719	239164	NO_2	YES	5	2.25	NO	2.12
91	Ross Road/Asda Traffic Island, Hfd (A49)	Roadside	350759	239125	NO_2	YES	7.5	1.1	NO	2.23
92	Rotherwas Industrial Estate, Hfd	Urban Background	352919	237840	NO_2	NO	N/A	1.9	NO	2.3
93	Rotherwas Relief Road, Hereford (B4399)	Suburban	351881	239984	NO_2	NO	N/A	5.5	NO	2.15
94	Edgar St opp Nolan Rd, Hfd (A49)	Roadside	350933	240798	NO_2	YES	3	2.35	9.35	N
95	Edgar St. nr Prior St. Hfd (A49)	Roadside	350876	240678	NO_2	YES	1	1.65	3.65	N
96	Edgar St. nr Junc Newtown Rd (A49)	Roadside	350941	240858	NO_2	YES	N/A	2.2	7.7	N

97	Newtown Rd, nr Postbox, Hfd	Roadside	351025	240874	NO_2	NO	0.5	2.4	2.9	N
98	Link Road A , Hereford	Urban Background	350992	240652	NO_2	NO	N/A	1.75	n/a	N
99	Link Road B, Hereford	Urban Background	351022	240668	NO_2	NO	N/A	2.36	n/a	N
100	Link Road C, Hereford	Urban Background	351440	240539	NO_2	NO	N/A	3	n/a	N
101	Widemarsh St, opp Garrick CP, Hfd	Roadside	351053	240290	NO_2	NO	0	1.7	1.7	N
102	Widemarsh St. nr juct Link Road, Hfd	Roadside	351100	240640	NO_2	NO	0.5	1.25	2.25	N
103	Bus stop, Newmarket Street, Hfd (A438)	Roadside	350898	240223	NO_2	YES	N/A	3.4	3.7	N
104	Wall Street, Hereford	Roadside	350979	240212	NO_2	YES	1	1.25	3.25	N
105	Aylestone Hill/Barscourt Rd, Hfd	Roadside	351725	240443	NO_2	NO	5	1.8	6.8	N
106	Commercial Road, Hfd	Roadside	351483	240323	NO_2	NO	2.5	2.9	5.4	N
107	St Mary's Church, Grandstand Rd, Hfd (A49)	Roadside	350412	241161	NO_2	NO	4	1.47	5.47	N
108	Roman Road, Hereford (A4103)	Urban Background	350166	242175	NO_2	NO	N/A	1.65	n/a	N
109	Bargates, opp	Roadside	349176	259020	NO_2	YES	0	0.95	7.45	N

	Perseverance Rd Leominster									
110	Terrace 1 Eastbound Bargates, Leominster (A44)	Roadside	349262	259030	NO_2	NO	5	1.4	6.4	N
111	Terrace 2, Eastbound, Bargates Leominster (A44)	Roadside	349228	259031	NO_2	NO	5	1.2	6.2	N

Notes:

(1) 0m if the monitoring site is at a location of exposure (e.g. installed on/adjacent to the façade of a residential property).

(2) N/A if not applicable.

Table A.3 – Annual Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2018 (%) (2)	NO_2 Annual Mean Concentration (µg/m³) (3)				
					2014	2015	2016	2017	2018
6	Urban Background	Diffusion Tube	-	100	28.93	25.53	25.92	22.9	22.8
9	Roadside	Diffusion Tube	-	100	**40.25**	35.94	37.96	31.8	32.6
10	Roadside	Diffusion Tube	-	41.7	**43.71**	38.54	39.71	-	**41.33a**
22	Roadside	Diffusion Tube	-	100	30.59	24.68	28.82	25.3	27.6
32	Roadside	Diffusion Tube	-	100	36.07	34.25	33.74	31.6	28.3
33	Roadside	Diffusion Tube	-	100	36.27	33.93	33.63	30.2	28.1
46	Roadside	Diffusion Tube	-	100	38.43	32.7	32.81	34.5	31.6
53	Roadside	Diffusion Tube	-	100	33.73	31.39	31.2	29.4	30.7
54	Urban Background	Diffusion Tube	-	91.7	25.58	22.42	24.42	20.7	23.7
57	Urban Background	Diffusion Tube	-	91.7	34.05	28.27	31.07	26.7	27.7
59	Urban Centre	Diffusion Tube	-	100	24.61	23.42	23.92	19.9	20.3
61a	Roadside	Diffusion Tube	-	100	**47.63**	**42.9**	**44.15**	**41.3**	**40.2**
61b	Roadside	Diffusion Tube	-	100	-	-	-	**45.1**	**43.5**
65	Urban Background	Diffusion Tube	-	100	**40.18**	36.35	36.04	30.6	32.2

74	Roadside	Diffusion Tube	-	100	19.44	19.59	18.82	18.6	17.6
75	Roadside	Diffusion Tube	-	100	36.7	30.33	29.6	21.9	24.3
79	Roadside	Diffusion Tube	-	100	35.33	32.76	31.46	30	30.1
82	Urban Background	Diffusion Tube	-	100	-	-	22.3	20.5	21.3
84	Suburban	Diffusion Tube	-	100	-	-	12.6	11.7	13
85	Rural	Diffusion Tube	-	100	-	-	8.8	7.9	9.3
86	Roadside	Diffusion Tube	-	100	-	-	16.8	13.4	15.6
87	Roadside	Diffusion Tube	-	91.7	-	-	-	30.2	30.1
88	Roadside	Diffusion Tube	-	100	-	-	-	33.3	33.8
89	Roadside	Diffusion Tube	-	91.7	-	-	-	36.57a	36.2
90	Roadside	Diffusion Tube	-	91.7	-	-	-	26.21a	26.8
91	Roadside	Diffusion Tube	-	100	-	-	-	30.69a	**40.9**
92	Urban Background	Diffusion Tube	-	100	-	-	-	11.6	13.9
93	Roadside	Diffusion Tube	-	100	-	-	-	10.8	11.9
94	Roadside	Diffusion Tube	-	83.3	-	-	-	-	30.8
95	Roadside	Diffusion Tube	-	75	-	-	-	-	43
96	Roadside	Diffusion Tube	-	83.3	-	-	-	-	31.7
97	Roadside	Diffusion Tube	-	75	-	-	-	-	26.7

98	Urban Background	Diffusion Tube	-	83.3	-	-	-	-	21.7
99	Urban Background	Diffusion Tube	-	75	-	-	-	-	19.8
100	Urban Background	Diffusion Tube	-	75	-	-	-	-	22.2
101	Roadside	Diffusion Tube	-	83.3	-	-	-	-	32.4
102	Roadside	Diffusion Tube	-	83.3	-	-	-	-	27.6
103	Roadside	Diffusion Tube	-	83.3	-	-	-	-	**40.1**
104	Roadside	Diffusion Tube	-	83.3	-	-	-	-	33.6
105	Roadside	Diffusion Tube	-	83.3	-	-	-	-	27.3
106	Roadside	Diffusion Tube	-	75	-	-	-	-	34.2
107	Roadside	Diffusion Tube	-	83.3	-	-	-	-	25.3
108	Urban Background	Diffusion Tube	-	83.3	-	-	-	-	22.5
109	Roadside	Diffusion Tube	-	33.4	-	-	-	-	**41.61a**
110	Roadside	Diffusion Tube	-	66.7	-	-	-	-	**29.22a**
111	Roadside	Diffusion Tube	-	66.7	-	-	-	-	**32.01a**
HRD1	Roadside	Automatic	-	95.8	-	-	-	**42**	**40**

☒ **Diffusion tube data has been bias corrected**

☒ **Annualisation has been conducted where data capture is <75%.**

Notes:

a = annualised data, using Leominster Automatic Monitoring and Rural Network and the Hereford Victoria Street automatic monitor. Please note the Hereford Victoria Street analyser is located in a ROADSIDE LOCATION. Please see Appendix C for the calculations.

Exceedances of the NO_2 annual mean objective of 40µg/m^3 are shown in **bold**

NO_2 annual means exceeding 60µg/m^3, indicating a potential exceedance of the NO_2 1-hour mean objective are shown in **bold and underlined.**

(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) Means for diffusion tubes have been corrected for bias. All means have been "annualised" as per Boxes 7.9 and 7.10 in LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Figure A.1.1 – Trends in NO_2 Hereford AQMA 2015 – 2018 (1)

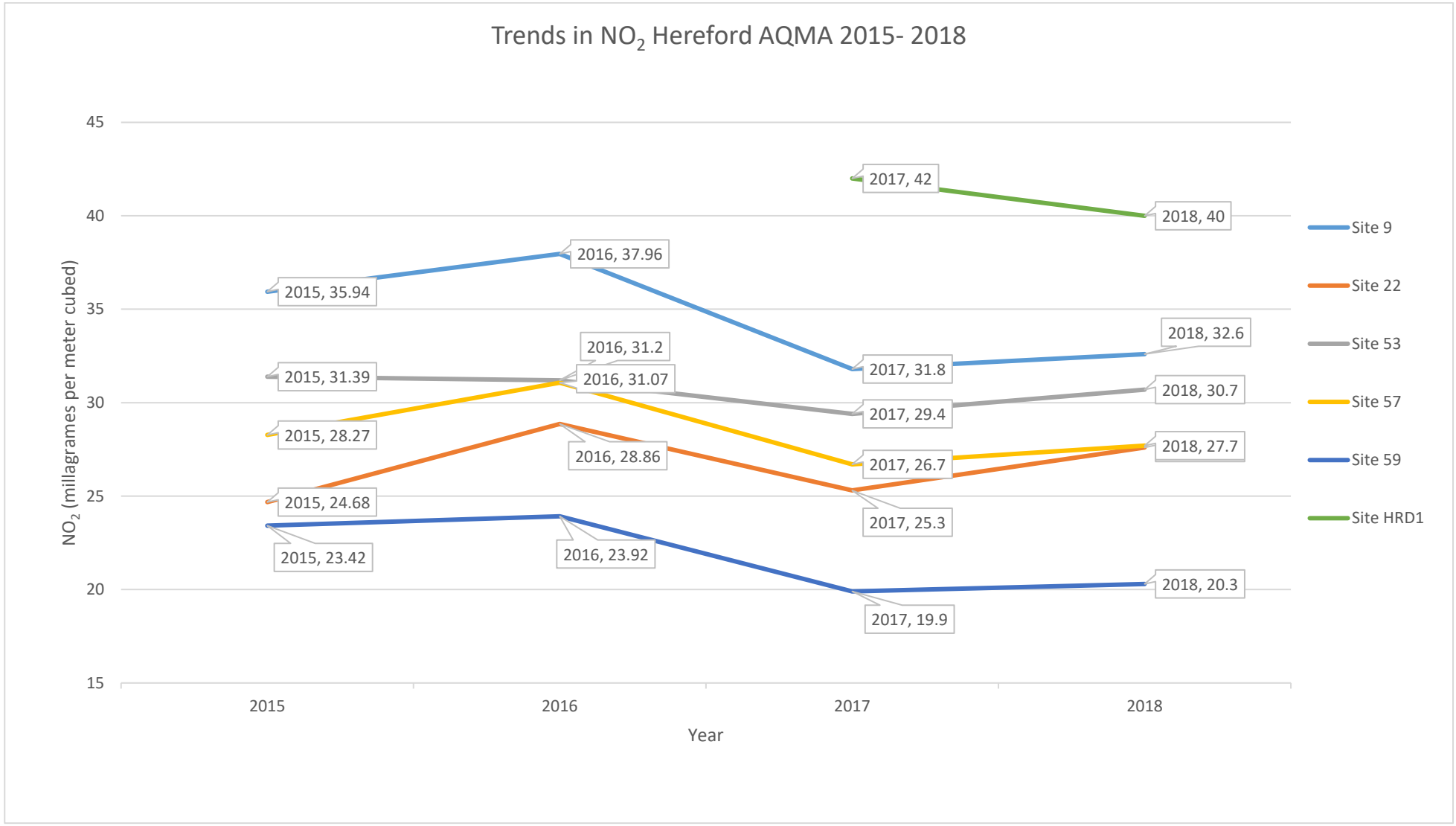


Figure A.1.2 – Trends in NO_2 Hereford AQMA 2015 – 2018 (2)

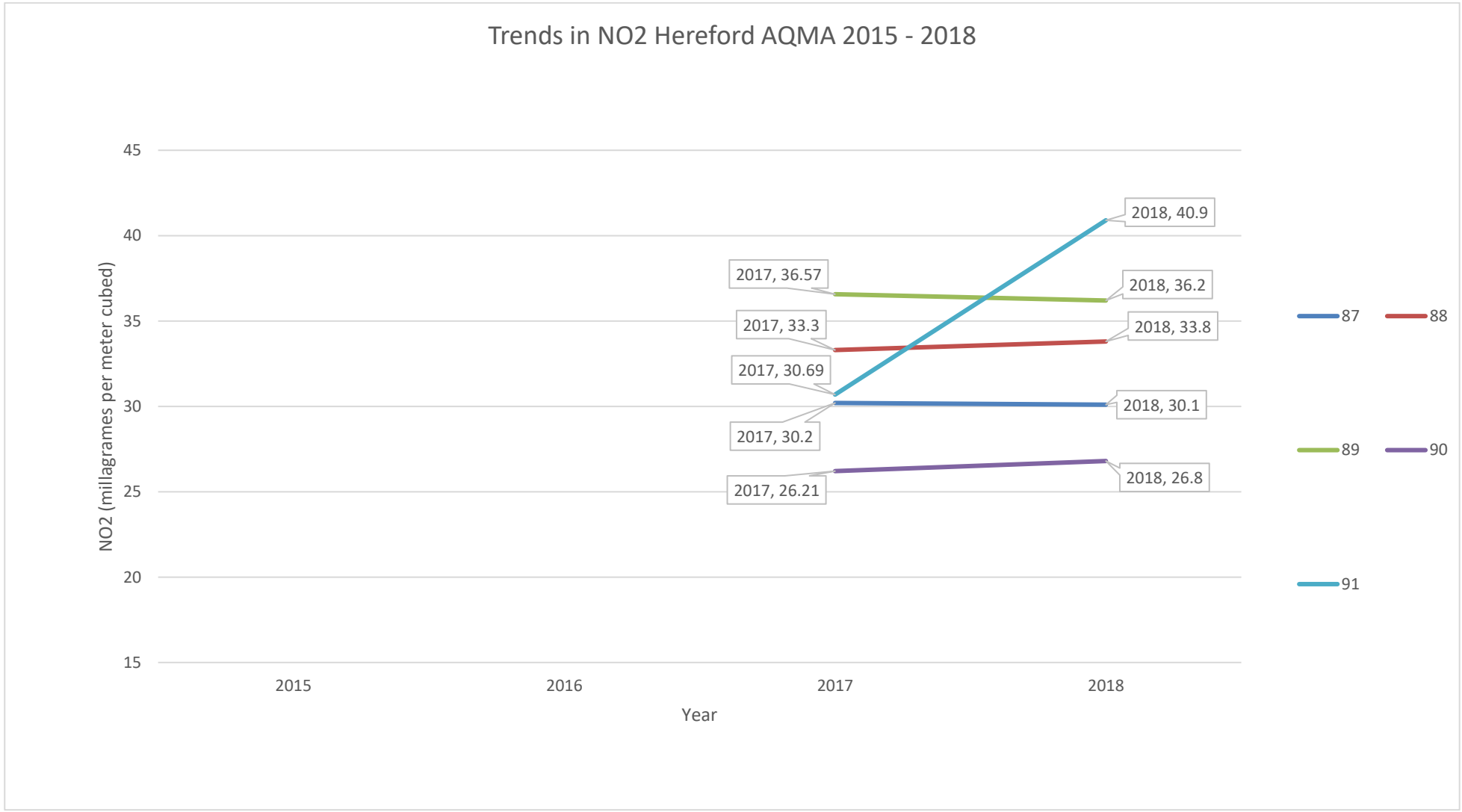


Figure A.2.1 – Trends in NO_2 Hereford, outside AQMA 2015 – 2018 (1)

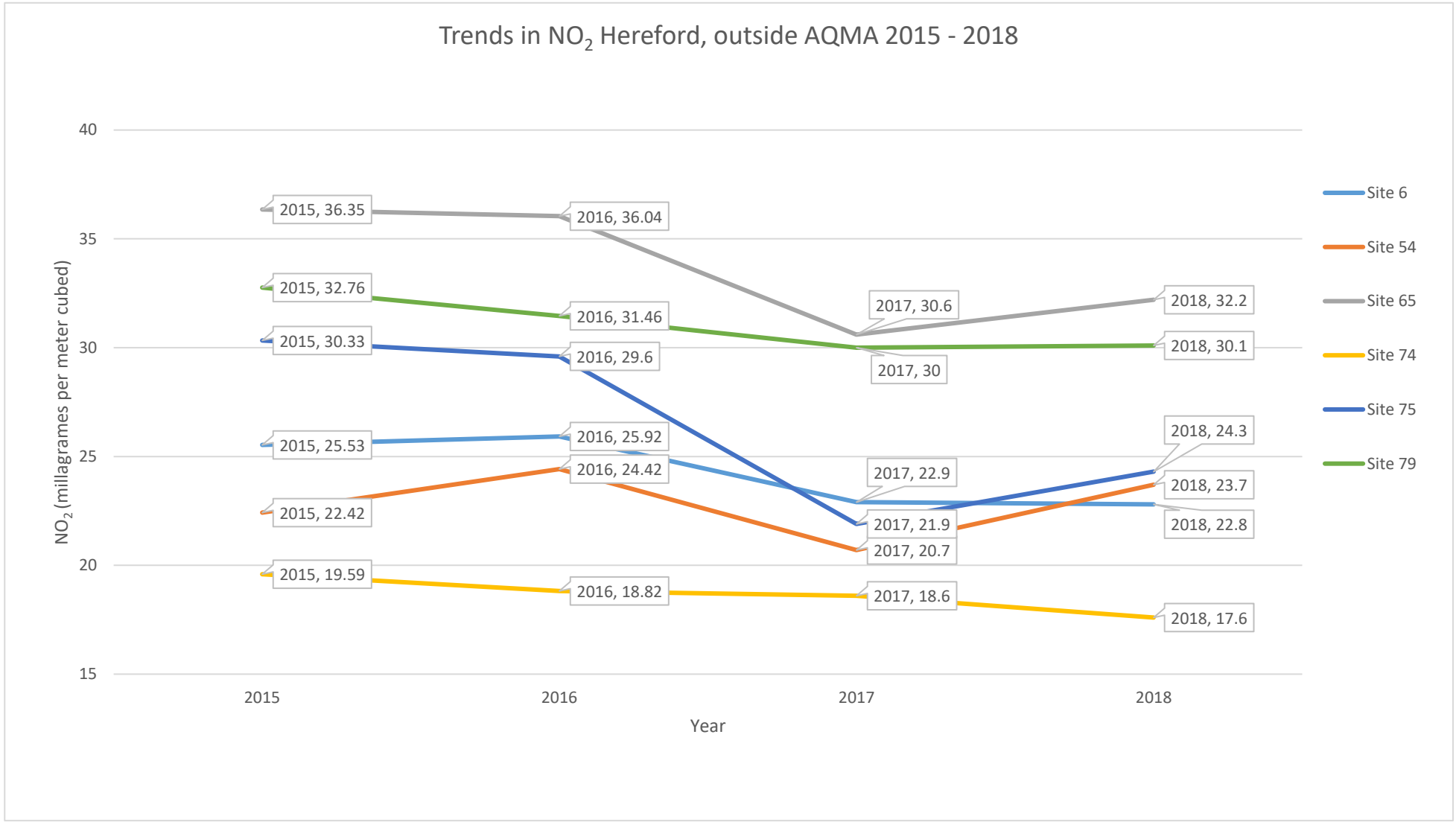


Figure A.2.2 - Trends in NO_2 Hereford, outside AQMA 2015 – 2018 (2)

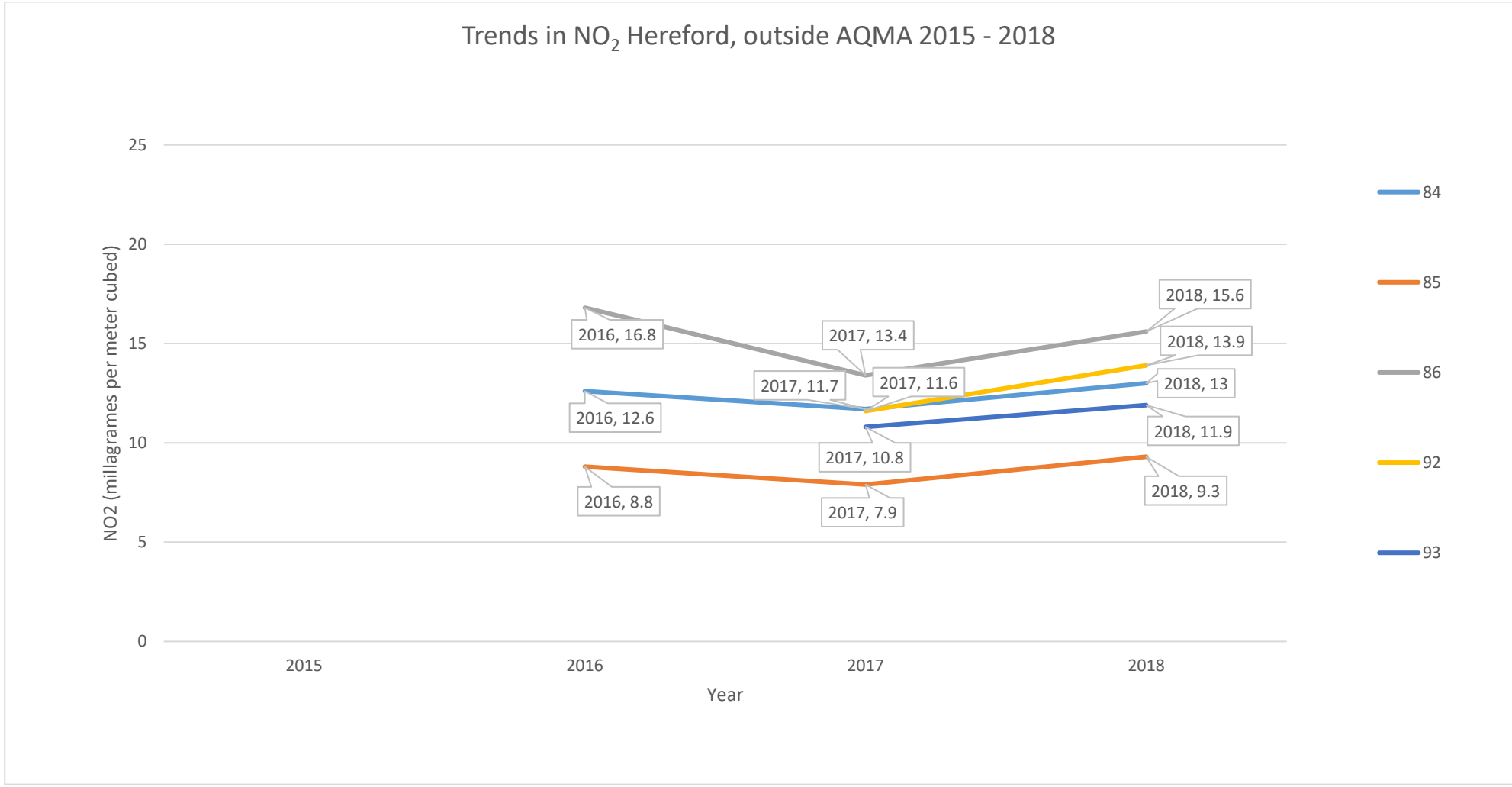


Figure A.3 – Trends in NO_2 Leominster AQMA 2015 - 2018

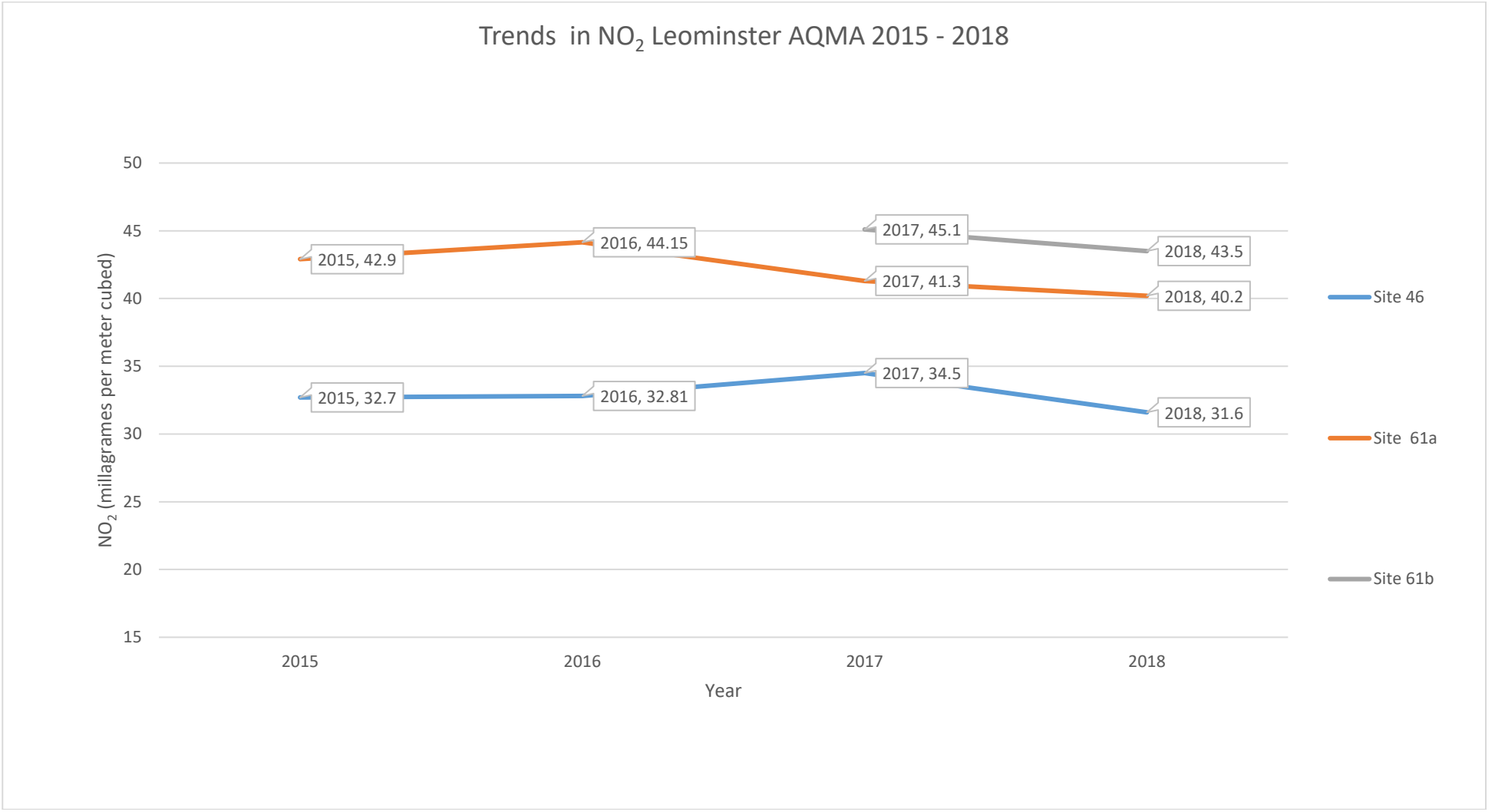


Figure A.4 – Trends in NO_2 A40 2015 – 2018

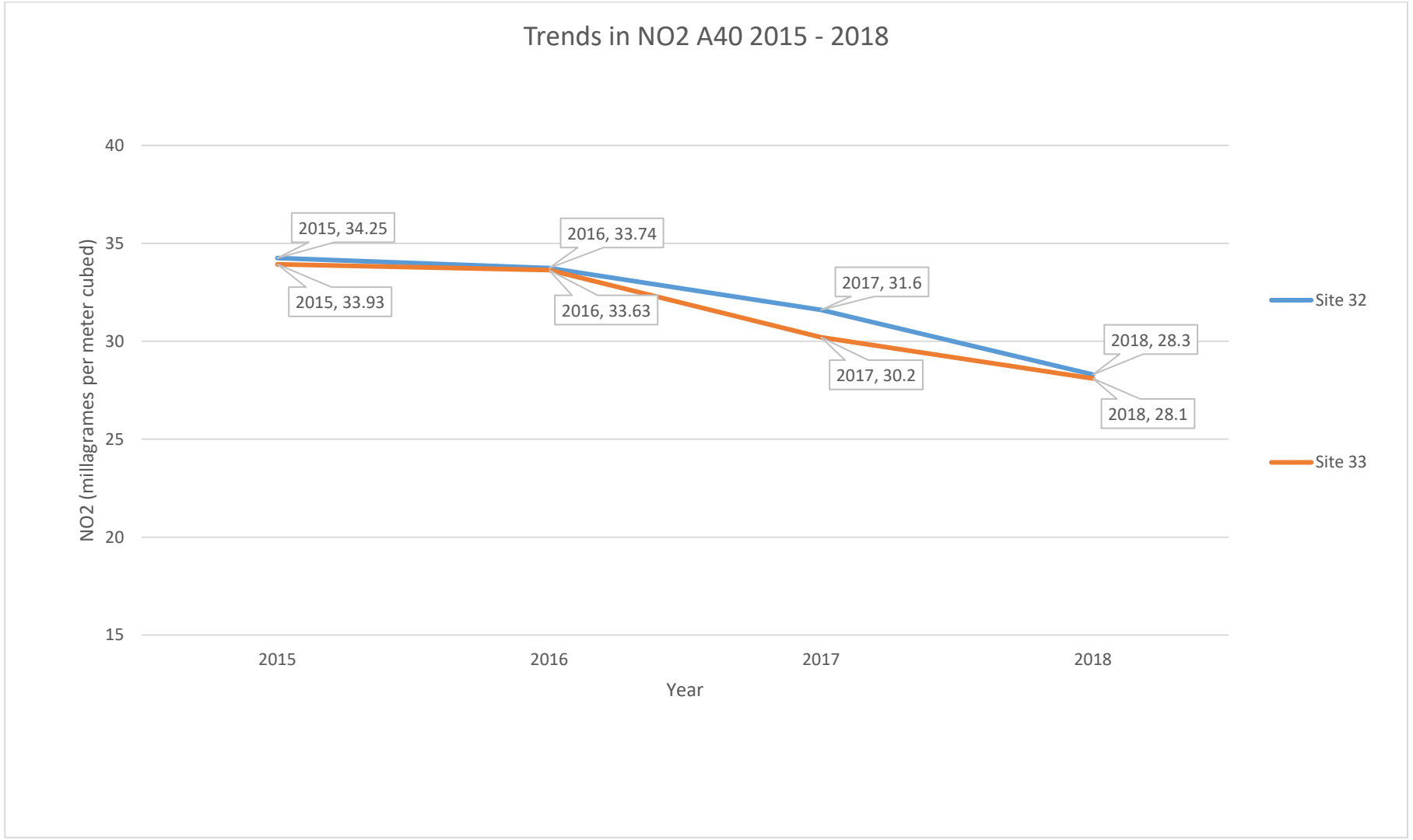


Table A.4 – 1-Hour Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2018 (%) (2)	NO_2 1-Hour Means > 200µg/m^3 (3)				
					2014	2015	2016	2017	2018
HRD1	Roadside	Automatic	-	95.8	-	-	-	**0**	**0**

Notes:

Exceedances of the NO_2 1-hour mean objective (200µg/m^3 not to be exceeded more than 18 times/year) are shown in **bold.**

(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) If the period of valid data is less than 85%, the 99.8th percentile of 1-hour means is provided in brackets.

Table A.5 – Annual Mean PM_{10} Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2018 (%) (2)	PM_{10} Annual Mean Concentration ($\mu g/m^3$) (3)				
				2014	2015	2016	2017	2018
HRD1	Roadside	-	79.4	-	-	-	25	24

☒ **Annualisation has been conducted where data capture is <75%**

Notes:

Exceedances of the PM_{10} annual mean objective of 40$\mu g/m^3$ are shown in **bold.**

(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) All means have been "annualised" as per Boxes 7.9 and 7.10 in LAQM.TG16, valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Table A.6 – 24-Hour Mean PM_{10} Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2018 (%) (2)	PM_{10} 24-Hour Means > 50µg/m^3 (3)				
				2014	2015	2016	2017	2018
HRD1	Roadside	-	79.4	-	-	-	**10**	2

Notes:

Exceedances of the PM_{10} 24-hour mean objective (50µg/m^3 not to be exceeded more than 35 times/year) are shown in **bold.**

(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) If the period of valid data is less than 85%, the 90.4th percentile of 24-hour means is provided in brackets.

Appendix B: Full Monthly Diffusion Tube Results for 2018

Table B.1 – NO_2 Monthly Diffusion Tube Results - 2018

Site ID	NO_2 Mean Concentrations (µg/m^3)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean		
													Raw Data	Bias Adjusted (0.93) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
6	19.5	23.7	26.6	27.5	22.1	18.6	22.8	21.8	25.9	27.3	30.5	27.9	24.5	22.8	19.7
9	25.0	36.6	38.8	33.5	47.5	30.5	35.3	27.8	26.9	37.8	41.3	39.7	35.1	32.6	**N/A**
10	-	-	-	-	-	-	39.4	36.5	36.4	46.4	44.6	-	45.9	**41.33a**	**N/A**
22	25.3	31.7	31.2	34.6	28.5	30.6	26.4	21.5	25.5	33.3	34.7	32.4	29.7	27.6	**N/A**
32	30.5	31.7	26.8	28.9	33	29.7	32	27.4	28.4	33.8	31.9	31.4	30.5	28.3	**N/A**
33	28.7	26.7	32.3	31.7	33.1	28.7	34.2	29.3	26.3	27.2	31.2	32.8	30.2	28.1	**N/A**
46	29.1	31.4	31.7	35.9	38.9	29.6	37.9	37.6	33.2	40.1	31.3	31.4	34.0	31.6	**N/A**
53	29.9	27.9	29.9	38.8	36	32.5	38.1	27.6	29.8	36.3	34.5	34.9	33.0	30.7	**N/A**
54	-	25	27	26.5	26	24.2	25.4	20.8	22.6	27.3	28.7	26.9	25.5	23.7	**N/A**
57	27.4	29.7	28.9	36.1	28.1	28.7	32.2	22.2	28.4	32.8	-	33.5	29.8	27.7	25.5
59	21.4	26.3	20.5	23.9	21.9	20	17.7	16.6	21.5	25	22.6	25	21.9	20.3	**N/A**
61A	42.6	35.6	41.8	47.2	51.6	38.9	48.9	38.6	42.6	46.4	40.4	44.3	43.2	**40.2**	**N/A**
61B	44.7	38.3	43.3	45.8	56.3	40.8	55.4	45.9	43.9	49.7	45.1	52.3	46.8	**43.5**	**N/A**
65	34.2	37.6	35.1	37.1	39.9	37.1	37.7	24.6	28.1	34.5	36.4	33.9	34.7	32.2	26.9
74	21.5	21	21.1	21.1	17.7	14.9	14.2	15.1	15.7	20	23.2	21.8	19.0	17.6	**N/A**

75	18.7	28.5	31.4	31	25.8	26.7	25.6	20.1	20.5	27.4	29.6	28.1	26.1	24.3	19.5
79	32.9	33.6	29.7	37.4	31.6	29.9	30.8	24.8	27.9	33.6	37.1	39.2	32.4	30.1	23.8
82	21.3	23.6	18.8	26.2	24.8	22.6	21.8	17.6	18.2	25.5	26.8	28.1	22.9	21.3	18.4
84	17	17.1	14.9	14.4	13	14	12	10	11.5	15.1	14.8	14.1	14.0	13.0	**N/A**
85	12	12.3	12.3	9.7	7.3	6.1	6.2	6	6.7	11.3	16.1	13.9	10.0	9.3	**N/A**
86	18.1	20.1	17.9	18.1	15.8	14.2	14.8	6	9.7	19.2	26.1	20.8	16.7	15.6	**N/A**
87	23.9	35	34.3	26.3	39.3	-	21.6	24.8	28.3	40.1	43.3	39.2	32.4	30.1	**N/A**
88	33.4	43.2	43.1	31	46.7	34.6	33.9	26.6	26.8	36.8	39.7	40.4	36.3	33.8	**N/A**
89	34.2	37.9	42.1	47.4	-	37.3	41.2	34.8	32.6	44.1	32.2	44.2	38.9	36.2	30.4
90	33.5	29.8	-	29.4	31.2	25.1	30.6	22.4	24.8	31.1	31.8	27.5	28.8	26.8	23.1
91	48.4	39.6	37.1	49.9	43.5	38.3	49.9	44.6	47	49.2	38.5	41.9	44.0	**40.9**	33.5
92	18.4	15.9	17.6	14.9	14.1	12.4	12.6	9.5	11.8	16	19.3	17	15.0	13.9	**N/A**
93	14	15.6	14.7	13.7	12.6	13.3	11.6	9.1	9.7	13.3	13.3	12.6	12.8	11.9	**N/A**
94	-	-	29.2	34.2	37.3	29.8	33.7	32.2	30.4	34.6	35.3	34.5	33.1	30.8	28.3
95	-	-	39.8	50.7	46.9	-	44.5	45	50.3	44	45	49.8	46.2	**43.0**	38.6
96	-	-	28.6	36.2	34.6	30	31.1	31.1	35.1	34.8	39.7	39.3	34.0	31.7	**N/A**
97	-	-	-	28.2	30.7	27.3	27	22.9	24.6	31.1	34.7	31.7	28.7	26.7	26.2
98	-	-	25	22	22.8	18.9	18.7	17.4	22.2	24.1	29.9	32.1	23.3	21.7	**N/A**
99	-	-	26.9	20.8	21	17.5	16.1	16.2	19.7	22.2	-	30.9	21.3	19.8	**N/A**
100	-	-	27.3	25.5	22.3	17.9	18.8	18.6	23.4	29.2	-	31.6	23.9	22.2	**N/A**
101	-	-	28.6	32.3	36.6	31.9	34.4	29.1	34.8	37	41	42.4	34.8	32.4	**N/A**
102	-	-	28.7	31.8	30.3	27.1	28.9	22.6	25.3	31.8	36.5	34	29.7	27.6	26.8
103	-	-	37.5	39.7	50.6	41.9	47	40.2	44.6	46.9	37	46.3	43.2	**40.1**	**N/A**
104	-	-	41.2	35.9	36.3	30.7	34.7	28.9	31.8	37	40.2	44.6	36.1	33.6	32.7
105	-	-	24.9	28.5	30.4	28.4	30.3	26.9	27.9	30.9	31	34.2	29.3	27.3	26.1
106	-	-	27.7	36.3	39.9	36.4	39.8	35.7	36.9	36.9	-	41.4	36.8	34.2	30.6

107	-	-	27.9	29.1	27.7	22.7	24.6	20.7	23.4	29.2	32.6	34.4	27.2	25.3	24.3
108	-	-	24.3	25.2	23.4	19.2	24.2	19.4	23.8	24.9	28.6	28.9	24.2	22.5	**N/A**
109	-	-	41	-	51.7	43	-	-	-	-	-	38.1	41.8	**41.61a**	**N/A**
110	-	-	-	30.3	33.2	34	31	21.3	27.5	36.8	-	35.7	34.8	**29.22a**	24.1
111	-	-	28.6	31.2	35.4	31.8	26.2	25.1	26.5	31.2	-	-	32.8	**32.01a**	**N/A**

☒ **Local bias adjustment factor used**

☒ **National bias adjustment factor used**

☒ **Annualisation has been conducted where data capture is <75%**

☒ **Where applicable, data has been distance corrected for relevant exposure**

Notes:

a = annualised data, using Leominster Automatic Monitoring and Rural Network and the Hereford Victoria Street automatic monitor. Please note the Hereford Victoria Street analyser is located in a ROADSIDE LOCATION. Please see Appendix C for the calculations.

Exceedances of the NO_2 annual mean objective of 40µg/m^3 are shown in **bold**.

NO_2 annual means exceeding 60µg/m^3, indicating a potential exceedance of the NO_2 1-hour mean objective are shown in **bold and underlined.**

(1) See Appendix C for details on bias adjustment and annualisation.

(2) Distance corrected to nearest relevant public exposure.

Appendix C: Supporting Technical Information / Air Quality Monitoring Data QA/QC

Factor from Local Co-location Studies (if available)

No local co-location studies for nitrogen dioxide have been undertaken in 2018.

Diffusion Tube Bias Adjustment Factors

The following UKAS accredited company provides Herefordshire Council with nitrogen dioxide diffusion tubes and analysis:

Gradko Environmental,
St Martins House,
77 Wales Street,
Winchester,
Hampshire, SO23 0RH
Tel 01962 860331
diffusion@gradko.co.uk

The 20% Triethanolamine (TEA) / De-ionised Water preparation methods is used.

The bias adjustment factor applied to the results in 2018 was 0.93 (spreadsheet 03/19) which were derived from the national studies. All sites are shown in Appendix B.

QA/QC of Diffusion Tube Monitoring

Under the WASP Scheme Gradko performed 100% satisfactory for all periods during 2018. Tube precision was generally 'Good' throughout 2018.

Calculation for estimating $PM_{2.5}$ from PM_{10} measurements

Step 1: Multiply PM_{10} recorded concentrations by nationally derived correction ratio

$24\mu g/m^3 \times 0.7 = 16.8\mu g/m^3$

Step 2: Estimated annual mean $PM_{2.5} = 16.8\mu g/m^3$

Table C.1 – Annualisation calculations

Site ID	Unadjusted diffusion tube mean (µg/m^3)	Annualisation factor: Victoria Street	Annualisation factor: Leominster	Average Annualisation factor	Annualisation & bias adjusted (0.92) concentration (µg/m^3)
10	40.66	1.12	1.06	1.09	41.33
109	44.27	0.99	1.02	1.01	41.61
110	31.23	1.06	0.73	0.90	26.22
111	29.63	1.07	1.26	1.16	32.01

Annualisation calculations for site 10

	B1	D1	B1 when D1 is Avaliable		
	Victoria St	site 10			
Jan	44.38831				
Feb	49.22523				
Mar	46.997				
April	42.64458				
May	41.79904				
June	36.90229				
July	36.46483	39.4	36.5		
Aug	31.16927	36.5	31.2		
Sept	31.80036	36.4	31.8		
Oct	39.20238	46.4	39.22424		
Nov	41.90305	44.6	41.9		
Dec	43.7				
	40.51636	40.66	36.12485		
Annual Mean B1		40.5			
Period Mean of B1		36.1			
Ratio of annual mean to period mean is				1.121884	
annualisation factor		1.092993			
Measured concentration M =			40.66		
Annualised average of D1 = M xRa					
Annualised average of D1 =			44.4411		
Then correct for Bias adjustmer			0.93 correction factor		
			41.33022		

	B1	D1	B1 when D1 is Avalia	
	LEO	site 10		
Jan	10.26972			
Feb	10.96438			
Mar	10.08087			
April	7.642212			
May	7.870314			
June	5.685172			
July	5.197854	39.4	5.197854	
Aug	4.605697	36.5	4.605697	
Sept	5.030644	36.4	5.030644	
Oct	10.01775	46.4	10.01775	
Nov	11.19118	44.6	11.19118	
Dec	10.64446		10.64446	
	8.266687	40.66	7.781263	
Annual Mean B1		8.3		
Period Mean of B1		7.8		
Ratio of annual mean to period mean is				1.064103
annualisation factor		1.092993		
Measured concentration M =			40.66	
Annualised average of D1 = M xRa				
Annualised average of D1 =			44.4411	
Then correct for Bias adjustmer			0.93 correction facto	
			41.33022	

Annualisation calculations for site 109

	B1	D1	B1 when D1 is Avaliable		
	Victoria St	site 109			
Jan	44.38831				
Feb	49.22523				
Mar	46.997	41	46.997		
April	42.64458				
May	41.79904	51.7	41.79904		
June	36.90229	43	36.90229		
July	36.46483				
Aug	31.16927				
Sept	31.80036				
Oct	39.20238				
Nov	41.90305				
Dec	43.7	38.1	43.7		
	40.51636	44.26667	40.80044		
Annual Mean B1		40.5			
Period Mean of B1		40.8			
Ratio of annual mean to period mean is				0.992647	
annualisation factor		1.010574			
Measured concentration M =			44.27		
Annualised average of D1 = M xRa					
Annualised average of D1 =			44.7381		
Then correct for Bias adjustmer			0.93 correction factor		
			41.60644		

	B1	D1	B1 when D1 is Avalia	
	LEO	site 109		
Jan	10.26972			
Feb	10.96438			
Mar	10.08087	41	10.08087	
April	7.642212			
May	7.870314	51.7	7.870314	
June	5.685172	43	5.685172	
July	5.197854			
Aug	4.605697			
Sept	5.030644			
Oct	10.01775			
Nov	11.19118			
Dec	10.64446	38.1	10.64446	
	8.266687	44.26667	8.066648	
Annual Mean B1		8.3		
Period Mean of B1		8.07		
Ratio of annual mean to period mean is				1.028501
annualisation factor		1.010574		
Measured concentration M =			44.27	
Annualised average of D1 = M xRa				
Annualised average of D1 =			44.7381	
Then correct for Bias adjustmer			0.93 correction facto	
			41.60644	

Annualisation calculations for site 110

	B1	D1	B1 when D1 is Avaliable		
	Victoria St	site 110			
Jan	44.38831				
Feb	49.22523				
Mar	46.997				
April	42.64458	30.3	42.64458		
May	41.79904	33.2	41.79904		
June	36.90229	34	36.90229		
July	36.46483	31	36.46483		
Aug	31.16927	21.3	31.16927		
Sept	31.80036	27.5	31.80036		
Oct	39.20238	36.8	39.20238		
Nov	41.90305				
Dec	43.7	35.7	43.7		
	40.51636	31.225	37.96034		
Annual Mean B1		40.5			
Period Mean of B1		38			
Ratio of annual mean to period mean is				1.065789	
annualisation factor		0.90277			
Measured concentration M =			31.23		
Annualised average of D1 = M xRa					
Annualised average of D1 =			28.19351		
Then correct for Bias adjustmer			0.93 correction factor		
			26.21996		

	B1	D1	B1 when D1 is Avalia	
	LEO	site 110		
Jan	10.26972			
Feb	10.96438			
Mar	10.08087			
April	7.642212	30.3	7.642212	
May	7.870314	33.2	7.870314	
June	5.685172	34	5.685172	
July	5.197854	31	5.197854	
Aug	4.605697	21.3	4.605697	
Sept	5.030644	27.5	5.030644	
Oct	10.01775	36.8	10.01775	
Nov	11.19118			
Dec	10.64446	35.7	43.7	
	8.266687	31.225	11.21871	
Annual Mean B1		8.3		
Period Mean of B1		11.22		
Ratio of annual mean to period mean is				0.73975
annualisation factor		0.90277		
Measured concentration M =			31.23	
Annualised average of D1 = M xRa				
Annualised average of D1 =			28.19351	
Then correct for Bias adjustmer			0.93 correction facto	
			26.21996	

Annualisation calculations for site 111

	B1	D1	B1 when D1 is Avaliable		
	Victoria St	site 111			
Jan	44.38831				
Feb	49.22523				
Mar	46.997	28.6	46.997		
April	42.64458	31.2	42.64458		
May	41.79904	35.4	41.79904		
June	36.90229	31.8	36.90229		
July	36.46483	26.2	36.46483		
Aug	31.16927	25.1	31.16927		
Sept	31.80036	26.5	31.80036		
Oct	39.20238	31.2	39.20238		
Nov	41.90305				
Dec	43.7				
	40.51636	29.62857	37.14039		
Annual Mean B1		40.5			
Period Mean of B1		38			
Ratio of annual mean to period mean is				1.065789	
annualisation factor		1.161683			
Measured concentration M =			29.63		
Annualised average of D1 = M xRa					
Annualised average of D1 =			34.42066		
Then correct for Bias adjustmer			0.93 correction factor		
			32.01121		

	B1	D1	B1 when D1 is Avalia	
	LEO	site 111		
Jan	10.26972			
Feb	10.96438			
Mar	10.08087	28.6	10.08087	
April	7.642212	31.2	7.642212	
May	7.870314	35.4	7.870314	
June	5.685172	31.8	5.685172	
July	5.197854	26.2	5.197854	
Aug	4.605697	25.1	4.605697	
Sept	5.030644	26.5	5.030644	
Oct	10.01775	31.2	10.01775	
Nov	11.19118			
Dec	10.64446			
	8.266687	29.62857	6.57852	
Annual Mean B1		8.3		
Period Mean of B1		6.6		
Ratio of annual mean to period mean is				1.257576
annualisation factor		1.161683		
Measured concentration M =			29.63	
Annualised average of D1 = M xRa				
Annualised average of D1 =			34.42066	
Then correct for Bias adjustmer			0.93 correction facto	
			32.01121	

Table C.2 – Estimation of NO_2 concentrations at the nearest receptor

Site Name/ID	Distance (m)		NO_2 Annual Mean Concentration (µg/m^3)		
	Monitoring Site to Kerb	Receptor to Kerb	Background*	Monitored at Site	Predicted at Receptor
6	0.2	2.0	14	22.8	19.7
57	0.3	0.8	14	27.7	25.5
65	1.4	5.2	14	32.2	26.9
75	1.3	12.0	14	24.3	19.5
79	1.0	7.0	14	30.1	23.8
82	1.3	3.4	7.0	21.3	18.4
89	2.2	6.6	14	36.2	30.4
90	2.1	7.1	14	26.8	23.1
91	1.1	4.2	14	40.9	33.5
94	3	5.4	14	30.8	28.3
95	1.6	3.2	14	43	38.6
97	2.4	2.8	14	26.7	26.2
102	1.3	1.7	14	27.6	26.8
104	1.2	1.5	14	33.6	32.7
105	1.5	2.3	14	27.3	26.1
106	2.9	5.8	14	34.2	30.6
107	4	5.5	14	25.3	24.3
110	1	4.8	6	32.5	24.1

Notes:
The background NO2 levels were identified using Defra background maps with the following grid references 350500, 240500 (Herefordshire sites), 360500, 224500 (Ross-on-Wye site) and 349500, 259500 (Leominster site).

Appendix D: Map(s) of Monitoring Locations and AQMAs

Figure D.1 – Map of Herefordshire Transport Network and Major Settlements

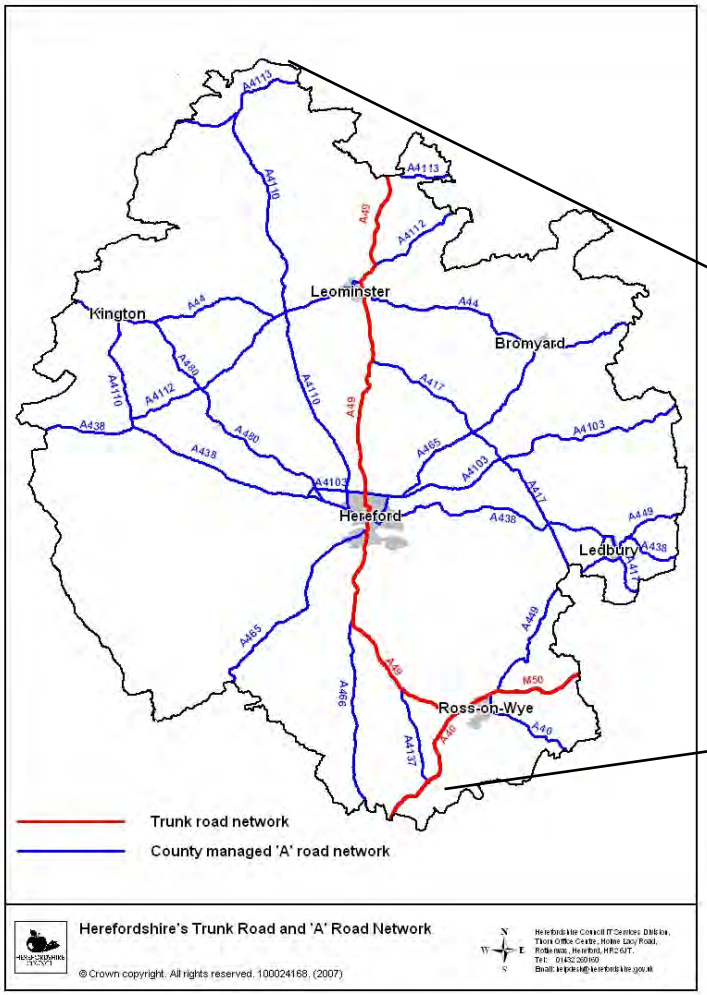


Figure D.2 – Location of Herefordshire

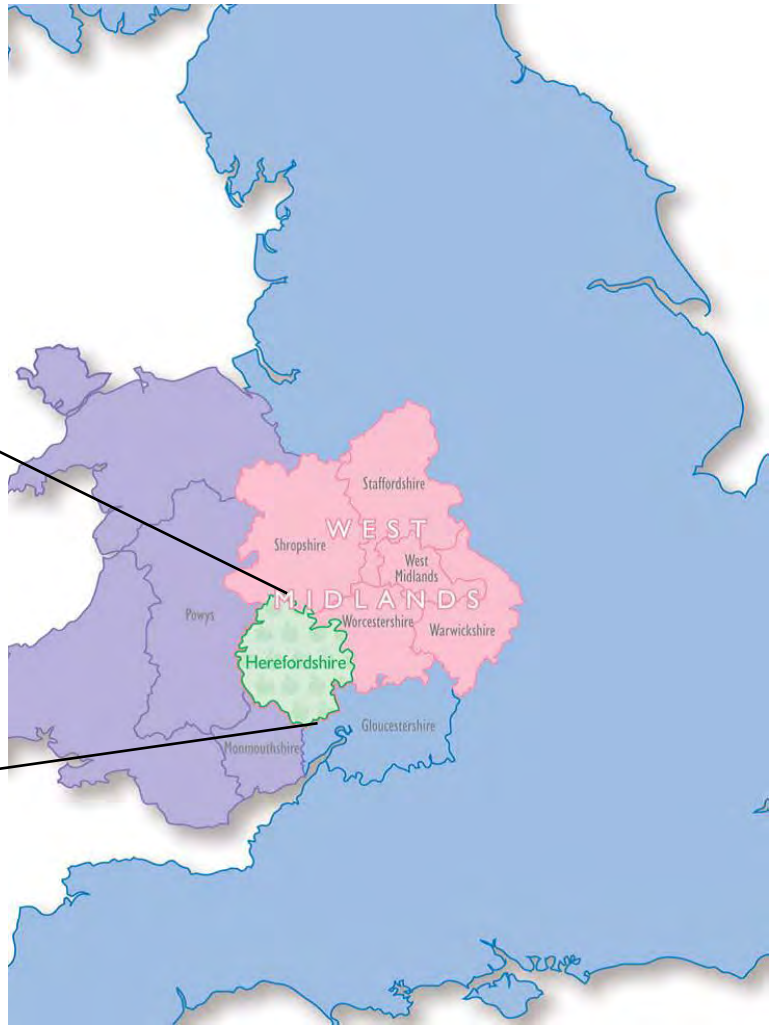


Figure D.3 – Hereford AQMA Boundary

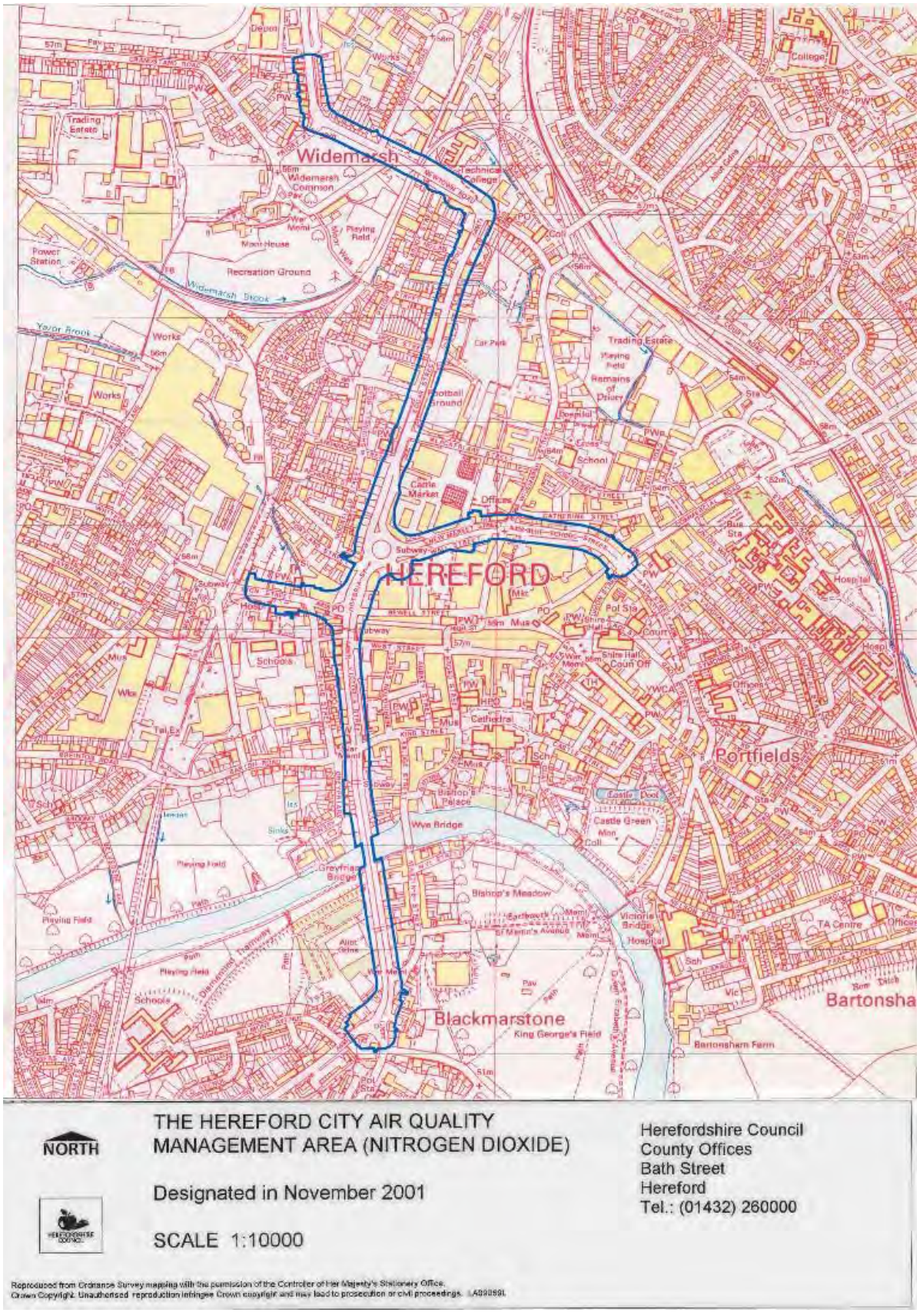


Figure D.4 – Hereford City (North) Monitoring Locations (1)

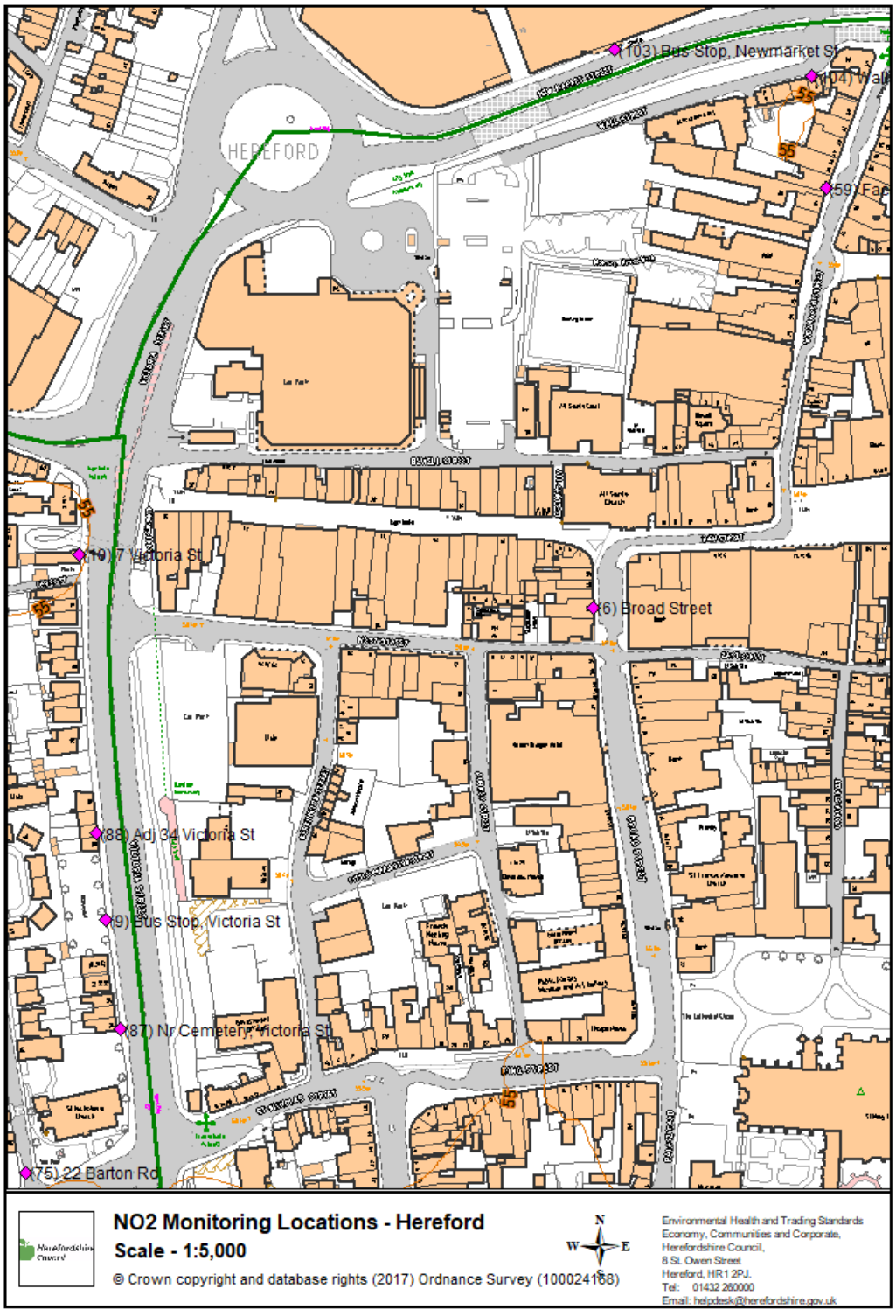


Figure D.5 – Hereford City (North) Monitoring Locations (2)

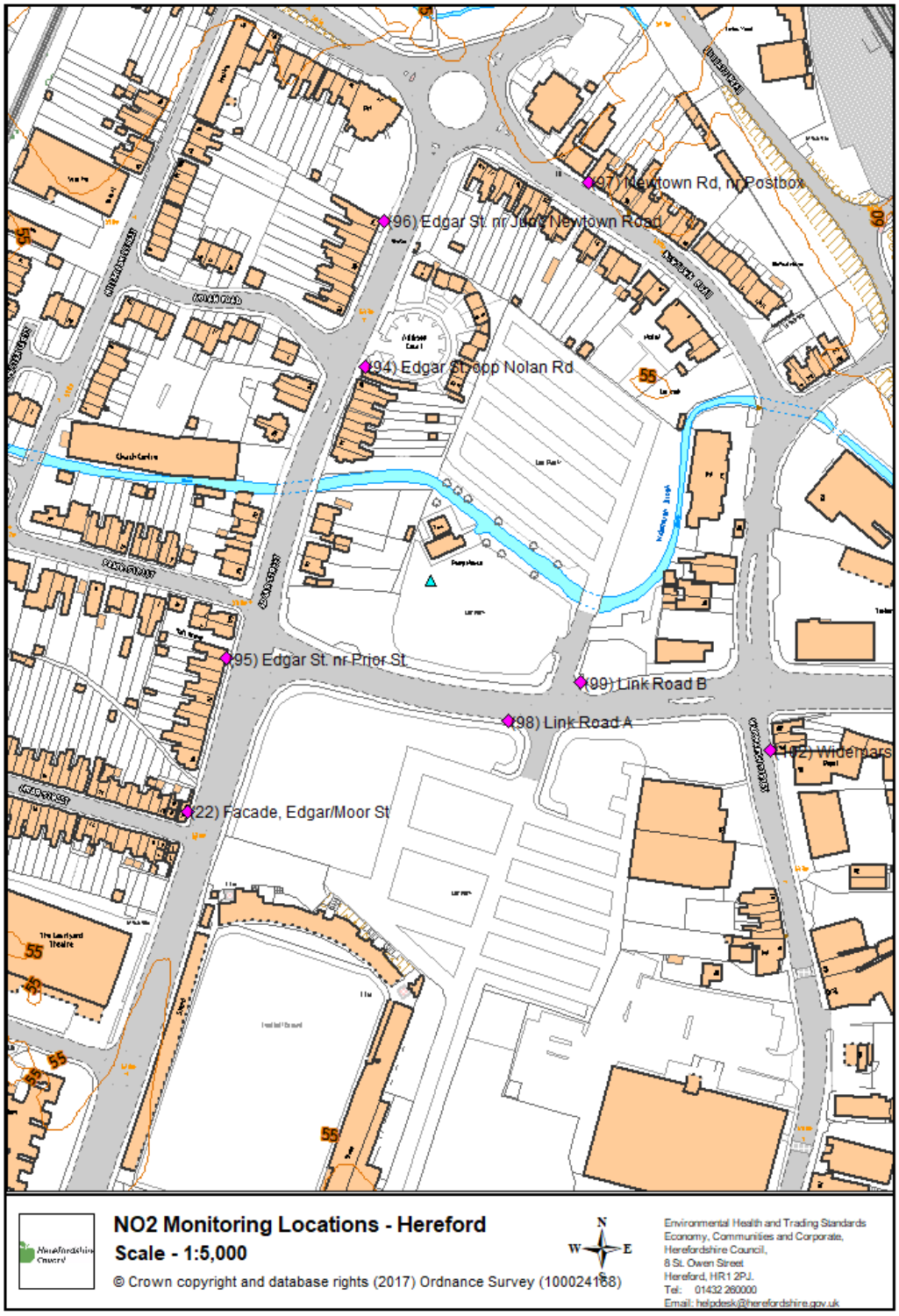


Figure D.6 – Hereford City (North) Monitoring Locations (3)

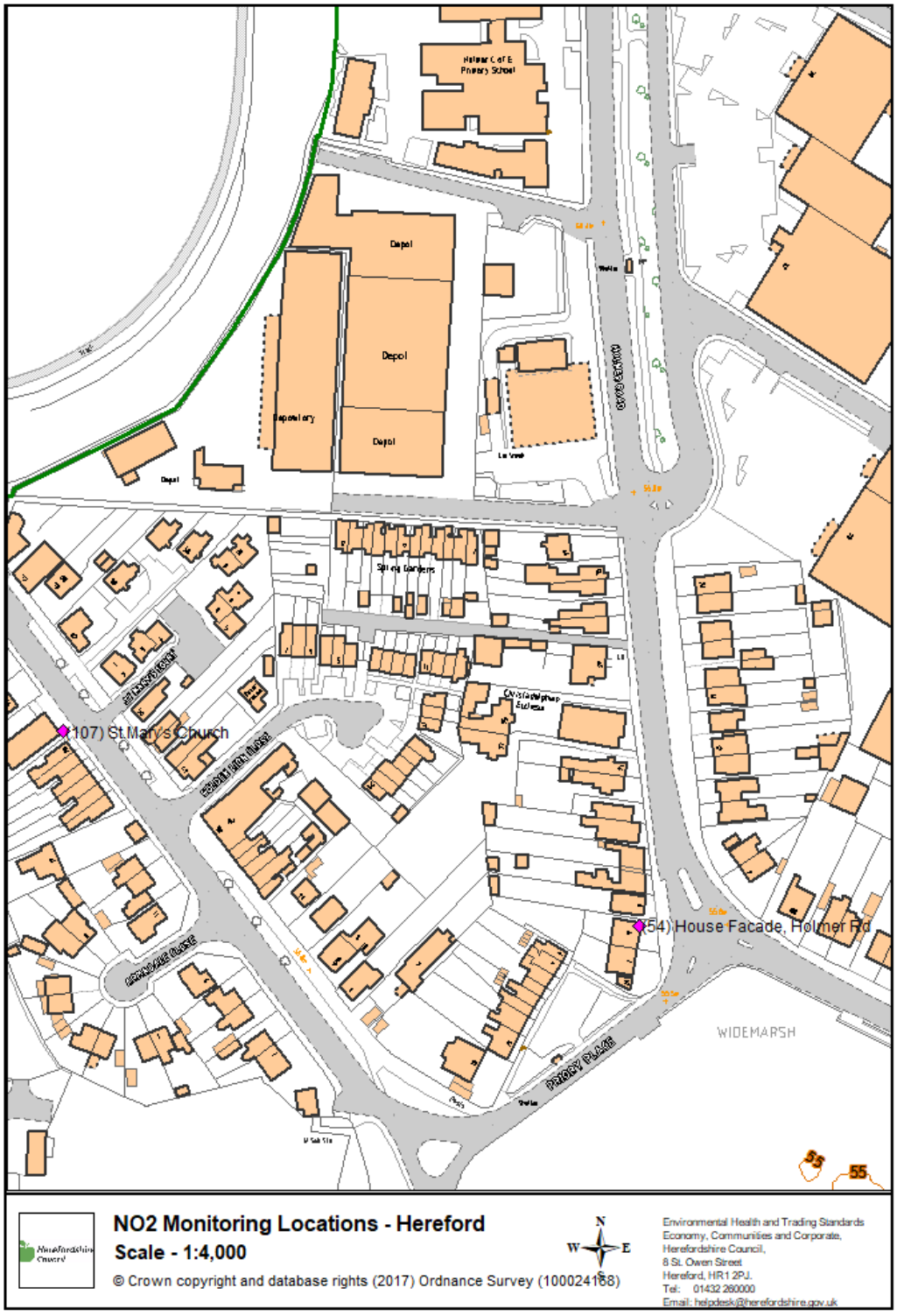


Figure D.7 – Hereford City (North) Monitoring Locations (4)

Figure D.8 – Hereford City (North) Monitoring Locations (5)

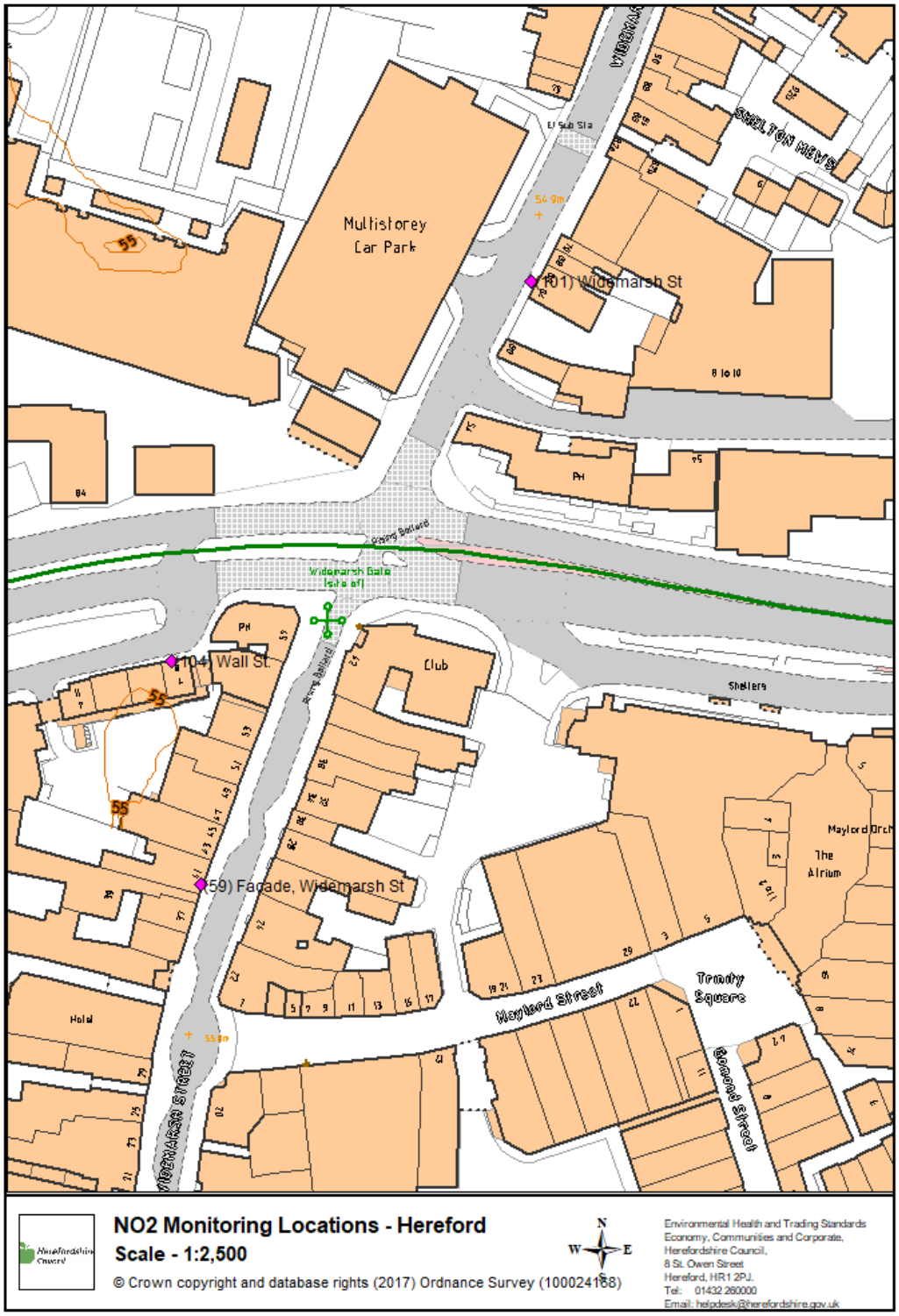


Figure D.9 – Hereford City (North) Monitoring Locations (6)

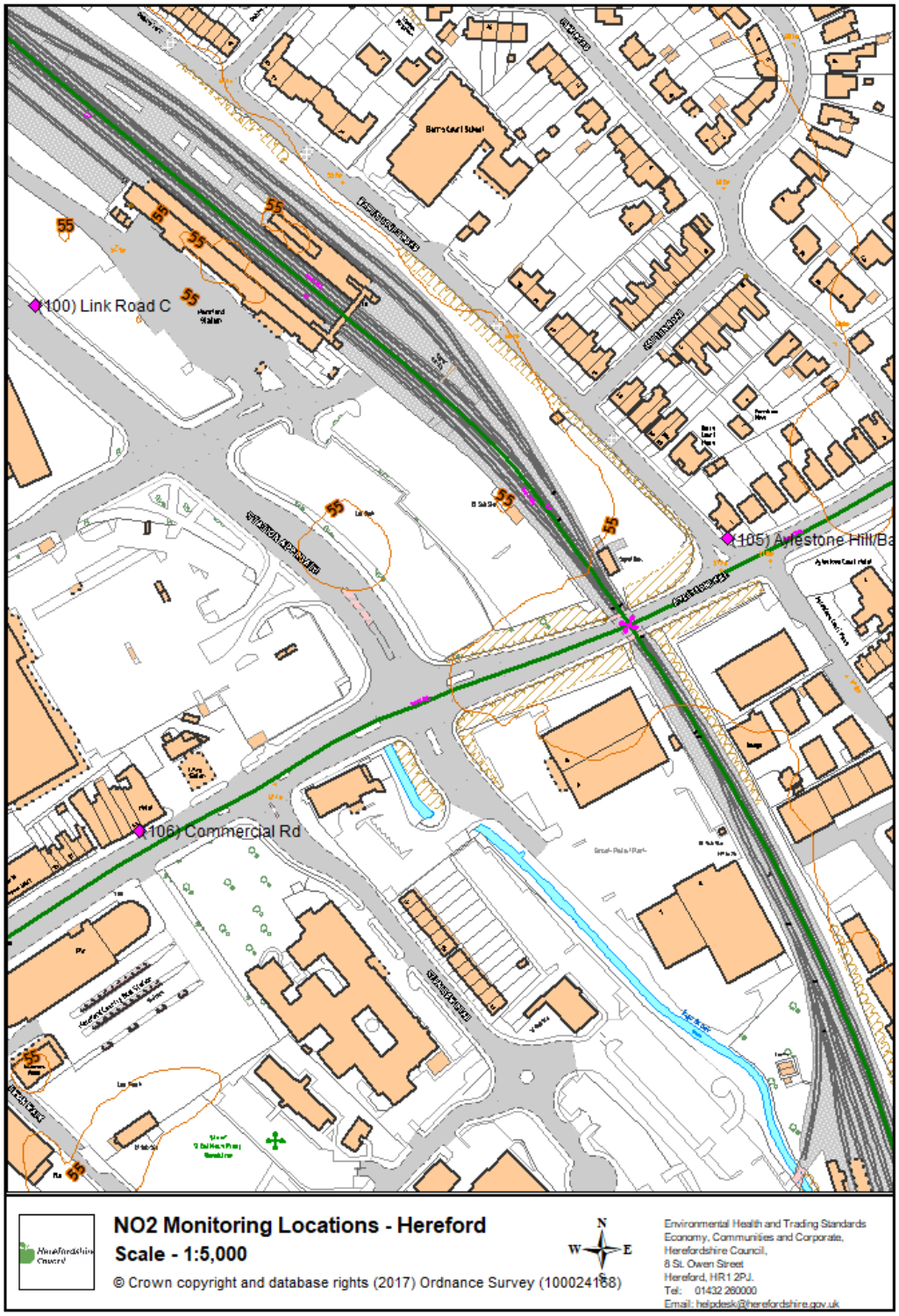


Figure D.10 – Hereford City (South) Monitoring Locations

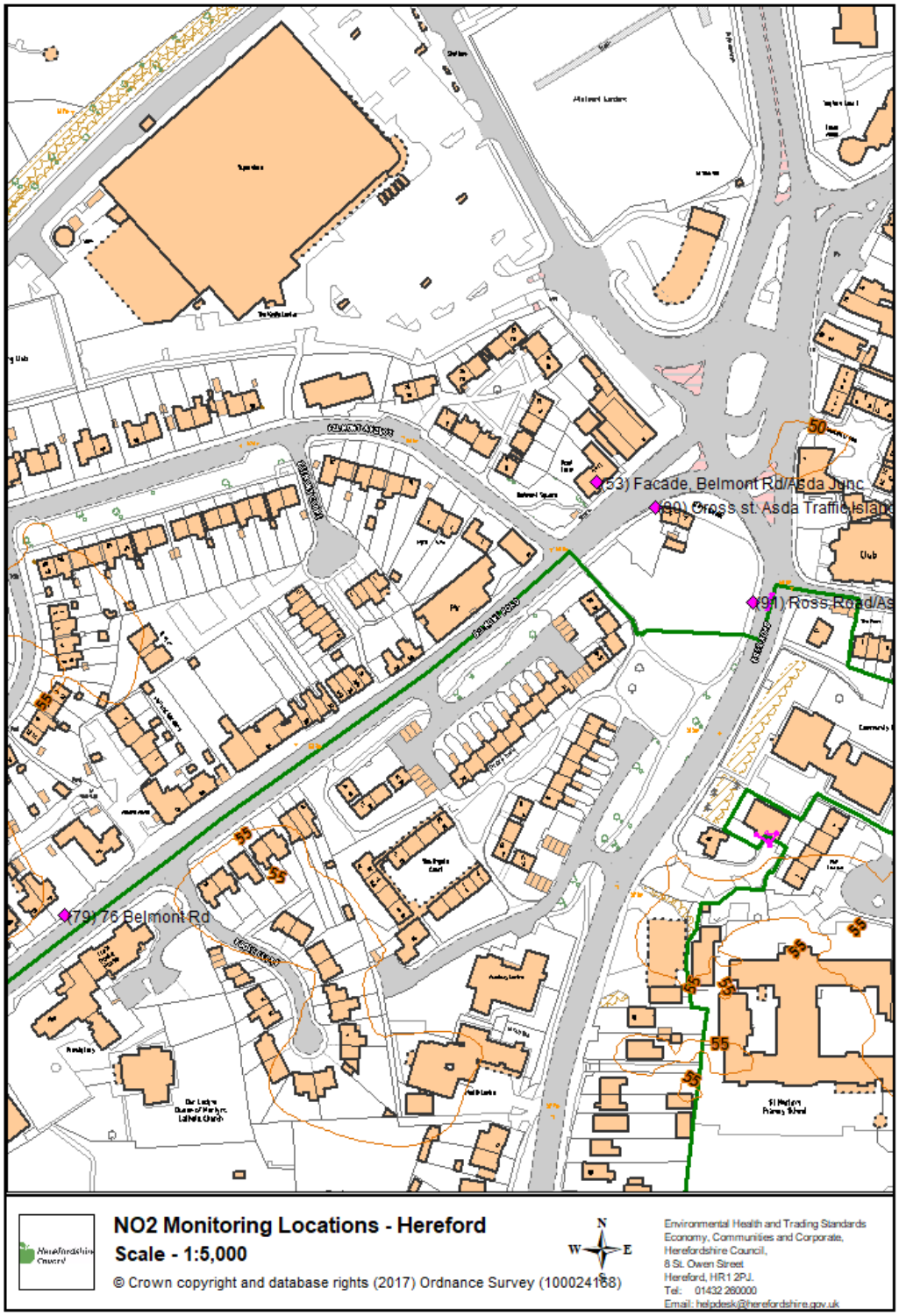


Figure D.11 - Kings Acre Road Monitoring Location

Figure D.12 - Three Elms Road Monitoring Location

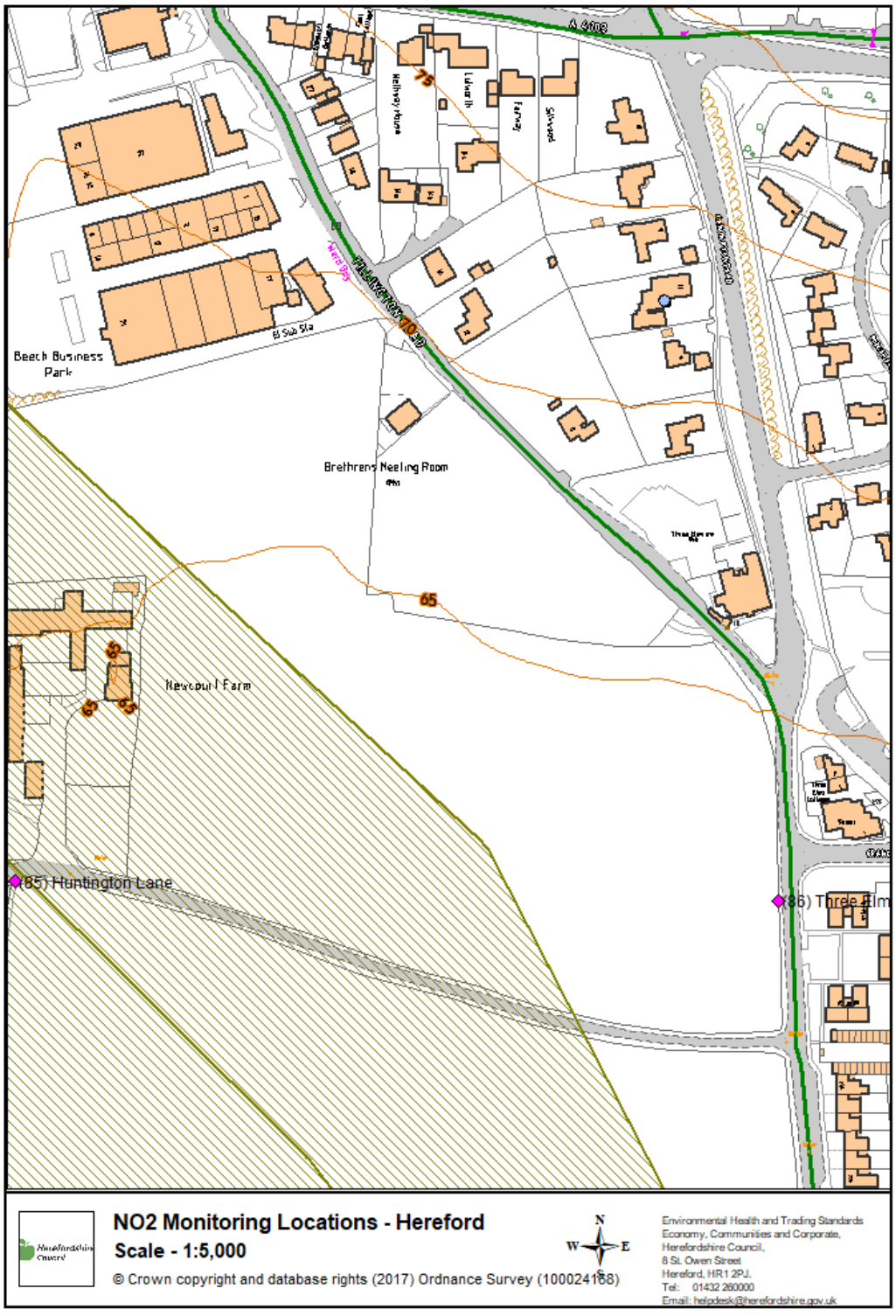


Figure D.13 – Whitecross Road Monitoring Locations

Figure D.14 – Rotherwas Industrial Estate Monitoring Location

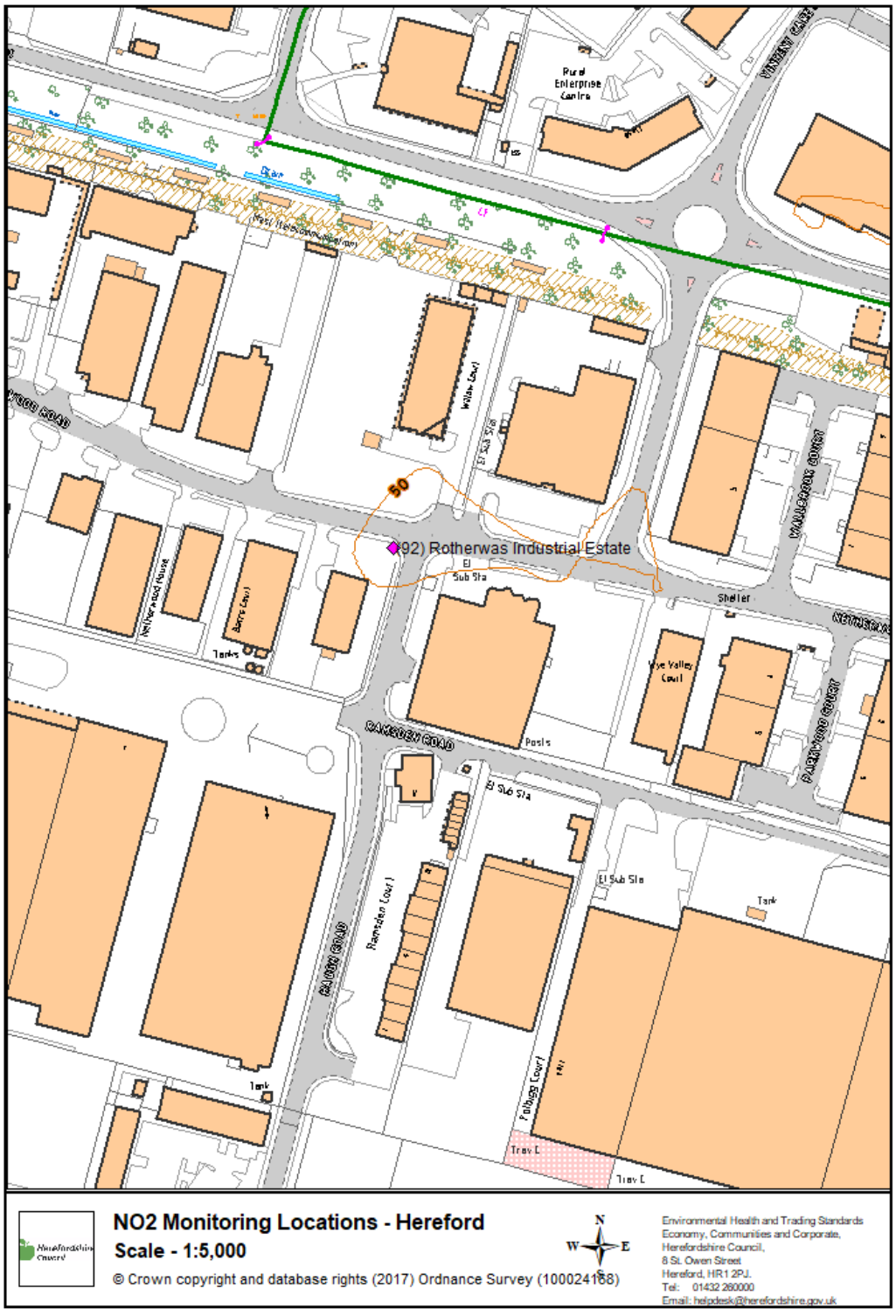


Figure D.15 – Rotherwas Relief Road Monitoring Location

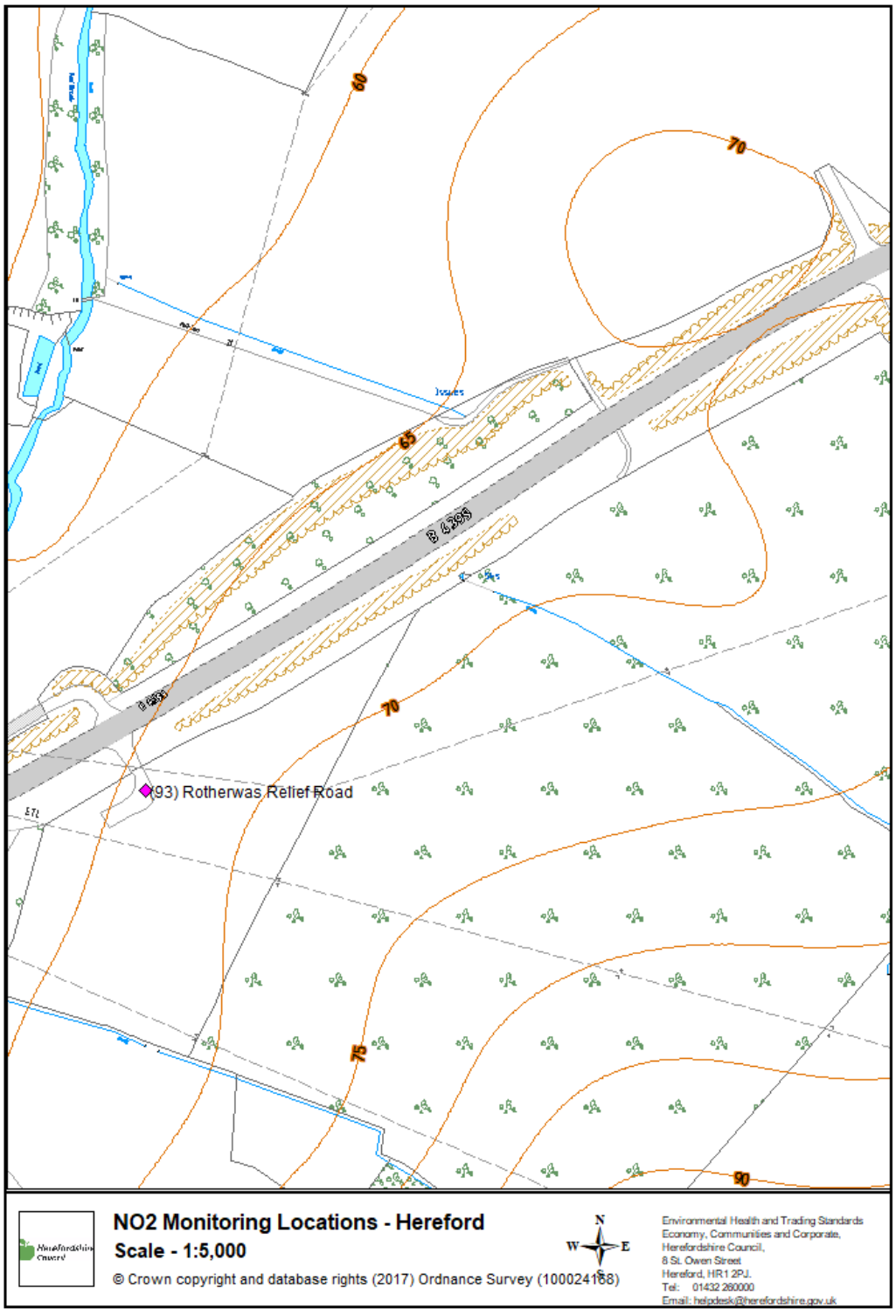


Figure D.16 – Roman Road Monitoring Location

Figure D.17 – Leominster AQMA Boundary

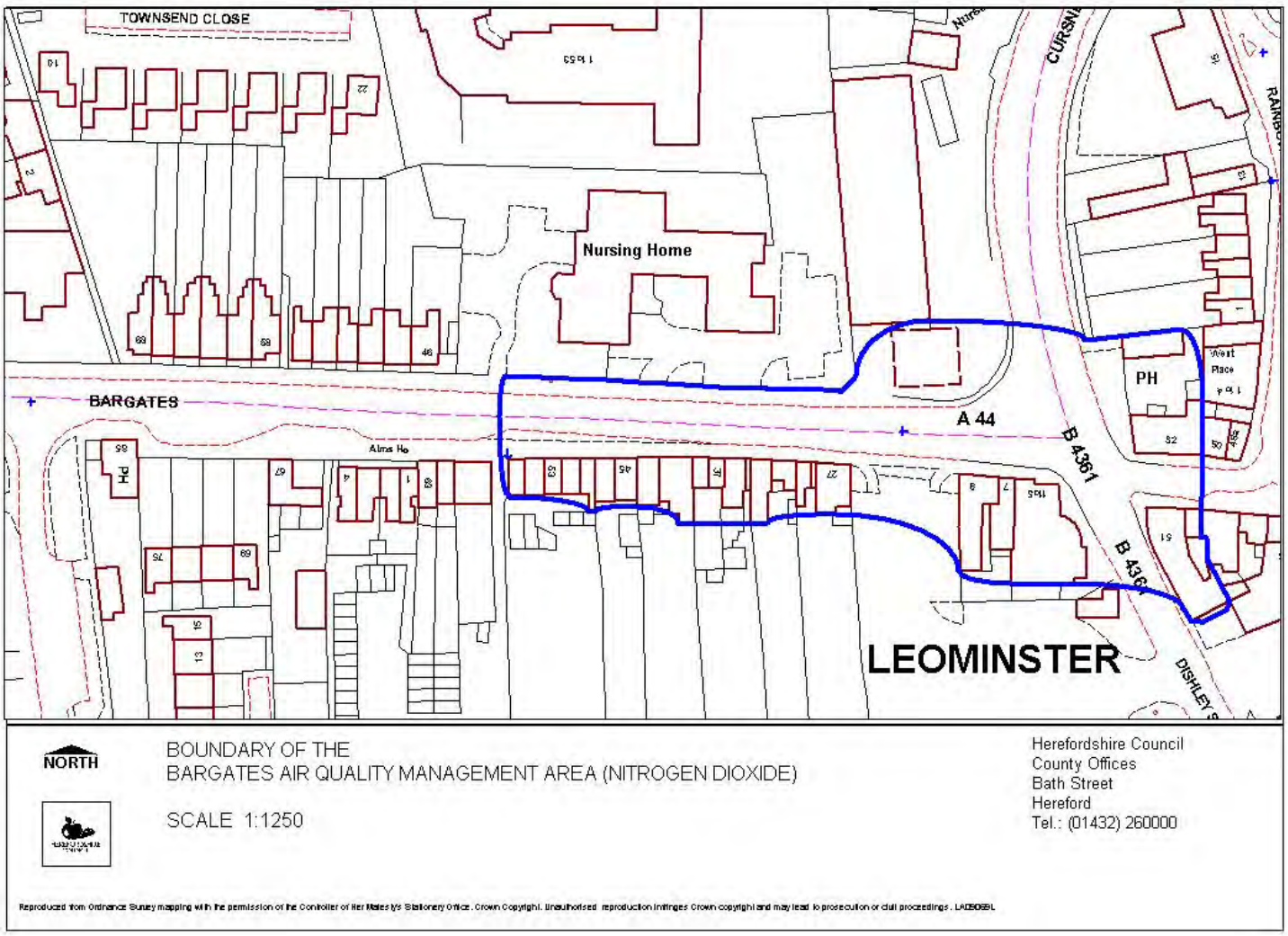


Figure D.18 – Leominster Monitoring Locations

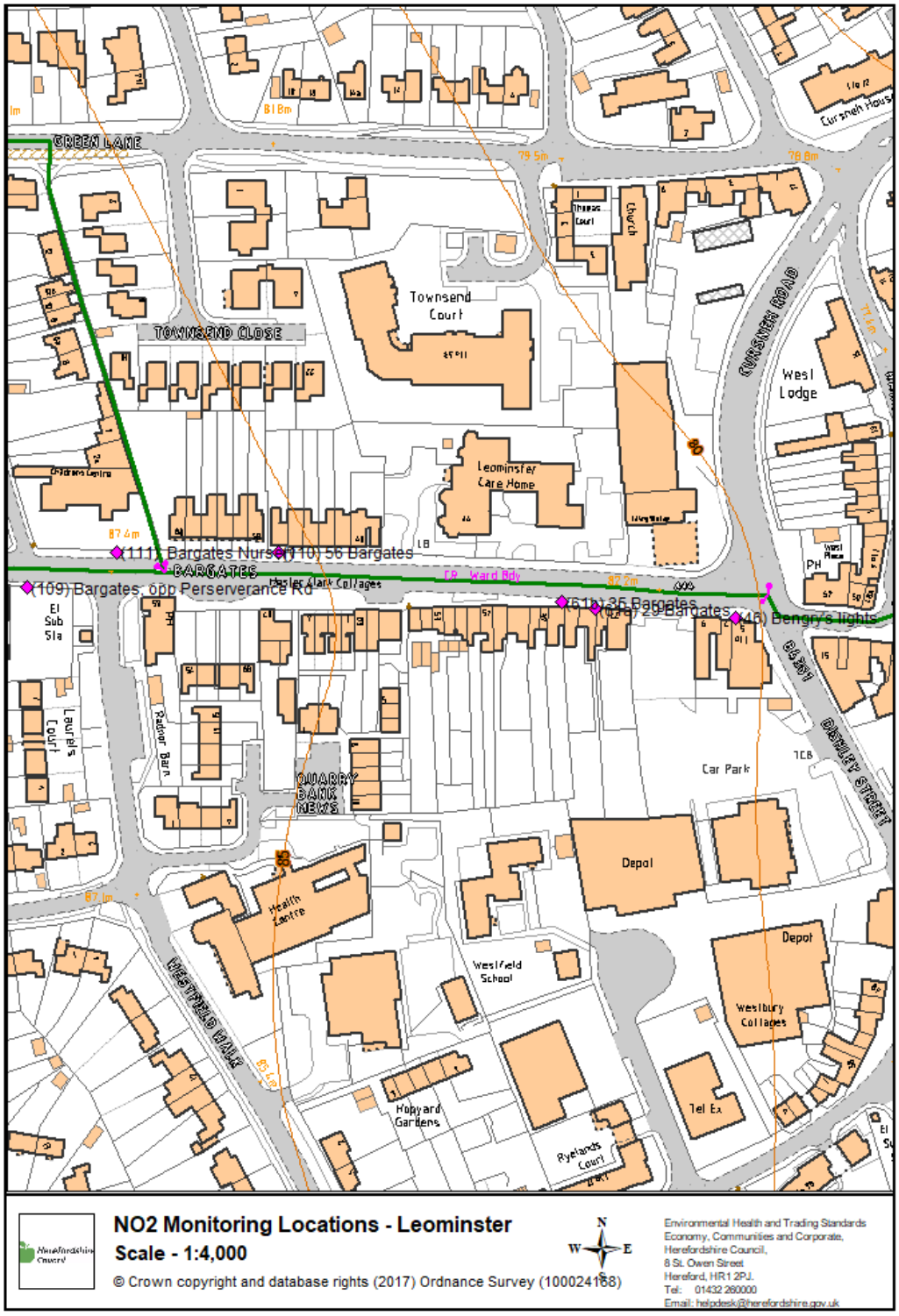


Figure D.19– A40 Corridor, Ross-on-Wye Monitoring Locations

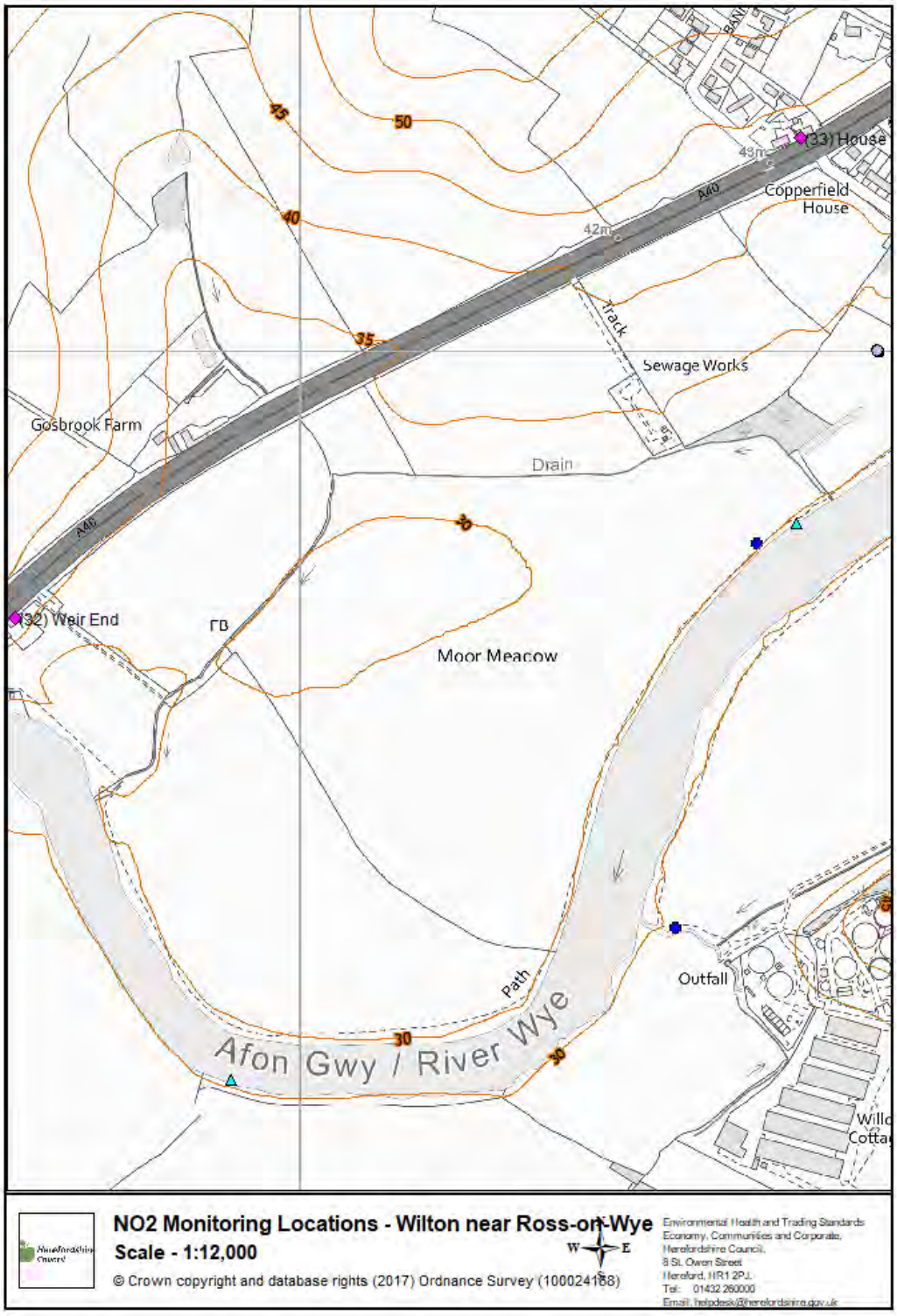


Figure D.20 – Ross-on-Wye Monitoring Location

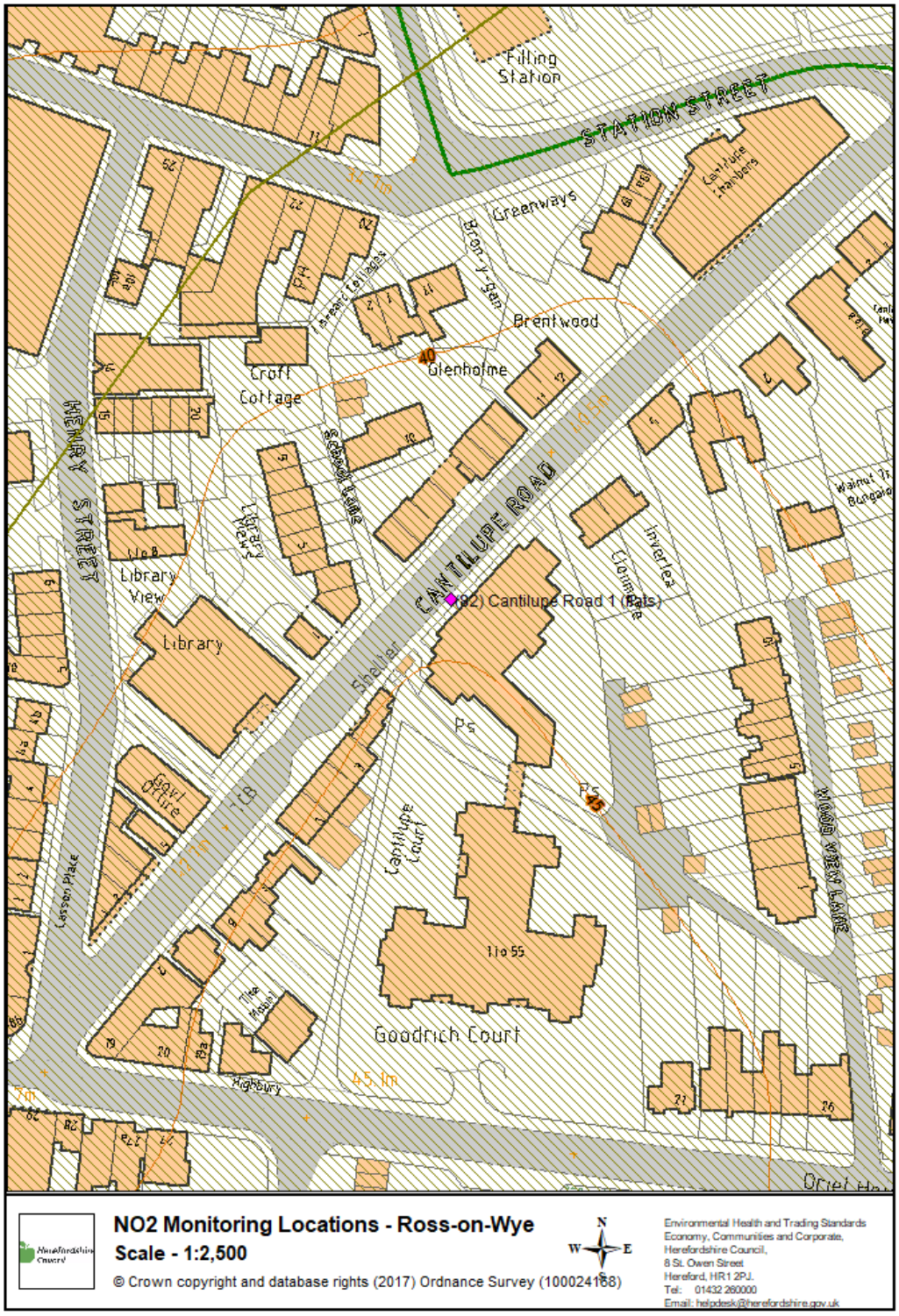
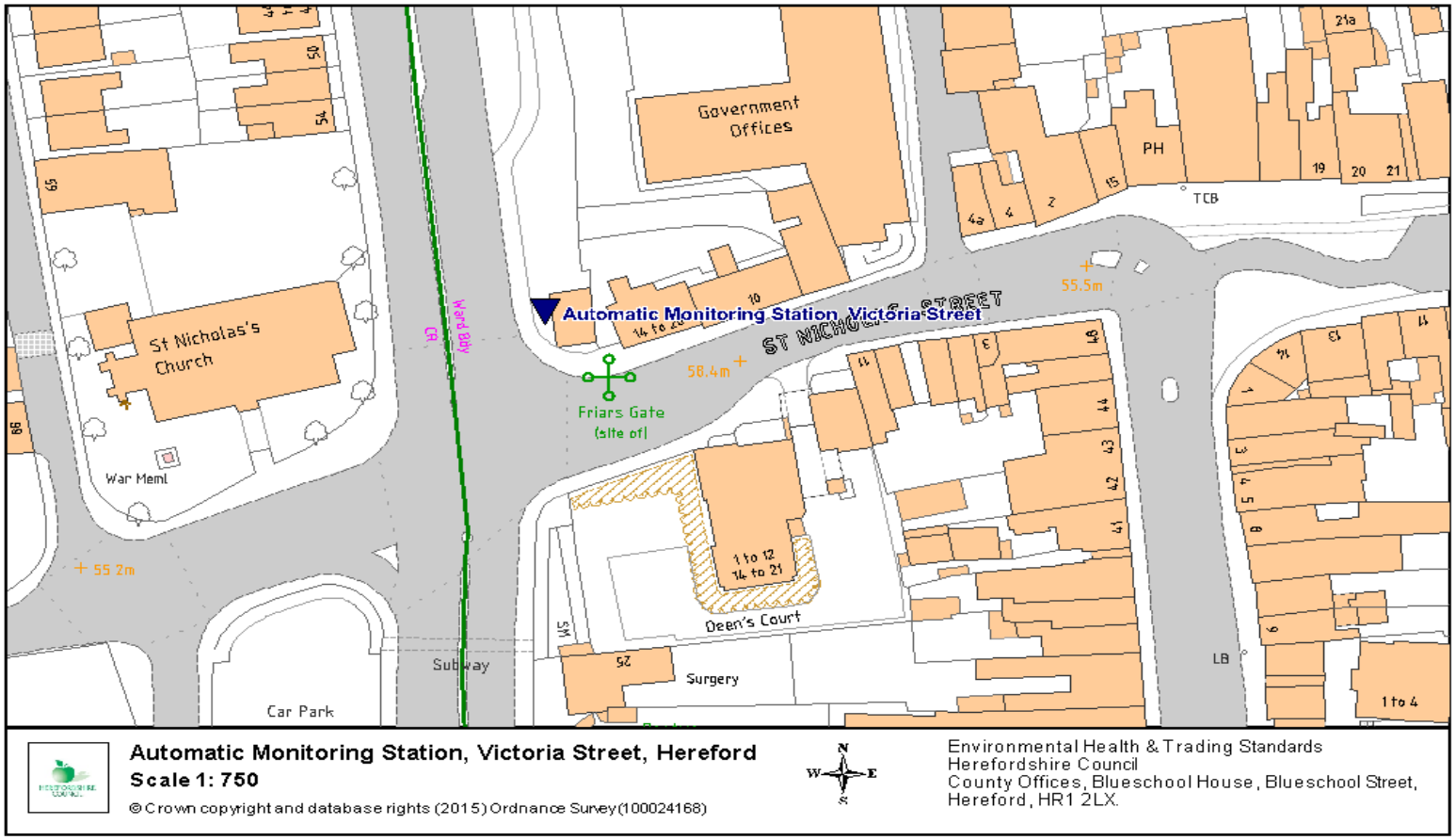


Figure D.21 – Location of the Automatic Monitoring Station (site HRD1), Hereford



Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England

Pollutant	Air Quality Objective[4]	
	Concentration	Measured as
Nitrogen Dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean
	40 µg/m^3	Annual mean
Particulate Matter (PM_{10})	50 µg/m^3, not to be exceeded more than 35 times a year	24-hour mean
	40 µg/m^3	Annual mean
Sulphur Dioxide (SO_2)	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean
	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean
	266 µg/m^3, not to be exceeded more than 35 times a year	15-minute mean

[4] The units are in microgrammes of pollutant per cubic metre of air (µg/m^3).

Glossary of Terms

Abbreviation	Description
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the local authority intends to achieve air quality limit values'
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
ASR	Air quality Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by Highways England
EU	European Union
FDMS	Filter Dynamics Measurement System
LAQM	Local Air Quality Management
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
PM_{10}	Airborne particulate matter with an aerodynamic diameter of 10µm (micrometres or microns) or less
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
QA/QC	Quality Assurance and Quality Control
SO_2	Sulphur Dioxide

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Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006

Defra. Abatement cost guidance for valuing changes in air quality, May 2013

Local Transport Plan 2016 – 2031 Strategy: https://www.herefordshire.gov.uk/directory_record/2093/local_transport_plan_2016-2031

Fine Particulate Matter ($PM_{2.5}$) in the United Kingdom, AQEG, 2012