



Woking Borough Council

2016 Air Quality Annual Status Report (ASR)

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



June 2016

Amec Foster Wheeler Environment
& Infrastructure UK Limited



Report for

Joseph Dufield
Woking Borough Council
Civic Office
Gloucester Square,
Woking
Surrey
GU21 6YL

Main contributors

Rachel Hicks

Issued by

Rachel Hicks

Approved by

Ben Warren

Amec Foster Wheeler

Floor 4
60 London Wall
London EC2M 5TQ
United Kingdom
Tel +44 (0) 203 215 1610

Doc Ref. 38243rr002i1

h:\projects\38243 sth aq woking asr\d design\reports\38243
woking asr 2016_issue3_v1.docx

Copyright and non-disclosure notice

The contents and layout of this report are subject to copyright owned by Amec Foster Wheeler (© Amec Foster Wheeler Environment & Infrastructure UK Limited 2016). save to the extent that copyright has been legally assigned by us to another party or is used by Amec Foster Wheeler under licence. To the extent that we own the copyright in this report, it may not be copied or used without our prior written agreement for any purpose other than the purpose indicated in this report. The methodology (if any) contained in this report is provided to you in confidence and must not be disclosed or copied to third parties without the prior written agreement of Amec Foster Wheeler. Disclosure of that information may constitute an actionable breach of confidence or may otherwise prejudice our commercial interests. Any third party who obtains access to this report by any means will, in any event, be subject to the Third Party Disclaimer set out below.

Third-party disclaimer

Any disclosure of this report to a third party is subject to this disclaimer. The report was prepared by Amec Foster Wheeler at the instruction of, and for use by, our client named on the front of the report. It does not in any way constitute advice to any third party who is able to access it by any means. Amec Foster Wheeler excludes to the fullest extent lawfully permitted all liability whatsoever for any loss or damage howsoever arising from reliance on the contents of this report. We do not however exclude our liability (if any) for personal injury or death resulting from our negligence, for fraud or any other matter in relation to which we cannot legally exclude liability.

Management systems

This document has been produced by Amec Foster Wheeler Environment & Infrastructure UK Limited in full compliance with the management systems, which have been certified to ISO 9001, ISO 14001 and OHSAS 18001 by LRQA.

Document revisions

No.	Details	Date
1	Draft Report	16/05/16
2	Final Report	25/05/16
3	Final Report	20/06/16



Woking Borough Council

Local Authority Officer	Joseph Dutfield
Department	Neighbourhood Services
Address	Woking Borough Council, Civic Office, Gloucester Square, Woking, Surrey GU21 6YL
Telephone	01483 743658
E-mail	Joseph.dutfield@woking.gov.uk
Report Reference number	38243r001i1
Date	May 2016

Executive summary: Air Quality in Our Area

Overview of Air Quality in Our Area

This overview is designed to provide a summary for those living and working in Woking Borough Council (WBC) of the state of air quality in the area and progress on the actions that the council and others, including the public, are taking or could take to improve air quality. It is also an opportunity to indicate whether any changes are required to the Action Plans.

The main findings and conclusions of this Annual Status Report (ASR) are as follows:

- ▶ Current challenges facing WBC include high concentrations of Nitrogen Dioxide (NO₂) along busy congested roads such as Anchor Hill and Guildford Road. Reducing concentrations of NO₂ at these busy congested areas are WBC's main priority for tackling air quality issues in the area; and
- ▶ The key action to improve air quality in Woking concerns the update of the Traffic Signals in operation at the junction of Anchor Hill and High Street, Knaphill to 'MOVA' (Microprocessor Optimised Vehicle Actuation).

Air Quality in Woking

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. There is also 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 billion³.

WBC have completed all past rounds of Review and Assessment. This ASR considers all new monitoring data and assesses the data against the Air Quality Strategy objectives. It also considers any changes that may have an impact on air quality. Progress on measures to improve air quality are identified, as well as WBC's approach to reducing emissions and/ or concentrations of fine particulates (PM_{2.5}), which has increased focus in the ASR as a result of emerging evidence of the health impacts.

A Further Assessment of NO₂ in the area around Anchor Hill carried out in 2015 showed that the AQMA should remain in place because although in some places the objective is being achieved, concentrations in other locations are above the Air Quality Objective (AQO).

The 2015 Updating and Screening Assessment determined that monitoring and analysis of concentrations at all locations included in the monitoring programme should continue, with specific consideration on Anchor Hill and Guildford Road.

Additional monitoring in the area around Guildford Road commenced in 2014 and recorded exceedances of the NO₂ AQO at five locations in 2015. It is recommended that further action is needed at Guildford Road, including dispersion modelling, to determine the extent of a proposed AQMA boundary.

Actions to Improve Air Quality

The Further Assessment of the Anchor Hill AQMA included recommendations to improve air quality at the junction. As a result of the recommendations, Surrey County Council (SCC) have updated the Traffic Signals in operation at the junction of Anchor Hill and High Street, Knaphill. There is not currently any

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

quantitative evidence that the new system has reduced pollutant concentrations in the area, however further upgrade to a MOVA (Microprocessor Optimised Vehicle Actuation) system is planned during 2016/2017.

Local Priorities and Challenges

One of the main priority locations in WBC for improving air quality is around the Anchor Hill area. Dispersion modelling in the 2012 Detailed Assessment identified predicted exceedances of the annual mean NO₂ AQO at the façade of properties at the top of Anchor Hill. Contour plots showed that concentrations at the three main housing blocks at the top of Anchor Hill exceeded the objective or were within 10% of the objective. Due to the historical trend of high pollution levels at this location and the modelled exceedances it was recommended that WBC declare an Air Quality Management Area (AQMA). The Council declared an AQMA as a result of exceedances of the annual mean NO₂ AQO at Anchor Hill.

Based on the results of the Anchor Hill Further Assessment in January 2015 it was recommended that the AQMA should remain in place as both monitoring and modelling results show that although in some places the objective was being achieved, concentrations in some places were above the AQO.

An Air Quality Action Plan was produced for the Anchor Hill AQMA in July 2015. The plan determined that the upgrade of signals at the Anchor Hill junction are likely to reduce NO₂ concentrations so that the annual mean AQO is no longer exceeded in the AQMA. The progress towards compliance is currently being tracked using monitoring data collected by WBC and being reported in the ASRs. The AQMA will be revoked when monitoring results from three consecutive years show no exceedances of the AQO, so that a permanent improvement in air quality can be demonstrated.

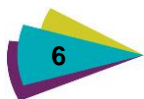
Several exceedances of the AQO for NO₂ were recorded in 2015 at Guildford Road. This is likely to be a local priority in 2016, with this ASR proposing further action is required to determine the extent of exceedances and the boundary of an AQMA. An AQAP can then be developed for this location.

How to get Involved

The following sources of information are available on WBC's website for improving air quality in the borough and seeking further information:

- ▶ List of Air Quality Management Areas (AQMAs) in the borough, where health based air quality standards are not expected to be met : http://www.woking.gov.uk/airquality#air_alert
- ▶ The Air Quality Action Plan for the Anchor Hill AQMA: http://aqma.defra.gov.uk/action-plans/woking-borough-council_aqap_final.pdf
- ▶ Overview of the air quality in Surrey and a range of articles about problems, solutions and how pollution affects the public: <http://www.woking.gov.uk/planning/envhealthservice/control/airquality/surreyair>
- ▶ airAlert service warning local residents who have respiratory problems of whenever the air pollution in Woking is going to be high. This is a free subscription service which individuals, who suffer from asthma, COPD, emphysema or other respiratory illnesses, can sign up to, and they will receive either an email, text message or voicemail giving an advanced warning of high pollution levels: <http://airalert.info/Surrey/Default.aspx>





Contents

1.	Local Air Quality Management	7
2.	Actions to Improve Air Quality	8
2.1	Air Quality Management Areas	8
2.2	Progress and Impact of Measures to Address Air Quality in Woking	10
2.3	PM _{2.5} – Local Authority Approach to Reducing Emissions and or Concentrations	14
3.	Air Quality Monitoring Data and Comparison with Air Quality Objectives and National Compliance	15
3.1	Summary of Monitoring Undertaken	15
	Automatic monitoring sites	15
	Non-automatic monitoring sites	15
3.2	Individual Pollutants	15
	Nitrogen dioxide	15
	Particulate Matter (PM ₁₀)	16
	Particulate Matter (PM _{2.5})	16
	Sulphur Dioxide (SO ₂)	16
	Benzene	16
3.3	Summary of Compliance with AQS Objectives	16
4.	Conclusions and Proposed Actions	17
4.1	Conclusions from new Monitoring Data	17
4.2	Proposed Actions	17

Table 2.1	Declared Air Quality Management Areas	8
Table 2.2	Progress on Measures to Improve Air Quality	11

Figure 2.1	Map of AQMA boundaries	9
------------	------------------------	---

Appendix A	Monitoring results
Appendix B	Full monthly diffusion tube results
Appendix C	QA:QC data
Appendix D	Maps of monitoring locations
Appendix E	Summary of Air Quality objectives in England



1. Local Air Quality Management

This report provides an overview of air quality in Woking during 2016. 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 or not the Air Quality Objectives (AQOs) are likely to be achieved. Where an exceedance is considered likely 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 Woking to improve air quality and any progress that has been made.

The statutory AQOs applicable to LAQM in England can be found in Table E1 in Appendix E.

2. Actions to Improve Air Quality

2.1 Air Quality Management Areas

(AQMA's are declared when there is an exceedance or likely exceedance of an AQO. After 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 the objectives.

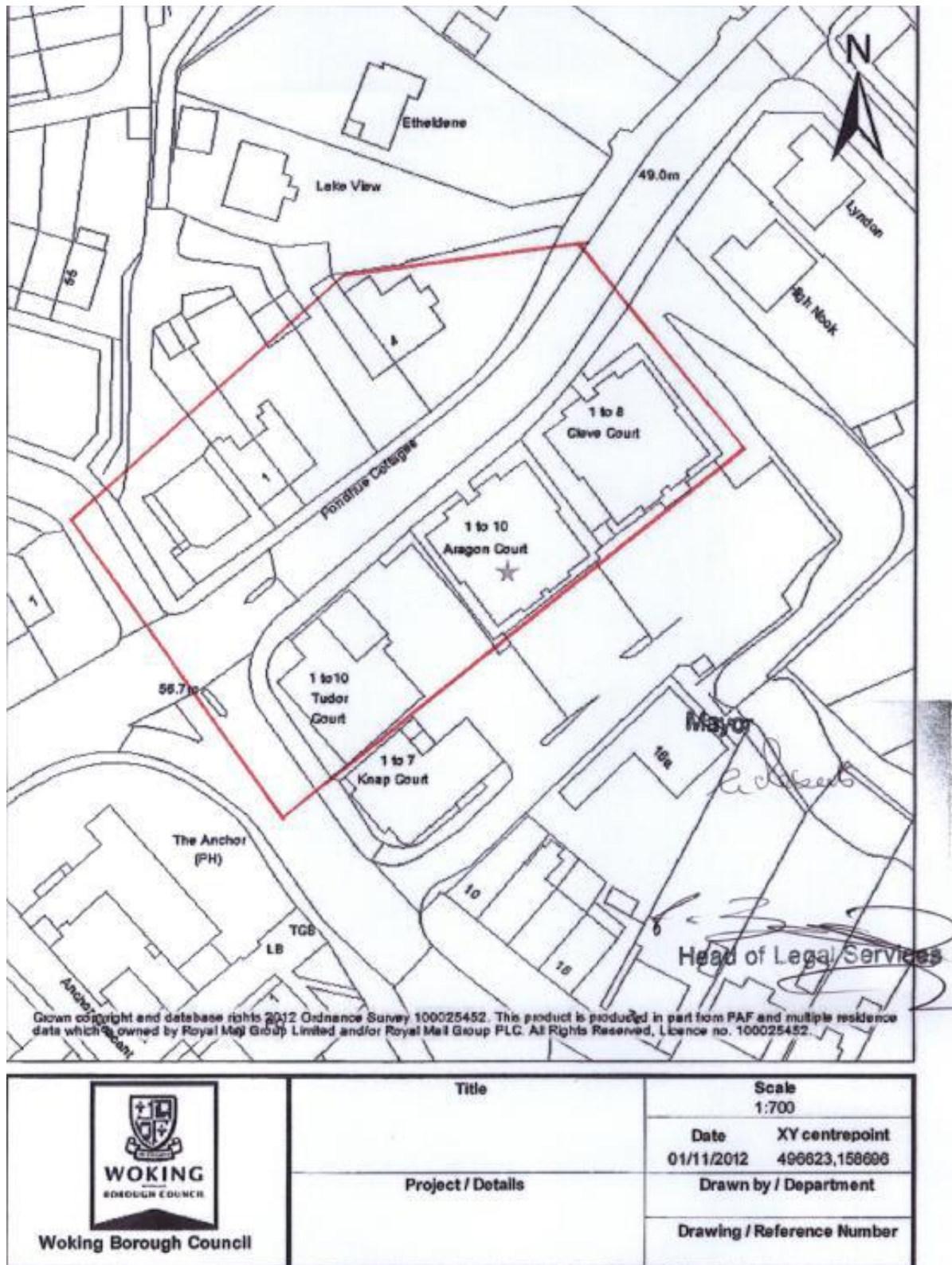
A summary of AQMA's declared by WBC can be found in Table 2.1. Further information related to declared or revoked AQMA's, including maps of AQMA boundaries are available online at http://uk-air.defra.gov.uk/aqma/local-authorities?la_id=317.

Table 2.1 Declared Air Quality Management Areas

AQMA Name	Pollutants and Air Quality Objectives	City/ Town	One Line Description	Action Plan
Anchor Hill AQMA	NO ₂	Knaphill, Woking	A small area covered by an AQMA covering a 4 way junction at the top of a steep hill.	Anchor Hill Air Quality Action Plan: http://aqma.defra.gov.uk/action-plans/woking-borough-council_aqap_final.pdf

Figure 2.1 shows the boundary of the Anchor Hill AQMA.

Figure 2.1 Map of AQMA boundaries



2.2 Progress and Impact of Measures to Address Air Quality in Woking

WBC has taken forward a number of measures during the current reporting year of 2016 in pursuit of improving local air quality. Details of all measures completed, in train or planned are set out in Table 2.2. More detail on these measures can be found in WBC's Anchor Hill AQAP and the Surrey Transport Plan: Air Quality Strategy (Surrey County Council, 2011).

WBC works from the Surrey Transport Plan (LT3). A twin-track strategy is proposed to address air quality in Surrey County Council (SCC), which focuses on AQMAs and synergies with other strategies to deliver countywide air quality improvements. Measures to improve air quality are included in a "Strategy Toolkit" within the Air Quality Strategy.

The Surrey Transport Plan expects the measures in Table 2.2 to be completed over the course of the next reporting year.

WBC's priorities for the coming year are to:

- ▶ Incorporate appropriate physical transport measures in the Infrastructure Delivery Plan, and implement as and when funding becomes available;
- ▶ Identify and agree options for the enforcement of existing parking and loading regulations, and implement as and when funding becomes available;
- ▶ Identify and agree options for supporting travel choices that are better for air quality, and implement as and when funding becomes available; and,
- ▶ Consider air quality issues in planning and other processes and areas of responsibility.
- ▶ Maintain synergy with the following strategies to deliver countywide air quality improvements:
 - ▶ Accessibility Strategy;
 - ▶ Congestion Strategy;
 - ▶ Freight Strategy;
 - ▶ Parking Strategy;
 - ▶ Passenger Transport Strategy: Part 1 - Local Bus and Part 2: Information;
 - ▶ Climate Change Strategy; and
 - ▶ Travel Planning Strategy.

Table 2.2 Progress on Measures to Improve Air Quality

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date
1	Urban Traffic Management and Control (UTMC)	Traffic Management	UTC, Congestion Management, Traffic Reduction	SCC / WBC	2015	2015	Restrain or reduce traffic volumes in AQMA	Y	Amended traffic signals at the busy junction in the Anchor Hill AQMA. There have been installation issues to date but a MOVA system should be installed in 2016/2017.	2016/2017
2	New and/or improved cycle lane	Transport Planning & Infrastructure	Cycle Network	SCC / WBC	n/a	2008 - 2011	Restrain or reduce traffic volumes in AQMA	Y	Various routes improved during Cycle Woking 2008 – 2011. See Planet Trails info at www.cyclewoking.info	Ongoing
3	New and/or improved cycle track	Transport Planning & Infrastructure	Cycle Network	SCC / WBC	n/a	2008 – 2011	Restrain or reduce traffic volumes in AQMA	Y	Various routes improved during Cycle Woking 2008 – 2011. See Planet Trails info at www.cyclewoking.info	Ongoing
4	Cycle parking	Transport Planning & Infrastructure	Cycle Network	SCC / WBC	n/a	2008 - 2011	Restrain or reduce traffic volumes in AQMA	Y	Various improvements made under Cycle Woking 2008 – 2011. Also more recently in 2015 the Cycle Hub was installed at Woking station providing storage for over 200 cycles and encouraging cycle / rail integration. A further new cycle storage compound is to be implemented at Brookwood station by August 2016. These storage facilities have been funded by Department for Transport funding secured by South West Trains together with WBC S106 funding contributions.	August 2016
5	Park and ride	Alternatives to Private Vehicle Use	Bus based Park & Ride	SCC / WBC	n/a	2012	Restrain or reduce traffic volumes in AQMA	Y	Following on from Cycle Woking, Surrey County Council's TravelSmart initiative won further Department for Transport Local Sustainable Transport Fund monies for the period from 2012 until 2015, with over £18 million to spend on schemes like improving and installing cycle lanes, investing in interactive and live travel information and encouraging and supporting more people in travelling	Ongoing
6	Park and stride	Alternatives to Private Vehicle Use	Other	SCC / WBC	n/a	2012	Restrain or reduce traffic volumes in AQMA	Y		Ongoing

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date
									sustainably. To deliver its programme of improvements, Travel SMART worked closely with borough councils, residents, community groups and businesses. See more info at: https://www.travelsmartsurrey.info/about	
7	Infrastructure to support the use of hybrid/electric vehicles	Traffic Management	Other	SCC / WBC	n/a	2015	Reduce tailpipe emissions in AQMA	Y	WBC trialed an electric car for six months as part of our car club arrangements for staff business use (CarShare). The trial ended in October 2015. WBC have recently installed a further six electric vehicle charging points in the Yellow Car Park. This is in addition to the eight existing points.	Ongoing
8	Car clubs	Alternatives to private vehicle use	Car Clubs	SCC / WBC	n/a	n/a	Restrain or reduce traffic volumes in AQMA	Y	The Council has a car club arrangement with Enterprise Rent A Car Ltd for staff business use – the CarShare scheme – see more info on 'ewokplus:'. Enterprise recently acquired City Car Club who recently won the contract to operate Surrey County Council's car club scheme that is also available for the public. In Woking, there are cars available in Guildford Road and at Quadrant Court. ^{4 5}	Ongoing
9	Workplace travel planning	Promoting Travel Alternatives	Personalised Travel Planning	SCC / WBC	n/a	n/a	Restrain or reduce traffic volumes in AQMA	Y	The Council has its own Staff Transport Plan including various initiatives to encourage alternative modes of transport to the car. Criteria has been applied to lease cars in order to lower emissions and air pollution associated with this fleet. Environmental standards also apply to cash alternative vehicles.	Ongoing

⁴ <http://www.woking.gov.uk/transport/parking/carparks/chargepoints>

⁵ <https://www.travelsmartsurrey.info/driving/car-clubs>

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date
10	Differential parking charges	Traffic Management	Emission based parking or permit charges	SCC / WBC	n/a	n/a	Reduce tailpipe emissions in AQMA	Y	Differential parking charges. ⁶ The cost of a season ticket is based on a vehicle's CO2 emission rating (determined by the Vehicle Certification Agency). A 50% discount is applied for vehicles that produce the lowest emissions (CO2 band A) and a 25% discount for band B vehicles. Those with a band G rating (the highest band) pay a 25% surcharge.	Ongoing
11	Encourage boroughs and districts to consider adopting minimum emissions standards or vehicle age restrictions into taxi licensing procedures	Promoting Low Emission Transport	Taxi Licensing conditions	SCC / WBC	n/a	2014	Reduce tailpipe emissions in AQMA	Y	With effect from the 4th of January 2014, WBC have required all Private Hire Vehicles and all non-wheelchair compliant Hackney Carriages to meet the Euro Emissions V (five) Criteria. As wheelchair accessible vehicles tend to be larger and more van-like, it is unrealistic for us to expect them to meet the low emissions criteria. However – there are at least 540 private hire vehicles in Woking – all of which are at least Euro Emissions V (five). Some even are Euro Emissions VI (six). Euro Emission Standard VI (six) has been applied to manufactures of new vehicles from September 2014 and they are given 12 months to comply. This means that from September 2015 no new vehicle (passenger car) should be being produced that is not Euro VI. Our policy is stating that as Euro Emissions VI (six) is to be applied to manufacturers from September 2014, it will therefore apply to new and renewal vehicles presented to Woking Borough Council from 20th of January 2022. With effect from the 20th of January 2022 there will be no Euro Emissions V (five) vehicles licenced by Woking Borough Council.	Ongoing

⁶ <http://www.woking.gov.uk/transport/parking/season>

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.

WBC is working to address PM_{2.5} through implementation of the measures to improve air quality detailed in Table 2.2.

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

3.1 Summary of Monitoring Undertaken

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

Automatic monitoring sites

There are no continuous monitoring sites located within Woking Borough.

Non-automatic monitoring sites

WBC undertook non- automatic (passive) monitoring of NO₂ using diffusion tubes at 28 sites during 2015. Table 1A in Appendix A shows the details of the sites.

Maps showing the location of the monitoring sites are provided in Figures A1 and A2 in Appendix A. Further details on Quality Assurance/Quality Control (QA/QC) and bias adjustment for the diffusion tubes are included in Appendix C.

3.2 Individual Pollutants

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

Nitrogen dioxide

Diffusion tube monitoring data

Table A3 in Appendix A compares the ratified and adjusted monitored NO₂ annual mean concentrations for the past 5 years with the AQO of 40 µgm⁻³.

For diffusion tubes, the full 2015 dataset of monthly mean values is provided in Appendix B.

Exceedances of the annual mean 40 µgm⁻³ objective limit were recorded at nine locations in 2015 when the 2015 national bias adjustment factor was used, as shown in bold in Table A2.

The monitoring site at the M25 is located on a bridge over the motorway. The site has recorded high concentrations of NO₂ as would be expected close to a motorway. Previous rounds of Review and Assessment have determined this site is not representative of relevant exposure (Woking Borough Council, 2014). It is confirmed this site is still not representative of relevant exposure in 2015. The monitoring site at Victoria Way has also recorded exceedances of the NO₂ AQO over a number of years and has been confirmed to be non-representative of relevant exposure as the properties in the locality are all commercial.

The Anchor Hill monitoring sites are located on a steep hill leading to a traffic light controlled junction. This site had a Detailed Assessment carried out in 2012 and a Further Assessment carried out in 2015. The results in the 2015 Further Assessment highlighted the need to consider options to reduce exposure of nearby residential receptors (Amec Foster Wheeler, 2015). Due to continued exceedances of the AQO at diffusion tubes “AH” and “AH6” along Anchor Hill, it is recommended that the AQMA remain in place until further monitoring consistently records concentrations below the AQO.

Analysis of UK continuous NO₂ monitoring data has shown that it is unlikely that the hourly mean NO₂ objective, of 18 hourly means over 200 µgm⁻³, would be exceeded where the annual mean objective is below 60 µgm⁻³. There is one exceedance of 60 µgm⁻³ in 2015 at the diffusion tube located near the M25, therefore

the hourly mean is likely to be breached. Despite the M25 monitor showing exceedances of $60 \mu\text{gm}^{-3}$ in 2015 and in previous years, it is not considered to be of a relevant exposure.

Guildford Road

All four diffusion tubes along Guildford Road, and diffusion tube “Cott 1” located at the end of Constitution Hill, recorded exceedances of the AQO in 2015. Although this is the first full year of monitoring data available at tubes CH2, CH3 and CH4, monitoring has been undertaken for the last four years at diffusion tubes CH. The AQO for NO_2 has been exceeded in 2012, 2013 and 2015 at diffusion tube CH. It is recommended that further action is taken at Guildford Road and Constitution Hill to determine if declaration of an AQMA is necessary.

LAQM (TG.16) guidance suggests that declaration of an AQMA should be provided in the ASR if the monitoring results are deemed sufficient to conclude on the risk of exceedance and the area likely to be affected. As the AQO was exceeded at five diffusion tubes along Guildford Road and Constitution Hill, the extent of exceedances at residential receptor locations is unclear, and it is suggested that collating further technical information is necessary to confirm the extent of the AQMA boundary to be declared. As suggested in the LAQM guidance, it is recommended that detailed dispersion work is undertaken to model the extent of exceedances at residential receptor locations, so that results can be appended to the 2017 ASR. It is not necessary for the local authority to wait until the next ASR to move to declaration; the information can be submitted via the RSW for earlier appraisal, approval and subsequent action.

Particulate Matter (PM_{10})

No PM_{10} monitoring is undertaken in the Woking Borough Council area.

Particulate Matter ($\text{PM}_{2.5}$)

No $\text{PM}_{2.5}$ monitoring is undertaken in the Woking Borough Council area.

Sulphur Dioxide (SO_2)

No SO_2 monitoring is undertaken in the Woking Borough Council area.

Benzene

No Benzene monitoring is undertaken in the Woking Borough Council area.

Monitoring for Benzene was undertaken using passive diffusion tubes at one site, Sandy Lane, until May 2008.

3.3 Summary of Compliance with AQS Objectives

Nine sites have been recorded as exceeding the annual mean objective levels for NO_2 . Seven of these sites (Anchor Hill and Guildford Road) are at locations of relevant exposure.

It is recommended that further action is considered at Guildford Road at this time. The AQO for NO_2 has been exceeded in 2012, 2013 and 2015 at diffusion tube CH. It is recommended that dispersion modelling is undertaken at Guildford Road to determine the extent of the proposed AQMA boundary, based on modelled concentrations at residential receptor locations.

As exceedances of the AQO have been recorded over consecutive years at Anchor Hill, it is recommended that the AQMA should remain and monitoring should continue at all six diffusion tube locations.

4. Conclusions and Proposed Actions

4.1 Conclusions from new Monitoring Data

Exceedances of the annual mean objective for NO₂ were recorded at the following nine locations in 2015:

- ▶ M25;
- ▶ Anchor Hill (AH)
- ▶ Anchor Hill (AH6);
- ▶ Victoria Way (VW);
- ▶ Guildford Road / Constitution Hill (Cott1);
- ▶ Guildford Road (CH);
- ▶ Guildford Road (CH2);
- ▶ Guildford Road (CH3) and;
- ▶ Guildford Road (CH4).

The M25 site has exceeded the AQO for several years and is not considered representative of relevant exposure. The exceedances at monitors located on Guildford Road are recorded in the first full year of monitoring at this site.

One site is within 10% of the AQO (36 µgm⁻³) and recorded an exceedance of the AQO in 2015:

- ▶ Anchor Hill (AH2).

Each of these sites has been analysed to determine if relevant exposure exists at the monitoring location. As there is relevant exposure at Anchor Hill, it has been determined that continued monitoring should be carried out and the AQMA should remain. The additional monitoring around Guildford Road should remain as a result of exceedances in this area. It is recommended that further action is taken at Guildford Road in relation to the declaration of an AQMA.

4.2 Proposed Actions

The monitoring programme should remain unchanged for the upcoming assessment year, with all diffusion tubes introduced in 2014 continued.

Due to concentrations being recorded that are above the NO₂ annual mean AQO at Anchor Hill, the existing AQMA should remain.

It is recommended that dispersion modelling is undertaken at Guildford Road to determine the extent of the proposed AQMA boundary, based on modelled concentrations at residential receptor locations.

The next course of action should be to submit the 2017 Annual Status Report.



Appendix A

Monitoring results

Table A1 Non-automatic monitoring sites in Woking

Site ID	Site Name	X	Y	Distance from road to relevant exposure (m)	Distance to kerb (m)	In AQMA?
Cott1	Guildford Road/ Constitution Hill 1	500437	158120	3	1	No
Cott2	Constitution Hill 2	500453	158100	15	1	No
M25	M25	505611	161180	2	2*	No
Church	Church Road	506401	160504	7*	1*	No
RC	Rosebery Crescent	500946	157110	10	1	No
AH	Anchor Hill 1	496618	158699	69	1	Yes
AH2	Anchor Hill 2	496615	158696	0	5	Yes
AH3	Anchor Hill 3	496646	158750	0	5	Yes
AH4	Anchor Hill 4	496679	158767	6	2	Yes
AH5	Anchor Hill 5	496594	158698	0	5	Yes
AH6	Anchor Hill 6	49587	158668	0	2.3	Yes
LGR	Lower Guildford Rd	496601	158668	0	3	Yes
LD	Lincoln Drive	503244	159659	12	1	No
VW	Victoria Way	500510	159030	36*	1	No
BD	Bitterne Drive	498025	158949	5*	1*	No
BR	Bagshot Road	495821	157793	15	1	No
BR1	Bagshot Road	495852	157188	21	1.5	No
PR	Dartnell Avenue (previously Parvis Road)	504926	161063	12	1	No
WL	Woodham Lane	502854	161062	31	1	No
GR	Goldsworth Road	499952	158545	6	1	No
MR	Monument Road	501611	159645	4	2	No
MR2	Monument Road	501613	159646	18	2	No
CW	Cavell Way	496214	157989	10*	1*	No

Site ID	Site Name	X	Y	Distance from road to relevant exposure (m)	Distance to kerb (m)	In AQMA?
BW	Broadway	495874	157971	18.7	1	No
CH	Constitution Hill 4 (Guildford Road)	500417	158102	7	1.5	No
CH2	Constitution Hill 5 (Guildford Road)	500367	158073	12	1	No
CH3	Constitution Hill 6 (Guildford Road)	500336	158017	20	1.5	No
CH4	Constitution Hill 7 (Guildford Road)	500337	157987	20	1	No

*Estimated from www.gridreferencefinder.com

Table A2 Results of 2011 - 2015 NO₂ diffusion tubes

Site ID	2011 (Bias adjustment factor = 1.06)	2012 (Bias adjustment factor = 0.91)	2013 (Bias adjustment factor = 0.87)	2014 (Bias adjustment factor = 0.8)	2015 (Bias adjustment factor = 1.07)
Cott1	29.7	34.8	36.0	31.0	40.7
Cott2	23.6	24.9	27.4	17.8	24.9
M25	66.3	50.4	52.1	50.3	61.0
Church	26.5	41.1	43.9	19.9	24.7
RC	19.3	18.6	21.4	17.7*	16.5
AH	47.7	35.1	41.5	37.1	44.1
AH2	37.6	42.8	36.5	29.1	36.7
AH3	28	30.4	30.7	20.7	27.1
AH4	-	33.3	32.0	24.6	34.5
AH5	-	15.5	32.0	26.3	34.0
AH6	-	-	32.0	33.5	40.9
LGR	-	-	32.3	25.2	32.0
LD	21.6	21.7	19.8	16.3	20.7
VW	42.8	37.8	40.4	27.4	43.2
BD	18.7	20.8	17.8	13.9	17.0
BR	32.6	30.6	30.6	24.5	31.6

Site ID	2011 (Bias adjustment factor = 1.06)	2012 (Bias adjustment factor = 0.91)	2013 (Bias adjustment factor = 0.87)	2014 (Bias adjustment factor = 0.8)	2015 (Bias adjustment factor = 1.07)
BR1	-	-	-	23.1*	26.2
PR	26.3	25.7	26.8	23.3	28.4
WL	33.7	31.7	33.3	26.4	29.0
GR	31.8	30.0	32.2	23.6	26.8
MR	38.6	32.5	33.3	27.1*	35.0
MR2	-	-	34.0	29.3	35.7
CW	-	22.6	28.1	21.5	23.5
BW	-	22.8	28.0	19.2	21.9
CH	-	41.1	43.9	34.2	48.8
CH2	-	-	-	40.6*	51.6
CH3	-	-	-	37.9*	51.5
CH4	-	-	-	34.5*	42.4

(-) Data not available

Exceedances of the AQP are shown in **bold**.

* Annualised because data capture was below 75%.



Appendix B

Full monthly diffusion tube results



Table B1 Raw diffusion tube data 2015

Site ID	January	February	March	April	May	June	July	August	September	October	November	December	Unadjusted Mean
Cott1	40	45	36	40	31	37	30	37	39	44	33	44	38.0
Cott2	34	30	-	20	16	19	16	23	26	34	20	18	23.3
M25	53	54	62	48	53	35	53	67	65	79	47	68	57.0
Church	28	28	20	24	16	17	18	22	26	33	23	22	23.1
RC	-	24	16	14	10	12	11	-	-	21	15	16	15.4
AH	48	56	35	30	26	39	33	44	44	46	47	47	41.3
AH2	40	38	26	37	31	29	31	34	37	35	36	38	34.3
AH3	29	29	35	35	12	22	20	20	25	29	24	24	25.3
AH4	34	36	44	56	20	20	23	26	29	35	30	34	32.3
AH5	25	62	22	32	21	28	26	33	32	37	31	32	31.8
AH6	44	44	31	26	34	36	37	42	41	36	42	46	38.3
LGR	38	32	32	33	21	22	30	27	35	37	27	25	29.9
LD	32	24	21	20	13	13	12	19	21	27	15	15	19.3
VW	44	42	-	45	27	30	32	34	41	79	35	35	40.4
BD	29	21	18	15	11	9	8	15	15	20	14	16	15.9



Site ID	January	February	March	April	May	June	July	August	September	October	November	December	Unadjusted Mean
BR	36	36	27	21	25	22	24	24	35	42	27	35	29.5
BR1	30	28	28	27	18	25	20	19	20	34	20	25	24.5
PR	37	33	26	26	18	19	21	23	28	35	24	28	26.5
WL	28	29	33	25	25	31	-	25	29	-	25	21	27.1
GR	28	29	31	27	22	25	19	22	25	21	26	26	25.1
MR	38	-	43	39	27	29	25	33	10	52	31	-	32.7
MR2	36	35	35	30	28	31	27	38	27	45	33	35	33.3
CW	30	27	23	21	19	13	17	19	22	23	24	25	21.9
BW	29	26	22	25	9	14	13	17	25	26	21	19	20.5
CH	45	58	46	46	38	41	37	45	42	58	42	49	45.6
CH2	48	41	55	62	46	49	29	53	48	62	46	40	48.3
CH3	45	52	38	59	43	37	43	55	53	53	51	49	48.2
CH4	43	-	40	49	36	39	36	40	47	51	44	47	39.7

Notes:

Exceedances of the AQO are shown in **bold**.

‘-’ Indicates no data.



Appendix C

QA:QC data

Diffusion tube bias adjustment factors

The diffusion tubes for 2015 were supplied by Lambeth Scientific Services, and prepared using a 50% triethanolamine (TEA)/Acetone method.

The bias adjustment factor has been taken from Defra's UK national bias adjustment spreadsheet (version 03/16) and is based on the results of 2 studies in the UK. As only 2 studies were used, caution should be taken when using the bias correction factor produced. The bias adjustment factor for 2015 monitored data is 1.07. Table B.1 below details the bias adjustment factors for the period 2011 through 2015 used to adjust the Woking monitoring data.

Table C.1 Bias adjustment factors

Year	National bias adjustment factor
2011	1.06
2012	0.91
2013	0.87
2014	0.80
2015	1.07

QA/ QC of diffusion tube monitoring

Lambeth Scientific Services are a UKAS accredited laboratory, complying with the requirements of ISO/IEC 17025.



Appendix D

Maps of monitoring locations

Figure D1 Location of non-automatic monitoring sites West – showing Anchor Hill

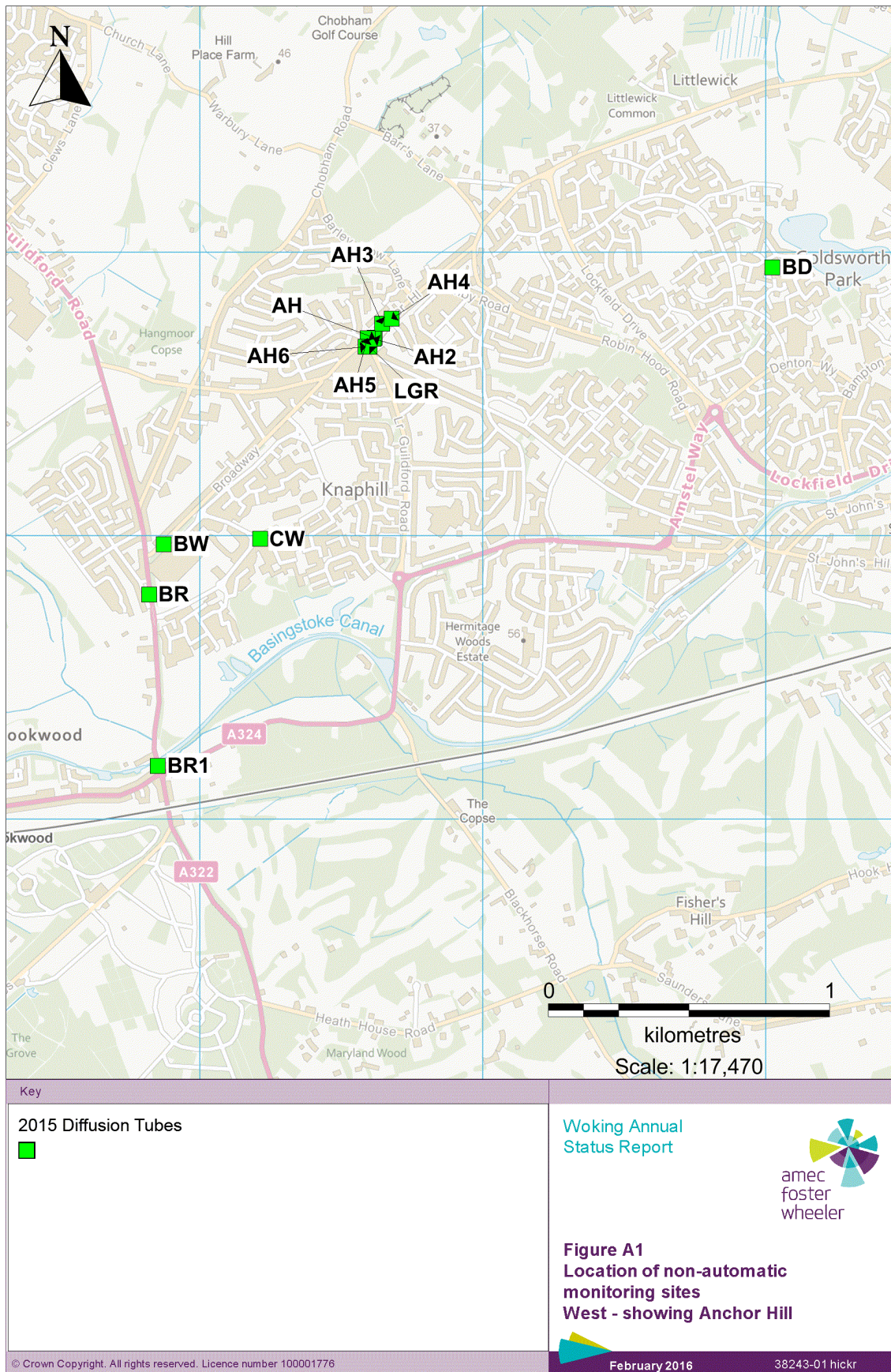
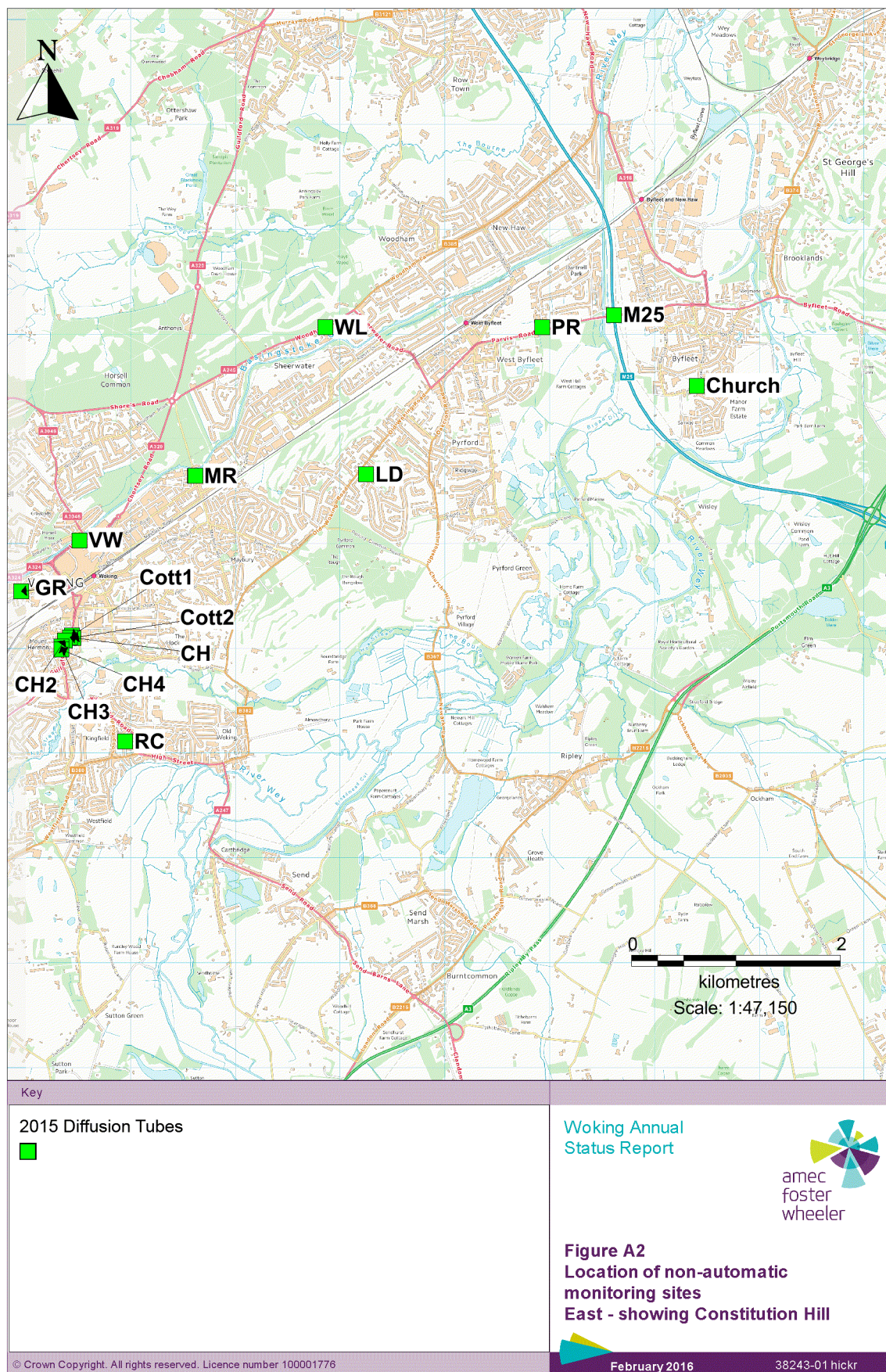


Figure D2 Location of non-automatic monitoring sites East – showing Guildford Road and Constitution Hill





Appendix E

Summary of Air Quality objectives in England

The air quality objectives applicable to LAQM in England are set out in the Air Quality (England) Regulations 2000 (SI 928), The Air Quality (England) (Amendment) Regulations 2002 (SI 3043), and are shown in Table E1. This table shows the objectives in units of microgrammes per cubic metre $\mu\text{g}/\text{m}^3$ (milligrammes per cubic metre, mg/m^3 for carbon monoxide) with the number of exceedances in each year that are permitted (where applicable).

Table E1 Air Quality Objectives included in regulations for the purpose of LAQM in England

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



Glossary of Terms

AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the LA 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
AQO	Air Quality Objective
ASR	Air quality Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
LAQM	Local Air Quality Management
NO2	Nitrogen Dioxide
NOx	Nitrogen Oxides
PM10	Airborne particulate matter with an aerodynamic diameter of 10µm (micrometres or microns) or less
PM2.5	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
QA/QC	Quality Assurance and Quality Control
SO2	Sulphur Dioxide



References

Environmental equity, air quality, socioeconomic status and respiratory health (2010).

Amec Foster Wheeler Environment & Infrastructure UK Ltd (2015). Air quality further assessment for Woking Borough Council

Defra (2006). Air quality and social deprivation in the UK: an environmental inequalities analysis.

Defra (2013) Abatement cost guidance for valuing changes in air quality.

Defra (2016). Local air quality management technical guidance LAQM.TG (16).

Woking Council (2014). Air quality progress report for Woking Council.

Surrey County Council (2011) Surrey transport plan: Air quality strategy.

