

Woking Borough Council

## Guildford Road AQMA

Air quality action plan



January 2018

Amec Foster Wheeler Environment  
& Infrastructure UK Limited



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### Document revisions

No.	Details	Date
1	Draft Report	06/07/2017
2	Final Report	11/01/2017



## Executive summary

Amec Foster Wheeler Environment & Infrastructure UK Limited ('Amec Foster Wheeler') has been commissioned by Woking Borough Council (WBC) to produce this Air Quality Action Plan (AQAP) detailing how WBC will work with other organisations in pursuit of compliance with the Air Quality Objectives (AQOs) within the Guildford Road Air Quality Management Area (AQMA).

Exceedances of the annual mean AQO for NO<sub>2</sub> have been recorded since 2012 at diffusion tubes located on Guildford Road. Diffusion tubes recorded concentrations above 40 µg m<sup>-3</sup> at four locations in this area in 2015. Following these exceedances, a Detailed Assessment for Guildford Road was produced in November 2016. Dispersion modelling included in this assessment indicated that concentrations at some receptor locations with relevant exposure were exceeding the AQO for NO<sub>2</sub> as a result of road traffic emissions around Guildford Road. Due to these exceedances, declaration of an AQMA on Guildford Road was recommended.

Consequently, WBC declared an AQMA on Guildford Road in May 2017 following exceedances of the annual mean nitrogen dioxide (NO<sub>2</sub>) AQO of 40 µg m<sup>-3</sup>. The AQMA comprises approximately 150 meters of Guildford Road including the junction with Mount Hermon Road and Constitution Hill, on its northern boundary.

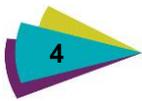
The highest NO<sub>2</sub> concentration modelled in the Detailed Assessment at a relevant receptor was 40.3 µg m<sup>-3</sup>, which is marginally above the annual mean AQO. For the purpose of this Action Plan it was calculated that a reduction of 12.28% road traffic emissions was required to achieve a concentration of 38 µg m<sup>-3</sup> at this receptor. This concentration is lower than the AQO but it represents the concentration at which there can be confidence that the AQO is not exceeded whilst taking the uncertainties of modelling into account. Source apportionment modelling suggests that road traffic emissions are responsible for 52% of the NO<sub>2</sub> concentration in the AQMA, including 27% from diesel vehicles.

Following distance correction annual mean concentrations predicted at the nearest sensitive receptors to the monitoring locations monitored in 2016 did not exceed the AQO. The high levels of NO<sub>2</sub> monitored in 2015 were likely due to increased traffic on Guildford Road following traffic diversion and roadworks in the Town Centre.

It is concluded that the reduced emissions associated with the replacement of older vehicles with newer, lower emitting models is likely to go a long way to reducing NO<sub>2</sub> concentrations so that the annual mean AQO is not exceeded in future.

Following discussion between WBC and Surrey County Council (SCC), it was determined that traffic management measures such as a speed limit reduction would not be feasible on the portion of Guildford Road within the AQMA. However, road improvement measures such as introducing cycling lanes and electric charging points are recommended.

The progress towards compliance will be tracked using the monitoring data collected by WBC and reported in the Annual Status Reports produced by the Council. The AQMA will be revoked when monitoring results from several consecutive years show no exceedance of the AQO, so that a permanent improvement in air quality can be demonstrated.



# Contents

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<b>1.</b>	<b>Introduction</b>	<b>5</b>
1.1	Background	5
1.2	Relevant legislation	5
1.3	Local Air Quality Management	7
1.4	Guildford Road AQMA	7
<b>2.</b>	<b>Guildford Road AQMA</b>	<b>9</b>
2.1	Monitoring data	9
2.2	2016 LAQM Detailed Assessment for Woking Borough Council	12
	Modelled concentrations	12
	Source apportionment	14
2.3	Required reductions	16
<b>3.</b>	<b>Existing policies</b>	<b>17</b>
3.1	European policies	17
3.2	Local development framework	17
3.3	Local transport plan	18
<b>4.</b>	<b>Guildford road AQAP measures</b>	<b>20</b>
<b>5.</b>	<b>Progress monitoring</b>	<b>24</b>
<b>6.</b>	<b>Consultation and stakeholder engagement</b>	<b>25</b>

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Table 1.1	NO <sub>2</sub> Air Quality objectives included in regulations for the purpose of LAQM in England	6
Table 1.2	Examples of where the air quality objectives should apply	6
Table 2.1	Diffusion Tube Locations	9
Table 2.2	Bias adjusted diffusion tube monitoring results for 2008-2016	9
Table 2.3	Modelled baseline NO <sub>2</sub> concentrations	12
Table 2.4	Source apportionment results on Guildford Road	14
Table 2.5	Estimates of emissions reductions required to achieve the annual NO <sub>2</sub> AQO.	16
Table 3.1	Annual mean background concentrations (500500, 158500)	17
Table 4.1	Air Quality Action Plan Measures	22

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Figure 2.1	Diffusion tube monitoring locations	11
Figure 2.2	Source apportionment – Guildford road	15

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Appendix A	Guildford Road AQMA boundary	
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# 1. Introduction

## 1.1 Background

Amec Foster Wheeler Environment & Infrastructure UK Limited ('Amec Foster Wheeler') has been commissioned by Woking Borough Council (WBC) to produce this Air Quality Action Plan (AQAP) detailing how WBC will work with other organisations in pursuit of compliance with the Air Quality Objectives (AQOs) within the Guildford Road Air Quality Management Area (AQMA).

A detailed assessment of Guildford Road was undertaken in November 2016 as a result of monitored exceedances of the annual mean nitrogen dioxide (NO<sub>2</sub>) AQO of 40 µg m<sup>-3</sup>. Dispersion modelling indicated that concentrations at some receptor locations with relevant exposure were exceeding the AQO as a result of road traffic emissions around Guildford Road. The following recommendations were made:

- ▶ It was recommended that an AQMA is declared along Guildford Road, with the boundary as determined in the assessment (see Appendix A); and
- ▶ Further monitoring is required around the junctions where Guildford Road meets York Road and Station Approach to confirm if the NO<sub>2</sub> annual mean AQO is exceeded where there is relevant exposure.

WBC declared an AQMA at Guildford Road in May 2017 as a result of exceedances of the AQO for NO<sub>2</sub>. A map of the AQMA is provided in Appendix A. The AQMA incorporates approximately 150 meters of Guildford Road where it meets Constitution Hill and Mount Hermon Road.

## 1.2 Relevant legislation

The legislative framework for air quality consists of legally enforceable EU Limit Values that are transposed into UK legislation as Air Quality Standards (AQS) that must be at least as challenging as the EU Limit Values. Action in the UK is then driven by the UK's Air Quality Strategy<sup>1</sup>.

The EU Limit Values are set by the European directive on air quality and cleaner air for Europe (2008/50/EC)<sup>2</sup> and the European directive relating to arsenic, cadmium, mercury, nickel, and polycyclic aromatic hydrocarbons in ambient air (2004/107/EC)<sup>3</sup>, as the principal instruments governing outdoor ambient air quality policy in the EU. The Limit Values are legally binding levels for concentrations of pollutants for outdoor air quality.

The two European directives, as well as the Council's decision on exchange of information were transposed into UK Law via the Air Quality Standards Regulations 2010<sup>4</sup>, which came into force in the UK on 11th June 2010, replacing the Air Quality Standards Regulations 2007<sup>5</sup>. Air Quality Standards are concentrations

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<sup>1</sup> Defra in partnership with the Scottish Executive, Welsh Assembly Government and Department of the Environment Northern Ireland (2007) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland.

<sup>2</sup> Official Journal of the European Union, (2008) Directive 2008/50/EC of the European Parliament and of The Council of 21 May 2008 on ambient air quality and cleaner air in Europe.

<sup>3</sup> Official Journal of the European Union, (2004) Directive 2004/107/EC of the European Parliament and of The Council of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air.

<sup>4</sup> The Stationery Office Limited (2010) Statutory Instrument 2010 No. 1001 Environmental Protection – The Air Quality Standards Regulation 2010.

<sup>5</sup> The Stationery Office Limited (2007) Statutory Instrument 2010 No. 64 Environmental Protection – The Air Quality Standards Regulation 2007.

recorded over a given time period, which are considered to be acceptable in terms of what is scientifically known about the effects of each pollutant on health and on the environment.

The Air Quality Strategy sets the AQOs, which give target dates and some interim target dates to help the UK move towards achievement of the EU Limit Values. The AQOs are a statement of policy intentions or policy targets and as such, there is no legal requirement to meet these objectives except in as far as they mirror any equivalent legally binding Limit Values in EU legislation. The most recent UK Air Quality Strategy for England, Scotland, Wales and Northern Ireland was published in July 2007.

Table 1.1 sets out the air quality objectives that are relevant to this AQAP, and the dates by which they are to be achieved. The LAQM Technical Guidance (LAQM TG (09))<sup>6</sup> suggests that the relationship between monitored hourly and annual NO<sub>2</sub> concentrations is such that if the monitored annual mean of NO<sub>2</sub> is less than 60µg m<sup>-3</sup>, exceedances of the hourly mean objective are unlikely.

Table 1.1 NO<sub>2</sub> Air quality objectives included in regulations for the purpose of LAQM in England

Pollutant	Concentration	Measured as	Date by which to be achieved
Nitrogen dioxide	200 µg m <sup>-3</sup> not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 µg m <sup>-3</sup>	Annual mean	31.12.2005

Guidance from the UK Government and Devolved Administrations makes clear that exceedance of the health based objectives should be assessed at outdoor locations where members of the general public are regularly present over the averaging time of the objective. Workplaces are excluded, as explained in Table 1.2 which provides an indication of those locations that may or may not be relevant for each averaging period.

Table 1.2 Examples of where the air quality objectives should apply

Averaging Period	Objectives should apply at:	Objectives should generally not apply at:
<b>Annual mean</b>	All locations where members of the public might be regularly exposed	Building facades of offices or other places of work where members of the public do not have regular access.
	Building facades of residential properties, schools, hospitals, care homes etc.	Hotels, unless people live there as their permanent residence.
		Gardens of residential properties.
<b>24-hour mean and 8-hour mean</b>	All locations where the annual mean objectives would apply, together with hotels	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
	Gardens or residential properties	
<b>1-hour mean</b>	All locations where the annual mean and 24 and 8-hour mean objectives would apply.	Kerbside sites where the public would not be expected to have regular access.
	Kerbside sites (e.g. pavements of busy shopping streets).	

<sup>6</sup> Defra (2009). *Local Air Quality Management: Technical Guidance*. London: Defra Publications. (LAQM.TG(09))

Averaging Period	Objectives should apply at:	Objectives should generally not apply at:
	Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where the public might reasonably be expected to spend one hour or more.	
	Any outdoor locations at which the public may be expected to spend one hour or longer.	
<b>15-minute mean</b>	All locations where members of the public might reasonably be expected to spend a period of 15 minutes or longer.	

### 1.3 Local air quality management

Part IV of the Environment Act 1995<sup>7</sup> places a statutory duty on local authorities to review and assess air quality in their areas under the Local Air Quality Management (LAQM) regime, and to determine whether or not the AQOs are likely to be achieved.

The Review and Assessment process is undertaken every year. Local authorities undertake an Annual Status Report to identify any significant changes that may have occurred since the last round.

Where exceedances for a certain pollutant are considered likely at a relevant location, the local authority is required to proceed to a Detailed Assessment for that pollutant. If the results of the Detailed Assessment confirm that an AQO is unlikely to be met, the local authority is required to declare AQMA.

Once a local authority has declared an AQMA, a remedial AQAP must be prepared and implemented to improve air quality within that area. Within 12 months of the AQMA declaration, a Further Assessment is required to provide local authorities with an opportunity to supplement the information they have already gathered from their earlier Review and Assessment work. The findings of the Further Assessment can be used to improve air quality and feed into the local authority's AQAP.

A local authority is also required to submit a Detailed Assessment in order to revoke an AQMA. The Detailed Assessment should outline the evidence for changes in the likelihood of exceedance of objectives occurring and demonstrate the cause of these changes.

### 1.4 Guildford Road AQMA

The following LAQM actions have taken place in relation to NO<sub>2</sub> concentrations at Guildford Road:

- ▶ Updating Screening and Assessment (2013 and 2014) – Exceedances of the NO<sub>2</sub> AQO were recorded at the site CH, located in the current AQMA in 2012 and 2013;
- ▶ Updating Screening and Assessment 2015 – New monitoring sites were introduced on Guildford Road in 2014. An exceedance of the AQO was recorded in 2014 at the site CH2, located in the current AQMA;
- ▶ Annual Status Report 2016 – Exceedances of the AQO were recorded at five sites on Guildford Road including three located in the current AQMA in 2015;
- ▶ 2016 LAQM Detailed Assessment for Woking Borough Council – This report was required to provide an accurate assessment of the likelihood of an AQO being exceeded at locations with relevant exposure in this area. The dispersion modelling indicated that concentrations were

<sup>7</sup> HMSO (1995) Environment Act 1995



exceeding the AQO at some receptor locations and recommended the declaration of an AQMA;  
and

- ▶ Annual Status Report 2017 – Exceedances of the AQO were recorded at several diffusion tube sites along Guildford Road in 2016. These results were used to predict concentrations at relevant receptor locations. This analysis indicated that the annual mean AQO was not exceeded at locations of relevant exposure at 2016. An annual mean NO<sub>2</sub> concentration of 36.2 µgm<sup>-3</sup> was predicted at the nearest property to diffusion tube CH in 2016 following distance correction.

## 2. Guildford Road AQMA

### 2.1 Monitoring data

WBC carry out monitoring of NO<sub>2</sub> concentrations at thirty locations across the borough using diffusion tubes. Three of these sites are within the AQMA and three are near its boundary. The diffusion tubes are roadside or kerbside sites. Table 2.1 presents the details of these NO<sub>2</sub> diffusion tube monitoring sites. Figure 2.1 shows their locations.

Table 2.1 Diffusion tube locations

Site ID	Site Name	X (m)	Y (m)	In AQMA?
Cott1	Constitution Hill 1	500437	158120	NO
Cott2	Constitution Hill 2	500453	158100	NO
CH	Constitution Hill 4	500417	158102	YES
CH2	Constitution Hill 5	500367	158073	YES
CH3	Constitution Hill 6	500330	158012	YES
CH4	Constitution Hill 7	500332	157983	NO

Table 2.2 displays the results of the diffusion tube monitoring from 2008 to 2016 as well as the bias adjustment factors used for each year. As seen on Table 2.2, long term monitoring data is available for two diffusion tubes (Cott1 and Cott2). Additional data is available since 2012 at the site CH, and since 2014 at three other sites (CH2, CH3, CH4). Overall, NO<sub>2</sub> concentrations decreased at every site before 2015.

In 2015, average levels were higher than all previous years. Exceedances of the AQO were recorded at each site before distance correction and one site after this adjustment. Concentrations in 2016 were lower than those recorded in 2015 and there were no more exceedances of the AQO after distance correction.

Based on knowledge of local traffic flows and development activity, it is considered that the high NO<sub>2</sub> levels recorded in 2015 were likely caused by increased traffic diverted on to Guildford Road, due to roadworks associated with development in the Town Centre.

Table 2.2 Bias adjusted diffusion tube monitoring results for 2008-2016

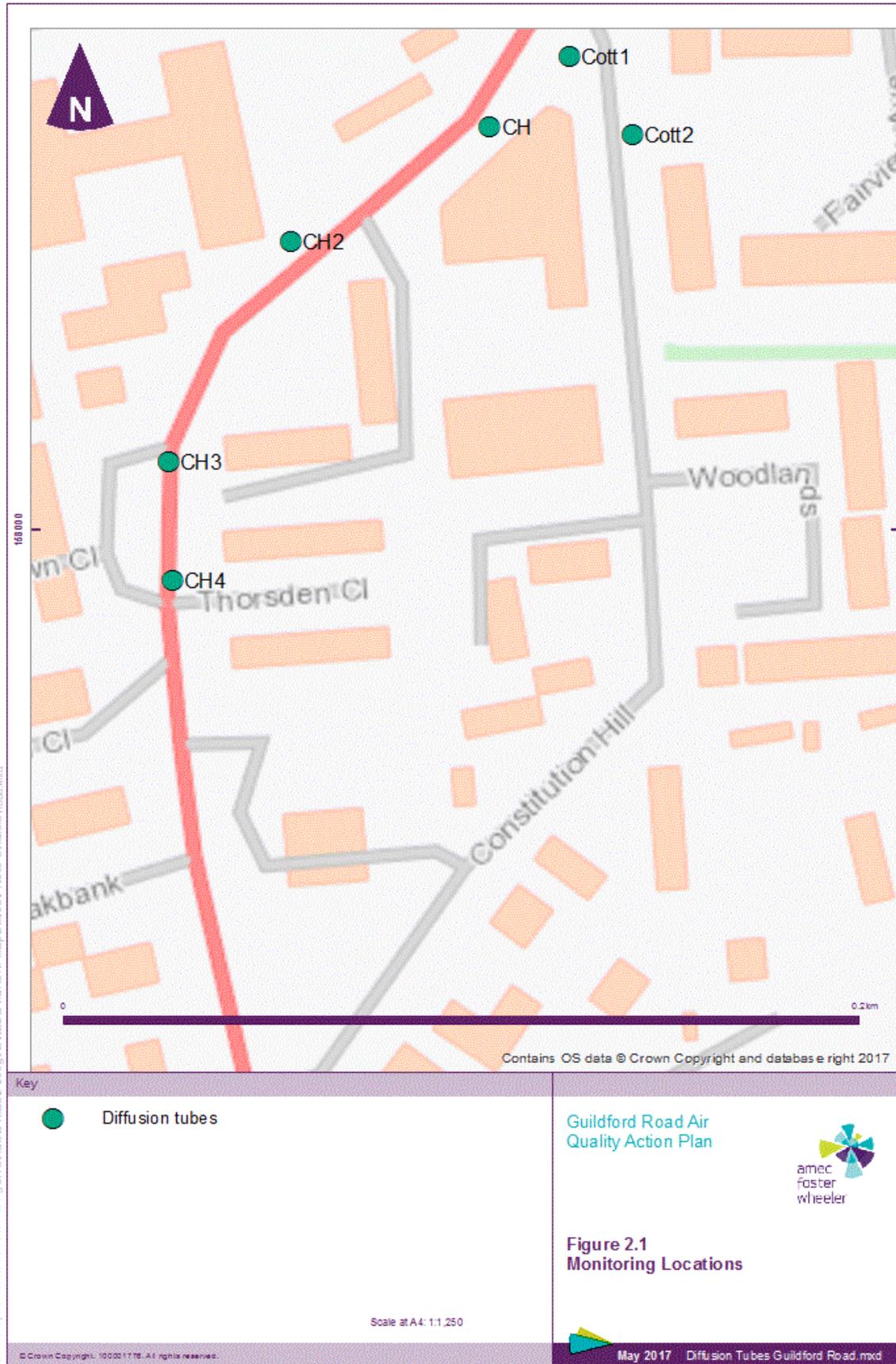
Site ID	Site Name	2008 (bias factor = 0.98)	Annual Mean Concentrations (µg m <sup>-3</sup> )							
			2009 (1.02)	2010 (1.08)	2011 (1.06)	2012 (0.91)	2013 (0.87)	2014 (0.87)	2015 (1.07)	2016 (0.94)
<b>Cott1</b>	Constitution Hill 1	38.4	38.8	<b>43.5</b>	39.7	34.8	36.0	31.0	<b>40.7</b> (34.7)	23.6 (22.2)
<b>Cott2</b>	Constitution Hill 2	28.0	27.1	32.0	23.6	24.9	27.4	17.8	24.9 (21.8)	33.9 (25.3)
<b>CH</b>	Constitution Hill 4	-	-	-	-	<b>41.1</b>	<b>43.9</b>	34.2	<b>48.8</b> (40.4)	<b>43.3</b> (36.2)

Annual Mean Concentrations ( $\mu\text{g m}^{-3}$ )

Site ID	Site Name	2008 (bias factor = 0.98)	2009 (1.02)	2010 (1.08)	2011 (1.06)	2012 (0.91)	2013 (0.87)	2014 (0.87)	2015 (1.07)	2016 (0.94)
CH2	Constitution Hill 5	-	-	-	-	-	-	<b>40.6*</b>	<b>51.6</b> (34.9)	<b>47.6</b> (32.6)
CH3	Constitution Hill 6	-	-	-	-	-	-	37.9*	<b>51.5</b> (35.0)	<b>45.4</b> (31.6)
CH4	Constitution Hill 7	-	-	-	-	-	-	34.5*	<b>42.4</b> (26.6)	<b>40.0</b> (25.2)

Notes: Figures in bold indicate a value above the annual mean AQO of  $40 \mu\text{g m}^{-3}$   
 Figures in bracket are distance corrected to the nearest exposure.

Figure 2.1 Diffusion tube monitoring locations



## 2.2 2016 LAQM Detailed Assessment for Woking Borough Council

### Modelled concentrations

In the 2016 Detailed Assessment, annual average NO<sub>2</sub> concentrations were predicted at relevant receptors using ADMS-Roads modelling software. Full details of the modelling process can be found in the Detailed Assessment.

The highest concentration at a relevant receptor location was predicted at receptor R2 on Guildford Road, with a concentration of 40.3 µg m<sup>-3</sup>. This location is a relevant residential receptor location. Diffusion tube CH is located near this location, and recorded a concentration exceeding the AQO in 2015. An exceedance was also predicted at receptor R21 with 42.2 µg m<sup>-3</sup>.

The dispersion modelling also indicated that NO<sub>2</sub> concentrations may be elevated around the junctions of Guildford Road with York Road and Station approach. Although there is no residential exposure at receptor R21 at ground floor level, there are residential properties close to the road in this area. Therefore, it was recommended that monitoring should be carried out to determine if the NO<sub>2</sub> annual mean AQO is exceeded.

Due to exceedances of the AQO predicted at residential receptor locations around the junction between Constitution Hill and Guildford Road, it was recommended to declare an AQMA in this area. The proposed boundary includes properties at Thorsden Close facing Guildford Road, where the predicted concentrations are within 5% of the AQO.

The modelled results were verified using 2015 monitoring data. The modelled results are given in Table 2.3. As all modelled annual mean concentrations were less than 60 µg m<sup>-3</sup>, exceedances of the hourly mean at relevant receptors in this area are unlikely.

Table 2.3 Modelled baseline NO<sub>2</sub> concentrations

Receptor ID	Receptor Location	X (m)	Y (m)	Z (m)	Total Modelled NO <sub>2</sub> (µg m <sup>-3</sup> )
R1 Ground Fl	Park Heights, Constitution Hill, Woking	500435	158111	1.5	34.5
R1 1st Fl	Park Heights, Constitution Hill, Woking	500435	158111	4.5	29.1
R2 Ground Fl	Park Heights, Constitution Hill, Woking	500427	158108	1.5	<b>40.3</b>
R2 1st Fl	Park Heights, Constitution Hill, Woking	500427	158108	4.5	30.3
R3 Ground Fl	Park Heights, Constitution Hill, Woking	500422	158102	1.5	<u>40.0</u>
R3 1st Fl	Park Heights, Constitution Hill, Woking	500422	158102	4.5	30.2
R4 Ground Fl	Constitution Hill, Woking	500440	158104	1.5	29.7
R4 1st Fl	Constitution Hill, Woking	500440	158104	4.5	27.1
R5	Park Heights, Constitution Hill, Woking	500421	158096	1.5	34.9
R6	Park Heights, Constitution Hill, Woking	500408	158085	1.5	34.6
R7	Guildford Rd, Woking	500383	158064	1.5	33.9
R8	Guildford Rd, Woking	500351	158026	1.5	33.7
R9	Thorsden Close, Woking	500351	158000	1.5	31.5
R10	Constitution Hill, Woking	500441	158090	1.5	26.8
R11	Constitution Hill, Woking	500445	158033	1.5	23.1

Receptor ID	Receptor Location	X (m)	Y (m)	Z (m)	Total Modelled NO <sub>2</sub> (µg m <sup>-3</sup> )
R12	Guildford Rd, Woking	500327	158033	1.5	29.5
R13	Guildford Rd, Woking	500343	158062	1.5	29.5
R14	Guildford Rd, Woking	500362	158076	1.5	32.7
R15	Guildford Rd, Woking	500394	158104	1.5	32.0
R16	Guildford Rd, Woking	500411	158125	1.5	31.0
R17	Guildford Rd, Woking	500404	158113	1.5	32.3
R18	Constitution Hill, Woking	500464	158138	1.5	28.3
R19	Hill View Rd, Woking	500475	158200	1.5	29.6
R20	Hillview Court, Woking	500483	158272	1.5	29.4
R21	Guildford Rd, Woking	500455	158292	1.5	<b>42.2</b>
R22	Thorsden Close, Woking	500354	157969	1.5	26.9
R23	Guildford Rd, Woking	500327	157931	1.5	24.8
R24	Guildford Rd, Woking	500371	157844	1.5	30.1
R25	Constitution Hill, Woking	500423	157947	1.5	18.6
R26	Mount Hermon Road, Woking	500400	158134	1.5	27.4
R27	Mount Hermon Road, Woking	500354	158125	1.5	24.0
R28	Guildford Rd, Woking	500371	157837	1.5	30.9
R29	Constitution Hill, Woking	500449	157998	1.5	18.4
R30	Guildford Rd, Woking	500383	158097	1.5	30.7

Figures in bold indicate a value above the annual mean AQO of 40 µg m<sup>-3</sup>

## Source apportionment

In order to develop an appropriate AQAP it is necessary to identify the sources contributing to the objective exceedances at locations within AQMAs. NO<sub>x</sub> sources were broken down into the regional and local background contribution as well as the local traffic contribution. Whilst NO<sub>x</sub> chemistry is non-linear, so changes to NO<sub>x</sub> emissions do not relate directly to changes in NO<sub>2</sub> concentrations, this approach provides a useful approximation of the changes required. Local traffic contributions were derived by apportioning the road-NO<sub>x</sub> contribution on Guildford Road in accordance with the contributions from each vehicle class in the Emissions Factor Toolkit.

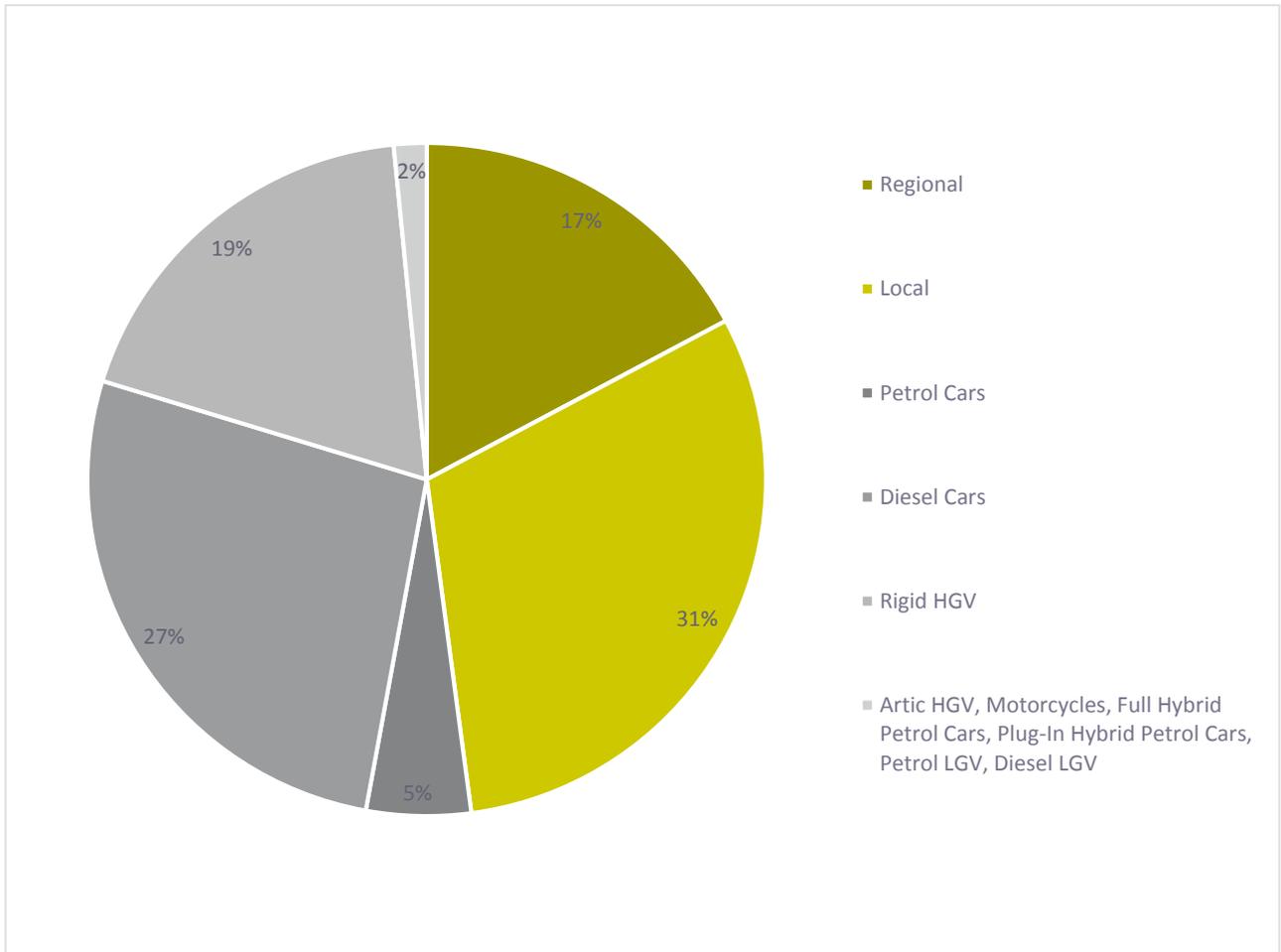
Table 2.4 sets out the source contributions to the total ambient concentration at representative receptors on Guildford Road – R2 Ground floor, as actual NO<sub>2</sub> concentrations and as percentages. The regional and local background concentrations used the gridded data for 2015 supplied by Defra. The source apportionment at the site is shown in Figure 2.2.

The results showed that local traffic sources were generally the predominant source of NO<sub>2</sub> concentrations within the AQMA, contributing over 50%. The emissions are a result of general traffic volume and congested traffic flow around the junction. Diesel cars were a key source of emission, contributing 26.86%. Rigid Heavy Goods Vehicles (HGVs) were also an important source, contributing 18.71%.

Table 2.4 Source apportionment results on Guildford Road

	Concentration $\mu\text{g m}^{-3}$	Contribution (%)
<b>Regional background</b>	6.93	<b>17.18%</b>
<b>Local background</b>	12.39	<b>30.71%</b>
<b>Local traffic</b>		<b>52.11%</b>
Petrol Cars	2.01	4.98%
Diesel Cars	10.83	26.86%
Rigid HGV	7.55	18.71%
Artic HGV	0.37	0.93%
Motorcycles	0.05	0.13%
Full Hybrid Petrol Cars	0.01	0.02%
Plug-In Hybrid Petrol Cars	0.00	0.00%
Full Hybrid Diesel Cars (%)	0.02	0.05%
Petrol LGV	0.00	0.01%
Diesel LGV	0.17	0.43%

Figure 2.2 Source apportionment – Guildford Road



## 2.3 Required reductions

The issue of NO<sub>2</sub> reduction is complex as a certain reduction in NO<sub>x</sub> emissions does not necessarily deliver an equivalent improvement in air quality (reduction in NO<sub>2</sub> concentrations) since non-linear chemical transformations take place between the emitted NO<sub>x</sub> and the background NO<sub>x</sub> and atmospheric ozone. The non-linear chemistry is taken into account when estimating the amount of emission reduction necessary to achieve the AQOs.

The calculated emissions reduction required at the modelled receptor (R2 Ground floor) with the highest NO<sub>2</sub> concentration in the AQMA is given in Table 2.5. This shows the reductions required to achieve the annual mean NO<sub>2</sub> AQO as both road-NO<sub>x</sub> concentrations and the percentage reductions required in road-NO<sub>x</sub> emissions. The reductions were calculated using the methodology in LAQM.TG (09).

Table 2.5 Estimates of emissions reductions required to achieve the annual NO<sub>2</sub> AQO.

Receptor	Modelled NO <sub>2</sub> concentration (µg m <sup>-3</sup> )	Road-NO <sub>x</sub> concentration (µg m <sup>-3</sup> )	Road-NO <sub>x</sub> concentration required for NO <sub>2</sub> concentration of 38 µg m <sup>-3</sup> (µg m <sup>-3</sup> )	% Road-NO <sub>x</sub> emissions reduction required (%)
Receptor 2 - Ground Floor	40.34	45.05	39.52	12.28%

The calculations highlighted that a reduction in road-NO<sub>x</sub> emissions and, therefore, road-NO<sub>x</sub> concentrations of 12.28% is required to achieve a NO<sub>2</sub> concentration of 38 µg m<sup>-3</sup>. This concentration represents an achievable level lower than the AQO.

The reduced emissions associated with the replacement of older vehicles with newer, lower emitting models and the improvement of road traffic management on Guildford Road, will help to reduce NO<sub>2</sub> concentrations so that the annual mean AQO will no longer be exceeded in the AQMA from 2018.

## 3. Existing policies

### 3.1 European policies

Traffic emissions are predicted to decline each year as new vehicles replace older ones. Following the introduction of European emission standards for road vehicles in 1992, emissions from the overall road vehicle fleet have been decreasing due to the penetration of new vehicles and trucks meeting the emission regulations. Future emissions (per vehicle) are therefore likely to continue to decrease as new vehicles, meeting the increasingly stringent emission regulations, replace older vehicles and form a greater part of the UK fleet. Market demand and future UK and European policies are likely to achieve further reductions in vehicle emissions. As the exceedance of the NO<sub>2</sub> annual mean AQO is only marginal at worst (distance corrected annual mean concentration of 40.4 µg m<sup>-3</sup> at the CH, Constitution Hill 4 site in 2015), existing European policies alone are likely to result in reduction in NO<sub>2</sub> concentration so that the AQO will no longer be exceeded within two years.

Table 3.1 shows the background NO<sub>x</sub> and NO<sub>2</sub> concentrations from the Defra concentration maps for the AQMA. NO<sub>2</sub> concentrations are expected to decrease by between 0.78 µg m<sup>-3</sup> per year on average between 2013 and 2018.

As seen on Table 2.2, long term monitoring results showed that NO<sub>2</sub> concentrations generally decreased at every site until 2015. In 2015, average levels were higher than all previous years. Concentrations in 2016 were lower than those recorded in 2015 and there were no more exceedances of the AQO after distance correction. It is considered that the high NO<sub>2</sub> levels recorded in 2015 were likely to have been caused by increased traffic diverted on to Guildford Road, due to roadworks associated with development in the Town Centre.

Table 3.1 Annual mean background concentrations (500500, 158500)

Year	NO <sub>x</sub>	NO <sub>2</sub>
2013	30.59	20.97
2014	29.43	20.14
2015	28.30	19.30
2016	27.03	18.57
2017	25.78	17.82
2018	24.54	17.07

### 3.2 Local development framework

Woking 2027<sup>8</sup> is the name of the WBC Local Development Framework (LDF). This is a statutory planning policy framework to guide future development in the borough between 2015 and 2027. Woking 2027 was adopted by WBC in October 2012. Core Strategy Objective 7 is of particular relevance to air quality. The objective is "To maintain and improve air and water quality and manage effectively the impacts of noise and light pollution." The following policies in the Core Strategy are related to air quality:

- ▶ CS1: A spatial strategy for Woking Borough

<sup>8</sup> <http://www.woking2027.info/> - Accessed July 2017

- ▶ *“The Core Strategy will make provision for the delivery of the following scale of uses between 2010 and 2027. 4,964 net additional dwellings, with an overall affordable housing provision target of 35% 28,000 sq.m of additional office floorspace and 20,000 sq.m of warehousing floorspace. 93,900 sq.m of additional retail floorspace.”*
- ▶ *“The impact of development will be fully assessed to ensure it does not adversely impact on sensitive environmental designations”*
- ▶ CS18: Transport and accessibility
  - ▶ *“Locating most new development in the main urban areas, served by a range of sustainable transport modes, such as public transport, walking and cycling to minimise the need to travel and distance travelled. “*
  - ▶ *“Ensuring development proposals provide appropriate infrastructure measures to mitigate the adverse effects of development traffic and other environmental and safety impacts (direct or cumulative). Transport Assessments will be required for development proposals, where relevant, to fully assess the impacts of development and identify appropriate mitigation measures. Developer contributions will be secured to implement transport mitigation schemes.”*
  - ▶ *“Supporting proposals that deliver improvements and increased accessibility to cycle, pedestrian and public transport networks and interchange facilities. In particular, proposals to improve easy access between Woking Rail Station and the town centre will be encouraged.”*

### 3.3 Local transport plan

The Surrey Transport Plan<sup>9</sup> is the third Local Transport Plan (LTP) for the county. It is a statutory plan (required by the Local Transport Act 2008 and Transport Act 2000), which replaced the second LTP on 1 April 2011. In common with the previous Plans, the Surrey Transport Plan is partly an aspirational document. The strategies look forward to 2026 and will be reviewed every three to five years as necessary. The Local Transport Strategies and Implementation Programmes will cover a three year cycle and will be updated and rolled forward annually. The accompanying strategic environmental assessment used a set of criteria to evaluate the likely environmental performance of the Plan, specifically including air quality. Air quality and climate change were found to represent a significant opportunity for impact, due to the accessibility and congestion measures planned. The assessment, based solely on the vision and objectives for the Plan, suggested that emissions of transport related air pollutants would be expected to fall over the lifetime of the Plan, although there would be potential for localised adverse impacts as a consequence of construction works associated with the maintenance and improvement of the transport network.

The Surrey Transport Plan Air Quality Strategy (2016) contains the following aims and objectives:

- ▶ *Aim: To improve air quality in AQMAs on the county road network such that Surrey’s borough and districts are able to undesignate (sic) these areas as soon as possible, with regard to other strategies and funding constraints.*
- ▶ Objectives:
  - ▶ *1. Working with the accountable borough or district council for each designated AQMA, to incorporate physical transport measures in the borough or district council’s Infrastructure Delivery Plan, agree options for the enforcement of existing regulations and agree options for supporting smarter travel choices, for future implementation as and when funding becomes available, in order to reduce air pollution from road traffic sources;*
  - ▶ *2. To provide assistance to the borough and district councils in producing their review and assessment reports, and Action Plan progress reports; and,*

<sup>9</sup> <http://new.surreycc.gov.uk/roads-and-transport/surrey-transport-plan-ltp3> - Accessed July 2017

- ▶ 3. *To consider air quality impacts when identifying and assessing transport measures in Surrey.*

A twin-track preferred strategy approach is proposed:

- ▶ **A focus on AQMAs** through incorporating appropriate physical transport measures in Infrastructure Delivery Plans, enforcing existing regulations for parking and loading, supporting travel choices that are better for air quality and considering air quality issues in planning and other processes and areas of responsibility; and
- ▶ **Countywide air quality improvements** delivered through synergies with other Surrey Transport Plan strategies and other county council strategies when and where these tend to restrain traffic growth, reduce vehicle delay, reduce vehicle emissions and improve the provision of travel information to people on the air quality impacts of their travel choices.

Partnership working with the boroughs and districts, the Highways Agency and with wider partners in Surrey is essential to the delivery of this strategy.

The Surrey Transport Plan Congestion Strategy (2014)<sup>10</sup> contains the following aims and objectives:

- ▶ *Aim: To improve the reliability of journeys, reduce delays at congestion hotspots and improve the provision of journey planning information for travel in Surrey.*
- ▶ *Objectives:*
  - ▶ 1. *Improve the reliability of journeys in terms of how long they take;*
  - ▶ 2. *Reduce delays for all modes of transport (car, bus and community transport, freight, pedestrians, cyclists) on key routes within Surrey and at congestion hotspots on Surrey's roads; and*
  - ▶ 3. *Improve the provision of information to allow people to plan their journeys.*

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<sup>10</sup> <https://www.surreycc.gov.uk/roads-and-transport/roads-and-transport-policies-plans-and-consultations/surrey-transport-plan-ftp3/surrey-transport-plan-strategies/congestion-strategy> - Accessed July 2017

## 4. Guildford road AQAP measures

The AQMA on Guildford Road covers approximately 150 meters of the road. Its Northern boundary is at the junction with Constitution Hill and Mount Hermon Road.

Dispersion modelling results from the 2016 Detailed Assessment highlighted that the highest modelled NO<sub>2</sub> concentration at a relevant receptor in the AQMA was of 40.3 µg m<sup>-3</sup>. A reduction in road-NO<sub>x</sub> emissions, and therefore road-NO<sub>x</sub> concentrations, of 12.28% is required to achieve a NO<sub>2</sub> concentration of 38 µg m<sup>-3</sup>.

NO<sub>2</sub> levels are monitored with diffusion tubes at six sites located in the AQMA and near its outer boundary. In 2015, annual mean values for NO<sub>2</sub> exceeded the AQO at five sites and in 2016 at four sites. However, after distance correction to predict concentrations at the locations of the nearest relevant exposure, the AQO was exceeded only at one site in 2015 (40.4 µg m<sup>-3</sup> at CH – Constitution Hill 4). There was no exceedance at relevant locations in 2016.

High NO<sub>2</sub> levels recorded in 2015 were likely due to increased traffic on Guildford Road caused by traffic diversion and roadwork as part of local development in the Town Centre. The levels recorded in 2016 were all lower than in 2015 possibly due to lower traffic and/or on Guildford Road.

Further local developments are planned in the Town Centre. Therefore, this AQAP seeks to recommend measures to put in place to effectively manage potential traffic increase due to diversion on to Guildford Road. Traffic congestion needs to be minimised or avoided to prevent any increase in NO<sub>2</sub> levels.

In order to reduce NO<sub>2</sub> levels in the AQMA and prevent any increase, several actions could be put in place. Recommended measures have been developed from the information available in the London Local Air Quality Management (LLAQM) Borough Air Quality Action Matrix<sup>11</sup>. The actions considered are included in Table 4.1 below. Measures No.1 to 3 are straightforward traffic management measures, which could reduce NO<sub>2</sub> levels and traffic congestion. However, after discussion between WBC and Surrey County Council (SCC), it was determined that these three measures would not be appropriate to the AQMA. Details on each measure are provided below.

Measure No.1 is to reduce the speed limit to 20 mph, to reduce acceleration, when the majority of emissions occur. This speed reduction measure should be displayed with traffic signs, rather than speed bumps, as there is evidence to suggest that speed bumps increase stop-start driving conditions and subsequently increase emissions. This measure was considered inappropriate by WBC and SCC due to the fact that the traffic would be at a standstill during peak times and may cause an increase in pollutant concentrations in the area.

Measure No.2 is to discourage any idling in the AQMA through anti-idling publicity campaigns and on-the-spot fines. This measure is easy to put into action and has the potential to reduce the general emissions in the area. This measure was considered unsuitable by WBC and SCC because there is a lot of stop-start traffic along Guildford Road within the AQMA, and there are in fact no parking places where vehicles are likely to be stopping. Discouraging idling is therefore unlikely to have a large positive impact on pollutant concentrations in the area. However, it is recognised that the increasing prevalence of manufacturer fitted stop-start technology in vehicles will likely have a beneficial impact in the long term.

In case of increased traffic due to local development, it is recommended that temporary traffic signals are considered for the junction between Guildford Road, Mount Hermon Road and Constitution Hill (Measure No.3). Subject to the system being able to improve the efficiency of traffic flow and reduce congestion when traffic flows increase, this would help to alleviate any temporary air quality problems. This measure was not considered feasible from a traffic perspective by SCC and WBC as it is possible that introducing traffic signals would add to congestion at some locations, as well as encourage more use of Mount Hermon Road, if the exit onto the A320 is controlled.

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<sup>11</sup> [https://www.london.gov.uk/sites/default/files/air\\_quality\\_action\\_matrix.pdf](https://www.london.gov.uk/sites/default/files/air_quality_action_matrix.pdf) - Accessed July 2017

Measures No.4 and 5 are actions encouraging a modal shift among residents. These measures are more expensive and may be overall more difficult to implement, but have been included as alternative measures which WBC may wish to consider in the long-term along Guildford Road, or for implementation elsewhere in the Borough. Measure No.4 suggests that it is possible that introducing cycling lanes would encourage residents to use bikes instead of cars, especially for short distance travel. Measure No. 5 suggests that installing residential electric charge points in the area would encourage the uptake of low and zero emission vehicles, in order to reduce emissions in the area. Evidence suggests that the majority of plug-in vehicle owners want to charge their vehicles at home, at night, as this is the most convenient time. WBC is currently looking at potential funding sources related to these measures. This includes funding to increase the provision of cycle lanes in the area and to change the road layout. The Woking Sustainable Transport Package Bid and the SCC Green Bus Fund are considered as additional potential funding sources. WBC is also looking at the possibility of implementing a policy on the number of charge points for new developments.

Finally, it is recommended that airAlert, the air quality early warning service for Surrey among local residents, is promoted (Measure No.6). This service is especially useful for vulnerable residents living with an underlying respiratory or cardiovascular condition, as high air pollution has the potential to severely worsen their symptoms. The service warns residents in advance of high pollution episodes and provide them with a health protection advice, e.g. to carry their medication and avoid strenuous activities outside.

Table 4.1 Air quality action plan measures

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	Comments
1	<b>Lowering the speed limit to 20 mph on Guildford Road</b>	Traffic Management	Reduction of speed limits, 20mph zones	WBC	N/a	N/a	Reduced NO <sub>2</sub> levels monitored	Medium	N/a	N/a	Speed limits signs could be introduced rather than speed bump as they increase stop-start driving conditions. However, this measure is considered unsuitable for the Guildford Road AQMA
2	<b>Discourage idling by any vehicles on Guildford Road</b>	Traffic Management	Anti-idling enforcement	WBC	N/a	N/a	Reduced NO <sub>2</sub> levels monitored	Medium	N/a	N/a	Signs could be put in place in the area to discourage idling. On-the-spot fines should be introduced. However, this measure is considered inappropriate for Guildford Road AQMA
3	<b>Introduce temporary traffic signals at the junction between Guildford Road, Constitution Hill and Mount Hermon Road in case of traffic diversion</b>	Traffic Management	Other	WBC	N/a	N/a	Reduced NO <sub>2</sub> levels monitored and decreased traffic congestion	Medium	N/a	N/a	In the event of traffic diversion into Guildford Road, traffic signals at the junction could allow a more fluid traffic flow and reduce congestion. However, this measure is considered inappropriate for the Guildford Road AQMA.
4	<b>Provision of cycling infrastructure on Guildford Road and at the junction with</b>	Transport Planning and Infrastructure	Cycle network	WBC	N/a	N/a	Reduced NO <sub>2</sub> levels monitored and decreased traffic congestion	Low	N/a	N/a	Introduction of cycle lanes on Guildford Road and at the junction would encourage residents to cycle.

Constitution Hill and Mount Hermon Road											
5	<b>Installation of residential electric charge point in Guilford Road neighbourhood</b>	Promoting Low Emission Transport	Procuring alternative refuelling infrastructure to promote Low Emission Vehicles, EV recharging	WBC	N/a	N/a	Reduced NO <sub>2</sub> levels monitored	High	N/a	N/a	Installation of residential charge point close to houses would increase the uptake of low and zero emission vehicles.
6	<b>Promotion of airAlert, the air quality early warning for Surrey</b>	Public Information	Via other mechanisms	WBC	N/a	N/a	Increased public awareness	Low	N/a	N/a	The airAlert service sends advanced high pollution warnings to vulnerable residents. This allows them to protect their health by modifying their behaviour (i.e. carrying medications, avoiding exercising outdoors)

## 5. Progress monitoring

The progress towards compliance will be tracked using the monitoring data collected by WBC and reported in the Annual Status Reports produced by the Council.

In accordance with Defra guidance<sup>12</sup> the AQMA will be revoked when monitoring results from several years show no exceedance of the AQO, so that a permanent improvement in air quality can be demonstrated. There will also be consideration of national trends in emissions, as well as local factors that may affect the AQMA, including measures introduced as part of the Action Plan, together with information from national monitoring on high and low pollution years.

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<sup>12</sup> Defra LAQM Support Website. Revoking an AQMA <http://laqm.defra.gov.uk/review-and-assessment/declare-or-revoke-aqmas/revoking-aqma.html> - Accessed June 2017

## 6. Consultation and stakeholder engagement

This AQAP was prepared by Amec Foster Wheeler on behalf by the Neighbourhood Service department of Woking Borough Council.

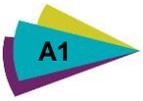
This AQAP will be subject to an annual review, appraisal of progress and reporting to the relevant Council Panel. Progress will be reported in the Annual Progress Reports produced by the Council.

Any comments should be addressed to:

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# Appendix A

## Guildford Road AQMA boundary

