2012 Air Quality Updating and Screening Assessment for Waverley Borough Council

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

April 2012

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Executive Summary

This report presents the findings of Waverley Borough Council's Updating and Screening Assessment (USA) of air quality within the Borough. The USA evaluates new and changed sources to identify those that may give rise to a risk of an exceedence of an air quality objective. Results from monitoring within the Borough are also presented and evaluated in relation to the objectives. Where a risk of an exceedence is identified at a relevant location, the Council will proceed to a Detailed Assessment.

Previous Review and Assessments have concluded that concentrations of carbon monoxide, benzene, 1,3-butadiene, lead, sulphur dioxide and PM_{10} are compliant with the relevant objectives. Air Quality Management Areas (AQMAs) have however been declared at three locations for exceedences of the annual mean nitrogen dioxide objective.

Monitoring data for 2011 show that there are measured exceedences of the annual mean nitrogen dioxide objective at locations representative of relevant exposure; it will therefore be necessary to proceed to Detailed Assessments for these areas. The USA has not, however, identified any significant changes in emissions sources within the Waverley Borough Council area.

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1 Introduction

1.1 Description of Local Authority Area

Waverley Borough is situated in the southwestern corner of Surrey. The Borough is largely rural with four main population centres: Farnham, Godalming, Haslemere and Cranleigh. Road traffic has been recognised as the major source of pollution in the Borough.

Two main trunk routes cross Waverley: the A31 London to Winchester and the A3 London to Portsmouth dual carriageways. The Hindhead Bypass of the A3 opened in July 2011, which was constructed to relieve a serious bottleneck through the village of Hindhead.

1.2 Purpose of Report

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

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

1.3 Air Quality Objectives

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

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

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	16.25μg/m^3	Running annual mean	31.12.2003
	5.0μg/m^3	Annual mean	31.12.2010
1,3-Butadiene	2.25μg/m^3	Running annual mean	31.12.2003
Carbon monoxide	10.0mg/m^3	Running 8-hour mean	31.12.2003
Lead	0.5μg/m^3	Annual mean	31.12.2004
	0.25μg/m^3	Annual mean	31.12.2008
Nitrogen dioxide	200μg/m^3 not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40μg/m^3	Annual mean	31.12.2005
Particles (PM_{10}) (gravimetric)	50μg/m^3, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40μg/m^3	Annual mean	31.12.2004
Sulphur dioxide	350μg/m^3, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125μg/m^3, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266μg/m^3, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

1.4 Summary of Previous Review and Assessments

In addition to the Updating and Screening Assessments (USA) and Progress Reports required by each round of the Review and Assessment process, Waverley Borough Council has to date completed a Detailed Assessment (DA) of air quality in Farnham, Godalming and Hindhead (2004) and an associated Further Assessment (2007). In 2011, an additional Detailed Assessment was carried out considering air quality in proximity to the Farnham Level Crossing.

The first round of review and assessment concluded that no exceedences of the air quality objectives were likely within the Borough and no Air Quality Management Areas (AQMAs) were required. The 2003 USA report required at the beginning of Round 2 concluded that exceedences of the annual mean nitrogen dioxide objective were possible, and consequently the 2004 DA was carried out. This confirmed that exceedences were likely, and three AQMAs were declared in 2005 for exceedences of the annual mean nitrogen dioxide objective in central Farnham, central Godalming and in Hindhead (Figures 1.1 to 1.3).

A Further Assessment was undertaken in 2007, which confirmed that the three AQMAs were still required, but that the Farnham AQMA should be extended. An Air Quality Action Plan has subsequently been put in place for the Farnham and Godalming AQMAs. The Hindhead Bypass (Hindhead Tunnel) was the main action for improving air quality within Hindhead; monitoring data in Hindhead will be carefully considered following the opening of the Bypass in 2011.

The fourth round of Review and Assessment began with the preparation of the 2009 Updating and Screening Assessment. This took into account updated guidance (LAQM.TG(09)), including revised criteria for the identification of narrow congested streets. Consequently one potential narrow congested street was identified, and the Council proceeded to carry out a DA.

The DA investigated air quality in the streets surrounding the Farnham railway level crossing, where traffic frequently queues. It concluded that concentrations of nitrogen dioxide are close to, but do not exceed the annual mean objective at locations of relevant exposure in proximity to the crossing, and an AQMA is not currently required. If concentrations measured at this location increase in future, the conclusion of the DA will be reconsidered.

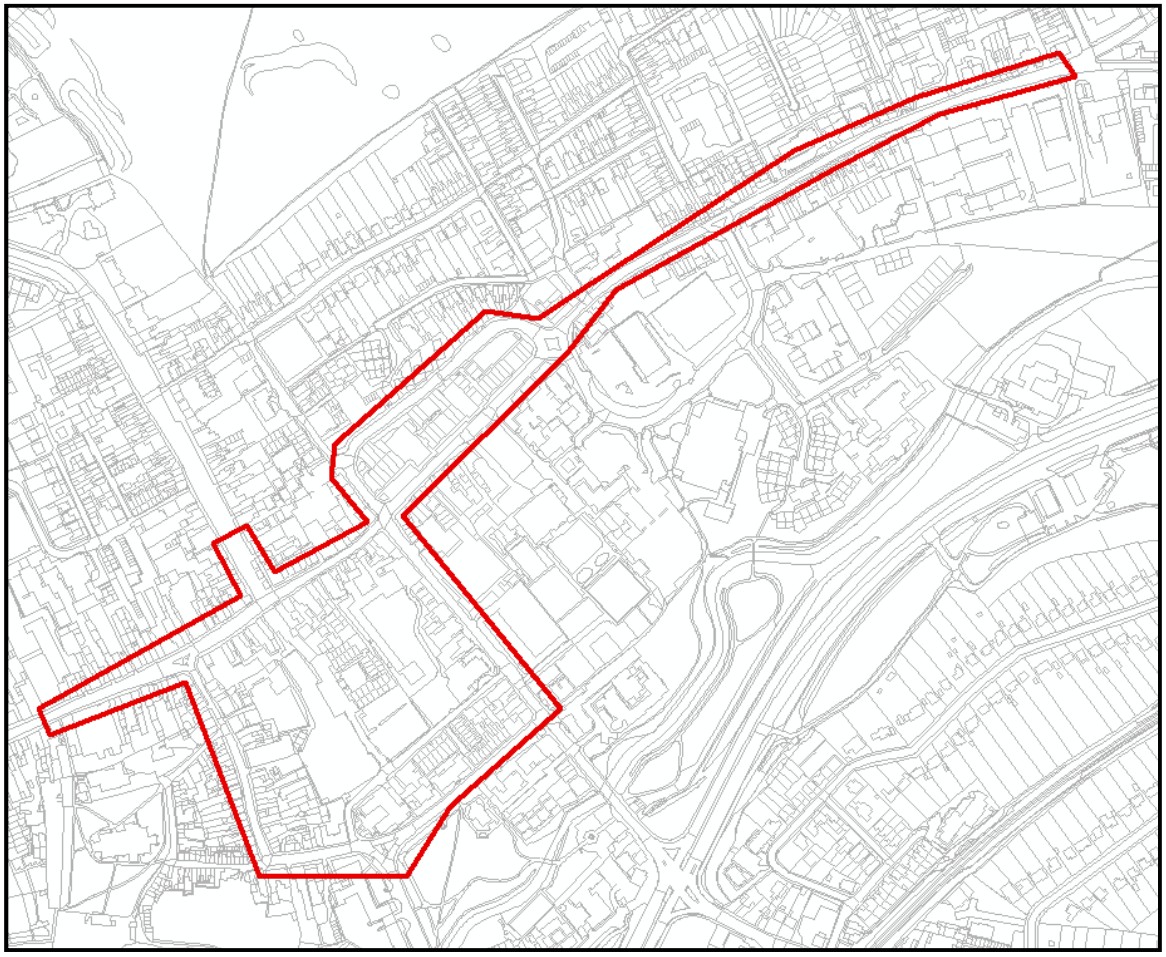


Figure 1.1 Farnham AQMA Boundary © Crown Copyright and database right 2012. Ordnance Survey LA100025451.

The Farnham AQMA (Figure 1.1) has been declared for an area which encompasses parts of Farnham town centre.

The Godalming AQMA (Figure 1.2) has been declared for an area which encompasses parts of Ockford Road and Flambard Way.

The Hindhead AQMA (Figure 1.3) has been declared for an area which encompasses parts of Portsmouth Road and London Road.

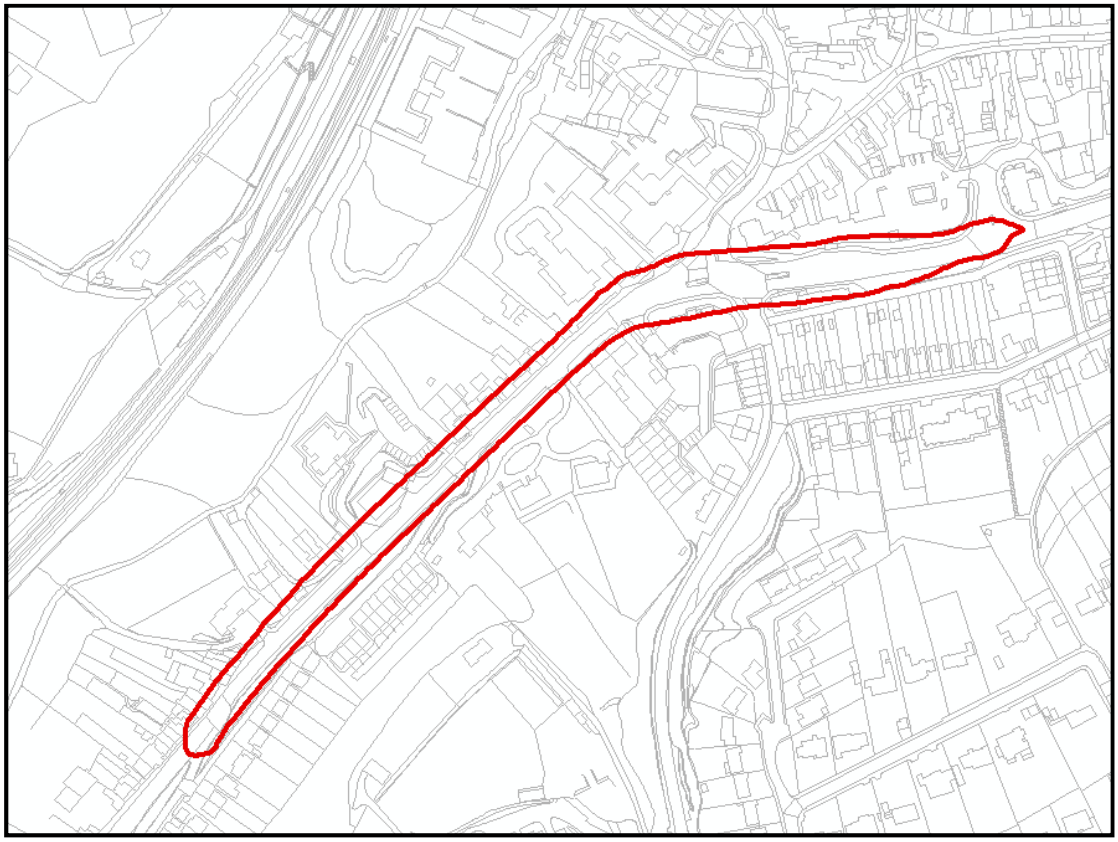


Figure 1.2 Godalming AQMA Boundary © Crown Copyright and database right 2012. Ordnance Survey LA100025451.

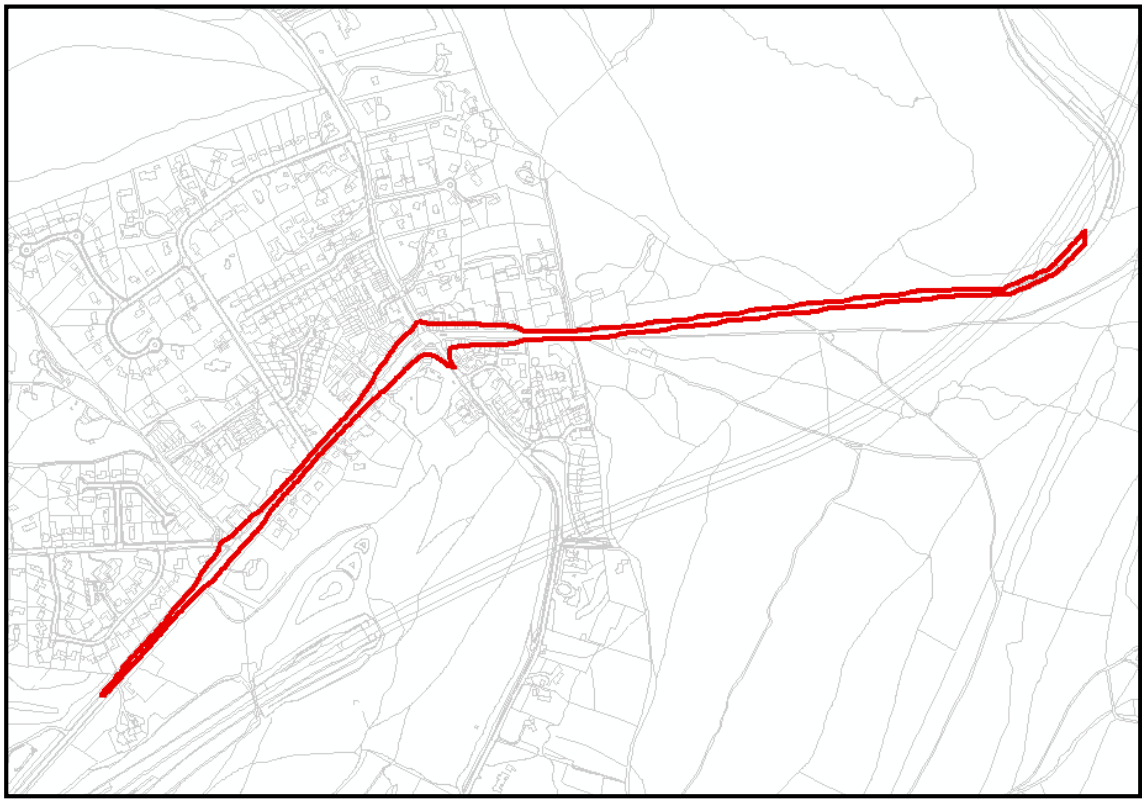


Figure 1.3 Hindhead AQMA Boundary © Crown Copyright and database right 2012. Ordnance Survey LA100025451.

2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

During 2011, monitoring was carried out by Waverley BC at 43 locations, including 3 sites where monitoring was carried out using automatic analysers with triplicate co-located diffusion tubes for the calculation of local bias adjustment factors. At each of these monitoring locations, nitrogen dioxide concentrations are measured; PM_{10} is also monitored at the Farnham automatic monitor.

2.1.1 Automatic Monitoring Sites

The three automatic monitors are located at roadside locations within, or adjacent to, each of the three AQMAs. All sites measure nitrogen dioxide, whilst the Farnham site also monitors PM_{10}. The location of each analyser is shown in Figures 2.1 to 2.3. No additional automatic monitoring stations have been established since the 2009 Updating and Screening Assessment. The equipment is serviced and calibrated on a monthly basis by Enviro Technology. Data from all three sites has been ratified by Air Quality Consultants. Further details of the QA/QC for the automatic monitors is presented in Appendix A.

The Farnham automatic monitoring site is located within the AQMA, at the junction of East Street (A325) and Bear Lane. Nitrogen dioxide concentrations are monitored using an API M200E chemiluminescence NO_x analyser, whilst PM_{10} concentrations are monitored using a Met One Beta-Attenuated (BAM) dust monitor.

The Godalming automatic monitoring site is located within the AQMA, adjacent to Ockford Road in Godalming town centre. It continuously monitors nitrogen dioxide concentrations using an API M200E chemiluminescence NO_x analyser.

The Hindhead automatic monitoring site is located at the edge of the Hindhead AQMA, close to the junction of the A3 Portsmouth Road and the A287 Hindhead Road. Nitrogen dioxide concentrations are monitored continuously using an API M200E chemiluminescence NO_x analyser.

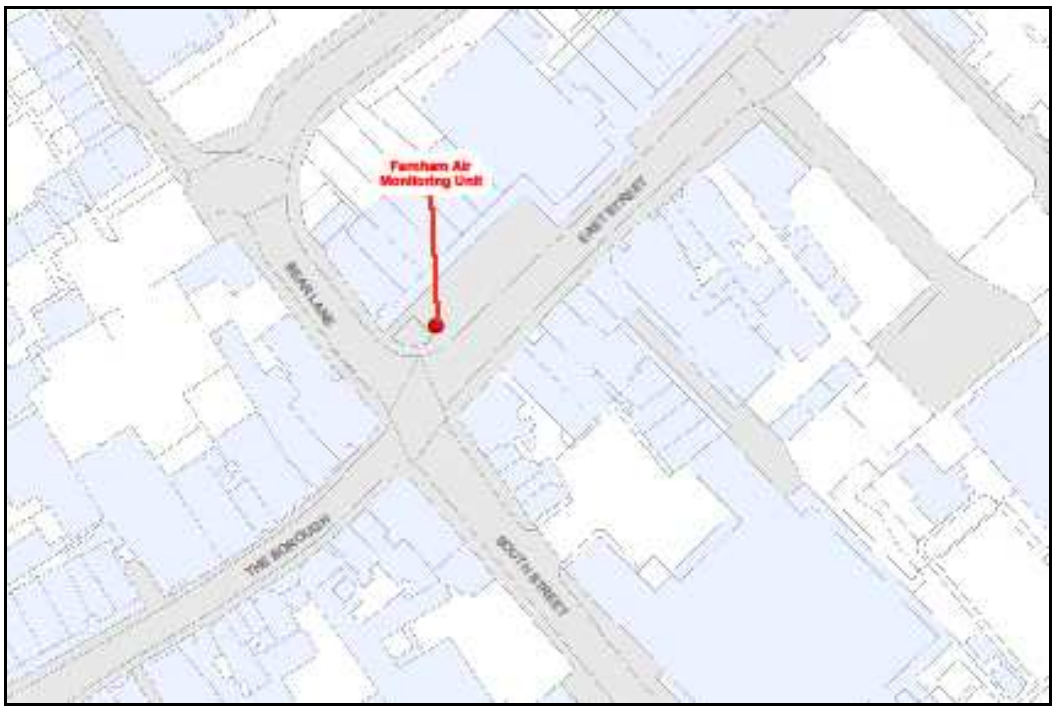


Figure 2.1 Farnham Automatic Monitoring Station © Crown Copyright and database right 2012. Ordnance Survey LA100025451

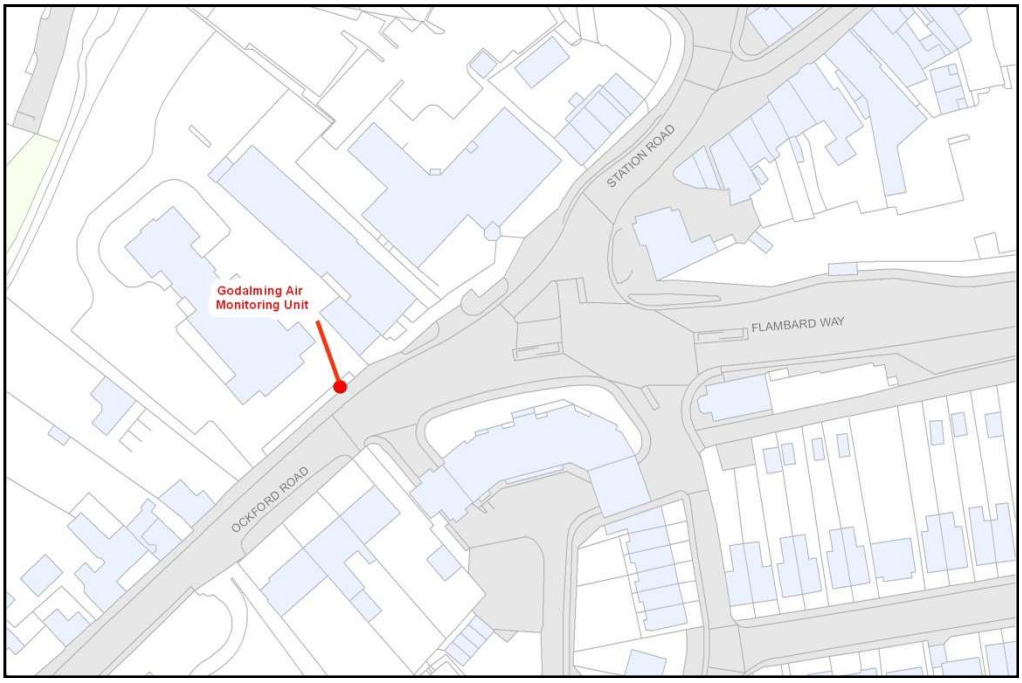


Figure 2.2 Godalming Automatic Monitoring Station © Crown Copyright and database right 2012. Ordnance Survey LA100025451

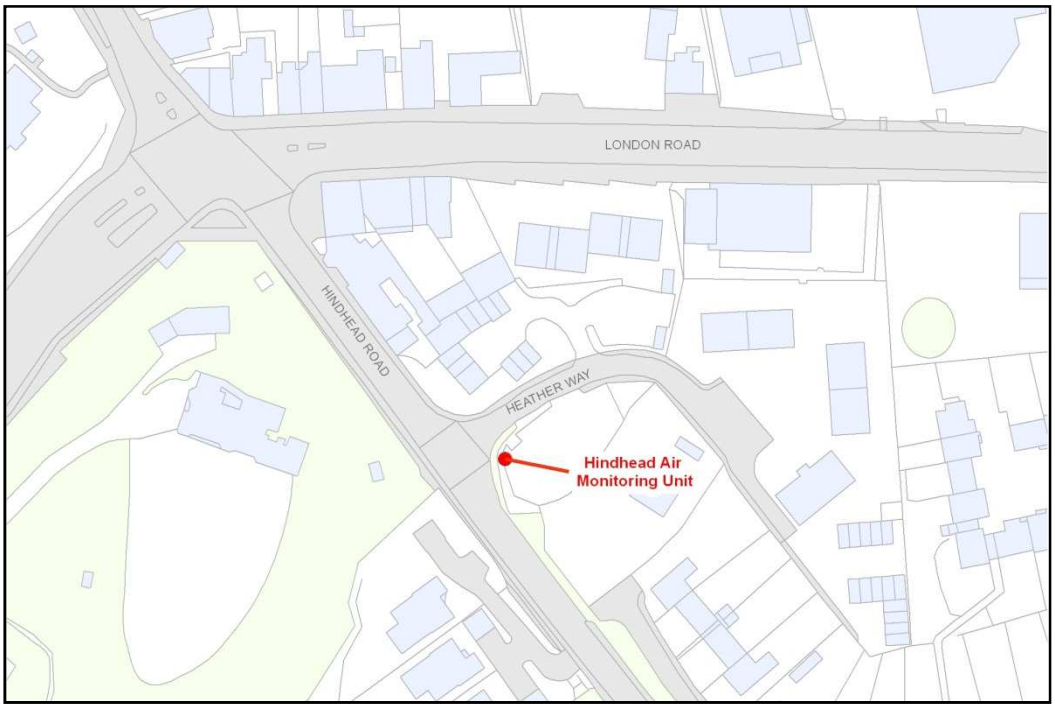


Figure 2.3 Hindhead Automatic Monitoring Station © Crown Copyright and database right 2012. Ordnance Survey LA100025451

Table 2.1 Details of Automatic Monitoring Sites

Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Pollutants Monitored	In AQMA?	Monitoring Technique	Relevant Exposure?	Distance to kerb of nearest road	Does this location represent worst-case exposure?
Farnham	Roadside	484087	146972	NO_2, PM_{10}	Y	Chemiluminescence, BAM	Y (20m)	5m	Y
Godalming	Roadside	496693	143695	NO_2	Y	Chemiluminescence	Y (25m)	3m	Y
Hindhead	Roadside	488819	135639	NO_2	N	Chemiluminescence	Y (20m)	7m	N

2.1.2 Non-Automatic Monitoring Sites

Nitrogen dioxide is monitored at 43 sites across the Waverley BC area: 20 sites in Farnham; 3 sites in Hindhead; 8 sites in Godalming; 4 sites in Haslemere; and a further 8 sites in locations across Cranleigh, Bramley, Milford and Dunsfold (see detailed maps in Appendix B). Triplicate diffusion tubes are co-located with each of the automatic analysers.

The diffusion tubes are prepared and analysed by Lambeth Scientific Services using the 50% TEA in acetone method. Tubes are changed on a monthly basis. See Appendix A for details of QA/QC of the diffusion tubes.

In the second half of 2011, two additional diffusion tubes monitoring sites (Farn18 and Farn19) were established, following the recommendations of the Farnham level crossing DA. In addition, the God7 site was moved to a new location across the road to avoid the constant loss of data from this site.

Table 2.2 Details of Non-Automatic Monitoring Sites

Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Pollutants Monitored	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure?	Distance to kerb of nearest road	Does this location represent worst-case exposure?
Farn1	Roadside	484020	146910	NO_2	Y	N	Next to café with pavement seating	1.8m	Y
Farn1B	Kerbside	484064	146928	NO_2	Y	N	N	0.9m	
Farn2	Roadside	483907	146831	NO_2	Y	N	Y15m	1.5m	
Farn3	Urban Background	483654	146600	NO_2	N	N	Y10m	N/A	
Farn4	Urban Background	483407	146794	NO_2	N	N	N	N/A	
Farn5	Roadside	484423	147233	NO_2	Y	N	Y10m	2.1m	
Farn6	Kerbside	483915	149039	NO_2	N	N	Y3.0m	1.0m	
Farn7	Roadside	484233	146782	NO_2	On Boundary	N	N	5.0m	
Farn8A/B/C	Roadside	484087	146972	NO_2	Y	Y	15m from pavement café	3.0m	
Farn9	Roadside	484761	149431	NO_2	N	N	Y2.0m	2.0m	
Farn10	Roadside	483152	148703	NO_2	N	N	Y20m	1.7m	
Farn11	Roadside	482717	145183	NO_2	N	N	Y6.0m	2.0m	
Farn12	Roadside	482766	145632	NO_2	N	N	Y2.0m	2.0m	
Farn13	Roadside	484371	146624	NO_2	N	N	Y0m	3.0m	Y
Farn14A/B	Roadside	484407	146603	NO_2	N	N	Y0m	2.0m	Y
Farn15	Roadside	484523	146490	NO_2	N	N	Y10m	1.5m	
Farn16	Roadside	484571	146556	NO_2	N	N	Y11m	0.5m	Y
Farn17	Roadside	484735	146540	NO_2	N	N	Y15m	0.5m	Y
Farn18	Roadside	484435	146678	NO_2	N	N	Y0m	21m	
Farn19	Roadside	484620	146493	NO_2	N	N	Y0m	0.5m	Y
God1	Roadside	496497	143508	NO_2	Y	N	Y0m	7.0m	

Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Pollutants Monitored	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure?	Distance to kerb of nearest road	Does this location represent worst-case exposure?
God2	Roadside	497294	143981	NO_2	N	N	N	2.0m	
God3	Roadside	497376	144153	NO_2	N	N	Y2.0m	2.0m	Y
God4	Roadside	497320	143864	NO_2	N	N	Y2.0m	1.9m	
God5	Roadside	496740	143700	NO_2	Y	N	Y30m	1.5m	
God6	Roadside	497387	143437	NO_2	N	N	Y1.0m	2.0m	
God7	Kerbside	496778	143656	NO_2	N	N	Y0m	0m	Y
God8A/B/C	Roadside	496693	143695	NO_2	Y	Y	Y0m	3m	Y
Pet1	Roadside	494483	141316	NO_2	N	N	Y2m	3.5m	
Hind1	Kerbside	488774	135705	NO_2	Y	N	Y20m	0.8m	Y
Hind2	Urban Background	488095	134369	NO_2	N	N	N	N/A	
Hasl1	Roadside	490486	132819	NO_2	N	N	N	2.2m	
Hasl2	Urban Background	489528	133005	NO_2	N	N	N	NA	
Hasl3	Roadside	490625	133143	NO_2	N	N	Y0m	1.5m	
Hasl4	Roadside	489090	132842	NO_2	N	N	Y1.6m	1.5m	
AU1/2/3	Roadside	488819	135639	NO_2	N	Y	Y10m	3.2m	
Cran1	Roadside	505808	139078	NO_2	N	N	N	1.3m	
Cran2	Urban Background	506883	138514	NO_2	N	N	Y	N/A	
Cran4	Roadside	504760	140683	NO_2	N	N	Y5.0m	1.7m	Y
Bram2	Roadside	501498	144049	NO_2	N	N	Y0m	3.7m	Y
Bram3	Roadside	500908	144780	NO_2	N	N	N	3.6m	
Dun1	Roadside	504051	135373	NO_2	N	N	N	5.0m	Y
Dun2	Roadside	502765	137319	NO_2	N	N	Y0m	5.0m	Y

2.2 Comparison of Monitoring Results with AQ Objectives

This section summarises air quality monitoring data measured within the Waverley BC area.

2.2.1 Nitrogen Dioxide

Automatic Monitoring Data

In 2011, measured concentrations at each automatic monitoring station reduced relative to concentrations measured in 2010. Concentrations at all three sites were below the annual mean objective in 2011. Figure 2.4 shows that overall at the Farnham and Godalming monitoring sites, there has been a slight reduction in concentrations over the 2007 – 2011 period.

At the Hindhead site there was a significant increase in concentrations in 2010, although concentrations remained below the annual mean nitrogen dioxide objective. It is not yet clear from the data whether the opening of the Hindhead Bypass has improved air quality within Hindhead, however its opening has not led to a deterioration in air quality.

The hourly mean objective has not been exceeded at any of the monitoring sites over the last five years. The number of hours with measured concentrations greater than 200μg/m^3 is well below the 18 permitted (or the 99.8th percentile is well below 200).

Data capture for the automatic sites was greater than 90% at all sites, apart from at Godalming, where the data capture was 89% as a result of communication issues in January 2011.

Table 2.3 Results of Automatic Monitoring of Nitrogen Dioxide: Comparison with Annual Mean Objective

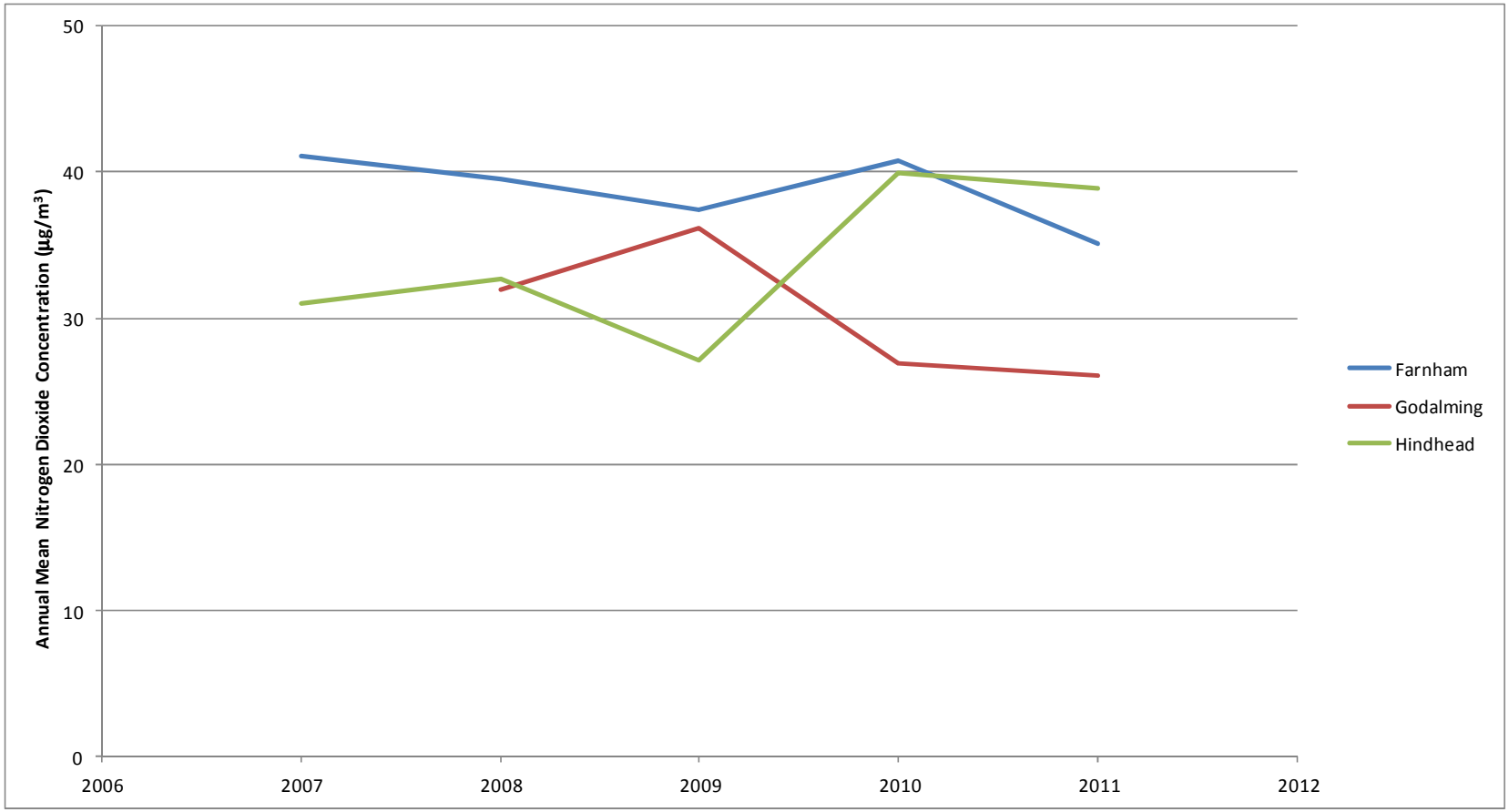
Site ID	Site Type	Within AQMA?	Data Capture 2011 (%)	Annual Mean Concentration (µg/m^3)				
				2007	2008	2009	2010	2011
Farnham	Roadside	Y	98	**41.1**	39.5	37.4	**40.8**	35.1
Godalming	Roadside	Y	89	N/A	32.0	36.2	26.9	26.1
Hindhead	Roadside	N	94	31.0	32.7	27.1	39.9	38.9
Objective				**40**				

Table 2.4 Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with 1-hour Mean Objective

Site ID	Site Type	Within AQMA?	Data Capture 2011 (%)	Number of Exceedences of Hourly Mean (200µg/m^3) [a]				
				2007	2008	2009	2010	2011
Farnham	Roadside	Y	98	1	0 (93)	0 (175)	0 (115)	0
Godalming	Roadside	Y	89	N/A	0 (143)	0 (145)	0 (104)	2 (104)
Hindhead	Roadside	N	94	0	0 (112)	0 (105)	1 (117)	0
Objective				**18 (200)**				

[a] Where data capture was less than 90%, the 99.8th percentile of hourly means in presented in brackets.

Figure 2.4 Trends in Annual Mean Nitrogen Dioxide Concentrations Measured at Automatic Monitoring Sites



Diffusion Tube Monitoring Data

Measured concentrations at the 43 diffusion tube monitoring sites in 2011 are presented in Table 2.5. Concentrations since 2007, at all sites where monitoring data are available, are presented in Table 2.6.

Data capture for a number of the diffusion tube sites was below 75%, and these data have been annualised following guidance in LAQM.TG(09). Further details are presented in Appendix A. Local bias adjustment factors were calculated from each of the three co-location studies. The factors calculated for Farnham and Hindhead were applied to diffusion tubes in those areas. The Godalming factor was based on only 9 months of data, as the co-location study commenced at the end of March 2011. For this reason, and because the factor calculated is significantly lower than the Farnham and Hindhead factors, the Godalming factor was not used to adjust the Godalming diffusion tube data. Instead, for tubes in Godalming, and other tubes outside of Farnham and Hindhead, an average factor was applied to the diffusion tubes. Further details are provided in Appendix A.

Concentrations have reduced in 2011 relative to 2010 concentrations at the majority of locations. The increase in concentrations at God7 is due to the relocation of the tube between 2010 and 2011. At the three other sites where increases were measured (Farn13, Hasl3 and AU1/2/3), the increase was less than 1μg/m^3. Overall however, between 2007 and 2011, concentrations have generally increased at the majority of sites.

Exceedences of the annual mean objective were measured at 10 sites during 2011, five of which are outside of existing AQMAs.

Farn13 and Farn14 are within the area recently investigated as part of the Detailed Assessment (Farnham level crossing). Concentrations at both locations have increased relative to those used in the DA, despite Farn13 being relocated such that it is now closer in height to relevant residential exposure (which is at first floor). Both tubes are located at the same distance from the road as the façade of the nearest properties, however Farn14 is located 2m closer to the level crossing than the nearest property, and residential exposure is located at first floor in this area. The DA predicted concentrations on Station Hill at ground floor level of between 47.7 and 50.4μg/m^3; by first floor level, concentrations were predicted to be around 14-15μg/m^3 lower. The measured concentration at Farn14 in 2011 was 54.3μg/m^3; based on the findings of the modelling, concentrations at first floor level are likely to be approaching, or just exceeding the annual mean objective. Farn14 is, however, located closer to the level crossing, which is the cause of the queuing, than the closest property. By Farn13, concentrations have reduced by almost 13μg/m^3; it is therefore likely that concentrations at the closest residential property to the level crossing will be below the annual mean objective. Efforts will be made to locate a

diffusion tube on the façade of the residential property at first floor level at 5 Station Hill in order to confirm that there are no exceedences at locations of relevant exposure.

The monitoring site God4 has measured exceedences of the annual mean objective for a number of years. This site was classified as being within the Godalming AQMA, however this has subsequently been found to be incorrect. The monitoring site is not located adjacent to relevant exposure, however there are residential properties a similar distance to the road approximately 30m to the west of the monitoring site adjacent to a junction. It will therefore be necessary to proceed to a Detailed Assessment for this location.

The monitoring site God7 was relocated in June 2011 to the opposite side of the road, due to significant tube losses in its original location. The measured concentration presented thus represents a 2011 annual mean equivalent concentration (it has been annualised), and therefore has a greater degree of uncertainty associated with it. The concentration is, however, significantly above the annual mean objective, and the tube location is representative of relevant exposure. A Detailed Assessment will therefore be necessary for this location.

Monitoring at Hasl3 is not carried out on the façade of relevant exposure due to difficulties locating the tube, however, there are properties at a similar distance from the High Street within proximity to the monitor. It will therefore be necessary to carry out a Detailed Assessment for this location.

Table 2.5 Results of Nitrogen Dioxide Diffusion Tubes in 2011 (Bias Adjusted)

Site ID	Location	Site Type	Within AQMA?	Triplicate or Co-located Tube	Data Capture (Months)	2011 Annual mean concentration ($\mu g/m^3$)[a]
Farn1	Café Rouge	Roadside	Y	N	10	**52.6**
Farn1B	Opposite Farn1	Kerbside	Y	N	10	**52.3**
Farn2	Roundabout West St and Downing St	Roadside	Y	N	9	**48.0**
Farn3	Bishopsmead, off West St	Urban Background	N	N	11	16.3
Farn4	Potters Gate School	Urban Background	N	N	5	17.6
Farn5	East St, St James House	Roadside	Y	N	9	38.6
Farn6	No. 120, A3016, Upper Hale	Kerbside	N	N	12	35.9
Farn7	South St	Roadside	Y	N	12	34.6
Farn8A/B/C	Co-located with Farnham analyser	Roadside	Y	Y	12	35.3
Farn9	Lamppost outside 95 Farnborough Rd, close to junction with Alma Lane	Roadside	N	N	11	39.0
Farn10	Junction of Old Park Close / Folly Hill (A287)	Roadside	N	N	12	24.8
Farn11	The Street junction	Roadside	N	N	12	32.6
Farn12	Bottom of A325 Wrecclesham Rd	Roadside	N	N	8	36.4
Farn13	Tasty House, 1 Station Hill	Roadside	Y	N	12	**41.6**
Farn14A/B	Elmsleigh House Dental Clinic, Station Hill	Roadside	N	N	11	**54.3**
Farn15	Tilford Rd	Roadside	N	N	7	32.3
Farn16	2A-2B Waverley Rd	Roadside	Y	N	11	31.0
Farn17	23 Waverley Lane	Roadside	N	N	4	28.0
Farn18	1-6 Compton House	Roadside	N	N	7	33.2
Farn19	Waverley Arms	Roadside	N	N	7	33.7
God1	70 Flambards Way	Roadside	Y	N	12	34.1
God2	Bridge St	Roadside	N	N	12	26.7
God3	Bridge Rd, outside nursery	Roadside	N	N	9	36.4
God4	Police Station, Flambards Way	Roadside	Y	N	12	**45.4**
God5	Flambard Way / High St / Ockford Rd junction	Roadside	Y	N	11	**42.6**

Site ID	Location	Site Type	Within AQMA?	Triplicate or Co-located Tube	Data Capture (Months)	2011 Annual mean concentration (µg/m^3)[a]
God6	Brighton Rd, near Underhill Close	Roadside	N	N	12	27.9
God7	Opposite 22 Holloway Hill	Roadside	N	N	5	**49.2**
God8A/B/C	Co-located with Godalming analyser	Roadside	Y	Y	9	28.1
Pet1	Petworth Road	Roadside	N	N	8	23.2
Hind1	London Rd / Hindhead Rd	Kerbside	Y	N	10	**49.7**
Hind2	Grove School, High Pitfold	Urban Background	N	N	11	16.7
Hasl1	Town Hall, High St	Roadside	N	N	12	32.3
Hasl2	Car Park, Weydown Rd	Urban Background	N	N	10	19.3
Hasl3	High St	Roadside	N	N	12	**43.1**
Hasl4	90 – 98 Wey Hill	Roadside	N	N	11	37.7
AU1/2/3	Co-located with Hindhead analyser	Roadside	N	Y	12	37.9
Cran1	Barclays Bank, High St	Roadside	N	N	11	22.8
Cran2	Avenue Rd	Urban Background	N	N	12	14.1
Cran4	Nutshell House, Rowly	Roadside	N	N	12	24.0
Bram2	3 Hirst Hill Cottages	Roadside	N	N	12	25.8
Bram3	12 Bramley High St	Roadside	N	N	12	22.2
Dun1	Alfold traffic island	Roadside	N	N	11	26.0
Dun2	Stovolds Hill opposite The Old Farmhouse	Roadside	N	N	11	18.5

[a] Bias adjustment factors: Farnham = 1.08, Hindhead =1.14, Average =1.11. See Appendix A for further details.

Table 2.6 Results of Nitrogen Dioxide Diffusion Tubes, 2007 to 2011 (Bias Adjusted)

Site ID	Site Type	Within AQMA?	Annual mean concentration (μg/m^3)				
			2007 (Bias Adjustment Factor = 1.02)	2008 (Bias Adjustment Factor = 0.98)	2009 (Bias Adjustment Factor = 1.03)	2010 (Bias Adjustment Factor = 1.08)	2011 (Bias Adjustment Factor = 1.08 – 1.14)
Farn1	Roadside	Y	35.2	**50.3**	**46.2**	**57.5**	**52.6**
Farn1B	Kerbside	Y	**56.1**	**59.9**	**62.4**	**67.9**	**52.3**
Farn2	Roadside	Y	37.3	**45.5**	**40.7**	**54.9**	**48.0**
Farn3	Urban Background	N	15.6	18.6	16.3	21.2	16.3
Farn4	Urban Background	N	17.0	19.4	24.1	21.5	17.6
Farn5	Roadside	Y	40.0	39.3	**41.7**	**42.3**	38.6
Farn6	Kerbside	N	26.8	33.8	32.3	**41.9**	35.9
Farn7	Roadside	Y	28.0	33.4	36.2	39.5	34.6
Farn8A/B/C	Roadside	Y	**41.1**	36.6	35.9	**40.2**	35.3
Farn9	Roadside	N	22.0	-	38.6	**41.9**	39.0
Farn10	Roadside	N	20.8	23.8	24.9	31.5	24.8
Farn11	Roadside	N	39.6	**50.6**	**47.6**	**42.4**	32.6
Farn12	Roadside	N	-	-	37.2	**45.0**	36.4
Farn13	Roadside	Y	-	-	-	**41.4**	**41.6**
Farn14A/B	Roadside	N	-	-	-	**59.8**	**54.3**
Farn15	Roadside	N	-	-	-	37.2	32.3
Farn16	Roadside	Y	-	-	-	36.9	31.0
Farn17	Roadside	N	-	-	-	30.2	28.0
Farn18	Roadside	N	-	-	-	-	33.2
Farn19	Roadside	N	-	-	-	-	33.7
God1	Roadside	Y	26.2	32.9	37.0	37.1	34.1
God2	Roadside	N	19.6	20.3	20.0	29.1	26.7
God3	Roadside	N	-	-	32.6	39.4	36.4
God4	Roadside	Y	34.2	**46.4**	**44.5**	**53.4**	**45.4**
God5	Roadside	Y	38.6	**42.2**	38.3	**43.5**	**42.6**
God6	Roadside	N	-	-	27.4	33.4	27.9

Site ID	Site Type	Within AQMA?	Annual mean concentration (μg/m^3)				
			2007 (Bias Adjustment Factor = 1.02)	**2008 (Bias Adjustment Factor = 0.98)**	**2009 (Bias Adjustment Factor = 1.03)**	**2010 (Bias Adjustment Factor = 1.08)**	**2011 (Bias Adjustment Factor = 1.08 – 1.14)**
God7	Roadside	N	-	-	25.8	32.6	**49.2**
God8A/B/C	Roadside	Y	-	-	-	-	28.1
Pet1	Roadside	N	26.7	27.5	22.5	28.6	23.2
Hind1	Kerbside	Y	32.5	**57.1**	**54.7**	**52.5**	**49.7**
Hind2	Urban Background	N	15.5	15.3	19.6	19.2	16.7
Hasl1	Roadside	N	24.0	31.6	33.0	35.7	32.3
Hasl2	Urban Background	N	11.4	13.2	14.3	21.3	19.3
Hasl3	Roadside	N	39.3	**48.7**	**44.3**	**42.4**	**43.1**
Hasl4	Roadside	N	28.5	38.2	**43.3**	**45.7**	37.7
AU1/2/3	Roadside	N	29.4	35.6	35.6	37.5	37.9
Cran1	Roadside	N	18.1	21.9	21.0	27.7	22.8
Cran2	Urban Background	N	13.5	14.9	15.5	22.2	14.1
Cran4	Roadside	N	16.8	22.8	20.6	27.9	24.0
Bram2	Roadside	N	19.0	22.5	25.4	31.1	25.8
Bram3	Roadside	N	20.5	23.4	23.7	26.7	22.2
Dun1	Roadside	N	22.9	27.0	25.3	33.2	26.0
Dun2	Roadside	N	17.7	18.8	19.0	18.9	18.5
Objective			**40**	**40**	**40**	**40**	**40**

Figure 2.5 Trends in Annual Mean Nitrogen Dioxide Concentrations measured at Diffusion Tube Sites in Farnham

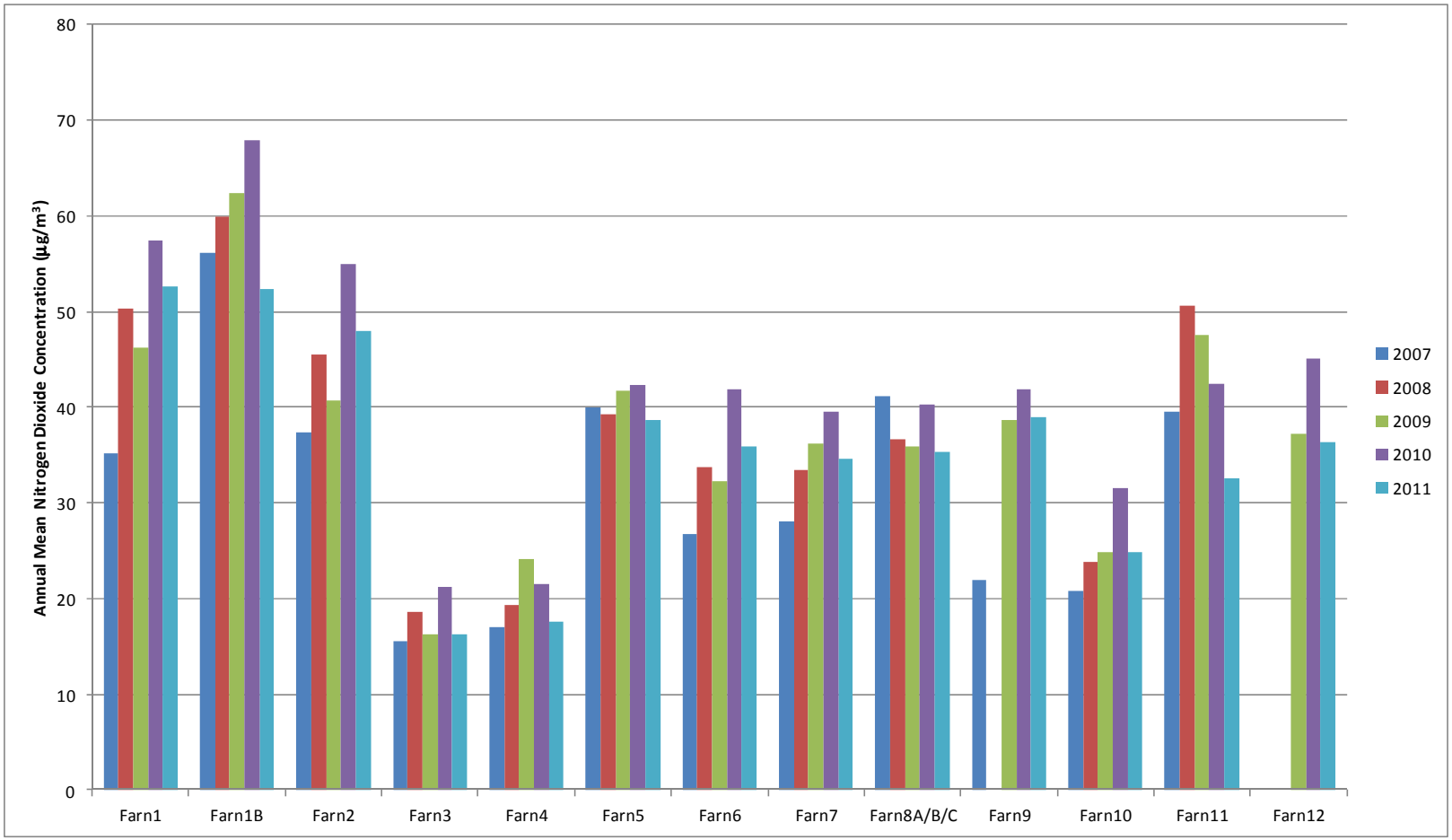


Figure 2.6 Trends in Annual Mean Nitrogen Dioxide Concentrations measured at Diffusion Tube Sites in Godalming

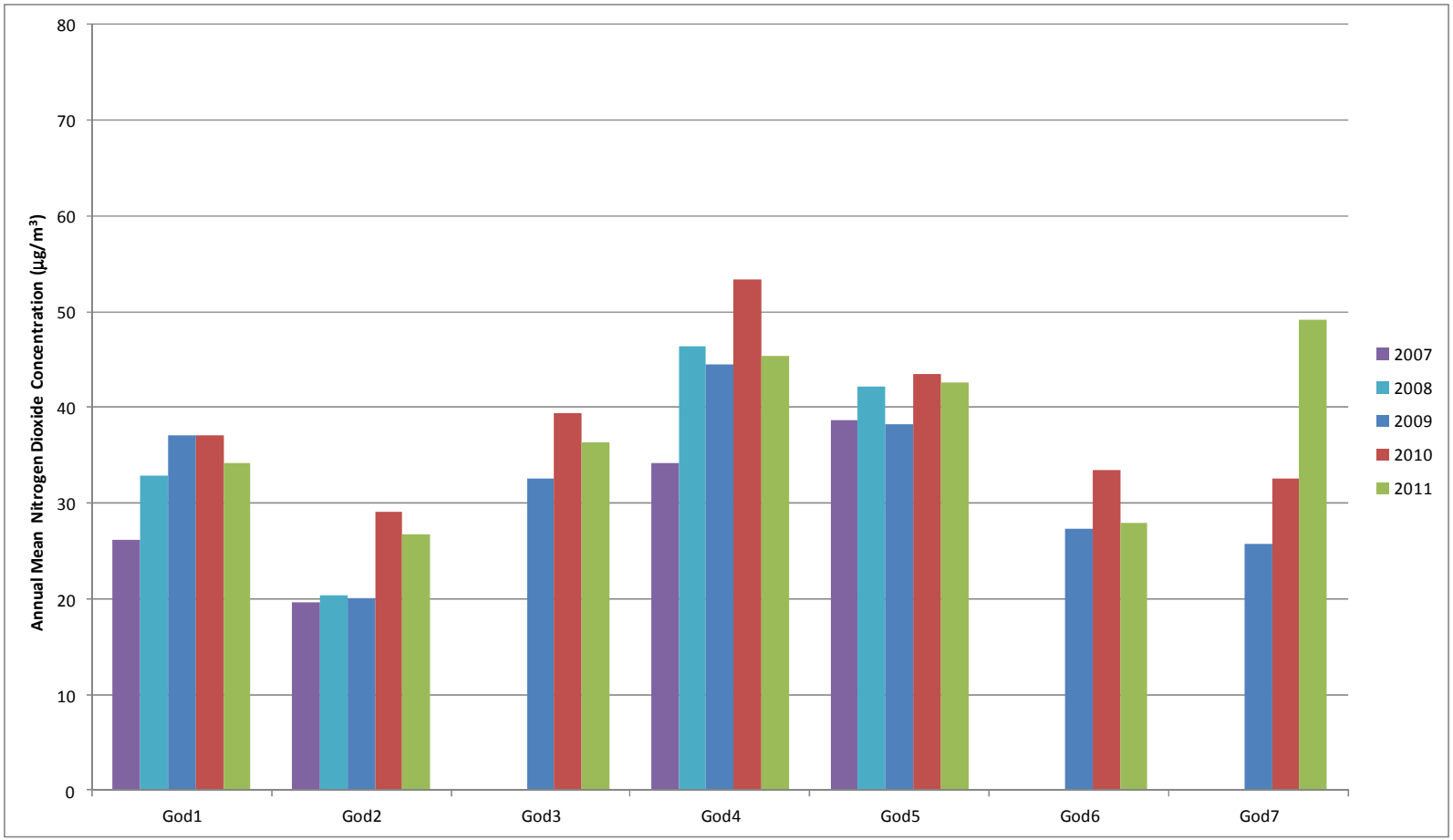
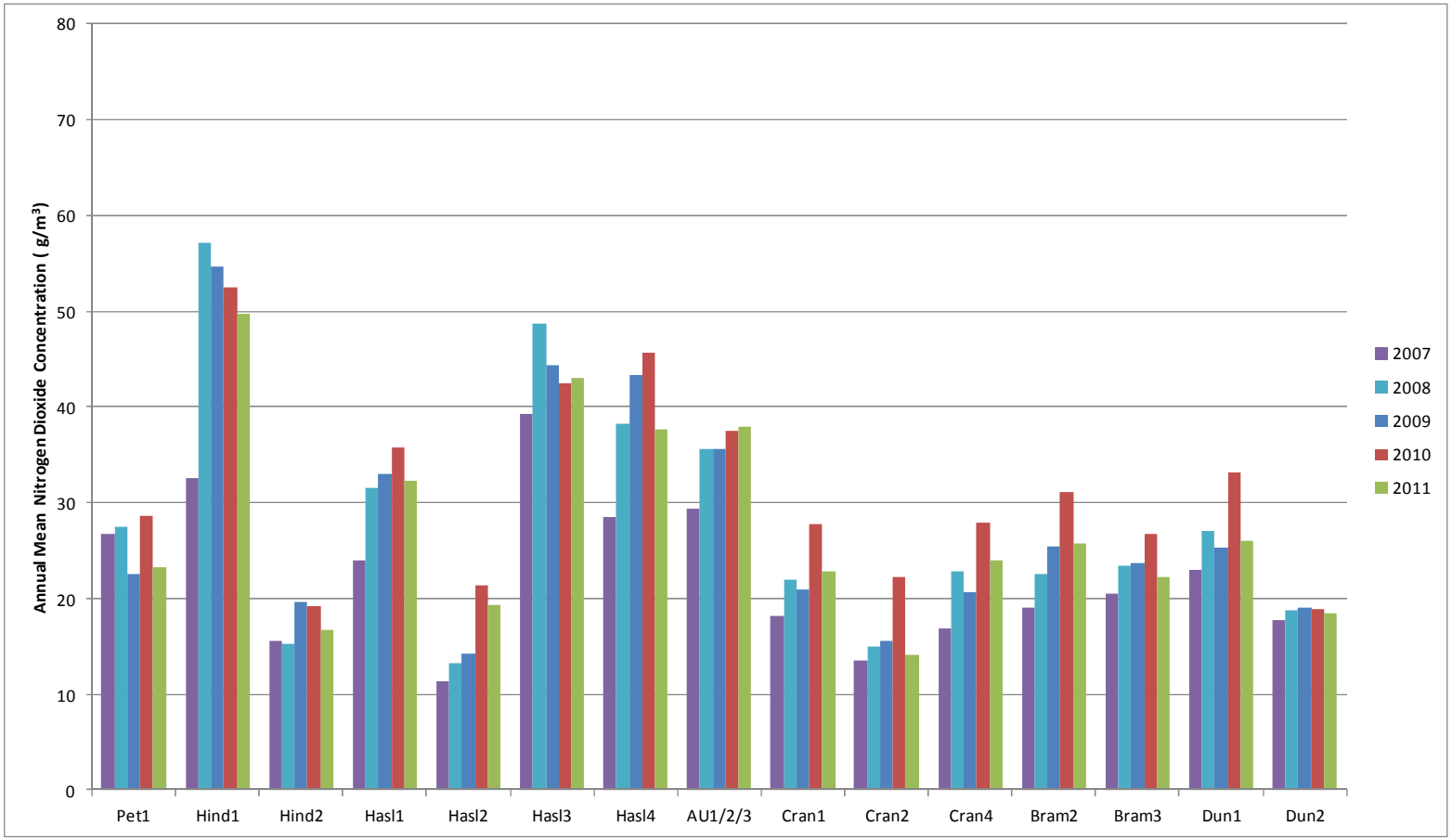


Figure 2.7 Trends in Annual Mean Nitrogen Dioxide Concentrations measured at Diffusion Tube Sites outside of Farnham and Godalming



2.2.2 PM_{10}

Measured PM_{10} concentrations have been well below the annual mean and daily mean objectives at the Farnham automatic analyser over the past five years. Exceedences of these objectives are unlikely at any location within the Waverley BC area.

Overall, concentrations have remained fairly constant, with no clear downward trend evident.

Table 2.7 Results of Automatic Monitoring of PM_{10}: Comparison with Annual Mean Objective

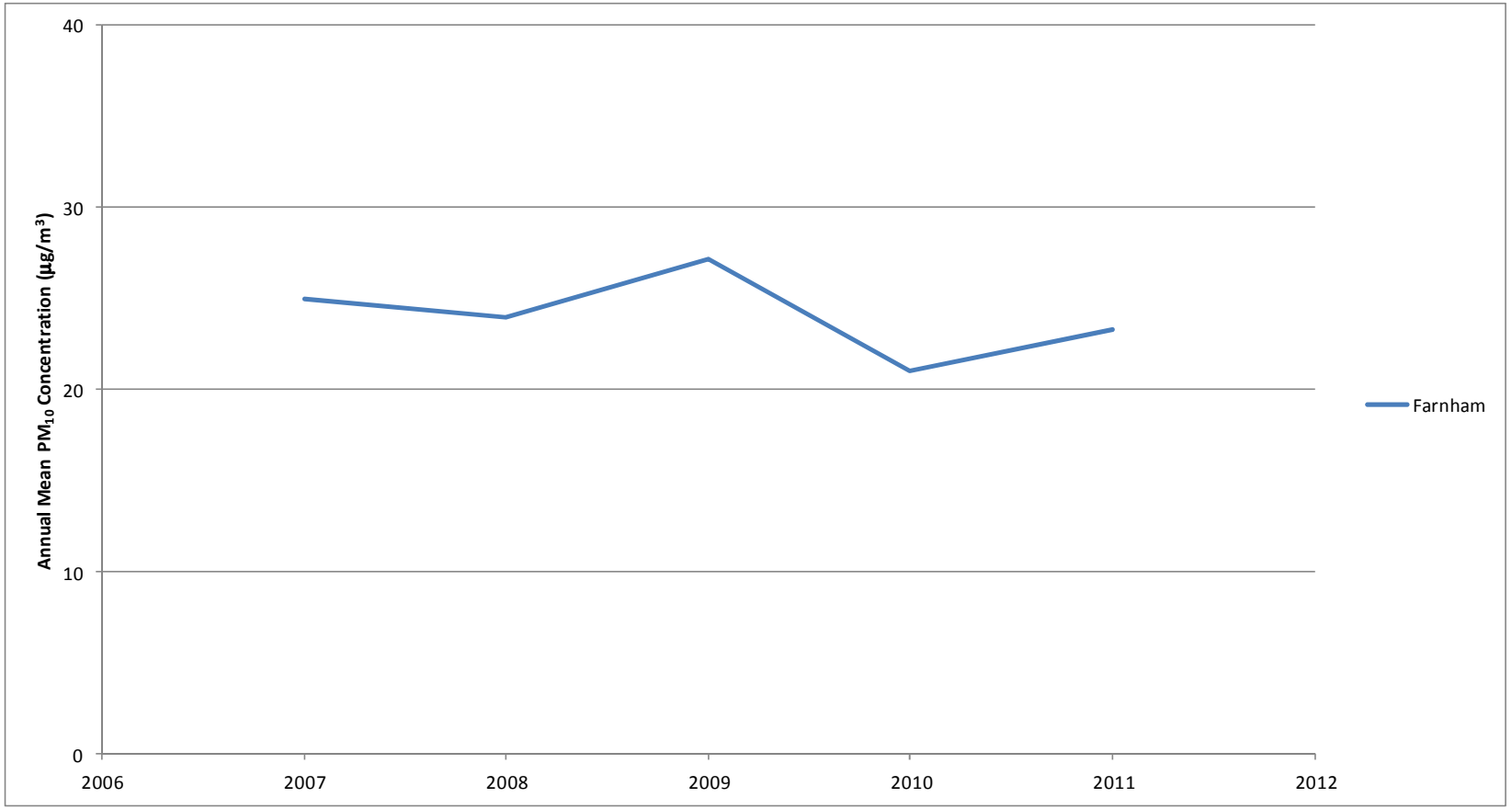
Site ID	Site Type	Within AQMA?	Data Capture 2011 (%)	Gravimetric Equivalent (Y or NA)	Annual Mean Concentration µg/m^3				
					2007	2008	2009	2010	2011
Farnham	Roadside	Y	96.4	Y	25	24	27.2	21.0	23.3
Objective					**40**				

Table 2.8 Results of Automatic Monitoring for PM_{10}: Comparison with 24-hour mean Objective

Site ID	Site Type	Within AQMA?	Data Capture 2011 (%)	Confirm Gravimetric Equivalent	Number of Exceedences of 24-Hour Mean (50 µg/m^3) [a]				
					2007	2008	2009	2010	2011
Farnham	Roadside	Y	96.4	Y	3	12 (35)	10 (47)	2	7
Objective					**35 (50)**				

[a] Where data capture was less than 90%, the 90th percentile of 24-hour means is presented in brackets

Figure 2.8 Trend in Annual Mean PM_{10} Concentrations



2.2.3 Sulphur Dioxide

Sulphur dioxide is not monitored within the Waverley Borough Council area.

2.2.4 Benzene

Benzene is not currently monitored within the Waverley Borough Council area. Monitoring ceased at the end of 2008; measured concentrations prior to cessation of monitoring were well below the objective.

2.2.5 Other pollutants monitored

No other pollutants are monitored within the Waverley Borough Council area.

2.2.6 Summary of Compliance with AQS Objectives

Measured nitrogen dioxide concentrations in 2011 have generally decreased from 2010, however, overall since 2007, concentrations in the area have increased. A number of monitoring sites at which exceedences of the annual mean objective have been measured in 2011 lie outside of existing AQMAs. It will therefore be necessary to proceed to a Detailed Assessment for these areas.

Waverley BC has measured concentrations of nitrogen dioxide above the annual mean objective at relevant locations outside of the existing AQMAs, and **will need to proceed to a Detailed Assessment**, for:

Flambard Way, Godalming, in proximity to the junction with Brighton Road / Wharf St

Holloway Hill, Godalming, in proximity to the junction with Flambard Way

High Street, Haslemere, between Cobden Lane and Church Road where properties lie in close proximity to the road.

3 Road Traffic Sources

3.1 Narrow Congested Streets with Residential Properties Close to the Kerb

The 2009 Updating and Screening Assessment identified one narrow congested street which met the revised assessment criteria, and which had not been previously assessed. As a consequence, a Detailed Assessment was carried out of air quality in Station Hill either side of the level crossing. The Detailed Assessment concluded that the annual mean objective was not exceeded at locations representing relevant exposure.

No additional narrow congested streets have been identified or created since the 2009 Updating and Screening Assessment. Monitoring within the Station Hill area suggests that concentrations have increased slightly since the Detailed Assessment was carried out, however it remains unlikely that exceedences of the annual mean objective will arise at locations of relevant exposure.

Waverley BC confirms that there are no new/newly identified congested streets with a flow above 5,000 vehicles per day and residential properties close to the kerb, that have not been adequately considered in previous rounds of Review and Assessment.

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

The criteria for assessing busy streets relevant for the hourly nitrogen dioxide objective are set out in Section A.2 of Box 5.3, LAQM.TG(09) and are unchanged from previous rounds of Review and Assessment. Busy streets where people may spend 1-hour or more close to traffic were considered in previous Updating and Screening Assessments, and no new locations have subsequently been identified.

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

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

The criteria for assessing roads with high flows of buses and/ or HGVs are set out in Section A.3 of Box 5.3, LAQM.TG(09) and are unchanged from previous rounds of Review and Assessment. Roads with high flows of buses and/ or HGVs were considered in previous Updating and Screening Assessments, and no new locations have subsequently been identified.

Waverley BC confirms that there are no new/newly identified roads with high flows of buses/HGVs.

3.4 Junctions

The criteria for assessing junctions are set out in Section A.4 of Box 5.3, LAQM.TG(09) and are unchanged from previous rounds of Review and Assessment. Busy junctions were considered in previous Updating and Screening Assessments, and where appropriate, were included in Detailed and Further Assessment, and in the subsequent AQMA declarations.

The Hindhead Bypass has been constructed and became operational in July 2011. An air quality assessment was carried out as part of the Environmental Impact Assessment submitted in support of the planning application. This concluded that the effects of the scheme on air quality would be positive, with no breaches of any of the air quality objectives at residential properties as a result of the scheme's implementation, and with the majority of local residents experiencing a reduction in exposure to traffic-related air pollutants. Now that the Bypass is operational, any changes to measured concentrations in the affected area will be considered in future years, and where appropriate, Detailed Assessments will be carried out. The Hindhead Bypass will remove traffic and reduce congestion within the Hindhead AQMA, and air quality is therefore expected to improve.

Waverley BC confirms that there are no new/newly identified busy junctions/busy roads which have not been adequately considered.

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

As described above, the Hindhead Bypass has been constructed and became operational in July 2011. An air quality assessment was carried out as part of the Environmental Impact Assessment submitted in support of the planning application. The Bypass will remove traffic and reduce congestion within the Hindhead AQMA, and air quality is therefore expected to improve. Future monitoring results will be considered.

Waverley BC confirms that there are no new / proposed roads constructed which have not been adequately considered, and conclude that it will not be necessary to proceed to a Detailed Assessment.

3.6 Roads with Significantly Changed Traffic Flows

The criteria for assessing new roads are set out in Section A.6 of Box 5.3, LAQM.TG(09) and are unchanged from previous rounds of Review and Assessment. Both Waverley Borough Council and Surrey County Council have confirmed that no significant changes meeting the criteria have occurred on existing roads in the Borough.

Waverley BC confirms that there are no new / newly identified roads with significantly changed traffic flows.

3.7 Bus and Coach Stations

Previous Updating and Screening Assessments have concluded that there are no bus stations within the Borough with more than 2,500 daily movements or with relevant exposure within 10m. Waverley Borough Council have confirmed that this continues to be the case.

Waverley BC confirms that there are no relevant bus stations in the Local Authority area.

4 Other Transport Sources

4.1 Airports

Farnborough Airport, located within the Rushmoor Borough Council area was granted permission at appeal to increase the number of flights. The airport now has permission for 50,000 aircraft movements. The airport is more than 1km from the Borough boundary, and the annual throughput remains well below 10 million passengers per year.

Dunsfold Aerodrome applied for permission to allow additional flights in connection with the 2012 Olympic Games, to a maximum of 6,600. Passenger throughput remains well below the 10 million criteria requiring a Detailed Assessment.

Waverley Borough Council confirms that there are no airports in the Local Authority area requiring assessment.

4.2 Railways (Diesel and Steam Trains)

Two railway lines cross Waverley Borough: one from Aldershot to Alton passing through Farnham, the other from Guildford to Portsmouth passing through Godalming and Haslmere. Both lines are electrified and so the majority of trains using these lines are electric-powered rather than diesel-powered.

4.2.1 Stationary Trains

The 2009 Updating and Screening Assessment did not identify any locations where diesel locomotives were stationary for more than 15 minutes on a regular basis. There has been no change to this position.

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

4.2.2 Moving Trains

Neither of the two rail lines through Waverley Borough are identified in Table 5.1 of LAQM.TG(09) as carrying large numbers of movements of diesel locomotives. This is consistent with the lines being electrified.

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

4.3 Ports (Shipping)

Waverley Borough is located inland and has no major rivers. No port facilities are present in the Borough.

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

5 Industrial Sources

5.1 Industrial Installations

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

The criteria for assessing industrial installations are set out in Section C.1 of Box 5.5, LAQM.TG(09) and are unchanged from previous rounds of Review and Assessment. There have been no new industrial installations within the Waverley Borough Council area since the 2009 USA was completed, and there are currently no proposals for any significant installations.

Waverley BC confirms that there are no new or proposed industrial installations for which planning approval has been granted within its area.

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

Waverley BC is not aware of any industrial installations which have significantly increased their emissions, and no new exposure has been introduced nearby to any existing installations. Data provided by the Environment Agency for the period 2008 to 2010 confirms that there were no significant changes to emissions from Part A installations regulated by themselves in the Surrey area.

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

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

There have been no new industrial installations within the Waverley Borough Council area since the 2009 USA was completed, and there are currently no proposals for any significant installations.

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

5.2 Major Fuel (Petrol) Storage Depots

The criteria for assessing major fuel (petrol) storage depots are set out in Section C.2 of Box 5.5, LAQM.TG(09) and are unchanged from previous rounds of Review and Assessment. The Updating and Screening Assessment of 2006 stated that there were no major fuel depots within the Borough and the Council has confirmed that this continues to be the case.

Waverley BC confirms that there are no major fuel (petrol) storage depots within the Local Authority area.

5.3 Petrol Stations

The criteria for assessing petrol stations are set out in Section C.3 of Box 5.5, LAQM.TG(09) and are unchanged from previous rounds of Review and Assessment. The Updating and Screening Assessment of 2006 stated that there were several petrol filling stations in the Borough with an annual throughput of more than 2 million litres per year, but that none were next to busy roads with more than 30,000 vehicles/day nor within 10m of a sensitive receptor. Waverley Borough Council confirmed in the 2009 USA that this position had not changed. Since then, no new facilities have been identified which meet the criteria requiring Detailed Assessment.

Waverley BC confirms that there are no petrol stations meeting the specified criteria**.**

5.4 Poultry Farms

The criteria for assessing poultry farms are set out in Section C.4 of Box 5.5, LAQM.TG(09); this was a new consideration for the 2009 Updating and Screening Assessment. The 2009 USA stated that there were no new or newly identified poultry farms were identified within the Borough which met the specified criteria; this position remains unchanged.

Waverley BC confirms that there are no poultry farms meeting the specified criteria.

6 Commercial and Domestic Sources

6.1 Biomass Combustion – Individual Installations

The criteria for assessing biomass combustion (individual installations) are set out in Section D.1a of Box 5.8, LAQM.TG(09). Since the 2009 USA, planning permission has been granted for the Tilford Complex and a replacement Leisure Centre in Farncombe. The Tilford Complex proposals include two biomass boilers, whilst the Leisure Centre also includes a biomass boiler.

Tilford Post Office and Garage Site, Tilford Street, Tilford, GU10 2BL

Two biomass boilers, with emissions from two stacks. In order to determine the impact from both stacks, emissions have been calculated from a combined stack of 0.283m diameter. The biomass toll provided on the Defra website has been used to determine the requirement for a Detailed Assessment. The maximum stack height that can be assessed using this tool is 40m; it has therefore been assumed that the stack is 40m, which is considered to be worst-case (as the stack is almost 60m).

Parameters:

Building Height:	59.4m
Stack Height:	59.6m
Stack Diameter:	0.2m (each stack)
Boilers:	2 x 60kW
Background PM_{10} in 2012:	13.8µg/m^3
Background NO_2 in 2012:	8.7µg/m^3

Parameters used in Biomass Calculator

Effective stack diameter:	0.283m
Building Height:	39.4m
Stack Height:	40m

Emissions, taken from the EMEP/EEA Air Pollutant Emission Inventory Guidebook 2009, for biomass boiler:

38g PM_{10}/GJ
211g NO_x/GJ

Emission rates calculated:
0.005g/s PM_{10}
0.025g/s NO_x
Assuming 100% NO_x conversion to NO_2 (as a worst-case): 0.025 g/s NO_2

Target Emission rates (from Biomass Calculator):
PM_{10}: 0.0126g/s
NO_2, annual mean: 0.0583g/s
NO_2, hourly mean: 0.0326g/s

The combined boiler emissions are smaller than the target emission rates, and therefore it is unlikely that emissions from the Tilford boilers will lead to any exceedences of the PM_{10} or nitrogen dioxide objectives.

Godalming Leisure Centre

Building Height: 6m
Stack Height: 9m
Stack Diameter: 0.2m
Boilers: 85kW
Background PM_{10} in 2012: 14.8µg/m^3
Background NO_2 in 2012: 11.3µg/m^3

Emissions (from manufacturer):
35g PM_{10}/GJ
76g NO_x/GJ

Emission rates calculated:
0.003g/s PM_{10}
0.006g/s NO_x
Assuming 100% NO_x conversion to NO_2: 0.006 g/s NO_2

Target Emission rates (from Biomass Calculator):
PM_{10}: 0.0285g/s
NO_2, annual mean: 0.1413g/s
NO_2, hourly mean: 0.0852g/s

The Godalming Leisure Centre boiler emissions are smaller than the target emission rates, and therefore it is unlikely that these emissions will lead to any exceedences of the PM_{10} or nitrogen dioxide objectives.

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

6.2 Biomass Combustion – Combined Impacts

The criteria for assessing biomass combustion (combined impacts) are set out in Section D.1b of Box 5.8, LAQM.TG(09). The estimated average PM_{10} background concentration in Waverley Borough in 2012 is 14.3 µg/m^3 (range 13.4 – 16.8 µg/m^3). Using the nomograms provided in TG(09) and data provided in Table 5.3, and assuming a worst-case background of 17 µg/m^3 in a large town, emissions of at least 6000 kg PM_{10} per year would be required in a square 500m by 500m in order for this type of emission source to be likely to lead to exceedence of the UK daily mean objective for PM_{10}. This is equivalent to over 200 households within a 500m by 500m grid square all burning wood in fireplaces as their primary fuel. Alternatively, there would need to be a minimum of 26,350m^2 of commercial floorspace (approximately equivalent to 10 large supermarkets) heated by biomass boilers within a 500m by 500m grid square all using wood as their primary fuel. Using this fact, and local knowledge of the district, it is considered highly unlikely that there are any areas of biomass combustion exceeding these criteria.

Waverley BC confirms that there are unlikely to be combined impacts from biomass combustion in the Local Authority area.

6.3 Domestic Solid-Fuel Burning

The criteria for assessing domestic solid-fuel burning are set out in Section D.2 of Box 5.8, LAQM.TG(09) and are unchanged from previous Review and Assessments. The 2006 USA concluded that there were no known areas of significant domestic coal or smokeless fuel burning, and that the likelihood of areas of domestic solid-fuel burning exceeding the criteria is highly unlikely. The Council has confirmed that this continues to be the case.

Waverley BC confirms that there are no areas of significant domestic fuel use in the Local Authority area.

7 Fugitive or Uncontrolled Sources

The 2009 Updating and Screening Assessment identified the following industrial processes within the Borough with the potential to emit fugitive dust:

- Timber process, Jewson Ltd, Farnham, EPA/TP/12
- Manufacture of plastic coating powder, Plascote Systems Ltd, Farnham, EPA/MCP/1
- Blending, packing, loading and use of bulk cement, RMC Readymix, Farnham, EPA/BC/11
- Manufacture of heavy clay goods, Swallow Tiles, Cranleigh, EPA/MHCG/28
- Blending, packing, loading and use of bulk cement, Tarmac Ltd, Farnham, EPA/BC/29
- Crushing and screening, Runfold South Recycling facility, Farnham, EPA/CS/14

No complaints had been received regarding fugitive dust problems caused by any of the above facilities, or any of the Borough's Landfill sites at the time of the last USA report in 2009. Waverley Borough Council has confirmed that there continues to be no complaints received regarding these processes.

No new potential fugitive or uncontrolled sources have been identified.

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

8 Conclusions and Proposed Actions

8.1 Conclusions from New Monitoring Data

A number of monitoring sites outside of existing AQMAs have measured exceedences of the annual mean nitrogen dioxide objective in 2011. It will therefore be necessary to proceed to Detailed Assessments for the following areas:

Flambard Way, Godalming, in proximity to the junction with Brighton Road / Wharf St

Holloway Hill, Godalming, in proximity to the junction with Flambard Way

High Street, Haslemere, between Cobden Lane and Church Road where properties lie in close proximity to the road.

8.2 Conclusions from Assessment of Sources

The Updating and Screening Assessment has not identified any significant changes to emissions sources within the Waverley BC area that will lead to a deterioration in air quality. There have been no new or significantly altered industrial processes, road, transport, commercial, domestic or fugitive sources of emissions for which more Detailed Assessment is required.

8.3 Proposed Actions

Detailed Assessments will be carried out as a consequence of measured exceedences of the annual mean nitrogen dioxide objective at locations representative of relevant exposure in the following areas:

Flambard Way, Godalming, in proximity to the junction with Brighton Road / Wharf St

Holloway Hill, Godalming, in proximity to the junction with Flambard Way

High Street, Haslemere, between Cobden Lane and Church Road where properties lie in close proximity to the road.

9 References

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Waverley Borough Council (2011) Air Quality Progress Report, April 2011, available at: www.waverley.gov.uk/site/scripts/download_info.php?downloadID=45

Waverley Borough Council (2011) Detailed Assessment of Air Quality at Station Hill, May 2011, available at:

www.waverley.gov.uk/site/scripts/download_info.php?downloadID=45

Appendices

Appendix A: QA/QC of Monitoring Data

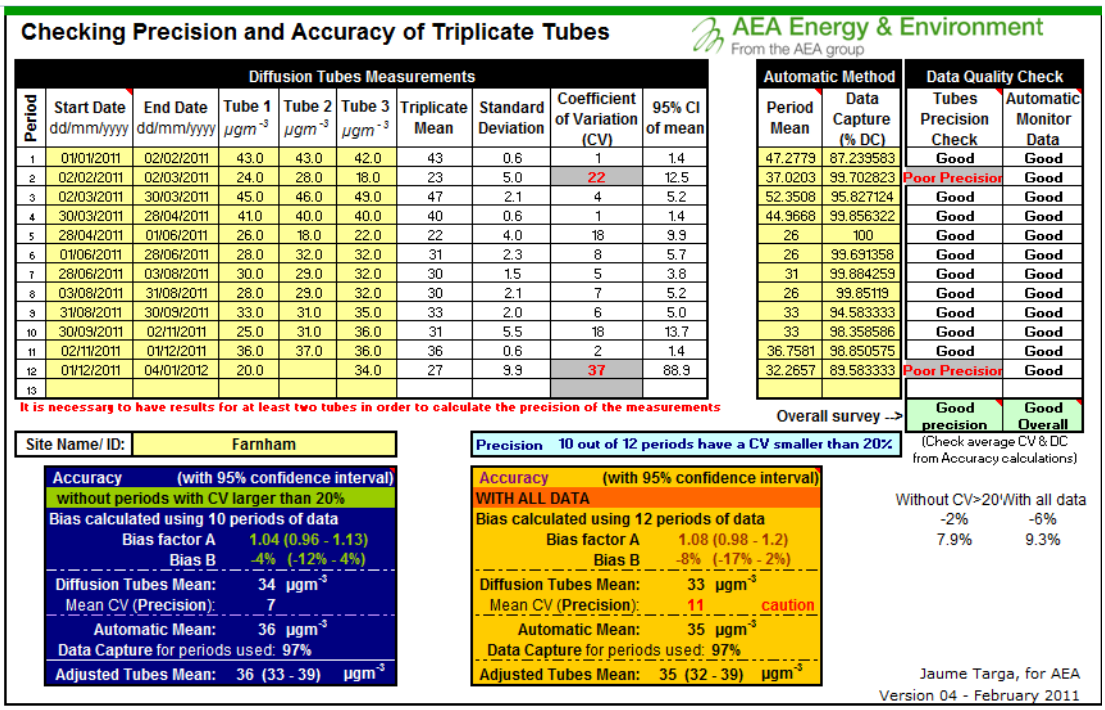
Appendix B: Maps of Diffusion Tube Monitoring Sites

Appendix A: QA/QC of Monitoring Data

Diffusion Tube QA/QC

Bias Adjustment Factors from Local Co-location Studies

Farnham bias adjustment factor



Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements

Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 µgm^{-3}	Tube 2 µgm^{-3}	Tube 3 µgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1	01/01/2011	02/02/2011	43.0	43.0	42.0	43	0.6	1	1.4
2	02/02/2011	02/03/2011	24.0	28.0	18.0	23	5.0	22	12.5
3	02/03/2011	30/03/2011	45.0	46.0	49.0	47	2.1	4	5.2
4	30/03/2011	28/04/2011	41.0	40.0	40.0	40	0.6	1	1.4
5	28/04/2011	01/06/2011	26.0	18.0	22.0	22	4.0	18	9.9
6	01/06/2011	28/06/2011	28.0	32.0	32.0	31	2.3	8	5.7
7	28/06/2011	03/08/2011	30.0	29.0	32.0	30	1.5	5	3.8
8	03/08/2011	31/08/2011	28.0	29.0	32.0	30	2.1	7	5.2
9	31/08/2011	30/09/2011	33.0	31.0	35.0	33	2.0	6	5.0
10	30/09/2011	02/11/2011	25.0	31.0	36.0	31	5.5	18	13.7
11	02/11/2011	01/12/2011	36.0	37.0	36.0	36	0.6	2	1.4
12	01/12/2011	04/01/2012	20.0		34.0	27	9.9	37	88.9
13									

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
47.2779	87.239583	Good	Good
37.0203	99.702823	Poor Precision	Good
52.3508	95.827124	Good	Good
44.9668	99.856322	Good	Good
26	100	Good	Good
26	99.691358	Good	Good
31	99.884259	Good	Good
26	99.85119	Good	Good
33	94.583333	Good	Good
33	98.358586	Good	Good
36.7581	98.850575	Good	Good
32.2657	89.583333	Poor Precision	Good
Overall survey -->		Good precision	Good Overall

(Check average CV & DC from Accuracy calculations)

Site Name/ ID: Farnham

Precision: 10 out of 12 periods have a CV smaller than 20%

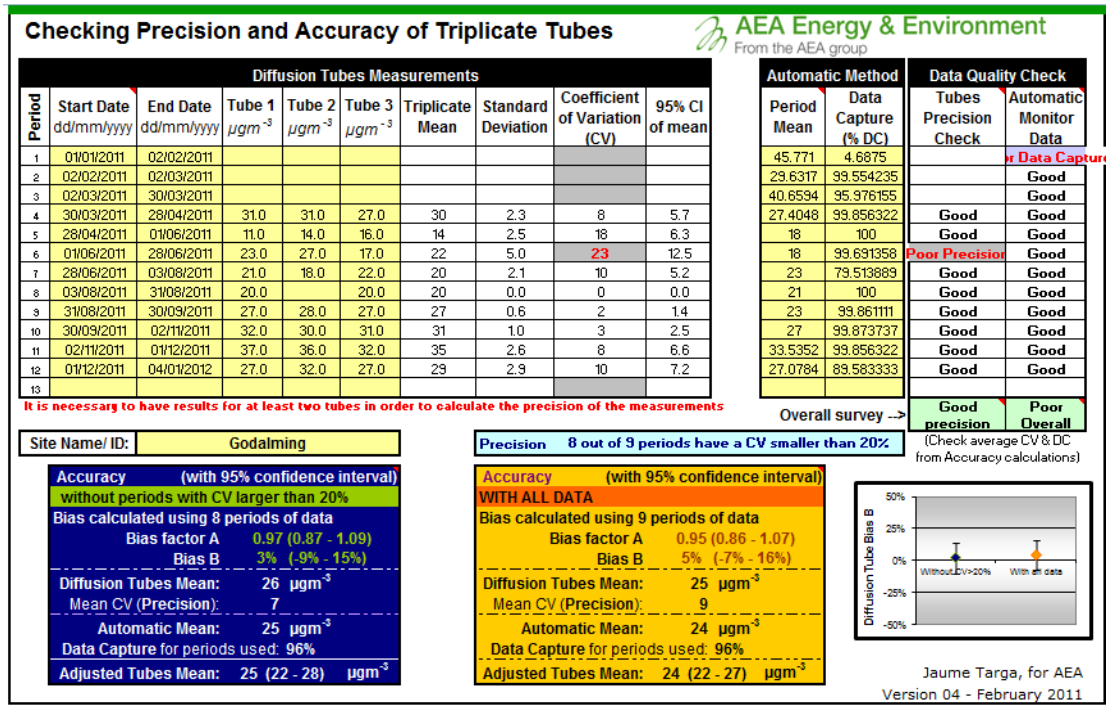
Accuracy (with 95% confidence interval) without periods with CV larger than 20%	
Bias calculated using 10 periods of data	
Bias factor A	1.04 (0.96 - 1.13)
Bias B	-4% (-12% - 4%)
Diffusion Tubes Mean:	34 µgm^{-3}
Mean CV (Precision):	7
Automatic Mean:	36 µgm^{-3}
Data Capture for periods used:	97%
Adjusted Tubes Mean:	36 (33 - 39) µgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 12 periods of data	
Bias factor A	1.08 (0.98 - 1.2)
Bias B	-8% (-17% - 2%)
Diffusion Tubes Mean:	33 µgm^{-3}
Mean CV (Precision):	11 caution
Automatic Mean:	35 µgm^{-3}
Data Capture for periods used:	97%
Adjusted Tubes Mean:	35 (32 - 39) µgm^{-3}

Without CV>20	With all data
-2%	-6%
7.9%	9.3%

Jaume Targa, for AEA
Version 04 - February 2011

Godalming bias adjustment factor



Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements

Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 µgm^{-3}	Tube 2 µgm^{-3}	Tube 3 µgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1	01/01/2011	02/02/2011							
2	02/02/2011	02/03/2011							
3	02/03/2011	30/03/2011							
4	30/03/2011	28/04/2011	31.0	31.0	27.0	30	2.3	8	5.7
5	28/04/2011	01/06/2011	11.0	14.0	16.0	14	2.5	18	6.3
6	01/06/2011	28/06/2011	23.0	27.0	17.0	22	5.0	23	12.5
7	28/06/2011	03/08/2011	21.0	18.0	22.0	20	2.1	10	5.2
8	03/08/2011	31/08/2011	20.0		20.0	20	0.0	0	0.0
9	31/08/2011	30/09/2011	27.0	28.0	27.0	27	0.6	2	1.4
10	30/09/2011	02/11/2011	32.0	30.0	31.0	31	1.0	3	2.5
11	02/11/2011	01/12/2011	37.0	36.0	32.0	35	2.6	8	6.6
12	01/12/2011	04/01/2012	27.0	32.0	27.0	29	2.9	10	7.2
13									

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
45.771	4.6875		or Data Capture
29.6317	99.554235		Good
40.6594	95.976155		Good
27.4048	99.856322	Good	Good
18	100	Good	Good
18	99.691358	Poor Precision	Good
23	79.513889	Good	Good
21	100	Good	Good
23	99.861111	Good	Good
27	99.873737	Good	Good
33.5352	99.856322	Good	Good
27.0784	89.583333	Good	Good
Overall survey -->		Good precision	Poor Overall

(Check average CV & DC from Accuracy calculations)

Site Name/ ID: Godalming

Precision: 8 out of 9 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval) without periods with CV larger than 20%	
Bias calculated using 8 periods of data	
Bias factor A	0.97 (0.87 - 1.09)
Bias B	3% (-9% - 15%)
Diffusion Tubes Mean:	26 µgm^{-3}
Mean CV (Precision):	7
Automatic Mean:	25 µgm^{-3}
Data Capture for periods used:	96%
Adjusted Tubes Mean:	25 (22 - 28) µgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 9 periods of data	
Bias factor A	0.95 (0.86 - 1.07)
Bias B	5% (-7% - 16%)
Diffusion Tubes Mean:	25 µgm^{-3}
Mean CV (Precision):	9
Automatic Mean:	24 µgm^{-3}
Data Capture for periods used:	96%
Adjusted Tubes Mean:	24 (22 - 27) µgm^{-3}

Jaume Targa, for AEA
Version 04 - February 2011

Hindhead bias adjustment factor

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements

Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 µgm^{-3}	Tube 2 µgm^{-3}	Tube 3 µgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1	01/01/2011	02/02/2011	36.0	36.0	36.0	36	0.0	0	0.0
2	02/02/2011	02/03/2011	25.0	26.0	25.0	25	0.6	2	1.4
3	02/03/2011	30/03/2011	42.0	39.0	40.0	40	1.5	4	3.8
4	30/03/2011	28/04/2011	36.0	39.0	36.0	37	1.7	5	4.3
5	28/04/2011	01/06/2011	35.0	34.0	34.0	34	0.6	2	1.4
6	01/06/2011	28/06/2011	37.0	37.0	43.0	39	3.5	9	8.6
7	28/06/2011	03/08/2011	31.0	35.0	35.0	34	2.3	7	5.7
8	03/08/2011	31/08/2011	25.0	28.0	34.0	29	4.6	16	11.4
9	31/08/2011	30/09/2011	39.0	39.0	38.0	39	0.6	1	1.4
10	30/09/2011	02/11/2011	35.0	36.0	35.0	35	0.6	2	1.4
11	02/11/2011	01/12/2011	36.0	30.0	36.0	34	3.5	10	8.6
12	01/12/2011	04/01/2012	21.0	31.0	30.0	27	5.5	20	13.7
13									

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
39.59	85.546875	Good	Good
43.1469	95.988113	Good	Good
44.9474	92.250373	Good	Good
40.7526	95.689655	Good	Good
41	94.362745	Good	Good
39	95.524691	Good	Good
41	95.717593	Good	Good
32	95.833333	Good	Good
39	95.694444	Good	Good
38	95.707071	Good	Good
33.1915	95.833333	Good	Good
35.0398	82.965686	Poor Precision	Good
	Overall survey -->	Good precision	Good Overall

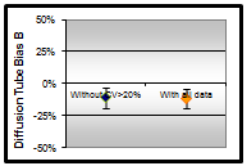
(Check average CV & DC from Accuracy calculations)

Site Name/ ID: Hindhead

Precision 11 out of 12 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval)
without periods with CV larger than 20%
Bias calculated using 11 periods of data
Bias factor A 1.13 (1.03 - 1.24)
Bias B -11% (-19% - -3%)
Diffusion Tubes Mean: 35 µgm^{-3}
Mean CV (Precision): 5
Automatic Mean: 39 µgm^{-3}
Data Capture for periods used: 94%
Adjusted Tubes Mean: 39 (36 - 43) µgm^{-3}

Accuracy (with 95% confidence interval)
WITH ALL DATA
Bias calculated using 12 periods of data
Bias factor A 1.14 (1.05 - 1.25)
Bias B -12% (-20% - -4%)
Diffusion Tubes Mean: 34 µgm^{-3}
Mean CV (Precision): 6
Automatic Mean: 39 µgm^{-3}
Data Capture for periods used: 93%
Adjusted Tubes Mean: 39 (36 - 43) µgm^{-3}



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Version 04 - February 2011

Bias adjustment factors for each of the three co-location studies were calculated using the spreadsheet provided by Defra. The factor calculated for the Godalming study was less than 1, whereas the factors calculated for the Farnham and Hindhead studies were greater than 1. As the study only commenced at the end of March 2011, and as the calculated factor was lower than those calculated for the two studies with 12 months data, the Godalming factor has not been used to adjust data. Instead, an average factor has been calculated from the Farnham and Hindhead studies.

For both the Farnham and Hindhead studies, the factor calculated including all data have been used as this produces slightly higher, and thus more precautionary, factors.

The Farnham factor has been applied to diffusion tubes deployed within Farnham, the Hindhead factor has been applied to tubes deployed in Hindhead, and the average factor has been applied to tubes deployed in all other locations.

The spreadsheets also show that, overall, the diffusion tubes had good precision.

National Bias Adjustment Factor

The national bias adjustment factor for diffusion tubes supplied and analysed by Lambeth Scientific Services for 2011 is 1.06. This factor is taken from spreadsheet version 03/12, and is based on six studies, including the three carried out by Waverley BC.

Discussion of Choice of Factor to Use

The local factors described above are greater than the national factor. Applying these factors to the 2011 diffusion tube data provides a worst-case assessment of concentrations.

WASP

Lambeth Scientific Services take part in the Workplace Analysis Scheme for Proficiency (WASP), operated by the Health and Safety Laboratory (HSL). During 2011, on average, 60% of samples were determined to have been satisfactory (1st quarter: 50%; 2nd quarter: 25%; 3rd quarter: 100%, 4th quarter: 25%).

Short-term to Long-term Data Adjustment (Annualisation)

Where a new monitoring site has been established, or where diffusion tubes were lost during the year, resulting in less than 9 months of data, the resulting period mean is not directly comparable to the objective. Therefore, in accordance with the guidance set out in Box 3.2 of LAQM.TG(09), the data have been adjusted to an annual mean, based on the ratio of concentrations during the short-term monitoring period to those over the 2011 calendar year. This has utilised data from five background sites operated as part of the Automatic Urban and Rural Network (AURN) where long-term data are available.

The annual mean nitrogen dioxide concentrations and the period means for each of the five monitoring sites from which adjustment factors have been calculated are presented in the tables below, along with the Ratio applied.

Jan – April, June

Site	Site Type	Annual Mean	Period Mean	Ratio
Brighton Preston Park	Urban Background	16.4	20.1	0.82
Horley	Suburban Background	20.9	24.0	0.87
Reading New Town	Urban Background	25.9	28.8	0.90
Southampton Centre	Urban Background	35.3	38.1	0.93
			Average	0.878

Jan – May, Oct - Dec

Site	Site Type	Annual Mean	Period Mean	Ratio
Brighton Preston Park	Urban Background	16.4	18.9	0.87
Horley	Suburban Background	20.9	23.1	0.90
Portsmouth	Urban Background	19.3	21.8	0.89
Reading New Town	Urban Background	25.9	29.7	0.87
Southampton Centre	Urban Background	35.3	38.6	0.92
			Average	0.889

Jan – March, May – July, Sept

Site	Site Type	Annual Mean	Period Mean	Ratio
Brighton Preston Park	Urban Background	16.4	16.1	1.02
Horley	Suburban Background	20.9	21.0	0.99
Portsmouth	Urban Background	19.3	18.7	1.03
Reading New Town	Urban Background	25.9	24.4	1.06
Southampton Centre	Urban Background	35.3	33.9	1.04
			Average	1.03

Jan – March, May

Site	Site Type	Annual Mean	Period Mean	Ratio
Brighton Preston Park	Urban Background	16.4	20.0	0.82
Horley	Suburban Background	20.9	24.5	0.85
Portsmouth	Urban Background	19.3	21.9	0.88
Reading New Town	Urban Background	25.9	29.3	0.88
Southampton Centre	Urban Background	35.3	37.1	0.95
			Average	0.878

June - Dec

Site	Site Type	Annual Mean	Period Mean	Ratio
Brighton Preston Park	Urban Background	16.4	13.5	1.21
Horley	Suburban Background	20.9	18.8	1.11
Portsmouth	Urban Background	19.3	17.9	1.08
Reading New Town	Urban Background	25.9	23.9	1.08
Southampton Centre	Urban Background	35.3	33.4	1.06
			Average	1.108

June, Aug – Sept, Nov- Dec

Site	Site Type	Annual Mean	Period Mean	Ratio
Brighton Preston Park	Urban Background	16.4	13.6	1.21
Horley	Suburban Background	20.9	19.1	1.09
Portsmouth	Urban Background	19.3	17.9	1.08
Reading New Town	Urban Background	25.9	24.6	1.06
Southampton Centre	Urban Background	35.3	33.6	1.05
			Average	1.098

Feb, May – June, Aug - Dec

Site	Site Type	Annual Mean	Period Mean	Ratio
Brighton Preston Park	Urban Background	16.4	14.4	1.14
Horley	Suburban Background	20.9	19.3	1.08
Portsmouth	Urban Background	19.3	18.3	1.06
Reading New Town	Urban Background	25.9	24.3	1.07
Southampton Centre	Urban Background	35.3	33.7	1.05
			Average	1.079

Automatic Monitoring QA/QC

Calibrations are carried out by Enviro Technology on behalf of Waverley BC on a monthly basis. Data for each of the three automatic monitoring sites have then been ratified by Air Quality Consultants using the following method:

The Farnham and Godalming sites monitor nitrogen dioxide using API M200E chemiluminescence NO_x analysers (ppb), whilst the Hindhead site monitors nitrogen dioxide using a Monitor Labs NO_x analyser and Envidas data logger. The Farnham automatic monitoring station also measures PM_{10} using a Met One BAM1020 Dust Monitor ($\mu g/m^3$). The nitrogen dioxide analysers return 15-minute average concentration readings, whilst the PM_{10} analyser returns hourly average values.

Prior to ratification, the raw PM_{10} concentrations are divided by 1.21 to make them equivalent to the reference method, following Defra guidance (Defra, 2009). The nitrogen dioxide and nitrogen oxides data are initially adjusted using calibration factors determined from the calibration reports. A visual examination of the data is then carried out, together with a comparison with monitoring data from three nearby national network sites: Horley, Reading New Town and Portsmouth (Defra, 2012), and an examination of fault logs for the instruments, with any erroneous data removed. Finally the data are converted from ppb to $\mu g/m^3$.

Once the data are ratified, 1-hour, 24-hour and period mean values are calculated, and appropriate statistics selected to allow comparison with the air quality objectives

Appendix B: Maps of Diffusion Tube Monitoring Sites

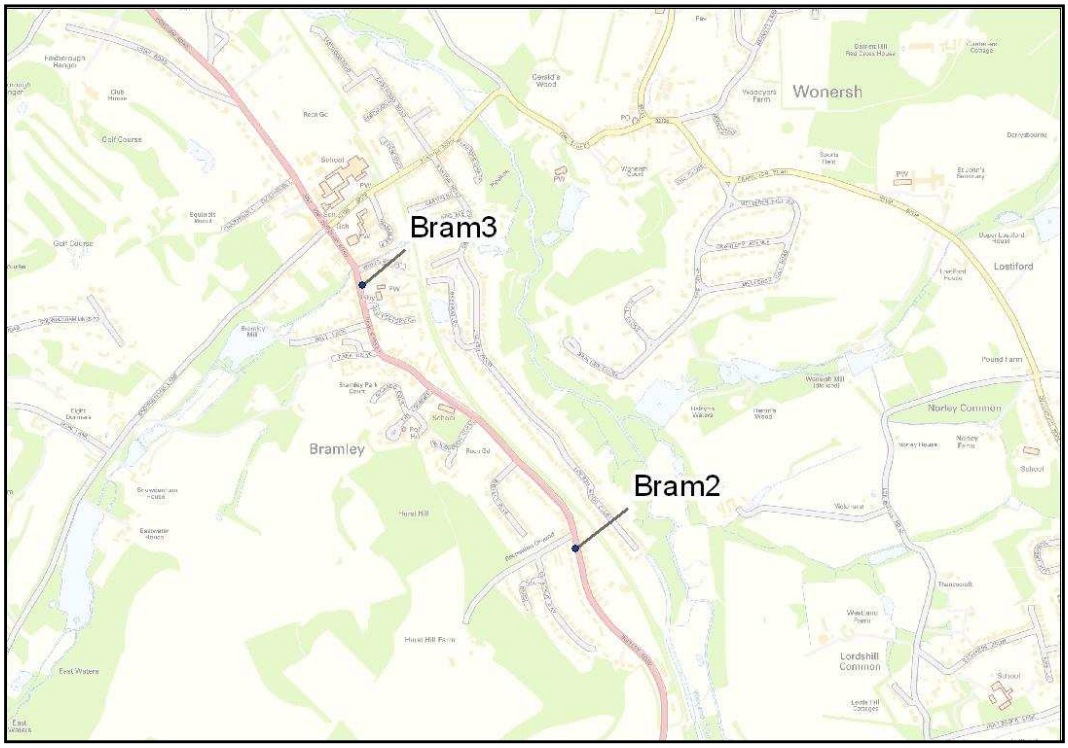

Figure B.1 Bramley Diffusion Tube Sites

Figure B.2 Cranleigh Diffusion Tube Sites

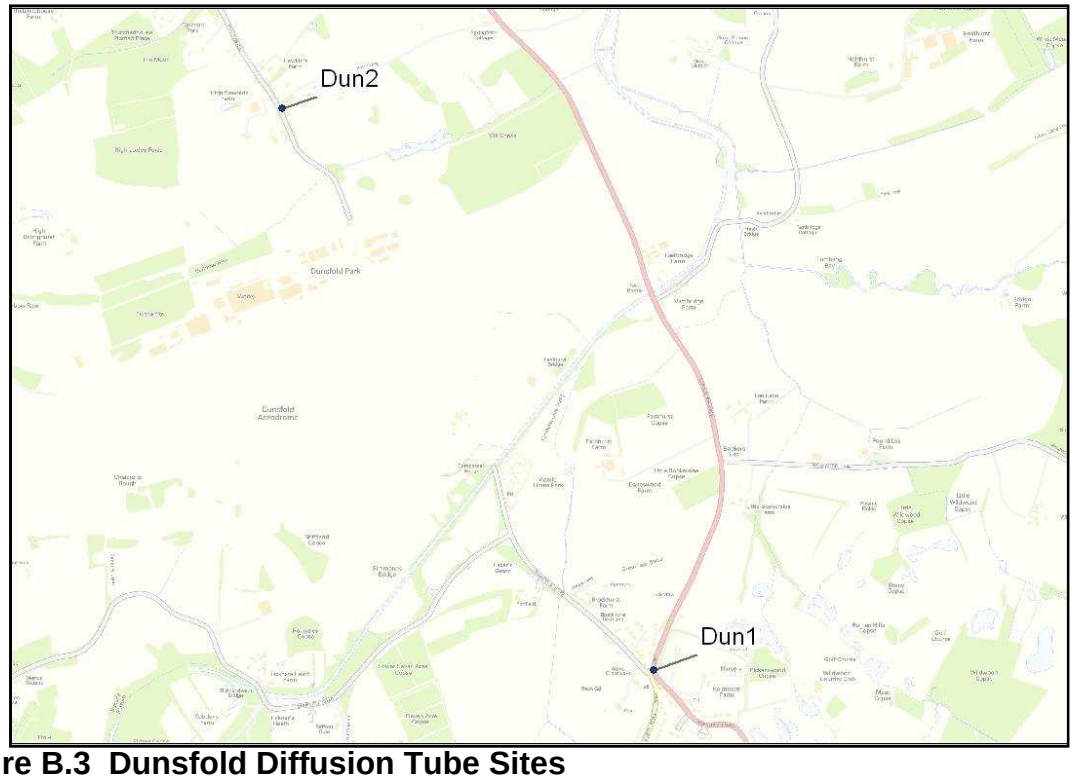

Figure B.3 Dunsfold Diffusion Tube Sites

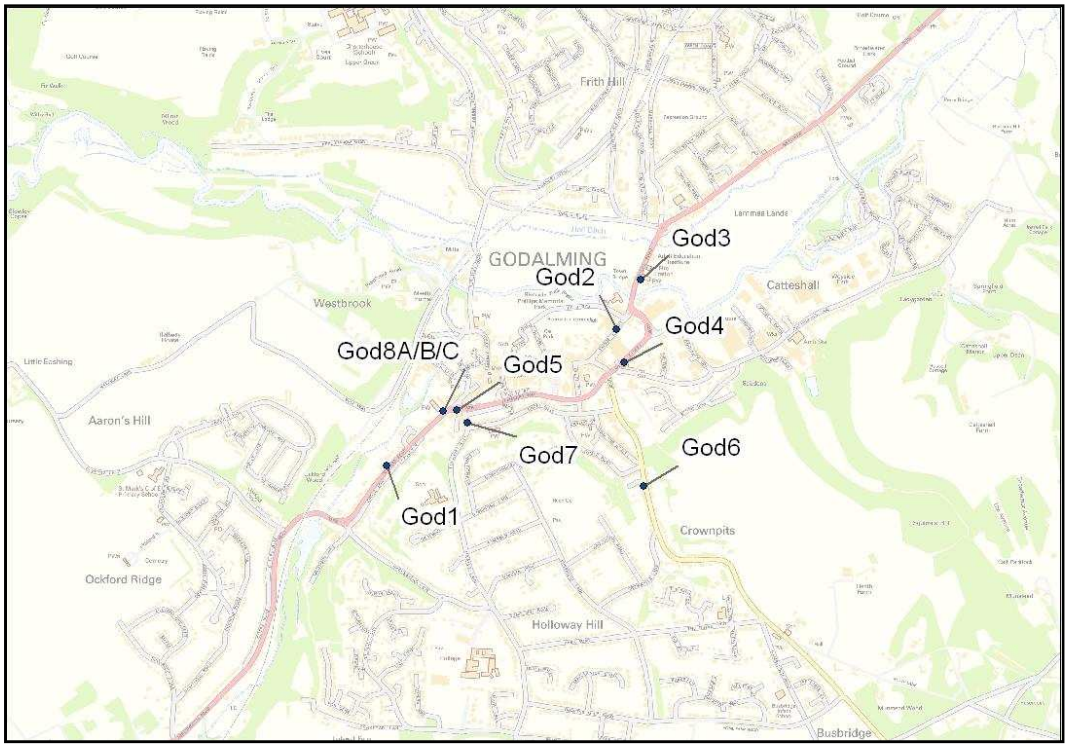

Figure B.4 Godalming Diffusion Tube Sites

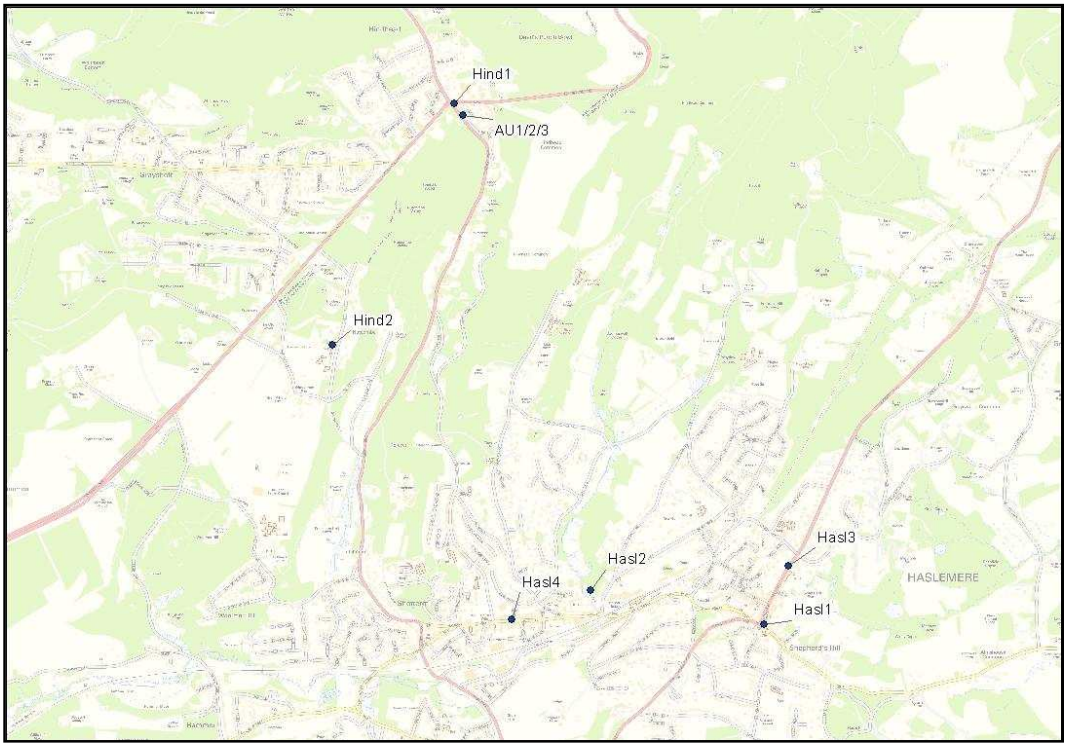

Figure B.5 Haslemere Diffusion Tube Sites

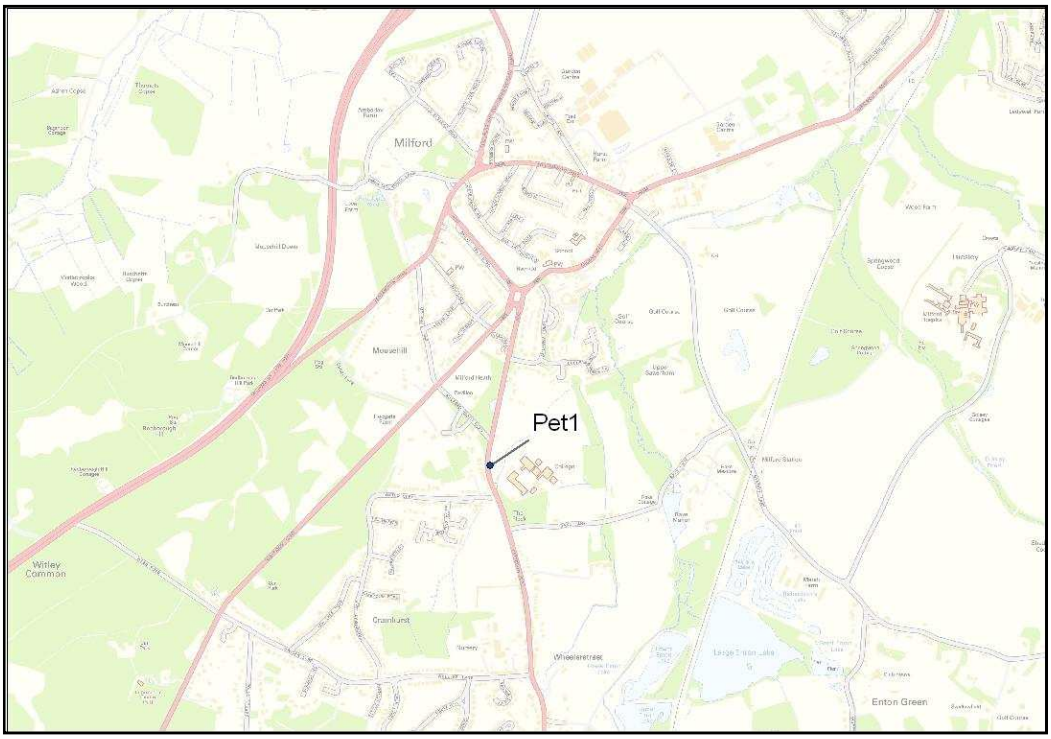

Figure B.6 Petworth Road Diffusion Tube Site

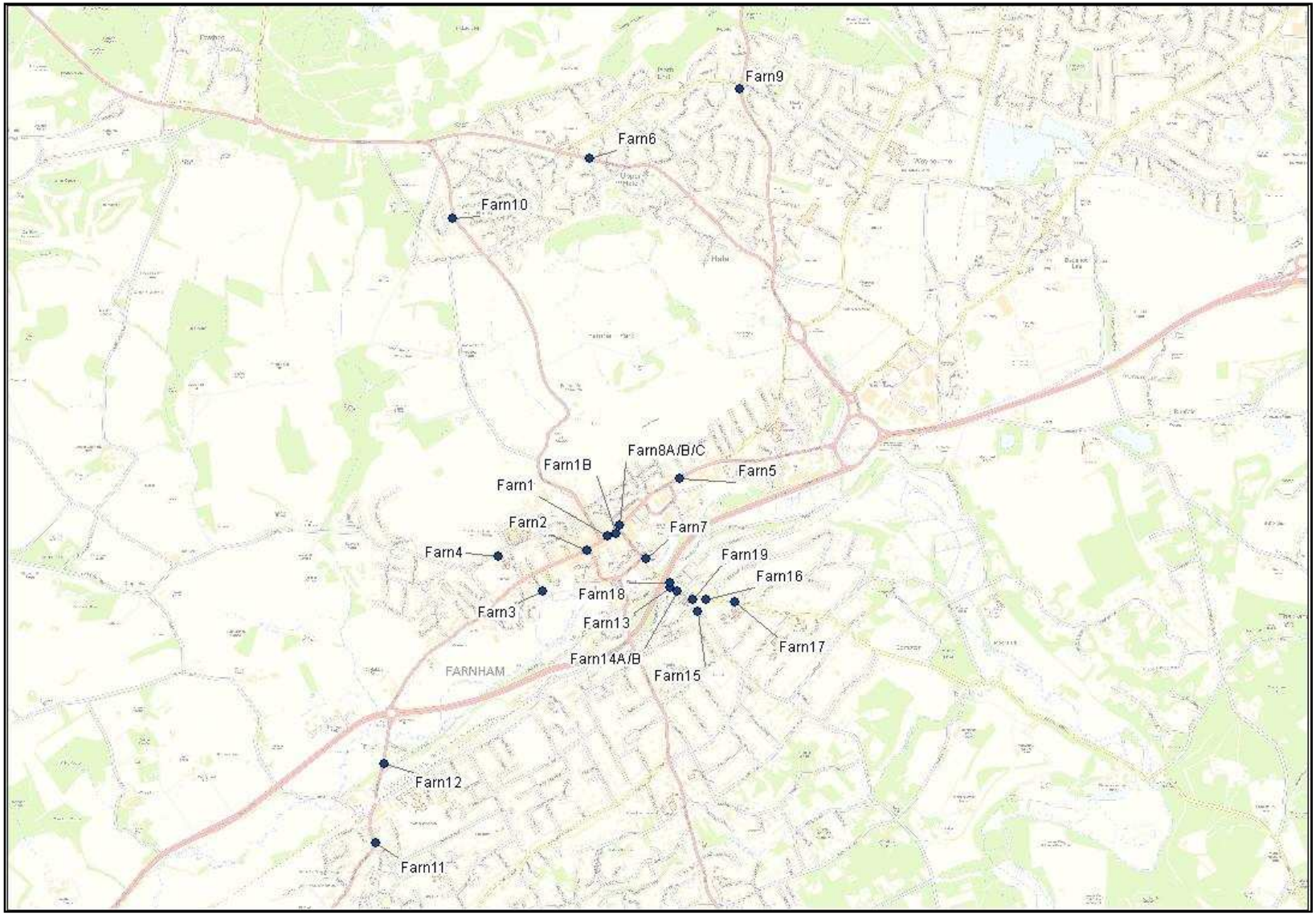

Figure B.7 Farnham Diffusion Tube Sites