

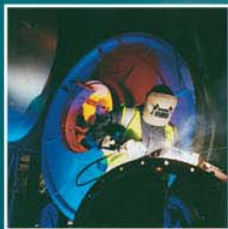
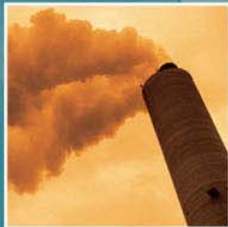
Royal Borough of Windsor and Maidenhead

Air Quality Review and Assessment

Detailed Assessment 2008

Final Report

August 2008



Entec

Creating the environment for business

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Royal Borough of Windsor and Maidenhead

Air Quality Review and Assessment

Final Report

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Executive Summary

Purpose of this Report

This report has been produced for the purpose of determining whether there are any exceedences of the annual mean air quality objective (AQO) for Nitrogen dioxide (NO₂) in the Royal Borough of Windsor and Maidenhead (RBWM).

In the Progress Report for 2007, RBWM identified three areas in the Borough which showed exceedences of the annual mean AQO for NO₂ based on concentrations monitored by bias adjusted diffusion tube in these areas. Following discussions with Defra it was decided that a Detailed Assessment for these three areas, given below, was required.

- Area 1 - Arthur Road, Alma Road, Osbourne Road, Winkfield Road and Imperial Way, Windsor;
- Area 2 - Bridge Road, Maidenhead; and
- Area 3 - Windsor Road, Maidenhead.

Where the Detailed Assessment indicates that some or all of the objectives may be potentially exceeded, the Local Authority has a duty to declare an Air Quality Management Area (AQMA). The declaration of an AQMA requires the local authority to implement an Action Plan (in consultation with others), to reduce air pollution levels so that the required air quality objectives are met. RBWM has already declared two AQMAs, in the centre of Maidenhead and in the centre of Windsor, for exceedences of the annual average AQO for NO₂.

This Detailed Assessment has utilised the last full year (2007) of monitoring data in RBWM and the detailed dispersion model, ADMS-Roads, to predict whether the annual mean AQO for NO₂ is likely to be exceeded in these areas and whether any Air Quality Management Areas need to be declared.

The ADMS-Roads modelling has been verified against continuous NO₂ monitoring in the Borough and then compared to the diffusion tube measurements to provide further confidence in the modelled concentrations. The results of the assessment show that the annual mean predicted NO₂ AQO is marginally exceeded in the base year of 2007 at several receptors along Arthur Road in Windsor (Area 1) (maximum concentration 40.3 µg m⁻³ in 2007). None of the other roads assessed in this area showed exceedences of the Annual average AQO for NO₂ at the facades of residential properties, outside the existing AQMA.

Exceedences were also predicted at a number of receptors along Bridge Road in Maidenhead (Area 2) (maximum concentration 65.9 µg m⁻³ in 2007) and at those receptors close to the M4 and along Windsor Road in Maidenhead (Area 3) (maximum concentration 53.6 µg m⁻³ in 2007). At all of the receptors modelled, the predicted concentrations were shown to reduce between 2007 and 2010.



The contour plots indicate that the exceedences predicted along Arthur Road in Windsor extend to an approximate distance of 10m from the kerbside. Along Bridge Road in Maidenhead the contour plots indicate exceedences extend between 20 and 30 metres from the kerbside. For Windsor Road in Maidenhead, exceedences predicted by the model are shown to extend approximately 100 metres from the edge of the M4 and 30 metres from the kerbside of Windsor Road.

Recommendations

- On the basis of the results of the Detailed Assessment, RBWM should consider declaring an AQMA in relation to exceedences of the annual mean AQO for Windsor Road, Maidenhead; Bridge Road, Maidenhead; and for Arthur Road, Windsor;
- The line of the $36 \mu\text{g m}^{-3}$ contour for annual mean NO_2 in 2007 should be used to define the extent of the likely exceedence and the extent of the new AQMA;
- Consideration should be given to the commissioning of a detailed traffic survey in order to determine vehicle numbers and speeds, the diurnal profile of vehicles, the fleet mix and queue lengths;
- Where possible, the diffusion tube sites in the areas identified as showing possible exceedences should be moved to the façades of residential buildings to ensure they are located where there is relevant exposure; and
- Following the declaration of exceedence areas as AQMAs, the council should undertake a Further Assessment, utilising where possible and funding permitting, new continuous monitoring data and revised traffic estimates to reduce uncertainty in the dispersion modelling. This updated information may also help in the formulation of an Action Plan to reduce emissions and move towards the attainment of the AQOs.



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1. Introduction

Entec UK Ltd has been commissioned by the Royal Borough of Windsor and Maidenhead (RBWM) to undertake a Detailed Assessment for three areas in the Borough. Monitoring data gathered in 2006 and reported in their Progress Report 2007, indicated that there may be exceedences of the Air Quality Objectives for nitrogen dioxide (NO₂) in these areas, outline below:

- Area 1 - Arthur Road, Alma Road, Osbourne Road, Winkfield Road and Imperial Road, Windsor;
- Area 2 - Bridge Road, Maidenhead; and
- Area 3 - Windsor Road, Maidenhead.

This assessment forms part of the statutory duties surrounding Local Air Quality Management (LAQM) under Part IV of the Environment Act, 1995 and subsequent Regulations. Where relevant, the potential effects of new or revised information have been assessed.

The report reviews the pollutants specified under LAQM with regard to guidance issued by Defra in 2003¹ that was updated in 2006² and the objectives specified in the Air Quality Standards Regulations (2007)³ and EU Limit Values.

For the purposes of determining the focus of review and assessment, local authorities should have regard to those locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the objective. The objectives do not apply at offices or other places of work where members of the general public do not have regular access.

Where the Detailed Assessment indicates that some or all of the objectives may be potentially exceeded, the Local Authority has a duty to declare an Air Quality Management Area (AQMA). The declaration of an AQMA requires the local authority to implement an Action Plan (in consultation with others), to reduce air pollution levels so that the required air quality objectives are met.

¹ Defra, Scottish Executive, Welsh Assembly Government, Department of Environment in Northern Ireland. Technical Guidance (LAQM.TG(03)). February 2003.

² Defra, Scottish Executive, Welsh Assembly Government, Department of Environment in Northern Ireland. Technical Guidance (LAQM.TG(03)) Update. 2006.

³ The Air Quality Standards Regulations (2007), Statutory Instrument 2007 No 64.



The assessment has utilised the ADMS-Roads Detailed Dispersion Model to assess the likelihood of the annual mean Air Quality Objective for NO₂ being exceeded at various locations in the Borough in 2007 and 2010.

1.1 Scope

The areas which are being considered in this Detailed Assessment are as follows:

- Area 1 - Arthur Road, Alma Road, Osbourne Road, Imperial Way and Winkfield Road, Windsor;
- Area 2 - Bridge Road, Maidenhead; and
- Area 3 - Windsor Road, Maidenhead.

These areas have been agreed with the Department for the Environment and Rural Affairs (DEFRA) following the submission of the Progress Report in 2007.

Traffic data utilised in the modelling have been supplied by RBWM and the Department for Transport (DfT). The Dispersion modelling has been verified using the continuous NO₂ monitoring data collected by RBWM at Clarence Road, Windsor and Frascati Way, Maidenhead.

1.2 Structure of the Report

The remainder of the report is structured as follows (Table 1.1)

Table 1.1 Structure of the Report

Section	Summary of Contents
2	Summary of the relevant existing Legislation and summaries of previous LAQM studies undertaken by RBWM.
3	Summary of existing monitoring data and discussion of trends.
4	Details of Methodology used for the Detailed Modelling Assessment, including the consideration of model uncertainty and accuracy. Methodology and discussion associated with model verification.
5	Presentation of the findings of the Detailed Modelling Assessment.
6	Summary of the findings of the Detailed Modelling Assessment and the existing monitoring data. Recommendations for the next step in the LAQM process.



2. Relevant Legislation and Previous LAQM Studies

2.1 Relevant Legislation

Part IV of the Environment Act 1995 requires that local authorities (LAs) periodically review air quality within their areas. This process of Local Air Quality Management (LAQM) is an integral part of delivering the Government's Air Quality Objectives (AQOs) first detailed in 1997 and updated in the Air Quality (England) Regulations 2000 and again in the Air Quality Standards Regulations 2007 (hereafter referred to as the Regulations). The Regulations seek to simplify air quality regulation and provide a new transposition of the Air Quality Framework Directive, First, Second and Third Daughter Directives and also transpose the Fourth Daughter Directive, relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air. The Air Quality Limit Values are transposed into the updated Regulations as 'Air Quality Standards' (AQS) with attainment dates in line with the European Directives.

This report provides an assessment against the Annual Mean for NO₂. The relevant AQS/AQO are shown in Table 2.1.

Table 2.1 Summary of Relevant Air Quality Standards and Objectives

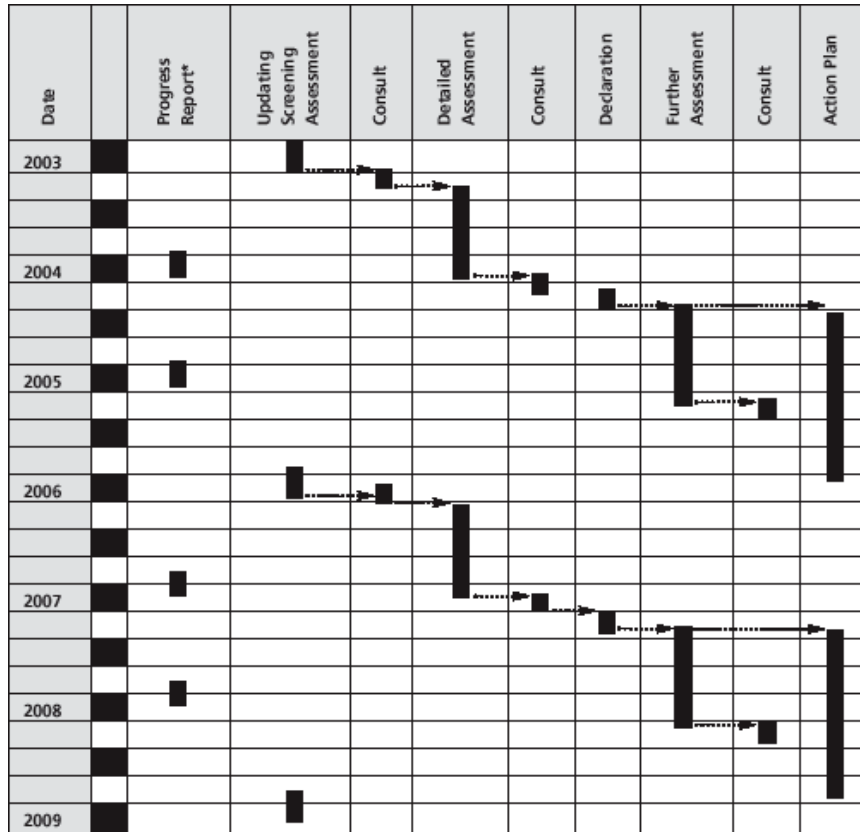
Pollutant	AQS or AQO	Averaging Period	Value ($\mu\text{g m}^{-3}$)	Date to be achieved and maintained thereafter
NO ₂	AQS	1 hour mean, not to be exceeded more than 18 times per year (Equivalent of 99.79 percentile)	200	1 st Jan 2010
	AQS	Annual Average	40	1 st Jan 2010

2.2 Previous LAQM Studies

The review and assessment of local air quality aims to identify areas where national policies to reduce vehicle and industrial emissions are unlikely to result in air quality meeting the Government's AQOs at locations of relevant public exposure. To carry out an 'Air Quality Review and Assessment' the Government has recommended a multi-stage approach as detailed in Figure 2.1.



Figure 2.1 Timetable for Review and Assessment (Phase 2, 2003, Phase 3, 2006 and Phase 4, 2009)



Following the initial Phase of assessments completed in 2002, Phase 2 and subsequent phases of review commence with the Updating and Screening Assessment (USA). The USA applies initial simple screening methods to establish whether there are areas that may potentially exceed the AQOs that should be assessed more closely. Whilst authorities must carry out the USA, it is not the intention that all will need to progress to a Detailed Assessment. Where it is concluded that a Detailed Assessment is not necessary, a Progress Report is required to be produced on an annual basis (in years when a USA or Detailed Assessment are not required).

The Detailed Assessment then uses more advanced methods of modelling and monitoring in areas identified to be at potential risk of exceeding the objectives in the Regulations. Where the review and assessment work indicates that some or all of the objectives might potentially be exceeded, the LA has a duty to declare an Air Quality Management Area (AQMA).

The declaration of an AQMA requires the LA to undertake a Further Assessment and implement an Air Quality Action Plan (AQAP) to reduce air pollution levels so that the required AQOs are met.



2.2.1 Phase 1 (2000 – 2002)

RBWM completed Stages 1, 2 and 3 of the Phase 1 Review and Assessment process. The Stage 1 & 2 report identified four Part A and twelve Part B authorised industrial processes in and around the Royal Borough of Windsor & Maidenhead. The Part A processes are located outside of the Borough of Windsor & Maidenhead and were not considered further in the Council's Review and Assessment. The Part B processes and other sources of emissions were investigated in the Council's Stage 2 review of the potential sources, and NO₂ and PM₁₀ emissions from road traffic required further assessment at Stage 3. Potential sources of mobile emissions were identified as the A404, A404 (M), A355, A322 (Eton), A308 (Braywick Road), A4, M4 (Junctions 7-8/9) and M25. The Stage 3 report concluded that the annual mean NO₂ and PM₁₀ AQOs may be exceeded at number of locations. The Council concluded that there was no 'relevant exposure' at these locations and did not declare an AQMA.

2.2.2 Phase 2 (2003 – 2005)

Since the publication of reports for the first round of review and assessment, there were a number of potential issues that needed to be addressed in terms of changes to the sources and emissions of pollutants that may affect ambient air quality in local authority areas. Furthermore, new policy developments and revisions to published guidance required consideration within the on-going assessment of air quality. An Updating & Screening Assessment was issued by RBWM in January 2004.

The USA concluded that the area including the roads, Broadway, Queen Street and Grenfell Place and the junction of the A332 and Clarence Road should proceed to a Detailed Assessment for NO₂. Elevated monitored concentrations of NO₂ were identified at a number of locations and, before undertaking a Detailed Assessment, it was recommended that further investigation of the diffusion tube locations, to ensure that they were representative of exposure, be undertaken at Priors Way, Wraysbury Road, St Lukes Road and Straight Road. It was found that these locations were not representative of exposure, although detailed dispersion modelling was undertaken at Wraysbury Road as this is adjacent to the M25 (Junctions 12-13) and Priors Way as this is adjacent to the M4 (Junctions 7-8).

The Detailed Assessment concluded that on the basis of detailed dispersion modelling and passive diffusion tube monitoring, the annual mean NO₂ air quality objective was unlikely to be met by the required date at locations in Maidenhead town centre and at the junction of the A332 and Clarence Road in Windsor. This led to RBWM declaring two Air Quality Management Areas (AQMAs) at these locations, which became effective from February 2005. Continuous monitoring of NO_x/NO₂ commenced within the AQMAs in March 2005.

The Progress report allowed an update of the monitoring data and other developments in the Borough, and updates on the progression of the Action Plan for the AQMA.

The Further Assessment provided an opportunity for the Council to revisit and revise the conclusions from the Detailed Assessment in relation to the location and extent of the AQMAs. It also formed the basis for the Council to develop an Action Plan to reduce emissions of nitrogen oxides (NO_x) from road traffic sources in the Borough.



It concluded that exceedences of the NO₂ annual mean AQO remained likely at the locations identified in the Detailed Assessment, namely Maidenhead town centre and at the junction of the A332 and Clarence Road in Windsor. Therefore the Council would not need to revoke or amend the AQMA. It was recommended that the Council should proceed to the formulation of an Air Quality Action Plan (AQAP).

The AQAP was integrated into the Local Transport Plan (LTP2) and was submitted to Department of Environment, Food and Rural Affairs (DEFRA) and Department for Transport (DfT) in March 2006.

2.2.3 Phase 3 (2006 – Present)

Updating and Screening Assessment 2006

Monitoring and estimated data for each of the air quality strategy pollutants predicted that the air quality objectives would not be exceeded at relevant sensitive receptor locations in the Borough in 2006, except for NO₂ in the AQMAs.

For NO₂ both of the continuous monitors showed annual average NO₂ concentrations for 2005 which exceeded the objective (40 µg m⁻³), although the hourly objective for NO₂ was not exceeded. The diffusion tubes located in the AQMA also showed exceedences of the annual mean objective.

Several of the diffusion tubes located outside of the AQMAs also showed exceedences of the annual mean objective for NO₂ in 2005. However these tubes were situated at kerbside and roadside locations and did not represent locations of relevant exposure. Some of these locations were also reviewed in the Detailed Assessment in 2004 which found no exceedences of the AQOs at locations of relevant exposure near to these diffusion tube sites.

No new developments in the Borough were identified which were likely to have a significant impact upon air quality and no new industrial, domestic or mobile sources, or amendments to these, were identified in the Borough, which were likely to have an impact on air quality.

The findings of the USA concluded that there was no requirement for a Detailed Assessment of any of the Air Quality Strategy Pollutants in the Borough.

However, because of the presence of a coach park in Arthur Road and as part of an agreement under a Section 106 (developer contributions) following an outlined planning application for a business premises in the area, RBWM started a 5 year NO₂ monitoring program using NO₂ diffusion tubes.

Progress Report 2007

The Progress Report produced in 2007 highlighted several areas where there was concentrations of NO₂ which exceeded the annual mean AQO. These areas were: Bridge Road in Maidenhead; Windsor Road, Maidenhead; Alma Road, Osbourne Road, Arthur Road, Winkfield Road and Imperial Way in Windsor. Following discussions



with Defra after submitting their Progress Report in 2007, it was decided that a Detailed Assessment of these areas was required.



3. Review of existing monitoring data

3.1 Introduction

In order to undertake a robust assessment of air quality effects, it is necessary to incorporate suitable monitoring data. This is to provide a means against which the predictive modelling results can be compared and the accuracy of the model can be investigated.

There are two principal methods by which air pollution can be monitored, either using passive sampling or by more sophisticated continuous monitoring devices. The Detailed Assessment focuses on the areas in the vicinity of:

- Area 1 - Arthur Road, Alma Road, Osbourne Road, Winkfield Road and Imperial Way in Windsor;
- Area 2 - Bridge Road, Maidenhead; and
- Area 3 - Windsor Road, Maidenhead.

This section of the report therefore reviews available monitoring data from all nearby, or relevant continuous monitoring stations and diffusion tube sites.

Consideration has been given to the quality assurance and control aspect of the monitoring programmes, to ensure the data are of a suitably high standard and appropriate for the purpose of Review and Assessment.

3.2 Continuous Monitoring

RBWM operates two continuous monitors in its Borough. These locations are considered as roadside (one in Windsor and one in Maidenhead). An additional continuous analyser, part of the London Air Quality Network operated by Imperial College and RBWM, is located at a rural background location (Ascot). The two monitors located in Windsor and Maidenhead are situated within the existing AQMAs. The Windsor monitor is located at a roundabout between the A332 and Clarence Road, with the Maidenhead Monitor located along Frascati Way. The Ascot Monitor is located at Silwood Park, with the nearest road (Cheapside Road) located approximately 140 m to the north-west. The locations of these monitors are shown in Appendix A.

The continuous monitoring sites are maintained, and the resulting data ratified, by Kings College ERG.

The following table shows the NO₂ annual mean concentrations from the three continuous monitoring locations in the Royal Borough of Windsor and Maidenhead. The table indicates that the AQO for Annual Average NO₂ was exceeded in the centre of Windsor and in the centre of Maidenhead in 2007. The hourly average AQO for NO₂ was not exceeded during 2007. The annual average AQO and the hourly AQO for NO₂ was not exceeded at the Ascot monitor.



Table 3.1 Continuous Monitoring data for NO_x and NO₂ at the Windsor, Maidenhead and Ascot sites in 2007

Monitor	Site Classification	Location of Monitor		Data Capture	Annual Mean NO _x	Annual Mean NO ₂	Exceedences of Hourly Mean
		X-Coordinate	Y-Coordinate		(µg m ⁻³)	(µg m ⁻³)	
Windsor	Roadside	495664	176592	96	119.3	46.7	2
Maidenhead	Roadside	488626	180994	98	129.3	50.3	6
Ascot	Rural	493810	169300	97	35.7	23.8	0

Notes: Ascot-Data after 4th May 2007 have not been fully ratified.
Maidenhead-Data after 5th October 2007 have not been fully ratified.
Windsor-Data after 5th October 2007 have not been fully ratified.

3.3 Passive Monitoring

Passive monitoring is undertaken in the Royal Borough of Windsor and Maidenhead using NO₂ diffusion tubes. These are supplied and analysed by UKAS accredited laboratory Gradko International to a preparation of 50% TEA in acetone.

The monitoring data for 2007 for the sites in the Borough, which are located in the study areas, are presented in Table 3.2 along with their classification and their location. These are considered as receptors in the Detailed Modelling Assessment and maps of their locations can be found in Appendix D.

Diffusion tubes have been found to produce results which can vary with the seasons/weather, the laboratory and the preparation methodology. To ensure that the data which is collected from the tubes is accurate, triplicate tubes are placed with a continuous analyser to monitor their precision and accuracy. This produces a bias correction factor which can be applied to all of the tubes in the Borough.

Bias correction factors were obtained for the triplicate tubes positioned with the continuous monitors in Windsor, Maidenhead and Ascot. This process utilised the precision and accuracy tool developed by AEA technology⁴ with the calculations shown in Appendix B. This tool calculated the following factors for each of the continuous monitoring locations:

⁴ http://www.uwe.ac.uk/aqm/review/Diffusion_Tube_Precision.pdf



- Windsor: 1.07 (Under-reading NO₂ concentrations by 7%) based on good precision and data capture with 12 months of data;
- Maidenhead: 1.11 (Under-reading NO₂ concentrations by 8%) based on good precision and data capture with 11 months of data;
- Ascot: 1.53 (Under-reading NO₂ concentrations by 35%) based on good precision and data capture with 11 months of data; and
- Average of 2 continuous monitors (Windsor and Maidenhead): 1.06 (Under-reading by 6%).

In addition, co-location studies from across the UK, which use the same laboratory and preparation method for the tubes, have a bias correction factor of 0.93. This is based on 6 monitoring locations.

Given the results above, the Windsor and Maidenhead monitors overall have the best data capture and the best precision, when compared with the other co-location studies. The average of these two continuous monitors produces the bias adjustment factor which is closest to 1. For these reasons the Windsor and Maidenhead continuous monitor average bias adjustment factor will be used at all of the diffusion tube locations.

This bias correction factor has been applied to the diffusion tubes and the subsequent data is shown in Appendix C for all of the tubes in the Borough. Those tubes which are considered in the Detailed Modelling Assessment are shown in Table 3.2. The bias corrected results for 2006 were obtained from RBWM, these were corrected using the bias adjustment factors obtained from the Maidenhead and Windsor monitors given in the table.

The diffusion tubes located in the assessment areas all show concentrations of NO₂ which either exceed the annual mean AQO for NO₂ in 2006 and 2007 or are close to the AQO, except for tubes WM2 and WM9 which show concentrations of NO₂ below the AQO in 2006 and 2007. Overall there appears to be a slight fluctuation in the concentrations measured during 2006 and 2007, but no trend of either decreasing or increasing concentrations of NO₂ is discernable.

Table 3.2 Diffusion tube monitoring data (tube locations included in the assessment)

Ref	Site Name	Location		Classification	Data Capture	Annual Mean	Annual Mean	Annual Mean	Annual Mean
		X - Coordinate	Y - Coordinate			Bias Corrected (µg m ⁻³)	(µg m ⁻³)	Bias Corrected (µg m ⁻³)	Predicted* (µg m ⁻³)
					Months	2006	2007	2007	2010
WM2	Priors Way	489706.19	178789.33	Urban Background	12	39.5	36.19	39.3	36.1



Table 3.2 (continued) Diffusion tube monitoring data (tube locations included in the assessment)

Ref	Site Name	Location		Classification	Data Capture	Annual Mean	Annual Mean	Annual Mean	Annual Mean
		X - Coordinate	Y - Coordinate			Bias Corrected ($\mu\text{g m}^{-3}$)	($\mu\text{g m}^{-3}$)	Bias Corrected ($\mu\text{g m}^{-3}$)	Predicted* ($\mu\text{g m}^{-3}$)
					Months	2006	2007	2007	2010
WM9	Alma Road	487982.65	182307.71	Roadside	12	32.7	29.49	32.0	28.6
WM10	<i>Imperial Road</i>	<i>496179.65</i>	<i>176330.42</i>	<i>Roadside</i>	<i>11</i>	<i>39.9</i>	41.62	45.2	40.4
WM18	AQMS Windsor 1	495664.00	176592.00	Roadside <i>collocated</i>	12	47.2	44.47	48.3	43.2
WM19	AQMS Windsor 2	495664.00	176592.00	Roadside <i>collocated</i>	11	48.3	43.73	47.4	42.5
WM20	AQMS Windsor 3	495664.00	176592.00	Roadside <i>collocated</i>	12	45.8	43.29	47.0	42.0
WM29	M4 Windsor Road	495289.77	166765.54	Roadside	11	62.5	56.31	61.1	54.7
WM31	Arthur Road 1	495895.67	176939.49	Roadside	11	47.2	48.00	52.1	46.6
WM32	Arthur Road 2	496081.73	176903.1	Roadside	12	44.0	38.70	45.2	40.5
WM33	Arthur Road 3	496312.13	176886.03	Roadside	8	59.7	55.12	59.8	53.5
0-2	<i>Dedworth Rd W</i>	<i>495086</i>	<i>176462</i>	<i>Roadside</i>	<i>10</i>	<i>31.6</i>	<i>28.96</i>	<i>31.4</i>	<i>28.1</i>
0-3	Winkfield + Imperial Rd W	495299	175557	Roadside	11	47.03	46.11	50.0	44.8
0-4	Osborne Rd + Alma Rd W	496282	176091	Roadside	11	51.52	37.31	40.5	36.2
0-13	Bridge Road M	489571	181334	Roadside	12	43.33	37.56	40.8	36.5

Notes

*Calculated using the methodology in LAQM TG (03) and the Update in 2006.

Site in Italics Located in Existing AQMA, exceedences of Annual mean AQO for NO₂ (40 $\mu\text{g m}^{-3}$) in bold

Bias adjustment factor used in 2006: Windsor Sites 1.11, Maidenhead sites 1.09, and Ascot sites 1.13



4. Dispersion Modelling Methodology

4.1 Introduction

Dispersion modelling of emissions from road traffic sources has been undertaken through the use of the commercially available ADMS-Roads 2.3 model. Designed specifically to model emissions from road traffic, it allows predictions to be made at a greater spatial resolution than monitoring techniques alone permit. Further information concerning the model used, methodology and uncertainties is included in this section.

4.2 Roads Modelling

ADMS-Roads has been used to model the dispersion of emissions of NO_x and NO₂ from road traffic sources in the following areas:

- Area 1: Arthur Road, Alma Road and Osbourne Road and Winkfield Road, and Imperial Way, Windsor;
- Area 2: Bridge Road, Maidenhead; and
- Area 3: Windsor Road, Maidenhead.

The model has been used to predict concentrations of pollutants at existing monitoring locations (for comparison of modelled versus monitored concentrations) and other relevant receptor locations. Details of the modelling locations are given in Appendix E. Furthermore, modelling has been undertaken across a two-dimensional grid with a 20 metre grid resolution, with the use of intelligent gridding to provide a denser network of grid points close to the road network. This enables the interpolation of contour lines of equal levels of ground level concentrations of NO₂.

All modelling has been undertaken for the base year (2007), which is the last full calendar year, and for 2010, which is the attainment date of the European obligations for NO₂.

4.3 Input Requirements for Detailed Dispersion Modelling

Data required for the modelling of road traffic includes the following:

- Annual Average Daily Traffic Flows (AADT) for each road in the study area for 2007 and for the objective for NO₂ (2010);
- The split between Heavy Duty Vehicles (HDVs) and Light Duty Vehicles (LDVs);



- Average vehicle speeds;
- Hourly sequential meteorological data in a format compatible with ADMS-Roads. The data used was supplied for the synoptic recording station at Heathrow for the year 2007;
- Road geometry - Co-ordinates to geo-reference each road link, road width measurements and height data. Sourced primarily from electronic mapping of the area; and
- Receptor locations - Located through the use of electronic mapping and Geographical Information Systems (GIS).

4.4 Traffic Data

RBWM supplied traffic flow data for inclusion in the Detailed Assessment. Data came from continuous traffic counters located in the Borough during 2006 and from other sources available to RBWM. Where data were not available from RBWM, data from the Department for Transport were used⁵. NRTF⁶ growth factors were used to estimate traffic counts for 2007 and 2010 making the assumption that the rate of traffic growth in the modelled area was 'central' (i.e. a medium level of growth was assumed, rather than a low or a high rate of growth). Data on average speed of traffic or queue lengths was not available and estimates were therefore based on the speed limit with appropriate reductions when approaching junctions and signals. In all cases, roads were modelled as flat and freely moving links, except for parts of the A332 in Windsor and the M4 at Windsor Road where road sections were modelled as elevated links. No street canyons were identified in the study areas using the criteria defined within the ADMS model.

The traffic data used in the Detailed Assessment are presented in Appendix F.

4.5 Background Concentrations

The ADMS-Roads model has been used to predict the contribution of NO_x and NO₂ from road traffic only, i.e. as a consequence of vehicle numbers and vehicle mix, excluding ambient background concentrations of the pollutant. Therefore, in addition to the modelled concentration, a suitable background value needs to be incorporated to obtain a value for the total concentration at each modelled receptor.

There are a number of options available for the inclusion of ambient background concentrations of NO_x and NO₂ in a dispersion modelling assessment, including data from diffusion tubes, continuous monitoring from suitable background sites or Defra approved UK wide estimates developed by Netcen.

⁵ www.dft.gov.uk/matrix

⁶ Department of the Environment, Transport and the Regions 1997. National Road Traffic Forecast (Great Britain) 1997.



The Netcen background concentrations are derived through a detailed process of modelling and verification against the Defra AURN monitoring sites. These data provide background NO_x and NO₂ (µg m⁻³) estimates for the years 2004, 2005 and 2010. From these data, the average NO_x background concentration for the vicinity of the study areas for 2005 was chosen as the most representative. Using correction factors in LAQM TG (03) and the 2006 Update, the 2005 concentrations were scaled to levels estimated for 2007. The same approach was taken to estimate background concentrations of NO₂. These data will be used with the model results to provide the background concentrations of NO_x and NO₂ for use in the model verification.

Table 4.1 provides the Netcen estimates of background concentrations in the Borough.

Table 4.1 Netcen Estimates for the Royal Borough of Windsor and Maidenhead

Location	Grid Square		Netcen 2007 NO _x (µg m ⁻³) [^]	Netcen 2010 NO _x (µg m ⁻³)	Netcen 2007 NO ₂ (µg m ⁻³) [^]	Netcen 2010 NO ₂ (µg m ⁻³)
Bridge Rd, Maidenhead	488500	181500	39.5	36.4	24.7	24.4
Windsor, continuous monitor	495500	176500	31.7	28.2	21.2	20.6
Windsor Rd, M4	490500	178500	30.7	25.8	20.8	19.5
Maidenhead, continuous monitor	489500	181500	28.8	25.6	20.0	19.4

Notes: [^]Estimated using guidance in LAQM TG (03) and LAQM TG (03) Update 2006

4.6 Margins of Error and Levels of Confidence in Monitored and Predicted Concentrations

For the purposes of a Detailed Assessment, it is considered important to undertake an estimation of uncertainty and systematic errors associated with the monitoring and modelling components of the study. Section 3.3 of this report addressed uncertainty surrounding the application of passive diffusion tube sampling, while the following section investigates the relationship between modelled concentrations against those recorded at the continuous monitoring sites in Windsor. There are many explanations for these errors, which may stem from uncertainty in the ambient background concentrations, the modelled number of vehicles, speeds and vehicle fleet composition.



4.6.1 Model Verification

In TG(03) Defra has provided guidance in terms of three preferred methods for undertaking dispersion model verification⁷, each suitable for different situations. Each method is summarised below:

- Method 1 - Adjustment of annual average NO₂ based on a single continuous monitoring site using a multiplication factor;
- Method 2 - Adjustment of annual average NO₂ based on a single continuous monitoring site using a constant offset of background; and
- Method 3 - Verification of annual average NO₂ based on two continuous roadside monitoring sites and 10 roadside diffusion tube sites.

The verification for the Detailed Assessment was based on the relationship between modelled and monitored concentrations at the site of the continuous monitoring stations located within the AQMA at Windsor and at Maidenhead. It was considered that the most appropriate method of verification would be through the application of Method 1. The final result of the verification did however show that the relationship assumed between NO_x and NO₂⁸ could have been improved at the location of the continuous monitor, as the final modelled concentration was 0.89 µg m⁻³ (Maidenhead, continuous monitor) and 0.88 µg m⁻³ (Windsor, continuous monitor) µg m⁻³ lower than the actual monitored concentration. On the basis of this information, a secondary correction factor, 1.018 (Maidenhead) and 1.019 (Windsor) was applied to the final NO₂ modelled concentration (NO₂TotMod) to bring this into line with the monitored concentration at Maidenhead and Windsor. The continuous monitoring data used for the model verification at Maidenhead was also used for the verification of the Windsor Road modelled results. Further information regarding the approach to verification is presented in Appendix G.

4.6.2 Random Error of the Model

Even after systematic errors have been taken into consideration, the model may still sometimes predict higher or lower than measured values. This is referred to as random error, and requires additional consideration.

Guidance issued by the NSCA⁹, provides a methodology for assessing random errors when there are insufficient monitoring data available to accurately determine the uncertainty associated with random errors.

⁷ LAQM TG.(03) page A3-37.

⁸ Deriving NO₂ from NO_x for Air Quality Assessments of Roads – Updated to 2006. Report by Air Quality Consultants on behalf of Defra.

⁹ NSCA 2004. Air Quality Management Areas: A Review of Procedures & Practice for Local Authorities.



Previous studies have identified a number of 'Stock U Values', which enable a calculation to be made of the Standard Deviation of the Model (SDM):

$SDM = U \times Co$ (where Co is the air quality objective under consideration)

The Stock U Value for NO_2 is given as between 0.1 and 0.2 for an annual mean, or between 0.3 and 0.5 for the 99.8th percentile of the 1-hour mean. Generally, Stock U values are higher for shorter averaging periods, which reflect the increased level of random error when predicting concentrations over this period.

Using the above information, the SDM of the model when applying a low Stock U Value for the annual mean NO_2 objective is given as follows:

$$SDM \text{ Annual Mean: } 0.1 \times 40 = 4 \mu\text{g m}^{-3}$$

This methodology adopts a top down approach to assessing pollutant concentrations. Where an exceedence of the objective is shown by validated model predictions, the line of uncertainty due to random errors is drawn at minus 1 SDM (the $36 \mu\text{g m}^{-3}$ contour for annual mean). This therefore indicates confidence in predicting the location of the exceedence, but uncertainty in defining the extent of an exceedence. Therefore, if exceedences of the annual mean NO_2 objective are shown, it would be recommended that an AQMA should be drawn based on the $36 \mu\text{g m}^{-3}$ contour line rather than the $40 \mu\text{g m}^{-3}$ line.



5. Detailed Dispersion Modelling Results

5.1 Introduction

The ADMS-Roads model has been used to predict concentrations of NO₂ at specific receptors and at grid points for the purpose of creating contour plots. Specific receptor locations correspond with monitoring sites and sensitive receptors such as the façades of residential properties. The results presented in this section have been verified in accordance with the procedures described in Section 4.6.1.

5.2 Predicted Annual Mean Concentrations

Table 5.1 presents the predicted 2007 and 2010 annual mean verified concentrations, for the diffusion tube and continuous monitoring locations, included in the modelling assessments. The predicted 2007 and 2010 annual mean verified concentrations for the remaining receptors modelled are presented in Appendix G. Predicted concentrations above the AQO of 40 µg m⁻³ are highlighted in bold. Contours showing the annual average concentrations for the modelled areas which show an exceedence at receptor locations of building facades are shown in Appendix H.

5.2.1 Area 1: Arthur Road, Alma Road, Osbourne Road, Winkfield Road and Imperial Way, Windsor

The annual average NO₂ AQO is likely to be exceeded at those receptors already located within the AQMA in Windsor in 2007 and in 2010.

In terms of areas outside the existing AQMA, Arthur Road shows concentrations which just exceeded the AQO in 2007, but no exceedences of the AQO were predicted for 2010. The maximum predicted concentration of NO₂ on Arthur Road in 2007 was 40.3 µg m⁻³ and in 2010 the maximum predicted concentration of NO₂ was 37.2 µg m⁻³.

Concentrations in Osbourne Road show that there were no predicted exceedences of the objective (maximum predicted NO₂ concentration 32.9 µg m⁻³) in 2007 and 2010 (maximum predicted NO₂ concentration 30.7 µg m⁻³).

Concentrations on Winkfield Road and Imperial Road outside the existing AQMA are below the objective in 2007 (Maximum predicted NO₂ concentration 39.5 µg m⁻³) and fall again in 2010 (Maximum predicted NO₂ concentration 35.8 µg m⁻³). Although the diffusion tube on Winkfield Road is predicting a concentration just above the annual mean NO₂ objective in 2007 (41.9 µg m⁻³), this diffusion tube is located on the kerbside; by 2010 the predicted annual mean concentration for this diffusion tube is below the annual mean NO₂ objective (37.6 µg m⁻³). The nearest property façade at this location is situated in excess of 6 metres from the diffusion tube and the kerb. It is therefore likely that the concentration of NO₂ will reduce with distance from the road and there would not be an



exceedence at the property façade. This is shown by the modelled receptor points at property facades along this road, which are not predicted to exceed the annual mean objective for NO₂.

The contour plots for Arthur Road highlight an area within approximately 10 – 20 metres of the kerb which shows an exceedence of the annual mean AQO for NO₂ in 2007. This area reduces in 2010, although some property facades still show an exceedence of the annual mean AQO for NO₂ in 2010. Exceedences may not necessarily occur at residential properties or other locations where the objectives apply, but it is assumed that the buildings within the contoured area are under residential occupation, therefore being relevant in terms of the exposure criteria for the annual mean AQO. The contours should be reviewed in the context of uncertainties as discussed in Section 4.73. Where annual mean NO₂ concentrations exceed 40 µg m⁻³ at a relevant receptor, the 36 µg m⁻³ contour should be considered as the line of possible exceedence.

5.2.2 Area 2: Bridge Road Maidenhead

Several receptor locations show predicted concentrations above the AQO for 2007 (Maximum predicted NO₂ concentration 65.9 µg m⁻³). The concentrations are predicted to reduce in 2010, although exceedences of the NO₂ annual mean AQO are still predicted. From the contour plots for this road it appears that there are several properties located within approximately 30 - 40 metres of the kerbside in an area which show an exceedence of the annual mean AQO for NO₂ in 2007. The number of properties located in the area of exceedence in 2010 is reduced. Exceedences may not necessarily occur at residential properties or other locations where the objectives apply, but it is assumed that the buildings within the contoured area are under residential occupation, therefore being relevant in terms of the exposure criterion for the annual mean AQO.

The contours should be reviewed in the context of uncertainties as discussed in Section 4.7.3. Where annual mean NO₂ concentrations exceed 40 µg m⁻³ at a relevant receptor, the 36 µg m⁻³ contour should be considered as the line of possible exceedence.

5.2.3 Area 3: Windsor Road, Maidenhead

Several receptor locations are predicted to exceed the AQO (Maximum predicted NO₂ concentration 53.6 µg m⁻³) in 2007. The predicted concentrations for 2010 (Maximum predicted NO₂ concentration 48.0 µg m⁻³) are lower than those predicted for 2007, but are still predicted to exceed the NO₂ annual mean AQO. From the contour plots, it is shown that the area which shows an exceedence of the annual mean AQO for NO₂ in 2007 stretches along the M4 and Windsor Road.

From the contour plots it appears that within a distance of approximately 100 metres from the edge of the M4 and within approximately 30 m of Windsor Road, the annual mean AQO for NO₂ is predicted to be exceeded in 2007 and 2010. Exceedences may not necessarily occur at residential properties or other locations where the objectives apply, but it is assumed that the buildings within the contoured area are under residential occupation, therefore being relevant in terms of the exposure criterion for the annual mean AQO.



The contours should be reviewed in the context of uncertainties as discussed in Section 4.7.3. Where annual mean NO₂ concentrations exceed 40 µg m⁻³ at a relevant receptor, the 36 µg m⁻³ contour should be considered as the line of possible exceedence.

Table 5.1 Predicted Annual Average NO₂ Concentrations at Monitoring Locations in 2007 and 2010

Receptor	2007 NO ₂ Verified Results (µg m ⁻³)	2010 NO ₂ Verified Results (µg m ⁻³)
Area 1 – Arthur Road, Alma Road, Osbourne Road, Winkfield Road and Imperial Way, Windsor		
WM31 Arthur Road	40.0	36.8
WM32 Arthur Road	39.8	36.7
WM33 Arthur Road	38.9	35.9
<i>WM10 Imperial Road</i>	48.5	44.2
01-04 Osbourne Road and Alma Road West	34.1	31.8
WM9 Alma Road	29.5	27.7
01-03 Winkfield and Imperial Road W	41.9	37.6
<i>Monitor Windsor</i>	46.7	42.5
Area 2 – Bridge Road, Maidenhead		
0-13 Bridge Road	61.3	55.5
Area 3 – Windsor Road, Maidenhead		
WM29 M4 Windsor Road	53.6	48.0
WM2 Priors Way	25.5	23.5

Notes Sites in Italics located in existing AQMA

Sites with exceedences of Annual mean AQO for NO₂ (40 µg m⁻³) are highlighted in bold

5.3 Comparison with Diffusion Tube Monitoring

Following the process of model verification, the modelled concentrations at the diffusion tube locations have been compared with the monitored values. Monitored diffusion tube concentrations in 2007 were used for this comparison, as they represent the most recent full calendar year of NO₂ monitoring which was also the base year for the modelling assessment. Accuracy of +/- 25% would be considered good for a dispersion model, but the inaccuracy of the diffusion tubes measurements should also be considered when evaluating the results.



Table 5.2 indicates the percentage difference between modelled (verified) and bias corrected monitored concentrations at the location of each diffusion tube. A negative value indicates that the verified modelled concentrations are below those monitored. The diffusion tube concentrations have been corrected for bias as discussed in Section 3.3. This comparison gives confidence in the accuracy of the dispersion modelling assessment.

Table 5.2 Difference between modelled and monitored concentrations at receptors.

Diffusion Tube	Annual Average Bias Corrected NO ₂ Concentration from Diffusion Tube (µg m ⁻³)	Annual Average Verified NO ₂ Modelled Concentration (µg m ⁻³)	% Difference
Area 1 – Arthur Road, Alma Road, Osbourne Road, Winkfield Road and Imperial Way, Windsor			
WM31 Arthur Road	52.1	40.0	-30.3
WM32 Arthur Road	45.2	39.8	-13.6
WM33 Arthur Road	59.8	38.9	-53.6
<i>WM10 Imperial Road</i>	40.5	34.1	-18.7
01-04 Osbourne Road and Alma Road West	32.0	29.5	-8.4
WM9 Alma Road	50.0	41.9	-19.4
01-03 Winkfield and Imperial Road W	52.1	40.0	-30.3
Area 2 – Bridge Road, Maidenhead			
0-13 Bridge Road	40.8	61.3	33.4
Area 3 – Windsor Road, Maidenhead			
WM29 M4 Windsor Road	61.10	53.63	-13.9
WM2 Priors Way	39.30	25.46	-54.4

Notes Site in Italics Located in Existing AQMA

As shown by the data in Table 5.2 the verified modelled values are between -54.4% and 33.4% of the monitored annual average concentrations, and also indicate that only half of the modelled results are within +/- 25% of the bias corrected diffusion tube results. The majority of the percentage differences are also negative values suggesting the model is under predicting values of NO₂ when compared to the monitored values, despite the process of model verification. The comparison of modelling and monitoring at Bridge Road in Maidenhead shows that the model



appears to be over predicting the values of NO₂. Refining the quality of model input data, including traffic volumes, percentages of heavy duty vehicles and vehicle speeds will help to further improve that accuracy of the modelling, but it is considered that the results are robust and can appropriately inform the need for an AQMA.



6. Summary and Recommendations

Following the results of the Progress Report and subsequent discussions with Defra, the annual mean concentrations of NO₂ in the following areas were considered to require a Detailed Assessment to be carried out:

- Area 1 - Arthur Road, Alma Road, Osbourne Road, Winkfield Road and Imperial Way, Windsor;
- Area 2 - Bridge Road, Maidenhead; and
- Area 3 - Windsor Road, Maidenhead.

The assessment has involved undertaking detailed dispersion modelling of road traffic emissions in these areas with the incorporation of local continuous monitoring data into the model verification process.

Compensation has been made for systematic errors by comparing modelled concentrations against monitored concentrations and deriving multiplying factors. This verification process aims to bring the modelled results into line with local measurements. There are many explanations for these differences, which may stem from uncertainty in the modelled number of vehicles, speeds and vehicle fleet composition. Further errors may result from estimates of emission factors, the use of meteorological data obtained for a year other than for which predictions are made, and because a conservative approach is often adopted throughout the modelling process.

The assessment has taken into consideration the exposure criteria of the relevant population, whereby the annual mean objective is relevant only at locations where the public may regularly be exposed. This involves modelling at building façades of residential properties, schools, hospitals, etc.

6.1 Summary of Modelled Concentrations

The Detailed Assessment, incorporating model verification against local continuous monitoring, has demonstrated that exceedences of the annual mean NO₂ AQO (40 µg m⁻³) are likely within the modelled areas of Arthur Road in Windsor, Bridge Road in Maidenhead, and Windsor Road (M4) in Maidenhead at relevant receptor locations.

When considering the effects of the random error of the model, as discussed in Section 4.7.2, a level of increased uncertainty is applied to modelled concentrations where the objective is likely to be exceeded. In these situations, contours are drawn of predicted ground level concentrations around the exceedence and it is suggested that the line of the 36 µg m⁻³ contour for annual mean NO₂ be used to define the extent of the likely exceedence and an AQMA.

If any new AQMAs are declared by the Royal Borough of Windsor and Maidenhead, a Further Assessment will be required that focus on air quality within the new AQMAs. The Further Assessment should primarily involve the updating of the dispersion modelling with revised estimates of traffic flows for 2008 and 2010, utilising updated traffic counts for both LDVs and HDVs.



Recommendations

- On the basis of the results of the Detailed Assessment, RBWM should consider declaring an AQMA in relation to exceedences of the annual mean AQO for Windsor Road, Maidenhead; Bridge Road, Maidenhead; and Arthur Road, Windsor;
- The line of the $36 \mu\text{g m}^{-3}$ contour for annual mean NO_2 in 2007 should be used as the basis of the extent of the likely exceedence and the extent of the new AQMA;
- Consideration should be given to the commissioning of a detailed traffic survey in order to determine vehicle numbers, the diurnal profile of vehicles, the fleet mix and queue lengths;
- Where possible, the diffusion tubes sites in the areas identified as showing possible exceedences should be moved to the facades of residential buildings to ensure they are located where there is relevant exposure; and
- Following the declaration of exceedence areas as AQMAs the council should undertake a Further Assessment utilising revised traffic estimates to reduce uncertainty in the dispersion modelling. This updated information may also help in the formulation of an Action Plan to reduce emissions and move towards attainment of the AQOs.



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Appendix A Locations of Continuous Monitors



Appendix A

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Appendix A

Figure A1 Maidenhead Continuous Monitor

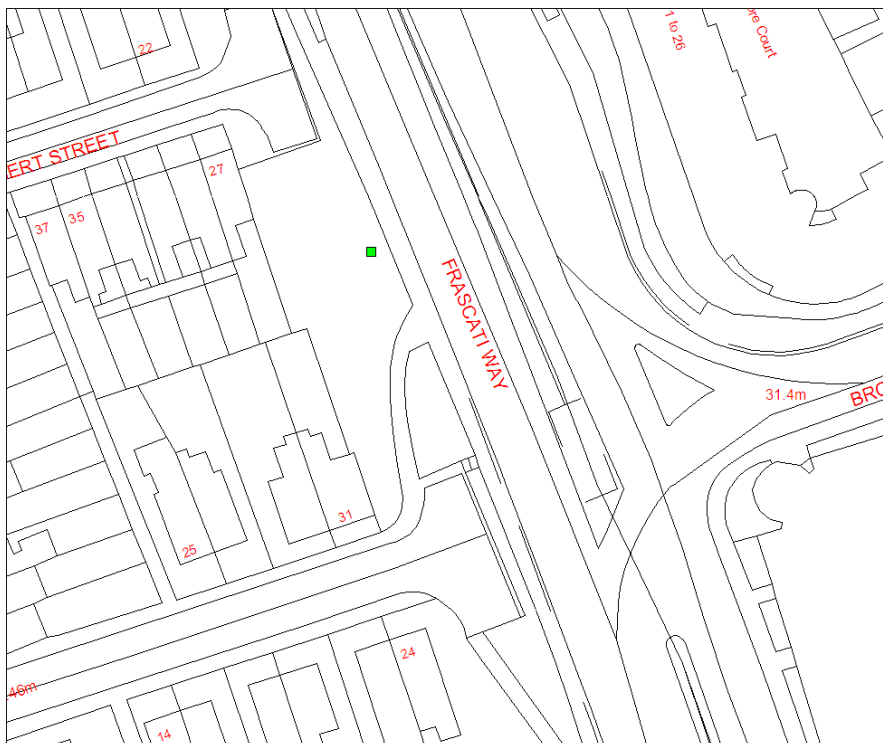


Figure A2 Windsor Continuous Monitor

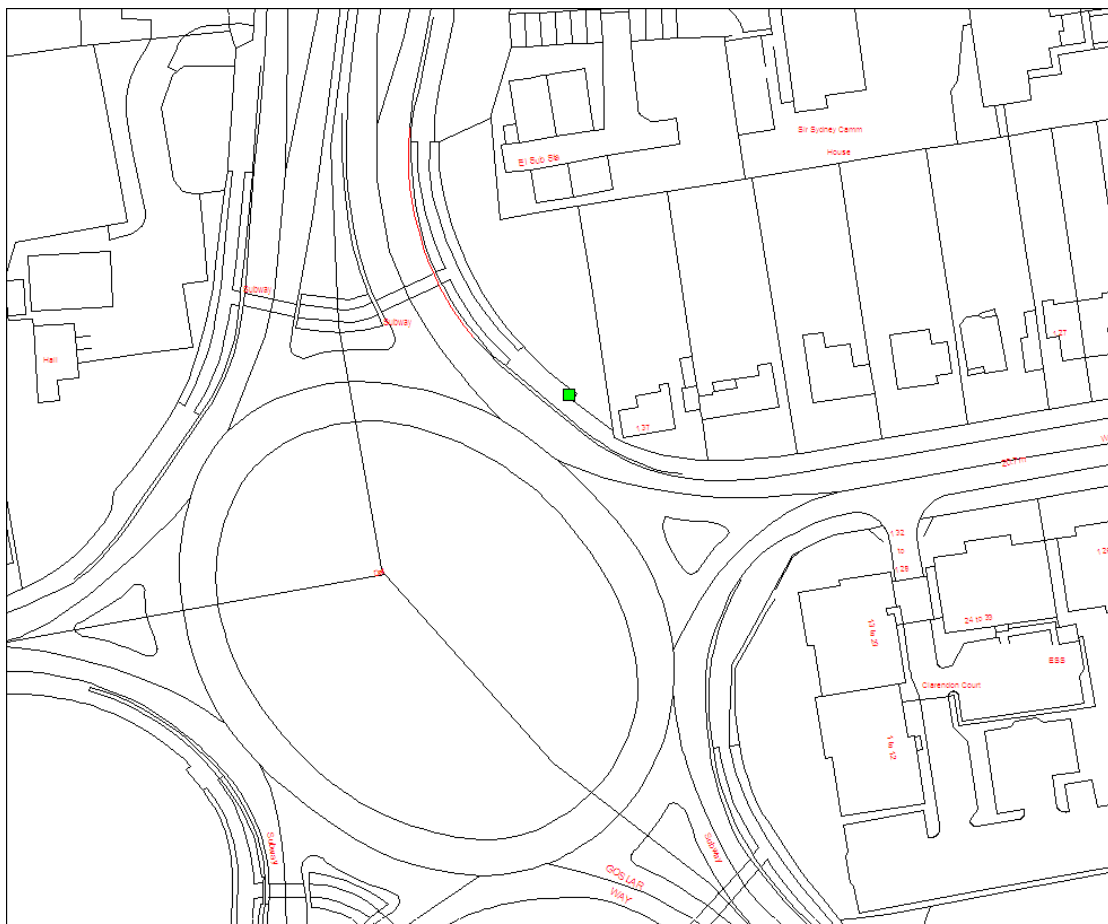
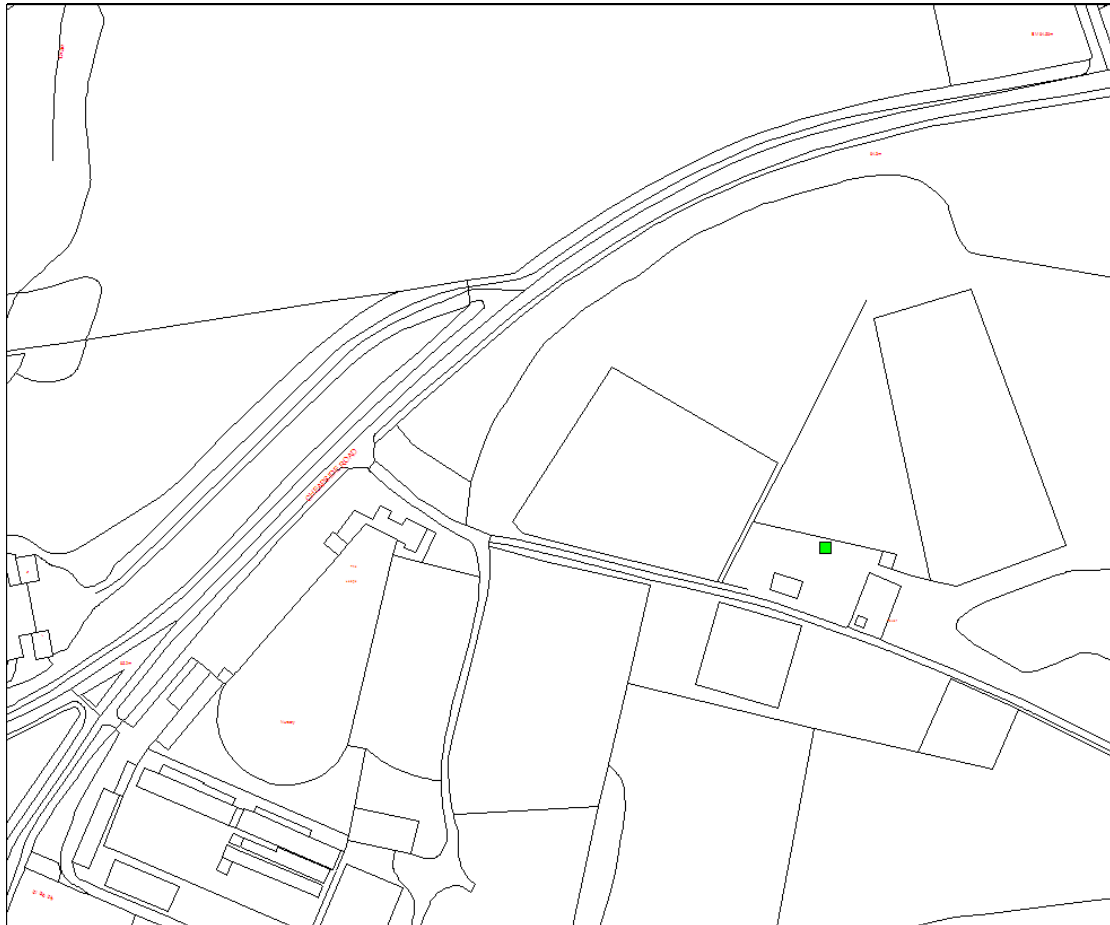


Figure A3 Ascot Continuous Monitor



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Appendix A

Appendix B Bias Correction



Appendix B

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Appendix B

Windsor Bias Correction

Checking Precision and Accuracy of Triplicate Tubes



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	03/01/2007	31/01/2007	39.26	41.58	42.89	41	1.8	4	4.6	
2	31/01/2007	05/03/2007	44.19	44.45	45.71	45	0.8	2	2.0	
3	05/03/2007	28/03/2007	43.09	41.95	32.52	39	5.8	15	14.4	
4	28/03/2007	02/05/2007	40.86	39.76	42.16	41	1.2	3	3.0	
5	02/05/2007	30/05/2007	38.83	37.23	39.49	39	1.2	3	2.9	
6	30/05/2007	04/07/2007	44.13	44.91	42.22	44	1.4	3	3.4	
7	04/07/2007	01/08/2007	44.49		47.12	46	1.9	4	16.7	
8	01/08/2007	29/08/2007	46.46	45.79	46.28	46	0.3	1	0.9	
9	29/08/2007	03/10/2007	39.00	39.27	36.59	38	1.5	4	3.7	
10	03/10/2007	31/10/2007	48.96	47.02	48.14	48	1.0	2	2.4	
11	31/10/2007	28/11/2007	54.94	47.96	49.29	51	3.7	7	9.2	
12	28/11/2007	02/01/2008	49.49	51.12	47.09	49	2.0	4	5.0	
13										

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

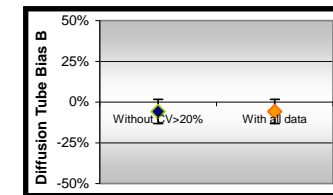
Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
41.99		Good	Good
51.399		Good	Good
53.298		Good	Good
55.399		Good	Good
39.199		Good	Good
42.296		Good	Good
42.99		Good	Good
42.296		Good	Good
41.689		Good	Good
51.899		Good	Good
54.999		Good	Good
50.478		Good	Good
Overall survey -->		Good precision	Good Overall DC

Site Name/ ID:

Precision 12 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 12 periods of data	
Bias factor A	1.07 (0.99 - 1.17)
Bias B	-7% (-14% - 1%)
Diffusion Tubes Mean:	44 μgm^{-3}
Mean CV (Precision):	4
Automatic Mean:	47 μgm^{-3}
Data Capture for periods used:	96%
Adjusted Tubes Mean:	47 (43 - 51) μgm^{-3}

Accuracy (with 95% confidence interval)	
WITH ALL DATA	
Bias calculated using 12 periods of data	
Bias factor A	1.07 (0.99 - 1.17)
Bias B	-7% (-14% - 1%)
Diffusion Tubes Mean:	44 μgm^{-3}
Mean CV (Precision):	4
Automatic Mean:	47 μgm^{-3}
Data Capture for periods used:	96%
Adjusted Tubes Mean:	47 (43 - 51) μgm^{-3}



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Version 03 - November 2006



Appendix B

Maidenhead Bias Correction

Checking Precision and Accuracy of Triplicate Tubes

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	03/01/2007	31/01/2007	40.32	42.74	42.90	42	1.4	3	3.6
2	31/01/2007	05/03/2007		47.30	45.73	47	1.1	2	10.0
3	05/03/2007	28/03/2007	44.38	44.45	43.36	44	0.6	1	1.5
4	28/03/2007	02/05/2007	38.54	45.35	26.95	37	9.3	25	23.1
5	02/05/2007	30/05/2007	42.42	44.73	43.79	44	1.2	3	2.9
6	30/05/2007	04/07/2007	45.13	48.95	48.77	48	2.2	5	5.4
7	04/07/2007	01/08/2007	45.19	46.74	46.85	46	0.9	2	2.3
8	01/08/2007	29/08/2007	47.06	46.64	48.31	47	0.9	2	2.2
9	29/08/2007	03/10/2007	34.74						
10	03/10/2007	31/10/2007	50.91	51.30	48.20	50	1.7	3	4.2
11	31/10/2007	28/11/2007	50.31	49.95	51.55	51	0.8	2	2.1
12	28/11/2007	02/01/2008	50.88	53.95	48.71	51	2.6	5	6.5
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
45.5	100	Good	Good
57.9	100	Good	Good
50.7	100	Good	Good
53.4	99	Poor Precision	Good
43.5	100	Good	Good
49.2	100	Good	Good
41	100	Good	Good
44.4	94	Good	Good
46.3	93		Good
56.3	96	Good	Good
57.8	100	Good	Good
62.3	100	Good	Good

Overall survey --> **Good precision** **Good Overall DC**

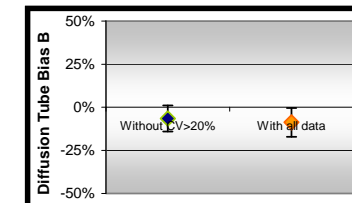
(Check average CV & DC from Accuracy calculations)

Site Name/ ID:

Precision **10 out of 11 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	1.08 (1 - 1.18)
Bias B	-8% (-15% - 0%)
Diffusion Tubes Mean:	47 μgm^{-3}
Mean CV (Precision):	3
Automatic Mean:	51 μgm^{-3}
Data Capture for periods used:	99%
Adjusted Tubes Mean:	51 (47 - 55) μgm^{-3}

Accuracy (with 95% confidence interval)	
WITH ALL DATA	
Bias calculated using 11 periods of data	
Bias factor A	1.11 (1.02 - 1.22)
Bias B	-10% (-18% - -2%)
Diffusion Tubes Mean:	46 μgm^{-3}
Mean CV (Precision):	5
Automatic Mean:	51 μgm^{-3}
Data Capture for periods used:	99%
Adjusted Tubes Mean:	51 (47 - 56) μgm^{-3}



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Version 03 - November 2006



Appendix B

Ascot Bias
Correction

Checking Precision and Accuracy of Triplicate Tubes



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	03/01/2007	31/01/2007	14.15	15.52	13.94	15	0.9	6	2.1
2	31/01/2007	05/03/2007	19.51	19.21	18.20	19	0.7	4	1.7
3	05/03/2007	28/03/2007	16.05	13.10	13.31	14	1.6	12	4.1
4	28/03/2007	02/05/2007	15.05	15.53	13.80	15	0.9	6	2.2
5	02/05/2007	30/05/2007	10.81	11.42		11	0.4	4	3.9
6	30/05/2007	04/07/2007	11.97	12.46	11.29	12	0.6	5	1.5
7	04/07/2007	01/08/2007	10.08	10.02	9.40	10	0.4	4	0.9
8	01/08/2007	29/08/2007	12.86	12.50	12.20	13	0.3	3	0.8
9	29/08/2007	03/10/2007							
10	03/10/2007	31/10/2007	21.01	20.36	20.60	21	0.3	2	0.8
11	31/10/2007	28/11/2007	22.70	21.33	21.51	22	0.7	3	1.9
12	28/11/2007	02/01/2008	22.45	23.84	23.08	23	0.7	3	1.7
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	Tubes Precision Check	Automatic Monitor Data
	14.1 99	Good	Good
	25.8 99	Good	Good
	23.3 99	Good	Good
	23.4 99	Good	Good
	15.9 99	Good	Good
	18.1 99	Good	Good
	14.8 99	Good	Good
	19.4 96	Good	Good
	24.1 80		Good
	36 98	Good	Good
	38.7 99	Good	Good
	36.3 93	Good	Good

Overall survey --> **Good precision** **Good Overall DC**

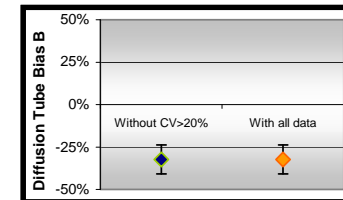
(Check average CV & DC from Accuracy calculations)

Site Name/ ID:

Precision 11 out of 11 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	1.53 (1.35 - 1.76)
Bias B	-35% (-43% - -26%)
Diffusion Tubes Mean:	16 μgm^{-3}
Mean CV (Precision):	5
Automatic Mean:	24 μgm^{-3}
Data Capture for periods used:	98%
Adjusted Tubes Mean:	24 (21 - 28) μgm^{-3}

Accuracy (with 95% confidence interval)	
WITH ALL DATA	
Bias calculated using 11 periods of data	
Bias factor A	1.53 (1.35 - 1.76)
Bias B	-35% (-43% - -26%)
Diffusion Tubes Mean:	16 μgm^{-3}
Mean CV (Precision):	5
Automatic Mean:	24 μgm^{-3}
Data Capture for periods used:	98%
Adjusted Tubes Mean:	24 (21 - 28) μgm^{-3}



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Version 03 - November 2006



Appendix B



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Appendix B

Appendix C Diffusion Tube Results



Appendix C

Ref	Site Name	Location		Classification	Data Capture	Annual Mean	Annual Mean	Annual Mean	Annual Mean
		X - Coordinate	Y - Coordinate			Bias Corrected ($\mu\text{g m}^{-3}$)	($\mu\text{g m}^{-3}$)	Bias Corrected ($\mu\text{g m}^{-3}$)	Predicted* ($\mu\text{g m}^{-3}$)
					Months	2006	2007	2007	2010
WM1	Longmead	494067.16	176764.19	Urban Background	12	21.9	20.67	22.4	20.6
WM2	Priors Way	489706.19	178789.33	Urban Background	12	39.5	36.19	39.3	36.1
WM5	Broadway Road	488828.78	181029.23	Roadside	9	56.7	46.87	50.9	45.5
WM6	South Road	488627.22	180963.05	Roadside	5	39.5	38.33	41.6	37.2
WM8	Mossey Vale	489857.82	182554.19	Urban Background	12	24.4	21.11	22.9	19.9
WM9	Alma Road	487982.65	182307.71	Roadside	12	32.7	29.49	32.0	28.6
WM10	Imperial Road	496179.65	176330.42	Roadside	11	39.9	41.62	45.2	40.4
WM11	St Lukes Road	New site			11	31.8	31.36	34.0	30.4
WM13	Wraysbury Road	502103.87	172507.7	Roadside	12	43.7	34.55	37.5	33.5
WM14	Wrays High Street	500484.51	174027.59	Roadside	12	29.7	26.36	28.6	25.6
WM15	M25 Wrays Road	502260.09	172335.34	Roadside	11	48.6	49.24	53.4	47.8
WM16	Ousley Road adj 47	499135.65	173623.52	Roadside	5	32.6	26.34	28.6	25.6
WM17	Horton Road	498876.67	177041.81	Roadside	12	31.2	27.58	29.9	26.8
WM18	AQMS Windsor 1	495664.00	176592.00	Roadside collocated	12	47.2	44.47	48.3	43.2
WM19	AQMS Windsor 2	495664.00	176592.00	Roadside collocated	11	48.36	43.73	47.4	42.5
WM20	AQMS Windsor 3	495664.00	176592.00	Roadside collocated	12	45.8	43.29	47.0	42.0
WM21	AQMS Maidenhead 1	488626.00	180994.00	Roadside collocated	11	52.4	44.54	48.3	43.2
WM22	AQMS Maidenhead 2	488626.00	180994.00	Roadside collocated	11	51.9	47.47	51.5	46.1
WM23	AQMS Maidenhead 3	488626.00	180994.00	Roadside collocated	11	53.1	45.01	48.8	43.7



Appendix C

Ref	Site Name	Location		Classification	Data Capture	Annual Mean	Annual Mean	Annual Mean	Annual Mean
		X - Coordinate	Y - Coordinate			Bias Corrected ($\mu\text{g m}^{-3}$)	($\mu\text{g m}^{-3}$)	Bias Corrected ($\mu\text{g m}^{-3}$)	Predicted* ($\mu\text{g m}^{-3}$)
						2006	2007	2007	2010
WM25	Sunninghill High Street	493625.63	167811.69	Roadside	12	30.1	27.03	29.3	26.2
WM26	Windsor Rd Paddock House	495289.77	166765.54	Roadside	4	32.9	25.82	28.0	25.1
WM27	London A30 train Station	496604.07	177865.68	Roadside	11	30.6	33.60	36.5	32.6
WM28	Eton Wick	489984.21	178715.91	Roadside	12	40.7	38.27	41.5	37.2
WM29	M4 Windsor Road	495289.77	166765.54	Roadside	11	62.5	56.31	61.1	54.7
WM30	Datchet	New site		Roadside	5	35.5	35.83	38.9	34.8
WM31	Arthur Road 1	495895.67	176939.49	Roadside	11	47.2	48.00	52.1	46.6
WM32	Arthur Road 2	496081.73	176903.1	Roadside	12	44.0	38.70	45.2	40.5
WM33	Arthur Road 3	496312.13	176886.03	Roadside	8	59.7	55.12	59.8	53.5
WM34	M'head Road opposite BP	New site		Background	8	43.7	35.52	38.5	34.5
0-1	Hythe End Road W'bury W	501366	172377	Roadside	12	21.8	20.27	22.0	19.7
0-2	Dedworth Rd W	495086	176462	Roadside	10	31.6	28.96	31.4	28.1
0-3	Winkfield + Imperial Rd W	495299	175557	Roadside	11	47.0	46.11	50.0	44.8
0-4	Osborne Rd + Alma Rd W	496282	176091	Roadside	11	51.5	37.31	40.5	36.2
0-9	Ascot High St 1 A	492460	168775	Roadside	12	32.8	31.92	34.6	31.0
0-12	Cookham Road M	488525	182471	Roadside	12	31.1	31.21	33.9	30.3
0-13	Bridge Road M	489571	181334	Roadside	12	43.3	37.56	40.8	36.5
0-14	Bath Road M	493810	169300	Roadside	4	32.9	32.97	35.8	32.0
0-15	Shoppenhangers Rd M	493810	169300	Roadside	5	38.7	34.45	37.4	33.4
SP1	Silwood Park Ascot	493810	169300	Rural collocated	12	17.2	15.86	17.2	15.8



Appendix C

Ref	Site Name	Location		Classification	Data Capture	Annual Mean	Annual Mean	Annual Mean	Annual Mean
		X - Coordinate	Y - Coordinate			Months	2006	2007	2007
						Bias Corrected ($\mu\text{g m}^{-3}$)	($\mu\text{g m}^{-3}$)	Bias Corrected ($\mu\text{g m}^{-3}$)	Predicted* ($\mu\text{g m}^{-3}$)
SP2	Silwood Park Ascot	492460	168775	Rural collocated	12	16.9	15.79	17.1	15.8
SP3	Silwood Park Ascot	488525	182471	Rural collocated	11	16.7	15.58	16.9	15.5

Notes *Calculated using the methodology in LAQM TG (03) and the Update in 2006.

Site in Italics Located in Existing AQMA

Bias adjustment factor used in 2006: Windsor Sites 1.11, Maidenhead sites 1.09, and Ascot sites 1.13

Sites with exceedences of Annual mean AQO for NO₂ ($40 \mu\text{g m}^{-3}$) are highlighted in bold



Appendix C

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Appendix C

Appendix D Locations of Diffusion Tubes included in the Modelling



Appendix D

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Appendix D

Location of Receptors in Area 1

Figure D1 Diffusion Tube WM31 (Arthur Road)

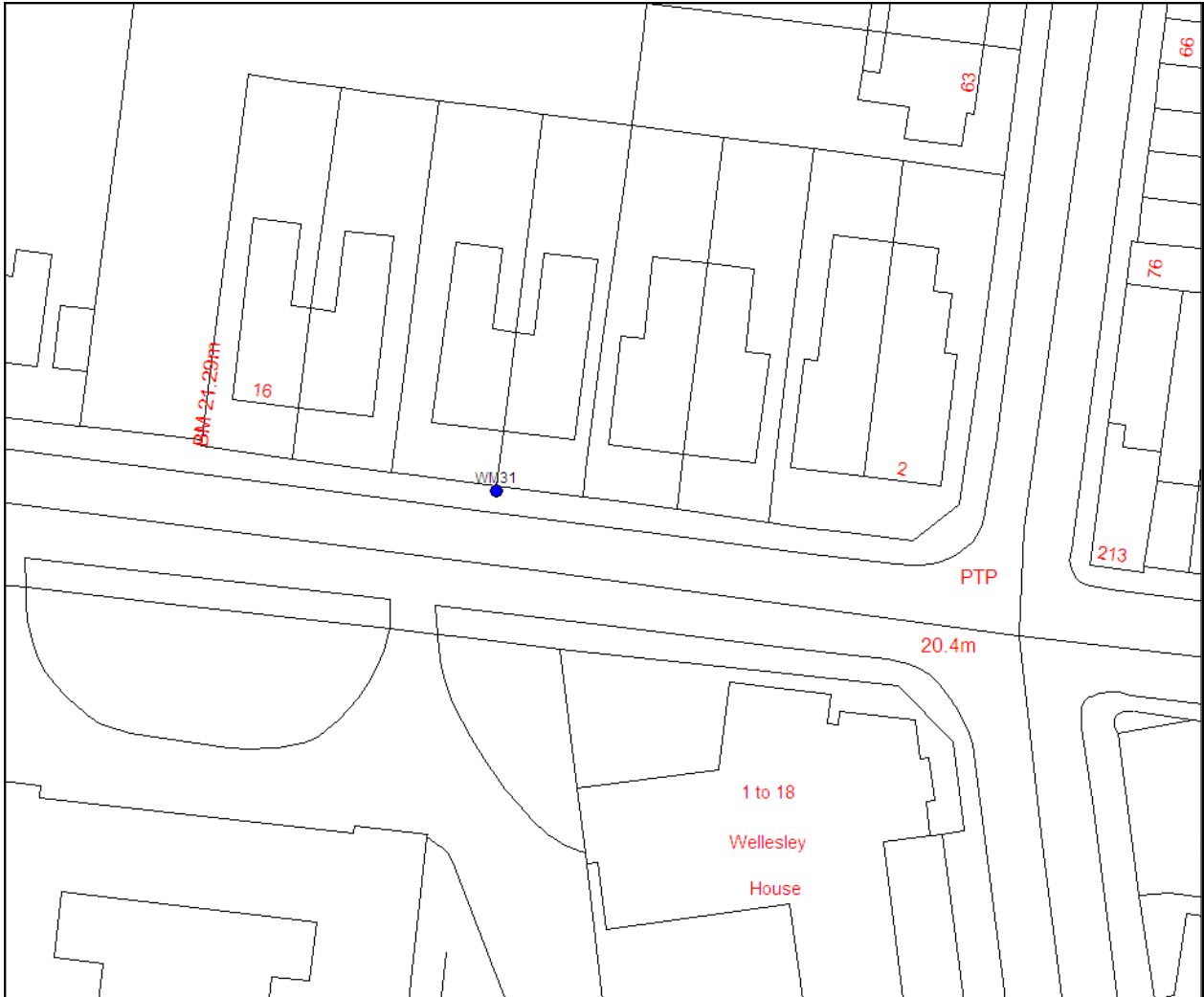


Figure D2 Diffusion Tube WM32 (Arthur Road)

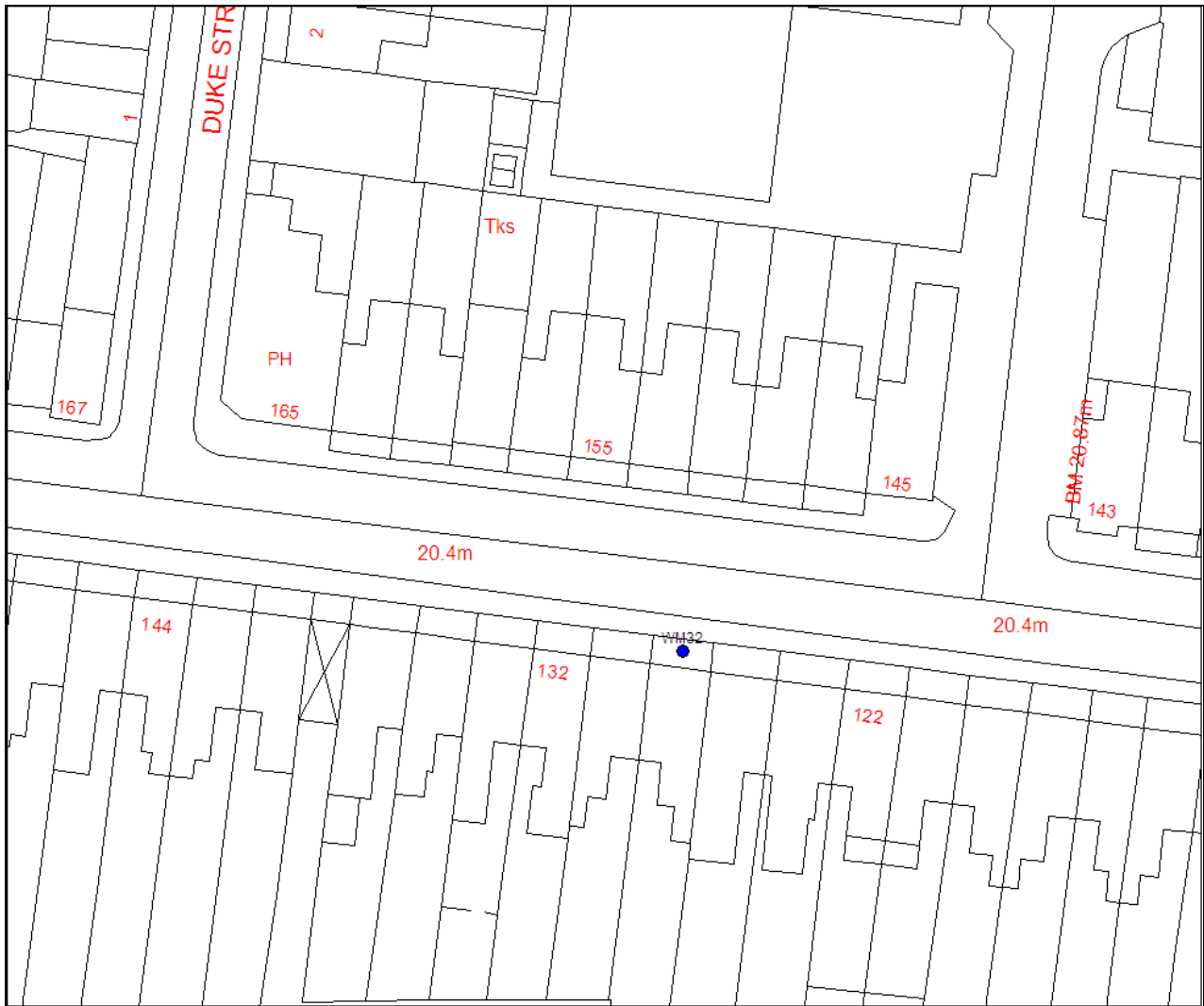


Figure D3 Diffusion Tube WM33 (Arthur Road)

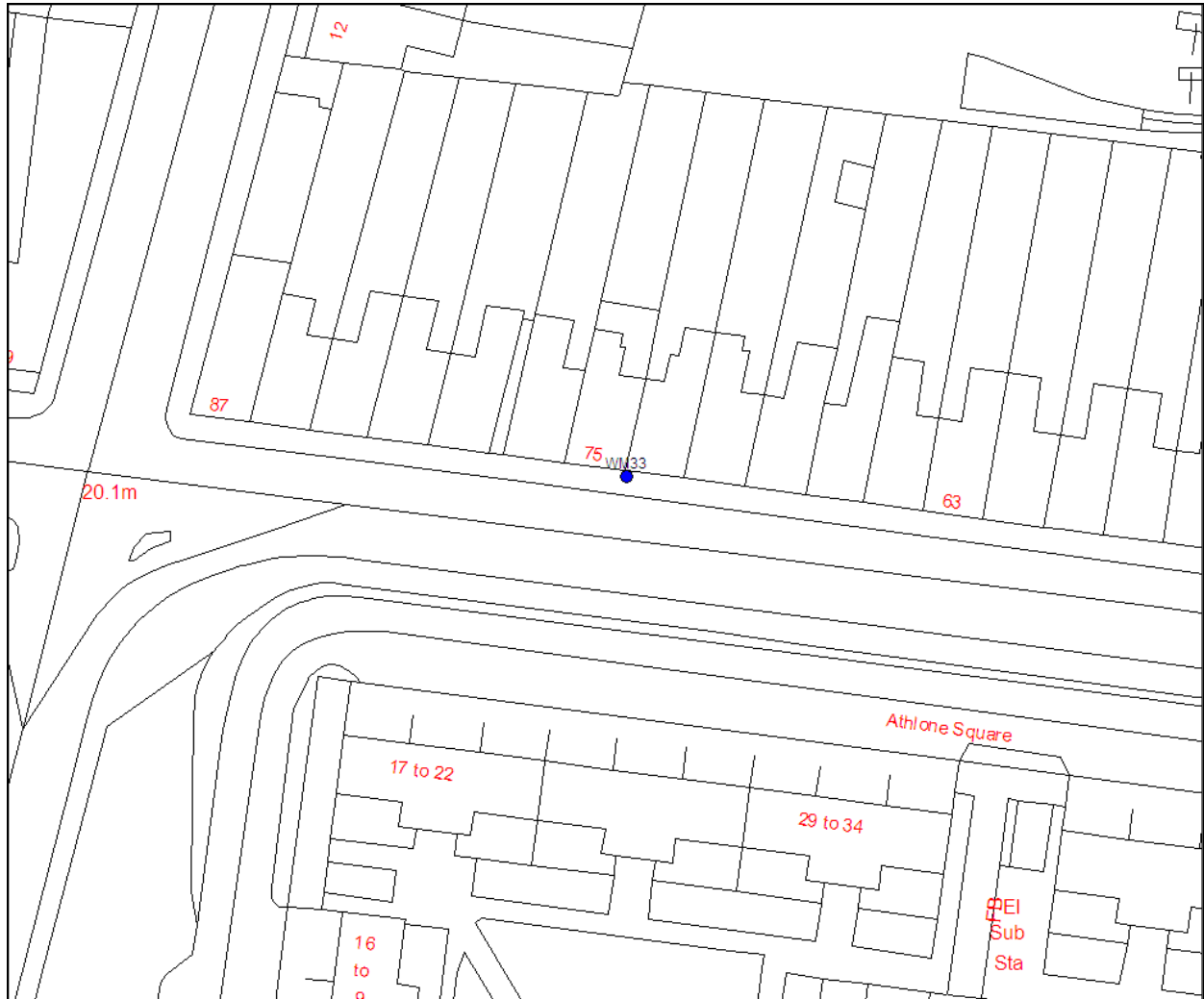


Figure D4 Diffusion Tube WM18 (Co-located with WM19 and WM20 and the Continuous Monitor in green) and WM24 (A332 Roundabout, now dis-continued in blue)

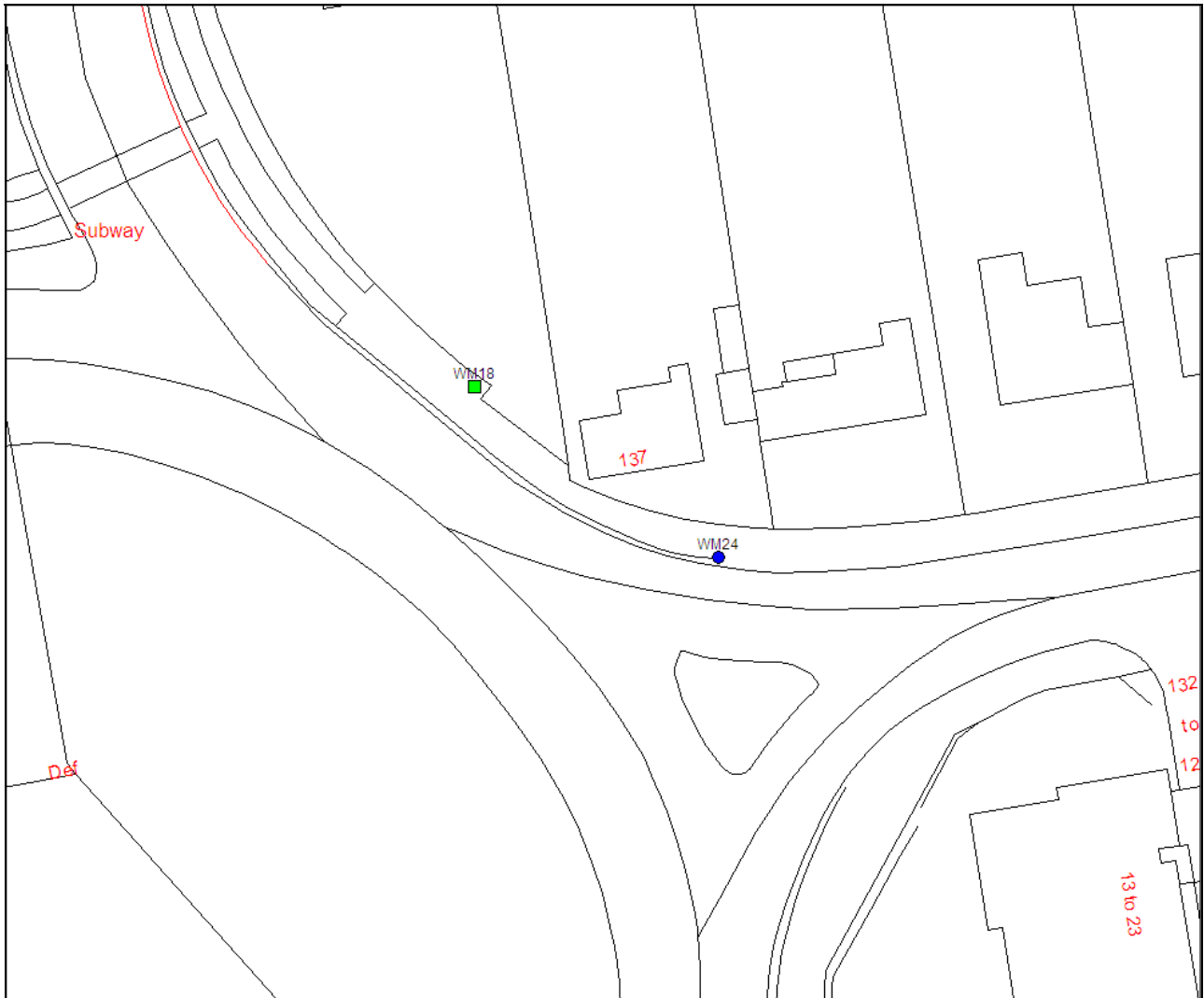


Figure D5 Diffusion Tube WM10 (Imperial Way)

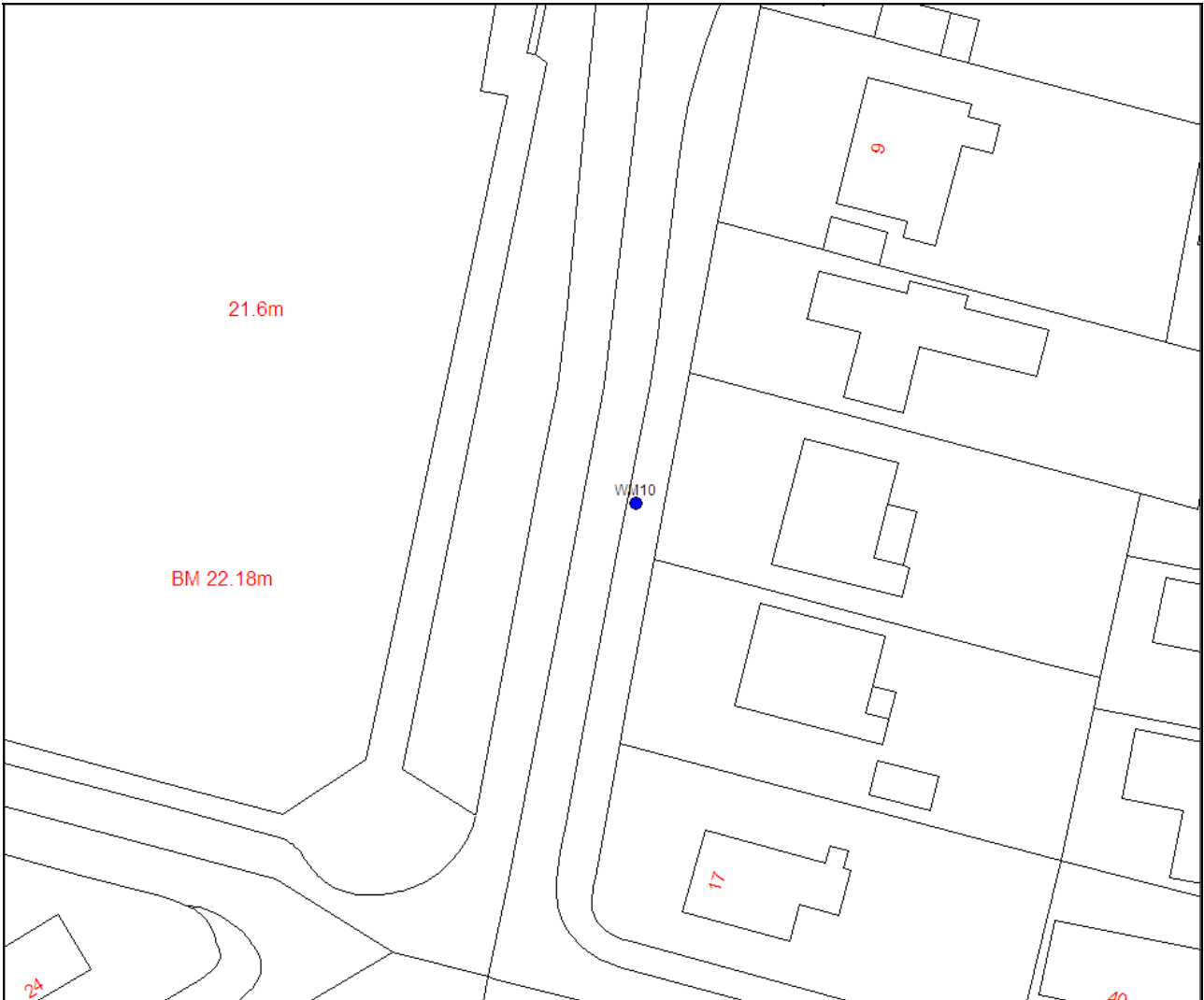


Figure D6 Diffusion Tube 0_4 (Osbourne Road)

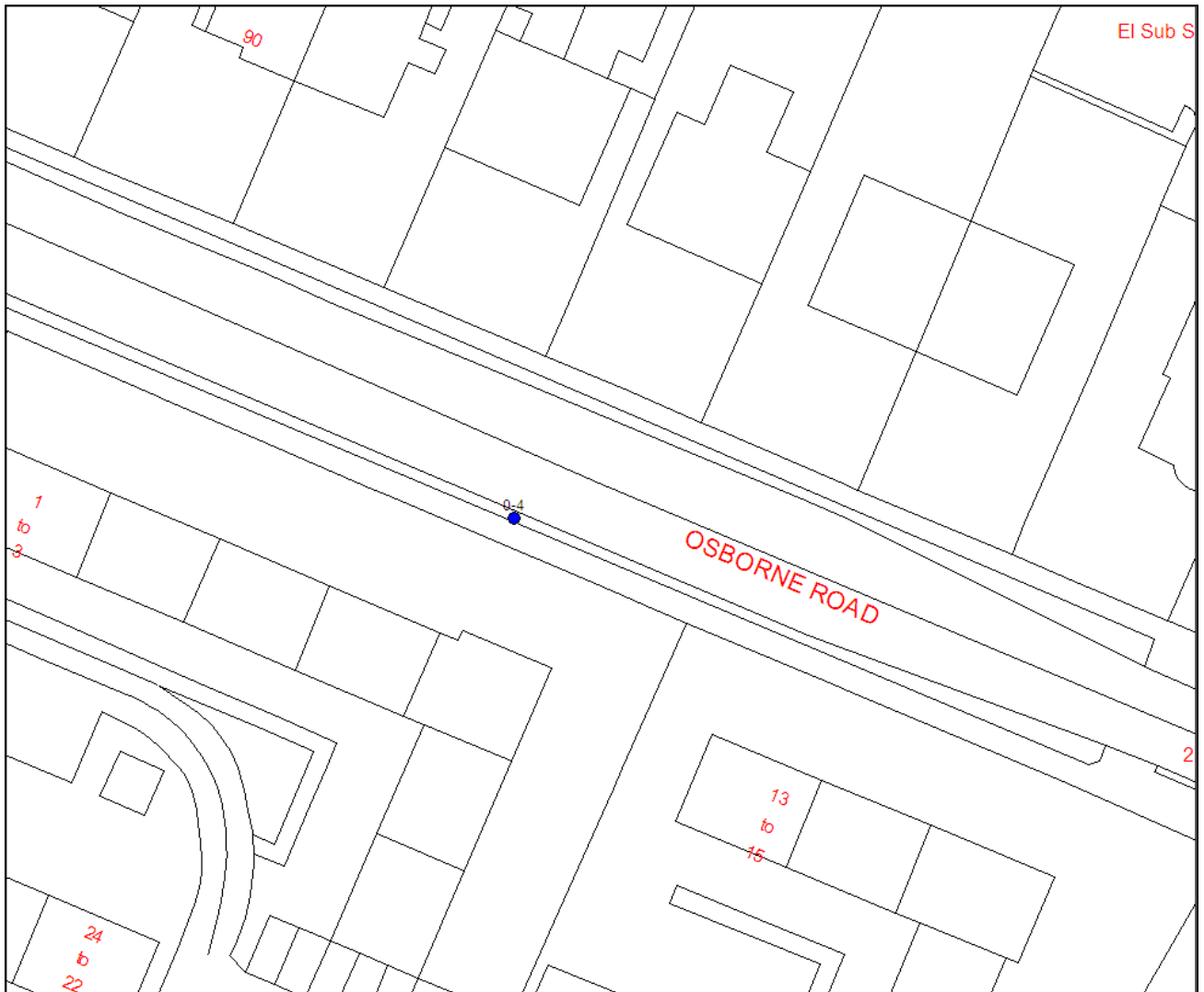


Figure D7 Diffusion Tube WM9 (Alma Road)

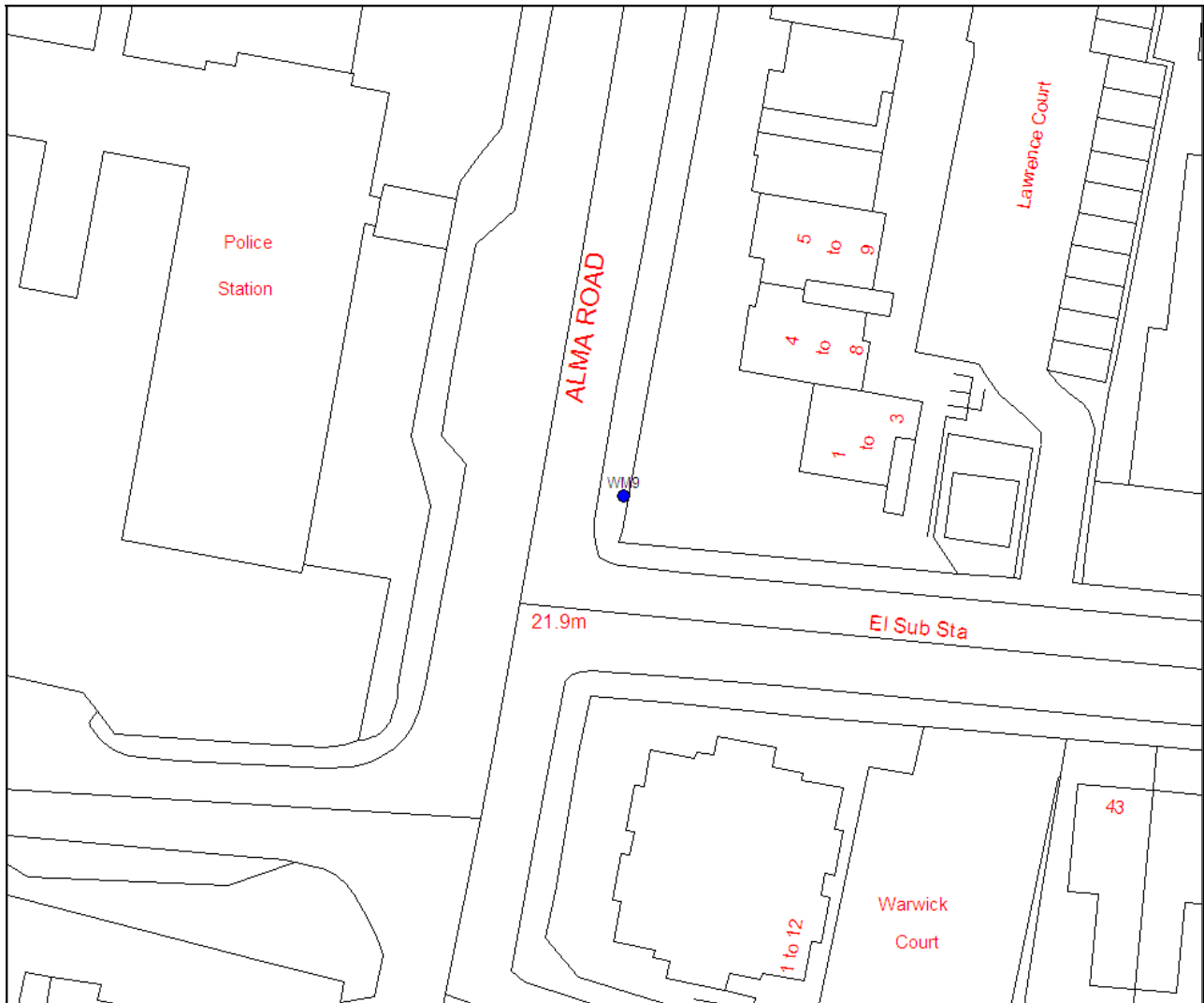
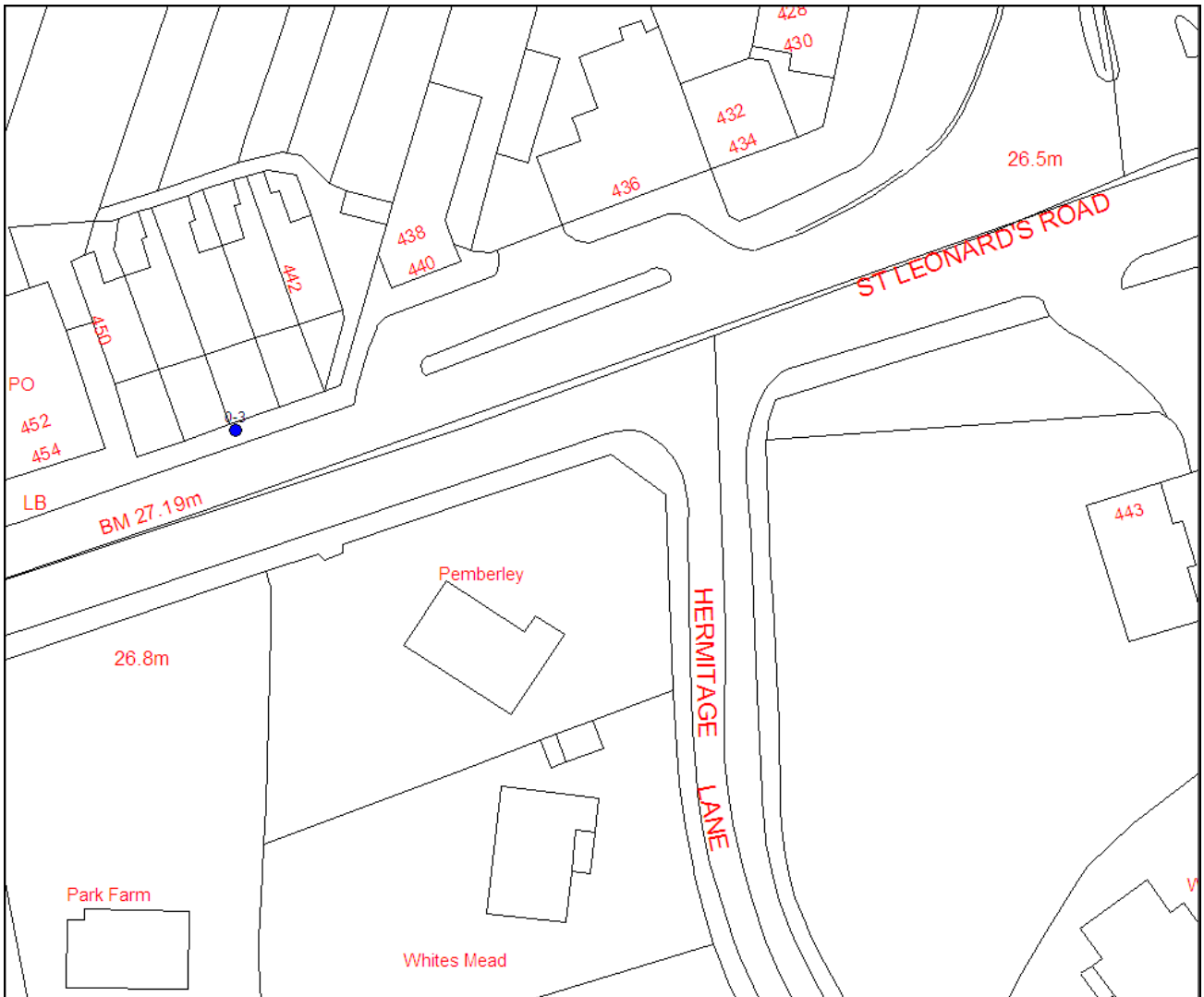
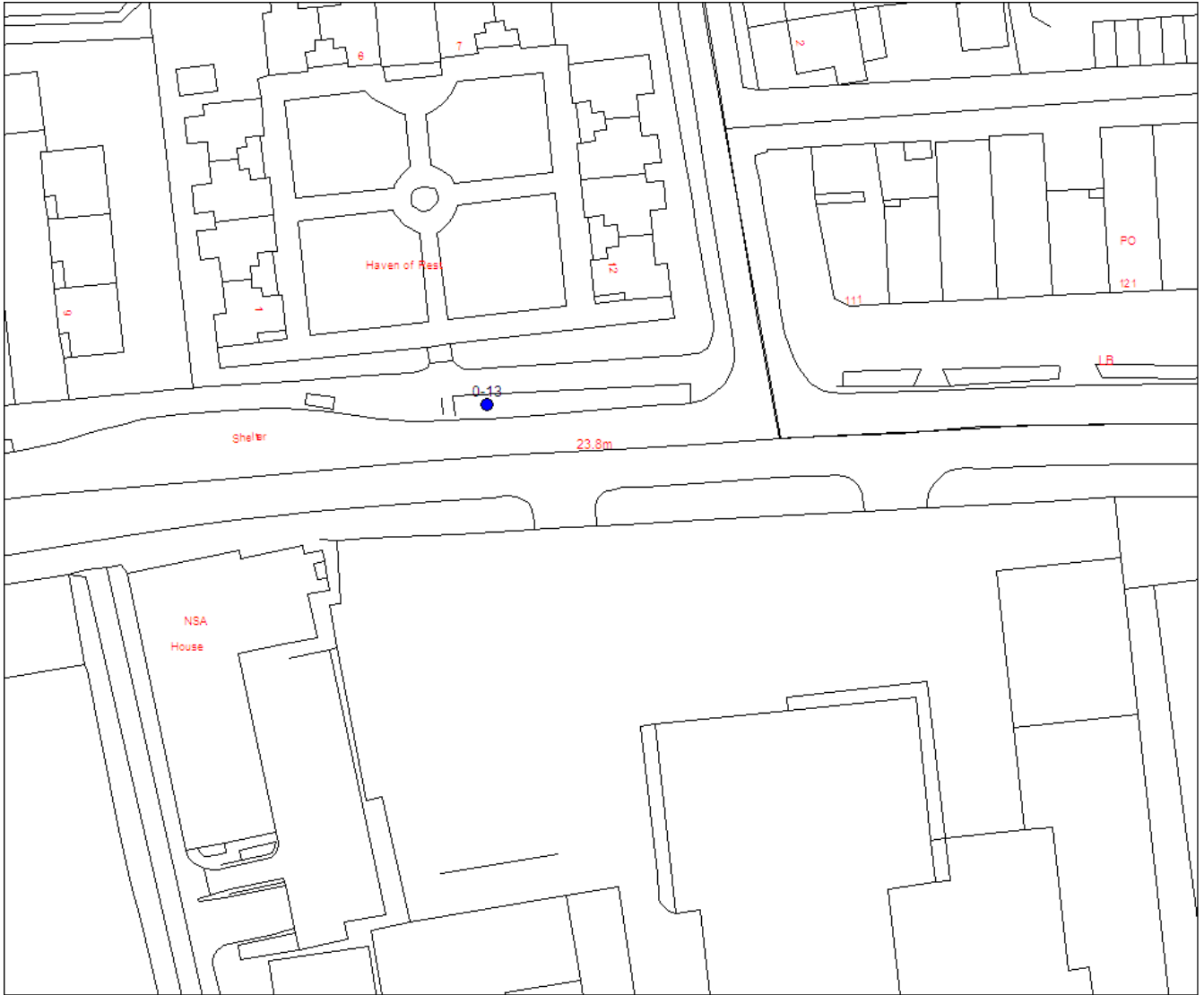


Figure D8 Diffusion Tube 0_3 (St Leonard's Road)



Location of Receptors in Area 2

Figure D9 Diffusion Tube 0-13 (Bridge Road)



Location of Receptors in Area 3

Figure D10 Diffusion Tube WM2

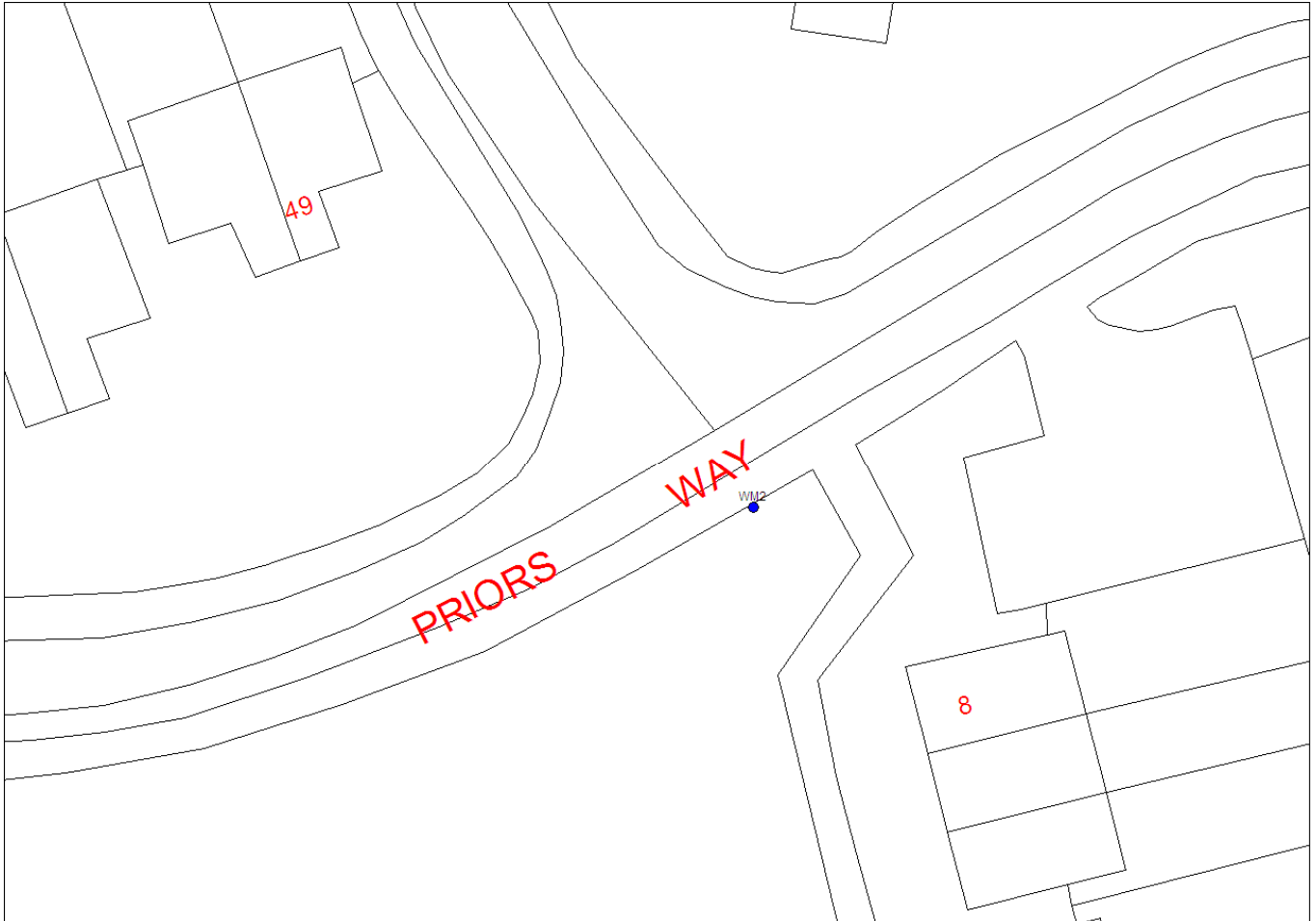


Figure D11 Diffusion Tube WM29



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Appendix D

Appendix E Details of Modelled Receptors



Appendix E

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Appendix E

Table E.1 Details of Modelled Receptors – Area 1: Arthur Road, Alma Road, Osbourne Road, Winkfield Road and Imperial Way, Windsor

Ref	Receptor	Location		Height
		x-coordinate	y-coordinate	metres
1	WM31 Arthur Road	495896	176939	2
2	WM32 Arthur Road	496082	176903	2
3	WM33 Arthur Road	496312	176886	2
4	WM10 Imperial Road	495613	176434	2
5	01-04 Osbourne Road and Alma Road W	496282	176091	2
6	WM9 Alma Road	496179	176330	2
7	01-03 Winkfield and Imperial Road W	495299	175557	2
8	<i>Monitor Windsor</i>	495664	176592	2
9	27 Arthur Road	496427	176871	1.5
10	51 Arthur Road	496367	176879	1.5
11	41-46 Athlone Square	496371	176854	1.5
12	17-22 Athlone Square	496297	176864	1.5
13	89 Arthur Road	496261	176895	1.5
14	19 Alma Road	496253	176858	1.5
15	121 Arthur Road	496170	176906	1.5
16	92 Arthur Road	496168	176890	1.5
17	151 Arthur Road	496086	176917	1.5
18	201 Arthur Road	495967	176931	1.5
19	26 Maidenhead Road	495831	176952	1.5
20	Club A332	495600	176916	1.5
21	106b Sidney Caine House	495675	176743	1.5
22	13-23 Claredon Court	495704	176554	1.5
23	14 Green Lane	495849	176357	1.5
24	Youth and Community	496010	176312	1.5
25	2 York Road	496095	176198	1.5
26	93 Alma Road	496181	176049	1.5
27	Osbourne Court	496203	176086	1.5
28	78 Alma Road	496233	176012	1.5



Appendix E

Ref	Receptor	Location		Height
		x-coordinate	y-coordinate	metres
29	103 Alma Road	496219	175993	1.5
30	18 Frances Road	496393	175947	1.5
31	40 Knights Place	496413	176029	1.5
32	Upton House School	496401	176054	1.5
33	13 Montpellier Court	496303	176071	1.5
34	90 Osbourne Road	496260	176012	1.5
35	1-7 Houston Court	496176	176191	1.5
36	73 Alma Road	496144	176262	1.5
37	16 Laurence Court	496192	176372	1.5
38	63 Alma Road	496184	176473	1.5
39	Pemberley	495316	175544	1.5
40	Hermitage Lodge	495227	175509	1.5
41	34 Alma Road	496232	176597	1.5
42	43 Alma Road	496221	176696	1.5
43	25 Alma Road	496239	176786	1.5
44	25 Imperial Road	495579	176286	1.5
45	65a Imperial Road	495510	175986	1.5
46	1-36 Imperial Road	495391	175627	1.5
47	429 St Leonards Road	495441	175588	1.5
48	364 St Leonards Road	495540	175622	1.5

Notes: Locations in Italics located in Existing AQMA



Appendix E

Table E.2 **Details of Modelled Receptors – Area 2: Bridge Road, Maidenhead**

Ref	Receptor	Location		Height
		x-coordinate	y-coordinate	metres
1	0-13 Bridge Road M	489571	181333	2
2	1 Bridge Road	489756	181319	1.5
3	121 Bridge Road	489646	181347	1.5
4	12 Haven of Rest	489583	181347	1.5
5	79 Smythes Almshouses	489592	181347	1.5
6	90 Moorbridge Road	489448	181300	1.5
7	Harvest Court	489267	181339	1.5
8	Sybase Court	489190	181375	1.5
9	Albany House	488879	181350	1.5
10	154 Bridge Road	489872	181320	1.5
11	17 Ray Drive	489875	181373	1.5
12	<i>Maidenhead Continuous Monitor</i>	<i>488626</i>	<i>180994</i>	2

Notes: Locations in Italics located in Existing AQMA



Table E.3 Details of Modelled Receptors – Area 3: Windsor Road, Maidenhead

Ref	Receptor	Location		Height
		x-coordinate	y-coordinate	metres
1	WM29 M4 Windsor Road	489985	178714	2
2	WM2 Priors Way	489707	178790	2
3	Priors Close	489661	178997	1.5
4	27 Windsor Road	489740	178990	1.5
5	2 Heathcote	489759	178907	1.5
6	83 Priors Way	489823	178834	1.5
7	31 Windsor Road	489859	178888	1.5
8	1 Windsor Road	490023	178733	1.5
9	33 Bray Court	490158	178624	1.5
10	56 Windsor Road	490133	178585	1.5
11	82 Windsor Road	490247	178513	1.5
12	1 Court Close	490286	178531	1.5
13	102 Windsor Road	490377	178438	1.5
14	53b Windsor Road	490392	178485	1.5
15	52 Windsor Road	489978	178690	1.5

Notes:



Appendix E

Appendix F Traffic Data



Appendix F

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Appendix F

Table F.1 Traffic Data

Road	AAHT 2006	Hourly HGV 2006	AAHT 2007	Hourly HGV 2007	AAHT 2010	Hourly HGV 2010
Area 1						
Alma Road (between Goslar Way and Osbourne Road)	399	13	407	13	423	13
Frances Road	399	13	407	13	423	13
Osbourne Road	399	14	407	14	423	15
Goslar Road	501	10	511	10	532	11
Alma Road (Between Goslar Way and Arthur Road)	200	7	203	7	211	7
Arthur Road	747	37	762	38	792	40
Maidenhead Road	694	35	708	35	735	37
A332	649	32	662	33	688	34
Winkfield Road	851	43	868	43	902	45
St Leonards Road West	851	43	868	43	902	45
St Leonards Road East	326	16	332	17	345	17
Imperial Road	747	37	762	38	792	40
Area 2						
Bridge Road	-	-	1250	69	1313	72
Frascati Way	--	-	1265	44	-	-
Area 3						
Windsor Road	716	16	730	17	759	17
M4	2592	182	2644	185	2748	193



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Appendix F

Appendix G Detailed Modelling Assessment Results



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Appendix G

Model Verification Windsor

Element	Value
[NO ₂]TotMon (Roadside total monitored NO ₂ concentration)	46.70
[NO _x]TotMon (Roadside total monitored NO _x concentration)	119.30
[NO _x]Bkgd (Background NO _x)	31.70
[NO ₂]Bkgd (Background NO ₂)	21.20
[NO _x]RoadsMod (Modelled roadside NO _x contribution)	29.91
[NO _x]RoadsMon (Monitored NO _x roadside contribution)	87.60
[NO ₂]RoadsMon (Monitored NO ₂ roadside contribution)	25.50
NO _x [AdjustmentRoadsMod] (adjustment factor for modelled roadside contribution)	2.93
NO _x [CorrRoadsMod]	87.60
F (proportion of NO _x converted to NO ₂)	0.28
[NO ₂]RoadsMod (Modelled Roadside NO ₂ =NO _x [CorrRoadsMod] x F)	24.62
[NO ₂]TotMod	45.82
Additional NO ₂ correction	1.019
FINAL NO ₂	46.70



Appendix G

Model Verification Maidenhead

Element	Value
[NO ₂]TotMon (Roadside total monitored NO ₂ concentration)	50.30
[NO _x]TotMon (Roadside total monitored NO _x concentration)	129.30
[NO _x]Bkgd (Background NO _x)	39.50
[NO ₂]Bkgd (Background NO ₂)	24.70
[NO _x]RoadsMod (Modelled roadside NO _x contribution)	15.78
[NO _x]RoadsMon (Monitored NO _x roadside contribution)	89.80
[NO ₂]RoadsMon (Monitored NO ₂ roadside contribution)	25.60
NO _x [AdjustmentRoadsMod] (adjustment factor for modelled roadside contribution)	5.69
NO _x [CorrRoadsMod]	89.80
F (proportion of NO _x converted to NO ₂)	0.28
[NO ₂]RoadsMod (Modelled Roadside NO ₂ =NO _x [CorrRoadsMod] x F)	24.71
[NO ₂]TotMod	49.41
Additional NO ₂ correction	1.018
FINAL NO ₂	50.3



Appendix G

Table G.1 Results of the Detailed Modelling – Area 1: Arthur Road, Alma Road, Osbourne Road, Winkfield Road and Imperial Way, Windsor

Ref	Receptor	NO ₂ Predicted Annual Mean Concentration 2007 with verification	NO ₂ Predicted Annual Mean Concentration 2010 with verification
		(µg m ⁻³)	(µg m ⁻³)
1	WM31 Arthur Road	40.0	36.8
2	WM32 Arthur Road	39.8	36.7
3	WM33 Arthur Road	38.9	35.9
4	<i>WM10 Imperial Road</i>	48.5	44.2
5	01-04 Osbourne Road and Alma Road W	34.1	31.8
6	WM9 Alma Road	29.5	27.7
7	01-03 Winkfield and Imperial Road W	41.9	37.6
8	<i>Monitor Windsor</i>	46.7	42.5
9	27 Arthur Road	39.7	36.6
10	51 Arthur Road	40.3	37.2
11	41-46 Athlone Square	31.1	29.1
12	17-22 Athlone Square	32.6	30.4
13	89 Arthur Road	38.6	35.6
14	19 Alma Road	31.6	29.6
15	121 Arthur Road	38.9	35.9
16	92 Arthur Road	38.3	35.4
17	151 Arthur Road	38.3	35.4
18	201 Arthur Road	40.1	36.9
19	26 Maidenhead Road	35.9	33.3
20	Club A332	28.1	26.4
21	106b Sidney Caine House	35.0	32.3
22	<i>13-23 Claredon Court</i>	47.2	43.0
23	14 Green Lane	29.4	27.7
24	Youth and Community	31.6	29.7
25	2 York Road	34.2	32.0
26	93 Alma Road	27.5	26.0
27	Osbourne Court	29.5	27.7
28	78 Alma Road	30.2	28.3
29	103 Alma Road	28.4	26.7



Appendix G

Ref	Receptor	NO ₂ Predicted Annual Mean Concentration 2007 with verification	NO ₂ Predicted Annual Mean Concentration 2010 with verification
		(µg m ⁻³)	(µg m ⁻³)
30	18 Frances Road	28.0	26.4
31	40 Knights Place	29.8	28.1
32	Upton House School	31.7	29.7
33	13 Montpellier Court	28.7	27.1
34	90 Osbourne Road	28.0	26.5
35	1-7 Houston Court	32.9	30.7
36	73 Alma Road	27.5	26.0
37	16 Laurence Court	27.4	25.9
38	63 Alma Road	25.6	24.4
39	Pemberley	39.5	35.8
40	Hermitage Lodge	36.4	32.7
41	34 Alma Road	27.3	25.8
42	43 Alma Road	26.0	24.7
43	25 Alma Road	29.0	27.3
44	25 Imperial Road	36.1	33.4
45	65a Imperial Road	31.8	29.8
46	1-36 Imperial Road	37.5	34.4
47	429 St Leonards Road	34.5	31.8
48	364 St Leonards Road	26.8	25.4

Notes:

Locations in Italics located in Existing AQMA

Sites with exceedences of Annual mean AQO for NO₂ (40 µg m⁻³) are highlighted in bold



Appendix G

Table G.2 Results of the Detailed Modelling – Area 2: Bridge Road, Maidenhead

Ref	Receptor	NO ₂ Predicted Annual Mean Concentration 2007 with verification (µg m ⁻³)	NO ₂ Predicted Annual Mean Concentration 2010 with verification (µg m ⁻³)
1	0-13 Bridge Road	61.3	55.5
2	1 Bridge Road	51.7	47.0
3	121 Bridge Road	46.1	42.1
4	12 Haven of Rest	43.7	40.0
5	79 Smythes Arms House	65.9	59.6
6	90 Moorbridge Road	63.0	57.0
7	Harvest Court	51.3	46.7
8	Sybase Court	50.0	45.6
9	Albany House	32.4	30.3
10	154 Bridge Road	42.4	38.8
11	17 Ray Drive	32.3	30.0
12	<i>Maidenhead Continuous Monitor</i>	61.3	55.5

Notes

Locations in Italics located in Existing AQMA

Sites with exceedences of Annual mean AQO for NO₂ (40 µg m⁻³) are highlighted in bold



Appendix G

Table G.3 Results of the Detailed Modelling – Area 3: Windsor Road, Maidenhead

Ref	Receptor	NO ₂ Predicted Annual Mean Concentration 2007 with verification	NO ₂ Predicted Annual Mean Concentration 2010 with verification
		(µg m ⁻³)	(µg m ⁻³)
1	WM29	53.6	48.0
2	WM2	25.5	23.5
3	Priors Close	34.9	31.7
4	27 Windsor Road	29.4	26.9
5	2 Heathcote	34.4	31.3
6	83 Priors Way	34.2	31.1
7	31 Windsor Road	30.8	28.1
8	1 Windsor Road	43.5	39.1
9	33 Bray Court	52.4	46.9
10	56 Windsor Road	50.8	45.5
11	82 Windsor Road	41.4	37.3
12	1 Court Close	43.2	38.9
13	102 Windsor Road	36.7	33.3
14	53b Windsor Road	34.7	31.5
15	52 Windsor Road	46.2	41.5

Notes:

Locations in Italics located in Existing AQMA

Sites with exceedences of Annual mean AQO for NO₂ (40 µg m⁻³) are highlighted in bold



Appendix H Contour Plots



Appendix H

Entec

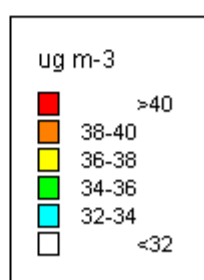
Creating the environment for business



Appendix H



Key



0m 300m

Scale 1:500 @ A4

Royal Borough of Windsor and Maidenhead
Air Quality Review and Assessment
Detailed Assessment 2008

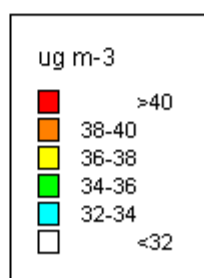
Figure H1
Area 1: Arthur Road
Annual Mean NO₂ Contour for 2007

August 2008
22240-01 Clema

Entec



Key



0m 300m

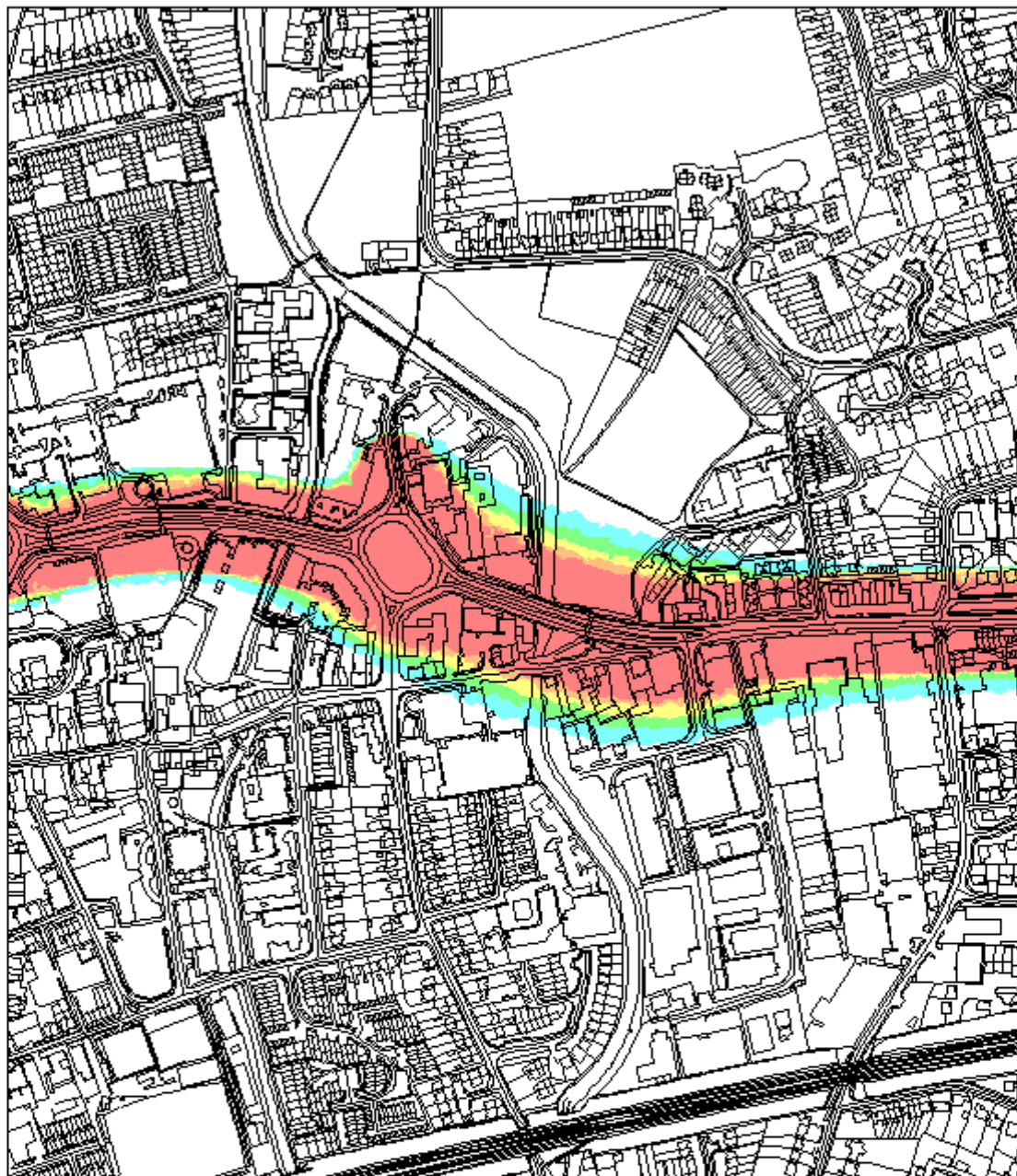
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Royal Borough of Windsor and Maidenhead
Air Quality Review and Assessment
Detailed Assessment 2008

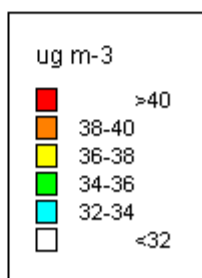
Figure H2
Area 1: Arthur Road
Annual Mean NO₂ Contour for 2010

August 2008
22240-01 Clema

Entec



Key

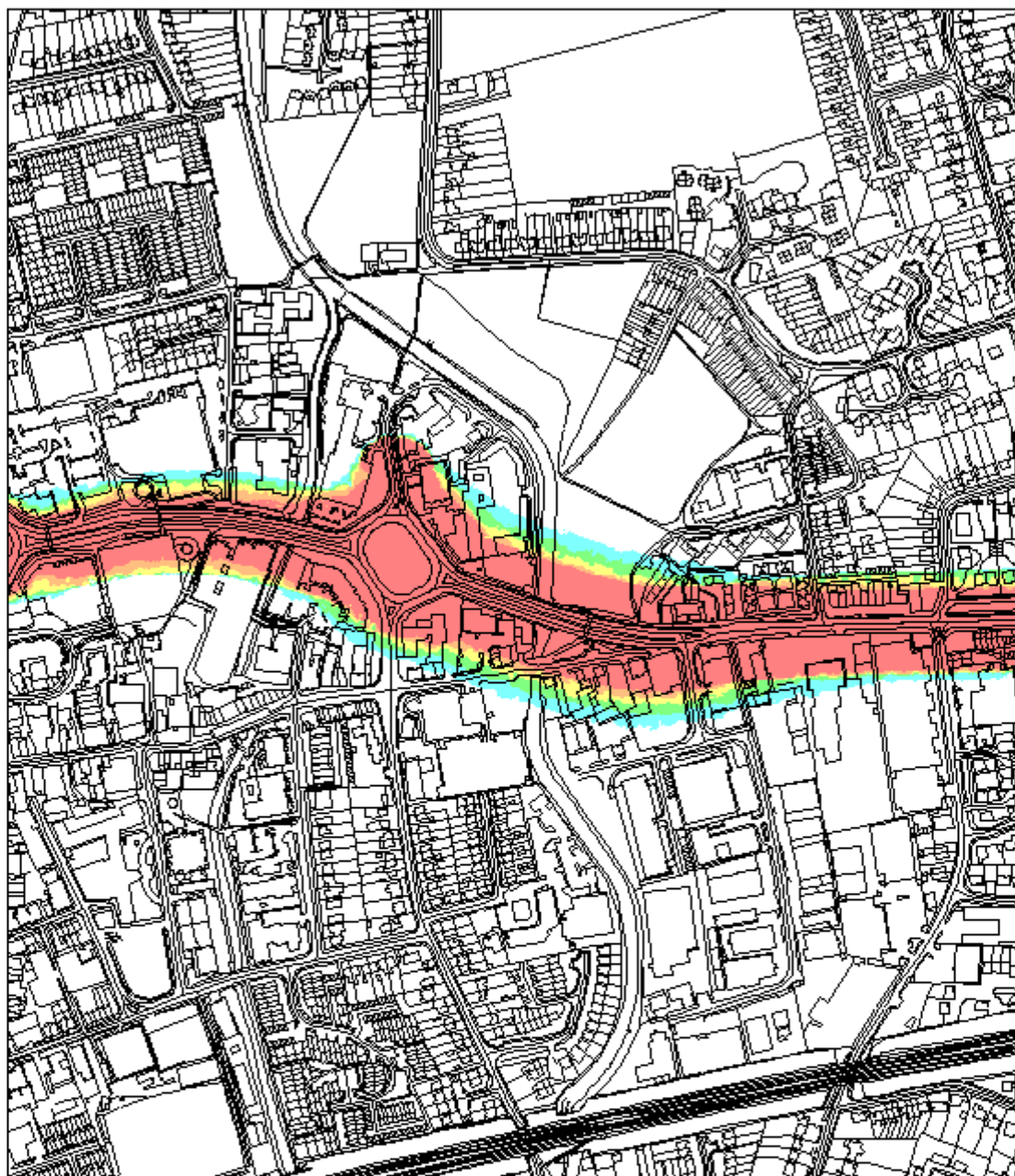


0m 360m

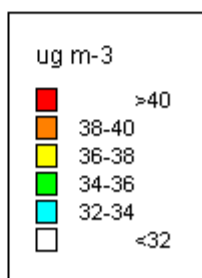
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Royal Borough of Windsor and Maidenhead
Air Quality Review and Assessment
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Figure H3
Area 2: Bridge Road
Annual Mean NO₂ Contour for 2007



Key

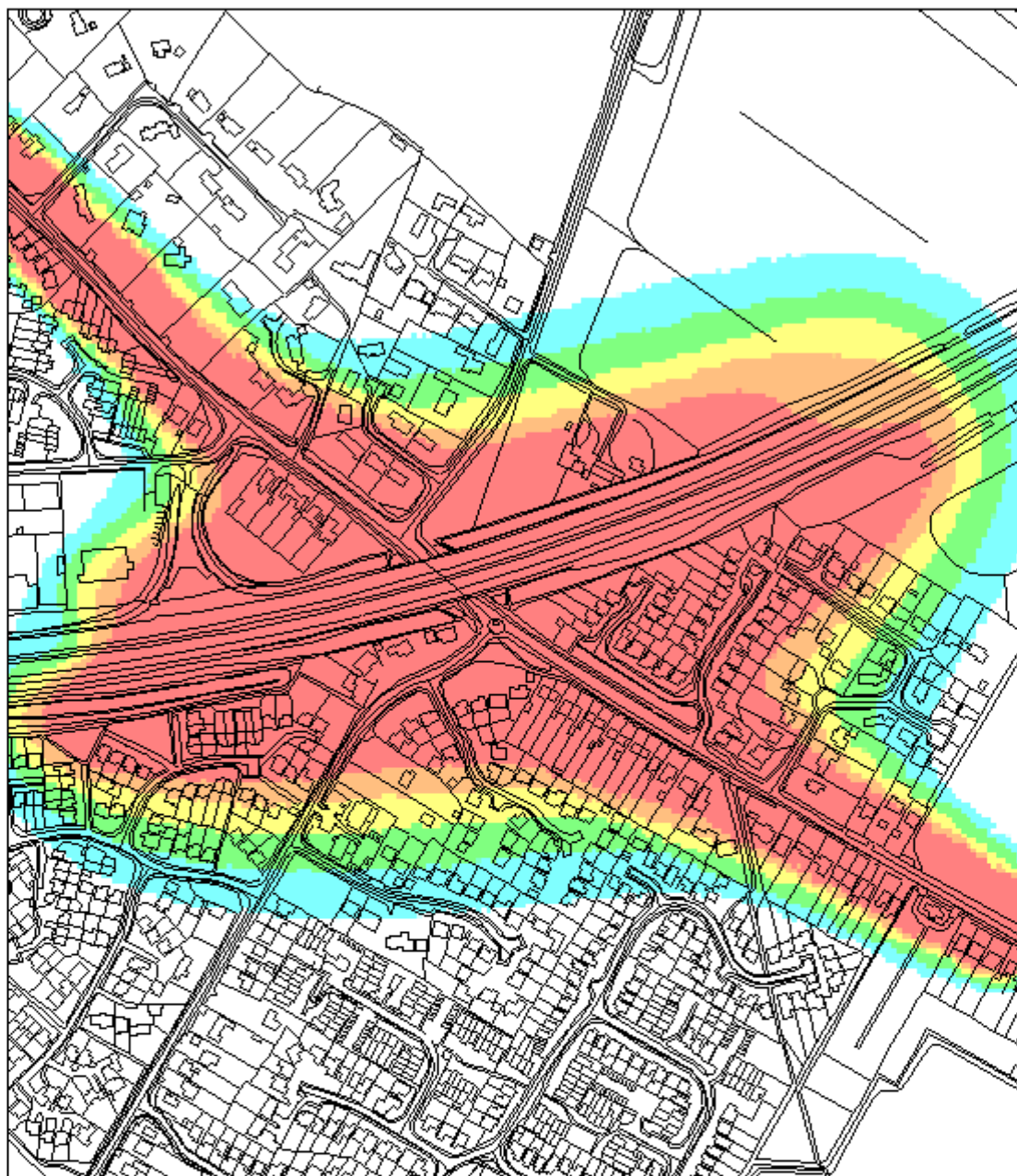


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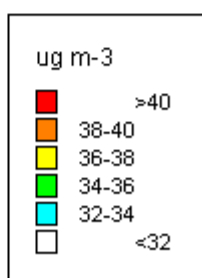
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Royal Borough of Windsor and Maidenhead
Air Quality Review and Assessment
Detailed Assessment 2008

Figure H4
Area 2: Bridge Road
Annual Mean NO₂ Contour for 2010



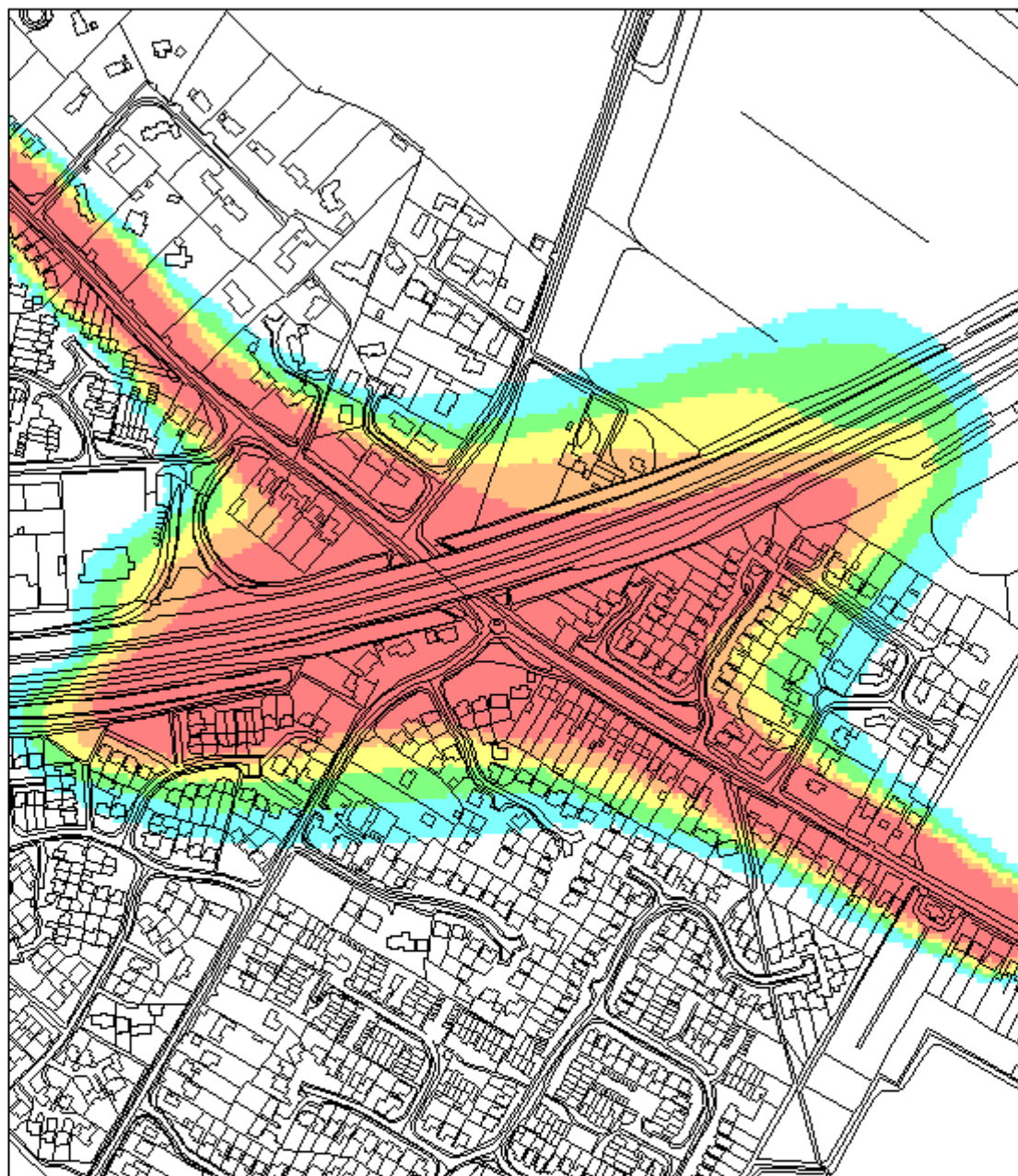
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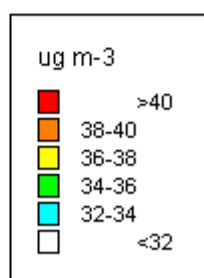
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Royal Borough of Windsor and Maidenhead
Air Quality Review and Assessment
Detailed Assessment 2008

Figure H5
Area 3: Windsor Road
Annual Mean NO₂ Contour for 2007



Key



0m 300m

Scale 1:500 @ A4

Royal Borough of Windsor and Maidenhead
Air Quality Review and Assessment
Detailed Assessment 2008

Figure H6
Area 3: Windsor Road
Annual Mean NO₂ Contour for 2010