THREE RIVERS DISTRICT COUNCIL

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2016 Air Quality Annual Status Report (ASR)

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

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Executive Summary: Air Quality in Our Area

Air Quality in Three Rivers District Council

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

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

Three Rivers is a sub-urban District of 88.8 square kilometres located in south-west Hertfordshire. It borders Watford and Hertsmere boroughs to the east, Buckinghamshire County (Chiltern and South Bucks Districts) to the west, St Albans City & District and Dacorum Borough to the north, and the London Boroughs of Hillingdon and Harrow to the south.
The key road links through the District are the M1 and M25 motorways, which are significant sources of local air pollutant emissions. There are no significant pollutant sources within the District apart from road traffic emissions.

Three Rivers District Council (TRDC) monitors primarily for Nitrogen Dioxide (NO_2). In 2011, the continuous monitoring site located in Rickmansworth was discontinued following continued low concentrations of NO_2 and Particulate Matter (PM_{10}). In addition, a number of diffusion tube site we discontinued in 2014 therefore TRDC now has 7 diffusion tubes district wide.

TRDC's Executive Committee approved the revocation of the Kings Langley and Chandlers Cross AQMA.

A new development is proposed in close proximity to the M25, this report recommends that diffusion tubes are located to represent relevant exposure at the

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

proposed development to assess whether or not the annual mean objective is likely to be exceeded.

The diffusion tube monitoring results indicate that neither the annual or hourly mean air quality objective for nitrogen dioxide are exceeded at any location in the district. The level of NO_2 recorded for 2015 shows a slight decrease in annual mean concentrations district wide.

In terms of air pollution, TRDC is very similar to an outer London suburb. The majority of our population lives within the M25 and many workers commute into London or around the motorway network. Road transport emissions are the major contribution to the burden of air pollution encountered in our district. As a result TRDC works to support Highways England with measures that look to improve air pollution associated with the M25.

To find more information regarding Air Quality in TRDC click on the following link: http://www.threerivers.gov.uk/service/air-quality

Actions to Improve Air Quality

In 2015, TRDC developed an Air Quality Action Plan for the years 2015-2020 which highlights the commitment TRDC has to continue to work towards improving air quality within the district. The proposals in this new air quality action plan aim to encourage reductions in emissions from road traffic, industry and homes. There is also a commitment to keep the community and our partners well informed about air quality and the actions to reduce pollution or minimise its effects on vulnerable people. Some of the measures we are proposing, such as adopting an airTEXT service, have already been pioneered in London but are completely new to TRDC. Other measures, such as the ongoing encouragement to the public to consider smarter and more sustainable transport methods; cycling, walking and public transport, are familiar themes. Local authorities have a long tradition of measuring and reporting upon air pollution, as such TRDC plan to extend its monitoring portfolio and aims to find out whether the pollution caused by high levels of very fine particles are a cause for concern locally.

Local Priorities and Challenges

Air quality in TRDC largely meets statutory objectives, but this is no cause for complacency. The assumption is made that the 2014/15 compliance for NO_2 is not sustainable, particularly when considering the proposed expansion of Heathrow and construction works of HS2 that will have an unpredictable impact on local AQ. It is safe to assume that this impact is unlikely to be positive. Therefore consideration, and the actions have been outlined that might reasonably be taken to reduce air pollution.

How to Get Involved

It is important that members of the public appreciate the impact that their transport choices have on air quality. With many TRDC residents commuting into London for work via train, consideration should be made to use alternative transport than private car use, in particularly for journeys to train stations.

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1 Local Air Quality Management

This report provides an overview of air quality in Three Rivers District Council during 2015. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995) and the relevant Policy and Technical Guidance documents.

The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where an exceedance is considered likely the local authority must declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives. This Annual Status Report (ASR) is an annual requirement showing the strategies employed by Three Rivers District Council to improve air quality and any progress that has been made.

The statutory air quality objectives applicable to LAQM in England can be found in Table E.1 in Appendix E.

2 Actions to Improve Air Quality

2.1 Air Quality Management Areas

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

A summary of AQMAs declared by Three Rivers District Council can be found in Table 2.1. Further information related to declared or revoked AQMAs, including maps of AQMA boundaries are available in Appendix D. For full list of AQMA in the UK visit http://uk-air.defra.gov.uk/aqma/list.

Monitoring results provides scope for TRDC to revoke AQMA 3 Chandlers Cross, AQMA 4 Chandlers Cross and AQMA 5 Kings Langley (see monitoring section).

Table 2.1 – Declared Air Quality Management Areas

AQMA Name	Pollutants and Air Quality Objectives	City / Town	One Line Description	Action Plan
1 Chorleywood AQMA	NO_2 annual mean	Chorleywood	Along the M25 from just south of Junction 18 to just north of where the motorway crosses the River Chess extending 74m either side of the centreline.	AQAP 2015-2020
2 Chorleywood AQMA	PM_{10} 24-hour mean	Chorleywood	A slightly narrower area from just north of Junction 18, along the M25 to just north of where the motorway crosses the River Chess extending 38m either side of the centreline.	AQAP 2015-2020
3 Chandlers Cross AQMA	NO_2 annual mean	Chandlers Cross	An area along the M25 from just west of where Chandler's Lane crosses the M25 to the beginning of Junction 19 of the motorway extending 74m either side of the centreline	AQAP 2015-2020
4 Chandlers Cross AQMA	PM_{10} 24-hour mean	Chandlers Cross	A slightly narrower area than that for NO2 extending 38m either side of the centreline.	AQAP 2015-2020

AQMA Name	Pollutants and Air Quality Objectives	City / Town	One Line Description	Action Plan
5 Kings Langley AQMA	NO_2 annual mean	Kings Langley	An area surrounding where the M25 crosses the railway extending 74m either side of the centreline	AQAP 2015-2020

2.2 Progress and Impact of Measures to address Air Quality in Three Rivers District Council

Three Rivers District Council has taken forward a number of measures during the current reporting year of 2015 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2. More detail on these measures can be found in the Air Quality Action Plan 2015-2020. Key completed measures are:

- Commission of two new PM2.5 monitors.
- Provision of AirTEXT
- Improvements to bus network- providing a wider reaching service
- Additional Cycle routes provided.
- Installation of electric vehicle charging point

Progress on the following measures has been slower than expected due to:

- Commissioning of one $PM_{2.5}$ monitor due to lack of suitable mounting location.

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

- Review LiftShare Scheme
- Review Staff incentive to encourage walking, cycling and car sharing
- Install NO_2 and $PM_{2.5}$ Monitors
- Apply for funding for a feasibility study into changing local road layouts and freight routes. Bid to be submitted.
- Install more electric vehicle charging points

Table 2.2 – Progress on Measures to Improve Air Quality

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date
1	AirTEXT	Public Information	Via other mechanisms	TRDC	Complete	April 2015 –April 2018	-	Exposure of most vulnerable	Operational	April 2018
2	$PM_{2.5}$ AQ Monitors	-	-	TRDC	Complete	April 2017	$PM_{2.5}$ AQ data	Inform future projects id required	Equipment sourced	TBC
3	LTP, Walking, Cycling and bus strategy	Promoting Travel Alternatives	Promote use of rail, promotion of cycling and of walking	TRDC	Ongoing	Ongoing	Decrease in private car use	NO_2/PM	Ongoing	Ongoing
4	Improvement of bus network	Transport Planning and Infrastructure	Bus route improvements	TRDC	Complete	Ongoing	Increased Bus use	NO_2/PM	Ongoing	TBC
5	OLEV initiative	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging	TRDC	complete	Ongoing	Increased electric vehicle ownership	NO_2/PM	One charging point installed	TBC
6	Additional cycle routes	Transport Planning and Infrastructure	Cycle network	TRDC	complete	Ongoing	Increase cycling	NO_2/PM	Ongoing	TBC
7	Alternative routes via green ways	Transport Planning and Infrastructure	Other	TRDC	compete	Ongoing	Use of greenways	Reduce exposure	Ongoing	TBC

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

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

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

In 2015, Three Rivers District Council developed and implemented an Air Quality Action Plan. Please find a link to the document here: http://www.threerivers.gov.uk/service/air-quality

This Action Plan highlights a number of measures that have been and will be implemented up until 2020. The measures look to improve levels of NO_2 and such measures are likely to have and positive impact on the levels of $PM_{2.5}$. In particularly, the promotion of alternative transport that private car use, increasing the cycle and bus networks, increasing the electric vehicle charging point network and by preventative measures, such as informing the most vulnerable when there are high levels of air pollution via AirTEXT. The latter prevents exposure rather than improving air quality, however in the interim this is a key action to protect the most vulnerable.

A number of actions to reduce pollutant levels, including $PM_{2.5}$, are based around the M25 corridor and TRDC continue to assist and work closely with Highways England and Public Health functions to identify the most appropriate interventions.

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

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

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

Due to financial pressures on services at Three Rivers District Council the automatic monitoring site in Rickmansworth was discontinued in September 2011. This continued pressure means that this site remains off-line.

3.1.2 Non-Automatic Monitoring Sites

Three Rivers District Council undertook non- automatic (passive) monitoring of NO_2 at 7 sites during 2016. Table A. in Appendix A shows the details of the sites.

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

3.2 Individual Pollutants

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

3.2.1 Nitrogen Dioxide (NO_2)

In 2014, TRDC changed the sampling location for diffusion tubes, this has resulted in their being only 2 years’ worth of data for the current DT locations. Nevertheless, pervious years data from the sample sites have been included for comparison.

Table A.1 in Appendix A compares the ratified and adjusted monitored NO_2 annual mean concentrations for the past 5 years with the air quality objective of 40µg/m^3.

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

Due to the monitoring network compromising diffusion tubes, it is not currently possibly to consider ratified continuous monitored data for exececedences of the NO_2 hourly mean concentration objective (200µg/m^3, not to occur more than 18 times per year), however, as described in the Technical Guidance (2016) if the annual mean is below 60µg/m^3 then the hourly mean concentration is not likely to be exceeded. Therefore, the data collected over the past 5 years, including 2015, demostrates that the 1-hour NO_2 is not exceeded at any location in the district.

Junction 18, M25 – Chorleywood

The Chorleywood AQMA extends along a 1.4km stretch of the M25 400 metres to the south and 1km to the north of junction 18. South of the junction there are 3 properties east of the carriageway and 4 to the west and to the north of the junction there are numerous properties to the west of the carriageway. In early 2013 this site was relocated to relevant exposure. The diffusion tube sites **S4**, **S5** and **S6** is located on the western side of junction 18 adjacent to the M25/A404 off slip. In 2015, the bias adjusted results obtained from this location are **34.3**, **35.2** and **35.7** µg/m^3 retrospectively, based on 100% data capture for all tubes. The sample sites represent relevant exposure; data capture is very good at 100% and shows annual mean concentrations for NO_2 as marginally below the national annual mean objective. The results have appeared to have reduced slightly compared to 2014 concentrations but are relatively similar to concentrations observed in 2013. The fluctuating nature observed of NO_2 concentrations at this location would indicate that the AQMA is still required at this location.

The Retreat, Kings Langley

Kings Langley AQMA located where the M25 crosses the railway extending 74m either side of the centreline which is located. In 2015, diffusion tube site **S3** saw an annual mean NO_2 concentration of 26.6 µg/m^3 based on a 100% data. This is well below the national annual mean objective of 40 µg/m^3 and has remained fairly constant for the past 5 years of monitoring. As recommended in the USA 2012, 2013, 2014 Progress Report and 2015 USA this AQMA is to be revoked. Three Rivers District Council's Executive Committee approved the revocation of this AQMA and the intention is that the revocation process be completed prior to the next annual status report.

Glen View, Chandlers Cross

The AQMA at Chandlers Cross contains 2 properties and a number of mobile homes along the M25 including Glen View which is the closest property to the carriageway. In 2015, diffusion tube site **S2** recorded a bias adjusted annual mean of 27.3 μg/m^3, with a data capture of 100% so confidence can be given in this result. Data since 2011 has seen fairly consistent reductions in NO_2 concentration year on year, nevertheless, 2015 has seen a slight increase in NO_2 concentrations recorded since 2014. This is probably as a result of the topography of this location which results in the measured levels being lower than expected. As recommended in the USA 2012, 2013, 2014 Progress Report and 2015 USA this AQMA is to be revoked. Three Rivers District Council's Executive Committee approved the revocation of this AQMA and the intention is that the revocation process be completed prior to the next review and assessment report.

Difussion Tube Outside AQMA

There are two diffusion tubes located outside Three Rivers AQMAs; **S1** at Watford Road, Croxley Green and **S7** at Rectory Road, Rickmansworth. In 2015, the bias adjusted annual mean concentration was measured at 26.0μg/m^3 and 25.9μg/m^3 retrospectively, both with a data capture of 100%. **S1** is located 24 metres from a relevant receptor and data has demonstrated a steady fall year on year for NO_2. This is contract to **S7** where the concentration of NO_2 which saw increases in 2013 and 2104. Nevertheless, 2015 has seen the lowest level recorded in 5 years.

3.2.2 Particulate Matter (PM_{10})

Due to financial pressures on services at Three Rivers District Council the automatic monitoring site in Rickmansworth was discontinued in September 2011. There is therefore no PM10 monitoring data to report or compare against the air quality objective.

Appendix A: Monitoring Results

Table A.1 – Details of Non-Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA ?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?
S1	Watford Road, Croxley Green	kerbside	507134	195283	NO_2	N	3	1	N
S2	Glen View Chandlers Cross A	background	506500	198600	NO_2	Y	97	17	N
S3	The Retreat Kings Langley A	background	508100	201800	NO_2	Y	7	4	N
S4	Sunrise Senior Living	kerbside	504162	196286	NO_2	Y	2	1	N
S5	Sunrise Senior Living	kerbside	504162	196286	NO_2	Y	2	1	N
S6	Sunrise Senior Living	kerbside	504162	196286	NO_2	Y	2	1	N
S7	Rectory Road Rickmansworth A	intermediate	505500	194400	NO2	N	30	10	N

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

(2) N/A if not applicable.

(3) Same area but slightly different location to represent relevant exposure

Table A.1 – Annual Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2015 (%) (2)	NO_2 Annual Mean Concentration (µg/m^3) (3)					
					2011	2012	2013	2014		2015
								Pre May	Post May	
S1	Kerbside	Diffusion Tube	100	100	54.2	33.9	33.0	38.0	28.0	26.0
S2	Background	Diffusion Tube	100	100	29.3	29.8	29.0	35.0	26.0	27.3
S3	Background	Diffusion Tube	100	100	28.2	27.2	31.0	31.0	26.0	26.6
S4	Kerbside	Diffusion Tube	100	100	**44.3**	**42.3**	36.0	**41.0**	34.0	34.3
S5	Kerbside	Diffusion Tube	100	100	**50.5**	**47.1**	35.0	**42.0**	34.0	35.2
S6	Kerbside	Diffusion Tube	100	100	**47.6**	**45.3**	37.0	**43.0**	37.0	35.7
S7	Intermediate	Diffusion Tube	100	100	26.7	28.4	30.0	33.0	27.0	25.9

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

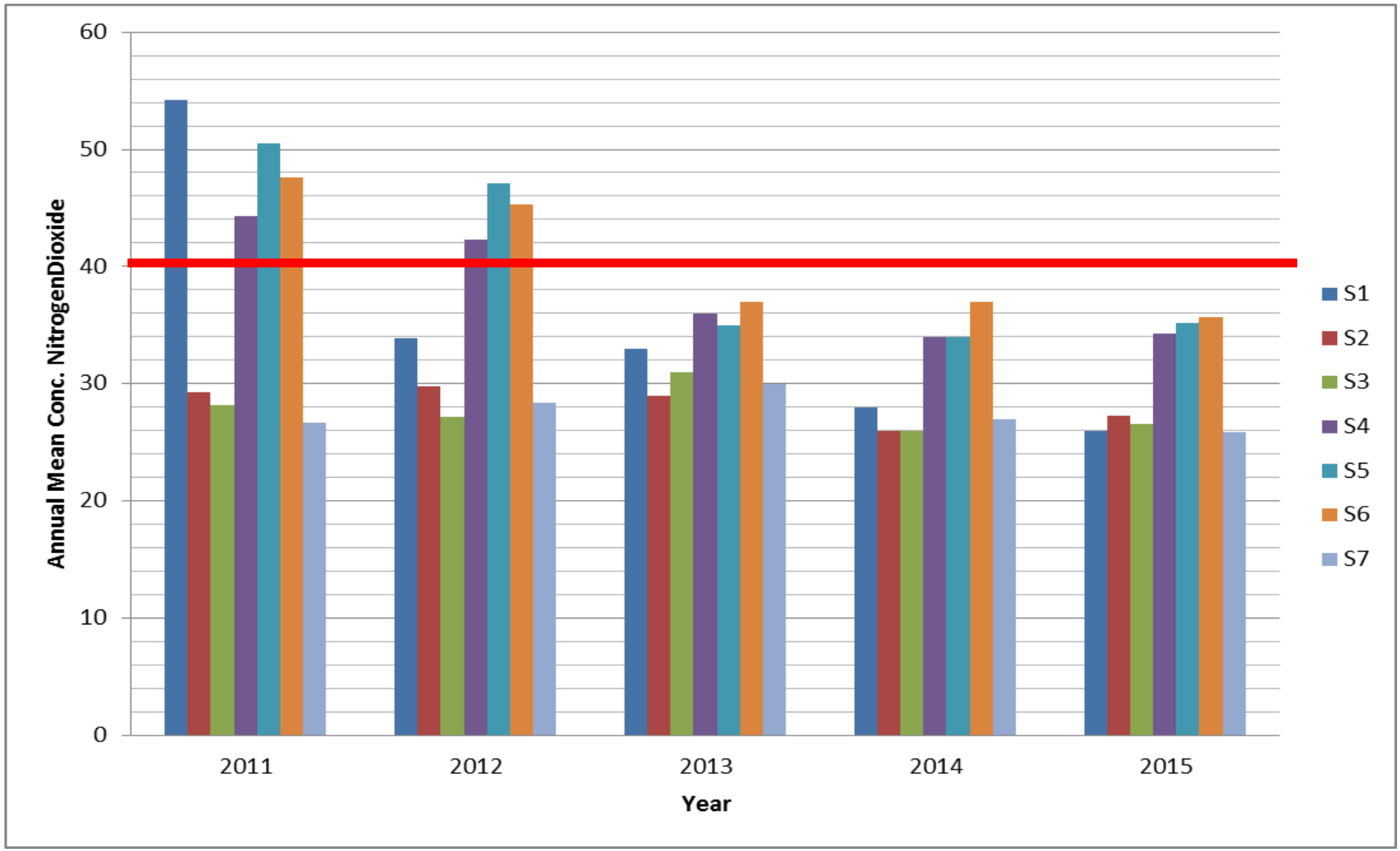
NO_2 annual means exceeding 60µg/m^3, indicating a potential exceedance of the NO_2 1-hour mean objective are shown in **bold and underlined.**

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

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

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

Graph 1 – Comparison of Annual Mean Concentrations of NO_2 for 2011-2015



Appendix B: Full Monthly Diffusion Tube Results for 2015

Table B.1 – NO_2 Monthly Diffusion Tube Results 2015

Site ID	NO_2 Mean Concentrations ($\mu g/m^3$)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean	
													Raw Data	Bias Adjusted (1)
S1	**41.5**	**40.2**	36.7	30.1	23.7	19.1	23.6	28.1	35.5	39.1	37.5	39.9	32.9	26.0
S2	38.4	**41.2**	32.7	28.6	32.1	18.4	28.5	30.8	35.1	37.4	**43.5**	**48.5**	34.6	27.3
S3	**46.4**	30.9	39.1	29.1	27.1	27.6	25.3	29.9	37.4	**41.4**	36.1	34.4	33.7	26.6
S4	**50**	**55.4**	**44.4**	**47.2**	37.1	32.9	39	**41.9**	**41.6**	**43.5**	**47.1**	**40.7**	**43.4**	34.3
S5	**48**	**50.2**	**44.5**	**44.7**	38.4	33.9	39.3	**42.6**	38.5	**43.4**	**47.4**	**63.8**	**44.6**	35.2
S6	**48.4**	**49.9**	33.8	**48.5**	**48.7**	29.3	**41.8**	**45.7**	**40.7**	**45.3**	**52.6**	**54.2**	**44.9**	35.7
S7	**41.3**	33.1	35.1	37.2	23.1	17.1	26.5	28.2	38	**47.6**	31	35.7	32.8	25.9

(1) See Appendix C for details on bias adjustment

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

Diffusion Tube Bias Adjustment Factors

Three Rivers District Council does not run a local triplicate co-location study, therefore the national factor is applied. This is identified from the review and assessment help desk website for ESG Didcot. The preparation method is 50% TEA/acetone. Results of the last three years and this year were:

2012: 0.79
2013: 0.81
2014: 0.81
2015: 0.79

QA/QC of diffusion tube monitoring

The Workplace Analysis Scheme for Proficiency (WASP) is an independent analytical performance testing scheme, operated by the Health and Safety Laboratory (HSL). WASP formed a key part of the former UK NO_2 Network's QA/QC, and remains an important QA/QC exercise for laboratories supplying diffusion tubes to Local Authorities for use in their Local Air Quality Management work.

Defra and the Devolved Administrations advise that diffusion tubes used for LAQM should be obtained from laboratories that have demonstrated satisfactory performance in the WASP scheme.

The WASP Rounds R113 – R120 (Apr 2011 – Mar 2014) show that ESG Didcot (formerly Harwell Scientific services) were classed as Satisfactory.

Appendix D: Map(s) of Monitoring Locations and AQMA locations

Figure 1 – Air Quality Management Areas Chorleywood NO_2 and PM_{10}

NB. PM10 AQMA awaiting revocation

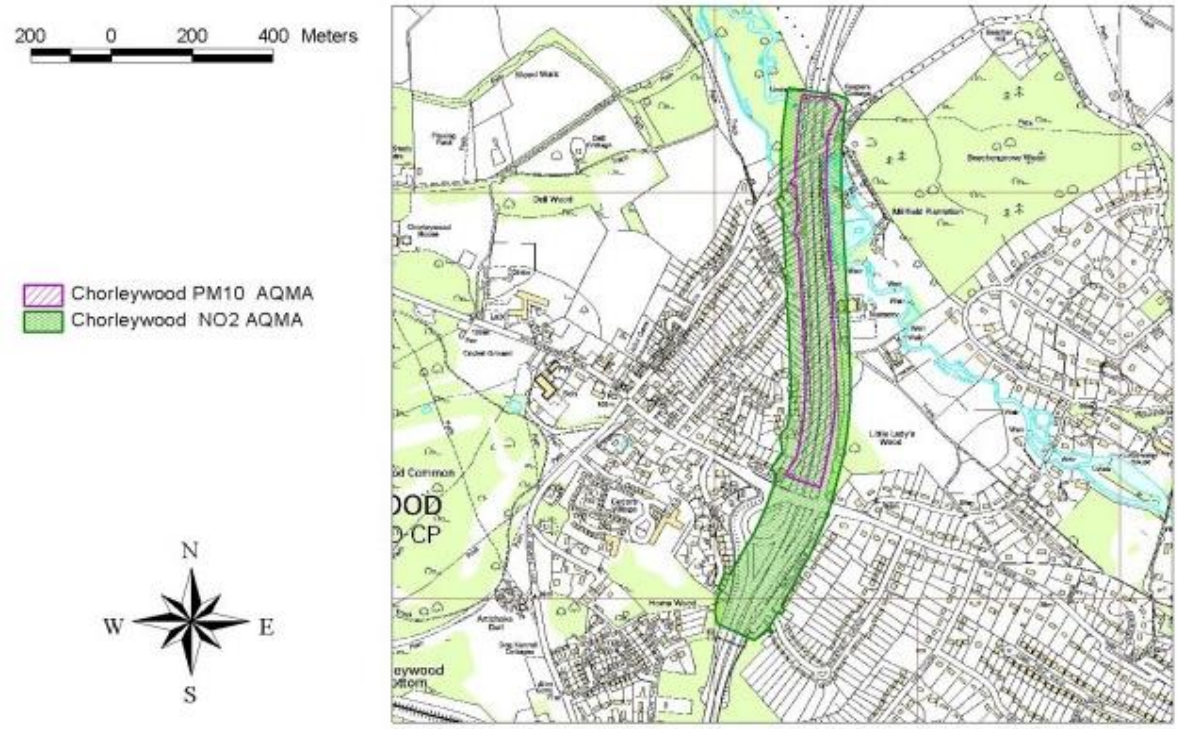


Figure 2 – Air Quality Management Areas Chandlers Cross NO_2 and PM_{10}

NB. Both AQMAs awaiting revocation

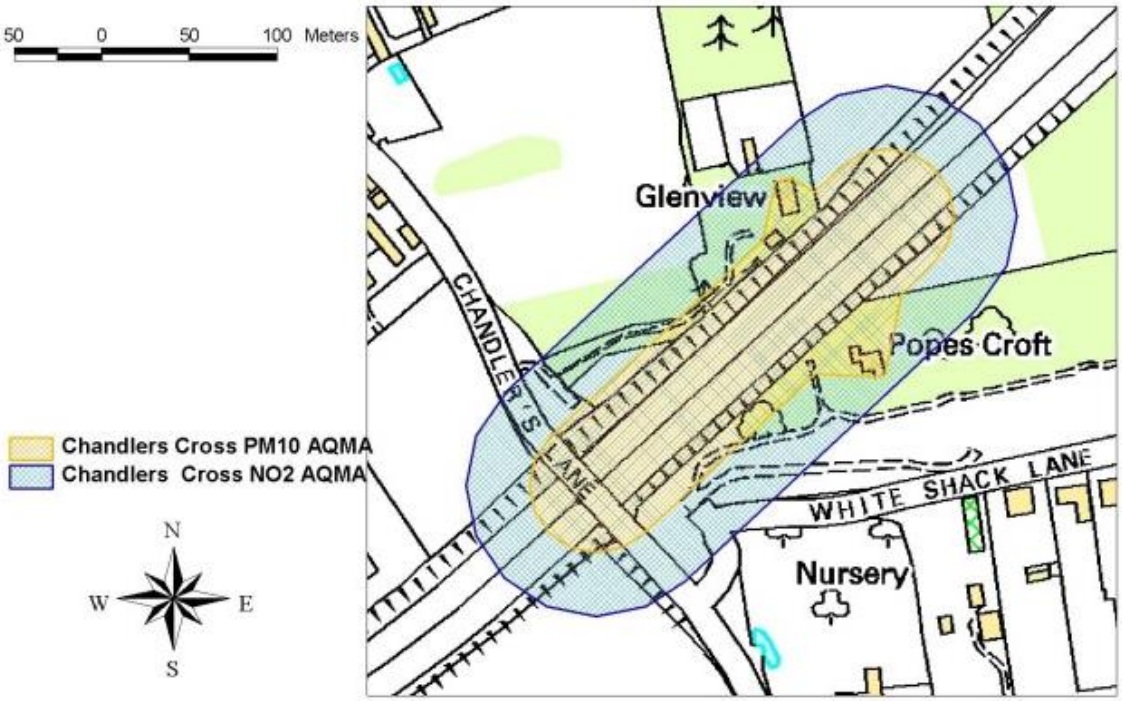
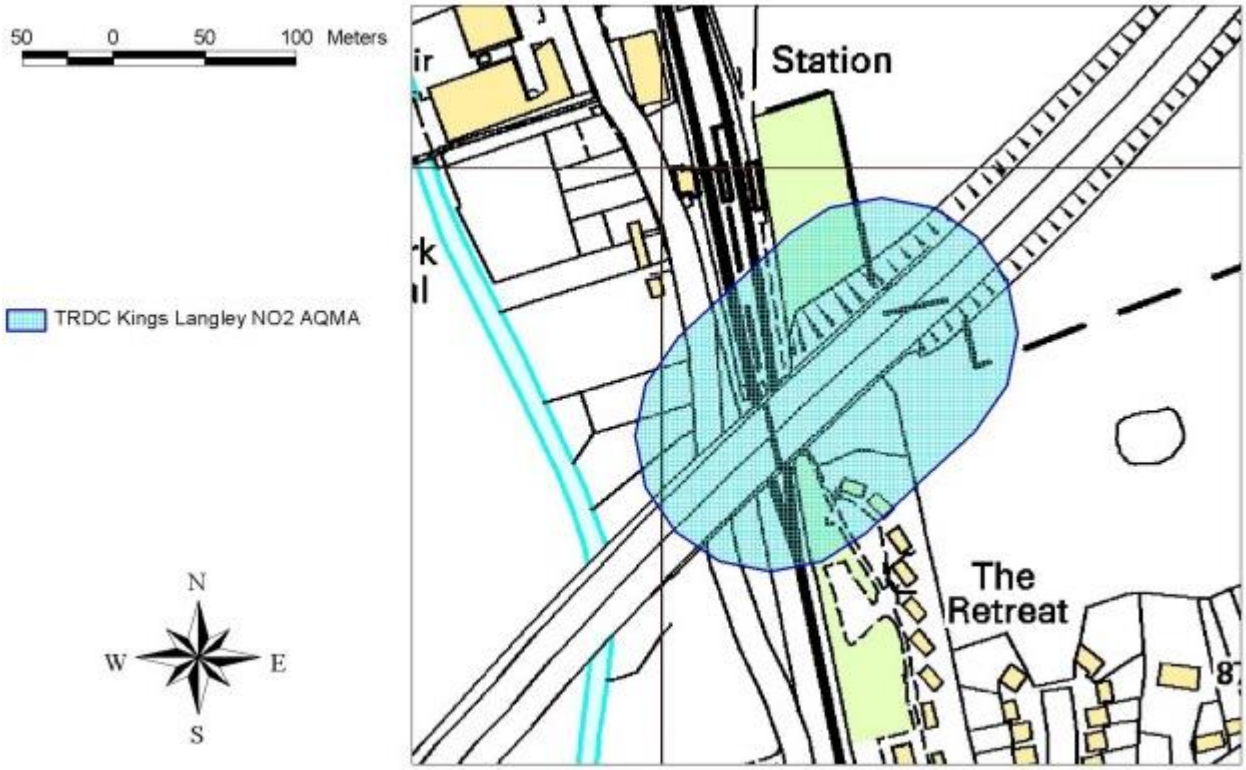


Figure 3 – Air Quality Management Area Kings Langley NO_2

NB. AQMA awaiting revocation



(Defra, 2016)

Figure 4 - Map of The Retreat, Abbots Langley diffusion tube (DT) site (S3)

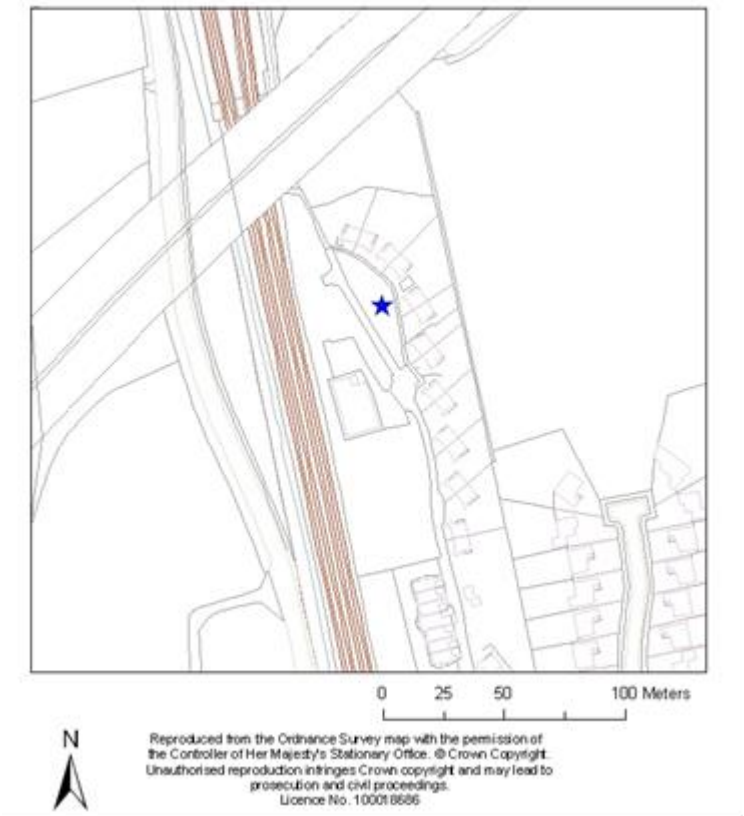


Figure 5 – Map of Junction 18 (M25) Chorleywood DT sites (S4, S5 & S6)

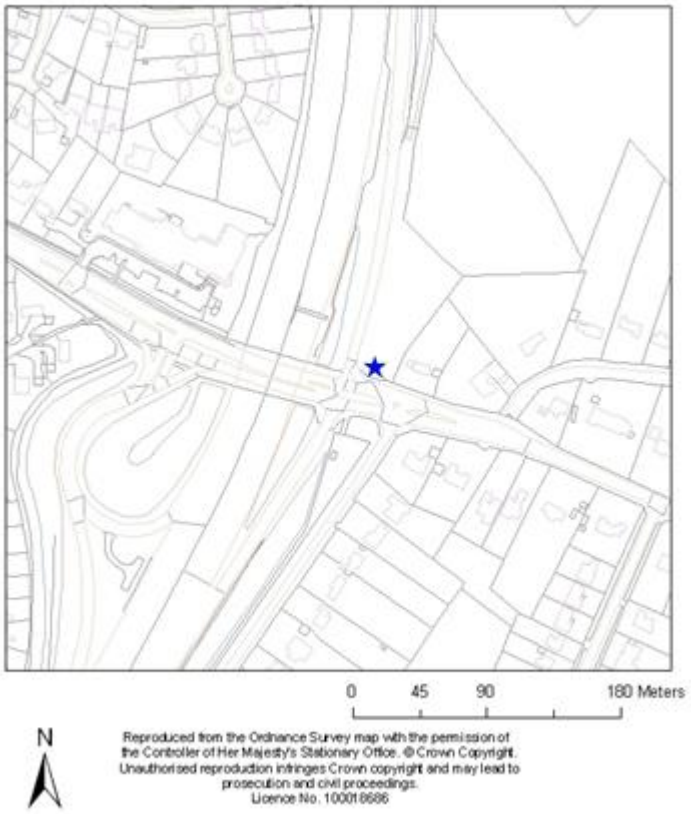


Figure 6 - Map of Glen View, Chandlers Cross DT site (S2)

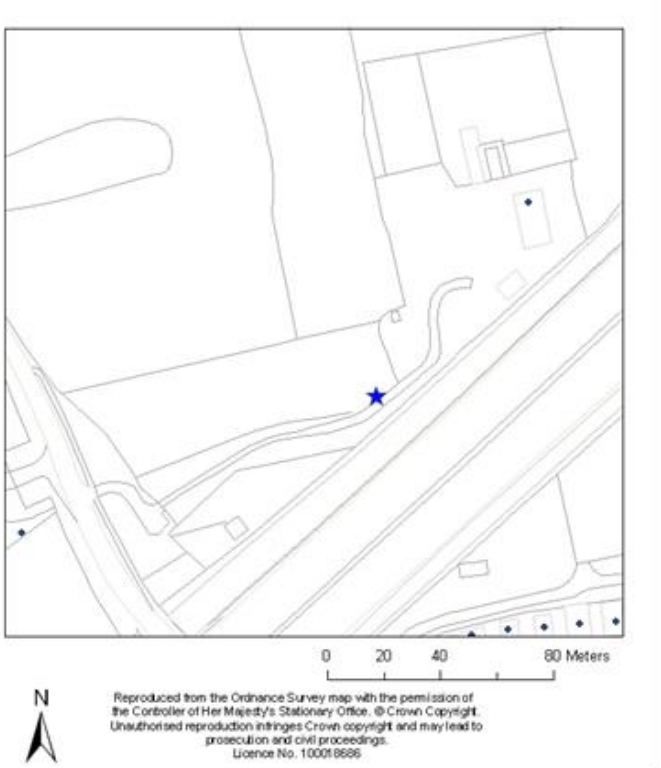


Figure 7 – Map of Watford Road, Croxley Green DT site (S1)

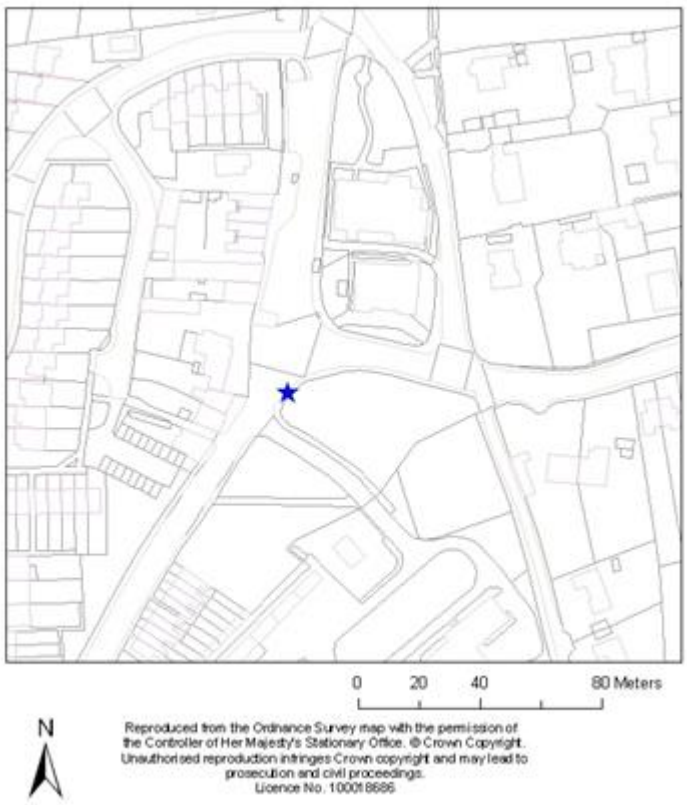
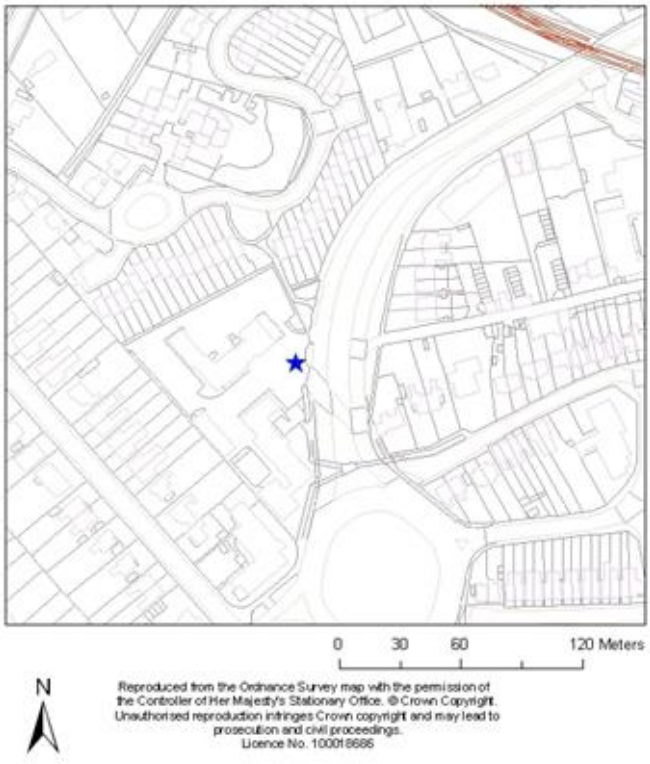


Figure 8 – Map of Rectory Road, Rickmansworth DT site (S7)



Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England

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

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

Glossary of Terms

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

References

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