



2019 Air Quality Annual Status Report (ASR)

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

June 2019

Three Rivers District Council

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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 billion³.

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 are 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.

In terms of air pollution, Three Rivers District Council (TRDC) is very similar to other outer London suburbs. The majority of our population lives close to 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, who are responsible for the motorway network, with developing and implementing measures to improve air pollution associated with the M25.

From 1st May 2019, TRDC delegated certain Environmental Health functions to Watford Borough Council including local air quality management.

Watford Borough Council has prepared this report to the best of its ability based on the limited data and information that has been provided by TRDC.

Concentrations of NO₂ measured in 2018 increased at six monitoring locations and decreased at seven monitoring locations.

The diffusion tube monitoring results indicate that the annual or hourly-mean air quality objective for nitrogen dioxide was not exceeded at most of the monitoring locations in the district.

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

However, exceedances of the annual mean objective of 40 µg/m³ were measured at the triplicate site at Belfry House on Uxbridge Road (Mill End 1). Two of the tubes recorded exceedances of the annual mean objective.

TRDC's Executive Committee approved the revocation of the NO₂ Kings Langley Air Quality Management Area (AQMA) and NO₂ and PM₁₀ Chandlers Cross AQMA. TRDC recently sought advice from the Department of Environment, Food and Rural Affairs (DEFRA) upon how to revoke the AQMAs. These AQMAs have now been revoked, there are two remaining AQMAs in Chorleywood (for NO₂ and PM₁₀).

Actions to Improve Air Quality

TRDC has developed an Air Quality Action Plan (AQAP) for the years 2015-2020 which highlighted the commitment TRDC has to continue to work towards improving air quality within the district. The measures in this AQAP 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. TRDC has previously used the airTEXT service to inform vulnerable individuals and groups across the district when air pollution levels are high. TRDC now also uses the Hertfordshire Air Quality Forecast to communicate air quality information across the district.

TRDC developed a Green Expectations Action Plan (2017/18) which included objectives and developing actions on:

- Minimising greenhouse gas emissions from new developments and existing properties;
- reducing the impact of carbon emissions and local air quality of travel associated with Council operations;
- developing and improving local cycling and walking routes and actively facilitate sustainable travel, and
- promoting local passenger transport and work with the statutory transport providers including bus and rail operators to encourage sustainable and healthy forms of travel.

Conclusions and Priorities

The 2019 Air Quality Annual Status Report (ASR) has identified that measured concentrations of NO₂ continue to be below the air quality objectives within the current AQMA's. There has been a continued downward trend at the established monitoring sites and measured concentrations have been consistently below the annual objective for NO₂ over the last 6 years.

TRDC has now revoked the NO₂ Kings Langley AQMA and NO₂ and PM₁₀ Chandlers Cross AQMA.

In 2018, a detailed assessment was undertaken to determine whether the remaining AQMA's in Chorleywood could also be revoked. The modelling study indicated that

there are no exceedances of the NO₂ and PM₁₀ annual mean objective at locations with relevant exposure in the area surrounding Junction 18 of the M25.

The modelled PM₁₀ concentrations were lower than the 40 µg/m³ annual mean limit value, the maximum modelled PM₁₀ concentration at the discrete receptors was 18.4 µg/m³. The results indicate that annual mean NO₂ concentrations are close to the air quality objective of 40 µg/m³ at locations where relevant exposure may be present.

It was recommended that TRDC continue to measure NO₂ and PM₁₀ and not revoke the AQMA.

The triplicate site located at Belfry House, Uxbridge Road (Mill End 1) has measured exceedances of the annual mean NO₂ objective of 40µg/m³. The available data for this site is quite limited, TRDC therefore intends to continue to measure NO₂ at this location over the next year.

Three Rivers District Council's priorities for the coming year are:

- To resume monitoring of NO₂ at the established monitoring sites;
- To resume monitoring of particulates at the two AQ Mesh Sensor sites.

Local Engagement and How to get involved

It is important that members of the public appreciate the impact of their transport choices on air quality. The TRDC Action Plan highlights that the District is developing strategies to develop Sustainable Travel and Better Buses to inform how it will support the County Council's bus services. TRDC has also supported Office for Low Emissions Vehicles (OLEV) initiatives to install electric vehicle charging points.

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1 Local Air Quality Management

This report provides an overview of air quality in Three Rivers District Council during 2018. 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 (AQMA's) 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 compliance with the objectives.

A summary of AQMA's declared by Three Rivers District Council can be found in Table 2.1. Further information related to declared or revoked AQMA's, including maps of AQMA boundaries are available online at https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=281.

Alternatively, see Appendix D: Map(s) of Monitoring Locations and AQMA's, which provides for a map of air quality monitoring locations in relation to the AQMA(s).

Measured concentrations of NO₂ continue to be below the air quality objectives within the current AQMA's. There has been a continued downward trend at the established monitoring sites and measured concentrations have been consistently below the annual objective for NO₂ over the last 6 years.

The Council has revoked the NO₂ Kings Langley AQMA and NO₂ and PM₁₀ Chandlers Cross AQMA.

In 2018, a detailed assessment was undertaken to determine whether the remaining AQMA's in Chorleywood could also be revoked. The modelling study indicated that there are no exceedances of the NO₂ and PM₁₀ annual mean objective at locations with relevant exposure in the area surrounding Junction 18 of the M25.

The modelled PM₁₀ concentrations were lower than the 40 µg/m³ annual mean limit value, the maximum modelled PM₁₀ concentration at the discrete receptors was 18.4 µg/m³. The results indicate that annual mean NO₂ concentrations are close to the air quality objective of 40 µg/m³ at locations where relevant exposure may be present.

It was recommended that TRDC continue to measure NO₂ and PM₁₀ and not revoke the AQMA.

The triplicate site located at Belfry House, Uxbridge Road (Mill End 1) has measured exceedances of the annual mean NO₂ objective of 40µg/m³.

Further monitoring using diffusion tubes commenced on the A412 in Rickmansworth from April 2017. The purpose of this monitoring was to ascertain current concentrations within residential areas, including a new school that may be impacted upon by the proposed HS2 construction works at Long Lane/ A412/ Denham Way.

Table 2.1 – Declared Air Quality Management Areas

AQMA Name	Date of Declaration	Pollutants and Air Quality Objectives	City / Town	One Line Description	Is air quality in the AQMA influenced by roads controlled by Highways England?	Level of Exceedance (maximum monitored/modelled concentration at a location of relevant exposure)				Action Plan		
						At Declaration		Now		Name	Date of Publication	Link
Chorleywood NO2 AQMA	Declared 01/04/2001	NO2 Annual Mean	Chorleywood	Along the M25 south of Junction 18 to just north of where the motorway crosses the River Chess	YES	>40	µg/m ³	30	µg/m ³	Three Rivers District Council Air Quality Action Plan	2015-2020	www.threerivers.gov.uk/download?id=34952
Chorleywood PM10 AQMA	Declared 01/04/2001	PM10 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	YES	>50, exceeded more than 35 times in a year	µg/m ³	Not monitored	µg/m ³	Three Rivers District Council Air Quality Action Plan	2015-2020	www.threerivers.gov.uk/download?id=34952

☐ TRDC does not confirm the information on UK-Air regarding their AQMA(s) is up to date.

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

Defra's appraisal of last year's ASR concluded that the report was well structured, detailed, and provided the information specified in the Guidance. The comments below were designed to assist in the development of future reports.

1. The ASR report continues to provide a concise summary of the current status of air quality monitoring and assessment within the district.
2. The Council has agreed to revoke AQMA's 3-5 and is awaiting further instruction from Defra regarding this. (Advice on revoking AQMAs was provided in the previous ASR).
3. Details of the revocation orders should be submitted to Defra, so that our AQMA records can be maintained and kept up to date.
4. The additional monitoring at sites Mill End 1 and Mill End 2 in Rickmansworth has indicated that a DA will be required to assess the extent of the NO₂ and PM₁₀ exceedances along the A412 in light of the HS2 construction work. This is supported.
5. The report states that source apportionment would further inform whether a diversion of HGVs from the A412, via J18 of the M25 might bring the area into compliance without compromising any new receptors on the diversion route. This is supported and an update on this should be provided in the next ASR.
6. Exceedances of the PM₁₀ annual mean and 24 hour mean were recorded at AQ Mesh 1 at Junction 18 of the M25 within the Chorleywood AQMA implying that this AQMA should remain at this time.
7. There were no exceedances of the NO₂ objectives at in the Chorleywood AQMA so the Council could move to revoke the NO₂ AQMA.
8. If there is any historical monitoring data for PM₁₀ or PM_{2.5} for AQ Mesh 1 (J18 of the M25) then it should be included in Table A4 for completeness.
9. It would be helpful to include maps that show the extent of each AQMA along with labelled locations of the air quality monitoring sites within each AQMA that links to the tabulated data in the results tables.
10. Advice on when to apply the distance correction calculation was revised in early 2018 and can be found in clauses 7.77-7.79 of LAQM TG(16).

Conclusions have been brought forward from last year's appraisal and actioned in this ASR:

1. Noted.
2. TRDC has revoked AQMAs 3-5.

3. The revocation orders will be uploaded to the RSW when they are available.
4. Further monitoring will be undertaken at Mill End 1 and Mill End 2 before proceeding to detailed assessment.
5. Source appointment will be undertaken in 2019.
- 6 & 7. Following detailed assessment, it was recommended that the Chorleywood AQMAs remain in place.
8. There is no historical monitoring data for PM₁₀ or PM_{2.5} for AQ Mesh 1.
9. Maps showing the extent of the AQMAs have been included. Maps showing the individual monitoring locations have also been included. The figure headings use the same tube references as shown in the results tables. These will be improved this year.
10. Noted.

TRDC's priorities for 2019 will be to resume monitoring of NO₂ at the established monitoring sites and to resume monitoring of particulates at the two AQ Mesh Sensor sites.

Table 2.2 – Progress on Measures to Improve Air Quality

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
1	AirTEXT	Public Information	Via other mechanisms	TRDC	Complete	April 2015-April 2018	Hits on Hertfords hire Air Quality Forecast website	Exposure of most vulnerable	Operational	Apr-18	Hertfords hire Air Quality Forecast used to communicate air quality information across the district
2	2 x indicative PM2.5 AQ Monitors	Other	Other	TRDC	Complete	Apr-17	PM2.5 AQ Data	Inform future projects if required	Equipment installed	TBC	Equipment installed, however monitoring ceased in 2017.
3	LTP, Walking, Cycling and bus strategy	Promoting Travel Alternatives	Intensive active travel campaign &	HCC/ TRDC	Ongoing	Ongoing	Decrease in private car use	NO2/PM10/PM2.5	Ongoing	Ongoing	Support of DAR bus scheme; 3 new cycling improvem

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			infrastructure								ent scheme; new footway along Aerodrome Way; cycle training etc
4	Improvement of bus network	Transport Planning and Infrastructure	Bus route improvements	HCC/TRDC	Complete	Ongoing	Increased bus use	NO2/PM10/PM2.5	Ongoing	Ongoing	Improvements to six routes; Intalink Partnership of Hertfordshire bus and passenger transport operators and local authorities
5	OLEV initiative	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote	HCC/TRDC	Complete	Ongoing	Increase electric vehicle ownership	NO2/PM10/PM2.5	One charging point installed	TBC	No information provided

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			Low Emission Vehicles, EV recharging, Gas fuel recharging								
6	Additional cycle routes	Transport Planning and Infrastructure	Cycle network	HCC/TRDC	Complete	Ongoing	Increase cycling	NO2/PM10/PM2.5	Ongoing	TBC	3 new cycling improvement scheme
7	Alternative routes via green ways	Transport Planning and Infrastructure	Other	HCC/TRDC	Complete	Ongoing	Use of greenways	Reduce exposure	Ongoing	TBC	No information provided

Measure 3

TRDC continues to allocate £40,000 a year to support the Dial-A-Ride (DAR) bus scheme to provide passenger transport (reducing private car use).

Measure 4

Contributions to improved bus services on six routes across the District enabled 78,397 additional passenger trips in 2018/19.

Measures 3 & 6

TRDC funded introduction of 3 new cycling improvement schemes in 2018/19.

Measure 3

Hertfordshire County Council's (HCC) Highways Service delivers a programme of transport improvement projects focusing on improving sustainable transport in the county – this is called the Integrated Transport Programme. The following schemes were in the delivery programme for 2018/19 in Three Rivers:

- New footway along Aerodrome Way connecting to an existing bus stop near the Warner Bros. Studios.

Measure 3

Programmes delivered by HCC's Active & Safer Travel Team, which supports sustainable travel, mode shift and the air quality agenda include:

- Bikeability cycle training;
- Road safety and active travel promotional activities and campaigns.

Measure 4

HCC also supports and administers the Intalink Partnership of Hertfordshire bus and passenger transport operators and local authorities. HCC are currently considering the introduction of an enhanced partnership plan and scheme. The aim of this will be to have more control over the service providers and will also incentivise fleet modernisation. The plan will also be to introduce ANPR data, real time timetabling data, mobile apps etc. to enable a better customer experience, which should help increase the number of passengers using the service.

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.

Three Rivers District Council is taking the following measures to address PM_{2.5} and key benefits to reducing PM_{2.5} emissions will come from the Air Quality Action Plan and Green Expectations Action Plan 2017/18.

The Action Plan includes:

- Continue to promote the installation of electric vehicle charging points, through working with planning and development departments to encourage new developments to take up charge points.

The Green Expectations Plan includes:

- Objective 16 - The Council will seek to reduce the impact of carbon emissions and local air quality of travel associated with Council operations;
- Objective 17 - The Council will develop and improve local cycling and walking routes and actively facilitate sustainable travel through the provision and promotion of new infrastructure;

TRDC is not currently undertaking sensor monitoring using its AQ Mesh monitoring instruments. Further details are provided in Section 3.

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.

TRDC has in the past undertaken monitoring with AQ Mesh Sensor instrumentation at two sites. One on Rickmansworth Rd, Chorleywood M25 J18 and the other at Mill End 1, Belfry House. The AQ Mesh Sensor instruments were not used to gather any data in 2018.

Table A. 1 in Appendix A shows the details of the sites. NB. Local authorities do not have to report annually on the following pollutants: 1,3 butadiene, benzene, carbon monoxide and lead, unless local circumstances indicate there is a problem. National monitoring results are available at <https://uk-air.defra.gov.uk/data/>

Maps showing the location of the monitoring sites are provided in Appendix D. Further details on how the monitors are calibrated and how the data has been adjusted are included in Appendix C.

3.1.2 Non-Automatic Monitoring Sites

TRDC undertook non-automatic (passive) monitoring of NO₂ at 9 sites during 2018, this included two triple sites on the A412 Uxbridge Road (Belfry House, Mill End 1 & Long Lane, Mill End 2). These have been in place since April 2017. Table A. 2 in Appendix A shows the details of the sites.

Maps showing the location of the monitoring sites are provided in Appendix D.

The NO₂ diffusion tube calendar of suggested exposure periods was not followed. Diffusion tubes were deployed from 14th December 2017 to 2nd August 2018. Diffusion tubes were not deployed between August and December 2018. Time weighted averages have therefore been calculated.

Further details on Quality Assurance/Quality Control (QA/QC) for the diffusion tubes, including bias adjustments and any other adjustments applied (e.g. “annualisation” and/or distance correction), are included in Appendix C.

3.2 Individual Pollutants

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

3.2.1 Nitrogen Dioxide (NO₂)

Table A. 3 in Appendix A compares the ratified and adjusted monitored NO₂ annual mean concentrations for the past 5 years with the air quality objective of 40µg/m³. For diffusion tubes, the 2018 dataset of monthly mean values is provided in Appendix B. Table B.1.

Table B.2 shows the NO₂ Monthly Diffusion Tube Results for the actual periods that the tubes were deployed. The time weighted averages, annualisation, bias adjustment and distance fall off calculations are shown. This is a more accurate representation of the dataset.

Table A. 4 in Appendix A compares the ratified continuous monitored NO₂ hourly mean concentrations for the past 5 years with the air quality objective of 200µg/m³, not to be exceeded more than 18 times per year.

Concentrations of NO₂ measured in 2018 increased at six monitoring locations and decreased at seven monitoring locations. Figure A.1 shows trends in Annual Mean NO₂ concentrations over the last 5 years.

The diffusion tube monitoring results indicate that the annual or hourly-mean air quality objective for nitrogen dioxide was not exceeded at most of the monitoring locations in the district.

Measured concentrations of NO₂ continue to be below the air quality objectives within the current AQMA's. There has been a continued downward trend at the established monitoring sites and measured concentrations have been consistently below the annual objective for NO₂ over the last 6 years.

Figure A.2 shows a decreasing trend in annual mean NO₂ concentrations at S2 (NA)/Chandlers Cross AQMA over the last 6 years, although there has been a slight increase in concentrations from 2017. Figure A.3 shows a decreasing trend in annual mean NO₂ concentrations at S3 (NA)/Kings Langley AQMA over the last 6 years.

Exceedances of the annual mean objective of 40 µg/m³ were measured at the triplicate site at Belfry House on Uxbridge Road (Mill End 1). Two of the tubes recorded exceedances of the annual mean objective (S1 (NB) 42 µg/m³ and S2 (NB) 44 µg/m³). The third tube did not record exceedances of the annual mean objective (S3 (NB) 39 µg/m³), this is most likely because in one monitoring period the tube was missing and the fact that the dataset only includes approximately six months data.

After applying distance correction, the predicated concentration at receptor was above the AQS objective for S1 (NB) (40 µg/m³) and S2 (NB) (42 µg/m³).

There were no exceedances above 60 ug/m³.

3.2.2 Particulate Matter (PM₁₀)

Table A. 5 in Appendix A compares the ratified and adjusted monitored PM₁₀ annual mean concentrations for the past 5 years with the air quality objective of 40µg/m³.

Table A. 6 in Appendix A compares the ratified continuous monitored PM₁₀ daily mean concentrations for the past 5 years with the air quality objective of 50µg/m³, not to be exceeded more than 35 times per year.

PM₁₀ concentrations were last measured in July 2017 (AQ Mesh 1) and November 2017 (AQ Mesh 2).

3.2.3 Particulate Matter (PM_{2.5})

Table A. 7 in Appendix A presents the ratified and adjusted monitored PM_{2.5} annual mean concentrations for the past 5 years.

PM_{2.5} concentrations were last measured in July 2017 (AQ Mesh 1) and November 2017 (AQ Mesh 2).

3.2.4 Sulphur Dioxide (SO₂)

Table A. 8 in Appendix A compares the ratified continuous monitored SO₂ concentrations for 2018 with the air quality objectives for SO₂.

SO₂ concentrations are currently not monitored.

Appendix A: Monitoring Results

Table A.1 – Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollut ants Monit ored	In AQ MA?	Monitoring Technique	Distance to Relevant Exposure (m) ⁽¹⁾	Distance to kerb of nearest road (m) ⁽²⁾	Inlet Height (m)
AQMesh 1	Junction 18 (M25) Chorleywood	Other	504161	196285	PM10, PM2.5	YES	Sensor (AQMesh) unit	2	1	3
AQMesh 2	Belfry House Uxbridge Road (Mill End 1)	Kerbside	505263	194250	PM10, PM2.5	NO	Sensor (AQMesh) unit	<0.5m	1.5	2

Notes:

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

(2) N/A if not applicable.

Table A.2 – 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 Continuous Analyser?	Height (m)
S1 (NA)	Watford Road, Croxley Green	Roadside	507134	195283	NO2	NO	3	1	NO	2.5
S2 (NA)	Chandlers Cross	Roadside	506430	198590	NO2	YES	97	17	NO	2.5
S3 (NA)	The Retreat, Kings Langley	Suburban	508100	201800	NO2	YES	7	4	NO	2.5
S4 (NA)	Sunrise Senior Living/Junction 18 M25, Chorleywood	Roadside	504162	196286	NO2	YES	2	1	NO	2.5
S5 (NA)	"	Roadside	504162	196286	NO2	YES	2	1	NO	2.5
S6 (NA)	"	Roadside	504162	196286	NO2	YES	2	1	NO	2.5
S7 (NA)	Rickmansworth Fire Station, Rectory Road	Roadside	505500	194400	NO2	NO	30	10	NO	2.5
S1 (NB)	Belfry House Uxbridge Road (Mill End 1)	Kerbside	505264	194251	NO2	NO	<0.5	1.5	NO	2.9
S2 (NB)	"	Kerbside	505264	194251	NO2	NO	<0.5	1.5	NO	2.9

S3 (NB)	"	Kerbside	505264	194251	NO2	NO	<0.5	1.5	NO	2.9
S4 (NB)	A412 Long Lane (Mill End 2)	Kerbside	504104	193684	NO2	NO	<0.5	1.8	NO	2.4
S5 (NB)	"	Kerbside	504104	193684	NO2	NO	<0.5	1.8	NO	2.4
S6 (NB)	"	Kerbside	504104	193684	NO2	NO	<0.5	1.8	NO	2.4

Notes:

- (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.

Table A.3 – Annual Mean NO₂ Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2018 (%) (2)	NO ₂ Annual Mean Concentration (µg/m ³) (3)				
					2014	2015	2016	2017	2018
S1 (NA)	Roadside	Diffusion Tube	50%	50%	28	26	25.9	27.3	28
S2 (NA)	Roadside	Diffusion Tube	50%	50%	26	27.3	26.1	24.6	26
S3 (NA)	Suburban	Diffusion Tube	50%	50%	26	26.6	30.1	27.1	28
S4 (NA)	Roadside	Diffusion Tube	50%	50%	34	34.3	30	32.5	32
S5 (NA)	Roadside	Diffusion Tube	50%	50%	34	35.2	34.4	33.1	31
S6 (NA)	Roadside	Diffusion Tube	50%	50%	37	35.7	34.5	34.1	31
S7 (NA)	Roadside	Diffusion Tube	50%	50%	27	25.9	28.2	27.1	28
S1 (NB)	Roadside	Diffusion Tube	50%	50%	-	-	-	53.1	42
S2 (NB)	Kerbside	Diffusion Tube	50%	50%	-	-	-	53.2	44
S3 (NB)	Kerbside	Diffusion Tube	42%	42%	-	-	-	48.5	39
S4 (NB)	Kerbside	Diffusion Tube	50%	50%	-	-	-	28.7	30

S5 (NB)	Kerbside	Diffusion Tube	50%	50%	-	-	-	29.7	30
S6 (NB)	Kerbside	Diffusion Tube	50%	50%	-	-	-	30	30

☒ **Diffusion tube data has been bias corrected**

☒ **Annualisation has been conducted where data capture is <75%**

Notes:

Exceedances of the NO₂ annual mean objective of 40µg/m³ are shown in **bold**.

NO₂ annual means exceeding 60µg/m³, indicating a potential exceedance of the NO₂ 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 Boxes 7.9 and 7.10 in LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

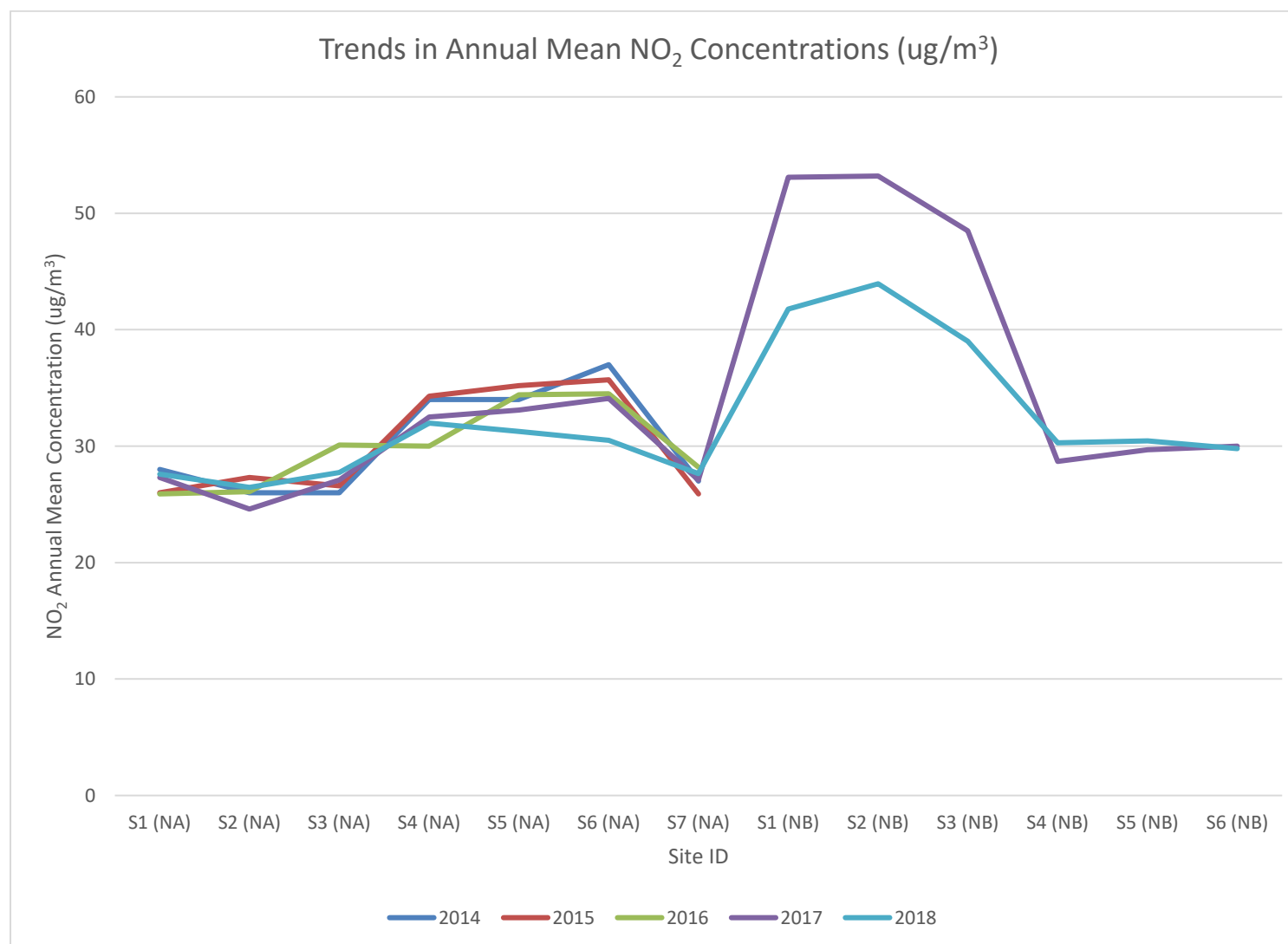
Figure A.1 – Trends in Annual Mean NO₂ Concentrations

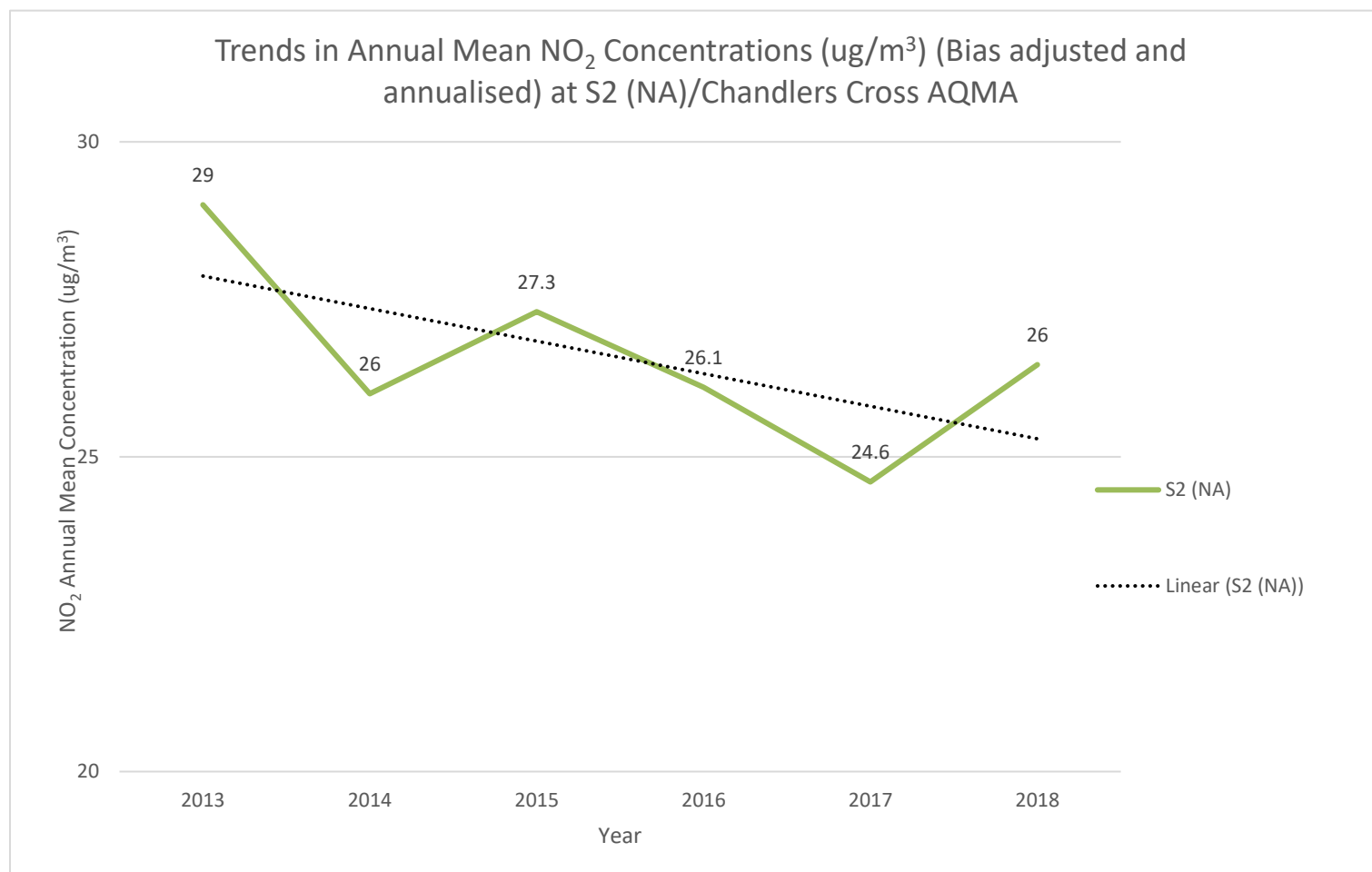
Figure A.2 – Trends in Annual Mean NO₂ Concentrations at S2 (NA)/Chandlers Cross AQMA

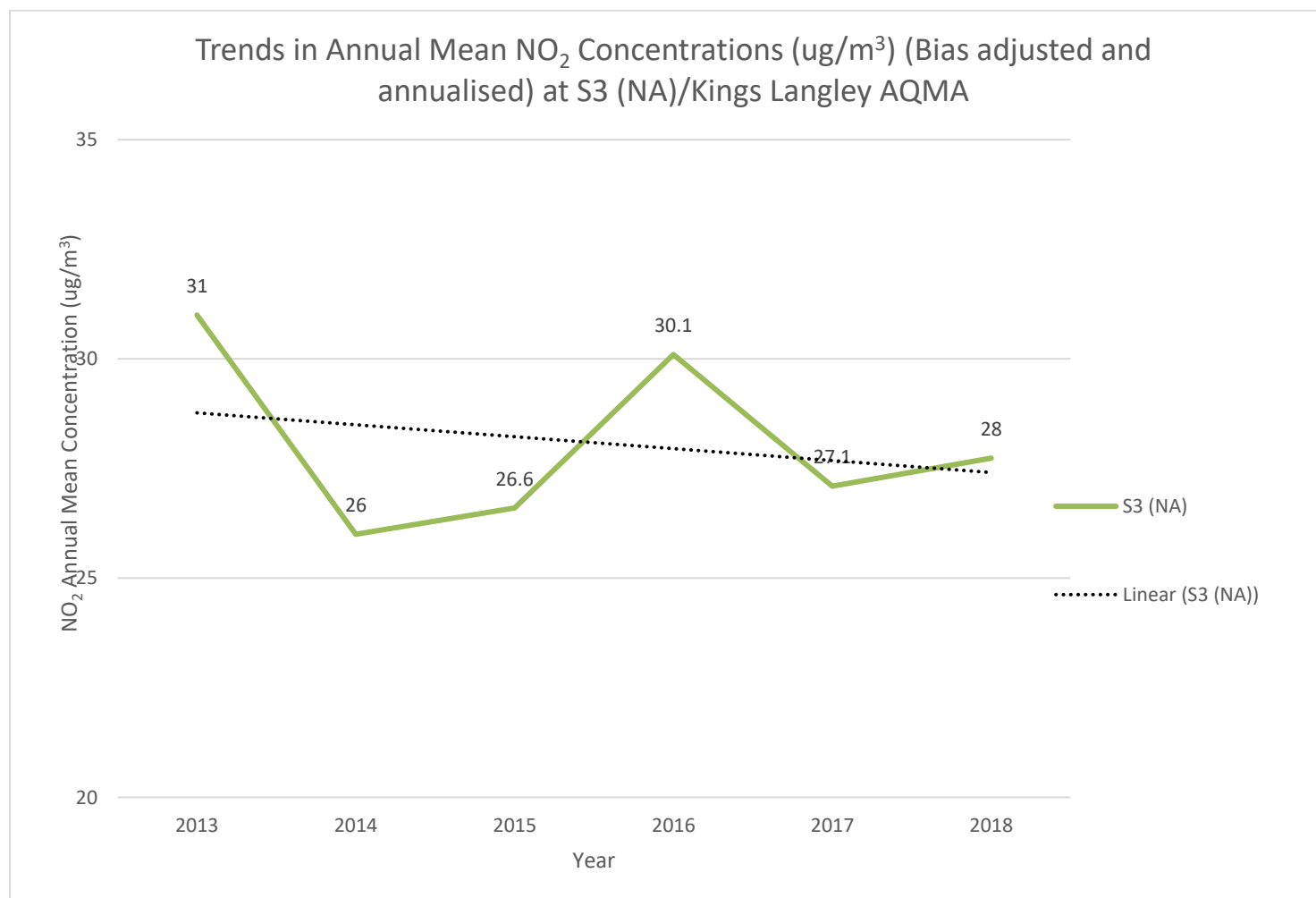
Figure A.3 – Trends in Annual Mean NO₂ Concentrations at S3 (NA)/Kings Langley AQMA

Table A.4 – 1-Hour Mean NO₂ Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data for Capture Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2018 (%) ⁽²⁾	NO ₂ 1-Hour Means > 200µg/m ³ ⁽³⁾				
					2014	2015	2016	2017	2018
-	-	-	-	-	-	-	-	-	-

Notes:

Exceedances of the NO₂ 1-hour mean objective (200µg/m³ not to be exceeded more than 18 times/year) are shown in **bold**.

(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) If the period of valid data is less than 85%, the 99.8th percentile of 1-hour means is provided in brackets.

Table A.5 – Annual PM10 Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2018 (%) ⁽²⁾	PM ₁₀ Annual Mean Concentration (µg/m ³) ⁽³⁾				
				2014	2015	2016	2017	2018
AQMesh 1 (1297150)	Other	0	0	-	-	-	41.6	-
AQMesh 2 (1298150)	Kerbside	0	0	-	-	-	34.5	-

☒ Annualisation has been conducted where data capture is <75% (of 2017 data)

Notes:

Exceedances of the PM₁₀ annual mean objective of 40µg/m³ are shown in **bold**.

(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) All means have been “annualised” as per Boxes 7.9 and 7.10 in LAQM.TG16, valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Table A.5 – 24-Hour Mean PM₁₀ Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2018 (%) ⁽²⁾	PM ₁₀ 24-Hour Means > 50µg/m ³ ⁽³⁾				
				2014	2015	2016	2017	2018
-	-	-	-	-	-	-	-	-

Notes:

Exceedances of the PM₁₀ 24-hour mean objective (50µg/m³ not to be exceeded more than 35 times/year) are shown in **bold**.

(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) If the period of valid data is less than 85%, the 90.4th percentile of 24-hour means is provided in brackets.

Table A.6 – PM_{2.5} Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2018 (%) ⁽²⁾	PM _{2.5} Annual Mean Concentration (µg/m ³) ⁽³⁾				
				2014	2015	2016	2017	2018
AQMesh 1 (1297150)	Other	0	0	-	-	-	9.3	-
AQMesh 2 (1298150)	Kerbside	0	0	-	-	-	12.6	-

☒ Annualisation has been conducted where data capture is <75% (of 2017 data)

Notes:

(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) All means have been “annualised” as per Boxes 7.9 and 7.10 in LAQM.TG16, valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Table A.7 – SO₂ Monitoring Results

Site ID	Site Type	Valid Capture monitoring Period (%) ⁽¹⁾	Valid Capture (%) ⁽²⁾	Number of Exceedances 2018 (percentile in bracket) ⁽³⁾		
				15-minute Objective (266 µg/m ³)	1-hour Objective (350 µg/m ³)	24-hour Objective (125 µg/m ³)
-	-	-	-	-	-	-

Notes:

Exceedances of the SO₂ objectives are shown in **bold** (15-min mean = 35 allowed a year, 1-hour mean = 24 allowed a year, 24-hour mean = 3 allowed a year)

(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) If the period of valid data is less than 85%, the relevant percentiles are provided in brackets.

Appendix B: Full Monthly Diffusion Tube Results for 2018

Table B.1 – NO₂ Monthly Diffusion Tube Results – 2018

Site ID	NO ₂ Mean Concentrations (µg/m ³)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean		
													Raw Data	Bias Adjusted (0.76) and Annualised ⁽¹⁾	Distance Corrected to Nearest Exposure ⁽²⁾
S1 (NA)	38.1	38.9	64.7	31	23.1	27.5							36	28	
S2	33.7	39.1	65.6	27.3	21.5	27.8							35	26	24
S3	38.5	37.6	58.8	31.7	26.7	29.8							36	28	26
S4	44.4	48.5	44.2	32.4	38.1	40.7							42	32	30
S5	43.1	43.1	44.2	42.8	34.9	39.5							41	31	30
S6	41.5	52.9	38.2	35.1	31.5	36.6							40	31	30
S7	35.5	40.8	40.8	33	33.6	34							36	28	
S1 (NB)	64.5	58.4	37.9	56.4	47.9	58.1							55	42	40
S2	64.6	64.4	38.6	62.2	46.5	65.1							58	44	42
S3	56.4	MISSING	29.8	57.4	43.9	66							41	39	
S4	44.1	40.9	56.6	37.6	26.2	37.3							40	30	
S5	40.8	43.2	53.8	37.9	26.3	42.2							40	30	
S6	38.1	40.9	53.4	37.1	30.4	39.4							39	30	

☐ Local bias adjustment factor used

- ☒ National bias adjustment factor used
- ☒ Annualisation has been conducted where data capture is <75%
- ☒ Where applicable, data has been distance corrected for relevant exposure

Notes:

Exceedances of the NO₂ annual mean objective of 40µg/m³ are shown in **bold**.

NO₂ annual means exceeding 60µg/m³, indicating a potential exceedance of the NO₂ 1-hour mean objective are shown in **bold and underlined**.

- (1) See Appendix C for details on bias adjustment and annualisation.
- (2) Distance corrected to nearest relevant public exposure.

Table B.2 - NO₂ Monthly Diffusion Tube Results – 2018 (for actual periods tubes were deployed)

Site ID	14/12/ 2017- 01/02/ 2018	01/02/ 2018- 22/03/ 2018	22/03/ 2018- 19/04/ 2018	19/04/ 2018- 17/05/ 2018	17/05/ 2018- 29/06/ 2018	29/06/ 2018- 02/08/ 2018	Raw Data	Time weighted average	No. of months	Annualised	Bias adjusted	% exposure	Distance from road
S1 (NA)	38.1	38.9	64.7	31	23.1	27.5	37	36	6	36	28	50%	
S2	33.7	39.1	65.6	27.3	21.5	27.8	36	35	6	35	26	50%	24
S3	38.5	37.6	58.8	31.7	26.7	29.8	37	36	6	36	28	50%	26
S4	44.4	48.5	44.2	32.4	38.1	40.7	41	42	6	42	32	50%	30
S5	43.1	43.1	44.2	42.8	34.9	39.5	41	41	6	41	31	50%	30
S6	41.5	52.9	38.2	35.1	31.5	36.6	39	40	6	40	31	50%	30
S7	35.5	40.8	40.8	33	33.6	34	36	36	6	36	28	50%	
S1 (NB)	64.5	58.4	37.9	56.4	47.9	58.1	54	55	6	55	42	50%	40
S2	64.6	64.4	38.6	62.2	46.5	65.1	57	58	6	58	44	50%	42
S3	56.4		29.8	57.4	43.9	66	51	51	5	52	39	42%	
S4	44.1	40.9	56.6	37.6	26.2	37.3	40	40	6	40	30	50%	
S5	40.8	43.2	53.8	37.9	26.3	42.2	41	40	6	40	30	50%	
S6	38.1	40.9	53.4	37.1	30.4	39.4	40	39	6	39	30	50%	

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

Diffusion tubes are supplied and analysed by Socotec, formerly Environmental Scientifics Group (ESG) Didcot, a UKAS accredited laboratory. The Council uses 50% TEA (triethanolamine) in acetone diffusion tubes.

QA/QC

Socotec participated in the following AIR NO₂ PT rounds during 2018:

AIR PT AR024 January - February 2018;
AIR PT AR025 April – May 2018;
AIR PT AR027 July-August 2018;
AIR PT AR028 September-October 2018.

100% of results submitted were determined to be satisfactory.

Bias adjustment

A national bias adjustment factor was used. The national bias adjustment factor for 2018 is 0.76.

A database of bias adjustment factors determined from Local Authority co-location studies throughout the UK has been collated by the Local Air Quality Management Helpdesk. Using orthogonal regression, combined bias adjustment factors have been calculated for each laboratory, year and preparation method combination for which data are available.

The Diffusion Tube Bias Adjustment Factors Spreadsheet for March 2019 was used.

The bias correction factors used are shown in Table 2.3, and the national spread sheet can be found at:

<http://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html>

Annualisation

During 2018 the valid data capture for all monitoring locations was below 75%. Therefore the calculated annual average was annualised according to the method outlined in boxes 7.9 and 7.10 in LAQM TG16. Data from a background monitoring site with more than 85% data capture is required for this calculation. A site known as Hillingdon UKA00266 was chosen from Defra's Automatic Urban Rural Network (AURN) of monitoring stations. This site was chosen as it was the nearest background site that had sufficient data capture. The calculated ratio is then used to adjust the calculated annual mean before it is bias adjusted. Further details on the Hillingdon monitoring site can be seen below.

Hillingdon UKA00266 monitoring station

The monitoring station is within a self-contained, air-conditioned housing located on an open grass area approximately 2.5 metres from the kerb of a residential road. The site is bordered on three sides by residential roads and on the fourth by the busy M4 motorway, which is approximately 30 metres from the station and above the height of the inlet. The general area is open and protected from the M4 by trees.

S1 (NA):

Month	Start Date	End Date	B1	D1	B1 when D1 is available
	14/12/2017	01/02/2018	54.0	38.1	54.0
	01/02/2018	22/03/2018	52.2	38.9	52.2
	22/03/2018	19/04/2018	60.0	64.7	60.0
	19/04/2019	17/05/2018	50.0	31	50.0
	17/05/2018	29/06/2018	31.1	23.1	31.1
	29/06/2018	02/08/2018	43.9	27.5	43.9
Aug	02/08/2018	05/09/2018	41		
Sept	05/09/2018	03/10/2018	42		
Oct	03/10/2018	31/10/2018	54		
Nov	31/10/2018	05/12/2018	55		
Dec	05/12/2018	09/01/2019	49		
Average			48.3		48.5
Ratio					1.00

S3 (NB):

Month	Start Date	End Date	B1	D1	B1 when D1 is available
	14/12/2017	01/02/2018	54.0	56.4	54.0
	01/02/2018	22/03/2018	52.2		
	22/03/2018	19/04/2018	60.0	29.8	60.0
	19/04/2019	17/05/2018	50.0	57.4	50.0
	17/05/2018	29/06/2018	31.1	43.9	31.1
	29/06/2018	02/08/2018	43.9	66	43.9
Aug	02/08/2018	05/09/2018	41		
Sept	05/09/2018	03/10/2018	42		
Oct	03/10/2018	31/10/2018	54		
Nov	31/10/2018	05/12/2018	55		
Dec	05/12/2018	09/01/2019	49		
Average			48.3		47.8
Ratio					1.01

Nitrogen Dioxide fall off with distance calculations

These were carried out on all measurements within AQMA's where located near relevant exposure and where the annual mean concentrations was exceeded.

Site Name/ID	Distance (m)		NO ₂ Annual Mean Concentration (µg/m ³)			Comment
	Monitoring Site to Kerb	Receptor to Kerb	Background	Monitored at Site	Predicted at Receptor	
S2 (NA)					-	Not able to calculate because receptor to kerb is 97m. Not relevant exposure.
S3 (NA)	4.0	11.0	17.0	28.0	24.9	
S4 (NA)	1.0	3.0	20.0	32.0	29.3	
S5 (NA)	1.0	3.0	20.0	31.0	28.6	
S6 (NA)	1.0	3.0	20.0	31.0	28.6	
S1 (NB)	1.5	2.0	16.0	42.0	40.4	Predicted concentration at Receptor above AQS objective.

Three Rivers District Council

S2 (NB)	1.5	2.0	16.0	44.0	42.2	Predicted concentration at Receptor above AQS objective.
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Appendix D: Map(s) of Monitoring Locations and AQMAs

Figure D. 1 - Air Quality Management Areas Chorleywood NO2 and PM10

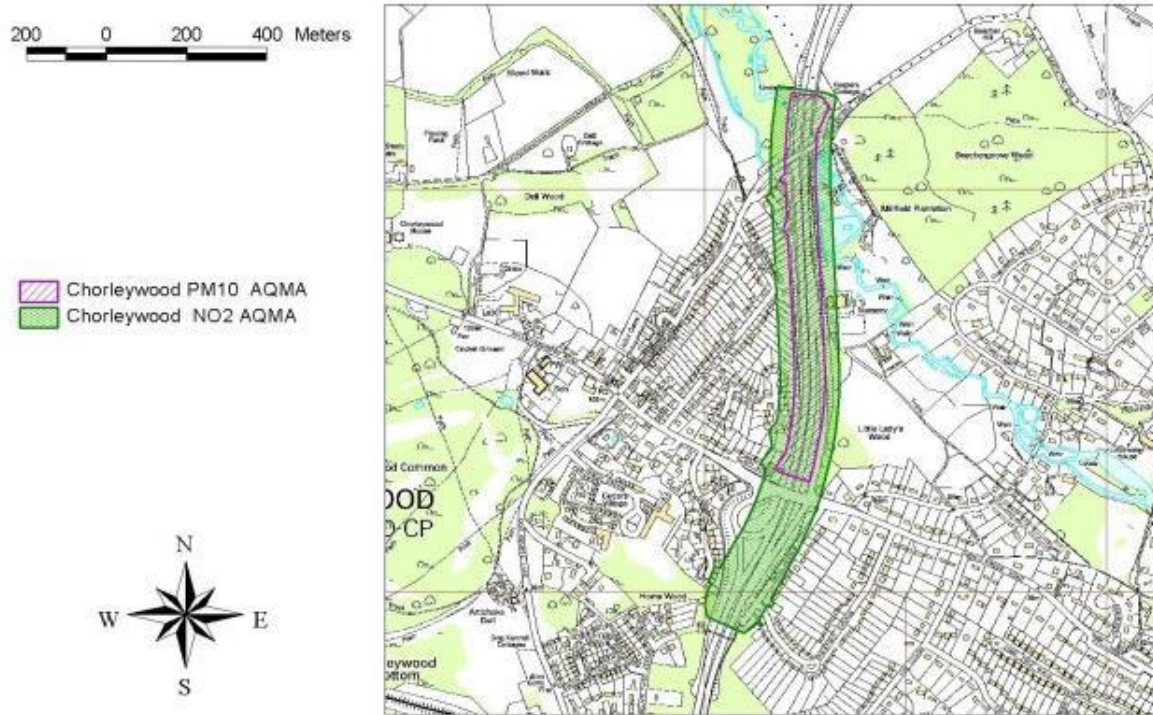


Figure D. 2 - Map of The Retreat, Abbots Langley diffusion tube (DT) site (NA) S3

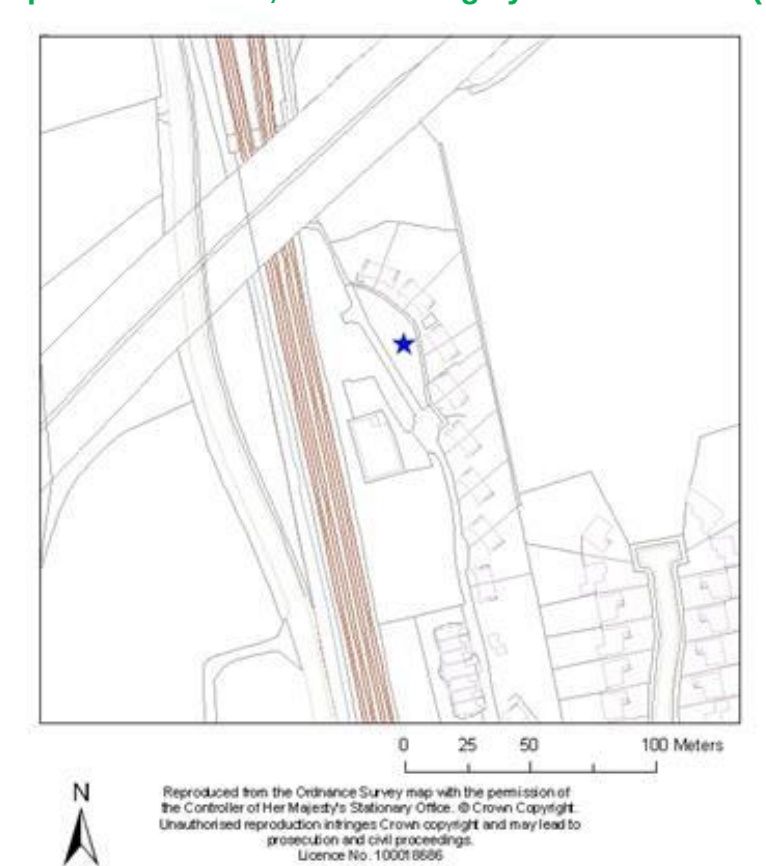


Figure D. 3 - Map of Junction 18 (M25) Chorleywood DT sites (NA) S4, S5 & S6

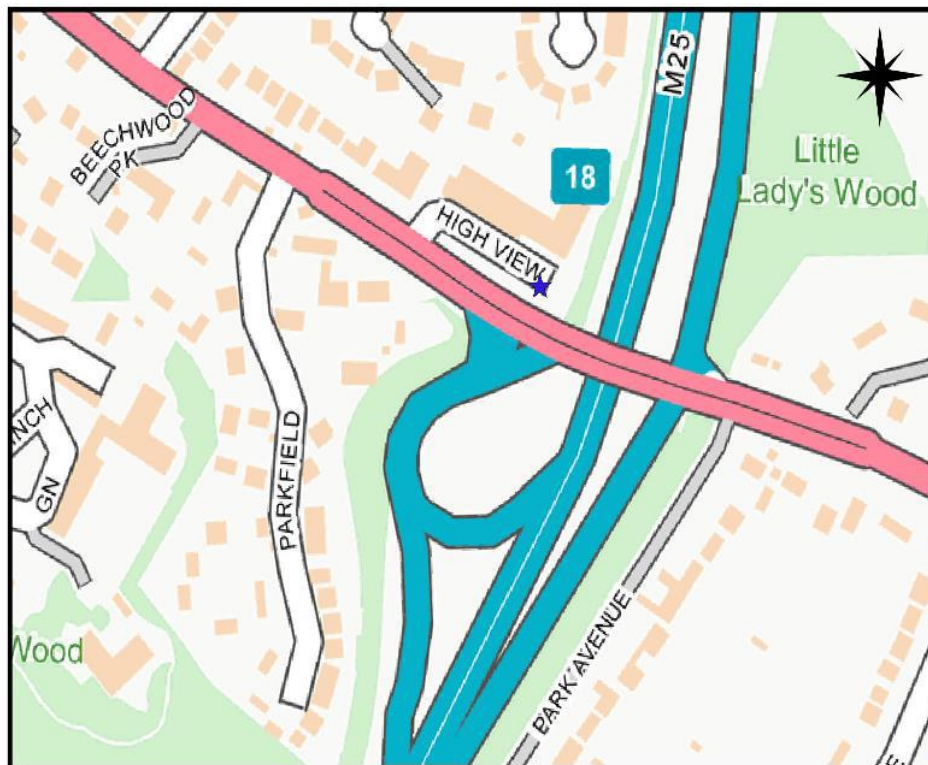


Figure D. 4 - Map of Glen View, Changers Cross DT site (NA) S2

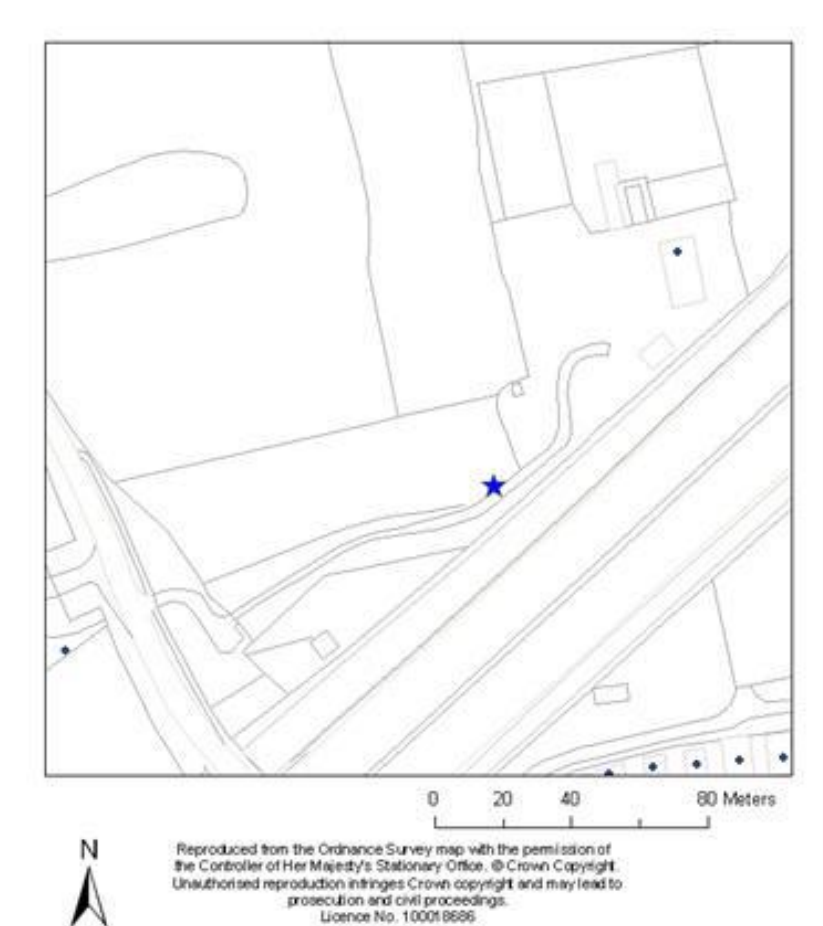


Figure D. 5- Map of Watford Road, Croxley Green DT site (NA) S1

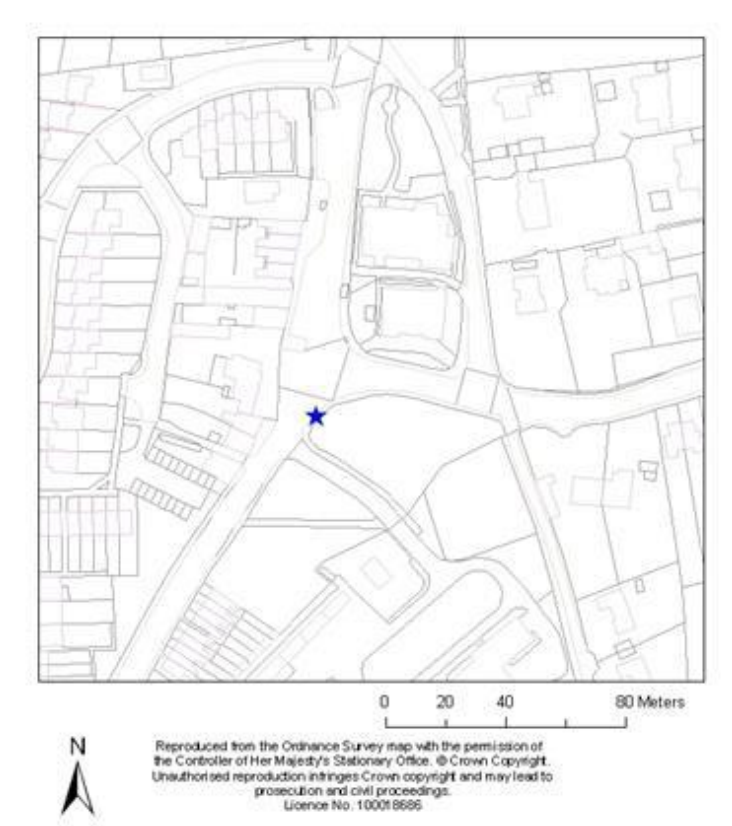


Figure D. 6 - Map of Rectory Road, Rickmansworth DT site (NA) S7

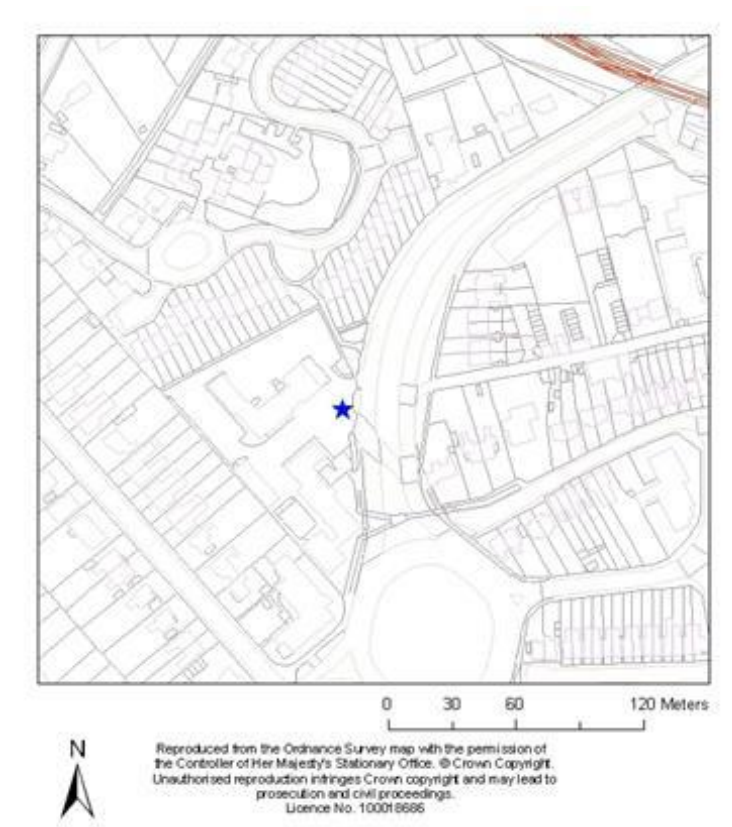


Figure D. 7 - Map AQ Mesh monitoring site, Junction 18 (M25), Chorleywood

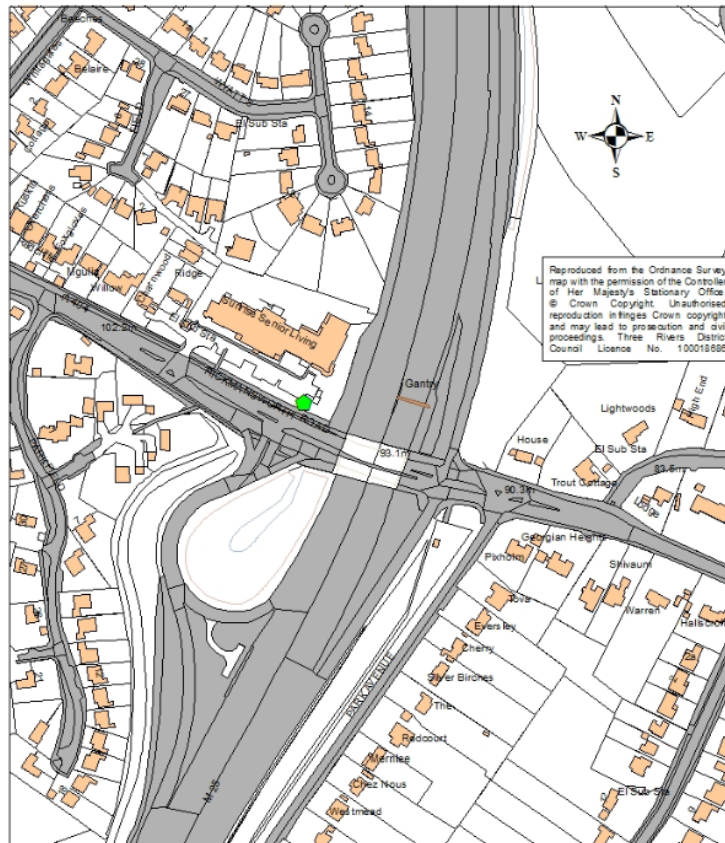


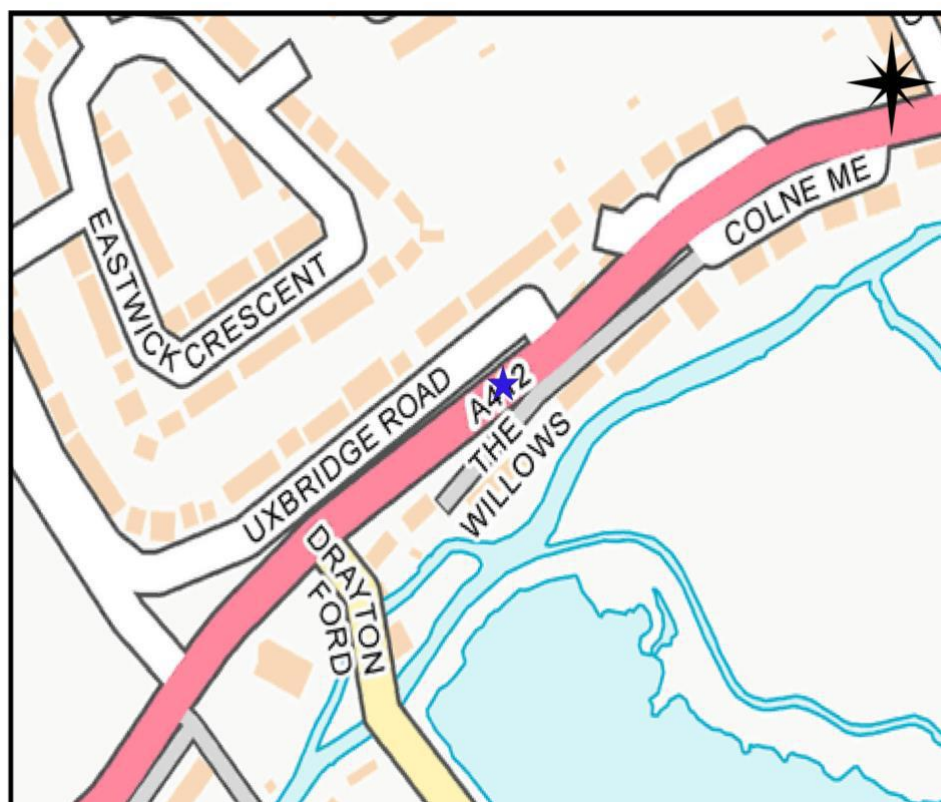
Figure D. 8 - Map AQ Mesh monitoring site, Belfry House, Uxbridge Rd (Mill End 1)



Figure D. 9 - Map of Uxbridge Road, Belfry House DT Triplicate site (NB) S1-S3



Figure D. 10 - Map of A412 Long Lane (Mill End 2) DT Triplicate site (NB) S4-S6



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/m³).

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

- LAQM Technical Guidance TG.16, 2018, DEFRA, Available at: <https://laqm.defra.gov.uk/documents/LAQM-TG16-February-18-v1.pdf>
- Ricardo Energy & Environment 2018 Air Quality Annual Status Report (ASR) Three Rivers District Council (2018)
- Ricardo Energy & Environment Three Rivers Detailed Assessment Junction 18, M25 (2018)
- Three Rivers District Council Air Quality Action Plan 2015-2020 (2015 Ed.)
- <http://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html>
- <https://laqm.defra.gov.uk/tools-monitoring-data/no2-falloff.html>