2018 Air Quality Annual Status Report (ASR) (for 2017 monitoring year)

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

November 2018

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Executive Summary: Air Quality in Our Area

1.1 Air Quality in the Borough of Swindon

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].

Air Quality within the Swindon Borough Council (SBC) area is generally very good.

In common with many towns and cities however, there are some discrete parts of the town where air quality is less good. These few areas are generally associated with congested traffic routes, and where dwellings lie close to the kerb; so called 'street canyons'. Where a street 'canyon' exists, exhaust gases do not disperse well.

One such area in Swindon is at Kingshill, and here it has been necessary to declare an Air Quality Management Area (AQMA) which covers a circa 280m stretch of the road South East of the junction with Bowood Road to the roundabout with Okus Road. The pollutant of concern here is Nitrogen Dioxide (NO_2), and the limit value which has been exceeded is the Annual Average limit of 40mcg/m^3.

An Air Quality Steering Group has been set up, and work has begun on identifying ways to reduce NO_2 levels here, and at other sites.

Monitoring of air quality indicates that the level of NO_2 at the façade of some dwellings on Kingshill reaches 55.8mcg/m^3. NO_2 exists in the air as a background pollutant, but here heavy traffic flows emit more, and this has led to the exceedance. The road is oriented away from prevailing winds, and is uphill & closely bounded by trees and houses, so the gas cannot disperse.

[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

Other areas with measured levels of Nitrogen Dioxide approaching the limit levels include Rodbourne Road/Iffley Road and the west end of Manchester Road near the bus station. The Rodbourne Road/Iffley Road location was added to the monitoring programme during 2017 and so a full year's worth of monitoring has not yet been completed. Here, the reported levels may not be representative. The latter location, Manchester Road, is subject to proposed infrastructure changes which are expected to have a positive effect on pollution levels.

Since the last report air quality report in 2017, monitoring has ceased at Bruce Street Bridges (Site S14), because Nitrogen Dioxide levels were consistently below the limit value following major works to improve flows across the roundabout complex there.

Overall, no clear overall trend in Nitrogen Dioxide levels could be observed in Swindon. A few sites experienced a slight worsening in pollution levels (Queens Drive, Kingshill Road), and a number of sites experienced a slight improvement (Cricklade Road, GWR Museum, Rodbourne Road). The number of major road and rail works in Swindon across the reporting period have affected traffic flows over relatively long periods, and it is likely that this has affected average pollution measurements at some sites.

We have identified no new major sources of prescribed pollutants in Swindon.

Levels of Nitrogen Dioxide around major roads continue to respond to rising levels of traffic, and/or the constant evolution of the town's road network. Swindon has much major development either planned or in train, and levels of pollution will respond to these changes on a continuing basis. New development is designed to account for what is now known of the effects of heavy road traffic, and so we do not expect any new areas of concern to be identified. There will be a continuing and growing pressure in areas already highlighted however, as new development across Swindon inevitably leads to increased traffic in all areas, including those already identified as potential hotspots.

We continue to monitor air quality with regard to Nitrogen Dioxide in Swindon using a wide network of 29 diffusion tubes at 25 locations, a reference standard real time monitor, and also with some shorter term and real-time monitors, coupled with traffic flow monitoring hardware.

Across Swindon; traffic derived Nitrogen Dioxide is the only pollutant of immediate concern, as it is across the UK, and it is not thought that levels of any of the other prescribed pollutants need to be formally considered at this time.

1.2 Actions to Improve Air Quality

Nitrogen Dioxide is principally a product of internal combustion engines, or of other burning of fossil fuels. Reducing impacts from this pollutant is currently principally dependant on influencing peoples travel choices and vehicle purchasing decisions. The drivers for this are inevitably national in nature, but Swindon runs a number of projects designed to influence the public in this way:

- Swindon Travel Choices; which seeks to enable people to make more sustainable choices for travel.
- Promoting low emission transport through the construction and/or upgrading of cycle ways, and the inception of Local Development Orders for alternative fuelling schemes in the Borough, such as electric vehicle charging points, or Hydrogen fuelling stations.
- A Cycle to work scheme available to all Council staff.
- The publication of Transport Vision 2026; which includes a number of vision outcomes to support sustainable transport.

More generally; the Council has pursued a programme of installing solar arrays on land which it owns, and air quality is an important factor in its Planning process for developments across the Borough. A battery storage facility, one of the largest yet in the UK, is to be built at Mannington, Swindon during 2018.

The Local Plan 2026 also seeks to move Swindon to a more sustainable future. Theme 4 considers actions to minimise congestion, journey time, and therefore noise and air quality. Swindon's Planning Policy TR1*: Sustainable Transport Networks*, enshrines these principles and aims for all future development.

1.3 Conclusions and Priorities

The air quality trend is not clear in Swindon. The Borough is subject to constant change and development of its and others' infrastructure, and it is an area of very high

current & planned housing growth. Although air quality has been relatively well controlled in the face of these pressures, it is clear that some discrete areas do not enjoy the good air quality that they should.

An area of persistent exceedance has been identified on a part of the A4289 corridor at Kingshill, and an air Quality Management area has now been declared there. Although Nitrogen Dioxide concentrations along most of this corridor are within limits, there are areas where measured levels are persistently above them, or are marginal. An Air Quality Action Plan is presently being developed to try to tackle the issue.

We will continue to use long term average measuring devices, and more recently commissioned shorter term devices, both traditional and novel, along with high resolution traffic monitoring, to understand where pressures may be growing, and where action may be needed to control threats to air quality from road traffic. Within the Air Quality Management Area, these devices will be used to inform the actions that may be required, and to monitor the results stemming from those actions.

Swindon now needs to accelerate and intensify its actions on protecting and improving air quality, and in particular; the effects from road traffic.

The number of petrol or diesel vehicles in use, their continuous growth in numbers, and the continuing use of those vehicles for short journeys which could be easily made on foot or bicycle, combined with the aggressive growth of the town will continue to exert constant upward pressure on local emissions. Improvements in emissions technology have only partially mitigated the relentless intensification of vehicle use to date nationwide, and this alone will not resolve air quality issues in Swindon.

1.4 Local Engagement and How to get Involved

The Council has set up a steering group comprised of Senior Managers, reporting to the Chief Executive, to identify measures to tackle the poor air quality at Kingshill, and to produce an Air Quality Action Plan setting out the means by which exceedance of Nitrogen Dioxide objectives can be remedied. The terms of reference for the Steering Group also includes the monitoring and protection of air quality across the Borough, and not just in the Management Area, although this will be its major foci.

The Council encourages the reduction of private vehicle use, reducing the number of motor powered vehicles and sources of airborne emissions (oxides of nitrogen, particulate matter, VOC etc.), contributing to improvements in air quality in the area.

Various Council initiatives promote healthy life choices by encouraging local residents to walk, cycle, or use public transport whenever possible.

One of the Council initiatives includes free guided bike rides around various areas of Swindon which introduces easy and comfortable routes connecting different locations, and safe and pleasant journeys around the Borough. Completing shorter journeys by cycle reduces the use of private motor powered vehicles and can positively affect local air quality. Further information may be found here: www.goskyride.com/swindon.

Some other measures and initiatives are listed below, described in section 2.2 and summarised in Table 2.2.

- The Council operates the Swindon Travel Choices website, which aims to help individuals plan journeys via walking, cycling or public transport. See this link: http://www.swindontravelchoices.co.uk/

- Promoting Low Emission Transport – The Council's Plan ("Vision for Swindon, How are we going to get there? Plan 2016-2020") has been published that sets out its vision for Swindon and the priorities it is trying to achieve for residents and the borough of Swindon. It gives details of the pledges made on how it will achieve the vision. Priority 1 of the Vision for Swindon commits the Council to "encourage the increased take-up of low-emission vehicles".

- The programme to construct solar arrays on Council-owned land. Priority 2 of the Council's "Vision for Swindon" is to "construct solar arrays on Council-owned land at Common Farm and Chapel Farm. A further scheme at Barnfield is ongoing.

- The Council has a Cycle To Work Scheme to encourage its staff to use more sustainable forms of transport
  http://www.swindonbug.co.uk/cycle-to-work ,
  http://www.swindontravelchoices.co.uk/cycle.aspx,

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2 Local Air Quality Management

This report provides an overview of air quality in the Borough of Swindon during calendar year 2017. It fulfils the reporting 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 Swindon Borough 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.

3 Actions to Improve Air Quality

3.1 Air Quality Management Areas

3.1.1 AQMA at Kingshill Road

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 the measures it intends to put in place in pursuit of compliance with the objectives.

In the light of monitoring data collected during 2017, and taking into account previous years' information, Swindon Borough Council has declared its first AQMA in 2018. The new AQMA is at a section of the A4289 at Kingshill Road, as described in Table 3.1.

Further information related to the AQMA, including maps of the AQMA boundaries, are to be found at Appendix D: Map(s) of Monitoring Locations and AQMAs, which also provides for a map of air quality monitoring locations in relation to the AQMA(s).

Table 3.1 – 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 (inc. date of publication)
						At Declaration	Now	
Kingshill	06/02/2018	Nitrogen Dioxide, National Objective = 40 µg/m^3	Swindon	An area encompassing 14 properties on Kingshill Road west of the junction of Clifton Road	No	56 µg/m^3	56 µg/m^3	Under preparation

The AQMA was declared in 2018 on the corrected mean monitoring data for the monitoring point at 102 Kingshill Road. This was after adjustments including laboratory bias adjustment and correction for distance from receptor. A distance correction tool is provided by DEFRA and has been used in this instance (see Appendix C). The use of this tool is described in the latest version of TG16 (Feb 2018).

The raw mean figures for the diffusion tubes at 101 Kingshill and 102 Kingshill are 64.1 and 56.2 ug/m3 respectively. However whereas the measurement at 102 was made by a tube attached to the facia for 101 Kingshill the monitoring point was at a lamp post on the pavement opposite.

TG16 (Feb 2018) states in section 7.79 “If the closest receptor is located on the opposite side of the road to where the monitoring location was sited, the calculator also cannot be used.” Hence the location opposite No 101 has been taken into account but the determination of an AQMA was made on the basis of the more accurate facia measure at no 102.

Swindon Borough Council has set up an Air Quality Steering Group, and has begun to consider the problem in detail. The following analysis of road traffic, and the relative contributions to the problem has been conducted, and options are being generated from that.

3.1.2 Analysis of Traffic Characteristics at Kingshill

Automatic traffic monitoring hardware has been installed, and used to provide the following detail on traffic flow on Kingshill. This data has been used to determine which type of vehicle(s) are contributing most to pollution at Kingshill Road, and then to estimate how much vehicle derived NO_2 would need to be reduced by.
Tables 3.2 and 3.3 give summary data for traffic flow on Kingshill (obtained from permanent in-carriageway monitoring).

Table 3.2 Summary Traffic Data

	2017	**2016**
AADT	16798	15690
Average Speed of vehicle (mph)	32.0	31.7
%HGV	1.4	1.3

(AADT=annual average daily traffic)

Table 3.3 Extracts of daily vehicle monitoring at Kingshill Road

Date	Day of week	Total Vehicles per 24 hrs	Total bus per 24hrs	Total Artic per 24hrs	Total Rigid per 24 hrs	Total car per 24 hrs	%cars	%HGV	% Goods	% Bus
12.12.2016	Mon	17281	16	26	270	16893	98	0.15	1.71	0.0009
19.12.2016	Mon	17188	10	20	237	16852	98	0.12	1.50	0.0006
25.12.2016	Sun	8967	0	2	15	8886	99.1	0.02	0.19	0.0000
26.12.2016	Mon	9808	1	2	28	9716	99.1	0.02	0.31	0.0001
19.01.2017	Thurs	17686	17	35	255	17324	98	0.20	1.64	0.0010
21.01.2017	Sat	16609	5	5	88	16448	99	0.03	0.56	0.0003
16.02.2017	Thurs	17511	12	26	241	17171	98.1	0.15	1.52	0.0007
25.02.2017	Sat	17055	11	6	100	16901	99.1	0.04	0.62	0.0006
26.02.2017	Sun	13619	9	3	45	13525	99.3	0.02	0.35	0.0007

Together, this data will be used to help develop mitigation measures in the Air Quality Action Plan.

This analysis shows the predominance of light vehicle types; with very few HGVs or Buses. The road remains quite heavily trafficked at weekends and on feast days, and this data together suggests that much of the traffic using Kingshill is local in nature. 98-99% of traffic using Kingshill is light cars and vans.

3.1.3 Assigning emissions to Vehicle Types

The Emissions Factors Toolkit (EFT) (v 8.0.1) has been used to model the relative contributions to NO_2 emissions on Kingshill of the different vehicle types, as shown in Table 3.4.

Table 3.4 Modelled contribution of road vehicles, by type, to road NOx Emissions

	Total all vehicles	LDV	HDV	Petrol Cars & Vans	Diesel Cars & Vans	**Rigid HGVs**	**Artic HGVs**
NOx Emissions rate LDVs g/km	5005	4382	623				
% Contribution	100	87.6	12.4	15.4	72.0	10.0	2.5

From this data it has also been estimated by what percentage NO_2 emissions must be reduced in order to achieve compliance with the annual mean objective for nitrogen dioxide (40ug/m^3). The outcome of this estimate is that to achieve the objective, a **reduction in road-derived NOx of 30% is required**. This source apportionment calculation may be found at Appendix F.

Light vehicles powered by diesel fuel contribute an estimated 72% of all NO_2 according to this model at this site. It is suspected however, from work carried out by Ricardo (https://ee.ricardo.com/news/measuring-real-world-driving-emissions-the-first) that emissions between petrol and diesel powered vehicles may differ according to the temperature of the engine at the time; especially with regard to NO_2. Early results suggest that petrol engines emit most NO_2 when cold, and that diesel engines do so when hot.

The above model may then overstate the contribution of diesel vehicles at this site given the presumption that a large portion of the traffic using Kingshill may be local, and so have a cold engine, and this may need further investigation.

The above, and further work will feed into the options appraisal for our Air Quality Action Plan.

3.2 Progress and Impact of Measures to address Air Quality in the Borough of Swindon

Defra's appraisal of last year's ASR concluded that the conclusions reached in the previous ASR were acceptable for all sources and pollutants.

Swindon Borough Council has taken forward a number of direct measures during the current reporting year of 2017 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 3.5.

Swindon Borough Council expects the following measures to be completed over the course of the next reporting year:

- Development of the Borough's solar power portfolio with the completion of schemes located on Borough-owned land
- Development of electric vehicle charging points

These will encourage the availability of alternative power supplies and use of alternatively powered vehicles, respectively, to reduce local dependence upon fossil fuels. Swindon Borough Council, as one of its visions and priorities, has set its Pledge 2 – that is to construct solar arrays on Council owned land. The Council has set a target to produce 200 Megawatts of renewable energy, equating to 15% of Swindon's total energy consumption, by 2020. The new solar arrays being constructed will be able to generate enough power for around 2,000 homes.

More detail on progress with the solar schemes can be found on the Public Power Solutions website (https://www.publicpowersolutions.co.uk/) which describes the various schemes completed to date.

Swindon Borough Council expects an additional solar scheme at Barnfield to be completed over the course of the next reporting year.

Electric vehicle charging points are available to encourage cleaner vehicle use. Various points are installed and available in and around Swindon (for locations see: https://www.zap-map.com/locations/swindon-charging-points/#)

In the light of the monitoring data for 2017, Swindon Borough Council has also taken forward an Air Quality Management Area (as described above), and is beginning to prepare an Air Quality Action Plan to reduce concentrations of Nitrogen Dioxide at this location.

Table 3.5: 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	Comments
	Title	Select from the categories in blue box	Select from the subcategories in blue box		Date	Date				Date	
1	Swindon Travel Choices	Alternatives	Personalised Travel Planning	Swindon Borough Council		Ongoing		N/A		N/A	
2	Promoting Low Emission Transport	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging	Swindon Borough Council	2014-2015	Completed	Establishment of LDO and alternative fuel fuelling schemes	N/A	Hydrogen fuelling plant (established outside of LDO)		
					2016-2017	Completed	Construction of pedestrian-cycle route in Covingham (also to be used by future NEV residents)	N/A		Completed spring 2018	
3	Programme to construct solar arrays on Council-owned land	Promoting Low Emission Plant	Low Emission Fuels for stationary and mobile sources in Public Procurement	Swindon Borough Council		Latest phase in 2018 is on the ground-mounted Solar Farm on former landfill in Shaw.	Generation capacity of 2.5MW	N/A		To be completed during 2018	
4	Battery storage	Promoting Low Emission Plant	Other Policy	Swindon Borough Council in partnership with Public Power Solutions	2018	2018-19	Battery storage scheme on land owned by the Council, with a permitted capacity of up to 50 MW	N/A	Planning permission granted Mar 2018, work in progress	To be completed during 2018	

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
5	Cycle To Work Scheme (SBC Staff)	Promoting Travel Alternatives	Promotion of cycling and walking	Swindon Borough Council in partnership with Cycle scheme		Oct 2014 - ongoing	Reduction in car journeys to/from Council workplaces	N/A			
6	Transport Vision 2026	Long Term Transport Strategy - Promoting Travel Alternatives	Promotion of public transport	Swindon and Wiltshire Local Enterprise Partnership	2014	ongoing	“Vision Outcomes” 1 to 9	N/A			Ref 1

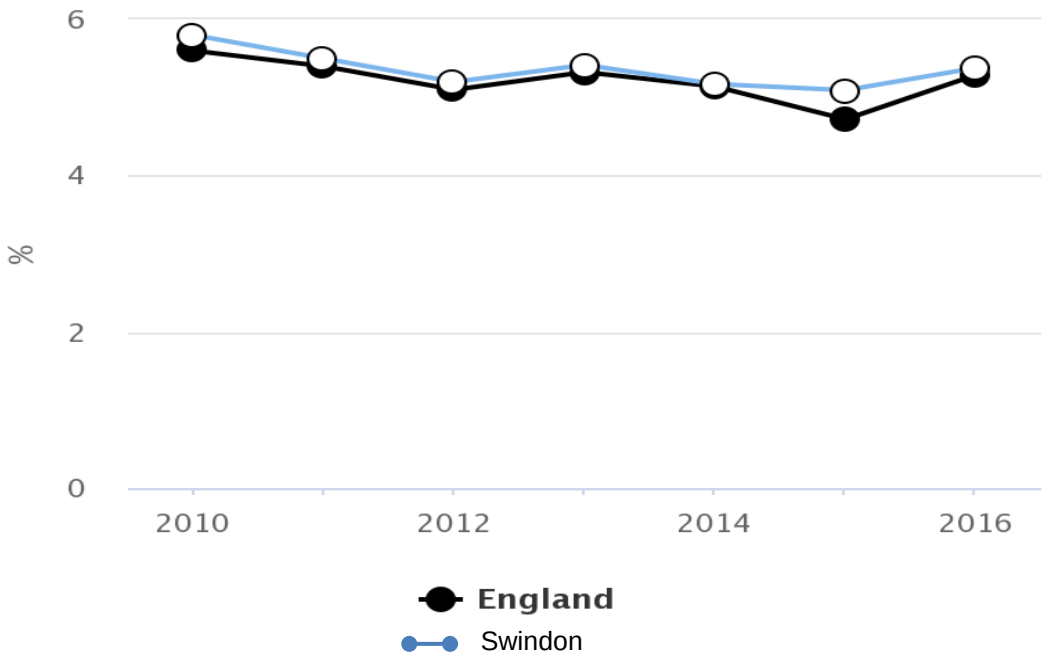
3.3 $PM_{2.5}$ – Local Authority Approach to Reducing Emissions and/or Concentrations

As detailed in Policy Guidance LAQM.PG16 (Chapter 7), local authorities are expected to work towards reducing emissions and/or concentrations of PM2.5 (particulate matter with an aerodynamic diameter of 2.5µm or less). There is clear evidence that PM2.5 has a significant impact on human health, including premature mortality, allergic reactions, and cardiovascular diseases.

Swindon Borough Council has previously carried out indicative monitoring of PM2.5 at locations where levels were expected to be highest but has found levels to be low, and is not taking any specific measures to address PM2.5 at this time.

Public Health England (PHE) publishes data that indicates the fraction of mortality in each area that is attributable to particulate air pollution. For Swindon, the fraction of mortality attributable to particulate air pollution is similar to England (see illustration below showing comparison of background annual average PM2.5 concentrations for the year of interest). The main source of particulates in Swindon is from transportation. The actions to reduce NOx will reduce particulates as well. The other sources such as solid fuels and industrial processes are well regulated (Environmental Permitting).

3.01 – Fraction of mortality attributable to particulate air pollution – Swindon



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

4.1 Summary of Monitoring Undertaken

4.1.1 Automatic Monitoring Sites

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

Swindon Borough Council undertook automatic (continuous) monitoring at Bath Road car park during 2017, however because of equipment failures, the monitoring data gathered subsequently is not sufficient for detailed analysis in the report. Detailed analysis will be available for the 2018 report. Table A.1 in Appendix A shows the details of the site.

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.

4.1.2 Non-Automatic Monitoring Sites

Council-sites

Swindon Borough Council undertook non- automatic (passive) monitoring of NO_2 at 29 sites during 2017. Table A2 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) for the diffusion tubes, including bias adjustments and any other adjustments applied (e.g. “annualisation” and/or distance correction), are included in Appendix C.

Other Monitoring

Some private air quality monitoring has been carried out to support a recent planning application for a waste to energy plant at Keypoint, in the Stratton area of Swindon. The outcomes are shown in Appendix H. The areas concerned are in east Swindon and include established residential areas plus in the vicinity of some of the main industrial sites at that side of Swindon. No concentrations of nitrogen dioxide or of sulphur dioxide exceeded (or came close to) the objective concentrations.

4.2 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.

4.2.1 Nitrogen Dioxide (NO_2)

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

For diffusion tubes, the full 2017 dataset of monthly mean values is provided in Appendix B. Data has been adjusted for periods variation as per para 7.188 of TG16.

Table 3 lists locations where bias adjusted concentrations of Nitrogen Dioxide exceeded Air Quality Objectives, however when these figures have been adjusted to estimate the concentration at the nearest receptor (normally a dwelling), in accordance with Technical Guidance LAQM.TG16, only one location - at the façade of 102 Kingshill Road - are indicated as exceeding the Nitrogen Dioxide objective value. As a result an AQMA (Air Quality Management Area) has been declared along a stretch of Kingshill Road.

It is significant that when Kingshill Road was closed during the first 2 weeks of July 2016 for emergency road repairs, the average concentration of Nitrogen Dioxide for that month was significantly reduced. This supports the Council’s view that the elevated concentrations of Nitrogen Dioxide experienced here are primarily due to vehicular traffic.

Figures 1, 2, 3 and 4 of Appendix A show 5 and 3 year trends at locations where concentrations of Nitrogen Dioxide exceed, or are close to exceeding, the Air Quality Objectives listed in Appendix E. Figure 1 – Devizes Rd & 2 Kingshill Rd/Clifton St and Cheney Manor Rd (Rodbourne Rd) show an overall negative trend in concentration of Nitrogen Dioxide. Monitoring at Swindon 1 - GWR Museum, Swindon 12 - Manchester Rd and Swindon 16 - Cricklade Rd (Moonraker) indicate a positive trend in concentration of NO_2. It should be noted that for the last two locations, monitoring data are only available for 3 years. Readings at 102 Kingshill Road are available for 12 months of last year and are relatively high in comparison to the 3 months of representative data available for last year report.

Table 4-1: Locations where adjusted concentrations of Nitrogen Dioxide exceeded

Site ID	Bias adjusted mean	Concentration at the receptor, using bias adjusted annual concentration of NO2
Swindon 1 - GWR Museum	37.1	36.4
Swindon 12 - Manchester Rd	39.1	38.7
Swindon 14 - Kingshill Rd/Clifton St	40.6	33.3
Swindon 18 - 102 Kingshill Road	56.2	55.9
Swindon 23 - 37 Devizes Rd*	45.6	36.7
Swindon 23 - 37 Devizes Rd*	46.9	37.7
Swindon 23 - 37 Devizes Rd*	45.0	36.3
Swindon 24, 30 Devizes Road	42.8	36.1
Swindon 25 - 68 Cheney Manor Rd (Rodbourne Rd)	39.9	35.4

* Triplicate

No sites recorded levels of above 60 µg/m^3 and therefore none are likely to exceed the 1-hour objective level (200 µg/m^3).

4.2.1 Particulate Matter (PM_{10})

There are no concerns regarding concentrations of PM_{10}.

4.2.2 Particulate Matter ($PM_{2.5}$)

There are no concerns regarding concentrations of $PM_{2.5}$.

Appendix A: Monitoring Results

Table A.1: Details of Automatic Monitoring Sites (futured)

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Inlet Height (m)
925100	Bath Road	Roadside	415,289.5	183,789.7	NOx	No	Chemiluminescent	16.0	4.5	2.5
1695150	Bath Road co-located	Roadside	415,289.5	183,789.7	NOx	No	AQMesh Pod	16.0	4.5	2.5
1696150	Bath Road co-located	Roadside	415,289.5	183,789.7	NOx	No	AQMesh Pod	16.0	4.5	2.5
1697150	Bath Road co-located	Roadside	415,289.5	183,789.7	NOx	No	AQMesh Pod	16.0	4.5	2.5

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 a Continuous Analyser?	Height (m)
S1	Swindon 1 - GWR Museum	Roadside	414629.34	184736.82	Nitrogen Dioxide	No	2.3	2.0	No	2.5
S2	Swindon 2 Bath Rd Car Park		415289.6	183789.81		No	18.4	5.3		2.6
S3	Swindon 4 - S4, 8 Okus Road		414758.67	183718.55		No	7.1	2.3		2.5
S4	Swindon 5 - 186 Kingshill Rd		414257.86	183972.1		No	4.3	2.0		2.6
S5	Swindon 6 - Chalet School, Queens Drive		416088.78	184906.88		No	0	7.5		2.8
S6	Swindon 8 - 102 Bath Road		414925.19	183741.49		No	7.1	3.0		2.7
S7	Swindon 9 - 31 Sandgate		417714.18	186315.55		No	3.4	12.6		1.3
S8	Swindon 11 - Devizes Rd, Bridal shop		415531.43	183666.32		No	0.3	4.8		2.8
S9	Swindon 12 - Manchester Rd		415156.96	185100.84		No	0.5	2.6		2.8
S10	Swindon 13 - Meadow Way Badbury		419347.33	180974.53		No	4.3	48.0		1.8
S11	Swindon 14 - Kingshill Rd/Clifton St		414733.29	183782.89	Nitrogen Dioxide	Yes	31.1 (12.4 across the road)	1.3		2.9

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?	Height (m)
S12	Swindon 15 - Westcott Place		414075.8	184040.99	Nitrogen Dioxide	No	8.2	1.2		2.8
S13	Swindon 16 - Cricklade Rd (Moonraker)		415677.18	187335.48	Nitrogen Dioxide	No	2.2	3.5		2.9
S14	Swindon 17 - Bruce St Bridges (to 09.05.2017)		413797.07	185505.47		No	0	5.3 (to Bruce St and 21.2 to the roundabout)		2.9
S14	Swindon 17 – Iffley Road (from 09.05.2017)		413893.07	185621.33		No	8.0	8.0		2.0
S15	Swindon 18 - 102 Kingshill Road		414698.37	183800.27	Nitrogen Dioxide	Yes	0	1.3		2.5
S16	Swindon 19 - 86 Clifton Road		414755.79	183788.58		No	11.0	8.3 (Kingshill and 1.3 to Clifton)		2.6
S17	Swindon 20 - A420 South Marston		419437.78	186764.67		No	27.5	12.5		2.7
S18	Swindon 21 - 63 Kingshill Rd		414552.28	183884.71		No	6.0	2.0		2.8
S19	Swindon 22 - 38 Farriers Close	Railway side	416145.9	185666.9	Nitrogen Dioxide	No	7.0	1.9		1.6
S20	Swindon 23 - 37 Devizes Rd	Road side	415547	183552.03	Nitrogen Dioxide	No	6.3	1.8		2.4

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?	Height (m)
S21	Swindon 23 - 37 Devizes Rd		415547	183552.03	Nitrogen Dioxide	No	6.3	1.8		2.4
S22	Swindon 23 - 37 Devizes Rd		415547	183552.03		No	6.3	1.8		2.4
S23	Swindon 24, 30 Devizes Road		415554.74	183494.78		No	3.4	2		2.4
S24	Swindon 25 - 68 Cheney Manor Rd (Rodbourne Rd)		413886	185672	Nitrogen Dioxide	No	2.6	2.4		3.2
S25	Swindon 26 - Tadpole Lane		411973.26	189625.23		No	15.7	0.7		2.3
S26	Swindon 27 - 66 Ermin St		417398.65	187353.88		No	0.7	1.9		2.5
S27 & S28	Bath Road - as S2 above					No				
S29	Swindon 18 - Opp 101 Kingshill Road		414,707	183,806		Yes	10	2.2		2.5

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 NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2017 (%) (2)	NO_2 Annual Mean Concentration (µg/m^3) (3)					
					2012	2013	2014	2015	2016	2017
GWR Museum	Roadside	DT	100	100	36.0	36.4	37.2	35.2	37.5	37.1
Bath Rd Car Park	Roadside	DT	100	100	26.2	24.2	25.4	25.5	23.9	21.8
8 Okus Road	Roadside	DT	100	100	22.4	25.4	26.7	19.6	24.3	19.9
186 Kingshill Rd	Roadside	DT	100	100	32.2	36.2	31.1	28.4	30.6	33.6
Chalet School, Queens Dr	Roadside	DT	100	100	29.3	32.4	32.9	32.1	31.8	34.3
102 Bath Road	Roadside	DT	100	100	26.0	25.4	26.9	35.2	33.9	36.9
31 Sandgate	Roadside	DT	100	100	21.6	22.8	21.7	18.0	24.7	21.0
Devizes Rd, Bridal shop	Roadside	DT	100	100	n/a	n/a	25.7	24.8	32.7	24.5
Manchester Rd	Roadside	DT	100	100	38.5	**41.8**	39.3	37.4	**43.4**	39.1
Meadow Way Badbury	Roadside	DT	100	100	29.8	29.4	31.1	30.4	30.1	28.4
Kingshill Rd/Clifton St	Roadside	DT	100	100	**41.4**	**44.8**	**47.4**	**41.3**	**38.6**	**40.6**
Westcott Place	Roadside	DT	100	100	31.4	31.4	32.3	30.2	33.6	31.2
Cricklade Rd (Moonraker)	Roadside	DT	100	100	31.4	32.3	36.2	35.8	**38.7**	35.2
Bruce St Bridges	Roadside	DT	42(4)	42(4)	25.9	26.1	28.2	25.4	26.6	27.6
Iffley Road	Roadside	DT	58(4)	58(4)	n/a	n/a	n/a	n/a	n/a	40.16
102 Kingshill Road	Roadside	DT	100	100	n/a	n/a	n/a	**56.9**	**51.2**	**56.2**
Swindon 19 - 86 Clifton Road	Roadside	DT	100	100	n/a	n/a	n/a	28.0	30.5	29.0
Swindon 20 - A420 South Marston	Roadside	DT	100	100	22.7	19.4	27.3	23.8	26.3	23.4
Swindon 21 - 63 Kingshill Rd	Roadside	DT	100	100	31.5	32.2	34.8	30.1	33.2	31.7
Swindon 22 - 38 Farriers Close	Rail-side	DT	100	100	23.06	32.40	24.37	22.4	20.6	21.0
Swindon 23 - 37 Devizes Rd	Roadside	DT	100	100	**44.6**	**46.7**	**45.6**	**44.4**	**42.3**	**45.6**

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2017 (%) (2)	NO_2 Annual Mean Concentration ($\mu g/m^3$) (3)					
					2012	2013	2014	2015	2016	2017
Swindon 23 - 37 Devizes Rd	Roadside	DT	100	100	**45.4**	**45.6**	**47.56**	**46.7**	**42.5**	**46.9**
Swindon 23 - 37 Devizes Rd	Roadside	DT	100	100	**45.5**	**44.8**	**44.9**	**45.6**	**41.2**	**45.0**
Swindon 24, 30 Devizes Road	Roadside	DT	100	100	25.4	27.4	28.4	**43.4**	**43.2**	**42.8**
Swindon 25 - 68 Cheney Manor Rd (Rodbourne Rd)	Roadside	DT	100	100	**42.5**	**44.8**	**42.4**	36.5	**41.6**	39.9
Tadpole Lane	Roadside	DT	100	100	17.9	18.6	17.7	15.3	15.5	16.5
66 Ermin St	Roadside	DT	100	100	26.6	30.5	31.2	29.4	28.7	28.3
S27 Bath Rd Car Park no 2	Roadside	DT	100	100	n/a	n/a	n/a	n/a	n/a	21.9
S28 Bath Rd Car Park no 3	Roadside	DT	100	100	n/a	n/a	n/a	n/a	n/a	22.7
S29 Opp 101 Kingshill Rd	Roadside	DT	100	100	n/a	n/a	n/a	63.8	51.5	64.1

☒ **Diffusion tube data has been bias corrected (confirm by selecting in box)**

☒ **Annualisation has been conducted where data capture is <75% (confirm by selecting in box)**

☒ **If applicable, all data has been distance corrected for relevant exposure (confirm by selecting in box)**

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.

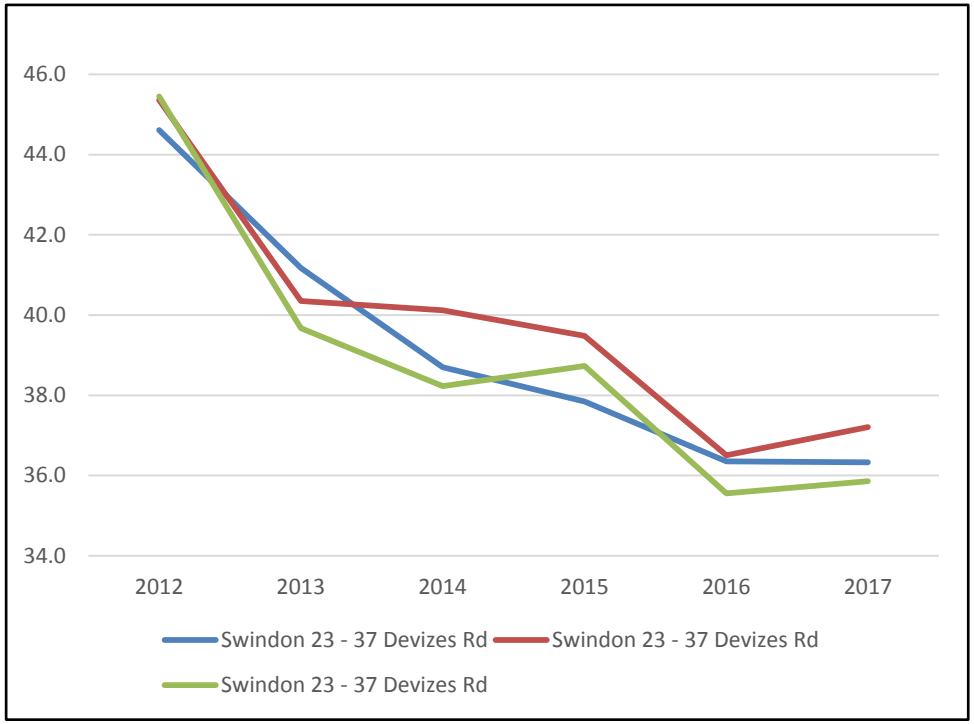
(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) Means for diffusion tubes have been corrected for bias (but not distance corrected). 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.

(4) Data capture in 2017 not for full year.

	Site relocated from Bruce Street
	Partial data capture in previous years

Figure 1: Trends in Annual Mean Nitrogen Dioxide Concentrations at Devizes Road



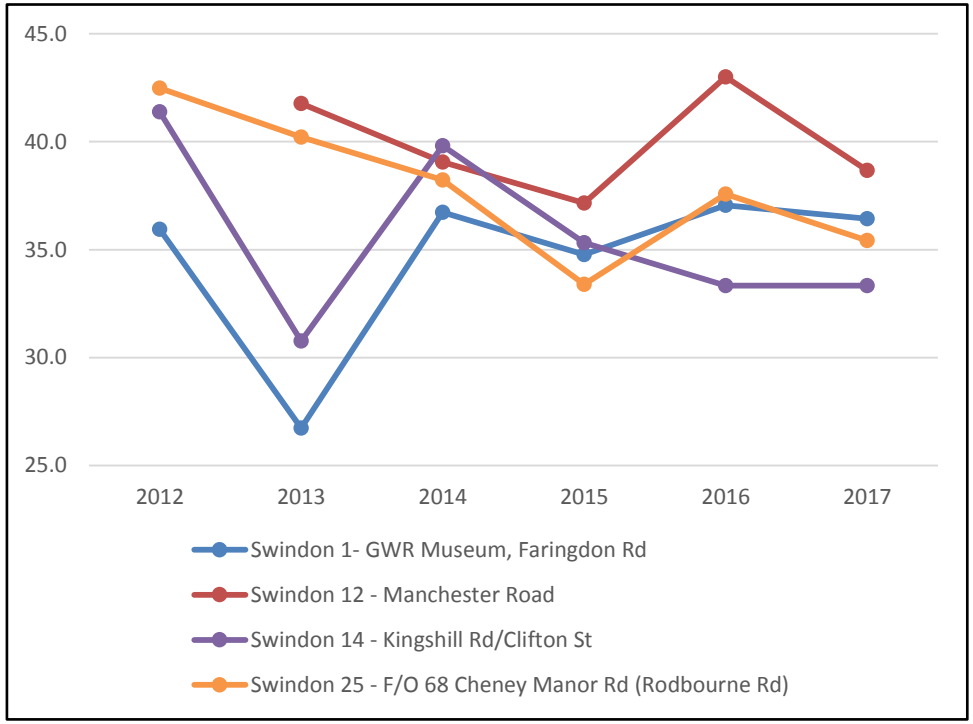


Figure 2 Trends in Annual Mean Nitrogen Dioxide Concentrations – other locations

Appendix B: Full Monthly Diffusion Tube Results for 2017

Table B.1 – NO_2 Monthly Diffusion Tube Results - 2017

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 and Annualised (1)	Distance Corrected to Nearest Exposure (2)
Swindon 1 - GWR Museum	56.4	58.7	48.3	47.3	43.3	45.7	42.5	38.8	46.9	44.8	47.5	57.7	48.2	37.1	36.4
Swindon 2 Bath Rd Car Park	38.2	41.3	34.3	24.8	21.1	24	20.6	18.5	23.5	31	26.9	35.7	28.3	21.8	20.9
Swindon 4 - S4, 8 Okus Road	34.4	39	28.2	25.7	27.7	17.7	17.3	16.8	20.1	23.7	21.9	37.2	25.8	19.9	18.1
Swindon 5 - 186 Kingshill Rd	56.4	47.5	47.7	46.3	35	41.1	34	32.5	40.1	43.6	43.5	56.7	43.7	33.6	30.1
Swindon 6 - Chalet School, Queens Drive	51.2	52.3	53.8	43.2	28.4	41.3	41	38.6	44.5	39.8	46.4	53.7	44.5	34.3	34.3
Swindon 8 - 102 Bath Road	52.2	60.1	57	52.6	42.9	42.1	44.9	35.9	40.6	48.6	46.8	50.6	47.9	36.9	29.2
Swindon 9 - 31 Sandgate	37.2	39.1	27.8	27.9	23.2	18.3	22.9	19	23.4	24.8	27.2	36.4	27.3	21.0	20.6
Swindon 11 - Devizes Rd, Bridal shop	45.9	51.3	33.7	32.7	24.3	29.9	21.5	22.4	26.1	28.2	29.1	37.4	31.9	24.5	24.4
Swindon 12 - Manchester Rd	62.8	55	46.4	58.4	52.6	40.7	43.8	43.8	47	49.5	48.6	60.2	50.7	39.1	38.7
Swindon 13 - Meadow Way Badbury	30	40.8	47.9	43.1	25.7	36.8	27.4	34.4	31.3	39.7	40.9	44	36.8	28.4	26.5
Swindon 14 - Kingshill Rd/Clifton St	65.4	70.4	53.5	55.9	43.6	51	41.5	32.1	51.4	52.4	52	62.9	52.7	40.6	33.3
Swindon 15 - Westcott Place	56.8	56.8	42	43	36.1	35.3	34.6	23.4	37.3	39.1	40.7	41.4	40.5	31.2	23.9
Swindon 16 - Cricklade Rd (Moonraker)	54.2	50.9	44.8	48.6	49.5	38	38	34.8	43.1	43.4	46.9	55.7	45.7	35.2	32.3
Swindon 17 - Bruce St Bridges	39.2	38	25.3	27.4	24.8								30.9	23.8	23.8
Swindon 17 - Iffley Rd from 10.05.2017						40.5	36.6	37.3	43.9	45.1	49.2	67.5	45.7	35.2	34.6

Swindon 18 - 102 Kingshill Road	98.4	112.9	76.4	70	60.1	63.1	62.3	52.2	62.5	64.4	68.1	84.8	72.9	56.2	**55.9**
Swindon 19 - 86 Clifton Road	51.6	38	36.8	34.2	32.4	35.5	33.7	34.5	35.6	35.7	37.5	45.7	37.6	29.0	24.7
Swindon 20 - A420 South Marston	42.8	34.3	33.7	33.8	28.5	20.5	24.6	18.3	28.1	28.1	29.3	42.7	30.4	23.4	21.5
Swindon 21 - 63 Kingshill Rd	58.6	43.3	45.1	44.1	45.4	30	30.1	27.7	38.8	38.8	36.6	55.5	41.2	31.7	25.7
Swindon 22 - 38 Farriers Close	35.8	38.1	32.4	31.5	21.5	18.3	19.6	16.4	24.3	22.1	29.8	36.9	27.2	21.0	20.6
Swindon 23 - 37 Devizes Rd	55.3	63.1	67	62.9	50.6	54.1	56.4	47.7	55.7	55.7	65.3	77.2	59.3	45.6	36.7
Swindon 23 - 37 Devizes Rd	73.7	64	59.5	63.7	51.7	54.9	58.2	47.9	60.3	54.7	62.5	79.2	60.9	46.9	37.7
Swindon 23 - 37 Devizes Rd	74.2	42.6	59.1	63.2	50.1	56.7	54	50.5	57	65.2	50.9	77.3	58.4	45.0	36.3
Swindon 24, 30 Devizes Road	70.3	68.3	51	57.7	51.5	48.9	42.6	43.5	55.4	55.7	58.1	63.4	55.5	42.8	36.1
Swindon 25 - 68 Cheney Manor Rd (Rodbourne Rd)	63.7	78.1	56.6	53.4	49.3	42.4	41.2	40.4	42.8	46.8	47.1	59.8	51.8	39.9	35.4
Swindon 26 - Tadpole Lane	35.6	25.9	22.6	22	16.1	15.6	16.3	14.8	18.3	18.7	23	28.3	21.4	16.5	12.7
Swindon 27 - 66 Ermin St	45.3	43.5	42.3	28.4	31	33.6	31.2	29.8	31.3	35.7	43.9	45.4	36.8	28.3	27.5
Bath Rd Car Park		44	36.5	28	20	25.3	23.4	19.2	21.5	27.5	29.9	37.8	28.5	21.9	19.8
Bath Rd Car Park	42.8	34.3	33.7	33.8	28.5	20.5	24.6	18.3	28.1	28.1	29.3	42.7	29.4	22.7	20.3
Opp 101 Kingshill Road	58.6	43.3	45.1	44.1	45.4	30	30.1	27.7	38.8	38.8	36.6	55.5	83.2	64.1	(3)

☒ **Local bias adjustment factor used (confirm by selecting in box)**

☒ **National bias adjustment factor used (confirm by selecting in box)**

☒ **Annualisation has been conducted where data capture is <75% (confirm by selecting in box)**

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) See Appendix C for details on bias adjustment and annualisation.

(2) Distance corrected to nearest relevant public exposure.

(3) Distance correction not used, as in accordance with TG16 this monitoring location is on opposite side of road to receptor

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

Diffusion Tube Bias Adjustment Factors

The nitrogen dioxide diffusion tube data has been adjusted using factors generated by the National Bias Adjustment Factor Database (Version Number 03/18) which is available on the LAQM Helpdesk Website (https://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html).

Swindon Borough Council's nitrogen dioxide diffusion tubes were supplied and analysed by ESG Group, Didcot and use 50% TEA in acetone.

The bias adjustment factor used 0.77

Discussion of Choice of Factor to Use

No co-location study was performed by Swindon Borough Council, therefore National bias adjustment factors based on 27 studies for ESG Didcot for 2017 were used.

Laboratory

Swindon Borough Council has employed Environmental Scientifics Group (ESG, now known as SOCOTEC Ltd) to supply and carry out the analysis of its diffusion tubes. ESG has advised the following.

- The manufacture and analysis of NO_2 diffusion tubes is covered by its UKAS accreditation.
- The method meets the requirements laid out in DEFRA's "Diffusion Tubes for Ambient NO_2 Monitoring: Practical Guidance."
- The laboratory has taken part in the WASP proficiency scheme since its inception (the WASP proficiency scheme has now been replaced with the IR PT scheme - new international PT scheme for laboratories involved in air quality analysis).
- In the AIR PT intercomparison scheme for comparing spiked Nitrogen Dioxide diffusion tubes, 100% of the SOCOTEC results for 2017 scored the highest possible result of **satisfactory**.

Annualisation of data

It has only been possible to carry out the monitoring survey at one site (S14 Iffley Road) for seven months between July and December 2017. The measured mean concentration M for this period is 45.7 adjusting to 34.6µg/m3. However it will be necessary to estimate the annual mean for this location, for comparison with the annual target concentration.

The procedure involves the following steps:

1. Identification of two to four nearby, long-term, continuous monitoring sites, ideally those forming part of the national network. The data capture for each of these sites should ideally be at least 85%. These sites should be background (Urban Background, Suburban or Rural) sites to avoid any very local effects that may occur at Urban Centre, Roadside or Kerbside sites, and should, wherever possible lie within a radius of about 50 miles. If no background sites are available, and the site to be annualised is itself a Urban Centre, Roadside or Kerbside site, then it is permissible to annualise using roadside or kerbside sites rather than background sites.

   The nearest sites that have characteristics similar to the areas requiring normalisation are located in Bristol and Bath. Although Swindon has a new background continuous monitoring site, this only became live on 9th January 2018, so there is too little data to provide a reasonable comparison.

2. Obtain the annual means, ‘Am’, for the calendar year for these sites.

3. Work out the period means, ‘Pm’, for the period of interest, in this case May to December 2017.

4. Calculate the ratio, ‘R’, of the annual mean to the period mean (‘Am/Pm’) for each of the sites.

5. Calculate the average of these ratios, ‘Ra’. This is then the annualisation factor.

6. Multiply the measured period mean concentration ‘M’ by this annualisation factor Ra to give the estimate of the annual mean for 2017.

For the diffusion tube location in Iffley Road, the best estimate of the annual mean in 2017 is 1.16 x 34.6µg/m3 =40.16 ug/m3, as set out in the table below. For the Bruce Street Bridges tube, the best estimate of the annual mean in 2017 (again using the table below) is 1.16 x 23.8µg/m3 = 27.56 ug/m3.

Background Site	Annual Average ‘Am’	Period Mean ‘Pm’	Ratio ‘Am/Pm’
	13.12.16-19.11.17	May9 2017-Nov19 2017	
AURN Bath Roadside	43	40	1.08
AURN Bristol St Pauls	24.1	19.4	1.24
Annualisation factor			1.16

Distance Corrections

Corrections for distance have been made that allow for the distance the diffusion tubes are from the roadside. These distance corrections have been made as set out in the example in Table C1.

The data to feed into this calculation, that is distance of measurement/receptor from kerb, the mean NO_2 are to be found in Tables A2 and B1 respectively.

Table C1 Example calculation output from fall off with distance calculator

This example is the passive monitoring site S1 Former GW Museum, Emlyn Square

Enter data into the red cells

Step 1	**How far from the KERB was your measurement made (in metres)?**	**2**	metres
Step 2	**How far from the KERB is your receptor (in metres)?**	**2.3**	metres
Step 3	**What is the local annual mean background NO_2 concentration (in µg/m^3)?**	**16.28**	µg/m^3
Step 4	**What is your measured annual mean NO_2 concentration (in µg/m^3)?**	**37.1**	µg/m^3
Result	**The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor**	**36.4**	µg/m^3

Appendix D: Map(s) of Monitoring Locations and AQMAs

Figure 3 Location of Diffusion Tubes in the Borough of Swindon

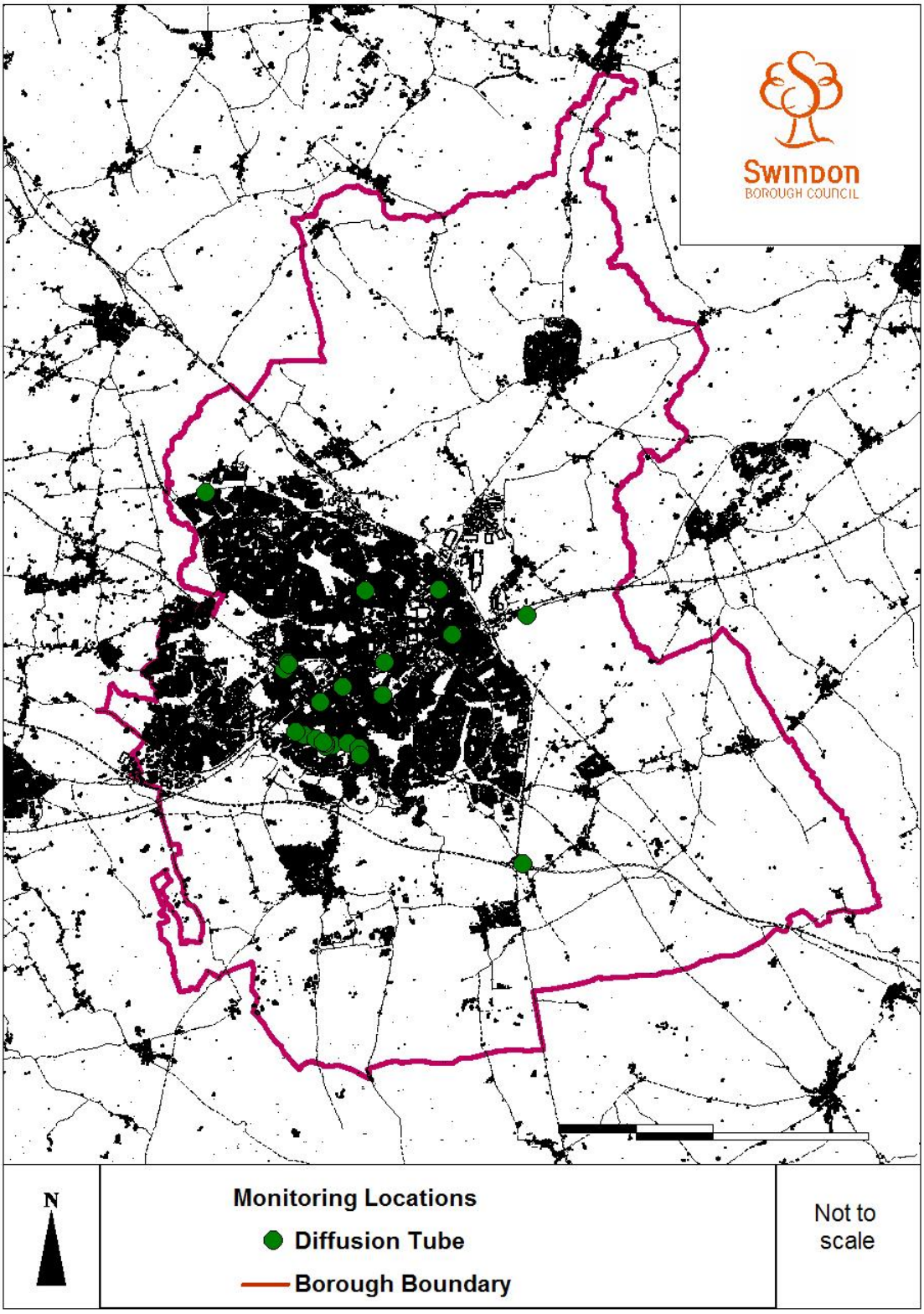


Figure 4 Kingshill Diffusion Tube Locations

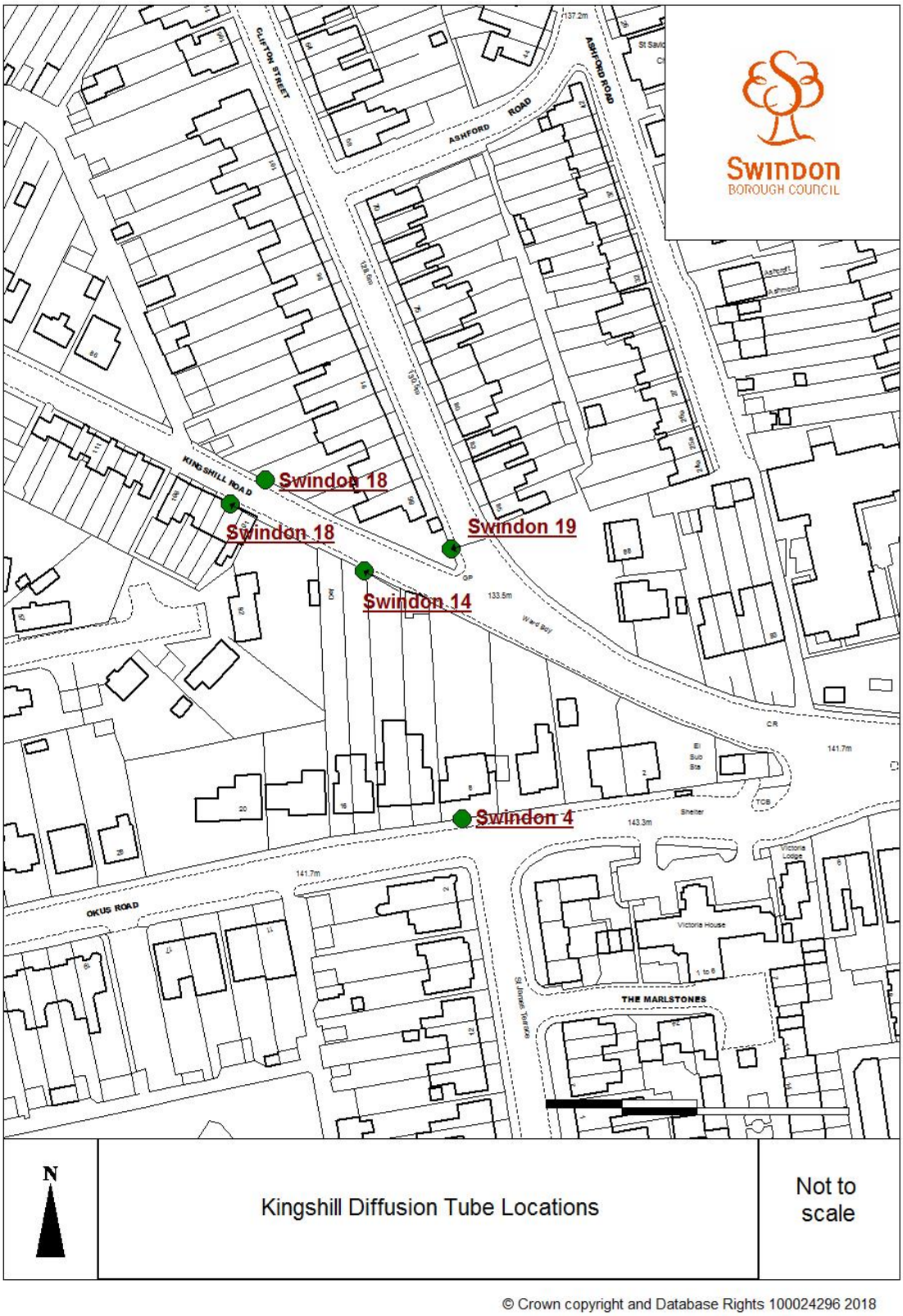


Figure 5 Bath Road and Devizes Road Diffusion Tube Locations

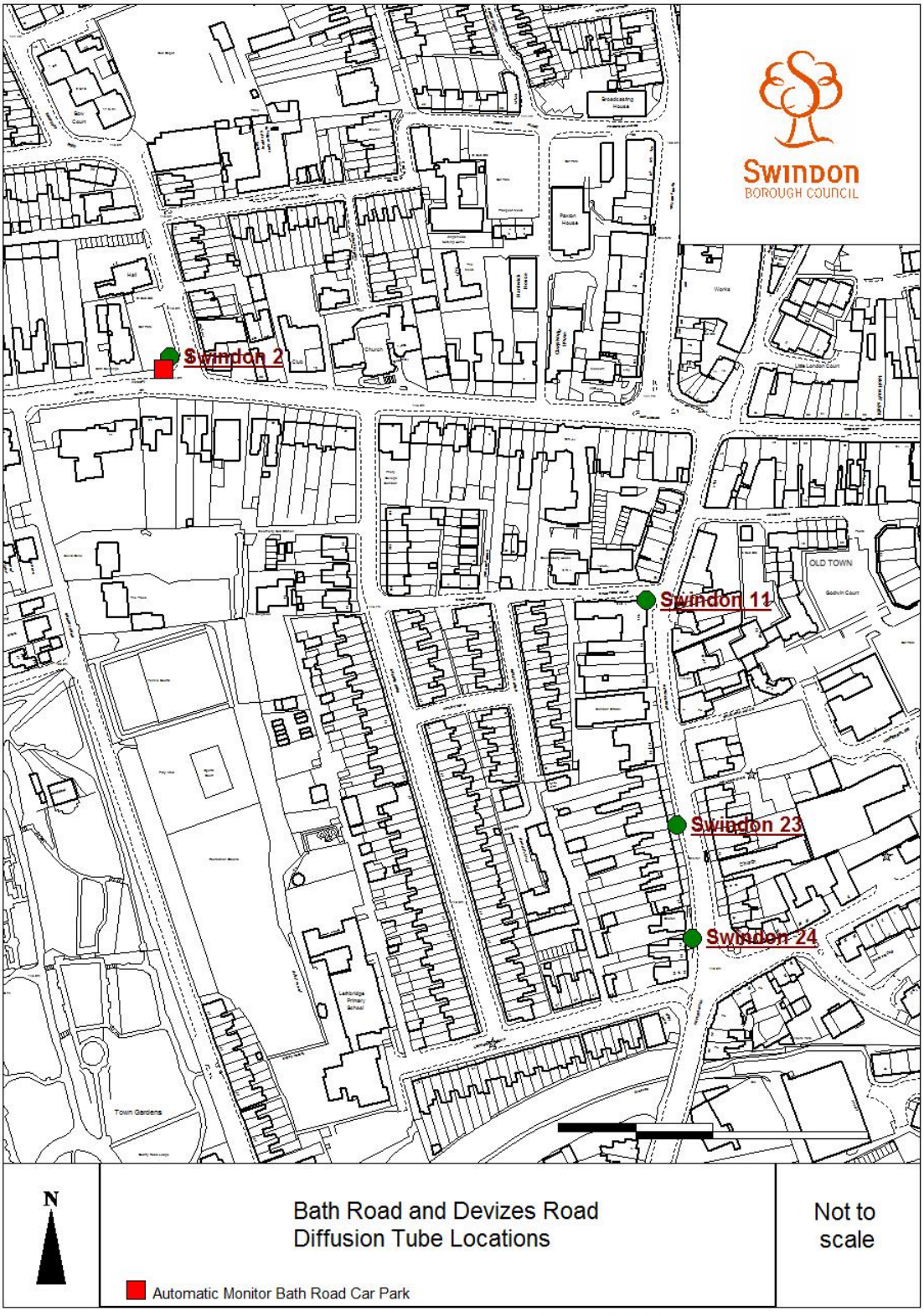


Figure 6 Location of Chemiluminescent (Real time) Monitor

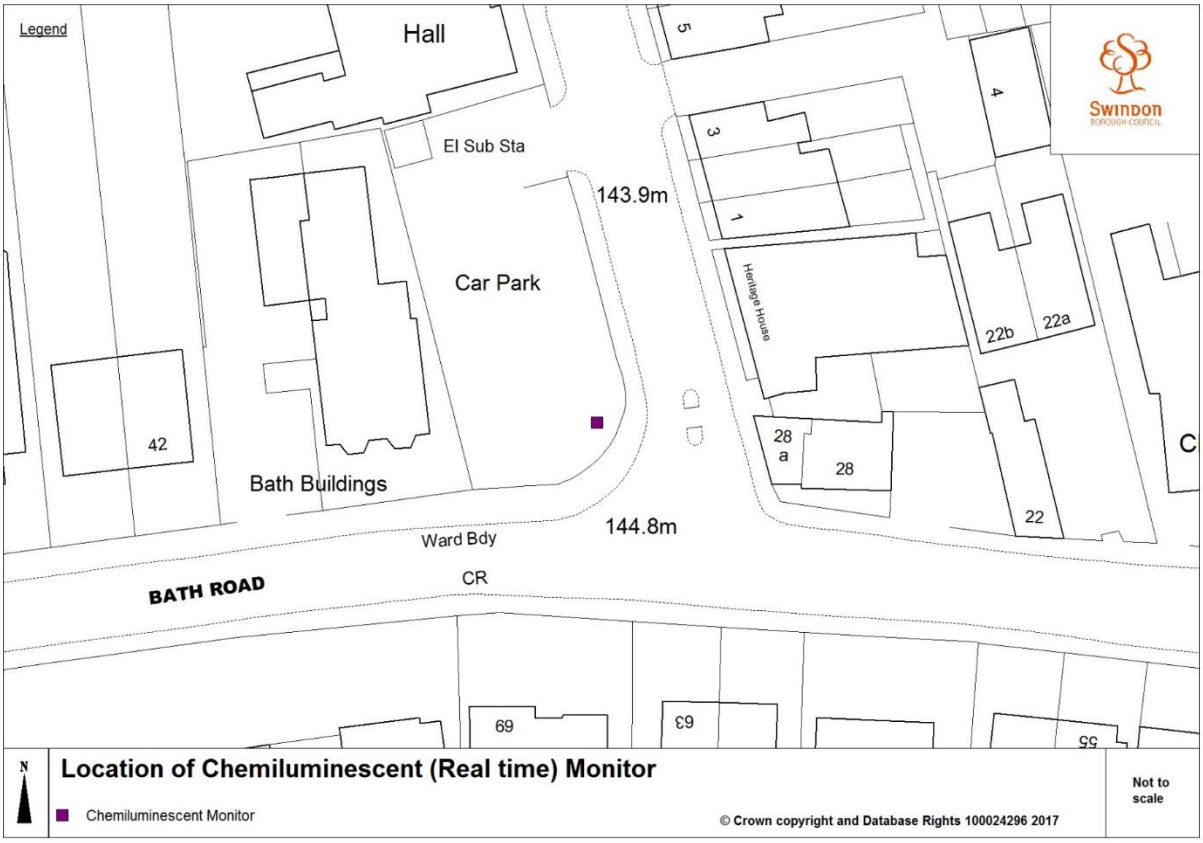


Figure 7 Location of Diffusion Tubes in the eastern and southern part of Swindon

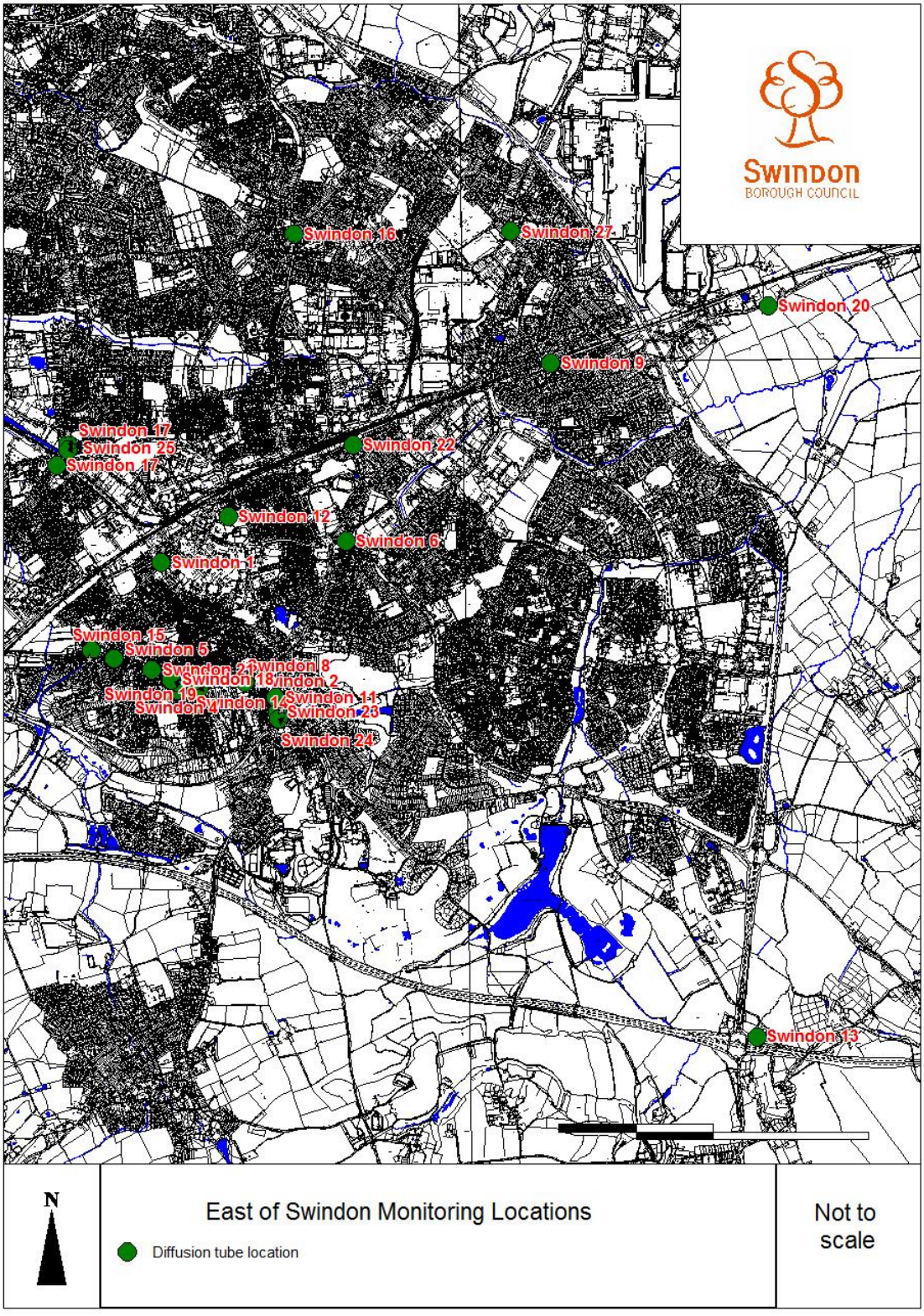


Figure 8 Location of Diffusion Tubes in Northern part of Swindon

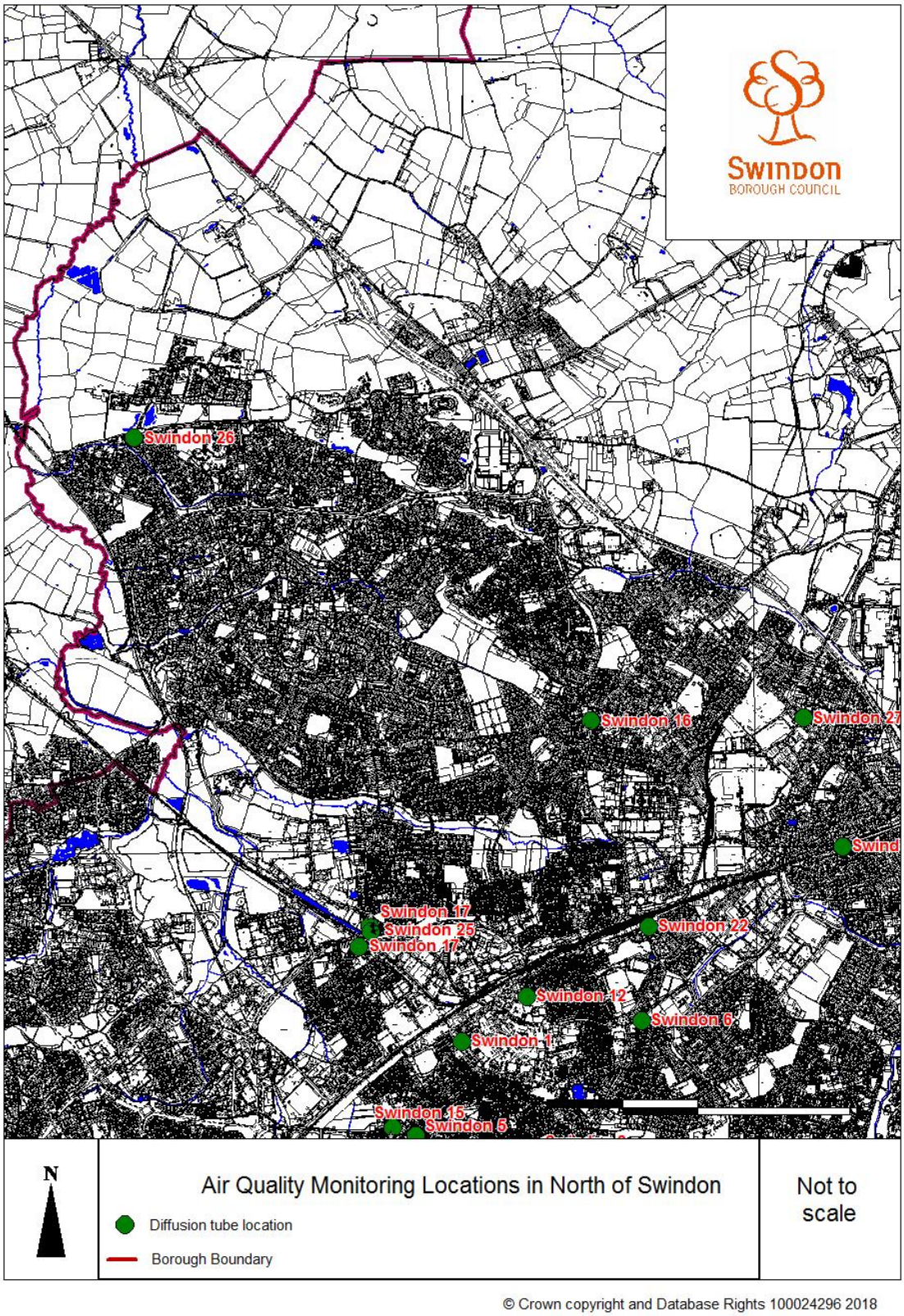


Figure 9 Kingshill AQMA area

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 micrograms of pollutant per cubic metre of air (µg/m^3).

Appendix F Calculation of Required Reduction in Road NOx Emissions

Step 1: Use the NOx to NO2 calculator to obtain the NOx concentration that equates to the 56µg/m3 NO2.

Concentration measured at receptor (ie 102 Kingshill Road) = 56 ug/m^3 NO2
Using version 6.1 of the DEFRA calculator NOx=97.42 ug/m^3

Step 2: Obtain the local background concentrations of NOx and NO2 for the year of interest, from the background maps

LB NO2 =13.16 ug/m^3
LB NOx =17.86 ug/m^3

Step 3: Calculate the current "road NOx" concentration (road NOx-current), i.e. the difference between total NOx (calculated or measured) and local background NOx.

Current road NOx =97.42-17.86 = 79.56 ug/m^3

Step 4: Calculate the road NOx concentration required to give a total NO2 concentration of 40µg/m3, i.e. the annual mean objective (road NOx-required). This can be done using the NO2 from NOx calculator by entering a total NO2 concentration of 40µg/m3 along with the local background NO2 concentrations. The calculator gives the road NOx-required concentration.

Road NOx concentration required to give a total NO2 concentration of 40µg/m^3

Road NOx concentration required RNOx= 56.26ug/m^3

Step 5: Calculate the road NOx reduction to go from the road NOx-current to the road NOx-required.

Road NOx reduction = 79.56-56.26 =23.3 ug/m^3

% required reduction in road NOx =23.3/79.56 = 30%

Source Apportionment for NO2

A calculation has been made to understand the contribution of all sources of emissions to the exceedance of air quality objectives within the AQMA. This is important to identify priorities whilst preparing an AQAP.

The source apportionment is to identify the main contributors to pollution and the circumstances that may be controlled, such as the spilt of vehicle type (cars, lorries etc), whether the traffic is stationary or moving and the relative contribution of background source.

From the national maps of background annual mean concentrations obtain the total background NO2 for the grid square within which the hot-spot is located [TB-NO2]

TB(NO2) for 17.3 as NOx=30.3 ug/m3
Local background NO2 (from DEFRA 2015) = 24.49 ug/m3

Regional NO_2(from DEFRA NO_2 background maps 2015) = 7.27 ug/m3

Regional NOx (from DEFRA NOx background maps 2015) = 13.95 ug/m3

LB NOx=TBNOx-RBNOx =30.3-13.95 = 16.35ug/m3

Step 2: Apportion the total background NO2 into regional and local using the regional and local NOx proportions:

[RB-NO2] = [TB-NO2] × ([RB-NOx] / [TB-NOx])
=17.3 x (13.95/30.3) = 7.96ug/m3

[LB-NO2] = [TB-NO2] × ([LB-NOx] / [TB-NOx])
=17.3 x (16.35/30.3) = 9.34

Step 3: Calculate the local NO2 contribution at the worst-case location [L-NO2] from the total measured minus background: [L-NO2] = [T-NO2] – [TB-NO2]
L-NO2 =55.9-17.3= 38.6 ug/m^3

Step 4: Apportion the local contributions to total NO2 concentration using the model concentrations or emission results for NOx.

Calculation

In this case the Emissions Factors Toolkit (EFT) has been used (V 8.0.1). The EFT is published by Defra and the Devolved Administrations to assist local authorities in carrying out Review and Assessment of local air quality as part of their duties under the Environmental Act 1995. The EFT allows calculation of road vehicle pollutant emission rates for NOx for a specified year, road type, vehicle speed and vehicle fleet composition.

Using the EFT the following contributions of different vehicle types to NOx has been determined:

Cars and light vans = 87.6%
Heavy Goods Vehicles – 12.4%

NO2 from small vans and cars (87.6%) x L NO2 =87.6 x 42.74 = 37.4 ug/m3
NO2 from HGVs (10.7%) x L NO2 =12.4 x 42.74 = 5.3 ug/m3

The final source apportionment of the worst-case NO_2 55.9g/m3 is thus:

Regional background = 3.45µg/m3 = (6.2%)
Local background = 9.71µg/m3 = (17.4%)
Local traffic: Heavy Goods Vehicles= 5.3g/m3 (9.5%)
Local traffic: cars = 37.4µg/m3 (67%)

Appendix G Traffic Analysis at Kingshill Road – Directional Volumes

Table G.1 Examples of traffic volumes at Kingshill Road extracted from continuous traffic measurement.

	Eastbound	Westbound	Total	% Increase over 01.01.2018
18.09.2017 (Monday)	8657	8538	17195	21
16.10.2017 (Monday)	8547	8336	16883	19
11.12.17 (Monday) 24 hour traffic	8688	8620	17307	22
01.01.18 (Monday) 24 hour traffic	7399	6804	14203	N/a
08.01.18 (Monday) 24 hour traffic	8358	6940	15297	7

Appendix H Third Party Monitoring

The results of background monitoring undertaken in support of the proposed Keypoint development and set out in Tables H1 and H2 below. The information is contained with the document: “Supplementary Environmental Information (SEI) to the Environmental Statement” by Pegasus Group, and dated October 2016. It was submitted to support planning application S/16/1055. The proposed development comprises the construction and operation of a Renewable Energy Centre (Use Class sui generis) for the recovery of energy (heat and electricity) from non-hazardous residual waste using an Advanced Conversion Technology (gasification) and an industrial warehouse (Use Class B8) within Keypoint Industrial Estate, off Thornhill Road, Swindon.

Interpretation is provided with this environmental impact assessment report. It states:

> “In all cases the measured mean concentration over the monitoring period was below 70% of the air quality standard.
>
> Within the air quality assessment an average ambient background concentration for nitrogen dioxide of 24.9 μgNO^2/m^3 was assumed. For all locations considered, with the exception of N10 (boundary of SDC warehouse) the measured background concentration is less than that assumed in the assessment and in most cases significantly less. The SDC warehouse position (N10) is roadside and is likely to be influenced by the significant movements of heavy goods vehicles, however this is the product of just two rounds of monitoring. The sampling location (N3) also on the SDC warehouse boundary around 50m nearer the Keypoint site shows a much lower concentration over five rounds of sampling and is considered to be more representative of the area. For the residential locations considered background concentrations are mostly less than 50% of the air quality standard and well below the background assumed in the air quality assessment.
>
> On the basis of the measurements reported above it is considered that the air quality assessment employed a background concentration which was higher, and in some cases significantly higher, than measured concentrations. This is particularly evident at the residential locations considered”.

Monitoring carried out in support of the Keypoint Development

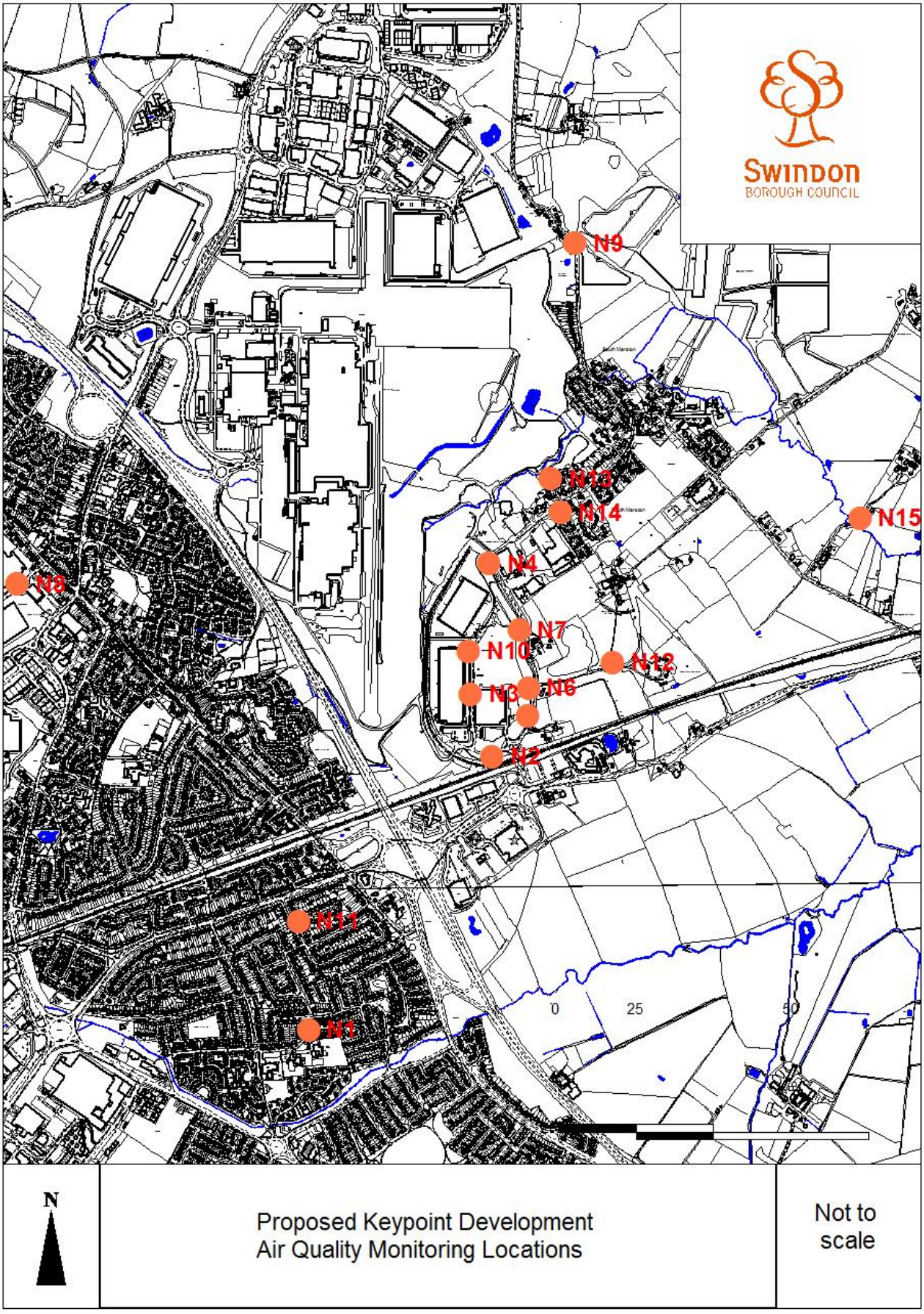
Table H.1 Measurements of Ambient Nitrogen Dioxide Concentrations

				Concentration (ugNO2/m3)					
Location	Details	Easting	Northing	1	2	3	4	5	Mean
Date				25/01-01/03/16	01/03-01/04/16	01/04-29/04/16	29/04-15/05/16	15/06-18/07/18	
N1	Towcester Road	418208	185841	17.2	18.6	15.1	11.5	9.2	14.3
N2	Railway Bridge	418691	186773	24.6	26.2	23.5	15.6	22.0	22.4
N3	Keypoint warehouse	418771	186980	27.9	29.2	20.7	13.8	16.7	21.6
N4	Thornhill Road	418830	187451	19.0	20.5	16.8	9.2	11.3	15.4
N5	Thornhill Road	418966	186924	18.4	17.2	16.7	10.4	11.5	14.8
N6	Thornhill Road	418968	187017	21.7	19.8	19.1			20.2
N7	Thornhill Road	418948	187217	16.2	16.6	16.2	11.5	10.8	14.3
N8	Parsonage Road	417204	187379	20.2	21.6				20.9
N8A						19.9	12.3	9.1	13.7
N9	Highworth Road	419129	188556	16.8	14.1	12.3	8.1	10.9	12.4
N10	Keypoint warehouse	418769	187146	25.5	29.7				27.6
N10A						22.4	17.3	11.9	17.2
N11	Jct Whilestone Way & Castle View Road	418174	186212	21.3	21.7	18.4	12.8	10.4	16.9
N12	Lane off Thornhill Road	419260	187107	14.9	17.7	3.7	7.7	8.1	10.4
N13	St Julians Community Woodland	419042	187741	17.8	14.3	15.3	9.5	10.0	13.4
N14	Ash Gardens, South Marston	419077	187622	21.2	20.0	16.1	10.2	11.5	15.8
N15	Rowborough Lane	420115	187607	13.1	12.5	12.3	7.6	7.7	10.6

Table H.2 Measurements of Ambient Sulphur Dioxide Concentrations

				Concentration (ugNO2/m3)					
Location	Details	Easting	Northing	1	2	3	4	5	Mean
Date				25/01-01/03/16	01/03-01/04/16	01/04-29/04/16	29/04-15/05/16	15/06-18/07/18	
N1	Towcester Road	418208	185841	3.4	<2.5	3.2	3.2	<2.3	3.1
N2	Railway Bridge	418691	186773	8.2	<2.5	<2.7	4.8	3.2	4.3
N3	Keypoint warehouse	418771	186980	5.0	<2.5	<2.7	1.7	3.8	3.1
N4	Thornhill Road	418830	187451	3.4	<2.5	3.6	2.2	<2.3	2.8
N5	Thornhill Road	418966	186924	4.4	<2.5	3.7	2.3	2.6	3.1
N6	Thornhill Road	418968	187017	<2.1	<2.5	3.2	1.7	<2.3	2.6
N7	Thornhill Road	418948	187217	2.3	<2.5	<2.7	<1.6	2.3	2.3
N8	Parsonage Road	417204	187379	7.7	<2.5				
N8A						3.6	<1.6	<2.3	2.5
N9	Highworth Road	419129	188556	<2.1	4.5	<2.7	2.4	12.4	4.8
N10	Keypoint warehouse	418769	187146	3.5	<2.5				
N10A						3.2	2.2	2.8	2.7
N11	Jct Whilestone Way & Castle View Road	418174	186212	3.7	2.7	<2.7	2.0	3.5	2.9
N12	Lane off Thornhill Road	419260	187107	<2.6	<2.5	<2.7	1.7	<2.3	2.4
N13	St Julians Community Woodland	419042	187741	<2.6	<2.5	<2.7	1.7	2.5	2.4
N14	Ash Gardens, South Marston	419077	187622	2.8	<2.5	<2.7	2.4	2.4	2.6
N15	Rowborough Lane	420115	187607	2.8	<2.5	3.0	5.3	<2.3	3.2

Figure 9 Monitoring Locations - Proposed Keypoint Development



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

1. Transport Vision 2026 for Swindon and Wiltshire Local Enterprise Partnership, March 2014