



Winchester
City Council

Detailed Assessment of PM₁₀

for the

Winchester City Council

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

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KING'S
College
LONDON

Acknowledgement

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Executive Summary

This is the Detailed Assessment of PM₁₀ for the Winchester City Council (“the Council”). This report fulfils this part of the Council’s commitment to the continuing Local Air Quality Management (LAQM) process. This Report provides an update of recent PM₁₀ air quality issues in the Winchester Air Quality Management Area (AQMA), including an assessment of monitoring results since designation. (Note - the Council has also produced a separate 2011 Air Quality progress report to update other air quality progress).

The Council’s earlier Review and Assessments of air quality confirmed that there were locations across the District with relevant public exposure where the Government’s air quality objectives were exceeded. This included the daily mean PM₁₀ objective. As a result of this finding the Council, in 2003, designated part of the city centre close to the inner ring road an AQMA for this pollutant. The extent of the AQMA was however determined for administrative reasons and consistency. The area was based on a dispersion modelling exercise for nitrogen dioxide (NO₂) and the area exceeding the annual mean objective for NO₂, rather than that of the area exceeding the daily mean PM₁₀ objective.

Since that time monitoring has been undertaken at two long term sites within the AQMA in accordance with the requirements of the Government’s technical guidance; one of these sites is a worst case location and the other located at a background site. In addition screening monitoring has also been undertaken at two other worst-case locations close to the inner ring road in the AQMA.

The results from the monitoring at all these locations since 2003 confirm that there has been no exceedence of the air quality objectives for PM₁₀. This was reported in the most recent Updating and Screening Assessment for 2009 and concentrations have remained low since that report was produced. A further analysis of the monitoring data has indicated that annual mean concentrations have reduced steadily throughout this period, by the order of 10 µg m⁻³, since 2003. Current levels are well below the annual mean objective and the indicative level given in the technical guidance for the daily mean objective.

Based on this evidence the Council will produce an AQMA Revocation Order to formally revoke the AQMA for daily mean PM₁₀ only.

The Council will however continue its air quality monitoring programme and action plan, plus retain its AQMA for nitrogen dioxide as part of its continuing local air quality management programme.

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1 Introduction to Air Quality and Action Plan Progress Report

1.1 Overview

This report provides a detailed assessment of air quality for the Winchester City Council (“the Council”). This forms part of the Council’s duties under Local Air Quality Management (LAQM) process of the Environment Act 1995. The purpose of the report is to support the Council’s decision to revoke its AQMA for the daily mean PM₁₀ objective only.

1.2 Background

Local air quality management forms a key part of the Government’s strategies (Defra, 2007) to achieve the air quality objectives under the Air Quality (England) Regulations 2000 and 2002. As part of its duties the Council has previously completed its reviews of local air quality and identified a risk of the daily mean PM₁₀ (see Table 1) objective being exceeded after the relevant date in parts of the Council’s area. It should be noted that the annual mean NO₂ objective was similarly identified as exceeding the air quality objective. The status of this pollutant was however discussed in the Council’s 2011 Air Quality Progress report and therefore it is not considered further within this report.

Table 1 PM₁₀ Air quality objectives relevant to this Detailed Assessment

Concentration	Measured as	Date to be achieved by
50 µg m ⁻³ not to be exceeded more than 35 times a year	Daily mean	31-Dec-2004
40 µg m ⁻³	Annual mean	31-Dec-2004

Note - the measured concentrations and number of periods not to be exceeded are the same as those specified in the EU Limit Values for the UK government, although it has a later compliance date of 1 January 2010 (from The Air Quality Standards Regulations 2010).

Local Authorities are required by section 88 (2) of the Environment Act 1995 to have regard to the government’s guidance documents when carrying out their LAQM duties. To assist local authorities and provide guidance for the overall LAQM process, the Department for Environment, Food and Rural Affairs (Defra) issued the following policy and technical guidance documents: LAQM PG 09 and LAQM TG 09.

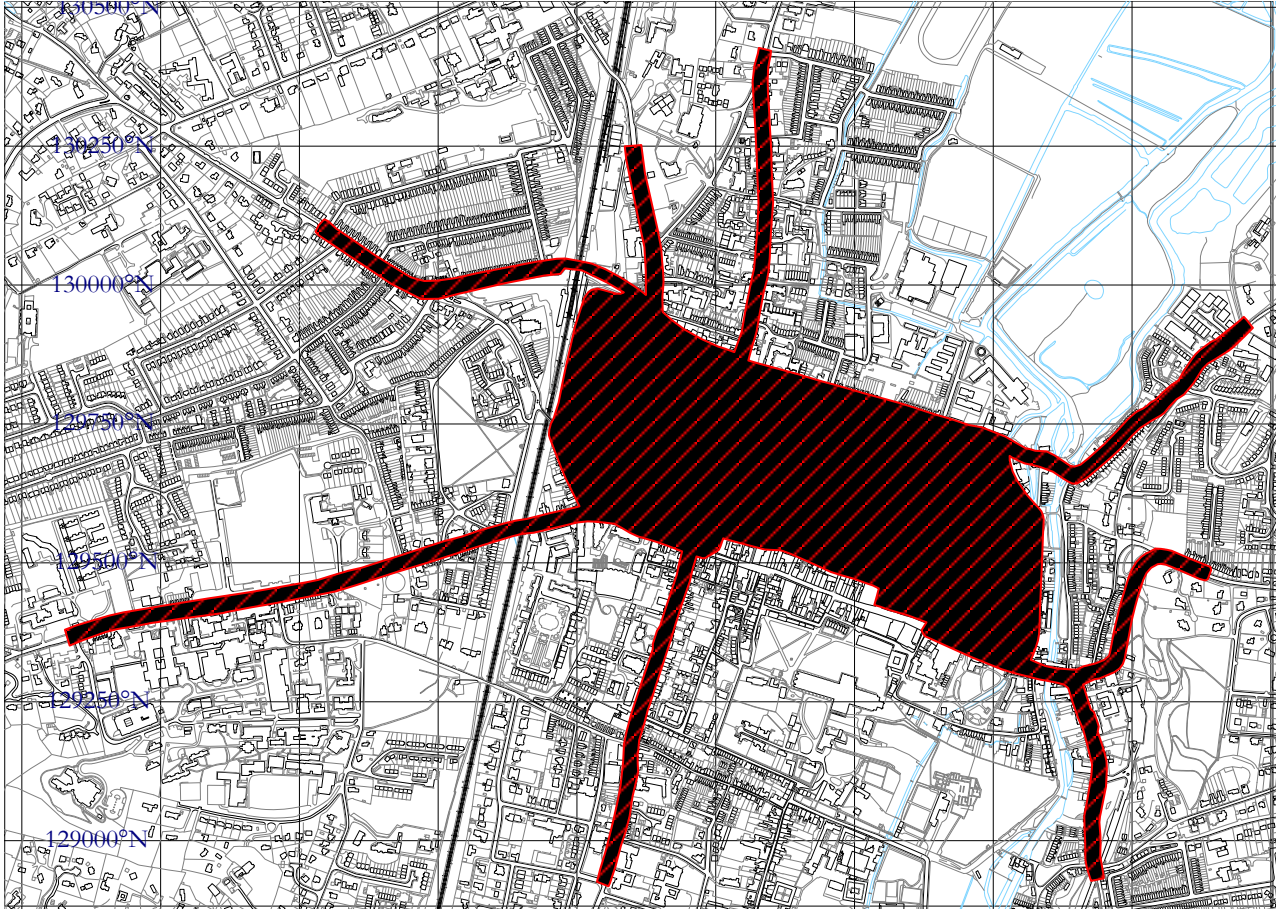
In earlier rounds of review and assessment (R&A) of local air quality management, the Council identified the area where the daily mean PM₁₀ objective was exceeded and where there was relevant public exposure. As a consequence, it designated parts of its area an Air Quality Management Area (AQMA) for the daily mean PM₁₀ objective and subsequently produced an Air Quality Action Plan.

The AQMA was designated in 2003 and it included the Winchester city centre one-way system and the area enclosed within it, plus the city centre end of the major roads feeding into it. The AQMA is shown in Figure 1. The extent of the AQMA was however determined for administrative reasons and consistency. The area was based on a dispersion modelling exercise for nitrogen dioxide (NO₂) and the area exceeding the annual mean objective for NO₂, rather than that of the area exceeding the daily mean PM₁₀ objective, which is less than that of NO₂.

In the Council’s fourth round Updating and Screening Assessment (USA) the PM₁₀ monitoring results in the AQMA were found to be well below the objective for the three years reported (Winchester, 2010). This included the monitoring results for 2006 to 2008 inclusive. On the basis of this finding the report indicated that the AQMA for PM₁₀ only could be revoked.

The overall aim of this detailed assessment is to identify with reasonable certainty whether or not a likely exceedence will still occur.

Figure 1 Winchester City Centre Air Quality Management Area



2 New monitoring results in the Winchester C.C area

2.1 Outline of monitoring undertaken

The Council continued monitoring PM₁₀ within the AQMA at its two fixed long-term sites:

- Echo Offices, St Georges Street – a roadside site (2.75m from the kerb) on the south side of the Winchester inner ring route. This site has a BAM 1024 analyser with an unheated inlet.
- Godson House, near Friarsgate - an urban background site, within the 18 m of the inner ring route. This site also has a BAM 1024 analyser with an unheated inlet.

The above sites are representative of nearby sites with relevant exposure.

The standards of QA/QC include regular calibrations and checks that are carried out, with subsequent data ratification undertaken by the external consultants in accordance with Defra guidance. In all cases the data are fully ratified unless reported otherwise.

An additional three Osiris PM₁₀ monitoring stations were also installed in the Winchester city centre in December 2005. One of these was co-located at the above mentioned background site and the remaining two were located at roadside locations at City Road (4.1m from the kerb) and North Walls (1.9m from the kerb). All of the roadside sites can be considered as worst-case locations. The locations of all two long-term monitoring sites are presented in Appendix 1. Monitoring using Osiris instruments ceased in April 2009.

2.2 Long term PM₁₀ monitoring in Winchester AQMA

The Council has undertaken continuous monitoring of PM₁₀ at its two fixed long-term continuous monitoring sites since 1997. It is important that this monitoring uses reference equivalent methods that meet the EU monitoring requirements for monitoring PM₁₀. The purpose of the reference equivalent methods is to seek consistency in measuring PM₁₀ concentrations between a range of sampler and analyser types that potentially give very different results.

Defra carried out extensive trials between 2004 and 2006 to establish which types of particulate analysers in use in the UK were equivalent to the European reference method (which relies on a gravimetric technique). The trials found that measurements made using BAM instruments (as used by the Council) were shown to be equivalent to the PM₁₀ reference method. However the BAM instrument (with unheated inlet) only met the equivalence criteria with the use of a correction factor that needs to be applied to measurements.

The results for the Winchester City Council for the daily mean PM₁₀ objective are shown in Table 2 and for the annual mean PM₁₀ objective in Table 3. The results reported are divided by a factor of 1.21, as required by the LAQM TG09 guidance. The results are for the 10-year period from 2001 to 2010 inclusive. The data capture for each year at both sites was greater than 75%, apart from 2004 at the Council's roadside site, which suffered instrument problems. The data capture for this year was low and less than 50% (hence it is not reported).

Table 2 Number of periods exceeding daily mean PM₁₀ standard (> 50 µg m⁻³) (2001 – 2010)

Site	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Background	3	2	21		8	8	10	5	1	1
Roadside	16	21	<i>20</i>	17	13	15	15	9	3	4

Note – the italics for the Roadside site in 2003 indicates that the high concentrations observed at the Winchester Background site during March and April were not monitored due to instrument problems. Hence the overall result for this site is considered to be unrepresentative for the year. (Note - despite not measuring this data the site still recorded a data capture of greater than 75%)

The results confirmed for each year of monitoring that there were days when the daily mean standard of $50 \mu\text{g m}^{-3}$ was exceeded. The 2004 daily mean objective however was not exceeded over the monitoring period shown at either site.

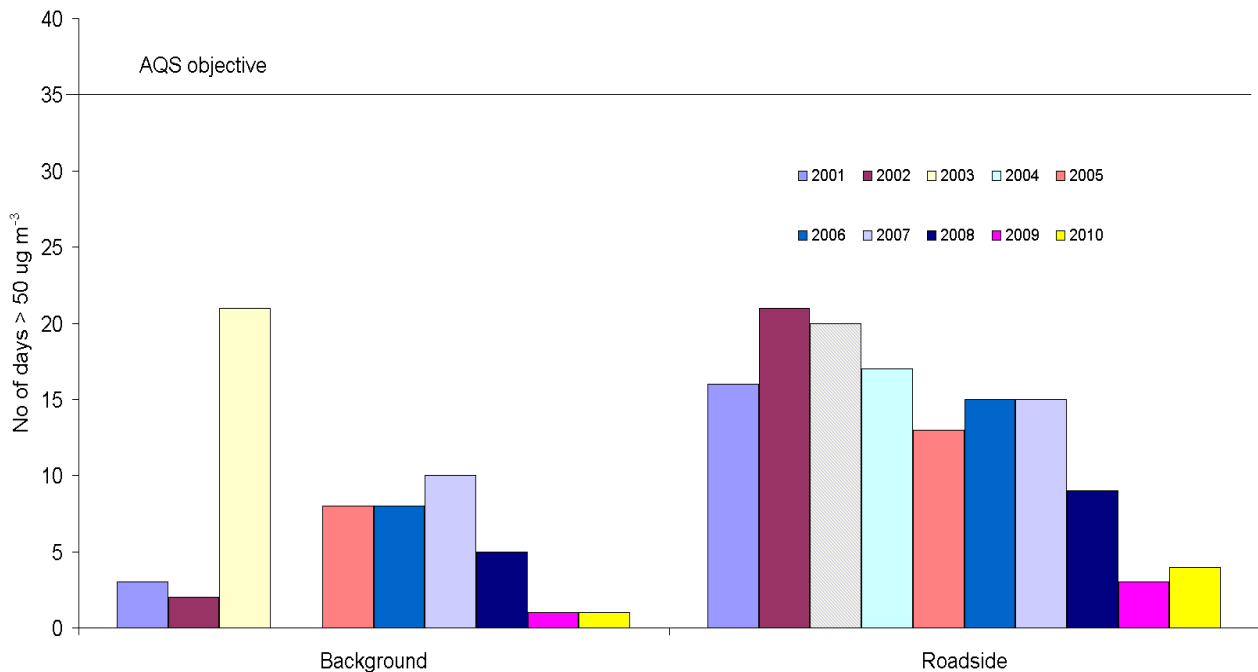
The highest number of days exceeding daily mean standard was 21 in 2003 at the Background site, although as already mentioned the Roadside site instrumentation problems during a 2003 meant that the result for this site was under represented. Despite this the number of days exceeding the standard was still almost the same i.e. with 20 days exceeding.

Table 3 Annual mean PM_{10} concentrations ($\mu\text{g m}^{-3}$) (2001 – 2010)

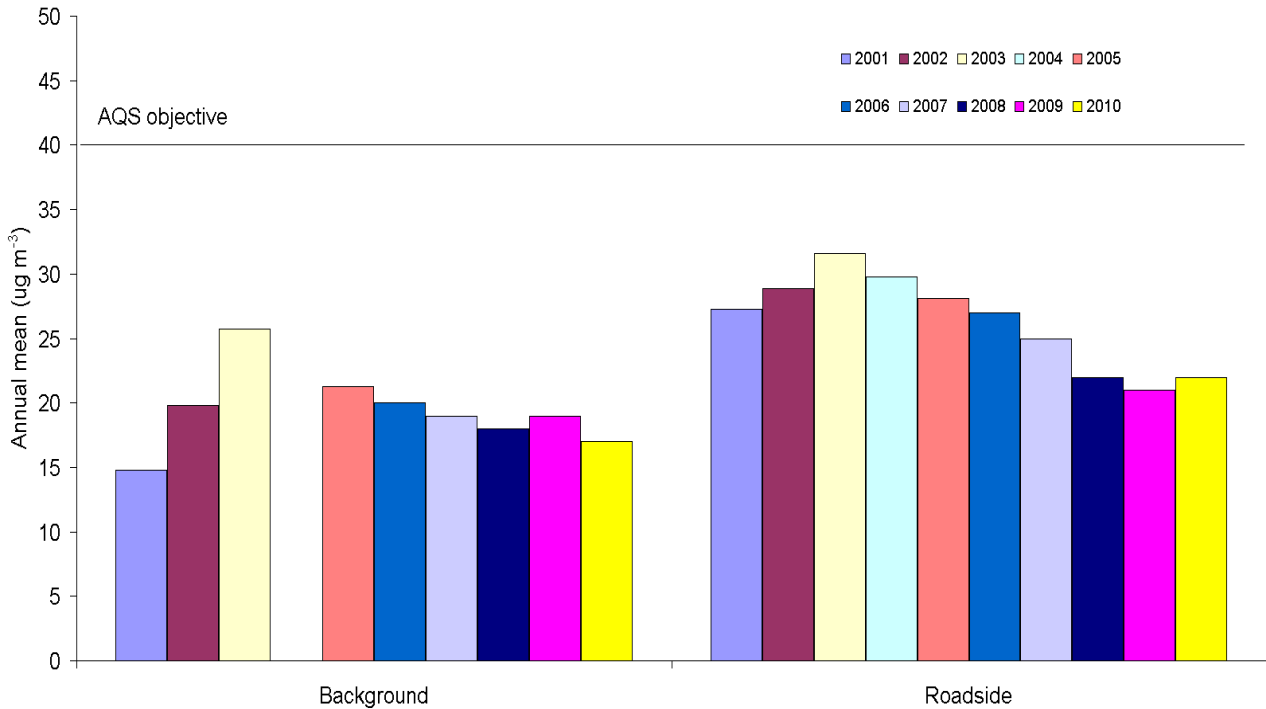
Site	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Background	15	20	26		21	20	19	18	19	17
Roadside	27	29	32	30	28	27	25	22	21	22

The highest annual mean results for the sites also arose in 2003. It should be noted that 2003 was a year with high pollutant concentrations in many areas, particularly the south of the UK, due to the long periods of high pressure that arose during the hot summer months. Such periods are conducive to secondary particle formation over wide areas. Despite the high pollution during 2003 the annual mean air quality objective was not exceeded at either site. The results for the sites are also shown in Figure 2 and Figure 3.

Figure 2 Number of periods exceeding daily mean PM_{10} standard ($> 50 \mu\text{g m}^{-3}$) (2001 – 2010)



The above figure indicates that over the period of monitoring the number of days that exceeded the $50 \mu\text{g m}^{-3}$ standard has decreased and for the past three years the total is less than 10 per year. The decrease in concentrations is also clearly seen in Figure 3, with both the roadside and background sites measuring concentrations of around $22 \mu\text{g m}^{-3}$. These figures confirm that the PM_{10} objectives were easily met.

Figure 3 Annual mean PM₁₀ concentrations ($\mu\text{g m}^{-3}$) (2001 – 2010)

2.3 PM₁₀ monitoring in Winchester AQMA using Osiris instruments

The LAQM TG 09 guidance indicates that light scattering systems, such as those used in Winchester are considered suitable for use in the Council's Review and Assessment of air quality, but not for Detailed Assessments. As they are portable instruments, which use a light scattering method to measure ambient concentration of fine particles, they are considered more suitable for screening purposes. The site locations include the long-term background site, plus two other roadside sites on the city ring road system to represent worst-case locations.

It is however worth reporting the results within this report since they are indicative of concentrations in the AQMA. The data reported here (see Table 4) were drawn from the Updating and Screening Assessment as monitoring ceased in early 2009. During the period of monitoring problems with reliability and data capture arose. Hence the 2006 data for the three sites are not reported and neither are the data for 2008 at the North Wall site. Furthermore as the data capture was below 90% for the years reported the number of days were determined using the 90th percentile.

Table 4 Results of PM₁₀ Osiris monitoring within the Winchester AQMA

Site location	2007	2008
<i>Daily mean objective (days > 50 $\mu\text{g m}^{-3}$)</i>		
Background Osiris	1	2
City Road	18	4
North Walls	10	-
<i>Annual mean objective ($\mu\text{g m}^{-3}$)</i>		
Background Osiris	16.4	18.6
City Road	21.1	21.1
North Walls	16.7	-

The results indicate that both objectives were not exceeded for the two years reported.

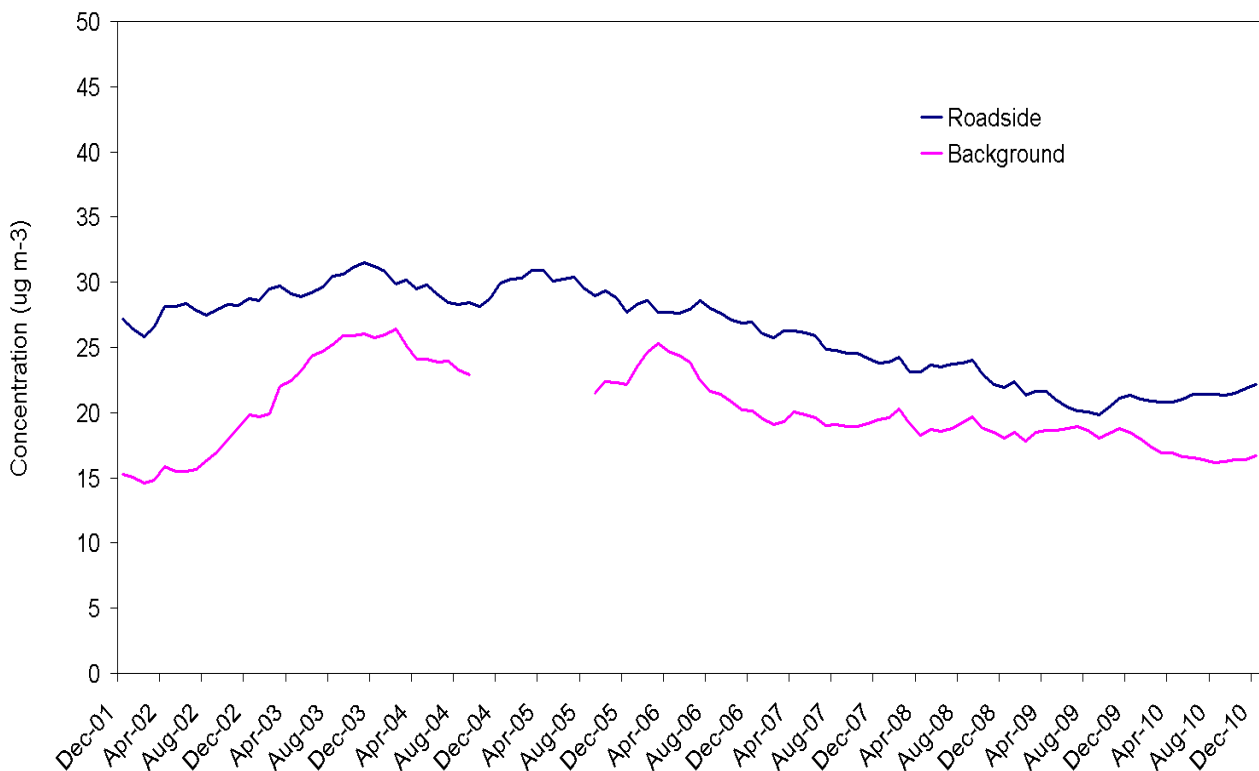
The co-located Osiris monitor also recorded slightly lower annual mean concentrations in 2007 than the BAM analyser, but marginally higher concentrations in 2008. Despite this the measurements for both years can be considered reasonable approximations.

For the roadside sites, albeit at different locations on the ring road system, the City Road site recorded slightly lower concentrations than the Roadside (Echo Offices) long term site, whereas the North Wall site recorded much lower concentrations that were similar to the background site during 2007 (the only year for which data were reported).

2.4 PM₁₀ monitoring trends in the Winchester AQMA

An analysis of rolling annual mean PM₁₀ concentrations is provided for the Winchester long-term monitoring sites to indicate possible trends over time. The analysis is for the period from 2000 through to 2010. This trend is uninterrupted for the Roadside site; the instrument problems in 2004 however interrupted the Background dataset. Figure 4 illustrates the changing concentrations over time of the rolling annual mean PM₁₀ concentrations. The use of rolling data in this way largely removes seasonal influences and thus provides a guide to changing trends over time.

Figure 4 Rolling annual mean PM₁₀ trends for Winchester monitoring sites (2000 to 2010)



The rolling annual mean trends for the Winchester sites showed similar trends at both sites for the period reported. As expected the concentrations at the Background site were lower due to its location furthest from the ring road system. Conversely higher concentrations arose at the Roadside site. Throughout the period shown the annual mean objective of 40 $\mu\text{g m}^{-3}$ was not exceeded.

Concentrations were highest following the pollution episodes in 2003 for both sites and the trend for both sites has been mainly downward since that time, with the Roadside site edging closer to that of the Background site until 2009. Since that time the Roadside site has diverged and increased slightly. This recent divergence however may change with further monitoring.

Using the relationship between the annual mean and 24-hour mean PM₁₀ concentrations from LAQM TG09 (paragraph 2-36) it can be seen that an annual mean of 32 $\mu\text{g m}^{-3}$ can represent the threshold of the daily mean objective (i.e. of 35 days greater than 50 $\mu\text{g m}^{-3}$). Based on the trend data above it can be seen that this level may have been marginally exceeded over 2003/4 period. Since that time the downward trend of the annual mean confirms that the daily mean also will have stayed below the daily mean objective (and then reduced further).

3 Conclusion

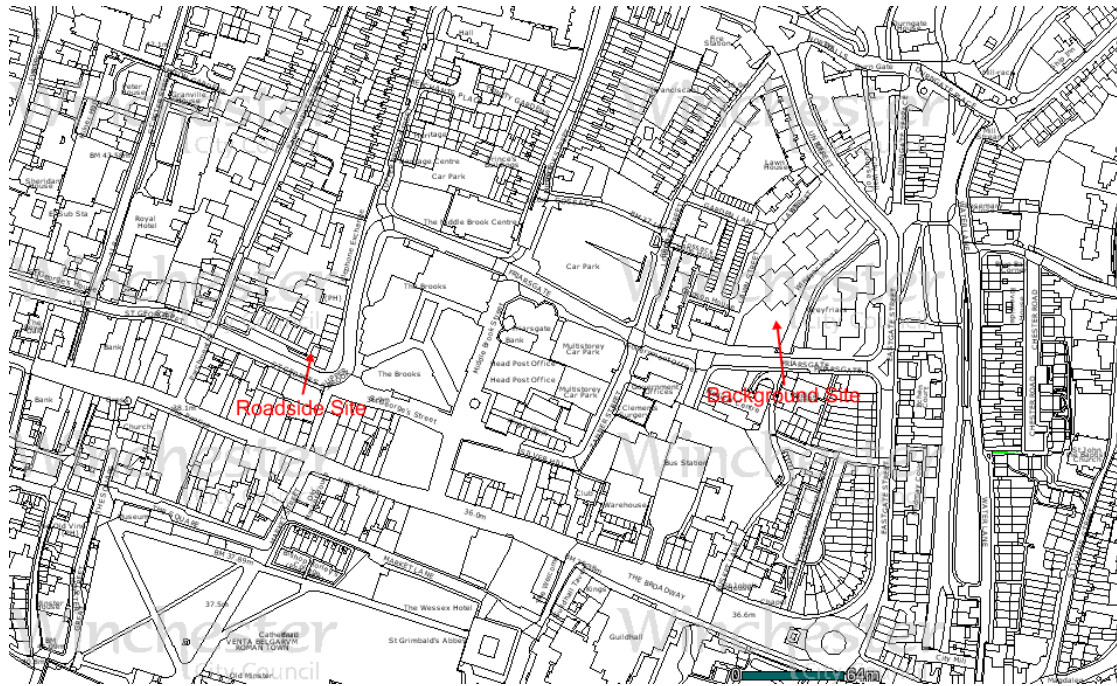
This Detailed Assessment fulfils the requirements of the Defra guidance. It has updated monitoring results in the Winchester City centre AQMA for PM₁₀ and provided an interpretation of the measurements for the past 10 years.

The up to date monitoring results continue to indicate that the Government's air quality objectives for PM₁₀ are easily met. Furthermore the daily mean PM₁₀ objective has not been exceeded in the AQMA (based on predictions using the data) since 2003/4. These results are from a worst-case location on the ring road system within the AQMA and based on this fact the Council can confidently assume that concentrations at other locations where there is relevant public exposure will be even lower.

Based on this evidence the Council will produce an AQMA Revocation Order to formally revoke the AQMA for daily mean PM₁₀ only.

The Council will however need to continue its air quality monitoring programme and action plan as part of its continuing local air quality management programme.

Appendix 1

Figure 5 Locations of the long-term PM₁₀ monitoring sites in the Winchester AQMA.Table 5 PM₁₀ data capture for year (%)

Site	2006	2007	2008	2009	2010
Background	96	99	99	95	94
Roadside	97	99	97	99	99