Local Air Quality Management

Detailed Assessment
February 2010

Shanes Castle
Devizes

Wiltshire Council
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Wiltshire Council – report log

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Executive summary

This Detailed Assessment (DA) forms part of the statutory duties surrounding the process of Local Air Quality Management (LAQM) and the on-going process of air quality assessment within the Wiltshire Council area. Part IV of the Environment Act 1995 requires local authorities to periodically review air quality within their areas. This process of LAQM is integral to delivering the UK Air Quality Objectives (AQO).

This report develops further the information gathered and the conclusions reached from previous rounds of the process of LAQM within the former Kennet District Council area, now part of the unitary Wiltshire Council.

This Detailed Assessment aims to identify with reasonable certainty whether the Air Quality Objectives are likely to be exceeded at relevant locations[1] and the requirement to declare an Air Quality Management Area (AQMA) in these areas.

The report concludes that an AQMA is required at the junction of the A342 and the A362 in Devizes, to cover a small area of exceedance of the annual mean Air Quality Objective for nitrogen dioxide (NO_2). The AQMA will be centred on Shanes Castle, located directly at the junction. Air quality monitoring is to be enhanced in the area with a view to modelling the air quality at the further assessment stage of the air quality management process.

[1] Relevant exposure is defined in the most recent DEFRA technical guidance, LAQM TG(09), as locations where members of the public are likely to be regularly present and are likely to be exposed for a period of time appropriate to the averaging period of the objective. For the annual mean objective, Box 1.4 clarifies this to be; 'All locations where members of the public might be regularly exposed. Building facades of residential properties, schools, hospitals, care homes etc'.

Contents

Chapter 1 – Introduction

1.1 The scope of the Detailed Assessment

This Detailed Assessment considers the air quality in the immediate vicinity of Shanes Castle in Devizes. It has been prepared by Wiltshire Council to form part of the statutory duties surrounding Local Air Quality Management (LAQM) under Part IV of the Environment Act, 1995 and subsequent regulations.

The report develops the conclusions reached in the progress report submitted by the former Kennet District Council in April 2008, which indicated the likelihood of a possible exceedence at a relevant location.

Where a Detailed Assessment indicates that a UK national Air Quality Objectives (AQO's) may potentially be exceeded, the local authority has a duty to declare an Air Quality Management Area (AQMA). The declaration of an AQMA triggers the requirement to carry out a further assessment of the air quality, collecting additional air quality monitoring data over a 12 month period and if the need is confirmed to develop an air quality action plan within 18 months of the original declaration, in consultation with the public.

The air quality action plan details how the authority will work towards reducing air pollution levels so that the relevant air quality objectives are met.

This Detailed Assessment is focussed on the immediate area surrounding 'Shanes Castle' at the junction of the A342 and the A361 in Devizes. 'Shanes Castle' is a 19th century castellated Toll House which had fallen into disrepair and was not occupied for years until renovated as a family home in 2004. It is located directly at the intersection of these two busy routes into the market town of Devizes. The location is shown in Figure 1.1.

Monitoring of the air quality in the vicinity of Shanes Castle was extended following the progress report completed by Kennet District Council in April 2007 which had indicated that NO_2 levels at Shanes Castle were likely to cause an exceedence of the annual mean air quality objective for NO_2, a mean annual concentration of 40µg/m^3.

Figure 1.1 – Location of Shanes Castle, Devizes

1.2 The Local Air Quality Management framework

Part IV of the Environment Act, 1995 requires that local authorities periodically review air quality within their areas. This process of Local Air Quality Management (LAQM) is an integral part of delivering the UK AQO's first detailed in 1997 with updates in the Air Quality (England) Regulations 2000 and again in the Air Quality Standards Regulations 2007 (hereafter referred to as the Regulations).

The Regulations seek to simplify air quality regulation and provide a new transposition of the European Union (EU) Air Quality Framework Directive, First, Second and Third Daughter Directives and also transpose the Fourth Daughter Directive, relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air. The Air Quality Limit Values are transposed into the updated Regulations as 'Air Quality Standards' (AQS) with attainment dates in line with the European directives.

The pollutants specified in the Regulations and to be assessed in the review and assessment process, with their relevant AQS/AQO concentrations, are shown in table 1.1. In addition to the regulations, the EU set limit values for NO_2 and benzene and indicative

values for PM10, to be achieved by 1 January 2010. This report provides an assessment against the annual mean and 1-hour mean standards for NO_2.

Table 1.1 – UK air quality standards

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	16.25µg/m^3	Running annual mean	31.12.2003
	5.00µg/m^3	Running annual mean	31.12.2010
1,3-Butadiene	2.25µg/m^3	Running annual mean	31.12.2003
Carbon monoxide	10.0mg/m^3	Running 8-hour mean	31.12.2003
Lead	0.5µg/m^3	Annual mean	31.12.2004
	0.25µg/m^3	Annual mean	31.12.2008
Nitrogen dioxide	200µg/m^3 not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40µg/m^3	Annual mean	31.12.2005
Particles (PM_{10}) (gravimetric)	50µg/m^3, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40µg/m^3	Annual mean	31.12.2004
Sulphur dioxide	350µg/m^3, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125µg/m^3, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266µg/m^3, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

1.3 Previous Kennet District Council assessments

1.3.1 Updating and Screening Assessment (USA) 2006

This document did not identify any risk of exceedance of the UK AQO's at any location in the former Kennet District Council area. Monitoring had commenced at Shanes Castle in 2004 as extensive restoration commenced with a view to occupation as a family home.

1.3.2 Progress report 2007

This report identified the possibility of a potential exceedance at Shanes Castle and recommended that further monitoring be carried out in the vicinity.

1.3.3 Progress report 2008

Following discussion with DEFRA in late 2007, a Detailed Assessment of the air quality at Shanes Castle was formally started at the beginning of 2008 and the 2008 progress report confirmed that this was underway.

Chapter 2 –Review of existing air quality monitoring data

2.1 Passive diffusion tube monitoring

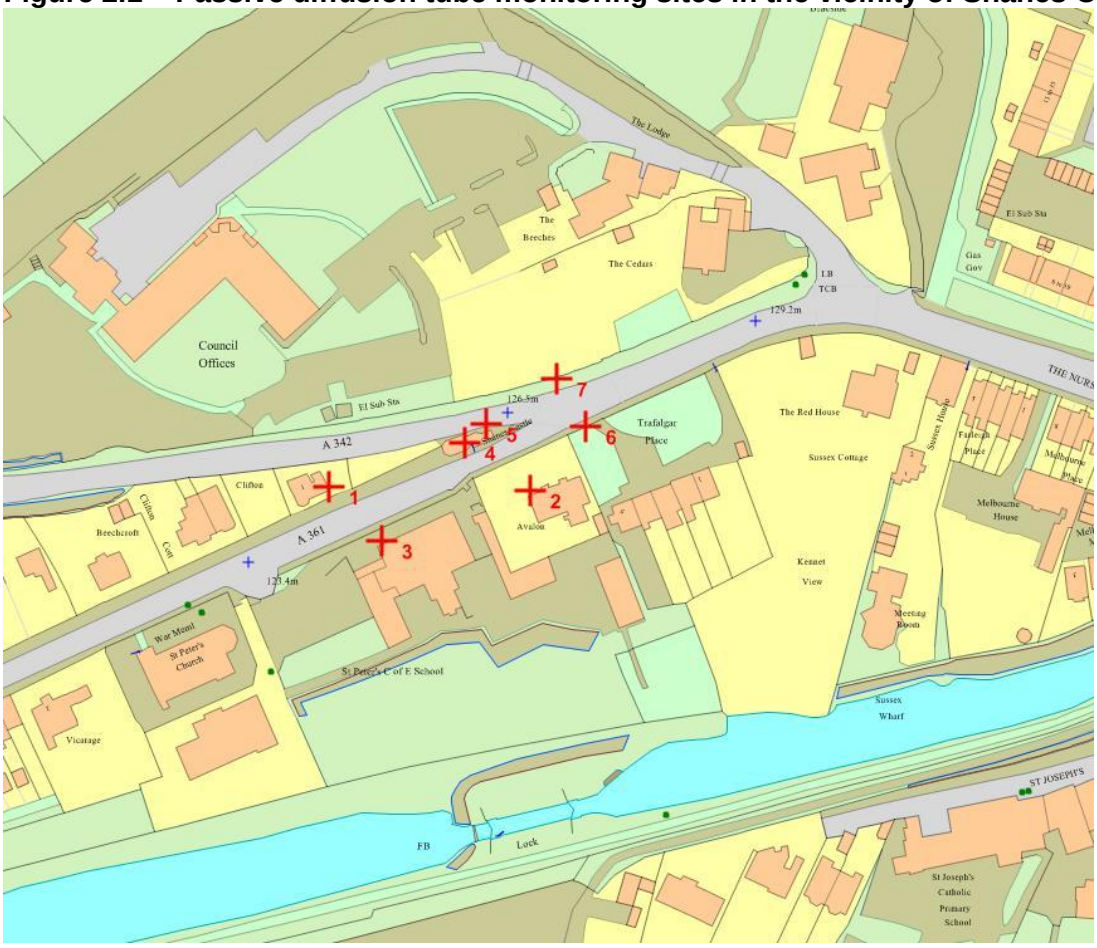
In order to undertake a robust assessment of air quality it is necessary to have suitable monitoring data. This Detailed Assessment is based solely upon the results obtained from the enhanced monitoring program for the vicinity of Shanes Castle, initiated as a consequence of the conclusions of the Kennet District Council 2007 Progress Report.

There are currently 25 passive diffusion tube monitoring sites within the former Kennet District Council area, with 7 of these locations falling within the immediate vicinity of the area covered by the Shanes Castle Detailed Assessment area.

The tube monitoring includes two other domestic properties and a local school as well as two roadside locations. The number of monitoring sites at Shanes Castle itself was also increased. A further two tubes were temporarily located at Shanes Castle, one on the roof and another inside the property. The purpose of these locations is to be discussed and the results are included in this Detailed Assessment.

The location of all the monitoring sites employed is shown in Figure 2.1.

Figure 2.1 – Passive diffusion tube monitoring sites in the vicinity of Shanes Castle



The details of the monitoring locations are set out Table 2.1 below.

Table 2.1 – Details of monitoring sites

Site Name	Ref.	Site Type	OS Grid Reference		Relevant Exposure?	Dist to Kerb
Hillsborough	1	Roadside	399715	161702	Y(1m)	3m
Avalon	2	Roadside	399776	161698	Y(1m)	5m
St Peters Sch.	3	Roadside	399736	161687	Y(1m)	3m
Shanes Castle1	4	Kerbside	399761	161718	Y(1m)	1m
Shanes Castle2	5	Kerbside	399761	161718	Y(1m)	1m
Trafalgar Pl. S	6	Roadside	399791	161718	Y(20m)	1m
Trafalgar Pl. N	7	Roadside	399797	161738	N	1m

The results from the Shanes Castle monitoring programme are presented in table 2.2 below. All data has been corrected using the relevant diffusion tube precision, accuracy and bias spreadsheet obtained from the University of the West of England (UWE) review and assessment website at:
http://www.uwe.ac.uk/aqm/review/R&Asupport/diffusiontube310309.xls

This spreadsheet compares bias correction factors from a number of surveys, categorising results on the basis of the laboratory preparing and analysing the tubes and a bias adjustment factor of 0.98 was derived from the spreadsheet for the tubes employed in this survey[2].

2 - Gradko tubes 50% Tea in Acetone, analysed by Lambeth Scientific Services (based on 7 studies).

Table 2.2 – Summary of the passive diffusion tube monitoring in the vicinity of Shanes Castle, 2008 (NO_2 ug/m^3)

Site Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean	Mean (bias)
Hillsborough	35	41	29	34		35	31		13	39	41	36	33.4	32.7
Avalon	49	32	21	21	23	15	17	12	23	21	31	24	24.1	23.6
St Peters School	40	35	19	20	26	19	25	14	26	25	42	30	26.8	26.2
Shanes Castle 1	47	43	43	52	58	45	40	37	46	44	50	41	45.5.	44.6
Shanes Castle 2	55	50	49	44	56	46	43	36	52	58	53	44	48.8	47.9
Shanes Castle Inside	23	24	20	24	22	-	29	-	-	-	-	-	23.6	23.2
Shanes Castle roof	22	38	-	20	19	-	23	-	-	-	-	-	24.4	23.9
Trafalgar Place South	42	52	39	52	59	36	33	27	37	40	57	-	43.1	42.2
Trafalgar Place North	65	67	58	65	48	59	60	51	50	59	60	49	57.6	56.4

Bias adjustment factor of 0.98 (derived from the national bias adjustment factor spreadsheet) for tubes analysed by Lambeth Scientific Services 2008 – 50% tea in acetone.

Chapter 3 – Conclusions and recommendations

3.1 Discussion of monitoring results

The monitoring results for 2008 clearly show a small, discreet area of exceedence centred on Shanes Castle itself and set out in Figure 3.2 below. The definition of this exceedence zone includes extrapolation of the Trafalgar Place South tube results back to the façade of the residential properties of Trafalgar Place itself by employing the online tool downloaded from the UK air quality archive website (shown below in Figure 3.1)

Based upon measured distances and a background reading of NO_2 from another site in Devizes the mean annual concentration of NO_2 at the façade of these dwellings is 26.1 ug/m^3 (from a roadside annual mean concentration of 42.2 ug/m^3).

Figure 3.1 – NO_2 distance from road calculator

This calculator allows you to predict the annual mean NO_2 concentration for a location ("receptor") that is close to a monitoring site, but nearer or further the kerb than the monitor. The next sheet shows your results on a graph.

Enter data into the yellow cells

Step 1	**How far from the KERB was your measurement made (in metres)?** (Note 1)	**1**	metres
Step 2	**How far from the KERB is your receptor (in metres)?** (Note 1)	**20**	metres
Step 3	**What is the local annual mean background NO_2 concentration (in µg/m^3)?** (Note 2)	**15.5**	µg/m^3
Step 4	**What is your measured annual mean NO_2 concentration (in µg/m^3)?** (Note 2)	**42.2**	µg/m^3
Result	**The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor** (Note 3)	**26.1**	µg/m^3

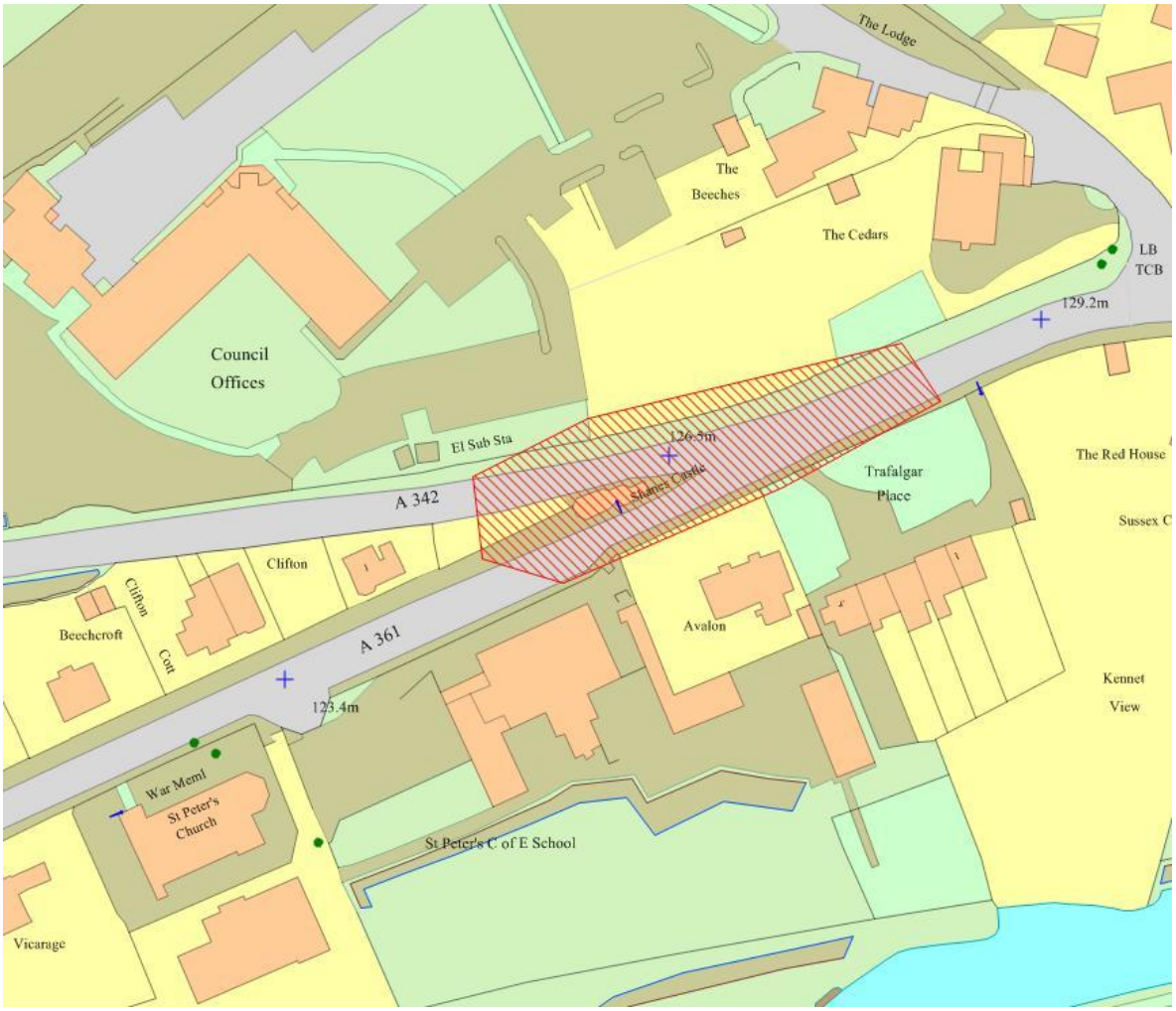
Note 1: This should be measured horizontally from the kerb and assumes that the monitor and receptor have similar elevations. Each distance should be greater than 0.1m and less than 50m (In practice, using a value of 0.1m when the monitor is closer to the kerb than this is likely to be reasonable). The receptor is the location for which you wish to make your prediction. The monitor can either be closer to the kerb than the receptor, or further from the kerb than the receptor. The closer the monitor and the receptor are to each other, the more reliable the prediction will be. When your receptor is further from the kerb than your monitor, it is recommended that the receptor and monitor should be within 20m of each other. When your receptor is closer to the kerb than your monitor, it is recommended that the receptor and monitor should be within 10m of each other.

Note 2: The measurement and the background must be for the same year. The background concentration could come from the national maps published at www.airquality.co.uk, or alternatively from a nearby monitor in a background location.

Note 3: The calculator follows the procedure set out in Box 2.3 of LAQM TG(09). The results will have a greater uncertainty than the measured data. More confidence can be placed in results where the distance between the monitor and the receptor is small than where it is large.

Issue 2: 16/03/09. Created by Dr Ben Marner; Approved by Prof Duncan Laxen. Contact: benmarner@aqconsultants.co.uk

Figure 3.2 Predicted area of exceedence



Paragraph 6.18 of the technical guidance (LAQM TG09) requires that the total number of people living within this zone of exceedence is to be estimated. However, given the discreet nature of the predicted area this total is known to be 4, a family of adults aged over18 living in Shanes Castle itself.

Additional monitoring within Shanes Castle has reassured the occupants that the internal air quality is of an acceptable quality and that the quality of the air on the roof garden also meets the requirements of the Air Quality Standards.

3.2 Dispersion modelling

No dispersion modelling has been carried out to support the Detailed Assessment. This was agreed with DEFRA and the monitoring helpdesk prior to commencing the report. It is proposed to monitor dispersion as part of the Further Assessment to be carried out for Shanes Castle within 12 months of any formal declaration of an AQMA at the site.

3.3 Conclusions to the Detailed Assessment

It is recommended that an AQMA is declared to cover the zone of exceedence and that Wiltshire Council begin the process of consultation around this zone. The extent of the AQMA will be reassessed at the further assessment stage of the AQM process, to be completed not more than one year from the formal declaration of an AQMA.

It is proposed that the further assessment will include modelling of the air quality in the area based upon an expanded monitoring programme. Additional sites are to be incorporated to ensure that the known, monitored area of exceedance does not extend further than the reported boundaries and to provide a robust source of information for the computer model.

It is also noted that the 2008 tubes were supplied and analysed by Lambeth Scientific Services. The new tube precision summary 2007/08 obtained from the air quality review and assessment website[3] has raised concerns about the reliability of the quality of the results from this laboratory for 2008. The 2009 tubes supplied by Bristol Scientific Services have performed more consistently in the survey and the company also supplies the rest of the former Wiltshire authorities with monitoring tubes.

Any modelling carried out at the further assessment stage of the process of AQM will also include information relating to the nature and profile of the traffic in the area. A full traffic survey is therefore likely to be required as part of the on-going process.

3 -www.uwe.ac.uk/aqm/review/R&Asupport/Tube%20Precision_2008_(Mar%2009).pdf)

3.4 Proposed Air Quality Management Area

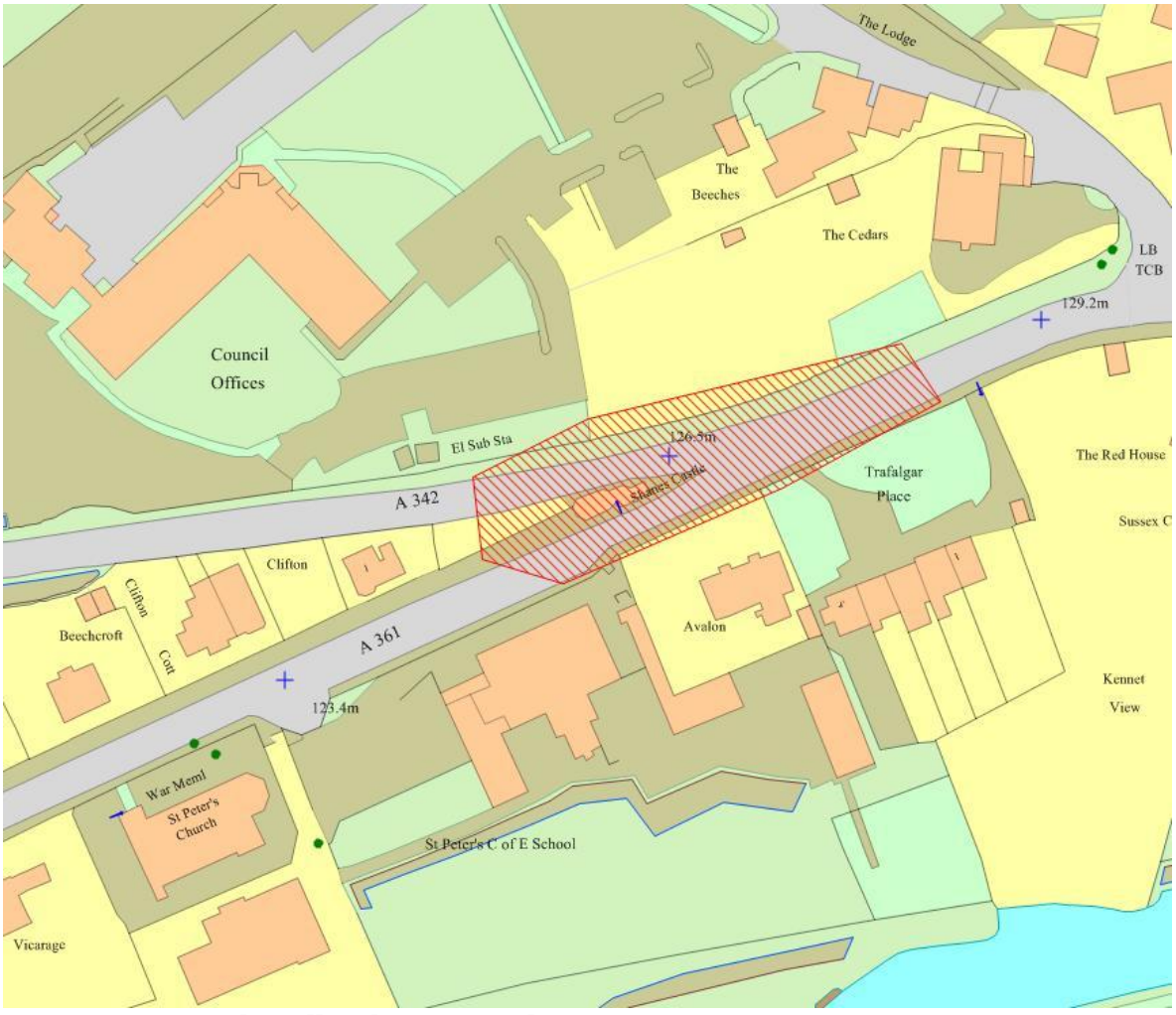
It is therefore proposed to declare an AQMA to cover the known area of exceedance as discussed. It is proposed to locate the eastern boundary at the entrance to the Wiltshire Council offices at Browfort where the road widens as no potential relevant exposure is located in this area.

The proposed AQMA will thus incorporate just the one property, Shanes Castle, and the family living there will be fully involved in the consultation process.

The AQMA will also incorporate the junction of the A361, Bath Road, and the A342, Dunkirk Hill.

A map of the proposed AQMA is set out in Figure 3.3.

Figure 3.3 – Proposed Devizes AQMA boundary



3.5 Recommendations

- On the basis of the results set out in this Detailed Assessment, Wiltshire Council should consider declaring an AQMA in relation to the exceedences of the annual mean AQO for nitrogen dioxide. The extent of the proposed AQMA is set out in Figure 3.3.
- The zone of exceedence should remain as defined in Figure 3.2 until the opportunity to run dispersion modelling based upon the more robust monitoring data has been completed as part of a further assessment.
- That the AQMA should be declared to cover the known area of exceedance in the immediate vicinity of Shanes Castle, at the junction of the A361 and the A342 in Devizes.
- A detailed traffic survey will be required in order to determine factors such as the diurnal profile of vehicles, the fleet mix and queue lengths. This will ensure that future uncertainty in modelling assessments can be reduced. The information will also help in the formation of an action plan to reduce emissions and move towards attainment of the annual mean AQO for nitrogen dioxide.