THANET DISTRICT COUNCIL

LOCAL AIR QUALITY MANAGEMENT

SAINT LAWRENCE AQMA FURTHER ASSESSMENT

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Executive Summary

Part IV of the Environment Act 1995 places a statutory duty on local authorities to review and assess the air quality within their area and take account of Government guidance when undertaking such work.

As part of the Third Round of Review and Assessment of air quality, Thanet District Council completed a Detailed Assessment in 2008, which concluded that there were predicted exceedences of the annual mean nitrogen dioxide (NO_2) objective in the High Street St Lawrence area and recommended declaration of an Air Quality Management Area (AQMA). In April 2010, the Council declared a new AQMA along the A255 High Street in St Lawrence at its junction with the B2014/B2050 Newington Road.

Bureau Veritas has been commissioned by Thanet District Council to provide a Further Assessment of air quality within the High Street St Lawrence AQMA, which will provide technical input to their Air Quality Action Plan.

The Further Assessment has been undertaken in accordance with Defra LAQM.TG (09)[1] Guidance methodologies. The Further Assessment aims, through assessment of monitoring data and modelled predictions,

- to confirm the original assessment of air quality in the AQMA against the prescribed objectives;
- to calculate more accurately how much of an improvement in air quality would be needed to deliver the air quality objectives within the AQMA;
- to refine knowledge of the sources of pollution so that air quality action plan measures can be properly targeted.

The information from the further assessment is required to assist the preparation of the Action Plan measures for the AQMA in order that the measures may be targeted and focused, thereby prioritising the most cost-effective approach to reducing air pollutant concentrations in the AQMA.

The findings of this report are the following:

- Updated monitoring and modelled results confirm that the High Street St Lawrence AQMA is still required in Thanet, as the AQS objective is still likely to be exceeded at relevant receptor locations.
- The source apportionment shows that, while background pollution levels contribute significantly, road traffic is the main contributor of the overall NO_x and NO_2 levels in the AQMA. Of the road traffic emissions, Heavy-Duty Vehicles (HGVs + buses) are the most significant contributors.
- The maximum reduction in NO_x concentrations required to comply with the AQS objectives in the St Lawrence AQMA is about 13µg/m^3 (equivalent to a 21% reduction in road-NO_x levels). This equates to about 4µg/m^3 reduction in NO_2 (10% reduction). Consequently, measures formulated in the Local Action Plan should aim to reduce the levels of NO_x / NO_2 within the AQMA by these amounts or more.
- Using roadside nitrogen dioxide projection factors from the Technical Guidance LAQM.TG(09), it is estimated that the annual mean objective would be met at all locations by 2012. However, this is likely to be an optimistic estimate, as projected concentrations are likely to be underestimated as shown by recent NO_2 monitoring trends across the UK.

[1] Defra (2009), Local Air Quality Management Technical Guidance LAQM.TG(09)

1 Introduction

1.1 Project Background

Part IV of the Environment Act 1995 places a statutory duty on local authorities to review and assess the air quality within their area and take account of Government guidance when undertaking such work. The Further Assessment is a legal requirement for local authorities that have declared an Air Quality Management Area (AQMA), a geographic area defined by high levels of pollution and exceedences of air quality objectives. It is intended to supplement information in the AQMA gathered in the Detailed Assessment. Bureau Veritas was commissioned by Thanet District Council to undertake the Further Assessment of the AQMA declared in April 2010 for nitrogen dioxide (NO_2), along the A255 High Street St Lawrence.

1.2 Legislative Background

This assessment focuses on those pollutants included in Air Quality Regulations for the purpose of Local Air Quality Management (LAQM), in respect of pollutant sources affecting air quality within the Council's administrative area.

The air quality objectives applicable to LAQM in England are set out in the Air Quality (England) Regulations 2000 (SI 928) and the Air Quality (England) (Amendment) Regulations 2002 (SI 3043). They are shown in Table 1. This table shows the objectives in units of micrograms per cubic metre (µg/m^3). For carbon monoxide the units used are milligrammes per cubic metre (mg/m^3). Table 1 includes the number of permitted exceedences in any given year (where applicable).

The UK Government and the Devolved Administrations have also set new national air quality objectives for $PM_{2.5}$. These objectives have not been incorporated into LAQM Regulations, and authorities have no statutory obligation to review and assess air quality against them.

The locations where the AQS objectives apply are defined in the AQS as locations outside buildings or other natural or man-made structures above or below ground where members of the public are regularly present and might reasonably be expected to be exposed to pollutant concentrations over the relevant averaging period of the AQS objective. Typically these include residential properties and schools/care homes for longer period (i.e. annual mean) pollutant objectives and high streets for short-term (i.e. 1-hour) pollutant objectives.

Table 1 - AQS objectives Included in Regulations for the Purpose of LAQM in England

Pollutant			Date to be Achieved by
	Concentration	Measured as	
Benzene (C_6H_6)	16.25 µg/m^3	Running annual mean	31.12.2003
	5.00 µg/m^3	Running annual mean	31.12.2010
1,3-Butadiene (C_4H_6)	2.25 µg/m^3	Running annual mean	31.12.2003
Carbon Monoxide (CO)	10.0 mg/m^3	Running 8-hour mean	31.12.2003

Pollutant	Concentration	Measured as	Date to be Achieved by
Lead	0.5 $\mu g/m^3$	Annual mean	31.12.2004
	0.25 $\mu g/m^3$	Annual mean	31.12.2008
Nitrogen Dioxide (NO_2)	200 $\mu g/m^3$ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 $\mu g/m^3$	Annual mean	31.12.2005
Particles (PM_{10}) (Gravimetric)	50 $\mu g/m^3$, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 $\mu g/m^3$	Annual mean	31.12.2004
Sulphur Dioxide (SO_2)	350 $\mu g/m^3$, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 $\mu g/m^3$, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 $\mu g/m^3$, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

1.3 Local Air Quality Management (LAQM) Review and Assessment

As established by the Environment Act 1995 Part IV, all local authorities in the UK are under a statutory duty to undertake an air quality assessment within their area and determine whether they are likely to meet the air quality objectives set down by Government for a number of pollutants. The process of Review and Assessment of air quality undertaken by local authorities is set out under the LAQM regime and involves a phased three yearly assessment of local air quality. Where the results of the Review and Assessment process highlight that problems in the attainment of health-based objectives for air quality will arise, the authority is required to declare an AQMA.

The LAQM regime was first set down in the 1997 National Air Quality Strategy (NAQS)[2] and introduced the idea of local authority Review and Assessment. The Government subsequently published policy and technical guidance related to the Review and Assessment processes in 1998. This guidance has since been reviewed and the latest documents include Policy Guidance

[2] DoE, 1997, 'The United Kingdom National Air Quality Strategy', The Stationary Office

(LAQM.PG (09))[3] and Technical Guidance (LAQM.TG (09))[4]. The guidance lays down a progressive, but continuous, framework for the local authorities to carry out their statutory duties to monitor, assess and review air quality in their area and produce action plans to meet the air quality objectives.

1.4 Summary of Review and Assessment in Thanet

Thanet District Council undertook its first Round of Review and Assessment of air quality between 1998 and 2001. The First Round concluded that all air quality objectives were likely to be met in Thanet and there was no need to declare any AQMA.

The first phase of the Second Round of Review and Assessment of air quality, the Updating and Screening Assessment (USA), was completed in July 2003, with the conclusion that all air quality objectives would be met. The 2004 annual Progress Report, however, highlighted 7 areas where exceedences of the NO_2 and (in 5 cases) PM_{10} annual mean objective may have been occurring, and recommended to proceed to a Detailed Assessment. The 2005 Detailed Assessment confirmed that The Square, Birchington should be declared an AQMA for NO_2 and PM_{10} on the basis of predicted exceedences of the annual mean objectives. An AQMA was declared in March 2006 and a continuous monitoring station was installed in 2007 to more accurately monitor changes in pollution levels. Thanet District Council has drawn up an Action Plan to improve air quality in this area.

The Third Round started with the USA 2006, which concluded that a Detailed Assessment was required following potential exceedences of the NO_2 annual mean AQS objective on Hereson Road in Ramsgate and on High Street in St Lawrence, due to road traffic emissions. The Detailed Assessment 2008 model results predicted that the NO_2 objectives were likely to be met along Hereson Road. However, exceedences were predicted at receptors on High Street, St Lawrence, and it was recommended that the Council consider declaration of an AQMA. In addition, a recommendation was made for continuous monitoring site on the High Street to provide more robust and accurate data.

The Fourth Round started with the USA 2009, which confirmed that St Lawrence High Street was at risk of exceeding the NO_2 annual mean AQS objective and that there was a need to declare an AQMA. The Council subsequently declared an Air Quality Management Area at High Street St Lawrence for annual mean NO_2 in April 2010.

The USA 2009 also indicated a significant increase in the number of exceedences of the PM_{10} 24-hour mean objective, through monitoring at the Boundary Road roadside continuous monitoring site. It was therefore also recommended that a Detailed Assessment of PM_{10} be undertaken for the junction of Boundary Road with Hereson Road / Victoria Road / King Street in Ramsgate.

The Detailed Assessment, which was completed in October 2009, confirmed that exceedences of the PM_{10} daily mean AQS objective were likely at the junction along Hereson Road, and it was recommended that the Council declare an AQMA for PM10 for this area. Following further monitoring, elevated PM10 daily mean levels were shown to have related to several major developments within the immediate vicinity during 2008. PM10 levels have since returned to normal.

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[3] Policy Guidance LAQM.PG(09) (2009), Part IV of the Environment Act 1995, Local Air Quality Management, Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland, The Stationery Office

[4] Technical Guidance LAQM.TG (09) (2009), Part IV of the Environment Act 1995, Local Air Quality Management, Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland, The Stationery Office

The annual Progress Report 2010 confirmed that exceedences continue to occur within the existing AQMAs in Birchington and St Lawrence.

1.5 Scope and Methodology of the Further Assessment

The approach of the Further Assessment is to provide the Council with an opportunity to supplement the information gathered in the previous LAQM reports and confirm whether the AQMA is still required or if it needs to be amended (increased or reduced).

The methodology is based on dispersion modelling and includes the following:

- Review of additional monitoring since the Detailed Assessment – including continuous monitoring and diffusion tubes,
- Assessment of reduction in pollutant concentrations that is required to meet the AQS objectives in the AQMA,
- Source apportionment of pollutants including relevance of background contributions and different vehicle classification on the roads of concern,
- Estimation of the likely date of compliance with the AQS objectives,
- Estimation of the population exposed to exceedences of the AQS objectives in the AQMA.

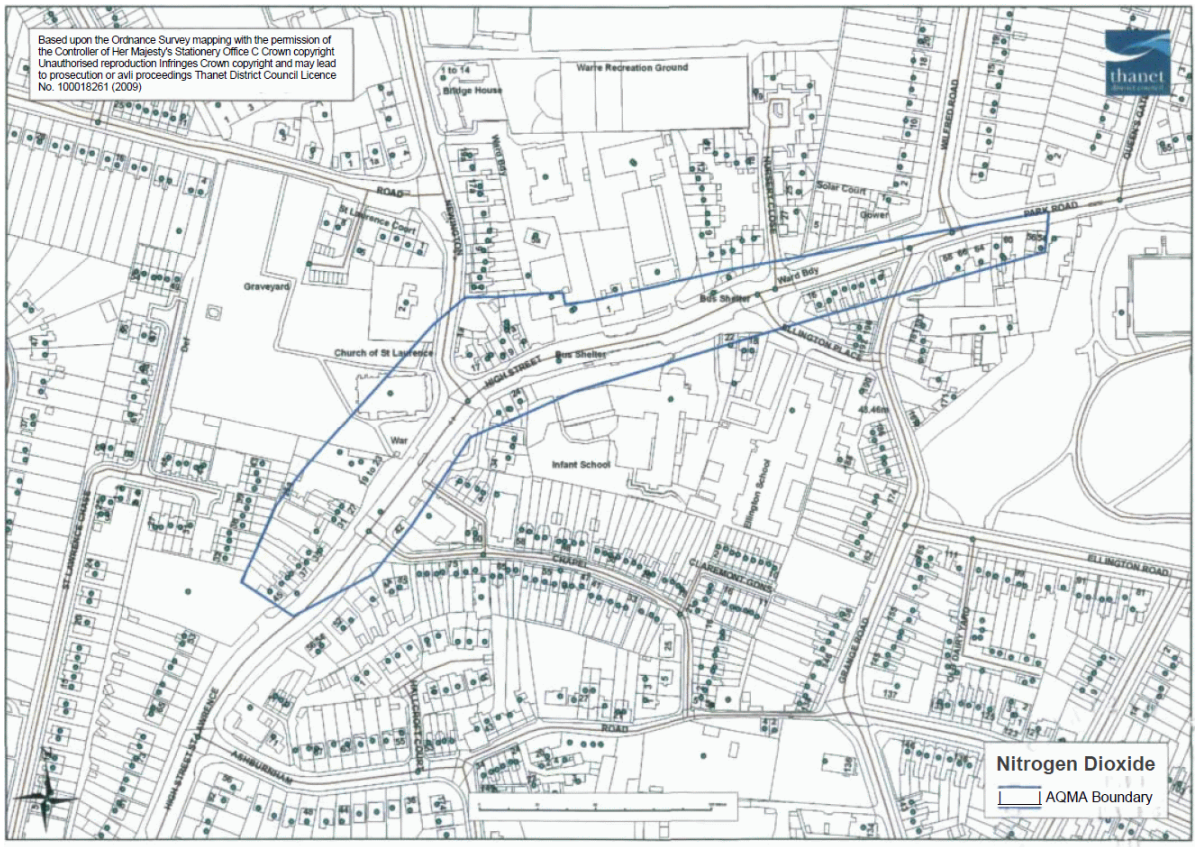
Detailed dispersion modelling was carried out as part of the Further Assessment based on the using the Cambridge Environmental Research Consultants (CERC) ADMS-Roads (v3.0.) atmospheric dispersion model. Results from NO_2 monitoring sites installed in the assessment area were used to verify and adjust the modelled results. NO_x and NO_2 concentrations were predicted for year 2010. The dispersion modelling was undertaken in accordance with the methodologies provided in the Technical Guidance (LAQM.TG(09)) Guidance for Detailed and Further Assessments and amended tools released in 2010.

2 Baseline Information

2.1 Air Quality Management Area (2009)

On 29th April 2010, the Council declared an AQMA along the A255 High Street St Lawrence for the NO_2 annual mean, in an area encompassing roads and properties around the junction of the High Street with the B2014/B2050 Newington Road. The designated AQMA is shown in Figure 1.

Figure 1 - High Street St Lawrence Air Quality Management Area



2.2 Traffic Data

The following roads were included in the modelling:

- The A255 High Street / Park Road, and
- The B2014/2050 Newington Road.

Traffic data for the A255 High Street / Park Road were extracted from Kent County Council traffic counts completed with detailed fleet composition data from DfT[5] available for year 2009. For Newington, data from automatic traffic count carried out in October 2008 were used.

Data included the annual average daily traffic (AADT), free flowing vehicle speed / speed limit data and breakdown of traffic flows into the following vehicle categories: cars, Light Goods Vehicles (LGVs), buses, and Heavy-Goods Vehicles (HGVs).

Traffic data were projected to year 2010 using growth factors from Tempro[6] and NTM[7] (National Road Traffic Forecasts) adjusted for the Thanet area.

Speed was reduced near junctions and along congested sections of roads to account for stop/ start emissions. Modelled roads are shown in Figure A1 in Appendix 4. All traffic data used in the assessment are provided in the Appendix 1.

2.3 Air Quality Monitoring Data

2.3.1 Continuous Monitoring Data

The Council installed a temporary nitrogen dioxide analyser in St Lawrence in September 2010 for a period of 6 months. The analyser, located within the AQMA in the High Street near the junction with the B2014/2050 Newington Road, was decommissioned at the end of March 2011. The ratified monitoring results for the site are shown in Table 2 below. The full monitoring reports are provided in Appendix 2.

The NO_2 average for the whole period of monitoring was 37.5 µg/m^3. Data was annualised to calculate the equivalent annual average for 2010, based on the recommended methodology described in Technical Guidance LAQM.TG(09) Box 3.2. The annual mean 2010 was 34.5µg/m^3, which is below the NO_2 AQS objective of 40µg/m^3.

[5] Downloaded from DfT website http://www.dft.gov.uk/matrix/

[6] Tempro (Trip End Model Presentation Program) version 6.2- Dataset 5.4 - Department for Transport

[7] National Traffic Model

Table 2 – St Lawrence NO_2 Continuous Analyser Results

Site ID	OS Grid Reference (X, Y)	Type	Within AQMA ?	Description	Monitoring Period (09/09/10 to 25/03/11)	Full Calendar Year 2010
Temporary St Lawrence Ramsgate	637092, 165325	Roadside	Yes	Period Mean NO_2 ($\mu g/m^3$)	37.5	34.5 *
				No. Hourly Mean NO_2 > 200 $\mu g/m^3$	0	-
				99.8th Percentile NO_2 ($\mu g/m^3$)	124.7	
				% Data Capture	96%	
* Data annualised based on Thanet and Canterbury urban background continuous monitoring stations						

2.3.2 Nitrogen Dioxide Diffusion Tube Data

Thanet District Council undertook monitoring at 22 NO_2 diffusion tubes sites in 2010, two of which are roadside sites located in the St Lawrence AQMA, which have been used to verify the modelled NO_2 concentrations.

The diffusion tubes are supplied and analysed by Harwell Scientifics utilising the 50% Triethanolamine (TEA) in acetone preparation method. Harwell Scientifics participate in the Workplace Analysis Scheme for Proficiency (WASP) for NO_2 diffusion tube analysis and the Annual Field Inter-Comparison Exercise. These provide strict performance criteria for participating laboratories to meet, thereby ensuring NO_2 concentrations reported are of a high calibre. The laboratory follows the procedures set out in the Harmonisation Practical Guidance.

With regard to the application of a bias adjustment factor for the diffusion tubes, the technical guidance LAQM.TG (09) and The LAQM Support website[8] recommend the use of a local bias adjustment factor where available and relevant to diffusion tube sites. Thanet has (triplicate) collocated diffusion tubes at the Boundary Road roadside site. For 2010, the local bias adjustment factor was 0.81 at this site[9]. As a comparison, the national bias correction factor for Thanet available in the spreadsheet of Diffusion Tube Bias Adjustment Factors[10] was 0.85 for this laboratory and preparation method in 2010.

Table 3 shows bias corrected diffusion tube results over the past 3 years for the sites located within the AQMA and used for model verification. For 2008 and 2009 results, the bias adjustment factors were taken from the Council's previous LAQM reports.

[8] http://laqm.defra.gov.uk/

[9] Details of the local bias factor calculation are available in the LAQM Progress Report 2011

[10] http://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html

Results show that both sites have been exceeding the annual mean NO_2 objective consistently over the past 3 years, although site TH54/64/65 was below - but very close to – the objective in 2010, with an annual mean of 39.6µg/m^3

Table 3 - Diffusion Tube Results near the AQMA

Site ID	Location	Within AQMA?	Data Capture 2010 %	Annual Mean Concentrations (µg/m^3) Adjusted for Bias		
				2008 (Bias Factor: 0.80)	2009 (Bias Factor: 0.92)	2010 (Bias Factor: 0.81)
TH54/64/65	High Street, St Lawrence (triplicate) - Facade	Yes	100	**41**	**45**	39.6
TH70/71/72 *	9 High Street, St Lawrence (triplicate)	Yes	100	**42**	**47**	**41.8**

* * Result is the mean of triplicate tube exposure

In bold, exceedence of the NO_2 annual mean AQS objective of 40µg/m^3

2.3.3 Background Concentrations

Local monitoring data and updated UK background maps were considered to determine the most appropriate background NO_2 and NO_x concentrations for this assessment.

NO_2 concentrations from the background maps for year 2010 are approximately 15µg/m^3 within the Thanet urban area. However, the nearest continuous monitoring background site in Thanet (College Road Margate urban background monitoring station, 5km North of the modelled area in St Lawrence) showed higher levels, with an NO_2 concentration of 19.8µg/m^3. This compares well with the results at NO_2 diffusion tube site installed in Ramsgate, Avebury Avenue (2km East of the modelled area in St Lawrence), where an annual mean of 18.7µg/m^3 was recorded in 2010.

To avoid underestimations in background and as diffusion tube data is less reliable than real-time analyser data, concentrations from the College Road continuous monitoring station in Margate was used in the assessment, as shown in Table 4 below. As there are no background monitoring sites closer to the AQMA, the Council may consider installing a background NO_2 diffusion tube in St Lawrence to inform future modelling work.

Table 4 - Background Concentrations Used for Assessment

Pollutant	2010 Background Concentration (µg/m^3)
NO_x	28.3
NO_2	19.8

Source: Margate Urban Background air quality continuous monitoring station

3 Dispersion Modelling Methodology

3.1 ADMS-Roads

Detailed dispersion modelling of NO_x was undertaken based on ADMS-Roads (version 3.0) atmospheric dispersion model from Cambridge Environmental Research Consultants (CERC). Conversion to NO_2 was based on the updated NO_X/NO_2 conversion model released by Defra in January 2010 as part of the updated LAQM.TG (09) tools[11].

ADMS-Roads is an advanced Gaussian dispersion model, which has been extensively used in local air quality management and has formed the basis for many AQMA declarations. A number of validation studies have been completed, showing overall good agreement between model outputs and observations at continuous monitoring sites.

3.2 Vehicle Emission Factors

The vehicle emissions have been calculated for the traffic data presented in Appendix 1 using the vehicle emission factors provided in the latest Emission Factors Toolkit (version 4.2.2) available on the LAQM Support website[12]. These are the most up-to-date road-traffic emission factors available for the UK released in 2009 by DfT.

The emissions factors are available for three different road types which act as a proxy for the differences in fleet composition of traffic in different conditions; urban, rural and motorway. For this assessment, the “urban” road type was selected to represent the emissions profiles for types of road included in the air quality model.

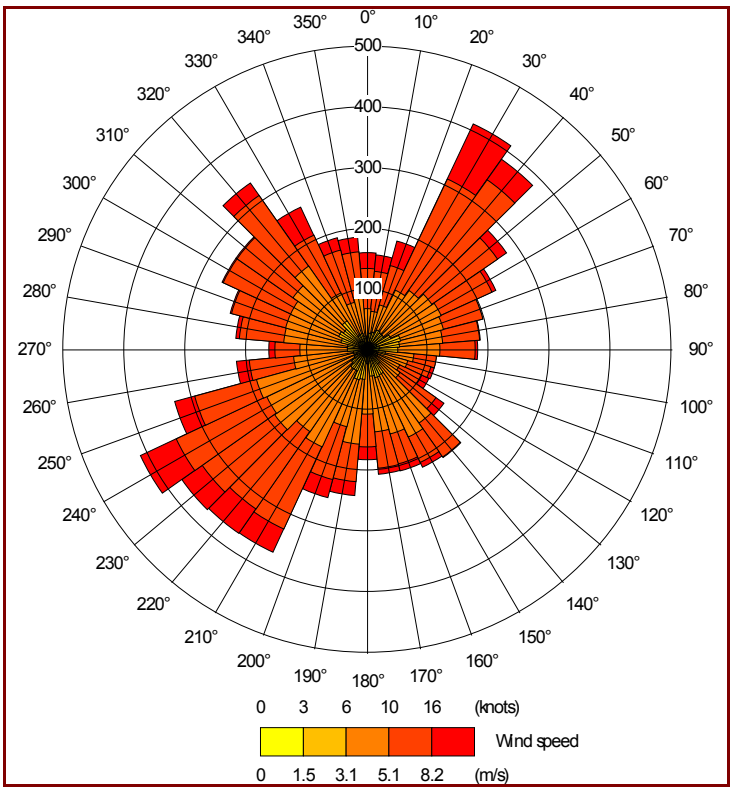
3.3 Meteorological Data

Dispersal of pollutant emissions is dependent (amongst other factors like topography and street canyon effects) upon the prevailing meteorological conditions at the time of emissions release. Hourly sequential meteorological data for 2010 from the closest Met Office station (Manston weather station, 2.5km West of St Lawrence) was used in this assessment. The wind rose derived from meteorological data is illustrated in Figure 2.

[11] http://laqm1.defra.gov.uk/review/tools/monitoring/calculator.php

[12] http://laqm.defra.gov.uk/review-and-assessment/tools/emissions.html

Figure 2 - Manston 2010 Hourly Sequential Meteorological Data



4 Results

4.1 Model Verification and Adjustment

Model verification at specific locations was carried out prior to predicting concentrations within the assessment area at sensitive receptor locations and on a grid of receptors for contour mapping. The objectives of the model verification are:

- to evaluate model performance,
- to show that the baseline is well established, and
- to provide confidence in the assessment

Comparison of the modelled and monitored results was carried out based on local NO_2 monitoring data from diffusion tubes and the continuous analyser in the assessment area. Predicted NO_2 was derived based on the latest NO_x/NO_2 conversion model released by Defra in January 2010[11].

During the verification process, Bureau Veritas aim to ascertain whether all final modelled NO_2 concentrations are within 25% of the monitored NO_2 concentrations. Modelled results may not compare as well at some locations for a number of reasons including:

- Errors in traffic flow and speed data estimates,
- Model setup (including street canyons, road widths, receptor locations),
- Model limitations (treatment of roughness and meteorological data),
- Uncertainty in monitoring data (notably diffusion tubes, e.g. bias adjustment factors and annualisation of short-term data),
- Uncertainty in emissions factors.

The above factors were all investigated as part of the model verification process to minimise the uncertainties as far as practicable. The model verification results are provided in Table 5.

Predicted concentrations are in good agreement with monitoring data, all modelled NO_2 results being within ±25% of monitored concentrations. The model overpredicts at the continuous monitoring site. However, it is in good agreement with the diffusion tube monitoring result across the road (triplicate site TH70/71/72). The full verification methodology is shown in Appendix 3.

Table 5 - Model Verification Results

Site	Within AQMA ?	Modelled NO_2 2010 ($\mu g/m^3$)	Monitored NO_2 2010 ($\mu g/m^3$)	Difference (Modelled - Monitored) ($\mu g/m^3$)	Percentage Difference
CM Station St Lawrence	Y	**40.6**	34.5	6.1	17.5%
TH54_64_65	Y	30.9	39.6	-8.7	-22.0%
TH70_71_72	Y	39.9	**41.8**	-1.9	-4.6%
Summary					
Number of sites	Within ±10%			1	
	Between ± 10-25%			2	
	Exceeds ±25%			0	
	Total			**3**	
In bold: exceedence of NO_2 annual mean AQS objective of 40µg/m^3					

4.2 Modelled NO_2 Concentrations

Annual average NO_2 concentrations were predicted for year 2010 at a number of specific receptors representing relevant public exposure, located at the facade of properties. Additionally, predictions were made to a 3m-grid spacing across the assessment areas to produce NO_2 concentration contour maps for year 2010. NO_2 concentrations were modelled at a height of 1.5m above ground, which represents the average respirable height of an adult.

The results at specific receptors are presented in Table 6 below. The location of the specific receptors is provided in Figure A1 in Appendix 3. NO_2 concentration contours for 2010 are illustrated in Appendix 4.

The model predicted exceedences of the AQS objective for annual NO_2 in 2010 at several receptors in the AQMA along the High Street at the junction with Newington Road. Concentrations are not predicted to exceed the objective at receptors outside the AQMA.

Analysis of UK continuous NO_2 monitoring data has shown that it is unlikely that the hourly mean NO_2 objective, of 18 hourly means over 200µg/m^3, would be exceeded where the annual mean objective is below 60µg/m^3 [13]. The maximum predicted annual average for NO_2 at sensitive receptors is below 60µg/m^3; therefore, the NO_2 hourly mean AQS objective is still expected to be met at all relevant locations near the junction.

Table 6 - Predicted NO_2 Concentrations at Specific Receptors

ID	X	Y	Z	In AQMA ?	Total Modelled NO_2 2010 µg/m^3
1	637082	165335	1.5	Yes	**42.2**
2	637085	165337	1.5	Yes	**41.4**
3	637083	165318	1.5	Yes	**44.3**
4	637089	165321	1.5	Yes	**41.3**
5	637094	165324	1.5	Yes	**41.0**
6	637008	165252	1.5	Yes	27.8
7	637013	165260	1.5	Yes	27.5
8	637011	165256	1.5	Yes	27.8
9	637342	165402	1.5	Yes	30.3
10	636998	165239	1.5	Yes	27.7
11	636989	165227	1.5	Yes	28.0
12	636992	165232	1.5	Yes	27.5
13	636995	165235	1.5	Yes	27.8
14	637285	165385	1.5	Yes	29.9
15	636974	165213	1.5	Yes	27.6
16	636979	165218	1.5	Yes	27.5
17	636982	165221	1.5	Yes	27.4
18	636984	165224	1.5	Yes	27.1

[13] Analysis of the relationship between annual mean nitrogen dioxide concentration and exceedences of the 1-hour mean AQS Objective – AEA - 2008

ID	X	Y	Z	In AQMA ?	Total Modelled NO_2 2010 µg/m^3
19	637264	165379	1.5	Yes	29.9
20	637244	165372	1.5	Yes	28.9
21	637360	165404	1.5	Yes	28.0
22	637271	165407	1.5	No	26.0
23	636940	165122	1.5	No	24.9
24	637060	165276	1.5	No	26.6
25	637006	165208	1.5	No	25.5
26	637251	165404	1.5	No	25.1
27	637013	165215	1.5	No	25.4
28	636988	165192	1.5	No	25.7
29	636993	165196	1.5	No	25.6
30	637017	165219	1.5	No	25.3
31	637208	165353	1.5	Yes	26.0
32	637003	165204	1.5	No	25.3
33	637335	165431	1.5	No	24.8
34	636934	165105	1.5	No	24.4
35	637026	165225	1.5	No	24.6
36	636968	165164	1.5	No	24.3
37	637378	165439	1.5	No	24.1
38	637198	165390	1.5	No	24.4
39	636918	165165	1.5	No	23.7
40	636907	165137	1.5	No	23.8
41	637094	165341	4.5	Yes	26.1
42	637076	165333	4.5	Yes	36.1
43	637097	165343	4.5	Yes	26.0
44	637100	165344	4.5	Yes	25.9
45	636895	165108	1.5	No	23.3
46	636931	165193	1.5	No	23.2
In bold: exceedence of NO_2 annual mean AQS objective of 40µg/m^3					

4.3 Source Apportionment

The breakdown of vehicle classification was taken into account in the model set-up. This allowed the determination of NO_x and NO_2 source apportionment at specific (worst case) receptors in the AQMA where exceedences were predicted. The source apportionment was carried out for the following vehicle classes:

- Cars;
- Light Goods Vehicles (LGVs);
- Buses; and
- Heavy Goods Vehicles (HGVs).

LAQM.TG(09) also recommends the calculation of regional background (for which local authorities do not have control over) and local background contribution (which authorities should have some influence over).

Proportions of each background source category from the modelled background maps have been used to categorise the regional and local background NO_x and NO_2 concentrations in the assessment area. As undertaking NO_2 source apportionment is not as simple as for NO_x due to the non-linear relationship between NO_x and NO_2 emissions, NO_2 contributions have been estimated based on Technical Guidance LAQM.TG(09).

Table 7 and Table 8 summarise the results at (worst case) receptors representing public exposure in the exceedence area for NO_x and NO_2 respectively.

4.3.1 NO_x Source Apportionment

The source apportionment indicates that, at the worst-case receptor:

- Road traffic emissions of NO_x account for 69% of the total NO_x concentration;
- Local background sources contribute to 12% of the total NO_x concentration, while regional background sources (outside the local authority's control) contribute to 19% of the total NO_x;
- The breakdown of road-traffic contribution shows that cars account for about 26% of the overall NO_x concentration, followed by HGVs (20%), LGVs (13%) and buses (10%);
- Combined contribution of HDVs (Heavy Duty Vehicles, based on both buses and HGVs) account for 30% of the total NO_x concentration.

4.3.2 NO_2 Source Apportionment

The source apportionment indicates that, at the worst-case receptor:

- The breakdown of contribution for NO_2 concentrations shows a higher contribution from background sources overall, with 28% of total NO_2 coming from regional background and a further 17% from local background sources; the remaining (55%) coming from road-traffic sources;
- The breakdown of road-traffic contribution shows that cars account for about 21% of the overall NO_2 concentration, followed by HGVs (16%), LGVs (11%) and buses (7%);
- Combined contribution of HDVs (Heavy Duty Vehicles, based on both buses and HGVs) account for 23% of the total NO_2 concentration.

The contribution of HDVs to the total NO_x and NO_2 concentrations is quite significant especially if compared to the proportion of the vehicle fleet they represent (3.4% on High Street / Park Road).

Table 7 - Source Apportionment of NO_X Concentrations at Highest Predicted Receptor

Receptor (Maximum Modelled Concentration)	Receptor 3 (Park Road)
Total NO_X in µg/m^3 (Total Background + Local Road Source)	91.8
NO_X Total Background (Local + Regional) in µg/m^3	28.3
NO_X Local Background in µg/m^3	10.6
NO_X Regional Background in µg/m^3	17.7
Local Road Source Contributions in µg/m^3	63.5
▪ NO_X CAR	24.4
▪ NO_X LGV	12.2
▪ NO_X BUS	8.8
▪ NO_X HGV	18.2
% Local background	11.6%
% Regional background	19.3%
% Road traffic	69.2%
▪ % due to CAR traffic	26.5%
▪ % due to LGV traffic	13.3%
▪ % due to BUS traffic	9.6%
▪ % due to HGV traffic	19.8%
▪ % CAR contribution of total road traffic	38.3%
▪ % LGV contribution of total road traffic	19.3%
▪ % BUS contribution of total road traffic	13.8%
▪ % HGV contribution of total road traffic	28.6%

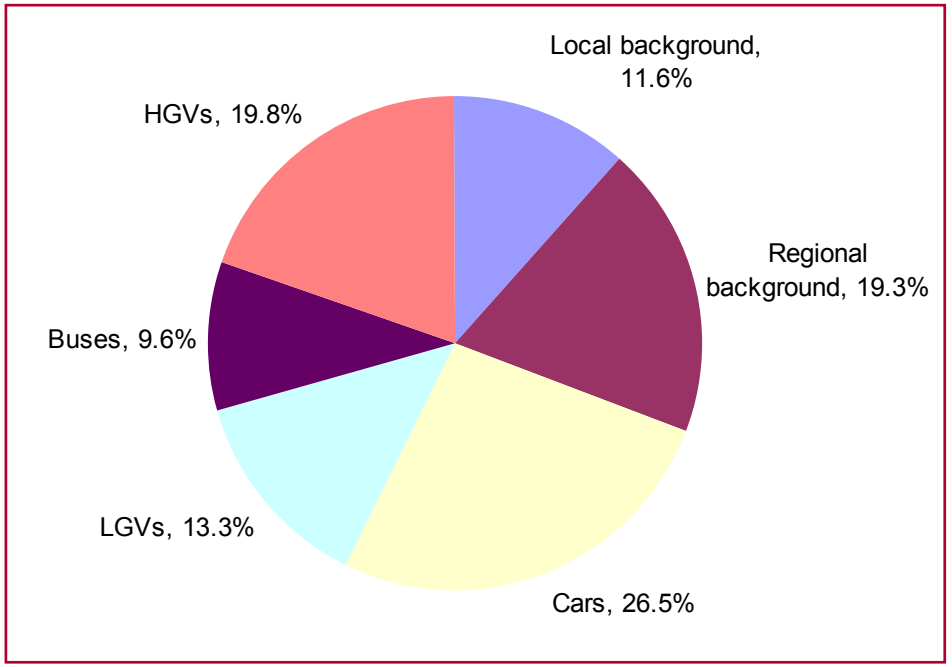
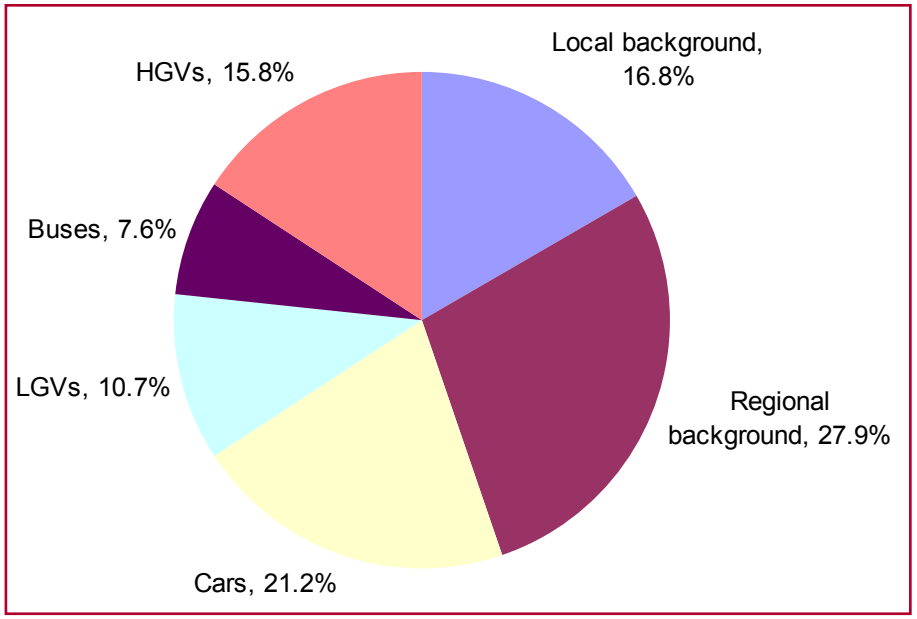


Table 8 - Source Apportionment of NO_2 Concentrations at Highest Predicted Receptor

Receptor (Maximum Modelled Concentration)	Receptor 3 (Park Road)
Total NO_2 in µg/m^3 (Total Background + Local Road Source)	44.3
NO_2 Total Background (Local + Regional) in µg/m^3	19.8
NO_2 Local Background in µg/m^3	7.4
NO_2 Regional Background in µg/m^3	12.4
Local Road Source Contributions in µg/m^3	24.5
▪ NO_2 CAR	9.4
▪ NO_2 LGV	4.7
▪ NO_2 BUS	3.4
▪ NO_2 HGV	7.0
% Local background	16.8%
% Regional background	27.9%
% Road traffic	55.3%
▪ % due to CAR traffic	21.2%
▪ % due to LGV traffic	10.7%
▪ % due to BUS traffic	7.6%
▪ % due to HGV traffic	15.8%
▪ % CAR contribution of total road traffic	38.3%
▪ % LGV contribution of total road traffic	19.3%
▪ % BUS contribution of total road traffic	13.8%
▪ % HGV contribution of total road traffic	28.6%



4.4 Required Reduction in NO_2 and NO_x to Comply with Objectives

A requirement of the Further Assessment is to determine the amount of NO_2 reduction required at the worst-case receptors within an AQMA. This approach highlights the maximum reduction in NO_2 required (as NO_x, in $\mu g/m^3$) to comply with the AQS objective, and assumes that other receptors will require less of a reduction. For the current assessment, the approach to estimate the required NO_2 reduction was to determine the levels of NO_x for the highest concentrations predicted at sensitive receptors relevant of public exposure. .

The methodology to determine the required reduction in NO_x and NO_2 is described in LAQM.TG(09) Section 7.21[14]. For NO_x, it requires the calculation of "current" and "required" road-NO_x concentrations. The results are shown in Table 9.

The maximum predicted road-NO_x reduction required within the St Lawrence AQMA to comply with the NO_2 AQS objective is $13.3\mu g/m^3$ in Park Road (equivalent to a reduction of 21% in road-NO_x concentrations). This equates to a $4.3\mu g/m^3$ reduction in NO_2 (equivalent to a reduction of 10% in total NO_2 concentrations). This is at the worst-case location, and therefore required reductions at all other receptors will be less.

Consequently, the formulation of the Action Plan should aim to reduce the levels of NO_x / NO_2 within the AQMA by this amount.

[14] An erratum in Box 7.2 of LAQM.TG(09) was corrected and is available at http://laqm.defra.gov.uk/supporting-guidance.html

Table 9 - Required NO_x and NO_2 Reduction

Receptor Name and Location	Concentration (µg/m^3)				Required Reduction in Local Road-NO_X		Modelled NO_2 (µg/m^3)	NO_2 AQS Objective (µg/m^3)	Required Reduction in NO_2	
	Modelled Total NO_x	Background NO_x	Road NOx-Current	Road NOx-required (equivalent to 40µg/m^3 NO_2)	µg/m^3	%			µg/m^3	%
1 - Park Road	85.3	28.3	57.0	50.2	6.8	12%	42.2	40	2.2	5%
2 - Park Road	82.8		54.5		4.3	8%	41.4		1.4	3%
3 - Park Road	91.8		63.5		13.3	21%	44.3		4.3	10%
4 - Park Road	82.4		54.1		3.8	7%	41.3		1.3	3%
5 - Park Road	81.4		53.1		2.8	5%	41.0		1.0	2%

4.5 Expected Date of Compliance with Objectives

As mentioned in Technical Guidance LAQM.TG(09), local authorities should provide an indication of the date by which the objectives are expected to be met. For this purpose, the guidance refers to a series of adjustment factors that can be used to project annual mean roadside nitrogen dioxide concentration to future years, up to 2020 (Box 2.1 page 2-4). These factors have been recently updated and are available on the LAQM Support website[15].

Using these factors in combination with the highest concentration (44.3µg/m^3) modelled at receptor 3 in Park Road; concentrations would meet the NO_2 AQS objective in 2012, with an annual mean of 39.1µg/m^3.

However, analysis of recent NO_2 roadside monitoring data has shown that concentrations have not decreased as previously expected and that NO_2 urban levels have remained stable[16]. Therefore, this result should considered as optimistic, as projected concentrations are likely to be underestimated.

4.6 Population Exposure

Technical Guidance LAQM.TG(09) requires local authorities to estimate the number of people exposed to pollutant concentrations above the relevant air quality objectives.

There are 5 residential properties in the area of exceedence illustrated in Appendix 5, all along Park Road at the junction with Newington Road (4 properties on the northern side, and 1 on the southern side). Considering 2 residents per house, it is estimated that 10 people are exposed to exceedences of the NO_2 annual mean AQS objective in the area.

[15] http://laqm.defra.gov.uk/supporting-guidance.html - Errata to LAQM.TG(09) – "Is the example in Box 2.1 of TG(09) correct?"

[16] http://laqm.defra.gov.uk/faqs/faqs.html - Recent FAQs - "Measured NO_x / NO_2 not declining in line with national forecasts"

5 Conclusions and Recommendations

As part of the Local Air Quality Management (LAQM) regime, a Further Assessment based on detailed dispersion modelling was carried out for the High Street St Lawrence Air Quality Management Area (AQMA) in Thanet. The AQMA was declared for nitrogen dioxide (NO_2) in April 2010 due to exceedences of the NO_2 annual mean Air Quality Strategy objective along the A255 High Street at its junction with the B2014/B2050 Newington Road.

The Further Assessment is required as part of the Review and Assessment of air quality for local authorities that have declared or amended an AQMA, with the objective to supplement information gathered in the previous assessments.

The Further Assessment has been undertaken in accordance with Defra's Technical Guidance LAQM.TG (09) methodologies, based on advanced atmospheric dispersion modelling of NO_2 traffic emissions, relying on updated background pollutant concentrations, monitoring, traffic and meteorological data for the year 2010.

Source apportionment of pollutant contribution was carried out to determine contributions of vehicle emissions and other sources to NO_X / NO_2 concentrations in the AQMA. The NO_x reduction to comply with the NO_2 annual mean AQS objective was calculated based on the highest concentration results at sensitive receptors relevant of public exposure (facades of properties).

The information from the further assessment is required to assist the preparation of the Action Plan measures for the AQMA in order that the measures may be targeted and focused, thereby prioritising the most cost-effective approach to reducing air pollutant concentrations in the AQMA.

5.1 Conclusions

The findings of this report are the following:

- Updated monitoring and modelled results confirm that the High Street St Lawrence AQMA is still required in Thanet, as the AQS objective is still likely to be exceeded at relevant receptor locations.

- The source apportionment shows that, while background pollution levels contribute significantly, road traffic is the main contributor of the overall NO_x and NO_2 levels in the AQMA. Of the road traffic emissions, Heavy-Duty Vehicles (HGVs + buses) are the most significant contributors.

- The maximum reduction in NO_x concentrations required to comply with the AQS objectives in the St Lawrence AQMA is about 13µg/m^3 (equivalent to a 21% reduction in road-NO_x levels). This equates to about 4µg/m^3 reduction in NO_2 (10% reduction). Consequently, measures formulated in the Local Action Plan should aim to reduce the levels of NO_x / NO_2 within the AQMA by these amounts or more.

- Using roadside nitrogen dioxide projection factors from the Technical Guidance LAQM.TG(09), it is estimated that the annual mean objective would be met at all locations by 2012. However, this is likely to be an optimistic estimate, as projected concentrations are likely to be underestimated as shown by recent NO_2 monitoring trends across the UK.

5.2 Recommendations

Results of the source apportionment should be used to proposed adequate mitigation measures in the Air Quality Action Plan. For example, it is likely that targeting HDVs would help reducing NO_2 concentration to a level below the Air Quality Strategy objective, as they are the main contributors in overall NOx / NO_2 levels.

It is also recommended that the Action Plan not only consider the implementation of local measures to be applied within the AQMA, but also other measures that may be relevant across a number of areas across the District.

As the maximum exceedence required is in the order of 4µg/m^3 (10% of the AQS objective), compliance with the objective may not need to rely on a single costly measure with high beneficial impact on air quality, and could be achieved through the combination of measures with lower individual impact that may be easier to implement.

As the closest background monitoring site lies 2km from the AQMA, the Council may also want to consider installing a background NO_2 diffusion tube in St Lawrence to support future dispersion modelling work.

Appendix 1 – Traffic Data

Table 10 - Traffic Data Used for the Detailed Assessment

Road Name	X	Y	Year	AADT	AADT 2010	%HDV	%Cars	%LGVs	%Buses	%HGVs
A255 High Street / Park Road	636995	165222	2009	14438	14533	3.4%	82.6%	14.0%	0.8%	2.6%
B2014 Newington Road	637038	165503	2008	12313	12477	3.2%	66.9%	29.9%	0.2%	3.0%

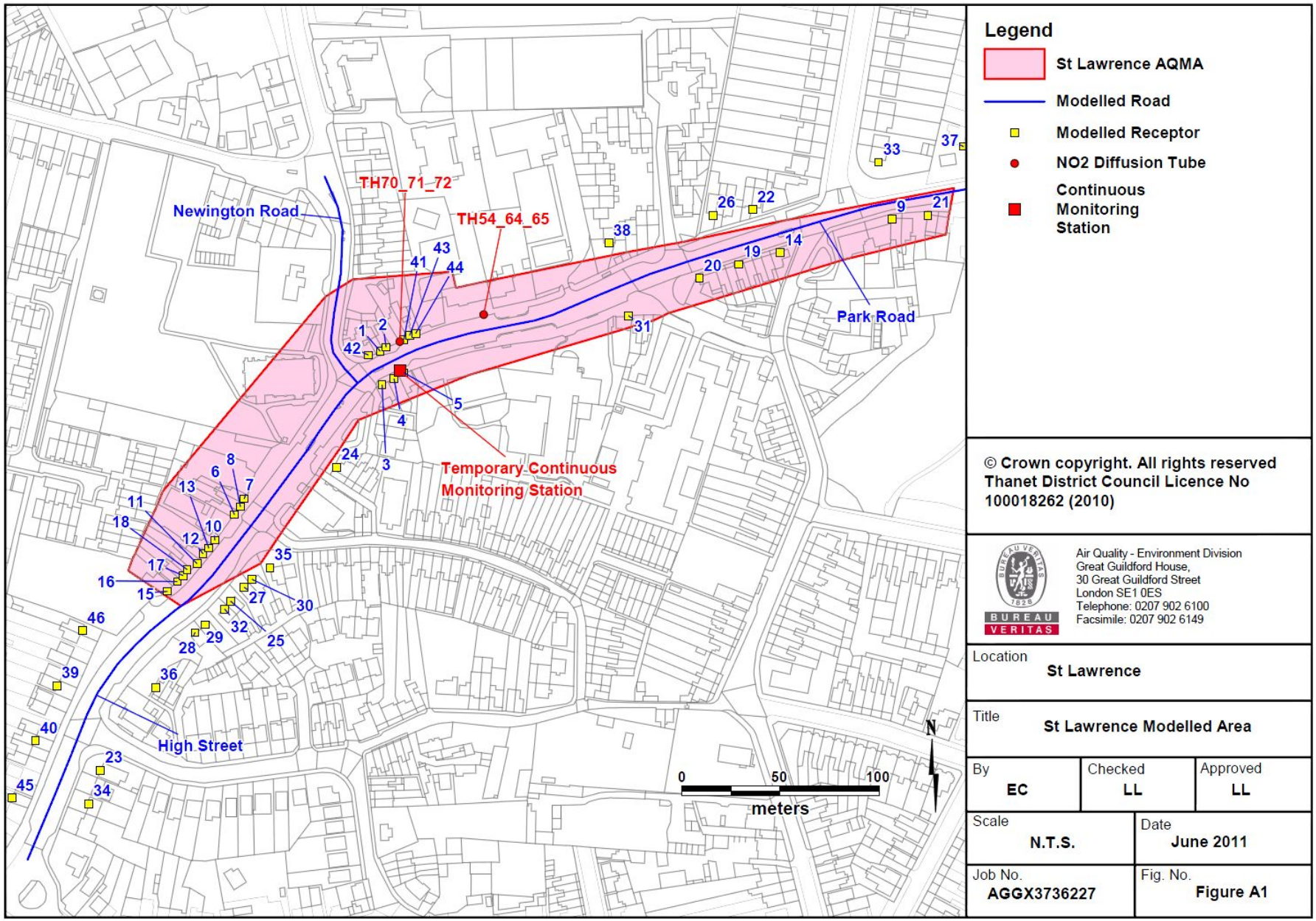
Appendix 2 – Ramsgate Monitoring Reports

Appendix 3 – Model Verification

Table 11 - NO_2 Model Verification (2010)

Site	Background NO_2 (µg/m^3)	Background NO_x (µg/m^3)	Monitored Total NO_x (µg/m^3)	Monitored Road Contribution NO_x (µg/m3)	Modelled Road Contribution NO_x (µg/m^3)	Ratio of Monitored Road NO_x/Modelled Road NO_x	Adjustment Factor (Regression) for Modelled Road Contribution	Adjusted Modelled Road Contribution NO_x (µg/m^3)	Adjusted Modelled Total NO_x (µg/m^3)	Modelled Total NO_2 (µg/m^3)	Monitored Total NO_2 (µg/m^3)	% Difference NO_2 [(Modelled - Monitored)/ Monitored]
CM Station St Lawrence	19.8	28.3	63.0	34.7	16.0	2.166	3.239	51.9	80.2	40.6	34.5	17.5%
TH54_64_65			77.3	49.0	7.8	6.267		25.3	53.6	30.9	39.6	-22.0%
TH70_71_72			84.0	55.7	15.4	3.618		49.9	78.2	39.9	41.8	-4.6%

Appendix 4 – Modelled Area


Legend
St Lawrence AQMA
Modelled Road
Modelled Receptor
NO2 Diffusion Tube
Continuous Monitoring Station
Newington Road
Park Road
High Street
TH70_71_72
TH54_64_65
Temporary Continuous Monitoring Station
0
50
100
meters
N
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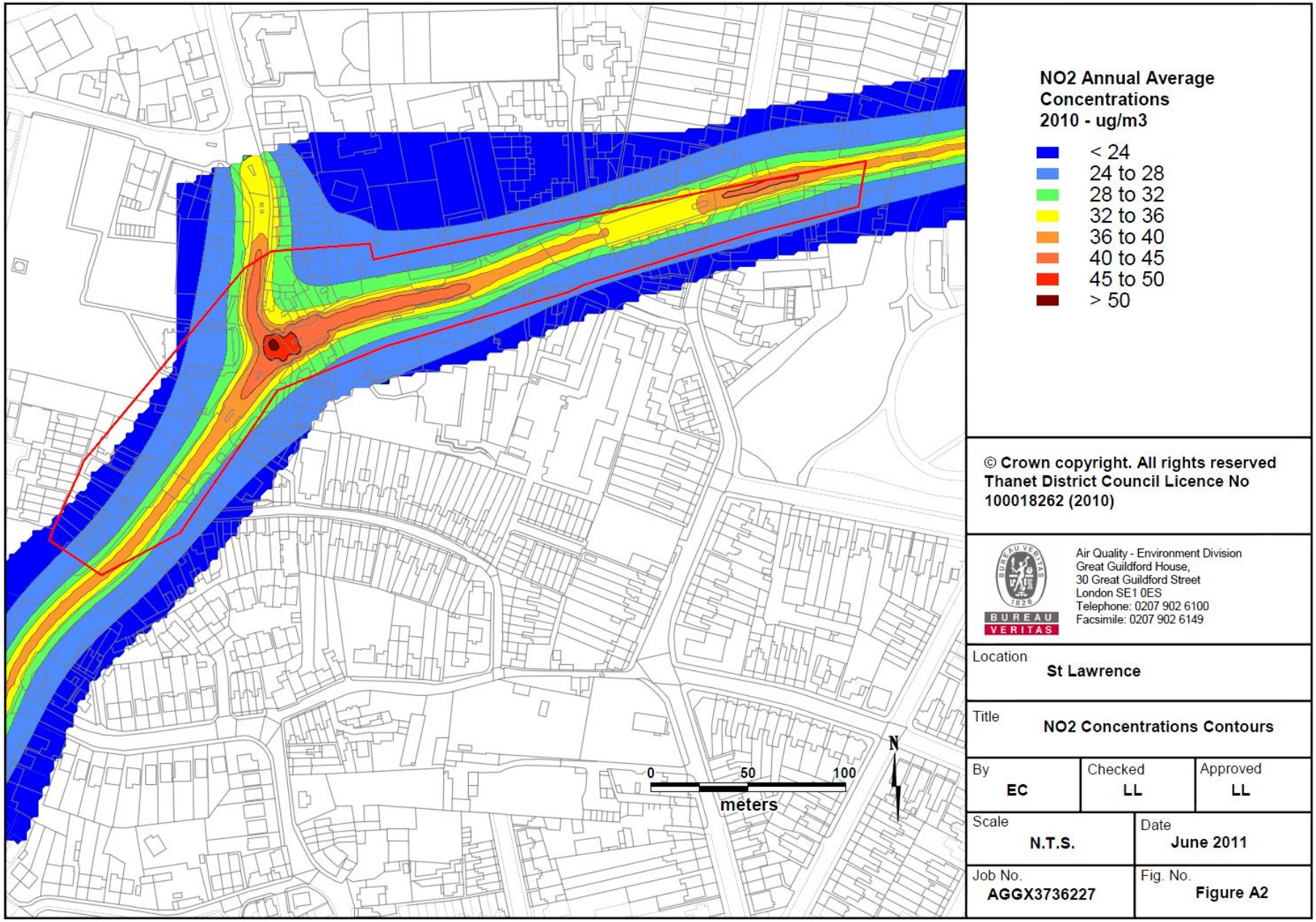
Air Quality - Environment Division
Great Guildford House,
30 Great Guildford Street
London SE1 0ES
Telephone: 0207 902 6100
Facsimile: 0207 902 6149
Location
St Lawrence
Title
St Lawrence Modelled Area
By
EC
Checked
LL
Approved
LL
Scale
N.T.S.
Date
June 2011
Job No.
AGGX3736227
Fig. No.
Figure A1

Appendix 5 – Modelled Contour Results



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Location: St Lawrence		
Title: NO2 Concentrations Contours		
By: EC	Checked: LL	Approved: LL
Scale: N.T.S.	Date: June 2011	
Job No.: AGGX3736227	Fig. No.: Figure A2	