

WEST LANCASHIRE BOROUGH COUNCIL

LOCAL AIR QUALITY MANAGEMENT – MOOR STREET

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. For local authorities that have identified areas, within their Detailed Assessment, risk of exceedence of Air Quality Strategy (AQS) objectives a Further Assessment is required.

This Further Assessment for nitrogen dioxide (NO₂) is required following the findings of the Detailed Assessment (DA), which identified exceedences of the NO₂ annual mean AQS objective near properties along Moor Street. The Detailed Assessment recommended for an Air Quality Management Area (AQMA) to be declared in Moor Street for the NO₂ annual mean. Defra has accepted the conclusions of the Detailed Assessment. Bureau Veritas has been commissioned by West Lancashire Borough Council to provide a Further Assessment for nitrogen dioxide at these locations.

The Further Assessment has been undertaken in accordance with Defra LAQM.TG(09)¹ Guidance methodologies. The Further Assessment aims to supplement the information gathered in the Detailed Assessment and confirm whether the AQMA is still required or if the original AQMA requires revision.

The following are the findings of the Further Assessment:

- The source apportionment shows that road traffic is the main contributor to the overall NO_x levels in the AQMA, as it contributes about 84%. Of the road traffic emissions, heavy-duty vehicles, HGVs and buses and coaches, are the most significant contributors, given the proportion of the vehicle fleet they represent;
- The exposure assessment shows that there are ten residential properties within the area of exceedence, which currently house 14 residents;
- The maximum predicted NO_x reduction required within the Moor Street AQMA to comply with the NO₂ AQS objective is 24.4µg/m³ (equivalent to an 21.6% improvement in NO_x. This equates to a 6.0µg/m³ reduction in NO₂ (equivalent to 13.0% improvement in NO₂). Consequently, measures formulated in the Air Quality Action Plan should aim to reduce the levels of NO_x / NO₂ within the AQMA by this amount;
- The modelled results for 2010 indicate that the annual mean NO₂ objective would continue to exceed within the AQMA. This needs to be considered in the context of the baseline year being modelled (model verification is based on 2008 monitoring results, which were lower compared to 2006 and 2007; likely due to meteorological influences) and model uncertainty (average uncertainty has been calculated as 3µg/m³); and
- Using roadside nitrogen dioxide projection factors from the Technical Guidance LAQM.TG(09), it is predicted that the annual mean objective would be met at this monitoring location by 2011 based on 2008 data. For 2007 monitoring results, the projection indicates that the compliance would not be achieved until 2013.

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

1 Introduction

1.1 Project Background

The Detailed Assessment carried out by Bureau Veritas in July 2009 concluded that the annual mean NO₂ objective has been exceeded at properties along Moor Street in Ormskirk within the jurisdiction of West Lancashire Borough Council. The Detailed Assessment also recommended for an AQMA to be declared along Moor Street.

The appraisal of the Detailed Assessment carried out by Defra accepted the conclusions of the report and recommended for a Further Assessment to be carried out of air quality within the AQMA. Bureau Veritas has been commissioned by West Lancashire Borough Council to undertake the Further Assessment of the AQMA, as required by Defra. The appraisal also recommended to assess the population exposure to the exceedences and the *magnitude of reduction required*. Both these recommendations have been dealt within this assessment.

Part IV of the Environment Act, 1995, places a statutory duty on local authorities to periodically review and assess the air quality within their area. The Further Assessment is a requirement of the third round of Review and Assessment of the Local Air Quality Management (LAQM) regime for local authorities that have declared an AQMA. It is intended to supplement information within the AQMA.

1.2 Legislative Background

The significance of existing and future pollutant levels are assessed in relation to the national air quality standards and objectives, established by Government. The revised Air Quality Strategy (AQS)² for the UK (released in July 2007) provides the over-arching strategic framework for air quality policy in the UK and contains national air quality standards and objectives established by the UK Government and devolved administrations to protect human health. The air quality objectives incorporated in the AQS and the UK Legislation are derived from the Limit Values prescribed in the EU Directives transposed into national legislation by member states.

The Clean Air for Europe (CAFE) programme was initiated in the late 1990s to draw together previous directives into a single EU Directive on air quality. The Directive 2008/50/EC³ introduces new obligatory standards for PM_{2.5} for Government but places no statutory duty on local Government to work towards achievement of these new standards.

The Air Quality Standards (England) Regulations 2007⁴ came into force on 15th February 2007 in order to align and bring together in one statutory instrument the Governments obligations to fulfil the requirements of the CAFE Directive.

The objectives for ten pollutants (benzene, 1,3-butadiene, carbon monoxide, lead, nitrogen dioxide (NO₂), sulphur dioxide (SO₂), particulates - PM₁₀ and PM_{2.5}, ozone and Polycyclic Aromatic Hydrocarbons (PAHs)) have been prescribed within the Air Quality Strategy² based on The Air Quality Standards (England) Regulations 2007.

Part IV of the Environment Act 1995 places a statutory duty on local authorities to periodically review and assess the current and the future air quality within their area – a process known as Local Air Quality Management (LAQM). The air quality objectives that apply to LAQM are defined in Air Quality Regulations 2000⁵ and Air Quality (England) (Amendment) Regulations 2002⁶ for seven

² The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (2007), Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland

³ Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe

⁴ The Air Quality Standards Regulations 2007, Statutory Instrument No 64, The Stationary Office Limited

⁵ The Air Quality (England) Regulations 2000 (Statutory Instrument 928)

⁶ The Air Quality (England) (Amendments) Regulations 2002 (Statutory Instrument 3043)

pollutants benzene, 1,3-butadiene, carbon monoxide, lead, NO₂, SO₂, particulates - PM₁₀. The objectives set out in the AQS for these pollutants are presented in Table 1.

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– Air Quality Objectives Included in the Air Quality Regulations for the Purpose of Local Air Quality Management in England

Pollutant	Objective	Concentration measured as	Date to be achieved by and maintained thereafter
Benzene All authorities	16.25 µg/m ³	running annual mean	31.12.2003
Authorities in England and Wales only	5.00 µg/m ³	annual mean	31.12.2010
1,3 Butadiene All authorities	2.25 µg/m ³	running annual mean	31.12.2003
Carbon monoxide Authorities in England, Wales and Northern Ireland only	10.0 µg/m ³	maximum daily running 8-hour mean	31.12.2003
Lead All authorities	0.5 µg/m ³	annual mean	31.12.2004
	0.25 µg/m ³	annual mean	31.12.2008
Nitrogen dioxide ^a All authorities	200 µg/m ³ , not to be exceeded more than 18 times a year	hourly mean	31.12.2005
	40 µg/m ³	annual mean	31.12.2005
Particles (PM₁₀) (gravimetric) ^b All authorities	50 µg/m ³ , not to be exceeded more than 35 times a year	24 hour mean	31.12.2004
	40 µg/m ³	annual mean	31.12.2004
Sulphur dioxide All authorities	350 µg/m ³ not to be exceeded more than 24 times a year	1 hour mean	31.12.2004
	125 µg/m ³ not to be exceeded more than 3 times a year	24 hour mean	31.12.2004
	266 µg/m ³ not to be exceeded more than 35 times a year	15 minute mean	31.12.2005

^a EU Limit values in respect of nitrogen dioxide to be achieved by 1st January 2010. There are, in addition, separate EU limit values for carbon monoxide, sulphur dioxide, lead and PM₁₀, to be achieved by 2005, and benzene by 2010.

^b Measured using the European gravimetric transfer sampler or equivalent.

* Rows shaded grey highlight the pollutants to be studied in this report.

1.3 Local Air Quality Management (LAQM)

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 Local Air Quality Management (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 Air Quality Management Area (AQMA) – a geographic area defined by high levels of pollution and exceedences of AQS objectives.

The LAQM regime was first set down in the 1997 National Air Quality Strategy (NAQS)⁷ 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 (LAQM.PG (09))⁸ and Technical Guidance (LAQM.TG (09))⁹. 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.

Defra and the Devolved Administrations released the latest Policy and Technical Guidance in February 2009, in anticipation of the fourth round of review and assessment.

1.4 Summary of the Review and Assessment by West Lancashire Borough Council

The first round of Review and Assessment carried out by the West Lancashire Borough Council concluded that all the objectives for the seven pollutants, to be considered for LAQM, were either being met or would be met by their target dates.

The USA undertaken in 2003 at the start of the second round of Review and Assessment also concluded that all the objectives for the LAQM pollutants were either being met or will be met by their target dates within the Borough.

The progress Report produced in 2004 acknowledged that diffusion tube monitoring of NO₂ was needed at a number of new locations in order to assess the air quality objectives more fully.

The USA produced at the third round of Review and Assessment in 2006 concluded that the objectives for all but annual mean NO₂ were being met within the Borough. The USA identified a potential for exceedence of NO₂ objective in Stanley Street, Ormskirk. The USA recommended that a Detailed Assessment should be carried out for Stanley Street to confirm the findings.

The Council commissioned automatic monitoring at a site along Stanley Street in July 2005. A Detailed Assessment report was produced in August 2006 based on the automatic monitoring of NO₂/NO_x. The report concluded that the monitoring levels were below the annual mean objective of NO₂ and hence an AQMA was not required.

The Council produced the LAQM Progress Report in 2007. The report used the latest monitoring data for NO₂ in 2006 and identified that an exceedence of the annual mean objective was likely to

⁷ DoE, 1997, 'The United Kingdom National Air Quality Strategy', The Stationery Office

⁸ 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

⁹ 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

occur in Moor Street. The report recommended continuing monitoring NO₂ at these locations to get more data to confirm the findings¹⁰.

Based on the further monitoring, as recommended in the Progress report 2007, the Progress Report produced by the Council in 2008 concluded that a Detailed Assessment was required for the Moor Street area in Ormskirk, West Lancashire.

The Council has submitted USA 2009 to Defra at the start of the fourth round of Review and Assessment. The USA also concluded the potential exceedences of annual mean NO₂ objective in Moor Street area of Ormskirk.

The Council produced a Detailed Assessment in July 2009 following from the recommendations of the Progress Report 2008. The Detailed Assessment using detailed dispersion modelling and new monitoring data. The Detailed Assessment concluded that while the annual mean NO₂ has been achieved at properties along St Helen's Road, Knowlsey Road and Wigan Road, properties along Moor Street show exceedence of the objective. The assessment recommended to declare an AQMA along Moor Street. The conclusions of the DA have been accepted by Defra, who have required the Council to declare an AQMA and to carry out a Further Assessment.

1.5 Scope and Methodology of the Further Assessment

The approach of the Further Assessment is to provide the local authority with an opportunity to supplement the information gathered in the Detailed Assessment and confirm whether the AQMA is still required or if the original AQMA needs to be refined (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,
- Identification of improvement in pollutant concentrations that is required to meet the objectives in the AQMA,
- Source apportionment of pollutants including relevance of background, industrial (if relevant), and different vehicle classification on the roads of concern, and identification of the most significant roads,

The detailed dispersion modelling has been undertaken using ADMS Roads Extra 2.3 part of Cambridge Environmental Research Consultants (CERC) Ltd Atmospheric Dispersion Modelling System. This system has been extensively validated by the model supplier and is frequently used in Local Air Quality Management.

Verification of the modelling has been undertaken using data from diffusion tube monitoring sites. All the diffusion tubes were bias adjusted.

The dispersion modelling was undertaken in accordance with the methodologies provided in the Technical Guidance (LAQM.TG (09)) for Detailed and Further assessments.

¹⁰ Due to technical difficulties related to placement of continuous monitoring sites, it was agreed with Defra to progress monitoring based on diffusion tubes

2 Baseline Information

2.1 Traffic Data

Traffic data for the Detailed Assessment has been provided by West Lancashire Borough Council. The traffic data was collected in March 2009. It is assumed that the traffic flow data for 2008, the baseline year, would be the same as confirmed with the Council. The Council provided vehicle classification in heavy and light categories and this data was further refined into vehicle categories, cars, LGVs, HGVs and buses/coaches, based on data obtained from DfT's¹¹ matrix site. This would assist in source apportionment work, if required at the Further Assessment stage.

The Council has provided the average vehicle speed data for the assessed roads. The speeds have been reduced at approaches to junctions as recommended in the technical guidance, LAQM.TG(09).

The traffic data for 2010 was projected from 2008 baseline flows using growth factors specific to Ormskirk area obtained from the latest TEMPRO¹² model from DfT.

The hourly traffic profiles for the assessed roads have been derived based on the traffic data provided by the Council. These traffic profiles have been used in the assessment and are presented in Appendix 1.

The traffic data used in the assessment is given in Table 2. All modelled roads are illustrated in Figure 7 Appendix 2.

Table 2 – Traffic Flow Data Used in the Assessment

Road	AADT	Vehicle Speed, kph	Cars	LGVs	HGVs	Buses
2008						
Stanley Street/Knowsley Rd	14837	40*	12501	1415	871	50
Wigan Road	10046	40*	8634	823	201	388
Park Road	16861	40*	15096	1169	506	89
Moor Street	12879	25	11069	1055	257	497
St Helen's Road - North of Park Rd	11241	25	9681	1164	156	240
St Helen's Road - South of Park Rd	11241	25	9330	1180	573	157
2010						
Stanley Street/Knowsley Rd	14957	40*	12602	1426	878	50
Wigan Road	10127	40*	8704	830	202	391
Park Road	16997	40*	15218	1179	511	90
Moor Street	12983	25	11158	1064	259	501
St Helen's Road - North of Park Rd	11332	25	9760	1174	157	242
St Helen's Road - South of Park Rd	11332	25	9406	1190	578	159

* The speed on these roads at junctions and approaches have been reduced to 20 kph

¹¹ DfT - Annual average Daily Traffic Flows <http://www.dft.gov.uk/matrix/>

¹² TEMPRO (Trip End Model Presentation Program) version 6.1 , dataset v5.4, Department for Transport, released March 2009

2.2 Air Quality Monitoring

Currently no automatic monitoring is carried out within the Borough. However, NO₂ is monitored at a number of locations using diffusion tubes. In March 2008 the Council extended the diffusion tube network and deployed triplicate diffusion tubes at 11 locations in the Moor Street area, as illustrated in Figure 7 Appendix 2.

The Council uses Bureau Veritas UK limited for the supply and analysis of diffusion tubes, which until Dec 2008 used 10% TEA (Trietanolamine) in water preparation method. The Council has used a bias adjustment factor of 0.87, 0.88 and 0.83 for 2006, 2007 and 2008 respectively, based on national default factors obtained from the Review and Assessment website spreadsheets.

The data for diffusion tubes having less than 9 months in 2008 has been annualised. The annualisation is based on automatic monitoring data from four urban background sites, Blackpool, Preston, Wigan Centre and Wirral Tranmere.

The bias corrected and annualised, where required, data for 2006-2008 is presented in Table 3. The concentrations marked bold show an exceedence of the relevant objective.

The results show that the diffusion tubes deployed in Moor Street have consistently exceeded the annual mean objective of NO₂.

Table 3 – Bias Corrected and Annualised NO₂ Diffusion Tube Results - 2006-2008

Site ID	Site Location	NO ₂ Annual Mean (µg/m ³)			
		2006 (Bias factor: 0.87)	2007 (Bias factor: 0.88)	2008 (Bias factor: 0.83)	Data Capture in 2008, Months
1N	Burscough Street	28.2	25.4	30	12
6N	54SouthportRoad	27.7	24	21.4	8
WL/1	59 Moor Street	42.9	44	N/A ²	-
WL/2	Chequer Close	31.1	29.4	25.3	11
WL/3	Halsall Lane	37.5	33.1	38.6	11
WL/4	40 Stanley Street	25.8	24.9	N/A ²	-
WL/5	3 Wigan Road	32.5	31.7	N/A ²	-
WL/6	Liverpool Road South	33	30.1	35	12
WL/7	49 Wigan Road	N/A ¹	34.4	32.1	12
11	14 Wigan Road	-	-	34.0	10
12	31 Knowsley Road	-	-	23.5	10
13	41 Stanley Street	-	-	39.5	10
14	55 Moor Street	-	-	40.3 ³	7
15	50 Moor Street	-	-	52.7	10
16	Junction of St Helens Rd/ Moor Street	-	-	41.3	10
17	19b St Helens Road	-	-	29.2	9
18	Beaconsfield Court	-	-	31.4 ³	4
19	16 St Helens Road	-	-	24.5	10
20	75 Aughton Street	-	-	26.6	10
21	Junction of Park Road/Aughton Street	-	-	35.1	10

Note: Sites 11-21 started in March 2008 as triplicate diffusion tube locations

¹ Data capture 25%

² the sites moved to more suitable locations for triplicate diffusion tubes

³ Data annualised as capture is less than 75%

2.3 Background Concentrations

As no monitoring data, automatic or diffusion tubes, is available from appropriate background sites close to the assessment area, hence LAQM.TG(09) updated background maps from the Air Quality Archive have been used to obtain the background concentrations for this assessment. The latest modelled background maps provide facility to remove contribution from a given sector such as from trunk or principal A roads. However, in this case no sectoral removal has been carried out. The reason is that the model area is much smaller than 1x1 km, the area over which the background concentrations are provided. By removing the contribution from a given sector, for example principal A roads, would have removed the contribution from roads which are not explicitly modelled within this assessment. However, the approach used in this assessment may be considered as conservative. The background concentrations used in the assessment are provided in Table 4.

Table 4 – Background Concentrations Used for the Assessment

Pollutant	Background Concentration ($\mu\text{g}/\text{m}^3$)	
	2008	2010
NO _x	18.6	16.6
NO ₂	15.1	13.7

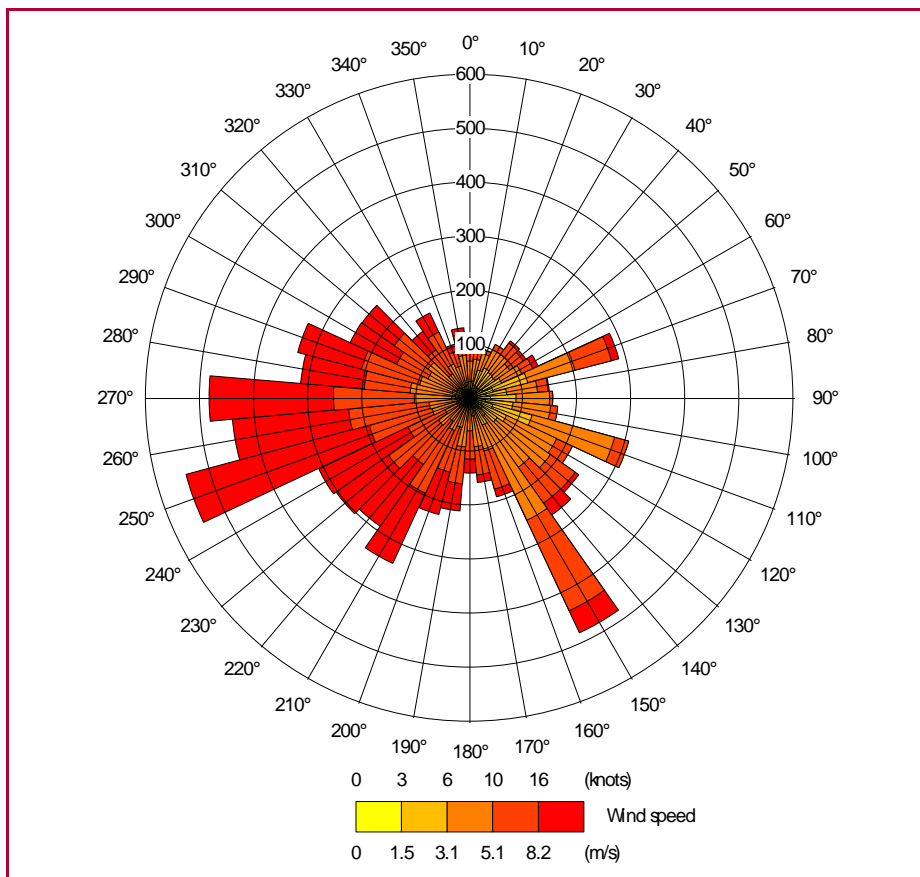
Based on background maps - OS Coordinates: 341500, 408500

3 Dispersion Modelling Methodology

Detailed dispersion modelling of NO₂ was undertaken using the Cambridge Environmental Research Consultants (CERC) Ltd ADMS-Roads advanced Gaussian air dispersion model. ADMS-Roads Extra 2.3 can model up to 600 road sources at any one time. The model is used extensively in local air quality management, and has formed the basis for many AQMA declarations. Conversion to NO₂ was based on the updated NO_x/NO₂ conversion model released by Defra in February 2009 as part of LAQM.TG(09) tools. Details

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 from the nearest representative station (Crosby) was used in this assessment, based on the year 2008. The cloud cover data is not recorded at Crosby station. This data has been included from two nearby stations, Liverpool and Blackpool. The wind rose for the meteorological data as shown in Figure 1. The figure shows that during 2008 the predominant wind directions are southwest, west and southeast.

Figure 1 - Wind Rose from 2008



4 Results

4.1 Model Verification and Adjustment

Model verification at specific monitoring locations was carried out prior to predicting concentrations within the whole domain. 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 modelled and monitored results was carried out based on local NO₂ monitoring data from 8 roadside diffusion tubes in Ormskirk. Monitoring site 16 (Junction of St Helen's Road and Moor Street) was not included in the model verification, as this site is likely to be impacted by idling bus emissions from the Ormskirk bus station across the road, which have not been taken into account in the model. Besides, traffic flows for Moor Street (west of St Helen's Road) were not available, which are also likely to contribute to the overall levels measured at this site. Similarly, sites 20 (Aughton Street) and 21 (Junction of Park Road and Aughton Street) were not included as Aughton Street traffic data were not available.

Predicted NO₂ concentrations were derived from the latest NO_x / NO₂ conversion method released with the Technical Guidance LAGM.TG(09). The details of the model verification are provided in Appendix 4.

During the verification process, Bureau Veritas aim to show that all final modelled NO₂ concentrations are within 25% of the monitored values. 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 data.

The above factors were all investigated as part of the model verification process to minimise the uncertainties as much as practicable.

The model verification results are provided Table 5. Predicted road-NO_x concentrations were adjusted by a factor of 4.2. Overall, resulting predicted NO₂ concentrations are in good agreement with the monitoring data, as all adjusted NO₂ concentrations are within 25% of the monitored concentrations, and predicted results at 5 sites out of 8 are within 10% of the monitoring results.

The highest difference between modelled and monitored data is observed at site 14. It is important to note that only 7 months monitoring data was available from this site in 2008, hence, the results were annualised to obtain the annual mean concentration. This would result in additional uncertainty in the monitoring data.

Especially, the model correctly predicts the exceedences monitored in Moor Street (sites 14 and 15) and the high NO₂ levels monitored in Stanley Street (site 13), where both predicted and monitoring results are very close to the AQS objective.

Table 5 – Model Verification Results

Site ID	Site Location	Monitored NO ₂ 2008 (µg/m ³)	Predicted Total NO ₂ 2008 (µg/m ³)	Difference Predicted / Monitored (µg/m ³)	Difference Predicted / Monitored (%)
11	14 Wigan Road	34.0	33.8	-0.1	-0.4%
12	31 Knowsley Road	23.5	27.3	3.8	16.3%
13	41 Stanley Street	39.5	39.3	-0.2	-0.6%
14	55 Moor Street	40.3	47.3	7.1	17.5%
15	50 Moor Street	52.7	46.8	-5.9	-11.2%
17	19b St Helens Road	29.2	27.6	-1.7	-5.8%
18	Beaconsfield Court	31.4	28.7	-2.7	-8.6%
19	16 St Helens Road	24.5	25.5	1.0	4.0%
Summary					
Number of Sites	Within ±10%			5	
	Between ± 10-25%			3	
	Exceeds ±25%			0	
	Total			8	

In bold: exceedence of NO₂ annual mean AQS objective

4.2 Modelled NO₂ Concentrations

Annual average NO₂ concentrations were predicted for the baseline year 2008 and future year 2010 at a number of specific receptors representing locations relevant of public exposure, located at the facade of properties (see Figure 7 Appendix 2). Additionally, predictions were made on a grid of receptors across the assessment area to produce an NO₂ concentration contour map for year 2008. All results were predicted at 1.5m from the ground, apart from a few specific receptors representing residential properties at first floor level in St Helen's Road and Moor Street, which were set to 4.5m. However, a conservative approach would be to include all properties falling within the 36µg/m³ concentration contour to account for potential modelling uncertainties.

Table 6 summarises the predicted NO₂ results at these receptors. NO₂ concentration contours are also illustrated in Figure 8 and Figure 9 Appendix 3.

The dispersion modelling confirms that the NO₂ annual mean AQS objective is likely to be exceeded at the façade of properties in Moor Street, as shown by results at receptors MoorSt_1 and MoorSt_2, where the model predicts NO₂ concentrations just above 45µg/m³ for 2008.

NO₂ concentrations at properties along Wigan Road and Stanley Street, in the area close to the junction with Moor Street, are predicted to be around 35-36µg/m³ (receptors WiganRd_1, WiganRd_3, StanleySt_2), which is below but close to the AQS objective.

An exceedence of the annual mean NO₂ is predicted to be unlikely at properties along Knowsley Road, St Helen's Road, and Park Road, as the model typically predicts NO₂ concentration below 30µg/m³.

Predicted results for year 2010 show an average decrease of about 2µg/m³ to 4µg/m³ for all modelled sensitive receptors. The AQS objective is still likely to be exceeded by this date in Moor Street, with concentrations predicted to be around 41-42µg/m³ at receptors MoorSt_1 and MoorSt_2.

Overall, the results confirm the need to declare an Air Quality Management Area in Moor Street for NO₂. The AQMA should encompass all residential properties in Moor Street, as well as the

properties in Stanley Street close to the junction with Moor Street/Wigan Road, which fall within the 40µg/m³ NO₂ concentration contour, as shown in Figure 9. However, a conservative approach would be to include all properties falling within the 36µg/m³ concentration contour to account for potential modelling uncertainties.

Table 6 – Predicted NO₂ Annual Mean Concentrations – Specific Receptors

Receptor ID	X(m)	Y(m)	Z(m)	NO ₂ 2008 (µg/m ³)	NO ₂ 2010 (µg/m ³)
KnowsleyRd_1	341696	408107	1.5	28.7	25.9
KnowsleyRd_2	341716	408080	1.5	28.5	25.7
KnowsleyRd_3	341695	408048	1.5	28.0	25.2
MoorSt_1	341647	408156	1.5	46.0	42.2
MoorSt_2	341686	408156	4.5 ⁽¹⁾	45.2	41.5
ParkRd_1	341402	408108	1.5	28.8	26.1
StanleySt_1	341706	408207	1.5	29.7	26.7
StanleySt_2	341731	408216	1.5	35.4	32.0
StanleySt_3	341749	408279	1.5	34.4	31.1
StanleySt_4	341722	408266	1.5	27.7	24.9
StHelensRd_1	341584	408089	1.5	24.8	22.4
StHelensRd_2	341581	408065	1.5	27.5	24.8
StHelensRd_3	341613	408072	1.5	25.8	23.3
StHelensRd_4	341624	408036	1.5	25.6	23.0
StHelensRd_5	341606	408142	4.5 ⁽¹⁾	22.6	20.4
StHelensRd_6	341609	408157	4.5 ⁽¹⁾	23.5	21.1
StHelensRd_7	341640	407927	1.5	24.1	21.6
WiganRd_1	341735	408166	1.5	36.9	33.5
WiganRd_2	341828	408154	1.5	27.7	24.9
WiganRd_3	341861	408146	1.5	35.3	32.0
WiganRd_4	341904	408135	1.5	24.9	22.4
WiganRd_5	341979	408166	1.5	24.9	22.5

In bold, exceedence of the NO₂ annual mean AQS objective (40µg/m³)

(1) Ground floor commercial premises - 1st floor residential

4.3 Source Apportionment

The breakdown of vehicle classification was taken into account in the model set-up. This allowed determining NO_x source apportionment at specific (worst case) receptor, MoorSt_1, within the proposed AQMA. The source apportionment was carried out for the following vehicle classes: cars, Light Goods Vehicles (LGVs), buses and Heavy Goods Vehicles (HGVs). To enable source apportionment of the background contribution, the modelled maps from the air quality archive have been utilised, as these incorporate a break down of background concentrations of NO_x by source. Proportions of each background source category have been used to categorise the total background NO_x and NO₂ in the assessment areas. The 1 x 1km grid square relevant to the receptor was x=341500, y=408500.

Table 7 and Table 8 summarise the results at (worst case) receptor representing public exposure in the proposed AQMA. The source apportionment indicates that:

- Road traffic emissions are the main contributor to NO_x, as these account for about 84% of the total NO_x concentration;
- Of the road traffic sources, cars and buses contribute about 28% each to the total NO_x concentration followed by more than 19% by HGVs;
- The contributions from buses and HGVs are disproportionately high as these only make about 4% and 2% respectively of the fleet on Moor Street.

Table 7 - Source Apportionment of NO_x Concentrations at Worst-case Specific Receptor

AQMA	Moor Street
Receptor (Maximum modelled concentration)	MoorSt_1
Total NO _x 2008 in µg/m ³ (Total Background + Local Road Source)	113.74
NO _x Total Background (Local + Regional) in µg/m ³	18.55
NO _x Local Background in µg/m ³	12.47
▪ <i>Includes: Road sources</i>	6.35
▪ <i>Industry (combustion in industry, energy production, extraction of fossil fuel, and waste)</i>	1.05
▪ <i>Domestic</i>	3.28
▪ <i>Aircraft</i>	0.00
▪ <i>Rail</i>	0.07
▪ <i>Other (ships, offroad and other emissions)</i>	1.2
▪ <i>Point sources</i>	0.5
NO _x Regional Background in µg/m ³	6.1
Local Road Source Contributions (cars+LGVs+buses+HGVs) in µg/m ³	95.2
▪ NO _x Cars	32.3
▪ NO _x LGVs	8.8
▪ NO _x Buses	32.0
▪ NO _x HGVs	22.1
% Local background	11.0
% Regional background	5.3
% Road traffic	83.7
▪ % due to Cars	28.4
▪ % due to LGVs	7.8
▪ % due to Buses	28.1
▪ % due to HGVs	19.4
▪ % Cars contribution of total road traffic	33.9
▪ % LGVs contribution of total road traffic	9.3
▪ % Buses contribution of total road traffic	33.6
▪ % HGVs contribution of total road traffic	23.2

Table 8 - Source Apportionment of NO₂ Concentrations at at Worst-case Specific Receptor

AQMA	Moor Street
Receptor (Maximum modelled concentration)	MoorSt_1
Total NO ₂ 2008 µg/m ³ (Total Background + Local Road Source Contributions)	46.0
NO ₂ Total Background (Local + Regional)	15.1
▪ NO ₂ Local Background	10.2
▪ NO ₂ Regional Background	4.9
Local Road Source Contributions (cars+LGVs+buses+HGVs) in µg/m ³	30.9
▪ NO ₂ Cars	10.5
▪ NO ₂ LGVs	2.9
▪ NO ₂ Buses	10.4
▪ NO ₂ HGVs	7.2
% Local background	22.1
% Regional background	10.8
% Road traffic	67.2
▪ % due to Cars	22.8
▪ % due to LGVs	6.2
▪ % due to Buses	22.5
▪ % due to HGVs	15.6
▪ % Cars contribution of total road traffic	33.9
▪ % LGVs contribution of total road traffic	9.3
▪ % Buses contribution of total road traffic	33.6
▪ % HGVs contribution of total road traffic	23.2

4.4 NO_x Reduction

A requirement of the Further Assessment is to determine the amount of NO₂ reduction required at the worst-case receptor within an AQMA. This approach highlights the maximum reduction in NO₂ required (as NO_x, in µg/m³) 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 NO₂ reduction was to determine the levels of NO_x for the highest concentration predicted at sensitive receptor relevant of public exposure. The results are shown in Table 9.

In order to determine the required reduction in NO_x, the NO₂ annual mean AQS objective of 40 µg/m³ was calculated to be equivalent to an 88.6 µg/m³ NO_x concentration (based on local background NO_x and the latest NO_x/NO₂ converter).

The maximum predicted NO_x reduction required within the Moor Street AQMA to comply with the NO₂ AQS objective is 24.4 µg/m³ (equivalent to an 21.6% improvement in NO_x). This equates to a 6.0 µg/m³ reduction in NO₂ (equivalent to 13.0% improvement in NO₂).

Consequently, the formulation of the Action Plan should aim to reduce the levels of NO_x/NO₂ within the Moor Street AQMA by this amount.

Table 9 - Required NO_x and NO₂ Reduction

Year	Receptor location	Modelled NO _x (µg/m ³)	NO _x (equivalent to 40µg/m ³ NO ₂) µg/m ³	Reduction NO _x required (µg/m ³)	% Reduction NO _x	Modelled NO ₂ (µg/m ³)	NO ₂ AQS objective (µg/m ³)	Reduction NO ₂ required (µg/m ³)	% Reduction NO ₂
2008	MoorSt_1	113.0	88.6	24.4	21.6	46.0	40.0	6.0	13.0

4.5 Date By Which The Objectives Should Be Met

As recommended in Technical Guidance LAQM.TG(09), the Further Assessment should provide an indication of the date by which the objectives are expected to be met.

This date has been estimated from the highest NO₂ annual mean monitored in the Moor Street AQMA, projected to future years.

Concentrations in future years were estimated based on the new roadside NO₂ projection factors provided in the new Technical Guidance LAQM.TG(09) and using the 2008 NO₂ concentration modelled at MoorSt_1 receptor in Moor Street. Results are provided in Table 10 below.

Based on this methodology, the NO₂ annual mean AQS objective is expected to be met by 2012. This date is only indicative, as based on national projection factors (excluding London), and therefore should be taken with caution. Moreover, this does not include potential reduction in NO₂ levels due to implementing the mitigation measures that would be presented in the Air Quality Action Plan.

Table 10 – Projected NO₂ Annual Mean for Future Years at Worst-Case Site

Location	Monitored NO ₂ Annual Mean 2008 (µg/m ³)	Projected NO ₂ Annual Mean (µg/m ³)			
		2009	2010	2011	2012
MoorSt_1	46.0	44.4	42.4	40.7	39.1

In bold, exceedence of the NO₂ annual mean AQS objective (40µg/m³)

4.6 Exposure Assessment

The new technical guidance requires local authorities to estimate the number of people exposed to pollutant concentrations above the relevant air quality objectives. The address database provided by the Council was used in the Geographical Information Systems (GIS) to determine the number of properties within the area of exceedence for the NO₂ annual mean objective. The Council then identified the residential properties among these and the number of people living in these premises. The summary of the exposure data is provided in Table 11.

Table 11 – Summary of Exposure Assessment

	Number
Total properties within area of exceedence	22
Residential properties within area of exceedence	10
People residing in residential properties	14

5 Conclusions and Recommendations

As part of the Local Air Quality Management (LAQM) regime, a Further Assessment based on detailed dispersion modelling has been carried out for the proposed Moor Street AQMA in Ormskirk, West Lancashire. The AQMA has been proposed for nitrogen dioxide (NO₂) in 2008 due to exceedences of the NO₂ annual mean Air Quality Strategy objective.

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

This assessment is based on advanced atmospheric dispersion modelling of traffic emissions of NO_x. The assessment has used updated background pollutant concentrations, monitoring data, traffic and meteorological data for the year 2008.

Source apportionment of pollutant contribution has been carried out to determine contributions of vehicle emissions and other sources to NO_x/NO₂ concentrations in the AQMA. The NO_x reduction to comply with the NO₂ annual mean AQS objective has been calculated based on the highest concentration results at sensitive receptors relevant of public exposure (facades of properties).

The following are the findings of this Further Assessment:

- The source apportionment shows that road traffic is the main contributor to the overall NO_x levels in the AQMA, as it contributes about 84%. Of the road traffic emissions, heavy-duty vehicles, HGVs and buses and coaches, are the most significant contributors, given the proportion of the vehicle fleet they represent;
- The exposure assessment shows that there are seven residential properties within the area of exceedence, which currently house 10 residents;
- The maximum predicted NO_x reduction required within the Moor Street AQMA to comply with the NO₂ AQS objective is 24.4µg/m³ (equivalent to an 21.6% improvement in NO_x. This equates to a 6.0µg/m³ reduction in NO₂ (equivalent to 13.0% improvement in NO₂). Consequently, measures formulated in the Air Quality Action Plan should aim to reduce the levels of NO_x / NO₂ within the AQMA by this amount;
- The modelled results for 2010 indicate that the annual mean NO₂ objective would continue to exceed within the AQMA. This needs to be considered in the context of the baseline year being modelled (model verification is based on 2008 monitoring results, which were lower compared to 2006 and 2007; likely due to meteorological influences) and model uncertainty (average uncertainty has been calculated as 3µg/m³); and
- Using roadside nitrogen dioxide projection factors from the Technical Guidance LAQM.TG(09), it is predicted that the annual mean objective would be met at this monitoring location by 2011 based on 2008 data. For 2007 monitoring results, the projection indicates that the compliance would not be achieved until 2013.

Appendices

Appendix 1

Hourly Traffic Profiles

Figure 2 - Hourly Traffic Profile for Stanley Street

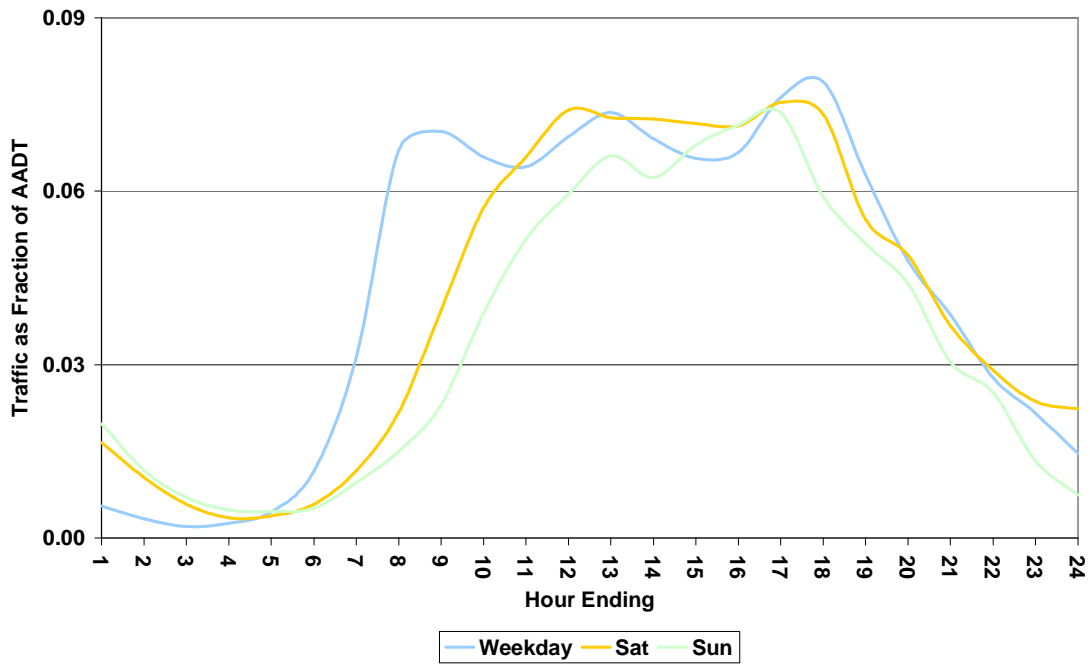


Figure 3 - Hourly Traffic Profile for Wigan Road

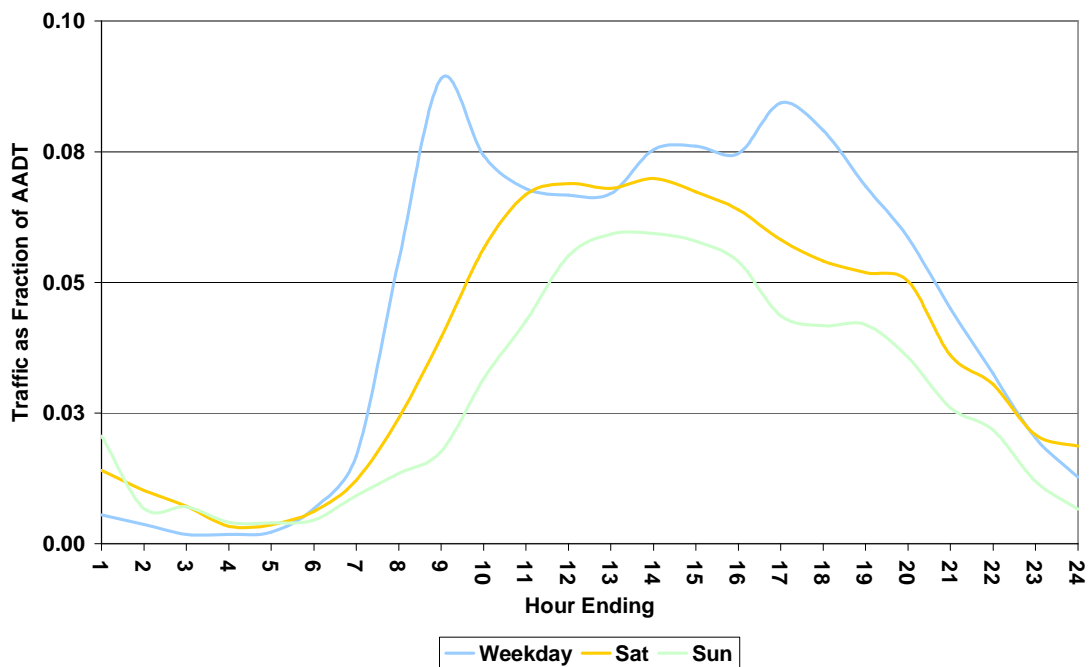


Figure 4 - Hourly Traffic Profile for Park Road

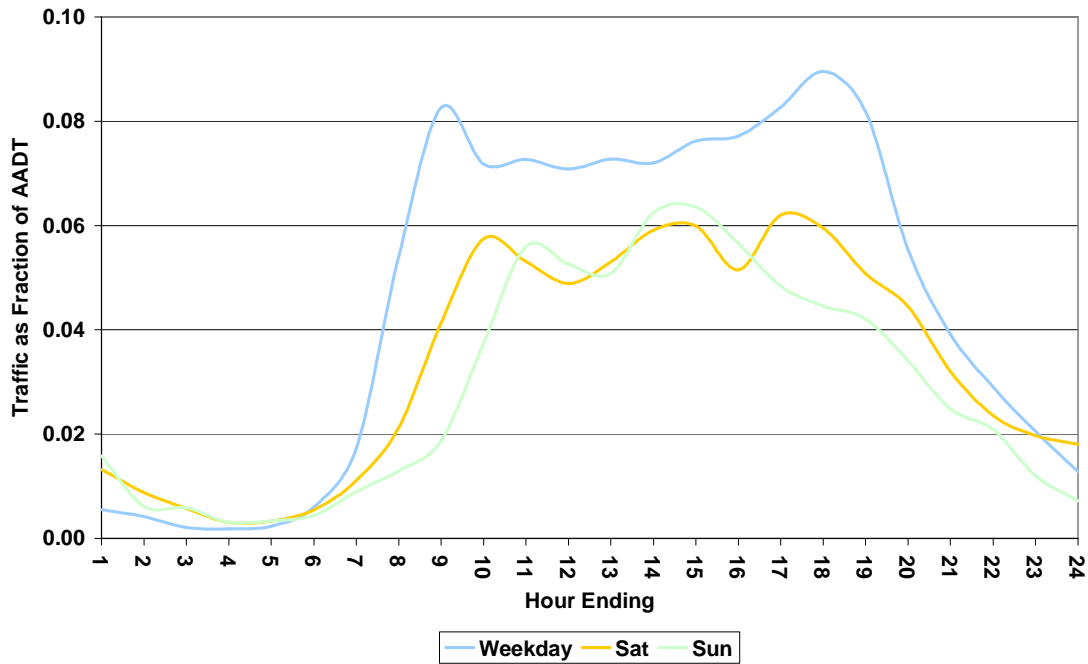


Figure 5 - Hourly Traffic Profile for Moor Street

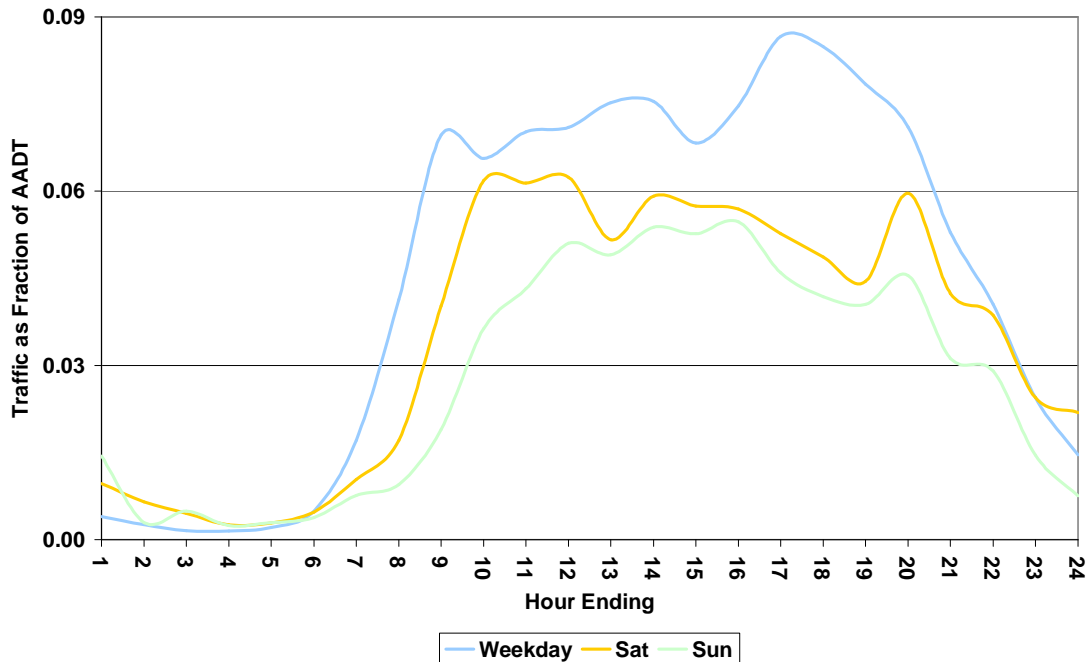
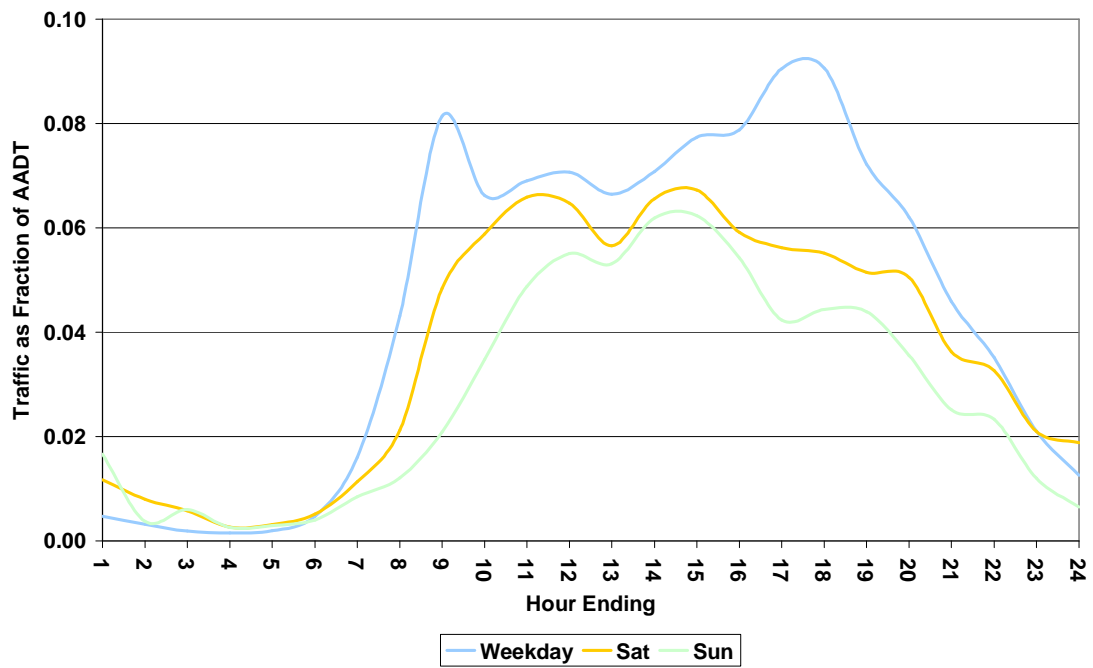
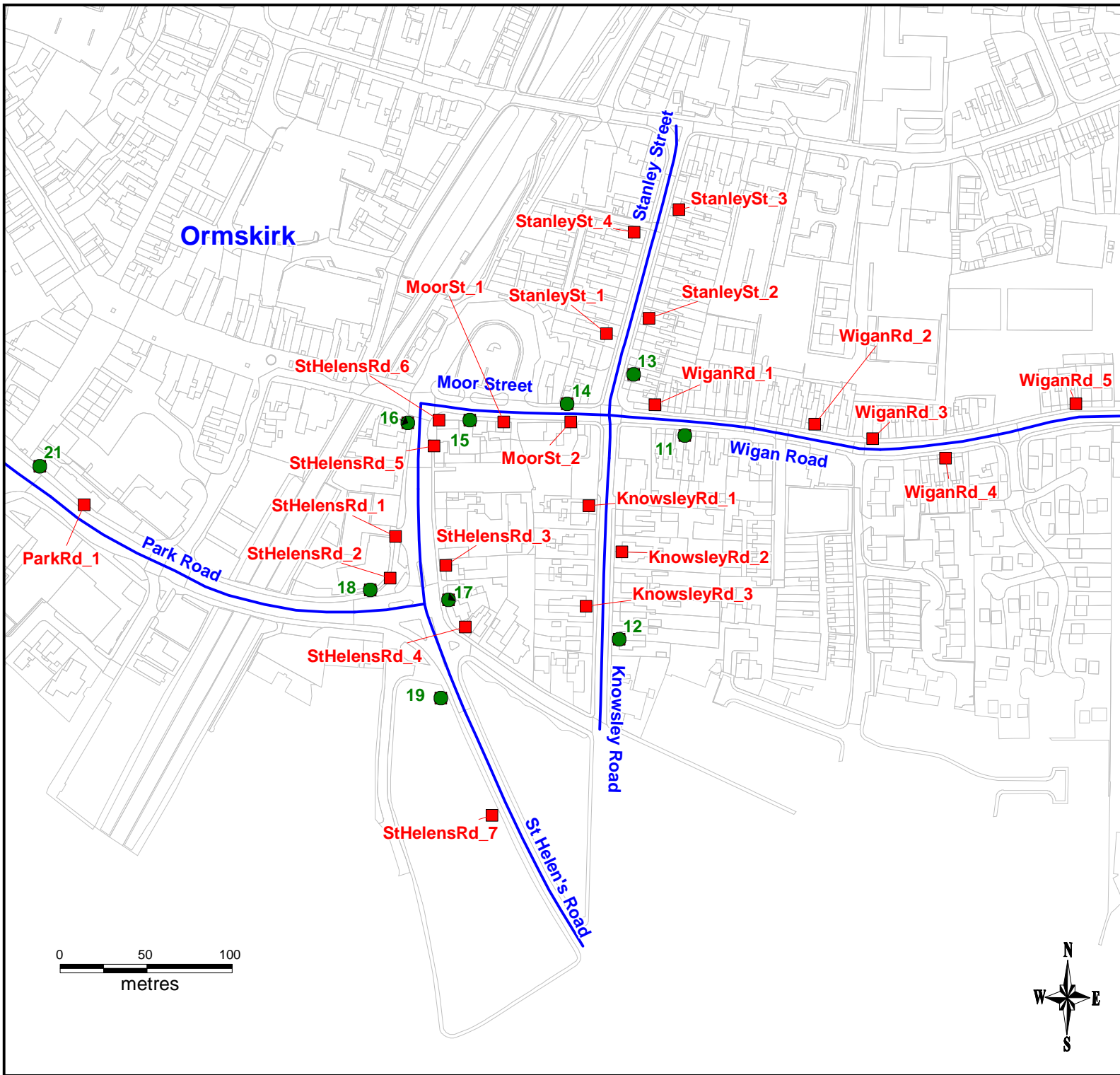


Figure 6 - Hourly Traffic Profile for St. Helens Road



Appendix 2

Modelled Roads Monitoring Sites and Receptors Location



Legend

- NO2 Diffusion Tube
- Specific Receptor
- Modelled Road

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Facsimile: 0207 902 6149

Location **Ormskirk - West Lancashire**

Title **Modelled Roads and Receptors**

By EC	Checked LL	Approved LL
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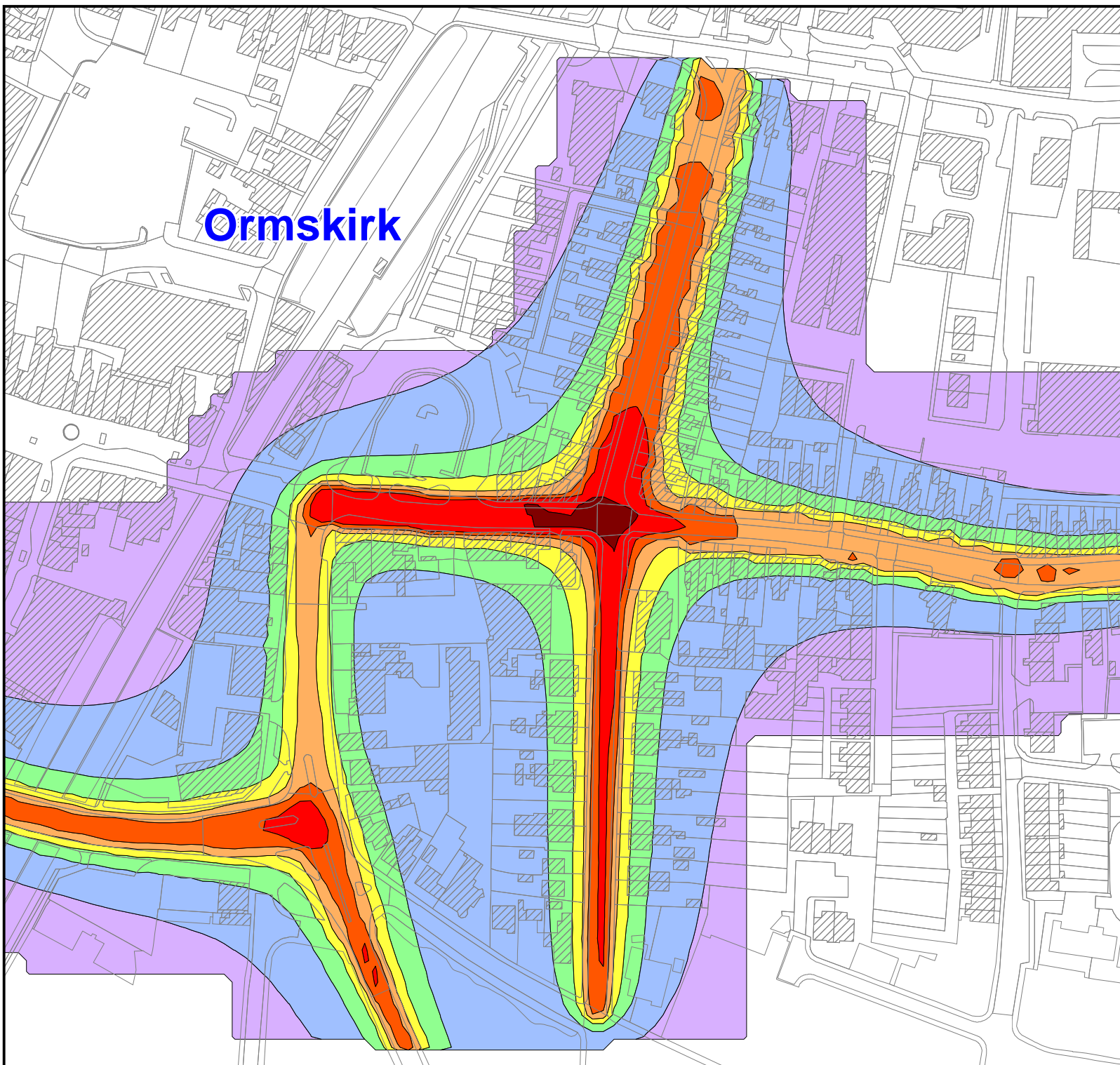
Scale N.T.S.	Date July 2009
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Job No. AGGX1406502	Fig. No. Figure 7
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Appendix 3

ADMS Modelled Results

Ormskirk



**NO2 Concentration Contours
2008 - ug/m3**

- < 20
- 20 to 24
- 24 to 28
- 28 to 32
- 32 to 36
- 36 to 40
- 40 to 50
- > 50

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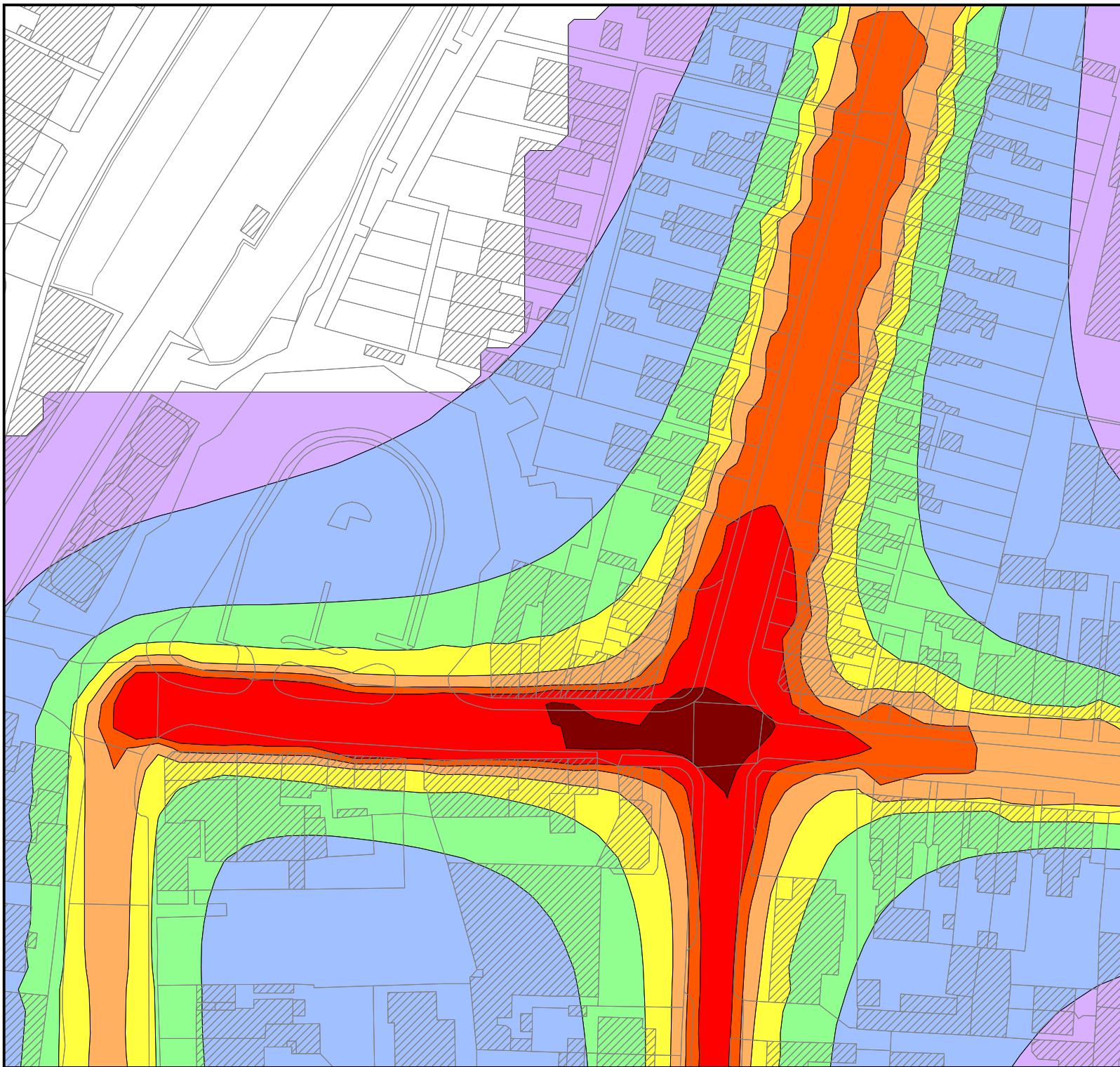
Location **Ormskirk - West Lancashire**

Title **Contours of NO2 Concentrations**

By EC	Checked LL	Approved LL
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Scale N.T.S.	Date July 2009
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Job No. AGGX1406502	Fig. No. Figure 8
-------------------------------	-----------------------------



**NO2 Concentration Contours
2008 - ug/m3**

- < 20
- 20 to 24
- 24 to 28
- 28 to 32
- 32 to 36
- 36 to 40
- 40 to 50
- > 50

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Location **Ormskirk - West Lancashire**

Title **Contours of NO2 Concentrations
Moor Street / Stanley Street Junction**

By EC	Checked LL	Approved LL
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Scale N.T.S.	Date July 2009
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Job No. AGGX1406502	Fig. No. Figure 9
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Appendix 4

Model Verification

Table 12 – Model Verification – Moor Street, Ormskirk – Based on 2008 Monitoring Data

Site ID	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/m ³)	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]
11	15.1	18.5	67.7	49.2	11.6	4.3	4.21	48.6	67.2	33.8	34.0	-0.4%
12			38.1	19.5	7.0	2.8		29.5	48.0	27.3	23.5	16.3%
13			86.9	68.3	16.0	4.3		67.5	86.0	39.3	39.5	-0.6%
14			89.9	71.3	24.1	3.0		101.5	120.1	47.3	40.3	17.5%
15			147.4	128.8	23.5	5.5		99.0	117.6	46.8	52.7	-11.2%
17			53.2	34.7	7.2	4.8		30.1	48.7	27.6	29.2	-5.8%
18			59.6	41.1	7.9	5.2		33.3	51.9	28.7	31.4	-8.6%
19			40.6	22.0	5.9	3.8		24.6	43.2	25.5	24.5	4.0%

In bold: exceedence of NO₂ annual mean AQS objective

Figure 10 - Adjusted Modelled NO₂ vs. Monitored NO₂

