

DERRY CITY COUNCIL

LAQM DETAILED ASSESSMENT 2010

BUNCRANA ROAD / RACECOURSE ROAD JUNCTION

BV/AQ/AGGX3995788/2651

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Executive Summary

Environment (Northern Ireland) Order 2002 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 2009 USA for Derry concluded that a Detailed Assessment was required at the junction of Buncrana and Racecourse Road due to monitored exceedences of the Air Quality Strategy (AQS) objective for annual mean NO₂. Bureau Veritas has been commissioned by Derry City Council to provide a review of air quality within the area of the junction.

The Detailed Assessment has been undertaken in accordance with Defra LAQM.TG (09)¹ Guidance methodologies and amended tools released in January 2010. The detailed assessment aims, through assessment of monitoring data and dispersion model predictions, to assess air quality at the junction of Buncrana Road and Racecourse Road to determine if an Air Quality Management Area (AQMA) is needed and to define the extent of exceedence of the NO₂ objective.

The findings of the Detailed Assessment are as follows:

- NO₂ diffusion tube data from 2009 indicates an exceedence of the NO₂ annual mean AQS objective at 5 Collon Terrace. Historical data from this site indicates air quality along this stretch of road may be an issue.
- With respect to the hourly NO₂ objective, there are no monitoring sites or modelled results showing annual mean NO₂ concentrations in excess of 60 µg/m³ at the junction and therefore it is unlikely that there will be any exceedences of the hourly NO₂ objective;
- Exceedences of the annual mean NO₂ objective were predicted through dispersion modelling along St Patrick's and Collon Terrace on Buncrana road. All properties along the two terraces are likely to be within 10% of the objective and the contour map confirms exceedence at the façade of a number of properties.
- As a result of these findings it is recommended that the council declare an AQMA for the NO₂ annual mean encompassing properties near the junction of Buncrana Road and Racecourse Road.

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

1 Introduction

1.1 Project Background

Environment (Northern Ireland) Order 2002 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. This Detailed Assessment is being carried out to review air quality within the Buncrana Road / Racecourse Road junction area after exceedences of the air quality objectives were identified in the 2009 Updating & Screening Assessment.

1.2 Legislative Background

The air quality objectives applicable to Local Air Quality Management (LAQM) in Northern Ireland are set out in the Air Quality Regulations (Northern Ireland) 2003, Statutory Rules of Northern Ireland 2003 (No. 342). The objectives are shown in Table 1.1. This table shows the objectives in units of microgrammes per cubic metre $\mu\text{g}/\text{m}^3$ (for carbon monoxide the units used are milligrammes per cubic metre, mg/m^3). Table 1.1 includes the number of permitted exceedences in any given year (where applicable).

Table 1 - Air Quality Objectives included in Regulations for the purpose of Local Air Quality Management in Northern Ireland

Pollutant	Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	$16.25 \mu\text{g}/\text{m}^3$	Running annual mean	31.12.2003
	$3.25 \mu\text{g}/\text{m}^3$	Running annual mean	31.12.2010
1,3-Butadiene	$2.25 \mu\text{g}/\text{m}^3$	Running annual mean	31.12.2003
Carbon monoxide	$10.0 \text{mg}/\text{m}^3$	Running 8-hour mean	31.12.2003
Lead	$0.5 \mu\text{g}/\text{m}^3$	Annual mean	31.12.2004
	$0.25 \mu\text{g}/\text{m}^3$	Annual mean	31.12.2008
Nitrogen dioxide	$200 \mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	$40 \mu\text{g}/\text{m}^3$	Annual mean	31.12.2005
Particles (PM ₁₀) (gravimetric)	$50 \mu\text{g}/\text{m}^3$, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	$40 \mu\text{g}/\text{m}^3$	Annual mean	31.12.2004
Sulphur dioxide	$350 \mu\text{g}/\text{m}^3$, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	$125 \mu\text{g}/\text{m}^3$, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	$266 \mu\text{g}/\text{m}^3$, 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, the Environment (Northern Ireland) Order 2002 Part III, all local/ district 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/ district 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 the AQS objectives.

The LAQM regime was first set down in the 1997 National Air Quality Strategy (NAQS)² and introduced the idea of local/ district 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))³ and Technical Guidance (LAQM.TG (09))⁴. The guidance lays down a progressive, but continuous, framework for the local/ district 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 and updated LAQM tools and emissions factors in 2010.

1.4 Summary of Review and Assessment in Derry City

Table 2 provides a summary of the previous reports completed by Derry City Council as part of the LAQM Review and Assessment process. An AQMA was declared in February 2005 at the Creggan Road / Infirmary Road junction in Derry following exceedence of the annual mean objective for NO₂.

Table 2 - Summary of Local Air Quality Management Review & Assessment reports

Report	Summary
2004 Detailed Air Quality Modelling of Domestic Fuel Use and Road Traffic Emissions in Derry (Stage 3)	Exceedences of the annual mean NO ₂ concentrations were modelled at the Creggan Road / Infirmary Road junction, and Derry City Council subsequently declared an AQMA in February 2005, and a draft Air Quality Action Plan was released in November 2006. The 2004 Detailed Assessment concluded that PM ₁₀ exceedences were not expected; however it was not possible to rule out potential exceedences of the SO ₂ or PM ₁₀ objectives due to the resolution of the modelling undertaken.
2005 Progress Report	The 2005 Progress Report provided a review of the most recent monitoring data within the local authority. Automatic monitoring of SO ₂ and PM ₁₀ at

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

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

Report	Summary
	Brandywell indicated a large drop in the number of 15-minute and daily mean exceedences, reflecting the decreased use of solid fuel in the area.
2006 Updating & Screening Assessment	<p>The Updating & Screening Assessment identified 2 locations to consider for the Detailed Assessment of NO₂: Dale's Corner and the Buncrana Road / Racecourse Road Junction.</p> <p>It was concluded that no further assessment was required for carbon monoxide, benzene, 1,3-butadiene, lead or sulphur dioxide, however assessment was required for PM₁₀ at a rural area near Claudy, and in the Culmore Point area.</p>
2007 Detailed Assessment and Further Assessment	<p>A Detailed Assessment was undertaken for Dale's Corner and Buncrana Road / Racecourse Road Junction following measured exceedence of the NO₂ annual mean objective. It was determined that a declaration of an AQMA at either location was not required as the modelling did not confirm exceedences of the air quality objectives at locations of relevant exposure.</p> <p>A Further Assessment was undertaken for the existing AQMA at Creggan Road / Infirmary Road, and it was concluded that there was a continuing need for the AQMA, though no extension was considered necessary.</p>
2008 Progress Report	Review of the most recent monitoring data recorded at the Creggan Road / Infirmary Road NO ₂ AQMA confirmed the continuing need for the AQMA. Decreases were seen in concentrations of SO ₂ . The Progress Report proposed that a new detailed dispersion modelling be undertaken at the Dale's Corner junction due to exceedences of the NO ₂ annual mean objective recorded at a new monitoring diffusion tube site at no.5 Glendermott Road
2008 Final Air Quality Action Plan	The final Air Quality Action Plan, released in September 2008, included detailed dispersion modelling to quantify the potential impact of various traffic measures which may be implemented to reduce air pollution in the area of the Creggan Road / Infirmary Road Junction. Proposals include the removal of HGVs on specific road links within the AQMA.
2008 Dale's Corner Detailed Assessment	The assessment confirmed that exceedences of the NO ₂ annual mean AQS objective were likely at the façade of properties along Glendermott Road and Limavady Road close to the junction and that an AQMA encompassing these properties should be declared.
2009 Updating & Screening Assessment	The Updating & Screening Assessment reviewed and assessed new monitoring data and potential new sources of pollutants within the area. There were no new or significantly changed sources identified which may cause potential exceedences of the AQS objectives. However, the assessment highlighted that a new Detailed Assessment was required with regard to NO ₂ at Buncrana Road / Racecourse Road junction based on updated monitoring data

1.5 Scope and Methodology of the Detailed Assessment

The scope of this assessment is to predict NO₂ concentrations at relevant receptor locations at the Buncrana Road / Racecourse Road junction for NO₂ with a view to determine if the declaration of an AQMA on this site is necessary.

The purpose of the Detailed Assessment is to provide the local authority with an opportunity to supplement the information they have gathered in their earlier Review and Assessment work and more accurately assess the impact of pollution sources on local receptors at identified hotspots through detailed dispersion modelling. Dispersion modelling can be used to predict concentrations over a wider area than can be monitored. It is important to ensure, as far as possible, that the results of modelling reflect the results from local monitoring sites across the assessment area and allow comparison of pollutant concentrations against the AQS objectives. This Detailed Assessment will identify with reasonable certainty whether or not pollutant concentrations are likely to exceed the AQS objectives and, if so, define the extent and magnitude of the exceedences.

Detailed dispersion modelling has been undertaken using the Cambridge Environmental Research Consultants (CERC) ADMS-Roads version 2.3 dispersion model using the latest Emission Factor Toolkit (EFT) released by Defra in 2010, based on updated vehicle emission factors published by Department for Transport (DfT) in 2009. Concentrations of NO₂ measured at roadside diffusion tube within the assessment areas in 2009 have been used to verify the model results.

The dispersion modelling was undertaken in accordance with the methodologies provided in the Technical Guidance (LAQM.TG (09)) for detailed and further assessments and amended tools released in 2010.

2 Baseline Information

2.1 Traffic Data

Derry City District Council provided updated manual and automatic traffic counts for 2009 for the roads in the assessment area. Data included the annual average daily traffic (AADT), speed data and breakdown of traffic flows into vehicle categories.

Speed was reduced near junctions to 20kph and along congested sections of the road by 10kph to account for stop/ start emissions. The traffic data used in this assessment are summarised in Appendix 1.

2.2 Air Quality Monitoring Data

2.2.1 Automatic Monitoring Data

There are three automatic monitoring sites installed in Derry, all outside the area of this detailed assessment. Therefore, the sites have not been used for model verification. However, the AURN (Automatic Urban and Rural Network) automatic monitoring site at Brooke Park, located 1.8 km south of the Buncrana Road/Racecourse Road junction, has been used for the background pollution data. Details of Brook Park are shown in Table 3.

Table 3 - Brooke Park Continuous Monitoring Results 2007 –2009

Location (NI OS Grid Coordinates)	Year	NO _x Annual Mean (µg/m ³)	NO ₂ Annual Mean (µg/m ³)	No. of NO ₂ Hourly Means > 200µg/m ³	% Data Capture for 2009
X 242962 Y 417217	2007	18.0	12.6	0	89
	2008	28.4	18.5	0	96
	2009	23.5	15.8	0	97

2.2.2 Nitrogen Dioxide Diffusion Tube Data

Table 4 provides details of non-automatic monitoring locations within the area of this Detailed Assessment. Non-automatic monitoring is undertaken using passive NO₂ diffusion tubes.

The Council monitored NO₂ at 36 sites across the city in 2009, many of which are either duplicate or triplicate sites. Four of these sites are in the location of this Detailed Assessment and are used in this study.

From October 2006 until December 2008 Bureau Veritas Laboratories prepared and analysed the diffusion tubes using the 10% TEA in water preparation. In accordance with the harmonisation of preparation and analysis of NO₂ diffusion tubes in the UK (AEA, 2008), Bureau Veritas changed their methodology to use 20% TEA in water in January 2009. Derry City Council recently (April 2009) switched to use the Gradko Laboratories for preparation and analysis of their NO₂ diffusion tubes.

Bias adjustment factors for 2007 and 2008 were taken from the 2009 Updating and Screening Assessment. Results from 2009 are calculated for April to December only due to the change in analytical laboratory and have been bias adjusted based on the local bias factor derived from the results of NO₂ diffusion tube sites co-located with the Dale's Corner automatic monitoring station. Location of the monitoring sites is provided in Figure A3.1 Appendix 3.

Table 4 - Diffusion Tube Results Used in Assessment

Site ID	Name	Within AQMA	X	Y	Data Capture 2009 %	NO ₂ Annual Average (µg/m ³ - Bias Adjusted)		
						2007 (Bias factor 0.88, national)	2008 (Bias factor, 0.83 national)	2009 (Bias factor, 0.93 local)
P1	53 Messines Park	No	243449	419013	75	27	21	27.3
P2	57 Messines Park	No	243418	419016	75	20	26	27.7
P3	19 St Patricks Terrace	No	243480	418970	75	20	42	36.4
P4	5 Collon Terrace	No	243519	418921	75	27	43	41.5

2.2.3 Background Concentrations

Local monitoring data and LAQM.TG (09) updated background pollutant maps were considered to determine appropriate NO_x and NO₂ background concentrations for this assessment. Table 5 shows the comparison of background concentrations from Brooke Park AURN continuous monitoring site and the nearest background maps 1km x 1km grid square. Brooke Park is around 1.8km from Buncrana Road / Racecourse road junction and is an urban background site. For this assessment the background concentrations from Brooke Park AURN continuous monitoring site have been used to be conservative. The data capture for NO₂ and NO_x was 86% in 2009, which is less than the recommended 90% data capture rate. Therefore, the data has been annualised for both pollutants. The AURN site has also been used to provide background concentrations in past reports thus providing a good level of continuity between assessments. The data from the past five years from Brooke Park is shown in Table 6 for information.

Table 5 - Background Concentrations (µg/m³)

Source	Location (NI OS Grid Coordinates)	Pollutant	2009 Background (µg/m ³)
Brooke Park AURN site	X 242962	NO _x	23.3 ^a
	Y 417217	NO ₂	15.8 ^a
LAQM Background maps	X 243096	NO _x	17.7
	Y 417402	NO ₂	12.8

a – Annualised

Table 6 - Monitoring Results at Brooke Park AURN Station.

Year	NO _x Annual Mean (µg/m ³)	NO ₂ Annual Mean (µg/m ³)	Data Capture (%)
2004	22	15	92
2005	18	12	92
2006	19	12	88
2007	18	13	89
2008	28	18	96
2009	23.3 ^a	15.8 ^a	87

a – Annualised

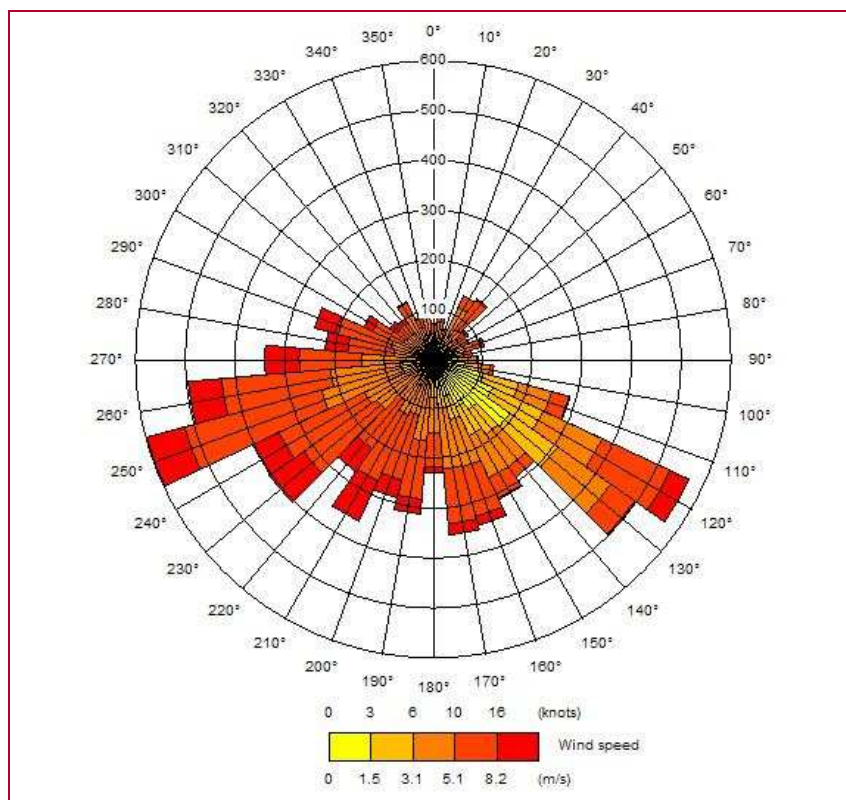
3 Dispersion Modelling Methodology

Detailed dispersion modelling of NO_x was undertaken based on ADMS-Roads (version 2.3) atmospheric dispersion model from Cambridge Environmental Research Consultants (CERC). Conversion to NO₂ was based on the updated NO_x/NO₂ conversion model released by Defra in January 2010 as part of the updated LAQM.TG (09) tools⁵.

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.

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 2009 from the closest Met Office station (Ballykelly, 10 miles North East of Derry) has been used in this assessment. The wind rose derived from meteorological data is shown in Figure 1.

Figure 1 – Ballykelly 2009 Hourly Sequential Meteorological Data



⁵ <http://laqm1.defra.gov.uk/review/tools/monitoring/calculator.php>

4 Results

4.1 Model Verification and Adjustment

Model verification was carried out prior to predicting concentrations within the assessment area at sensitive receptor locations. 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 NO₂ monitoring data from diffusion tubes in the assessment area. Predicted NO₂ was derived based on the latest NO_x/NO₂ conversion model released by Defra in January 2010⁵.

During the verification process, Bureau Veritas aim to ascertain whether all final modelled NO₂ concentrations are within 25% of the monitored NO₂ 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 7.

Overall, predicted concentrations are in good agreement with monitoring data, as the majority of modelled NO₂ results are within ±10% of monitored concentrations. The full verification methodology is shown in Appendix 2.

Table 7 – Model Verification Results at Monitoring Sites in the Assessment Area

Site	Within AQMA (yes/no)	Modelled NO ₂ 2009 (µg/m ³)	Monitored NO ₂ 2009 (µg/m ³)	Difference (Modelled - Monitored) (µg/m ³)	Percentage Difference
P1	No	30.6	27.3	3.3	12.2%
P2	No	30.4	27.7	2.7	9.8%
P3	No	37.0	36.4	0.6	1.6%
P4	No	38.0	41.5	-3.5	-8.5%
Summary					
Number of sites	Within ±10%			3	
	Between ± 10-25%			1	
	Exceeds ±25%			0	
	Total			4	

In bold: exceedence of NO₂ annual mean AQS objective

4.2 Modelled NO₂ Concentrations

Annual average NO₂ concentrations were predicted for 2009 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 NO₂ concentration contour maps for year 2009. NO₂ 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 8 below. The location of the specific receptors is provided in Figure A3.1 Appendix 3. NO₂ concentration contours for 2009 are also illustrated in Appendix 4.

The model predicted exceedences of the AQS objective for annual NO₂ in 2009 at a number of properties along St Patrick's Terrace and Collon Terrace on Buncrana Road. Concentrations of NO₂ at specific receptors were predicted to be over the annual mean AQS objective at Number 12 Collon Terrace and at number 7 St Patrick's Terrace. Other properties along St Patrick's and Collon Terrace are all very close to the AQS for annual NO₂. The model is slightly under predicting NO₂ in this area as seen in the verification, suggesting that all facades along these two terraces would be within 10% or above the objective (i.e. 36µg/m³ or above). Figure A4.1 in Appendix 4 confirms that the area of exceedence would encompass properties along St Patrick's and Collon terrace.

Based on these results, it is therefore recommended that the Council declare an Air Quality Management Area for NO₂ at the junction of Buncrana Road and Racecourse Road, encompassing the properties described above.

Analysis of UK continuous NO₂ monitoring data has shown that it is unlikely that the hourly mean NO₂ objective, of 18 hourly means over 200µg/m³, would be exceeded where the annual mean objective is below 60µg/m³⁶. The maximum predicted annual average for NO₂ is below 60µg/m³; therefore, the NO₂ hourly mean AQS objective is expected to be met at all relevant locations near the junction.

Table 8 – Predicted NO₂ Concentrations at Specific Receptors

ID	Name	X	Y	Z	Total Modelled NO ₂ 2009 µg/m ³
1	15 St Patricks Terrace	243496.2	418958.9	1.5	37.2
2	12 Collon Terrace	243494.9	418937	1.5	40.0
3	7 St Patricks Terrace	243528.8	418937.3	1.5	40.5
4	2 St Patricks Terrace	243549.1	418924	1.5	39.2
5	61 Buncrana Road	243398.8	419025.5	1.5	31.1
6	14 Buncrana Road	243367.7	419012.3	1.5	24.5
7	22 St Patricks Terrace	243471.6	418981.9	1.5	38.5
8	4 Messines Terrace	243486.2	419031.2	1.5	30.0
9	47 Racecourse Road	243470.3	419063.9	1.5	27.1
10	2 Pennyburn	243428.8	418903.4	1.5	19.8
11	2 Maybrooke Terrace	243595.9	418893.4	1.5	35.6
12	53 Racecourse Road	243449.7	419013	1.5	31.3
13	55 Buncrana Road	243423.8	419010.2	1.5	33.0
14	10 Buncrana Road	243390.5	418993.9	1.5	24.7
15	9 Racecourse Road	243506.6	419091.7	1.5	26.6
16	1 Buncrana Road	243546.7	418902.4	1.5	38.0
17	65 Buncrana Road	243341.6	419063.7	1.5	29.3

⁶ AEAT (May 2008) Analysis of the relationship between annual mean nitrogen dioxide concentration and exceedences of the 1-hour mean AQS Objective. A report produced for the Department for Environment, Food and Rural Affairs, the Scottish Government, the Welsh Assembly Government and the Department of the Environment in Northern Ireland.

5 Conclusions and Recommendations

As part of the Local Air Quality Management (LAQM) regime, a Detailed Assessment for nitrogen dioxide (NO₂) was carried out for the junction of Buncrana Road and Racecourse Road in Derry. This Detailed Assessment is being undertaken as part of the Review and Assessment of air quality at the junction to inform the council if declaration of an AQMA should be considered.

This assessment was based on advanced atmospheric dispersion modelling of NO_x traffic emissions, relying on updated background pollutant concentrations, air quality monitoring, traffic and meteorological data for the year 2009.

The findings of the Detailed Assessment are as follows:

- NO₂ diffusion tube data from 2009 indicates an exceedence of the NO₂ annual mean AQS objective at 5 Collon Terrace. Historical data from this site indicates air quality along this stretch of road may be an issue.
- With respect to the hourly NO₂ objective, there are no monitoring sites or modelled results showing an annual mean NO₂ concentrations in excess of 60 µg/m³ at or near the junction and therefore it is unlikely that there will be any exceedences of the hourly NO₂ objective;
- Exceedences of the annual mean NO₂ objective were predicted through dispersion modelling along St Patrick's and Collon Terrace on Buncrana road. Most properties along the two terraces are close to the objective (i.e. 36µg/m³ or above) and the contour map confirms exceedence at the façade of a number of properties. As a result of these findings it is recommended that the Council declare an Air Quality Assessment Area for the NO₂ annual mean encompassing the properties near the junction of Buncrana Road and Racecourse Road. The extents of the AQMA should be based on the results of the modelling as provided in this assessment. It is also recommended that the council extend their monitoring in the area to support future LAQM work.

Appendix 1 – Traffic Data

Table A1-1 – Derry Detailed Assessment Buncrana Road and Racecourse Road Traffic Data

Road Link	Road	%HDV	2009 AADT
Bun_DEHL	Buncrana Road (North)	2.9	12417
Buncrana_Rd_N	Buncrana Road (North)	2.9	16275
Rac_DBCG	Racecourse Road (West)	7.1	2496
Racecourse_W	Racecourse Road (West)	7.3	4224
Bun_CLME	Buncrana Road (South)	3.4	11997
Buncrana_Rd_S	Buncrana Road (South)	3.8	16275
Rac_GHMB	Racecourse Road (East)	4.2	7987
Racecourse_E	Racecourse Road (East)	3.3	14395
Turn_K	Buncrana Road (South)	10.8	416
Turn_J	Racecourse Road (East)	2.2	3863
Turn_F	Buncrana Road (North)	2.0	2545
Turn_A	Racecourse Road (West)	4.6	1313

Traffic data for the Detailed Assessment was derived using the manual counts and Automatic Traffic Count (ATC) data provided by the council.

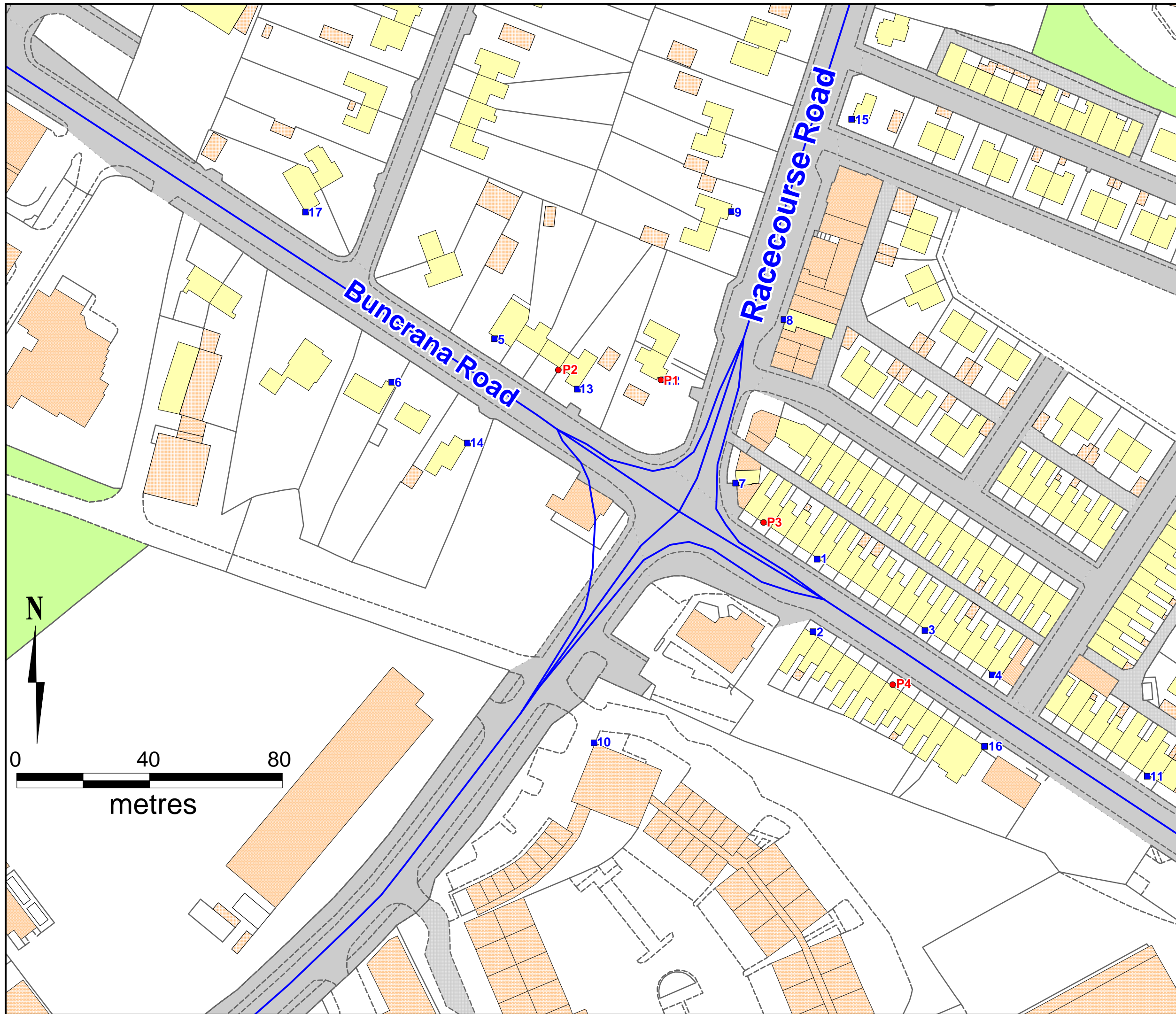
Appendix 2 – Model Verification

Table A2-1 – Model Verification: Derry Detailed Assessment Buncrana / Racecourse Road

Site	Background NO ₂ (µg/m ³)	Background 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]
P1	15.8	23.3	26.0	7.7	3.4	4.488	34.5	57.8	30.6	27.3	12.2%
P2			27.0	7.6	3.6		34.0	57.3	30.4	27.7	9.8%
P3			50.7	11.7	4.3		52.5	75.8	37.0	36.4	1.6%
P4			66.7	12.3	5.4		55.4	78.7	38.0	41.5	-8.5%

Appendix 3 – Modelled Area

OS maps provided for this assessment did not show the new road layout recently completed at the Buncrana Road / Racecourse Road junction. The new road layout was provided by the council and the model set up was based on this new junction layout. The new road layout is shown in Figure A3.2 in Appendix 3.



- Legend**
- Modelled Road
 - Modelled Receptor
 - NO2 Diffusion Tube

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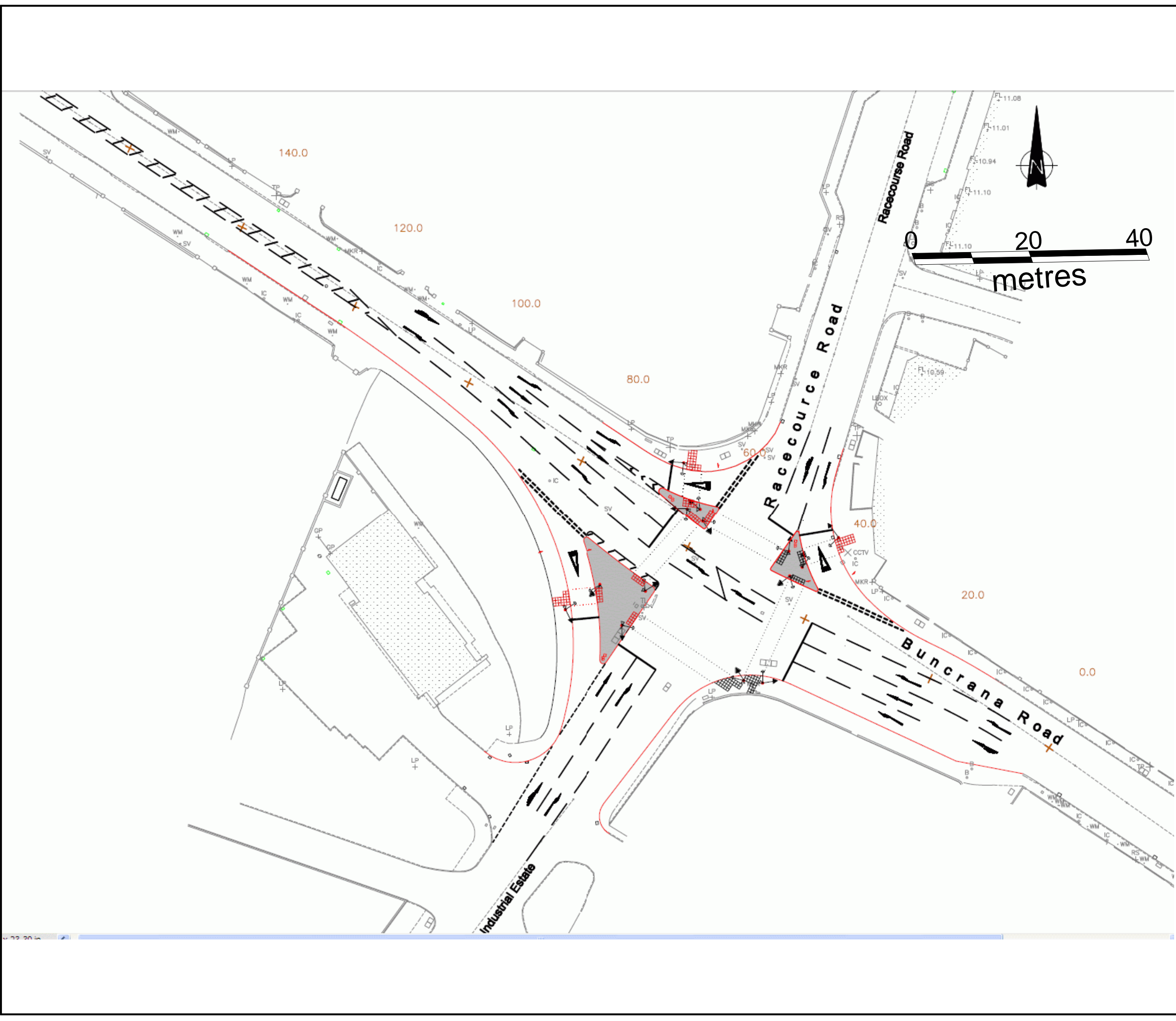
Location **Buncrana Road / Racecourse Road Junction - Derry**

Title **Modelled Area**

By JB	Checked JB	Approved EC
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Scale N.T.S.	Date August 2010
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Job No. AGGX3995788	Fig. No. Figure A3.1
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No Window

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Location **Bunrana Road / Racecourse Road Junction - Derry**

Title **New junction layout**

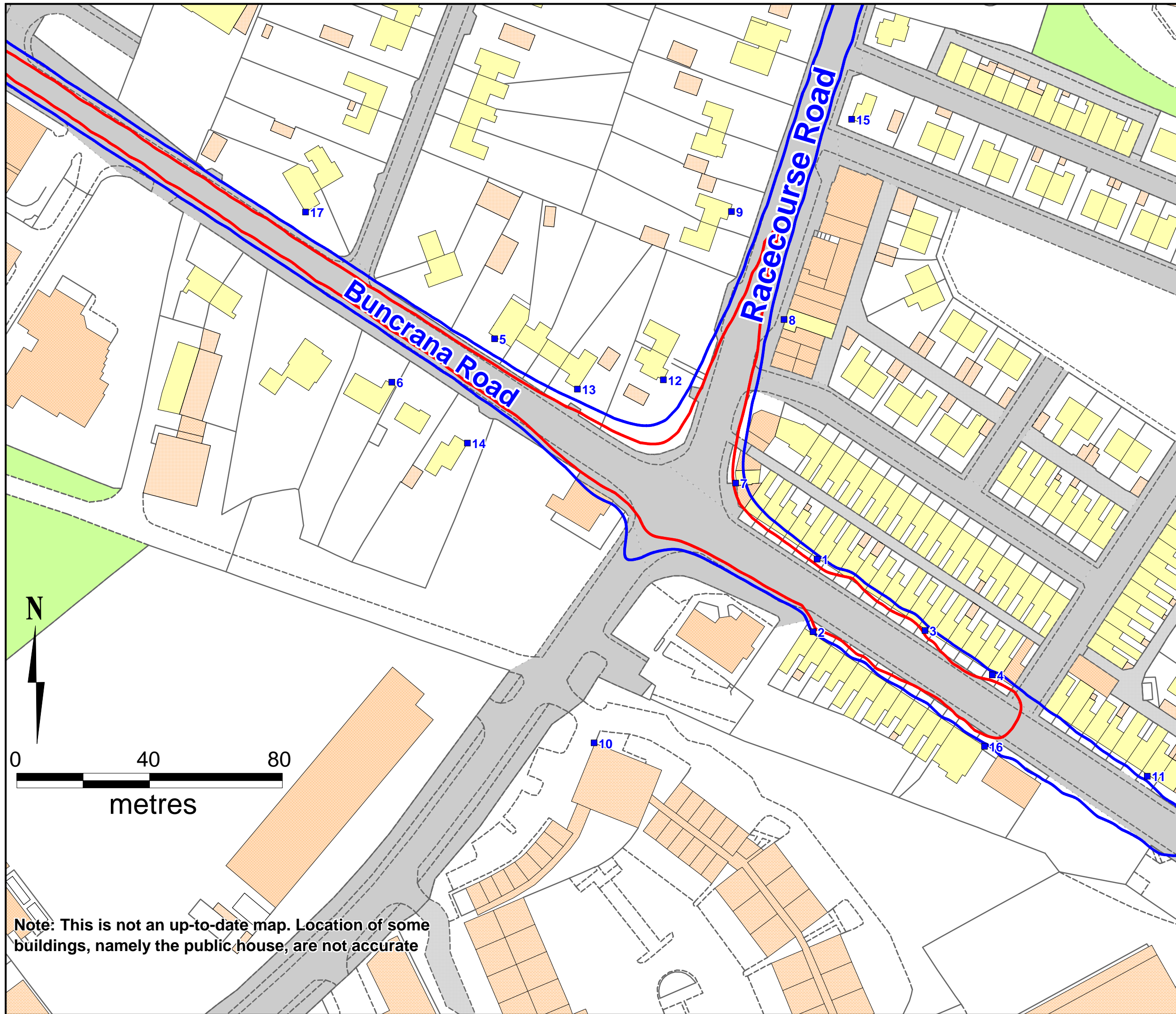
By JB	Checked JB	Approved EC
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Scale N.T.S.	Date August 2010
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Job No. AGGX3995788	Fig. No. Figure A3.2
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Appendix 4 – Modelled Contour Results



Legend
 NO2 contours
 — 36ug/m3
 — 40ug/m3
 ■ Modelled Receptors

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Location **Buncrana Road / Racecourse Road Junction - Derry**

Title **Modelled Contours**

By JB	Checked JB	Approved EC
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Scale N.T.S.	Date August 2010
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Job No. AGGX3995788	Fig. No. Figure A4.1
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Note: This is not an up-to-date map. Location of some buildings, namely the public house, are not accurate