

REPORT N° 70007052-PF7

IPSWICH CORE STRATEGY

AIR QUALITY REPORT

MAY 2016

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Project no: Air Quality Report
Date: May 2016

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QUALITY MANAGEMENT

| ISSUE/REVISION | FIRST ISSUE | REVISION 1 | REVISION 2 | REVISION 3 |
|----------------|-----------------------------------|------------|------------|------------|
| Remarks | Final | | | |
| Date | 27/05/2016 | | | |
| Prepared by | F Hoyle / J Harrington / A Talbot | | | |
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| Signature | | | | |
| Project number | | | | |
| Report number | 1 | | | |
| File reference | | | | |

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1 INTRODUCTION

1.1 ABOUT THIS STUDY

- 1.1.1 WSP | Parsons Brinckerhoff has been commissioned to undertake an air quality modelling study for the Ipswich urban area. The objective of the study is to indicate locations on the highway network where there is high, medium or low risk of non-compliance with current standards for air quality in relation to locations identified for future development under the Ipswich Core Strategy and Policies Development Plan Document Review, and Ipswich Site Allocations and Policies (Incorporating IP-One Area Action Plan) Development Plan Document (the Ipswich Local Plan)¹. Locations indicated to have medium to high risk can then be prioritised for further investigation and/or mitigation as appropriate.
- 1.1.2 The Local Plan as submitted identifies a need for 13,550 new dwellings in the Borough to 2031 and also seeks to encourage the provision of approximately 12,500 new jobs.
- 1.1.3 The study examines historical air quality monitoring data collected by Ipswich Borough Council (IBC) to examine long-term trends in ambient nitrogen dioxide (NO₂) concentrations. Ambient air quality in terms of NO₂ and particulate pollutants (PM₁₀ and PM_{2.5}) in 2015 have been modelled based on road traffic modelling conducted for this year. The outcomes of the analyses of pollutant trends and modelling have then been used to inform a qualitative assessment of risk of future non-compliance. In the time available it has not been possible to undertake air quality modelling of the 2031 future forecast scenario for road traffic reflecting conditions with all Local Plan proposals in place.
- 1.1.1 The purpose of the report is not to predict precisely where air quality exceedances will occur in 2031. However, it does enable the Council to identify locations where there may be a risk of an exceedance in 2031. This will help to inform the need for future monitoring and mitigation. The scope of the work is to:
- Confirm the baseline air quality conditions. IBC provided WSP | Parsons Brinckerhoff with air quality monitoring data and reports for the period 2009-2015;
 - Confirm locations of street canyons. These are narrow streets lined by buildings which can have a worsening effect on air quality;
 - Undertake detailed modelling of the baseline conditions in 2015, based upon the 2015 traffic model;
 - Consider the 2015 baseline conditions alongside the Local Plan to identify areas of low, medium and high risk of exceedance in 2031;
 - Consider the potential for mitigation.

¹ Ref. <https://www.ipswich.gov.uk/localplan>

1.1.2 This report outlines the methodology used and presents the findings and recommendations of the study.

1.1.3 Transport modelling to support the Local Plan has been undertaken by WSP | Parsons Brinckerhoff in 2016. This transport model was initially run in 2008. It was updated to 2015 using information related to development in and around Ipswich and works to the road network that had taken place since 2008. The model identifies junctions which are predicted to be at, close to or over capacity at 2031.

1.2 CONTEXT

LEGISLATION, POLICY AND GUIDANCE

LEGISLATION

1.2.1 Under the Environment Act 1995 (c.25)² local authorities have responsibility for Local Air Quality Management (LAQM) in accordance with the Government's Air Quality Strategy (AQS)³ and associated guidance.

1.2.2 Standards and objectives are set in relation to LAQM in the Air Quality (England) Regulations 2000 (SI 928)⁴ and the Air Quality (England) (Amendment) Regulations 2002 (SI 3043). New Regulations that would supersede these are currently being consulted on⁵. The relevant objectives to this study are given in Table 1-1.

Table 1-1 Relevant air quality objectives

| POLLUTANT | CONCENTRATION ($\mu\text{g}/\text{m}^3$) | AVERAGING PERIOD | NUMBER OF EXCEEDANCES PERMITTED PER YEAR |
|---|--|------------------------|--|
| Nitrogen dioxide (NO ₂) | 200 | 1 hour ('hourly') mean | 18 |
| | 40 | Annual mean | - |
| Particulate Matter (PM ₁₀) | 40 | Annual mean | - |
| | 50 | 24 hour ('daily') mean | 35 |
| Particulate Matter (PM _{2.5}) | 25 | Annual mean | - |

1.2.3 The regulations state that exceedances of the objectives should be assessed in relation to *"the quality of the air at locations which are situated outside of buildings or other natural or man-made structures, above or below ground, and where members of the public are regularly present"*.

² Ref. <http://www.legislation.gov.uk/ukpga/1995/25/contents>

³ Ref. <https://www.gov.uk/government/publications/the-air-quality-strategy-for-england-scotland-wales-and-northern-ireland-volume-1>

⁴ Ref. http://www.legislation.gov.uk/uksi/2000/928/pdfs/uksi_20000928_en.pdf

⁵ Ref. https://consult.defra.gov.uk/communications/laqm-review-next-steps/supporting_documents/The%20Air%20Quality%20England%20Regulations%202015aa.pdf

- 1.2.4 The local authority is required to periodically publish reports on local air quality conditions and LAQM according to procedure published by the Department for Environment, Food and Rural Affairs (DEFRA). Where a local authority identifies likely exceedance of one or more air quality objective it is required to undertake further investigation, and where necessary declare an Air Quality Management Area (AQMA) and produce an Action Plan to bring about improvement. In the case of two-tier authorities including IBC and Suffolk County Council (SCC) the Secretary of State expects collaboration in meeting air quality objectives - in particular in ensuring effective Action Plan measures.
- 1.2.5 Numerically similar 'limit values' for air quality have been legislated by the European Union (EU). The Secretary of State is ultimately accountable to the EU for compliance and taking action to address any non-compliance. The limit values have been incorporated in UK legislation under the Air Quality Standards Regulations 2010 (SI 1001)⁶. The LAQM regime has an important role in assisting the Secretary State in achieving limit value compliance.

POLICY

- 1.2.6 National and local planning policies account for the Government's requirements for local air quality. Relevant extracts from policy documents are given below.

THE NATIONAL PLANNING POLICY FRAMEWORK (NPPF)⁷

- Paragraph 124 *"Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan"*;
- Paragraph 109 *"The planning system should contribute to and enhance the natural and local environment by: ...preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soils, air, water, or noise pollution.."*;
- Paragraph 110 *"In preparing plans to meet development needs, the aim should be to minimise pollution and other adverse effects on the local and natural environment. Plans should allocate land with the least environmental or amenity values, where consistent with other policies in this Framework"*;
- Paragraph 122 *"...local planning authorities should focus on whether the development itself is an acceptable use of the land, and the impact of the use, rather than the control of processes or emissions themselves where these are subject to approval under pollution control regimes. Local planning authorities should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities"*; and
- Paragraph 203 *"Local Planning authorities should consider where otherwise unacceptable development could be made acceptable though the use of conditions or planning obligations. Planning Obligations should only be used where it is not possible to address unacceptable impacts through a planning condition."*

⁶ Ref. <http://www.legislation.gov.uk/uksi/2010/1001/contents/made>

⁷ Ref. <https://www.gov.uk/government/publications/national-planning-policy-framework--2>

IPSWICH BOROUGH COUNCIL LOCAL PLAN

- 1.2.7 The Local Plan strategy is to support the continued regeneration of central Ipswich (the IP-One area) as well as planning for a major urban extension for 3,500 dwellings to the north of Ipswich (Ipswich Garden Suburb). The plan provides for the creation of approximately 12,500 jobs, for example through the provision of employment land for new development, and these would be located in the town centre and in the Employment Areas which are dispersed across the town. In addition to the Ipswich Garden Suburb, the Plan allocates land for a further 1,929 dwellings, many of which are within the IP-One area.
- 1.2.8 The Local Plan identifies a residual requirement of 3,778 dwellings, which cannot be met within the Borough. Part of the Plan strategy is therefore to work with neighbouring authorities to address this residual need. The Council has identified a timescale in its 2015 Local Development Scheme which schedules work to begin in 2016.
- 1.2.9 The Local Plan seeks to ensure that new development takes place in a way which promotes sustainable travel and does not adversely affect air quality. Policy DM17 'Transport and Access in New Developments' requires new development to not result in a significant impact on air quality or an AQMA and to incorporate electric charging points where this would be consistent with the scale and location of the development. This is supported by requirements relating to the promotion of pedestrian and cycle accessibility and associated facilities.

GUIDANCE

DEFRA LAQM GUIDANCE

- 1.2.10 Policy and technical guidance for LAQM is given by DEFRA in LAQM.PG(16)⁸ and LAQM.TG(16)⁹, respectively. The former is to assist regional and local authorities in maximising the public health benefits through local action. The latter is to assist those within local authorities who are responsible for LAQM to ensure activities such as monitoring and modelling are undertaken in an appropriate manner. Both give guidance on reporting requirements.
- 1.2.11 LAQM.TG(16) sets out relevant locations for public exposure in 'Box 1.1 – Examples of Where the Air Quality Objectives Should Apply'; this is extracted below for information.

IBC SUPPLEMENTARY GUIDANCE ON AIR QUALITY MANAGEMENT AND NEW DEVELOPMENT

- 1.2.12 Supplementary guidance produced by the Suffolk Air Quality Management Group for Suffolk Local Authorities in 2011 relates to new developments and aims to maintain and - where possible – improve air quality, and ensure a consistent approach to LAQM and new development in Suffolk¹⁰. Procedure for conducting and considering the outcomes of air quality assessments is set by this guidance and the principles of addressing significant impacts through a hierarchy of redesign, mitigation and – as a last resort - offsetting.

⁸ Ref. <http://laqm.defra.gov.uk/supporting-guidance.html>

⁹ Ref. <http://laqm.defra.gov.uk/supporting-guidance.html>

¹⁰ Ref.

https://www.ipswich.gov.uk/sites/default/files/Appendix_1_Proposed_Supplementary_Guidance_October_2011v5.pdf

Box 1.1 – Examples of Where the Air Quality Objectives Should Apply

| Averaging Period | Objectives should apply at: | Objectives should generally not apply at: |
|------------------------------|---|---|
| Annual mean | All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes etc. | Building façades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term. |
| 24-hour mean and 8-hour mean | All locations where the annual mean objective would apply, together with hotels. Gardens of residential properties ¹¹ . | Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term. |
| 1-hour mean | All locations where the annual mean and: 24 and 8-hour mean objectives apply. Kerbside sites (for example, pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more. Any outdoor locations where members of the public might reasonably be expected to spend one hour or longer. | Kerbside sites where the public would not be expected to have regular access. |
| 15-min mean | All locations where members of the public might reasonably be exposed for a period of 15 minutes | |

Extract from LAQM.TG(16)

IBC LOCAL AIR QUALITY MANAGEMENT

1.2.13 IBC has declared four AQMA's due to measured exceedances of the AQS objective for annual average NO₂, these are:

- Norwich Road – Chevallier Street Junction (since 2006)
- St Margaret's Street – Crown Street (since 2006)
- Grimwade Street – St Helen's Street Junction – Star Lane gyratory (since 2006)
- Bramford Road/Yarmouth Road/Chevallier Street (since 2010)

- 1.2.14 All the AQMA's (illustrated in Figure 1-1) relate to road vehicle exhaust emissions of oxides of nitrogen (NO_x) at, or in the vicinity of busy road junctions.
- 1.2.15 An Air Quality Action Plan was introduced by IBC in 2008 to implement measures to bring about improvements in local air quality¹¹. Action Plan progress has been reported by IBC.

¹¹ Further information and reports can be found on the IBC website:
<https://www.ipswich.gov.uk/airqualitymanagement>

2 METHODOLOGY

2.1 ANALYSIS OF LONG-TERM TRENDS

2.1.1 Monitoring data for NO₂ have been provided by IBC for the period 2005 to 2015 inclusive for the monitoring sites illustrated in Figure 2-1. The statistic of interest is the annual mean concentration. The analysis of long-term trends seeks to determine whether or not annual mean NO₂ concentrations are falling, increasing or stable - or that there is no clear trend. Established statistical techniques have been used including the Mann-Kendall test for a trend and the Sen's method for determining the slope of the linear trend line. The Mann-Kendall test indicates whether or not the trend is statistically significant. If statistically significant then one can be reasonably confident of a sustained trend. If not statistically significant then it is possible that there is no clear trend and that the pattern is random. The Sen's slope method indicates the direction and rate of change in annual mean concentration regardless of whether there is a statistically significant trend.

2.1.2 The monitoring data were first of all screened to remove annual mean concentrations that were based on inadequate data capture, so if less than 9 months of data were captured at a particular IBC monitoring site in any one year the annual mean was excluded from the analysis. Eighty four sites that have been in operation at some time between 2005 and 2015 have annual mean data meeting this criterion. Of these 84 sites, a further 22 were rejected as having less than 5 years of data. The annual mean NO₂ concentration data for the remaining 62 sites were then analysed using the 'MAKESENS' spreadsheet application, developed by the Finnish Meteorological Institute¹².

2.2 DISPERSION MODELLING

2.2.1 Dispersion modelling has been undertaken by WSP | Parsons Brinckerhoff to give estimates of annual mean concentrations of NO_x, PM₁₀ and PM_{2.5} in units of micrograms per cubic metre (µg/m³) due to road traffic sources. The concentrations have been determined for the town centre area in 2015. The modelled area is bounded approximately by Yarmouth Road and Chevallier Street to the west, Valley Road and Colchester Road to the north, the railway line connecting to Felixstowe in the east and the River Orwell to the south (Figure 2-2 shows the extent of the model). This includes all the current AQMAs.

2.2.2 Industry standard dispersion model software known as 'ADMS-Roads Extra' has been used¹³. The model has been based on traffic flow and speed data derived from traffic modelling for the year 2015 undertaken by WSP | Parsons Brinckerhoff for SCC, and meteorological data from the nearest and most representative established weather station at Wattisham, which is situated approximately 15 kilometres (km) to the north-west of Ipswich.

2.2.3 Annual mean concentrations and statistics for NO₂, PM₁₀ and PM_{2.5} that are comparable with the air quality objectives have been derived, and the performance of the model verified using methods given by DEFRA in LAQM.TG(16).

2.2.4 Further details of model inputs and verification are given in Appendix A and Appendix B respectively.

¹² Ref. <http://en.ilmatieteenlaitos.fi/makesens>

¹³ Ref. <http://www.cerc.co.uk/>

2.3 ASSESSMENT OF RISK OF FUTURE NON-COMPLIANCE

2.3.1

To indicate the risk of future non-compliance with one or more air quality objective the outputs of the analyses of trends and dispersion modelling have been examined in conjunction with Ordnance Survey base mapping, IBC mapping for site proposals (see Appendix C for list) and junction capacity information using ArcMap Geographical Information System (GIS) software to determine the spatial relationships. Junction capacity at 2031 has been modelled through the Ipswich Traffic Appraisal Modelling Suite (ITAMS) Forecast Model Report (WSP | Parsons Brinckerhoff May 2016).

3 FINDINGS

3.1 LONG-TERM TRENDS

- 3.1.1 Trend statistics are shown at monitoring site locations in Figure 3-1, and are given in full in Appendix D.
- 3.1.2 Generally, at 59 out of 62 monitoring sites, long-term trends in annual mean NO₂ concentrations appear to have been falling, as indicated by negative Sen's slope values. Considering monitoring from 2005, in 22 cases there are statistically significant falling trends.
- 3.1.3 Looking at the graphical plots (in Appendix D) for sites with data from 2005 there is evidence for concentrations peaking around 2010; this 'peak' is reflected in data for other monitoring sites across the UK and is attributed to particularly cold winter conditions. Therefore, taking the data from 2009 onwards there are statistically significant falling trends at 28 sites.
- 3.1.4 At three of the 62 sites there are contrary increasing trends for measurements between 2006 and 2013 at two and 2011 and 2015 at one. These trends are, however, not statistically significant with a greater than 10% chance of the pattern in the data being random.

3.2 DISPERSION MODELLING

NITROGEN DIOXIDE (NO₂)

- 3.2.1 Modelled annual mean NO₂ concentrations in 2015 are illustrated in Figure 3-2a (overview), Figure 3-2b, Figure 3-2c and Figure 3-2d. Exceedances of the air quality objective (Table 1-1) generally occur within the road space. As indicated in Figures 3-2b and 3-3c, locations where exceedances encroach on adjacent areas with relevant exposure are generally confined to within the extents of the existing AQMA. Relevant exposure relates to the presence of sensitive receptors (such as houses or schools) where the exceedance is experienced. The 40µg/m³ line is shown on the figures, within this line concentrations are indicated to be at higher concentrations.

PM₁₀

- 3.2.2 Annual mean concentrations of PM₁₀ in 2015 are illustrated in Figure 3-3 and are well below the air quality objective in 2015 (Table 1-1). Daily concentrations of PM₁₀ are also in compliance with the air quality objective in 2015 (Table 1-1). Therefore, there is a low risk of exceedance of the air quality objective relevant to PM₁₀ in 2031.

PM_{2.5}

Annual mean concentrations of PM_{2.5} in 2015 are illustrated in Figure 3-4 and are well below the air quality objective in 2015 (Table 1-1). Therefore, there is a low risk of exceedance of the air quality objective relevant to PM_{2.5} in 2031.

3.3 RISK OF FUTURE NON-COMPLIANCE

- 3.3.1 Given the evidence of falling trends in annual mean NO₂ concentrations in the IBC area (Section 3.1) and improvements in vehicle emissions as older more polluting vehicles are progressively replaced by vehicles with more stringent Euro 6 type approval for exhaust emissions, it is expected that ambient concentrations near to roads will be lower in the future than they are at present. Although there has been controversy in recent times regarding lack of real improvements in vehicle emissions compared to previous Government and industry forecasts, there is a growing body of evidence from independent on-road measurements by organisations such as Leeds University Institute of Transport Studies of vehicle emissions that Euro 6 vehicles will deliver improvements on current levels.
- 3.3.2 Risk of non-compliance in the future will be greatest at locations on the road network where junctions are likely to be at or near capacity in terms of traffic. Future developments within the IBC area will add to traffic on the local road network and - whilst individual vehicles are likely to give rise to lower emissions of NO_x and other pollutants - the additional number of vehicles on the road may give rise to congestion at particular junctions with the potential for elevated ambient pollutant concentrations.
- 3.3.3 Relative risks have been considered in relation to current Local Plan proposals and existing locations with relevant exposure. These risks have been classified as low, medium or high in relation to potential future non-compliance with air quality objectives (considering annual mean NO₂ as the pollutant currently with compliance issues). Figure 3-5a, Figure 3-5b, Figure 3-5c illustrate the risks for different locations within the IBC area.

4 CONCLUSIONS AND RECOMMENDATIONS

- 4.1.1 The current monitoring in Ipswich indicates that in relation to air quality objectives the risk in 2015 relates only to NO₂. Concentrations of PM₁₀ and PM_{2.5} are well below objective levels and are therefore not a risk. Looking at the long-term trends, annual mean concentrations of NO₂ appear to be declining.
- 4.1.2 Where locations have been identified as medium or high risk of NO₂ exceedances it is recommended that further investigation is carried out to confirm baseline air quality conditions. This could be through diffusion tube monitoring. If no monitoring has previously been carried out in these locations then this should be considered.
- 4.1.3 If high risk is subsequently confirmed then highway based measures should be investigated to avoid traffic conditions in the future that may result in a new, or sustain an existing, air quality problem. Highway based measures could include improvements to junction configuration, setting priorities for certain vehicle types, dynamic signal controls and intelligent transport system technology amongst other things.
- 4.1.4 Increased use of cycling and walking in place of the private car would also assist in reducing the level of risk.
- 4.1.5 Further understanding of the sources of the emissions (e.g. contributions from different types of vehicle) would assist in targeting effective mitigation measures.
- 4.1.6 Continuing improvements to emissions are likely to, at least in part, mitigate emissions from the modelled increase in traffic waiting times at certain junctions in peak hours.

FIGURES

| | |
|-------------|---|
| FIGURE 1-1 | AQMA |
| FIGURE 2-1 | IBC NO ₂ MONITORING SITES IN 2015 |
| FIGURE 2-2 | EXTENT OF DISPERSION MODEL |
| FIGURE 3-1 | LONG-TERM TRENDS IN ANNUAL MEAN NO ₂ CONCENTRATIONS SINCE 2005 |
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| FIGURE 3-3 | OVERVIEW OF MODELLED ANNUAL MEAN PM ₁₀ CONCENTRATIONS IN 2015 |
| FIGURE 3-4 | OVERVIEW OF MODELLED ANNUAL MEAN PM _{2.5} CONCENTRATIONS IN 2015 |
| FIGURE 3-5A | RISK OF FUTURE NON-COMPLIANCE WITH AIR QUALITY OBJECTIVES |
| FIGURE 3-5B | RISK OF FUTURE NON-COMPLIANCE WITH AIR QUALITY OBJECTIVES |
| FIGURE 3-5C | RISK OF FUTURE NON-COMPLIANCE WITH AIR QUALITY OBJECTIVES |

Appendix A

DISPERSION MODEL INPUTS

SETUP DATA

Name of site: Ipswich Town Centre

Project: Base 2015

Coordinate System: OSGB 1936 British National Grid (epsg:27700)

MODEL OPTIONS:

N/A

PALLET:

→ Pollutants

ADDITIONAL INPUT FILES:

N/A

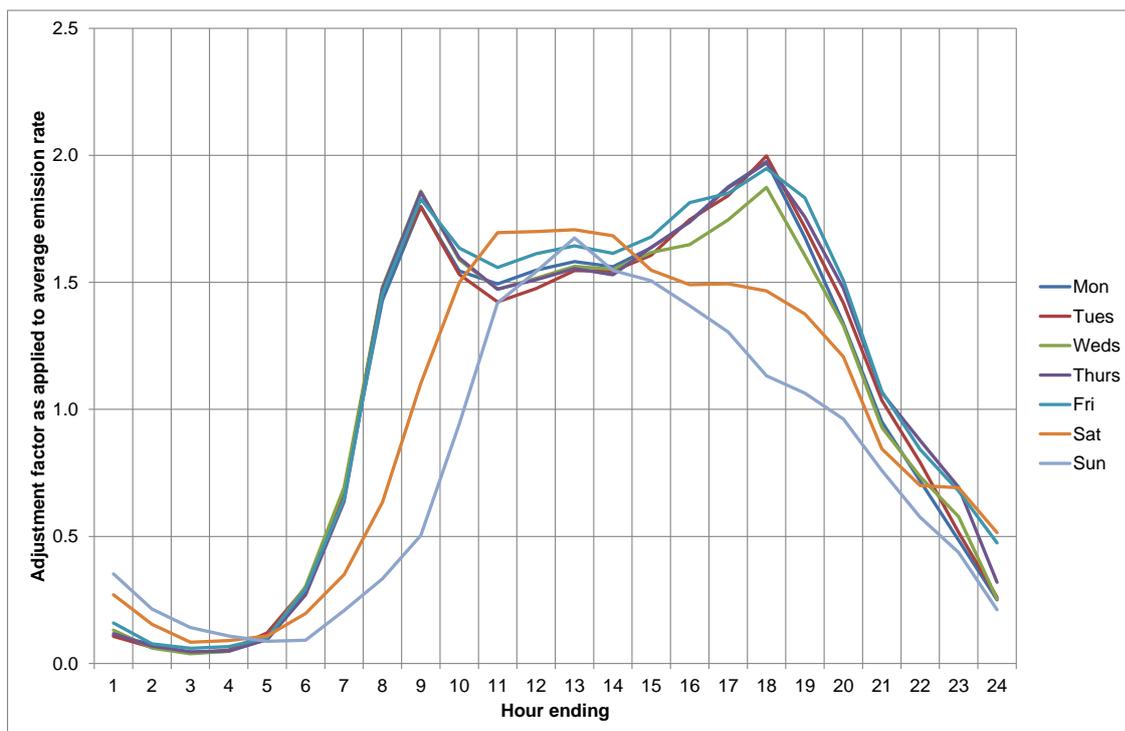
SOURCE DATA

SOURCES

Road sources

TIME-VARYING SOURCE DATA:

→ .fac file



Data derived from 71 Automatic Traffic Count sites in 2015.

METEOROLOGY

SITE DATA:

→ Latitude: 52.05°

DISPERSION SITE

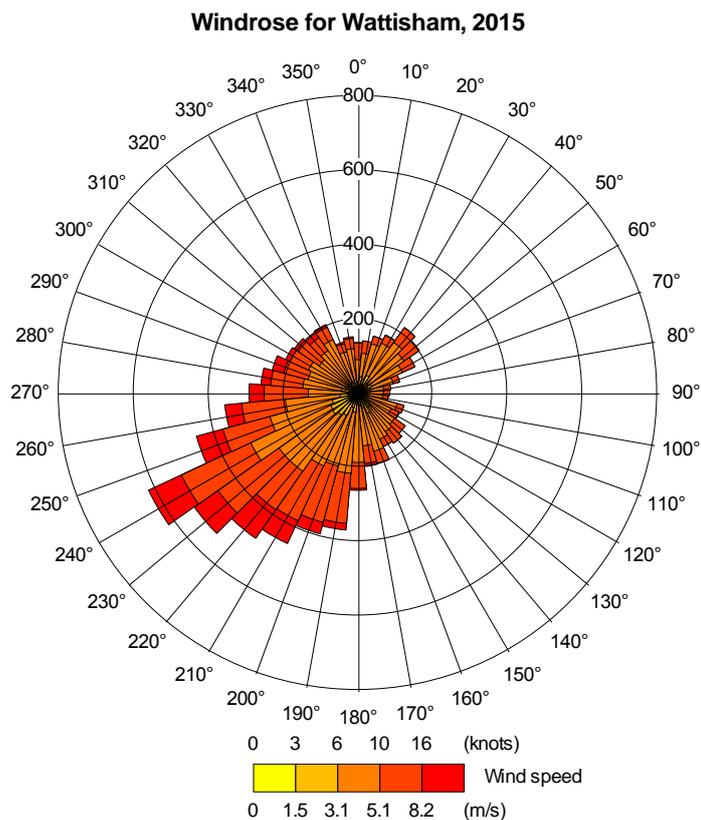
- Surface roughness: 0.5m
- Surface albedo: 0.23
- Priestley-Taylor parameter: 1
- Minimum Monin-Obukhov length: 30m

MET. MEASUREMENT SITE

- Surface roughness: 0.2m
- Surface albedo: 0.23
- Priestley-Taylor parameter: 1
- Minimum Monin-Obukhov length: 2m

MET. DATA:

- Supplied by ADM Ltd (approved WSP | Parsons Brinckerhoff supplier)
- Wattisham 2015
- Height of recorded wind: 10m
- Met data in sectors: 10°
- Met data are hourly sequential



BACKGROUND

→ Not model input. Post-processing incorporation of LAEI 2015 model data. Ordinary Kriging method to interpolate data to model grid (25m) resolution.

GRIDS

→ Gridded spacing: Regular

- x min 614800, x max 615800, number of points 41 | y min 243700, y max 246300, number of points 105
- x min 615800, x max 616800, number of points 41 | y min 243700, y max 246300, number of points 105
- x min 616800, x max 617800, number of points 41 | y min 243700, y max 246300, number of points 105

→ Source-oriented grids: Road, Line

→ Specific points: IBC_monitoring_sites.asp file

OUTPUT

→ NO_x: long term annual mean

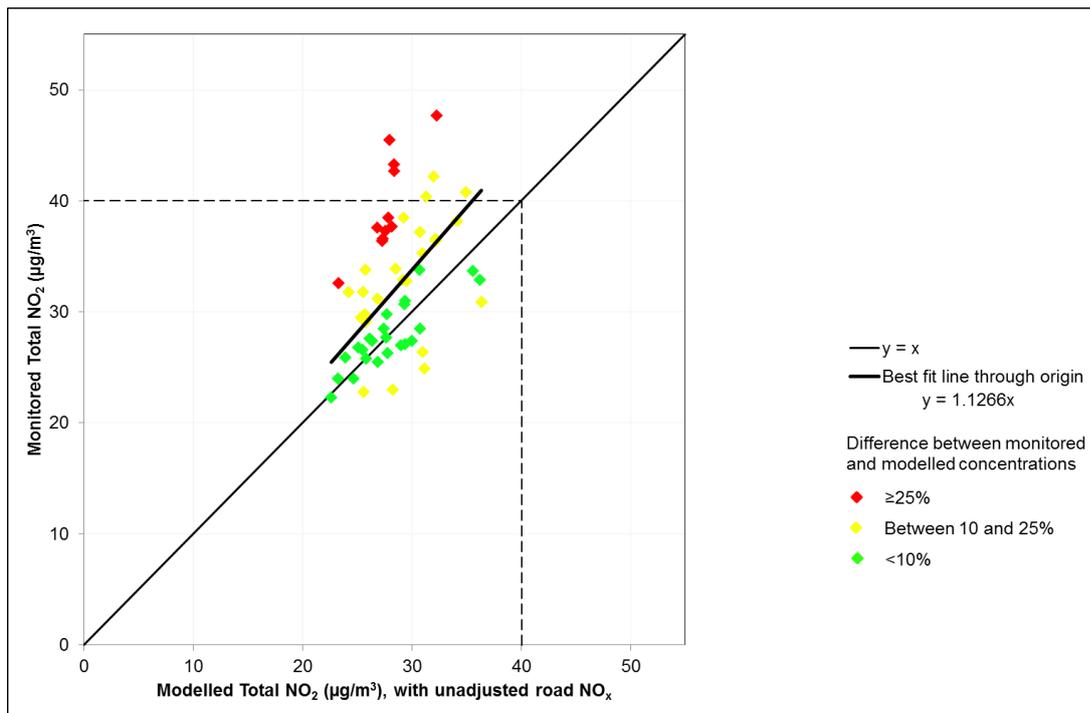
→ PM₁₀: long term annual mean

→ PM_{2.5}: long term annual mean

Appendix B

MODEL VERIFICATION

| Site ID | Monitor Type | Site Type | Site Description | Background Annual Mean NO ₂ | Total Annual Mean NO ₂ | | Difference | |
|---------|--------------|-----------|------------------------------------|--|-----------------------------------|--|------------|---------|
| | | | | | Monitored (A) | Modelled (B), with Unadjusted Road NO _x | B - A (C) | C/A (%) |
| 14 | DT | UR | Chevalier Street | 18.5 | 47.7 | 32.2 | -15.5 | -32.4% |
| 1 | DT | UR | Civic Drive | 19.9 | 26.3 | 27.7 | 1.4 | 5.5% |
| 16 | DT | UR | Valley/Norwich Road | 18.6 | 36.4 | 32.2 | -4.3 | -11.7% |
| 15 | DT | UR | Cornhill o/s No 17 | 20.7 | 24.0 | 23.2 | -0.8 | -3.3% |
| 44 | DT | UR | Bramford Road | 18.3 | 36.6 | 27.3 | -9.3 | -25.4% |
| 29 | DT | UR | Fore Hamlet | 19.3 | 30.9 | 36.4 | 5.5 | 17.6% |
| 37 | DT | UR | Lower Brook Street | 20.2 | 24.9 | 31.1 | 6.2 | 25.0% |
| 27 | DT | UR | St Helen's St/Argyle Street | 20.2 | 35.3 | 30.9 | -4.4 | -12.4% |
| 26 | DT | UR | St Helen's St/Grimwade Street | 20.2 | 31.0 | 29.3 | -1.7 | -5.4% |
| 21 | DT | UR | St Margaret's Plain | 20.4 | 36.6 | 32.1 | -4.5 | -12.2% |
| 20 | DT | UR | St Margaret's Plain/Fonnereau Road | 20.4 | 32.9 | 29.1 | -3.8 | -11.5% |
| 22 | DT | UR | St Margaret's Plain/Northgate St | 20.5 | 37.7 | 28.1 | -9.6 | -25.4% |
| 39 | DT | UK | Star Lane/Fore Street | 20.3 | 42.2 | 32.0 | -10.2 | -24.3% |
| 43 | DT | UR | Yarmouth Rd/Bramford Road | 18.5 | 40.4 | 31.3 | -9.1 | -22.6% |
| 31 | DT | UR | Star Lane opp St Peters St | 20.0 | 33.7 | 35.6 | 1.8 | 5.5% |
| 4 | DT | UR | Berners Street o/s No. 31 | 19.6 | 33.8 | 25.7 | -8.1 | -23.9% |
| 2 | DT | UR | Chevallier St o/s No's 6 to 8 | 18.5 | 40.8 | 34.9 | -5.9 | -14.4% |
| 35 | DT | UR | Cobden Place | 20.5 | 27.4 | 30.0 | 2.6 | 9.4% |
| 34 | DT | UR | College Street | 19.8 | 38.2 | 34.1 | -4.1 | -10.7% |
| 36 | DT | UR | Franciscan Way/Wolsey St | 20.0 | 29.8 | 27.7 | -2.1 | -7.1% |
| 23 | DT | UR | St Margarets Green | 20.4 | 23.0 | 28.2 | 5.2 | 22.7% |
| 70 | DT | UR | Argyle Street o/s No. 11 | 20.2 | 32.8 | 29.5 | -3.3 | -10.1% |
| 69 | DT | UR | Argyle Street o/s Nos. 2-4 | 20.2 | 26.4 | 31.0 | 4.6 | 17.3% |
| 50 | DT | UR | Barrack lane/St Matthews St | 19.5 | 27.7 | 27.6 | -0.1 | -0.3% |
| 55 | DT | UR | Berners St o/s No. 21 | 19.6 | 31.2 | 26.8 | -4.4 | -14.0% |
| 56 | DT | UR | Berners St o/s No. 32 | 19.6 | 28.5 | 27.4 | -1.1 | -3.9% |
| 57 | DT | UR | Berners St o/s No. 41-43 | 19.5 | 25.9 | 23.9 | -2.0 | -7.8% |
| 58 | DT | UR | Berners St o/s No. 58 | 19.4 | 26.6 | 25.5 | -1.2 | -4.3% |
| 83 | DT | UR | Bond Street o/s No. 29 | 20.7 | 29.8 | 25.7 | -4.1 | -13.9% |
| 8 | DT | UR | Bramford Road o/s No 122 | 18.5 | 33.9 | 28.5 | -5.4 | -16.0% |
| 7 | DT | UR | Bramford Road o/s No 205 | 18.3 | 32.6 | 23.3 | -9.3 | -28.7% |
| 84 | DT | UK | Carr Street/Majors Corner | 20.9 | 25.8 | 25.8 | 0.0 | -0.1% |
| 28 | DT | UR | Chevallier St o/s Nos 32/34 | 18.5 | 37.2 | 30.7 | -6.5 | -17.4% |
| 74 | DT | UR | Grimwade St o/s No. 25 | 20.2 | 27.0 | 29.0 | 2.0 | 7.3% |
| 75 | DT | UR | Grimwade St o/s No. 28 | 20.2 | 25.5 | 26.9 | 1.4 | 5.3% |
| 85 | DT | UR | Old Foundry Road o/s No. 5 | 20.9 | 31.8 | 25.5 | -6.3 | -19.8% |
| 78 | DT | UR | Orchard St o/s No. 7 | 20.4 | 24.0 | 24.6 | 0.6 | 2.6% |
| 73 | DT | UR | Regent St/St Helens St | 19.9 | 22.8 | 25.6 | 2.8 | 12.1% |
| 77 | DT | UR | St Helens St - Albury Ct | 20.4 | 27.6 | 26.1 | -1.5 | -5.4% |
| 72 | DT | UR | St Helens St o/s No. 125 | 19.9 | 36.4 | 27.3 | -9.2 | -25.1% |
| 76 | DT | UR | St Helens St/Grimwade St 44 | 20.3 | 37.3 | 27.5 | -9.8 | -26.2% |
| 71 | DT | UR | St Helens Street o/s No. 93 | 20.0 | 27.4 | 26.3 | -1.1 | -3.9% |
| 62 | DT | UR | St Matthews St o/s No. 27 | 19.8 | 38.5 | 29.2 | -9.3 | -24.1% |
| 53 | DT | UR | St Matthews St o/s No. 67 | 19.6 | 45.5 | 27.9 | -17.6 | -38.6% |
| 59 | DT | UR | St Matthews St rbt co-locate | 19.7 | 33.8 | 30.7 | -3.1 | -9.3% |
| 54 | DT | UR | St Matthews St/Berners St | 19.7 | 30.7 | 29.3 | -1.4 | -4.6% |
| 66 | DT | UR | Woodbridge Rd o/s No 30A | 20.4 | 38.5 | 27.8 | -10.7 | -27.8% |
| 68 | DT | UR | Woodbridge Rd o/s No. 62 | 20.2 | 42.7 | 28.4 | -14.4 | -33.6% |
| 67 | DT | UR | Woodbridge Rd/Bianche St | 20.2 | 27.1 | 29.3 | 2.2 | 8.3% |
| 18 | DT | UR | Yarmouth Rd o/s flat 2 No 5 | 18.5 | 29.1 | 25.7 | -3.4 | -11.6% |
| 45 | DT | UR | Chevallier Street | 18.6 | 28.5 | 30.7 | 2.2 | 7.8% |
| 40 | DT | UR | Norwich Road o/s No. 131 | 18.9 | 26.8 | 25.1 | -1.7 | -6.5% |
| 63 | DT | UR | St Matthews St o/s No. 19 | 19.9 | 37.6 | 26.8 | -10.8 | -28.7% |
| 13 | DT | UR | Bramford Road o/s No 18 | 18.4 | 22.3 | 22.6 | 0.3 | 1.3% |
| 33 | DT | UR | Key Street/Premier Inn | 20.0 | 32.9 | 36.2 | 3.3 | 10.0% |
| 32 | DT | UR | Spring Road o/s No 8 | 19.5 | 31.8 | 24.2 | -7.6 | -24.0% |
| 17 | DT | UR | Woodbridge Rd o/s Atlas Hse | 20.0 | 43.3 | 28.3 | -15.0 | -34.6% |
| 79 | DT | UR | Woodbridge Rd/St Helens Sch | 19.9 | 29.5 | 25.3 | -4.2 | -14.2% |



Best Fit Line

Equation

$$y = 1.1266x$$

Slope

1.1266

Differences between monitored and modelled concentrations

| | |
|--|-----------|
| Within +10% | 9 |
| Within -10% | 13 |
| Within $\pm 10\%$ | 22 |
| Within +10 to +25% | 6 |
| Within -10 to -25% | 19 |
| Within ± 10 to $\pm 25\%$ | 25 |
| Over +25% | 0 |
| Under -25% | 11 |
| Greater $\pm 25\%$ | 11 |
| Within $\pm 25\%$ | 47 |

Uncertainty Statistics

Root Mean Square Error

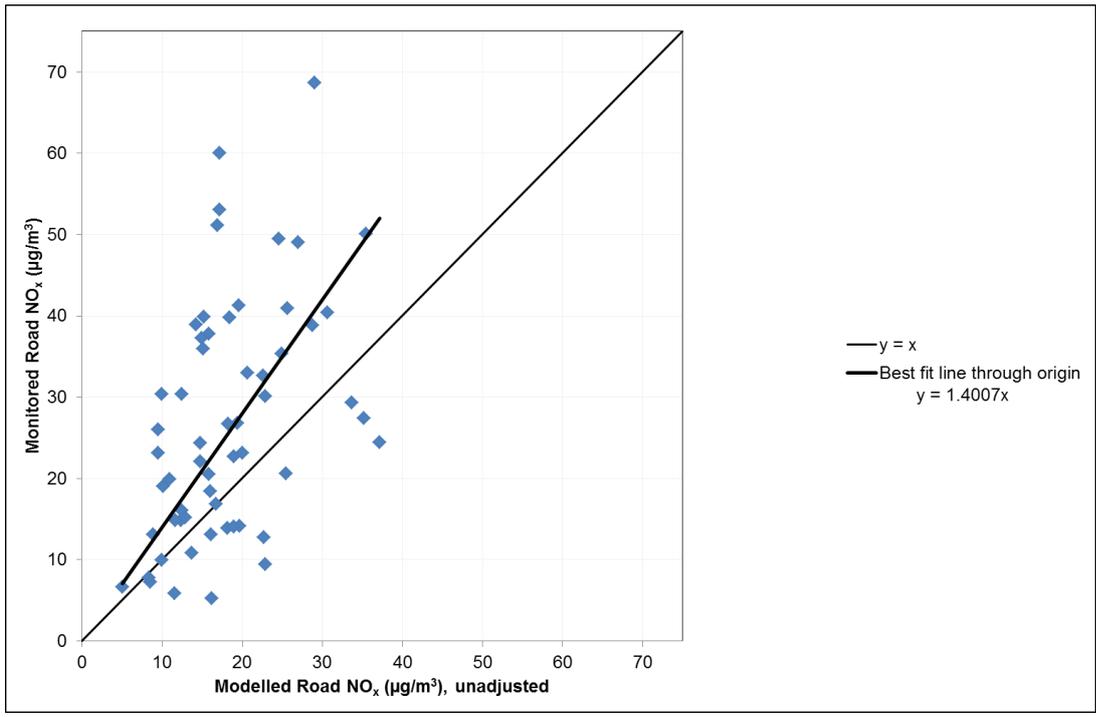
6.6

Fractional Bias

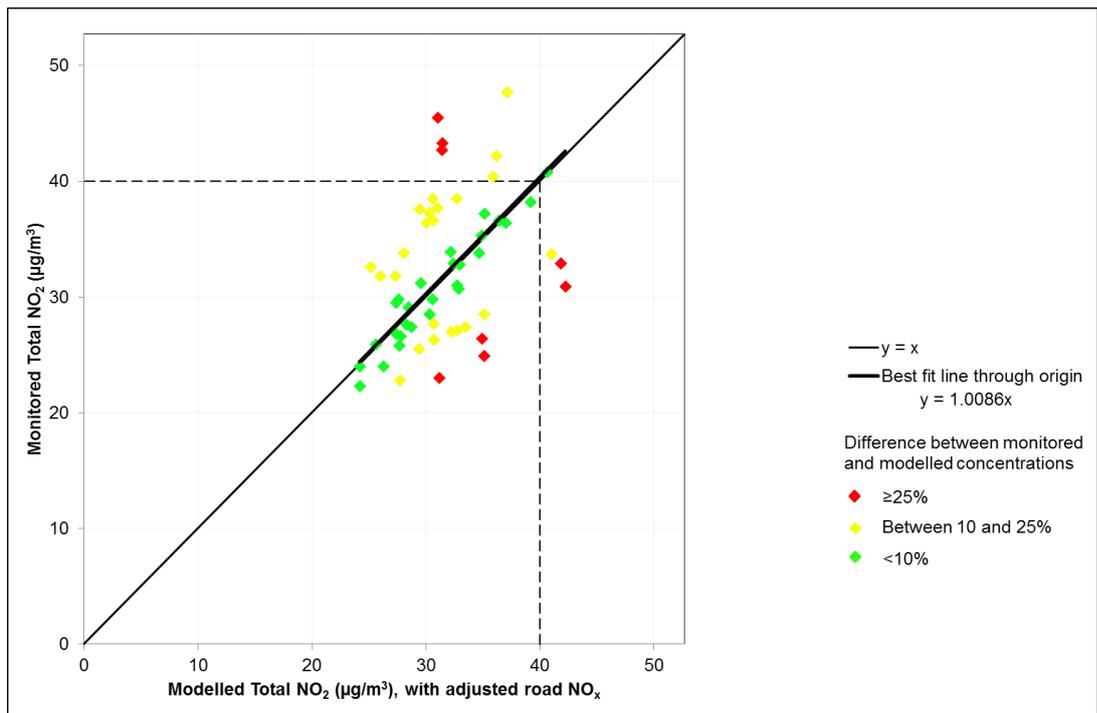
0.123

Model tends to underestimate concentrations

| Site ID | Monitored NO ₂ (A) | Background NO _x | Background NO ₂ | Monitored Road NO _x (B) | Modelled Road NO _x (C) | B/C | Adjusted Modelled Road NO _x |
|---------|-------------------------------|----------------------------|----------------------------|------------------------------------|-----------------------------------|--------|--|
| 14 | 47.7 | | 18.5 | 68.7 | 29.0 | 2.3655 | 40.7 |
| 1 | 26.3 | | 19.9 | 13.1 | 16.1 | 0.8089 | 22.6 |
| 16 | 36.4 | | 18.6 | 38.8 | 28.8 | 1.3497 | 40.3 |
| 15 | 24.0 | | 20.7 | 6.7 | 5.0 | 1.3237 | 7.0 |
| 44 | 36.6 | | 18.3 | 39.8 | 18.4 | 2.1613 | 25.8 |
| 29 | 30.9 | | 19.3 | 24.4 | 37.1 | 0.6575 | 52.0 |
| 37 | 24.9 | | 20.2 | 9.5 | 22.9 | 0.4128 | 32.1 |
| 27 | 35.3 | | 20.2 | 32.6 | 22.6 | 1.4451 | 31.6 |
| 26 | 31.0 | | 20.2 | 22.7 | 19.0 | 1.1945 | 26.6 |
| 21 | 36.6 | | 20.4 | 35.4 | 24.9 | 1.4189 | 34.9 |
| 20 | 32.9 | | 20.4 | 26.7 | 18.2 | 1.4630 | 25.5 |
| 22 | 37.7 | | 20.5 | 37.8 | 15.8 | 2.3881 | 22.2 |
| 39 | 42.2 | | 20.3 | 49.5 | 24.6 | 2.0135 | 34.4 |
| 43 | 40.4 | | 18.5 | 49.0 | 26.9 | 1.8197 | 37.7 |
| 31 | 33.7 | | 20.0 | 29.3 | 33.7 | 0.8709 | 47.2 |
| 4 | 33.8 | | 19.6 | 30.4 | 12.5 | 2.4372 | 17.5 |
| 2 | 40.8 | | 18.5 | 50.1 | 35.4 | 1.4127 | 49.6 |
| 35 | 27.4 | | 20.5 | 14.1 | 19.7 | 0.7163 | 27.6 |
| 34 | 38.2 | | 19.8 | 40.4 | 30.6 | 1.3205 | 42.9 |
| 36 | 29.8 | | 20.0 | 20.5 | 15.8 | 1.2937 | 22.2 |
| 23 | 23.0 | | 20.4 | 5.3 | 16.2 | 0.3250 | 22.7 |
| 70 | 32.8 | | 20.2 | 26.8 | 19.4 | 1.3847 | 27.1 |
| 69 | 26.4 | | 20.2 | 12.7 | 22.7 | 0.5619 | 31.8 |
| 50 | 27.7 | | 19.5 | 16.9 | 16.7 | 1.0098 | 23.4 |
| 55 | 31.2 | | 19.6 | 24.3 | 14.7 | 1.6515 | 20.6 |
| 56 | 28.5 | | 19.6 | 18.4 | 16.0 | 1.1514 | 22.4 |
| 57 | 25.9 | | 19.5 | 13.1 | 8.9 | 1.4744 | 12.5 |
| 58 | 26.6 | | 19.4 | 14.8 | 12.4 | 1.1961 | 17.4 |
| 83 | 29.8 | | 20.7 | 19.1 | 10.2 | 1.8737 | 14.2 |
| 8 | 33.9 | | 18.5 | 33.0 | 20.6 | 1.5973 | 28.9 |
| 7 | 32.6 | | 18.3 | 30.4 | 9.9 | 3.0569 | 13.9 |
| 84 | 25.8 | | 20.9 | 10.0 | 9.9 | 1.0049 | 13.9 |
| 28 | 37.2 | | 18.5 | 40.9 | 25.6 | 1.5974 | 35.9 |
| 74 | 27.0 | | 20.2 | 13.9 | 18.1 | 0.7651 | 25.4 |
| 75 | 25.5 | | 20.2 | 10.8 | 13.7 | 0.7909 | 19.2 |
| 85 | 31.8 | | 20.9 | 23.1 | 9.5 | 2.4408 | 13.3 |
| 78 | 24.0 | | 20.4 | 7.2 | 8.5 | 0.8481 | 12.0 |
| 73 | 22.8 | | 19.9 | 5.8 | 11.5 | 0.5058 | 16.1 |
| 77 | 27.6 | | 20.4 | 14.9 | 11.7 | 1.2740 | 16.3 |
| 72 | 36.4 | | 19.9 | 35.9 | 15.1 | 2.3752 | 21.2 |
| 76 | 37.3 | | 20.3 | 37.3 | 15.0 | 2.4892 | 21.0 |
| 71 | 27.4 | | 20.0 | 15.2 | 12.9 | 1.1782 | 18.0 |
| 62 | 38.5 | | 19.8 | 41.3 | 19.6 | 2.1062 | 27.4 |
| 53 | 45.5 | | 19.6 | 60.0 | 17.2 | 3.4943 | 24.1 |
| 59 | 33.8 | | 19.7 | 30.1 | 22.9 | 1.3133 | 32.1 |
| 54 | 30.7 | | 19.7 | 23.2 | 20.0 | 1.1559 | 28.1 |
| 66 | 38.5 | | 20.4 | 39.9 | 15.2 | 2.6194 | 21.3 |
| 68 | 42.7 | | 20.2 | 51.1 | 16.9 | 3.0300 | 23.6 |
| 67 | 27.1 | | 20.2 | 14.1 | 18.9 | 0.7440 | 26.5 |
| 18 | 29.1 | | 18.5 | 22.1 | 14.8 | 1.4956 | 20.7 |
| 45 | 28.5 | | 18.6 | 20.6 | 25.5 | 0.8073 | 35.7 |
| 40 | 26.8 | | 18.9 | 16.1 | 12.4 | 1.2972 | 17.4 |
| 63 | 37.6 | | 19.9 | 38.9 | 14.2 | 2.7372 | 19.9 |
| 13 | 22.3 | | 18.4 | 7.8 | 8.4 | 0.9327 | 11.7 |
| 33 | 32.9 | | 20.0 | 27.4 | 35.2 | 0.7795 | 49.3 |
| 32 | 31.8 | | 19.5 | 26.0 | 9.5 | 2.7462 | 13.3 |
| 17 | 43.3 | | 20.0 | 53.1 | 17.2 | 3.0922 | 24.0 |
| 79 | 29.5 | | 19.9 | 19.9 | 10.9 | 1.8219 | 15.3 |



| Site ID | Background Annual Mean NO ₂ | Total Annual Mean NO ₂ | | Difference | |
|---------|--|-----------------------------------|--|------------|------------|
| | | Monitored (A) | Modelled (B), with Adjusted Road NO _x | B - A (C) | C/A * 100% |
| 14 | 18.5 | 47.7 | 37.1 | -10.6 | -22.2% |
| 1 | 19.9 | 26.3 | 30.7 | 4.4 | 16.7% |
| 16 | 18.6 | 36.4 | 37.0 | 0.6 | 1.6% |
| 15 | 20.7 | 24.0 | 24.2 | 0.2 | 0.8% |
| 44 | 18.3 | 36.6 | 30.6 | -6.0 | -16.3% |
| 29 | 19.3 | 30.9 | 42.2 | 11.3 | 36.7% |
| 37 | 20.2 | 24.9 | 35.1 | 10.2 | 41.0% |
| 27 | 20.2 | 35.3 | 34.9 | -0.4 | -1.2% |
| 26 | 20.2 | 31.0 | 32.7 | 1.7 | 5.6% |
| 21 | 20.4 | 36.6 | 36.4 | -0.2 | -0.5% |
| 20 | 20.4 | 32.9 | 32.4 | -0.5 | -1.5% |
| 22 | 20.5 | 37.7 | 31.0 | -6.7 | -17.7% |
| 39 | 20.3 | 42.2 | 36.2 | -6.0 | -14.3% |
| 43 | 18.5 | 40.4 | 35.9 | -4.5 | -11.2% |
| 31 | 20.0 | 33.7 | 41.0 | 7.3 | 21.7% |
| 4 | 19.6 | 33.8 | 28.1 | -5.7 | -17.0% |
| 2 | 18.5 | 40.8 | 40.6 | -0.2 | -0.4% |
| 35 | 20.5 | 27.4 | 33.5 | 6.1 | 22.2% |
| 34 | 19.8 | 38.2 | 39.2 | 1.0 | 2.6% |
| 36 | 20.0 | 29.8 | 30.6 | 0.8 | 2.6% |
| 23 | 20.4 | 23.0 | 31.2 | 8.2 | 35.5% |
| 70 | 20.2 | 32.8 | 32.9 | 0.1 | 0.4% |
| 69 | 20.2 | 26.4 | 34.9 | 8.5 | 32.2% |
| 50 | 19.5 | 27.7 | 30.7 | 3.0 | 10.7% |
| 55 | 19.6 | 31.2 | 29.6 | -1.7 | -5.3% |
| 56 | 19.6 | 28.5 | 30.3 | 1.8 | 6.4% |
| 57 | 19.5 | 25.9 | 25.6 | -0.3 | -1.2% |
| 58 | 19.4 | 26.6 | 27.8 | 1.2 | 4.4% |
| 83 | 20.7 | 29.8 | 27.6 | -2.2 | -7.4% |
| 8 | 18.5 | 33.9 | 32.2 | -1.7 | -5.1% |
| 7 | 18.3 | 32.6 | 25.2 | -7.4 | -22.8% |
| 84 | 20.9 | 25.8 | 27.7 | 1.9 | 7.2% |
| 28 | 18.5 | 37.2 | 35.1 | -2.1 | -5.6% |
| 74 | 20.2 | 27.0 | 32.2 | 5.2 | 19.4% |
| 75 | 20.2 | 25.5 | 29.4 | 3.9 | 15.3% |
| 85 | 20.9 | 31.8 | 27.3 | -4.5 | -14.1% |
| 78 | 20.4 | 24.0 | 26.3 | 2.3 | 9.5% |
| 73 | 19.9 | 22.8 | 27.7 | 4.9 | 21.6% |
| 77 | 20.4 | 27.6 | 28.3 | 0.7 | 2.5% |
| 72 | 19.9 | 36.4 | 30.0 | -6.4 | -17.5% |
| 76 | 20.3 | 37.3 | 30.3 | -7.0 | -18.8% |
| 71 | 20.0 | 27.4 | 28.7 | 1.3 | 4.8% |
| 62 | 19.8 | 38.5 | 32.7 | -5.8 | -15.0% |
| 53 | 19.6 | 45.5 | 31.0 | -14.5 | -31.8% |
| 59 | 19.7 | 33.8 | 34.7 | 0.9 | 2.5% |
| 54 | 19.7 | 30.7 | 32.9 | 2.2 | 7.0% |
| 66 | 20.4 | 38.5 | 30.6 | -7.9 | -20.5% |
| 68 | 20.2 | 42.7 | 31.4 | -11.3 | -26.5% |
| 67 | 20.2 | 27.1 | 32.7 | 5.6 | 20.7% |
| 18 | 18.5 | 29.1 | 28.5 | -0.6 | -2.2% |
| 45 | 18.6 | 28.5 | 35.1 | 6.6 | 23.2% |
| 40 | 18.9 | 26.8 | 27.4 | 0.6 | 2.2% |
| 63 | 19.9 | 37.6 | 29.4 | -8.2 | -21.7% |
| 13 | 18.4 | 22.3 | 24.2 | 1.9 | 8.5% |
| 33 | 20.0 | 32.9 | 41.8 | 8.9 | 27.1% |
| 32 | 19.5 | 31.8 | 26.0 | -5.8 | -18.3% |
| 17 | 20.0 | 43.3 | 31.4 | -11.9 | -27.4% |
| 79 | 19.9 | 29.5 | 27.4 | -2.1 | -7.2% |



Best Fit Line

Equation $y = 1.0086x$
 Slope 1.0086

Differences between modelled and monitored concentrations

| | |
|---------------------------|-----------|
| Within +10% | 16 |
| Within -10% | 11 |
| Within ±10% | 27 |
| Within +10 to +25% | 9 |
| Within -10 to -25% | 14 |
| Within ±10 to ±25% | 23 |
| Over +25% | 5 |
| Under -25% | 3 |
| Greater ±25% | 8 |
| Within ±25% | 50 |

Uncertainty Statistics

Root Mean Square Error 5.7 $\mu\text{g}/\text{m}^3$
 Fractional Bias 0.016

Model tends to underestimate concentrations

Appendix C

SITE PROPOSALS

| ID | ADDRESS | SITE AREA | SITE REF | POLICY | ALLOCATION | ANNOTATION | INIPONE | PATH |
|----|---------------------------------------|-----------|----------|--------|------------------------------------|------------|---------|---|
| 0 | 72 Foundation Street | 0.03 | IP272 | SP3 | Land with Planning Permission | IP272 | Yes | |
| 1 | Bus Depot, Sir Alf Ramsey Way | 1.07 | IP004 | SP2 | Land allocated for Residential Use | IP004 | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39430#d39430 |
| 2 | Bus Depot, Sir Alf Ramsey Way | 1.07 | IP004 | SP5 | Land allocated for Employment Use | | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39430#d39430 |
| 3 | Former Tooks Bakery, Old Norwich Road | 2.79 | IP005 | SP2 | Land allocated for Residential Use | IP005 | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39431#d39431 |
| 4 | Former Tooks Bakery, Old Norwich Road | 2.79 | IP005 | SP7 | Land allocated for community use | | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39431#d39431 |
| 5 | Warehouse, Paul's Road | 0.63 | IP006 | SP2 | Land allocated for Residential Use | IP006 | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39432#d39432 |
| 6 | Victoria Nurseries, Westerfield Road | 0.39 | IP009 | SP2 | Land allocated for Residential Use | IP009 | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39433#d39433 |
| 7 | Co-op Depot, Felixstowe Road | 1.96 | IP010a | SP2 | Land allocated for Residential Use | IP010a | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39434#d39434 |
| 8 | Co-op Depot, Felixstowe Road | 1.96 | IP010a | SP7 | Land allocated for community use | | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39434#d39434 |
| 9 | Felixstowe Road | 2.79 | IP010b | SP2 | Land allocated for Residential Use | IP010b | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39435#d39435 |

| ID | ADDRESS | SITE AREA | SITE REF | POLICY | ALLOCATION | ANNOTATION | INIPONE | PATH |
|----|--|-----------|----------|--------|------------------------------------|------------|---------|---|
| 10 | Smart Street/Foundation Street | 0.15 | IP011a | SP2 | Land allocated for Residential Use | IP011a | Yes | http://ipswich.jdi-consult.net/documents/pdfs21/2015%20new%20site%20sheets%20without%20IP178.pdf |
| 11 | Smart Street/Foundation Street | 0.69 | IP011b | SP2 | Land allocated for Residential Use | IP011b | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39436#d39436 |
| 12 | Smart Street/Foundation Street | 0.69 | IP011b | SP5 | Land allocated for Employment Use | | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39436#d39436 |
| 13 | Peter's Ice Cream etc, Grimwade Street | 0.32 | IP012 | SP2 | Land allocated for Residential Use | IP012 | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39437#d39437 |
| 14 | West End Road Surface Car Park | 1.21 | IP015 | SP2 | Land allocated for Residential Use | IP015 | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39438#d39438 |
| 15 | West End Road Surface Car Park | 1.21 | IP015 | SP5 | Land allocated for Employment Use | | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39438#d39438 |
| 16 | Opposite 674-734 Bramford Road | 2.27 | IP029 | SP2 | Land allocated for Residential Use | IP029 | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39439#d39439 |
| 17 | Opposite 674-734 Bramford Road | 2.27 | IP029 | SP6 | Land allocated for open space | | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39439#d39439 |
| 18 | 103-115 Burrell Road | 0.43 | IP031 | SP2 | Land allocated for Residential Use | IP031 | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39440#d39440 |
| 19 | King George V Field, Old Norwich Road | 3.54 | IP032 | SP2 | Land allocated for Residential Use | IP032 | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39441#d39441 |

| ID | ADDRESS | SITE AREA | SITE REF | POLICY | ALLOCATION | ANNOTATION | INIPONE | PATH |
|----|--|-----------|----------|--------|---|------------|---------|---|
| 20 | King George V Field, Old Norwich Road | 3.54 | IP032 | SP6 | Land allocated for open space | | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39441#d39441 |
| 21 | Land at Bramford Road (Stock's site) | 2.04 | IP033 | SP2 | Land allocated for Residential Use | IP033 | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39442#d39442 |
| 22 | Land at Bramford Road (Stock's site) | 2.04 | IP033 | SP6 | Land allocated for open space | | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39442#d39442 |
| 23 | Key Street/Star Lane/Burtons Site | 0.54 | IP035 | SP5 | Land allocated for Employment Use | IP035 | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39442#d39442 |
| 24 | Island Site | 6.02 | IP037 | SP2 | Land allocated for Residential Use | IP037 | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39443#d39443 |
| 25 | Island Site | 6.02 | IP037 | SP5 | Land allocated for Employment Use | | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39443#d39443 |
| 26 | Island Site | 6.02 | IP037 | SP6 | Land allocated for open space | | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39443#d39443 |
| 27 | Land between Vernon Street and Stoke Quay (west) | 0.48 | IP039a | SP2 | Land allocated for Residential Use | IP039a | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39444#d39444 |
| 28 | Civic Centre area, Civic Drive | 1.61 | IP040 | SP10 | Land allocated for predominantly retail use | IP040 | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39445#d39445 |
| 29 | Land between Cliff Quay and Landseer Road | 1.78 | IP042 | SP3 | Land with Planning Permission | IP042 | Yes | |

| ID | ADDRESS | SITE AREA | SITE REF | POLICY | ALLOCATION | ANNOTATION | INIPONE | PATH |
|----|--|-----------|----------|--------|--|------------|---------|---|
| 30 | Commercial Bldgs & Jewish Burial Ground, Star Lane | 0.7 | IP043 | SP2 | Land allocated for Residential Use | IP043 | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39446#d39446 |
| 31 | Commercial Bldgs & Jewish Burial Ground, Star Lane | 0.7 | IP043 | SP5 | Land allocated for Employment Use | | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39446#d39446 |
| 32 | Land at Commercial Road | 2.86 | IP047 | SP6 | Land allocated for open space | | Yes | http://ipswich.jdi-consult.net/documents/pdfs21/2015%20new%20site%20sheets%20without%20IP178.pdf |
| 32 | Land at Commercial Road | 2.86 | IP047 | SP5 | Land allocated for Employment Use | | Yes | http://ipswich.jdi-consult.net/documents/pdfs21/2015%20new%20site%20sheets%20without%20IP178.pdf |
| 32 | Land at Commercial Road | 2.86 | IP047 | SP2 | Land allocated for Residential Use | IP047 | Yes | http://ipswich.jdi-consult.net/documents/pdfs21/2015%20new%20site%20sheets%20without%20IP178.pdf |
| 33 | Mint Quarter | 1.33 | IP048 | SP2 | Land allocated for Residential Use | IP048 | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39447#d39447 |
| 34 | Mint Quarter | 1.33 | IP048 | SP6 | Land allocated for open space | | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39447#d39447 |
| 35 | No. 8 Shed, Orwell Quay | 0.76 | IP049 | SP12 | Land allocated for Education and ancillary Use/ Waterfront Use | IP049 | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d40225#d40225 |
| 36 | Old Cattle Market site, Portman Road (South) | 2.21 | IP051 | SP5 | Land allocated for Employment Use | IP051 | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d40226#d40226 |
| 37 | Land between Lower Orwell Street and Star Lane | 0.39 | IP052 | SP3 | Land with Planning Permission | IP052 | Yes | |

| ID | ADDRESS | SITE AREA | SITE REF | POLICY | ALLOCATION | ANNOTATION | INIPONE | PATH |
|----|--|-----------|----------|--------|------------------------------------|------------|---------|---|
| 38 | Land between Lower Orwell Street and Star Lane | 0.39 | IP052 | SP5 | Land allocated for Employment Use | | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d40227#d40227 |
| 39 | Land between Old Cattle Market and Star Lane | 1.72 | IP054 | SP2 | Land allocated for Residential Use | IP054 | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39448#d39448 |
| 40 | Land between Old Cattle Market and Star Lane | 1.72 | IP054 | SP5 | Land allocated for Employment Use | | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39448#d39448 |
| 41 | Raeburn Road South/Sandy Hill Lane | 5.82 | IP058 | SP5 | Land allocated for Employment Use | IP058 | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d40229#d40229 |
| 42 | Elton Park Industrial Estate | 2.63 | IP059a | SP2 | Land allocated for Residential Use | IP059a | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39449#d39449 |
| 43 | Elton Park Industrial Estate | 0.34 | IP059b | SP3 | Land with Planning Permission | IP059b | No | |
| 44 | Lavenham Road School site | 1.08 | IP061 | SP2 | Land allocated for Residential Use | IP061 | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39450#d39450 |
| 45 | Lavenham Road School site | 1.08 | IP061 | SP6 | Land allocated for open space | | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39450#d39450 |
| 46 | J J Wilson, White Elm Street | 0.32 | IP066 | SP2 | Land allocated for Residential Use | IP066 | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39451#d39451 |
| 47 | Former British Energy Site, Cliff Quay | 4.66 | IP067 | SP5 | Land allocated for Employment Use | IP067 | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d40230#d40230 |
| 48 | Church and land at Upper Orwell Street | 0.07 | IP074 | SP3 | Land with Planning Permission | IP074 | Yes | |

| ID | ADDRESS | SITE AREA | SITE REF | POLICY | ALLOCATION | ANNOTATION | INIPONE | PATH |
|----|---|-----------|----------|--------|------------------------------------|------------|---------|---|
| 49 | 240 Wherstead Road | 0.49 | IP080 | SP2 | Land allocated for Residential Use | IP080 | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39452#d39452 |
| 50 | Banks of river, upriver from Princes Street | 0.76 | IP083 | SP6 | Land allocated for open space | IP083 | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d40231#d40231 |
| 51 | 79 Cauldwell Hall Road | 0.3 | IP088 | SP3 | Land with Planning Permission | IP088 | No | |
| 52 | Waterworks Street | 0.3 | IP089 | SP2 | Land allocated for Residential Use | IP089 | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39453#d39453 |
| 53 | Europa Way | 1.15 | IP090 | SP2 | Land allocated for Residential Use | IP090 | No | http://ipswich.jdi-consult.net/documents/pdfs21/2015%20new%20site%20sheets%20without%20IP178.pdf |
| 54 | Rear of Grafton House, Russell Road | 0.31 | IP094 | SP5 | Land allocated for Employment Use | IP094 | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d40232#d40232 |
| 55 | Handford Road (east) | 0.22 | IP096 | SP2 | Land allocated for Residential Use | IP096 | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39454#d39454 |
| 56 | Transco, south of Patteson Road | 0.57 | IP098 | SP2 | Land allocated for Residential Use | IP098 | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39455#d39455 |
| 57 | Part former Volvo site, Raeburn Road South | 2.3 | IP099 | SP5 | Land allocated for Employment Use | IP099 | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d40233#d40233 |
| 58 | Depot, Beaconsfield Road | 0.33 | IP105 | SP2 | Land allocated for Residential Use | IP105 | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39456#d39456 |
| 59 | Rear of Jupiter Road and Reading Road | 0.49 | IP109 | SP3 | Land with Planning Permission | IP109 | No | |

| ID | ADDRESS | SITE AREA | SITE REF | POLICY | ALLOCATION | ANNOTATION | INIPONE | PATH |
|----|--------------------------------------|-----------|----------|--------|------------------------------------|------------|---------|---|
| 60 | St Clement's Hospital Grounds | 11.85 | IP116 | SP3 | Land with Planning Permission | IP116 | No | |
| 62 | BT Depot, Woodbridge Road | 1.07 | IP129 | SP3 | Land with Planning Permission | IP129 | No | |
| 63 | South of South Street (revised) | 0.04 | IP130 | SP3 | Land with Planning Permission | IP130 | No | |
| 64 | Milton Street | 0.29 | IP131 | SP2 | Land allocated for Residential Use | IP131 | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39458#d39458 |
| 65 | Bridge Street, Northern Quays (west) | 0.18 | IP132 | SP5 | Land allocated for Employment Use | | Yes | http://ipswich.jdi-consult.net/documents/pdfs21/2015%20new%20site%20sheets%20without%20IP178.pdf |
| 65 | Bridge Street, Northern Quays (west) | 0.18 | IP132 | SP2 | Land allocated for Residential Use | IP132 | Yes | http://ipswich.jdi-consult.net/documents/pdfs21/2015%20new%20site%20sheets%20without%20IP178.pdf |
| 66 | South of Felaw Street | 0.37 | IP133 | SP2 | Land allocated for Residential Use | IP133 | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39459#d39459 |
| 67 | 112-116 Bramford Road | 0.17 | IP135 | SP2 | Land allocated for Residential Use | IP135 | No | http://ipswich.jdi-consult.net/documents/pdfs21/2015%20new%20site%20sheets%20without%20IP178.pdf |
| 68 | Silo, College Street | 0.16 | IP136 | SP2 | Land allocated for Residential Use | IP136 | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39460#d39460 |
| 69 | Land north of Whitton Lane | 6.93 | IP140 | SP5 | Land allocated for Employment Use | IP140 | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d40234#d40234 |
| 70 | Duke Street | 0.39 | IP142 | SP2 | Land allocated for Residential Use | IP142 | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39461#d39461 |

| ID | ADDRESS | SITE AREA | SITE REF | POLICY | ALLOCATION | ANNOTATION | INIPONE | PATH |
|----|---|-----------|----------|--------|--|------------|---------|---|
| 71 | Duke Street | 0.39 | IP142 | SP6 | Land allocated for open space | | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39461#d39461 |
| 72 | Ransomes Europark (east)/Land around Makro | 5.29 | IP146 | SP5 | Land allocated for Employment Use | IP146 | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d40235#d40235 |
| 73 | Land between railway junction and Hadleigh Road | 4.7 | IP147 | SP5 | Land allocated for Employment Use | IP147 | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d40236#d40236 |
| 74 | Land at Pond Hall Farm | 24.76 | IP149 | SP8 | Land allocated for Country Park and Visitor Centre | IP149 | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d40237#d40237 |
| 75 | Land south of Ravenswood (revised) | 4.1 | IP150a | SP3 | Land with Planning Permission | IP150a | No | |
| 76 | Ravenswood | 9.6 | IP150b | SP7 | Land allocated for Leisure Use | IP150b | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d40238#d40238 |
| 77 | Ravenswood | 4.78 | IP150c | SP5 | Land allocated for Employment Use | IP150c | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d40239#d40239 |
| 78 | Airport Farm Kennels, north of A14 | 7.37 | IP152 | SP5 | Land allocated for Employment Use | IP152 | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d40240#d40240 |
| 79 | 2 Park Road | 0.35 | IP161 | SP3 | Land with Planning Permission | IP161 | No | |
| 80 | Eastway Business Park, Europa Way | 2.08 | IP165 | SP2 | Land allocated for Residential Use | IP165 | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39462#d39462 |
| 81 | Stoke Park Drive | 0.29 | IP168 | SP3 | Land with Planning Permission | IP168 | No | |
| 82 | 23-25 Burrell Road | 0.08 | IP169 | SP3 | Land with Planning Permission | IP169 | Yes | |

| ID | ADDRESS | SITE AREA | SITE REF | POLICY | ALLOCATION | ANNOTATION | INIPONE | PATH |
|----|-------------------------------------|-----------|----------|--------|------------------------------------|------------|---------|---|
| 83 | 15-19 St Margaret's Street | 0.08 | IP172 | SP2 | Land allocated for Residential Use | IP172 | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39463#d39463 |
| 84 | 7-9 Woodbridge Road | 0.05 | IP176 | SP3 | Land with Planning Permission | IP176 | Yes | |
| 86 | Websters saleyard site, Dock Street | 0.11 | IP188 | SP2 | Land allocated for Residential Use | IP188 | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39463#d39463 |
| 87 | Bath Street (Griffin Wharf) | 4.7 | IP200 | SP3 | Land with Planning Permission | IP200 | Yes | |
| 88 | Burton's College Street | 0.1 | IP205 | SP3 | Land with Planning Permission | IP205 | Yes | |
| 89 | Cranfields | 0.71 | IP206 | SP3 | Land with Planning Permission | IP206 | Yes | |
| 90 | Regatta Quay | 0.85 | IP211 | SP3 | Land with Planning Permission | IP211 | Yes | |
| 91 | Old Foundry Road | 0.02 | IP214 | SP2 | Land allocated for Residential Use | IP214 | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39466#d39466 |
| 92 | Waterford Road | 0.35 | IP221 | SP2 | Land allocated for Residential Use | IP221 | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39465#d39465 |
| 93 | Helena Road | 1.87 | IP226 | SP3 | Land with Planning Permission | IP226 | Yes | |
| 94 | Arcade Street | 0.06 | IP245 | SP2 | Land allocated for Residential Use | IP245 | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39467#d39467 |
| 95 | London Road | 0.06 | IP246 | SP3 | Land with Planning Permission | IP246 | No | |
| 96 | Electric House, Lloyds Avenue | 0.04 | IP253 | SP3 | Land with Planning Permission | IP253 | Yes | |

| ID | ADDRESS | SITE AREA | SITE REF | POLICY | ALLOCATION | ANNOTATION | INIPONE | PATH |
|-----|--------------------------|-----------|----------|--------|------------------------------------|------------|---------|---|
| 97 | Sports Club, Henley Road | 0.87 | IP256 | SP2 | Land allocated for Residential Use | IP256 | No | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d39468#d39468 |
| 98 | Old Suffolk College site | 1.58 | IP258 | SP7 | Land allocated for education use | IP258 | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d40241#d40241 |
| 99 | Odeon Cinema site | 0.2 | IP260 | SP7 | Land allocated for Leisure Use | IP260 | Yes | http://ipswich.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=5&docelemid=d40242#d40242 |
| 101 | Tacket Street (28-32) | 0.12 | IP264 | SP3 | Land with Planning Permission | IP264 | Yes | |

Appendix D

LONG-TERM TRENDS

NO2

Mann-
Kendall
trendSen's
slope
estimate

| Time series | First year | Last Year | n | Test S | Test Z | Signific. | Q | Qmin99 | Qmax99 | Qmin95 | Qmax95 | B | Bmin99 | Bmax99 | Bmin95 | Bmax95 |
|---|------------|-----------|----|--------|--------|-----------|--------|--------|--------|--------|--------|---------|--------|--------|--------|--------|
| <i>Chevalier Street</i> | 2005 | 2015 | 11 | | -0.23 | | -0.267 | -1.898 | 1.139 | -1.115 | 0.709 | 50.37 | 61.78 | 42.44 | 56.31 | 44.83 |
| <i>Civic Drive</i> | 2005 | 2015 | 11 | | -1.17 | | -0.200 | -0.825 | 0.300 | -0.735 | 0.203 | 29.80 | 33.72 | 27.80 | 33.28 | 27.90 |
| <i>Valley/Norwich Road</i> | 2005 | 2015 | 11 | | -3.11 | ** | -0.900 | -1.700 | -0.336 | -1.313 | -0.555 | 42.90 | 48.50 | 40.04 | 45.81 | 41.95 |
| <i>Cornhill o/s No 17</i> | 2005 | 2015 | 10 | | -2.33 | * | -0.933 | -1.497 | 0.146 | -1.373 | -0.231 | 33.48 | 38.08 | 28.24 | 37.27 | 29.88 |
| <i>Fore Street</i> | 2005 | 2015 | 10 | | -1.53 | | -0.683 | -1.821 | 0.664 | -1.565 | 0.275 | 46.51 | 50.99 | 37.20 | 49.78 | 39.34 |
| <i>Bramford Road</i> | 2008 | 2015 | 8 | -12 | | | -1.033 | | | | | 46.47 | | | | |
| <i>Fore Hamlet</i> | 2008 | 2015 | 8 | -12 | | | -0.788 | | | | | 38.35 | | | | |
| <i>Kings Avenue</i> | 2007 | 2015 | 8 | -16 | | + | -0.635 | | | | | 22.63 | | | | |
| <i>Lower Brook Street</i> | 2008 | 2015 | 8 | -19 | | * | -0.825 | | | | | 33.10 | | | | |
| <i>St Helen's St/Argyle Street</i> | 2008 | 2015 | 8 | -10 | | | -1.283 | | | | | 49.76 | | | | |
| <i>St Helen's St/Grimwade Street</i> | 2008 | 2015 | 8 | -18 | | * | -1.292 | | | | | 43.7917 | | | | |
| <i>St Helen's Street</i> | 2008 | 2015 | 8 | -18 | | * | -1.155 | | | | | 51.7075 | | | | |
| <i>St Margaret's Plain</i> | 2008 | 2015 | 8 | -9 | | | -0.450 | | | | | 40.8 | | | | |
| <i>St Margaret's Plain/Fonnereau Road</i> | 2008 | 2015 | 8 | -12 | | | -0.417 | | | | | 36.4583 | | | | |
| <i>St Margaret's Plain/Northgate St</i> | 2008 | 2015 | 8 | -8 | | | -0.296 | | | | | 40.8104 | | | | |
| <i>St Matthews Street</i> | 2008 | 2015 | 8 | -15 | | | -0.915 | | | | | 50.1325 | | | | |
| <i>Star Lane/Fore Street</i> | 2008 | 2015 | 8 | -14 | | | -1.090 | | | | | 50.125 | | | | |

NO2

Mann-
Kendall
trendSen's
slope
estimate

| Time series | First year | Last Year | n | Test S | Test Z | Signific. | Q | Qmin99 | Qmax99 | Qmin95 | Qmax95 | B | Bmin99 | Bmax99 | Bmin95 | Bmax95 |
|--------------------------------------|------------|-----------|---|--------|--------|-----------|--------|--------|--------|--------|--------|-------|--------|--------|--------|--------|
| <i>Yarmouth Rd/Bramford Road</i> | 2008 | 2015 | 8 | -14 | | | -0.800 | | | | | 45.65 | | | | |
| <i>Norwich Road/Anglesea Road</i> | 2008 | 2014 | 7 | -11 | | | -0.700 | | | | | 33.4 | | | | |
| <i>Star Lane opp St Peters St</i> | 2009 | 2015 | 7 | -15 | | * | -1.000 | | | | | 42.7 | | | | |
| <i>Berners Street o/s No. 31</i> | 2010 | 2015 | 6 | -13 | | * | -1.500 | | | | | 48 | | | | |
| <i>Chevallier St o/s No's 6 to 8</i> | 2010 | 2015 | 6 | -5 | | | -1.675 | | | | | 56.75 | | | | |
| <i>Cobden Place</i> | 2010 | 2015 | 6 | -9 | | | -0.400 | | | | | 31.25 | | | | |
| <i>College Street</i> | 2010 | 2015 | 6 | -13 | | * | -1.300 | | | | | 51.2 | | | | |
| <i>Franciscan Way/Wolsey St</i> | 2010 | 2015 | 6 | -13 | | * | -1.550 | | | | | 42.5 | | | | |
| <i>St Margarets Green</i> | 2010 | 2015 | 6 | -12 | | * | -0.720 | | | | | 29.66 | | | | |
| <i>Argyle Street o/s No. 11</i> | 2011 | 2015 | 5 | -4 | | | -1.533 | | | | | 48.13 | | | | |
| <i>Argyle Street o/s Nos. 2-4</i> | 2011 | 2015 | 5 | -6 | | | -1.000 | | | | | 36.40 | | | | |
| <i>Barrack lane/St Matthews St</i> | 2011 | 2015 | 5 | -4 | | | -0.992 | | | | | 34.23 | | | | |
| <i>Berners St o/s No. 21</i> | 2011 | 2015 | 5 | -4 | | | -0.400 | | | | | 35.20 | | | | |
| <i>Berners St o/s No. 32</i> | 2011 | 2015 | 5 | -4 | | | -1.158 | | | | | 39.65 | | | | |
| <i>Berners St o/s No. 41-43</i> | 2011 | 2015 | 5 | -6 | | | -0.892 | | | | | 34.03 | | | | |

NO2

Mann-Kendall trend

Sen's slope estimate

| Time series | First year | Last Year | n | Test S | Test Z | Signific. | Q | Qmin99 | Qmax99 | Qmin95 | Qmax95 | B | Bmin99 | Bmax99 | Bmin95 | Bmax95 |
|------------------------------------|------------|-----------|---|--------|--------|-----------|--------|--------|--------|--------|--------|---------|--------|--------|--------|--------|
| <i>Berners St o/s No. 58</i> | 2011 | 2015 | 5 | -8 | | + | -0.650 | | | | | 32.30 | | | | |
| <i>Bond Street o/s No. 29</i> | 2011 | 2015 | 5 | -10 | | * | -0.613 | | | | | 36.30 | | | | |
| <i>Bramford Road o/s No 122</i> | 2011 | 2015 | 5 | -4 | | | -0.363 | | | | | 37.53 | | | | |
| <i>Bramford Road o/s No 205</i> | 2011 | 2015 | 5 | -8 | | + | -0.775 | | | | | 39.6 | | | | |
| <i>Carr Street/Majors Corner</i> | 2011 | 2015 | 5 | -8 | | + | -1.200 | | | | | 37.8 | | | | |
| <i>Chevallier St o/s Nos 32/34</i> | 2011 | 2015 | 5 | -8 | | + | -1.525 | | | | | 50.1 | | | | |
| <i>Civic Drive by Victoria PH</i> | 2010 | 2014 | 5 | -4 | | | -1.325 | | | | | 46.7 | | | | |
| <i>Dock Street</i> | 2010 | 2015 | 5 | -8 | | + | -1.483 | | | | | 42.15 | | | | |
| <i>Grimwade St o/s No. 25</i> | 2011 | 2015 | 5 | -8 | | + | -0.713 | | | | | 34.125 | | | | |
| <i>Grimwade St o/s No. 28</i> | 2011 | 2015 | 5 | -3 | | | -0.417 | | | | | 28.0333 | | | | |
| <i>Old Foundry Road o/s No. 5</i> | 2011 | 2015 | 5 | -2 | | | -0.371 | | | | | 35.125 | | | | |
| <i>Orchard St o/s No. 7</i> | 2011 | 2015 | 5 | -8 | | + | -0.933 | | | | | 32.6667 | | | | |
| <i>Regent St/St Helens St</i> | 2011 | 2015 | 5 | -4 | | | -1.158 | | | | | 34.3833 | | | | |
| <i>St Helens St - Albury Ct</i> | 2011 | 2015 | 5 | -8 | | + | -1.138 | | | | | 38.925 | | | | |

NO2

Mann-
Kendall
trendSen's
slope
estimate

| Time series | First year | Last Year | n | Test S | Test Z | Signific. | Q | Qmin99 | Qmax99 | Qmin95 | Qmax95 | B | Bmin99 | Bmax99 | Bmin95 | Bmax95 |
|-------------------------------------|------------|-----------|---|--------|--------|-----------|--------|--------|--------|--------|--------|---------|--------|--------|--------|--------|
| <i>St Helens St - County Hall</i> | 2011 | 2015 | 5 | -10 | | * | -1.863 | | | | | 52.3375 | | | | |
| <i>St Helens St o/s No. 125</i> | 2011 | 2015 | 5 | -6 | | | -0.950 | | | | | 46.45 | | | | |
| <i>St Helens St/Grimwade St 44</i> | 2011 | 2015 | 5 | -4 | | | -0.813 | | | | | 43.8125 | | | | |
| <i>St Helens Street o/s No. 93</i> | 2011 | 2015 | 5 | 0 | | | -0.100 | | | | | 27.8 | | | | |
| <i>St Matthews St o/s No. 27</i> | 2011 | 2015 | 5 | -5 | | | -0.800 | | | | | 46.10 | | | | |
| <i>St Matthews St o/s No. 60</i> | 2011 | 2015 | 5 | -6 | | | -0.725 | | | | | 53.25 | | | | |
| <i>St Matthews St o/s No. 67</i> | 2011 | 2015 | 5 | -4 | | | -0.683 | | | | | 52.33 | | | | |
| <i>St Matthews St rbt co-locate</i> | 2011 | 2015 | 5 | -8 | | + | -0.800 | | | | | 41.30 | | | | |
| <i>St Matthews St/Berners St</i> | 2011 | 2015 | 5 | -6 | | | -0.588 | | | | | 36.13 | | | | |
| <i>St Matthews St/Portman Rd</i> | 2011 | 2015 | 5 | 4 | | | 0.775 | | | | | 29.60 | | | | |
| <i>Woodbridge Rd o/s No 30A</i> | 2011 | 2015 | 5 | -4 | | | -1.050 | | | | | 48.25 | | | | |
| <i>Woodbridge Rd o/s No. 62</i> | 2011 | 2015 | 5 | -8 | | + | -1.583 | | | | | 58.60 | | | | |
| <i>Woodbridge Rd/Blanche St</i> | 2011 | 2015 | 5 | -4 | | | -1.067 | | | | | 37.83 | | | | |

NO2

Mann-Kendall trend

Sen's slope estimate

| Time series | First year | Last Year | n | Test S | Test Z | Signific. | Q | Qmin99 | Qmax99 | Qmin95 | Qmax95 | B | Bmin99 | Bmax99 | Bmin95 | Bmax95 |
|------------------------------------|-------------------|------------------|----------|---------------|---------------|------------------|----------|---------------|---------------|---------------|---------------|----------|---------------|---------------|---------------|---------------|
| <i>Yarmouth Rd o/s flat 2 No 5</i> | 2011 | 2015 | 5 | -6 | | | -0.300 | | | | | 32.20 | | | | |
| <i>Chevallier Street</i> | 2006 | 2013 | 8 | 8 | | | 0.633 | | | | | 30.28 | | | | |
| <i>St Margarets Street</i> | 2006 | 2013 | 8 | 8 | | | 1.000 | | | | | 45.00 | | | | |

