

# **The Lake Lothing (Lowestoft) Third Crossing Order 201[\*]**

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Lake Lothing  
**THIRD  
CROSSING**

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**Document 6.3: Environmental Statement  
Volume 3 Appendices**

## **Appendix 8D**

**Scheme Specific Air Quality Monitoring**

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# Appendix 8D Scheme Specific Air Quality Monitoring

## 1.1 Introduction

1.1.1 A Scheme specific programme of NO<sub>2</sub> diffusion tube monitoring was undertaken for 12 months to establish the baseline condition and for model verification purposes. The monitoring started in December 2016 and ended in December 2017.

## 1.2 Monitoring Locations

1.2.1 A total of 45 sites were selected for diffusion tube monitoring. Details of the site locations are provided in Table 0-1 and the monitoring results are presented in Table 0-2.

## 1.3 Bias Adjustment

1.3.1 Monitoring of NO<sub>2</sub> using diffusion tubes is demonstrated to have a degree of uncertainty of +/- 25% when compared to automatic ambient monitoring data<sup>1</sup>, known as systematic bias, however diffusion tubes are a low cost method of monitoring suitable to give an indication of average NO<sub>2</sub> concentrations and can be deployed at many locations over a wide area.

1.3.2 A bias adjustment factor, which can be derived using local or national data, is applied to the diffusion tube results to adjust for any systematic bias. Detailed guidance on bias correction for NO<sub>2</sub> diffusion tubes is given in LAQM TG(16)<sup>2</sup>.

1.3.3 To facilitate local bias adjustment, the guidance recommends that co-located diffusion tubes are sited at the inlet of a continuous analyser for each month of the monitoring programme. The closest continuous analyser to the monitoring area is the Norwich Lakenfields urban background continuous analyser, which is managed by Defra as part of the Automatic Urban and Rural Network (AURN). The AURN is the main network of air quality monitoring stations used by Defra for compliance reporting against the Ambient Air Quality Directives<sup>3</sup>.

1.3.4 The Defra LAQM TG(16) guidance states that *“the value of a local co-location study (and the subsequent bias adjustment) will be improved if the concentrations being measured are similar to those in the wider survey. Broadly, this equates to carrying out a co-location study at roadside locations in order to derive a bias adjustment factor to be applied to a survey of roadside concentrations”*.

1.3.5 Subsequent to a review of the co-located monitoring data obtained at the Norwich AURN site, it was considered not to be representative of the concentrations experienced within the Scheme study area, given the lack of passing traffic at the AURN site. Therefore, in line with LAQM.TG(16) and associated guidance<sup>4</sup>, a nationally derived bias correction factor has been applied.

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<sup>1</sup> Defra (2008) Diffusion Tubes for Ambient NO<sub>2</sub> Monitoring: Practical Guidance for Laboratories and Users.

<sup>2</sup> Defra (2018) Local Air Quality Management Technical Guidance (LAQM TG16).

<sup>3</sup> Defra (2018) Automatic Urban and Rural Network Introduction <https://uk-air.defra.gov.uk/networks/network-info?view=aurm> as accessed 04/01/18

<sup>4</sup> Defra (2017) National Diffusion Tube Bias Adjustment Factor Spreadsheet, Spreadsheet Version Number: 09/17. <https://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html> as accessed 02/02/18

- 1.3.6 LAQM.TG(16) states that where a nationally derived correction factor is used, “*the nationally derived factor will also include any locally derived factors based on collocation data sent to NPL (National Physical Laboratory). As such, the national factor is likely to be more reliable*”.
- 1.3.7 National bias adjustment factors are specific to the laboratory used to supply the diffusion tubes used for the study. In this case, the 2017 National Factor of 0.77 for the ESG laboratory Didcot, for diffusion tubes with a composition of 50% TEA in acetone, was applied to the monitoring results.
- 1.3.8 The bias adjusted period means are representative of an annual mean for 2017, given that over 11 months of the monitoring period was within that year. However, for the purposes of undertaking model verification for the Base Year (2016) assessment, the 2017 annual means were annualised accordingly to provide 2016 concentrations.
- 1.3.9 Annualisation was undertaken following the procedure given in TG(16) Box 7.9. AURN sites situated within 50 miles of the diffusion tube NO<sub>2</sub> monitoring locations are considered ideal where the data capture is at least 85% for the appropriate year of measurement. The AURN network did not provide adequate coverage within 50 miles with adequate data capture to use only Urban Background, Suburban or Rural sites therefore additional continuous analyser sites have been incorporated into the annualisation procedure. The locations given below represent the most suitable continuous analyser locations within 50 miles with adequate data capture. A factor of 1.08 was calculated using 2016 data from the following continuous analysers;
- Cambridge Roadside (Roadside AURN)
  - Norwich Lakenfields (Urban Background AURN)
  - Wicken Fen (Rural AURN)
  - Kings Lynn Gaywood Roadside (Kings Lynn Council)
  - Swaffham Roadside (Breckland Council)

## 1.4 Monitoring Results

- 1.4.1 The bias adjusted and annualised results show that 2016 NO<sub>2</sub> annual mean concentrations ranged from 10.5 µg/m<sup>3</sup> to 32.1 µg/m<sup>3</sup>. The monitoring has not identified an exceedance of the annual mean NO<sub>2</sub> limit value of 40 µg/m<sup>3</sup> at any of the monitoring locations, all of which included triplicate tube sampling. The highest annual mean concentration of NO<sub>2</sub> was identified at location WSP18 on Bridge Road Lowestoft.

Table 0-1 Scheme Specific NO<sub>2</sub> Diffusion Tube Monitoring Location Site Details

Site ID	Location	X	Y	Height (m)	Type
WSP1	The Street	646969	289448	2.6	Roadside
WSP2	Keel Close	650658	290542	2.4	Roadside
WSP3	Ark Close	652043	286689	2.5	Roadside
WSP4	Cranleigh Rd	652627	290378	2.4	Roadside

Site ID	Location	X	Y	Height (m)	Type
<b>WSP5</b>	Laxfield Rd	652933	290798	2.6	Roadside
<b>WSP6</b>	The Avenue	653463	291452	2.6	Roadside
<b>WSP7</b>	Long Road	652989	291235	2.5	Roadside
<b>WSP8</b>	Ranworth Avenue	652264	291476	2.6	Roadside
<b>WSP9</b>	Clarkes Lane	651286	291552	2.4	Roadside
<b>WSP10</b>	Winston Avenue	652174	292221	2.6	Roadside
<b>WSP11</b>	Dell Road	652694	292311	2.6	Roadside
<b>WSP12</b>	Kirkley Run	653291	291968	2.6	Roadside
<b>WSP13</b>	Notley Road	653665	292175	2.5	Roadside
<b>WSP14</b>	Durban Road	653921	292379	2.5	Kerbside
<b>WSP15</b>	Waveney Crescent	653770	292370	2.4	Kerbside
<b>WSP16</b>	Crompton Road	652406	292476	2.6	Roadside
<b>WSP17</b>	Victoria Road	652144	292483	2.4	Roadside
<b>WSP18</b>	Bridge Road	652230	292922	2.6	Roadside
<b>WSP19</b>	Lakeland Drive	652728	293347	2.5	Roadside
<b>WSP20</b>	Princes Walk	653310	293434	2.5	Kerbside
<b>WSP21</b>	Peto Way	653533	293136	2.3	Roadside
<b>WSP22</b>	Rotterdam Road	653873	293148	2.6	Roadside
<b>WSP23</b>	Denmark Street	654159	292951	2.6	Roadside

Site ID	Location	X	Y	Height (m)	Type
<b>WSP24</b>	Denmark Road	654661	292916	2.5	Roadside
<b>WSP25</b>	Battery Green Road	655011	292965	2.4	Roadside
<b>WSP26</b>	A47	655111	293373	2.25	Roadside
<b>WSP27</b>	Milton Road East	654909	293431	2.6	Roadside
<b>WSP28</b>	Minden Road	654164	293603	2.6	Kerbside
<b>WSP29</b>	High Beech	653600	293805	2.6	Roadside
<b>WSP30</b>	B1375 Sands Lane	652570	293874	2.5	Roadside
<b>WSP31</b>	Lime Avenue	651656	293963	2.5	Roadside
<b>WSP32</b>	Lavenham Way	652975	294138	2.5	Roadside
<b>WSP33</b>	Dunsten Drive	652123	294561	2.6	Roadside
<b>WSP34</b>	Union Lane	652351	295278	2.5	Urban Background
<b>WSP35</b>	Jenkins Green	653081	295367	2.5	Roadside
<b>WSP36</b>	Leonard Drive	653264	295954	2.4	Roadside
<b>WSP37</b>	Blyford Road	653439	295274	2.6	Kerbside
<b>WSP38</b>	Thirlmere Road	653165	294640	2.6	Urban Background
<b>WSP39</b>	Woods Loke East	653252	294147	2.6	Roadside
<b>WSP40</b>	Bramfield Road	653221	294263	2.5	Kerbside
<b>WSP41</b>	Ashley Downs	654226	294460	2.6	Roadside
<b>WSP42</b>	Church Road	654538	294044	2.5	Kerbside

Site ID	Location	X	Y	Height (m)	Type
<b>WSP43</b>	A47	654595	294747	2.5	Roadside
<b>WSP44</b>	Hubbards Lane	654492	295716	2.5	Kerbside
<b>WSP45</b>	Old Lane	653630	296575	2.5	Roadside

Table 0-2 Scheme Specific NO<sub>2</sub> Diffusion Tube Monitoring Results

Site ID	P1 (µg/m <sup>3</sup> )	P2 (µg/m <sup>3</sup> )	P3 (µg/m <sup>3</sup> )	P4 (µg/m <sup>3</sup> )	P5 (µg/m <sup>3</sup> )	P6 (µg/m <sup>3</sup> )	P7 (µg/m <sup>3</sup> )	P8 (µg/m <sup>3</sup> )	P9 (µg/m <sup>3</sup> )	P10 (µg/m <sup>3</sup> )	P11 (µg/m <sup>3</sup> )	P12 (µg/m <sup>3</sup> )	Bias Adjusted* Period Average Concentration (µg/m <sup>3</sup> )	2016 Annualised Concentration (µg/m <sup>3</sup> )
WSP1	21.1	24.8	16.0	14.0	10.5	12.2	11.0	8.4	9.5	12.3	16.4	17.0	11.1	12.0
WSP2	24.6	33.6	18.2	17.2	16.0	15.1	14.7	12.4	14.8	16.9	21.5	27.1	14.9	16.1
WSP3	20.9	26.9	18.9	16.9	12.8	15.3	12.0	10.4	13.4	14.7	20.2	22.7	13.2	14.2
WSP4	29.3	27.7	26.5	20.2	19.7	20.8	15.2	14.8	17.5	19.5	23.9	27.9	16.9	18.3
WSP5	26.5	30.0	15.4	16.9	16.2	20.4	12.9	11.0	12.7	12.9	20.6	25.6	14.2	15.4
WSP6	25.5	36.8	22.3	23.3	13.8	12.8	15.5	12.8	15.1	15.9	23.7	25.1	15.5	16.8
WSP7	22.2	37.0	25.7	19.5	17.1	17.5	16.9	13.5	14.6	19.5	24.1	26.5	16.3	17.6
WSP8	21.7	34.1	17.5	16.4	13.3	14.4	12.4	8.9	11.0	14.7	20.7	25.3	13.5	14.6
WSP9	22.5	27.6	17.5	14.5	10.8	13.4	11.3	9.0	11.1	13.4	18.4	18.6	12.1	13.1

Site ID	P1 ( $\mu\text{g}/\text{m}^3$ )	P2 ( $\mu\text{g}/\text{m}^3$ )	P3 ( $\mu\text{g}/\text{m}^3$ )	P4 ( $\mu\text{g}/\text{m}^3$ )	P5 ( $\mu\text{g}/\text{m}^3$ )	P6 ( $\mu\text{g}/\text{m}^3$ )	P7 ( $\mu\text{g}/\text{m}^3$ )	P8 ( $\mu\text{g}/\text{m}^3$ )	P9 ( $\mu\text{g}/\text{m}^3$ )	P10 ( $\mu\text{g}/\text{m}^3$ )	P11 ( $\mu\text{g}/\text{m}^3$ )	P12 ( $\mu\text{g}/\text{m}^3$ )	Bias Adjusted* Period Average Concentration ( $\mu\text{g}/\text{m}^3$ )	2016 Annualised Concentration ( $\mu\text{g}/\text{m}^3$ )
<b>WSP10</b>	25.3	33.6	No Data	16.5	No Data	0.0	11.0	7.9	10.5	14.0	20.0	11.8	12.9	13.9
<b>WSP11</b>	27.3	31.5	24.1	20.9	15.5	17.0	15.7	11.6	14.4	17.4	21.7	24.9	15.5	16.8
<b>WSP12</b>	28.1	38.1	26.0	20.5	16.2	17.1	15.5	11.7	14.7	18.0	22.4	25.6	16.3	17.6
<b>WSP13</b>	28.4	37.0	22.5	19.4	14.9	15.9	14.2	11.2	13.5	17.2	22.5	23.5	15.4	16.7
<b>WSP14</b>	26.7	33.8	23.4	22.0	20.3	17.3	17.1	13.6	14.5	16.4	21.6	25.5	16.2	17.5
<b>WSP15</b>	25.5	32.8	22.7	21.5	16.0	14.9	15.5	12.4	12.1	17.5	20.6	26.3	15.3	16.5
<b>WSP16</b>	24.2	32.3	21.0	16.7	12.7	14.7	13.1	10.3	12.5	16.5	19.4	19.5	13.7	14.8
<b>WSP17</b>	32.2	39.2	30.8	24.0	19.7	37.2	20.2	18.5	21.7	24.3	25.3	30.4	20.8	22.5
<b>WSP18</b>	36.0	50.2		33.6	46.3	24.0	41.8	35.9	38.4	34.8	33.9	49.1	29.7	32.1
<b>WSP19</b>	23.2	32.4	20.0	17.6	16.5	16.6	13.9	11.6	15.3	17.5	22.3	22.0	14.7	15.9



Site ID	P1 ( $\mu\text{g}/\text{m}^3$ )	P2 ( $\mu\text{g}/\text{m}^3$ )	P3 ( $\mu\text{g}/\text{m}^3$ )	P4 ( $\mu\text{g}/\text{m}^3$ )	P5 ( $\mu\text{g}/\text{m}^3$ )	P6 ( $\mu\text{g}/\text{m}^3$ )	P7 ( $\mu\text{g}/\text{m}^3$ )	P8 ( $\mu\text{g}/\text{m}^3$ )	P9 ( $\mu\text{g}/\text{m}^3$ )	P10 ( $\mu\text{g}/\text{m}^3$ )	P11 ( $\mu\text{g}/\text{m}^3$ )	P12 ( $\mu\text{g}/\text{m}^3$ )	Bias Adjusted* Period Average Concentration ( $\mu\text{g}/\text{m}^3$ )	2016 Annualised Concentration ( $\mu\text{g}/\text{m}^3$ )
<b>WSP20</b>	21.6	28.1	19.9	15.9	12.0	15.2	13.0	11.6	13.8	14.6	17.4	19.0	13.0	14.0
<b>WSP21</b>	32.1	44.2	28.8	23.8	20.8	25.5	23.2	20.5	20.8	25.5	26.1	27.0	20.4	22.1
<b>WSP22</b>	33.5	42.7	32.9	23.2	22.3	24.6	21.9	20.3	20.4	11.1	31.2	No Data	19.9	21.5
<b>WSP23</b>	33.0	48.5	36.0	27.6	28.7	27.5	25.9	21.4	25.3	14.1	31.8	36.0	22.8	24.7
<b>WSP24</b>	38.2	48.2	41.7	37.3	31.4	36.0	30.6	26.2	30.0	0.0	37.6	38.9	27.7	30.0
<b>WSP25</b>	43.7	46.7	41.7	36.1	30.4	35.0	29.4	30.7	32.2	34.5	39.3	45.4	28.6	30.9
<b>WSP26</b>	41.9	42.7	39.2	36.0	No Data	35.5	27.7	30.7	30.1	35.8	34.2	41.7	27.7	29.9
<b>WSP27</b>	32.4	34.8	25.5	21.4	No Data	0.0	0.0	15.7	17.4	22.2	26.9	31.0	19.5	21.0
<b>WSP28</b>	31.8	30.5	25.2	21.0	17.3	21.5	18.3	16.7	18.2	20.3	26.5	31.0	17.9	19.3
<b>WSP29</b>	22.5	33.3	22.2	17.2	14.8	17.9	14.6	12.3	14.7	18.4	20.2	25.6	15.0	16.2

Site ID	P1 ( $\mu\text{g}/\text{m}^3$ )	P2 ( $\mu\text{g}/\text{m}^3$ )	P3 ( $\mu\text{g}/\text{m}^3$ )	P4 ( $\mu\text{g}/\text{m}^3$ )	P5 ( $\mu\text{g}/\text{m}^3$ )	P6 ( $\mu\text{g}/\text{m}^3$ )	P7 ( $\mu\text{g}/\text{m}^3$ )	P8 ( $\mu\text{g}/\text{m}^3$ )	P9 ( $\mu\text{g}/\text{m}^3$ )	P10 ( $\mu\text{g}/\text{m}^3$ )	P11 ( $\mu\text{g}/\text{m}^3$ )	P12 ( $\mu\text{g}/\text{m}^3$ )	Bias Adjusted* Period Average Concentration ( $\mu\text{g}/\text{m}^3$ )	2016 Annualised Concentration ( $\mu\text{g}/\text{m}^3$ )
<b>WSP30</b>	31.9	41.4	23.8	25.1	23.8	23.7	20.4	17.5	21.6	21.0	26.3	25.6	19.4	21.0
<b>WSP31</b>	22.8	30.5	19.3	14.5	12.0	13.9	11.6	10.2	12.2	16.1	16.5	17.9	12.7	13.7
<b>WSP32</b>	22.9	35.2	21.5	17.3	12.7	15.5	11.8	10.3	12.0	17.1	19.4	11.4	13.3	14.4
<b>WSP33</b>	20.5	29.8	17.5	13.8	11.0	11.8	11.1	8.8	9.8	12.1	16.9	17.9	11.6	12.6
<b>WSP34</b>	18.4	25.7	13.6	10.8	9.2	11.0	9.1	6.8	7.8	10.9	12.6	15.1	9.7	10.5
<b>WSP35</b>	23.5	30.8	17.2	15.0	12.3	13.7	10.7	9.6	11.8	15.1	19.0	22.0	12.9	13.9
<b>WSP36</b>	23.0	29.8	20.4	14.5	12.4	13.1	11.2	9.8	11.0	15.5	17.7	19.5	12.7	13.7
<b>WSP37</b>	25.3	28.1	22.1	20.3	13.8	15.8	12.8	0.0	12.6	16.4	20.5	23.1	14.7	15.9
<b>WSP38</b>	26.6	34.0	23.2	19.0	15.0	16.6	13.7	0.0	14.7	18.8	22.6	20.2	15.7	17.0
<b>WSP39</b>	23.4	29.2	21.3	16.1	14.3	14.8	12.2	10.6	13.1	6.5	18.5	19.7	12.8	13.9

Site ID	P1 ( $\mu\text{g}/\text{m}^3$ )	P2 ( $\mu\text{g}/\text{m}^3$ )	P3 ( $\mu\text{g}/\text{m}^3$ )	P4 ( $\mu\text{g}/\text{m}^3$ )	P5 ( $\mu\text{g}/\text{m}^3$ )	P6 ( $\mu\text{g}/\text{m}^3$ )	P7 ( $\mu\text{g}/\text{m}^3$ )	P8 ( $\mu\text{g}/\text{m}^3$ )	P9 ( $\mu\text{g}/\text{m}^3$ )	P10 ( $\mu\text{g}/\text{m}^3$ )	P11 ( $\mu\text{g}/\text{m}^3$ )	P12 ( $\mu\text{g}/\text{m}^3$ )	Bias Adjusted* Period Average Concentration ( $\mu\text{g}/\text{m}^3$ )	2016 Annualised Concentration ( $\mu\text{g}/\text{m}^3$ )
<b>WSP40</b>	22.6	30.6	21.6	15.1	13.5	13.8	12.6	11.4	12.2	15.9	13.9	20.1	13.1	14.1
<b>WSP41</b>	26.2	30.0	27.7	20.0	13.6	16.6	13.1	12.0	13.8	18.3	21.9	27.2	15.4	16.7
<b>WSP42</b>	29.8	35.1	25.7	17.9	15.7	19.3	14.0	12.9	15.3	17.8	23.8	28.9	16.4	17.8
<b>WSP43</b>	No Data	No Data	27.6	22.9	No Data	No Data	20.0	15.3	18.0	20.7	24.5	24.0	Inadequate Data Capture	Inadequate Data Capture
<b>WSP44</b>	21.9	28.3	20.9	13.5	10.5	13.1	9.8	8.7	10.5	14.2	16.9	18.7	12.0	13.0
<b>WSP45</b>	21.3	29.8	17.7	15.1	12.1	13.1	11.2	8.6	8.9	13.7	15.8	19.4	12.0	13.0

