BUROHAPPOLD ENGINEERING

TfL Landholdings at Northwood

Air Quality Assessment Addendum

034233

11 March 2016

Revision 02

Revision	Description	Issued by	Date	Checked
00	Draft	PH	03/03/16	TC
01	TfL comments	PH	04/03/16	TC
02	LBH Comments	PH	11/03/16	TC

W:\034233 Green Lane, Northwood Station Phase 2\F32 Environmental\03 Reports\AQ\Addendum 2016\final addendum\160311 PH 034233 Air Quality Assessment Addendum 02.docx

author	**Peter Henshaw**
date	**11/03/16**
approved	**Trevor Curson**
signature	
date	**11/03/16**

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Contents

Table of Tables

Table of Figures

Glossary

Term	Definition
AQAL	Air quality assessment level
AQMA	Air quality management area
LBH	London Borough of Hillingdon
NOx	Nitrogen oxides
NO2	Nitrogen dioxide

Executive summary

An air quality assessment has been produced by BuroHappold (October, 2015) for the proposed development at TfL's Landholdings at Northwood in the London Borough of Hillingdon (LBH). This addendum provides an update to the assessment, following the completion of a six month air quality monitoring study, and the comments received from LBH.

Existing baseline conditions in the vicinity of the site are considered following the air quality monitoring study.

Air quality monitoring data are also used in order to carry out model verification and to assess model performance.

An updated traffic emissions dispersion modelling study is also carried out in order to respond to comments from LBH's air quality team. This updated study utilises updated traffic data, and also considers the impact of vehicle congestion.

Air quality monitoring results indicate the national air objective is achieved at all monitoring locations. Also, modelling predictions indicate that the national objective will be achieved at all receptors during the operation of the development. In terms of the impact of the development on local air quality, modelling results show that the impact is negligible at all receptors except at two locations where the impact is predicted to be slight adverse.

Mitigation measures have been outlined which are proposed to result in local air quality improvements.

1 Introduction

An air quality assessment (hereafter referred to as the original assessment) has been produced by BuroHappold and submitted in support of a planning application for the proposed development at TfL's Landholdings at Northwood (application ref: 7108/APP/2015/4037) in the London Borough of Hillingdon (LBH)[1].

The original assessment considers baseline conditions in the vicinity of the site and also assesses construction and operational impacts associated with the proposed development.

This addendum should be read alongside the original assessment and it provides an update to the assessment, in particular by considering the existing baseline air quality conditions following a six month monitoring study. The addendum also responds to comments received from LBH's air quality team, and an updated dispersion modelling study is carried out in order to assess updated traffic flows and consider the impact of vehicle congestion.

The air quality monitoring data, obtained from the monitoring study, were also used in a model verification study in order to assess the performance of the dispersion model used to predict the impact of traffic emissions associated with the development.

The addendum also sets out proposed mitigation measures where required.

[1] BuroHappold, 2015. TfL Landholdings at Northwood *Air Quality Assessment*, 27th October 2015

2 Air quality monitoring study

In order to assess baseline conditions in the vicinity of the site, a six-month air quality monitoring study was carried out from 1st July 2015 until 4th January 2016, as agreed with LBH.

UK air quality objectives for nitrogen dioxide (NO_2) are widely exceeded at roadside locations throughout Greater London and many urban areas. The monitoring study has therefore focused on this pollutant. Air quality objectives for NO_2 are presented in Table 2-1.

In areas where air quality objectives are not likely to be met by the relevant target date, local authorities are required to declare an AQMA and develop an air quality action plan in pursuit of the air quality objectives.

LBH has carried out a phased review and assessment of local air quality within the Borough. LBH currently has one AQMA within its administrative area which has been declared for exceedences of the annual mean NO_2 air quality objective. The development site is not located within the declared AQMA (which is located in the south of LBH approximately 5 km from the proposed development site).

Table 2-1 NO_2 National Air Quality Objectives included in the Air Quality (England) Regulations 2000

Pollutant	Objective	Date to be achieved and maintained thereafter
Nitrogen dioxide	200 µg/m^3 measured as a 1-hour mean, not to be exceeded more than 18 times a year	31st December 2005
	40 µg/m^3 measured as an annual mean	

Diffusion tubes were used to measure NO_2 concentrations at four roadside locations as agreed with LBH. At each location, diffusion tubes were set up in triplicate and exposed for a month at a time. Following each exposure period, the tubes were sent to Gradko Ltd. laboratories for analysis.

The four monitoring sites are located to the north of the application site, where the impact of traffic emissions is expected to be greatest (i.e. at busy junctions and areas where congestion occurs). These locations are at the junction of Green Lane, Station Approach and Eastbury Road, at a height of approximately 2.5 m.

Diffusion tube locations are presented in Figure 2-1 . Photos of tube locations are presented in Figure 2-2 to Figure 2-5.

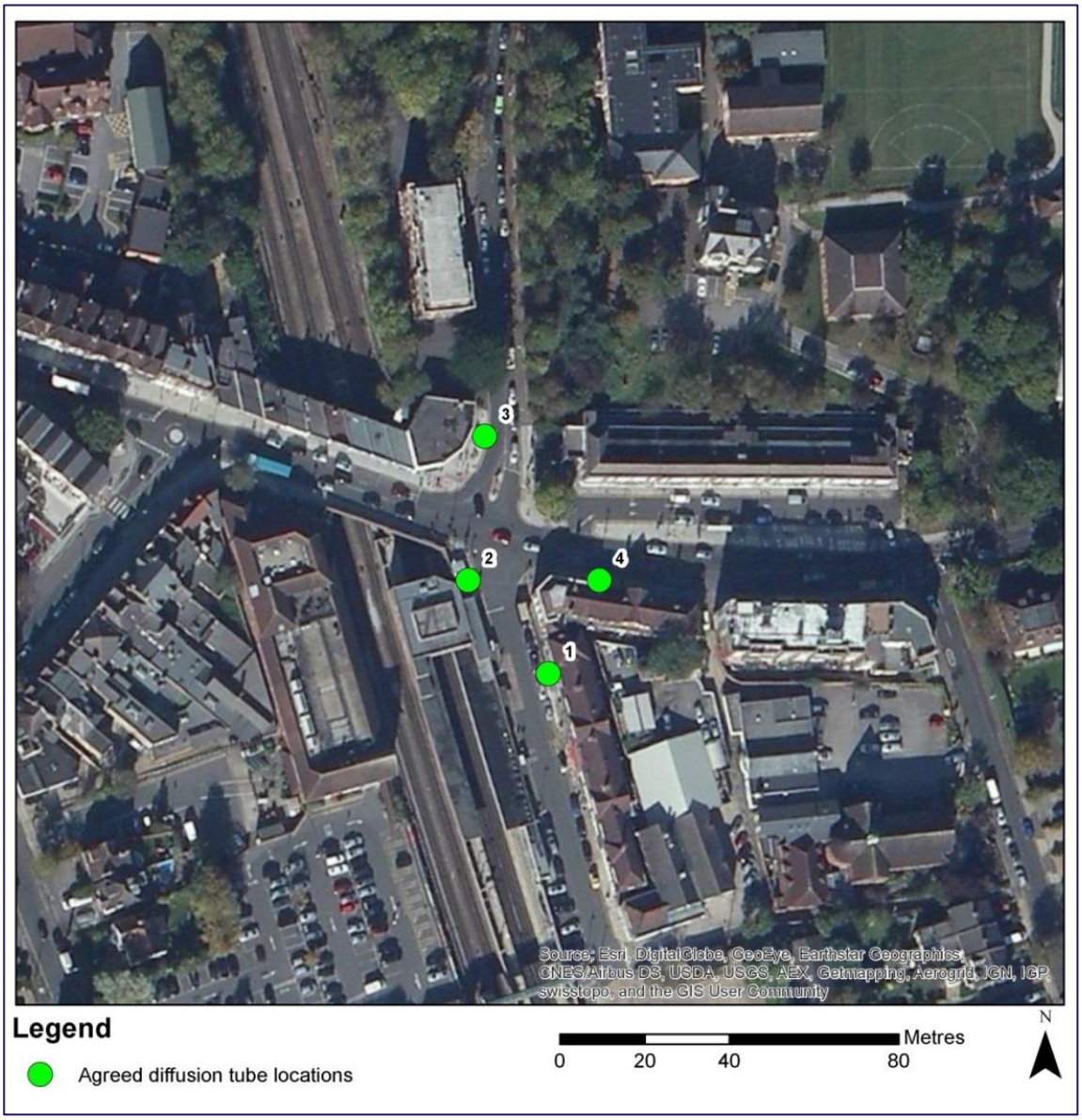

Figure 2-1 Agreed air quality monitoring locations

Figure 2-2 Diffusion tube 1

Figure 2-3 Diffusion tube site 2

Figure 2-4 Diffusion tube site 3

Figure 2-5 Diffusion tube site 4

Results from the six months monitoring study have been annualised (see Table 2-2) following Defra guidance[2] and bias adjusted using Defra national bias adjustment factors[3] (a bias adjustment factor of 0.92 has been applied) in order to provide a comparison with the annual mean NO_2 objective.

As requested by LBH, a number of monitoring sites were considered for the annualisation procedure, with the sites that produced the most conservative results selected. Sites considered are presented in Appendix A. The five sites which had the highest ratio of annual to period mean, and therefore lead to the most conservative annualisation conversion were subsequently used, as shown in Table 2-2.

Monitoring data from three automatic urban background sites have been used in the annualisation of the six-month data. Two LBH diffusion tube sites located within close vicinity to schools in the borough have also been used in order to capture emission patterns associated with school traffic. Monitoring results are presented in Table 2-3. All sites are below the annual mean NO_2 objective. Raw diffusion tube data is presented in Appendix B.

Table 2-2 Calculation of annualisation ratio

Site	Site type	Annual mean 2015 (Am)	Period mean 01/07/15-04/01/16 (Pm)	Ratio (Am/Pm)
Ealing Southall	Urban Background	25.6	24	1.07
Hillingdon Harlington (2014)	Urban Background	37	35.5	1.04
North Kensington	Urban Background	30	28.8	1.04
LBH diffusion tube, HD301	Roadside	40.1	38.9	1.03
LBH diffusion tube, HD204	Background	40.5	39.7	1.02
			Average (Ra)	**1.04**

Table 2-3 Diffusion tube monitoring results (annualised and bias adjusted)

Site number	Location	Indicative grid reference		Average monthly NO_2 concentration, µg/m^3						2015 Annual mean* NO_2 µg/m^3
		X	Y	July	August	September	October	November	December	
1	Station Approach, East	509261	191432	24.5	27.5	36.4	40.0	28.4	30.7	29.9
2	Station Approach, West	509242	191454	30.3	29.5	38.5	40.2	32.9	28.2	31.3
3	Eastbury Road, West	509246	191488	32.6	31.0	40.0	43.8	34.1	37.5	34.9
4	Green Lane, South	509273	191454	33.7	39.5	39.3	46.9	37.8	35.4	37.1

*annualised and bias adjusted

[2] Defra (2009) Part of the Environment Act 1995: Local Air Quality Management: Technical Guidance (LAQM.TG(09)), Department for Environment Food and Rural Affairs, February 2009

[3] Defra National Diffusion Tube Bias Adjustment Factor Spreadsheet (version 09/15). Available at: http://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html

3 Traffic emissions modelling

3.1 Traffic emissions

Traffic emissions were assessed in the original assessment, however in order to address comments from LBH regarding model verification, and the explicit modelling of vehicle congestion an updated traffic emissions dispersion modelling study has been undertaken. Revised traffic generation figures have also been produced which are lower than those previously used in the original assessment as a result of revisions to the quantum of commercial uses proposed in the application. This revised traffic data has therefore been used in this study.

The methodology for this assessment follows that of the original assessment, as detailed in Section 5.1 of the original report, however additionally traffic queues have been explicitly modelled using the data shown in Table 3-1.

Queueing data was input into the model as a road source, assuming a length of 4 metres per car, and speed of 5kph. This gives a representative AADT of 30,000 vehicles. To account for the variation between AM and PM peak queueing, a time varying file (.fac) was applied to the queues.

AM peak queueing takes place between 0800-0900, and PM peak queueing takes place between 1700-1800.

Table 3-1 Queueing data used in modelling study

Scenario	Road	AM Peak (0800-0900)		PM Peak (1700-1800)	
		Number of vehicles in queue (mean max)	Queue length (m)	Number of vehicles in queue (mean max)	Queue length (m)
2015 baseline	Green Lane (W)	16	64	15	60
	Green Lane (E)	17	68	12	48
	Eastbury Road	11	44	6	24
	Station Approach	1	4	3	12
	Maxwell Road Rbt	11	44	6	24
	Green Lane (W) Rbt	7	28	6	24
	Hallowell Rd	2	8	1	4
2020 Base	Green Lane (W)	19	76	17	68
	Green Lane (E)	24	96	14	56
	Eastbury Road	15	60	6	24
	Station Approach	2	8	4	16
	Maxwell Road Rbt	40	160	9	36
	Green Lane W Rbt	59	236	59	236
	Hallowell Road	4	16	1	4
2020 Base + Dev	Green Lane (W)	12	48	9	36
	Green Lane (E)	20	80	13	52
	Eastbury Road	15	60	7	28
	Central Way	2	8	4	16
	Maxwell Road	10	40	8	32
	Green Lane W	13	52	13	52
	Hallowell Road	8	32	1	4

3.2 Model verification

Modelled roadside NOx concentrations, calculated using the dispersion model ADMS-Roads, were compared against data from the diffusion tube monitoring study undertaken. This has been carried out in order to ensure that modelled results are representative of monitored data from the study area. Local Air Quality Management Technical Guidance (LAQM-TG(09))[4] provides a methodology for model verification which has been followed for the purposes of this assessment.

NO_x concentrations were predicted at the four roadside monitoring sites (see Figure 2-1) using ADMS-Roads.

Monitored NO_2 has been converted to NOx using the Defra NOx-NO2 conversion spreadsheet, and background NOx has been removed in order to give monitored road NOx, which can be compared with modelled road NOx.

Model verification results are presented in Figure 3-1. Results indicate that the model is under predicting road NOx, therefore it is necessary to adjust results (see Table 3-2 and Figure 3-2).

Adjusted Road NOx has then been converted to NO_2 and added to background NO_2 concentrations (from the Harefield hospital diffusion tube monitoring site) to give total adjusted NO_2 (see Figure 3-3).

Adjustment has subsequently been applied to all modelled results.

[4] *Defra (2009) Part of the Environment Act 1995: Local Air Quality Management: Technical Guidance (LAQM.TG(09)), Department for Environment Food and Rural Affairs, February 2009*

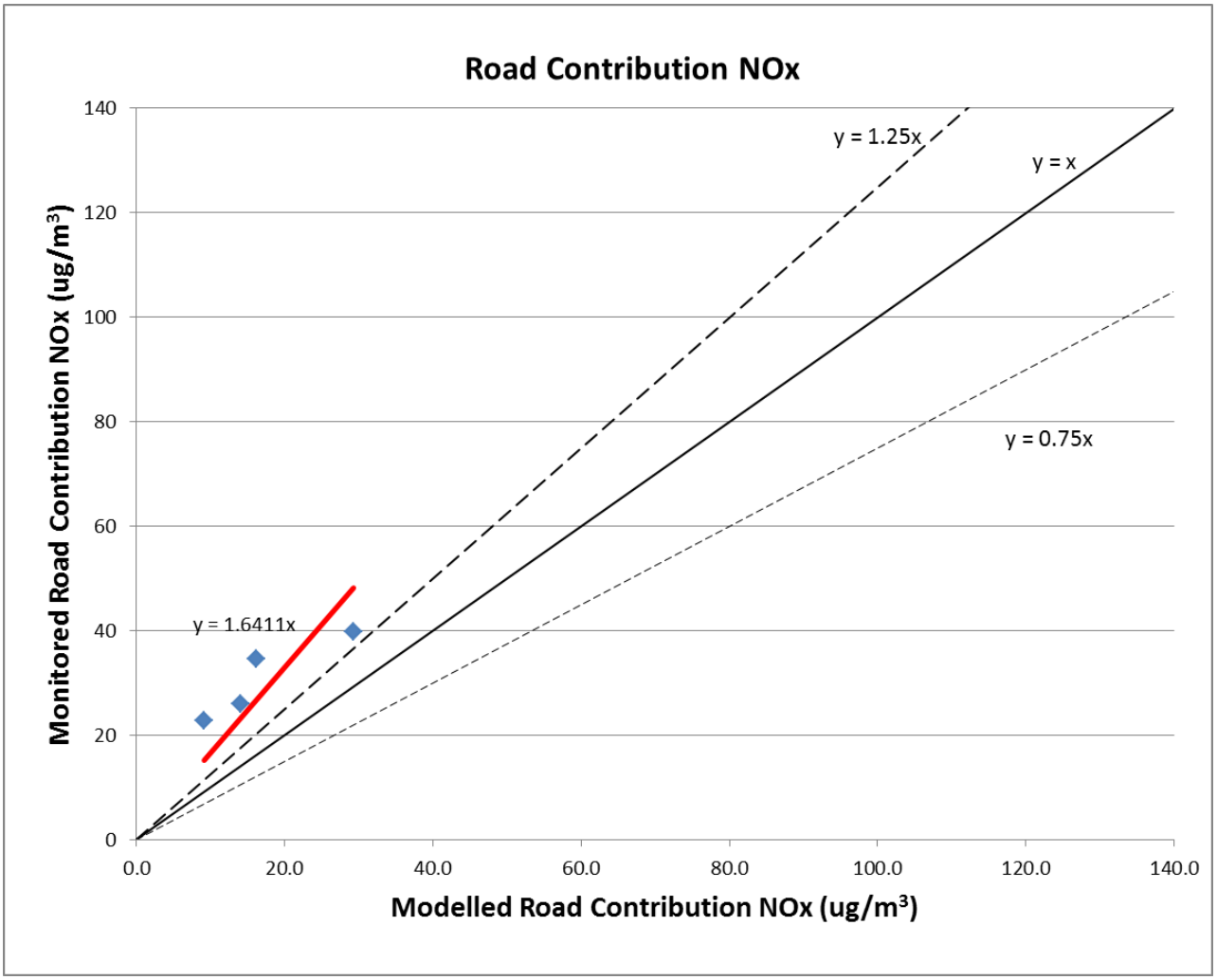

Figure 3-1 Monitored vs modelled road NOx

Table 3-2 Adjustment of modelled results

Diffusion Tube	Background		Modelled Road NOx	Monitored Road NOx	Adjusted Modelled Road NOx	Adjusted Total Modelled NOx	Adjusted Total Modelled NO_2	% Difference after Adjustment
	NOx	NO_2						
1	28.9	19.1	9.2	22.8	15.1	44.0	26.4	-11.8
2	28.9	19.1	14.1	26.1	23.1	52.0	30.0	-4.2
3	28.9	19.1	16.2	34.5	26.6	55.5	31.5	-9.7
4	28.9	19.1	29.3	39.9	48.1	77.0	40.3	8.7

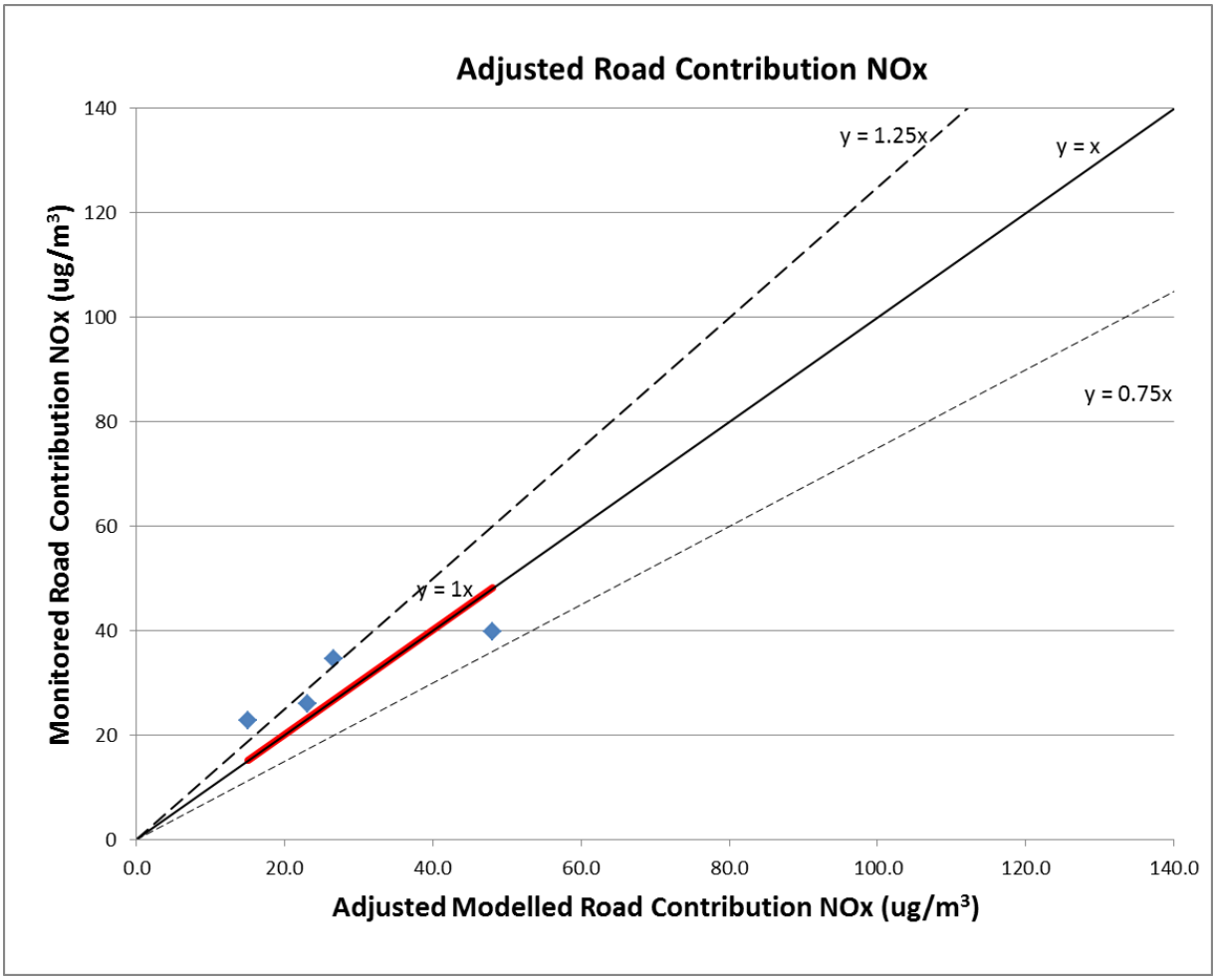

Figure 3-2 Adjusted road NOx

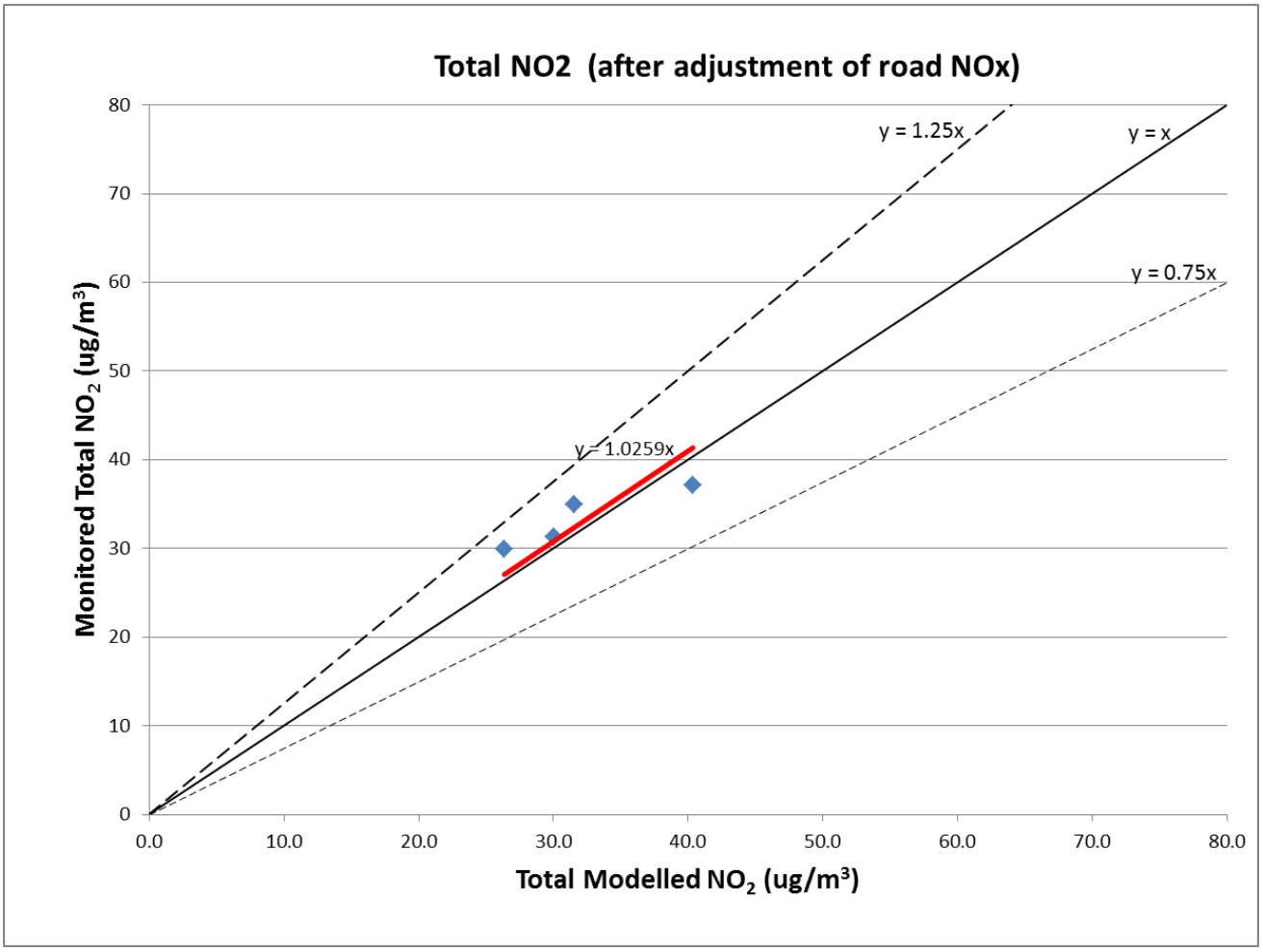

Figure 3-3 Adjusted total NO_2

3.3 Traffic emissions modelling results

Adjusted modelled road NO_2 has been added to background NO_2 concentration (from the Harefield Hospital diffusion tube site) to give total NO_2 at assessment receptors for all scenarios (see Table 3-3)

Modelling results indicate that the national NO_2 objective (40µg/m^3) will be achieved at all receptor locations.

In terms of the impacts of the development on local air quality, modelling results show that the impact is negligible at all receptors except receptor 3 and 5 where the impact is predicted to be slight adverse. At receptor 3 this slight adverse impact is largely due to a change in road layout associated with the development. There is a reduction in predicted concentrations at three receptors as a result of the development, however the impact is considered negligible.

Table 3-3 Predicted NO_2 concentrations at receptors

Receptor	Predicted total annual mean concentration (µg/m^3)			% of AQAL	%change relative to AQAL	Impact descriptor
	Baseline 2015	Do Nothing 2020	Do Something 2020			
1	33.9	36.8	36.5	91.2	-1	Negligible
2	33.2	35.0	34.7	86.9	-1	Negligible
3	33.9	35.7	36.8	91.9	3	**Slight adverse**
4	31.5	32.7	32.5	81.1	-1	Negligible
5	30.1	31.4	32.1	80.2	2	**Slight adverse**
6	n/a	n/a	36.3	90.8	n/a	n/a
7	n/a	n/a	35.0	87.4	n/a	n/a
8	n/a	n/a	35.0	87.4	n/a	n/a

4 Mitigation measures

The measures shown in Table 4-1 are proposed to mitigate the predicted impacts associated with the proposed development.

Table 4-1 Mitigation measures

Mitigation measure	Impact on air quality
Green wall located on central way	A reduction in particulate matter concentrations
Junction improvements associated with the development	Reduced congestion and subsequent vehicle emissions
Measures by TfL to reduce pollutant emissions associated with buses across London, including the following: Retrofitting older buses with selective catalytic reduction equipment; Increasing the proportion of new Euro VI buses in the fleet (around 1,000 now) which emit a fraction of the NOx and PM (note: most of these are also hybrid) Increasing the proportion of hybrid buses in the fleet (there are currently around 1650 hybrids across London, by 2020 there will be more than 3,000; Looking at the potential of range-extended hybrids to operate for longer periods in all-electric mode; Trialling new technologies such as pure-electric and hydrogen fuel cell (zero emissions) in readiness for wider rollout.	Reductions in NOx and PM_{10} emissions.

In addition, it should be noted that the TfL bus fleet will shortly meet a milestone of cutting NOx emissions across London by 20% compared to 2012 levels.

5 Conclusions

The following conclusions should be noted with regard to this addendum:

- Six months air quality monitoring has been carried out at worst case roadside locations in the vicinity of the proposed development site. The annual mean NO_2 objective will be achieved at all monitoring sites considered;
- A dispersion modelling study has been carried out to predict the impact of the proposed development on local air quality. The maximum impact will be slight adverse at two existing receptor locations; this is largely due to the change in road layout associated with the development. There is a reduction in predicted concentrations at three receptors as a result of the development;
- National air quality objectives are predicted to be achieved at all existing and future receptors; and
- Mitigation measures have been outlined which are proposed to result in local air quality improvements.

Appendix A NO_2 monitoring sites considered for annualisation

Monitoring site	type	PM	AM	Ratio (AM/PM)
Ealing Southall	Automatic Urban Background	24	25.6	1.07
Hillingdon Harlington (2014)	Automatic Urban Background	35.5	37	1.04
North Kensington	Automatic Urban Background	28.8	30	1.04
HD301	Diffusion Tube Roadside	38.9	40.1	1.03
HD204	Diffusion Tube Background	39.7	40.5	1.02
Haringey Priory Park	Automatic Urban Background	22.9	23	1.00
Sutton Worcester Park	Automatic Roadside	46.8	46.9	1.00
HD60	Diffusion Tube Roadside	32.6	32.6	1.00
Westminster Horseferry Road	Automatic Urban Background	46.2	46	1.00
Camden Bloomsbury	Automatic Urban Background	45.4	45	0.99
HD74	Diffusion Tube Roadside	30.3	30	0.99
HD57	Diffusion Tube Roadside	41.4	40.7	0.98
Richmond NPL (teddington)	Automatic Urban Background	34.8	27	0.78

Appendix B Raw diffusion tube data

gradko environmental
(A division of Gradko International Ltd.)
St. Martins House, 77 Wales Street Winchester, Hampshire SO23 0RH
tel.: 01962 860331 fax: 01962 841339 e-mail:diffusion@gradko.co.uk

ilac-MRA UKAS TESTING 2187

LABORATORY ANALYSIS REPORT

NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER J04126R

BOOKING IN REFERENCE J04126

DESPATCH NOTE 24527

CUSTOMER BUROHAPPOLD ENGINEERING Attn: Peter Henshaw
17 NEWMAN STREET
LONDON
W1T 1PD

DATE SAMPLES RECEIVED 03/08/2015

Location	Sample Number	Exposure Data Date On	Date Off	Time (hr.)	µg/m^3 *	ppb *	TOTAL µg NO_2
1a	567446	01/07/2015	31/07/2015	718.00	24.54	12.81	1.28
1b	567447	01/07/2015	31/07/2015	718.00	23.75	12.39	1.24
1c	567448	01/07/2015	31/07/2015	718.00	25.25	13.18	1.32
2a	567449	01/07/2015	31/07/2015	717.92	28.83	15.05	1.50
2b	567450	01/07/2015	31/07/2015	717.92	30.87	16.11	1.61
2c	567451	01/07/2015	31/07/2015	717.92	31.13	16.25	1.62
3a	567452	01/07/2015	31/07/2015	717.92	32.89	17.16	1.72
3b	567453	01/07/2015	31/07/2015	717.92	32.95	17.20	1.72
3c	567454	01/07/2015	31/07/2015	717.92	32.09	16.75	1.67
4a	567455	01/07/2015	31/07/2015	717.62	32.02	16.71	1.67
4b	567456	01/07/2015	31/07/2015	717.62	35.39	18.47	1.85
4c	567457	01/07/2015	31/07/2015	717.62	33.59	17.53	1.75
5-Control	567458			718.00	0.18	0.09	0.01
Laboratory Blank				718.00	0.06	0.03	0.003

Comment: Results are not blank subtracted
Results have been corrected to a temperature of 293 K (20°)

Overall M.U. 5.2% +/-

Limit of Detection 0.010µgNO_2

Tube Preparation : 20% TEA / Water

Analysed on UV05 Camspec M550

Analyst Name Chris Fraser

Date of Analysis 10/08/2015

Date of Report 10/08/2015

Analysis carried out in accordance with documented in-house Laboratory Method GLM7

REPORT OFFICIALLY CHECKED

Gradko International Ltd
This signature confirms the authenticity of these results
Signed.....
L. Gates, Laboratory Manager

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(A division of Gradko International Ltd.)
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tel.: 01962 860331 fax: 01962 841339 e-mail:diffusion@gradko.co.uk

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LABORATORY ANALYSIS REPORT

NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER J04753R

BOOKING IN REFERENCE J04753
DESPATCH NOTE 24550
CUSTOMER BUROHAPPOLD ENGINEERING Attn: Peter Henshaw
17 NEWMAN STREET
LONDON
W1T 1PD

DATE SAMPLES RECEIVED 02/09/2015

Location	Sample Number	Exposure Data Date On	Date Off	Time (hr.)	µg/m^3 *	ppb *	TOTAL µg NO_2
1a	580989	31/07/2015	01/09/2015	770.92	28.62	14.94	1.60
1b	580990	31/07/2015	01/09/2015	770.92	27.91	14.57	1.56
1c	580991	31/07/2015	01/09/2015	770.92	25.90	13.52	1.45
2a	580992	31/07/2015	01/09/2015	770.92	29.24	15.26	1.64
2b	580993	31/07/2015	01/09/2015	770.92	30.95	16.15	1.73
2c	580994	31/07/2015	01/09/2015	770.92	28.24	14.74	1.58
3a	580995	31/07/2015	01/09/2015	770.92	31.37	16.37	1.76
3b	580996	31/07/2015	01/09/2015	770.92	30.51	15.92	1.71
3c	580997	31/07/2015	01/09/2015	770.92	31.17	16.27	1.75
4a	580998	31/07/2015	01/09/2015	770.83	40.10	20.93	2.25
4b	580999	31/07/2015	01/09/2015	770.83	40.73	21.26	2.28
4c	581000	31/07/2015	01/09/2015	770.83	37.80	19.73	2.12
Control	581001			770.92	0.26	0.14	0.01
Laboratory Blank				770.92	0.09	0.05	0.005

Comment: Results are not blank subtracted
Results have been corrected to a temperature of 293 K (20°)

Overall M.U. 7.8% +/- **Limit of Detection** 0.017µgNO_2

Tube Preparation : 20% TEA / Water

Analysed on UV 04 Camspec M550

Analyst Name Blazej Fiser

Date of Analysis 14/09/2015 **Date of Report** 14/09/2015

Analysis carried out in accordance with documented in-house Laboratory Method GLM7

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tel.: 01962 860331 fax: 01962 841339 e-mail:diffusion@gradko.co.uk

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The Diffusion Tubes have been tested within the scope of Gradko International Ltd. Laboratory Quality Procedures calculations and assessments involving the exposure procedures and periods provided by the client are not within the scope of our UKAS accreditation. Those results obtained using exposure data shall be indicated by an asterisk. Any queries concerning the data in this report should be directed to the Laboratory Manager Gradko International Ltd. This report is not to be reproduced, except in full, without the written permission of Gradko International Ltd.

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LABORATORY ANALYSIS REPORT

NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER J05291R

BOOKING IN REFERENCE J05291
DESPATCH NOTE 24551
CUSTOMER BUROHAPPOLD ENGINEERING Attn: Peter Henshaw
17 NEWMAN STREET
LONDON
W1T 1PD

DATE SAMPLES RECEIVED 02/10/2015

JOB NUMBER

Location	Sample Number	Exposure Data Date On	Date Off	Time (hr.)	µg/m^3 *	ppb *	TOTAL µg NO_2
1a	597176	01/09/2015	01/10/2015	715.33	36.37	18.98	1.89
1b	597177	01/09/2015	01/10/2015	715.33	35.98	18.78	1.87
1c	597178	01/09/2015	01/10/2015	715.33	36.71	19.16	1.91
2a	597179	01/09/2015	01/10/2015	715.42	38.04	19.85	1.98
2b	597180	01/09/2015	01/10/2015	715.42	29.29	15.29	1.52
2c	597181	01/09/2015	01/10/2015	715.42	38.87	20.29	2.02
3a	597182	01/09/2015	01/10/2015	715.42	39.06	20.39	2.03
3b	597183	01/09/2015	01/10/2015	715.42	40.77	21.28	2.12
3c	597184	01/09/2015	01/10/2015	715.42	40.06	20.91	2.08
4a	597185	01/09/2015	01/10/2015	715.42	36.62	19.11	1.90
4b	597186	01/09/2015	01/10/2015	715.42	42.44	22.15	2.21
4c	597187	01/09/2015	01/10/2015	715.42	38.94	20.32	2.02
Control	597188			715.42	0.01	0.00	0.00
Laboratory Blank				715.42	0.25	0.13	0.013

Comment: Results are not blank subtracted
Results have been corrected to a temperature of 293 K (20°)

Overall M.U. 5.2% +/- **Limit of Detection** 0.010µgNO_2

Tube Preparation : 20% TEA / Water

Analysed on UV05 Camspec M550

Analyst Name Chris Fraser

Date of Analysis 05/10/2015 **Date of Report** 05/10/2015

Analysis carried out in accordance with documented in-house Laboratory Method GLM7

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LABORATORY ANALYSIS REPORT

NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER J06122R

BOOKING IN REFERENCE J06122
DESPATCH NOTE 25317
CUSTOMER BUROHAPPOLD ENGINEERING Attn: Peter Henshaw
17 NEWMAN STREET
LONDON
W1T 1PD

DATE SAMPLES RECEIVED 03/11/2015

Location	Sample Number	Exposure Data Date On	Date Off	Time (hr.)	µg/m^3 *	ppb *	TOTAL µg NO_2
1a	613512	01/10/2015	02/11/2015	769.17	41.67	21.75	2.33
1b	613513	01/10/2015	02/11/2015	769.17	38.68	20.19	2.16
1c	613514	01/10/2015	02/11/2015	769.17	39.58	20.66	2.21
2a	613515	01/10/2015	02/11/2015	769.17	41.27	21.54	2.31
2b	613516	01/10/2015	02/11/2015	769.17	41.00	21.40	2.29
2c	613517	01/10/2015	02/11/2015	769.17	38.37	20.03	2.15
3a	613518	01/10/2015	02/11/2015	769.17	44.27	23.11	2.48
3b	613519	01/10/2015	02/11/2015	769.17	43.56	22.74	2.44
3c	613520	01/10/2015	02/11/2015	769.17	43.45	22.67	2.43
4a	613521	01/10/2015	02/11/2015	769.17	44.61	23.29	2.49
4b	613522	01/10/2015	02/11/2015	769.17	48.70	25.42	2.72
4c	613523	01/10/2015	02/11/2015	769.17	47.47	24.78	2.65
Travel Blank	613524			769.17	0.14	0.07	0.01
Laboratory Blank				769.17	0.11	0.06	0.006

Comment: Results are not blank subtracted
Results have been corrected to a temperature of 293 K (20°)

Overall M.U. 7.8% +/-

Limit of Detection 0.017µgNO_2

Tube Preparation : 20% TEA / Water

Analysed on UV 04 Camspec M550

Analyst Name Anna Paczosa

Date of Analysis 16/11/2015

Date of Report 17/11/2015

Analysis carried out in accordance with documented in-house Laboratory Method GLM7

REPORT OFFICIALLY CHECKED

Gradko International Ltd
This signature confirms the authenticity of these results
Signed.....
L. Gates, Laboratory Manager

(A division of Gradko International Ltd.)
St. Martins House, 77 Wales Street Winchester, Hampshire SO23 0RH
tel.: 01962 860331 fax: 01962 841339 e-mail:diffusion@gradko.co.uk

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LABORATORY ANALYSIS REPORT

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LABORATORY ANALYSIS REPORT

NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER J06639R

BOOKING IN REFERENCE J06639
DESPATCH NOTE 25318
CUSTOMER Burohappold Engineering Attn: Peter Henshaw
17 Newman Street
London
W1T 1PD

DATE SAMPLES RECEIVED 02/12/2015

Location	Sample Number	Exposure Data Date On	Date Off	Time (hr.)	µg/m^3 *	ppb *	TOTAL µg NO_2
1a	627528	02/11/2015	01/12/2015	699.33	26.53	13.85	1.35
1b	627529	02/11/2015	01/12/2015	699.33	27.70	14.46	1.41
1c	627530	02/11/2015	01/12/2015	699.33	31.02	16.19	1.58
2a	627531	02/11/2015	01/12/2015	699.33	32.11	16.76	1.63
2b	627532	02/11/2015	01/12/2015	699.33	34.52	18.02	1.75
2c	627533	02/11/2015	01/12/2015	699.33	32.11	16.76	1.63
3a	627534	02/11/2015	01/12/2015	699.33	34.85	18.19	1.77
3b	627535	02/11/2015	01/12/2015	699.33	30.60	15.97	1.56
3c	627536	02/11/2015	01/12/2015	699.33	36.93	19.27	1.88
4a	627537	02/11/2015	01/12/2015	699.33	38.22	19.95	1.94
4b	627538	02/11/2015	01/12/2015	699.33	38.67	20.18	1.97
4c	627539	02/11/2015	01/12/2015	699.33	36.52	19.06	1.86
Travel Blank	627540			699.33	0.18	0.10	0.01
Laboratory Blank				699.33	0.10	0.05	0.005

Comment: Results are not blank subtracted

Tube 627530 was dirty when received. Result may be compromised.

Results have been corrected to a temperature of 293 K (20°)

Overall M.U. 7.8% +/-

Limit of Detection 0.017µgNO_2

Tube Preparation : 20% TEA / Water

Analysed on UV 04 Camspec M550

Analyst Name Anna Paczosa

Date of Analysis 04/12/2015

Date of Report 04/12/2015

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LABORATORY ANALYSIS REPORT

Analysis carried out in accordance with documented in-house Laboratory Method GLM7

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LABORATORY ANALYSIS REPORT

NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER K00116R

BOOKING IN REFERENCE K00116
DESPATCH NOTE 25319
CUSTOMER Burohappold Engineering Attn: Peter Henshaw
17 Newman Street
London
W1T 1PD

DATE SAMPLES RECEIVED 05/01/2016

Location	Sample Number	Exposure Data Date On	Date Off	Time (hr.)	µg/m^3 *	ppb *	TOTAL µg NO_2
1a	644143	01/12/2015	04/01/2016	813.50	31.22	16.29	1.85
1b	644144	01/12/2015	04/01/2016	813.50	32.05	16.73	1.90
1c	644145	01/12/2015	04/01/2016	813.50	28.82	15.04	1.70
2a	644146	01/12/2015	04/01/2016	813.42	29.35	15.32	1.73
2b	644147	01/12/2015	04/01/2016	813.42	27.27	14.23	1.61
2c	644148	01/12/2015	04/01/2016	813.42	27.97	14.60	1.65
3a	644149	01/12/2015	04/01/2016	813.42	35.48	18.52	2.10
3b	644150	01/12/2015	04/01/2016	813.42	36.46	19.03	2.16
3c	644151	01/12/2015	04/01/2016	813.42	40.46	21.12	2.39
4a	644152	01/12/2015	04/01/2016	813.33	34.13	17.81	2.02
4b	644153	01/12/2015	04/01/2016	813.33	34.63	18.07	2.05
4v	644154	01/12/2015	04/01/2016	813.33	37.33	19.48	2.21
Control	644155			813.50	0.16	0.08	0.01
Laboratory Blank				813.50	0.10	0.05	0.006

Comment: Results are not blank subtracted
Results have been corrected to a temperature of 293 K (20°)

Overall M.U. 5.2% +/- **Limit of Detection** 0.010µgNO_2

Tube Preparation : 20% TEA / Water

Analysed on UV05 Camspec M550

Analyst Name Chris Fraser

Date of Analysis 11/01/2016 **Date of Report** 11/01/2016

Analysis carried out in accordance with documented in-house Laboratory Method GLM7

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The Diffusion Tubes have been tested within the scope of Gradko International Ltd. Laboratory Quality Procedures calculations and assessments involving the exposure procedures and periods provided by the client are not within the scope of our UKAS accreditation. Those results obtained using exposure data shall be indicated by an asterisk. Any queries concerning the data in this report should be directed to the Laboratory Manager Gradko International Ltd. This report is not to be reproduced, except in full, without the written permission of Gradko International Ltd.

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