Water Eaton

PR6a : Land East of Oxford Road

Air Quality Assessment
Inputs

Bellway | STRATEGIC LAND

CHRIST CHURCH
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WE/ AQ1/P02

6.1 Assessment Inputs

6.1.1 The Proposed Development has the potential to introduce future site users to poor air quality. Dispersion modelling using ADMS Roads was therefore undertaken to predict pollutant concentrations across the site to consider site suitability for the proposed end-use.

6.1.2 The assessment was undertaken in accordance with the guidance contained within the DEFRA document LAQM.TG(16) and the EPUK and IAQM guidance.

Dispersion Model

6.1.3 Dispersion modelling was undertaken using the ADMS-Roads dispersion model (version 5.0). ADMS-Roads is developed by Cambridge Environmental Research Consultants (CERC) and is routinely used throughout the world for the prediction of pollutant dispersion from road sources. Modelling predictions from this software package are accepted within the UK by the Environment Agency and DEFRA.

6.1.4 The model requires input data that details the following parameters:

- Assessment area;
- Traffic flow data;
- Vehicle emission factors;
- Spatial co-ordinates of emissions;
- Street width;
- Meteorological data;
- Roughness length; and
- Monin-Obukhov length.

Assessment Area

6.1.5 Ambient concentrations were predicted over the Proposed Development site and surrounding highway network. One Cartesian grid was included in the model over the area at approximately NGR: 449860, 210900 and 450870, 211910 at height of 1.5m to represent the proposed ground floor level for the 2031 opening year scenario.

6.1.6 Results were subsequently used to produce contour plots within the Surfer software package. Reference should be made to Figure 6.6 within Appendix 6.2 for a graphical representation of the verification inputs and operation phase DS extents, respectively.

Traffic Flow Data

6.1.7 Development flow traffic data and associated network distribution was provided by i-Transport, the appointed Transport Consultants for the scheme, and indicated that a total flow generation of 1,123 AADT is anticipated as a result of the Proposed Development.

6.1.8 Baseline traffic data for the following road links were obtained from the Department for Transport (DfT):

- A4144 Woodstock Road
- A44 Woodstock Road
- A40 Northern Bypass

6.1.9 The Dft Matrix web tool enables the user to view and download traffic flows on every link of the A-road and motorway network in Great Britain for the years 1999 to 2019. The DfT matrix is

referenced in DEFRA guidance LAQM.TG(22) as being a suitable source of data for air quality assessments and is therefore considered to provide a reasonable representation of traffic flows in the vicinity of the site.

6.1.10 Growth factors provided by the Trip End Model Presentation Program (TEMPRO) software package were utilised to allow for conversion from the obtained 2019 traffic flow to 2031 which was used to represent the opening year scenario. Vehicle speeds were estimated based on the free flow potential of each link and local speed limits. Road widths were estimated from aerial photography and UK highway design standards.

6.1.11 A summary of the traffic data used in the verification scenario is provided in Table 6.1.1.

Table 6.1.1 2019 Verification Traffic Data

Road Link		Road Width (m)	24 Hour AADT Flow	HDV Pop (%)	Mean Vehicle Speed (km/hr)	Data Source
L1	A34 - Western Bypass - Northbound	8.0	39,663	19.4	60	DfT
L2	A34 - Western Bypass - Southbound	8.0	39,663	19.4	60	DfT
L3	Roundabout - Oxford Road	11.0	16,186	4.0	15	TC
L4	Oxford Road - Northbound Slip Slow Down	13.5	9,734	5.2	15	TC
L5	Oxford Road - Southbound Slip Slow Down	5.9	9,734	5.2	15	TC
L6	Oxford Road	9.4	19,468	5.2	30	TC
L7	Oxford Road - Bypass	9.8	19,468	5.2	30	TC
L8	Oxford Road - Bypass	10.7	19,468	5.2	30	TC
L9	Oxford Road - North of Park & Ride	11.0	19,468	5.2	30	TC
L10	Oxford Road - South of Park & Ride	11.3	17,382	4.0	30	TC
L11	Oxford Road between PR6a access points	10.5	18,262	4.8	30	TC
L12	Oxford Road - South PR6a access points	10.0	18,262	4.8	30	TC
L13	A40 Banbury Road - North of Cutteslowe Roundabout	12.0	20,606	4.8	25	TC
L14	A40 Banbury Road - North of Cutteslowe Roundabout - Slow Down	12.0	20,606	4.8	15	TC
L15	Roundabout - North Way	13.3	25,114	4.3	15	TC
L16	North Avenue - A40 - Slow Down	18.0	26,500	3.1	15	TC
L17	North Avenue - A40	7.3	26,500	3.1	20	TC
L18	North Avenue - A40 -SD - off Wolvercote Roundabout	8.6	13,250	3.1	15	TC
L19	North Avenue - A40 - SD - onto Wolvercote Roundabout	8.0	13,250	3.1	15	TC
L20	Banbury Road - Slow Down	13.7	18,188	5.1	15	TC
L21	Banbury Road	8.5	18,188	5.1	20	TC
L22	A40 - Eastbound - Slow Down	6.5	17,582	4.4	15	TC
L23	A40 - Eastbound	7.0	17,582	4.4	40	TC
L24	A40 - Westbound - Slow Down	11.9	17,582	4.4	15	TC
L25	A40 - Westbound	7.5	17,582	4.4	40	TC
L26	Roundabout - Wolvercote	12.5	25,577	5.5	15	TC
L27	Woodstock Road A4144- SD off Woodcote Roundabout	8.0	6,789	4.5	15	DfT

Road Link		Road Width (m)	24 Hour AADT Flow	HDV Pop (%)	Mean Vehicle Speed (km/hr)	Data Source
L28	Woodstock Road A4144 - SD onto Woodcote Roundabout	7.4	6,789	4.5	15	DfT
L29	Woodstock Road A4144	8.5	13,577	4.5	20	DfT
L30	Woodstock Road - A44 - Northbound - Slow Down	10.5	15,177	6.5	15	DfT
L31	Woodstock Road - A44 - Northbound	6.4	15,177	6.5	50	DfT
L32	Woodstock Road - A44 - Northbound Slow Down, roundabout approach	12.2	15,177	6.5	15	DfT
L33	Roundabout	12.8	19,009	8.7	15	
L34	Woodstock Road - A44 - Southbound - SD	10.0	15,177	6.5	15	DfT
L35	Woodstock Road - A44 - Southbound	10.0	15,177	6.5	60	DfT
L36	Woodstock - A44 - Southbound - SD	10.0	15,177	6.5	15	DfT
L37	Northern Bypass Road -A40 - SD - onto Wolvercote Roundabout	13.0	12,369	8.5	15	DfT
L38	Northern Bypass Road -A40 - SD - off Wolvercote Roundabout	7.0	12,369	8.5	15	DfT
L39	Northern Bypass Road - A40	13.0	24,738	8.5	15	DfT
L40	Northern Bypass Road - A40	13.0	24,738	8.5	50	DfT
L41	Northern Bypass Road - A40	8.0	24,738	8.5	50	DfT
L42	Northern Bypass Road	7.3	24,738	8.5	50	DfT
L43	SLIP onto Western Bypass roundabout - northbound	7.0	3,966	19.4	15	DfT
L44	SLIP onto Western Bypass roundabout - northbound	8.5	3,966	19.4	15	DfT
L45	SLIP onto A44 from A34 - northbound	6.7	3,966	19.4	15	DfT
L46	SLIP onto A44 from A34 - northbound	6.7	14,909	5.2	15	DfT
L47	SLIP onto A34 Southbound from roundabout	5.9	3,966	19.4	15	DfT
L48	Godstow Road - northbound on to Woodstock Roundabout	4.4	2,284	1.6	15	TC
L49	Godstow Road - southbound on to Woodstock Roundabout	5.2	2,284	1.6	15	TC
L50	Godstow Road	4.2	4,567	1.6	15	TC
L51	Five Mile Drive - SD	7.4	1,286	0.8	15	TC
L52	Five Mile Drive - SD	5.1	1,286	0.8	15	TC
L53	Five Mile Drive	6.2	2,571	0.8	15	TC
L54	Five Mile Drive - Opposite Harbour Road	6.2	2,571	0.8	20	TC
L55	SLIP on to A34	7.0	3,966	19.4	15	TC
L56	Slip off A34	13.5	3,966	19.4	15	TC
L57	A44 - onto Roundabout - Slow Down	10.9	14,909	5.2	15	TC
L58	A44 - onto Roundabout	10.9	14,909	5.2	30	TC
L59	A44 - onto Roundabout - Slow Down	7.6	14,909	5.2	15	TC
L60	Roundabout - Loop Farm	9.3	16,773	6.1	15	TC
L61	A44 - on to Loop Farm	7.6	14,909	5.2	30	TC

Road Link		Road Width (m)	24 Hour AADT Flow	HDV Pop (%)	Mean Vehicle Speed (km/hr)	Data Source
	Roundabout					
L62	A44 - on to Loop Farm Roundabout - Slow Down	10.3	14,909	5.2	15	TC
L63	A4260 - Frieze Way from Loop Farm Roundabout - SD	8.9	6,489	2.1	15	TC
L64	A4260 - Frieze Way	6.7	6,489	2.1	60	TC
L65	A4260 - Frieze Way - SD - on to Oxford Road Roundabout	11.3	6,489	2.1	15	TC
L66	A4260 - Frieze way Southbound (Junction Slowdown)	9.0	6,489	2.1	15	TC
L67	A4260 - Frieze Way - Southbound - SD from Loop Farm Roundabout	7.0	6,489	2.1	60	TC
L68	A4260 - Frieze Way - Southbound	7.3	6,489	2.1	15	TC
L69	A4260 - off Oxford Road Roundabout - Northbound - SD	10.4	11,204	2.9	15	TC
L70	A4260 - off Oxford Road Roundabout - Northbound	6.1	11,204	2.9	15	TC
L71	A4260 - off Oxford Road Roundabout - Southbound SD	10.2	11,204	2.9	15	TC
L72	A4260 - off Oxford Road Roundabout - Southbound	10.2	11,204	2.9	15	TC
L73	A4260	13.4	22,408	2.9	30	TC
L74	A44 - North of Loop Farm Roundabout - Northbound - Junction Slowdown	7.4	12,148	5.0	15	TC
L75	A44 - North of Loop Farm Roundabout - Southbound - Junction Slowdown	8.2	12,148	5.0	15	TC
L76	A44 - North of Loop Farm Roundabout	7.2	24,295	5.0	55	TC
L77	Bicester Road - East of Oxford Road - Northbound - Junction Slowdown	7.0	4,945	6.9	15	TC
L78	Bicester Road - East of Oxford Road - Southbound - Junction Slowdown	7.0	4,945	6.9	15	TC
L79	Bicester Road - East of Oxford	7.5	9,890	6.9	35	TC
L80	Bicester Road - East of Oxford - Junction Slowdown	10.0	9,890	6.9	15	TC
L81	Bicester Road - East of Oxford - Junction Slowdown (canyon)	8.0	9,890	6.9	15	TC
L82	Bicester Road - East of Oxford	7.8	9,890	6.9	35	TC
L83	Oxford Parkway Park & Ride Access	9.1	6,350	7.0	15	TC
L84	Oxford Parkway Park & Ride	6.7	6,350	7.0	15	TC

6.1.12 Reference should be made to Figure 6.6 within Appendix 6.2 for a graphical representation of the road link locations used within the verification assessment. The road width and mean vehicle speed shown in Table 6.1.1 remained the same for the 2031 scenarios.

6.1.13 A summary of the 2031 traffic data is shown in Table 6.1.2.

Table 6.1.2 2031 Traffic Data

Road Link		DM Scenario		DS Scenario	
		24 Hr AADT Flow	HDV Prop (%)	24 Hr AADT Flow	HDV Prop (%)
L1	A34 - Western Bypass - Northbound	46,564	18.3	46,844	18.2
L2	A34 - Western Bypass - Southbound	46,564	18.3	46,844	18.2
L3	Roundabout - Oxford Road	18,765	4.5	19,224	4.4
L4	Oxford Road - Northbound Slip Slow Down	10,280	5.9	10,750	5.6
L5	Oxford Road - Southbound Slip Slow Down	10,280	5.9	10,750	5.6
L6	Oxford Road	20,560	5.9	21,499	5.6
L7	Oxford Road - Bypass	20,560	5.9	21,499	5.6
L8	Oxford Road - Bypass	20,560	5.9	21,499	5.6
L9	Oxford Road - North of Park & Ride	20,560	5.9	21,499	5.6
L10	Oxford Road - South of Park & Ride	19,646	6.2	20,592	5.9
L11	Oxford Road between PR6a access points	18,084	6.7	19,030	6.3
L12	Oxford Road - South PR6a access points	18,597	6.5	19,543	6.2
L13	A40 Banbury Road - North of Cutteslowe Roundabout	20,339	5.9	21,600	5.6
L14	A40 Banbury Road - North of Cutteslowe Roundabout - Slow Down	20,339	5.9	21,600	5.6
L15	Roundabout - North Way	24,134	4.6	24,762	4.5
L16	North Avenue - A40 - Slow Down	24,941	2.4	25,174	2.4
L17	North Avenue - A40	24,941	2.4	25,174	2.4
L18	North Avenu - A40 -SD - off Wolvercote Roundabout	12,471	2.4	12,587	2.4
L19	North Avenue - A40 - SD - onto Wolvercote Roundabout	12,471	2.4	12,587	2.4
L20	Banbury Road - Slow Down	17,521	5.5	18,295	5.2
L21	Banbury Road	17,521	5.5	18,295	5.2
L22	A40 - Eastbound - Slow Down	16,868	4.9	16,989	4.8
L23	A40 - Eastbound	16,868	4.9	16,989	4.8
L24	A40 - Westbound - Slow Down	16,868	4.9	16,989	4.8
L25	A40 - Westbound	16,868	4.9	16,989	4.8
L26	Roundabout - Wolvercote	27,272	5.4	27,341	5.4
L27	Woodstock Road A4144- SD off Woodcote Roundabout	7,505	4.5	7,505	4.5
L28	Woodstock Road A4144 - SD onto Woodcote Roundabout	7,505	4.5	7,505	4.5
L29	Woodstock Road A4144	15,009	4.5	15,009	4.5
L30	Woodstock Road - A44 - Northbound - Slow Down	16,778	6.5	16,778	6.5
L31	Woodstock Road - A44 - Northbound	16,778	6.5	16,778	6.5
L32	Woodstock Road - A44 - Northbound Slow Down, roundabout approach	16,778	6.5	16,778	6.5

Road Link		DM Scenario		DS Scenario	
		24 Hr AADT Flow	HDV Prop (%)	24 Hr AADT Flow	HDV Prop (%)
L33	Roundabout	21,286	8.6	21,314	8.6
L34	Woodstock Road - A44 - Southbound - SD	16,778	6.5	16,778	6.5
L35	Woodstock Road - A44 - Southbound	16,778	6.5	16,778	6.5
L36	Woodstock - A44 - Southbound - SD	16,778	6.5	16,778	6.5
L37	Northern Bypass Road -A40 - SD - onto Wolvercote Roundabout	13,674	8.5	13,674	8.5
L38	Northern Bypass Road -A40 - SD - off Wolvercote Roundabout	13,674	8.5	13,674	8.5
L39	Northern Bypass Road - A40	27,348	8.5	27,348	8.5
L40	Northern Bypass Road - A40	27,348	8.5	27,348	8.5
L41	Northern Bypass Road - A40	27,348	8.5	27,348	8.5
L42	Northern Bypass Road	27,348	8.5	27,348	8.5
L43	SLIP onto Western Bypass roundabout - northbound	4,385	19.4	4,385	19.4
L44	SLIP onto Western Bypass roundabout - northbound	4,656	18.3	4,684	18.2
L45	SLIP onto A44 from A34 - northbound	4,385	19.4	4,385	19.4
L46	SLIP onto A44 from A34 - northbound	16,481	5.2	16,481	5.2
L47	SLIP onto A34 Southbound from roundabout	4,656	18.3	4,684	18.2
L48	Godstow Road - northbound on to Woodstock Roundabout	2,696	1.5	2,718	1.5
L49	Godstow Road - southbound on to Woodstock Roundabout	2,696	1.5	2,718	1.5
L50	Godstow Road	5,392	1.5	5,436	1.5
L51	Five Mile Drive - SD	1,421	0.8	1,421	0.8
L52	Five Mile Drive - SD	1,421	0.8	1,421	0.8
L53	Five Mile Drive	2,842	0.8	2,842	0.8
L54	Five Mile Drive - Opposite Harbour Road	2,842	0.8	2,842	0.8
L55	SLIP on to A34	4,656	18.3	4,684	18.2
L56	Slip off A34	4,656	18.3	4,684	18.2
L57	A44 - onto Roundabout - Slow Down	16,481	5.2	16,481	5.2
L58	A44 - onto Roundabout	16,481	5.2	16,481	5.2
L59	A44 - onto Roundabout - Slow Down	16,481	5.2	16,481	5.2
L60	Roundabout - Loop Farm	22,553	5.2	22,717	5.1
L61	A44 - on to Loop Fram Roundabout	16,481	5.2	16,481	5.2
L62	A44 - on to Loop Farm Roundabout - Slow Down	16,481	5.2	16,481	5.2
L63	A4260 - Frieze Way from Loop Farm Roundabout - SD	9,560	2.4	9,842	2.3
L64	A4260 - Frieze Way	9,560	2.4	9,842	2.3
L65	A4260 - Frieze Way - SD - on to Oxford Road Roundabout	9,560	2.4	9,842	2.3

Road Link		DM Scenario		DS Scenario	
		24 Hr AADT Flow	HDV Prop (%)	24 Hr AADT Flow	HDV Prop (%)
L66	A4260 - Frieze way Southbound (Junction Slowdown)	9,560	2.4	9,842	2.3
L67	A4260 - Frieze Way - Southbound - SD from Loop Farm Roundabout	9,560	2.4	9,842	2.3
L68	A4260 - Frieze Way - Southbound	9,560	2.4	9,842	2.3
L69	A4260 - off Oxford Road Roundabout - Northbound - SD	11,477	5.6	11,632	5.6
L70	A4260 - off Oxford Road Roundabout - Northbound	11,477	5.6	11,632	5.6
L71	A4260 - off Oxford Road Roundabout - Southbound SD	11,477	5.6	11,632	5.6
L72	A4260 - off Oxford Road Roundabout - Southbound	11,477	5.6	11,632	5.6
L73	A4260	22,954	5.6	23,263	5.6
L74	A44 - North of Loop Farm Roundabout - Northbound - Junction Slowdown	13,429	5.0	13,429	5.0
L75	A44 - North of Loop Farm Roundabout - Southbound - Junction Slowdown	13,429	5.0	13,429	5.0
L76	A44 - North of Loop Farm Roundabout	26,858	5.0	26,858	5.0
L77	Bicester Road - East of Oxford Road - Northbound - Junction Slowdown	6,213	3.5	6,224	3.5
L78	Bicester Road - East of Oxford Road - Southbound - Junction Slowdown	6,213	3.5	6,224	3.5
L79	Bicester Road - East of Oxford	12,425	3.5	12,449	3.5
L80	Bicester Road - East of Oxford - Junction Slowdown	12,425	3.5	12,449	3.5
L81	Bicester Road - East of Oxford - Junction Slowdown (canyon)	12,425	3.5	12,449	3.5
L82	Bicester Road - East of Oxford	12,425	3.5	12,449	3.5
L83	Oxford Parkway Park & Ride Access	6,350	7.0	6,350	7.0
L84	Oxford Parkway Park & Ride	6,350	7.0	6,350	7.0

6.1.14 Reference should be made to Figure 6.6 within Appendix 6.2 for a graphical representation of the road link locations used within the operation phase assessment.

Emission Factors

6.1.15 Emission factors for each link were calculated using the relevant traffic flows and the Emissions Factor Toolkit (version 11.0) released in November 2021, which incorporates updated COPERT 5.3 vehicle emissions factors for NO_x, PM_{10} and $PM_{2.5}$ and EURO 6 vehicle fleet sub-categories.

Car Park Emission

6.1.16 Emissions associated with car movements within the current car park and the proposed multi-storey car park were represented within the model through the use of area and volume sources

to represent the DM and DS scenarios. This was in accordance with the methodology provided within CERC Helpdesk Note 'Modelling Car Parks'. NOx and PM emission rates were calculated using the following parameters:

- Number of car movements;
- 2019 emission factors (g/km);
- Average journey length (km); and
- Site area (m^2)/volume (m^3).

6.1.17 Cold-start emissions were also calculated using the Exempt spreadsheet tool provided by DEFRA for inclusion in the model.

6.1.18 To ensure an accurate representation of both existing and proposed carparks a combination of area and volume sources was utilised within the ADMS-roads model, it should be noted that some of the existing car parking will be retained as part of the proposed development. The journey length (D) for the volume sources were measured using the drawings provided by form existing base maps. The site area, and volume (CP) was calculated from the relevant car-park dimensions. The sections of the carpark and their inputs are presented in Table 6.1.3.

Table 6.1.3 Car Park Inputs

Scenario	Modelled in	Journey Length (km)	Site Area (m^2)
Car Park Area 1	Baseline, DM and DS	0.5	31,342
Car Park Area 2	Baseline, DM and DS	0.3	10,679
Car Park Area 3	Baseline, DM and DS	0.3	3,914

Number of Car Movements

6.1.19 Based on the information provided by Transport Monitoring at Oxfordshire County Council, it was determined that the Oxford Parkway Park & Ride would generate approximately 2032 two-way vehicles (M) as a worst-case assumption, respectively.

Emission Factors

6.1.20 The 2019 emission factor per vehicle for cars (EF) was obtained from the Emission Factor Toolkit (version 11.0), which was the most recent available from the DEFRA website at the time of assessment. The following emission factors were utilised and are shown in Table 6.1.4.

- NOx - 0.539g/km;
- PM10 - 0.0386g/km; and
- PM2.5 – 0.0251g/km;

Table 6.1.4 Car Park Emissions Factors

Pollutant	2019 Emission Factors (g/km)	2031 Emission Factors (g/km)
NO_x	0.55691	0.31274
PM_{10}	0.03581	0.03326
$PM_{2.5}$	0.02194	0.01936

Cold Start Emissions

Cold start emissions (CS) were obtained from the Exempt v1.0 spreadsheet available from DEFRA and are summarised in Table 6.1.5.

Table 6.1.5 Car Park Cold Start

Source	Pollutant	Cold Start Emissions (g)
		2019 Emission Factors
Car Park Area 1	NO_x	0.214
	PM_{10}	0.009
	$PM_{2.5}$	0.009

Car Park Area 2	NO_x	0.146
	PM_{10}	0.005
	$PM_{2.5}$	0.005
Car Park Area 3	NO_x	0.146
	PM_{10}	0.005
	$PM_{2.5}$	0.005

Calculation of Emissions

6.1.21 The following equation for the calculation of the car park emission rates was obtained from the Helpdesk Note:

$$\text{Emission rate } (g/m^3/s) = \frac{(EF \times D \times M) + (CS \times M/2)}{60 \times 60 \times 24 \times CP}$$

Where:

- EF = Emission factor (g/km);
- D = Average distance travelled (km);
- M = Vehicle movements (per day);
- CS = Cold start emission factor (g/trip); and
- CP = Car park volume (m^3) or area (m^2).

6.1.22 The equation was used with the relevant inputs to calculate the emission factors for each car park as shown in Table 6.1.6.

Table 6.1.6 Car Park Pollutant Emissions

Source	Pollutant	Emission Rate (g/m3/s)	
		2019 Emission Factors	2031 Emission Factors
Car Park Area 1	NO_x	$1.97x10^{-7}$	$1.35x10^{-7}$
	PM_{10}	$1.15x10^{-8}$	$1.08x10^{-8}$
	$PM_{2.5}$	$7.93x10^{-9}$	$7.27x10^{-9}$
Car Park Area 2	NO_x	$1.23x10^{-7}$	$8.53x10^{-8}$
	PM_{10}	$6.90x10^{-9}$	$6.50x10^{-9}$
	$PM_{2.5}$	$4.77x10^{-9}$	$4.37x10^{-9}$
Car Park Area 3	NO_x	$1.23x10^{-7}$	$8.53x10^{-8}$
	PM_{10}	$6.90x10^{-9}$	$6.50x10^{-9}$
	$PM_{2.5}$	$4.77x10^{-9}$	$4.37x10^{-9}$

NOx to NO2 Conversion

6.1.23 Predicted annual mean NO_x concentrations from the dispersion model were converted to NO_2 concentrations using the NO_x to NO_2 Calculator (v.8.1) provided by DEFRA, which is the method detailed within LAQM.TG(16).

Meteorological Data

6.1.24 Meteorological data used in this assessment was taken from Brize Norton meteorological station over the period 1st January 2019 to 31st December 2019 (inclusive).

6.1.25 Brize Norton meteorological station is located at approximate NGR: 462190, 191600 which is approximately 22.3km south-west of the Proposed Development. Although there is a large distance between the application site and Brize Norton the use of this data has prior approval from the Environmental Health Department at OCC and is therefore considered to provide a reasonable representation of conditions at the development site.

6.1.26 All meteorological records used in the assessment were provided by Atmospheric Dispersion

Modelling (ADM) Ltd, which is an established distributor of data within the UK. Reference should be made to Figure 5 within Appendix 6.2 for a wind rose of utilised meteorological data.

Roughness Length

6.1.27 The specific roughness length (z_0) values used to represent conditions during the verification process, DM/DS scenario, as well as conditions at the Brize Norton meteorological station are summarised in Table 6.1.7.

Table 6.1.7 Utilised Roughness Lengths

Scenario	Roughness Length (m)	ADMS Description
Verification, DM and DS Scenarios	0.5	Parkland, open suburbia
Brize Norton	0.3	Agricultural Areas (Max)

6.1.28 These values of z_0 are considered appropriate for the morphology of the assessment area.

Monin-Obukhov Length

6.1.29 The Monin-Obukhov length provides a measure of the stability of the atmosphere within certain urban or rural contexts. The specific length values used to represent conditions during the verification process, DM/DS scenario, as well as conditions at the Brize Norton are summarised in Table 6.1.8.

Table 6.1.8 Utilised Monin-Obukhov Lengths

Scenario	Monin-Obukhov Length (m)	ADMS Description
Verification, DM and DS Scenarios	30	Mixed Urban/Industrial
Brize Norton	10	>50,000 Small town

6.1.30 This Monin-Obukhov value is considered appropriate for the morphology of the assessment area.

Background Concentrations

6.1.31 The 2031 annual mean background concentrations detailed in Table 6.8 within the Main Es Chapter was used in the dispersion modelling assessment to represent annual mean pollutant levels at the Proposed Development site.

6.1.32 Table 6.1.9 displays the specific background concentrations as predicted by DEFRA, utilised to represent the condition at the monitoring locations used within the verification process.

Table 6.1.9 Predicted Background Pollutant Concentrations for Monitoring Locations

Monitoring Location	DEFRA Grid Square	Pollutant	2019 Predicted Background Concentration (µg/m³)
Oxford Road	449500 213500	NOx	16.48
		NO_2	12.29
Bicester Road, Bramley Close	450500, 213500	NOx	18.34
		NO_2	13.60
DT25, DT26	450500, 210500	NOx	19.14
		NO_2	14.07
DT27, DT28, DT29, DT71	449500, 210500	NOx	23.22
		NO_2	16.76

6.1.33 Table 6.1.10 displays the predicted background concentrations by DEFRA used in the operational phase assessment for the sensitive receptor locations.

Table 6.1.10 Predicted Background Pollutant Concentrations at Sensitive Receptors

Monitoring Location	DEFRA Grid Square	Pollutant	2031 Predicted Background Concentration (µg/m³)
R1 to R10, R12, R14 and R16	450500, 210500	NO_x	14.72
		NO_2	11.09
		PM_{10}	14.57
		$PM_{2.5}$	9.63
R11	450500, 209500	NO_x	14.52
		NO_2	10.93
		PM_{10}	13.95
		$PM_{2.5}$	9.46
R15	451500, 210500	NO_x	10.83
		NO_2	8.35
		PM_{10}	14.25
		$PM_{2.5}$	8.94
R17 to R20. R22 to R26	449500, 210500	NO_x	17.13
		NO_2	12.75
		PM_{10}	16.07
		$PM_{2.5}$	10.05
R21	449500, 209500	NO_x	14.18
		NO_2	10.68
		PM_{10}	13.60
		$PM_{2.5}$	9.05
R26 to R29	449500, 213500	NO_x	11.77
		NO_2	9.01
		PM_{10}	14.04
		$PM_{2.5}$	9.54
R30	450500, 213500	NO_x	11.78
		NO_2	9.04
		PM_{10}	15.64
		$PM_{2.5}$	9.98
R31	449500, 212500	NO_x	11.69
		NO_2	8.96
		PM_{10}	14.21
		$PM_{2.5}$	9.34

6.1.34 2019 background concentrations for each receptor location have been used for the sensitivity analysis. The results of this are detailed in Appendix 6.5.

Verification

6.1.35 The predicted results from a dispersion model may differ from measured concentrations for a large number of reasons, including:

- Estimates of background concentrations;
- Uncertainties in source activity data such as traffic flows and emission factors;
- Variations in meteorological conditions;
- Overall model limitations; and
- Uncertainties associated with monitoring data, including locations.

6.1.36 Model verification is the process by which these and other uncertainties are investigated and where possible minimised. In reality, the differences between modelled and monitored results are likely to be a combination of all of these aspects.

6.1.37 For the purpose of this assessment model verification was undertaken for 2019, using traffic data, meteorological data and monitoring results from this year.

6.1.38 OCC and CDC undertakes periodic monitoring of NO_2 concentrations at 9 roadside monitoring location within the assessment extents. The road contribution to total NO_x concentration was calculated from the monitored NO_2 result for use in the verification process. This was undertaken following the methodology contained within DEFRA guidance LAQM.TG(16). The monitored annual mean NO_x concentration and calculated road NO_x concentration are summarised in Table 6.1.11.

Table 6.1.11 NO_x Concentrations

Site ID	Monitored Road NOx Concentration (µg/m³)	Modelled Road NOx Concentration (µg/m³)	% Difference ((Monitored - Modelled)/Monitored)) * 100
DT25	41.69	33.54	20%
DT26	52.87	34.28	35%
DT29	17.68	15.01	15%
DT71	47.35	33.97	28%
Bicester Road (2)	39.59	26.81	32%
Oxford Road	23.63	19.86	16%
Bramley Close	19.73	16.45	17%
DT27*	23.72	28.71	-21%
DT28*	17.68	18.01	-2%

* DT27 and DT28 *were not included within the verification process due to suitable correlation with monitored NO_x concentration prior to adjustment. In both cases this is due to significant overestimations prior to adjustment.*

6.1.39 According to LAQM.TG(22), no adjustment is necessary where the results of the model all lie within 10% of the monitored concentrations or provide systematic overpredictions (DT27 and DT28). Subsequently, specific monitors have not been included within the calculation of the NOx adjustment factor.

6.1.40 The monitored and modelled NO_x road contribution concentrations were graphed and the equation of the trend line based on the linear progression through zero was calculated, as shown in Graph 1

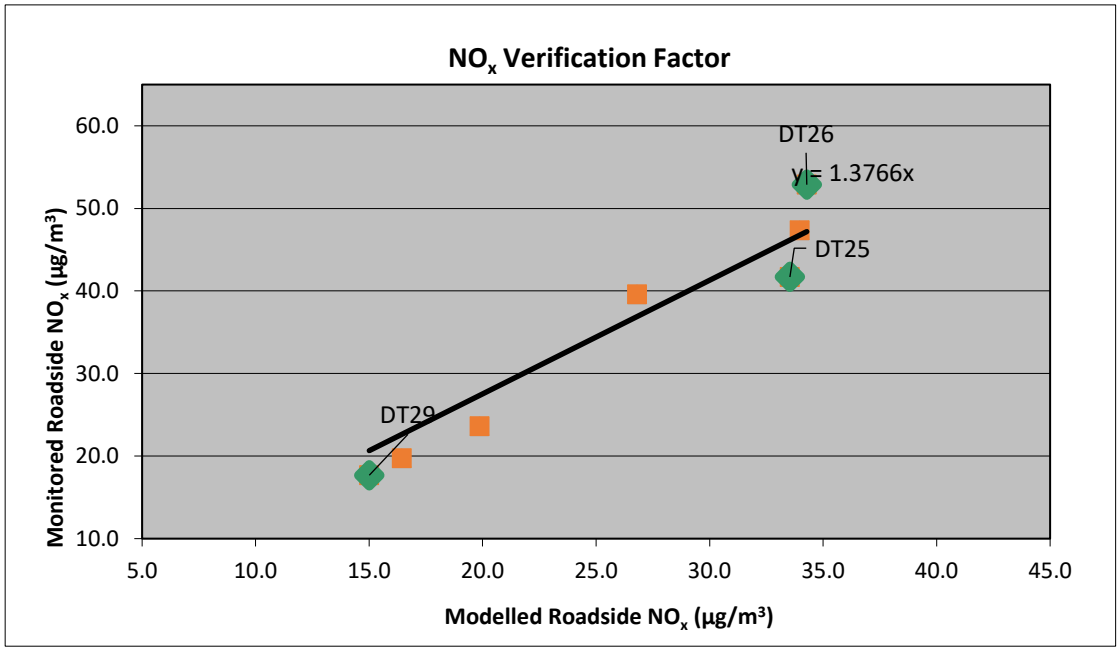
6.1.41 The monitored and modelled NO_x road contribution concentrations were compared and this indicated that a verification factor of Insert Factor was required to be applied to all NOx modelling results.

6.1.42 This indicated that a verification factor of **1.3707** was required to be applied to all NO_x modelling results, showing the model overestimated pollutant concentrations throughout the assessment extents.

6.1.43 An adjustment factor of 1 has been applied where modelled concentrations are observed within 10% of monitored NO_x concentrations, or in cases where systematic overpredictions occur. This method ensures that over adjustment is avoided at locations where the initial modelling provides suitable correlation to monitored concentrations.

6.1.44 Graph 1 is provided below.

Graph 6.1.1 Verification Adjustment Factor



6.1.45 Table 6.1.12 presents the monitored annual mean NO_2 concentrations and the adjusted modelled total NO_2 concentration based on the above verification factor. Exceedances of the annual mean NO_2 AQO are highlighted in bold.

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Table 6.1.12 NO_2 Concentrations

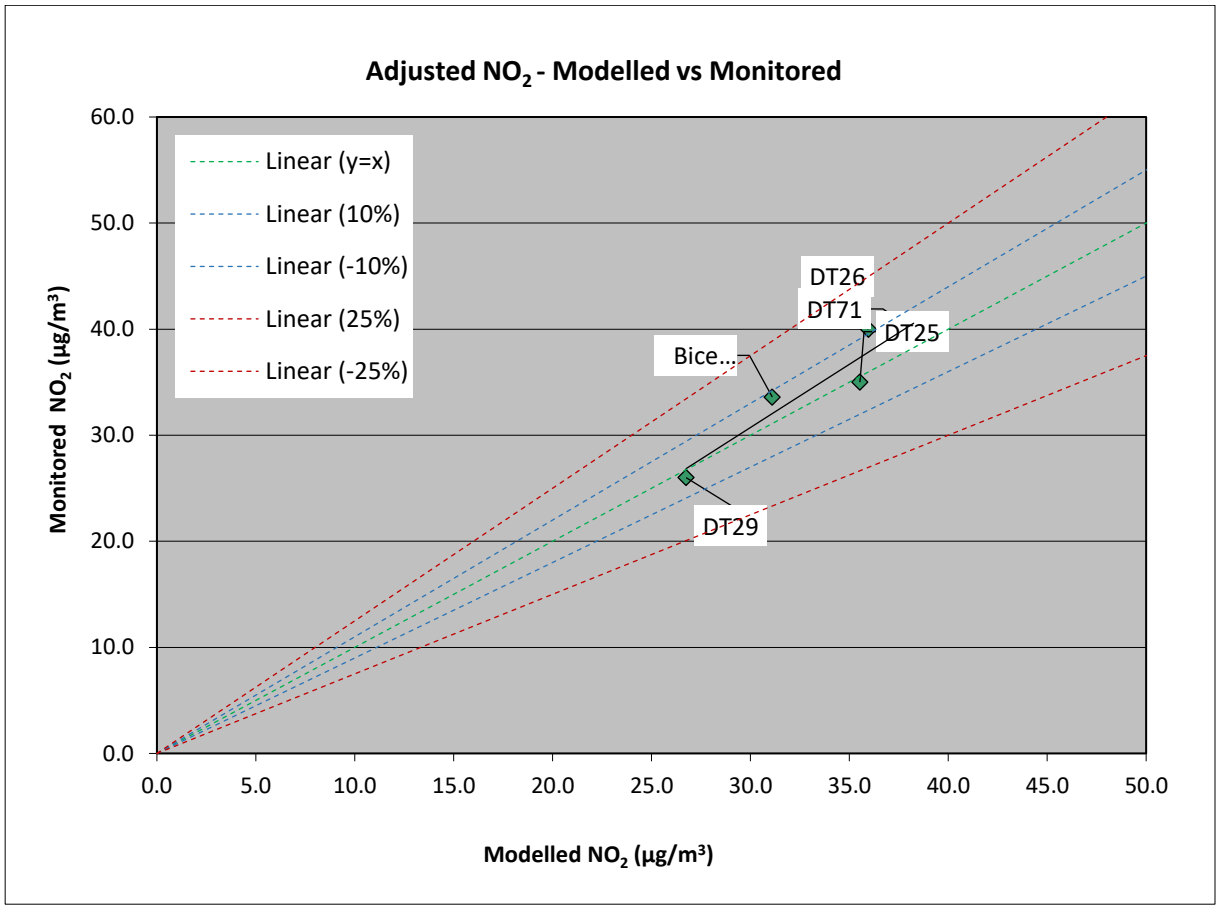
Site ID	Monitored Road NO_2 Concentration (µg/m³)	Modelled Road NO_2 Concentration (µg/m³)	% Difference ((Monitored - Modelled)/Monitored)) * 100
DT25	35.00	35.53	-2%
DT26	40.00	35.96	10%
DT29	26.00	26.75	-3%
DT71	40.00	38.25	4%
Bicester Road (2)	33.60	31.10	7%
Oxford Road	24.70	25.57	-4%
Bramley Close	24.00	24.65	-3%
DT27*	29.00	35.18	-21%
DT28*	26.00	28.65	-10%

** Adjustment factor of 1.0 applied*

6.1.46 As demonstrated in Table 6.1.12 the percentage difference between modelled and monitored concentrations is deemed acceptable and is less than 25% in all cases, and less than 10% at all locations. This reduces uncertainties in the model predictions and provide a robust representation of pollutant concentrations in accordance with the guidance suggested in LAQM.TG(16).

6.1.47 A graphical representation of the adjusted NO_2 concentrations is provided within Graph 2.

Graph 6.1.2 Graph 2 – Modelled vs Monitored NO_2



6.1.48 As PM_{10} and $PM_{2.5}$ monitoring is not undertaken within the assessment extents, the NOx adjustment factor of **1.3525** was utilised to adjust model predictions of PM_{10} and $PM_{2.5}$ in accordance with the guidance provided within LAQM.TG(16)[2].