Appendix B - Glossary

Table B-1 – Glossary

Term	Definition
Annual Average Daily Traffic	A daily total traffic flow (24 hrs), expressed as a mean daily flow across all 365 days of the year.
Adjustment	Application of a correction factor to modelled results to account for uncertainties in the model
Accuracy	A measure of how well a set of data fits the true value.
Air quality objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedances within a specific timescale (see also air quality standard).
Air quality standard	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive sub-groups (see also air quality objective).
Ambient air	Outdoor air in the troposphere, excluding workplace air.
Annual mean	The average (mean) of the concentrations measured for each pollutant for one year.
AQMA	Air Quality Management Area.
Conservative	Tending to over-predict the impact rather than under-predict.
Data capture	The percentage of all the possible measurements for a given period that were validly measured.
DEFRA	Department for Environment, Food and Rural Affairs.
Emission rate	The quantity of a pollutant released from a source over a given period of time.
Exceedance	A period of time where the concentrations of a pollutant is greater than the appropriate air quality standard.
HDV/HGV	Heavy Duty Vehicle/Heavy Goods Vehicle.
LAQM	Local Air Quality Management.
Model adjustment	Following model verification, the process by which modelled results are amended. This corrects for systematic error.
NO_2	Nitrogen dioxide.
NO_x	Nitrogen oxides.
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5 micrometres.

Road link	A length of road which is considered to have the same flow of traffic along it. Usually, a link is the road from one junction to the next.
μg/m^3 microgrammes per cubic metre	A measure of concentration in terms of mass per unit volume. A concentration of 1ug/m^3 means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.
Uncertainty	A measure, associated with the result of a measurement, which characterizes the range of values within which the true value is expected to lie. Uncertainty is usually expressed as the range within which the true value is expected to lie with a 95% probability, where standard statistical and other procedures have been used to evaluate this figure. Uncertainty is more clearly defined than the closely related parameter 'accuracy' and has replaced it on recent European legislation.
Validation (modelling)	Refers to the general comparison of modelled results against monitoring data carried out by model developers.
Validation (monitoring)	Screening monitoring data by visual examination to check for spurious and unusual measurements (see also ratification).
Verification (modelling)	Comparison of modelled results versus any local monitoring data at relevant locations.

Appendix C - Scheme Specific Monitoring

Introduction

A Proposed Development specific NO_2 passive diffusion tube monitoring programme was completed by WSP to establish baseline concentrations for the whole study area. The three-month programme began in November 2018 and ended February 2019.

Details of the seven monitoring site locations are presented in **Table C-1** and shown in **Figure 1**. Where site conditions allowed, the monitoring locations were not located in proximity (within 10 m) to the following localised sources or sinks of air pollutants, and areas that could cause undue disturbance to free flow air flow around the diffusion tubes:

- Heater flues (particularly low-level balanced flues);
- Trees and other vegetation;
- Extractor vents; and/or,
- Underground ventilation shafts

Table C-1 – Scheme Specific Monitoring Site Locations and Details

Site ID	Location	Height (m)
MC01	Woodstock Road, Begbroke, Kidlington	2.0
MC02	A44, Kidlington	2.0
MC03	194 Woodstock Road, Yarnton, Kidlington	2.0
MC04	107 Rutten Lane, Yarnton, Kidlington	2.0
MC05	190 Cassington Road, Yarnton, Kidlington	2.0
MC06	209 Woodstock Road, Yarnton, Kidlington	2.0
MC07	Spring Hill Road, Kidlington	2.0

NO_2 DIFFUSION TUBE MONITORING RESULTS

Bias Adjustment of Period Mean Concentrations

Diffusion tubes are affected by several sources of interference which can cause substantial under or over estimation of concentrations. This is often referred to as bias, when compared to concentrations measured by the more accurate chemiluminescent analysers referred to as continuous monitors.

As a result, Defra advises applying an appropriate bias adjustment factor to measured diffusion tube concentrations. The bias adjustment factor used in this study was obtained from the National Diffusion Tube Bias Adjustment Factor Spreadsheet[1]. This is formulated by data collected by local authorities throughout the country as they locate diffusion tubes in the vicinity of a continuous monitor and compare the results. By inputting the chosen analyser, the method

[1] https://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html June 2020

of analysis and the year into the spreadsheet, an average of the relevant bias factors across the country can be obtained. This equated to 0.92 in 2018. This bias adjustment factor was applied to the annualised diffusion tube data from the monitoring survey to calculate the final concentration for the monitoring locations.

Annualisation

All monitoring results were adjusted based upon the methodology contained within Box 7.9 of LAQM.TG (16). In this procedure, data from nearby (within 50 miles) continuous monitoring sites with annual datasets are used to generate a factor to convert period data into annual data. Two AURN 'Urban' sites (AURN) were used for annualisation:

- Oxford St Ebbes; and
- Reading New Town.

The period means for these two sites were calculated to match the period of time that monitoring was undertaken by WSP. The annual mean for both of these sites was also calculated for 2018, the year of verification. The ratio of the annual mean to the period mean at each site was then calculated, with the average of these values equating to the annualisation factor. This factor is applied to the monitoring period mean to obtain a value for the 2018 annualised mean concentration at the scheme-specific monitoring locations.

A summary of these data can be seen in **Tables C-2**, **C-3** and **C-4**.

Table C-2 – Diffusion Tube Monitoring Results

Site ID	**Monthly Measurements (µg/m³)**			**Period Mean (µg/m³)**
	7/11/18 – 3/12/18	**3/12/18 – 3/1/19**	**3/1/19 – 5/2/19**	
MC01	25.3	21.6	21.0	22.7
MC02	26.9	23.3	23.3	24.5
MC03	30.3	23.8	23.3	25.8
MC04	23.7	21.4	19.6	21.6
MC05	18.5	18.4	18.2	18.4
MC06	29.8	31.5	30.1	30.5
MC07	17.4	17.8	16.0	17.1

Table C-3 – Annualisation Factor

Site ID	AURN Period Mean (µg/m³)	AURN 2018 Annual Mean (µg/m³)	AM/PM
Reading New Town	30.3	25.7	0.85
Oxford St Ebbes	18.5	14.5	0.79
		Annualisation Factor	**0.82**

Table C-4 – Bias Adjusted Annual Mean Diffusion Tube Monitoring Results 2018

Site ID	Period Mean (µg/m^3)	2018 Annualised Mean (Annualisation Factor = 0.82) (µg/m^3)	2017 Bias Adjusted Annual Mean (Bias Factor = 0.92) (µg/m^3)
MC01	22.7	18.5	17.0
MC02	24.5	20.0	18.4
MC03	25.8	21.0	19.3
MC04	21.6	17.6	16.2
MC05	18.4	15.0	13.8
MC06	30.5	24.9	22.9
MC07	24.1	13.9	12.8

Appendix D - Dispersion Model Approach & Verification

Introduction

Air pollution in urban areas is dominated by emissions from road vehicles. The main pollutants of concern from road traffic are oxides of nitrogen (NO_x/NO_2) and fine particulate matter (PM_{10} & $PM_{2.5}$), since these pollutants are most likely to approach their relevant air quality limit values in proximity to major road links.

The introduction of the Proposed Development has the potential to change the total flow, distribution and characteristics of traffic movements on the affected road links, which would result in changes to emissions of the aforementioned pollutants. The local air quality assessment was completed to predict the potential impacts of these changes on ambient pollutant concentrations at identified sensitive receptors within proximity to affected roads.

The air quality conditions were described for the base year (2018), opening year without development (2029) and opening year with development (2029).

The changes in local traffic related pollution levels predicted at the receptor locations were assessed by comparing the predicted concentrations of NO_2, PM_{10} and $PM_{2.5}$ with the current air quality objectives and considering the change (improvement or worsening) between the 'without' and 'with' development scenarios.

Atmospheric Dispersion Model Selection

The predicted impacts on local air quality associated with changes to vehicle emissions as a result of the operation of the scheme were assessed using Cambridge Environmental Research Consultants (CERC) atmospheric dispersion modelling system for roads (ADMS-Roads v5.0).

ADMS-Roads applies advanced algorithms for the height-dependence of wind speed, turbulence and stability to produce improved predictions of air pollutant concentrations within the given model domain. It can predict long-term and short-term concentrations, as well as calculations of percentile concentrations.
ADMS-Roads is a validated model, developed in the UK by CERC[2]. The model validation process includes comparisons with data from the UK's Automatic Urban Rural Network (AURN) and specific verification exercises using standard field, laboratory and numerical data sets. CERC is also involved in European programmes on model harmonisation, and their models were compared favourably against other EU and U.S. EPA systems.

Atmospheric Dispersion Modelling Process

The procedures involved in undertaking the dispersion modelling assessment are outlined below:

- Collation of input data – traffic data (flows, speeds, percentage of Heavy-Duty Vehicles (HDVs)), road network mapping, sensitive receptor coordinates and meteorological data;
- Input of data in to the ADMS-Roads model for the scenarios to be modelled;
- Development of emissions inventories for each pollutant to be assessed, using DEFRA's emission factor toolkit (EFT v10.1);
- Running the ADMS-Roads model for each considered scenario;
- Conversion of modelled NO_X concentrations to NO_2 concentrations using DEFRA's NO_x-NO_2 calculator v8.1;
- Addition of DEFRA background concentrations to the modelled concentrations;
- Verification and adjustment of modelled road-NO_x contributions from the assessed road network through analysing the ADMS-Roads modelled road-NO_x outputs versus scheme specific monitored road-NO_x for the base year scenario (2018);

[2] Further information in relation to this is available from the CERC web site at http://www.cerc.co.uk/environmental-software/model-validation.html

- Comparison of predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations at all receptors to the relevant air quality objectives in each scenario; and
- Analysis of changes in pollutant concentrations between the 'without development' and 'with development' scenarios to assess the significance of impacts associated with the Proposed Development on local air quality.

Traffic Data

Traffic flow data comprising Annual Average Daily Traffic (AADT) flows, traffic composition (percentage HDVs) and average link speeds (km/h) were used in the modelling as provided by the projects transport consultant (Vectos) for the assessed road network. Appropriate assumptions were made with respect to traffic speeds on approach to and progress through junctions (i.e. lower speeds on approach and progress through junction). Traffic flows at roundabout were calculated by averaging the AADT of the approach roads. Full traffic data is provided in **Tables D1**, **D2** and **D3** below.

Table D1 – 2018 Baseline Flows

Road Links	Modelled Speed/Junction Speed (kph)	AADT	HDV%
A44 Oxford Road	80/16	14,482	3.7%
A4095 Grove Road	48/16	12,882	4.7%
A4095 Upper Campsfield Road	97/16	8,379	8.4%
Langford Lane	48/16	11,560	3.0%
Sandy Lane	48/16	3,403	0.0%
A4260 Frieze Way	113/16	12,753	1.7%
A44 Woodstock Road (South of Loop Farm Roundabout)	113/16	28,375	6.2%
A44 Woodstock Road (North of Loop Farm Roundabout)	80/16	24,349	5.9%
Cassington Road	64/16	3,030	0.9%
Rutten Lane (South of Merton Way)	48/16	3,332	0.0%
Spring Hill	48/16	856	0.0%

Table D-2 – 2029 Without Proposed Development Flows

Road Links	Modelled Speed/Junction Speed (kph)	AADT	HDV%
A44 Oxford Road	80/16	15,518	3.5%
A4095 Grove Road	48/16	13,024	4.7%
A4095 Upper Campsfield Road	97/16	9,075	7.8%
Langford Lane	48/16	12,006	2.9%
Sandy Lane	48/16	3,403	0.0%
A4260 Frieze Way	113/16	14,676	1.4%
A44 Woodstock Road (South of Loop Farm Roundabout)	113/16	32,838	5.4%
A44 Woodstock Road (North of Loop Farm Roundabout)	80/16	28,543	5.1%
Cassington Road	64/16	3,053	0.9%

Rutten Lane (South of Merton Way)	48/16	3,332	0.0%
Spring Hill	48/16	856	0.0%

Table D-3– 2029 With Proposed Development Flows

Road Links	Modelled Speed/Junction Speed (kph)	AADT	HDV%
A44 Oxford Road	80/16	15,562	3.5%
A4095 Grove Road	48/16	13,067	4.7%
A4095 Upper Campsfield Road	97/16	9,274	7.6%
Langford Lane	48/16	12,186	2.9%
Sandy Lane	48/16	3,403	0.0%
A4260 Frieze Way	113/16	14,794	1.4%
A44 Woodstock Road (South of Loop Farm Roundabout)	113/16	33,847	5.2%
A44 Woodstock Road (North of Loop Farm Roundabout)	80/16	29,669	4.9%
Cassington Road	64/16	3,066	0.9%
Rutten Lane (South of Merton Way)	48/16	3,355	0.0%
Spring Hill	48/16	856	0.0%

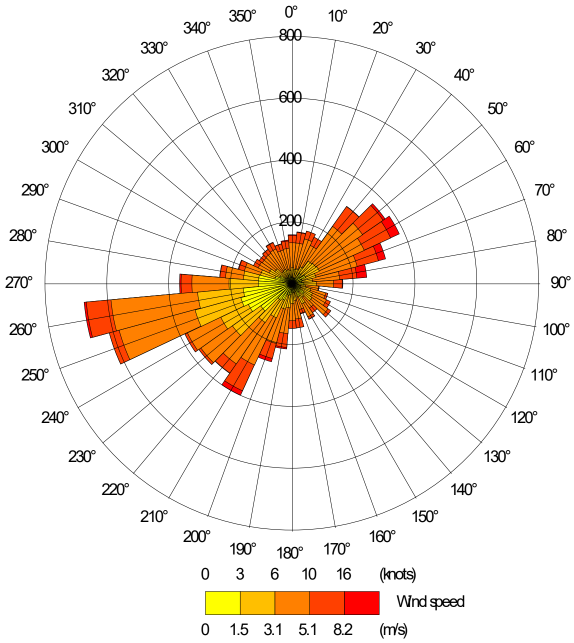
Meteorological Data

ADMS-Roads utilises hourly sequential meteorological data; including wind direction, wind speed, temperature, precipitation and cloud cover, to facilitate the prediction of pollution dispersion between source and receptor.

Meteorological data input to the model were obtained from the closest meteorological station, Brize Norton, for the year 2018. The 2018 data was used to be consistent with the base/verification traffic year and were applied to the remaining scenarios for the local air quality assessment.

The 2018 wind rose is presented as **Figure D1**, which shows that the prevailing wind direction is from the west-southwest, with wind speeds predominantly in the range 3.1-5.1 m/s.

Figure D-1 – 2018 Wind Rose for Brize Norton



Conversion of NO_X to NO_2

Oxides of nitrogen (NO_x) concentrations were predicted using the ADMS-Roads model. The modelled road contribution of NO_x at the modelled receptor locations was then converted to NO_2 using the NO_x to NO_2 calculator[3], in accordance with DEFRA guidance.

Model Validation

The ADMS-Roads dispersion model has been validated for road traffic assessments and is considered to be fit for purpose. Model validation undertaken by the software developer Cambridge Environmental Research Consultants (CERC) is unlikely to have included validation in the vicinity of the scheme considered in this assessment. It is therefore necessary to perform a comparison of model results with local monitoring data at relevant locations.

Model Verification

The comparison of modelled concentrations with local monitored concentrations is a process termed 'verification'. Model verification investigates the discrepancies between modelled and measured concentrations, which can arise due to the presence of inaccuracies and/or uncertainties in model input data, modelling and monitoring data assumptions. The following are examples of potential causes of such discrepancy:

- Estimates of background pollutant concentrations;
- Meteorological data uncertainties:
- Traffic data uncertainties;
- Model input parameters such as 'roughness length'; and
- Overall limitations of the dispersion model

Full details of the model verification process specific to the Proposed Development modelling assessment are provided in the 'Assessment Verification Methodology' section below.

[3] v8.1, https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc

Model Precision

Residual uncertainty may remain after systematic error or 'model accuracy' has been accounted for in the final predictions. Residual uncertainty may be considered synonymous with the 'precision' of the model predictions, i.e. how wide the scatter or residual variability of the predicted values compare with the monitored true value, once systematic error has been allowed for. The quantification of model precision provides an estimate of how the final predictions may deviate from true (monitored) values at the same location over the same period. Suitable local monitoring data for the purpose of verification is used for model verification.

An evaluation of model performance has been undertaken to establish confidence in model results. LAQM.TG16 identifies a number of statistical procedures that are appropriate to evaluate model performance and assess the uncertainty. The statistical parameters used in this assessment are:

- Root mean square error (RMSE);
- Fractional bias (FB); and
- Correlation coefficient (CC).

A brief explanation of each statistic is provided in **Table D4**, and further details can be found in DEFRA's LAQM.TG16 document.

Table D-4 – Model Performance Statistics

Statistical Parameter	Comments	Ideal value
RMSE	RMSE is used to define the average error or uncertainty of the model. The units of RMSE are the same as the quantities compared. If the RMSE values are higher than 25% of the objective being assessed, it is recommended that the model inputs and verification should be revisited in order to make improvements. For example, if the model predictions are for the annual mean NO_2 objective of 40µg/m^3, if an RMSE of 10µg/m^3 or above is determined for a model it is advised to revisit the model parameters and model verification. Ideally an RMSE within 10% of the air quality objective would be derived, which equates to 4µg/m^3 for the annual mean NO_2 objective.	0.00
Fractional Bias	It is used to identify if the model shows a systematic tendency to over or under predict. FB values vary between +2 and -2 and has an ideal value of zero. Negative values suggest a model over-prediction and positive values suggest a model under-prediction.	0.00
Correlation Coefficient	It is used to measure the linear relationship between predicted and observed data. A value of zero means no relationship and a value of 1 means absolute relationship. This statistic can be particularly useful when comparing a large number of model and observed data points.	1.00

The calculations were carried out after model adjustment to provide information on the improvement of the model predictions as a result of the application of the verification adjustment factors

Assessment Verification Methodology

The verification process involves a review of the modelled pollutant concentrations against corresponding monitoring data to determine how well the air quality model has performed. Depending on the outcome it may be considered that the model has performed adequately and that there is no need to adjust any of the modelled results LAQM.TG16.

Alternatively, the model may perform outside of the ideal performance limits as stated by LAQM.TG16 (i.e. model agrees within +/-25% of monitored equivalent, but ideally within +/-10%). There is then a need to check all the input data to ensure that it is reasonable and accurately represented in the air quality modelling process.

Where all input data, such as traffic data, emissions rates, and background concentrations have been checked and considered as reasonable, then the modelled results require adjustment to best align with the monitoring data. This may either be a single verification adjustment factor to be applied to the modelled concentrations across the study area, or a range of different adjustment factors to account for different zones in the study area e.g. major roads, local roads.

The air quality model has been run to predict the 2018 annual mean road-NO_x contribution at four scheme specific diffusion tubes adjacent to the modelled road network, based on traffic data provided for the 2018 baseline scenario.

The model outputs of road-NO_x have been compared with the 'measured' road-NO_x, which was determined from the NO_2 concentrations measured using diffusion tubes at the monitoring locations, utilising the NO_x from NO_2 calculator provided by DEFRA and the NO_2 background concentration (from the DEFRA background map). As discussed in the methodology section, the most recent suitable data available for model verification purposes is 2018 data.

The tables and figure below present the data used in the verification exercise.

Table D-5 – Data Used in Model Verification

Monitoring Site	2018 Measured Data (µg/m^3)	Measured Road-NO_x (µg/m^3) (from NO_x:NO_2 calculator)	Modelled Road-NO_x (µg/m^3) – Before Adjustment	Modelled Annual Mean NO_2 Concentration (µg/m^3) – *Before Adjustment*	% Difference (Measured vs Monitored NO_2)
MC02	18.4	13.0	6.4	14.9	-19.0%
MC04	16.2	9.1	1.7	12.2	-24.4%
MC05	13.8	4.7	1.9	12.3	-10.9%
MC06	22.9	21.8	8.9	16.3	-28.8%

Table D5 shows that the model is under predicting at all locations and is less than -25% of the monitored equivalent at one location (MC06). Therefore, verification of the model was progressed to derive an appropriate road-NO_x adjustment factor.

The road-NO_x adjustment factor was determined as the slope of the best fit line between the 'measured' road contribution and the model derived road contribution, forced through zero (see **Figure D2**). This factor (2.36) was then applied to the modelled road-NO_x concentration for each monitoring site to provide adjusted modelled road-NO_x concentrations (as shown in **Table D6**). The total NO_2 concentrations were then determined by inputting the adjusted modelled road-NO_x concentrations and the background NO_2 concentration into the NO_x to NO_2 calculator.

Figure D-2 – Comparison of Measured Road-NO_x with Unadjusted Modelled Road-NO_x

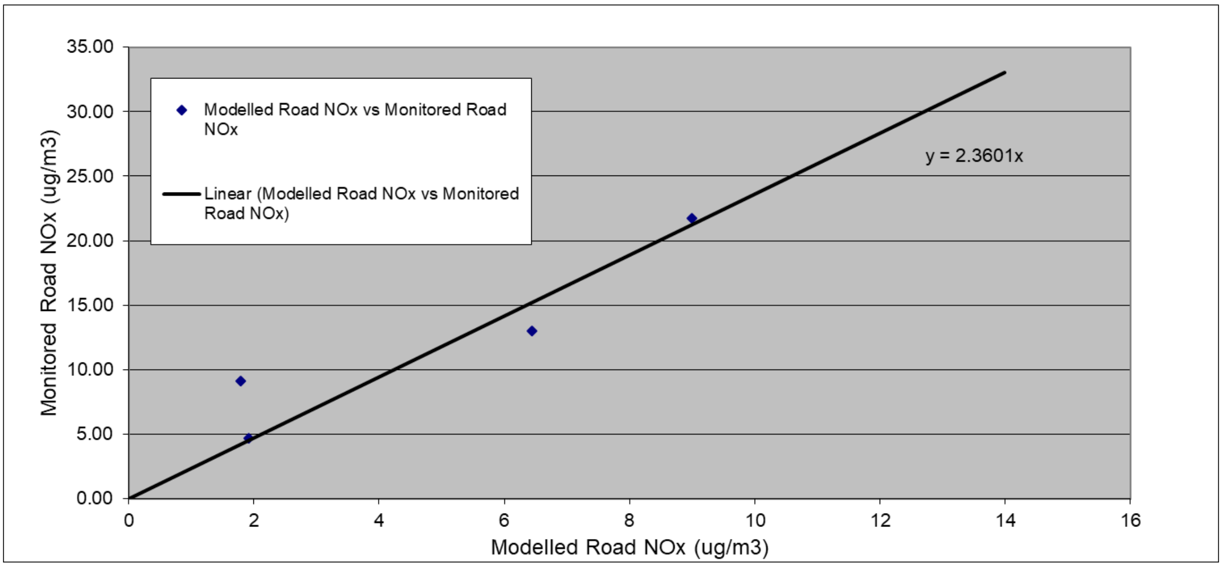


Table D-6 – Model Results After Adjustment

Monitoring Site	2018 Measured Data (µg/m³)	Modelled Annual Mean NO_2 Concentration (µg/m³) – *After Adjustment*	% Difference (Measured vs Monitored NO_2)
MC02	17.8	19.5	6.1%
MC04	15.7	13.6	-16.2%
MC05	13.4	13.7	-0.7%
MC06	22.2	22.6	-1.2%

With the adjustment of modelled road-NO_x applied, the resulting annual mean NO_2 concentrations at each monitoring site were within +/- 20% of the monitored equivalents.

Statistical analyses undertaken for the results presented in **Table D4** demonstrates the following:

- An RMSE value equal to 1.4 µg/m³, which is within the ideal range of 4 µg/m³ (10% of the annual mean objective);
- Given the small number of monitoring locations available for model verification, a fractional bias or correlation coefficient statistic was not derived based on DEFRA LAQM.TG16 guidance, which states that this statistic is particularly useful for a larger number of data points.

PM_{10} & $PM_{2.5}$

There are no local PM_{10} or $PM_{2.5}$ monitoring data against which the model could be verified. Consequently, the verification factor determined above for adjusting the road-NO_x contribution has been applied to the predicted road-PM_{10} and road-$PM_{2.5}$ contributions, consistent with guidance set out in LAQM.TG(16).

Appendix E – Dispersion Model Results

Table E-1 – Predicted Annual Mean NO_2 Concentrations (μg/m^3)

Receptor	2018 Base (μg/m^3)	2029 Without Dev (μg/m^3)	2029 With Dev (μg/m^3)	% of AQAL	Change (μg/m^3)	Change as a % of AQO	Impact
R1	24.0	24.2	24.2	60.6	<0.1	<0.1	Negligible
R2	15.6	15.7	15.7	39.3	<0.1	<0.1	Negligible
R3	15.7	15.9	15.9	39.8	<0.1	0.1	Negligible
R4	20.9	21.6	21.8	54.4	0.2	0.5	Negligible
R5	13.9	14.2	14.2	35.5	<0.1	0.2	Negligible
R6	19.6	19.9	20.0	50.0	0.1	0.3	Negligible
R7	19.9	21.1	21.4	53.4	0.3	0.8	Negligible
R8	29.7	31.7	32.2	80.4	0.5	1.3	Negligible
R9	19.1	20.1	20.4	51.0	0.3	0.7	Negligible
R10	21.2	22.4	22.7	56.7	0.3	0.8	Negligible
R11	16.0	16.6	16.8	42.0	0.2	0.4	Negligible
R12	19.2	20.1	20.4	50.9	0.3	0.6	Negligible
R13	29.3	31.0	31.5	78.7	0.5	1.1	Negligible

R14	15.2	15.4	15.5	38.6	<0.1	0.1	Negligible
R15	13.4	13.5	13.5	33.7	<0.1	<0.1	Negligible
R16	13.3	13.4	13.4	33.5	<0.1	<0.1	Negligible
R17	24.0	25.5	25.8	64.6	0.3	0.9	Negligible
R18	33.0	34.7	35.1	87.8	0.4	1.0	Negligible
R19	10.8	10.9	10.9	27.4	<0.1	0.1	Negligible
R20	25.5	26.9	27.2	68.1	0.3	0.9	Negligible
R21	14.8	14.9	15.0	37.5	<0.1	0.1	Negligible
R22	21.2	22.1	22.4	55.9	0.3	0.6	Negligible
R23	12.4	12.5	12.5	31.3	<0.1	<0.1	Negligible
R24	10.5	10.5	10.5	26.2	<0.1	<0.1	Negligible
PR1	-	-	14.8	37.0	-	-	-
PR2	-	-	14.8	36.9	-	-	-
PR3	-	-	14.7	36.8	-	-	-
PR4	-	-	14.8	36.9	-	-	-
PR5	-	-	14.7	36.7	-	-	-
PR6	-	-	14.7	36.8	-	-	-
PR7	-	-	15.2	38.0	-	-	-

PR8	-	-	16.8	42.0	-	-	-
PR9	-	-	13.9	34.8	-	-	-
PR10	-	-	13.6	34.0	-	-	-
PR11	-	-	12.4	31.0	-	-	-

Table E-2 – Predicted Annual Mean PM_{10} Concentrations (µg/m^3)

Receptor	2018 Base (µg/m^3)	2029 Without Dev (µg/m^3)	2029 With Dev (µg/m^3)	% of AQAL	Change (µg/m^3)	Change as a % of AQO	Impact
R1	17.6	17.6	17.6	43.9	<0.1	<0.1	Negligible
R2	16.1	16.1	16.1	40.4	<0.1	<0.1	Negligible
R3	16.1	16.1	16.1	40.2	<0.1	<0.1	Negligible
R4	16.9	16.9	16.9	42.3	<0.1	<0.1	Negligible
R5	15.9	15.9	15.9	39.7	<0.1	<0.1	Negligible
R6	18.5	18.5	18.5	46.3	<0.1	<0.1	Negligible
R7	17.4	17.3	17.4	43.5	0.1	<0.1	Negligible
R8	18.6	18.5	18.6	46.6	0.1	<0.1	Negligible
R9	17.3	17.2	17.3	43.2	0.1	<0.1	Negligible
R10	17.4	17.3	17.4	43.5	0.1	<0.1	Negligible
R11	16.8	16.8	16.8	42.0	<0.1	<0.1	Negligible
R12	17.1	17.1	17.1	42.8	0.1	<0.1	Negligible
R13	18.1	18.0	18.1	45.2	0.1	<0.1	Negligible
R14	16.1	16.1	16.1	40.2	<0.1	<0.1	Negligible
R15	16.7	16.7	16.7	41.9	<0.1	<0.1	Negligible

R16	16.1	16.1	16.1	40.3	<0.1	<0.1	Negligible
R17	17.5	17.4	17.5	43.7	0.1	<0.1	Negligible
R18	20.3	20.3	20.3	50.8	0.1	<0.1	Negligible
R19	14.6	14.6	14.6	36.4	<0.1	<0.1	Negligible
R20	17.9	17.9	17.9	44.8	0.1	<0.1	Negligible
R21	16.2	16.2	16.2	40.5	<0.1	<0.1	Negligible
R22	17.0	17.0	17.0	42.6	<0.1	<0.1	Negligible
R23	16.0	16.0	16.0	39.9	<0.1	<0.1	Negligible
R24	15.5	15.5	15.5	38.9	<0.1	<0.1	Negligible
PR1	-	-	16.2	40.6	-	-	-
PR2	-	-	16.2	40.6	-	-	-
PR3	-	-	16.2	40.5	-	-	-
PR4	-	-	16.2	40.5	-	-	-
PR5	-	-	16.2	40.5	-	-	-
PR6	-	-	16.2	40.5	-	-	-
PR7	-	-	16.3	40.6	-	-	-
PR8	-	-	16.5	41.4	-	-	-
PR9	-	-	16.2	40.4	-	-	-

PR10	-	-	16.1	40.3	-	-	-
PR11	-	-	15.9	39.8	-	-	-

Table E-3 – Predicted Annual Mean $PM_{2.5}$ Concentrations (µg/m³)

Receptor	2018 Base (µg/m³)	2029 Without Dev (µg/m³)	2029 With Dev (µg/m³)	% of AQAL	Change (µg/m³)	Change as a % of AQO	Impact
R1	11.3	11.2	11.3	45.0	<0.1	<0.1	Negligible
R2	10.3	10.3	10.3	41.2	<0.1	<0.1	Negligible
R3	10.3	10.3	10.3	41.1	<0.1	<0.1	Negligible
R4	10.8	10.8	10.8	43.1	<0.1	<0.1	Negligible
R5	10.1	10.1	10.1	40.3	<0.1	<0.1	Negligible
R6	12.8	12.8	12.8	51.2	<0.1	<0.1	Negligible
R7	11.2	11.2	11.2	45.0	<0.1	<0.1	Negligible
R8	12.0	12.0	12.0	48.1	0.1	<0.1	Negligible
R9	11.2	11.1	11.2	44.6	<0.1	<0.1	Negligible
R10	11.3	11.2	11.3	45.0	<0.1	<0.1	Negligible
R11	10.9	10.9	10.9	43.6	<0.1	<0.1	Negligible
R12	11.1	11.0	11.1	44.3	<0.1	<0.1	Negligible
R13	11.7	11.7	11.7	46.8	<0.1	<0.1	Negligible
R14	10.5	10.5	10.5	41.9	<0.1	<0.1	Negligible
R15	10.2	10.2	10.2	40.8	<0.1	<0.1	Negligible

R16	10.5	10.5	10.5	42.0	<0.1	<0.1	Negligible
R17	11.3	11.3	11.3	45.3	<0.1	<0.1	Negligible
R18	12.7	12.6	12.7	50.7	<0.1	<0.1	Negligible
R19	9.6	9.6	9.6	38.6	<0.1	<0.1	Negligible
R20	11.6	11.5	11.6	46.3	<0.1	<0.1	Negligible
R21	10.5	10.5	10.5	42.2	<0.1	<0.1	Negligible
R22	11.1	11.0	11.1	44.2	<0.1	<0.1	Negligible
R23	10.4	10.4	10.4	41.6	<0.1	<0.1	Negligible
R24	9.8	9.8	9.8	39.1	<0.1	<0.1	Negligible
PR1	-	-	10.5	42.2	-	-	-
PR2	-	-	10.5	42.2	-	-	-
PR3	-	-	10.5	42.1	-	-	-
PR4	-	-	10.5	42.2	-	-	-
PR5	-	-	10.5	42.1	-	-	-
PR6	-	-	10.5	42.1	-	-	-
PR7	-	-	10.6	42.3	-	-	-
PR8	-	-	10.8	43.0	-	-	-
PR9	-	-	10.5	42.1	-	-	-

PR10	-	-	10.5	42.0	-	-	-
PR11	-	-	10.4	41.5	-	-	-