

APPENDIX 9.2

Former Monckton Coke and Chemical Works

Air Quality Glossary

Prepared for: Monckton Developments Ltd

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1.0 INTRODUCTION

SLR Consulting Ltd (SLR) has been commissioned by Monckton Developments Ltd to undertake an Air Quality Impact Assessment and Air Quality Chapter to the Environmental Statement (ES) to support the planning application for a proposed residential scheme on land at the former Monckton Coke and Chemical Works (the 'Application Site'). This air quality glossary should be read in conjunction with and appends Chapter 9 (Air Quality) to the ES.

The proposed scheme is described as:

"Remediation and redevelopment of the site to include up to 500 residential units (use class C3), up to 400sqm of A1-A5 uses, along with any ancillary parking, amenity, and all other associated public, semi public and private realm, soft/hard landscaping, infrastructure and highways works, access and a new internal road network connecting with the existing road network."

This air quality glossary describes the scope and assessment methodology. It then presents the 'baseline appraisal / exposure assessment', emissions impact calculation and assessment of residual dust and odour post-remediation works.

1.1 Structure of Report

The remainder of this report is structured as follows:

- Section 2 presents the assessment methodology;
- Section 3 presents the baseline site-suitability review as part of an 'exposure' assessment;
- Section 4 presents the emissions impact calculation; and
- Section 5 presents the assessment of residual dust and odour impacts.

2.0 ASSESSMENT METHODOLOGY

2.1 Construction Phase Dust Assessment

The assessment has been undertaken with reference to Institute of Air Quality Management (IAQM) '*Guidance on the assessment of dust from construction and demolition*'. The assessment of risk is determined by considering the risk of dust effects arising from four activities in the absence of mitigation:

- demolition;
- earthworks;
- construction; and
- track-out.

The assessment methodology considers three separate dust impacts with account being taken of the sensitivity of the area that may experience these effects:

- annoyance due to dust soiling;
- the risk of health effects due to an increase in exposure to Particulate Matter with an aerodynamic diameter of less than 10µg (PM₁₀); and
- harm to ecological receptors.

The first stage of the assessment involves a screening to determine if there are sensitive receptors within threshold distances of the site activities associated with the construction phase of the scheme. No further assessment is required if there are no receptors within a certain distance of the works; 350m for human receptors and 50m for designated ecological receptors.

The dust emission class (or magnitude) for each activity is determined on the basis of the guidance, indicative thresholds and expert judgement. The risk of dust effects arising is based upon the relationship between the dust emission magnitude and the sensitivity of the area. The risk of impact is then used to determine the mitigation requirements

Descriptors for magnitude of impact and impact significance used in this assessment of construction phase dust are as presented in Appendix A.

2.2 Baseline Review – Exposure Assessment

An 'exposure assessment' has been undertaken following the Barnsley Metropolitan Borough Council (BMBC) *Air Quality and Emissions Good Practice Planning Guidance* to determine whether future occupants of the scheme are likely to be exposed to existing levels of poor air quality.

2.3 Development Classification

The assessment has been undertaken in accordance with the requirements of the BMBC *Air Quality and Emissions Good Practice Planning Guidance* (2020) which initially requires for the 'development type classification' to be identified.

The classification of the development is initially determined based on adapted criteria from the Department for Transport (DfT) which depend on the area of the proposed land use (i.e. residential, retail, office etc.; in relation to residential the threshold criteria is >50 units) and the following additional criteria:

- any development generating 30 or more two-way vehicle movements in any hour;

- any development generating 100 or more two-way vehicle movements per day;
- any development proposing 100 or more parking spaces;
- any relevant development proposed in a location where local transport infrastructure is inadequate; or
- any relevant development proposed in a location adjacent to an Air Quality Management Area (AQMA).

Any development that is below these criteria is classified as 'minor'; developments that meet the criteria are classified as 'medium' unless they also meet the following additional criteria, in which case they are classified as 'major':

- where the proposed development falls within the Town and Country Planning (Environmental Impact Assessment) (England and Wales Regulations 2011 and includes air quality and/or transport as a specific likely impact;
- proposals located within an AQMA;
- proposals that could increase the existing traffic flow on roads >10,000 Annual Average Daily Traffic (AADT) by 5% or more;
- proposals that increase traffic by 5% or more on road canyons with an AADT > 5,000;
- proposals that could introduce or significantly alter congestion (DfT congestion) and includes the introduction of substantial road infrastructure changes;
- proposals that reduce average speeds by more than 10 kph;
- proposals that include additional Heavy Goods Vehicles (HGV) movements by more than 10% of total trips;
- where significant demolition works are proposed; and/or
- where significant construction works are proposed.

Based on the above thresholds, the Proposed Development is considered to be classified as 'major'. As such, the assessment has been undertaken to quantify the potential impact and effect on air quality arising from road vehicle emissions associated with change in development trips during the operational phase of the scheme, with reference to the following documents:

- Local Air Quality Management Technical Guidance (LAQM.TG(16));
- Design Manual for Roads and Bridges (DMRB), LA 105 – Air Quality, Highways England (2019);
- Land-Use Planning and Development Control: Planning for Air Quality (v1.2, 2017) – Environmental Protection UK (EPUK) and IAQM; and
- BMBC *Air Quality and Emissions Good Practice Planning Guidance*, (March 2020).

2.4 Traffic Emissions Assessment

2.2.1 Screening Assessment

The traffic emissions screening assessment has been undertaken on the basis of the EPUK-IAQM guidance. The guidance includes indicative criteria to define what constitutes a 'significant' increase in traffic movements to determine when a quantitative assessment of traffic emissions may be required. They are intended to function as a sensitive 'trigger' for initiating an assessment in cases where there is a possibility of significant effects arising on local air quality. The indicative criteria are:

- a change in Light Duty Vehicle (LDV) (LDV as defined by the DMRB as <3.5 tonnes) flow of more than 500 AADT outside of an AQMA;
- a change in LDV flow of more than 100 AADT within or adjacent to an AQMA;
- a change in Heavy Duty Vehicle (HDV) (HDV as define by the DMRB >3.5 tonnes) flow of more than 100 AADT outside of an AQMA; and/or
- a change in HDV flow of more than 25 AADT within or adjacent to an AQMA.

2.2.2 Dispersion Modelling

The screening assessment has identified that predicted trip generation exceeds the EPUK-IAQM indicative criteria for areas outside of the declared BMBC AQMAs.

Detailed air dispersion modelling has been undertaken using the Cambridge Environmental Research Consultants (CERC) ADMS-Roads air dispersion model, following guidance provided in LAQM.TG(16) to predict concentrations of NO₂ and PM₁₀ for the various scenarios. The model requires various input data, including emissions from each section of road (based upon vehicle flows and vehicle type), and the road characteristic (including road width and street canyon height, where applicable).

The following scenarios have been modelled:

- Verification scenario: baseline 2019 situation verified to 2019 local monitoring data;
- 'Do Minimum' scenario (DM): situation if the scheme is not taken forward (opening year 2030); and
- 'Do Something' scenario (DS): situation if the scheme is taken forward (opening year 2030).

Descriptors for marginal change and predicted impact used in this assessment are based on both the EPUK and IAQM Guidance.

2.2.3 Traffic Emission Factors and Sensitivity Assessment

DEFRA provides an Emission Factor Toolkit (EFT) in order to calculate emissions from a given length of road based on the traffic composition (number of vehicles of each type) and speed data. Emission factors improve with time as new vehicles registered in the UK have to meet progressively tighter European type approval emissions categories, referred to as "Euro" standards. As the proportion of vehicles in the fleet meeting a particular Euro standard increases, the vehicle emissions from the fleet theoretically improve. In order to reflect this, the EFT provides projected emission factors for future years.

Emission factors were determined for each scenario using the latest EFT (v9.0).

Reference should be made to Appendix B for presentation of the traffic data entered into the assessment. Speeds used in the model were based on posted limits and adjusted for junctions following guidance in LAQM.TG(16).

Modelled traffic exhaust concentrations of NO_x have been subject to verification in accordance with LAQM.TG(16) and annual mean NO₂ concentrations calculated using the latest DEFRA 'NO_x-NO₂ Calculator' (v7.1). The traffic mix within the calculator has been set to "All non-urban UK traffic" for a 2030 year (i.e. the predicted development opening year). 'Barnsley' was selected as the local authority.

In summary, the assessment has utilised the following inputs:

- 2030 emission factors from v9.0 of the EFT; and,
- 2030 mapped background concentrations sourced from the DEFRA mapping study.

Recent evidence indicates a disparity between the emission factors and ambient monitoring data. To address this uncertainty, an additional modelling scenario has been assessed in which it has been assumed there is no

improvement in vehicle emissions from a precautionary 2019 baseline year and no improvement in backgrounds from the 2019 DEFRA mapping study base year, mirroring that year of the 2019 verification assessment. Reference should be made to Appendix C for presentation of the sensitivity modelling scenario. These modelling assumptions and sensitivity on the dispersion modelling inputs are in accordance with principles of the IAQM's *Position Statement on Dealing with Uncertainty in Vehicle NO_x Emissions within Air Quality Assessments*.

2.2.4 Meteorological Data

To calculate pollutant concentrations at identified sensitive receptor locations the dispersion model uses sequential hourly meteorological data, including wind direction, wind speed, temperature, cloud cover and stability, which exert significant influence over atmospheric dispersion.

The dispersion modelling has been undertaken using 2019 data from Doncaster Sheffield Robin Hood Airport. This site is located approximately 31km south east of the proposed scheme. It is also the closest and most relevant meteorological station that records all of the parameters necessary for dispersion modelling.

The meteorological dataset used in this assessment was provided by ADM Ltd. A windrose is presented in Figure 4-1.

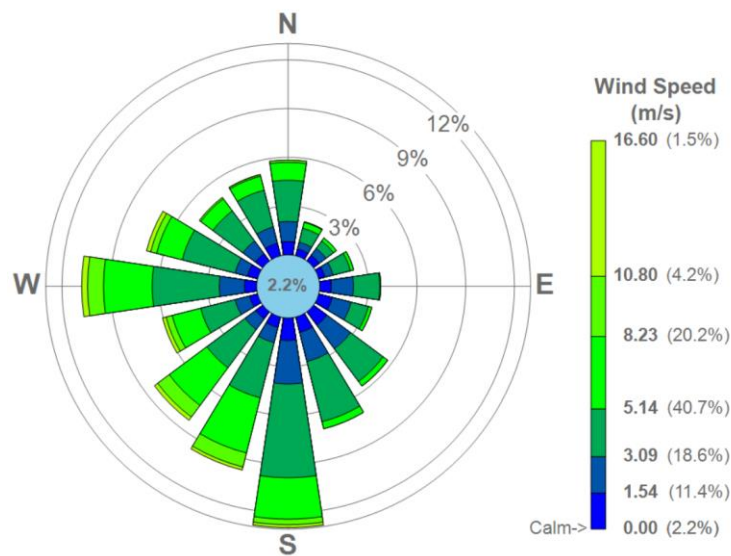


Figure 2-1
Wind rose for Robin Hood (Doncaster Sheffield) Airport (2019)

2.2.5 Background Concentrations

DEFRA provide modelled background pollutant concentration data on a 1km x 1km spatial resolution across the UK that is routinely used to support LAQM and Air Quality Assessments. Background pollutant concentrations are based upon the 2017 base year (May 2019 update) DEFRA update and projected forward. Mapped background concentrations for nitrogen dioxide (NO₂) and PM₁₀ were obtained for the grid squares containing the proposed scheme and surrounding study area for the assessment scenario years.

2.2.6 Sensitive Receptors

LAQM.TG(16) provides guidance on assessing air quality against the regulations, stating that the Air Quality Assessment Levels (AQALs) should be assessed at locations where members of the public are likely to be regularly present and are likely to be exposed for a period of time appropriate to the averaging period of the standard.

Human receptor locations have been characterised with reference to LAQM.TG(16) Box 1.1. According to LAQM.TG(16) exceedances of the AQALs should be assessed in relation to:

“the quality of the air at locations which are situated outside of buildings or other natural or man-made structure, above or below ground, and where members of the public are regularly present”

The receptor locations considered representative of potential exposure within the Air Quality Assessment of road traffic emissions are shown in Table 9.11 of the supporting ES Chapter 9.

Annual mean NO₂ concentrations were calculated at relevant receptor locations. The risk of exceeding the 1-hour mean AQAL was assessed according to the guidance in LAQM.TG(16). This Guidance states that:

“exceedances of the NO₂ 1-hour mean are unlikely to occur where the annual mean is below 60µg/m³”.

Annual mean PM₁₀ concentrations were calculated for these receptor locations. The risk of exceeding the 24-hour mean AQAL was assessed according to the guidance in LAQM.TG(16). This Guidance provides the calculation below to determine compliance:

No. 24-hour mean exceedances = $-18.5 + 0.00145 \times \text{annual mean}^3 + (206/\text{annual mean})$

2.2.7 Assessing Significance

The EPUK-IAQM guidance requires a judgment on the significance of the 'effect', this is based upon consideration, as necessary, of the following factors:

- determination of baseline air quality exposure in the vicinity of the application site utilising the DEFRA PCM Model Output;
- the existing and future air quality in the absence of the development;
- the extent of current and future population exposure to the impacts;
- the worst-case assumptions adopted when undertaking the prediction of impacts; and
- the extent to which the application scheme has adopted best practice to eliminate and minimise emissions.

2.5 Significance of Air Quality Impacts

The EPUK and IAQM guidance¹ considers a number of factors for the determination of significance of predicted air quality impacts.

To determine the significance of predicted air quality impacts based upon a site-suitability assessment, such as that undertaken as part of this assessment, the EPUK & IAQM guidance states:

"Where the air quality is such that an air quality objective at the building façade is not met, the effect on residents or occupants will be judged as significant, unless provision is made to reduce their exposure by some means."

To identify the above, an 'exposure assessment' has been undertaken as outlined in Section 3.

¹ EPUK and IAQM, 'Land-Use Planning and Development Control: Planning for Air Quality', v1.2 2017.

3.0 BASELINE SITE SUITABILITY REVIEW

This section presents a review of SLR's site-specific monitoring data and BMBC Air Quality and Emissions Good Practice Planning Guidance 'Exposure Assessment' in consideration with the proposed scheme, for the purposes of identifying requirements for mitigation to be embedded into the scheme design.

3.1 BMBC Air Quality and Emissions Good Practice Planning Guidance – Exposure Assessment

The BMBC Air Quality Technical Planning Guidance includes a requirement for an 'exposure assessment' to determine whether future occupants of the scheme are likely to be exposed to existing levels of poor air quality. An 'exposure assessment' is required if the development meets any of the following criteria:

- the proposal is adjacent to or within an AQMA;
- the proposal is in a location 20m from roads at or above the relevant national objective highlighted on the Department for Environment, Food and Rural Affairs (DEFRA) GIS modelled maps; and/or
- the proposal is one of the following land-use types:
 - Hotels (C1); residential institutions (C2) or dwelling houses (C3);
 - Homes of Multiple Occupations (C4); or
 - Non-residential institutions (D1).

In consideration of the above criterion:

- the proposed scheme is not located within or adjacent (i.e. within 200m) to an AQMA, as discussed within the supporting ES Chapter 9;
- the proposed scheme is not located within 20m of a road above the annual mean roadside NO₂ AQAL as presented within Section 3.2; and
- the Application Site is a C3 use-class proposed scheme, however, it is not located adjacent to a road where the baseline traffic flow is in excess of 10,000 AADT (as outlined in Appendix B, Table B-3).

Therefore, based upon the above there is no requirement to quantify air pollutant concentrations at the proposed scheme and no requirement for mitigation measures to make the scheme acceptable relative to on-site pollutant exposure.

3.2 DEFRA PCM

The BMBC *Air Quality and Emissions Good Practice Planning Document* states that DEFRA's National Pollutant Climate Mapping (PCM) GIS website² should be used to ascertain if the development is located within 20m of roads at or above the relevant national objective. The closest road to the proposed development with a mapped roadside NO₂ concentration in 2018 is the A61 (Wakefield Road). This is located approximately 3.7km south west of the proposed development site. The NO₂ roadside concentration on A61 Wakefield Road is 10 – 20 µg/m³ in 2018.

² <https://uk-air.defra.gov.uk/data/gis-mapping>, accessed June 2020.

3.3 Significance of Air Quality Impacts

The EPUK and IAQM guidance³ considers a number of factors for the determination of significance of predicted air quality impacts.

To determine the significance of predicted air quality impacts based upon a site-suitability assessment, such as that undertaken as part of this assessment, the EPUK & IAQM guidance states:

“Where the air quality is such that an air quality objective at the building façade is not met, the effect on residents or occupants will be judged as significant, unless provision is made to reduce their exposure by some means.”

As the ‘exposure assessment’ indicates no requirement to quantify air pollutant concentrations at the proposed scheme and no requirement for mitigation measures to make the scheme acceptable, the overall effect is considered ‘not significant’.

³ EPUK and IAQM, ‘Land-Use Planning and Development Control: Planning for Air Quality’, v1.2 2017.

4.0 EMISSION IMPACT OF THE PROPOSED DEVELOPMENT

An estimation of the likely emission impact of the Application Site has been undertaken, in accordance with the methodology outlined within Appendix 4 of the *Air Quality Technical Planning Guidance*⁴. This method is also stated within the EPUK and IAQM guidance⁵. The calculation has utilised the EFT v9.0, as produced by DEFRA.

Information for input into the Damage Cost Calculation was sourced from Met Engineers the appointed Transport Consultant, and the National Transport Statistics (NTS)⁶, in accordance with the BMBC methods. All development trips are LDVs.

Reference should be made to Table 4-1 and Table 4-2 for a presentation of the emission calculation inputs and outputs, respectively.

Table 4-1
Emission Impact Calculation – Inputs

Input Parameter	Inputs
Total Trips ^(A)	3,343
Average trip length (km) ^(B)	10
Speed (kph)	50
2017 Base Damage cost NOx (£ per tonne) ^(C)	9,066
2017 Base Damage cost PM _{2.5} (£ per tonne) ^(C)	81,518
Notes: (A) Based on traffic data provided by Optima Highways. All vehicle trips assumed to be as cars (i.e. LDVs). (B) Average trip length from the National Travel Survey: England 2013. (C) An uplift of 2% per year (from the 2017 base-year damage cost based on the latest published DEFRA Air Quality Appraisal toolkit (May 2020)) has been applied to calculate the corresponding damage cost at the development opening year, 2030.	

Table 4-2
Emission Impact Calculation – Outputs

Output Parameter	Year				
	2030 ^(A)	2031	2032	2033	2034
Annual NOx Emissions (tonnes/year)	1.58	1.58	1.58	1.58	1.58

⁴ Air Quality and Emissions Good Practice Planning Guidance, Barnsley Metropolitan Borough Council, March 2020.

⁵ Environmental Protection UK and Institute of Air Quality Management, '*Land-Use Planning and Development Control: Planning for Air Quality (2014 Update)*', 2014.

⁶ National Travel Survey: England 2013, Department for Transport, July 2014.

Annual PM ₁₀ Emissions (tonnes/year)	0.38	0.38	0.38	0.38	0.38
Annual PM _{2.5} Emissions (tonnes/year) (B)	0.26	0.26	0.26	0.26	0.26
Note: (A) Years between 2030-34 utilise EFT v9.0 emission rates for 2030; (B) Converted utilising Central Transport PM ₁₀ to PM _{2.5} factor of 0.673.					

Table 4-3
Emission Impact Calculation – Outputs

Output Parameter	Year					
	2030	2031	2032	2033	2034	5-Year Total (£)
NOx contribution (£)	18,846	18,573	18,304	18,038	17,777	91,537
PM _{2.5} contribution (£)	27,500	27,101	26,708	26,321	25,940	133,570
Total						225,107

In summary, over a 5-year period an emission cost has been calculated at £225,107.

The above damage costs provide an indicator of the financial commitment required to offset emissions. The amount (value) determined is not a direct indication of the monetary contribution required to off-set impacts upon air quality. Rather, the scale of damage cost will determine the level of appropriate mitigation required for specific proposals. The Interdepartmental Group on Costs and Benefits (IGCB) department of DEFRA, who produced the 'Damage Cost' guidance, has stated that⁷:

“The damage costs methodology was designed for economic appraisal of government policies that lead to air quality changes and wider cost-benefit analysis. While our guidance can be used to estimate the damage to society caused per tonne of emissions, we don’t provide any recommendations for the right level of compensation required to offset the impacts of air pollution.”

⁷ E-mail communication between Interdepartmental Group on Costs and Benefits department of DEFRA, and SLR Consulting Ltd, dated 28th January 2016.

5.0 ASSESSMENT OF RESIDUAL DUST AND ODOUR EMISSIONS

As part of the proposed scheme, as the former use of the site is a coke and chemical works, it is proposed that remediation works of the site are undertaken. Following this, the 'treated' grossly impacted material and the lower level impacted material (i.e. soils containing a low level of contamination) will be 'entombed' within the site with an imported cap placed over the treated and contaminated material. The cap placed over the material will be made of clean imported soils and will not have any contamination present. The thickness of the cap is yet to be determined (the specification is based upon the level of remaining contamination to ensure that there is no surface flux from the treated surface).

These remediation works involve the treatment of grossly impacted material (i.e. heavily contaminated soils) to prevent any future risk to groundwater and human health. The scope of these works will be completed under the scope of an Environmental Permit, issued and Regulated by the Environment Agency. The Environmental Permit would be required to be 'surrendered' to confirm that the remediation activities are no longer required to be undertaken and that contaminated material has been treated / immobilised appropriately to ensure that it does not cause an impact on the receiving environment. At the end of the remediation works, the geo-environmental team which have undertaken the remediation works will provide a validation report which would be reviewed and agreed by the EA (Groundwater Team) and BMBC Environmental Health.

The point at which the 'construction' phase of the scheme commences could not occur until such time that all of the remediation measures (including the capping) outlined above has been undertaken and signed off as being complete. All services will be placed within the capping layer, to ensure that any of the contaminated material remains undisturbed and there is no pathway for contamination / impact to occur. There will be a joined-up approach between the construction method for the site and the remediation strategy to ensure that no resulting pathways are created (and therefore potential for impact) into the areas where contaminated soils have been immobilised on site.

Notwithstanding, an assessment of the potential for any residual dust or odour effects from the contaminated materials has been undertaken. This assessment considers potential impacts subsequent to the above remediation activities having been carried out and completed.

The assessment has been undertaken in accordance with the IAQM 'Guidance on the Assessment of Odour for Planning'. The methodology is summarised below and available to download on the IAQM website⁸ and therefore not reproduced in full within this assessment.

The IAQM method is a risk-based approach based on the source-pathway-receptor conceptual model, i.e. the hypothetical relationship between the source (S) of the pollutant, the pathway (P) by which exposure might occur, and the receptor (R) that could be adversely affected.

5.1.1 Source Potential

The source of the previously treated materials will be entombed by a layer of non-contaminated soils. A capping layer will be placed across the previously treated materials to prevent mobilisation during any subsequent construction works. Therefore, there is considered to be no source of potential dust or odour, and the 'source' term is considered to be 'zero'.

5.1.2 Pathway Effectiveness

The IAQM odour guidance (IAQM, 2018) states:

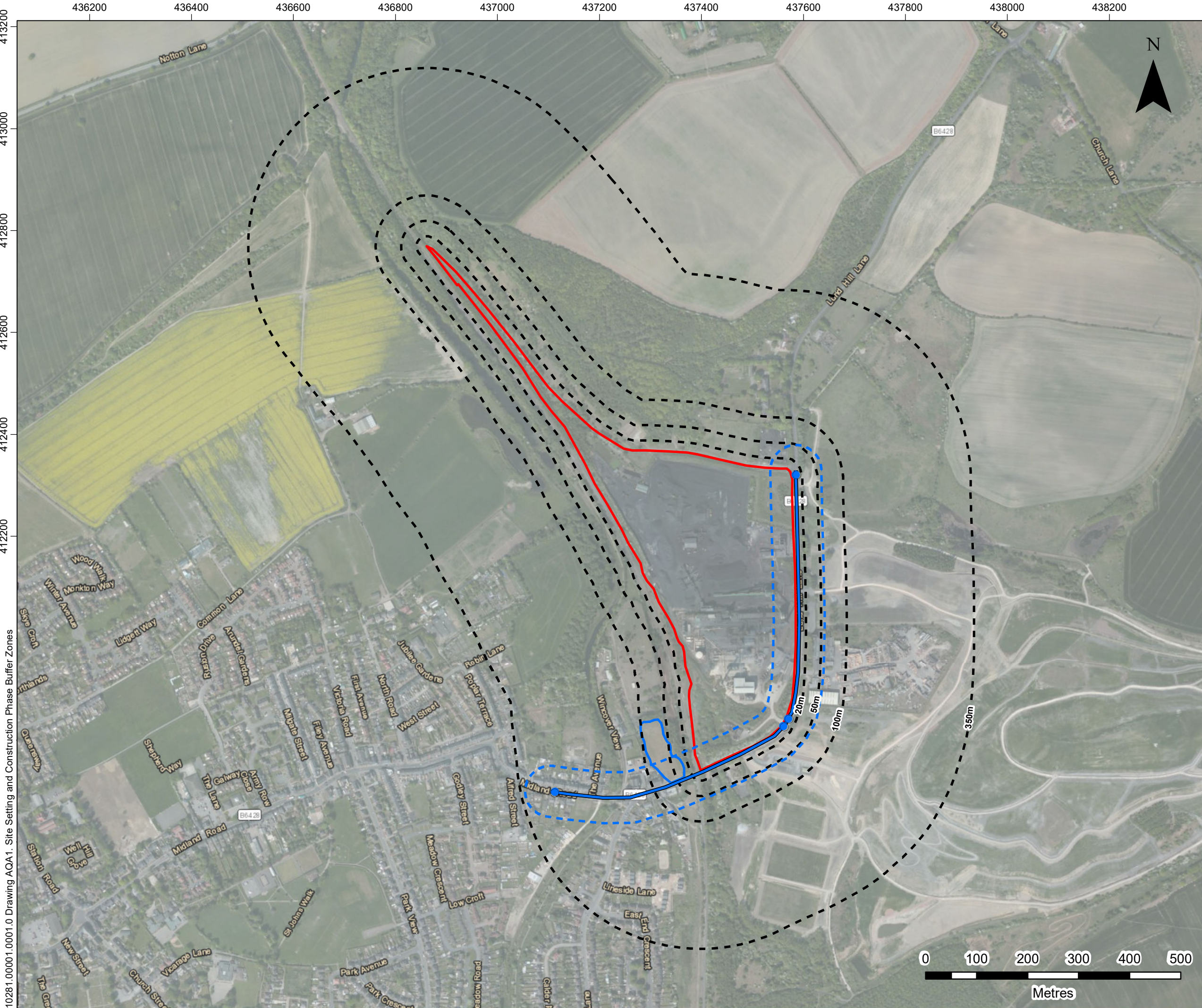
⁸ IAQM, Guidance on the Assessment of Odour for Planning, v1.1 2018, <http://www.iaqm.co.uk/text/guidance/odour-guidance-2014.pdf>, accessed June 2020.

“Before an adverse effect (such as disamenity, annoyance, nuisance or complaints) can occur, there must be odour exposure. For odour exposure to occur all three links in the source-pathway-receptor chain must be present.”

Following the IAQM odour guidance (IAQM, 2018) as there is no potential for the emission source to be released into the atmosphere, there would be no potential for the adverse effects to occur: the pathway and receptor elements of the source-pathway-receptor conceptual model are therefore considered immaterial.

Therefore, overall as there is considered a negligible risk, the level of effect of residual dust and odour post-remediation activities is considered to be ‘not significant’.

Drawings



LEGEND

SITE BOUNDARY

LAND OWNERSHIP

SITE BOUNDARY BUFFERS

TRACKOUT

TRACKOUT 50M BUFFER



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MONCKTON AQIA

AIR QUALITY ASSESSMENT

SITE SETTING AND
CONSTRUCTION PHASE BUFFER ZONES

AQ1

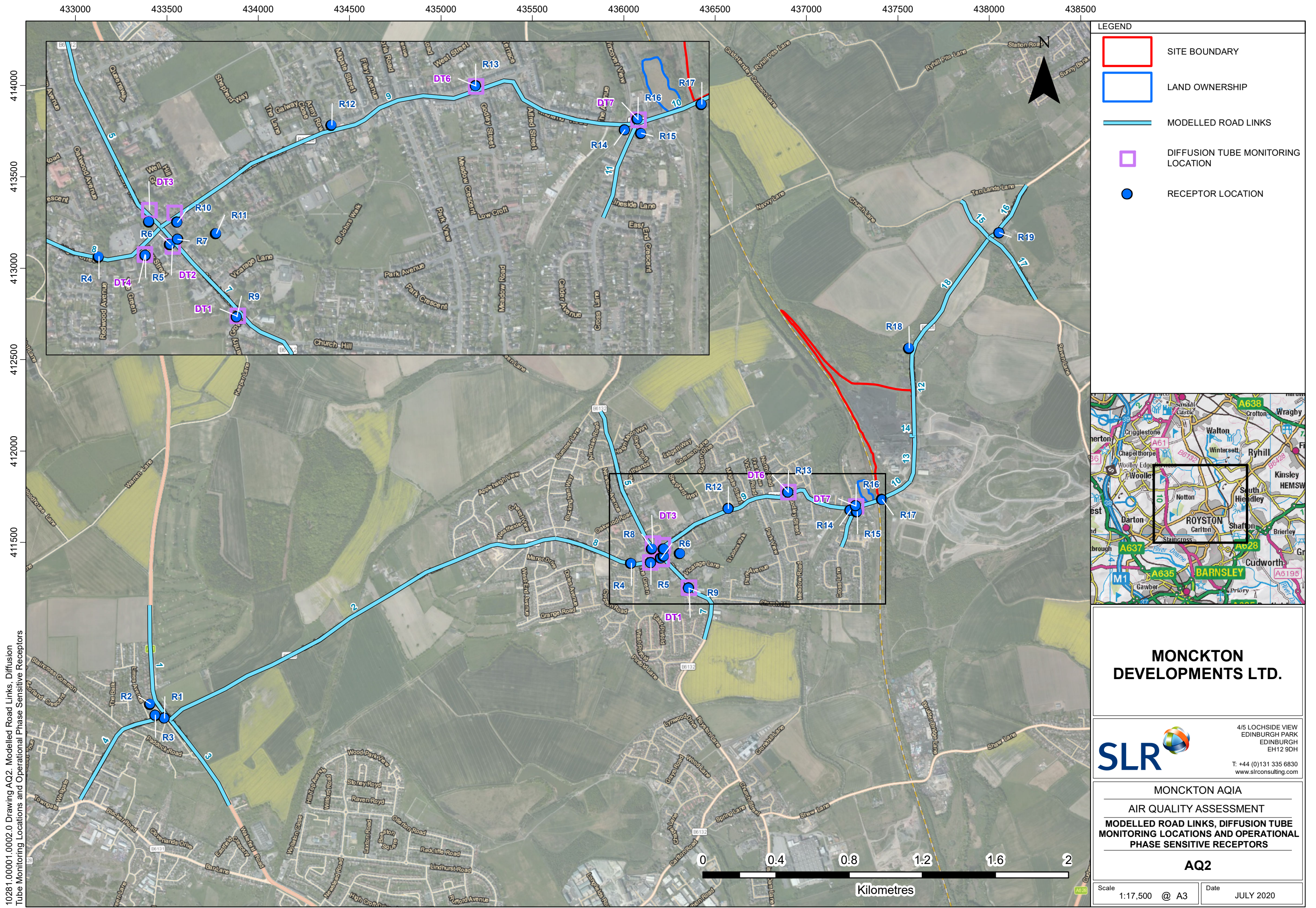
Scale
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Appendix A – Construction Dust Assessment Methodology

Predicting Risk

The assessment of risk is determined by considering the predicted change in conditions as a result of the development. The risk category for potential dust effects arising from site works is defined into 4No. potential activities:

- demolition;
- earthworks;
- construction; and
- trackout.

The determination of risk categories presented above are based upon the descriptors presented within IAQM: Guidance on the assessment of dust from demolition and construction.

Sensitivity of Receptor

To determine the significance of dust effects associated with the construction phase of the development, an evaluation of the sensitivity of the surrounding area is required. Receptors can demonstrate different sensitivities to changes in their environment, and are classified as detailed within Table A-1.

Quoted distances to the nearest receptor are from the dust emission sources. Where this is not known, receptor distances are determined from the site boundary. The risk category is based upon the distance of site works to the nearest receptor.

Table A-1
Methodology for Defining Sensitivity to Dust Effects

Sensitivity of Area	Examples		
	Human Receptors		Ecological Receptors ^(A)
	Dust Soiling Effects	Health Effects of PM ₁₀	
High	- users can reasonably expect an enjoyment of a high level of amenity; or - the appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. - indicative examples include dwellings, museums and other culturally important collections, medium and long term car parks and car showrooms.	- locations where members of the public are exposed over a time period relevant to the air quality objective for PM₁₀ (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day). - Indicative examples include residential properties. Hospitals, schools and residential care homes should also be considered as having equal sensitivity to residential areas for the purposes of this assessment.	- locations with an international or national designation and the designated features may be affected by dust soiling; or - locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List For Great Britain. - indicative examples include a Special Area of Conservation (SAC) designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings.
Medium	users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level	locations where the people exposed are workers, and exposure is over a time period relevant to the air quality	locations where there is a particularly important plant species, where its dust

Sensitivity of Area	Examples		
	Human Receptors		Ecological Receptors ^(A)
	Dust Soiling Effects	Health Effects of PM ₁₀	
	- of amenity as in their home; or - the appearance, aesthetics or value of their property could be diminished by soiling; or - the people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. - indicative examples include parks and places of work.	- objective for PM₁₀ (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day). - indicative examples include office and shop workers, but will generally not include workers occupationally exposed to PM₁₀, as protection is covered by Health and Safety at Work legislation.	- sensitivity is uncertain or unknown; or - locations with a national designation where the features may be affected by dust deposition. - indicative example is a Site of Special Scientific Interest (SSSI) with dust sensitive features.
Low	- the enjoyment of amenity would not reasonably be expected; or - property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or - there is transient exposure, where the people or property would reasonably be	- locations where human exposure is transient. - indicative examples include public footpaths, playing fields, parks and shopping streets.	- locations with a local designation where the features may be affected by dust deposition. - indicative example is a local Nature Reserve with dust sensitive features.

Sensitivity of Area	Examples		
	Human Receptors		Ecological Receptors ^(A)
	Dust Soiling Effects	Health Effects of PM ₁₀	
	expected to be present only for limited periods of time as part of the normal • pattern of use of the land. • indicative examples include playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads.		
Notes: (A) Only applicable if ecological habitats are present which may be sensitive to dust effects.			

Assessment of Impact Significance – Dust Effects

Table A-2 to Table A-4 illustrate how the sensitivity of the area may be determined for dust soiling, human health and ecosystem impacts, respectively. The highest level of sensitivity from each table should be recorded.

Table A-2
Sensitivity of Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance from Source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10 – 100	Medium	Medium	Low	Low
	1 – 10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	<1	Low	Low	Low	Low

Table A-3
Sensitivity of Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM ₁₀ Concentration	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32µg/m ³	>100	High	High	High	Medium	Low
		10 – 100	High	High	Medium	Low	Low
		1 – 10	High	Medium	Low	Low	Low
	28 – 32µg/m ³	>100	High	High	Medium	Low	Low
		10 – 100	High	Medium	Low	Low	Low
		1 – 10	High	Medium	Low	Low	Low
	24 – 28µg/m ³	>100	High	Medium	Low	Low	Low
		10 – 100	High	Medium	Low	Low	Low
		1 – 10	Medium	Low	Low	Low	Low
	<24µg/m ³	>100	Medium	Low	Low	Low	Low
		10 – 100	Low	Low	Low	Low	Low
		1 – 10	Low	Low	Low	Low	Low
Medium	>32µg/m ³	>10	High	Medium	Low	Low	Low
		1 – 10	Medium	Low	Low	Low	Low
	28 – 32µg/m ³	>10	Medium	Low	Low	Low	Low

	24 – 28µg/m ³	1 – 10	Low	Low	Low	Low	Low
		>10	Low	Low	Low	Low	Low
		1 – 10	Low	Low	Low	Low	Low
	<24µg/m ³	>10	Low	Low	Low	Low	Low
		1 – 10	Low	Low	Low	Low	Low
Low	-	1	Low	Low	Low	Low	Low

Table A-4
Sensitivity of Area to Ecological Impacts

Receptor Sensitivity	Distance from the Source (m) ^(A)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low
Note: (A) For trackout, the stand-offs should be measured from the side of the roads used by construction traffic.		

Defining the Risk of Impact

Table A-5 to Table A-8 illustrates how the dust emission magnitude should be combined with the sensitivity of the area to determine the risk of impacts with no mitigation measures applied.

Table A-5
Risk of Dust Impacts – Demolition

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

Table A-6
Risk of Dust Impacts – Earthworks

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table A-7
Risk of Dust Impacts – Construction

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table A-8
Risk of Dust Impacts – Trackout

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

APPENDIX B – Model Input and Verification

Model Input Summary

The modelling parameters are summarised in Table B-1.

Table B-1
Summary of Modelling Inputs

Parameter	Description	Input Variable
Surface Roughness	Surface roughness of the modelling domain as a function of land use	A roughness length z_0 of 0.5m was used within the assessment area of this dispersion modelling study. This value is for 'parkland, open suburbia' and therefore considered appropriate for the surface roughness of the dispersion modelling assessment area.
Road Source Emissions	Source of the emission factors used	EFT v.9.0 (2019)
Emission Year	Modelling year used to factor the traffic emissions	2019 verification year; 2030 for the opening year of the development to assume no improvements in vehicle emission rates; and 2019 for the additional sensitivity scenario to assume no improvements in vehicle emission rates.
Road Type	Road type within the EFT emission database	Urban (not London) for road links L1 to L14 Rural (not London) for road links L15 to L18
Elevation of Road	Height of the road link above ground level	0m for all road links.
Gradients	Gradient and length of road link to calculate associated elevated HDV emissions following LAQM.TG(16) method	No gradients were applied.
Road Width	Width of the road link	Road widths obtained from Google Earth.
Road Speed	Road speed in km/h	Variable based on surveyed speed on relevant road links (where available) or posted limit, and adjustment for road geometry in line with LAQM.TG(16)
Time Varied Emissions	Daily, weekly or monthly variations in emissions applied to sources	No time varying emissions were applied.
Meteorology	Representative hourly sequential meteorological data	2019 meteorological data from Doncaster Sheffield Robin Hood Airport

Background	Background pollutant concentration considered during the modelling	DEFRA Mapped backgrounds (2017 base year) projected to development opening year (2030). The 'in-grid square' contribution from 'primary 'A' road' have been removed, where relevant, from the background annual mean NO_x concentration estimates, and background annual mean NO₂ estimates have been corrected using DEFRA's Background Sector Removal Tool. DEFRA mapped background concentrations for 2030 has been selected to represent the opening year of the development with future predicted improvements in background pollutant concentrations. For the additional sensitivity scenario, DEFRA mapped background concentrations for 2019 were utilised to assume no future predicted improvements in background pollutant concentrations.
Output	Output as gridded or specified points	At specified points as detailed.
Pollutant Output	Pollutants modelled and averaging time	NO ₂ and PM ₁₀ annual mean, calculated 1-hour mean NO ₂ and 24-hour mean PM ₁₀

Traffic Data

The traffic flow data was provided by Met Consultancy Group, Transport Consultants to the Applicant, and applied in the assessment as detailed in Table B-2 and Table B-3 below.

It is noted that the traffic data provided by the transport consultant assumes the Application Site will generate only LDVs.

Table B-2
Traffic Data used within the Dispersion Modelling Assessment – AADT Traffic Data

Link		24-hour AADT (total flow)		Marginal Change AADT (B)
		2030 DM ^(A)	2030 DS ^(A)	
L1	Wakefield Road A61 (North of Shaw Lane)	10,930	10,947	+17
L2	Lee Lane (B6428)	11,259	11,769	+510
L3	Wakefield Road A61 (South of Shaw Lane)	14,462	14,948	+486
L4	Shaw Lane (B6428)	13,483	14,043	+560
L5	Station Road (B6132)	5,956	5,990	+34
L6	Midland Road (B6428)	9,143	10,814	+1,671
L7	Church Street (B6132)	10,665	11,133	+468
L8	High Street (B6428)	10,359	11,529	+1,170
L9	Lund Hill Lane (B6428) West of Cross Lane	4,323	5,995	+1,672
L10	Lund Hill Lane (B6428) East of Cross Lane	5,906	8,046	+2,140
L11	Cross Lane	3,355	3,823	+468
L12	Lund Hill Lane (North of Dev Access)	5,906	7,110	+1,204
L13	Lund Hill Lane (South of Dev Access)	5,906	7,999	+2,093
L14	Development Access	-	3,176	+3,176
L15	Church Lane (North of Lund Hill Lane)	6,493	6,994	+501
L16	Hall Field Lane	4,653	4,954	+301
L17	Church Lane (South of Lund Hill Lane)	8,966	9,367	+401
L18	Lund Hill Lane (West of Church Lane)	5,648	6,852	+1,204
DM = 'do-minimum' DS = 'do-something' (A) Scenario modelled as an assumed 2030 development opening year, with 2030 emission factors and 2030 mapped background pollutant concentrations. (B) Marginal changed assessed between the 2030 DM and DS scenarios, reflecting the opening year.				

Model Verification

Traffic Data

Traffic data applied as part of the 2019 verification assessment is presented in Table B-3.

Table B-3
Traffic Flow (AADT) – 2019 Verification

Ref	Description	2019 Verification			Speed (A)
		Total AADT	LDV AADT	HDV AADT	(km/h)
L1	Wakefield Road A61 (North of Shaw Lane)	8,625	8,453	173	64
L2	Lee Lane (B6428)	8,258	8,093	165	96
L3	Wakefield Road A61 (South of Shaw Lane)	10,861	10,535	326	64
L4	Shaw Lane (B6428)	10,961	10,742	219	48
L5	Station Road (B6132)	5,067	4,966	101	48
L6	Midland Road (B6428)	7,715	7,484	231	48
L7	Church Street (B6132)	8,897	8,719	178	48
L8	High Street (B6428)	8,247	8,082	165	48
L9	Lund Hill Lane (B6428) West of Cross Lane	3,609	3,465	144	56
L10	Lund Hill Lane (B6428) East of Cross Lane	4,989	4,889	100	56
L11	Cross Lane	2,925	2,808	117	48
L12	Lund Hill Lane (North of Dev Access)	4,989	4,839	150	56
L13	Lund Hill Lane (South of Dev Access)	4,989	4,839	150	56
L14	Development Access	-	-	-	-
L15	Church Lane (North of Lund Hill Lane)	5,661	5,548	113	96
L16	Hall Field Lane	3,897	3,819	78	96
L17	Church Lane (South of Lund Hill Lane)	7,817	7,661	156	96
L18	Lund Hill Lane (West of Church Lane)	4,765	4,622	143	56

Note:

(A) Where relevant, links have been modelled with an additional slow down link modelled at 20kmph.

Calculation of Correction Factors

The model output of road-NO_x (i.e. the component of total NO_x coming from road traffic exhaust emissions) has been compared with the 'measured' road-NO_x.

For this calculation, the following assessment inputs were used, which are considered to be representative of the development locale:

- DEFRA's NO_x to NO₂ calculator version 7.1;
- 'Barnsley' was selected as the Local Authority; and
- 2019 DEFRA mapped background for the grid square containing the diffusion tubes (May 2019 update) (mapped background NO₂ concentration of 10.6µg/m³ from grid square NGR: x436500, y411500 for DT1, DT2, DT4, and DT5 and mapped background NO₂ concentration of 9.82µg/m³ from grid square NGR: x437500, y411500 for DT7).

Monitoring data versus modelling data is shown in Table B-4 below with the applied primary adjustment factors. Monitoring locations DT3 and DT6 were omitted from the model verification process due to insufficient data capture during the monitoring survey to allow for annualisation. Further details regarding the monitoring survey methodology can be found within Appendix 9.1.

Table B-4
Verification Data 2019 – Monckton, Royston – Overall Model Performance

Monitoring Location	Modelled NO _x Road Contribution (µg/m ³)	Calculated NO _x Road Contribution (µg/m ³)	Adjusted Modelled NO _x Road Contribution (µg/m ³)	Monitored NO ₂ Concentration (µg/m ³)	Adjusted Modelled NO ₂ Concentration (µg/m ³)	Difference (%)
DT1	5.23	23.6	26.5	22.6	24.0	+6.24
DT2	7.80	36.2	39.4	28.6	30.1	+5.14
DT4	5.89	26.7	29.8	24.1	25.6	+6.18
DT5	8.41	47.8	42.5	33.8	31.5	-6.89
DT7	2.81	19.3	14.2	19.9	17.3	-12.86
Adjustment Factor			5.0547			

As stated with LAQM.TG(09), refinements have been made to the model performance without *"providing unreasonable data inputs in order to reduce model adjustment factors is not an acceptable approach"*.

In accordance with LAQM.TG(16), the ratio of 'Calculated Road Contribution' to 'Modelled NO_x Road Contribution' has been calculated and reviewed. This average relationship is a minimum of 1:4.50 (monitoring location DT1) and a maximum of 1:6.85 (monitoring location DT7).

LAQM.TG(16) states *"In order to provide more confidence in the model predictions and the decisions based on these, the majority of results should be within 25% of the monitored concentrations as a minimum, preferably within 10%"*. Table B-4 illustrates that the difference between modelled and calculated road NO_x concentrations is within 10% at four locations and within 25% at one location.

As stated in LAQM.TG(16), a graph of modelled versus calculated road NO_x contributions has been prepared, including a trend line which presents the following requirements:

"The equation of the trend line should be in the format of

$y = mx$ (intercept at 0)

y is monitored road contribution NO_x and

x is modelled road contribution NO_x

m is the regression correction factor to apply to the modelled road contribution NO_x."

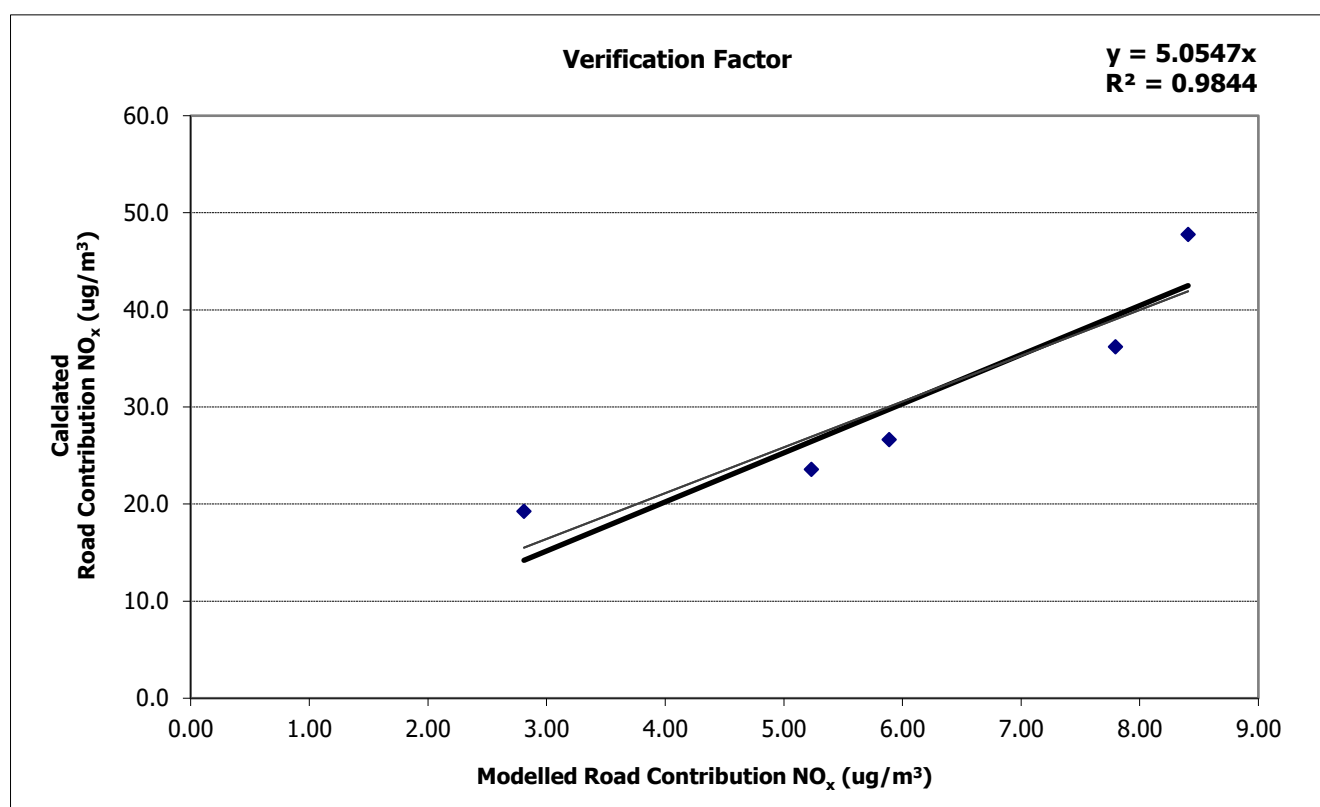


Figure B-1
Site Specific Diffusion Tube Monitoring Verification

As presented in in Table B-4, and Figure B-1 modelled NO_x concentrations have therefore been verified using a factor of 5.0547. Modelled PM₁₀ concentrations have further been verified using a factor of 5.0547, following the recommendations of LAQM.TG(16) guidance.

Model Performance

An evaluation of model performance has been undertaken to establish confidence levels in model results, based upon the calculated factors of 5.0547 for the study area. LAQM.TG(16) identifies a number of statistical procedures that are appropriate to evaluate model performance and assess uncertainty. The statistical parameters used in this assessment are:

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

A brief for explanation of each statistic is provided in

Table B-5, and further details can be found in LAQM.TG(16).

Table B-5
Model Performance

Parameter	Comments	Value
Root Mean Square Error	RMSE is used to define the average error or uncertainty of the model. The units of RMSE are the same as the quantities compared	1.92µg/m ³ (i.e. 4.79% of the AQAL)

	If the RMSE values are higher than $\pm 25\%$ 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 40 $\mu\text{g}/\text{m}^3$, if an RMSE of 10 $\mu\text{g}/\text{m}^3$ or above is determined for a model, the local authority would be 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 4 $\mu\text{g}/\text{m}^3$ for the annual average NO ₂ AQAL.	
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.	0.0040

As indicated in Table B-8, the RMSE value is calculated to be 1.92 $\mu\text{g}/\text{m}^3$ / 4.79% and therefore is within the required $\pm 25\%$ of the annual mean AQAL for all monitoring locations considered within the verification assessment. Furthermore, the FB is calculated to be 0.0040 which is within the required +2 and -2 range.

Therefore, model performance and uncertainty are considered to be satisfactory and all monitoring locations have been retained within the verification study

APPENDIX C – Operational Phase Sensitivity Assessment Results

In order to provide further assessment and sensitivities on the assessment inputs, an additional scenario has been considered based as described above which considers:

- 2019 background concentrations from the DEFRA mapping study (2017 base year, May 2019 update); and
- NO_x emission factors obtained from EFT v9.0 for 2019.

The results of this sensitivity modelling are presented in the following subsections. No sensitivity analysis has been undertaken on modelled annual mean PM₁₀ concentrations.

Nitrogen Dioxide Annual Mean

Table C-1 below presents the modelled annual mean NO₂ concentrations at the selected receptor locations assuming no improvement in traffic emissions or backgrounds from the 2019 verified year. Any exceedences of the annual mean AQAL are displayed in bold text.

Table C-1
Modelled Annual Mean NO₂ Concentrations – 2030 Development Opening Year: 2019 Sensitivity Assessment

Receptor	Predicted 2030 NO ₂ Concentration (µg/m ³) ^(A)		Change (µg/m ³)	Change as a Percentage of the AQAL (%)
	'Do-minimum'	'Do-something'		
R1 ^(B)	42.7	43.5	+0.81	2.03
R2 ^(B)	21.8	22.0	+0.25	0.63
R3 ^(B)	34.3	35.0	+0.71	1.78
R4 ^(C)	30.5	32.4	+1.88	4.70
R5 ^(C)	27.7	29.2	+1.54	3.85
R6 ^(C)	34.7	36.0	+1.29	3.23
R7 ^(C)	25.1	26.0	+0.95	2.38
R8 ^(C)	32.8	34.1	+1.24	3.10
R9 ^(C)	25.0	25.7	+0.68	1.70
R10 ^(C)	34.4	36.7	+2.34	5.85
R11 ^(C)	16.8	17.4	+0.58	1.45
R12 ^(C)	25.8	28.2	+2.38	5.95
R13 ^(C)	18.6	21.3	+2.70	6.75
R14 ^(D)	21.9	24.7	+2.79	6.98
R15 ^(D)	17.6	19.4	+1.84	4.60
R16 ^(D)	22.4	25.8	+3.44	8.60
R17 ^(D)	17.5	20.2	+2.61	6.53
R18 ^(E)	14.6	15.7	+1.08	2.70
R19 ^(F)	24.3	25.2	+0.95	2.38
DT1 ^(B)	25.8	25.8	+0.68	-
DT2 ^(B)	33.0	33.0	+1.18	-
DT3 ^(B)	32.3	32.3	+0.91	-

Receptor	Predicted 2030 NO ₂ Concentration (µg/m ³) ^(A)		Change (µg/m ³)	Change as a Percentage of the AQAL (%)
	'Do-minimum'	'Do-something'		
DT4 ^(B)	29.0	29.0	+1.52	-
DT5 ^(B)	35.7	35.7	+2.43	-
DT6 ^(B)	20.9	20.9	+2.60	-
DT7 ^(C)	25.3	25.3	+3.34	-

Note:

- (A) Scenario modelled as an assumed 2030 development opening year, with 2019 emission factors and 2019 mapped background pollutant concentrations.
- (B) Annual mean concentration inclusive of 2019 background NO_x concentration of 13.9µg/m³.
- (C) Annual mean concentration inclusive of 2019 background NO_x concentration of 14.3µg/m³.
- (D) Annual mean concentration inclusive of 2019 background NO_x concentration of 13.2µg/m³.
- (E) Annual mean concentration inclusive of 2019 background NO_x concentration of 12.3µg/m³.
- (F) Annual mean concentration inclusive of 2019 background NO_x concentration of 12.1µg/m³.

As shown, there is a predicted exceedence of the annual mean NO₂ AQAL in in both the 'do-minimum' and 'do-something' scenarios at receptor R1 as part of the 2019 sensitivity assessment scenario. However, it should be noted that exceedence at this receptor location occurs in both the 'do-minimum' and 'do-something' scenarios and is not as a result of additional development trips.

The maximum predicted change in annual mean NO₂ concentrations associated with additional development trips as part of the 2019 sensitivity assessment scenario at modelled locations of relevant exposure is +3.44µg/m³, representing 8.60% of the AQAL, as predicted at sensitive receptor R16 (Residential – Midland Road).

Predicted impacts on annual mean NO₂ concentrations as part of the 2019 sensitivity assessment scenario are summarised in Table C-2, based upon the descriptors presented within EPUK and IAQM guidance⁹.

Table C-2

Summary of Predicted Annual Mean NO₂ Impacts: Road Vehicle Emissions – 2030 Development Opening Year: 2019 Sensitivity Assessment

Receptor	Concentration with the Development	Percentage Change Relative to AQAL (%)	Impact
R1	103 - 109% of the AQAL	2 - 5% of the AQAL	Moderate, Adverse
R2	<75% of the AQAL	1% of the AQAL	Negligible
R3	76 - 94% of the AQAL	2 - 5% of the AQAL	Slight, Adverse
R4	76 - 94% of the AQAL	2 - 5% of the AQAL	Slight, Adverse
R5	<75% of the AQAL	2 - 5% of the AQAL	Negligible
R6	76 - 94% of the AQAL	2 - 5% of the AQAL	Slight, Adverse
R7	<75% of the AQAL	2 - 5% of the AQAL	Negligible
R8	76 - 94% of the AQAL	2 - 5% of the AQAL	Slight, Adverse

⁹ EPUK and IAQM, 'Land-Use Planning and Development Control: Planning for Air Quality', v1.2 2017.

Receptor	Concentration with the Development	Percentage Change Relative to AQAL (%)	Impact
R9	<75% of the AQAL	2 - 5% of the AQAL	Negligible
R10	76 - 94% of the AQAL	6 - 10% of the AQAL	Moderate, Adverse
R11	<75% of the AQAL	1% of the AQAL	Negligible
R12	<75% of the AQAL	6 - 10% of the AQAL	Slight, Adverse
R13	<75% of the AQAL	6 - 10% of the AQAL	Slight, Adverse
R14	<75% of the AQAL	6 - 10% of the AQAL	Slight, Adverse
R15	<75% of the AQAL	2 - 5% of the AQAL	Negligible
R16	<75% of the AQAL	6 - 10% of the AQAL	Slight, Adverse
R17	<75% of the AQAL	6 - 10% of the AQAL	Slight, Adverse
R18	<75% of the AQAL	2 - 5% of the AQAL	Negligible
R19	<75% of the AQAL	2 - 5% of the AQAL	Negligible

As indicated, the predicted percentage change of annual mean NO₂ concentrations part of the 2019 sensitivity assessment scenario are '1% of the AQAL' at two receptors, '2-5% of the AQAL' at twelve receptors and '6-10% of the AQAL' at six receptors. The predicted concentrations with the development range are between '103-109% of the AQAL' to '<75% of the AQAL'. An unmitigated 'negligible' impact is predicted at eight receptor locations, an unmitigated 'slight, adverse' impact is predicted at nine receptor locations and an unmitigated 'moderate, adverse' impact is predicted at two receptor locations.

Analysis of Assessment Sensitivities

Sensitivity modelling has been undertaken which utilises 2019 emission factors (EFT v9.0) and 2019 background concentrations (May 2019 DEFRA release, 2017 mapping base year) to reflect the 2030 development opening year.

It is noted that this precautionary assessment assumes that road traffic emission factors and background concentrations in the 2030 development opening year will remain at the 2019 base year level. Furthermore, the precautionary assessment assumes that road traffic flows predicted in the 2030 development opening year will occur in 2019.

DEFRA projections and the basis for future year road traffic emission factor reductions are based upon a number of assumptions, including the following:

- improvements in the fleet composition based on European emission factor standards from pre-Euro I/1 to Euro VI/6, resulting in lower exhaust emissions, particularly from September 2014 when all new vehicles are required to be Euro VI compliant;
- improvements in the quality of fuel and some degree of retrofitting, resulting in lower exhaust emissions; and
- improvements and conversions in the technology of National fleet vehicles, resulting in lower exhaust emissions.

It is considered that the 2019 modelling predictions presented within this sensitivity modelling are worst-case reflections to provide confidence in the modelling predictions, and do not reflect likely impacts from additional development trips in the development opening year. Actual impacts in the development opening year are likely to

be lower than those predicted given the projected road traffic exhaust emission factor improvements, as indicated by the impact assessment scenario and modelled concentrations in ES Chapter 9, Air Quality.

DEFRA mapped background concentrations and their future year projections are based on a number of assumptions which include the following:

- all assumptions underlying the latest (2017) NO_x emission projections for road transport, as detailed above;
- updated road transport forecasts for Great Britain from the DfT;
- updated assumptions on diesel car penetration rates provided by the DfT; and
- updated vehicle sales projections for cars and LGVs based on information provided by the DfT.

In relation to trends in air pollutant concentrations within BMBC's area, a review of the BMBC 2019 Air Quality Annual Status Report containing monitoring data for up to 2018 has been undertaken.

Due to there being no monitoring locations within the study area, there is limited data available to determine overall trends in local NO₂. The most recent BMBC Air Quality Annual Status Report (ASR) has been reviewed to determine any borough wide trends in NO₂ concentrations. The most recently published 2019 BMBC ASR states the following:

"Overall, there has been a very welcome and significant reduction in NO₂ concentrations, as detailed in our 2018 diffusion tube dataset."

In addition to this statement, it is noted that monitored NO₂ concentrations over the past five years have followed an overall trend of reducing within areas of concern such as the Barnsley AQMAs which is discussed within the 2019 BMBC ASR.

On this basis, the annual mean AQALs for both NO₂ and PM₁₀ are not predicted to be exceeded as a result of additional trips from the proposed development at any modelled location as part of the 2030 development opening year scenario on which the main conclusions of the supporting ES Chapter 9, Air Quality is based upon.

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